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MMLA

McGovern MacVittie Lodge & Associates, Inc.

August 15, 1995

Pima County Department of Transportation - Floodplain Review
201 N. Stone, 4th Floor
Tucson, Arizona 85701-1207

Attention: Mr. Tom Helfrich
Chief Hydrologist

Regarding: 49ers Country Club
MMLA 89032-05-49

Dear Mr. Helfrich,

Thank you for meeting with Chris Rod on August 14, 1995 to discuss your comment letter dated August 7, 1995. The following text addresses you comments.

- 1) A copy of the portion of USGS quadrangle map depicting the contributing area has been provided (Figure 1).
- 2) A 400-scale aerial photograph covering the drainage basin and subject property has been provided (Figure 2).
- 3) The 1-hour, 100-hour rainfall amount of 2.54 was extrapolated by the computer program used to calculate discharges using the Pima County Method. Pima County Isopluvials were used to determine the 2-year, and 100-year, 6-hour and 24-hour rainfall intensities. The 1-hour 100-year rainfall intensity was determined by the computer. The software was provided by Mr. John Wallace of Pima County Flood Control District. A copy of the isopluvials are provided at the end of this document.
- 4) Plots of the cross-sections used to determine the 100-year floodplain are provided (Figure 4). The table below summarizes the results of the hydraulic analysis. Manning's Equation was used to calculate the flow depth. The calculations are enclosed with this text.



Table 1
Summary of the Hydraulic Analysis

Cross-section	Slope (%)	Width (ft)	Velocity (fps)	Depth of Flow (ft)
1	2.0	186	4.01	0.9*
2	0.6	410	2.21	0.6*
3	0.5	702	1.82	0.7

* excludes flow within the proposed channel

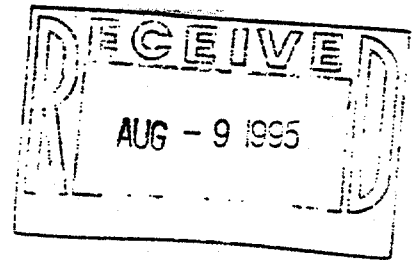
- 5) The project site is subject to 100-year discharge of 290 cfs from a 71 acre watershed located to the northeast. Flow travels west across the property as sheet flow discharging onto the adjacent course to the west. This flow will be conveyed south through the fairway into a proposed drainage way. The flow will then be conveyed through the drainage way and discharge into the Tanque Verde Creek.
- 6) The floodplain map has been revised to accurately represent the characteristics of the project site and is depicted on Figure 4. The floodplain map illustrates the two new cul-de-sacs and drainage implements proposed for the area west of Wentworth Road as well as the proposed layout for the parcel.
- 7) The 100-year peak discharge of 290 cfs is not fully contained within the floodplain. Approximately 61 cfs breaks out from the floodplain and is conveyed south through the existing drainage channels along Wentworth Road. These channel discharges flow into the Tanque Verde Creek to the south. An additional break out occurs across cul-de-sac 2. The culvert capacity and the capacity of the roadway were rated simultaneously. The weir equation was used to determine the amount of flow that breaks out over the road. This analysis demonstrated that 51 cfs continues south towards the Tanque Verde Creek while 2 cfs breaks out and flows southwest towards the golf course. The calculations are provided at the end of this document. The road cross-section is depicted in Figure 4.

Thank you for your time. If you need additional information please contact Chris Rod or Bill Zimmerman at 292-2300.

Sincerely

McGovern, MacVittie, Lodge & Associate Inc.

Thomas C. Lodge P.E.



PIMA COUNTY PUBLIC WORKS
DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT
201 NORTH STONE AVENUE, THIRD FLOOR
TUCSON, ARIZONA 85701-1207

ANTONIO (TONY) C. PAEZ
DIRECTOR

(520) 740-6410
FAX (520) 620-1933

McGovern MacVittie Lodge & Associates
Attention: Mr. William Zimmerman
800 East Wetmore Road
Tucson, Arizona
85719

August 7, 1995

Regarding: 49er Country Club
MMLA 89032-05-49

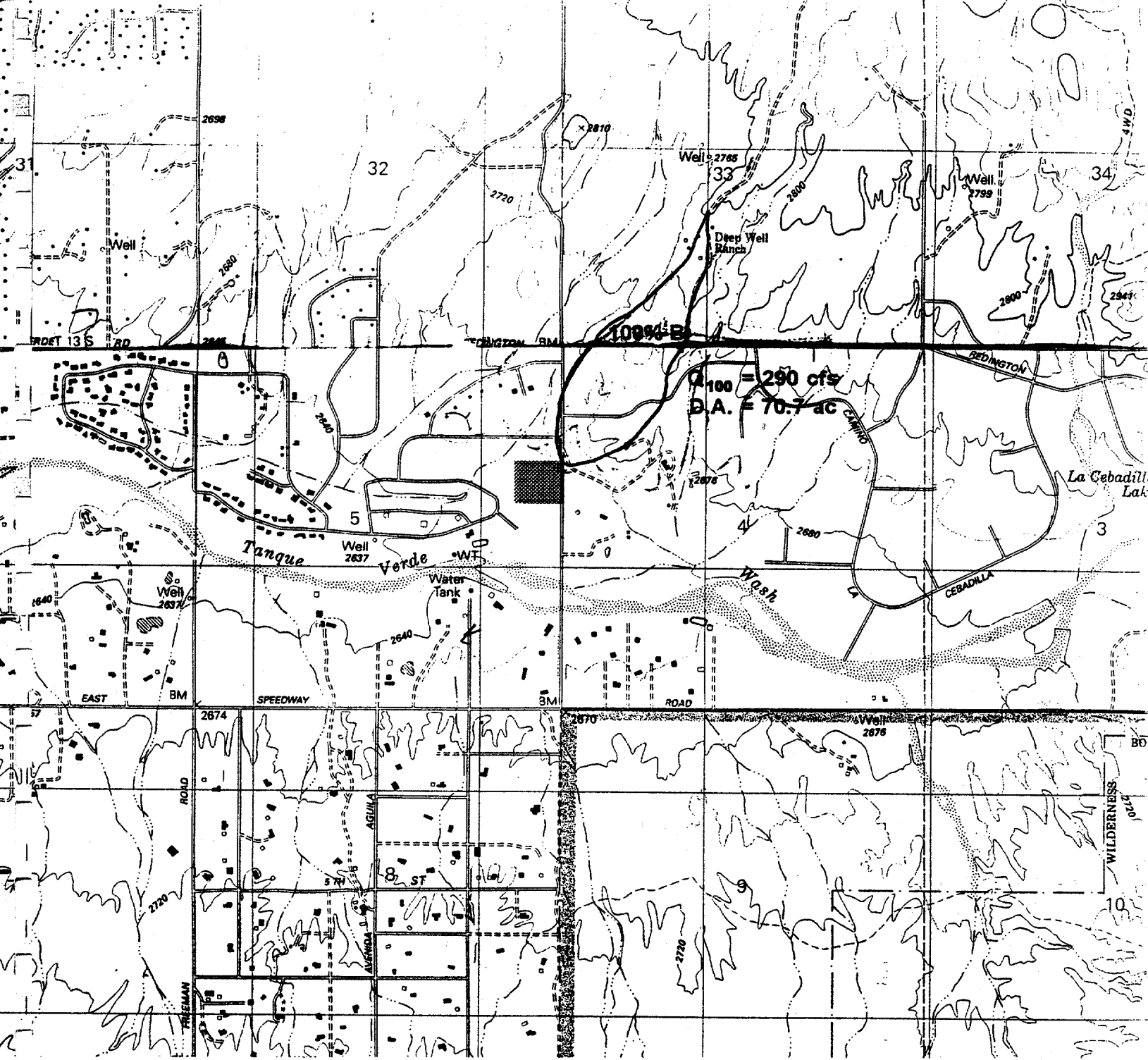
Thank you for providing the information I requested pertaining to drainage conditions affecting Lots 315 through 326 of 49er Country Club Estates. Based upon a review of the information provided, supplemental support documentation is requested. This support documentation is as follows:

1. Copy of a USGS quadrangle map delineating the contributing drainage area.
2. A copy an aerial photograph covering the drainage basin and subject property.
3. Support documentation addressing the 1-hour, 100-year rainfall amount of 2.54 inches.
4. A plot of all cross sections.
5. A brief discussion of where the surface flow goes, and its possible downstream impacts, upon exiting the subject property.
6. Label the red line provided on the topographic map. I assume this represents the 100-year floodplain affecting the subject property.
7. Based upon the analysis provided, it appears as if all surface runoff draining into this area traverses the northern lots with no impact to the southern lots. Additionally, the analysis did not consider flow being contained and conveyed within Wentworth Road. Please provide a brief discussion that would support this position or revise the flood limits.

Again, thank you for your assistance. Should you have questions please do not hesitate to contact me at 740-6350.

Respectfully,

Thomas Helfrich
Manager, Flood Control Planning



LOCATION MAP FIGURE 1



Scale 1" = 2000'



Project Site

CONTOUR INTERVAL 40 FT.
- WATERSHED BOUNDRY



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MMLA JOB NO. 89032-05-52

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49'ers Country Club Estates - Cross Section 1

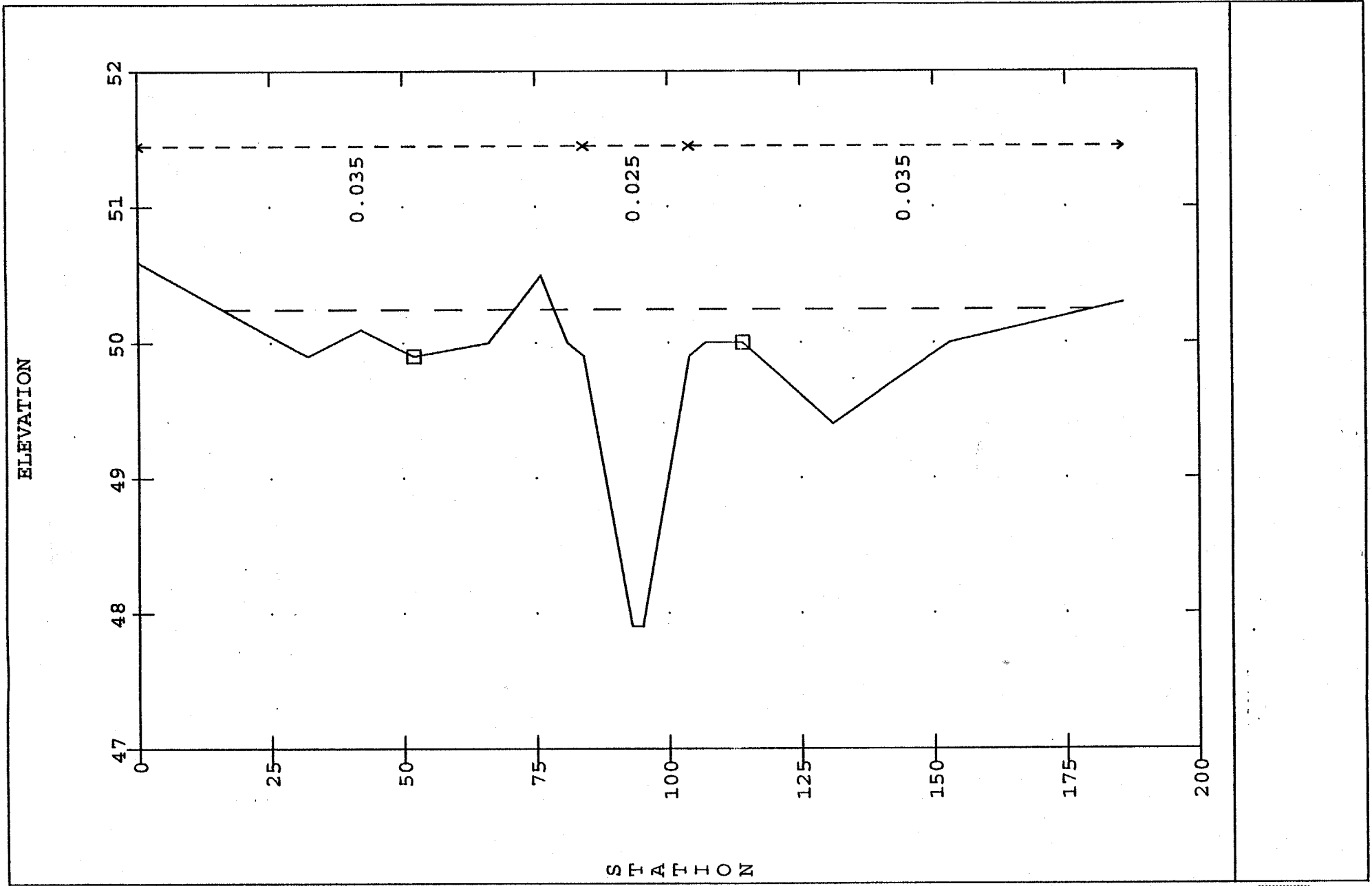


FIGURE 3
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MMI A No. 89032.05-45

