PVSP DRAINAGE STUDY
PHASE III

Prepared for

Town of Paradise Valley
City of Scottsdale
City of Phoenix
Flood Control District of Maricopa County

ADDENDUM

Prepared by

Collar, Williams and White Engineering, Inc.
Water Resources Associates, Inc.
Scottsdale, Arizona
November 1, 1978

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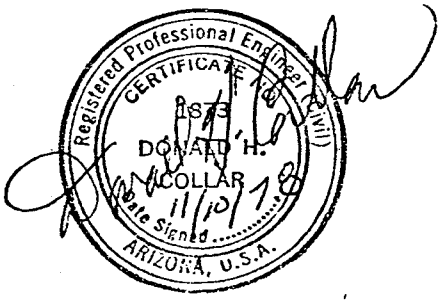

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ADDENDUM
PVSP DRAINAGE STUDY
PHASE III

In response to the Committee's review of the PVSP, Phase III - Final Report, the following Addendum is provided to include the Physical and the design changes that have been reported within the study area since the writing of the Report in July 1978, also to clarify and answer questions raised by the members of the Committee.

Clarification, Page 1-1

For clarification, Page 1-1 has been changed and a new Page number 1-1a, containing the changes, is transmitted, with this Addendum, for insertion in the original Report.

Plate 7, Corrections

Plate 7 (Project B, Volume I, "Hydraulics") originally showed all structures in the 64th Street system. Because of required corrections, Plate 7 has been changed, eliminating the Shea Boulevard box culverts. A second Plate, designated 7A, which shows only the Shea culverts, has been added.

Design of Shea Boulevard

We have been informed that the City of Phoenix has recently redesigned Shea Boulevard. Plate 60-1, Volume I, "Hydraulics" for 60th Place, Flood Protection System, recommends that the design profile of Shea Boulevard should be altered to induce flood flows in a southerly direction along 60th Place. We are in agreement with the Town of Paradise Valley and the Committee that 60th Place is a better route to drain the area towards the Indian Bend Wash rather than the 61st Place drainage way that now exists.

Correction, Plate 1, Project A

In the Hydraulic Section, Plate 1, Project A, the surface area should read 20.1 acres rather than 10.1 shown, with the volume remaining at 44 acre feet and the regulated outlet at 50 cfs, as per the instructions of the City of Phoenix in their communications with the Flood Control District, dated May 1, 1978. The correct volume and discharge was used in all computations. A corrected Plate 1, Project A is included for insertion.

Correction, Plate 1, Project B

Similarly, in the Hydraulic Section, Plate 1, Project B, the surface area is 22.4 acres rather than 12.4 acres. The volume of 52 acre feet and regulated outlet of 50 cfs were correct and all computations were based on the units. A revised Plate is included for insertion.

"No Project" Hydrographs

Two "No Project" hydrographs have been added to the Hydrology Section. One at CP 303 which shows the effect of not having the Acoma and Sereno Park Detention Basins. And, the hydrograph at CP 103, south of Thunderbird along Scottsdale Road, shows the effect of not having the Scottsdale Airport Detention Basin and not including the waters from drainage area C-2.

Clarification and Correction, Page 2-6

For clarification and correction, Page 2-6 has been changed and new Pages numbered 2-6a and 2-6b, containing the changes are transmitted, with this Addendum, for insertion in the original Report.

Clarification, Page 2-7

For clarification, Page 2-7 has been changed and a new Page numbered 2-7a, containing the changes, is transmitted, with this Addendum, for insertion in the original Report.

Correction Relating to "Brumad" Master Plan

The Committee brought to our attention that a drainage area for the "Brumad"-"Buenavante" master drainage plan includes drainage areas CC 1, CC 2, and CC 3. Hydrographs and accompanying data sheets show the impact of the addition of these drainage areas on the Cactus Road Detention Basin.

At the time of this writing, we have been advised by the members of the Capitol Improvements Engineering Section of the City of Scottsdale that the design of the Cactus Road Detention Basin is being altered from the dimensions provided and which were used in the July Report. However, the included hydrographs were calculated on the basis of basin criteria provided us for the July Report. The surface area of the detention basin is approximately 15 acres with a volume of 100 acre feet and a regulated outflow of approximately 200 cfs.

We have been advised that the basin will be excavated 2 feet deeper and that the size of the outlet structure will be changed.

