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The City of Glendale, Arizona

***Stormwater Management Plan
Capital Improvement
Program Summary***

By

Camp Dresser & McKee Inc.

***Jointly Funded
by the***

City of Glendale and the Flood Control District of Maricopa County

January 1986

A023.703

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

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March 5, 1986

Mr. Ronald G. Reimer
Engineering Department
City of Glendale
5850 West Glendale Avenue
Glendale, Arizona 85301

Re: Stormwater Management Plan

Dear Mr. Reimer:

We have prepared the final versions and are enclosing 10 copies each of the Executive Summary and the Capital Improvement Program. The masters of both of these documents will be given to you so that additional copies can be printed.

Respectfully submitted,

CAMP DRESSER & McKEE Inc.

Roger G. Fry
Associate

RGF/jco

Enclosures: as noted

→ copy: Kebba Buckley, (2 copies) ✓
Jeff Kracht

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1. Introduction

The City of Glendale, in order to alleviate current and possible future flooding problems, and to plan improvements for its existing storm drainage system, selected Camp Dresser & McKee Inc. (CDM) to develop a Stormwater Management Plan. The Executive Summary of the plan highlights the concepts and evaluation methods contributing to the plan and briefly describes all components of the recommended plan. This document, a supplement to the Executive Summary, presents an overview of the improvements recommended by CDM, detailed cost estimates for implementing and maintaining the proposed system, and a phased construction schedule.

2. Recommended Infrastructure Improvements

DRAINAGE SYSTEM CONFIGURATIONS

A number of alternative pipe systems were developed and evaluated. Of these, Alternative 1A, for lands south of the Arizona Canal Diversion Channel (ACDC), was determined to be the best because of its low cost, use of existing rights-of-way, and low level of anticipated disruption. Alternative 5, for the lands between ACDC and Skunk Creek, was judged the best because of its low cost and use of the ACDC, which is under construction. The recommended plan, a combination of Alternatives 1A and 5, is illustrated in Figures 1 and 2.

COORDINATION WITH OTHER UTILITIES

Installation of the complete storm drainage system will be a large undertaking which will require many years to accomplish as well as close coordination with projects and improvements planned by other utilities. In order to eliminate unnecessary disruption, the storm drainage system should be coordinated with other planned infrastructure improvements in the City. Whenever major reconstruction of streets occurs, the stormwater system should be installed. If downstream portions of the stormwater system are not ready, the pipe can be blocked at each end and connected at a later time.