49'ers Country Club Estates - Cross Section 2

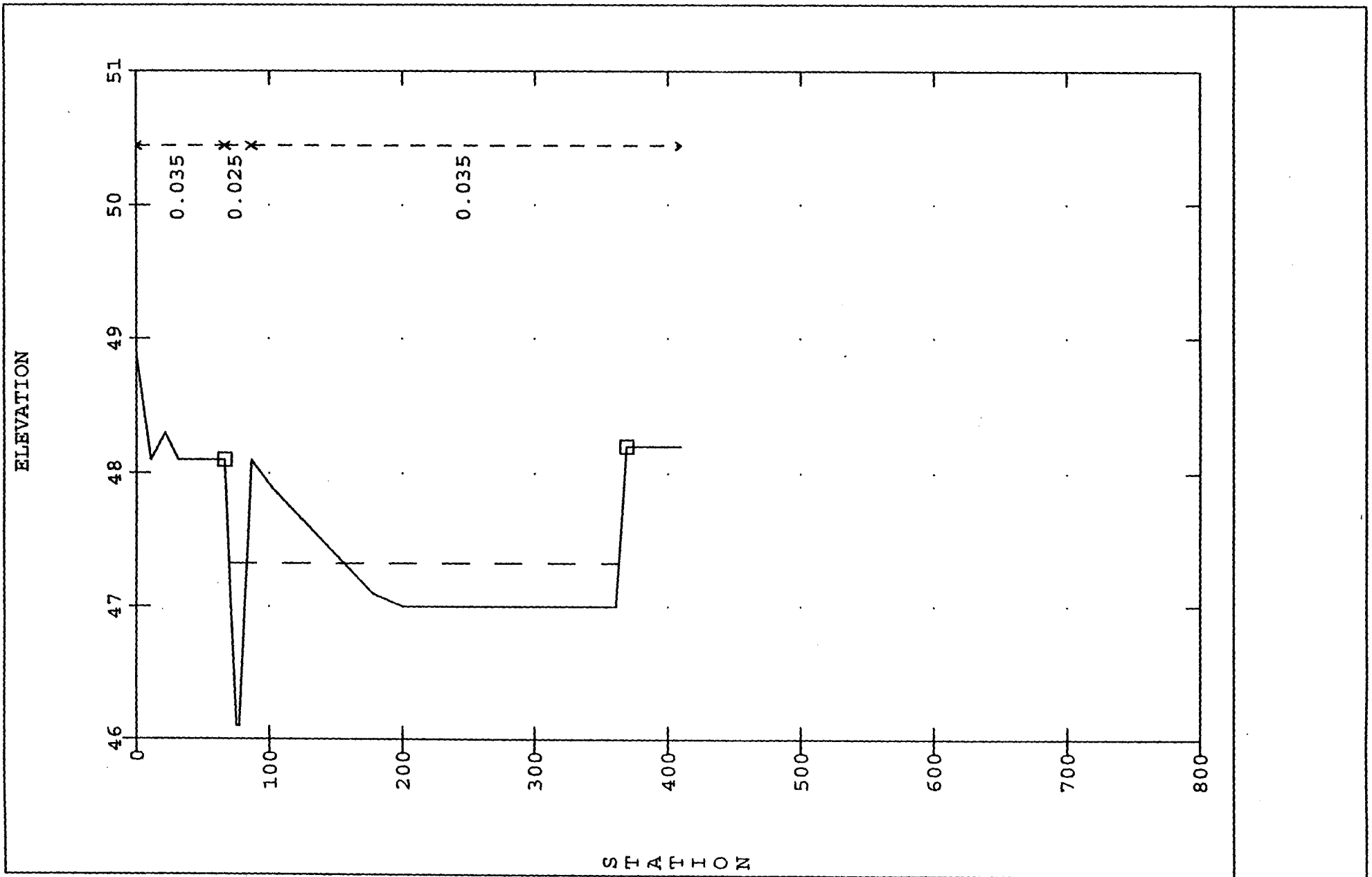


FIGURE 3
Page 2 of 3



49'ers Country Club Estates - Cross Section 3

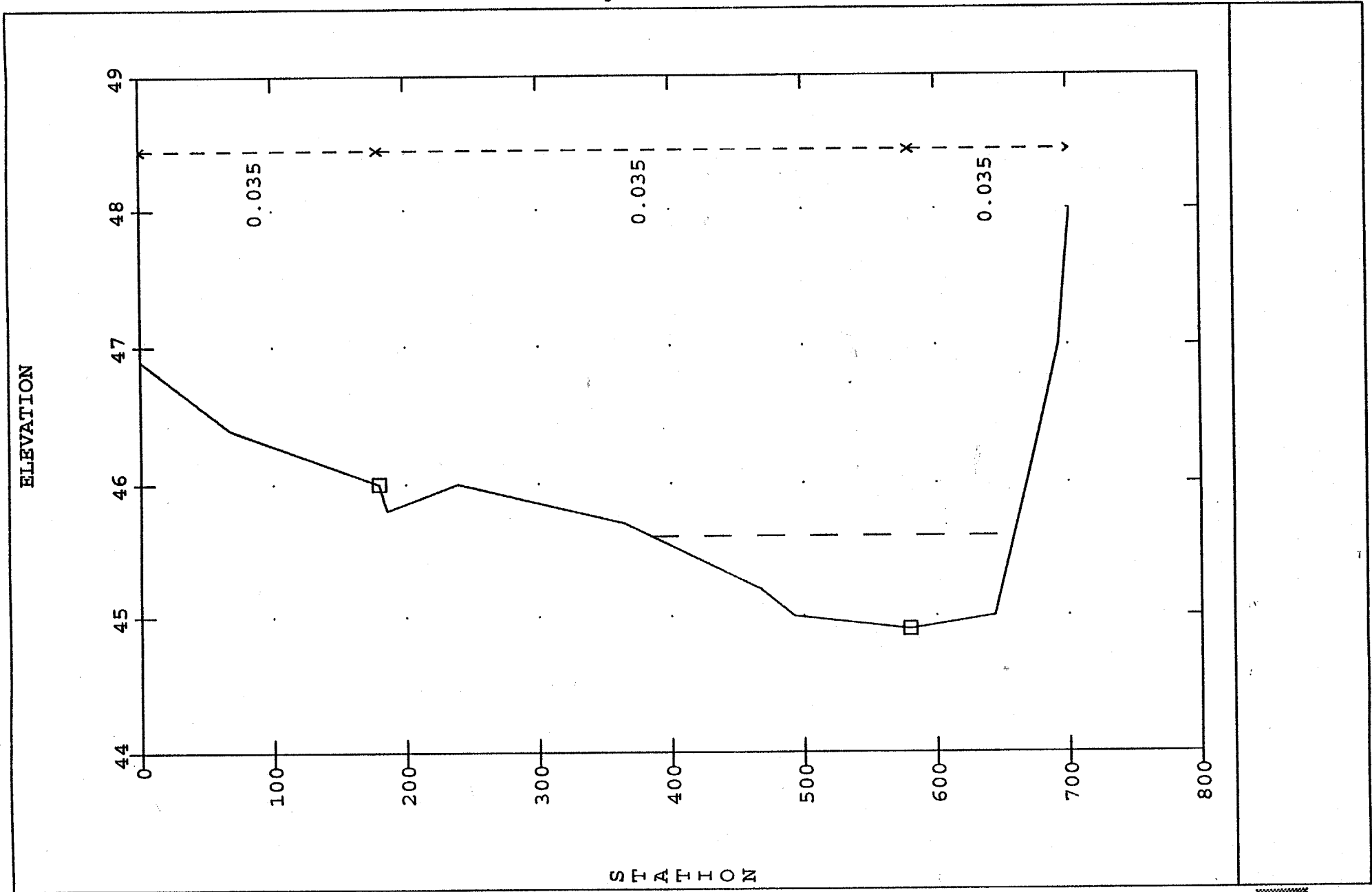


FIGURE 3
Page 3 of 3

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MMLA No. 89032.05.15

HYDROLOGIC CALCULATIONS

PROJECT NAME AND LOCATION: 49ERS COUNTRY CLUB

DRAINAGE CONCENTRATION POINT: OFFSITE 1

WATERSHED AREA (A): 70.70 acres

LENGTH OF WATERCOURSE (Lc): 4400. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2200. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft
4400. 210.0

MEAN SLOPE (Sc): .0477 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): SUBURBAN

