FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WATERSHED MANAGEMENT BRANCH

PROJECT NAME: Old Cross Cut Canal/Lafayette Drain

PROJECT LOCATION: See attached map

REQUESTED BY: Don Rerick, Project Manager, P&PM Division

DATE REQUESTED: October 1992

BRIEF DESCRIPTION OF THE OBJECTIVE: Analyze the Hydrology for the Old Cross Cut Canal based on a proposed 10-year Lafayette Interceptor Drain

PROJECT HYDROLOGIST(s): Amir Motamedi (based on previous work by Tom Hieb) AM 9/20/93

DATE COMPLETED: September 20, 1993

CHECKED BY: Ted Lehman (technical), Don ~~Rerick~~ (report) DM 9/21/93

1ST REVISION: July 16, 1993 (report)

2ND REVISION: August 19, 1993 (report)

3RD REVISION: September 2, 1993 (report)

RESPONSE DATE: September 20, 1993

COORDINATED:

FILE: OCCC (AMM)

OLD CROSS CUT CANAL/LAFAYETTE INTERCEPTOR DRAIN
HYDROLOGY REPORT
September 21, 1993

OBJECTIVE

To analyze the hydrology for the Old Cross Cut Canal (OCCC) based on a proposed 10-year Lafayette Interceptor Drain (LID).

BACK GROUND INFORMATION

The study area is separated into two watersheds (see Figure 1): **Arcadia Watershed** (above Arizona Canal), and the **Old Cross Cut Watershed** (below Arizona Canal to McDowell Road). Floodwaters generated in the Arcadia area in excess of the Arizona Canal capacity will spill into the Old Cross Cut Watershed at 56th and 48th Streets during the 10-year and greater events.

Two projects are proposed for the two watersheds. The LID is proposed to reduce the flooding in the Arcadia area. It extends from 64th Street to 40th Street along Lafayette Boulevard.

The reconstructed OCCC is proposed to carry the 10-year flow from the Arcadia Area Watershed (and any overflow from larger events) along with local drainage below the Arizona Canal. It extends from the Arizona Canal to McDowell Road along 48th Street.

Since outflow from the Arcadia area does have a marked effect on the design of the OCCC, all previous studies have investigated both watersheds at the same time.

The OCCC has previously been studied by the Corps of Engineers, Los Angeles District, in the report entitled *"Old Cross Cut, Phoenix, Arizona, Hydrology for Feasibility Studies for Flood Control and Allied Purposes," June 1987.*

Hard copies of several HEC-1 files for the LID and the OCCC design are available at the District. These analyses were performed by the Corps of Engineers, Los Angeles District. Models include SPF, 100-, 50-, and 25- year analyses of the OCCC with and without full or partial contribution from a 25-year LID. The HEC-1 printouts are dated April 1987, revised September 1988.

A second feasibility report, *"Phoenix Metropolitan Area, Old Cross-Cut Canal, Phoenix, Arizona," April 1989, revised October 1989,* further analyzed the OCCC. Hard copies for several HEC-1 files associated with this report are also available at the District.

In 1990, Greiner, Inc. was retained by the Flood Control District of Maricopa County and the City of Phoenix to design the OCCC improvements. The results of their analysis can be found in the report *"Old Cross Cut Canal Drainage Improvements," May 24, 1991.* Greiner modelled the Old Cross Cut Watershed using District approved methodologies, and used the Arcadia Watershed's overflow hydrographs as generated by the Corps (1985).

