DRAINAGE REPORT

INDIAN BEND WASH AT SCOTTSDALE ROAD

SCOTTSDALE ROAD IMPROVEMENTS

PROJECT S-5510

May, 1985

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PURPOSE

The purpose of the report is to investigate the existing drainage conditions at the location where Indian Bend Wash crosses under Scottsdale Road. This investigation will define the problems in this area and will attempt to recommend solutions.

EXISTING CONDITIONS:

At the present time (May, 1985) Indian Bend Wash passes under Scottsdale Road through 3 - 10' x 8' box culverts which are approximately 100' long. Indian Bend Wash flows to this location from a northwesterly direction and immediately downstream (southeast) of the box culverts it empties into a lake on the McCormick Ranch Golf Course (See Exhibit 1). As shown in Exhibit 2 the area draining to a point immediately upstream of the existing box culverts is approximately 44 square miles. As it flows from the northwest, Indian Bend Wash is contained in an engineered floodway until it exits Camelback Country Club Golf Course (pt. A - Exhibit 3) at a point approximately 830' northwest of the box culvert at Scottsdale Road. Between Camelback Golf Course and Scottsdale Road, the area is presently undeveloped and Indian Bend Wash shows evidence of scouring an ill-defined path through this area and depositing silt into the lake on McCormick Ranch Golf Course. In addition to the aforementioned, the Indian Bend Wash flow is eroding an area immediately upstream of the box culverts which results in undermining of the shoulder section on the west side of Scottsdale Road.

Results of the Scottsdale Flood Study (Ref. 4) show that the existing box structure is inadequate for the storms of 10, 50 and 100 year return frequency. The runoff from these storms are greater than the capacity of the box culverts which results in flows crossing over the top of the road or flowing south on or parallel to Scottsdale Road and ultimately reaching a low point along Scottsdale Road and draining into Stillman Wash and/or Mummy Mountain Wash. For the 100 year frequency storm, the flood study shows that the downstream lake on McCormick Ranch actually backs up to the Scottsdale Road pavement elevation (1296.2 ±) in the area of the box culvert.

The 50 year frequency storm flood backs the above lake to an elevation (1295.3) which is above the downstream top of the culvert opening (top/culvert = 1293.0). The 10 year frequency storm results in a lake elevation which is approximately equal to the top of the box culvert opening.

Because of the above existing conditions, there is considerable flooding of Scottsdale Road during the occurrence of the 10 to 100 year frequency storms. The purpose of this report is to address the following points:

1. Increase the capacity of the existing 3 - 10' x 8' box culverts by means of adding additional culverts or replacing the existing culverts with a bridge in order to direct more flow under Scottsdale Road rather than over and along it.

2. Construct channel improvements upstream and downstream of the new structure to alleviate the existing siltation problems.

3. Construct improvements immediately upstream and downstream of the new structure to prevent erosion of the channel banks and undermining of the roadway subsurface.

HYDROLOGIC AND HYDRAULIC METHODS:

Hydrology for this report is provided by the City of Scottsdale Flood Insurance Study (Ref. 4). According to this source (p. 10), the peak discharge (cfs) for Indian Bend Wash at Scottsdale Road is:

10 year	50 Year	100 Year
3,400 cfs	11,000 cfs	16,000 cfs

These values were plotted on log-probability paper (Exhibit 4) and from the plot of this graph, a 25 year peak discharge was interpolated to be 6,900 cfs. This value was used to design a structure to convey the 25 year flood under Scottsdale Road.

Water surface profiles for the area in the vicinity of the box culvert were determined using the HEC-2 computer program (Ref. 5). Backwater elevations were computed starting with the above mentioned McCormick Ranch Lake surface elevations for the 10, 50 & 100 year frequency storms and working upstream through the box culvert. Cross sections were developed from the concept paving plans for Scottsdale Road (Ref. 6) to reflect the proposed

improvements of the existing box culvert and also any upstream and downstream modifications to Indian Bend Wash. Results of the HEC-2 computer runs are included in this report.

RESULTS:

An investigation was made of alleviating the effects of floods caused by the 25 year and 100 year frequency storms. It was immediately observed that since the level of the lake on McCormick Ranch Golf Course is approximately the same as Scottsdale Road for the 100 yr storm, that enlarging the structure under the road would have no significant effect on lowering the water surface crossing the road. Therefore, for the 100 year event, drainage paths would be approximately the same even if improvements are made. The only way to accommodate flows from the 100 year storm is to significantly lower the normal operating level of the McCormick Ranch Golf Course Lake to decrease the backwater elevation at the downstream end of the structure beneath Scottsdale Road.

Because it is unfeasible to design a structure to significantly lower the 100 year upstream water surface at Scottsdale Road because of the downstream lake elevation, it was decided to direct attention to alleviating the effects of the flows caused by the 25 year frequency storm. After examining the results of several HEC-2 computer runs, it was found that the 25 year peak discharge (6900 cfs) could be contained within a structure/channel system if the existing 3 - 10' x 8' box culverts were increased to 8 - 10' x 8' box culverts or a bridge of comparable size. With this structure, all runoff from the 25 year storm will pass under Scottsdale Road. As mentioned

above, enlarging the structure under Scottsdale Road to accommodate the 25 year storm will have little effect on the upstream water surface elevations caused by the 100 year storm because of the high backwater elevations caused by McCormick Ranch Lake.

