28-45

October 4, 1985

Mr. Collis Lovely
Collar, Williams and White Engr., Inc.
2922 N. 70th Street
Scottsdale, Arizona 85251

Subject: Drainage Master Plan for the
Herberger Property Development
Zoning Case 93-Z-84

Dear Mr. Lovely:

I concur with your proposal to allow submission and review of plans for your client's property east of Scottsdale Road to proceed before the analysis of the drainage problems west of Scottsdale Road has been completely understood and covered in the master plan; however, we are not quite to the point where I can approve the portion of the drainage master plan for the area east of Scottsdale Road.

Enclosed is the Master Drainage Plan which accompanied the report you delivered to us on October 1, 1985. I have made comments in red concerning things which need to be addressed. In summary, these things are:

1. The channel side slope protection, and, in three locations, channel landscaping.

2. Two locations where I believe catch basins or scuppers are needed.

3. The lack of information on catch basin size, type, and flow capacity calculations.

When I reviewed the report the first time, I concentrated so much on the major problems outlined in my September 12, 1985, letter concerning the report that I neglected to look at the catch basin indications and comment on the lack of data on them. I'm sorry that I didn't make those comments also in my September 12th review report.

Charles D. Connett, P.E.
Senior Civil Engineer

Copies to: John Faramelli
Grish Shirvani

COLLAR, WILLIAMS & WHITE ENGINEERING, INC.
Civil Engineers, Land Surveyors and Aerial Mapping
2702 N. 44th STREET
SUITE 205-B
PHOENIX, ARIZONA 85008
PHONE 957-3350

3779

LETTER OF TRANSMITTAL

DATE	JOB NO.
3-20-87	870827
ATTENTION	BILL ERICKSON
RE:	SHEA-SCOTT

TO City of Scotts
7447 E. INDIAN SCHOOL
2nd floor

GENTLEMEN:
WE ARE SENDING YOU [X] HEREWITH [ ] UNDER SEPARATE COVER VIA _____,
[X] COPIES OF THE FOLLOWING ITEMS:

[ ] PLANS [ ] ORIGINALS [ ] COPY OF LETTER [ ] SPECIFICATIONS [X] REPORTS
[ ] PRINTS OF THE FOLLOWING: [ ] _____

PLATS:
_____ PRELIMINARY PLAN
_____ PRE-FINAL
_____ FINAL
_____ _____
_____ _____
_____ _____

PLANS:
_____ MASTER PLAN
_____ SITE STUDIES
_____ SKETCH
_____ WATER
_____ SEWER
_____ PAVING
_____ GRADING & DRAINAGE
_____ BOUNDARY & TOPOGRAPHY
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

REPORTS & DESCRIPTIONS:
_____ SOILS TEST REPORT
_____ LEGAL DESCRIPTION
_____ COST ESTIMATES
✓ SURVEY
✓ DRAINAGE STUDY
_____ CALCULATIONS

HEALTH DEPARTMENT FORMS
_____ SUBDIVISION APPLICATION
_____ APPLICATION FOR APPROVAL TO CONSTRUCT
_____ WATER SERVICE AGREEMENT
_____ SEWER SERVICE AGREEMENT
_____ GARBAGE SERVICE AGREEMENT
_____ _____

FEES IN THE AMOUNT OF $ _____
FOR _____

THESE ARE TRANSMITTED as checked below:
[ ] FOR REVIEW [ ] FOR APPROVAL [ ] ESTIMATING ONLY [ ] SIGNATURE
[X] PER YOUR REQUEST [ ] FOR YOUR USE [ ] FOR BID [ ] RESUBMIT FOR APPROVAL
[ ] _____

_____ . . . _____

REMARKS: _____

COPY TO: _____

VERY TRULY YOURS
COLLAR, WILLIAMS & WHITE ENGINEERING, INC.
CONSULTING CIVIL ENGINEERS
Signed David Hill

if enclosures are not as noted, kindly notify us at once.

RESPONSES TO SEPTEMBER 12, 1985

REVIEW COMMENTS ON HERBERGER MASTER DRAINAGE REPORT

EAST OF SCOTTSDALE ROAD

1. The difference in the 100 year peak flow data for flows along Shea Boulevard are due to the following reasons:
   a. Different "C" values and
   b. Slightly larger drainage area size for the watershed above the existing 8'x2' CBC.