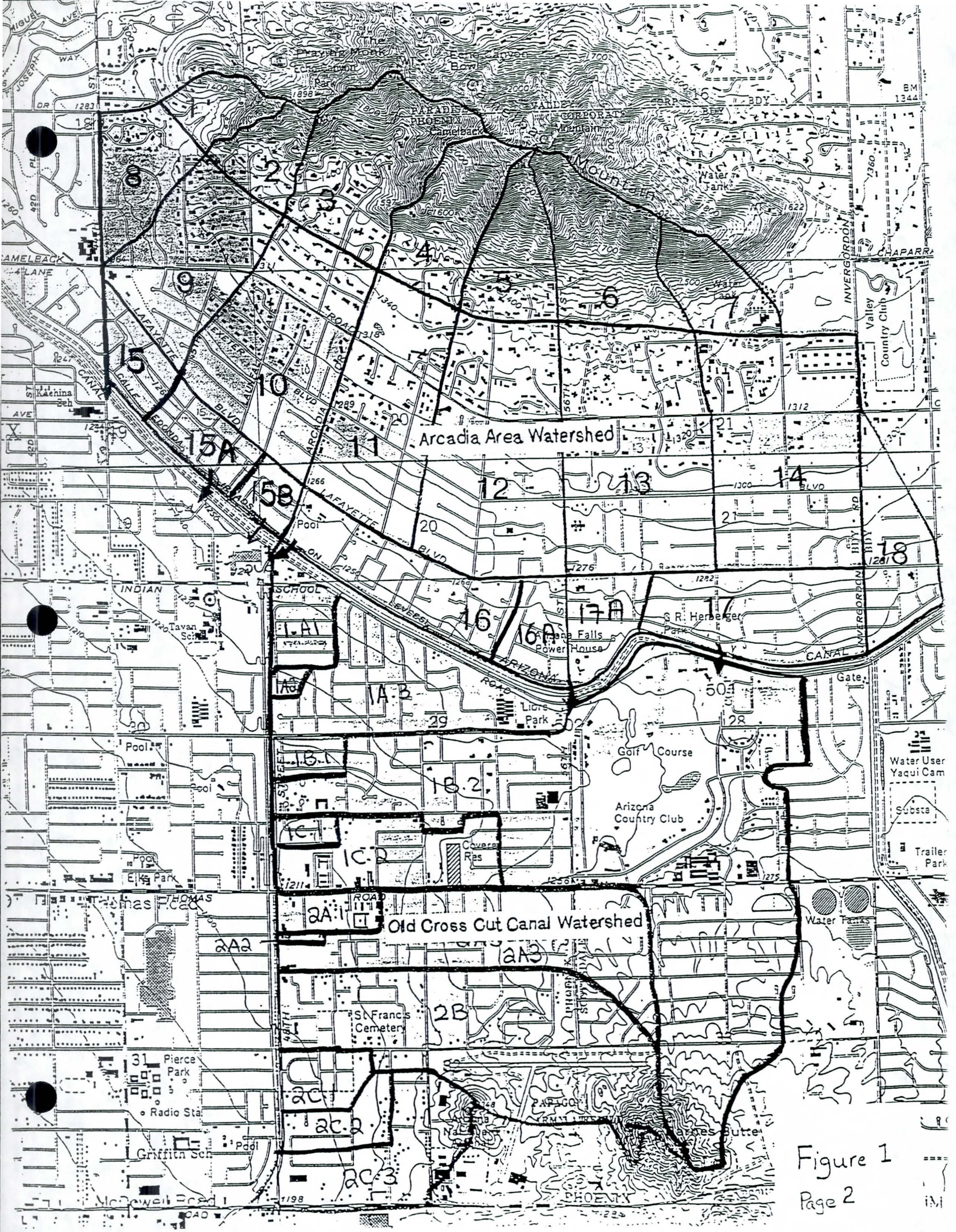


Figure 1
Page 2

In the Spring of 1991, the Hydrology Division of the District reanalyzed the hydrology for the LID, and developed frequency-discharge curves for this project. These results were reported through an interoffice memorandum, dated July 1, 1991, to the project manager. The results from this in-house study were used by Greiner for their design of the OCCC at that time.

In July 1992, the District's Hydrology and Engineering Divisions analyzed a preliminary basin sizing as an integral part of the LID, based on a 25- year local storm. Results of this analysis were reported to the project manager in an interoffice memorandum dated July 13, 1992.

In October 1992, the District was asked to analyze other alternatives for the OCCC, this time with a 10-year LID. This report includes the results and conclusions from that analysis.

METHOD OF ANALYSIS

Since the HEC-1 model for the OCCC below the Arizona Canal was recently developed by Greiner, it was not revised during this analysis with the exception of one minor change. That change consists of renaming three concentration points for clarity.

Major changes were made to the Arcadia Watershed model. The Arcadia Model analyzes the area above the Arizona Canal, which overflows into the Old Cross Cut Watershed at two locations for frequencies of 10- to 100-year return periods. These locations are at 48th Street at the Arizona Canal, and 56th Street at the Arizona Canal.

Two models were available to the District at the time of study for the Arcadia Watershed:

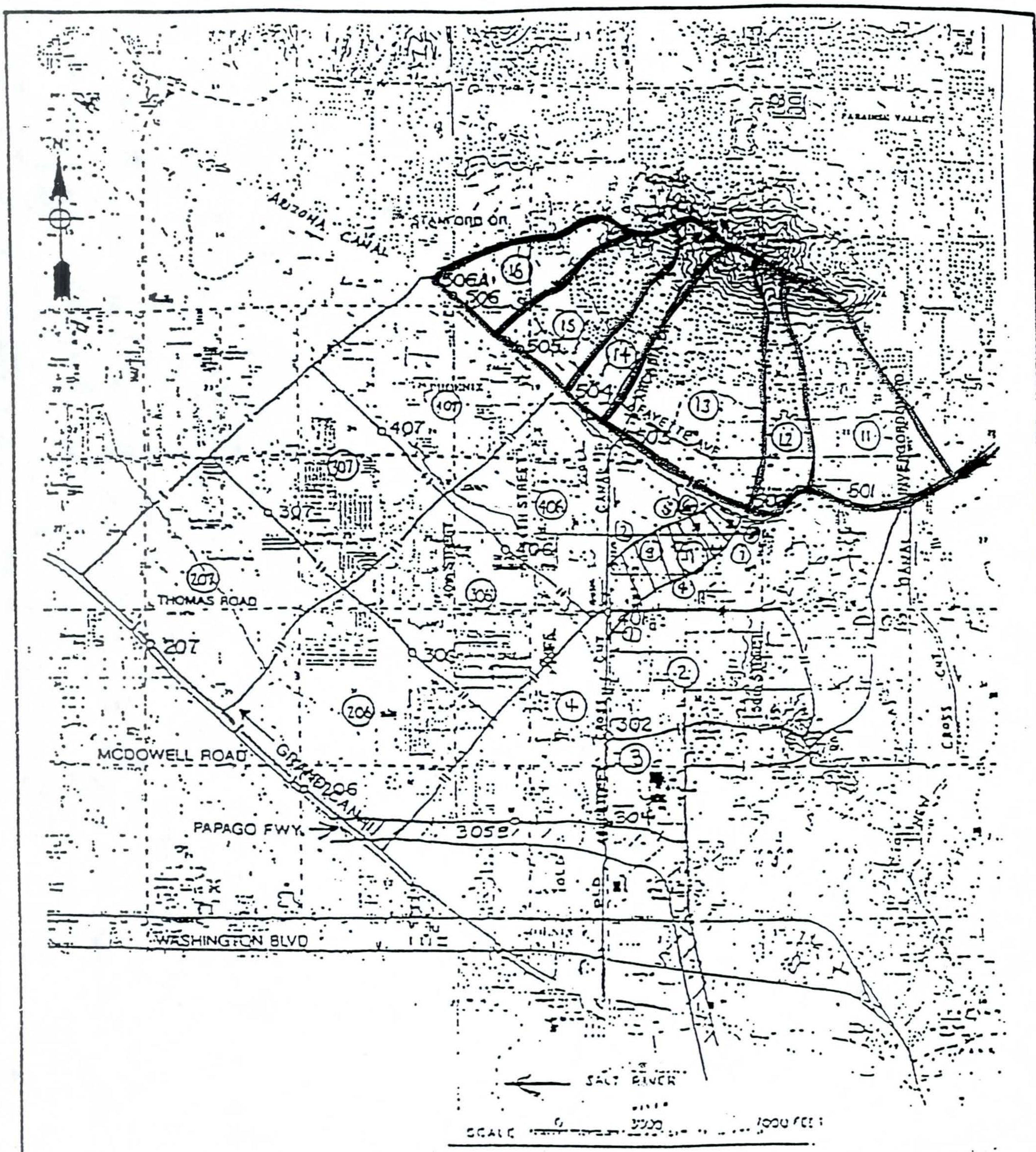
1. The District's HEC-1 model developed by Tom Hieb in June/July 1991 for the LID. This model uses the established criteria for hydrologic design in Maricopa County as of July 1991. The subbasin delineation was based on the assumption that a 25-year LID is in place, therefore, the ponding above the Arizona Canal was not analyzed.

2. A second model available to the District was the Corps' model developed for the LID as a part of the overall OCCC design in 1988. The two models differ not only in their subbasin delineation, but also in methodologies used (see Figure 2).

Both models were examined closely, and it was decided that since the design consultant for the LID will use the District's approved methodologies, the District's model should be the basis for this new analysis. Therefore, the District's 1991 model is used as the basis for the analysis with few changes.

The Arcadia model was to be updated and then utilized to see the changes in the overflows into the Old Cross Cut Watershed if a 10-year LID is constructed.

The existing Greiner model for the Old Cross Cut Watershed has been modified using the newly generated overflows to see the effects on the design of OCCC.



STORM DRAIN

CONCENTRATION POINT

SUBAREA NUMBER

OLD CROSS CUT STUDY

Figure 2
DRAINAGE AREA MAP

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

CHANGES FROM THE PREVIOUS MODELS

The District's Arcadia model was modified as follows (see Figure 1):

1. Further breakdown of the subbasins to account for the ponding above the Arizona Canal. This is necessary in order to compare the pre and post LID conditions. It was determined that subbasin 18 is drained through a collector channel to Indian Bend Wash, therefore, it was extracted from the model.

2. Incorporating the Arizona Canal inflows and the ponding above the Arizona Canal into the model.

3. Updating the time of concentration (T_c) calculations using the new MCUHP1.

4. Changing the rainfall distribution to show the effects of localized (over LID) and regional (over LID and OCCC) storms.

Subbasins 15, 16, and 17 were further subdivided in the new model. This was done to match the Corps' concentration points at the Arizona Canal. Field observations show no defined subbasin boundaries separating these areas. However, it appears that the Corps of Engineers' model may have analyzed the subbasin hydraulics separately, so the same methodology was followed in this analysis.

Subbasin 18 is drained through the Indian Bend Wash Collector Channel to the east, therefore, it was not included in the revised model.

The inflow from the Arizona Canal into the watershed was also considered in the model though it does not contribute to the flooding problem. The data was developed by the Corps, and was used in their 1988 HEC-1 model. There are minor discrepancies in the data (canal capacity and inflow hydrograph) in the Corps' published report (Old Cross Cut, June 1987), and those found in the Corps' HEC-1 analysis. The District's analysis used the Corps' latest data without any further examination.

There has been a revision to the District's Unit Hydrograph Program (MCUHP1) since the original model was developed in the Summer of 1991. Therefore, the time of concentration for the entire model was redeveloped for the input file.

The final revision included changing the areal reduction to see the effects of a localized storm (over the LID), versus a storm covering the entire OCCC and the LID Watersheds.