RECOMMENDATIONS:

In order to lessen the effects of flooding of Scottsdale Road due to the flows in Indian Bend Wash, it was decided to study storms in the 25-100 year frequency range and decide from the results of the HEC-2 computer runs which events could be feasibly alleviated. As mentioned before, downstream backwater conditions and economic considerations prevent moderation of the effects of the 100 year frequency storm. Because of this it was decided to design a structure to carry the 25 year peak discharge (6900 cfs) under Scottsdale Road. From backwater calculations by the HEC-2 program it was found that this could be accomplished by enlarging the present structure to 8 - 10' x 8' box culverts, or as an alternative, installing a bridge of comparible size.

In addition to the above, the problem of upstream scour and erosion with the accompanying deposition of silt in McCormick Ranch Lake must be addressed. The channel for Indian Bend Wash between Scottsdale Road upstream to Camelback Golf course is ill-defined and is susceptible to scour because there is no channel lining to protect the earthen drainageway from erosion. In addition, there is a drop of approximately 5' immediately upstream of the box culvert opening which causes the surrounding area to be unstable. The solution to these problems are shown on Sheet 18 of the Scottsdale Road

Paving Plans (Ref. 6). This plan sheet shows concrete and riprap channel lining immediately upstream of the structure opening. In addition, the plans call for the construction of a concrete drop structure upstream of the opening. The purpose of this structure is to dissipate energy from the channel flow of Indian Bend Wash by dropping it into the backwater caused by McCormick Ranch Lake. This structure will prevent erosion which presently exists when channel flow drops into the backed-up lake surface. The bank protection is needed in this area to prevent scouring which occurs as a result of turbulence caused by channel flow trying to enter the culvert opening. It is also recommended that the Indian Bend Wash drainageway be regraded and grasslined from the drop structure northwest to match the section within Camelback Golf Course.

REFERENCES:

1. City of Scottsdale Design Procedures and Criteria, Section 2, "Drainage Report Preparation"

2. City of Scottsdale Design Procedures and Criteria, Section 3, "Design of Facilities to Manage Storm Water Runoff"

3. U.S. Army Corps. of Engineers, L.A. District, "Phoenix Urban Study Final Report" December 1981

4. Federal Emergency Management Agency, "Flood Insurance Study - City of Scottsdale" June 4, 1984

5. U.S. Army Corps. of Engineers, "HEC-2, Water Surface Profiles Users Manual"

6. Henningson, Durham & Richardson - 20 '/" Paving Plans, "Scottdale Road - Hummingbird Lane to Eastwood Lane Paving Improvements - Project S-5510" Final Concept Plans - May, 1985

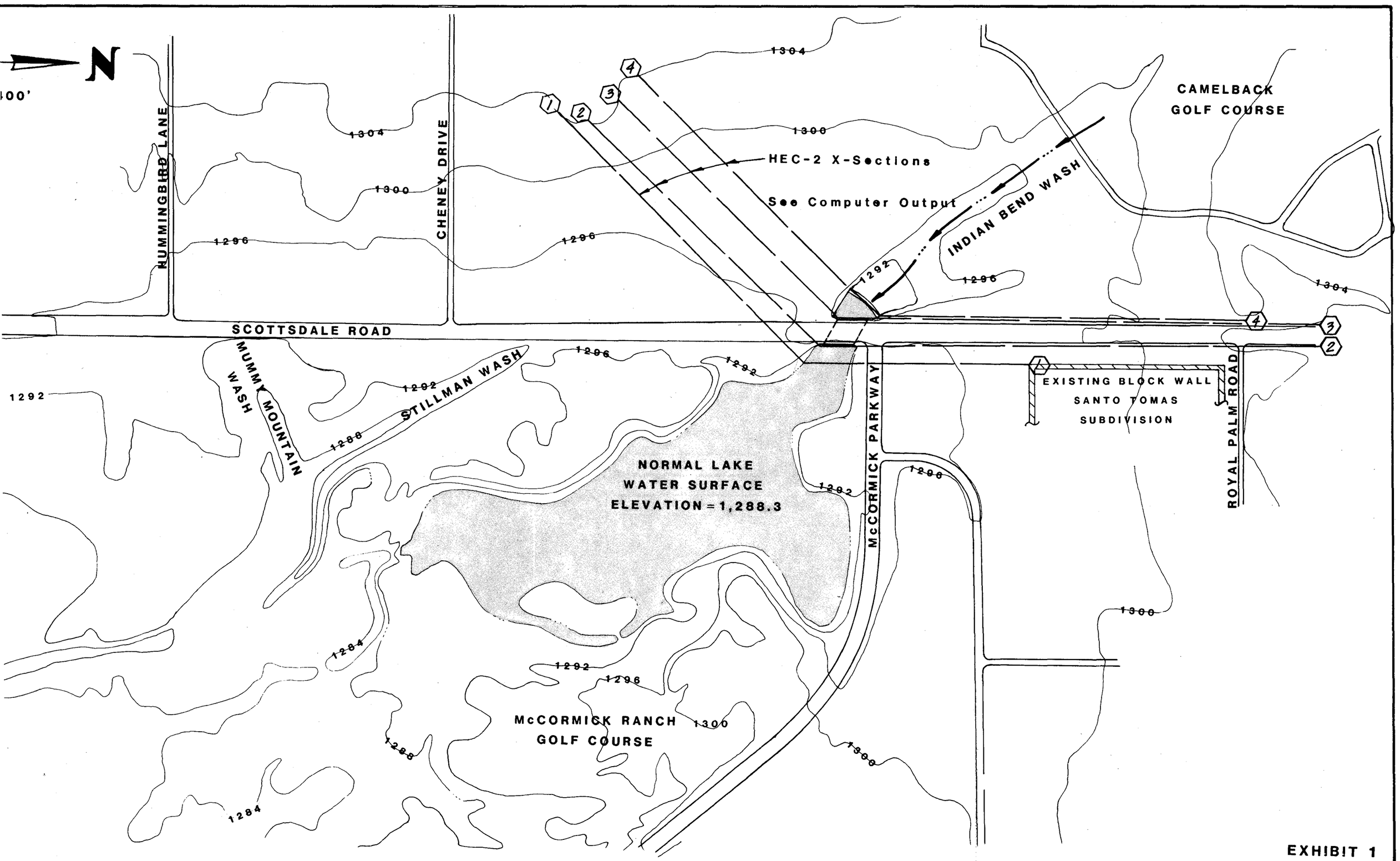
N
HUMMINGBIRD LANE
CHENEY DRIVE
SCOTTSDALE ROAD
HEC-2 X-Sections
See Computer Output
INDIAN BEND WASH
CAMELBACK
GOLF COURSE
MUMMY MOUNTAIN WASH
STILLMAN WASH
NORMAL LAKE
WATER SURFACE
ELEVATION = 1,288.3
McCORMICK PARKWAY
EXISTING BLOCK WALL
SANTO TOMAS
SUBDIVISION
ROYAL PALM ROAD
McCORMICK RANCH
GOLF COURSE
1304
1300
1296
1292
1288
1284
1
2
3
4