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.18	1.51	1.73	2.02	2.28	2.54
P 2	1.32	1.69	1.95	2.27	2.56	2.85
P 3	1.41	1.82	2.09	2.43	2.75	3.06
P 6	1.59	2.05	2.35	2.74	3.10	3.45
P24	2.00	2.59	2.98	3.49	3.95	4.40

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 30 %

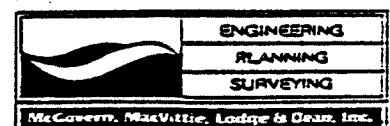
IMPERVIOUS COVER= 20. %

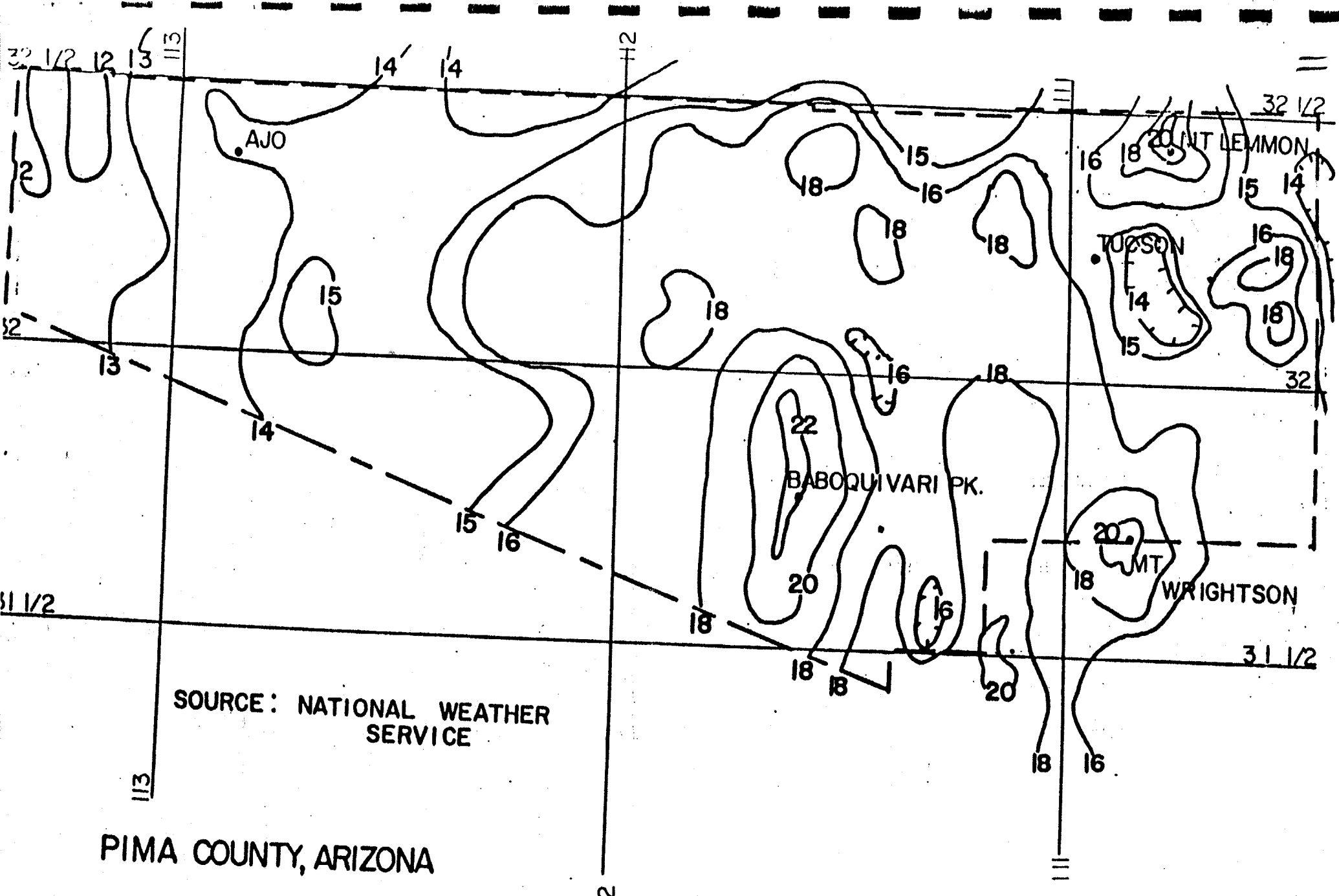
RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.263	.367	.429	.498	.550	.594
Tc (FUNCTION OF i) :	30.15	26.41	24.80	23.37	22.45	21.78
SOLUTION OF Tc (MINUTES):	22	16	14	12	11	10
RAINFL INT. @ Tc (IN/HR):	2.230	3.358	4.112	5.092	5.952	6.848
RUNOFF RATE @ Tc (IN/HR):	.587	1.232	1.764	2.534	3.275	4.068
PEAK DISCHARGE (CFS) :	42.	88.	126.	181.	233.	290.