A runoff a runoff coefficent, "C" value, of 0.35 was used in the 1982 study, it clearly indicated that it represented present watershed conditions. The current study used a "C" value of 0.55 to reflect future post development conditions and used recommended procedures in the City's Drainage Design Manual, which was not available or in effect at the time of the 1982 study.

The acreage difference is due to the uncertainity in 1982 of how the onsite property would be developed and the unavailability in 1982 of the more detailed 400 scale aerial photographs, used in the current study to determine drainage area sizes. In 1982, the areas were determined from 2000 scale U.S.G.S. quad maps.

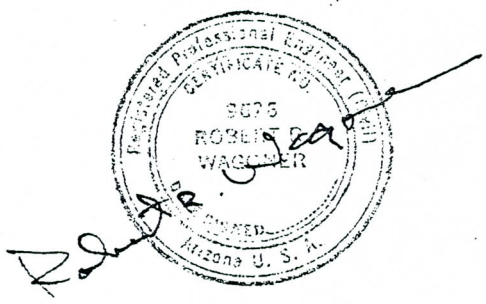
2-4. Questions 2 thorugh 4 relate to the area West of Scottsdale Road and will be addressed in the Addendum for the West side.

MASTER DRAINAGE REPORT AND PLAN

SHEA SCOTTSDALE MASTER PLAN

Prepared for

Herberger Enterprises, Inc.



August 16, 1985
Revised: October 8, 1985

By

Collar, Williams, & White Eng., Inc.
2702 North 44th Street, Suite 205-B
Phoenix, AZ 85008

Collar, Williams & White Engineering, Inc.

DONALD H. COLLAR, P.E.
President
ROBERT R. WAGONER, P.E., R.L.S.
Vice President

Consulting Engineers
2702 N. 44th Street, Suite 205-B
Phoenix, Arizona 85008
(602) 957-3350

GEORGE J. TEPLY, P.E.
ROBERT E. MOHNING, P.E.
LES F. OLSON, P.E., R.L.S.
DON L. FERRIS JR., P.E., R.L.S.
JAMES B. BAKKEDAHL, P.E.
WM. ROSS NELSON, R.L.S.
GERALD RASMUSSEN, R.L.S.

October 9, 1985

Charles D. Connett, P.E.
Senior Civil Engineer
City of Scottsdale
Project Review
3939 Civic Center Plaza
Scottsdale, Arizona 85251

Re: Shea-Scottsdale Master Drainage Plan
C.W.W. NO. 850827

Dear Mr. Connett:

Enclosed is the Final Shea-Scottsdale Master Drainage Plan for the Herberger Properties East of Scottsdale Road.

We have addressed the additional points brought out in your October 4, 1985, review. We have added to the Appendix: Section 4 on street drainage calculations and catch basin information as requested; a discussion of channel design assumptions discussing slope protection and landscaping following Section 2; and added scupper or catch basins where indicated on the drainage map.

We hope this satisfactorily meets your requirements. If your have any questions or comments, please do not hesitate to contact us.

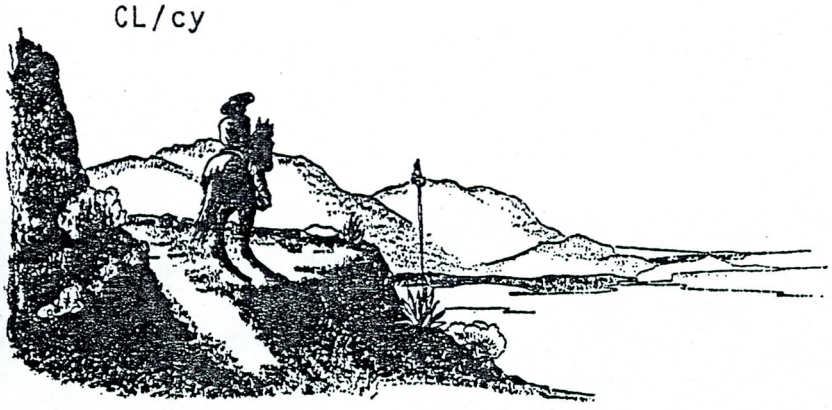
Respectfully submitted,

COLLAR, WILLIAMS & WHITE ENG., INC.

