PRE-FINAL REPORT

LATERAL DRAINAGE

OF

INDIAN BEND WASH PROJECT

Scottsdale check print #2 23JAN78 please return with final.

Thanks Cen

FOR

FLOOD CONTROL DISTRICT

OF

MARICOPA COUNTY, ARIZONA

Prepared by

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REVISED

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INDIAN BEND WASH PROJECT
DRAINAGE STUDY

1. OBJECTIVE

This study was initiated by the Flood Control District of Maricopa County, Arizona, for the purpose of determining the 100-year flood flows and alternative methods for handling these flows which would be diverted by the Indian Bend Wash Inlet Project. The drainage study is to include an evaluation of the flows at the intersections of Indian Bend Road with Scottsdale Road and with Hayden Road. It is also to include an area east of Hayden Road, south of the Arizona Canal, and north of Valley Vista Lane.

2. GENERAL INVESTIGATION

Drainage areas were developed from available aerial topography within the study area and additional aerial photography flown for the study. All drainage delineation as shown on Plate No. 1 was verified by field inspection of the study area. Flows for the 100-year flood were developed using the procedures outlined in the manual, "Hydrologic Design for Highway Drainage in Arizona", published by the Arizona Highway Department. The Arizona Highway Department uses two basic methods for computing runoff from small drainage basins, the Soil Conservation Service Method and the Rational Method.

PLATE I	INDIAN BEND WASH INLET PROJECT LATERAL DRAINAGE VICINITY MAP	SULLIVAN & MASSON CONSULTING ENGINEERS PHOENIX, ARIZONA	SCALE 1" = 2000' DATE NOV., 1977

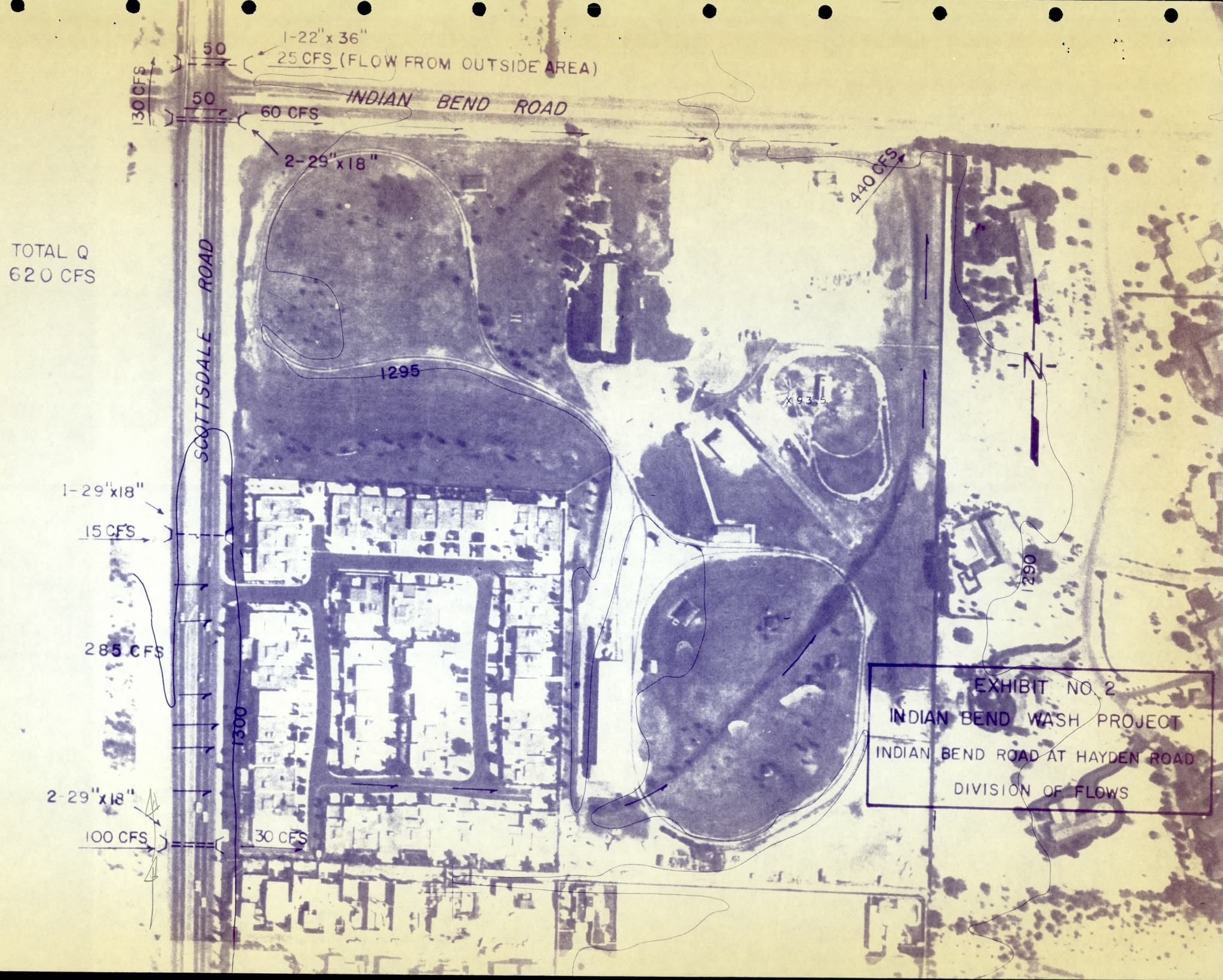
3. HYDROLOGIC INVESTIGATION

Flows were developed for three different areas as indicated on Plate No. 1: (1) Area west of Scottsdale Road shown as Area Number 1; (2) Areas north of Indian Bend Road between Pima Road and Indian Bend Wash shown as Area Numbers 2, 3, 4, 5, and (3) Area east of Indian Bend Wash south of the Arizona Canal shown as Area Numbers 6, 7, 8, 9 and 10. For Area Number 1, the "Soil Conservation Method" was used for computing the runoff. Although this area is basically an urban area, the one acre zoning and the nature of the terrain indicated that the S.C.S. "Unit Hydrograph Approach" would yield the most realistic results of the study.

