US Army Corps of Engineers
Los Angeles District

**Gila River Basin**

15

# Phoenix, Arizona, and Vicinity (Including New River)

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

# Arizona Canal Diversion Channel
# DETENTION BASINS STUDY

FINAL

M

A118.905

CAR

US Army Corps of Engineers
Los Angeles District

Gila River Basin

15

# Phoenix, Arizona, and Vicinity (Including New River)

# Arizona Canal Diversion Channel
# DETENTION BASINS STUDY

FINAL
March 1987

Gila River Basin

Phoenix, Arizona, and Vicinity
(Including New River)

Arizona Canal Diversion Channel

DETENTION BASINS STUDY

FINAL

March 1987

DEC 19 '88

Gila River Basin

Phoenix, Arizona, and Vicinity
(Including New River)

Arizona Canal Diversion Channel

DETENTION BASINS STUDY

FINAL

March 1987

DEC 1 9 '88

## EXECUTIVE SUMMARY

The Arizona Canal Diversion Channel (ACDC) is a feature of the Phoenix, Arizona, and Vicinity (including New River) flood-control project. The concrete channel will be located in metropolitan Phoenix, Arizona, and will be north of and adjacent to the Arizona Canal between 40th Street and Skunk Creek. (See pl. 1). The channel, approximately 16.5 miles long, will provide protection to urban development south of the Arizona Canal by diverting floodflows westward to Skunk Creek.

On July 19, 1986, the Phoenix City Council requested the Corps of Engineers to conduct a study to determine the effect of using detention basins at the upstream end of the ACDC on costs and channel sizes in reaches 4 and 3. Reach 4 is the most upstream segment of the ACDC, extending from Cudia City Wash to Dreamy Draw, about 4.2 miles. Reach 3 is the next segment downstream from reach 4; it extends about 3.6 miles from Dreamy Draw to Cave Creek. This report provides a description of the study conducted by the Corps and presents the study results.

Four basin sites were considered in the study. These sites, shown on plates 2 and 3, are identified in this report as Stanford Drive, 35th Street, Biltmore North, and Biltmore South. The Biltmore South basin was eliminated from the study early because of its small size and difficulty of operation. The detention-basin sites were determined in coordination with the local sponsor, the Flood Control District of Maricopa County (FCDMC), and opponents of the current design for reaches 4 and 3. An important criteria in selecting the basin sites was to minimize the impacts on the Town of Paradise Valley. This criteria restricted the size of the Stanford Drive basin significantly. Stanford Drive detention basin, as defined in this report, would require the acquisition of five more homes than the channel only (FDM) plan currently approved for construction in reaches 4 and 3. The 35th Street detention basins would require the acquisition of at least three additional homes.

Various combinations, seven in all, of the three remaining basins coupled with the ACDC were studied. Each combination or plan required a redesign of the ACDC through reaches 4 and 3, nearly 55 miles of channel design in all. Cost estimates were then prepared for each plan and compared to the channel only (FDM) plan. One important assumption employed in the redesign of the channel was that any decrease in channel size resulting from the basins would be taken in width rather than depth. As well as having significant technical advantages for the study, the assumption was considered more consistent with local desires to improve the esthetics of the channel, either by covering portions of it or by providing more landscaping space. A sensitivity analysis showed that absorbing all of the channel reduction in width did not significantly affect the cost estimates.

All of the detention-basin plans considered in this report would cost more than the currently approved channel only (FDM) plan. The differences in cost, though ranging from $2.3 million to $9.3 million,

were not large (2 to 7 percent) compared to the overall costs of reaches 4 and 3. Summary Table I lists the various plans and their costs. In all cases the detention basin plans studied would increase local costs over the FDM plan.

The maximum reduction in channel size produced by the detention basins occurred between the basin sites and 24th street, a reach that would be 74 percent covered channel under the currently approved channel only plan. The greatest reduction in channel width west of 24th Street, resulting from a combination of all three basins, was 7 feet, which decreased rapidly with distance westward. Summary Table II provides summary information on the maximum-channel-width reduction for each detention-basin plan.

Summary Table I. Cost Comparison.

| Alternative Plan Basin Combination and Plan Designation | Flood Control Cost[a] | | | Percent of Cost in Excess of Channel-Only Plan |
|---|---|---|---|---|
| | Federal[a] | Local[b] | Total | |
| Channel only (E-FDM) | $75,327,000 | $51,843,000 | $127,170,000 | - |
| Stanford Drive basin (E-A) | 74,320,000 | 55,130,000 | 129,450,000 | 2 |
| 35th Street basin (E-B) | 76,001,000 | 53,899,000 | 129,900,000 | 2 |
| Biltmore North basin (E-C) | 78,443,000 | 52,587,000 | 131,030,000 | 3 |
| Stanford Drive and 35th Street basins (E-AB) | 74,711,000 | 57,089,000 | 131,800,000 | 4 |
| Stanford Drive and Biltmore North basins (E-AC) | 78,267,000 | 55,543,000 | 133,810,000 | 5 |
| 35th Street and Biltmore North basins (E-BC) | 79,362,000 | 54,428,000 | 133,790,000 | 5 |
| Stanford Drive, 35th Street and Biltmore North basins (E-ABC) | 78,746,000 | 57,734,000 | 136,480,000 | 7 |

a. Cost for reaches 4 and 3 (1986 prices).
b. Adjusted for 2.3-percent required local contribution.

Summary Table II. Channel-Width Reductions Resulting from Detention Basins.

| Alternative Plan Basin Combination and Plan Designation | Decrease in ACDC Channel Width Compared to Channel Only Plan[a] | | | | | |
|---|---|---|---|---|---|---|
| | Reach 4 | | | Reach 3[b] | | |
| | Location | Length[b] (feet) | Width (feet) | Location | Length[b] (feet) | Width (feet) |
| Channel only (E-FDM) | - | - | - | - | - | - |
| Stanford Drive (E-A) | Stanford Drive basin to near 24th Street | 7280[c] | 6 | Dreamy Draw to near 7th Street | 4900 | 2 |
| 35th Street (E-B) | About 700 feet east of 32nd Street to near 24th Street | 6610 | 4 | Dreamy Draw to near 7th Street | 4900 | 4 |
| Biltmore North (E-C) | Biltmore North basin to near 24th Street | 3670 | 2 | Dreamy Draw to near 7th Street | 4900 | 1 |
| Stanford Drive and 35th Street (E-AB) | Stanford Drive basin to near Biltmore golf course bridge | 3900 | 16 | Dreamy Draw to near 7th Street | 4900 | 5 |
| Stanford Drive and Biltmore North (E-AC) | Biltmore North basin to near 24th Street | 3830 | 7 | Dreamy Draw to near 7th Street | 4900 | 3 |
| 35th Street and Biltmore North (E-BC) | Biltmore North basin to near 24th Street | 3635 | 6 | Dreamy Draw to near 7th Street | 4900 | 5 |
| Stanford Drive, 35th Street and Biltmore North (E-ABC) | Stanford Drive basin to near Biltmore golf course bridge | 3900 | 16 | Dreamy draw to near 7th Street | 4900 | 6 |

a. This table displays only maximum channel-width reductions. Lesser width reductions occur upstream and downstream from locations shown. See table 4 of the report for widths throughout reaches 4 and 3.
b. Total lengths of reaches 4 and 3 are 21,593 and 18,800 feet, respectively.
c. About 74 percent of this reach would be covered channel under the channel only plan.

CONTENTS


| | Page |
|---|---|
| Executive Summary | iii |
| Introduction | 1 |
| Purpose of Study | 2 |
| Scope of Study | 2 |
| Description of Alternatives | 2 |
| Bases of Design | 4 |
| Hydrology | 4 |
| Detention Basins | 4 |
| Sediment Allowance | 5 |
| Volume Analysis | 5 |
| Results | 7 |
| Hydraulics | 7 |
| Design Assumptions and Analysis | 8 |
| Arizona Canal Diversion Channel (ACDC) | 8 |
| Summary of Hydraulic Results and Discussion of Detention Basin Plans | 12 |
| Geotechnical | 12 |
| Recreation | 13 |
| Esthetics | 13 |
| Evaluations of Alternatives | 13 |
| Environmental | 13 |
| Economics | 14 |
| Costs | 15 |
| Comparison to Feature Design Memorandum (FDM) Plan | 16 |
| Conclusions | 17 |
| References | 19 |


Figures


| | | |
|---|---|---|
| 1. | Hydrograph Illustration | 10 |
| 2. | Typical Spillway Profile | 11 |


Tables


| | | |
|---|---|---|
| 1. | Pertinent Data | 21 |
| 2. | 35th Street Detention-Basin Elevation-Storage-Outflow Relationships | 23 |
| 3. | Summary of Hydraulic Data | 25 |
| 4. | Channel Widths | 27 |
| 5. | Summary of First Costs for Flood-Control Alternative Plans | 29 |
| 6. | Summary of First Cost for Flood Control (FDM) | 31 |
| 7. | Summary of First Cost for Flood Control (Stanford Drive Detention Basin and ACDC) | 33 |

CONTENTS (Continued)

Page

Tables (Continued)

8. Summary of First Cost for Flood Control (35th Street Detention Basin and ACDC)..... 35
9. Summary of First Cost for Flood Control (Biltmore North Detention Basin and ACDC)..... 37
10. Summary of First Cost for Flood Control (Stanford Drive and 35th Street Detention Basins, and ACDC)..... 39
11. Summary of First Cost for Flood Control (Stanford Drive and Biltmore North Detention Basins, and ACDC)..... 41
12. Summary of First Cost for Flood Control (35th Street and Biltmore North Detention Basins, and ACDC)..... 43
13. Summary of First Cost for Flood Control (Stanford Drive, 35th Street, and Biltmore North Detention Basins, and ACDC)..... 45

Plates

1. Flood-Control Plan
2. Study Area Location Map
3. Detention-Basins Location Map
4. Subarea Boundaries
5. Schematic Diagram With Three Detention Basins
6. ACDC Design Hydrographs With Stanford Basin
7. ACDC Design Hydrographs at CP 102 Above 32nd Street
8. ACDC Design Hydrographs With Three Detention Basins

Appendix

Detailed First Cost Estimates

# INTRODUCTION

The Arizona Canal Diversion Channel (ACDC) is a feature of the Phoenix, Arizona, and Vicinity (including New River) flood control project. The channel will be located in metropolitan Phoenix, Arizona, and will be north of and adjacent to the Arizona Canal between 40th Street and Skunk Creek. The channel, approximately 16.5 miles long, will provide protection to residences, businesses, and other developments of urban Phoenix south of the Arizona Canal by diverting flows to Skunk Creek. Because of the vastness of the project, the ACDC is presently divided into six segments for the purpose of staged construction. The segments are identified as reaches 1, 2A, 2B, 3, and 4 (including Cudia City Wash sediment basin), and Cave Creek Channel (including Cave Creek sediment basin). The detail design for reach 1 is presented in the "Phoenix, Arizona, and Vicinity (Including New River), Design Memorandum No. 3, Part 5 (GDM)," dated March 1985. Detail designs for reaches 2A, 2B, 3, and 4 and Cave Creek Channel are presented in "Phoenix, Arizona, and Vicinity (Including New River), Design Memorandum No. 12 (FDM)," dated April 1986. These projects were authorized by the Flood Control Act of 1965. (See pl. 1).

Prior to the start of construction on reach 1 of the ACDC, opposition to the channel began to organize and become more vocal. The opposition centered around two major concerns: (1) negative esthetic impacts of a large concrete channel in a densely developed urban area and (2) loss of business at the Arizona Biltmore Hotel and possibly loss of the hotel's 5-star rating. In response to the public criticism, the Phoenix City Council established a task force of lay citizens to review alternatives to reach 4 of the ACDC (Dreamy Draw to Cudia City Wash). The task force identified the use of detention basins in reach 4, as having the potential for being less costly than the reach 4 design shown in the FDM. The use of detention basins might also result in significant decreases in the ACDC size in reaches 3 and 4. In a motion passed at their meeting on July 29, 1986, the Council asked the Corps to study the feasibility of detention basins in reach 4. In the same motion, the Council agreed to support the FDM plan for reach 4 if a detention basin plan did not prove feasible. Feasibility was to be based on a cost comparison with the FDM design and on the reduction in the size (particularly the width) of ACDC reaches 3 and 4 resulting from the use of detention basins.

The Corps of Engineers agreed to perform an analysis of the proposed detention basins. Four basin sites were identified for analysis. These sites are shown on plates 2 and 3 and are identified as Stanford Drive, 35th Street, Biltmore North, and Biltmore South. This report presents the Corps' analysis of the potential effects of detention basins located at these sites.

## PURPOSE OF STUDY

The purpose of this study is to provide a comparison of costs and channel widths of the FDM design of the ACDC reaches 3 and 4 versus the costs and widths along the same channel reaches that would result from constructing detention basins in reach 4.

## SCOPE OF STUDY

Construction of reach 1 of the ACDC (Cactus Road to Skunk Creek) is completed. A construction contract for reach 2A (47th Drive to Cactus Road) was awarded in October 1986, and a contract for reach 2B (29th Avenue to 47th Drive) is scheduled to be awarded in May 1987. Because of these construction schedules and because detention basins in reach 4 would have little effect on reaches 1, 2A, and 2B, they were not included in this study. The designs of Cudia City Wash sediment basin, Cave Creek sediment basin, and Cave Creek Channel would not be affected by the inclusion of the basins. These features, therefore, were not included in this study. The Biltmore South detention basin was deleted from the study because of: (1) its small capacity (12 acre-feet), (2) the difficulty of getting the ACDC flows to the basin, and (3) the difficulty in emptying the basin once the peak flows receded in the ACDC. The study described in this report includes the ACDC, reaches 4 and 3 (Cudia City Wash to Cave Creek), and three detention basins located north of reach 4 (Stanford Drive, 35th Street, and Biltmore North detention basins). (See pls. 2 and 3).

Reductions in channel size and flood control costs were determined for each of the three basin alternatives and all combinations thereof. Each of the basin alternatives would consist of one or more basins in combination with the corresponding downsized ACDC.

## DESCRIPTION OF ALTERNATIVES

The Stanford Drive detention-basin alternative (Alt. E-A) includes a basin located adjacent to and north of the ACDC, between 34th and 36th Streets. The basin would be somewhat triangular in shape with an average depth below ground surface of 18 feet. The basin would have an area of 12.3 acres at the spillway crest, and 12.8 acres would be required for rights-of-way. The spillway crest would be 2.5 feet deep and 310 or 480 feet long, dependent upon the alternative selected. The basin inlet and side slopes would be 1 vertical on 3 horizontal and the inlet would be covered with 18-inch-thick grouted stone. The outlet of the basin would consist of an intake structure and a 3.0-foot-diameter reinforced concrete pipe, 30 feet long, with a flap gate. The water drained from the basin would be discharged into the ACDC.

The 35th Street detention-basin alternative (Alt. E-B) includes a flow-through basin that would be located on an unnamed wash, approximately 1/4 mile north of the ACDC, just west of 35th Street. The

basin would be rectangular in shape with an average depth below ground surface of 27 feet. The basin would have an area of 7.8 acres at the spillway crest, and 12.4 acres would be required for rights-of-way. The spillway crest would be approximately 500 feet long. The basin side slopes would be 1 vertical on 2 horizontal and would be covered with 15-inch-thick grouted stone at the inlet and 12-inch-thick grouted stone at the spillway. The crest, downstream slope, and apron of the spillway would be covered with 18-inch-thick grouted stone. The outlet of the basin would consist of an intake tower and a 4.5-foot-diameter reinforced concrete pipe, 904 feet long. The water drained from the basin would be discharged into the ACDC. Because the basin would be located in a residential area, further consideration of the basin's configuration would be made if this alternative is selected.

The Biltmore North detention-basin alternative (Alt. E-C) includes a detention basin adjacent to and north of the ACDC on the Arizona Biltmore hotel golf course. The basin would be shaped to complement the existing contours of the golf course with an average depth below ground surface of 40 feet. The basin would have an area of 10.5 acres at the spillway crest, and 18.3 acres would be required for rights-of-way. The spillway crest would be 4.0 feet deep and 200, 250, 450, or 525 feet long, dependent upon the alternative selected. The basin inlet and side slopes would be 1 vertical on 2 horizontal, and 1 vertical on 4 horizontal, respectively. The inlet would be covered with 16-inch-thick grouted stone. The outlet of the basin would consist of an intake structure and a 3.0-foot-diameter reinforced conrete pipe, 27-feet long, with a flap gate. The water drained from the basin would be discharged into the ACDC.

The Stanford Drive and 35th Street detention-basins alternative (Alt. E-AB) would include the detention basins at their respective locations.

The Stanford Drive and Biltmore North detention-basins alternative (Alt. E-AC) would include the detention basins at their respective locations.

The 35th Street and Biltmore North detention-basins alternative (Alt. E-BC) would include the detention basins at their respective locations.

The Stanford Drive, 35th Street, and Biltmore North detention-basins alternative (Alt. E-ABC) would include all three detention basins at their respective locations.

For additional physical data of the basins, see table 1.

# BASES OF DESIGN

## Hydrology

Information and study results such as general description of the drainage area, precipitation and runoff, synthesis of standard project flood (SPF), and discharge-frequency analysis are presented in references 1 and 2. These design memorandums were approved by the South Pacific Division in 1975 and 1985, respectively. The contributing drainage areas of the study site are shown on plate 4; and a schematic of the ACDC for the plan, including all three of the basins, is shown on plate 5.

To develop the hydrographs in this study, as in the all channel design, the August 1954 Queen Creek Storm, with a 7-hour duration, was transposed to the Phoenix area and critically centered over the drainage area above each concentration point. This rainfall was then applied to synthesized unit hydrographs from each area in order to determine the SPF hydrographs. The 100-year hydrograph was then determined by applying the urbanized watershed frequency relationship (Ref. 2), to the SPF hydrograph (0.45 x SPF = 100-year flood). Each subarea hydrograph was then routed through the ACDC using the Muskingum routing procedure.

### Detention Basins

Stanford Drive basin is a 138 acre-foot side-spillway basin which receives peak flow from the ACDC and detains it until the flow in the ACDC starts receding. The basin also receives flow from a 0.17-square mile directly-contributing drainage area.

The 35th Street basin is an instream flow-through basin located on a 1.14-square-mile unnamed tributary to the ACDC, downstream from 35th Street. The 100-year peak inflow to the basin is 2100 cfs, and the maximum outflow is about 220 cfs during the design event. The design volume of this basin consists of 123 acre-feet for contributing flow, 5 acre-feet for sediment, and approximately 20 acre-feet for 2.5 feet of freeboard.

The Biltmore North basin is a 62-acre-foot side-spillway basin which receives peak flow from the ACDC and detains it until the flow in the ACDC starts receding. The basin would also receive flow from a 0.23-square-mile directly-contributing drainage area.

The size of each detention basin was primarily dictated by the physical limitations of its respective site. The spillway designs were based on elevation-capacity curves and the 100-year design flood hydrograph. Pertinent data for each basin is listed in table 1; the elevation-storage-outflow relationships of 35th Street detention basin are presented in table 2; and the design discharges for the ACDC are listed in table 3.

Routings of the hydrographs at the Stanford Drive and Biltmore North detention basins were based on the simplified assumption that the basins would temporarily store that portion of the hydrograph required to achieve the maximum reduction in peak discharges. This simplified analysis is considered adequate for this study; however, a spillway rating curve would need to be developed if further detailed studies are found warranted. Hence, this study presents the idealized optimum effect of the detention basins on reducing channel size; detailed hydraulic design could result in somewhat larger channel-size requirements.