PRECIPITATION VALUES

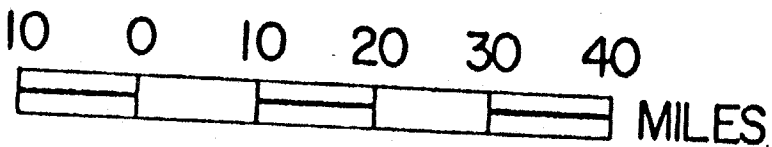
RETURN PERIOD (YEARS)	PRECIPITATION VALUES (INCHES)			
	6 HOUR DURATION		24 HOUR DURATION	
	MAP VALUE	CORRECTED VALUE	MAP VALUE	CORRECTED VALUE
2	1.60		2.0	
5				
10				
25				
50				
100	3.41		4.4	





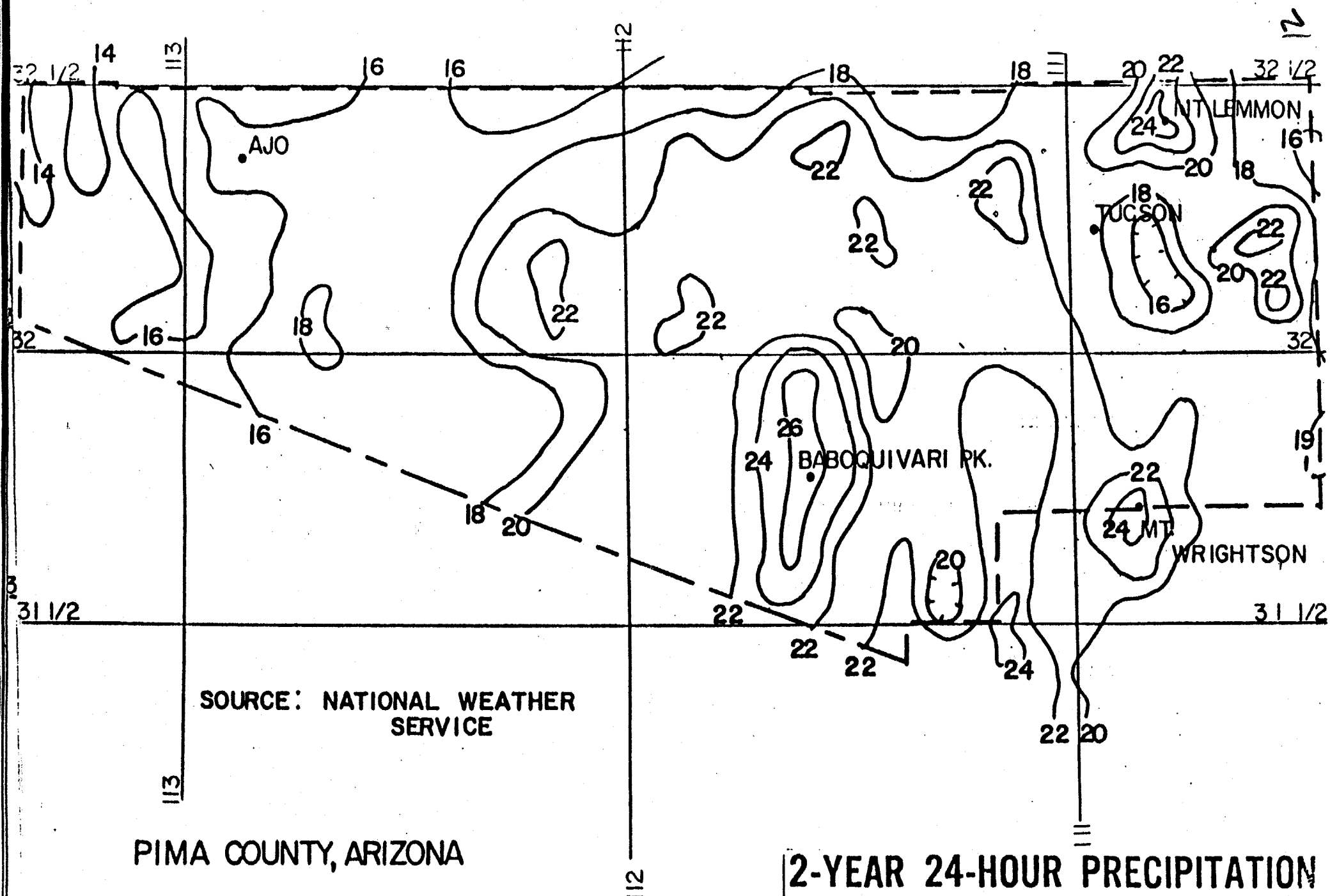
SOURCE: NATIONAL WEATHER SERVICE

PIMA COUNTY, ARIZONA



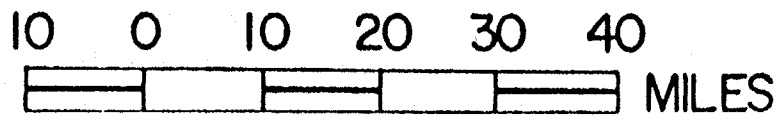
2-YEAR 6-HOUR PRECIPITATION
 -10- ISOPLUVIALS OF 2-YEAR 6-HOUR
 PRECIPITATION IN TENTHS

(79)