ANALYSIS:

Two scenarios were examined for the Lafayette area. First scenario, *Existing Condition Model,* examines the 25-, 50-, and 100-year local storms over the Arcadia Watershed. The overflows at 48th and 56th Streets are stored in the computer to be used in the OCCC model.

Second scenario, *with the 10-year LID model*, examines a local 10-year storm centered over the Arcadia Watershed. The flows reaching Lafayette Boulevard are used for preliminary sizing of the LID. The model was then modified for the 25-, 50-, and 100-year storms, with the 10-year flows calculated previously, to be diverted by a storm drain at Lafayette Boulevard and conveyed to the OCCC at 48th Street.

Both models assume that the Arizona Canal starts at the normal operating level, and spills at 48th and 56th Streets once the capacity is exceeded, due to floodwaters entering the canal from the Arcadia Watershed.

Two scenarios are also examined for the OCCC. The 25-, 50-, and 100-year general storms (over both Arcadia and Old Cross Cut Watersheds), with and without the 10-year LID in place. Greiner used the first scenario, with a 10-year LID for their proposed design of the OCCC (see Greiner Report of May 14, 1993, Model 4).

Both models assume that the Arizona Canal is spilling at a rate of 1,000 cfs (28.3 m^3/s), from the beginning of the simulation, into the OCCC at the wasteway at 48th Street.

ASSUMPTIONS:

1. It is assumed that the Arizona Canal spills at a constant 1,000 cfs (28.3 m^3/s) into the OCCC. The decision to include the 1,000 cfs (28.3 m^3/s) was based on Salt River Project's legal rights to use the wasteway at 48th street, and not based on any quantitative analysis.

2. The hydraulic data provided by the Corps' 1988 analysis was used to route the stormwaters in the ponding area above the Arizona Canal.

3. An open channel (non-pressure flow) was assumed for the LID for the design of the OCCC, with flows limited to 1,190 cfs (33.7 m^3/s) into the OCCC. <u>During the final LID design, the routing reaches may be modified if required.</u>

4. It is assumed that the LID will capture <u>ALL</u> of the 10-year flow above Arcadia.

RESULTS:

The following tables show the results of the HEC-1 model at major concentration points in the Arcadia Watershed for the two scenarios. The tables also compare the peak flows with those estimated by the Corps' model.

TABLE 1

ARCADIA WATERSHED, EXISTING CONDITIONS Peak flows (cfs)						
LOCATION	25-YEAR		50-YEAR		100-YEAR	
	FCD	COE	FCD	COE	FCD	COE
overflows, 48th Street at Arizona Canal	364	700	515	1000	631	1100
overflows, 56th Street at Arizona Canal	243	140	327	240	391	360

TABLE 2

ARCADIA WATERSHED, WITH 10-YEAR LID* Used for OCCC design Peak flows (cfs)			
LOCATION	25-YEAR	50-YEAR	100-YEAR
overflows, 48th Street at Arizona Canal	105	238	348
overflows, 56th Street at Arizona Canal	50	119	156
Lafayette Interceptor Drain at OCCC	1194	1194	1194

*Since the proposed LID will have a 10-year design capacity, it is not compared to the Corps' which has a 25-year design capacity.

The overflows estimated for the Arcadia area are then carried into the OCCC model. Tables 3 and 4 show the peak flows in the OCCC based on the inflows from the Arcadia area in Tables 1 and 2. It also includes 1,000 cfs (28.3 m^3/s) spill from the Arizona Canal into the OCCC.

TABLE 3

OLD CROSS CUT CANAL - EXISTING CONDITIONS*				
CROSS STREET	**C.P.**	**25-YR**	**50-YR**	**100-YR**
Lafayette Interceptor Drain	LAF	0	0	0
Indian School Road	AO	1370	1530	1640
Weldon	SUB1A1	1400	1560	1700
Whitton	SUB1A	1400	1570	1700
Osborn	SUB1A3	1760	2040	2270
Richardson	SUB1B1	1780	2060	2300
Earl	SUB1B2	2300	2830	3310
Pinchot	SUB1C1	2320	2850	3330
Thomas Road	SUB1C2	2410	2960	3470
Windsor	SUB2A1	2440	3000	3530
North of Virginia	SUB2A2	2450	3000	3540
Virginia	SUB2A3	2640	3270	3850
Oak	SUB2B	3000	3690	4350
Holly	SUB2C1	3050	3730	4410
Granada	SUB2C2	3090	3790	4490
McDowell	SUB2C	3250	3970	4710
HEC-1 MODEL	-------------	**25NO_DRN**	**50NO_DRN**	**100N_DRN**