Routing through the 35th Street detention basin was accomplished using the Modified Puls reservoir routing procedure and the elevation-storage-outflow relationships presented in table 2.

Sediment Allowance

The sediment allowance for the 35th Street basin is 5 acre-feet. This was determined by reducing the Cudia City Wash sediment basin design volume according to the slope of a drainage area versus sediment production curve from Southern California Streams. For the Stanford Drive and Biltmore North side-spillway basins, the directly contributing drainage area was so small that a token amount of 1 acre-foot was reserved for sediment. Spillway flow from the ACDC will be reasonably free of sediment because: (1) the Cudia City Wash sediment basin is upstream from the basins and (2) there is little opportunity for sediment to enter into the channel between the Cudia City Wash sediment basin and the detention basins.

Volume Analysis

The existing ACDC design (without detention basins) is based on the peak flow at each location in the channel, without particular interest in the volume. Because the channel capacity always increases downstream, there is little chance of inducing flooding of a previously unaffected area. When detention basins are added, however, the distribution of volume in the design flood becomes critical. A longer, greater volume hydrograph could cause overflows downstream from a basin where the ACDC design capacity is less than the design capacity upstream from the basin. Therefore, the critical design factors are dependent on the amount and distribution of the volume in the hydrograph and the capability of the spillway to pass the peak flow and not allow the ACDC design discharge to be exceeded.

Historically, the type of storm that produces high-peak discharges in small watersheds like the study area is a high-intensity, short-duration, localized thunderstorm that has a fairly small areal extent. Nearly all rainfall occurs in about 6 hours, with most of the rain falling in 2 to 3 hours.

Examples of storms having these characteristics are the June 22, 1972, and August 28-29, 1986, storms. Longer duration general storms, which produce more total volume of rain, are often 1 - 3 days of

relatively lower-intensity rainfall. These storms can produce very high-peak discharges from large basins, as was seen in 1978 and 1980, but do not produce nearly as high a peak discharge from small basins as do intense local thunderstorms.

Because the amount and distribution of flood volume in the design hydrograph is important when detention basins are included in the flood-control system, the limited volume data that is available was inspected. Using the recorded runoff volume data available from the "Agua Fria Tributary at Youngtown," USGS No. 9-5137 drainage area (0.13 sq. mi.), and "Salt River Tributary in South Mountain Park," USGS No. 9-5122 drainage area (1.75 sq. mi.), it was found that, for events which produce the annual maximum peak discharge, the 1-day average-flow rate was less than 3 percent of the peak discharge. This indicates that, on small drainage areas, the flood events that produce maximum peak discharges are of very short duration. The design storm used to shape the design-flood hydrographs for the ACDC is based on the August 1954 Queen Creek local storm. This design storm has a 7-hour duration with most of the rain occurring in the maximum 3 hours. In fact, the maximum 1-hour amount for a small areal extent is about 80 percent of the total storm amount. The ACDC hydrographs shaped with this storm have an average 1-day flow rate of about 7 percent of the peak, as compared with less than 3 percent for the streamgauge records mentioned above. Volume-frequency analyses of the streamgauge records for larger watersheds, such as Indian Bend Wash and New River near Phoenix (ref. 3), produce much higher ratios of 1-day volumes to peak flows for high peak discharges (on the order of 15 percent), indicating the volume is distributed over a longer period of time, and there is relatively more volume than in the events causing high peaks in small watersheds. Thus, it was concluded that the relationship between peak discharge and volume in the ACDC design hydrographs was adequate.

The adequacy of the volume and distribution of the ACDC design hydrographs shaped by the 7-hour Queen Creek storm, which represents the critical design condition for the detention basins, was further tested by comparison with National Oceanic and Atmospheric Administration (NOAA) rainfall depths (volume). The 100-year design-flood-runoff volume derived from the 7-hour storm over the 4.9-square-mile Cudia City Wash drainge area is 580 acre-feet, which is equivalent to about 2.22 inches of runoff from the watershed. The NOAA 7-hour; 100-year-point rainfall for the study area is about 3.25 inches, and the 24-hour, 100-year-point rainfall is 3.80 inches, which amounts to rainfall volumes of 850 and 990 acre-feet, respectively, over the Cudia City Wash watershed. The design-flood-runoff volume is 68 percent of the NOAA 100-year, 7-hour rainfall volume and about 58 percent of the NOAA 100-year, 24-hour rainfall volume. Based on this comparison of the design-storm-runoff volume with the NOAA rainfall volume, the design storm is considered to have adequate volume and appropriate distribution for the detention-basin analysis.

## Results

The Stanford Drive detention basin reduced the peak 100-year discharge from Cudia City Wash by about 3000 cfs or 45 percent. The downstream peak reduction effect of this basin is quickly overcome as the flow from subarea 2B enters the ACDC approximately 1200 feet downstream from the Stanford Drive basin. (See pls. 5 and 6.) This basin, as do all of the basins, becomes less effective downstream because additional inflow to the channel adds to the peak discharge further downstream.

The 35th Street detention basin, by itself, reduces the ACDC 100-year design discharge by about 1200 cfs. The 35th Street basin retains its peak discharge reduction capabilities further downstream than the other basins because it is a flow-through basin and detains the entire 100-year hydrograph, minus the outflow, instead of just diverting and storing the peak of the hydrograph. Plate 7 shows design hydrographs at CP 102 above 32nd Street (downstream from 35th Street basin) for each alternative.

The Biltmore North detention basin operates like a combination of the other two basins because it detains the peak of the ACDC overflow and also detains directly contributing inflow. It is the smallest of the three basins and, therefore, overall is less effective at reducing the 100-year design discharge. It becomes even less effective in combination with the other basins because the upstream basins alter the hydrograph shape such that the magnitude of the peak reduction is decreased for the same volume detained.

When two or three basins were included in one alternative, the effect on the channel design discharges were not additive. For instance, the 35th Street basin decreased the overall hydrograph while the Stanford Drive basin just reduced the peak. When each was combined with the Biltmore North basin, the 35th Street basin did not affect the ACDC peak-reduction capability of the Biltmore North basin as much as the Stanford Drive basin did. Incorporating the Stanford Drive and the 35th Street basins together resulted in a design hydrograph which combined the effect of each basin to create a greater reduction in design flows than the sum of the reductions caused by each basin separately. (See pl. 7.) Hydrographs at each concentration point for the alternative that includes all three basins are presented on plate 8.

## Hydraulics

The primary objective of the hydraulic study was to evaluate the extent to which the base widths of reaches 3 and 4 of the FDM plan could be reduced to accommodate the attenuated design peak discharges associated with the detention-basin plans, while maintaining the wall heights, channel slopes, and channel alignment as presented in the FDM.

## Design Assumptions and Analysis

Stanford Drive and Biltmore North detention basins are contiguous to the channel and would function primarily as storage facilities for flows diverted from the ACDC through a side overflow spillway. (See pl. 3.) The 35th Street basin would be an off-channel basin that would detain flows from an unnamed wash which flows into the ACDC. A basin on this wash would decrease the design-peak discharges in the ACDC. The detained floodflows would be released from the 35th Street basin into the ACDC via a covered reinforced-concrete pipe.

To expedite the evaluation of the peak-reducing capability of the Stanford Drive and Biltmore North detention basins, these basins were assumed to function at maximum efficiency. The upper portions of the inflow hydrographs were truncated at the discharge level. (See line 1 of fig. 1.) The volume represented by the truncated segment would be equivalent to the effective storage capacity of the basin as measured at the sill elevation of the side overflow spillway. The attenuated peak discharge and the resultant decrease in design discharges along the ACDC were used to resize the channel. The actual impact of the basin on the inflow hydrograph could be more realistically represented by line 2 of figure 1. The approximation that was applied is considered adequate for this initial evaluation of the feasibility of the detention basins.

Pertinent data for each detention basin is presented in table 1.

A broad-crested weir section (C = 3.087) was used in determining the spillway requirements. Figure 2 illustrates the simplified assumptions that were applied in determining the length of the spillway. No attempt was made to establish a spillway configuration that would function at optimum efficiency since this would not only be beyond the scope of this study, but would not be a significant factor in meeting the objectives of this study.

The sill for each side overflow spillway was set at an elevation that would provide a reasonable discharge head (1.5 to 2 feet) at the controlling downstream end of the spillway during peak-flow conditions. The approximate length of the spillway was computed based on the assumption that the controlling water surface profile at the downstream end of the spillway would be basically similar to the design water-surface profile (n = 0.014) in the FDM. This would be consistent with the assumption discussed earlier on maintaining the FDM water-surface profile (n = 0.016) for setting the wall heights. Table 1 presents the pertinent data including spillway length and spillway sill elevations.

## Arizona Canal Diversion Channel

Water-surface computations for the FDM were based on "n" values of 0.014 and 0.016 for design water-surface profiles and for determining top of wall-height requirements, respectively. For this study an "n" value of 0.016 was applied for determining channel base-width reductions with the intent of maintaining the FDM channel wall height. All other

FDM design features, including channel invert slope and channel alignment, were preserved for this hydraulic study. It can be reasonably anticipated that the design water surface (n = 0.014), for the alternative plans would approximate the design water-surface profile in the FDM.

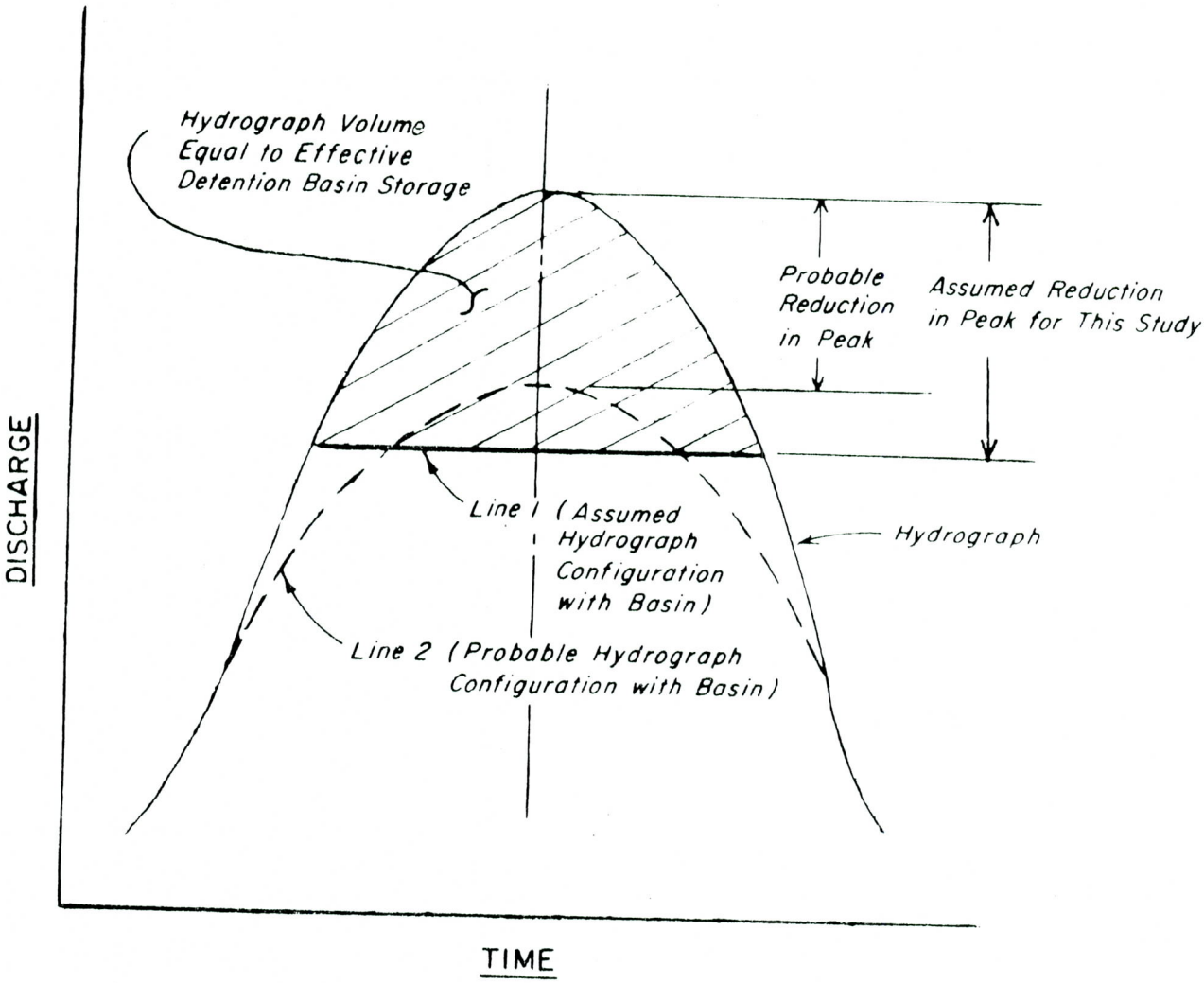



Figure 1. Hydrograph Illustration

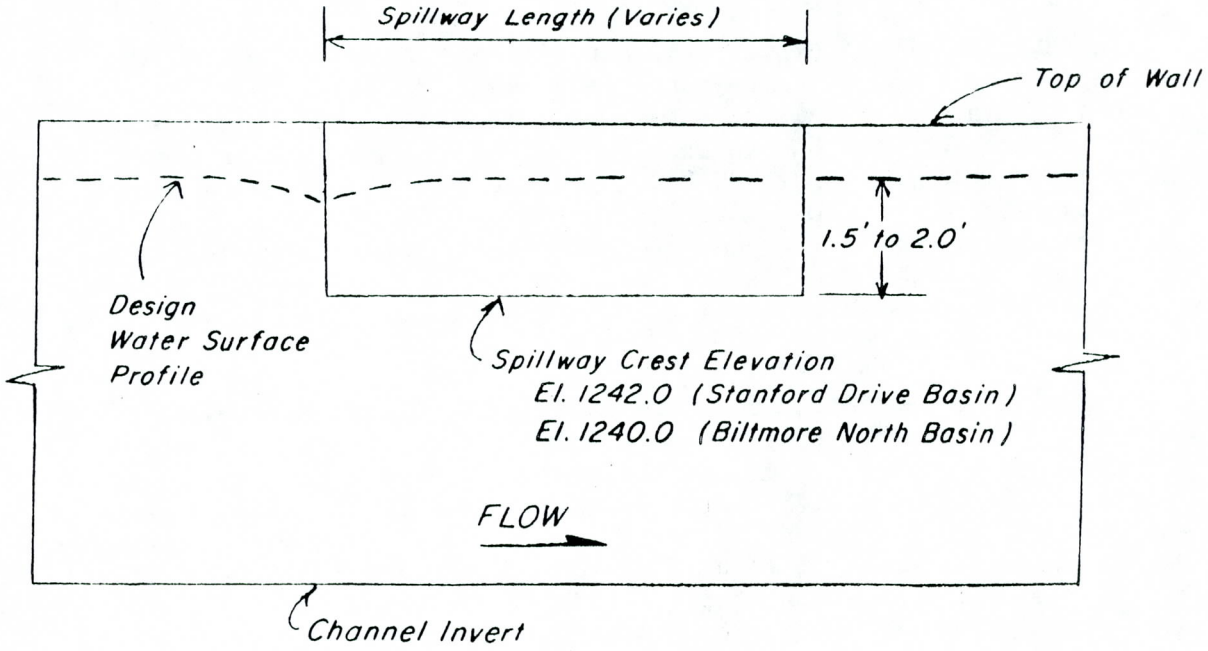



Figure 2. Typical Spillway Profile

## Summary of Hydraulic Results and Discussion of Detention-Basin Plans

Table 3 summarizes the altered peak discharges and channel widths at selected locations due to the inclusion of the alternative detention-basin(s) plans. Table 4 provides a detailed list of channel widths for all of the alternatives.

Should final design studies be initiated on any of the detention-basin plans, hydraulic consideration must be given to the reliability of a side-overflow spillway to route a hydrograph, particularly under the given conditions, where shape of the hydrograph, actual backwater conditions that may prevail, "fixed" storage aspects of the basins, range of friction coefficients, and bridge-pier-debris loadings would have a significant effect on how adequately the system would function.

## Geotechnical

The Stanford Drive detention basin site has surficial materials generally consisting of silty sands to gravelly silty sands. Alternating layers of well-cemented (or caliche-cemented) and poorly cemented alluvium were encountered to a depth of 29 feet near the Arizona Canal in drill hole DH 82-8, part of the subsurface investigation for the ACDC. Limited water-well data for the Cudia City Wash area indicates that groundwater at this site may be at depths as shallow as 30 feet. The presence of layers of well-cemented alluvium will probably necessitate ripping techniques to be employed to facilitate excavation.

The 35th Street detention-basin site has surficial materials consisting of gravelly silty sands with scattered cobbles and rock fragments to 6 inches. Numerous exposures of caliche-cemented rock fragments are present at a depth of about 1 to 2 feet along the banks of the drainage channel which enters the project area from the northeast. No subsurface information (including groundwater levels) is available for this site but it is anticipated that the alluvial materials will be well-cemented due to their closer proximity to the Phoenix Mountains. This would likely require a significant amount of ripping and possibly some light blasting to facilitate excavation of the alluvial materials and any shallow bedrock.

The Biltmore North detention-basin site has surficial materials which consist mainly of clayey sandy gravels. Alternating layers of well-cemented and poorly cemented alluvium were encountered to a depth of 28 feet near the Arizona Canal in ACDC drill hole DH 82-2. Ripping techniques would undoubtedly have to be employed to facilitate excavation of the well-cemented alluvium within the basin limits, particularly in the upper reaches of the basin which are closer to the Phoenix Mountains. Water-well data is not available for this site but groundwater was not encountered during the 1982 subsurface investigations for the ACDC in this reach.

### Recreation

The Town of Paradise Valley has consistently opposed project-related recreational facilities within the town and, therefore, no plans have been made to include recreation in the Stanford Drive and 35th Street detention basins. The Biltmore North detention basin would remain private property, and the hotel's golf course would be restored in the bottom of the basin. Recreation would be incorporated into the Phoenix portions of the ACDC reaches 3 and 4 as shown in the FDM.

### Esthetics

High visibility landscape designs as defined in the FDM would be developed for the Stanford Drive and 35th Street detention basins. These plantings would consist of low and moderate water-demanding trees, shrubs, and ground cover which would furnish a wide variety of colors, textures, and plant heights.

Restoration of the golf course within the Biltmore North detention basin would be required to adhere to hydrological considerations established by the City of Phoenix, Maricopa County Flood Control District, and the U.S. Army Corps of Engineers.

## EVALUATIONS OF ALTERNATIVES

### Environmental

A "Final Environmental Impact Statement" (FEIS) was prepared by the Corps in March 1976 to address the environmental impacts associated with construction of the ACDC as discussed in the GDM. In addition, the Corps completed an "Environmental Assessment," along with a "Finding of No Significant Impact" (EA/FONSI), as part of the FDM, to address changes made subsequent to completion of the FEIS. This report will address only those changes resulting from the construction of the detention basins.

The existing land use of the areas affected by the detention basin alternative would be changed from urban/disturbed scrub to open space, with landscaping being added for esthetic treatment.