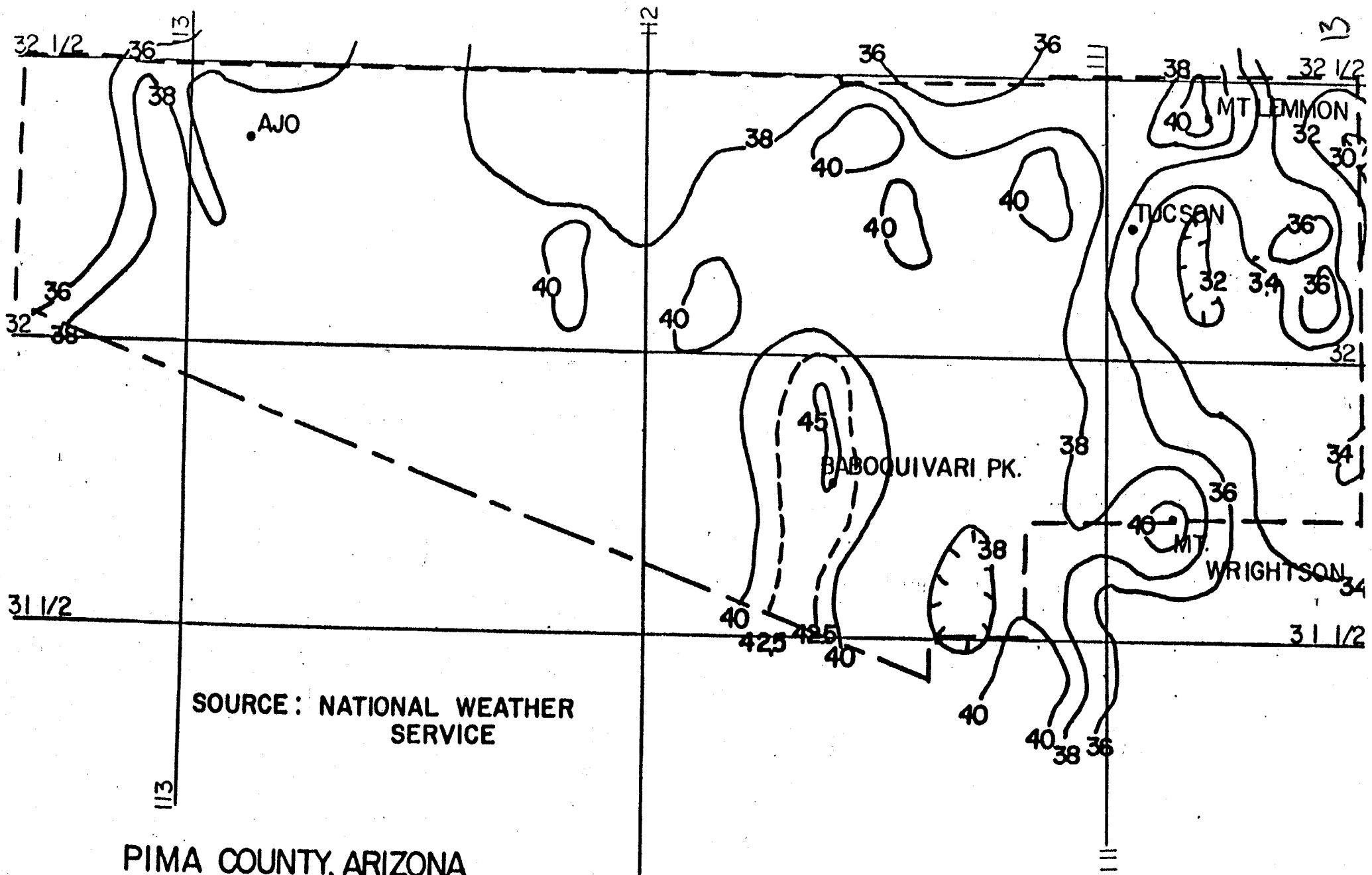


SOURCE: NATIONAL WEATHER SERVICE

PIMA COUNTY, ARIZONA

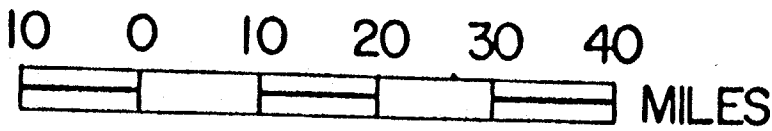


2-YEAR 24-HOUR PRECIPITATION
 —30— ISOPLUVIALS OF 2-YEAR 24-HOUR
 PRECIPITATION IN TENTHS OF AN INCH



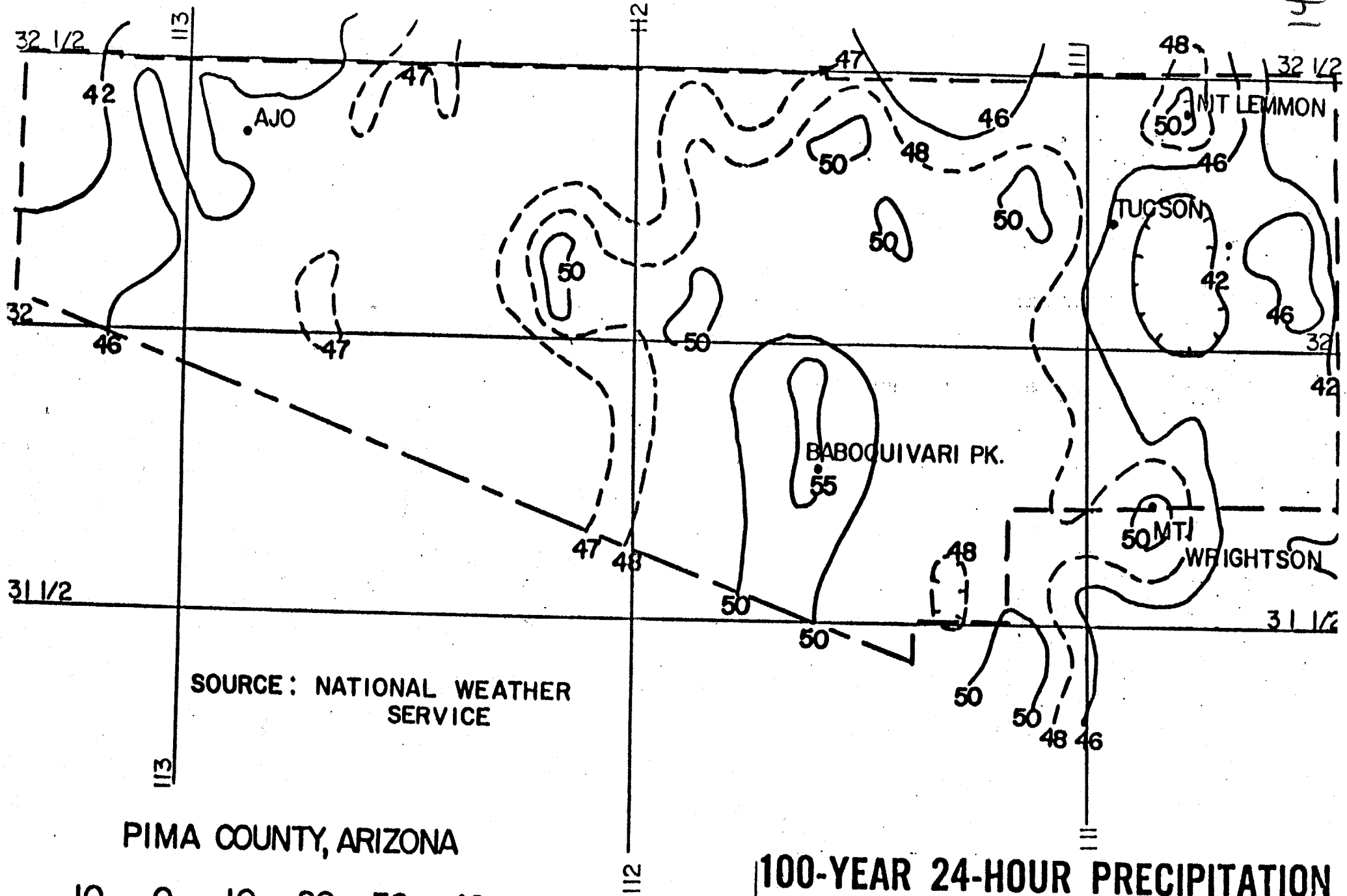
SOURCE: NATIONAL WEATHER SERVICE

PIMA COUNTY, ARIZONA



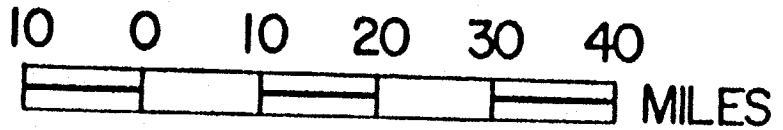
100-YEAR 6-HOUR PRECIPITATION
 —30— ISOPLUVIALS OF 100-YEAR 6-HOUR
 PRECIPITATION IN TENTHS OF AN INCH

(68)



SOURCE: NATIONAL WEATHER SERVICE

PIMA COUNTY, ARIZONA



100-YEAR 24-HOUR PRECIPITATION
 —20— ISOPLUVIALS OF 100-YEAR 24-HOUR
 PRECIPITATION IN TENTHS OF AN INCH

(06)

HYDRAULIC CALCULATIONS

MANNING'S CALCULATIONS

JOB # 89032-05-52
49ERS COUNRTY CLUB
BY: CR
8/10/95

CROSS SECTION 1

STATION	0.00	ELEVATION	50.60	MANNING'S 'n'	0.000
STATION	32.00	ELEVATION	49.90	MANNING'S 'n'	0.035
STATION	42.00	ELEVATION	50.10	MANNING'S 'n'	0.035
STATION	52.00	ELEVATION	49.90	MANNING'S 'n'	0.035
STATION	66.00	ELEVATION	50.00	MANNING'S 'n'	0.035
STATION	76.00	ELEVATION	50.50	MANNING'S 'n'	0.035
STATION	81.00	ELEVATION	50.00	MANNING'S 'n'	0.035
STATION	84.00	ELEVATION	49.90	MANNING'S 'n'	0.035
STATION	93.00	ELEVATION	47.90	MANNING'S 'n'	0.025
STATION	95.00	ELEVATION	47.90	MANNING'S 'n'	0.025
STATION	104.00	ELEVATION	49.90	MANNING'S 'n'	0.025
STATION	107.00	ELEVATION	50.00	MANNING'S 'n'	0.035
STATION	114.00	ELEVATION	50.00	MANNING'S 'n'	0.035