EXHIBIT 1

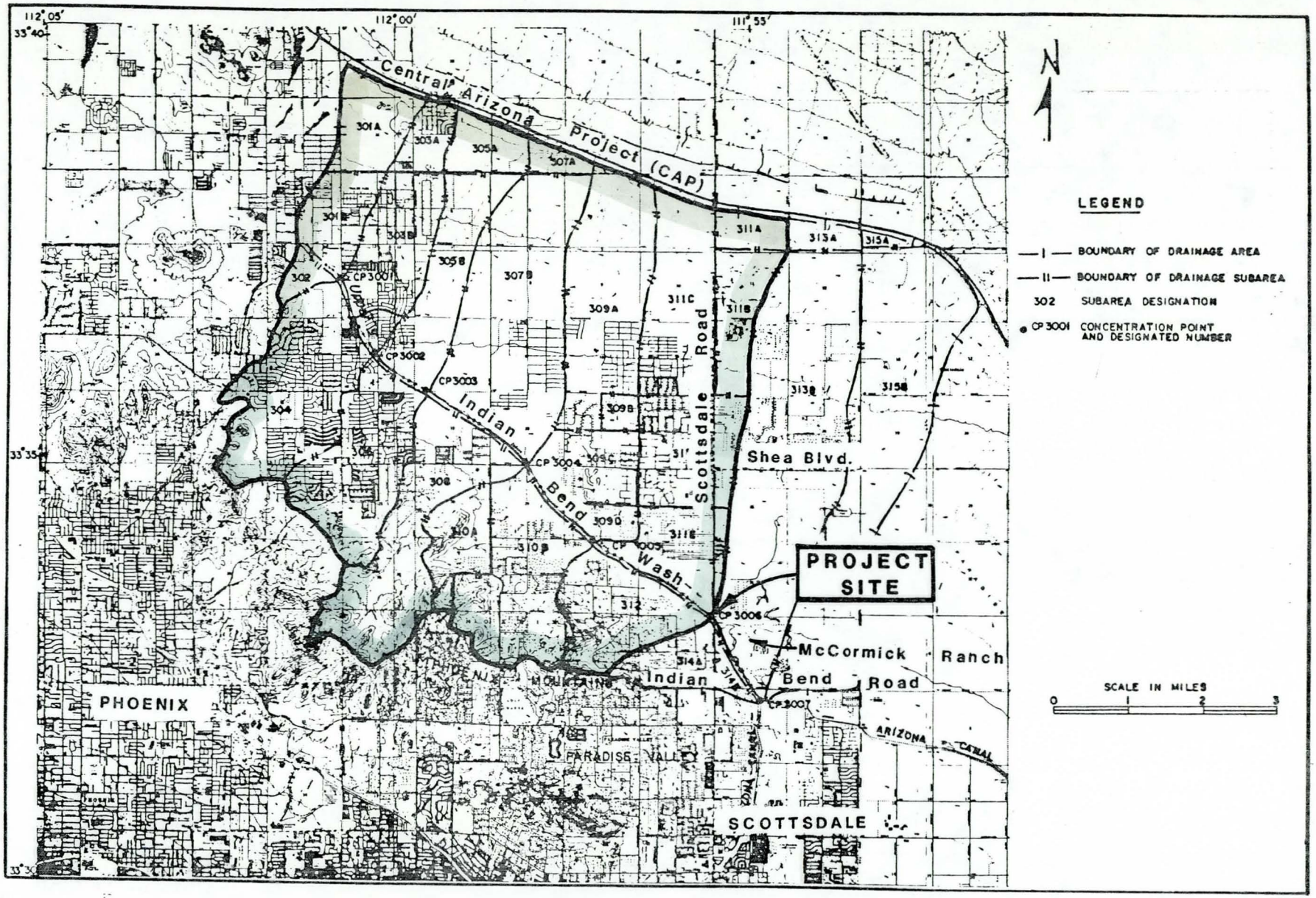
112°05'
112°00'
111°55'
33°40'
33°35'
33°30'
Central Arizona Project (CAP)
Indian Bend Wash
Scottsdale Road
Shea Blvd.
PROJECT SITE
McCormick Ranch Road
Indian Bend Road
PHOENIX
PARADISE VALLEY
SCOTTSDALE
ARIZONA CANAL
CP3001
CP3002
CP3003
CP3004
CP3005
CP3006
CP3007
301A
303A
305A
307A
301B
303B
305B
307B
302
304
306
308
309A
309B
309C
310A
310B
311A
311B
311C
312
313A
313B
314A
315A
315B
N
LEGEND
I BOUNDARY OF DRAINAGE AREA
II BOUNDARY OF DRAINAGE SUBAREA
302 SUBAREA DESIGNATION
CP3001 CONCENTRATION POINT AND DESIGNATED NUMBER
SCALE IN MILES
0 1 2 3