The esthetic effects of excavating the Stanford Drive and 35th Street basins would be mitigated with appropriate landscaping. Stanford Drive basin would be enclosed with ornamental steel fencing similar to that approved for use on the ACDC. The esthetic impact of excavating the Biltmore North basin would be mitigated by restoring the golf course.

The esthetic-design concept for the ACDC would remain unchanged if a detention-basin plan were to be implemented. However, the basin(s) would result in a narrower channel in some reaches of the ACDC, thus making additional space available for landscaping.

A literature search and field survey for cultural resources at the site of the detention basin was conducted as a part of this study. This work disclosed no significant cultural resources. Certain portions of the detention-basin areas were not accessible during the field surveys and would have to be examined prior to implementing a detention-basin plan that would affect the unsurveyed areas. If a detention basin alternative were to be selected over the FDM plan, additional survey and coordination with the Arizona State Historic Preservation Officer (SHPO) should be completed for the Stanford Drive and/or 35th Street detention basin alternative(s). If the Biltmore North detention basin alternative is selected, the SHPO might require on-site monitoring during construction in the event sites remain buried beneath the golf course. All these actions would have to be coordinated with the SHPO as per the Memorandum of Agreement (1976) for the New River and Phoenix City Streams project.

Vegetation and wildlife resources were examined for this report and because of the urban nature of the basin site, it was determined that basin construction would not significantly impact the biotic resources.

Social resources would be the primary impact for any of the proposed detention basin alternatives. The effect of removing eight more homes compared to the FDM plan for the construction of the Stanford Drive basin (five homes) and 35th Street basin (three homes) would be a significant impact. This would need to be fully covered in an appropriate National Environmental Policy Act document.

If a detention basin plan were to be selected over the FDM plan, preparation of a supplement to the FEIS would be required. As noted in Engineer Regulation 200-2-2, Appendix C, " . . . where there are significant impacts resulting from design changes or new circumstances have occurred, a draft and final EIS supplement . . . shall be prepared." In addition, the impacts noted above are considered to be significant in light of the definition of significance provided in part 40 of the "Code of Federal Regulations" (CFR), section 1508.27.

## Economics

All the plans considered in this report protect the same area from flooding, and all the plans would completely control the one-percent chance (100-year) flood. For floods in excess of the 100-year flood, the detention-basin alternatives would produce less benefits than the all-channel design because the reduced size channels downstream from the basins would control a smaller portion of the larger flood peaks than would the all-channel design. A simplistic, but reasonably accurate, illustration can be drawn from the standard project flood on Cudia City Wash. This flood, with about a 500-year recurrence interval has an estimated peak of 15,000 cubic feet per second (cfs). The all-channel plan would divert 6700 cfs of this flood to the west, and, because the channel continually increases in size to the west, it would always be able to divert 6700 cfs. The remainder of the flood, about 8300 cfs,

would overflow the Arizona Canal, causing damage below the canal. With the Stanford Drive basin in place, the reduced channel size downstream from the basin would convey only 3700 cfs of the Cudia City Wash SPF, leaving approximately 11,300 cfs to overflow the Arizona Canal, an increase of about 3000 cfs over the all-channel plan. The distribution of flows provided here may not be precise, but they are sufficiently accurate to demonstrate the difference in operation between the FDM plan and the detention-basin plans.

## Costs

A summary of first costs and cost apportionment for flood control estimates are presented in tables 5 through 13. Quantities of the principal construction items for each plan were estimated on the basis of a detailed design. Unit costs from the FDM based on a breakdown of plant, labor, and materials or from abstracts for similar work in the Phoenix area were used and escalated to October 1986 price levels. Contingency allowances of 15 and 20 percent are included in the estimates for the channel and basins, respectively. Costs for engineering and design and for supervision and administration are based on a percentage of the construction cost. The percentage is derived on the basis of cost for similar work by the Los Angeles District.

The cost estimate for each alternative was based on a channel design with the same wall heights as the FDM channel in order to achieve the maximum reduction in channel width. The sensitivity of using a channel design with less width reduction in order to reduce the wall heights, and possibly the overall cost, was analyzed. This was done for Alternative E-ABC, the three-basin alternative, in the 7,225-foot reach from the Stanford Drive detention-basin site just east of 32nd Street to 24th Street. This is the reach where the greatest width reductions, 16 feet for a length of 3,425 feet and 11 feet for 3,800 feet, were achieved. Design problems that would be created by a higher channel invert from the Stanford basin site upstream to Cudia City Wash were not analyzed. The reach downstream of 24th Street was not included in the analysis because the maximum reduction was only 7 to 6 feet for the remainder of Reach 4 and only 2 feet for most of Reach 3. The analysis was based on comparing the cost of a 20- to 25-foot-wide channel with the cost of a 28- to 35-foot-wide channel having about 6-foot less wall height. The analysis indicated that the wider channel would cost approximately 11 percent more than the narrower channel in the study reach. The greater cost for the wider channel is likely caused by 68 percent of the channel reach being covered.

Costs of lands and damages were based on a combination of estimated land values of the rights-of-way acquired and remaining to be acquired by local interests. The sites under study were inspected; knowledgeable principals, real estate brokers and government officals were interviewed;

and the real estate market was analyzed to make an estimate of cost. Included are costs for severance damages, acquisition, and relocation assistance.

The ACDC rights-of-way widths from the FDM, instead of reduced rights-of-way widths, were used for each alternative because: (1) much of the land has been acquired, thus it may not be feasible to sell narrow strips of land; (2) there would be little, if any, difference in cost for alternative widths in the covered reaches; and (3) it would be desirable to retain land gained from channel-width reductions for esthetic treatment. A sensitivity analysis based on FDM lands costs indicated that, if the rights-of-way widths were to be reduced the same amount as the channel-width reductions for each alternative, the maximum savings in costs would be approximately, as follows: Alt. E-A, $281,000; Alt. E-B, $429,000; Alt. E-C, $87,000; Alt. E-AB, $772,000; Alt. E-AC, $398,000; E-BC, $542,000; and E-ABC, $854,000. In fact, the savings would be much less than these amounts.

## COMPARISON TO FEATURE DESIGN MEMORANDUM (FDM) PLAN

The ACDC wall heights, lengths, and geometric configurations for each detention basin alternative studied would be the same as those discussed in the FDM plan. The same reaches of channel designated as covered for the FDM plan would also be covered for each of the alternative plans, except for a short reach at the Biltmore North detention basin. Cudia City Wash and Cave Creek sediment basins and Cave Creek Channel, as described in the FDM plan, would also be constructed as part of any basin plan.

Reach 4, as described in the FDM, begins at Cudia City Wash and extends downstream to Dreamy Draw, a distance of approximately 4.2 miles. In this reach, the channel will be rectangular with base widths ranging from 36 to 50 feet. The channel is 36 feet wide along the Biltmore Estates. Wall heights will vary from 21.2 to 24.5 feet, generally. A maximum wall height of 30.5 feet will occur for a 120-foot reach on the western end of the 24th Street covered section. The channel will be open except for a reach along Stanford Drive east of 32nd Street (1297 feet) and from just east of the Arizona Biltmore Hotel to 24th Street (4625 feet).

Reach 3, as described in the FDM, begins at Dreamy Draw and extends downstream to Cave Creek, approximately 3.6 miles long. In this reach, the channel will be rectangular with base widths ranging from 50 feet to 60 feet and wall heights ranging from 19.0 feet to 23.0 feet. The channel will be open except for a covered portion adjacent to the Sunnyslope High School (2565 feet).

See table 3 for channel widths associated with each alternative plan.

## CONCLUSIONS

As can be seen in table 5, "Summary of First Costs for Flood Control Alternative Plans", the FDM channels only plan is the least-cost alternative of the plans considered in this report. The FDM plan would also produce somewhat greater benefits than the detention basin plans considered, as discussed under "Economics". The flood-control cost for the FDM plan is $127,170,000; $2,280,000 less than the lowest cost basin plan (Stanford Drive detention basin) and $9,310,000 less than the basin plan with the greatest flood control cost (all three basins), the plan that would produce the most reduction in ACDC widths. Table 5 shows that local costs for all the detention-plans would increase compared to the FDM plan.

The greatest channel-width reduction which would result from constructing only one of the basins would result from constructing the Stanford Drive detention basin. As shown in table 3, this plan would result in reductions up to 6 feet in some places along reach 4. The flood-control cost for building the Stanford Drive detention basin would be $129,450,000, or $2,280,000 more than the FDM plan.

The greatest channel-width reductions for any one combination of basins would be the plan that would include all three of the basins. This plan would result in reductions as much as 16 feet in some places along reach 4, but the flood-control cost for this plan would be $136,480,000, or $9,310,000 more than the FDM plan. Plan E-AB, which includes the Stanford Drive and 35th Street detention basins would produce almost as much reduction in channel width as would the three-basin plan but at a substantially lower cost of $131,800,000.

For all the detention-basin alternatives, the greatest width reductions, 0 to 15 feet, would occur between Stanford Drive detention basin and 24th Street, a reach that would include 74-percent covered channel under the FDM plan. The greatest channel-width reduction west of 24th Street, resulting from a combination of all three basins, would be 7 feet, which would decrease rapidly with distance westward.

The associated channel widths and summary of flood control costs for each alternative can be seen in tables 4 and 5, respectively. All the plans discussed in this report, the associated total flood-control costs, and the costs above the FDM plan cost for reaches 3 and 4 are listed, as follows:

| ACDC (Cudia City Wash to Cave Creek) Plan Cost | | Total Flood Control Cost | Cost Above FDM Plan |
|---|---|---|---|
| E-FDM | Without detention basins (FDM plan) | $127,170,000 | $0 |
| E-A | With Stanford Drive detention basin | 129,450,000 | 2,280,000 |
| E-B | With 35th Street detention basin | 129,900,000 | 2,730,000 |
| E-C | With Biltmore North detention basin | 131,030,000 | 3,860,000 |
| E-AB | With Stanford Drive & 35th Street detention basins | 131,800,000 | 4,630,000 |
| E-AC | With Stanford Drive & Biltmore North detention basins | 133,810,000 | 6,640,000 |
| E-BC | With 35th Street & Biltmore North detention basins | 133,790,000 | 6,620,000 |
| E-ABC | With Stanford Drive, 35th Street, & Biltmore North detention basins | 136,480,000 | 9,310,000 |

## REFERENCES


1. Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 2, Hydrology, Part 1, October 1974.

2. Gila River Basin, Phoenix, Arizona and Vicinity (Including New River). Design Memorandum No. 2, Hydrology, Part 2, 1982.

3. Gila River Tributaries, Central Arizona Water Control Study Hydrology Report, May 1982.

Table 1. Pertinent Data.

| Item | Unit | Amount | | |
|---|---|---|---|---|
| | | Stanford Drive Detention Basin | 35th Street Detention Basin | Biltmore North Detention Basin |
| Drainage area (directly-contributing) | sq mi | 0.17 | 1.14 | 0.23 |
| Spillway: | | | | |
| Crest elevation | ft, msl | 1242.0 | 1255.0 | 1240.0 |
| Crest length: | | | | |
| Alternative E-A | ft | 480 | | |
| Alternative E-B | ft | | 500 | |
| Alternative E-C | ft | | | 525 |
| Alternative E-AB | ft | 310 | 500 | |
| Alternative E-AC | ft | 480 | | 250 |
| Alternative E-BC | ft | | 500 | 450 |
| Alternative E-ABC | ft | 310 | 500 | 200 |
| Outlet works: | | | | |
| Conduit diameter | ft | 3.0 | 4.5 | 3.0 |
| Conduit length | ft | 30 | 904 | 27 |
| Intake elevation | ft, msl | 1225.0 | 1231.9 | 1222.0 |
| Basin: | | | | |
| Depth below spillway crest | ft | 19 | 23 | 18 |
| Average depth below ground surface | ft | 18 | 27 | 40 |
| Maximum depth below ground surface | ft | 31 | 32 | 65 |
| Area at spillway crest | acre | 12.3 | 7.8 | 10.5 |
| Area of rights-of-way | acre | 12.8 | 12.4 | 18.3 |
| Gross capacity at spillway crest | acre-ft | 138 | 148 | 62 |
| 100-year flood: | | | | |
| Total volume | acre-ft | 138 a | 154 | 62 a |
| Peak inflow: | | | | |
| Overland | cfs | 290 | 2100 | 380 |
| Over spillway | cfs | 3000 | 0 | 1300 |
| Peak outflow | cfs | b | 220 | b |

a. Combined volume from direct runoff and side spillway.

b. Three-foot diameter conduit with flap gate would be provided for nominal discharge after ACDC flows recede.

Table 2. 35th Street Detention-Basin Elevation-Storage Outflow Relationships.

| Elevation (ft) | Storage[a] (ac-ft) | Outflow (cfs) |
|---|---|---|
| 1233.5 | 0 | 0 |
| 1235 | 8 | 27 |
| 1237 | 19 | 75 |
| 1241 | 43 | 122 |
| 1245 | 69 | 160 |
| 1249 | 96 | 193 |
| 1255 | 141 | 235 |

a. Excluding volume for sediment.

Table 3. Summary of Hydraulic Data.

| Concentration Point of 100-yr. Peak Design Discharge | | Alternative Plans | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ACDC Cudia City Wash to Cave Creek FDM Plan (E-FDM) | | Stanford Drive Detention Basin & ACDC Cudia City Wash to Cave Creek (E-B) | | 35th Street Detention Basin & ACDC Cudia City Wash to Cave Creek (E-B) | | Biltmore North Detention Basin & ACDC Cudia City Wash to Cave Creek (E-C) | | Stanford Drive & 35th Street Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AB) | | Stanford Drive & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AC) | | 35th Street & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-BC) | | Stanford Drive, 35th Street, & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-ABC) | |
| No. | Location (Drainage Area) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) | Discharge (cfs) | Width (ft) |
| 101 | Below Cudia City Wash (4.9 sq mi) | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 |
| | Above Stanf Dr Det Bas | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 | 6,700 | 36 |
| 102S | Below Stanf Dr Det Bas (5.1 sq mi) | 6,700 | 36 | 3,700 | 30 | 6,700 | 36 | 6,700 | 36 | 3,700 | 20 | 3,700 | 30 | 6,700 | 36 | 3,700 | 20 |
| | Above 35th St Det Bas | 6,700 | 36 | 3,700 | 30 | 6,700 | 36 | 6,700 | 36 | 3,700 | 20 | 3,700 | 30 | 6,700 | 36 | 3,700 | 20 |
| 102 | Below 35th St Det Bas (6.3 sq mi) | 7,900 | 36 | 5,400 | 30 | 6,700 | 32 | 7,900 | 36 | 3,900 | 20 | 5,400 | 30 | 6,700 | 32 | 3,900 | 20 |
| | Above Bilt N. Det Bas | 7,900 | 36 | 5,400 | 30 | 6,700 | 32 | 7,900 | 36 | 3,900 | 27 | 5,400 | 29 | 6,700 | 32 | 3,900 | 20 |
| 808D | Below Bilt N. Det Bas (6.5 sq mi) | 8,000 | 36 | 5,500 | 30 | 6,800 | 32 | 6,500 | 34 | 4,000 | 27 | 4,600 | 29 | 5,400 | 30 | 3,400 | 25 |
| 103 | Near Sahuaro Drive (7.7 sq mi) | 8,300 | 36-40 | 6,500 | 30-38 | 7,100 | 32-36 | 7,200 | 34-39 | 4,900 | 27-33 | 5,900 | 29-35 | 6,000 | 30-34 | 4,600 | 25-33 |
| 104 | Near Ocotillo Road (8.8 sq mi) | 8,700 | 40 | 7,400 | 38 | 7,500 | 36 | 8,000 | 39 | 6,000 | 33-35 | 7,000 | 35-37 | 6,600 | 34-35 | 5,800 | 33-34 |
| 105 | Below 16th Street (9.9 sq mi) | 9,000 | 40-50 | 8,200 | 38 | 7,800 | 36-46 | 8,600 | 39-49 | 7,100 | 35-45 | 7,900 | 37-47 | 7,200 | 35-45 | 6,900 | 34-44 |
| 107D | Below Dreamy Draw (11.8 sq mi) | 10,000 | 50-60 | 9,900 | 48-60 | 9,200 | 46-58 | 10,000 | 49-60 | 9,000 | 45-58 | 9,700 | 47-60 | 9,000 | 45-58 | 8,800 | 44-58 |
| 108 | Below 10th Street (14.5 sq mi) | 13,000 | 60 | 13,000 | 60 | 12,000 | 58 | 13,000 | 60 | 12,000 | 58 | 13,000 | 60 | 12,000 | 58 | 12,000 | 58 |

Note: The channel width(s) are in the vicinity of the corresponding concentration point.