Collis Lovely

Collis Lovely, Senior Hydrologist

CL/cy



Scottsdale Office:
2922 N. 70th Street
Scottsdale, Arizona 85251
(602) 947-5433

Collar, Williams & White Engineering, Inc.

DONALD H. COLLAR, P.E.
President
ROBERT R. WAGONER, P.E., R.L.S.
Vice President

Consulting Engineers
2702 N. 44th Street, Suite 205-B
Phoenix, Arizona 85008
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DON L. FERRIS JR., P.E., R.L.S.
JAMES B. BAKKEDAHL, P.E.
WM. ROSS NELSON, R.L.S.
GERALD RASMUSSEN, R.L.S.

September 30, 1985

Charles D. Connett, P.E.
Senior Civil Engineer
City of Scottsdale
Project Review
3939 Civic Center Plaza
Scottsdale, Arizona 85251

Re: Shea-Scottdale
Master Drainage Plan
CWW No. 850827

Dear Mr. Connett:

In response to your letter of September 12, 1985, regarding our drainage report for the Herberger Properties, we are submitting the enclosed revised report and the attached response to question No. 1 of your specific comments. We have addressed all of your questions and suggestions on all components East of Scottsdale Road and are pursuing the resolution of drainage problems West of Scottsdale Road.

The solution of problems West of Scottsdale Road associated with the 71st Street channel may take some additional time to resolve. The properties of the proposed development, on the East and West side of Scottsdale Road have two totally separate drainage systems which do not affect one another. Therefore, in the interium, we are requesting approval of the enclosed drainage report for all properties East of Scottsdale Road.

As a solution is arrived at for properties West of Scottsdale Road, an Addendum to the drainage report will be submitted for your approval.

Thank you for your cooperation and assistance on this project. If you have any questions or comments, please do not hesitate to contact us.

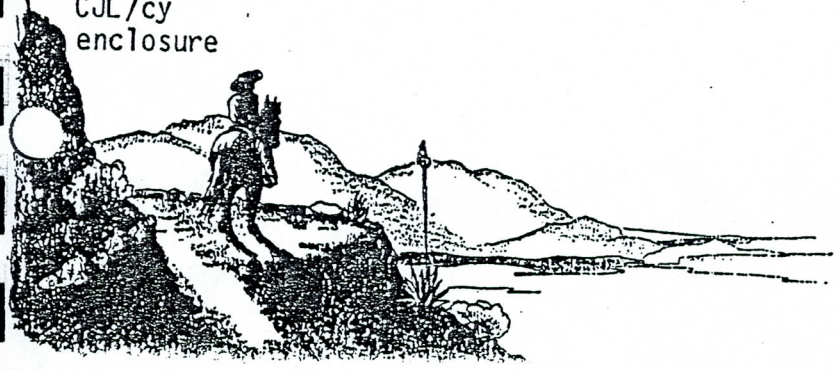
Respectfully submitted,

COLLAR, WILLIAMS & WHITE ENG., INC.

Collis J. Lovely

Collis J. Lovely, Senior Hydrologist

CJL/cy
enclosure



Scottsdale Office:
2922 N. 70th Street
Scottsdale, Arizona 85251
(602) 947-5433

PREFACE

This is the final master drainage report for the area East of Scottsdale Road within "Shea-Scottsdale Master Plan".

An Addendum to this report covering the area West of Scottsdale Road within the "Shea-Scottsdale Master Plan" will be submitted at a later date.

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Figures

Appendix
Calculation Sheets

MASTER DRAINAGE PLAN
SHEA SCOTTSDALE MASTER PLAN

I. DESCRIPTION OF PROPERTY

A. Existing Drainage Patterns

The property includes 18 different parcels totaling 165 acres. Approximately Three-fourths of the property is located East of Scottsdale Road on both sides of Shea Boulevard between Miller and Scottsdale Roads from near the Mescal Street alignment South to Mountain Veiw Road and Gainey Ranch. The other major portion of the property is located West of Scottsdale Road between Gold Dust Avenue and the Berniel Channel from Chaparral High School to Scottsdale Road. One 5 acre parcel is located North of Gold Dust Avenue adjacent the 71st Street drainage channel.

