Lower Hassayampa Watershed

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DRAINAGE DESIGN REPORT
FOR
SUN VALLEY PARKWAY
DRAINAGE ENHANCEMENT

PREPARED BY

COLLAR, WILLIAMS & WHITE ENGINEERING
2702 NORTH 44TH STREET
PHOENIX, ARIZONA 85008

NOVEMBER 21, 1988

REVISED DECEMBER 2, 1988

07.0-00-2-12/88

DRAINAGE DESIGN REPORT

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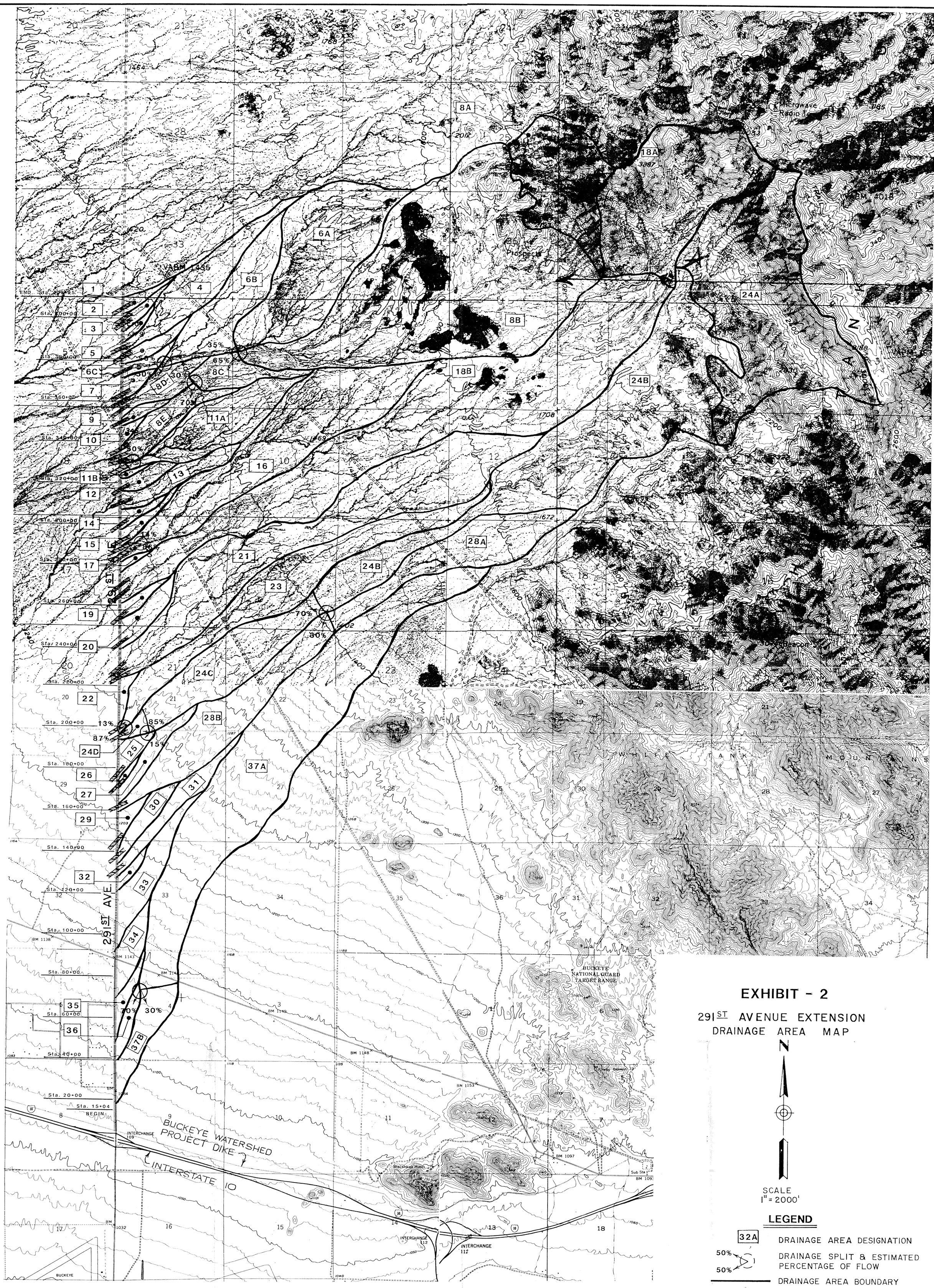

EXHIBIT - 2

291ST AVENUE EXTENSION
DRAINAGE AREA MAP

N

SCALE
1" = 2000'

LEGEND

32A	DRAINAGE AREA DESIGNATION
50% / 50%	DRAINAGE SPLIT & ESTIMATED PERCENTAGE OF FLOW
	DRAINAGE AREA BOUNDARY
	PROPOSED 291st AVE PARKWAY
	CULVERT CROSSING

SHEET 1 OF 1

SURVEY PROJECT NO.

DESIGN PROJECT NO. 850840-7

SUN VALLEY PARKWAY
291st. AVE. (I-10 to Northern Ave.)

DRAINAGE AREA MAP

FLOOD CONTROL DISTRICT RECEIVED JAN 12 '91

SCALE: 1" = 2000'
DATE 1/14/87
CHECKED C.J.L.
DRAWN T.A.
DESIGNED R.A.D.

REVISIONS

NO	DATE	APP.	DESCRIPTION

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EXHIBIT - 2

1. INTRODUCTION

The purpose of this report is to document the design of the proposed drainage enhancements to the Sun Valley Parkway.

This report includes: the design of the collector ditch and spillway inlets located in Phase II from Station 850+00 to 1000+00; the outlet protection at Warner Wash crossing; the detention basin collector ditches and spillway inlets in Phase I from Station 59+00 to 260+00.

2. INTERCEPTOR CHANNEL COLLECTOR DITCH

A. Hydrology

1. Phase II

The drainage area above each tributary inlet and section of collector ditch shown on Exhibit A was delineated using aerial photos and 100 scale topographic maps. Each tributary inlet and the location of spillway inlets located at the drop structures were field verified. For the seven major tributaries A through I (See Exhibits A & B) peak discharges were taken directly from the original design drainage report. The smaller intermediate areas were delineated and separate calculations made for each to estimate the Q_{100} (See Table 1 for results). The original design

Hydrology for Drainage Areas
Table 1

SUMMARY OF HYDROLOGIC DATA

REFER TO EXHIBIT 'A'

DRAIN CONC. Sta.	PTS INCL.	AREA AC	L FT.	ELEVATIONS TOP	ELEVATIONS BOT	SLOPE %	CN or C	tp or tc	PEAK RUNOFF IN C.F.S. FOR RETURN PERIODS IN YR i		10	25	50	100
		TRIBUTARY INLET STRUCTURES												
998+10	J & I Split	403	13,800	2000	1670	2.39	86	48	—					80
995+62	I Split	582	17,000	2000	1670	1.90	86	60	—					40
991+32	I Split	582	17,000	2000	1670	1.90	86	60	—					60
976+58	O	49	5200	1780	1641	2.70	.43	22.8	4.7					10
970+20	H	1616	7000	1755	1620	1.90	86	48	—					27
966+61	M	14.7	2000	1667	1626	2.00	.43	12.2	6.5					4
963+46	L	3	640	1638	1621	2.70	.43	4.5	7.0					0
960+25	K	5	1310	1645	1618	2.10	.43	8.7	7.0					1
953+53	I	13.4	2300	1657	1609	2.10	.43	13.4	6.2					31
946+30	G	162	4500	1680	1600	1.80	86	46	—					17
937+55	F	90	3800	1622	1582	1.00	86	63	—					12
933+45	F	15.2	1550	1603	1585	1.50	.43	11.2	6.7					4
890+56	C	1042	16500	1800	1525	1.70	86	72	—					121
878+70	A	11.1	1510	1551	1529	1.50	.43	11.0	6.8					32
876+35	B	267	13,000	1800	1520	2.10	86	49	—					43
		COLLECTOR DITCH SPILLWAYS												
986+12	P	14.3	2190	1695	1653	1.90	.43	13.4	6.2					38
~~972+90~~	~~[illegible]~~	~~1.0~~	~~490~~	~~[illegible]~~	~~[illegible]~~	~~1.60~~	~~.43~~	~~4.2~~	~~7.0~~					~~3~~
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~990~~	~~[illegible]~~	~~[illegible]~~	~~1.50~~	~~.43~~	~~3.0~~	~~7.0~~					~~10~~
919+17	N	22.5	2700	1608	1574	1.30	.43	18.2	5.1					49
910+10	A	12.9	2180	1591	1564	1.20	.43	16.0	5.6					32
896+78	A	11.8	2030	1580	1547	1.60	.43	13.5	6.2					31
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~.43~~	~~[illegible]~~	~~[illegible]~~					~~[illegible]~~
869+72	C	6.6	1200	1537	1523	1.20	.43	10.0	7.0					20
~~[illegible]~~	~~[illegible]~~	~~1.1~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~1.10~~	~~.43~~	~~[illegible]~~	~~[illegible]~~					~~[illegible]~~
854+53	A	3.5	850	1516	1501	1.70	.43	6.7	7.0					14

criteria, runoff coefficients, and precipitation data were used throughout the evaluation and design of the drainage enhancements. Although, since the natural drainageways are often shallow or indistinct the probability of washes overflowing and experiencing "breakouts" is very high during moderate or major storm events. As a result, the Q_{100} given for many collector ditch sections on the plans reflects what is estimated to be the maximum probable runoff which could enter that particular reach and exceeds what was calculated as runoff from the immediate contributing area.

The Q_{100} given for the interceptor channel is computed by routing the incoming flows and is not a direct sum of those incoming flows.

2. Phase I

The drainage area above each culvert or basin inlet shown on Exhibit D was delineated using aerial photos. The tributary inlets and the location of embankment protection were decided upon after field visits verified the areas of greatest concern. Peak discharges for the major tributaries were taken directly from the original

design report for Phase I. Due to the extreme sheet flow conditions in the vicinity of the basins the quantity of runoff reaching the interceptor ditches was "estimated" much as it was in portions of the Phase II drainage enhancements.

B. Ditch Capacity Calculations

The capacities for the standard size collector ditch were determined beginning at a minimum slope of 0.5% and increasing at one half a percent increments. The results are listed in Table 3 and are located in Appendix A along with the backup calculations.

Capacities were evaluated at three different depths in the channel: Q_1 to the top of the berm, depth = 2.5'; Q_2 to the top of the compacted earth channel, depth = 2.0'; Q_3 to the top of the gunite channel lining, depth = 1.5'. A weighted Mannings "n" was used for the first two depths. The capacity of the earth-lined ditches are also given at the depths of 1.5', 2.0' and 2.5' with Manning's n = .03 at all depths. Capacities are listed on the plans along with the actual estimated maximum discharge collected and conveyed. An "n" of .022 was used for gunite (See Table 4, Appendix B).

C. Estimated Ditch Section Discharges

The actual flow depths for each section of ditch at the actual design slope and incoming flow was also checked to insure the ditch capacity was not exceeded. Actual flows are shown on the plans. Calculations are given in Appendix B for both Phase I and Phase II

D. Tributary Inlets

The major tributaries were located by aerial photos first and field verified. Inlet sizing was based on field observations of the natural channel width and character and on calculated peak flows and velocities for the inlet section. Table 2 shows hydrologic and hydraulic variables and the dimensions for each of the tributary inlets. The smaller tributaries with less than 150 cfs were designed to have a gunite lined standard or non-standard (wider as needed) spillway inlet.

The heavier and stronger poured-in-place concrete structures are designed for the larger incoming tributaries. Computations for each inlet are included in Appendix C. The velocities and flow depths given for the tributary inlets were computed as though baffle blocks were not being used. The resultant velocities with baffle blocks will be much lower but are difficult

PROJECT NAME Sun Valley Parkway Phase II

JOB NO.

TRIBUTARY - INLET SUMMARY

DATE 10/26/88

Table 2

	Station	Discharge (Cfs)	Inlet Type	Topwidth (Ft.)	Bottom (Ft.)	Slope	Invert elev.	Flow Depth	Velocity
	876+35	430	T.I.S.	55	45	1.79%	523.4	1.2	7.3
	878+70	32	S.S.	30	10	5.30%	526.6	.4	7.4
	890+58	1215	T.I.S.	70	60	0.90%	535.0	2.4	7.8
	933+45	44	S.S.	30	10	9.97%	584.0	.4	10.2
	937+55	120	N.S.S.	70	10	3.10%	585.0	0.9	9.5
	946+30	177	T.I.S.	135	50	4.17%	599.2	0.5	6.5
	953+53	316	N.S.S.	45	10	7.16%	609.0	.4	8.5
	960+25	15	N.S.S.	35	15	8.92%	618.2	.2	6.0
	963+46	9	S.S.	30	10	9.33%	621.8	.2	5.6
	966+61	41	N.S.S.	75	10	6.94%	625.8	.4	8.8
	970+20	271	T.I.S.	70	30	7.91%	631.7	0.8	11.1
	976+58	100	N.S.S.	75	20	5.67%	641.0	.5	9.4
	986+12	38	N.S.S.	60	40	7.59%	651.4	.2	5.6
	991+30	600	T.I.S.	150	130	5.60%	658.5	.4	12.0
	995+64	400	T.I.S.	75	65	5.70%	662.9	.4	13.6
	998+12	300	T.I.S.	75	65	3.60%	662.6	.8	15.5

T.I.S. = Tributary Inlet Structure - Grouted Rip-Rap

S.S. = Standard Spillway Inlet (Gunite) 10 ft bottom, 30 ft top

N.S.S. = Non-standard Spillway - dimensions given

to assess accurately and are not shown.

The baffle block energy dissipators are provided to prevent scour of the channel bottom not the opposite channel bank. Previous erosion of that bank occurred because large amount of sediment were deposited in the channel from washouts of the south bank by the large runoff in August of 1988. These deposits created, in effect, a low flow channel along the toe of the north bank. Subsequent smaller storm runoff then experienced higher than design velocities because of the reshaped channel bottom.