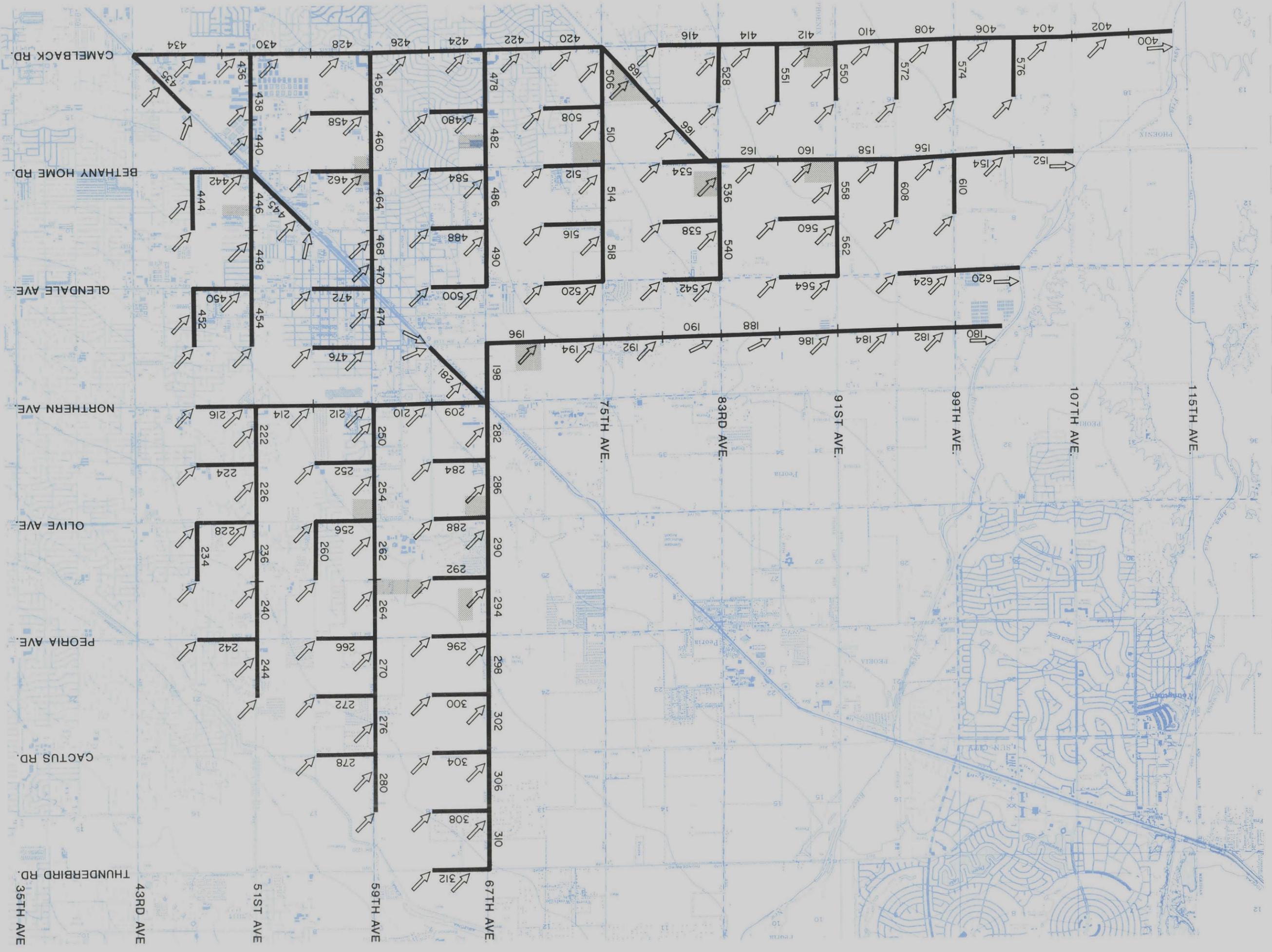
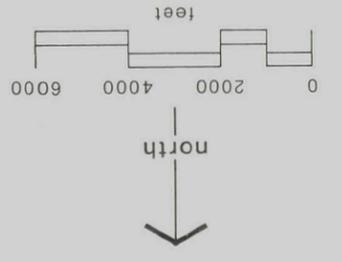
Improvements planned for the stormwater system should also be coordinated with future work anticipated for the water and sewer systems. Advance planning of the locations of pipes and utilities can reduce problems that could occur at a later time. During construction of facilities, sleeves should be installed at proposed crossings so that pipes can later be inserted without relocating or extensively modifying the existing facility.

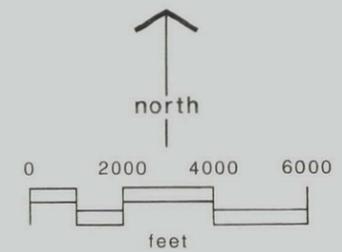
Based on available maps of the current sanitary sewer system, there are seven locations when sewer sizes larger than 24 inches cross the proposed path of the storm drainage system. Each of these locations would have to

FIGURE 1
RECOMMENDED PLAN

LEGEND

- PIPE
- PIPE NUMBER
- FLOW DIRECTION
- DETENTION BASIN





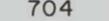
- LEGEND**
-  PIPE
 -  704 PIPE NUMBER
 -  FLOW DIRECTION
 -  DETENTION BASIN

FIGURE 2
RECOMMENDED PLAN
 NORTH OF ARIZONA CANAL

THE CITY OF GLENDALE
 STORMWATER
 MANAGEMENT PLAN

Camp Dresser & McKee Inc.

be examined in detail to determine the difficulty of installing an underground stormwater pipe. Twin pipes or a squashed-shaped box may be needed to accommodate the crossing.

Major water lines, generally located on the east side of the City, will probably not interfere with the proposed drainage system. Rerouting of pressure water pipes can also be accomplished more easily than rerouting gravity sewer lines.

In addition, for all developing areas south of the Arizona Canal that are currently used for agriculture, coordination with the Salt River Project over the existing irrigation canals will be required.