Table 4. Channel Widths.

| Location | | Channel Widths of Alternative Plans in Feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Station | Description | ACDC Cudia City Wash to Cave Creek FDM Plan (E-FDM) | Stanford Drive Detention Basin & ACDC Cudia City Wash to Cave Creek (E-A) | 35th Street Detention Basin & ACDC Cudia City Wash to Cave Creek (E-B) | Biltmore North Detention Basin & ACDC Cudia City Wash to Cave Creek (E-C) | Stanford Drive & 35th Street Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AB) | Stanford Drive & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AC) | 35th Street & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-BC) | Stanford Drive, 35th Street & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-ABC) |
| 999+93 | Just west of Cudia City Wash | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| 982+05 | | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| 980+35 | | 36 | Transition | 36 | 36 | 36 | Transition | 36 | 36 |
| 977+25 | Lower end of Stanford Dr. detention basin | 36 | 30 | 36 | 36 | 20 | 30 | 36 | 20 |
| 976+00 | Upper end of covered channel at Stanford Dr. | 36 | 30 | 36 | 36 | 20 | 30 | 36 | 20 |
| 970+75 | | 36 | 30 | 36 | 36 | 20 | 30 | 36 | 20 |
| 970+55 | Just east of 35th Street Wash | 36 | 30 | 32 | 36 | 20 | 30 | 32 | 20 |
| 967+30 | Confluence of 35th Street Wash and ACDC | 36 | 30 | 32 | 36 | 20 | 30 | 32 | 20 |
| 963+54 | Centerline of 32nd Street | 36 | 30 | 32 | 36 | 20 | 30 | 32 | 20 |
| 946+25 | | 36 | 30 | 32 | 36 | 20 | 30 | 32 | 20 |
| 945+50 | | 36 | 30 | 32 | | 20 | 30 | 32 | 20 |
| 945+45 | Upper end of FDM covered channel E. of hotel | 36 | 30 | 32 | | 20 | 30 | | 20 |
| 943+50 | | 36 | 30 | 32 | Transition | 20 | 30 | | 20 |
| 943+15 | Golf course bridge E. of AZ. Biltmore Hotel | 36 | 30 | 32 | | 20 | | Transition | 20 |
| 943+00 | | 36 | 30 | 32 | | 20 | Transition | | 20 |
| 941+35 | | 36 | 30 | 32 | | 20 | | | Transition |
| 941+00 | Lower end of Biltmore N. detention basin | 36 | 30 | 32 | 34 | 27 | 29 | 30 | 25 |
| 905+00 | Just east of 24th Street | 36 | 30 | 32 | 34 | 27 | 29 | 30 | 25 |
| 904+70 | | 36 | Transition | Transition | 34 | Transition | Transition | Transition | Transition |
| 904+65 | | 36 | | | 35 | | | | |
| 904+45 | | 40 | 38 | 36 | 39 | 33 | 35 | 34 | 33 |
| 903+94 | Centerline of 24th Street | 40 | 38 | 36 | 39 | 33 | 35 | 34 | 33 |
| 840+10 | | 40 | 38 | 36 | 39 | 33 | 35 | 34 | 33 |
| 840+00 | | 40 | 38 | 36 | 39 | 35 | 37 | 35 | 34 |
| 785+15 | Centerline of 12th Street | 40 | 38 | 36 | 39 | 35 | 37 | 35 | 34 |
| 784+70 | | 40 | 38 | 36 | 39 | 35 | 37 | 35 | 34 |
| 783+70 | | 50 | 48 | 46 | 49 | 45 | 47 | 45 | 44 |
| 778+00 | Dreamy Draw | 50 | 48 | 46 | 49 | 45 | 47 | 45 | 44 |
| 731+10 | | 50 | 48 | 46 | 49 | 45 | 47 | 45 | 44 |
| 730+61 | Centerline of 7th Street | 50 | Transition | Transition | Transition | Transition | Transition | Transition | Transition |
| 729+00 | | 50 | | | | | | | |
| 728+50 | | 60 | 60 | 58 | 60 | 58 | 60 | 58 | 57 |
| 649+90 | | 60 | 60 | 58 | 60 | 58 | 60 | 58 | 57 |
| 649+82 | | 60 | 60 | 58 | 60 | 58 | 60 | 58 | 58 |
| 593+50 | | 60 | 60 | 58 | 60 | 58 | 60 | 58 | 58 |
| 590+00 | | 60 | 60 | Transition | 60 | Transition | 60 | Transition | Transition |
| 587+50 | Just east of Cave Creek | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |

Table 5. Summary of First Costs for Flood Control Alternative Plans.
(October 1986 Price Levels)

| Cost Acct. No. | Description | Alternative Plans: ACDC Cudia City Wash to Cave Creek FDM Plan (E-FDM) | Stanford Drive Detention Basin & ACDC Cudia City Wash to Cave Creek (E-A) | 35th Street Detention Basin & ACDC Cudia City Wash to Cave Creek (E-B) | Biltmore North Detention Basin & ACDC Cudia City Wash to Cave Creek (E-C) | Stanford Drive & 35th Street Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AB) | Stanford Drive & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-AC) | 35th Street & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-BC) | Stanford Drive, 35th Street & Biltmore North Detention Basins & ACDC Cudia City Wash to Cave Creek (E-ABC) |
|---|---|---|---|---|---|---|---|---|---|
| | Construction: | | | | | | | | |
| 09. | Basin(s) | $0 | $2,810,000 | $3,660,000 | $4,240,000 | $6,230,000 | $6,930,000 | $7,860,000 | $10,340,000 |
| 09. | Channel | 64,300,000 | 60,600,000 | 61,200,000 | 62,700,000 | 57,500,000 | 59,800,000 | 59,800,000 | 56,800,000 |
| | Total, basin(s) and channel | 64,300,000 | 63,410,000 | 64,860,000 | 66,940,000 | 63,730,000 | 66,730,000 | 67,660,000 | 67,140,000 |
| 30. | Engineering and design | 6,430,000 | 6,341,000 | 6,486,000 | 6,694,000 | 6,373,000 | 6,673,000 | 6,766,000 | 6,714,000 |
| 31. | Supervision and administration | 6,370,000 | 6,319,000 | 6,444,000 | 6,656,000 | 6,367,000 | 6,707,000 | 6,804,000 | 6,746,000 |
| | Total, construction | 77,100,000 | 76,070,000 | 77,790,000 | 80,290,000 | 76,470,000 | 80,110,000 | 81,230,000 | 80,600,000 |
| | Lands and relocations: | | | | | | | | |
| | Lands and damages: | | | | | | | | |
| | Basin(s) | 0 | 3,910,000 | 3,090,000 | 0 | 7,000,000 | 3,910,000 | 3,090,000 | 7,000,000 |
| | Channel | 37,000,000 | 37,000,000 | 37,000,000 | 37,000,000 | 37,000,000 | 37,000,000 | 37,000,000 | 37,000,000 |
| | Total, lands and damages | 37,000,000 | 40,910,000 | 40,090,000 | 37,000,000 | 44,000,000 | 40,910,000 | 40,090,000 | 44,000,000 |
| | Relocations: | | | | | | | | |
| | Utilities | 2,220,000 | 2,073,000 | 2,054,000 | 2,183,000 | 1,860,000 | 1,956,000 | 1,990,000 | 1,770,000 |
| | Golf course | 0 | 0 | 0 | 840,000 | 0 | 840,000 | 840,000 | 840,000 |
| | Roads and bridges | 10,850,000 | 10,397,000 | 9,966,000 | 10,717,000 | 9,470,000 | 9,994,000 | 9,640,000 | 9,270,000 |
| | Total, relocations | 13,070,000 | 12,470,000 | 12,020,000 | 13,740,000 | 11,330,000 | 12,790,000 | 12,470,000 | 11,880,000 |
| | Total, lands and relocations | 50,070,000 | 53,380,000 | 52,110,000 | 50,740,000 | 55,330,000 | 53,700,000 | 52,560,000 | 55,880,000 |
| | Total, flood control | 127,170,000 | 129,450,000 | 129,900,000 | 131,030,000 | 131,800,000 | 133,810,000 | 133,790,000 | 136,480,000 |
| | Difference from FDM plan | 0 | 2,280,000 | 2,730,000 | 3,860,000 | 4,630,000 | 6,640,000 | 6,620,000 | 9,310,000 |

Table 6. Summary of First Cost for Flood Control Alternative Plan (E-FDM)
Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Dreamy Draw to Cave Creek (Reach 3) | Total, Channel |
|---|---|---|---|---|
| | Construction: | | | |
| 09. | Channel | $36,200,000 | $28,100,000 | $64,300,000 |
| 30. | Engineering and design | 3,620,000 | 2,810,000 | 6,430,000 |
| 31. | Supervision and administration | 3,580,000 | 2,790,000 | 6,370,000 |
| | Total, construction | 43,400,000 | 33,700,000 | 77,100,000 |
| | Lands and relocations: | | | |
| | Lands and damages | 16,800,000 | 20,200,000 | 37,000,000 |
| | Relocations: | | | |
| | Utilities | 1,680,000 | 540,000 | 2,220,000 |
| | Roads and bridges | 6,720,000 | 4,130,000 | 10,850,000 |
| | Total, relocations | 8,400,000 | 4,670,000 | 13,070,000 |
| | Total, lands & relocations | 25,200,000 | 24,870,000 | 50,070,000 |
| | Total, flood control | 68,600,000 | 58,570,000 | 127,170,000 |

Table 7. Summary of First Costs for Flood Control Alternative Plan (E-A)
Stanford Drive Detention Basin
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | Stanford Drive Detention Basin | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|
| | Construction: | | | | | |
| 09. | Basin or channel..... | $2,810,000 | $32,600,000 | $28,000,000 | $60,600,000 | $63,410,000 |
| 30. | Engineering and design..... | 281,000 | 3,260,000 | 2,800,000 | 6,060,000 | 6,341,000 |
| 31. | Supervision and administration..... | 279,000 | 3,240,000 | 2,800,000 | 6,040,000 | 6,319,000 |
| | Total, construction..... | 3,370,000 | 39,100,000 | 33,600,000 | 72,700,000 | 76,070,000 |
| | Lands and relocations: | | | | | |
| | Lands and damages..... | 3,910,000 | 16,800,000 | 20,200,000 | 37,000,000 | 40,910,000 |
| | Relocations: | | | | | |
| | Utilities..... | 0 | 1,540,000 | 533,000 | 2,073,000 | 2,073,000 |
| | Golf course..... | 0 | 0 | 0 | 0 | 0 |
| | Roads and bridges..... | 0 | 6,290,000 | 4,107,000 | 10,397,000 | 10,397,000 |
| | Total, relocations..... | 0 | 7,830,000 | 4,640,000 | 12,470,000 | 12,470,000 |
| | Total, lands & relocations. | 3,910,000 | 24,630,000 | 24,840,000 | 49,470,000 | 53,380,000 |
| | Total, flood control..... | 7,280,000 | 63,730,000 | 58,440,000 | 122,170,000 | 129,450,000 |

Table 8. Summary of First Costs for Flood Control Alternative Plan (E-B)
35th Street Detention Basin
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | 35th Street Detention Basin | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|
| | Construction: | | | | | |
| 09. | Basin or channel..... | $3,660,000 | $33,700,000 | $27,500,000 | $61,200,000 | $64,860,000 |
| 30. | Engineering and design..... | 366,000 | 3,370,000 | 2,750,000 | 6,120,000 | 6,486,000 |
| 31. | Supervision and administration..... | 364,000 | 3,330,000 | 2,750,000 | 6,080,000 | 6,444,000 |
| | Total, construction..... | 4,390,000 | 40,400,000 | 33,000,000 | 73,400,000 | 77,790,000 |
| | Lands and relocations: | | | | | |
| | Lands and damages..... | 3,090,000 | 16,800,000 | 20,200,000 | 37,000,000 | 40,090,000 |
| | Relocations: | | | | | |
| | Utilities..... | 0 | 1,540,000 | 514,000 | 2,054,000 | 2,054,000 |
| | Golf course..... | 0 | 0 | 0 | 0 | 0 |
| | Roads and bridges..... | 0 | 6,000,000 | 3,966,000 | 9,966,000 | 9,966,000 |
| | Total, relocations..... | 0 | 7,540,000 | 4,480,000 | 12,020,000 | 12,020,000 |
| | Total, lands & relocations. | 3,090,000 | 24,340,000 | 24,680,000 | 49,020,000 | 52,110,000 |
| | Total, flood control..... | 7,480,000 | 64,740,000 | 57,680,000 | 122,420,000 | 129,900,000 |

Table 9. Summary of First Costs for Flood Control Alternative Plan (E-C)
Biltmore North Detention Basin
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | Biltmore North Detention Basin | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|
| | Construction: | | | | | |
| 09. | Basin or channel..... | $4,240,000 | $34,600,000 | $28,100,000 | $62,700,000 | $66,940,000 |
| 30. | Engineering and design..... | 424,000 | 3,460,000 | 2,810,000 | 6,270,000 | 6,694,000 |
| 31. | Supervision and administration..... | 426,000 | 3,440,000 | 2,790,000 | 6,230,000 | 6,656,000 |
| | Total, construction..... | 5,090,000 | 41,500,000 | 33,700,000 | 75,200,000 | 80,290,000 |
| | Lands and relocations: | | | | | |
| | Lands and damages..... | 0 | 16,800,000 | 20,200,000 | 37,000,000 | 37,000,000 |
| | Relocations: | | | | | |
| | Utilities..... | 0 | 1,650,000 | 533,000 | 2,183,000 | 2,183,000 |
| | Golf course..... | 840,000 | 0 | 0 | 0 | 840,000 |
| | Roads and bridges..... | 0 | 6,590,000 | 4,127,000 | 10,717,000 | 10,717,000 |
| | Total, relocations..... | 840,000 | 8,240,000 | 4,660,000 | 12,900,000 | 13,740,000 |
| | Total, lands & relocations. | 840,000 | 25,040,000 | 24,860,000 | 49,900,000 | 50,740,000 |
| | Total, flood control..... | 5,930,000 | 66,540,000 | 58,560,000 | 125,100,000 | 131,030,000 |

Table 10. Summary of First Costs for Flood Control Alternative Plan (E-AB)
Stanford Drive and 35th Street Detention Basins
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | Detention Basins: Stanford Drive Detention Basin | Detention Basins: 35th Street Detention Basin | Detention Basins: Total, Basins | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|---|---|
| | Construction: | | | | | | | |
| 09. | Basin or channel..... | $2,570,000 | $3,660,000 | $6,230,000 | $30,100,000 | $27,400,000 | $57,500,000 | $63,730,000 |
| 30. | Engineering and design..... | 257,000 | 366,000 | 623,000 | 3,010,000 | 2,740,000 | 5,750,000 | 6,373,000 |
| 31. | Supervision and administration..... | 253,000 | 364,000 | 617,000 | 2,990,000 | 2,760,000 | 5,750,000 | 6,367,000 |
| | Total, construction..... | 3,080,000 | 4,390,000 | 7,470,000 | 36,100,000 | 32,900,000 | 69,000,000 | 76,470,000 |
| | Lands and relocations: | | | | | | | |
| | Lands and damages..... | 3,910,000 | 3,090,000 | 7,000,000 | 16,800,000 | 20,200,000 | 37,000,000 | 44,000,000 |
| | Relocations: | | | | | | | |
| | Utilities..... | 0 | 0 | 0 | 1,350,000 | 510,000 | 1,860,000 | 1,860,000 |
| | Golf course..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Roads and bridges..... | 0 | 0 | 0 | 5,540,000 | 3,930,000 | 9,470,000 | 9,470,000 |
| | Total, relocations..... | 0 | 0 | 0 | 6,890,000 | 4,440,000 | 11,330,000 | 11,330,000 |
| | Total, lands & relocations. | 3,910,000 | 3,090,000 | 7,000,000 | 23,690,000 | 24,640,000 | 48,330,000 | 55,330,000 |
| | Total, flood control..... | 6,990,000 | 7,480,000 | 14,470,000 | 59,790,000 | 57,540,000 | 117,330,000 | 131,800,000 |

Table 11. Summary of First Costs for Flood Control Alternative Plan (E-AC)
Stanford Drive and Biltmore North Detention Basins
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

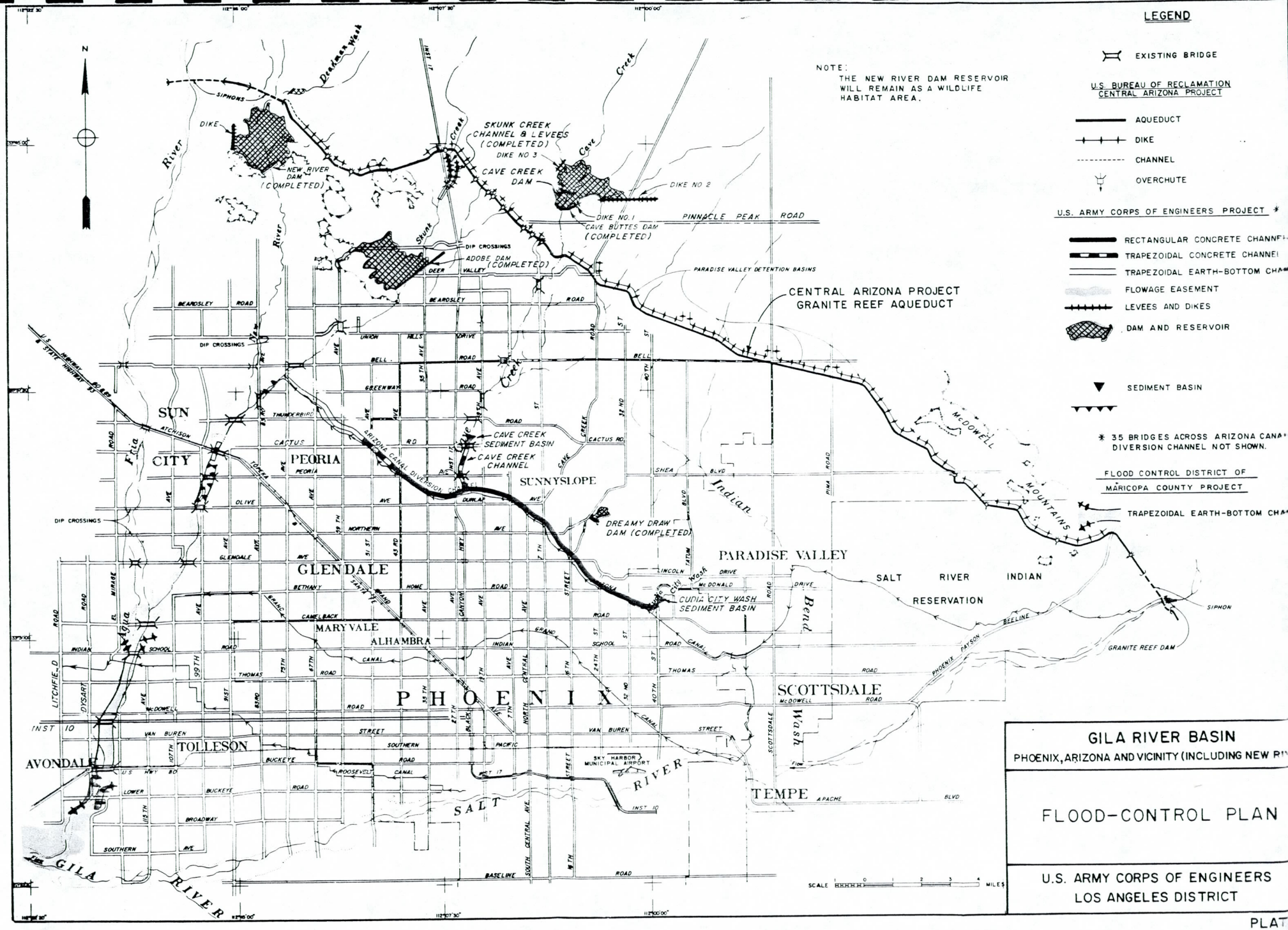
| Cost Acct. No. | Description | Detention Basins: Stanford Drive Detention Basin | Detention Basins: Biltmore North Detention Basin | Detention Basins: Total, Basins | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|---|---|
| | Construction: | | | | | | | |
| 09. | Basin or channel..... | $2,810,000 | $4,120,000 | $6,930,000 | $31,900,000 | $27,900,000 | $59,800,000 | $66,730,000 |
| 30. | Engineering and design..... | 281,000 | 412,000 | 693,000 | 3,190,000 | 2,790,000 | 5,980,000 | 6,673,000 |
| 31. | Supervision and administration..... | 279,000 | 408,000 | 687,000 | 3,210,000 | 2,810,000 | 6,020,000 | 6,707,000 |
| | Total, construction..... | 3,370,000 | 4,940,000 | 8,310,000 | 38,300,000 | 33,500,000 | 71,800,000 | 80,110,000 |
| | Lands and relocations: | | | | | | | |
| | Lands and damages..... | 3,910,000 | 0 | 3,910,000 | 16,800,000 | 20,200,000 | 37,000,000 | 40,910,000 |
| | Relocations: | | | | | | | |
| | Utilities..... | 0 | 0 | 0 | 1,430,000 | 526,000 | 1,956,000 | 1,956,000 |
| | Golf course..... | 0 | 840,000 | 840,000 | 0 | 0 | 0 | 840,000 |
| | Roads and bridges..... | 0 | 0 | 0 | 5,910,000 | 4,084,000 | 9,994,000 | 9,994,000 |
| | Total, relocations..... | 0 | 840,000 | 840,000 | 7,340,000 | 4,610,000 | 11,950,000 | 12,790,000 |
| | Total, lands & relocations. | 3,910,000 | 840,000 | 4,750,000 | 24,140,000 | 24,810,000 | 48,950,000 | 53,700,000 |
| | Total, flood control..... | 7,280,000 | 5,780,000 | 13,060,000 | 62,440,000 | 58,310,000 | 120,750,000 | 133,810,000 |

Table 12. Summary of First Costs for Flood Control Alternative Plan (E-BC)
35th Street and Biltmore North Detention Basins
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