E. Interceptor Ditch Spillways

1. The Interceptor Ditch Spillways are designed to be constructed of gunite and are of two types: standard and non-standard. The sketch in Appendix D shows a typical section at the top of a typical spillway (also see plans) and lists the capacity of the section at two depths. Supporting data is also included in Appendix D.

2. Computations were made to determine the efficiency of one of the standard spillways which is on a continuous grade. The interception capacity was calculated much like a curb opening inlet in a street

that is on-grade. The assumptions, equations and results are given in Appendix E.

3. WAGNER WASH OUTLET PROTECTION

Rock riprap was designed for the outlet at Wagner Wash to protect it during the 100 year peak flow of 5110 cfs. A Mannings rating on the channel cross-section revealed the 100 year flow would be contained within the banks.

The riprap design calculations were based on methodology found in FHA Highways and River Environment, and Hydraulic Engineering Circular No. 14.

4. DETENTION BASIN DITCHES AND INLETS

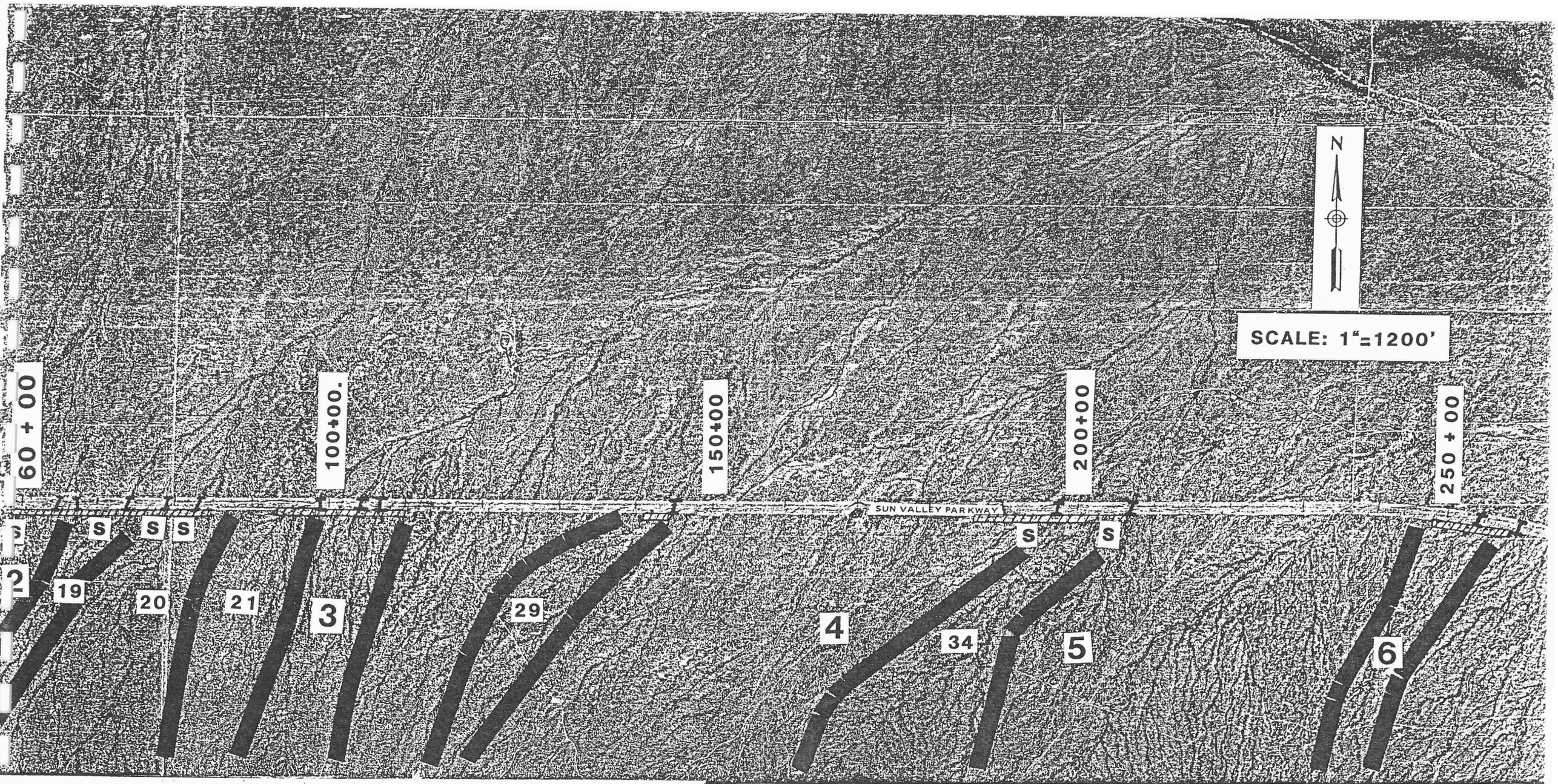
Interceptor ditches have been designed to protect the sides of the existing detention basins located in Phase I form Station 58+00 to 254+69. The ditches will be located along the south sides of the basins and will be earth-lined where velocities for the 100 year runoff are estimated to be less than 5 fps. The 100 year discharges from contributing areas have been computed and are listed along with watershed information in Table 5 (Also see Exhibits C and D). The spillway inlets from the ditches to the basins are gunite lined and sized to carry the 100 year runoff. Certain detention basins (93+50 to 98+75, e.g.) will have protective lining along the south bank to protect it from erosion due to massive sheet flows. The locations where lining

will be used were field verified with determining factors being existing erosion of the banks and/or absence of calcareous soils. The south bank of the detention basin beginning at Sta. 102+50 and extending to Sta. 106+90 is an instance where lining is unnecessary. This bank will remain unlined because although it has already been subjected to large quantities of runoff, in a sheet flow condition, the resultant erosion is insignificant. Inspection of this bank reveals that it is composed of caliche or "hardpan" which resists infiltration by surface water and is highly resistant to erosion.

Table 6 is a list of all inlets into the basins including Q_{100}, D_{100}, V_{100} and dimensions.

5. BAFFLE BLOCK DESIGN

Baffle block energy dissipators are to be constructed for six of the seven Tributary Inlet Structures in Phase II and for one inlet structure in Phase I (Station 193+00, approximately). The design procedure used is found in the "Design of Small Dams", Chapter IX, B.193.h. The design procedure could not be followed exactly because of the configuration of the spillways. As a result the longitudinal spacing of the blocks is usually less than recommended in the design procedure. The blocks are constructed of concrete masonry units with steel reinforcing and the structural design calculations are included in Appendix H along with 7 which lists design dimensions computed from "Design of Small Dams".



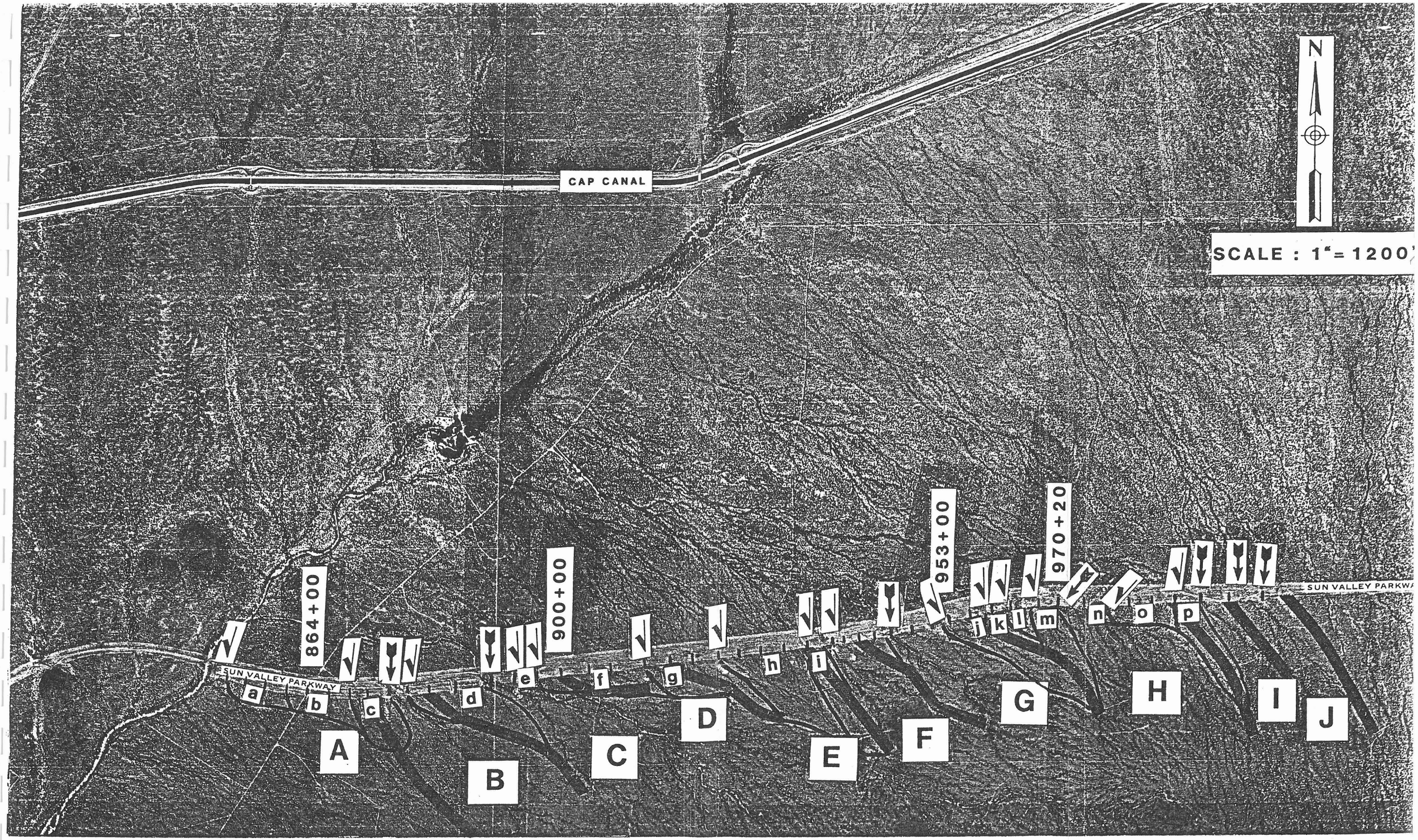
LEGEND

▨	DETENTION BASIN	■	BASIN BOUNDARY
S	SPILLWAY LOCATION	1	DRAINAGE AREA
I	CULVERTS		

EXHIBIT D

11 - 21 - 88

SEE ALSO EXHIBIT C



LEGEND

INDICATES TRIBUTARY INLETS

INDICATES DROP STRUCTURE LOCATION

INDICATES SPILLWAY LOCATION

EXHIBIT A

APPENDIX A

FORM 204-1

TABLE 3

COLLECTOR DITCH CAPACITY FOR VARIOUS LONGITUDINAL SLOPES FOR DEPTHS OF 1.5', 2.0' and 2.5', (GUNITE LINING TO 1.5'). AND FOR A DEPTH OF 2.5' FOR EARTH LINED DITCH.

SLOPE (FT/FT)	SIDE SLOPES (H:V) *	DEPTH OF FLOW (FT)	N_{w1} **	Q-CAPACITY (cfs)	VELOCITY @ CAPACITY (fps)	MAX. Q CAPACITY	EARTH LINED
						D = 2.5' N = .025	D = 2.5' N = .030
.0050	5:1	1.5	.022	44 (Q_3)	3.9		
		2.0	.024	86 (Q_2)	4.3	150 (Q_1)	125
.0075	"	1.5	.022	54	4.8	184	
		2.0	.024	106	5.3		154
.010	"	1.5	.022	62	5.5	213	
		2.0	.024	122	6.1		177
.015	"	1.5	.022	76	6.7	261	
		2.0	.024	150	7.5		217
.020	"	1.5	.022	88	7.8	301	
		2.0	.024	173	8.6		251
.025	"	1.5	.022	98	8.7	336	
		2.0	.024	193	9.7		280
.030	"	1.5	.022	107	9.5	368	
		2.0	.024	212	10.6		307
.035	"	1.5	.022	116	10.3	398	
		2.0	.024	229	11.4		332
.040	"	1.5	.022	124	11.0	425	
		2.0	.024	224	12.2		355

* ASSUME BOTH SIDES = 5:1 BECAUSE THAT IS WORST CASE FOR CAPAC.

** N_{GUNITE} = 0.022 ; $N_{EXCAVATED\ EARTH}$ = 0.030

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N. 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO.