EAST OF SCOTTSDALE ROAD:

Offsite runoff enters the parcels North of Shea via 73rd, 74th and 75th Streets along Parcel 16 and flows South via the existing natural channels on the property to two existing box culverts on Shea Boulevard. There is one 8' x 2' C.B.C. just East of the Shea/Scottsdale Shopping Center; and one 10' x 3' C.B.C. approximately 500 feet West of Miller Road. The existing flow patterns are from North to South with a natural divide, or high spot, approximately halfway between 74th and 75th Streets which splits the flow on the property between the two box culverts at Shea. Flows from 73rd and 74th Streets enter West of the divide and flow across Parcels 16 and 15 to the smaller culvert at the Southwest corner of Parcel 15. Flows from 75th Street enter Parcel 16 east of the divide and flow Southeasterly across Parcel 17 to the box culvert West of Miller Road along the South edge of Parcel 17.

Both box culverts on Shea Boulevard discharge into existing drainage easements located along the East and West boundaries of the property South of Shea Boulevard. The easements are located along the edge of Parcels 11 and 12 and Parcel 14. There is an existing channel of unknown capacity in Parcel 14 below the 10 x 3 C.B.C. The easement on the West side below the 8 x 2 box has no effective channel capacity and water currently floods down the alley behind the Windmill Plaza Shopping Plaza. At the South end of Windmill Plaza a berm diverts flow West to Scottsdale Road, where it turns South and flows along the East side of Scottsdale Road to an existing double 8' x 3' C.B.C. at Mountain View Road. This culvert crosses Scottsdale Road and empties into the Berniel Channel.

Water discharged from the 10 x 3 C.B.C. just West of Miller Road flows along the East side of Parcel 14 to a box culvert at Gold Dust Avenue where it enters an existing designed channel in the Casa Buena subdivision. This flow continues South through to a culvert under Mountain View Road and into Gainey Ranch.

The same natural drainage divide, or high spot, continues down the middle of the property South of Shea Boulevard along the proposed 74th Street alignment. Runoff West of this divide flows South across Parcels 11 and 12 to the berm which diverts it West to Scottsdale Road. Parcels 13 and 14 are East of the divide and runoff from them flows South to an existing diversion ditch above Gold Dust Avenue which intercepts flow and diverts it East to the existing channel thru Casa Buena.

Natural runoff from Parcels 7, 8, 9 and 10 flow from North to Southwest it is concentrated at the Southwest corner of Parcel 9. The double box culvert crossing Scottsdale Road at the Mountain View Road alignment discharges all the flows into the Berniel Channel.

WEST OF SCOTTSDALE ROAD:
Existing onsite runoff patterns on Parcels 1 and 2 are from Northwest to Southeast and from North to South on Parcels 4, 5, and 6. Runoff either enters the 71st Street channel which flows into the Berniel Channel although most flows South directly into the Berniel Channel.

B. Existing Onsite Cover and Soil Conditions

The property is largely undeveloped desert in relatively natural condition. Vegetative cover is desert brush and grass. Cover density was assumed to be 15%, and hydrologic soil group "B" was used for the entire property.

C. Existing Onsite Development

EAST OF SCOTTSDALE ROAD:
There are no existing houses, building or streets thru the applicants property to affect drainage patterns. However, Parcels 7, 8, and 10 South of Shea contain several manmade ditches and berms that divert flows to protect pieces of property which have routed flows away from their natural flow path.

South of Windmill Plaza a berm has diverted flows coming South along the back of the Plaza West along the Northern boundary of Parcels 7 and 8 to Scottsdale Road, otherwise it would have continued South across Parcels 8 & 9 toward Gainey Ranch.

A berm and ditch beginning above the Northwest corner of the intersection of Gold Dust Avenue and 74th Street diverts flow East preventing it from dumping onto Gold Dust Avenue. Another berm runs South along the East border of Parcel 10, preventing flow from Parcel 10 entering 74th Street. An intercepting ditch along the South border of the property then collects flow .

from Parcels 7, 8, 9, and 10 and diverts it West to the culvert at Scottsdale Road at the Mountain View Road alignment, where it enters the Berniel Channel.