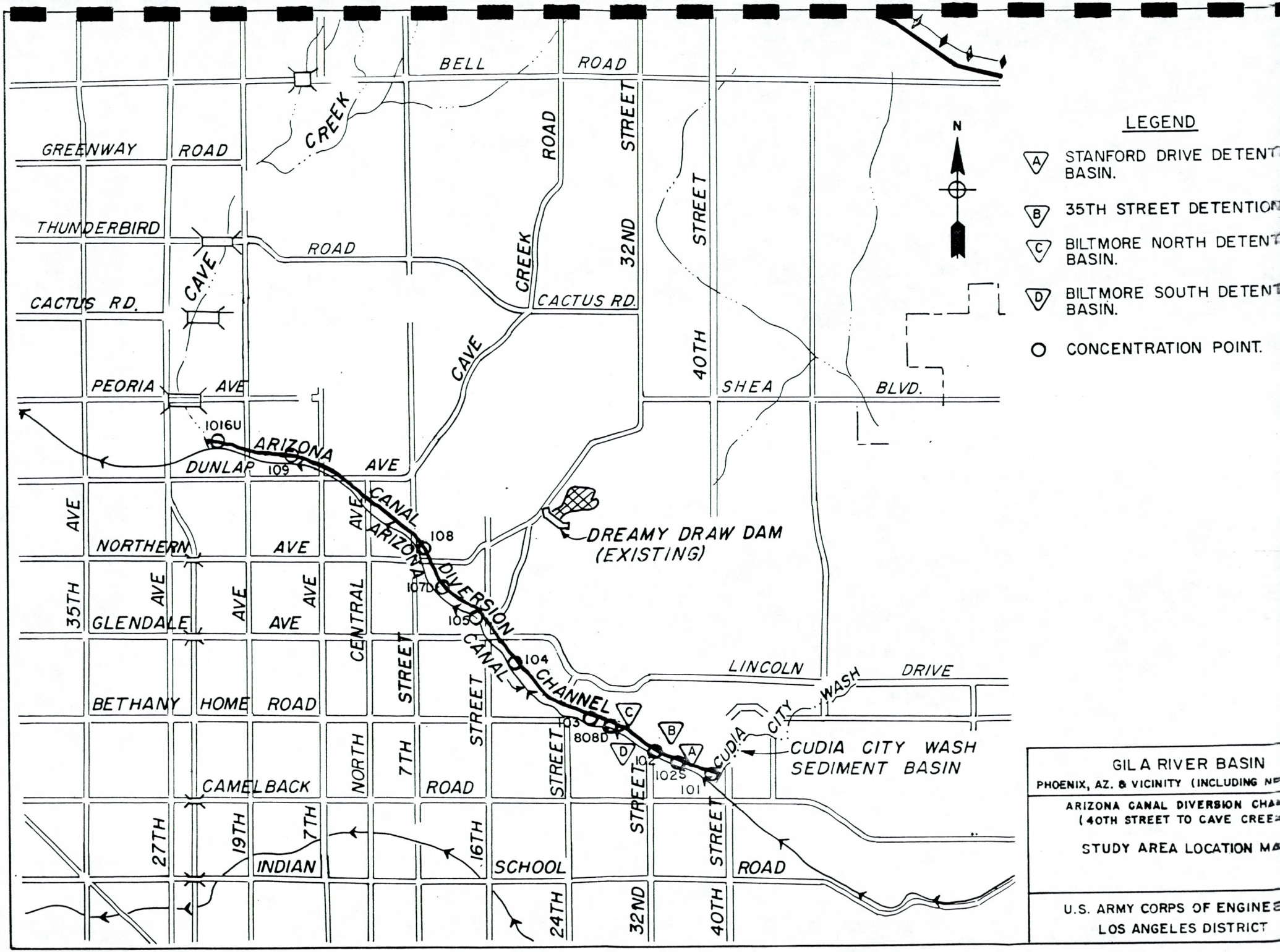
| Cost Acct. No. | Description | Detention Basins | | | Arizona Canal Diversion Channel | | | Grand Total |
|---|---|---|---|---|---|---|---|---|
| | | 35th Street Detention Basin | Biltmore North Detention Basin | Total, Basins | Cudia City Wash to Dreamy Draw (Reach 4) | Dreamy Draw to Cave Creek (Reach 3) | Total, Channel | |
| | Construction: | | | | | | | |
| 09. | Basin or channel..... | $3,660,000 | $4,200,000 | $7,860,000 | $32,400,000 | $27,400,000 | $59,800,000 | $67,660,000 |
| 30. | Engineering and design..... | 366,000 | 420,000 | 786,000 | 3,240,000 | 2,740,000 | 5,980,000 | 6,766,000 |
| 31. | Supervision and administration..... | 364,000 | 420,000 | 784,000 | 3,260,000 | 2,760,000 | 6,020,000 | 6,804,000 |
| | Total, construction..... | 4,390,000 | 5,040,000 | 9,430,000 | 38,900,000 | 32,900,000 | 71,800,000 | 81,230,000 |
| | Lands and relocations: | | | | | | | |
| | Lands and damages..... | 3,090,000 | 0 | 3,090,000 | 16,800,000 | 20,200,000 | 37,000,000 | 40,090,000 |
| | Relocations: | | | | | | | |
| | Utilities..... | 0 | 0 | 0 | 1,480,000 | 510,000 | 1,990,000 | 1,990,000 |
| | Golf course..... | 0 | 840,000 | 840,000 | 0 | 0 | 0 | 840,000 |
| | Roads and bridges..... | 0 | 0 | 0 | 5,710,000 | 3,930,000 | 9,640,000 | 9,640,000 |
| | Total, relocations..... | 0 | 840,000 | 840,000 | 7,190,000 | 4,440,000 | 11,630,000 | 12,470,000 |
| | Total, lands & relocations. | 3,090,000 | 840,000 | 3,930,000 | 23,990,000 | 24,640,000 | 48,630,000 | 52,560,000 |
| | Total, flood control..... | 7,480,000 | 5,880,000 | 13,360,000 | 62,890,000 | 57,540,000 | 120,430,000 | 133,790,000 |

Table 13. Summary of First Costs for Flood Control Alternative Plan (E-ABC)
Stanford Drive, 35th Street and Biltmore North Detention Basins
and Arizona Canal Diversion Channel (Cudia City Wash to Cave Creek).
(October 1986 Price Levels)

| Cost Acct. No. | Description | Detention Basins: Stanford Drive Detention Basin | Detention Basins: 35th Street Detention Basin | Detention Basins: Biltmore North Detention Basin | Detention Basins: Total, Basins | Arizona Canal Diversion Channel: Cudia City Wash to Dreamy Draw (Reach 4) | Arizona Canal Diversion Channel: Dreamy Draw to Cave Creek (Reach 3) | Arizona Canal Diversion Channel: Total, Channel | Grand Total |
|---|---|---|---|---|---|---|---|---|---|
| | Construction: | | | | | | | | |
| 09. | Basin or channel..... | $2,570,000 | $3,660,000 | $4,110,000 | $10,340,000 | $29,500,000 | $27,300,000 | $56,800,000 | $67,140,000 |
| 30. | Engineering and design..... | 257,000 | 366,000 | 411,000 | 1,034,000 | 2,950,000 | 2,730,000 | 5,680,000 | 6,714,000 |
| 31. | Supervision and administration..... | 253,000 | 364,000 | 409,000 | 1,026,000 | 2,950,000 | 2,770,000 | 5,720,000 | 6,746,000 |
| | Total, construction..... | 3,080,000 | 4,390,000 | 4,930,000 | 12,400,000 | 35,400,000 | 32,800,000 | 68,200,000 | 80,600,000 |
| | Lands and relocations: | | | | | | | | |
| | Lands and damages..... | 3,910,000 | 3,090,000 | 0 | 7,000,000 | 16,800,000 | 20,200,000 | 37,000,000 | 44,000,000 |
| | Relocations: | | | | | | | | |
| | Utilities..... | 0 | 0 | 0 | 0 | 1,270,000 | 500,000 | 1,770,000 | 1,770,000 |
| | Golf course..... | 0 | 0 | 840,000 | 840,000 | 0 | 0 | 0 | 840,000 |
| | Roads and bridges..... | 0 | 0 | 0 | 0 | 5,400,000 | 3,870,000 | 9,270,000 | 9,270,000 |
| | Total, relocations..... | 0 | 0 | 840,000 | 840,000 | 6,670,000 | 4,370,000 | 11,040,000 | 11,880,000 |
| | Total, lands & relocations.. | 3,910,000 | 3,090,000 | 840,000 | 7,840,000 | 23,470,000 | 24,570,000 | 48,040,000 | 55,880,000 |
| | Total, flood control..... | 6,990,000 | 7,480,000 | 5,770,000 | 20,240,000 | 58,870,000 | 57,370,000 | 116,240,000 | 136,480,000 |

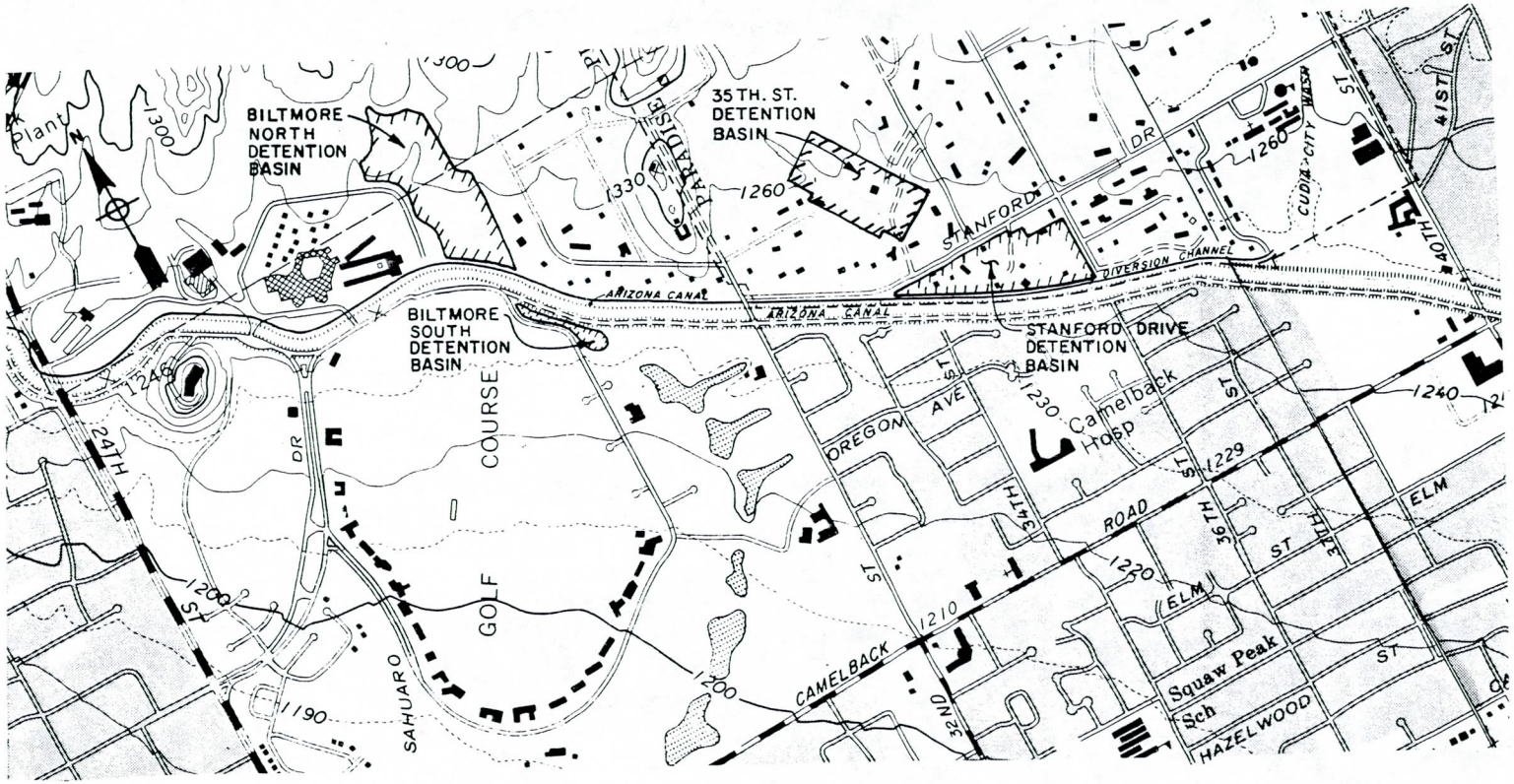

LEGEND
EXISTING BRIDGE
U.S. BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
AQUEDUCT
DIKE
CHANNEL
OVERCHUTE
U.S. ARMY CORPS OF ENGINEERS PROJECT *
RECTANGULAR CONCRETE CHANNEL
TRAPEZOIDAL CONCRETE CHANNEL
TRAPEZOIDAL EARTH-BOTTOM CHANNEL
FLOWAGE EASEMENT
LEVEES AND DIKES
DAM AND RESERVOIR
SEDIMENT BASIN
* 35 BRIDGES ACROSS ARIZONA CANAL DIVERSION CHANNEL NOT SHOWN.
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY PROJECT
TRAPEZOIDAL EARTH-BOTTOM CHANNEL
NOTE:
THE NEW RIVER DAM RESERVOIR WILL REMAIN AS A WILDLIFE HABITAT AREA.
CENTRAL ARIZONA PROJECT
GRANITE REEF AQUEDUCT
SKUNK CREEK CHANNEL & LEVEES (COMPLETED)
DIKE NO 3
CAVE CREEK DAM
DIKE NO 2
DIKE NO. 1
CAVE BUTTES DAM (COMPLETED)
NEW RIVER DAM (COMPLETED)
ADOBE DAM (COMPLETED)
PINNACLE PEAK ROAD
PARADISE VALLEY DETENTION BASINS
CAVE CREEK SEDIMENT BASIN
CAVE CREEK CHANNEL
DREAMY DRAW DAM (COMPLETED)
CUDIA CITY WASH SEDIMENT BASIN
SIPHONS
DIKE
DIP CROSSINGS
SUN CITY
PEORIA
SUNNYSLOPE
GLENDALE
MARYVALE
ALHAMBRA
PHOENIX
PARADISE VALLEY
SCOTTSDALE
TOLLESON
AVONDALE
TEMPE
SALT RIVER INDIAN RESERVATION
SKY HARBOR MUNICIPAL AIRPORT
SALT RIVER
GILA RIVER
Indian Bend Wash
McDOWELL MOUNTAINS
GRANITE REEF DAM
SIPHON
ARIZONA CANAL DIVERSION
SCALE
MILES
GILA RIVER BASIN
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)
FLOOD-CONTROL PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLAT




GILA RIVER BASIN
PHOENIX, AZ. & VICINITY (INCLUDING NE
ARIZONA CANAL DIVERSION CHA
(40TH STREET TO CAVE CREE
STUDY AREA LOCATION MA