EXHIBIT 2

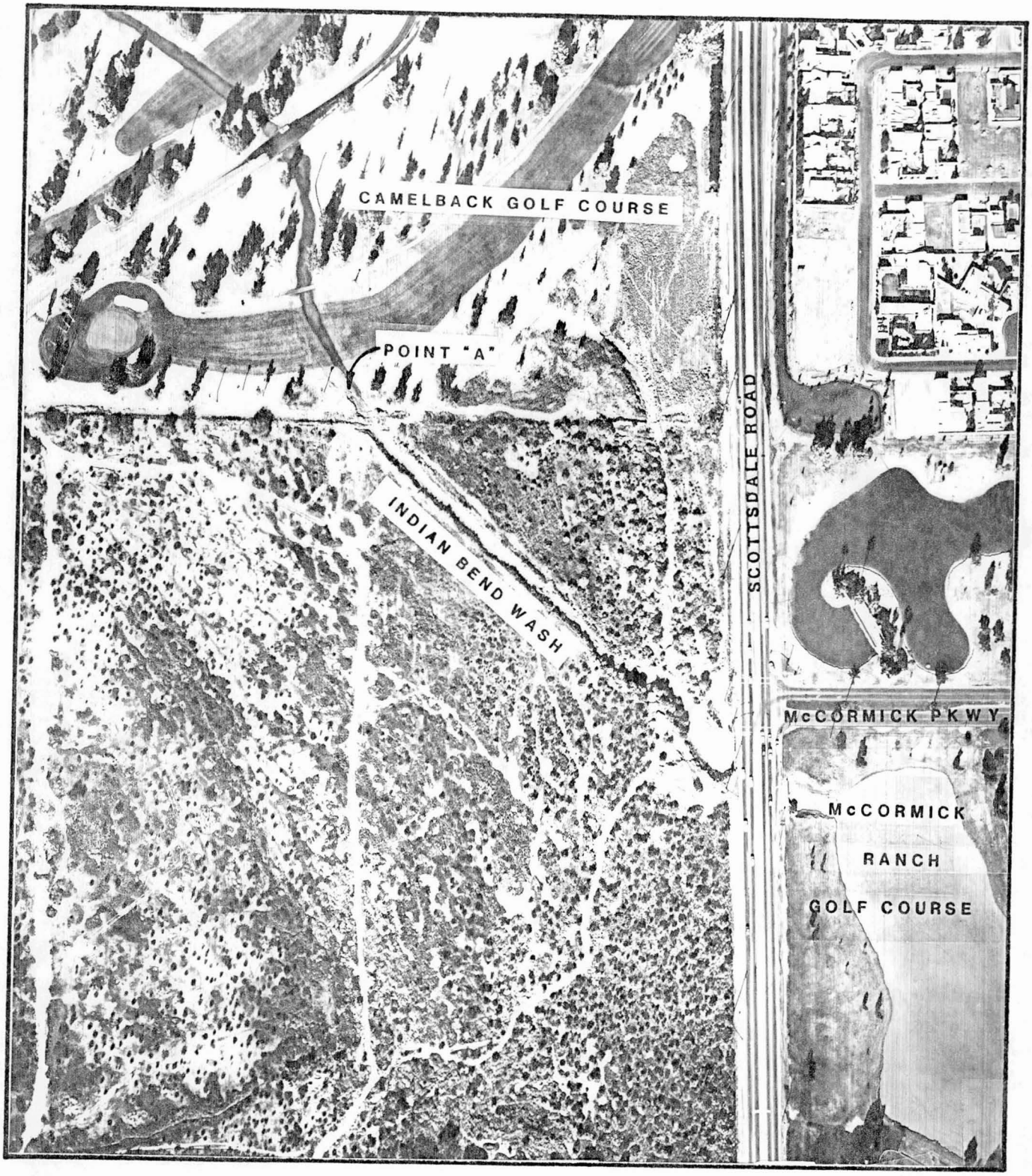
CAMELBACK GOLF COURSE
POINT "A"
INDIAN BEND WASH
SCOTTSDALE ROAD
McCORMICK PKWY
McCORMICK
RANCH
GOLF COURSE