WEST OF SCOTTSDALE ROAD:
The 71st Street channel is an existing development which runs along the East side of Parcel 1 and between Parcels 2 and Parcels 5 and 6. This channel carries flow South through a 70 foot easement to the Berniel Channel. The design capacity of this channel was based on, yet uncompleted, upstream flood control features identified in the PVSP Drainage Study. This channel could be overtopped and the applicant's property flooded during major flood events if the upstream improvements are not completed as originally planned.

D. Adjacent Offsite Developments

The following three areas are the only adjacent properties which significantly impact drainage on the proposed development, except for the 71st Street channel which is discussed separately under watershed areas above the property.

1) Runoff is discharged onto the property thru existing drainage easements at the South ends of the 73rd and 74th Street cul-de-sacs and from the dead end of 75th Street. These flows will have to be picked up and delivered safely via designed channels around the edge of the proposed development to their existing concentration points at Shea Boulevard.

2) Uncontrolled runoff from the Southeast corners of the existing Windmill Plaza Shopping Center could flow across the the proposed extension of Gold Dust Avenue and on to Parcel 8 of the proposed development if not intercepted. Runoff from the shopping center, which currently has no designed onsite retention facilities, will have to be intercepted to protect

the proposed development and control flows onto Gold Dust Avenue.

3) Flows from the adjacent Miller Road drainage area are routed onto the Southeast corner of Parcel 16 along the North side of Shea Boulevard where it is routed to the 10 x 3 box culvert. This flow will have to be intercepted and combined with the 75th Street flows and conveyed safely to the existing box culvert.

II. WATERSHED AREAS ABOVE THE PROPERTY

A. Existing Drainage Patterns

EAST OF SCOTTSDALE ROAD:

The Northern limit of the drainage area above the 73rd, 75th Street and Miller Road watersheds is Cactus Road. The Buena Vante development North of Cactus Road has cut off all drainage from the North diverting it West to the Cactus detention basin or East to the Hayden Road channel.

Runoff starts from the Cactus Road right-of-way and flows: down Miller Road to Shea Boulevard; and down 74th Place to Cholla where it turns East on Cholla then South down 75th Street to Parcel 16 of the proposed development. Runoff coming down 73rd Street onto the property originates just below Cactus from residential lots flowing overland to Cholla Road where it is routed South down 73rd Street and out thru two drainage easements on to the Northwest corner of Parcels 15 and 16.

The upper watershed limit of the 74th Street drainage is Cholla. The size of each watershed area above concentration points and peak discharges are listed below, as well as, shown on the attached Master Drainage Plan.

Drainage Concentration Points and Watershed Areas East of Scottsdale Road

Concentration Point	Watershed	Drainage Area (acres)	Post Develop 100 Year Discharge (cfs)
1	73rd Street	58	80
2	74th Street	16	63
3	73rd plus 74th Streets	74	101
4	75th Street	59	126
5	Miller Road	63	123
6	75th Street plus Miller Road	140	269
7	C.P. 3 plus Onsite above Shea Boulevard	97	176
8	C.P. 7 plus Onsite above Gold Dust Avenue	127	220
9	C.P. 8 plus Onsite above Mountain View Road	180	281
11	C.P. 6 plus Onsite Below Shea Boulevard	158	288
12	C.P. 7 plus Onsite Below Shea Boulevard	154	268
13	C.P. 12 plus Onsite Parcels 7 & 8	164	275

WEST OF SCOTTSDALE ROAD:

The property located West of Scottsdale Road is bissected by the existing 71st Street drainage channel. The watershed area contributing to this channel originates at the C.A.P. Canal and from areas East of Scottsdale Road North of Cactus Road and West of Scottsdale Road from Bell Road to the Berniel Channel.

All the watershed area East of Scottsdale Road and North of Cactus Road is routed through the recently completed Cactus Road detention basin located on the Northeast corner of Cactus and Scottsdale Roads. Runoff from the area West of Scottsdale Road flows across undeveloped desert North of Hearn Road then down various streets and channels, including 69th, 70th, and 71st Streets and 68th Place, across Thunderbird, Sweetwater, Cactus and Cholla where it is concentrated into the 71st Street channel. Discharge from the Cactus Road basin is also routed to the 71st Street channel.