*INCLUDES 1,000 CFS FROM SRP
*INCLUDES OVERFLOWS AT 48TH AND 56TH STREETS

TABLE 4

OLD CROSS CUT CANAL WITH 10-YR LID*				
CROSS STREET	**C.P.**	**25-YR**	**50-YR**	**100-YR**
Lafayette Interceptor Drain	LAF	1190	1190	1190
Indian School Road	AO	2310	2440	2560
Weldon	SUB1A1	2340	2490	2610
Whitton	SUB1A	2350	2500	2620
Osborn	SUB1A3	2520	2740	2950
Richardson	SUB1B1	2540	2760	2980
Earl	SUB1B2	3080	3550	4000
Pinchot	SUB1C1	3090	3560	4020
Thomas Road	SUB1C2	3180	3680	4160
Windsor	SUB2A1	3220	3730	4220
North of Virginia	SUB2A2	3220	3730	4230
Virginia	SUB2A3	3430	4000	4540
Oak	SUB2B	3830	4490	5110
Holly	SUB2C1	3880	4540	5180
Granada	SUB2C2	3930	4590	5250
McDowell	SUB2C	4080	4780	5470
HEC-1 MODEL	------------	**25W_DRN**	**50W_DRN**	**100W_DRN**

*INCLUDES 1,000 CFS FROM SRP
*INCLUDES OVERFLOWS AT 48TH AND 56TH STREETS

COMPARISON OF THE RESULTS:

This latest analysis somewhat confirms District's previous analysis performed in 1991. Overall, the estimated peak flows by the District are much less than those by the Corps of Engineers. This may be due to the following:

1. The Corps uses an assumption for the future condition development, which is more conservative than the assumptions made by the District for their design.

2. Different, yet similar design storms are used by the two agencies.

3. The Corps generates the 100-year runoff as a fraction of the Standard Project Flood, while the District uses the 100-year storm to generate the 100-year runoff.

These items may explain part of the differences, however, the results depend on each agency's interpretation of the future development, retention policy enforcement, and degree of conservatism.

While interpreting the results, one must keep in mind the following points:

1. The LID *increases* the flow into the OCCC in two ways:

    a. The LID makes the Arcadia system more efficient by discharging directly into the OCCC before ponding occurs upstream of the Arizona Canal. This will reduce the time separating the peak runoff generated above and below the Arizona Canal.

    b. The LID will increase the contributing area to the OCCC corridor by connecting the area between 40th and 48th Streets to the OCCC outfall.

2. Even with a 10-year LID in place, there will be stormwater overflows at 48th and 56th Streets during larger events (see Table 2).

APPENDIX A

PARAMETER ESTIMATION:

Note: Hydrology parameters for the Old Cross Cut Watershed can be found in the report entitled *"Old Cross Cut Canal Drainage Improvements," May 24, 1991,* by Greiner, Inc.

Rainfall:

The following precipitation depths are used for the study area:

6-HOUR PRECIPITATION DEPTH (inches)			
10	25	50	100
2.0	2.5	2.9	3.2

Depth-Area reductions curves and temporal distribution of the rainfall from the Drainage Design Manual for Maricopa County, Volume I (Hydrology Manual) was used for this study.

Both the LID and the OCCC design use a 6-hour duration design storm.

Rainfall Losses:

The Green and Ampt infiltration method is used for estimating rainfall losses. These values remain unchanged from the District's 1991 model, except for subbasins 15, 16, 17, and 18 which were further subdivided.

RAINFALL LOSSES					
SUBBASIN	XKSAT	PSIF	DTHETA	%RTIMP	IA
1	0.42	4.3	0.35	69	0.15
2	0.42	4.3	0.35	67	0.15
3	0.42	4.3	0.35	61	0.15
4	0.42	4.3	0.35	64	0.15
5	0.42	4.3	0.35	64	0.15
6	0.42	4.3	0.35	64	0.15
7	0.37	4.0	0.35	63	0.15
8	0.67	4.3	0.25	64	0.2
9	0.67	4.3	0.25	33	0.2
10	0.67	4.3	0.25	17	0.2
11	0.67	4.3	0.25	17	0.2
12	0.635	4.2	0.25	19	0.2
13	0.37	4.4	0.25	20	0.2
14	0.55	3.9	0.25	17	0.2
15	0.67	4.3	0.25	24	0.2
15A	0.67	4.3	0.25	28	0.2
15B	0.67	4.3	0.25	21	0.2
16	0.65	4.0	0.25	20	0.2
16A	0.46	4.6	0.25	20	0.2
17	0.29	5.5	0.25	20	0.2
17A	0.43	4.8	0.25	20	0.2

Hydrograph Generation:

Clark Unit Hydrograph is used in this analysis. The parameters remain unchanged from the District's 1991 study except for subbasins 15, 16, 17, and 18.