The analysis for this Addendum (following the text) shows that the 100-year summer volume will exceed the 100 acre foot capacity by approximately 40 acre feet. However, with the revisions being made by the Scottsdale Engineering Department

(verbal communication), the basin should act similar to the manner presented in the July Report. Necessary corrections have been made on Plate 2.

Winter/Summer Hydrographs

The Committee requested amplification on the difference between winter and summer hydrographs as included in the report. Sub-basin drainage area data sheets are included in the report for the 2 and 100-year summer storms. The data sheet format is similar to the Arizona Department of Highways' SCS form that the engineering community is familiar with.

Some of the data on those forms also is used for the winter storms. The necessary elements for computing winter storms by the Corps of Engineer method contained on the sheets are slope, length of basin, width of basin, time of concentration, and impervious/pervious infiltration indices.

The winter storm was derived from the Corps of Engineers' Phoenix Valley S graph and the Corps' six-hour precipitation (seven-hour duration) storm. The Corps of Engineers' storm distribution for the six-hour precipitation is so arranged that approximately 5.50 inches of rainfall occur within the six-hour period, and an additional hour of rainfall occurs at the beginning of the storm to provide antecedent moisture conditions so that, at the beginning of the six-hour storm, runoff will instantaneously occur from the pervious area.

The modification for this study was made in that the six-hour storm had a precipitation total of 3.35 inches rather than the Corps' 5.50 inches. In addition, modification to the infiltration is that the highest rate of infiltration the Corps uses is 0.4 inch per hour. For this study, a constant infiltration rate of 0.7 inch per hour was used. A unit graph was then derived which can be applied to any area. The time of concentration for each sub-basin is considered to be the peak time for that basin for routing purposes. The unit hydrograph, in tabular form, is included in the Addendum, following the text.

Two-Year Frequency "Project/No Project"

A comparison of "Project" and "No Project" conditions for the 2-year frequency summer storm tabulation at selected street locations has been included in this Addendum. The street locations are ones deemed to be critical and show the impact of the implementation of this study on those intersections. These selected locations show that implementation of this project would be greatly beneficial in reducing road-closure durations in all instances.

Locations where this project will not have a great impact will be interior areas adjacent to Shea Boulevard where local runoff is now a problem. The outside runoff will be controlled to the degree as shown in the report with the interior runoff in developed subdivisions being approximately the same as it is today.

The only remedy for this problem is to locate land within the developed areas that could be used for detention basins. This solution will probably be very costly and most likely will include the condemnation of lands on which homes are now placed.

Each individual of the Committee must evaluate these problems with respect to their own situations.

Detention Above the Hearn Basin

The Committee has informed us that in Project Area B, which includes the Hearn Detention Basin, additional detention areas are being planned.

On the date of this writing, we were advised that two additional detention basins will be included in the drainage area for Project B.

The first of these basins is a 30-acre park and detention basin at approximately 60th Street, 1/2 mile south of Bell Road

The second is a detention basin with a surface area of approximately 15 acres located approximately 1/4 mile north of Greenway Road at 67th Street.

No other information is available at this time.

We strongly recommend that a follow-up project be initiated to analyze the impact of the proposed basins.

These basins could relieve the excessive burden that has been placed on the Hearn Detention Basin.

Routing from the Hearn Detention Basin

With respect to the Hearn Detention Basin, the Committee has indicated that the uncontrolled discharge from this basin should be routed towards the east rather than towards 64th Street as shown in the Report.

In light of the information concerning potential additional basins, any routing from the Hearn Basin would not be meaningful at this time. Routing of uncontrolled flows, from this basin, to the south would cause the uncontrolled peaks to flow through the subdivisions south of the Hearn Basin. We strongly recommend that this alternative routing be reviewed very carefully by the Committee before any new project is commenced.

Reply to "Conservative" Approach

Some concern has been expressed by the Committee in the criteria used for computing flood peaks and volumes.

Page 2-2 of the Hydrology Section sets forth the criteria as relayed to us by the Committee. It must be stressed that these criteria and the computations contained within the July 1978 Report are for preliminary design. The final design for any portion of the project may be modified to suit the needs and necessities of the location and the laws of each political subdivision.

Page 2-1 of the Hydrology Section states that storms of the magnitude, intensity and duration used as criteria for Phase III of the PVSP Study have occurred in the Phoenix Area within the period of recorded history.