EXHIBIT 3

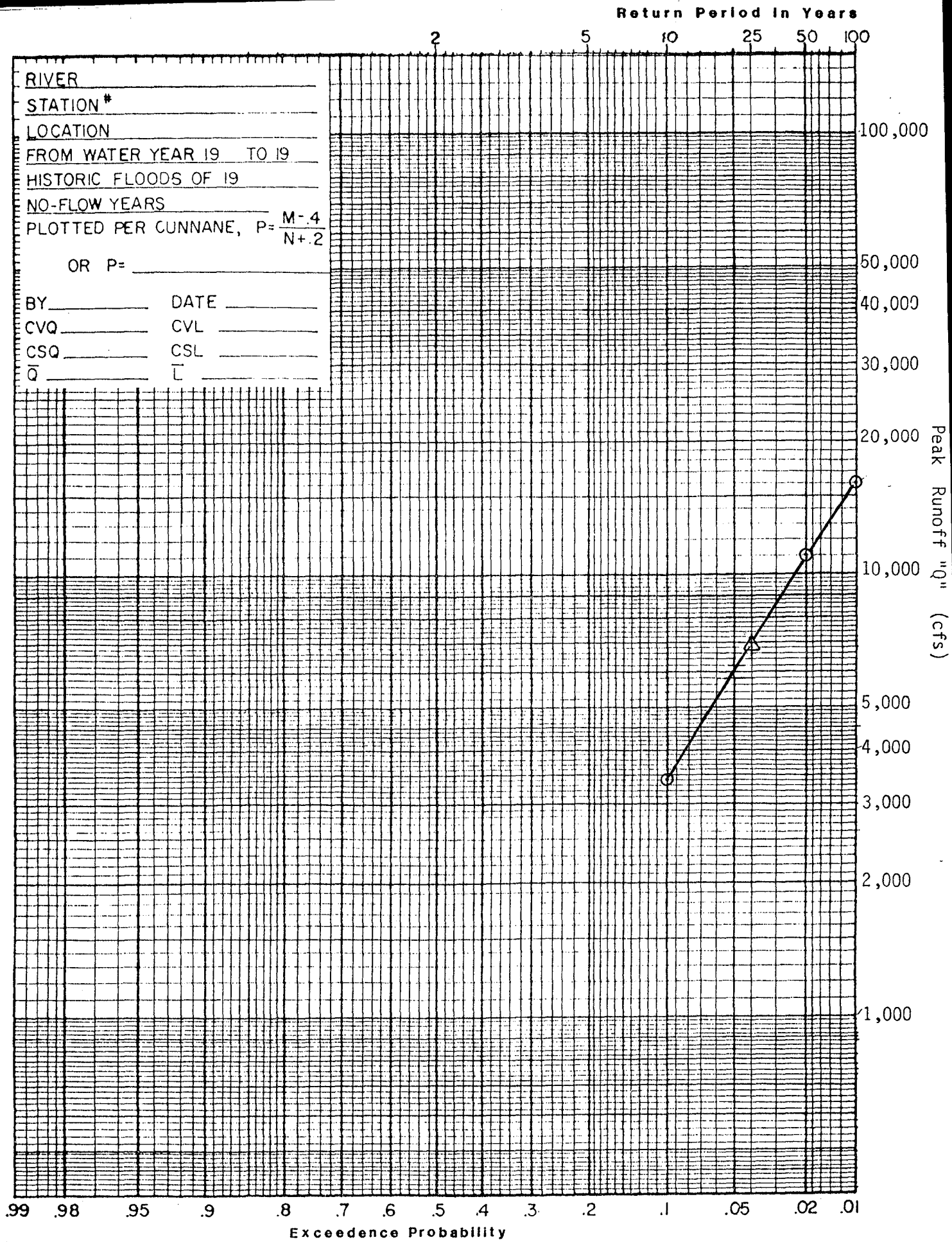
Return Period in Years
2
5
10
25
50
100
RIVER
STATION #
LOCATION
FROM WATER YEAR 19 TO 19
HISTORIC FLOODS OF 19
NO-FLOW YEARS
PLOTTED PER CUNNANE, P= M-.4 / N+.2
OR P=
BY
DATE
CVQ
CVL
CSQ
CSL
Q̄
L̄
100,000
50,000
40,000
30,000
20,000
10,000
5,000
4,000
3,000
2,000
1,000
Peak Runoff "Q" (cfs)
.99
.98
.95
.9
.8
.7
.6
.5
.4
.3
.2
.1
.05
.02
.01
Exceedence Probability