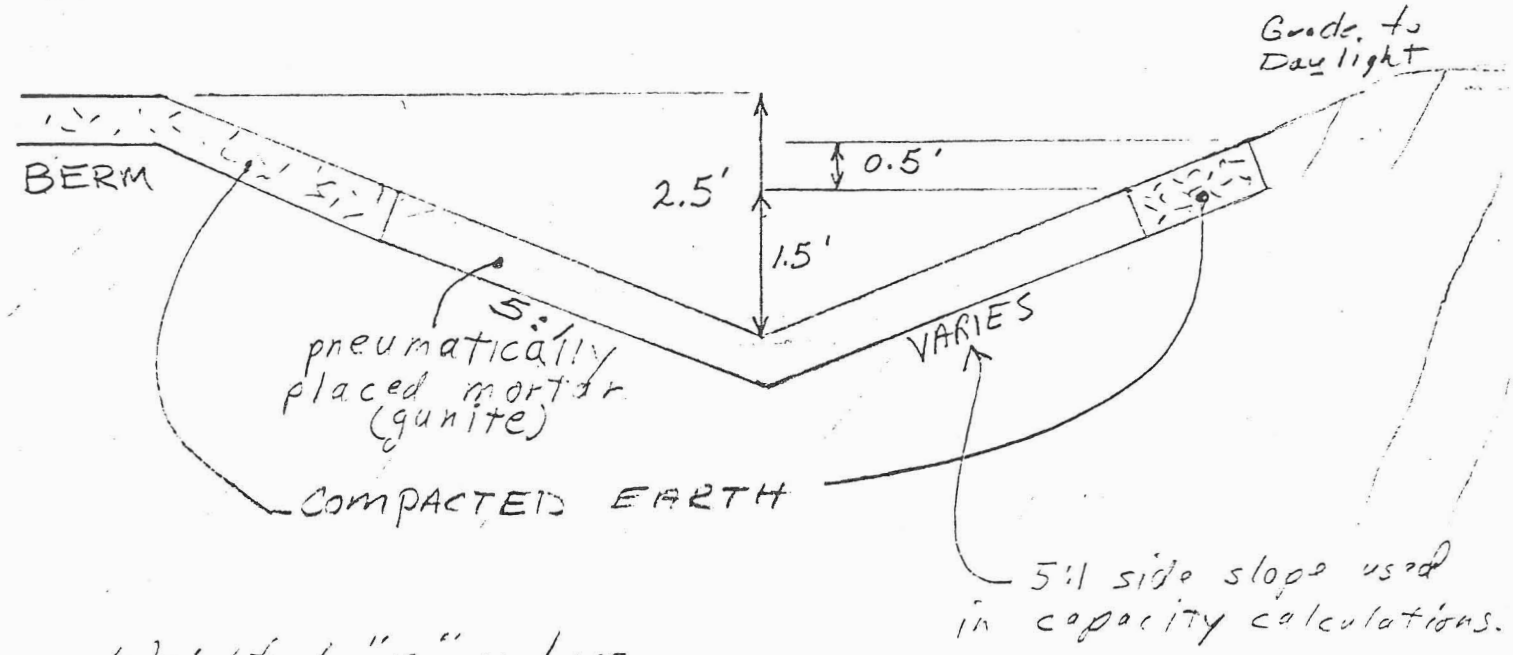
JOB Sun Valley Parkway Phase II
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Phase II Intercepter Channel

Capacity Calculations

Collecter Ditch Typical Section

Assumed "n" values:
gunite = 0.022
compacted earth = 0.030



Weighted "n" values

Depth = 1.5 ft n = 0.022
= 2.0 n = 0.024
= 2.5 n = 0.025

Maximum Capacity at minimum slope of 0.005 ft/ft

Depth = 1.5 ft Q_{capac} = _____ cfs
= 2.0 =
= 2.5 =

FORM 204-1

```
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  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005000
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  FLOW TOP- WIDTH(FEET) =          15.00
  FLOW AREA(SQUARE FEET) =            11.25
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =      3.89
  UNIFORM FROUDE NUMBER =      .792
  PRESSURE + MOMENTUM(POUNDS) =           681.14
  AVERAGED VELOCITY HEAD(FEET) =        .235
  SPECIFIC ENERGY(FEET) =       1.735


                    Press RETURN to continue ===>
```

GUNITE LINED

```
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  FLOW AREA(SQUARE FEET) =            11.25
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.77
  UNIFORM FROUDE NUMBER =      .970
  PRESSURE + MOMENTUM(POUNDS) =           846.21
  AVERAGED VELOCITY HEAD(FEET) =        .353
  SPECIFIC ENERGY(FEET) =       1.853


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=============================================================================
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  ))))) NORMAL DEPTH FLOW(CFS) =     61.91
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  FLOW AREA(SQUARE FEET) =          11.25
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.50
  UNIFORM FROUDE NUMBER =    1.120
  PRESSURE + MOMENTUM(POUNDS) =         1011.29
  AVERAGED VELOCITY HEAD(FEET) =       .470
  SPECIFIC ENERGY(FEET) =      1.970


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  ))))) NORMAL DEPTH FLOW(CFS) =     75.87
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  FLOW AREA(SQUARE FEET) =          13.69
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.71
  UNIFORM FROUDE NUMBER =    1.378
  PRESSURE + MOMENTUM(POUNDS) =         1341.43
  AVERAGED VELOCITY HEAD(FEET) =       .705
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  FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.78
  UNIFORM FROUDE NUMBER =    1.584
  PRESSURE + MOMENTUM(POUNDS) =         1671.57
  AVERAGED VELOCITY HEAD(FEET) =       .941
  SPECIFIC ENERGY(FEET) =      2.441


                    Press RETURN to continue ===>


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  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     8.70
  UNIFORM FROUDE NUMBER =    1.771
  PRESSURE + MOMENTUM(POUNDS) =         2001.72
  AVERAGED VELOCITY HEAD(FEET) =      1.176
  SPECIFIC ENERGY(FEET) =      2.676


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----------------------------------------------------------------------------
))))) NORMAL DEPTH FLOW(CFS) =     107.24
FLOW TOP- WIDTH(FEET) =          15.00
FLOW AREA(SQUARE FEET) =            11.25
HYDRAULIC DEPTH(FEET) =        .75
FLOW AVERAGE VELOCITY(FEET/SEC.) =      9.53
UNIFORM FROUDE NUMBER =     1.940
PRESSURE + MOMENTUM(POUNDS) =           2331.86
AVERAGED VELOCITY HEAD(FEET) =       1.411
SPECIFIC ENERGY(FEET) =       2.911
```

Press RETURN to continue ===)

```
****************************************************************************
))CHANNEL INPUT INFORMATION((((
----------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    1.50
CHANNEL Z(HORICONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .045000
MANNINGS FRICTION FACTOR =  .0220
============================================================================
NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
))))) NORMAL DEPTH FLOW(CFS) =     115.85
FLOW TOP- WIDTH(FEET) =          15.00
FLOW AREA(SQUARE FEET) =            11.25
HYDRAULIC DEPTH(FEET) =        .75
FLOW AVERAGE VELOCITY(FEET/SEC.) =     10.30
UNIFORM FROUDE NUMBER =     2.096
PRESSURE + MOMENTUM(POUNDS) =           2662.00
AVERAGED VELOCITY HEAD(FEET) =       1.646
SPECIFIC ENERGY(FEET) =       3.146
```

Press RETURN to continue ===)

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    1.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .040000
  MANNINGS FRICTION FACTOR =  .0220
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =     123.82
  FLOW TOP- WIDTH(FEET) =         15.00
  FLOW AREA(SQUARE FEET) =           11.25
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    11.01
  UNIFORM FROUDE NUMBER =    2.240
  PRESSURE + MOMENTUM(POUNDS) =          2992.14
  AVERAGED VELOCITY HEAD(FEET) =      1.881
  SPECIFIC ENERGY(FEET) =      3.381


                          Press RETURN to continue ===>
```

```
*****************************************************************************
))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    1.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .045000
  MANNINGS FRICTION FACTOR =  .0220
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =     131.34
  FLOW TOP- WIDTH(FEET) =         15.00
  FLOW AREA(SQUARE FEET) =           11.25
  HYDRAULIC DEPTH(FEET) =       .75
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    11.67
  UNIFORM FROUDE NUMBER =    2.376
  PRESSURE + MOMENTUM(POUNDS) =          3322.29
  AVERAGED VELOCITY HEAD(FEET) =      2.116
  SPECIFIC ENERGY(FEET) =      3.616


                          Press RETURN to continue ===>
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =     86.43
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.32
  UNIFORM FROUDE NUMBER =     .762
  PRESSURE + MOMENTUM(POUNDS) =         1555.75
  AVERAGED VELOCITY HEAD(FEET) =       .290
  SPECIFIC ENERGY(FEET) =      2.290


                          Press RETURN to continue ===)


*****************************************************************************
))CHANNEL INPUT INFORMATION((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007500
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    105.07
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.25
  UNIFORM FROUDE NUMBER =     .933
  PRESSURE + MOMENTUM(POUNDS) =         1917.62
  AVERAGED VELOCITY HEAD(FEET) =       .433
  SPECIFIC ENERGY(FEET) =      2.433


                          Press RETURN to continue ===)
```

```
*****************************************************************************
>>>CHANNEL INPUT INFORMATION<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =    122.22
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.11
  UNIFORM FROUDE NUMBER =    1.077
  PRESSURE + MOMENTUM(POUNDS) =         2279.50
  AVERAGED VELOCITY HEAD(FEET) =       .580
  SPECIFIC ENERGY(FEET) =      2.580


                    Press RETURN to continue ===>
```

```
*****************************************************************************
>>>CHANNEL INPUT INFORMATION<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .015000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =    149.69
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.48
  UNIFORM FROUDE NUMBER =    1.319
  PRESSURE + MOMENTUM(POUNDS) =         3003.25
  AVERAGED VELOCITY HEAD(FEET) =       .870
  SPECIFIC ENERGY(FEET) =      2.870


                    Press RETURN to continue ===>
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .020000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    172.85
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     8.64
  UNIFORM FROUDE NUMBER =    1.523
  PRESSURE + MOMENTUM(POUNDS) =         3727.00
  AVERAGED VELOCITY HEAD(FEET) =      1.160
  SPECIFIC ENERGY(FEET) =      3.160


                    Press RETURN to continue ===)


*****************************************************************************
))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .020000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    [illegible]
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =          20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     [illegible]
  UNIFORM FROUDE NUMBER =    1.703
  PRESSURE + MOMENTUM(POUNDS) =         4450.75
  AVERAGED VELOCITY HEAD(FEET) =      1.450
  SPECIFIC ENERGY(FEET) =      [illegible]


                    Press RETURN to continue ===)
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .030000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    211.70
  FLOW TOP- WIDTH(FEET) =         20.00
  FLOW AREA(SQUARE FEET) =           20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    10.58
  UNIFORM FROUDE NUMBER =    1.865
  PRESSURE + MOMENTUM(POUNDS) =          5174.50
  AVERAGED VELOCITY HEAD(FEET) =      1.740
  SPECIFIC ENERGY(FEET) =      3.740


                    Press RETURN to continue ===)


*****************************************************************************
))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .035000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    228.66
  FLOW TOP- WIDTH(FEET) =         20.00
  FLOW AREA(SQUARE FEET) =           20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    11.43
  UNIFORM FROUDE NUMBER =    2.015
  PRESSURE + MOMENTUM(POUNDS) =          5899.25
  AVERAGED VELOCITY HEAD(FEET) =      2.030
  SPECIFIC ENERGY(FEET) =      4.030


                    Press RETURN to continue ===)
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.00
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .040000
  MANNINGS FRICTION FACTOR =  .0240
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    244.45
  FLOW TOP- WIDTH(FEET) =        20.00
  FLOW AREA(SQUARE FEET) =           20.00
  HYDRAULIC DEPTH(FEET) =     1.00
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    12.22
  UNIFORM FROUDE NUMBER =    2.154
  PRESSURE + MOMENTUM(POUNDS) =         6622.00
  AVERAGED VELOCITY HEAD(FEET) =      2.320
  SPECIFIC ENERGY(FEET) =      4.320


                    Press RETURN to continue ===)
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =     212.74
  FLOW TOP- WIDTH(FEET) =          25.00
  FLOW AREA(SQUARE FEET) =           31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.81
  UNIFORM FROUDE NUMBER =     1.073
  PRESSURE + MOMENTUM(POUNDS) =          4431.69
  AVERAGED VELOCITY HEAD(FEET) =        .720
  SPECIFIC ENERGY(FEET) =       3.220


                    Press RETURN to continue ===)

*****************************************************************************
))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    [illegible]
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .015000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =     [illegible]
  FLOW TOP- WIDTH(FEET) =          25.00
  FLOW AREA(SQUARE FEET) =           31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =      [illegible]
  UNIFORM FROUDE NUMBER =     1.314
  PRESSURE + MOMENTUM(POUNDS) =          5035.04
  AVERAGED VELOCITY HEAD(FEET) =       1.079
  SPECIFIC ENERGY(FEET) =       [illegible]


                    Press RETURN to continue ===)
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .020000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    300.87
  FLOW TOP- WIDTH(FEET) =         25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     9.63
  UNIFORM FROUDE NUMBER =    1.510
  PRESSURE + MOMENTUM(POUNDS) =         7238.38
  AVERAGED VELOCITY HEAD(FEET) =      1.439
  SPECIFIC ENERGY(FEET) =      3.939


                          Press RETURN to continue ===)


*****************************************************************************
))CHANNEL INPUT INFORMATION((
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   [illegible]
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .025000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    374.70
  FLOW TOP- WIDTH(FEET) =         25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    10.[illegible]
  UNIFORM FROUDE NUMBER =    1.[illegible]
  PRESSURE + MOMENTUM(POUNDS) =         [illegible]
  AVERAGED VELOCITY HEAD(FEET) =      1.[illegible]
  SPECIFIC ENERGY(FEET) =      4.299


                          Press RETURN to continue ===)
```

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .030000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =     368.48
  FLOW TOP- WIDTH(FEET) =          25.00
  FLOW AREA(SQUARE FEET) =           31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     11.79
  UNIFORM FROUDE NUMBER =     1.859
  PRESSURE + MOMENTUM(POUNDS) =         10045.07
  AVERAGED VELOCITY HEAD(FEET) =       2.159
  SPECIFIC ENERGY(FEET) =       4.659


                        Press RETURN to continue ===>


*****************************************************************************
>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =    2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .030000
  MANNINGS FRICTION FACTOR =  .0250
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =     368.01
  FLOW TOP- WIDTH(FEET) =          25.00
  FLOW AREA(SQUARE FEET) =           31.25
  HYDRAULIC DEPTH(FEET) =      1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     11.77
  UNIFORM FROUDE NUMBER =     1.858
  PRESSURE + MOMENTUM(POUNDS) =         10040.42
  AVERAGED VELOCITY HEAD(FEET) =       2.157
  SPECIFIC ENERGY(FEET) =       4.657


                        Press RETURN to continue ===>
```

```
*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =   2.50
   CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
   BASEWIDTH(FEET) =       .00
   CONSTANT CHANNEL SLOPE(FEET/FEET) =  .040000
   MANNINGS FRICTION FACTOR =  .0250
=============================================================================
   NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
   ))))) NORMAL DEPTH FLOW(CFS) =    425.49
   FLOW TOP- WIDTH(FEET) =        25.00
   FLOW AREA(SQUARE FEET) =          31.25
   HYDRAULIC DEPTH(FEET) =     1.25
   FLOW AVERAGE VELOCITY(FEET/SEC.) =    13.62
   UNIFORM FROUDE NUMBER =    2.146
   PRESSURE + MOMENTUM(POUNDS) =        12851.76
   AVERAGED VELOCITY HEAD(FEET) =      2.879
   SPECIFIC ENERGY(FEET) =      5.379


                    Press RETURN to continue ===)
```

```
*****************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------
NORMAL DEPTH(FEET) =   2.50
CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005000
MANNINGS FRICTION FACTOR =  .0300
=================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------
))))) NORMAL DEPTH FLOW(CFS) =    125.36
FLOW TOP- WIDTH(FEET) =         25.00
FLOW AREA(SQUARE FEET) =           31.25
HYDRAULIC DEPTH(FEET) =      1.25
FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.01
UNIFORM FROUDE NUMBER =      .632
PRESSURE + MOMENTUM(POUNDS) =          2599.55
AVERAGED VELOCITY HEAD(FEET) =        .250
SPECIFIC ENERGY(FEET) =       2.750
```