The statistical analysis for the frequency of these storms and the intensity of the rainfall are as provided by the Weather Bureau and the State Climatologist and are included in this Addendum, following the text.

Runoff characteristics of the area are from criteria developed by the Soil Conservation Service for a fully developed area with 50% impervious surface. The areas that are pervious have been assigned an 0.7 inch per hour infiltration rate as derived from imperical data. All these criteria were provided by the Committee.

Storms on all of the areas were hydrographed and routed with no attenuation. The routing was by means of computing the velocity of the flood peak from point-to-point using the streets and hard surface areas as water carriers.

Three methods were investigated to try to attenuate the flood peaks.. Each proved less than satisfactory for application to this whole study.

The first method examined was the "Muskingum" flood routing method which is generally used for flood routing in a natural channel. The Muskingum procedure will give an indication of attenuation for a flat-valley area when routing floods in natural channels with wide over banks. This method can be used in the less densely populated areas where side yards can be used as over banks but does not provide satisfactory answers in the more densely developed areas where over banks are not very significant.

The "Successive-Average Lag" method is used in well defined channels such as the streets and alley ways, and where over-bank storage is assumed not to be significant.

Reservoir routing by the "Modified Puls" was tried in portions that have significant areas of retention, very-mild slopes, and for detention basins.

As previously stated, the information contained in the report may be modified. Any one particular unit may be extracted from the bulk and attenuated as the final design dictates.

The Committee review states that where "basins are overtopped, the resulting hydrograph," as shown in the Report, "would be unrealistic." We would be in basic agreement with this statement, if the Committee's design instructions were modified.

The instructions received were to route the uncontrolled flow along the same path as the controlled flow. Basin configurations that were provided did not include emergency spillways or freeboard. The basins would be entrenched and over topped when the volume of the basin was exceeded and the water-surface elevation reached the existing ground level.

When final design is begun, the detention basin sheets contained in the July Report will make easy work of designing emergency spillways. Also, at that time, additional storage computations can be readily calculated from the relationship of the depths of water flowing over a spillway to the surface area/volume relationship behind the emergency spillway.

100-YEAR FREQUENCY WINTER STORM HYDROGRAPH

AT CP 103

NO PROJECT

t	q
0.00	0
0.10	124
0.20	395
0.30	793
0.40	1017
0.50	1288
0.60	1753
0.70	1739
0.80	1303
0.90	781
1.00	490
1.10	303
1.20	193
1.30	122
1.40	78
1.50	51
1.60	34
1.70	22
1.80	13
1.90	9
2.00	6
2.10	3
2.20	1
2.30	0
2.40	0
2.50	0
2.60	0
2.70	0
2.80	0
2.90	0
3.00	0
3.10	0
3.20	0
3.30	0
3.40	0
3.50	0
3.60	0
3.70	0
3.80	0
3.90	0
4.00	0
4.10	0
4.20	0
4.30	0
4.40	0
4.50	0
4.60	0
4.70	0
4.80	0
4.90	0
5.00	0
5.10	0
5.20	0
5.30	0
5.40	0
5.50	0
5.60	0
5.70	0
5.80	0
5.90	0

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

100-YEAR FREQUENCY SUMMER STORM HYDROGRAPH

AT CP 303

NO PROJECT

t	q
0.00	0
0.10	121
0.20	423
0.30	620
0.40	1051
0.50	1310
0.60	825
0.70	565
0.80	616
0.90	727
1.00	754
1.10	707
1.20	591
1.30	436
1.40	304
1.50	217
1.60	161
1.70	116
1.80	84
1.90	61
2.00	44
2.10	32
2.20	23
2.30	17
2.40	12
2.50	9
2.60	7
2.70	5
2.80	4
2.90	2
3.00	1
3.10	0
3.20	0
3.30	0
3.40	0
3.50	0
3.60	0
3.70	0
3.80	0
3.90	0
4.00	0
4.10	0
4.20	0
4.30	0
4.40	0
4.50	0
4.60	0
4.70	0
4.80	0
4.90	0
5.00	0
5.10	0
5.20	0
5.30	0
5.40	0
5.50	0
5.60	0
5.70	0
5.80	0
5.90	0