U.S. ARMY CORPS OF ENGINE
LOS ANGELES DISTRICT




SCALE: 1000 0 1000 2000 FEET

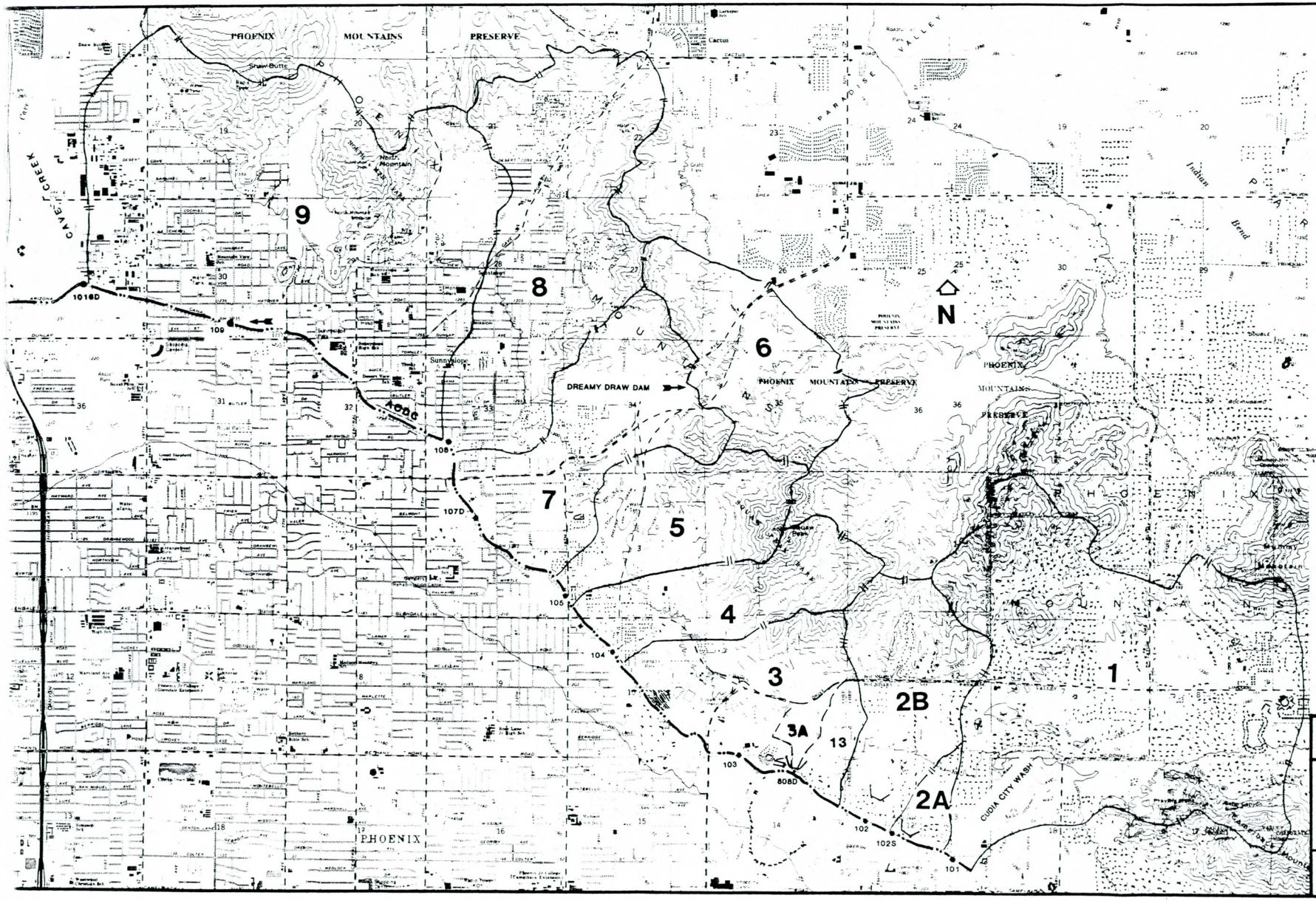
GILA RIVER BASIN
PHOENIX, AZ. & VICINITY (INCLUDING NEW RIVER

ARIZONA CANAL DIVERSION CHANNEL

DETENTION BASINS
LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE




## LEGEND

SUBAREA BOUND

SPILLWAY

CONCENTRATION P

ARIZONA CANAL DIVERSION CHAN

## SCALE

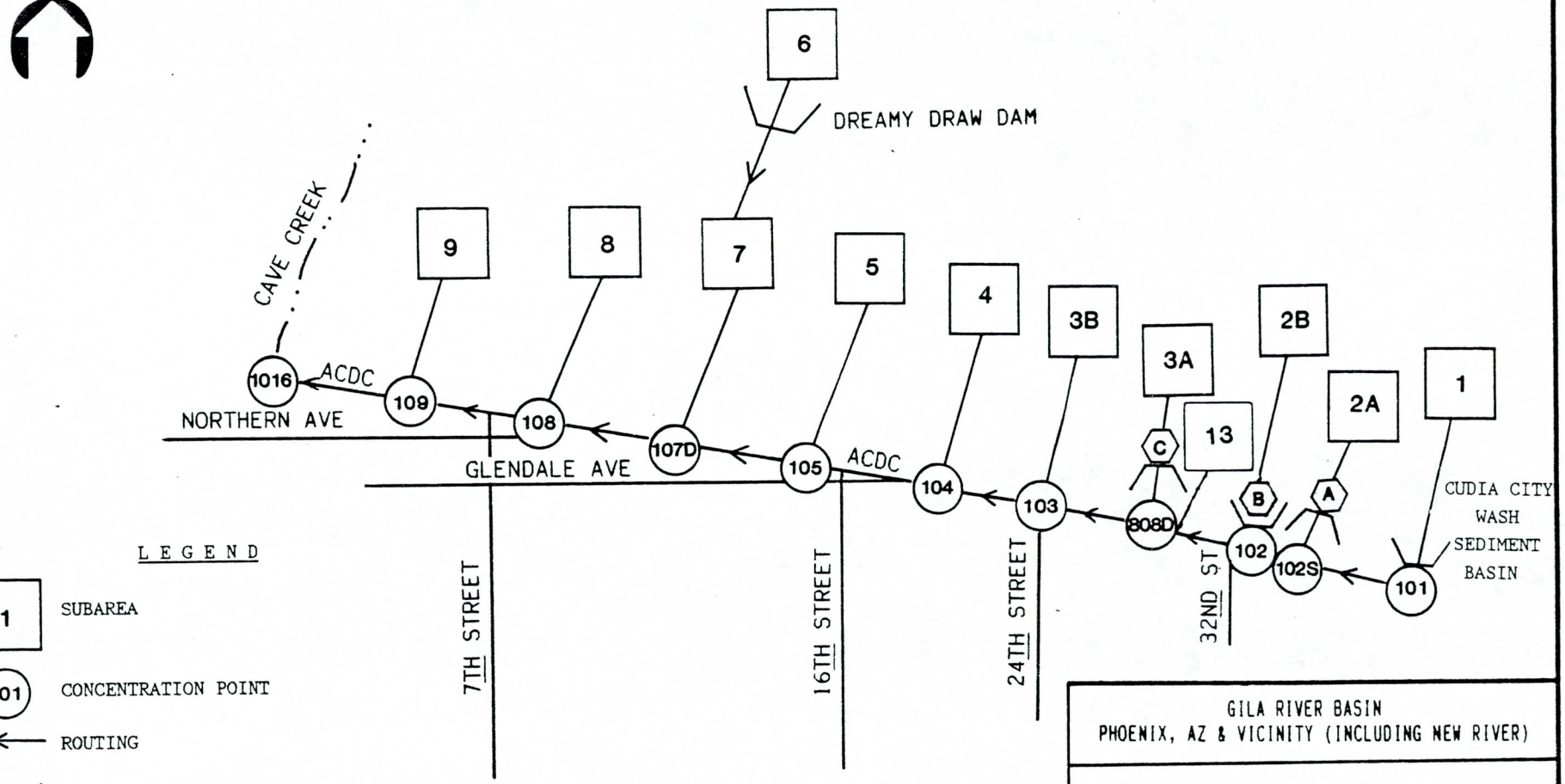
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN
PHOENIX, AZ & VICINITY (INCLUDING NEW

ARIZONA CANAL DIVERSION CHANN

SUBAREA BOUNDARIES

US ARMY CORPS OF ENGINEER
LOS ANGELES DISTRICT




LEGEND

- 1 — SUBAREA
- 101 — CONCENTRATION POINT
- ROUTING
- SPILLWAY
- A — STANFORD DRIVE DETENTION BASIN
- B — 35TH STREET DETENTION BASIN
- C — BILTMORE NORTH DETENTION BASIN

-- NOT TO SCALE --

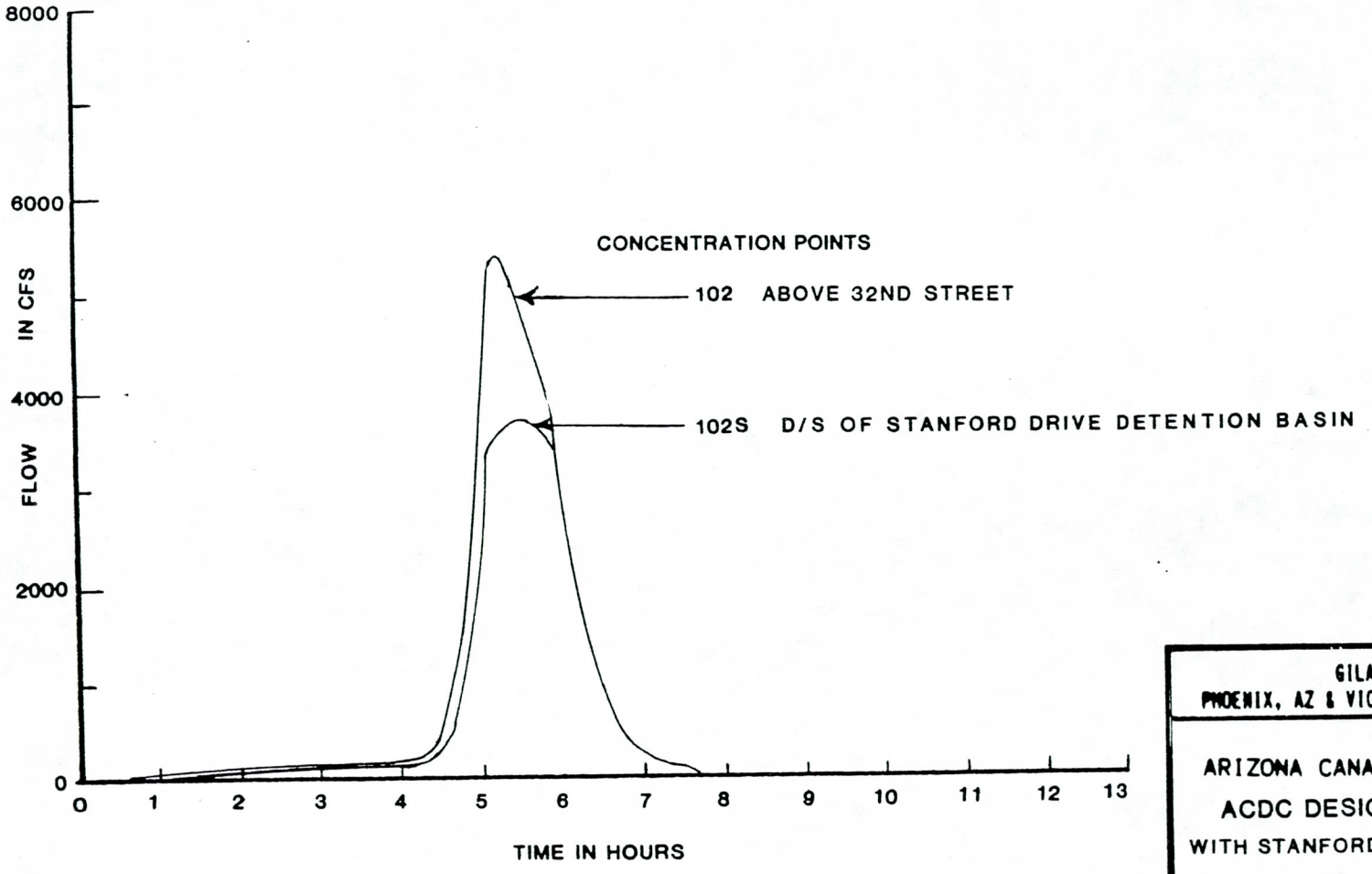
GILA RIVER BASIN
PHOENIX, AZ & VICINITY (INCLUDING NEW RIVER)

ARIZONA CANAL DIVERSION CHANNEL

SCHEMATIC DIAGRAM

WITH 3 DETENTION BASINS

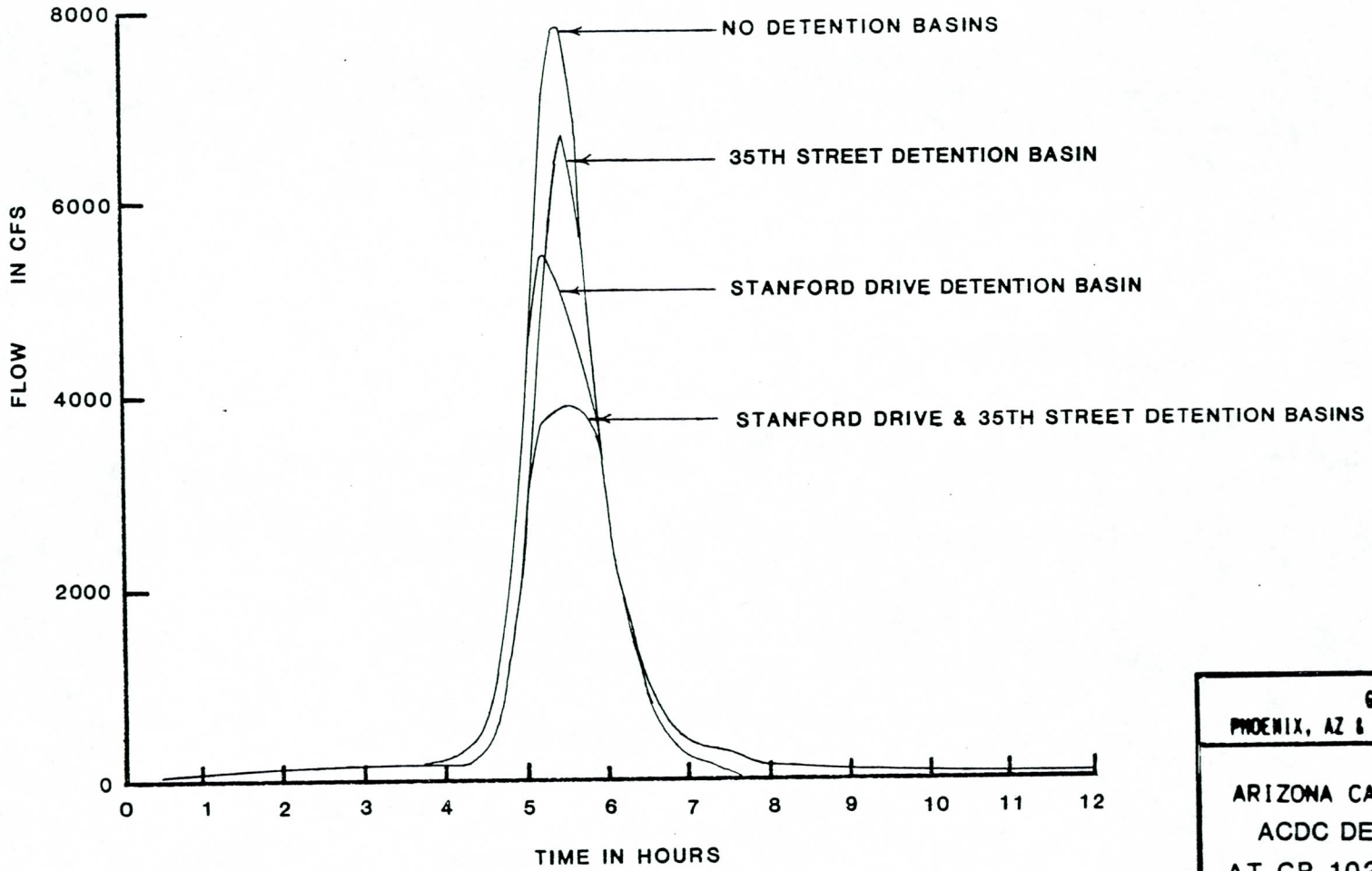
US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT




GILA RIVER BASIN
PHOENIX, AZ & VICINITY (INCLUDING NEW RIVER)

ARIZONA CANAL DIVERSION CHANNEL
ACDC DESIGN HYDROGRAPHS
WITH STANFORD DRIVE DETENTION BASIN

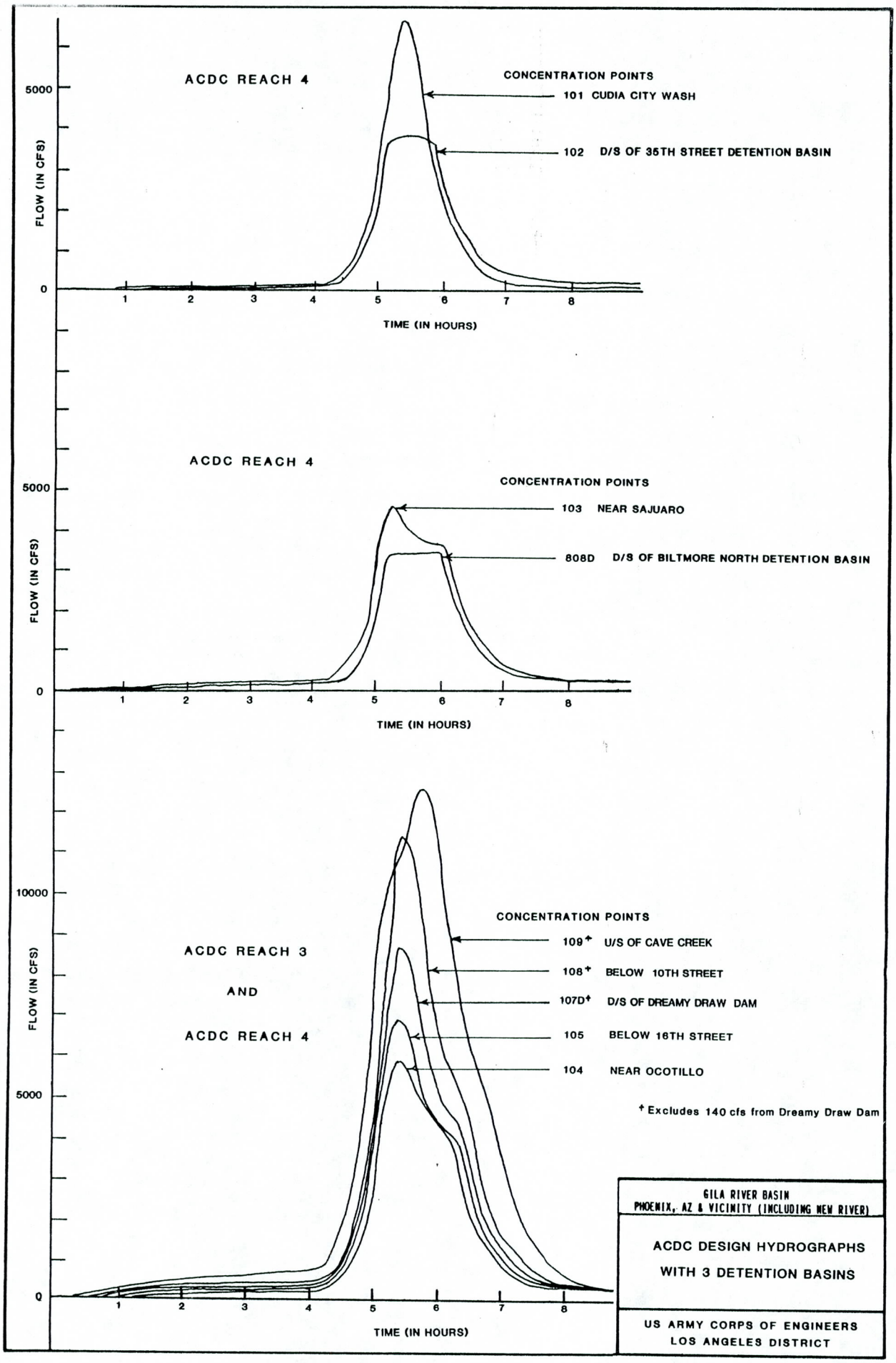
US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT




GILA RIVER BASIN
PHOENIX, AZ & VICINITY (INCLUDING NEW RIVER)

ARIZONA CANAL DIVERSION CHANNEL
ACDC DESIGN HYDROGRAPHS
AT CP 102 ABOVE 32ND STREET

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT




GILA RIVER BASIN
PHOENIX, AZ & VICINITY (INCLUDING NEW RIVER)