EARTH-LINED

Press RETURN to continue ===)

```
*****************************************************************
))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------
NORMAL DEPTH(FEET) =   2.50
CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007500
MANNINGS FRICTION FACTOR =  .0300
=================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------
))))) NORMAL DEPTH FLOW(CFS) =    153.57
FLOW TOP- WIDTH(FEET) =         25.00
FLOW AREA(SQUARE FEET) =           31.25
HYDRAULIC DEPTH(FEET) =      1.25
FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.91
UNIFORM FROUDE NUMBER =      .774
PRESSURE + MOMENTUM(POUNDS) =          3096.02
AVERAGED VELOCITY HEAD(FEET) =        .375
SPECIFIC ENERGY(FEET) =       2.875
```

Press RETURN to continue ===)

```
*************************************************************************
,,,)CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
  MANNINGS FRICTION FACTOR =  .0300
=========================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    177.29
  FLOW TOP- WIDTH(FEET) =        25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =     1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.67
  UNIFORM FROUDE NUMBER =     .894
  PRESSURE + MOMENTUM(POUNDS) =         3574.09
  AVERAGED VELOCITY HEAD(FEET) =       .500
  SPECIFIC ENERGY(FEET) =      3.000


                    Press RETURN to continue ===)
```

```
*************************************************************************
))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =       .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .015000
  MANNINGS FRICTION FACTOR =  .0300
=========================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
  ))))) NORMAL DEPTH FLOW(CFS) =    217.13
  FLOW TOP- WIDTH(FEET) =        25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =     1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.95
  UNIFORM FROUDE NUMBER =    1.095
  PRESSURE + MOMENTUM(POUNDS) =         4548.64
  AVERAGED VELOCITY HEAD(FEET) =       .750
  SPECIFIC ENERGY(FEET) =      3.250


                    Press RETURN to continue ===)
```

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .030000
  MANNINGS FRICTION FACTOR =  .0300
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =    307.07
  FLOW TOP- WIDTH(FEET) =        25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =     1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =     9.83
  UNIFORM FROUDE NUMBER =    1.549
  PRESSURE + MOMENTUM(POUNDS) =         7472.27
  AVERAGED VELOCITY HEAD(FEET) =      1.499
  SPECIFIC ENERGY(FEET) =      3.999


                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
  NORMAL DEPTH(FEET) =   2.50
  CHANNEL Z(HORIZONTAL/VERTICAL) =    5.00
  BASEWIDTH(FEET) =      .00
  CONSTANT CHANNEL SLOPE(FEET/FEET) =  .035000
  MANNINGS FRICTION FACTOR =  .0300
=============================================================================
  NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
  >>>>> NORMAL DEPTH FLOW(CFS) =    331.67
  FLOW TOP- WIDTH(FEET) =        25.00
  FLOW AREA(SQUARE FEET) =          31.25
  HYDRAULIC DEPTH(FEET) =     1.25
  FLOW AVERAGE VELOCITY(FEET/SEC.) =    10.61
  UNIFORM FROUDE NUMBER =    1.673
  PRESSURE + MOMENTUM(POUNDS) =         8446.82
  AVERAGED VELOCITY HEAD(FEET) =      1.749
  SPECIFIC ENERGY(FEET) =      4.249


                    Press RETURN to continue ===>
```

APPENDIX B

PROJECT NAME Sunvalley Parkway Phase II

JOB NO.

Estimated Maximum Ditch Section Discharges

DATE 10/26/88

Table 4

STATION TO STATION	Q^*_{MAX} (c.f.s)
851+00 to 854+03	5
854+03 to 860+93	14
860+93 to 869+72	3
869+72 to 876+36	20
878+70 to 890+00	32
890+00 to 893+83	120
893+83 to 896+76	80
896+76 to 910+10	31
910+10 to 915+00	32
915+00 to 918+67	25
918+67 to 932+95	49
932+95 to 935+60	44
935+60 to 946+78	120
946+78 to 953+10	177
953+10 to 960+72	36
960+72 to 962+96	15
962+96 to 965+67	9
965+67 to 970+25	41
970+25 to 972+52	271
972+52 to 975+95	3
975+95 to 985+62	100
985+62 to 990+00	33
990+00 to 993+85	100
993+85 to 995+64	50
995+64 to 997+14	150

* Q_{MAX} = Estimated Maximum Discharge in Reach From Direct Runoff And Spillover From Adjacent Area.

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .004500
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      36.55
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      3.25
    UNIFORM FROUDE NUMBER =      .661
    PRESSURE + MOMENTUM(POUNDS) =           581.10
    AVERAGED VELOCITY HEAD(FEET) =         .164
    SPECIFIC ENERGY(FEET) =       1.664


                                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .005500
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      40.41
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      3.59
    UNIFORM FROUDE NUMBER =      .731
    PRESSURE + MOMENTUM(POUNDS) =           632.23
    AVERAGED VELOCITY HEAD(FEET) =         .200
    SPECIFIC ENERGY(FEET) =       1.700


                                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .007500
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      43.10
```

```
FLOW AREA(SQUARE FEET) =          11.25
HYDRAULIC DEPTH(FEET) =       .75
FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.19
UNIFORM FROUDE NUMBER =      .853
PRESSURE + MOMENTUM(POUNDS) =           734.49
AVERAGED VELOCITY HEAD(FEET) =        .273
SPECIFIC ENERGY(FEET) =      1.773


                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    1.50
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .008700
MANNINGS FRICTION FACTOR =   .0250
=============================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =      50.82
FLOW TOP- WIDTH(FEET) =         15.00
FLOW AREA(SQUARE FEET) =           11.25
HYDRAULIC DEPTH(FEET) =       .75
FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.52
UNIFORM FROUDE NUMBER =      .919
PRESSURE + MOMENTUM(POUNDS) =           795.85
AVERAGED VELOCITY HEAD(FEET) =        .317
SPECIFIC ENERGY(FEET) =      1.817


                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    1.50
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .009300
MANNINGS FRICTION FACTOR =   .0250
=============================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =      52.54
FLOW TOP- WIDTH(FEET) =         15.00
FLOW AREA(SQUARE FEET) =           11.25
HYDRAULIC DEPTH(FEET) =       .75
FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.67
UNIFORM FROUDE NUMBER =      .950
PRESSURE + MOMENTUM(POUNDS) =           826.53
AVERAGED VELOCITY HEAD(FEET) =        .339
SPECIFIC ENERGY(FEET) =      1.839


                    Press RETURN to continue ===>
```

```
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010000
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      54.48
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.84
    UNIFORM FROUDE NUMBER =      .985
    PRESSURE + MOMENTUM(POUNDS) =           862.33
    AVERAGED VELOCITY HEAD(FEET) =        .364
    SPECIFIC ENERGY(FEET) =       1.864


                                  Press RETURN to continue ===>

*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010900
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      56.88
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.06
    UNIFORM FROUDE NUMBER =     1.029
    PRESSURE + MOMENTUM(POUNDS) =           908.34
    AVERAGED VELOCITY HEAD(FEET) =        .397
    SPECIFIC ENERGY(FEET) =       1.897


                                  Press RETURN to continue ===>

*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .012300
    MANNINGS FRICTION FACTOR =  .0250
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      60.42
    FLOW TOP- WIDTH(FEET) =          15.00
```

```
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.37
    UNIFORM FROUDE NUMBER =     1.093
    PRESSURE + MOMENTUM(POUNDS) =           979.93
    AVERAGED VELOCITY HEAD(FEET) =        .448
    SPECIFIC ENERGY(FEET) =       1.948


                                    Press RETURN to continue ===>

 ***********************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .013500
    MANNINGS FRICTION FACTOR =   .0250
=======================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      63.30
    FLOW TOP- WIDTH(FEET) =         15.00
    FLOW AREA(SQUARE FEET) =           11.25
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.63
    UNIFORM FROUDE NUMBER =     1.145
    PRESSURE + MOMENTUM(POUNDS) =           1041.29
    AVERAGED VELOCITY HEAD(FEET) =        .492
    SPECIFIC ENERGY(FEET) =       1.992


                                    Press RETURN to continue ===>

 ***********************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .015800
    MANNINGS FRICTION FACTOR =   .0250
=======================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      68.48
    FLOW TOP- WIDTH(FEET) =         15.00
    FLOW AREA(SQUARE FEET) =           11.25
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.09
    UNIFORM FROUDE NUMBER =     1.239
    PRESSURE + MOMENTUM(POUNDS) =           1158.89
    AVERAGED VELOCITY HEAD(FEET) =        .575
    SPECIFIC ENERGY(FEET) =       2.075


                                    Press RETURN to continue ===>

 ***********************************************************************
```

```
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .016700
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      70.41
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.26
    UNIFORM FROUDE NUMBER =     1.274
    PRESSURE + MOMENTUM(POUNDS) =           1204.91
    AVERAGED VELOCITY HEAD(FEET) =         .608
    SPECIFIC ENERGY(FEET) =       2.108


                                  Press RETURN to continue ===>


**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .018300
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      73.70
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.55
    UNIFORM FROUDE NUMBER =     1.333
    PRESSURE + MOMENTUM(POUNDS) =           1286.73
    AVERAGED VELOCITY HEAD(FEET) =         .666
    SPECIFIC ENERGY(FEET) =       2.166


                                  Press RETURN to continue ===>


**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .019200
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      75.49
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
```

```
    PRESSURE + MOMENTUM(POUNDS) =          1332.74
    AVERAGED VELOCITY HEAD(FEET) =         .699
    SPECIFIC ENERGY(FEET) =       2.199


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .020000
    MANNINGS FRICTION FACTOR =  .0250
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      77.05
    FLOW TOP- WIDTH(FEET) =         15.00
    FLOW AREA(SQUARE FEET) =           11.25
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.85
    UNIFORM FROUDE NUMBER =    1.394
    PRESSURE + MOMENTUM(POUNDS) =          1373.65
    AVERAGED VELOCITY HEAD(FEET) =         .728
    SPECIFIC ENERGY(FEET) =       2.228


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .021500
    MANNINGS FRICTION FACTOR =  .0250
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      79.89
    FLOW TOP- WIDTH(FEET) =         15.00
    FLOW AREA(SQUARE FEET) =           11.25
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.10
    UNIFORM FROUDE NUMBER =    1.445
    PRESSURE + MOMENTUM(POUNDS) =          1450.35
    AVERAGED VELOCITY HEAD(FEET) =         .783
    SPECIFIC ENERGY(FEET) =       2.283


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
```

```
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .022000
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      80.81
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.18
    UNIFORM FROUDE NUMBER =     1.462
    PRESSURE + MOMENTUM(POUNDS) =           1475.92
    AVERAGED VELOCITY HEAD(FEET) =         .801
    SPECIFIC ENERGY(FEET) =       2.301


                                   Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .023000
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      82.63
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.34
    UNIFORM FROUDE NUMBER =     1.495
    PRESSURE + MOMENTUM(POUNDS) =           1527.05
    AVERAGED VELOCITY HEAD(FEET) =         .838
    SPECIFIC ENERGY(FEET) =       2.338


                                   Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .030000
    MANNINGS FRICTION FACTOR =   .0250
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      94.37
    FLOW TOP- WIDTH(FEET) =          15.00
    FLOW AREA(SQUARE FEET) =            11.25
    HYDRAULIC DEPTH(FEET) =        .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.39
    UNIFORM FROUDE NUMBER =     1.707
```

```
    SPECIFIC ENERGY(FEET) =        2.595

                                    Press RETURN to continue ===>

 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .035200
    MANNINGS FRICTION FACTOR =  .0250
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     102.22
    FLOW TOP- WIDTH(FEET) =         15.00
    FLOW AREA(SQUARE FEET) =           11.25
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      9.09
    UNIFORM FROUDE NUMBER =    1.849
    PRESSURE + MOMENTUM(POUNDS) =          2150.87
    AVERAGED VELOCITY HEAD(FEET) =       1.282
    SPECIFIC ENERGY(FEET) =       2.782

                                    Press RETURN to continue ===>
```

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .004500
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      72.88
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =           20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      3.64
    UNIFORM FROUDE NUMBER =      .642
    PRESSURE + MOMENTUM(POUNDS) =          1346.67
    AVERAGED VELOCITY HEAD(FEET) =        .206
    SPECIFIC ENERGY(FEET) =       2.206


                                  Press RETURN to continue ===>

*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .005500
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =      80.57
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =           20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.03
    UNIFORM FROUDE NUMBER =      .710
    PRESSURE + MOMENTUM(POUNDS) =          1461.04
    AVERAGED VELOCITY HEAD(FEET) =        .252
    SPECIFIC ENERGY(FEET) =       2.252


                                  Press RETURN to continue ===>

*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .007500
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
```

```
FLOW AREA(SQUARE FEET) =          20.00
HYDRAULIC DEPTH(FEET) =      1.00
FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.70
UNIFORM FROUDE NUMBER =      .829
PRESSURE + MOMENTUM(POUNDS) =          1689.78
AVERAGED VELOCITY HEAD(FEET) =        .344
SPECIFIC ENERGY(FEET) =      2.344