UNIT HYDROGRAPH				
SUBBASIN	DA[@]	L[*]	S[#]	K_b
1	0.0623	0.379	1550	0.152
2	0.0734	0.331	1731	0.150
3	0.227	0.663	1584	0.135
4	0.142	0.616	2198	0.141
5	0.113	0.568	2350	0.144
6	0.179	0.663	2000	0.138
7	0.0956	0.521	1850	0.124
8	0.108	0.549	82	0.029
9	0.207	0.720	63	0.027
10	0.298	0.750	112	0.026
11	0.260	0.780	108	0.026
12	0.365	0.830	124	0.025
13	0.395	0.850	120	0.025
14	0.380	0.800	66	0.025
15	0.0819	0.189	79	0.029
15A	0.0491	0.189	79	0.031
15B	0.033	0.17	64	0.032
16	0.181	0.33	69	0.027
16A	0.054	0.4	50	0.03
17	0.198	0.36	92	0.027
17A	0.072	0.45	67	0.03

[@] Drainage area in square miles
[*] Length of the watercourse in miles
[#] Slope in feet/mile

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 1 OF 21

DETAIL Hydrology COMPUTED TWH DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: SUB1 Sub-Basin Area: 0.0623 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	90	0.4	60
PVC	10	0.4	—

XKSAT= 0.4
PSIF= 4.3
RTIMP= 0.9 (0.6) = 0.54

adj. XKSAT= 1.05 (0.4) = 0.42
DTHETA= 0.35
IA= 0.15

zoning	%AREA	RTIMP
RE-35	78	15
PAD-4	22	85

DI = 0.304 RTIMP = 0.54 + 0.5(0.304) = 69%

Hydrograph:

K_b = 0.152

Length= 0.379 miles
Elev. High= 1898
Elev. Low= 1310

K_b= − 0.03 log (640 × 0.0623) + 0.2
Slope= 1550 ft/mile

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 2 OF 21

DETAIL Hydrology COMPUTED TWH DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: SUB2 Sub-Basin Area: 0.0734 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	96	0.4	60
PVC	4	0.4	0
			NI = .96 (0.6) = 0.576

XKSAT= 0.4

PSIF= 4.3

$RTIMP_b$= 0.96 (0.60) = 0.567

adj. XKSAT= 1.05 (0.4) = 0.42

DTHETA= 0.35

IA= 0.15

zoning	%AREA	RTIMP
RE-35	70	15
open	20	0
PAD-4	10	85
		DI = 0.19

RTIMP = 0.576 + 0.5(0.19) = 67%

Hydrograph:

Length= 0.331 miles

Elev. High= 1900 Elev. Low= 1327

K_b= -0.03 log (640 × 0.0734) + 0.2 = 0.15

Slope= 1731 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 3 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6/91

Parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: SUB 3 **Sub-Basin Area:** 0.227 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (Inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	93	0.4	60
PVC	4	0.4	0
Va	3	0.4	0
			NI= .93(0.6)=.558

XKSAT= .4
PSIF= 4.3
RTIMP= 0.93(0.6)=0.558

adj. XKSAT= 1.05(0.4)= 0.42
DTHETA= 0.35
IA= 0.15

zoning	%AREA	RTIMP
RE-35	70	15
Open	30	0
		DI= .105

RTIMP= 0.558+ .5(.105) = 61%

Hydrograph:

Length= 0.663 miles
Elev. High= 2400
Elev. Low= 1350

K_b= - 0.03 log (640 * 0.227) +0.2= 0.135
Slope= 1584 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 4 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6/91

Parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: SUB 4 Sub-Basin Area: 0.142 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	100	.4	60

XKSAT= 0.4
PSIF= 4.3
RTIMP= 0.6

adj. XKSAT= 1.05(.4) = 0.42
DTHETA= 0.35
IA= 0.15

zoning	%AREA	RTIMP
RE-35	53	15
open	47	0
		DI = 0.08

RTIMP = 0.6 + .5(.08) = 64%

Hydrograph:

Length= 0.616 miles
Elev. High= 2704
Elev. Low= 1350

K_b= − 0.03·log(640 × 0.142) + 0.2 = 0.141
Slope= 2198

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 5 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6/91

Parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: SUB 5 Sub-Basin Area: 0.113 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	100	.4	60

XKSAT= .4
PSIF= 4.3
RTIMP= 0.6

adj. XKSAT= .42
DTHETA= .35
IA= 0.15

zoning	%AREA	RTIMP
RE_35	53	15
open	47	0

DI= 0.6 + 0.5(0.08) = 64%/~~12~~

Hydrograph:

Length= 0.568 miles
Elev. High= 2704
Elev. Low= 1370

K_b= −0.03 log(640 · 0.113) + 0.2 = 0.14
Slope= 2350 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 6 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6,91

Parameter estimation CHECKED BY ______ DATE ______

Sub Basin Name: SUB 6 Sub-Basin Area: 0.179 miles^2

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	100	0.4	60

XKSAT= 0.4
PSIF= 4.3
RTIMP= 0.60

adj. XKSAT= 0.42
DTHETA= 0.6
IA= 0.15

zoning	%AREA	RTIMP
RH	45	10*
open	49	0
RE-35	16	15

*estimated from Aerial photo

DI = 0.069 %IMP = 0.6 + 0.5 (0.069) = 64%

Hydrograph:

Length= 0.663 miles
Elev. High= 2704
Elev. Low= 1378

K_b= -0.03 log (640 * 0.179) + 0.2 = 0.138
Slope= 2000 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Drain

DETAIL Hydrology COMPUTED TWH DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: Sub 7 Sub-Basin Area: 0.0956 $miles^2$

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
RO, RU	84	0.4	60%
TrB	16	0.06	0