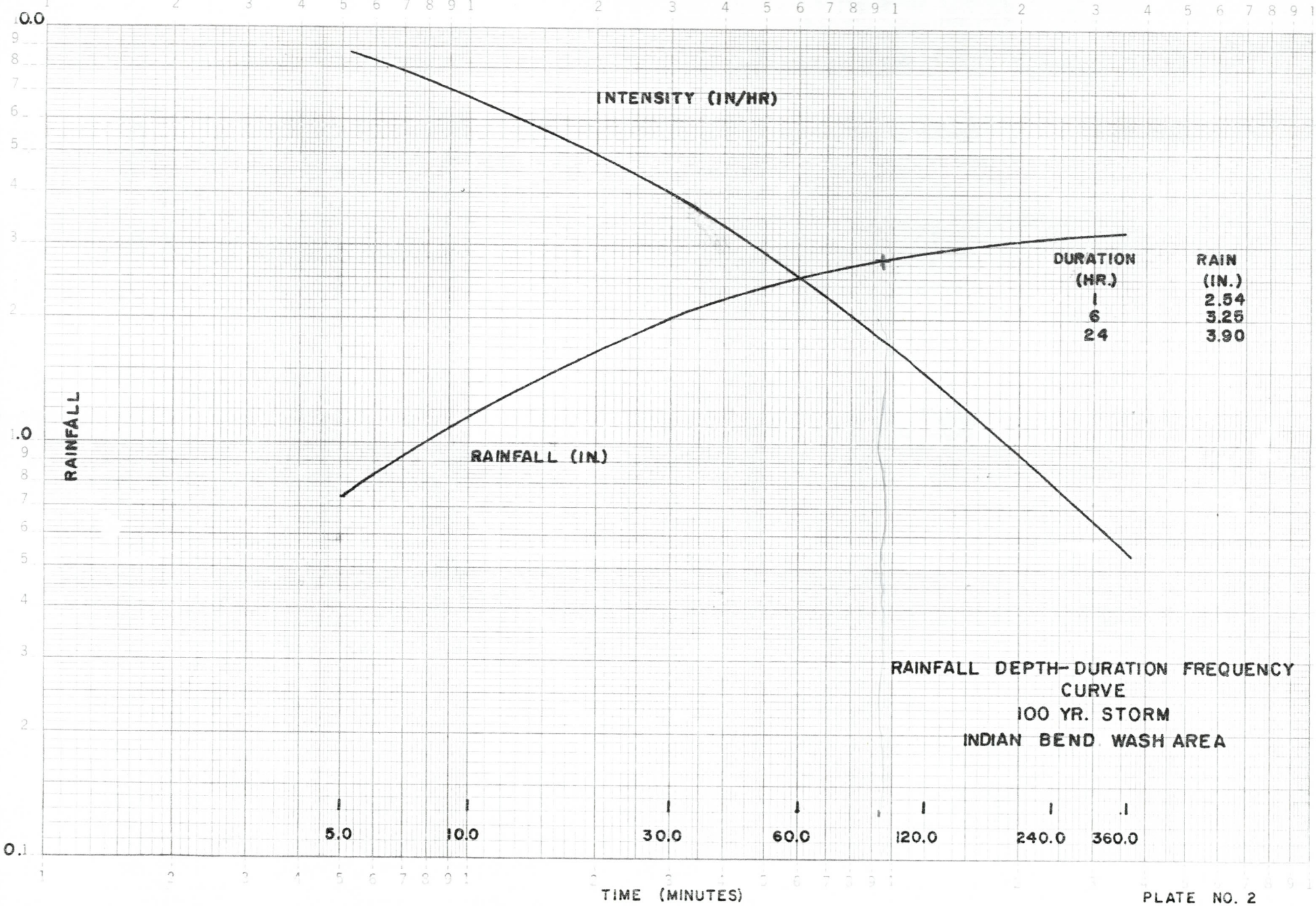
Because of the size of the areas, and the extent of existing and anticipated development in the areas east of Indian Bend Wash, the Rational Method was used for computing the runoff.

A. Rainfall

Rainfall Depth - Duration Frequency curves were developed for the study area from the precipitation maps prepared by the U.S. Weather Bureau. Rainfall amounts for the 100-year frequency with durations of 5 minutes to 24 hour durations are shown on Plate Number 2.


1-22" x 36"
25 CFS (FLOW FROM OUTSIDE AREA)
50
50
130 CFS
60 CFS
INDIAN BEND ROAD
2-29" x 18"
440 CFS
TOTAL Q
620 CFS
SCOTTSDALE ROAD
1295
X 93.5
N
1-29" x 18"
15 CFS
285 CFS
1300
1290
2-29" x 18"
100 CFS
30 CFS
EXHIBIT NO. 2
INDIAN BEND WASH PROJECT
INDIAN BEND ROAD AT HAYDEN ROAD
DIVISION OF FLOWS

K+E LOGARITHMIC • 2 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323



DURATION (HR.)	RAIN (IN.)
1	2.54
6	3.25
24	3.90

RAINFALL DEPTH-DURATION FREQUENCY CURVE
100 YR. STORM
INDIAN BEND WASH AREA

PLATE NO. 2

B. Rainfall-Runoff.

Runoff for the unit hydrograph method was computed using the S.C.S. "Runoff Curve Number" procedure. The curve number is indicative of the amount of runoff a storm will produce depending on the land use, type of vegetation, and the hydrologic soil group. The general vegetation in the area west of Scottsdale Road is desert brush with an estimated density of 15%. The hydrologic soil group in this area is Group "C". Based on these combined factors, a runoff curve number of 89 was used.

In the two study areas east of Indian Bend Wash, the urbanization consists primarily of single-family homes with some multi-family units. The ASCE manual "Design and Construction of Sanitary and Storm Sewers", dated 1969, shows a range of Runoff Coefficients for the Rational Method as follows:

Description of Area	Runoff Coefficients
Residential	
Single Family	0.30 - 0.50
Multi-Units	0.40 - 0.60

A conservative runoff coefficient of 0.50 was selected for use in the study.

4. RESULTS OF STUDY

A. Area 1.

This area of 1.43 square miles begins on the north slope of Camelback Mountain and flows for 2.4 miles in an easterly direction, draining the area bounded on the north by Indian Bend Road, and, generally, Lincoln drive on the south. The drainage flows through a fairly well defined wash north of Lincoln Drive until it reaches a point just west of Scottsdale Road. At this point, the flows become divided sheet flow breaking to the northeast and the southeast. The flows that find their way to Indian Bend Road and ultimately Indian Bend Wash are the flows this study is concerned with. The total 100-year flow for Area No. 1 was computed at 1,235 CFS. A complete breakdown of the computations is shown on Exhibit No. 1. Of the total 100-year flow reaching Scottsdale Road, 50% of the flow diverts to the northeast. A division of flows has been developed for the intersection of Indian Bend Road and Scottsdale Road as shown on Exhibit No. 2. The total 100-year flow that reaches the south side of Indian Bend Road to be diverted into the wash is 440 CFS.

based on some comps? Need to see how this was arrived at.

should be based on some hydraulic comps.

B. Areas 2, 3, 4 & 5

These areas have a combined drainage area of 0.8 square miles and are located on the north side of

EXHIBIT NO. 1

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

LOCATION DATA:

Highway Indian Bend Road @ Scottsdale Rd. County _____

Location _____

Project No. Indian Bend Wash Station _____

Name of Stream Area No. 1

DESIGN DATA:

Design Frequency	100	years
Drainage Area	1.43	square miles
Drainage Length	12,700	feet
Elevation		
Top of Drainage Area	2,000	feet
At Structure	1,300	feet
Drainage Area Slope	5.4	%
Drainage Width	3,800	feet
Width factor W_f	0.89	
Vegetative Cover Type	Desert Brush	
Vegetative Cover Density	15	%
Soil Group	C	
Precipitation		
P = 6 hour =	3.25	inches
P = 24 hour =	3.90	inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.54 (2.8)	inches
Curve Number		89	
Runoff	Q =	1.50	inches
Time of Concentration	Tc	0.95	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.84	hours

$\frac{12700}{95(3600)} = 3.71$

Peak Discharge $Qp = \frac{484\,AQ}{Tp} = \frac{484(1.43)(1.5)}{0.84}$

$= 1,235$ cfs

Computed by D. Gilbertson Date 1/6/78

(1) STA	Slope	T_c
0+00 - 16+00 = S1 = 650/1600 =	35%	0.06 Hr.
16+00 - 127+00 = S2 = 140/11,100 =	1.3%	0.89 Hr.
	Total	0.95 Hr.