ACDC DESIGN HYDROGRAPHS
WITH 3 DETENTION BASINS

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

# Appendix

## Detailed First Cost Estimates

CONTENTS


| | Page |
|---|---|
| Stanford Drive Detention Basin for Alternative E-A | 1 |
| Stanford Drive Detention Basin for Alternative E-AB | 2 |
| Stanford Drive Detention Basin for Alternative E-AC | 3 |
| Stanford Drive Detention Basin for Alternative E-ABC | 4 |
| 35th Street Detention Basin for Alternatives E-B, E-AB, E-BC, and E-ABC | 5 |
| Biltmore North Detention Basin for Alternative E-C | 7 |
| Biltmore North Detention Basin for Alternative E-AC | 8 |
| Biltmore North Detention Basin for Alternative E-BC | 9 |
| Biltmore North Detention Basin for Alternative E-ABC | 10 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-FDM | 11 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-A | 13 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-B | 15 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-C | 17 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-AB | 19 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-AC | 21 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-BC | 23 |
| Arizona Canal Diversion Channel-Cudia City Wash to Dreamy Draw for Alternative E-ABC | 25 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-FDM | 27 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-A | 29 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-B | 31 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-C | 33 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-AB | 35 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-AC | 37 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-BC | 39 |
| Arizona Canal Diversion Channel-Dreamy Draw to Cave Creek for Alternative E-ABC | 41 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | STANFORD DRIVE DETENTION BASIN for Alternative E-A | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 10,200 | |
| | Excavation, basin.. | 285,000 | CY | 6.65 | 1,895,250 | |
| | Backfill, toe..... | 327 | CY | 2.60 | 850 | |
| | Stone..... | 7,780 | Ton | 15.50 | 120,590 | |
| | Grouting stonework. | 1,110 | CY | 88.30 | 98,013 | |
| | Portland cement.... | 3,130 | CWT | 4.30 | 13,459 | |
| | Outlet works..... | 1 | Job | LS | 10,300 | |
| | Steel picket fence. | 2,230 | LF | 30.80 | 68,684 | |
| | Esthetic treatment. | 1 | Job | LS | 85,000 | |
| | Subtotal, detention basin..... | | | | 2,343,346 | |
| | Contingencies..... | | | | 466,654 | |
| | Total, detention basin..... | | | | | $2,810,000 |
| 30 | Engineering and design..... | | | | | 281,000 |
| 31 | Supervision and administration..... | | | | | 279,000 |
| | Total, construction..... | | | | | 3,370,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $3,910,000 |
| | Relocations, utilities | 1 | Job | LS | | 0 |
| | Total, lands & relocations..... | | | | | 3,910,000 |
| | Total, flood control, Stanford Drive Detention Basin..... | | | | | 7,280,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | STANFORD DRIVE DETENTION BASIN for Alternative E-AB | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 10,200 | |
| | Excavation, basin.. | 282,000 | CY | 6.65 | 1,875,300 | |
| | Backfill, toe..... | 211 | CY | 2.60 | 549 | |
| | Stone..... | 1,150 | Ton | 15.50 | 17,825 | |
| | Grouting stonework. | 287 | CY | 88.30 | 25,342 | |
| | Portland cement.... | 2,020 | CWT | 4.30 | 8,686 | |
| | Outlet works..... | 1 | Job | LS | 10,300 | |
| | Steel picket fence. | 2,230 | LF | 30.80 | 68,684 | |
| | Esthetic treatment. | 1 | Job | LS | 85,000 | |
| | Subtotal, detention basin..... | | | | 2,142,886 | |
| | Contingencies..... | | | | 427,114 | |
| | Total, detention basin..... | | | | | $2,570,000 |
| 30 | Engineering and design..... | | | | | 257,000 |
| 31 | Supervision and administration..... | | | | | 253,000 |
| | Total, construction..... | | | | | 3,080,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $3,910,000 |
| | Relocations, utilities | 1 | Job | LS | | 0 |
| | Total, lands & relocations..... | | | | | 3,910,000 |
| | Total, flood control, Stanford Drive Detention Basin..... | | | | | 6,990,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | STANFORD DRIVE DETENTION BASIN for Alternative E-AC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 10,200 | |
| | Excavation, basin.. | 285,000 | CY | 6.65 | 1,895,250 | |
| | Backfill, toe..... | 327 | CY | 2.60 | 850 | |
| | Stone..... | 7,780 | Ton | 15.50 | 120,590 | |
| | Grouting stonework. | 1,110 | CY | 88.30 | 98,013 | |
| | Portland cement.... | 3,130 | CWT | 4.30 | 13,459 | |
| | Outlet works..... | 1 | Job | LS | 10,300 | |
| | Steel picket fence. | 2,230 | LF | 30.80 | 68,684 | |
| | Esthetic treatment. | 1 | Job | LS | 85,000 | |
| | Subtotal, detention basin..... | | | | 2,343,346 | |
| | Contingencies..... | | | | 466,654 | |
| | Total, detention basin..... | | | | | $2,810,000 |
| 30 | Engineering and design..... | | | | | 281,000 |
| 31 | Supervision and administration..... | | | | | 279,000 |
| | Total, construction..... | | | | | 3,370,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $3,910,000 |
| | Relocations, utilities | 1 | Job | LS | | 0 |
| | Total, lands & relocations..... | | | | | 3,910,000 |
| | Total, flood control, Stanford Drive Detention Basin..... | | | | | 7,280,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | STANFORD DRIVE DETENTION BASIN for Alternative E-ABC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 10,200 | |
| | Excavation, basin.. | 282,000 | CY | 6.65 | 1,875,300 | |
| | Backfill, toe..... | 211 | CY | 2.60 | 549 | |
| | Stone..... | 1,150 | Ton | 15.50 | 17,825 | |
| | Grouting stonework. | 287 | CY | 88.30 | 25,342 | |
| | Portland cement.... | 2,020 | CWT | 4.30 | 8,686 | |
| | Outlet works..... | 1 | Job | LS | 10,300 | |
| | Steel picket fence. | 2,230 | LF | 30.80 | 68,684 | |
| | Esthetic treatment. | 1 | Job | LS | 85,000 | |
| | Subtotal, detention basin..... | | | | 2,142,886 | |
| | Contingencies..... | | | | 427,114 | |
| | Total, detention basin..... | | | | | $2,570,000 |
| 30 | Engineering and design..... | | | | | 257,000 |
| 31 | Supervision and administration..... | | | | | 253,000 |
| | Total, construction..... | | | | | 3,080,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $3,910,000 |
| | Relocations, utilities | 1 | Job | LS | | 0 |
| | Total, lands & relocations..... | | | | | 3,910,000 |
| | Total, flood control, Stanford Drive Detention Basin..... | | | | | 6,990,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | 35TH STREET DETENTION BASIN for Alternatives E-B, E-AB, E-BC, and E-ABC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $37,000 | |
| | Clearing & grubbing | 1 | Job | LS | 8,100 | |
| | Stripping..... | 230 | CY | $3.30 | 759 | |
| | Excavation, basin.. | 261,000 | CY | 7.10 | 1,853,100 | |
| | Excavation, outlet works..... | 6,760 | CY | 6.50 | 43,940 | |
| | Excavation, toe and apron..... | 13,740 | CY | 4.05 | 55,647 | |
| | Compacted fill, embankment..... | 726 | CY | 10.40 | 7,550 | |
| | Compacted fill, outlet works..... | 4,170 | CY | 10.40 | 43,368 | |
| | Sand backfill, outlet works..... | 1,510 | CY | 15.90 | 24,009 | |
| | Sand bedding, outlet works..... | 321 | CY | 15.90 | 5,104 | |
| | Backfill, toe..... | 9,490 | CY | 2.60 | 24,674 | |
| | Stone..... | 16,600 | Ton | 15.50 | 257,300 | |
| | Grouting stonework. | 3,960 | CY | 88.30 | 349,668 | |
| | Reinforced-concrete pipe, 54-inch diameter | 904 | LF | 106.00 | 95,824 | |
| | Portland cement.... | 27,900 | CWT | 4.30 | 119,970 | |
| | Intake tower..... | 1 | Job | LS | 11,400 | |
| | Aggregate base..... | 383 | CY | 15.50 | 5,937 | |
| | Asphaltic concrete pavement..... | 291 | Ton | 37.40 | 10,883 | |
| | Boundary fencing... | 1,300 | LF | 5.15 | 6,695 | |
| | Staff gages..... | 5 | Ea | 265.00 | 1,325 | |
| | Esthetic treatment. | 1 | Job | LS | 85,000 | |
| | Subtotal, detention basin..... | | | | 3,047,253 | |
| | Contingencies..... | | | | 612,747 | |
| | Total, detention basin..... | | | | | $3,660,000 |
| 30 | Engineering and design..... | | | | | 366,000 |
| 31 | Supervision and administration..... | | | | | 364,000 |
| | Total, construction..... | | | | | 4,390,000 |

Note: "Excavation, basin" includes 25% common and 75% ripping, with possibly minor light blasting.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | 35TH STREET DETENTION BASIN (Continued) for Alternatives E-B, E-AB, E-BC, and E-ABC | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $3,090,000 |
| | Relocations, utilities | 1 Job | LS | | | 0 |
| | Total, lands & relocations | | | | | 3,090,000 |
| | Total, flood control, 35th Street Detention Basin | | | | | 7,480,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | BILTMORE NORTH DETENTION BASIN for Alternative E-C | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 4,500 | |
| | Excavation, basin.. | 531,000 | CY | 6.15 | 3,265,650 | |
| | Backfill, toe..... | 357 | CY | 2.60 | 928 | |
| | Topsoil..... | 5,630 | CY | 21.00 | 118,230 | |
| | Stone..... | 2,040 | Ton | 15.50 | 31,620 | |
| | Grouting stonework. | 510 | CY | 88.30 | 45,033 | |
| | Portland cement.... | 3,590 | CWT | 4.30 | 15,437 | |
| | Outlet works..... | 1 | Job | LS | 11,600 | |
| | Esthetic treatment. | 1 | Job | LS | 0 | |
| | Subtotal, detention basin..... | | | | 3,533,998 | |
| | Contingencies..... | | | | 706,002 | |
| | Total, detention basin..... | | | | | $4,240,000 |
| 30 | Engineering and design..... | | | | | 424,000 |
| 31 | Supervision and administration..... | | | | | 426,000 |
| | Total, construction..... | | | | | 5,090,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $0 |
| | Relocations, golf course..... | 1 | Job | LS | | 840,000 |
| | Total, lands & relocations..... | | | | | 840,000 |
| | Total, flood control, Biltmore North Detention Basin..... | | | | | 5,930,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | BILTMORE NORTH DETENTION BASIN for Alternative E-AC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 4,500 | |
| | Excavation, basin.. | 523,000 | CY | 6.15 | 3,216,450 | |
| | Backfill, toe..... | 170 | CY | 2.60 | 442 | |
| | Topsoil..... | 5,630 | CY | 21.00 | 118,230 | |
| | Stone..... | 970 | Ton | 15.50 | 15,035 | |
| | Grouting stonework. | 242 | CY | 88.30 | 21,369 | |
| | Portland cement.... | 1,710 | CWT | 4.30 | 7,353 | |
| | Outlet works..... | 1 | Job | LS | 11,600 | |
| | Esthetic treatment. | 1 | Job | LS | 0 | |
| | Subtotal, detention basin..... | | | | 3,435,979 | |
| | Contingencies..... | | | | 684,021 | |
| | Total, detention basin..... | | | | | $4,120,000 |
| 30 | Engineering and design..... | | | | | 412,000 |
| 31 | Supervision and administration..... | | | | | 408,000 |
| | Total, construction..... | | | | | 4,940,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $0 |
| | Relocations, golf course..... | 1 | Job | LS | | 840,000 |
| | Total, lands & relocations..... | | | | | 840,000 |
| | Total, flood control, Biltmore North Detention Basin..... | | | | | 5,780,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | BILTMORE NORTH DETENTION BASIN for Alternative E-BC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 4,500 | |
| | Excavation, basin.. | 528,000 | CY | 6.15 | 3,247,200 | |
| | Backfill, toe..... | 306 | CY | 2.60 | 796 | |
| | Topsoil..... | 5,630 | CY | 21.00 | 118,230 | |
| | Stone..... | 1,750 | Ton | 15.50 | 27,125 | |
| | Grouting stonework. | 436 | CY | 88.30 | 38,499 | |
| | Portland cement.... | 3,080 | CWT | 4.30 | 13,244 | |
| | Outlet works..... | 1 | Job | LS | 11,600 | |
| | Esthetic treatment. | 1 | Job | LS | 0 | |
| | Subtotal, detention basin..... | | | | 3,502,193 | |
| | Contingencies..... | | | | 697,807 | |
| | Total, detention basin..... | | | | | $4,200,000 |
| 30 | Engineering and design..... | | | | | 420,000 |
| 31 | Supervision and administration..... | | | | | 420,000 |
| | Total, construction..... | | | | | 5,040,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $0 |
| | Relocations, golf course..... | 1 | Job | LS | | 840,000 |
| | Total, lands & relocations..... | | | | | 840,000 |
| | Total, flood control, Biltmore North Detention Basin..... | | | | | 5,880,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | BILTMORE NORTH DETENTION BASIN for Alternative E-ABC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Detention basin: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $41,000 | |
| | Clearing & grubbing | 1 | Job | LS | 4,500 | |
| | Excavation, basin.. | 522,000 | CY | 6.15 | 3,210,300 | |
| | Backfill, toe..... | 136 | CY | 2.60 | 354 | |
| | Topsoil..... | 5,630 | CY | 21.00 | 118,230 | |
| | Stone..... | 776 | Ton | 15.50 | 12,028 | |
| | Grouting stonework. | 194 | CY | 88.30 | 17,130 | |
| | Portland cement.... | 1,370 | CWT | 4.30 | 5,891 | |
| | Outlet works..... | 1 | Job | LS | 11,600 | |
| | Esthetic treatment. | 1 | Job | LS | 0 | |
| | Subtotal, detention basin..... | | | | 3,421,033 | |
| | Contingencies..... | | | | 688,967 | |
| | Total, detention basin..... | | | | | $4,110,000 |
| 30 | Engineering and design..... | | | | | 411,000 |
| 31 | Supervision and administration..... | | | | | 409,000 |
| | Total, construction..... | | | | | 4,930,000 |
| | Lands & relocations: | | | | | |
| | Lands & damages..... | | | | | $0 |
| | Relocations, golf course..... | 1 | Job | LS | | 840,000 |
| | Total, lands & relocations..... | | | | | 840,000 |
| | Total, flood control, Biltmore North Detention Basin..... | | | | | 5,770,000 |

Note: "Excavation, basin" includes 50% ripping and 50% common.

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW for Alternative E-FDM | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 42,900 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 34,400 | CY | $7.20 | 247,680 | |
| | Excavation, channel..... | 1,420,000 | CY | 3.05 | 4,331,000 | |
| | Compacted fill..... | 476,000 | CY | 3.30 | 1,570,800 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 21,800 | CY | 58.70 | 1,279,660 | |
| | Concrete, footing.. | 45,400 | CY | 64.00 | 2,905,600 | |
| | Concrete, wall..... | 64,400 | CY | 82.20 | 5,293,680 | |
| | Concrete, top slab. | 18,800 | CY | 120.00 | 2,256,000 | |
| | Portland cement.... | 887,000 | CWT | 4.30 | 3,814,100 | |
| | Steel reinforcement | 17,300,000 | lbs | 0.35 | 6,055,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,600 | LF | 30.80 | 1,004,080 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 31,520,000 | |
| | Contingencies..... | | | | 4,680,000 | |
| | Total, channel..... | | | | | $36,200,000 |
| 30 | Engineering & design..... | | | | | 3,620,000 |
| 31 | Supervision & administration..... | | | | | 3,580,000 |
| | Total, construction..... | | | | | 43,400,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-FDM | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Water | 1 Job | LS | | $1,440,000 | |
| | Sewer | 1 Job | LS | | 158,000 | |
| | Gas | 1 Job | LS | | 46,000 | |
| | Telephone | 1 Job | LS | | 36,000 | |
| | Total utilities | | | | 1,680,000 | |
| | Roads | 1 Job | LS | | 130,000 | |
| | Bridges | 1 Job | LS | | 6,590,000 | |
| | Total, roads & bridges | | | | 6,720,000 | |
| | Total, relocations | | | | | 8,400,000 |
| | Total, lands & relocations | | | | | 25,200,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 68,600,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW
for Alternative E-A

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 42,000 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 32,100 | CY | $7.20 | 231,120 | |
| | Excavation, channel..... | 1,340,000 | CY | 3.05 | 4,087,500 | |
| | Compacted fill..... | 473,000 | CY | 3.30 | 1,560,900 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 14,700 | CY | 58.70 | 862,890 | |
| | Concrete, footing.. | 43,500 | CY | 64.00 | 2,784,000 | |
| | Concrete, wall..... | 60,200 | CY | 82.20 | 4,948,440 | |
| | Concrete, top slab. | 12,300 | CY | 120.00 | 1,476,000 | |
| | Portland cement.... | 764,000 | CWT | 4.30 | 3,285,200 | |
| | Steel reinforcement | 15,200,000 | lbs | 0.35 | 5,320,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,100 | LF | 30.80 | 988,680 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 28,305,730 | |
| | Contingencies..... | | | | 4,294,270 | |
| | Total, channel..... | | | | | $32,600,000 |
| 30 | Engineering & design..... | | | | | 3,260,000 |
| 31 | Supervision & administration..... | | | | | 3,240,000 |
| | Total, construction..... | | | | | 39,100,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-A | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,540,000 | |
| | Roads | 1 Job | LS | | 120,000 | |
| | Bridges | 1 Job | LS | | 6,170,000 | |
| | Total, roads & bridges | | | | 6,290,000 | |
| | Total, relocations | | | | | 7,830,000 |
| | Total, lands & relocations | | | | | 24,630,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 63,730,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL--CUDIA CITY WASH TO DREAMY DRAW for Alternative E-B | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 42,200 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 32,800 | CY | $7.20 | 236,160 | |
| | Excavation, channel..... | 1,330,000 | CY | 3.05 | 4,056,500 | |
| | Compacted fill..... | 474,000 | CY | 3.30 | 1,564,200 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 16,300 | CY | 58.70 | 956,810 | |
| | Concrete, footing.. | 44,700 | CY | 64.00 | 2,860,800 | |
| | Concrete, wall..... | 61,900 | CY | 82.20 | 5,088,180 | |
| | Concrete, top slab. | 14,700 | CY | 120.00 | 1,764,000 | |
| | Portland cement.... | 808,000 | CWT | 4.30 | 3,474,400 | |
| | Steel reinforcement | 15,900,000 | lbs | 0.35 | 5,565,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 29,328,750 | |
| | Contingencies..... | | | | 4,371,250 | |
| | Total, channel..... | | | | | $32,700,000 |
| 30 | Engineering & design..... | | | | | 3,370,000 |
| 31 | Supervision & administration..... | | | | | 3,330,000 |
| | Total, construction..... | | | | | 40,400,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-B | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,540,000 | |
| | Roads | 1 Job | LS | | 120,000 | |
| | Bridges | 1 Job | LS | | 5,880,000 | |
| | Total, roads & bridges | | | | 6,000,000 | |
| | Total, relocations | | | | | 7,540,000 |
| | Total, lands & relocations | | | | | 24,340,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 64,740,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW
for Alternative E-C

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 41,100 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 34,700 | CY | $7.20 | 249,840 | |
| | Excavation, channel..... | 1,390,000 | CY | 3.05 | 4,239,500 | |
| | Compacted fill..... | 454,000 | CY | 3.30 | 1,498,200 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 18,400 | CY | 58.70 | 1,080,080 | |
| | Concrete, footing.. | 45,200 | CY | 64.00 | 2,892,800 | |
| | Concrete, wall..... | 62,900 | CY | 82.20 | 5,170,380 | |
| | Concrete, top slab. | 15,600 | CY | 120.00 | 1,872,000 | |
| | Portland cement.... | 835,000 | CWT | 4.30 | 3,590,500 | |
| | Steel reinforcement | 16,400,000 | lbs | 0.35 | 5,740,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,900 | LF | 30.80 | 1,013,320 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 30,110,220 | |
| | Contingencies..... | | | | 4,489,780 | |
| | Total, channel..... | | | | | $34,600,000 |
| 30 | Engineering & design..... | | | | | 3,460,000 |
| 31 | Supervision & administration..... | | | | | 3,440,000 |
| | Total, construction..... | | | | | 41,500,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-C | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,650,000 | |
| | Roads | 1 Job | LS | | 130,000 | |
| | Bridges | 1 Job | LS | | 6,460,000 | |
| | Total, roads & bridges | | | | 6,590,000 | |
| | Total, relocations | | | | | 8,240,000 |
| | Total, lands & relocations | | | | | 25,040,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 66,540,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW for Alternative E-AB | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 40,400 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 30,300 | CY | $7.20 | 218,160 | |
| | Excavation, channel..... | 1,230,000 | CY | 3.05 | 3,751,500 | |
| | Compacted fill..... | 472,000 | CY | 3.30 | 1,557,600 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 10,100 | CY | 58.70 | 592,870 | |
| | Concrete, footing.. | 41,400 | CY | 64.00 | 2,649,600 | |
| | Concrete, wall..... | 58,400 | CY | 82.20 | 4,800,480 | |
| | Concrete, top slab. | 8,560 | CY | 120.00 | 1,027,200 | |
| | Portland cement.... | 689,000 | CWT | 4.30 | 2,962,700 | |
| | Steel reinforcement | 13,900,000 | lbs | 0.35 | 4,865,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,200 | LF | 30.80 | 991,760 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 26,176,770 | |
| | Contingencies..... | | | | 3,923,230 | |
| | Total, channel..... | | | | | $30,100,000 |
| 30 | Engineering & design..... | | | | | 3,010,000 |
| 31 | Supervision & administration..... | | | | | 2,990,000 |
| | Total, construction..... | | | | | 36,100,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-AB | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,350,000 | |
| | Roads | 1 Job | LS | | 100,000 | |
| | Bridges | 1 Job | LS | | 5,440,000 | |
| | Total, roads & bridges | | | | 5,540,000 | |
| | Total, relocations | | | | | 6,890,000 |
| | Total, lands & relocations | | | | | 23,690,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 59,790,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW
for Alternative E-AC