                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    2.00
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .008700
MANNINGS FRICTION FACTOR =   .0270
=============================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =     101.34
FLOW TOP- WIDTH(FEET) =         20.00
FLOW AREA(SQUARE FEET) =          20.00
HYDRAULIC DEPTH(FEET) =      1.00
FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.07
UNIFORM FROUDE NUMBER =      .893
PRESSURE + MOMENTUM(POUNDS) =          1827.02
AVERAGED VELOCITY HEAD(FEET) =        .399
SPECIFIC ENERGY(FEET) =      2.399


                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    2.00
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =       .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .009300
MANNINGS FRICTION FACTOR =   .0270
=============================================================================
NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =     104.77
FLOW TOP- WIDTH(FEET) =         20.00
FLOW AREA(SQUARE FEET) =          20.00
HYDRAULIC DEPTH(FEET) =      1.00
FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.24
UNIFORM FROUDE NUMBER =      .923
PRESSURE + MOMENTUM(POUNDS) =          1895.64
AVERAGED VELOCITY HEAD(FEET) =        .426
```

```
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010000
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     108.64
    FLOW TOP- WIDTH(FEET) =          20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.43
    UNIFORM FROUDE NUMBER =      .957
    PRESSURE + MOMENTUM(POUNDS) =          1975.70
    AVERAGED VELOCITY HEAD(FEET) =        .458
    SPECIFIC ENERGY(FEET) =       2.458


                                    Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010900
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     113.43
    FLOW TOP- WIDTH(FEET) =          20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.67
    UNIFORM FROUD


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .012500
    MANNINGS FRICTION FACTOR =   .0270
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     120.49
    FLOW TOP- WIDTH(FEET) =          20.00
```

```
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.02
    UNIFORM FROUDE NUMBER =     1.062
    PRESSURE + MOMENTUM(POUNDS) =          2238.75
    AVERAGED VELOCITY HEAD(FEET) =        .564
    SPECIFIC ENERGY(FEET) =       2.564


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .013500
    MANNINGS FRICTION FACTOR =   .0270
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     126.23
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.31
    UNIFORM FROUDE NUMBER =     1.112
    PRESSURE + MOMENTUM(POUNDS) =          2376.00
    AVERAGED VELOCITY HEAD(FEET) =        .619
    SPECIFIC ENERGY(FEET) =       2.619


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .016700
    MANNINGS FRICTION FACTOR =   .0270
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     140.40
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.02
    UNIFORM FROUDE NUMBER =     1.237
    PRESSURE + MOMENTUM(POUNDS) =          2741.98
    AVERAGED VELOCITY HEAD(FEET) =        .765
    SPECIFIC ENERGY(FEET) =       2.765


                                    Press RETURN to continue ===>


 ***********************************************************************************
```

```
NORMAL DEPTH(FEET) =    2.00
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =        .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .015800
MANNINGS FRICTION FACTOR =   .0270
==========================================================================
NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =     136.56
FLOW TOP- WI
```

```
**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    2.00
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =        .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .015800
MANNINGS FRICTION FACTOR =   .0270
==========================================================================
NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =     136.56
FLOW TOP- WIDTH(FEET) =          20.00
FLOW AREA(SQUARE FEET) =            20.00
HYDRAULIC DEPTH(FEET) =      1.00
FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.83
UNIFORM FROUDE NUMBER =     1.203
PRESSURE + MOMENTUM(POUNDS) =          2639.05
AVERAGED VELOCITY HEAD(FEET) =         .724
SPECIFIC ENERGY(FEET) =       2.724


                                   Press RETURN to continue ===>


**************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
NORMAL DEPTH(FEET) =    2.00
CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
BASEWIDTH(FEET) =        .00
CONSTANT CHANNEL SLOPE(FEET/FEET) =   .018300
MANNINGS FRICTION FACTOR =   .0270
==========================================================================
NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
>>>>> NORMAL DEPTH FLOW(CFS) =     146.97
FLOW TOP- WIDTH(FEET) =          20.00
FLOW AREA(SQUARE FEET) =            20.00
HYDRAULIC DEPTH(FEET) =      1.00
```

```
    PRESSURE + MOMENTUM(POUNDS) =          2924.98
    AVERAGED VELOCITY HEAD(FEET) =         .839
    SPECIFIC ENERGY(FEET) =       2.839


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .019200
    MANNINGS FRICTION FACTOR =  .0270
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     150.54
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =           20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.53
    UNIFORM FROUDE NUMBER =    1.326
    PRESSURE + MOMENTUM(POUNDS) =          3027.91
    AVERAGED VELOCITY HEAD(FEET) =         .880
    SPECIFIC ENERGY(FEET) =       2.880


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .020000
    MANNINGS FRICTION FACTOR =  .0270
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     153.65
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =           20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.68
    UNIFORM FROUDE NUMBER =    1.354
    PRESSURE + MOMENTUM(POUNDS) =          3119.40
    AVERAGED VELOCITY HEAD(FEET) =         .916
    SPECIFIC ENERGY(FEET) =       2.916


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
```

```
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .021500
    MANNINGS FRICTION FACTOR =   .0270
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     159.30
    FLOW TOP- WIDTH(FEET) =          20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.97
    UNIFORM FROUDE NUMBER =     1.404
    PRESSURE + MOMENTUM(POUNDS) =          3290.96
    AVERAGED VELOCITY HEAD(FEET) =         .985
    SPECIFIC ENERGY(FEET) =       2.985


                                  Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .022000
    MANNINGS FRICTION FACTOR =   .0270
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     161.15
    FLOW TOP- WIDTH(FEET) =          20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.06
    UNIFORM FROUDE NUMBER =     1.420
    PRESSURE + MOMENTUM(POUNDS) =          3348.15
    AVERAGED VELOCITY HEAD(FEET) =        1.008
    SPECIFIC ENERGY(FEET) =       3.008


                                  Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .023000
    MANNINGS FRICTION FACTOR =   .0270
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     164.77
    FLOW TOP- WIDTH(FEET) =          20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.24
    UNIFORM FROUDE NUMBER =     1.452
```

```
    SPECIFIC ENERGY(FEET) =       3.054


                                    Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .030000
    MANNINGS FRICTION FACTOR =  .0270
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     188.18
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      9.41
    UNIFORM FROUDE NUMBER =     1.658
    PRESSURE + MOMENTUM(POUNDS) =          4263.11
    AVERAGED VELOCITY HEAD(FEET) =       1.375
    SPECIFIC ENERGY(FEET) =       3.375


                                    Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .035200
    MANNINGS FRICTION FACTOR =  .0270
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     203.83
    FLOW TOP- WIDTH(FEET) =         20.00
    FLOW AREA(SQUARE FEET) =            20.00
    HYDRAULIC DEPTH(FEET) =      1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     10.19
    UNIFORM FROUDE NUMBER =     1.796
    PRESSURE + MOMENTUM(POUNDS) =          4857.83
    AVERAGED VELOCITY HEAD(FEET) =       1.613
    SPECIFIC ENERGY(FEET) =       3.613


                                    Press RETURN to continue ===>
```

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .004500
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     127.42
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.08
    UNIFORM FROUDE NUMBER =      .643
    PRESSURE + MOMENTUM(POUNDS) =          2631.86
    AVERAGED VELOCITY HEAD(FEET) =        .258
    SPECIFIC ENERGY(FEET) =       2.758


                                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .005500
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     140.87
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.51
    UNIFORM FROUDE NUMBER =      .711
    PRESSURE + MOMENTUM(POUNDS) =          2855.61
    AVERAGED VELOCITY HEAD(FEET) =        .316
    SPECIFIC ENERGY(FEET) =       2.816


                                    Press RETURN to continue ===>


*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .007500
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
```

```
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.26
    UNIFORM FROUDE NUMBER =      .830
    PRESSURE + MOMENTUM(POUNDS) =          3303.11
    AVERAGED VELOCITY HEAD(FEET) =        .430
    SPECIFIC ENERGY(FEET) =       2.930


                                  Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .008700
    MANNINGS FRICTION FACTOR =  .0280
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     177.17
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.67
    UNIFORM FROUDE NUMBER =      .894
    PRESSURE + MOMENTUM(POUNDS) =          3571.60
    AVERAGED VELOCITY HEAD(FEET) =        .499
    SPECIFIC ENERGY(FEET) =       2.999


                                  Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .009300
    MANNINGS FRICTION FACTOR =  .0280
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     183.18
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      5.86
    UNIFORM FROUDE NUMBER =      .924
    PRESSURE + MOMENTUM(POUNDS) =          3705.85
    AVERAGED VELOCITY HEAD(FEET) =        .534
    SPECIFIC ENERGY(FEET) =       3.034


                                  Press RETURN to continue ===>
```

```
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010000
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     189.95
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.08
    UNIFORM FROUDE NUMBER =      .958
    PRESSURE + MOMENTUM(POUNDS) =          3862.48
    AVERAGED VELOCITY HEAD(FEET) =        .574
    SPECIFIC ENERGY(FEET) =       3.074


                                    Press RETURN to continue ===>

 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .010900
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     198.31
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      6.35
    UNIFORM FROUDE NUMBER =     1.000
    PRESSURE + MOMENTUM(POUNDS) =          4063.85
    AVERAGED VELOCITY HEAD(FEET) =        .625
    SPECIFIC ENERGY(FEET) =       3.125


                                    Press RETURN to continue ===>

 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .012300
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     210.67
    FLOW TOP- WIDTH(FEET) =          25.00
```

```
    UNIFORM FROUDE NUMBER =     1.063
    PRESSURE + MOMENTUM(POUNDS) =          4377.10
    AVERAGED VELOCITY HEAD(FEET) =        .706
    SPECIFIC ENERGY(FEET) =       3.206


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .013500
    MANNINGS FRICTION FACTOR =   .0280
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     220.70
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.06
    UNIFORM FROUDE NUMBER =     1.113
    PRESSURE + MOMENTUM(POUNDS) =          4645.59
    AVERAGED VELOCITY HEAD(FEET) =        .775
    SPECIFIC ENERGY(FEET) =       3.275


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .015800
    MANNINGS FRICTION FACTOR =   .0280
===================================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     238.76
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.64
    UNIFORM FROUDE NUMBER =     1.204
    PRESSURE + MOMENTUM(POUNDS) =          5160.21
    AVERAGED VELOCITY HEAD(FEET) =        .906
    SPECIFIC ENERGY(FEET) =       3.406


                                    Press RETURN to continue ===>


 ***********************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
```

```
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .016700
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     245.47
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      7.86
    UNIFORM FROUDE NUMBER =     1.238
    PRESSURE + MOMENTUM(POUNDS) =           5361.59
    AVERAGED VELOCITY HEAD(FEET) =         .958
    SPECIFIC ENERGY(FEET) =       3.458


                                    Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .018300
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     256.96
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.22
    UNIFORM FROUDE NUMBER =     1.296
    PRESSURE + MOMENTUM(POUNDS) =           5719.58
    AVERAGED VELOCITY HEAD(FEET) =        1.050
    SPECIFIC ENERGY(FEET) =       3.550


                                    Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .019200
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     263.20
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.42
```

```
    PRESSURE + MOMENTUM(POUNDS) =
    AVERAGED VELOCITY HEAD(FEET) =       1.102
    SPECIFIC ENERGY(FEET) =       3.602


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .020000
    MANNINGS FRICTION FACTOR =  .0280
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     268.63
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.60
    UNIFORM FROUDE NUMBER =     1.355
    PRESSURE + MOMENTUM(POUNDS) =          6099.95
    AVERAGED VELOCITY HEAD(FEET) =       1.147
    SPECIFIC ENERGY(FEET) =       3.647


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .021500
    MANNINGS FRICTION FACTOR =  .0280
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     278.52
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =           31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.91
    UNIFORM FROUDE NUMBER =     1.405
    PRESSURE + MOMENTUM(POUNDS) =          6435.58
    AVERAGED VELOCITY HEAD(FEET) =       1.233
    SPECIFIC ENERGY(FEET) =       3.733


                                   Press RETURN to continue ===>


 ****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
```

```
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .021500
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     278.52
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      8.91
    UNIFORM FROUDE NUMBER =     1.405
    PRESSURE + MOMENTUM(POUNDS) =          6435.58
    AVERAGED VELOCITY HEAD(FEET) =       1.233
    SPECIFIC ENERGY(FEET) =       3.733


                                    Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .023000
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     288.07
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      9.22
    UNIFORM FROUDE NUMBER =     1.453
    PRESSURE + MOMENTUM(POUNDS) =          6771.20
    AVERAGED VELOCITY HEAD(FEET) =       1.320
    SPECIFIC ENERGY(FEET) =       3.820


                                    Press RETURN to continue ===>


 ************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =   .030000
    MANNINGS FRICTION FACTOR =   .0280
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     329.00
    FLOW TOP- WIDTH(FEET) =          25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     10.53
    UNIFORM FROUDE NUMBER =     1.659
    PRESSURE + MOMENTUM(POUNDS) =          8337.43
```

Press RETURN to continue ===>

```
*****************************************************************************
>>>>CHANNEL INPUT INFORMATION<<<<
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =     5.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .035200
    MANNINGS FRICTION FACTOR =  .0280
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH FLOW(CFS) =     356.38
    FLOW TOP- WIDTH(FEET) =         25.00
    FLOW AREA(SQUARE FEET) =            31.25
    HYDRAULIC DEPTH(FEET) =      1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     11.40
    UNIFORM FROUDE NUMBER =     1.798
    PRESSURE + MOMENTUM(POUNDS) =          9500.92
    AVERAGED VELOCITY HEAD(FEET) =       2.019
    SPECIFIC ENERGY(FEET) =       4.519
```

Press RETURN to continue ===>

APPENDIX C

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL T.I.S. @ 876+36

DISCHARGE IS = 430 CFS
BOTTOM WIDTH IS = 45 FT
SLOPE IS = .0179 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .03
TOP WIDTH IS = 51.16 FT
AREA IS = 59.22 SQ FT
WETTED PERIMETER IS = 51.63 FT
HYDRAULIC RADIUS IS = 1.15 FT
NORMAL DEPTH IS = 1.23 FT
VELOCITY IS = 7.26 FPS
FROUDE NUMBER IS = 1.19