$\frac{1600}{.06(3600)} = 7.4$ FPS

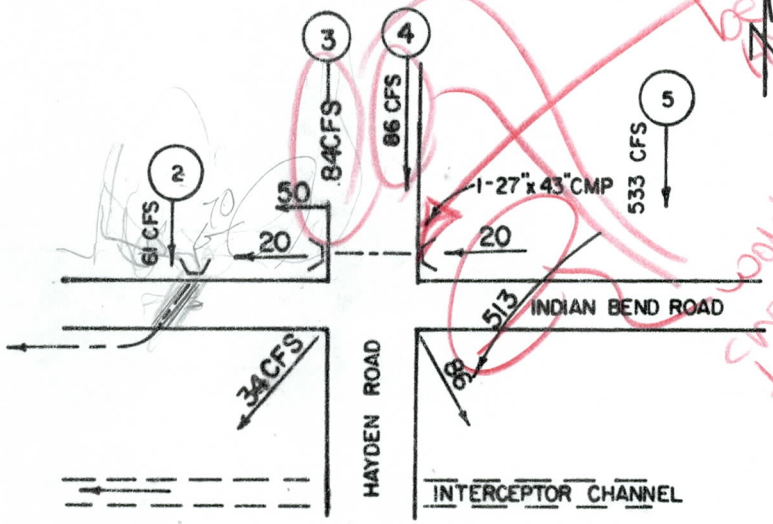
$\frac{11100}{.89(3600)} = 3.46$ FPS

Indian Bend Road between Indian Bend Wash and Pima Road. Each of the areas drain south to Indian Bend Road. The 100-year peak flow was computed using the Rational Method for each of these areas as shown below:

Area No.	Drainage Area (AC)	100-Yr. Discharge (CFS)
2	18	61
3	42	84
4	32	86
5	418	533

Complete computations are shown on Exhibit No. 3. The direction and estimate amounts of the 100-year flow in the vicinity of the intersection of Indian Bend Road and Hayden Road are shown below:

These splits should be based on detailed hydraulic calcs.



Couldn't 500+ cfs crossing I.B. road tend to be deep enough to force more than 20 cfs west?

Except for 20 CFS that flows west through the culvert under Hayden Road, all floods east of Hayden Road

EXHIBIT NO. 3

INDIAN BEND WASH PROJECT

INDIAN BEND ROAD
AT
HAYDEN ROAD

AREA NO.		2	3	4	5
DRAINAGE AREA (AC)		18	152	32	418
Length	(Ft.)	1,560	5,500	3,200	6,800
Elev. (Max.)	(Ft.M.S.L.)			1,292	1,307
Elev. (Min.)	(Ft.M.S.L.)			1,282	1,281
Elev.	(Ft.)			10	26
Slope	(%)	0.30(1)	0.31(1)	0.31	0.38
Vel.	(Ft./Sec.)	2.5(2)	3.2(2)	3.2(2)	
T_c	(Min.)	11	29	17	60(3)
C		0.50	0.50	0.50	0.50
I	(In/Hr.)	6.80	4.0	5.40	2.55
A	(AC)	18	42	32	418
Q = CIA	(CFS)	61	84	86	533

Good

$\frac{6000}{60(60)} = 1.9$ fps

Looks low in relation to

$\frac{1560}{11(60)}$

To get the peak at the intersection the areas should be combined and computed for various Tc's.

(1) Based on Street Plans

(2) Based on Est. Vel. of Flow In Street

(3) $T_c = \frac{.04593}{S^{.385}} L^{.77}$ (KIRPICH EQUATION)

based on what?

Area 5, now flow across Indian Bend Road and will flow into the interceptor channel when completed. Flows from Area 4 appear to flow south across the intersection and will drain into the interceptor channel. Area 3 drains down the west side of Hayden Road to the intersection where it divides. As estimated 50 CFS is diverted down Indian Bend roadside ditch west to the wash, with the remainder flowing south along Hayden Road and Southwest over the southwest corner of the intersection. Because of the restricted size of the roadside ditch west of Hayden Road, a 48-inch C.M.P. is proposed to be installed across Indian Bend Road approximately 700 feet west of Hayden Road and will extend west along the south side of Indian Bend Road to Indian Bend Wash.

C. Areas 6, 7, 8, 9 & 10.

These areas are located south of the Arizona Canal and drain south, ultimately draining into Indian Bend Wash. The 100-year peak flows computed using the Rational Method are shown below:

Area No.	Drainage Area (AC)	100-Yr. Drainage (CFS)
6	51	84
7A	80	156
7B	13	62
7C	9	29
8	8	20
9	48	96
10	97	150

Complete computations are shown on Exhibit No. 4. Under project conditions Area 6 will drain directly to Indian Bend Wash. Area 7 will drain generally to the south and southwest to the intersection of Valley Vista and Hayden Road. Area 8 is on a fill and drains to the intersection of Valley Vista and Hayden Road. Runoff from Areas 9 and 10 (145 acres) normally drains into and south along Street, dividing at McDonald Drive with the runoff eventually flowing into Indian Bend Wash. During high flows, runoff from Areas 9 and 10 can get high enough in 82nd Street to be diverted through the Saguaro High School grounds and Valley Vista Lane west to Hayden Road. A diagram showing the direction and quantity of flows for the 100-year flood are shown on Exhibit No. 5. See appendix C detailed hydrologic and hydraulic data.

This will drain to McDonald

EXHIBIT NO. 4

INDIAN BEND WASH PROJECT

HAYDEN ROAD
AT
VALLEY VISTA AVENUE

AREA NO.		6	7A	7B	7C	8	9	10
DRAINAGE AREA (AC)		51	80	9	13	8	48	97
Length	(Ft.)	3,200	2,800	800	800	900	2,700	4,200
Elev.	(Ft.)	7.0	10.0	3.0	2.0	0.5	10.0	12.0
Slope	(Ft/Ft.)	0.0022	0.0036	0.0038	0.0025	0.0006	0.0037	0.0029
T_c (1) (Min.)		41	31	11	14	21	30	46
C (Fig. 3-3)		0.5	0.5	0.5	0.8	0.5	0.5	0.5
I	(In/Hr.)	3.3	3.9	6.5	6.0	4.9	4.0	3.1
A	(Ac)	51	80	9	13	8	48	97
Q = CIA	(CFS)	84	156	29	62	20	96	150