DETENTION FACILITIES

The recommended plan calls for the use of detention facilities to reduce the cost of the system. Detention facilities would be located in city parks or vacant space whenever possible. Due to the multipurpose use of these areas, the use as a detention facility must be carefully coordinated to avoid unnecessary disruption, inconvenience, and maintenance problems. In planning the detention facilities, it will be necessary to ensure that no flooding or damage will occur to buildings and structures. It may be desirable to grade or build compartments in the facility so that some unflooded space will remain after frequent, small storms. Complete inundation would occur only during major storms.

The length of time water would be stored in the detention facility would depend on the size of the storm and the design of the facilities' outlet structure. However, it is anticipated that during major storms, park facilities would drain in 2 hours and other facilities would be emptied within 1 day after the end of the storm.

3. Capital Costs of the Recommended Plan

The capital expenditures needed to implement the recommended plan are summarized in Table 1. Detailed cost breakdowns for the facilities required under the recommended Plan are presented in Tables 2 and 3.

The costs presented here are estimates based upon July 1985 construction costs in Maricopa County. Included are engineering, legal, and administration (20 percent), plus 20 percent for contingencies.

The total cost for the no-detention alternative is \$232 million; cost for the detention alternative is \$186 million. Unit cost per square mile ranges from \$7 million to \$9 million. These estimated capital costs are for trunk stormwater facilities that accommodate 160 acres or more, except where smaller subareas are formed by a canal, road, railroad, wash, or river.

Total costs are for stormwater facilities in addition to existing ones. Land costs are based upon purchase price at the following rates per acre:

<u>Zoning Category</u>	<u>Cost Per Acre</u>
Agricultural	\$ 40,000
Residential	\$ 75,000
Industrial	\$100,000
Commercial	\$175,000

Detention basin cost of construction is defined as 20 percent of the land cost. The unit costs for pipes, or equivalent box culverts, include the cost of catch basins, manholes, and collection pipes between catch basins and the trunk stormwater pipe.

The costs for building and house drains, laterals, and retention basins will be in addition to the cost of the trunk stormwater system facilities.

TABLE 1
CAPITAL COSTS OF THE RECOMMENDED PLAN

Area	Capital Costs in Millions of Dollars			
	No Detention		Detention	
	Total Cost	Cost per Sq. Mile	Total Cost	Cost per Sq. Mile
ALTERNATIVE 1A Camelback Road to ACDC (34.5 sq. miles)				
Pipes	214		137	
Detention Basins	-		29	
	<u>214</u>	6.2	<u>166</u>	4.8
ALTERNATIVE 5 ACDC to Skunk Creek (8.5 sq. miles)				
Pipes	18		14	
Detention Basins	-		1.7	
	<u>18</u>	2.1	<u>15.7</u>	1.8
RECOMMENDED PLAN				
Pipes	232		151	
Detention Basin	-		31	
TOTAL	<u>232</u>		<u>182</u>	

TABLE 2
CAPITAL COSTS FOR ALTERNATIVE 1A FACILITIES

Pipe Size (ft)	Unit Price (dollars)	No Detention		Detention	
		Total Length (ft)	Amount (dollars)	Total Length (ft)	Amount (dollars)
1.5	58	0	0	7,920	459,000
2.0	63	0	0	5,280	333,000
2.5	71	2,640	187,000	2,640	187,000
3.5	100	5,100	510,000	5,100	510,000
4.0	120	26,100	3,132,000	34,020	4,082,000
4.5	140	28,010	3,921,000	30,650	4,291,000
5.0	160	18,120	2,899,000	23,400	3,744,000
5.5	185	28,740	5,317,000	33,880	6,268,000
6.0	210	28,860	6,061,000	36,040	7,568,000
6.5	235	13,200	3,102,000	15,840	3,722,000
7.0	260	20,940	5,444,000	42,060	10,936,000
8.0	320	30,060	9,619,000	32,160	10,291,000
9.0	390	28,040	10,936,000	18,220	7,106,000
10.0	450	41,440	18,648,000	31,340	14,103,000
11.0	530	9,880	5,236,000	5,280	2,798,000
12.0	600	1,320	792,000	18,180	10,908,000
13.0	680	5,280	3,590,000	2,640	1,795,000
14.0	760	7,740	5,882,000	2,640	2,006,000
15.0	850	0	0	5,280	4,488,000
16.0	940	10,560	9,926,000	2,640	2,482,000
17.0	1,030	9,880	10,176,000	0	0
18.0	1,130	23,760	26,849,000	0	0
19.0	1,230	2,640	3,247,000	0	0
20.0	1,330	12,900	17,157,000	0	0
Pipe Subtotal			152,631,000		98,077,000
Engineering, legal, administration 20%			30,526,200		19,615,400
Contingencies 20%			30,526,200		19,615,400
<u>TOTAL</u>			<u>213,683,400</u>		<u>137,307,800</u>