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 878+70

DISCHARGE IS = 32 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .053 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 13 FT
AREA IS = 4.31 SQ FT
WETTED PERIMETER IS = 13.09 FT
HYDRAULIC RADIUS IS = .33 FT
NORMAL DEPTH IS = .38 FT
VELOCITY IS = 7.42 FPS
FROUDE NUMBER IS = 2.27

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL T.I.S. @ 890+56

DISCHARGE IS = 1215 CFS
BOTTOM WIDTH IS = 60 FT
SLOPE IS = .009 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .03
TOP WIDTH IS = 71.81 FT
AREA IS = 155.67 SQ FT
WETTED PERIMETER IS = 72.72 FT
HYDRAULIC RADIUS IS = 2.14 FT
NORMAL DEPTH IS = 2.36 FT
VELOCITY IS = 7.8 FPS
FROUDE NUMBER IS = .93

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 933+45

DISCHARGE IS = 44 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0997 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 13.01 FT
AREA IS = 4.32 SQ FT
WETTED PERIMETER IS = 13.1 FT
HYDRAULIC RADIUS IS = .33 FT
NORMAL DEPTH IS = .38 FT
VELOCITY IS = 10.18 FPS
FROUDE NUMBER IS = 3.11

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL N.S.S. @ 937+55

DISCHARGE IS = 120 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .031 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 17.37 FT
AREA IS = 12.6 SQ FT
WETTED PERIMETER IS = 17.59 FT
HYDRAULIC RADIUS IS = .72 FT
NORMAL DEPTH IS = .92 FT
VELOCITY IS = 9.520001 FPS
FROUDE NUMBER IS = 1.97

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL T.I.S. @ 946+28

DISCHARGE IS = 177 CFS
BOTTOM WIDTH IS = 50 FT
SLOPE IS = .0417 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .03
TOP WIDTH IS = 52.65 FT
AREA IS = 27.23 SQ FT
WETTED PERIMETER IS = 52.86 FT
HYDRAULIC RADIUS IS = .52 FT
NORMAL DEPTH IS = .53 FT
VELOCITY IS = 6.5 FPS
FROUDE NUMBER IS = 1.59

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL N.S.S. @ 953+60

DISCHARGE IS = 36 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0716 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 12.94 FT
AREA IS = 4.22 SQ FT
WETTED PERIMETER IS = 13.04 FT
HYDRAULIC RADIUS IS = .32 FT
NORMAL DEPTH IS = .37 FT
VELOCITY IS = 8.520001 FPS
FROUDE NUMBER IS = 2.63

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL N.S.S. @ 960+22

DISCHARGE IS = 15 CFS
BOTTOM WIDTH IS = 25 FT
SLOPE IS = .1028 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 25.93 FT
AREA IS = 2.95 SQ FT
WETTED PERIMETER IS = 25.96 FT
HYDRAULIC RADIUS IS = .11 FT
NORMAL DEPTH IS = .12 FT
VELOCITY IS = 5.08 FPS
FROUDE NUMBER IS = 2.65

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 963=46

DISCHARGE IS = 9 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0933 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 11.21 FT
AREA IS = 1.6 SQ FT
WETTED PERIMETER IS = 11.24 FT
HYDRAULIC RADIUS IS = .14 FT
NORMAL DEPTH IS = .15 FT
VELOCITY IS = 5.62 FPS
FROUDE NUMBER IS = 2.62

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL N.S.S. @ 966+65

DISCHARGE IS = 41 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0694 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 13.2 FT
AREA IS = 4.65 SQ FT
WETTED PERIMETER IS = 13.3 FT
HYDRAULIC RADIUS IS = .35 FT
NORMAL DEPTH IS = .4 FT
VELOCITY IS = 8.82 FPS
FROUDE NUMBER IS = 2.62

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL T.I.S. @ 970+25

DISCHARGE IS = 271 CFS
BOTTOM WIDTH IS = 30 FT
SLOPE IS = .0791 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .03
TOP WIDTH IS = 33.82 FT
AREA IS = 24.35 SQ FT
WETTED PERIMETER IS = 34.11 FT
HYDRAULIC RADIUS IS = .71 FT
NORMAL DEPTH IS = .76 FT
VELOCITY IS = 11.13 FPS
FROUDE NUMBER IS = 2.31

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL N.S.S. @ 976+62

DISCHARGE IS = 100 CFS
BOTTOM WIDTH IS = 20 FT
SLOPE IS = .0567 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 23.89 FT
AREA IS = 10.67 SQ FT
WETTED PERIMETER IS = 24.01 FT
HYDRAULIC RADIUS IS = .44 FT
NORMAL DEPTH IS = .49 FT
VELOCITY IS = 9.37 FPS
FROUDE NUMBER IS = 2.47

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL N.S.S. @ 986+12

DISCHARGE IS = 38 CFS
BOTTOM WIDTH IS = 40 FT
SLOPE IS = .0759 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 41.34 FT
AREA IS = 6.8 SQ FT
WETTED PERIMETER IS = 41.38 FT
HYDRAULIC RADIUS IS = .16 FT
NORMAL DEPTH IS = .17 FT
VELOCITY IS = 5.58 FPS
FROUDE NUMBER IS = 2.43

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL T.I.S. @ 991+32

DISCHARGE IS = 600 CFS
BOTTOM WIDTH IS = 135 FT
SLOPE IS = .056 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .015
TOP WIDTH IS = 136.84 FT
AREA IS = 50.07 SQ FT
WETTED PERIMETER IS = 136.98 FT
HYDRAULIC RADIUS IS = .37 FT
NORMAL DEPTH IS = .37 FT
VELOCITY IS = 11.98 FPS
FROUDE NUMBER IS = 3.49

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL T.I.S. @ 995+62

DISCHARGE IS = 400 CFS
BOTTOM WIDTH IS = .65 FT
SLOPE IS = .057 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .015
TOP WIDTH IS = 67.22 FT
AREA IS = 29.4 SQ FT
WETTED PERIMETER IS = 67.4 FT
HYDRAULIC RADIUS IS = .44 FT
NORMAL DEPTH IS = .44 FT
VELOCITY IS = 13.6 FPS
FROUDE NUMBER IS = 3.63

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL T.I.S. @ 998+35

DISCHARGE IS = 800 CFS
BOTTOM WIDTH IS = 65 FT
SLOPE IS = .036 FT/FT
SIDE SLOPE (Z1) = 2.5
SIDE SLOPE (Z2) = 2.5
MANNING'S N = .015
TOP WIDTH IS = 68.86 FT
AREA IS = 51.68 SQ FT
WETTED PERIMETER IS = 69.16 FT
HYDRAULIC RADIUS IS = .75 FT
NORMAL DEPTH IS = .77 FT
VELOCITY IS = 15.48 FPS
FROUDE NUMBER IS = 3.15

APPENDIX D

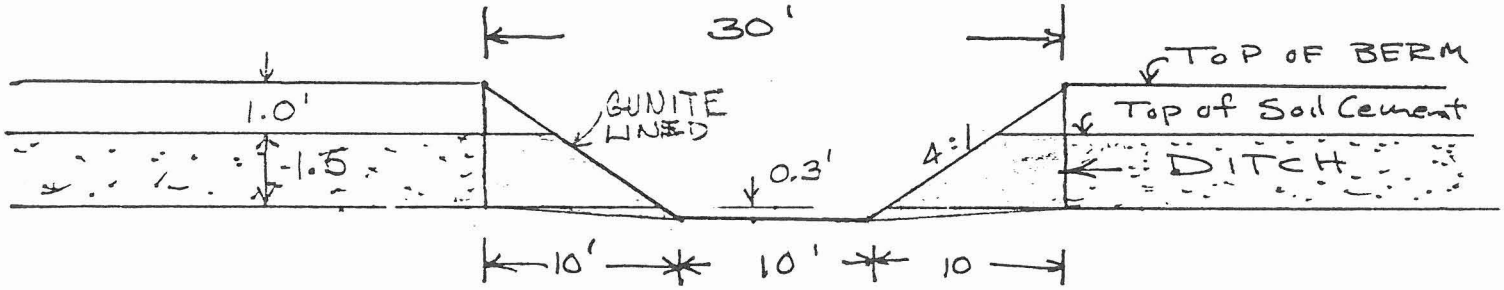
Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N. 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO.

JOB
SHEET NO. OF
CALCULATED BY CJL DATE 10/23/88
CHECKED BY DATE 12:45 AM
SCALE

Spillway Inlet Section (TYPICAL)

Looking North Cross Section thru ℄ of Ditch



Minimum Slope = 2.0 %

$n = 0.022$
for Gunite Lining

CAPACITY = 330 cfs @ D = 1.8'

CAPACITY = 800 cfs @ D = 2.8'

FORM 204-1

CHANNEL S.V. - STANDARD SPILLWAYS (S.S.)

DISCHARGE IS = 330 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .02 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 24.13 FT
AREA IS = 30.14 SQ FT
WETTED PERIMETER IS = 24.57 FT
HYDRAULIC RADIUS IS = 1.23 FT
NORMAL DEPTH IS = 1.77 FT
VELOCITY IS = 10.95 FPS
FROUDE NUMBER IS = 1.73

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL S.V. - STANDARD SPILLWAYS (S.S.)

DISCHARGE IS = 800 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .02 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 31.92 FT
AREA IS = 57.42 SQ FT
WETTED PERIMETER IS = 32.59 FT
HYDRAULIC RADIUS IS = 1.76 FT
NORMAL DEPTH IS = 2.74 FT
VELOCITY IS = 13.93 FPS
FROUDE NUMBER IS = 1.83

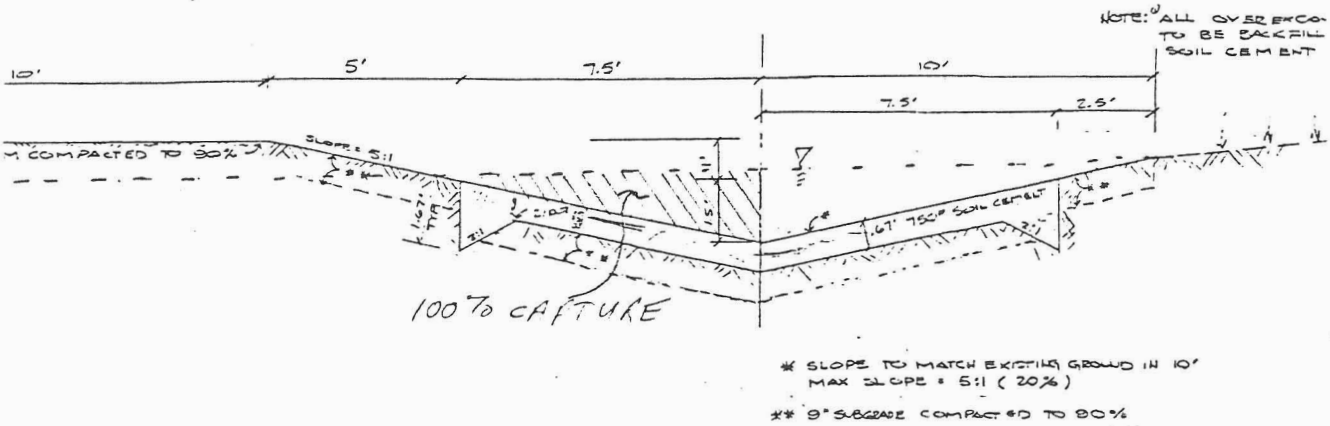
APPENDIX E

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-5433

JOB NO.

JOB SUN VALLEY PARKWAY
SHEET NO. 1 OF 2
CALCULATED BY T.G. DATE 10-24-88
CHECKED BY DATE
SCALE

INTERCEPTION AND CARRYOVER CALCULATIONS OF INTERCEPTOR DITCH SPILLWAYS ON GRADE



* SLOPE TO MATCH EXISTING GROUND IN 10'
MAX SLOPE = 5:1 (20%)

** 8" SUBGRADE COMPACTED TO 90%

TYPICAL DITCH SECTION

ASSUMPTIONS:

1.) CROSS-HATCHED PORTION OF FLOW (SEE ABOVE) HAS 100% CAPTURE EFFICIENCY. (SEE ALSO THE SPILLWAY DETAIL). $= \frac{Q_{TOTAL}}{2}$

2.) CAPTURE RATE OF REMAINDER OF FLOW IN DITCH IS IDENTICAL TO THAT OF A CURB OPENING INLET ON GRADE WITH A VERTICAL CURB.

3.) ACTUAL SIDE SLOPES WILL VARY ON ALTERNATE SIDE. USE 12:1 FOR CARRYOVER CALCULATIONS.

FORM 204-1

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-5433

JOB NO.

JOB: SUN VALLEY
SHEET NO. 2 OF 2
CALCULATED BY: T.B. DATE: 10-24-88
CHECKED BY: DATE:
SCALE:

REFERENCE:
HEC-12
DRAINAGE O
HIGHWAY
PAVEMENT
— FED. HWY. A
EQ. (13), p. 5
EQ. (14), p. 60

LENGTH OF OPENING REQUIRED: $L_T = K Q_T^{.42} S^{0.3} \left(\frac{1}{n\, S_x}\right)^{0.6}$ $\left(\begin{matrix} K = 0.6 \\ n = .035 \end{matrix}\right)$

EFFICIENCY OF SPILLWAY: $E = 1 - (1 - L/L_T)^{1.8}$

CARRY-OVER: $Q_c = Q_T - (Q_T)(E) = Q_T(1-E)$

REMINDER: Q_T = ½ of ACTUAL TOTAL DISHARGE IN DITCH; SEE ASSUMPTION #1.

Q_c = TOTAL CARRY-OVER.