(1) KIRPICH EQUATION $T_c = \frac{.04593}{S^{.385}} L^{.77}$

look ok

$\frac{2700}{30(60)} = 1.5595$

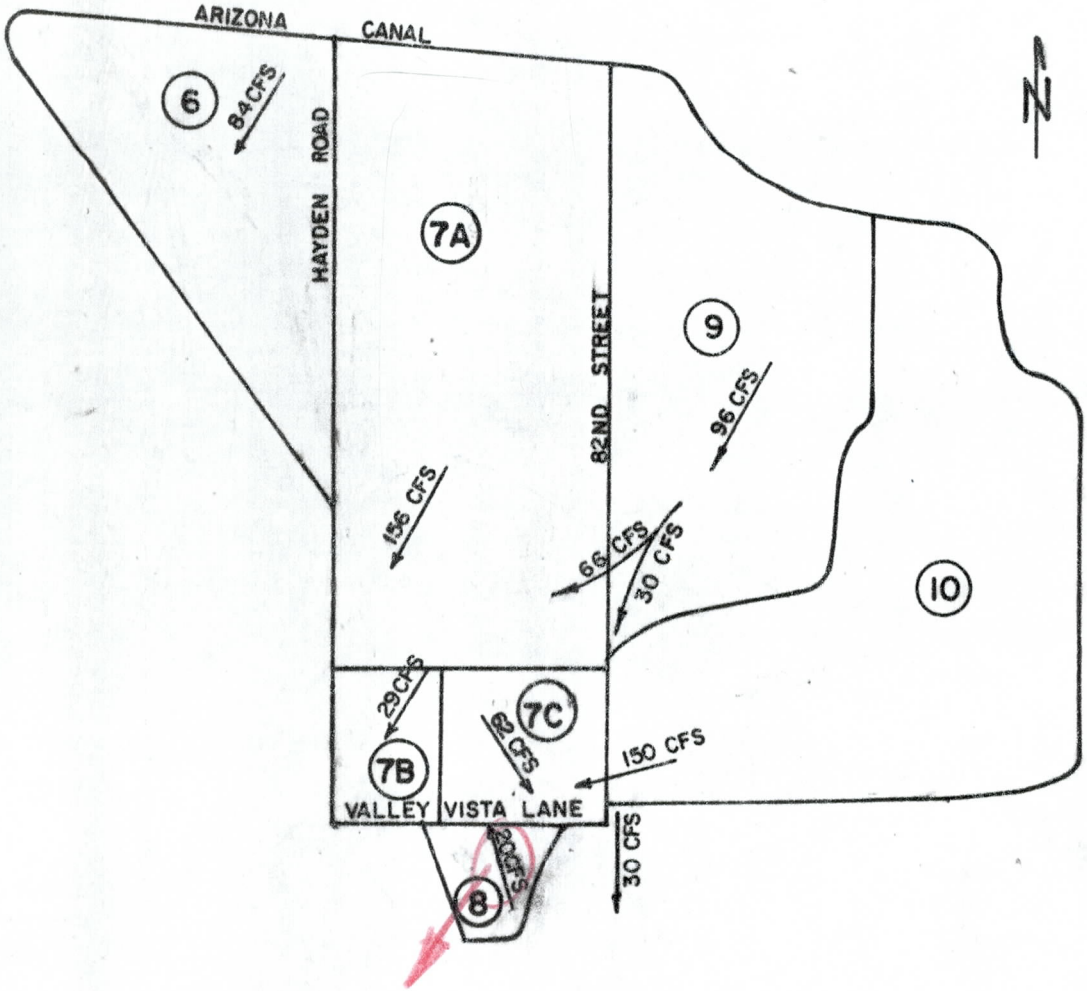
$\frac{4200}{46(60)} = 1.5285$

EXHIBIT NO. 5

INDIAN BEND WASH PROJECT

HAYDEN ROAD AT VALLEY VISTA LANE

DIVISION OF FLOWS



needs key map showing recommendations & locations.

6. RECOMMENDATIONS

a. Indian Bend Road

Storm water runoff will be intercepted by the vertical relocation of Indian Bend Road approximately 1300' east of Scottsdale Road. See Exhibit 2. To preclude ponding storm water in McCormick Railroad Park and adjacent residential development, a drainage structure should be constructed at approximately station 18+00 on Indian Bend Roads monument line. The structure should be designed to accommodate a peak flow of 370 cfs.

A storm drain should be constructed approximately 1300' west of Hayden Road. The 48" line would collect storm water on the north side of Indian Bend Road pass under the roadway and ultimately discharge into Indian Bend Wash. See page 5 and Appendix A.

a. Hayden Road & Valley Vista Lane

Storm water generated in drainage areas 7A&7B and intercepted by flood well construction will necessitate constructing structures under both Hayden Road & Valley Vista Lane. Further a 24" storm drain paralleling Hayden Road will require adandonment since the flood wall will be built east of the present inlet. See Exhibit 5 and Appendix B.

A structure, discharging directly into Indian Bend Wash, should be located between the tennis courts and baseball diamond at Saguaro High School. Another should be located along Valley Vista Lane adjacent to the football field. This structure should be designed to discharge into a lake south of Valley Vista Lane. The two structures should be designed to have a combined capacity of 185cfs.

82ND

The 66cfs diverted from area 9 to area 7A will not necessitate an increase in the 185cfs design discharge due to a long flow time from 32nd St. to the inlet. A surface gradient of approximately 0%, 0.2' in 1300' exists between the inlet and the schoolgrounds immediately north of Saguaro High School.

NO.

Storm water runoff generated in areas 7C, 8 & 10 will be intercepted by the vertical relocation of Valley Vista Lane. Based on data presented in Exhibit 5 and Appendix C, a structure accommodating 156cfs should be constructed on the south side of ValleyVista Lane approximately 700 West of 82nd Street. This facility would discharge into the lake located south of Valley Vista Lane.

Flow from the 100 year event generated in area 9 will be carried in 82nd Street & (30cfs), or flow into area 7A, (66cfs.)

OTHER CONSIDERATIONS

A structure should also be built on the north side of Valley Vista Lane approximately 600' from Hayden Road. It's purpose would be to collect nuisance water flowing in the High School's north-south service driveway adjacent the campus. The structure should have a capacity of approximately 20cfs, and discharge into the lake south of Valley Vista Lane.

APPENDIX A

date: Sht. No.

by: D. GILBERTSON

ck:

IND. BEND WASH S&M 7091

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

DIVISION OF FLOWS HAYDEN RD. & IND. BEND RD.

- DESIGN FLOW FOR STORM WATER INTERCEPTED BY THIS PROJECT WILL BE EQUAL TO THAT CURRENTLY CARRIED IN THE ROADSIDE DITCH ON THE N SIDE OF IND. BEND RD. THIS FLOW IS 70 cfs±

- MOST STORM WATER, 513 CFS±, FROM AREA 5 WILL NOT CROSS Hayden Rd AT THE INTERSECTION SINCE THE 43"X27" CMP. has LIMITED CAPACITY & INDIAN BEND RD. IS LOWER THAN HAYDEN Rd. FOR A CONSIDERABLE DIST. E. OF THE INTERSECTION, Approx 900'.

show some calcs.

IND. BEND WASH - S&M 7091

SULLIVAN & MASSON CONSULTING ENGINEERS

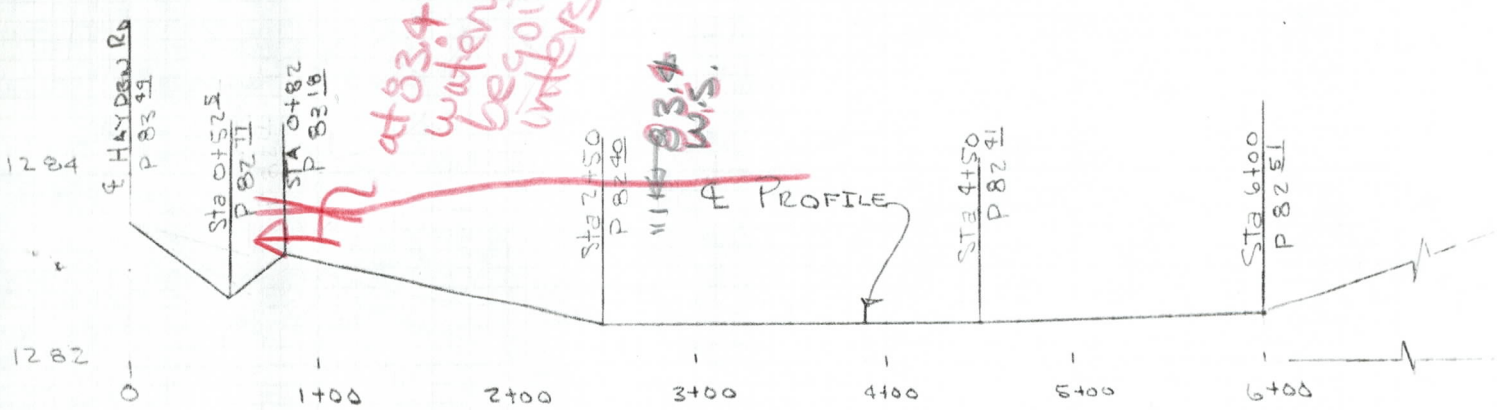
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

by: D. GILBERTSON

ck:

WEIR FLOW OVER INDIAN BEND RD E. OF HAYDEN



CHECK WEIR CAPACITY (STA 2+50 TO 4+50', D=1')

$Q = CLH^{3/2}$ $C = 2.6$, $L = 100$. $H = 1'$

$Q = (2.6)(200')(1)^{1.5}$

$Q = 520$ cfs

TOTAL WEIR CAPACITY > THAN TOTAL 533 CFS Q FROM AREA 5

PROJECT: Ind. Bend Wash

S&M 7091

DESIGNER: _____

DATE: _____

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____ TW_1 = _____

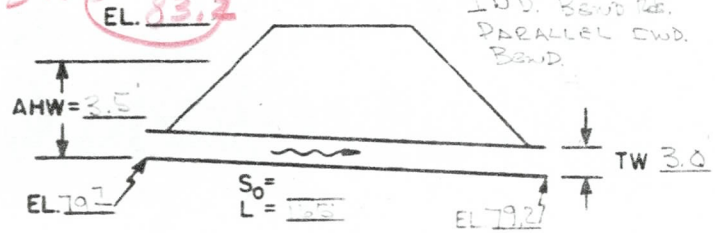
Q_2 = _____ TW_2 = _____

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

SKETCH

should be 83.4 see A-2

STATION: N. Side Int. Hayden & Ind. Bend Rds. Parallel Ind. Bend.



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. 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
CMP Headwall	45	43 x 27	1.55	3.5												
	20	43 x 27			0.5	1	/	/	3.0	3.0	0.5	3.5				

SUMMARY & RECOMMENDATIONS:

Since Ditch At Outlet End Will Likely Be Full
Use Outlet Control Cond. 20 cfs

Figure 7

A-3

date: Sht. No.

by: D. GILBERTSON

ck:

IND. BEND WASH S&M 7091

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

Is this HYDRAULIC Grade line

CHECK CAPACITY OF 43"X27" CMP W SIDE HAYDEN

S= 0.003'/FT

ASSUME PIPE FLOW EQUIVAL PIPE DIA = 36"

C = 90

FROM ASCE - M & REP No. 37

HAZEN & WILLIAMS FORMULA

Q = 30 cfs

by manning

n=.024

K=3.06.3

Q=17CFS

SINCE DITCH CAPACITY IS 70 CFS &

30 + 20 cfs ENTER THE CHANNEL FROM THE 2 43 X27" CMP, 20 cfs CAN ENTER THE CHANNEL FROM WATER FLOWING DOWN HAYDEN RD ∴ DESIGN Q FOR THE STRUTURE AT 78th PLACE IS 70 CFS. NOTE DUE TO SHORT Tc AREA 2 WILL NOT CONTRIBUTE TO THE DESIGN Q.

not true it's peak rate will not contribute but the rate at a Tc = to other area will contribute

Q=17+17+20+ over Intersection

?

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725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

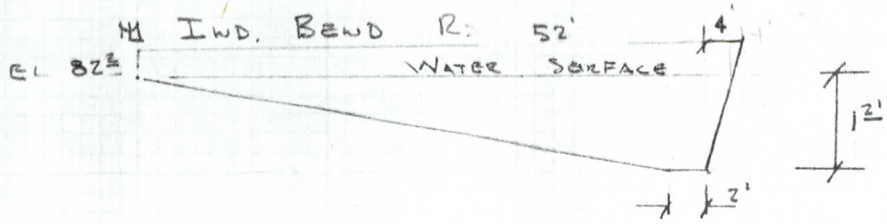
by: D. GILBERTSON

ck:

IWD. BEND WASH S&M 7091

DITCH CAPACITY CALCS - Existing DITCH -

- DITCH CAPACITY STA 54+95



A = 35 FT²

WP = 56 , n = 0.022

S = 0.0033'/FT

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

$$Q = \frac{1.49}{0.022}\left(\frac{35}{56}\right)^{2/3}(0.0033)^{1/2}(35\ FT^2)$$

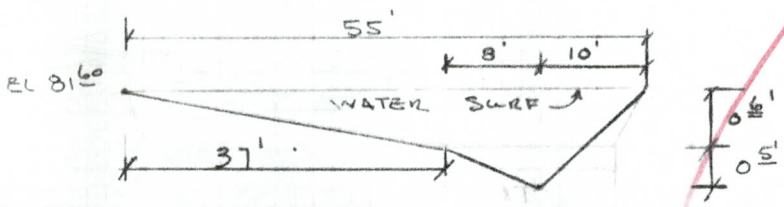
$$Q = (1730.1)(0.0033)^{1/2}$$

$$Q = 94\ CFS$$

V = 2.7 FPS

What about capacity over WP?

- DITCH CAPACITY STA 52+00



A = 23 SF

WP = 57' S = 0.0033'/FT

n = 0.022

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

$$Q = \frac{1.49}{0.022}\left(\frac{23}{57}\right)^{2/3}(0.0033)^{1/2}\ 23$$

$$Q_2 = 48\ cfs$$

V = 2.1 FPS

1/2' over WP Q ≅ 60 cfs add'l

a significant figure

AVG CAPACITY $\frac{94 + 48}{2} \cong 70\ cfs$ USE 70 CFS FOR DESIGN

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

by: D. GILBERTSON

ck:

IND. BEND WASH SAM 7091

INLET STA 50+25 INVERT 1276, AVAIL HEAD 6.0

35'N M IND. BEND. Rd. Top of St. 128

OUTLET STA 39+60 INVERT EL 1271.8, 30' S. M IND Bend Rd.

LENGTH 1130 $S = 5.2'/1130$

$= 0.0046'/FT$

DESIGN Q = 70 CFS, CK. INLET, OUTLET CONTROL, PIPE FLOW

TRY 48" RCP

- INLET CONTROL, $HW/D = \underline{1.5}$ Q = 100 cfs, Sq Edge HEC #5, FHWA

- OUTLET CONTROL:

$$H = \left[1 + K_e + \frac{29 n^2 L}{R^{1.33}}\right] \frac{V^2}{2g}$$ HEC #5 F...

DESIGN Q = 70 cfs. $V = Q/A$

K = 0.2 HWL

$R = \frac{12.56}{12.56} = \underline{1.0}$

$V = 70\,cfs / 12.56\,ft^2$

$V = \underline{5.57}$ fps

n = 0.012

$$H_{REQ} = \left[1 + 0.2 + \frac{(29)(0.012)^2(1130)}{1^{1.33}}\right] \frac{(5.57)^2}{(2)(32.2)}$$

$= [5.92][0.48]$

$= 2.85'$

$H_{AVAIL} = HW - TW + LS_o$ HW = 4.5 TW = 4.0, LS_o = 4.2

$= 4.5 - 4.0 + 4.2$

$= 4.7$

$4.7 > 2.85 \therefore$ OK

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

by: D. G[illegible]

ck:

IND BEND WASH SYM 7091

HAZEN WILLIAMS ASCE MP # 35 pg. 83

C=100 S=0.0096'/FT

Q= 80 cfs

48" RCP OK

APPENDIX B

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

by: D. GILBERTSON

ck:

IND BEND WASH S&M 7091

HAYDEN RD

- A STRUCTURE IS REQUIRED APPROX. 800' N. OF VALLEY VISTA DRIVE TO CONVEY APPROX. 95 cfs DIRECTLY TO IND. BEND WASH. FOLLOWING IS LISTING OF DESIGN DATA FOR SUCH A STRUCTURE