THE 71ST STREET CHANNEL:

The existing 71st Street channel was designed to carry 1100 cfs. The design was based on the 1978 PVSP Drainage Study which included several assumed conditions within the contributing watershed area which do not yet exist. The result is that there is approximately 500 additional acres above Hearn Road which contribute runoff to the 71st Street channel which the 1978 study assumed would be diverted West thru a detention basin above Hearn Road and into the 64th Street drainage. A basin has been built along Hearn in Sand Piper Park but no diversion structure has even been installed. Consequently parts or all of the drainage areas designated as "B-1", "B-7", and "B-8" in the PVSP study contribute runoff to the 71st Street channel. (See enclosed drainage map from PVSP report)

A second assumption that field checks have raised some question about is whether flows coming down 68th Place cross Cactus, as assumed in the 1978 study, and continue South to the proposed Gary Road basin, or turn East at Cactus and enter the 71st Street channel system. Recent runoff events have turned East rather than cross Cactus at 68th Place, however, it is uncertain what would happen during a 100 year flood event. At least some flow during a major flood would end up in the 71st Street channel. The effect of this is that more runoff is routed directly to the 71st Street system than was assumed when the 1100 cfs design value was determined.

Another major difference in the PVSP assumptions and present watershed conditions is that the Gary Road detention basin has not yet been constructed.

The result is that the existing 71st Street channel may only be one-third the size needed to contain the 100 year flood event. Unless runoff from the area above Hearn Road is diverted into the basin at Sandpiper Park and if flows coming

down 68th Place are not routed thru a detention basin at Gary Road, the 71st Street channel will remain significantly undersized.

B. Watershed Cover and Soil Conditions

The watershed areas are almost 100% developed primarily in single family home subdivisions. The exception being the undeveloped desert area North of Hearn Road. A curve number of 87 was used for developed areas and 83 was used for undeveloped desert.

C. Existing Development

Extensive development East of Scottsdale Road and the diversion of all flows North of Cactus Road by the Buena Vante Development has had a major impact on drainage. Buena Vante and the construction of the Cactus Road detention basin effectively protects every thing South of Cactus and East of Scottsdale Road. The Cactus Road basin, however, discharges into the 71st Street channel.

D. Effect of Future Development

EAST OF SCOTTSDALE ROAD:

This area is developed to the point where future additional development would not make a significant impact on drainage within the proposed development.

WEST OF SCOTTSDALE ROAD:

Future development within the contributing drainage area above the proposed development could have a very significant impact on flooding conditions on Parcels 1 thru 6. These Parcels are adjacent to the 71st Street channel which is significantly undersized based on present watershed conditions. The development of the vacant desert land above Hearn Road; the improvment of drainage across Cactus Road between 68th Street and Scottsdale Road; the construction of the proposed Gary Road

detention basin; and the development of vacant land between Gary Road and Gold Dust Avenue could all significantly affect drainage patterns and flooding.

If development is guided to achieve consistancy with the design assumptions made in the PVSP study flood conditions on the property adjacent, the 71st Street channel could be greatly improved, if not completely protected from the 100 year flood event.

III. EVALUATION OF THE EFFECTS OF THE PROPOSED DEVELOPMENT

A. Pre and Post Development Topography

The only significant topographic differences between adjacent property is along 74th Street in the Casa Buena II development, along the East side of Parcel 10. A grade break within Parcel 10 will be maintained to prevent runoff from flowing East on to 74th Street.

B. Pre and Post Development Runoff

A comparision of pre and post development peak discharges for the 100 year flood event was made at several key concentration points: C.P. 7, 8, and 9. Curve numbers, and where appropriate, the time of concentration was adjusted to reflect the proposed development according to the future zoning catagory for each parcel and the proposed drainage system.

The following peak flow values were obtained:

C.P. #	Pre-Developed Q100	Post-Developed Q100
6	249 cfs	269 cfs
7	160 cfs	176 cfs
8	173 cfs	220 cfs
9	227 cfs	281 cfs
11	274 cfs	288 cfs

Proposed channels and culverts were sized for the higher Post-Development conditions.