STATION	131.00	ELEVATION	49.40	MANNING'S 'n'	0.035
STATION	153.00	ELEVATION	50.00	MANNING'S 'n'	0.035
STATION	186.00	ELEVATION	50.30	MANNING'S 'n'	0.035

RESULTS

Equivalent Manning's 'n' 0.031
Chanel Slope 2.000%
W.S. Elevation 50.26
Area 72.58 SF
Perimeter 160.08 Ft.
Near Bank 15.4
Far Bank 182.0
Discharge 290.70 cfs
Velocity 4.01 fps

JOB # 89032-05-52
49ERS COUNRTY CLUB
BY: CR
8/10/95

CROSS SECTION 2

STATION	0.00	ELEVATION	48.90	MANNING'S 'n'	0.000
STATION	11.00	ELEVATION	48.10	MANNING'S 'n'	0.035
STATION	22.00	ELEVATION	48.30	MANNING'S 'n'	0.035
STATION	32.00	ELEVATION	48.10	MANNING'S 'n'	0.035
STATION	58.00	ELEVATION	48.10	MANNING'S 'n'	0.035
STATION	67.00	ELEVATION	48.10	MANNING'S 'n'	0.035
STATION	76.00	ELEVATION	46.10	MANNING'S 'n'	0.025
STATION	78.00	ELEVATION	46.10	MANNING'S 'n'	0.025
STATION	87.00	ELEVATION	48.10	MANNING'S 'n'	0.025
STATION	102.00	ELEVATION	47.90	MANNING'S 'n'	0.035
STATION	178.00	ELEVATION	47.10	MANNING'S 'n'	0.035
STATION	201.00	ELEVATION	47.00	MANNING'S 'n'	0.035
STATION	241.00	ELEVATION	47.00	MANNING'S 'n'	0.035
STATION	283.00	ELEVATION	47.00	MANNING'S 'n'	0.035
STATION	361.00	ELEVATION	47.00	MANNING'S 'n'	0.035
STATION	369.00	ELEVATION	48.20	MANNING'S 'n'	0.035
STATION	410.00	ELEVATION	48.20	MANNING'S 'n'	0.035

RESULTS

Equivalent Manning's 'n' 0.034
Channel Slope 0.600%
W.S. Elevation 47.59
Area 131.41 SF
Perimeter 248.84 Ft.
Near Bank 69.3
Far Bank 364.9
Discharge 290.50 cfs
Velocity 2.21 fps