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-1

Frequency in years 100
Drainage area in sq. mi. 0.135
Length in ft. 2900
Elevation, ft. msl:
Top of Basin 1450
Bottom of Basin 1430
Basin Slope in % 0.7
Basin Width in ft. 1250
Time of Concentraion in hrs. 0.40
Precipitation:
Duration in hrs. 0.40
Point Precipitation in inches 1.89
Rainfall intensity in./hr. 4.75
Pervious Area in sq. mi. 0.068
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.067
Curve Number 97
Runoff (Q) in inches 1.60
Time of Peak in hrs. 0.27
Peak Discharge in cfs 392
Runoff Volume in af. 11

October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-2

Frequency in years 100
Drainage area in sq. mi. 0.156
Length in ft. 2700
Elevation, ft. msl:
    Top of Basin 1430
    Bottom of Basin 1410
Basin Slope in % 0.7
Basin Width in ft. 1500
Time of Concentraion in hrs. 0.37
Precipitation:
    Duration in hrs. 0.37
    Point Precipitation in inches 1.80
    Rainfall intensity in./hr. 4.89
Pervious Area in sq. mi. 0.078
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.078
Curve Number 97
Runoff (Q) in inches 1.52
Time of Peak in hrs. 0.24
Peak Discharge in cfs 468
Runoff Volume in af. 13

October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-3

Frequency in years 100
Drainage area in sq. mi. 0.165
Length in ft. 5000
Elevation, ft. msl:
    Top of Basin 1410
    Bottom of Basin 1370
Basin Slope in % 0.8
Basin Width in ft. 2000
Time of Concentraion in hrs. 0.78
Precipitation:
    Duration in hrs. 0.78
    Point Precipitation in inches 2.44
    Rainfall intensity in./hr. 3.14
Pervious Area in sq. mi. 0.083
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.082
Curve Number 96
Runoff (Q) in inches 1.97
Time of Peak in hrs. 0.52
Peak Discharge in cfs 304
Runoff Volume in af. 17

October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-1

Frequency in years 2
Drainage area in sq. mi. 0.135
Length in ft. 2900
Elevation, ft. msl:
Top of Basin 1450
Bottom of Basin 1430
Basin Slope in % 0.7
Basin Width in ft. 1250
Time of Concentraion in hrs. 0.40
Precipitation:
Duration in hrs. 0.40
Point Precipitation in inches 0.64
Rainfall intensity in./hr. 1.60
Pervious Area in sq. mi. 0.068
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.067
Curve Number 98
Runoff (Q) in inches 0.45
Time of Peak in hrs. 0.27
Peak Discharge in cfs 112
Runoff Volume in af. 3

October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-2

Frequency in years 2
Drainage area in sq. mi. 0.156
Length in ft. 2700
Elevation, ft. msl:
Top of Basin 1430
Bottom of Basin 1410
Basin Slope in % 0.7
Basin Width in ft. 1500
Time of Concentraion in hrs. 0.37
Precipitation:
Duration in hrs. 0.37
Point Precipitation in inches 0.61
Rainfall intensity in./hr. 1.65
Pervious Area in sq. mi. 0.078
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.078
Curve Number 98
Runoff (Q) in inches 0.44
Time of Peak in hrs. 0.24
Peak Discharge in cfs 134
Runoff Volume in af. 4

October 1978

HYDROLOGIC BASIN DATA SHEET

WATER RESOURCES ASSOCIATES INC.
Scottsdale Arizona

DRAINAGE AREA LOCATION

CC-3

Frequency in years 2
Drainage area in sq. mi. 0.165
Length in ft. 5000
Elevation, ft. msl:
Top of Basin 1410
Bottom of Basin 1370
Basin Slope in % 0.8
Basin Width in ft. 2000
Time of Concentraion in hrs. 0.78
Precipitation:
Duration in hrs. 0.78
Point Precipitation in inches 0.72
Rainfall intensity in./hr. 0.92
Pervious Area in sq. mi. 0.083
Infiltration in./hr. 0.70
Impervious Area in sq. mi. 0.082
Curve Number 96
Runoff (Q) in inches 0.41
Time of Peak in hrs. 0.52
Peak Discharge in cfs 63
Runoff Volume in af. 4