  - OUTLET EL. 1262.28
  - Length 150'
  - Exist. Grd EL @ INLET 1268.5
  - Bottom OF FLOOD WALL Footing 1265, Top OF WALL 78

WITH S = 0.002', H AVAILABLE 6.0

TRY. 2 30" RCP WOULD CARRY: $H/D = 2.4$, INVERT 62.5

50 cfs Ea INLET CONTROL

$K_e = 0.2$ HW 6.0 TW = 2.5

$LS_o = 0.3$ H = 3.7

=7 47 cfs Ea OUTLET CONTROL

THE STRUCTURES REQUIRED WOULD BE 2, 30" RCPS

IND. BEND WASH SFM 7091

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date: Sht. No.
by: D. GILBERTSON
ck:

CHECK CAPACITY OF 24" RG RCP

OUTLET EL 1262.7 STA 6+52

INLET EL 1266.6 STA 19+81.5

$$\text{Slope} = \frac{1266.6 - 1262.7}{1981.5 - 652} = \frac{3.9'}{1329.5} = 0.00293'/\text{FT}$$

Assume Gravity Flow

n = 0.012
D = 24"
S = 0.29 '/100 FT

Q = 14 CFS, FIELDS HYD. CAL.

Assume Pressure Flow

C = 120
S = 0.002
D = 24"

Q = 11 CFS.

HAZEN WILLIAMS FORMULA
ASCE MAN. OF PRACTICE No. 37
FIG 23

USE 11 CFS

APPENDIX C

SULLIVAN & MASSON CONSULTING ENGINEERS
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IND. BEND WASH S&M 7091

date: Sht. No.

by: D. GILBERTSON

ck:

DIVISION OF FLOWS & PRELIM DESIGN.

- ATTACHED Hydrograph Depicts Design Q For Stormwater Intercepted By the Vertical Relocation of Valley Vista Lane. ALSO Capacity CALCS FOR 82ND St. ARE PRESENTED. A drainage structure Designed to Pass 155 cfs±, Should be LOCATED On the S. Side of Valley Vista Lane Approx 700' From Hayden Rd.

Prelim Design Data Follows.

OUTLET EL.	1259
Exist Grd @ STRUCTURE-INLET	1267±
LENGTH	500' ±
SLOPE	0.00275'/F
INVERT EL	1260.5
H(AVAIL)	6.5' ±
OUTLET LOCATION	LAKE E OF HAYDEN S. VALLEY

TRY 54" R.C.P. HW/D = 1.44, Q = 150 cfs ⇒ INLET CONTROL

KE = 0.20, TW = 4.5 LSo = 1.5 h = 3

HW = 6.5

Q = 135 cfs ⇒ OUTLET CONTROL

135 < 155 ∴ No Good

TRY 66" RCP

HW/D = 1.2 Q = 180 cfs ⇒ INLET CONTROL

K = 0.20 TW = 6.5 LSo = 1.5 h = 3

HW = 6.5

Q = 160 cfs ⇒ OUTLET CONTROL

PIPE APPROX 66" RCP.

date: Sht. No.

by: D. GILBERTSON

ck:

IND. BEND WASH S&M 7091

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A PIPE IS REQUIRED APPROX 120' E. OF HAYDEN RD. TO PASS APPROX 95cfs OF STORM WATER RUNOFF GENERATED IN AREAS 7A & B & INTERCEPTED BY FLOOD WALL CONSTRUCTION. FOLLOWING IS PRELIM. DESIGN INFO

OUTLET EL	1259'
EXIST GRD @ INLET STRUCT	1266.5
BOTTOM OF FLOOD WAL FOOTING	1262.5
LENGTH	230'
TOP OF WALL	1276

WITH S = 0.0022 H AVAIL. = 7.0

TRY 30" R.C.P. (2 EA) INVERT 1259.5 CLEARANCE CROWN TO BOTTOM FOOTING 0.5'

HW/D = 2.8' Q = 56cfs EA INLET CONTROL

K = 0.2, HW = 7.0 LSO = 0.5' H = 5
TW = 2.5'
Q = 50cfs OUTLET CONTROL

2 30" RCP WOULD PASS

APPROX 100 cfs

IND BEND WASH S&M 7091

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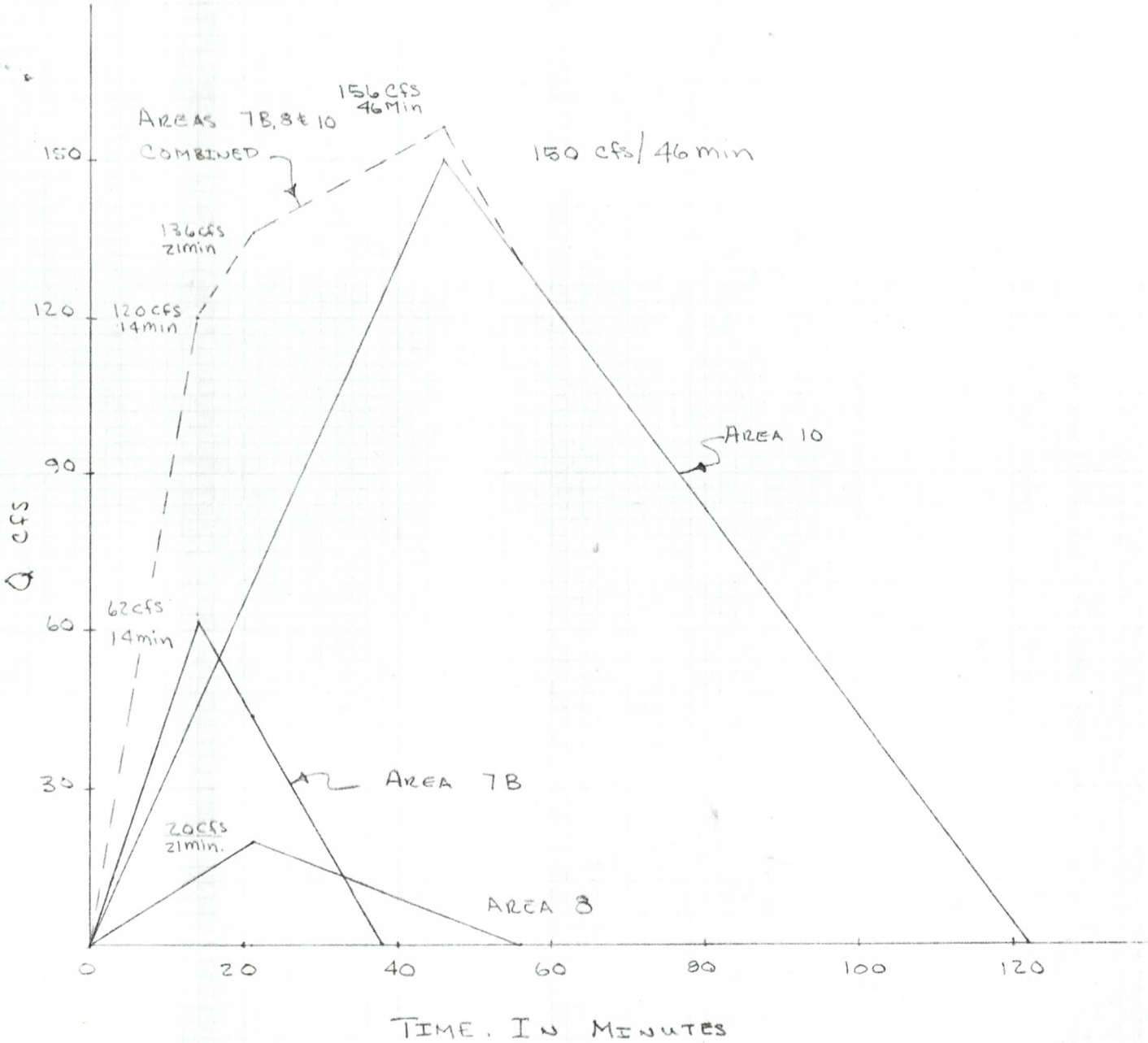
date: Sht. No.