EXHIBIT 4

HEC-2 INPUT

```
B>TYPE SCT8B
T1  25 YEAR DISCHARGE - CHANGE X-SECT. TO ACCOUNT FOR LAKES
T2  INDIAN WASH  -  IND. BEND RD. TO WEST END/BRIDGE SCOTTSDALE RD.
T3  SCOTTSDALE ROAD BRIDGE - ENLARGE TO  8 - 10' X 8' CULVERT
J1    -10       2                                                  1294.00
J2      1              -1
NC   .035    .035    .025      .3      .5
QT      3    6900   16000
X1    1.0      21    9935   10150
GR   1305    9100    1300    9100    1300    9230    1299    9290    1293    9310
GR   1293    9380    1297    9400    1297    9490    1295    9495    1293    9525
GR   1293    9800    1295    9810    1296    9915    1296    9935    1284    9990
GR   1284   10125    1295   10150    1296   10360    1296   10750    1300   11530
GR   1304   11800
NC  0.025   0.025   0.025      .3      .5
X1    2.0      15    9980   10100      95     100      95
X3     10
GR   1306    7700    1302    8500    1301    8720    1300    8885  1297.6    9435
GR1296.0    9875  1294.5    9980  1293.0    9985  1285.0    9985  1285.0   10090
GR1293.0   10090  1294.5   10100    1296   10450    1300   11380    1304   11625
SB   1.25     1.6     2.6              89       9     640          1285.5  1285.0
NC  0.035   0.035   0.015      .1      .3
QT      2    6900   16000
X1    3.0      13    9895   10030     100     130     110
X2                      1  1292.5  1297.0                                      15
X3     10                                                  1297.0  1297.0
BT      4    9895  1297.0  1297.0    9915  1297.0  1293.5   10020  1297.0  1293.5
BT  10030  1297.0  1297.0
GR1306.5    7700  1302.5    8500  1300.5    8885    1298    9450  1297.0    9895
GR1293.5    9915  1285.5    9915  1285.5   10020  1293.5   10020    1297   10030
GR1296.0   10100    1300   11250    1304   11540
NC  0.035   0.035   0.020     0.3     0.5
X1    4.0      12    9790    9925      10     150     100
GR   1306    8050    1304    8160    1300    8750    1298    8900    1297    9200
GR   1297    9350    1296    9790    1290    9800    1290    9915    1296    9925
GR   1300   11000    1304   11430
EJ
T1  100 YEAR STORM
T2  INDIAN BEND WASH
T3  SCOTTSDALE ROAD BRIDGE
J1              3                                                  1296.20
J2     15              -1


ER
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B>A:

A>TYPE SCT8BO

PC\
*****************************************************                                  ****************************************
*  WATER SURFACE PROFILES                           *                                  *  U.S. ARMY CORPS OF ENGINEERS        *
*  VERSION OF NOVEMBER 1976                         *                                  *  THE HYDROLOGIC ENGINEERING CENTER   *
*  UPDATED MARCH 1982                               *                                  *  609 SECOND STREET, SUITE D          *
*                                                   *                                  *  DAVIS, CALIFORNIA 95616             *
*  RUN DATE  85/05/28. TIME  15.58.20.              *                                  *  (916) 440-2105 (FTS) 448-2105       *
*****************************************************                                  ****************************************


                                        X     X  XXXXXXX   XXXXX              XXXXX
                                        X     X  X        X     X            X     X
                                        X     X  X        X                       X
                                        XXXXXXX  XXXX     X          XXXXX    XXXXX
                                        X     X  X        X                  X
                                        X     X  X        X     X            X
                                        X     X  XXXXXXX   XXXXX             XXXXXXX

 85/05/28.    15.58.20.                                                                                  PAGE     1


*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MARCH 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
*************************************************

T1  25 YEAR DISCHARGE - CHANGE X-SECT. TO ACCOUNT FOR LAKES
T2  INDIAN WASH  -  IND. BEND RD. TO WEST END/BRIDGE SCOTTSDALE RD.
T3  SCOTTSDALE ROAD BRIDGE - ENLARGE TO  8 - 10' X 8' CULVERT

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10.       2.        0.        0.  0.000000      0.00       0.0        0.  1294.000     0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1.000     0.000    -1.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CCHV= .300 CEHV= .500
*SECNO 1.000

3265 DIVIDED FLOW

1.00	10.00	1294.00	0.00	1294.00	1294.23	.23	0.00	0.00	1296.00
6900.	245.	6655.	0.	359.	1693.	0.	0.	0.	1295.00
0.00	.68	3.93	0.00	.035	.025	.035	0.000	1284.00	9306.67
.000265	0.	0.	0.	0	0	0	0.00	576.89	10147.73

CCHV= .300 CEHV= .500
*SECNO 2.000

3301 HV CHANGED MORE THAN HVINS

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA= 1294.50 ELREA= 1294.50

2.00	8.72	1293.72	0.00	0.00	1294.60	.88	.05	.32	1294.50
6900.	0.	6900.	0.	0.	919.	0.	3.	1.	1294.50
.00	0.00	7.51	0.00	.025	.025	.025	0.000	1285.00	9982.58
.001158	95.	95.	100.	2	0	0	0.00	112.25	10094.83

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.60	2.60	0.00	89.00	9.00	640.00	0.00	1285.50	1285.00

CCHV= .100 CEHV= .300
*SECNO 3.000
PRESSURE FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD
1296.61	1295.00	.37	0.	6900.	640.	560.	1292.50	1297.00

```
 SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
 Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
 TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
 SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=     1297.00 ELREA=     1297.00