SPILLWAY CARRY-OVER TABLE

STATION	Q_{TOTAL} (cfs)	Q_T (cfs)	S (ft/ft)	Sx (ft/ft)	L_T (ft.)	L (ft.)	E	Q_c (cfs)	
~~[illegible]~~	~~[illegible]~~	~~25~~	~~[illegible]~~	~~[illegible]~~	~~22.7~~	~~10~~	~~.55~~	~~9~~	*
~~[illegible]~~	~~[illegible]~~	~~21~~	~~[illegible]~~	~~[illegible]~~	~~22.3~~	~~10~~	~~.55~~	~~7~~	*
896+78	38	19	.0107	.083	21.7	10	.67	6	
~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~26.5~~	~~10~~	~~.57~~	~~12~~	REMOVE

* NO LONGER "ON-GRADE" INLETS

FORM 204-1

APPENDIX F

WAGNER WASH OUTLET

RESPONSE TO QUESTIONS (See following page)

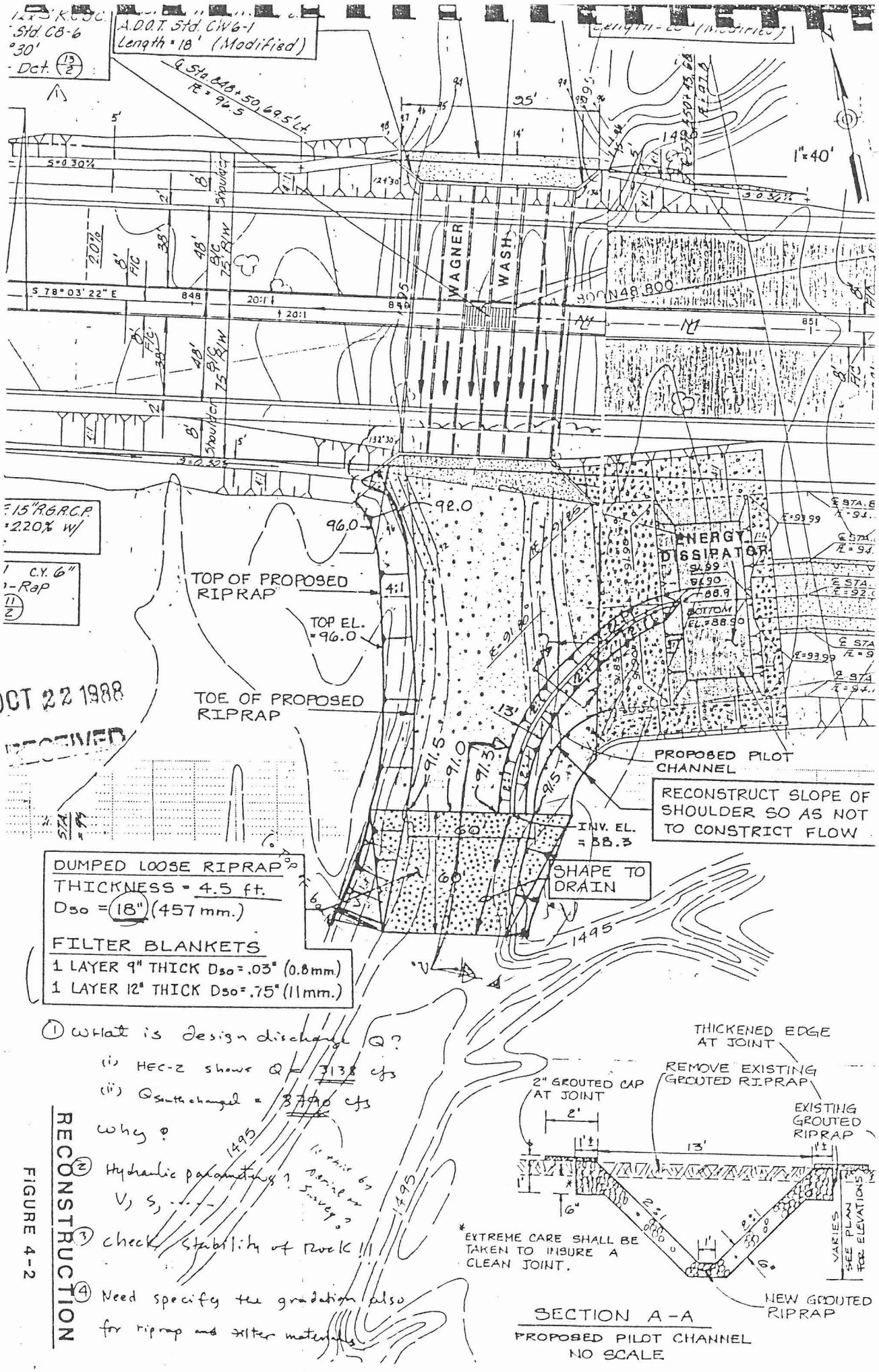
1. Design Q for riprap calcs is 5110 cfs for as per HEC -1 run on 100 year Wagner Wash post development condition. The HEC-2 Q or 3138 cfs is for 100 year pre-development conditions in Wagner Wash, and the Q of 3790 cfs is for the 100 year flow in the South channel.

2. The hydraulic parameters for riprap design have been included with this report.

3. The size of the riprap required to insure stability was calculated using two methods. The first method was based on tractive force calculations and resulted in a D_{50} of 5 inches. The second method was based on the HEC-14 recommendations for energy dissipators. Based on our velocity of 15 ft/sec, the stone size was 1.5 ft. We decided to use the conservative value.

4. Gradations calculations for the riprap and filter blankets have been included with this correspondence and the gradations have been added to the plans.

(4)



① What is design discharge Q?

(i) HEC-2 shows Q = 3138 cfs

(ii) Q southchannel = 3790 cfs

Why?

② Hydraulic parameters? V, S, ...

③ Check stability of Rock !!!

④ Need specify the gradation also for riprap and filter materials

RECONSTRUCTION

FIGURE 4-2

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N. 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO.

JOB Sun Valley
SHEET NO. 1 OF
CALCULATED BY J.L. DATE 10-7-88
CHECKED BY DATE
SCALE

Rip-Rap design for Wagner Wash Channel bottom

Tractive Force Calcs

Q = 5110 cfs
Width (B) of floodway = 90 ft.
Depth of flow (y) = 5 ft.
Slope (S) = .0053 1/ft
Side Slope (SS) = varies (.25 and vertical)
Velocity (V) = 15.1 fps

Maximum Tractive Force: From Chow fig. 7-7
For bottom of channel with $B/y = 90/5 = 18$
Unit Tractive Force (U.T.F.) = 1.0

τ_{max} bottom $= U.T.F.\ \gamma y S = 1(62.4)5(.0053) = 1.65$ lb/ft^2

Rip-Rap Calcs

τ_{perm} bottom $= 0.04(\gamma_s - \gamma) D_{50}$ (Eqn. 33) - EM 1110-2-1601

$= 0.04(165 - 62.4) D_{50} = 4.1\ D_{50}$ (Assume density of riprap material is 165 lb/ft

Let τ_{max} bottom $= \tau_{perm}$ bottom

$$D_{50} = \frac{1.65 \text{ lb/ft}^2}{4.1 \text{ lb/ft}^3} = .40 \text{ ft.} \approx 5 \text{ inches}$$

$$W_{50} = \frac{D_{50}^3 \pi \gamma_s}{6} = \frac{(.40)^3 \pi 165}{6} = 5.5 \text{ lb stone}$$

FORM 204-1

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N. 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO.

JOB: Sun Valley
SHEET NO. 2 OF
CALCULATED BY: [illegible] DATE: 10-10-88
CHECKED BY: DATE:
SCALE:

Flow velocity = 15 ft/s

Stone size = 1.5 ft. From "Hydraulic Design of Energy Dissipators for Culverts and Channels", HEC-14, Sept. 1983 Fig. II-C-1

Rip-Rap gradation: from Fig. 6.4.3 FHA Highways and River Environments

D_{15} = 8" (203mm), D_{50} = 18" (457mm), D_{85} = 32" (813mm), D_{100} = 36" (914

Rip-Rap thickness: 1.5 times D_{100} = 54" = 4.5 ft.
From "Sizing Riprap for the Protection of Approach Embankments and Spur Dikes and Limiting the Depth of Scour at Bridge Piers and Abutments" Volume 2. ADOT

Particle size distribution of wash bed: Gravelly, sandy loam

$D_{15} \cong .06$ mm, $D_{50} \cong .5$ mm, $D_{85} \cong 5.0$ mm

Gradation Requirements of filter blankets

1) $\frac{D_{50}\ (\text{Filter})}{D_{50}\ (\text{Base})} < 40$

2) $5 < \frac{D_{15}\ (\text{Filter})}{D_{15}\ (\text{Base})} < 40$

3) $\frac{D_{15}\ (\text{Filter})}{D_{85}\ (\text{Base})} < 5$

FORM 204-1

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N. 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO.

JOB Sun Valley
SHEET NO. 3 OF
CALCULATED BY J.D. DATE 10-26-98
CHECKED BY DATE
SCALE

First filter blanket:

$D_{85} = 4.5''$ (114 mm)
$D_{50} = 2.5''$ (63 mm)
$D_{15} = 1''$ (25 mm)

Second filter blanket

$D_{85} = 1''$ (25 mm)
$D_{50} = 0.5''$ (13 mm)
$D_{15} = 0.2''$ (5 mm)

Check first filter blanket:

1) $\frac{D_{50} \text{ filter}}{D_{50} \text{ base}} = \frac{18}{2.5} = 7.2 < 40$ ok

2) $\frac{D_{15} \text{ filter}}{D_{15} \text{ base}} = \frac{8}{1} = 8$ $(>5 \text{ \& } <40)$ ok

3) $\frac{D_{15} \text{ filter}}{D_{85} \text{ base}} = \frac{8}{4.5} = 1.8 < 5$ ok

Check second filter blanket:

1) $\frac{D_{50} \text{ filter}}{D_{50} \text{ base}} = \frac{2.5}{1} = 2.5 < 40$ ok

2) $\frac{D_{15} \text{ filter}}{D_{15} \text{ base}} = \frac{1}{.2} = 5$ $(=5 \text{ \& } <40)$ ok

3) $\frac{D_{15} \text{ filter}}{D_{85} \text{ base}} = \frac{1}{1} = 1 < 5$ ok

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PHONE: (602) 957-3350

JOB NO.

JOB Sun Valley
SHEET NO. 4 OF
CALCULATED BY J.A. DATE 10-26-88
CHECKED BY DATE
SCALE

Results:

Need a layer of riprap 4.5 ft. thick with the following gradation:

$D_{15} = 8''(203\ mm)$, $D_{50} = 18''(457mm)$, $D_{85} = 32''(813mm)$

Need 2 filter blankets:

First one closest to the bed of the channel should be 1 ft. thick with the following gradation:

$D_{15} = 1''(25\ mm)$, $D_{50} = 2.5''(63mm)$, $D_{85} = 4.5''(114mm)$

Second filter blanket closest to the rip rap should be 1 ft. thick with the following gradation:

$D_{15} = 0.2''(5mm)$, $D_{50} = 0.5''(13mm)$, $D_{85} = 1''(25mm)$

FORM 204-1

FILENAME IS SUNVLY1

WAGNER WASH

CHANNEL SLOPE .0053

MANNINGS 'N' .017

CROSS SECTION ID NUMBER IS 1

1

NUMBER OF CROSS SECTION COORDINATE POINTS IS 7

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	96.00
2	19.00	91.50
3	39.00	91.00
4	62.00	91.30
5	80.00	91.50
6	81.00	95.00
7	90.00	96.00

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	NORMAL VELOCITY FPS	NORMAL FLOW CFS
96.00	339.3	93.2	90.0	3.6	3.8	15.1	5102.9

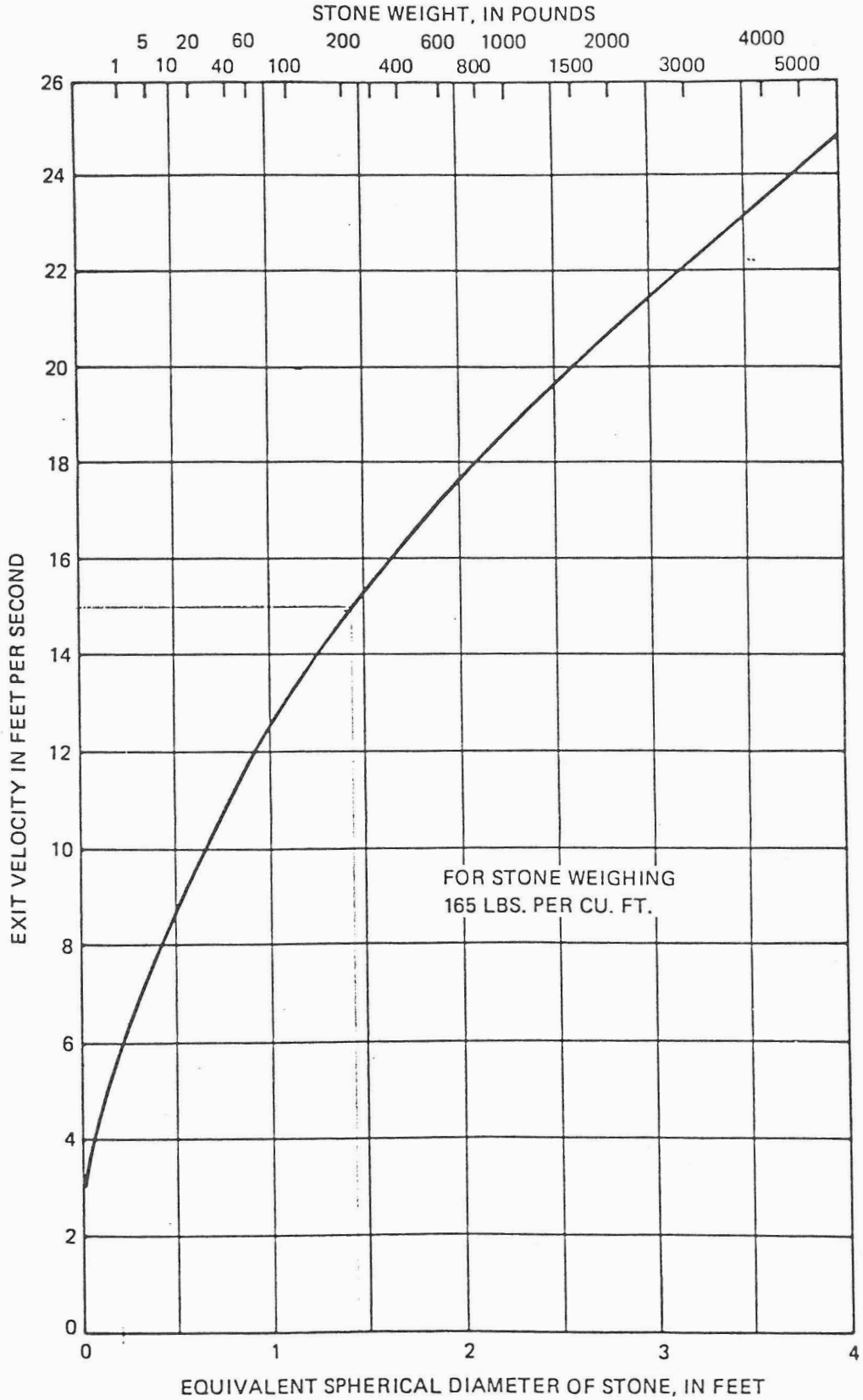

FIGURE II-C-1. RIPRAP SIZE FOR USE DOWNSTREAM OF ENERGY DISSIPATORS FROM REFERENCE II-C-1.