JOB # 89032-05-52
49ERS COUNTRY CLUB
BY: CR
8/10/95

CROSS SECTION 3

STATION	0.00	ELEVATION	46.90
STATION	68.00	ELEVATION	46.40
STATION	180.00	ELEVATION	46.00
STATION	186.00	ELEVATION	45.80
STATION	239.00	ELEVATION	46.00
STATION	365.00	ELEVATION	45.70
STATION	468.00	ELEVATION	45.20
STATION	493.00	ELEVATION	45.00
STATION	580.00	ELEVATION	44.90
STATION	644.00	ELEVATION	45.00
STATION	693.00	ELEVATION	47.00
STATION	702.00	ELEVATION	48.00

RESULTS

Manning's 'n' 0.035
Channel Slope 0.500%
W.S. Elevation 45.58
Area 126.35 SF
Perimeter 268.70 Ft.
Near Bank 389.5
Far Bank 658.2
Discharge 229.38 cfs
Velocity 1.82 fps

CHANNEL CALCULATIONS

JOB # 89032-05-52
49ers Country Club
BY: cr
8/15/95

CROSS SECTION F-F

STATION	100.00	ELEVATION	100.00
STATION	109.00	ELEVATION	98.00
STATION	111.00	ELEVATION	98.00
STATION	120.00	ELEVATION	100.00

RESULTS

Manning's 'n' 0.025
Channel Slope 0.200%
W.S. Elevation 100.00
Area 22.00 SF
Perimeter 20.44 Ft.
Near Bank 100.0
Far Bank 120.0
Discharge 61.42 cfs
Velocity 2.79 fps

ROADWAY CALCULATIONS

JOB # 89032-05-52
49ERS COUNTRY CLUB
BY: CR
8/10/95

CROSS SECTION WEIR 1

STATION	0.00	ELEVATION	47.90
STATION	10.00	ELEVATION	47.50
STATION	15.00	ELEVATION	47.40
STATION	30.00	ELEVATION	47.30
STATION	55.00	ELEVATION	47.40
STATION	71.00	ELEVATION	47.60
STATION	131.00	ELEVATION	47.00
STATION	174.00	ELEVATION	48.20

RESULTS

W.S. Elevation 47.40
Discharge 12.21 cfs
Velocity 0.00 fps

JOB # 89032-05-52
49ERS COUNTRY CLUB
BY: CR
8/10/95

CROSS SECTION WEIR 1

STATION	0.00	ELEVATION	47.90
STATION	10.00	ELEVATION	47.50
STATION	15.00	ELEVATION	47.40
STATION	30.00	ELEVATION	47.30
STATION	55.00	ELEVATION	47.40
STATION	71.00	ELEVATION	47.60
STATION	131.00	ELEVATION	47.00
STATION	174.00	ELEVATION	48.20

RESULTS

W.S. Elevation 47.50
Discharge 25.21 cfs
Velocity 0.00 fps

JOB # 89032-05-52
49ERS COUNTRY CLUB
BY: CR
8/10/95

CROSS SECTION WEIR 1

STATION	0.00	ELEVATION	47.90
STATION	10.00	ELEVATION	47.50
STATION	15.00	ELEVATION	47.40
STATION	30.00	ELEVATION	47.30
STATION	55.00	ELEVATION	47.40
STATION	71.00	ELEVATION	47.60
STATION	131.00	ELEVATION	47.00
STATION	174.00	ELEVATION	48.20

RESULTS

W.S. Elevation 47.60
Discharge 44.20 cfs
Velocity 0.00 fps

JOB # 89032-05-52
49ERS COUNTRY CLUB
BY: CR
8/10/95

CROSS SECTION WEIR 1

STATION	0.00	ELEVATION	47.90
STATION	10.00	ELEVATION	47.50
STATION	15.00	ELEVATION	47.40
STATION	30.00	ELEVATION	47.30
STATION	55.00	ELEVATION	47.40
STATION	71.00	ELEVATION	47.60
STATION	131.00	ELEVATION	47.00
STATION	174.00	ELEVATION	48.20

RESULTS

W.S. Elevation 47.70
Discharge 71.00 cfs
Velocity 0.00 fps

CULVERT CALCULATIONS

RESULTS

=====

Entrance Type: MITERED (CMP)
Discharge is 5.00 cfs
1 X 24 " CMP X 70 FT. LONG
Manning's 'n' 0.024
Inlet Control HW/D 0.57
Inlet Control HW 1.14
Ke 0.70
H 0.18
Critical Depth 0.79
Dc+D/2 1.39
Tailwater 0.50
H0 1.39
L*SO 0.14
Outlet HW 1.44

OUTLET CONTROL GOVERNS HW= 1.44
Outlet Velocity 4.35 fps

RESULTS

=====

Entrance Type: HEADWALL (CMP)
Discharge is 10.00 cfs
1 X 24 " CMP X 70 FT. LONG
Manning's 'n' 0.024
Inlet Control HW/D 0.84
Inlet Control HW 1.67
Ke 0.50
H 0.70
Critical Depth 1.13
Dc+D/2 1.57
Tailwater 1.13
H0 1.57
L*S0 0.14
Outlet HW 2.13

OUTLET CONTROL GOVERNS HW= 2.13
Outlet Velocity 5.45 fps

RESULTS

=====

Entrance Type: MITERED (CMP)
Discharge is 15.00 cfs
1 X 24 " CMP X 70 FT. LONG
Manning's 'n' 0.024
Inlet Control HW/D 1.18
Inlet Control HW 2.36
Ke 0.70
H 1.65
Critical Depth 1.40
Dc+D/2 1.70
Tailwater 1.13
HO 1.70
L*SO 0.14
Outlet HW 3.21

OUTLET CONTROL GOVERNS HW= 3.21
Outlet Velocity 6.41 fps

RESULTS

=====

Entrance Type: MITERED (CMP)
Discharge is 20.00 cfs
1 X 24 " CMP X 70 FT. LONG
Manning's 'n' 0.024
Inlet Control HW/D 1.64
Inlet Control HW 3.27
Ke 0.70
H 2.93
Critical Depth 1.61
Dc+D/2 1.80
Tailwater 1.13
HO 1.80
L*SO 0.14
Outlet HW 4.60

OUTLET CONTROL GOVERNS HW= 4.60
Outlet Velocity 7.40 fps