October 1978

CACTUS ROAD DETENTION BASIN

100-YEAR FREQUENCY SUMMER STORM HYDROGRAPH

INFLOW AT CP 104

TOTAL OUTFLOW AT CP 105

Time (hrs)	Inflow (cfs)	Average Inflow (cfs)	Controlled Outflow (cfs)	Uncontrolled Outflow (cfs)	Basin Storage (af)	Total Outflow (cfs)
0.00	0	0	0	0	0.00	0
0.10	147	73	5	0	0.56	5
0.20	660	403	9	0	3.82	9
0.30	1508	1084	22	0	12.60	22
0.40	1988	1748	48	0	26.65	48
0.50	1851	1920	81	0	41.84	81
0.60	1547	1699	115	0	54.93	115
0.70	1545	1546	146	0	66.50	146
0.80	1547	1546	180	0	77.79	180
0.90	2298	1923	224	0	91.83	224
1.00	2417	2358	244	1125	100.00	1369
1.10	1668	2042	244	1799	100.00	2042
1.20	1053	1361	244	1117	100.00	1361
1.30	686	870	244	626	100.00	870
1.40	449	567	244	324	100.00	567
1.50	380	414	244	170	100.00	414
1.60	337	358	244	114	100.00	358
1.70	296	316	244	73	100.00	316
1.80	264	280	244	36	100.00	280
1.90	237	250	244	7	100.00	250
2.00	215	226	244	0	99.85	244
2.10	197	206	244	0	99.54	244
2.20	182	189	244	0	99.09	244
2.30	169	175	244	0	98.52	244
2.40	156	162	243	0	97.85	243
2.50	145	150	241	0	97.10	241
2.60	134	139	238	0	96.29	238
2.70	126	130	235	0	95.42	235
2.80	119	123	232	0	94.51	232
2.90	112	116	229	0	93.57	229
3.00	106	109	226	0	92.60	226
3.10	101	104	223	0	91.61	223
3.20	95	98	220	0	90.60	220
3.30	90	93	216	0	89.58	216
3.40	86	88	213	0	88.55	213
3.50	81	84	210	0	87.50	210
3.60	77	79	206	0	86.45	206
3.70	74	76	203	0	85.39	203
3.80	70	72	200	0	84.34	200
3.90	67	69	197	0	83.28	197
4.00	64	66	193	0	82.23	193
4.10	61	63	190	0	81.17	190
4.20	58	60	187	0	80.12	187
4.30	55	57	184	0	79.07	184
4.40	53	54	180	0	78.03	180
4.50	51	52	177	0	76.99	177
4.60	48	50	174	0	75.96	174
4.70	46	47	171	0	74.94	171
4.80	44	45	168	0	73.92	168
4.90	43	44	165	0	72.92	165
5.00	41	42	162	0	71.92	162
5.10	39	40	159	0	70.94	159
5.20	38	39	156	0	69.96	156
5.30	36	37	154	0	69.00	154
5.40	35	36	151	0	68.05	151
5.50	33	34	148	0	67.11	148
5.60	32	33	145	0	66.17	145
5.70	31	32	143	0	65.25	143
5.80	30	31	140	0	64.35	140
5.90	29	30	138	0	63.45	138