     3.00     10.54   1296.04      0.00      0.00   1296.61       .57      2.01      0.00   1297.00
    6900.        0.    6900.        0.        0.     1134.        0.        6.        1.   1297.00
      .01      0.00      6.08      0.00      .035      .015      .035     0.000   1285.50   9900.48
  .000239      100.      110.      130.         2         0         0      0.00    126.77  10027.26


FLOW DISTRIBUTION FOR SECNO=      3.00        CWSEL=   1296.04

STA=     9900.    10030.
  PER Q=     100.0
   AREA=    1134.4
    VEL=       6.1

CCHV=     .300 CEHV=     .500
*SECNO 4.000

3301 HV CHANGED MORE THAN HVINS

     4.00      5.62   1295.62      0.00      0.00   1297.13      1.51       .05       .47   1296.00
    6900.        0.    6900.        0.        0.      701.        0.        8.        1.   1296.00
      .01      0.00      9.85      0.00      .035      .020      .035     0.000   1290.00   9790.61
  .001991       10.      100.      150.         2         0         0      0.00    133.78   9924.39
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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MARCH 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
**************************************************
```

T1 100 YEAR STORM
T2 INDIAN BEND WASH
T3 SCOTTSDALE ROAD BRIDGE

J1	ICHECK	INQ	NINV	IDIR	•STRT	METRIC	HVINS	Q	WSEL	FQ
	0.	3.	0.	0.	0.000000	0.00	0.0	0.	1296.200	0.000

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 2

CCHV=     .300 CEHV=     .500
*SECNO 1.000

3265 DIVIDED FLOW

     1.00     12.20   1296.20      0.00   1296.20   1296.70       .50      0.00      0.00   1296.00
   16000.      2554.    13306.      138.     1314.     2155.      229.        0.        0.   1295.00
     0.00      1.94      6.17       .60      .035      .025      .035     0.000   1284.00   9299.33
  .000510        0.        0.        0.         0         0         0      0.00   1393.67  10789.00


CCHV=     .300 CEHV=     .500
*SECNO 2.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     2.00     11.80   1296.80   1296.80      0.00   1298.28      1.48       .08       .49   1294.50
   16000.      629.    13555.     1815.      251.     1285.      617.        6.        3.   1294.50
     .00      2.51     10.55      2.94      .025      .025      .025     0.000   1285.00   9654.75
  .001582      95.       95.      100.         3         8         0      0.00    981.47  10636.21


SPECIAL BRIDGE

5227 DOWNSTREAM ELEV IS   1292.82 ,NOT   1296.80 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)

SB   XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.25      1.60      2.60      0.00      89.00     9.00      640.00    0.00      1285.50   1285.00

CCHV=     .100 CEHV=     .300
*SECNO 3.000

3301 HV CHANGED MORE THAN HVINS

PRESSURE AND WEIR FLOW
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD
1312.33	1301.36	0.00	5657.	10415.	640.	560.	1292.50	1297.00

3.00	17.80	1303.30	0.00	0.00	1303.38	.08	5.10	0.00	1297.00
16000.	3774.	7066.	5160.	5625.	2110.	6964.	29.	8.	1297.00
.02	.67	3.35	.74	.035	.015	.035	0.000	1285.50	8340.22
.000034	100.	110.	130.	2	0	2	0.00	3148.95	11489.17

FLOW DISTRIBUTION FOR SECNO= 3.00 CWSEL= 1303.30

STA=	8340.	8500.	8885.	9450.	9895.	10030.	10100.	11250.	11489.
PER Q=	.1	1.6	9.0	12.9	44.2	2.7	28.7	.9	
AREA=	63.8	692.6	2287.6	2580.5	2110.3	475.9	6093.7	394.5	
VEL=	.1	.4	.6	.8	3.3	.9	.8	.3	

CCHV= .300 CEHV= .500
*SECNO 4.000

4.00	13.36	1303.36	0.00	0.00	1303.40	.04	.00	.01	1296.00
16000.	6310.	4570.	5120.	7222.	1744.	6374.	58.	14.	1296.00
.04	.87	2.62	.80	.035	.020	.035	0.000	1290.00	8253.88
.000042	10.	100.	150.	1	0	0	0.00	3107.70	11361.58

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*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MARCH 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

TSDALE ROAD BRIDGE - ENL