by: D. GILBERTSON

ck:

100 YR. EVENT VALLEY VISTA LANE

COMBINED HYDROGRAPH



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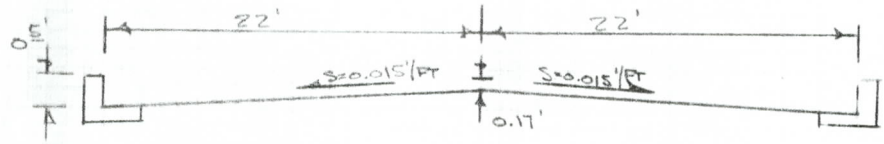
by: D. GILBERTSON

ck:

IND. BEND WASH SIM 7091

STREET CAPACITY CALCS. - 82ND ST.



$A = \left(\frac{0.5' + 0.17'}{2}\right)(22')\,2$

$= \underline{14.7}\ FT^2$

$WP = (22 + 0.5')\,2$

$= \underline{45'}$

$R = \frac{14.7\ FT^2}{45'}$

$= \underline{\underline{0.33}}$

CAPACITY CALCULATIONS

AT ROSE LANE $S = 0.0019'/FT$, $n = 0.015$

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$

$V = \frac{1.49}{0.015}(0.33)^{2/3}(0.0019)^{1/2}$

$V = 2.06$ FPS

$Q = VA$

$Q = (2.06\ FPS)(14.7\ FT^2)$

$= 30.28$

$= \underline{\underline{30\ cfs\ \ use}}$

AT VALLEY VISTA LANE

$S = 0.0015$ $n = 0.015$

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$

$V = \frac{1.49}{0.015}(0.33)^{.67}(0.0015)^{1/2}$

$V = 1.83$ FPS

$Q = VA$

$Q = (1.83\ FPS)(14.7\ FT^2)$

IND. BEND WASH S&M 7091

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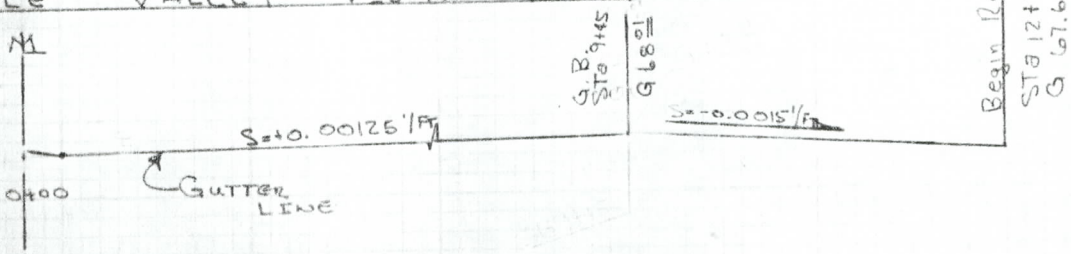
date: Sht. No.

by: D. GILBERTSON

ck:

PROFILE VALLEY VISTA LANE



SINCE AN ADVERSE CROWN EXISTS ON VALLEY VISTA LANE 82ND ST. WILL CARRY APPROX. 30 CFS TO McDONALD RD.

- CHECK CAPACITY OF 18" RCP 28' N. OF M ON VALLEY VISTA LANE.

S=0.0014'/FT, C=120

- Assume Pipe Flow

Use HAZEN-WILLIAMS FORMULA

Q= 4 fps ASCE-M&REP-No 37.

Use 4 fps

APPENDIX D

SULLIVAN & MASSON CONSULTING ENGINEERS
725 WEST McDOWELL ROAD — PHOENIX, ARIZONA 85007 — 602-257-8525

date: Sht. No.

by: D. GILBERTS

ck:

IND. BEND. WASH

DIVISION OF FLOWS FROM AREA 1 ALONG SCOTTSDALE RD.

GENERAL INFO.

- Median with 6" Curb exists on ℄ of Scottsdale Rd. From 54' S. of Ind. Bend Rd. To a point 802' S. of Ind Bend Rd. (T.C. VARIES IN EL. FROM 1299.5 TO 1301.35, S. END H
- SCOTTSDALE Rd HAS A High Point LOCATED APPROX 700' NORTH OF LINCOL DR. EL. 1302.5.

DIVISION OF FLOW ASSUMPTIONS

- 1235 cfs GENERATED IN AREA 1 DIVIDES EVENLY APPROX 1200' W. OF SCOTTSDALE RD., 620 cf TO THE N.E. 620 cfs TO S.E.
- APPROX 130 CFS CROSSES IND BEND RD., WEIR FLOW, AND FLOWS NORTHWARD INTO IND BEND WASH. & 50 cfs FLOW DOWN N. SIDE OF IND. BEND Rd. Assuming INT. FLOODED IN 100 YR EVENT
- 620 cfs - 180 cfs = 440 cfs FLOWS INTO RAILROAD PARK & MUST BE ACCOMMODATED BY A BOX CULVERT LOCATED 1300' E. OF SCOTTSDALE RD. ON IND. BEND. RD.

SEE ATTACHED SHEETS FOR CALCS.

NOTE: THE CAPACITY OF LINCOLN DR TO ACCOMODATE STORM WATER RUNOFF WAS NOT INCLUDED IN THIS METHODOLOGY.

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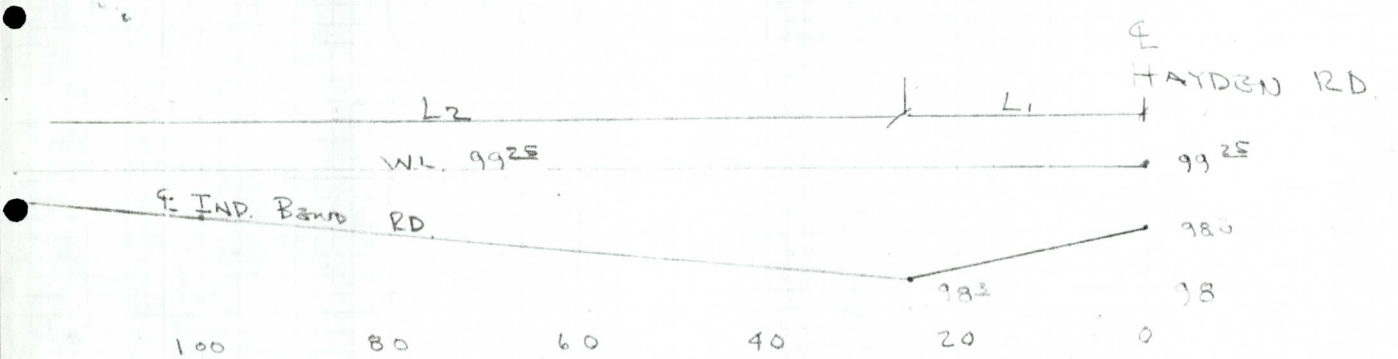
IND. BEND WASH S&M 7091

date: Sht. No.

by: D. Gilbertson

ck:

WIER FLOW OVER INDIAN BEND RD:



WIER FLOW ACROSS INDIAN BEND RD.