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

CACTUS ROAD DETENTION BASIN

100-YEAR FREQUENCY WINTER STORM HYDROGRAPH

INFLOW AT CP 104

TOTAL OUTFLOW AT CP 105

Time (hrs)	Inflow (cfs)	Average Inflow (cfs)	Controlled Outflow (cfs)	Uncontrolled Outflow (cfs)	Basin Storage (af)	Total Outflow (cfs)
0.00	0	0	0	0	0.00	0
0.25	13	6	5	0	0.03	5
0.50	38	25	5	0	0.44	5
0.75	74	56	7	0	1.46	7
1.00	102	88	8	0	3.11	8
1.25	122	112	11	0	5.20	11
1.50	140	131	15	0	7.61	15
1.75	152	146	19	0	10.24	19
2.00	164	158	23	0	13.03	23
2.25	175	169	28	0	15.94	28
2.50	185	180	34	0	18.96	34
2.75	194	189	40	0	22.05	40
3.00	203	198	46	0	25.20	46
3.25	212	208	53	0	28.41	53
3.50	236	224	60	0	31.80	60
3.75	358	297	71	0	36.48	71
4.00	544	451	89	0	43.95	89
4.25	1065	804	127	0	57.95	127
4.50	1450	1258	194	0	79.93	194
4.75	1219	1335	244	119	100.00	363
5.00	1140	1180	244	936	100.00	1180
5.25	917	1028	244	784	100.00	1028
5.50	821	869	244	625	100.00	869
5.75	522	671	244	428	100.00	671
6.00	323	423	244	179	100.00	423
6.25	317	320	244	76	100.00	320
6.50	294	306	244	62	100.00	306
6.75	243	269	244	25	100.00	269
7.00	192	218	244	0	99.46	244
7.25	162	177	244	0	98.07	244
7.50	143	153	244	0	96.18	244
7.75	125	134	241	0	93.98	241
8.00	108	117	232	0	91.59	232
8.25	94	101	224	0	89.06	224
8.50	82	88	215	0	86.44	215
8.75	72	77	206	0	83.77	206
9.00	63	68	197	0	81.09	197
9.25	56	60	189	0	78.42	189
9.50	50	53	180	0	75.79	180
9.75	45	48	172	0	73.21	172
10.00	40	43	164	0	70.69	164
10.25	36	38	157	0	68.23	157
10.50	33	35	150	0	65.85	150
10.75	30	32	143	0	63.55	143
11.00	27	29	137	0	61.31	137
11.25	24	26	130	0	59.15	130
11.50	22	23	124	0	57.05	124
11.75	20	21	119	0	55.04	119
12.00	19	20	113	0	53.10	113
12.25	17	18	108	0	51.23	108
12.50	16	17	104	0	49.43	104
12.75	15	16	99	0	47.71	99
13.00	14	15	95	0	46.05	95
13.25	13	14	91	0	44.46	91
13.50	12	13	87	0	42.92	87
13.75	11	12	83	0	41.45	83
14.00	10	11	79	0	40.02	79
14.25	9	10	76	0	38.64	76
14.50	9	9	73	0	37.32	73
14.75	3	6	70	0	36.00	70

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

CACTUS ROAD DETENTION BASIN

2-YEAR FREQUENCY SUMMER STORM HYDROGRAPH

INFLOW AT CP 104

TOTAL OUTFLOW AT CP 105

Time (hrs)	Inflow (cfs)	Average Inflow (cfs)	Controlled Outflow (cfs)	Uncontrolled Outflow (cfs)	Basin Storage (af)	Total Outflow (cfs)
0.00	0	0	0	0	0.00	0
0.10	40	20	5	0	0.12	5
0.20	196	118	6	0	1.05	6
0.30	447	322	9	0	3.63	9
0.40	554	500	14	0	7.65	14
0.50	486	520	21	0	11.77	21
0.60	398	442	26	0	15.21	26
0.70	390	394	31	0	18.20	31
0.80	384	387	37	0	21.09	37
0.90	354	369	42	0	23.79	42
1.00	309	331	47	0	26.15	47
1.10	249	279	51	0	28.04	51
1.20	201	225	54	0	29.45	54
1.30	167	184	56	0	30.51	56
1.40	144	156	58	0	31.32	58
1.50	126	135	59	0	31.95	59
1.60	110	118	60	0	32.43	60
1.70	99	105	61	0	32.80	61
1.80	91	95	61	0	33.08	61
1.90	84	88	62	0	33.29	62
2.00	78	81	62	0	33.45	62
2.10	73	75	62	0	33.55	62
2.20	69	71	63	0	33.62	63
2.30	65	67	63	0	33.66	63
2.40	61	63	63	0	33.66	63
2.50	58	60	63	0	33.64	63
2.60	55	57	62	0	33.59	62
2.70	52	54	62	0	33.52	62
2.80	50	51	62	0	33.43	62
2.90	48	49	62	0	33.32	62
3.00	46	47	62	0	33.20	62
3.10	44	45	61	0	33.06	61
3.20	42	43	61	0	32.91	61
3.30	40	41	61	0	32.75	61
3.40	39	40	60	0	32.58	60
3.50	37	38	60	0	32.40	60
3.60	36	37	59	0	32.21	59
3.70	34	35	59	0	32.01	59
3.80	33	34	59	0	31.80	59
3.90	32	33	58	0	31.59	58
4.00	31	32	58	0	31.38	58
4.10	29	30	57	0	31.15	57
4.20	28	29	57	0	30.92	57
4.30	27	28	56	0	30.68	56
4.40	26	27	56	0	30.44	56
4.50	25	26	55	0	30.20	55
4.60	25	25	55	0	29.95	55
4.70	24	25	54	0	29.71	54
4.80	23	24	54	0	29.46	54
4.90	22	23	53	0	29.21	53
5.00	21	22	52	0	28.95	52
5.10	21	21	52	0	28.69	52
5.20	20	21	51	0	28.44	51
5.30	19	20	51	0	28.18	51
5.40	19	19	50	0	27.92	50
5.50	18	19	50	0	27.66	50
5.60	17	18	49	0	27.40	49
5.70	17	17	49	0	27.14	49
5.80	16	17	48	0	26.88	48
5.90	16	16	48	0	26.61	48