APPENDIX G

PROJECT NAME SON VALLEY FRWY - PHASE I. JOB NO. 850840-6

HYDROLOGY - DETENTION BASINS AND SPILLWAY INLETS DATE 3-87

BASINS

	STA FROM	STA TO	LENGTH	AVER. WIDTH	AVER. MAX. DEP.	ACFT	100-YEAR INFLOW	
	58+00	64+00	600	70	1.5	1.44	1180	
	64+90	67+00	210	65	2.7	0.89	932	
	68+10	71+03	293	77	1.5	0.78	SAME	
	71+26	73+17	191	78	2.2	0.75	"	
	74+18	78+70	452	70	1.8	1.31	242	C.P. 19
	79+30	83+54	424	71	1.4	0.97	29	
	93+62	98+74	514	62	1.2	0.88	221	
	99+38	101+30	194	74	2.7	0.89	41	
	107+07	110+17	310	78	2.4	1.33	573	
	143+08	145+90	282	72	2.6	1.21	480	
	186+05	190+78	473	81	1.8	1.58	SAME	
	191+05	193+25	220	80	2.5	1.01	"	
	193	197					4200	C.P. 4
	198+20	201+18	298	83	3.2	1.82	1361	
	201+50	205+84	434	83	5.0	4.13	1664	323 at Sta 204
	249+06	253+40	434	82	2.0	1.63	228	
	254+69	259+76	507	80	28	2.61	1771	68cfs at Sta 258

PROJECT NAME SUN VALLEY PARKWAY PHASE I

JOB NO. 871236

TRIBUTARY - INLET SUMMARY

DATE 11/16/88

TABLE 6

	Station	Discharge Q100 (cfs)	Inlet Type	Topwidth (FT.)	Bottom Width (FT.)	Slope %	Flow Depth	Velocity ft/sec
	59+00	215	N.S.S.	60	50	7.9	0.4	10.3
	70+84	8	S.S.	30	10	6.8	0.2	4.9
	77+50	10	S.S.	30	10	3.7	0.2	4.4
	82+15	20	S.S.	30	10	3.3	0.3	5.4
	194+50	418	T.I.S.	170±	150	18.5	N/A	N/A (BAFFLE BLOCKS)
	203+92	75	S.S.	30	10	10.0	0.5	12.2

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL N.S.S. @ 59+00

DISCHARGE IS = 215 CFS
BOTTOM WIDTH IS = 50 FT
SLOPE IS = .079 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 53.26 FT
AREA IS = 21.05 SQ FT
WETTED PERIMETER IS = 53.36 FT
HYDRAULIC RADIUS IS = .39 FT
NORMAL DEPTH IS = .41 FT
VELOCITY IS = 10.21 FPS
FROUDE NUMBER IS = 2.86

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 70+84

DISCHARGE IS = 8 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .068 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 11.24 FT
AREA IS = 1.64 SQ FT
WETTED PERIMETER IS = 11.27 FT
HYDRAULIC RADIUS IS = .15 FT
NORMAL DEPTH IS = .15 FT
VELOCITY IS = 4.87 FPS
FROUDE NUMBER IS = 2.25

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 77+50

DISCHARGE IS = 10 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .037 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 11.69 FT
AREA IS = 2.29 SQ FT
WETTED PERIMETER IS = 11.74 FT
HYDRAULIC RADIUS IS = .19 FT
NORMAL DEPTH IS = .21 FT
VELOCITY IS = 4.37 FPS
FROUDE NUMBER IS = 1.74

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 82+15

DISCHARGE IS = 20 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .033 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 12.62 FT
AREA IS = 3.71 SQ FT
WETTED PERIMETER IS = 12.7 FT
HYDRAULIC RADIUS IS = .29 FT
NORMAL DEPTH IS = .33 FT
VELOCITY IS = 5.4 FPS
FROUDE NUMBER IS = 1.76

CRITICAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL T.I.S. @ 194+50 W/ BAFFLE BLOCKS ON SPILLWAY

DISCHARGE = 4198 CFS
BOTTOM WIDTH = 150 FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
TOP WIDTH = 172.59 FT
CRITICAL DEPTH = 2.82 FT
CRITICAL VELOCITY = 9.22 FPS

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL S.S. @ 203+92

DISCHARGE IS = 75 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .1 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .022
TOP WIDTH IS = 14.08 FT
AREA IS = 6.14 SQ FT
WETTED PERIMETER IS = 14.21 FT
HYDRAULIC RADIUS IS = .43 FT
NORMAL DEPTH IS = .51 FT
VELOCITY IS = 12.21 FPS
FROUDE NUMBER IS = 3.26

APPENDIX H

FORM 204-1

TABLE 7 DESIGN OF BAFFLE BLOCK DISSIPATORS* FOR TRIBUTARY INLETS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	H (ft) [1] (ht. of blocks)	L_1 [2] (ft)	L_2 [3] (ft)	L_s [4] (ft)	
[illegible]	[illegible]	65	0.036	1.67	12.3	1.33	1.33	37	75	
[illegible]	[illegible]	65	0.057	1.06	6.2	1.33	1.33	23	65	
[illegible]	[illegible]	130	0.056	0.87	4.6	0.67	1.33	14	65	
[illegible]	[illegible]	30	0.076	1.36	9.0	1.33	1.33	17	95	
[illegible]	177	50	0.042	0.73	3.5	0.67	1.33	32		[illegible]
[illegible]	1215	60	0.0090	2.33	20.3	1.33	1.33	148	70	
[illegible]	430	45	0.018	1.42	9.6	1.33	1.33	74	55	

1 $H \geq 0.8 D_c$

2 $L_1 \leq$ LENGTH OF STANDARD CINDER BLOCK

3 $L_2 \leq$ [illegible] BETWEEN ROWS RECOMMENDED, ACTUAL DISTANCES VARY

4 L_s = LONGITUDINAL LENGTH OF SPILLWAY

[illegible] $\frac{[illegible]}{[illegible]}$ [illegible] $\frac{[illegible]}{1X-193-h.}$ [illegible] PATTERN OF BLOCKS [illegible]

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PHONE: (602) 957-3350

JOB NO.

JOB ____ SHEET NO. ____ OF ____

CALCULATED BY ____ DATE ____

CHECKED BY ____ DATE ____

SCALE ____

Collar, Williams & White Engineering
Consulting Engineers and Land Surveyors
2702 N 44TH ST., SUITE 100A
PHOENIX, ARIZONA 85008
PHONE: (602) 957-3350

JOB NO. 871236-2

JOB: SUN VALLEY PHASE II-P
SHEET NO. 1 OF 1
CALCULATED BY: B. H. DATE: 11/88
CHECKED BY: DATE:
SCALE:

CMU ENERGY DISSIPATOR DESIGN

MAX. FORCE = 962# (FROM HYDROLOGY DEPT. CALCS)
FOR 16" HIGH DISSIPATOR APPLY LOAD @ MID-POINT (CONSERVATIVE)

$M = Fa = (962^{\#})(8'')$
$M \cong 7700''-\# = 641'-\#$

ASSUME "d" = 4" & BLOCK IS FULLY GROUTED (NO SPECIAL INSP.)

CHECK SHEAR

$b = 16''$ $j \cong 0.9$
$d = 4''$

$f_v = \frac{V}{bjd} = \frac{962^{\#}}{16(.9)(4)} = 16.7 \text{ psi} < 25 \text{ psi}$ ∴ OK FOR SHEAR

CHECK FLEXURE $n = 40$

$F = 0.021$

$K = M/F = \frac{0.64'-K}{0.021} = 30.5$

$\rho_{REQ} = 0.0014 < 0.0125 = \rho_{MAX}$

USE 4 - #4's PER CMU BLOCK

CHECK OVERREINFORCEMENT

$f_c = \frac{2M}{jkbd^2}$ $k = 0.714$; $j = 0.762$

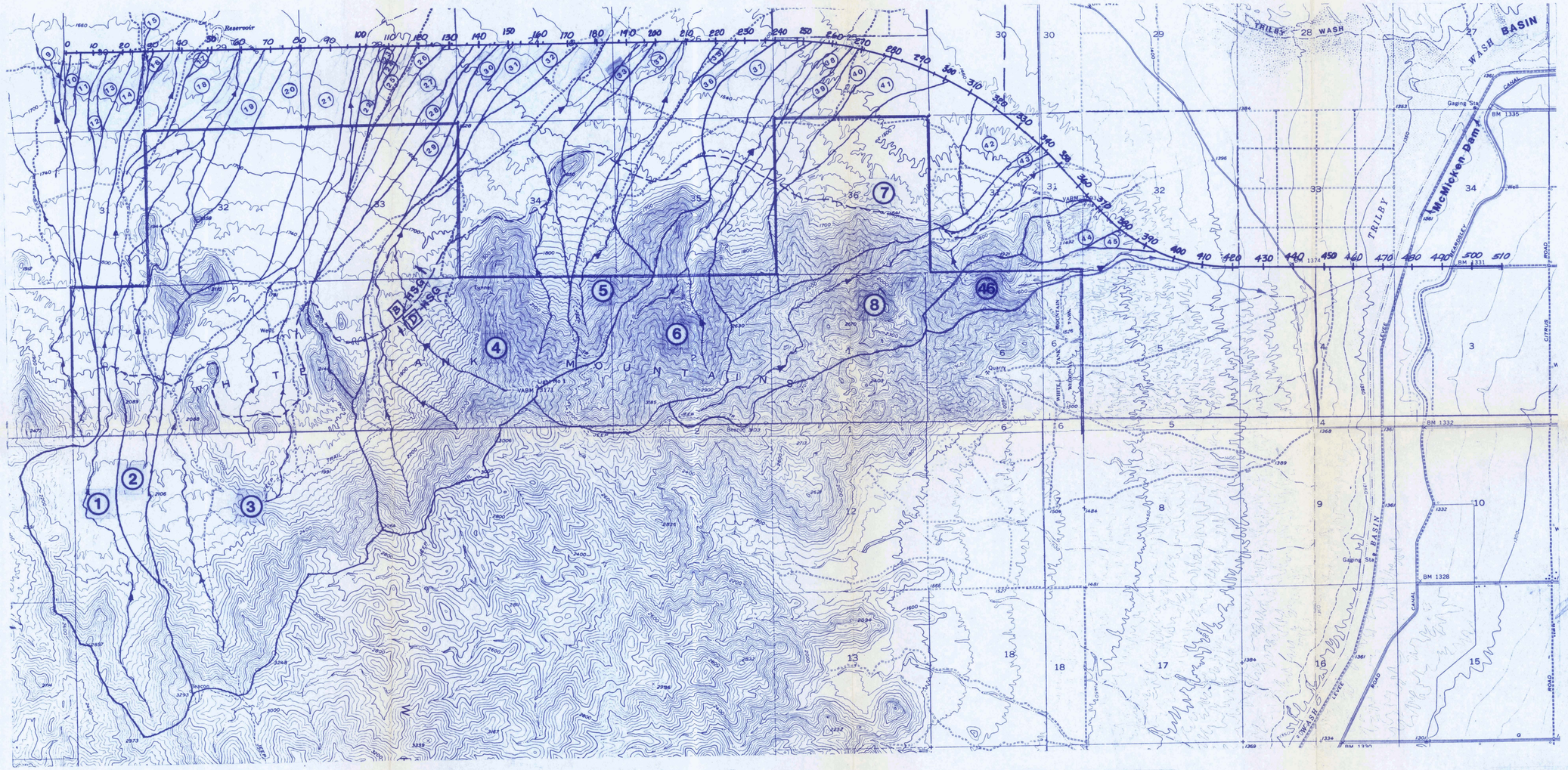
$f_c = \frac{2(7700''-\#)}{(0.76)(0.71)(16)(4)^2}$

$f_c = 111 \text{ psi} < 250 \text{ psi} = f_{ALL}$

∴ NO COMPRESSION FAILURE WILL OCCUR FOR THE MAXIMUM APPLIED LOAD NOTED ABOVE

Registered Professional Engineer (Structural)
CERTIFICATE NO. 21827
WILLIAM B. HIGGINS
Date Signed 11/16/88
ARIZONA, U.S.A.

FORM 204-1



FLOOD CONTROL DISTRICT
RECEIVED
OCT 28 '88

	CH ENG		P & PM
	DEP		HYDRO
	ADMIN		GEOL
	FINANCE		FEL
	S.A.		
	LEGAL		

REMARKS

SUN VALLEY PARKWAY
DRAINAGE AREA MAP
PHASE I

① DRAINAGE AREA
MAJOR WASH

EXHIBIT C

Collar, Williams & White Engineering, Inc.
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2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
(602) 947-6433

DESIGN PROJ. NO.	SURVEY PROJ. NO.	PREPARED DATE
850840-6		MARCH, 1987