TABLE 3
CAPITAL COSTS FOR ALTERNATIVE 5 FACILITIES

Pipe Size (ft)	Unit Price (dollars)	No Detention		Detention	
		Total Length (ft)	Amount (dollars)	Total Length (ft)	Amount (dollars)
1.5	58	0	0	5,040	292,000
2.0	63	0	0	2,640	166,000
4.5	140	8,280	1,159,000	10,920	1,529,000
5.0	160	3,940	630,000	6,580	1,053,000
5.5	185	2,400	444,000	2,400	444,000
6.0	210	8,780	1,844,000	8,780	1,844,000
7.0	260	16,020	4,165,000	10,980	2,855,000
8.0	320	2,640	845,000	1,900	608,000
9.0	390	5,140	2,005,000	2,500	975,000
10.0	450	4,540	2,043,000	0	0
Pipe Subtotals			13,135,000	9,766,000	
Engineering, legal, administration 20%			2,627,000	1,953,200	
Contingencies 20%			2,627,000	1,953,200	
<u>TOTAL</u>			<u>18,389,000</u>	<u>13,672,400</u>	

TABLE 4
CAPITAL COSTS FOR ALTERNATIVE 1A DETENTION BASINS

Detention Basin Location	Area (acres)	Land Purchase and Construction (dollars per acre)	Amount (dollars)
Bethany Home Rd. and 75th Ave.	11	90,000	990,000
Bethany Home Rd. and 83rd Ave.	9	90,000	810,000
Camelback Rd. and 91st Ave.	9	90,000	810,000
North of Bethany Home Rd. on 51st Ave.	9	48,000	432,000
Bethany Home Rd. and 59th Ave.	11	48,000	528,000
South of Bethany Home Rd. on 67th Ave.	10	90,000	900,000
North of Camelback Rd. on 75th Ave.	39	90,000	3,510,000
Bethany Home Rd. and 91st Ave.	35	90,000	3,150,000
South of Peoria Ave. on 59th Ave., Sahuaro Ranch Park	12	48,000	576,000
Olive Ave. and 59th Ave.	10	120,000	1,200,000
Olive Ave. and 51st Ave.	13	90,000	1,170,000
South of Peoria Ave. on 67th Ave.	11	90,000	990,000
Olive Ave. and 67th Ave.	10	90,000	900,000
Orangewood Ave., West of 67th Ave.	38	120,000	4,560,000
Detention Basin Subtotal			<u>20,526,000</u>
Engineering, legal, administration 20%			4,105,000
Contingencies 20%			4,105,000
<u>TOTAL</u>			<u>28,736,000</u>

TABLE 5
CAPITAL COSTS FOR ALTERNATIVE 5 DETENTION BASINS

Detention Basin Location	Area (acres)	Land Purchase and Construction (dollars per acre)	Amount (dollars)
Bell Rd. East of 59th Ave.	5	90,000	450,000
South of Bell Rd. on 59th Ave.	3	120,000	360,000
South of Greenway Rd. on 59th Ave.	9	48,000	432,000
Detention Basin Subtotal			<u>1,242,000</u>
Engineering, legal, administration 20%			248,400
Contingencies 20%			248,400
<u>TOTALS</u>			<u>1,738,800</u>

4. Operation and Maintenance Costs of the Recommended Plan

In order to ensure proper functioning of the recommended stormwater facilities, an ongoing operation and maintenance (O&M) program will have to be initiated. The typical activities constituting this program are described in the Executive Summary.

The annual operation and maintenance costs for pipes are estimated to be 0.5 percent of the capital cost of the trunk stormwater pipes. The annual operation and maintenance costs for detention basins are estimated to be 1.0 percent of the acquisition and construction cost. Table 6 presents the annual operation and maintenance costs for the recommended plan.

Included in the 0.5 and 1.0 percent amounts are the costs for all personnel, equipment, supplies, and administration and general expenses necessary to operate and maintain the trunk stormwater facilities. An approximate breakdown of annual costs would be: operation--60 percent; equipment--20 percent; administration--15 percent; and supplies--5 percent.