$Q = C L H^{3/2}$

$C = 2.6$

$L_1 = 25'$, $L_2 = 105'$

For L_1

$H = \frac{0.45 + 0.95}{2} = 0.7$

$Q = (2.6)(25)(0.7)^{1.5}$

$Q_1 = 38$ CFS

For L_2

$H = \frac{0 + 0.95}{2} = 0.48$

$Q = (2.6)(105)(0.48)^{1.5}$

$Q_2 = 89$ cfs

$Q_T = Q + Q_2$

$Q_T = 127$ cfs

use 130 cfs

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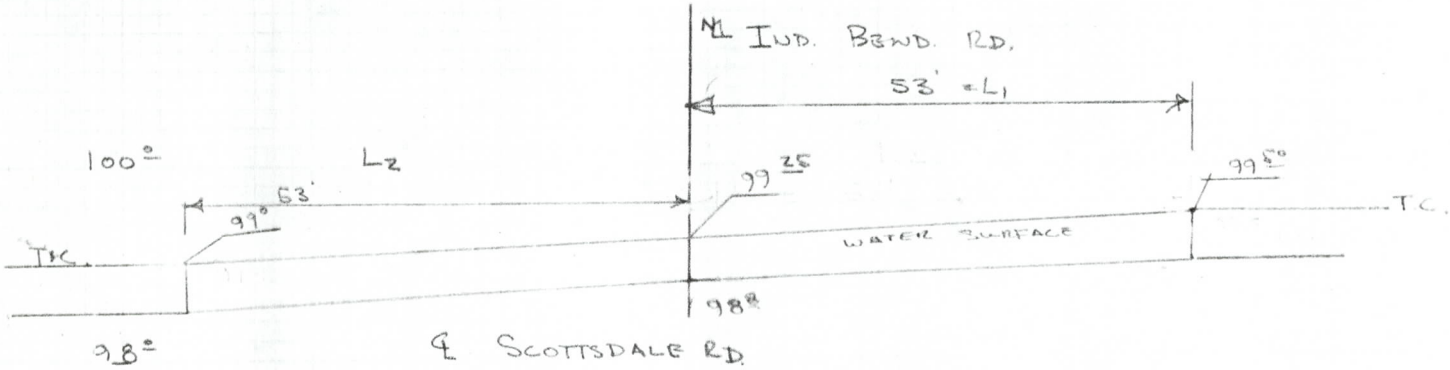
ck:

IND. BEND WASH S&M 7091

WIER FLOW OVER SCOTTSDALE RD.



WIER FLOW ACROSS SCOTTSDALE RD. $Q = CLH^{3/2}$

L_1

$Q = CLH^{3/2}$

$Q = (2.6)(53)(0.5)^{1.5}$

$Q = 49$

use 50 CFS

L_2

$Q = CL\ H^{3/2}$

$Q = (2.6)(53)(0.5)^{1.5}$

$Q = 50$ CFS

PROJECT: Ind. Bend WASH

DESIGNER: D. Gilbertson

DATE: _____

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____ TW_1 = _____

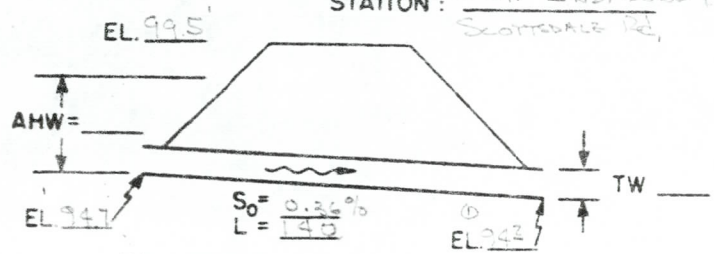
Q_2 = _____ TW_2 = _____

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

SKETCH

① 50'S.
② 35'N.

STATION: INT. IND. BEND & SCOTTSDALE Rd.



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. 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
CMP-HWL	30	2EA 29x18"	3.2	4.8												
Slope & Tapered	16				0.2	3.8			1.5		0.5	4.8				
CMP-HWL	40	1 36x22"	2.6	4.8												
	25				0.2	3.5			1.8		0.5	4.8				L=140'

SUMMARY & RECOMMENDATIONS:

Assume Outlet Control Conditions govern since Int. will likely be flooded during 100 yr event

Figure 7

PROJECT: Ind Bend Wash

DESIGNER: D. Gilbertson

DATE: 1/6/78

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____ TW_1 = _____

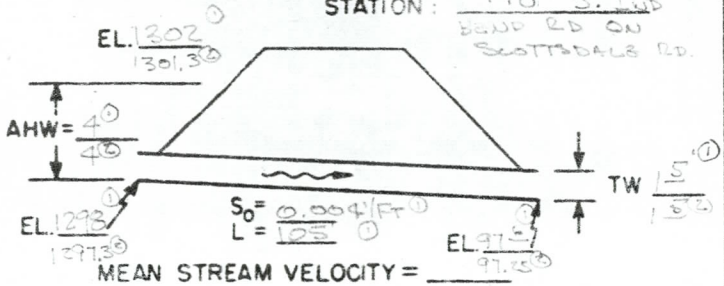
Q_2 = _____ TW_2 = _____

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

SKETCH

① 1280' ℄

STATION: ② 770 S. Ind Bend Rd on Scottsdale Rd.



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. 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 EA 29"X18" CMP - 90° HWL	27 EA 54 TOT	2 29"X18"	2.7	4'												1280 N Ind.
	15 EA 30 TOT				0.2	2.9			1.5'		0.4	4.0				Bend Rd.
1 EA 29"X18" CMP-HWL		29"X18"	Same		Cap. Ac				Dinnage		29"X18"		About			770' N Ind.
Slope Tapered																Bend Rd.

SUMMARY & RECOMMENDATIONS:

Assume Outlet Control Conditions Govern since Roadway will Likely Be Flooded During 100 YR Event

Figure 7

D-5

SULLIVAN & MASSON CONSULTING ENGINEERS
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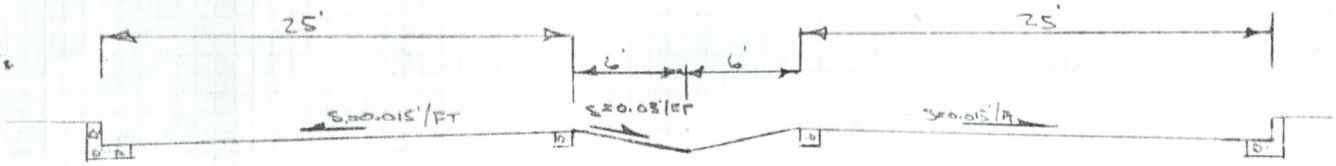
IND BEND WASH. S&M 7091

date: Sht. No.

by: D. Gilbertson

ck:

CAPACITY CALS. FOR LINCOLN DR.



$$A = \left[\left(\frac{0.58 + 0.20}{2}\right)25' + \left(\frac{0.20 + 0.38}{2}\right)6'\right]2$$

$$= [9.75 + 1.74]2$$

$$= 23 \text{ Ft}^2$$

WP = 63' $R = \frac{23}{63}$

$= 0.365$

n = 0.015 S = 0.0089

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$V = \frac{1.49}{0.015}(0.365)^{2/3}(0.0064)^{1/2}$$

$$V = 4.0 \text{ FPS}$$

$$Q = VA$$

$$Q = (4.0 \text{ fps})(23 \text{ Ft}^2)$$

$$= 93 \text{ cfs}$$

NOTE: CURB HEIGHT 7"

Min Slope 0.64%

Max Slope 0.89%