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
	1.000	0.00	0.00	0.00	1284.00	6900.00	1294.00	0.00	1294.23	2.65	3.93		
	2051.97	4238.14											
	1.000	0.00	0.00	0.00	1284.00	16000.00	1296.20	0.00	1296.70	5.10	6.17	3698.37	7083.53
	2.000	95.00	0.00	0.00	1285.00	6900.00	1293.72	0.00	1294.60	11.58	7.51	918.72	2027.78
*	2.000	95.00	0.00	0.00	1285.00	16000.00	1296.80	1296.80	1298.28	15.82	10.55	2153.30	4022.35
	3.000	110.00	1297.00	1292.50	1285.50	6900.00	1296.04	0.00	1296.61	2.39	6.08	1134.38	4461.37
*	3.000	110.00	1297.00	1292.50	1285.50	16000.00	1303.30	0.00	1303.38	.34	3.35	14699.00	27359.91
	4.000	100.00	0.00	0.00	1290.00	6900.00	1295.62	0.00	1297.13	19.91	9.85	700.68	1546.25
	4.000	100.00	0.00	0.00	1290.00	16000.00	1303.36	0.00	1303.40	.42	2.62	15340.34	24581.20

TSDALE ROAD BRIDGE -- ENL

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	6900.00	1294.00	0.00	0.00	0.00	576.89	0.00
	1.000	16000.00	1296.20	2.20	0.00	0.00	1393.67	0.00
	2.000	6900.00	1293.72	0.00	-.28	0.00	112.25	95.00
*	2.000	16000.00	1296.80	3.08	.60	0.00	981.47	95.00
	3.000	6900.00	1296.04	0.00	2.31	0.00	126.77	110.00
*	3.000	16000.00	1303.30	7.26	6.50	0.00	3148.95	110.00
	4.000	6900.00	1295.62	0.00	-.41	0.00	133.78	100.00
	4.000	16000.00	1303.36	7.73	.06	0.00	3107.70	100.00

Enclosed is a comparison of the effects of using two different configurations for the structure under Scottsdale Road @ Indian Bend Wash. Calculations were made following procedures and using charts contained in Hydraulic Engineering Circular #5 - "Hydraulic Charts for Selection of Highway Culverts" (U.S. Dept. Commerce - BPR.).

The present structure for Indian Bend Wash under Scottsdale Road is 3-10'x8' with an Inlet I.E. = 1285.5 and an outlet I.E. = 1285.0. Because it empties into McCormick Lake with a normal operating surface of 1288.3± there is always water standing in the culvert. This calculation will examine the effects of:

1. Adding 5-10'x8' Box Culverts to the existing 3-10'x8' " "
2. Replacing the existing 3-10'x8' Box Culverts with a sufficient number of 10'x5' Box Culverts raised 3' higher to eliminate backwater in the culvert at <u>normal operating level</u>

As the calculation sheets show, it will take 13-10'x~~8~~5' Box Culverts to do the same job as 8-10'x8' Box Culverts because

flow through the box depends on:

1. difference in water surface elevation between the upstream and downstream sections
2. area of opening thru the structure

As the calculation sheets show, the 13 - 10'x~~8~~5' Boxes will require considerably more concrete & rebar than the 9-10'x8'. Boxes. In addition, the wider opening will require addition channel work both upstream & downstream

PROJECT: Scottsdale Rd.

DESIGNER: T. H.

DATE:

HYDROLOGIC AND CHANNEL INFORMATION

Alternate #1:

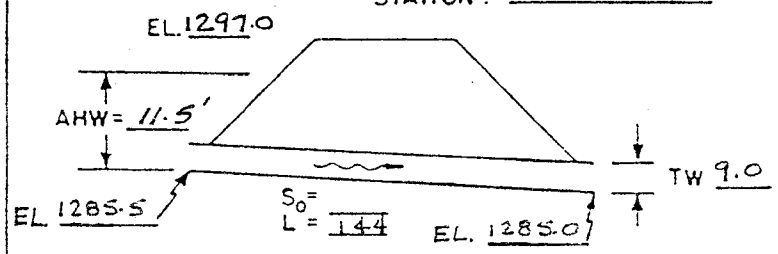
Use 8 - 10' x 8' Box Culvert.
Inlet I.E. = 1285.5
Outlet I.E. = 1285.0

Q_1 = 6900 cfs TW_1 =
Q_2 = TW_2 =

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION :



MEAN STREAM VELOCITY =
MAX. STREAM VELOCITY =

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
2	6900	8 - 10x8	1.36	10.88	0.2	2.54	—	—	9.0	9.0	0.5	11.04	11.04			UPSTREAM W.S. = 1296.54

SUMMARY & RECOMMENDATIONS:

8 - 10' x 8' = 1237 C.Y. Conc.
97 Ton Steel

Opening Area = 640 SF

PROJECT: Scottsdale Rd.

DESIGNER: T.H.

DATE:

HYDROLOGIC AND CHANNEL INFORMATION

Alternate #2

Use 13 - 10' x 5' Box Culvert

Inlet I.E. = 1288.5

Outlet I.E. = 1288.0

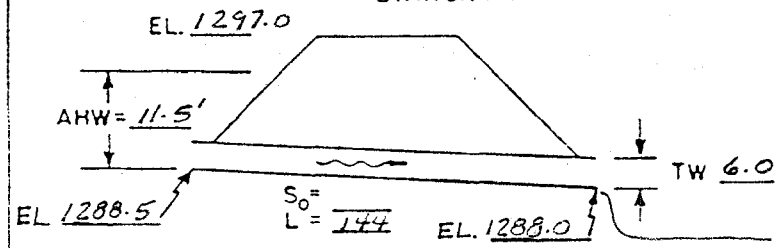
Q_1 = 6900 cfs TW_1 =

Q_2 = TW_2 =

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION :



MEAN STREAM VELOCITY =

MAX. STREAM VELOCITY =

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2	6900	13-10'x5'	1.67	8.35	0.2	2.60	—	—	6.0	6.0	0.5	8.10	8.35			UPSTREAM W.S. = 1296.85

SUMMARY & RECOMMENDATIONS:

13 - 10' x 5' = 1770 C.Y. Conc.
147 Ton Steel

Opening Area = 650 SF