These costs would be in addition to the annual costs now being expended by the City for operation and maintenance of existing stormwater facilities, exclusive of current and future park operation and maintenance costs.

TABLE 6
ANNUAL OPERATION AND MAINTENANCE COSTS OF THE RECOMMENDED PLAN

Area	Pipes		Detention Basins		Total	
	No Detention	Detention	No Detention	Detention	No Detention	Detention
Camelback Road to ACDC	\$1,068,000	\$687,000	\$0	\$287,000	\$1,068,000	\$ 974,000
ACDC to Skunk Creek	<u>\$ 92,000</u>	<u>\$ 68,000</u>	<u>\$0</u>	<u>\$ 17,000</u>	<u>\$ 92,000</u>	<u>\$ 85,000</u>
TOTALS	<u>\$1,160,000</u>	<u>\$755,000</u>	<u>\$0</u>	<u>\$304,000</u>	<u>\$1,160,000</u>	<u>\$1,059,000</u>

5. Sequencing of the Construction Program

It is recommended that the construction of trunk stormwater facilities be accomplished in three phases: Phase 1 representing immediate action and the highest priorities; Phase 2 representing short-range goals; and Phase 3 representing long-range goals.

Phase 1 -- Immediate Action

The implementation of stormwater facilities with detention is heavily dependent upon the availability of land for detention basins. Sites must be large enough and in locations appropriate for creating beneficial effects in downstream conditions. The following activities are recommended for immediate action:

1. Control land use at desired sites. This is of primary concern. Land use control can be accomplished by a variety of means:
 - . Granting developers increased density, then requesting that portions of their land be dedicated to detention;
 - . Obtaining an option on desired property;
 - . Purchasing desired property; or
 - . Any other method available to the City.
2. Formulate and enter into an interagency agreement with the City of Phoenix that will provide for joint stormwater management where stormwater flows cross 43rd Avenue from east to west near Northern Avenue, and 51st Avenue from east to west in the vicinity of Thunderbird Road.
3. Design and construct interim facilities at those road intersections where flooding occurs during relatively minor storms. The interim improvements would generally conform to the management plan recommendations and could consist of a pipe that temporarily empties into SRP irrigation or drainage facilities, a roadside ditch, a temporary detention basin, a dry well, or a small sump and booster pump system.

Approximate capital expenditures that would be incurred by the City for Phase 1 are estimated to total less than \$3 million.

Phase 2 -- Short Range (1985-1989)

Short range activities would include the following:

1. Formulate and enter into interagency agreements with the City of Peoria, Maricopa County (for drainage of lands near Camelback Road and New River), Arizona Department of Transportation (for use of the pipe system along Grand Avenue), Flood Control District of Maricopa County (for discharging stormwaters into the ACDC), and the Salt River Project (for temporary and/or permanent use of SRP's irrigation and drainage facilities).
2. Plan for the design of road improvements that will provide adequate space for constructing stormwater pipes within road rights-of-way. Establish alignments of major water lines and sanitary sewer pipes that will not conflict with the trunk stormwater facilities.
3. Design and construct those stormwater pipes and detention basins that are within or alongside current land development or road improvement projects.
4. Construct pipes or interim open channels at the downstream (west) end of Bethany Home Road and Orangewood Avenue, and proceed upstream as funds become available. This will establish two major stormwater outlets from Glendale to New River.
5. Construct trunk stormwater pipes along 59th and 67th Avenue that drain southerly and empty into the ACDC. These facilities will allow Glendale the use of inlets into the ACDC that currently are under design by the Corps of Engineers.

Approximate capital expenditures that would be incurred by the City for Phase 2 are estimated to be in the range of \$5 million to \$10 million.

Phase 3 -- Long Range (1990-1999 and 2000-2010)

The long range plan will consist of installing all of the remaining facilities not constructed during Phases 1 and 2. Downstream facilities should be constructed first, with construction proceeding upstream.

Following is a summary of estimated capital expenditures for Phases 1, 2 and 3.

<u>Phase</u>	<u>Period</u>	<u>Estimated Capital Expenditures</u>
Immediate Action	1985-1989	Less than \$3 million
Short Range	1985-1989	\$10 million
Long Range	1990-1999	\$70 million
	2000-2010	\$100 million