XKSAT= 0.84 (.4) + 0.16 (0.06) = 0.35
adj. XKSAT= 0.37
PSIF= 4.0
DTHETA= 0.35
RTIMP= 0.84 (0.6) = 0.504
IA= 0.15

zoning	%AREA	RTIMP
RH*	100	25*

* minor mixed zoning & Golf course, estimated from aerial photography

RTIMP = .504 + 0.5 (0.25) = 63%

Hydrograph:

Length= 0.521 miles
K_b= 0.124
Elev. High= 2302
Elev. Low= 1336
Slope= 1850 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Drain PAGE 8 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6/91

parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: Sub 8 **Sub-Basin Area:** 0.108 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
PVC	53	0.4	0
Va	44	0.4	0
Ru	3	0.4	60

XKSAT= 0.4
PSIF= 4.3
RTIMP= 0.03 (0.6) = 0.018

adj. XKSAT= 0.67
DTHETA= 0.25
IA= 0.2

zoning	%AREA	RTIMP
RE-24	31	18
PAD-4	35	85
PAD-9	25	85
C-O	9	75

DI = 0.663 , RTIMP = 0.663 + 0.5 (0.018) = 64%

Hydrograph:

Length= 0.549 miles
Elev. High= 1310
Elev. Low= 1265

K_b= − 0.00625 log (640 × 0.108) + 0.04 = 0.02
Slope= 82 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT *Lafayette Interceptor Drain*
DETAIL *Hydrology* COMPUTED *TWH* DATE *6.91*
parameter estimation CHECKED BY ______ DATE ______

Sub Basin Name: *Sub9* **Sub-Basin Area:** *0.207* miles²

Precipitation

Duration: *6* hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	*66*	*0.4*	*0*
PVC	*28*	*0.4*	*0*
Ru	*6*	*0.4*	*60*

XKSAT= *0.4*
PSIF= *4.3*
RTIMP= *.06 (0.6) = .036*

adj. XKSAT= *0.67*
DTHETA= *0.25*
IA= *0.2*

zoning	%AREA	RTIMP
RE-24	*41*	*18*
RE-35	*21*	*15*
R1-18	*17*	*18*
PAD7	*7*	*85*
PAD-4	*4*	*85*
P-1, C1, etc	*10*	*85*

DI = .314
RTIMP = 33%

Hydrograph:

Length= *0.72* miles
Elev. High= *1310*
Elev. Low= *1265*
K_b= *0.027*
Slope= *63 ft/mi*

Sub Basin Name: Sub 10 Sub-Basin Area: 0.298 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	97	0.4	0
PvC	3	0.4	0

XKSAT= 0.4 adj. XKSAT= 0.67
PSIF= 4.3 DTHETA= 0.25
RTIMP= 0 IA= 0.2

zoning	%AREA	RTIMP
RE-24	68	18
RE-35	26	15
RI-18	6	18

DI=0.172 RTIMP=17%

Hydrograph:

Length= 0.75 miles K_b= 0.0216
Elev. High= 1350 Elev. Low= 1266 Slope= 112 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 11 OF 21

DETAIL Hydrology COMPUTED TWH DATE 6,91

parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: Sub 11 Sub-Basin Area: 0.260 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	96	0.4	0
Ru	4	0.4	60

XKSAT= 0.4 adj. XKSAT= 0.67

PSIF= 4.3 DTHETA= 0.25

RTIMP= 0.04 (0.6) = .024 IA= 0.2

zoning	%AREA	RTIMP
RE-35	85	.15
RE-24	15	18

DI = 0.155 RTIMP = 0.155 + 0.5 (0.024) = 17%

Hydrograph:

Length= 0.78 miles K_b= 0.026

Elev. High= 1350 Elev. Low= 1266 Slope= 108 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 12 OF 21
DETAIL Hydrology COMPUTED TWH DATE 6/91
Parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: Sub 12 Sub-Basin Area: 0.365 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	81	0.4	0
Ro	14	0.4	60
TrB	5	0.06	0

XKSAT= 0.95(.4) + .05(.06) = 0.38
PSIF= 4.2
RTIMP= .14 (.60) = .084

adj. XKSAT= 1.67 (.38) = .635
DTHETA= .25
IA= 0.2

zoning	%AREA	RTIMP
RE-35	93	15
RE-24	7	18

DI = 0.152 RTIMP = 0.152 + 0.5(0.084) = 19%

Hydrograph:

Length= 0.83 miles
Elev. High= 1370
Elev. Low= 1267
K_b= 0.025
Slope= 124 ft/mi

Sub Basin Name: Sub 13 Sub-Basin Area: 0.395 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
TrB	48	.06	
Va	33	.40	
Ru	12	.40	
LaA	7	.15	

XKSAT= .48(.06) + .45(.4)+.07(.15)=.22 adj. XKSAT= 1.67(.22).37
PSIF= 4.4 DTHETA= .25
RTIMP= .12(.60)=.072 IA=0.2

zoning	%AREA	RTIMP
RE-35	70	15
RE-24	30	18

DI=0.159 RTIMP= 0.159 + 0.5(.072) = 20%

Hydrograph:

Length= 0.85 miles K_b= 0.025
Elev. High= 1378 Elev. Low= 1276 Slope= 120

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 14 OF 21
DETAIL Hydrology COMPUTED TWH DATE 6/91
Parameter Estimation CHECKED BY DATE

Sub Basin Name: Sub 14 Sub-Basin Area: 0.380 miles^2

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	47	.4	0
TrB	18	.4	0
Mv	16	.25	0
LaA	17	.15	0
Ru	2	.40	60

XKSAT= .67(.4)+.16(.25)+.17(.15) = .33 adj. XKSAT= .55
PSIF= 3.9 DTHETA= .25
RTIMP= .02(.6)=.012 IA=0.2

zoning	%AREA	RTIMP
RE-35	70	15
RE-24	30	18

DI= 0.159 IMP= 0.159 + .5(.012) = 17%

Hydrograph:

Length= 0.8 miles K_b= 0.025
Elev. High= 1336 Elev. Low= 1283 Slope= 66

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 15 OF 21

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: 15

Sub-Basin Area: 0.0819 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	100	0.4	0

XKSAT= .4

PSIF= 4.3

RTIMP= 0

adj. XKSAT= 0.67

DTHETA= 0.25

IA= 0.2

zoning	%AREA	RTIMP
RE-24	10	18
R1-10	90	25

Hydrograph:

Length= 0.189 miles

K_b= 0.029

Elev. High=

Elev. Low=

Slope= 79

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: SUB 15A Sub-Basin Area: 0.0491 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	100	0.4	0

XKSAT= 0.4
PSIF= 4.3
RTIMP= Ø

adj. XKSAT= 0.67
DTHETA= 0.25
IA= 0.2

zoning	%AREA	RTIMP
R1-10	80	25
RE-24	10	18
RS	10	70

NI=28 RTIMP=28%

Hydrograph:

Length= 0.189 miles
Elev. High=
Elev. Low=
K_b= 0.031
Slope= 79 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 17 OF 21

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: 15B

Sub-Basin Area: 0.033 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	100	0.4	0

XKSAT= 0.4
PSIF= 4.3
RTIMP= Ø

adj. XKSAT= 0.67
DTHETA= 0.25
IA= 0.2

zoning	%AREA	RTIMP
R1-10	30	25
R1-14	60	20
RE-24	10	18

RTIMP= 21%

Hydrograph:

Length= 0.17 miles
Elev. High=
Elev. Low=

K_b= 0.032
Slope= 64

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 18 OF 21

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: Sub 16 Sub-Basin Area: 0.181 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	93	0.4	0
Es	5	0.25	0
Mv	2	0.25	0

XKSAT= 0.39 adj. XKSAT= 0.65
PSIF= 4.0 DTHETA= 0.25
RTIMP= 0 IA= 0.2

zoning	%AREA	RTIMP
R1-14	89	20
RE-24	11	18

DI= 0.198 RTIMP= 20%

Hydrograph:

Length= 0.33 miles K_b= 0.027
Elev. High= Elev. Low= Slope= 69

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain PAGE 19 OF 21

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: Sub 16A

Sub-Basin Area: 0.054 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Va	21	0.4	0
Mv	79	0.25	0

XKSAT= 0.28

PSIF= 4.6

RTIMP= 0

adj. XKSAT= 0.46

DTHETA=0.25

IA=0.2

zoning	%AREA	RTIMP
R1-14	89	20
RE-14	11	18

DI=0.198 RTIMP = 20%

Hydrograph:

Length= 0.4 miles

K_b=0.03

Elev. High=

Elev. Low=

Slope= 50 ft/mi

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Lafayette Interceptor Drain

DETAIL Hydrology COMPUTED ______ DATE ______

Parameter Estimation CHECKED BY ______ DATE ______

Sub Basin Name: Sub 17 Sub-Basin Area: 0.198 miles²

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Mv	41	0.25	0
LaA	59	0.15	0

XKSAT= 0.175
PSIF= 5.5
RTIMP= 0

adj. XKSAT= 0.29
DTHETA= 0.25
IA= 0.2

zoning	%AREA	RTIMP
RE-24	17	18
R1-10	5	25
R1-14	78	20

DI = 0.199 RTIMP = 20%

Hydrograph:

Length= 0.36 miles K_b= 0.027
Elev. High= Elev. Low= Slope=

DETAIL Hydrology COMPUTED AMM DATE

Parameter Estimation CHECKED BY DATE

Sub Basin Name: Sub 17a Sub-Basin Area: 0.072 $miles^2$

Precipitation

Duration: 6 hours

frequency	2	10	25	50	100	SPF
depth (inches)						

Losses

Soils

unit	%AREA	XKSAT	RTIMP
Mv	73	0.25	0
LaA	11	0.15	0
Va	16	0.40	0

XKSAT= 0.26
PSIF= 4.8
RTIMP= 0

adj. XKSAT= 0.43
DTHETA= 0.25
IA= 0.2

zoning	%AREA	RTIMP
R1-14	84	20
RE-14	16	18

DI = 0.197 RTIMP = 20%

Hydrograph:

Length= 0.45 miles
Elev. High=
Elev. Low=
K_b= 0.03
Slope= 67 ft/mi