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 40,200 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 31,500 | CY | $7.20 | 226,800 | |
| | Excavation, channel..... | 1,300,000 | CY | 3.05 | 3,965,500 | |
| | Compacted fill..... | 470,000 | CY | 3.30 | 1,551,000 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 12,300 | CY | 58.70 | 722,010 | |
| | Concrete, footing.. | 44,300 | CY | 64.00 | 2,835,200 | |
| | Concrete, wall..... | 59,900 | CY | 82.20 | 4,923,780 | |
| | Concrete, top slab. | 10,900 | CY | 120.00 | 1,308,000 | |
| | Portland cement.... | 743,000 | CWT | 4.30 | 3,194,900 | |
| | Steel reinforcement | 14,900,000 | lbs | 0.35 | 5,215,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,700 | LF | 30.80 | 1,007,160 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 27,708,550 | |
| | Contingencies..... | | | | 4,191,450 | |
| | Total, channel..... | | | | | $31,900,000 |
| 30 | Engineering & design..... | | | | | 3,190,000 |
| 31 | Supervision & administration..... | | | | | 3,210,000 |
| | Total, construction..... | | | | | 38,300,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-AC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,430,000 | |
| | Roads | 1 Job | LS | | 110,000 | |
| | Bridges | 1 Job | LS | | 5,800,000 | |
| | Total, roads & bridges | | | | 5,910,000 | |
| | Total, relocations | | | | | 7,340,000 |
| | Total, lands & relocations | | | | | 24,140,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 62,440,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW for Alternative E-BC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 40,600 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 32,100 | CY | $7.20 | 231,120 | |
| | Excavation, channel..... | 1,300,000 | CY | 3.05 | 3,965,000 | |
| | Compacted fill..... | 471,000 | CY | 3.30 | 1,544,300 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 13,500 | CY | 58.70 | 792,450 | |
| | Concrete, footing.. | 44,200 | CY | 64.00 | 2,828,800 | |
| | Concrete, wall..... | 60,600 | CY | 82.20 | 4,981,320 | |
| | Concrete, top slab. | 12,200 | CY | 120.00 | 1,464,000 | |
| | Portland cement.... | 762,000 | CWT | 4.30 | 3,276,600 | |
| | Steel reinforcement | 15,200,000 | lbs | 0.35 | 5,320,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 33,000 | LF | 30.80 | 1,016,400 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 28,190,090 | |
| | Contingencies..... | | | | 4,209,910 | |
| | Total, channel..... | | | | | $32,400,000 |
| 30 | Engineering & design..... | | | | | 3,240,000 |
| 31 | Supervision & administration..... | | | | | 3,260,000 |
| | Total, construction..... | | | | | 38,900,000 |

Note: "Excavation, channel includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-BC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,480,000 | |
| | Roads | 1 Job | LS | | 110,000 | |
| | Bridges | 1 Job | LS | | 5,600,000 | |
| | Total, roads & bridges | | | | 5,710,000 | |
| | Total, relocations | | | | | 7,190,000 |
| | Total, lands & relocations | | | | | 23,990,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 62,890,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL—CUDIA CITY WASH TO DREAMY DRAW
for Alternative E-ABC

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 39,000 | |
| | Shoring..... | 1 | Job | LS | 282,000 | |
| | Excavation (blasting), channel..... | 29,100 | CY | $7.20 | 209,520 | |
| | Excavation, channel..... | 1,220,000 | CY | 3.05 | 3,721,000 | |
| | Compacted fill..... | 468,000 | CY | 3.30 | 1,544,400 | |
| | Miscellaneous fill, compacted..... | 43,400 | CY | 0.80 | 34,720 | |
| | Concrete, invert... | 8,110 | CY | 58.70 | 476,057 | |
| | Concrete, footing.. | 42,000 | CY | 64.00 | 2,688,000 | |
| | Concrete, wall..... | 57,700 | CY | 82.20 | 4,742,940 | |
| | Concrete, top slab. | 7,330 | CY | 120.00 | 879,600 | |
| | Portland cement.... | 667,000 | CWT | 4.30 | 2,868,100 | |
| | Steel reinforcement | 13,500,000 | lbs | 0.35 | 4,725,000 | |
| | Invert access ramps | 1 | Job | LS | 281,000 | |
| | Invert access ladders..... | 540 | LF | 30.80 | 16,632 | |
| | Aggregate base..... | 4,260 | CY | 15.50 | 66,030 | |
| | Asphalt concrete paving..... | 4,320 | Ton | 37.40 | 161,568 | |
| | Fencing, channel... | 32,900 | LF | 30.80 | 1,013,320 | |
| | Steel picket gate, single-drive..... | 3 | Ea | 2,100.00 | 6,300 | |
| | Steel pipe gate, single-drive..... | 14 | Ea | 670.00 | 9,380 | |
| | Manholes..... | 1 | Job | LS | 7,770 | |
| | Side drain..... | 1 | Job | LS | 86,500 | |
| | Drainage system.... | 1 | Job | LS | 138,000 | |
| | Hydrologic facilities | 1 | Job | LS | 25,600 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,450,000 | |
| | Subtotal, channel..... | | | | 25,626,437 | |
| | Contingencies..... | | | | 3,873,563 | |
| | Total, channel..... | | | | | $29,500,000 |
| 30 | Engineering & design..... | | | | | 2,950,000 |
| 31 | Supervision & administration..... | | | | | 2,950,000 |
| | Total, construction..... | | | | | 35,400,000 |

Note: "Excavation, channel" includes 10% ripping and 90% common.

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL-CUDIA CITY WASH TO DREAMY DRAW-Continued for Alternative E-ABC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $16,800,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $1,270,000 | |
| | Roads | 1 Job | LS | | 100,000 | |
| | Bridges | 1 Job | LS | | 5,300,000 | |
| | Total, roads & bridges | | | | 5,400,000 | |
| | Total, relocations | | | | | 6,670,000 |
| | Total, lands & relocations | | | | | 23,470,000 |
| | Total, flood control, ACDC (Cudia City Wash to Dreamy Draw) | | | | | 58,870,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK for Alternative E-FDM | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 36,000 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 52,500 | CY | $6.10 | 320,250 | |
| | Excavation (common), channel..... | 1,400,000 | CY | 2.60 | 3,640,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 25,600 | CY | 58.70 | 1,502,720 | |
| | Concrete, footing.. | 33,300 | CY | 64.00 | 2,131,200 | |
| | Concrete, wall..... | 43,500 | CY | 82.20 | 3,575,700 | |
| | Concrete, top slab | 11,200 | CY | 120.00 | 1,344,000 | |
| | Portland cement.... | 662,000 | CWT | 4.30 | 2,846,600 | |
| | Steel reinforcement | 12,700,000 | lbs | 0.35 | 4,445,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 24,416,498 | |
| | Contingencies..... | | | | 3,683,502 | |
| | Total, channel..... | | | | | $28,100,000 |
| 30 | Engineering & design..... | | | | | 2,810,000 |
| 31 | Supervision & administration..... | | | | | 2,790,000 |
| | Total, construction..... | | | | | 33,700,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-FDM | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Water | 1 Job | LS | | $225,000 | |
| | Sewer | 1 Job | LS | | 240,000 | |
| | Gas | 1 Job | LS | | 33,000 | |
| | Power | 1 Job | LS | | 14,000 | |
| | Telephone | 1 Job | LS | | 28,000 | |
| | Total utilities | | | | 540,000 | |
| | Roads | 1 Job | LS | | 310,000 | |
| | Bridges | 1 Job | LS | | 3,820,000 | |
| | Total, roads & bridges | | | | 4,130,000 | |
| | Total, relocations | | | | | 4,670,000 |
| | Total, lands & relocations | | | | | 24,870,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 58,570,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK
for Alternative E-A

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 35,600 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 51,200 | CY | $6.10 | 312,320 | |
| | Excavation (common), channel..... | 1,390,000 | CY | 2.60 | 3,614,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 25,300 | CY | 58.70 | 1,485,110 | |
| | Concrete, footing.. | 33,300 | CY | 64.00 | 2,131,200 | |
| | Concrete, wall..... | 43,500 | CY | 82.20 | 3,575,700 | |
| | Concrete, top slab | 11,200 | CY | 120.00 | 1,344,000 | |
| | Portland cement.... | 660,000 | CWT | 4.30 | 2,838,000 | |
| | Steel reinforcement | 12,600,000 | Lbs | 0.35 | 4,410,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 24,320,958 | |
| | Contingencies..... | | | | 3,679,042 | |
| | Total, channel..... | | | | | $28,000,000 |
| 30 | Engineering & design..... | | | | | 2,800,000 |
| 31 | Supervision & administration..... | | | | | 2,800,000 |
| | Total, construction..... | | | | | 33,600,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-A | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $533,000 | |
| | Roads | 1 Job | LS | | 307,000 | |
| | Bridges | 1 Job | LS | | 3,800,000 | |
| | Total, roads & bridges | | | | 4,107,000 | |
| | Total, relocations | | | | | 4,640,000 |
| | Total, lands & relocations | | | | | 24,840,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 58,440,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK for Alternative E-B | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 35,000 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 49,900 | CY | $6.10 | 304,390 | |
| | Excavation (common), channel..... | 1,360,000 | CY | 2.60 | 3,536,000 | |
| | Compacted fill..... | 364,000 | CY | 3.30 | 1,201,200 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 24,000 | CY | 58.70 | 1,408,800 | |
| | Concrete, footing.. | 33,300 | CY | 64.00 | 2,131,200 | |
| | Concrete, wall..... | 43,500 | CY | 82.20 | 3,575,700 | |
| | Concrete, top slab | 10,400 | CY | 120.00 | 1,248,000 | |
| | Portland cement.... | 648,000 | CWT | 4.30 | 2,786,400 | |
| | Steel reinforcement | 12,400,000 | lbs | 0.35 | 4,340,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 23,937,218 | |
| | Contingencies..... | | | | 3,562,782 | |
| | Total, channel..... | | | | | $27,500,000 |
| 30 | Engineering & design..... | | | | | 2,750,000 |
| 31 | Supervision & administration..... | | | | | 2,750,000 |
| | Total, construction..... | | | | | 33,000,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-B | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $514,000 | |
| | Roads | 1 Job | LS | | 296,000 | |
| | Bridges | 1 Job | LS | | 3,670,000 | |
| | Total, roads & bridges | | | | 3,966,000 | |
| | Total, relocations | | | | | 4,480,000 |
| | Total, lands & relocations | | | | | 24,680,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 57,680,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK for Alternative E-C | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 35,700 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 51,900 | CY | $6.10 | 316,590 | |
| | Excavation (common), channel..... | 1,400,000 | CY | 2.60 | 3,640,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 25,400 | CY | 58.70 | 1,490,980 | |
| | Concrete, footing.. | 33,300 | CY | 64.00 | 2,131,200 | |
| | Concrete, wall..... | 43,500 | CY | 82.20 | 3,575,700 | |
| | Concrete, top slab | 11,200 | CY | 120.00 | 1,344,000 | |
| | Portland cement.... | 661,000 | CWT | 4.30 | 2,842,300 | |
| | Steel reinforcement | 12,700,000 | lbs | 0.35 | 4,445,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 24,396,498 | |
| | Contingencies..... | | | | 3,703,502 | |
| | Total, channel..... | | | | | $28,100,000 |
| 30 | Engineering & design..... | | | | | 2,810,000 |
| 31 | Supervision & administration..... | | | | | 2,790,000 |
| | Total, construction..... | | | | | 33,700,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-C | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | 533,000 | |
| | Roads | 1 Job | LS | | 307,000 | |
| | Bridges | 1 Job | LS | | 3,820,000 | |
| | Total, roads & bridges | | | | 4,127,000 | |
| | Total, relocations | | | | | 4,660,000 |
| | Total, lands & relocations | | | | | 24,860,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 58,560,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK
for Alternative E-AB

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 34,900 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 49,200 | CY | $6.10 | 300,120 | |
| | Excavation (common), channel..... | 1,360,000 | CY | 2.60 | 3,536,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 23,500 | CY | 58.70 | 1,379,450 | |
| | Concrete, footing.. | 33,200 | CY | 64.00 | 2,124,800 | |
| | Concrete, wall..... | 43,200 | CY | 82.20 | 3,551,040 | |
| | Concrete, top slab | 10,400 | CY | 120.00 | 1,248,000 | |
| | Portland cement.... | 642,000 | CWT | 4.30 | 2,760,600 | |
| | Steel reinforcement | 12,400,000 | lbs | 0.35 | 4,340,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 23,849,938 | |
| | Contingencies..... | | | | 3,550,062 | |
| | Total, channel..... | | | | | $27,400,000 |
| 30 | Engineering & design..... | | | | | 2,740,000 |
| 31 | Supervision & administration..... | | | | | 2,760,000 |
| | Total, construction..... | | | | | 32,900,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-AB | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $510,000 | |
| | Roads | 1 Job | LS | | 290,000 | |
| | Bridges | 1 Job | LS | | 3,640,000 | |
| | Total, roads & bridges | | | | 3,930,000 | |
| | Total, relocations | | | | | 4,440,000 |
| | Total, lands & relocations | | | | | 24,640,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 57,540,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK for Alternative E-AC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 35,400 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 50,500 | CY | $6.10 | 308,050 | |
| | Excavation (common), channel..... | 1,390,000 | CY | 2.60 | 3,614,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 25,100 | CY | 58.70 | 1,473,370 | |
| | Concrete, footing.. | 33,300 | CY | 64.00 | 2,131,200 | |
| | Concrete, wall..... | 43,500 | CY | 82.20 | 3,575,700 | |
| | Concrete, top slab | 11,200 | CY | 120.00 | 1,344,000 | |
| | Portland cement.... | 659,000 | CWT | 4.30 | 2,833,700 | |
| | Steel reinforcement | 12,600,000 | lbs | 0.35 | 4,410,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 24,300,448 | |
| | Contingencies..... | | | | 3,599,552 | |
| | Total, channel..... | | | | | $27,900,000 |
| 30 | Engineering & design..... | | | | | 2,790,000 |
| 31 | Supervision & administration..... | | | | | 2,810,000 |
| | Total, construction..... | | | | | 33,500,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-AC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | 526,000 | |
| | Roads | 1 Job | LS | | 304,000 | |
| | Bridges | 1 Job | LS | | 3,780,000 | |
| | Total, roads & bridges | | | | 4,084,000 | |
| | Total, relocations | | | | | 4,610,000 |
| | Total, lands & relocations | | | | | 24,810,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 58,310,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK for Alternative E-BC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 34,900 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 49,200 | CY | $6.10 | 300,120 | |
| | Excavation (common), channel..... | 1,360,000 | CY | 2.60 | 3,536,000 | |
| | Compacted fill..... | 365,000 | CY | 3.30 | 1,204,500 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 23,500 | CY | 58.70 | 1,379,450 | |
| | Concrete, footing.. | 33,200 | CY | 64.00 | 2,124,800 | |
| | Concrete, wall..... | 43,200 | CY | 82.20 | 3,551,040 | |
| | Concrete, top slab | 10,400 | CY | 120.00 | 1,248,000 | |
| | Portland cement.... | 642,000 | CWT | 4.30 | 2,760,600 | |
| | Steel reinforcement | 12,400,000 | lbs | 0.35 | 4,340,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 23,849,938 | |
| | Contingencies..... | | | | 3,550,062 | |
| | Total, channel..... | | | | | $27,400,000 |
| 30 | Engineering & design..... | | | | | 2,740,000 |
| 31 | Supervision & administration..... | | | | | 2,760,000 |
| | Total, construction..... | | | | | 32,900,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-BC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $510,000 | |
| | Roads | 1 Job | LS | | 290,000 | |
| | Bridges | 1 Job | LS | | 3,640,000 | |
| | Total, roads & bridges | | | | 3,930,000 | |
| | Total, relocations | | | | | 4,440,000 |
| | Total, lands & relocations | | | | | 24,640,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 57,540,000 |

Detailed First Cost Estimate
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| | ARIZONA CANAL DIVERSION CHANNEL—DREAMY DRAW TO CAVE CREEK for Alternative E-ABC | | | | | |
| | FLOOD CONTROL | | | | | |
| | Construction: | | | | | |
| 09 | Channel: | | | | | |
| | Diversion & control of water..... | 1 | Job | LS | $154,000 | |
| | Clearing & grubbing | 1 | Job | LS | 33,900 | |
| | Shoring..... | 1 | Job | LS | 58,000 | |
| | Excavation (blasting), channel..... | 48,500 | CY | $6.10 | 295,850 | |
| | Excavation (common), channel..... | 1,350,000 | CY | 2.60 | 3,510,000 | |
| | Compacted fill..... | 360,000 | CY | 3.30 | 1,188,000 | |
| | Miscellaneous fill. compacted..... | 35,900 | CY | 0.80 | 28,720 | |
| | Concrete, invert... | 23,000 | CY | 58.70 | 1,350,100 | |
| | Concrete, footing.. | 33,200 | CY | 64.00 | 2,124,800 | |
| | Concrete, wall..... | 43,200 | CY | 82.20 | 3,551,040 | |
| | Concrete, top slab | 10,400 | CY | 120.00 | 1,248,000 | |
| | Portland cement.... | 639,000 | CWT | 4.30 | 2,747,700 | |
| | Steel reinforcement | 12,300,000 | lbs | 0.35 | 4,305,000 | |
| | Retaining wall..... | 1 | Job | LS | 72,000 | |
| | Invert access ramps | 1 | Job | LS | 148,000 | |
| | Invert access ladders..... | 380 | LF | 30.80 | 11,704 | |
| | Aggregate base..... | 4,160 | CY | 15.50 | 64,480 | |
| | Asphalt concrete pavement..... | 4,210 | Ton | 37.40 | 157,454 | |
| | Fencing, channel... | 32,500 | LF | 30.80 | 1,001,000 | |
| | Steel picket gate, single-drive..... | 2 | Ea | 2,100.00 | 4,200 | |
| | Steel pipe gate, single-drive..... | 12 | Ea | 670.00 | 8,040 | |
| | Manholes..... | 1 | Job | LS | 2,930 | |
| | Side drains..... | 1 | Job | LS | 67,000 | |
| | Hydrologic facilities | 1 | Job | LS | 23,000 | |
| | Esthetic design & erosion control.. | 1 | Job | LS | 1,570,000 | |
| | Subtotal, channel..... | | | | 23,724,918 | |
| | Contingencies..... | | | | 3,575,082 | |
| | Total, channel..... | | | | | $27,300,000 |
| 30 | Engineering & design..... | | | | | 2,730,000 |
| 31 | Supervision & administration..... | | | | | 2,770,000 |
| | Total, construction..... | | | | | 32,800,000 |

Detailed First Cost Estimate (Continued)
(October 1986 Price Levels)

| Cost Acct No. | Description | Quantity | Unit | Unit Cost | Amount Subtotal | Amount Total |
|---|---|---|---|---|---|---|
| ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK (Continued) for Alternative E-ABC | | | | | | |
| | Lands & relocations: | | | | | |
| | Lands & damages | | | | | $20,200,000 |
| | Relocations: | | | | | |
| | Utilities: | | | | | |
| | Total utilities | | | | $500,000 | |
| | Roads | 1 Job | LS | | 290,000 | |
| | Bridges | 1 Job | LS | | 3,580,000 | |
| | Total, roads & bridges | | | | 3,870,000 | |
| | Total, relocations | | | | | 4,370,000 |
| | Total, lands & relocations | | | | | 24,570,000 |
| | Total, flood control, ACDC (Dreamy Draw to Cave Creek) | | | | | 57,370,000 |