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

100-YEAR FREQUENCY SUMMER STORM HYDROGRAPH

AT CP 105

NO PROJECT

t	q
0.00	0
0.10	147
0.20	660
0.30	1624
0.40	2368
0.50	2500
0.60	2416
0.70	2636
0.80	2437
0.90	1814
1.00	1105
1.10	703
1.20	456
1.30	296
1.40	194
1.50	128
1.60	84
1.70	58
1.80	39
1.90	25
2.00	16
2.10	12
2.20	9
2.30	5
2.40	2
2.50	1
2.60	0
2.70	0
2.80	0
2.90	0
3.00	0
3.10	0
3.20	0
3.30	0
3.40	0
3.50	0
3.60	0
3.70	0
3.80	0
3.90	0
4.00	0
4.10	0
4.20	0
4.30	0
4.40	0
4.50	0
4.60	0
4.70	0
4.80	0
4.90	0
5.00	0
5.10	0
5.20	0
5.30	0
5.40	0
5.50	0
5.60	0
5.70	0
5.80	0
5.90	0

Water Resources Associates, Inc.
Scottsdale, Arizona
October 1978

100-YEAR WINTER STORM

UNIT HYDROGRAPH FOR THE PVSP STUDY

t	q
0.00	0
0.25	0
0.50	22
0.75	44
1.00	66
1.25	70
1.50	75
1.75	80
2.00	85
2.25	88
2.50	92
2.75	94
3.00	96
3.25	98
3.50	102
3.75	129
4.00	302
4.25	434
4.50	1107
4.75	932
5.00	302
5.25	216
5.50	150
5.75	100
6.00	90
6.25	85
6.50	77
6.75	66
7.00	22
7.25	0
7.50	0
7.75	0
8.00	0

t = time in hours

q = discharge per sq. mi. in cfs

Precipitation:

7 hour duration

6 hour intensity = 3.35"

Water Resources Associates, Inc.
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October 1978

COMPARISON OF "PROJECT" AND "NO PROJECT" CONDITIONS
FOR THE 2-YEAR FREQUENCY SUMMER STORM
AT SELECTED STREET LOCATIONS

Location	No Project Conditions		Project Conditions	
	Street Closure In Hours	Runoff Duration In Hours	Street Closure In Hours	Runoff Duration In Hours
56th Street South of Thunderbird	0.8	2.6	0.55	7.0
56th Street North of Cactus	1.3	2.6	Open all the time	8.0
56th Street South of Shea	0.7	2.0	0.1	7.0
64th Street North of Joan D'Arc	0.95	2.2	0.45 With improved section 0.20	12.0
64th Street North of Cactus	1.2	12.0	0.70	2.20
Cactus Road West of Scottsdale Road	0.5	1.50	With 60" Storm Drain 0.10	1.50

Water Resources Associates, Inc.
Scottsdale, Arizona
10/78

ESTIMATED RETURN PERIODS FOR SHORT-DURATION PRECIPITATION IN ARIZONA
(Inches)

Station: Phoenix WBO

Latitude: 33° 26'

Longitude: 112° 01'

Elevation (feet): 1117

RETURN PERIOD (YEARS)

DURATION	1	2	5	10	25	50	100
5 min.	0.17	0.26	0.38	0.47	0.59	0.68	0.77
10 min.	0.27	0.40	0.59	0.72	0.91	1.06	1.20
15 min.	0.34	0.50	0.74	0.92	1.15	1.34	1.52
30 min.	0.47	0.70	1.03	1.27	1.60	1.86	2.10
1 hr.	0.60	0.88	1.30	1.61	2.02	2.35	2.66
2 hr.	0.65	0.94	1.39	1.72	2.15	2.49	2.82
3 hr.	0.69	1.01	1.48	1.82	2.27	2.62	2.97
6 hr.	0.81	1.16	1.70	2.07	2.57	2.96	3.35
12 hr.	0.91	1.30	1.90	2.30	2.84	3.26	3.69
24 hr.	1.02	1.44	2.10	2.53	3.12	3.57	4.04

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