IV. PROVISIONS FOR DEVELOPMENT PHASING

Tenative plans for development of the various parcels is from the farthest upstream areas North of Shea Boulevard downslope towards Mountain View Road and the Berniel Channel. This sequence is ideal from a drainage standpoint, and the detailed site drainage plan for Parcels 16 and 17 (North of Shea) have already been completed and submitted for approval.

The only major phasing problem could come about if the parcels West of Scottsdale Road, adjacent the 71st Street channel were developed prior to the completion of all the upstream flood control features of the PVSP study. Ideally all the necessary upstream improvements will be completed prior to the development of Parcels 1 thru 6. If they are, it is our assumption that the existing channel is adequately sized to convey the 100 year flood event.

If upstream features are not in place a contingency plan to allow development of the parcels could include enlargement of the existing 71st Street channel adjacent the property and the construction of diversion dikes along the East or West and the North borders of the parcels to keep flood waters from entering the property. The flood waters would be diverted into the enlarged channel so adjacent property would not be impacted while the various parcels are protected.

V. CULVERT ANALYSIS

The three existing culverts affected by the proposed development and the three proposed culverts were all analized for the post-development one hundred year peak discharge.

The existing 10'x3' CBC on Shea Boulevard and the double 8'x3' CBC crossing Scottsdale Road, at C.P.'s 6 and 9 respectively, are adequate to pass the new Q100 even though it may be higher than the original design discharge.

The existing 8'x2' CBC on Shea Boulevard just East of Windmill Plaza, however, is considerably undersized. It will not pass the revised Q100 of 176 c.f.s. without overtopping Shea Boulevard. The present estimated capacity is 126 c.f.s. with a headwater depth equal to top of curb. The addition of a 4'x2' barrel would provide a total capacity of 188 c.f.s.

The new culverts being proposed are: one 10x2.5 CBC at C.P. No. 3 and a 10x3.5 CBC between C.P. 5 and 6 as part of the Briarwood North and Crestwood dvelopments, and a 10'x3' CBC at C.P. No. 8 on Gold Dust Avenue.

Although the existing double 8x3 CBC on Scottsdale Road near Mt. View Road alignment will pass the design discharge, it does have a sediment deposition problem. Our proposed extension of this culvert to meet the proposed Scottsdale Road channel should increase the efficiency of this culvert by increasing the approach velocities which in turn will keep the sediment moving through the box. The proposed development should also reduce the actual amount of sediment being currently delivered to the culvert by stabilizing the upstream channels and watershed areas now contributing sediment.

Culvert analysis sheets are included in the appendix for all six culverts mentioned above.

APPENDIX

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway South end existing 73rd St. County Maricopa
Location Concentration Point 1
Project No. Shea Scottsdale Master Plan Station C.P. #1
Name of Stream 73rd St Drainage Area

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	57.74	acres
	A_2		acres
	A_3		acres
Drainage Length		3880	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1380	feet
Drainage Area Slope		0.72	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	55	minutes
Rainfall Intensity	i	2.65	inches/hour
Runoff Coefficient	C_1	CN = 87	
	C_2		
	C_3		
Weighted Runoff Coefficient	C	C = 0.52	
Peak Discharge Qp = CiA =		80	cfs

Computed by C. Lovely Date 8-8-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Scend 75th St. and Peoria County Maricopa
Location Conc. Pt 4
Project No. Shea Scottsdale Master-Plan Station C.P. 4
Name of Stream 75th Street Drainage

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	59	acres
	A_2		acres
	A_3		acres
Drainage Length		5000	feet
Elevation			
Top of Drainage Area		1378	feet
At Structure		1360	feet
Drainage Area Slope		0.56	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc $\frac{5000'}{3 \text{ fps}}$	28	minutes
Rainfall Intensity	i	4.1	inches/hour
Runoff Coefficient	C_1		
	C_2		
	C_3		
Weighted Runoff Coefficient	C	0.52	
Peak Discharge Qp = CiA =		126	cfs

Computed by C. Lovely Date 8-8-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Miller and Shea Blvd County Maricopa
Location Concentration Point 5, S.E. corner Parcel 16
Project No. Shea Scottsdale Master Plan Station CP #5
Name of Stream Miller Rd Drainage Area

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	63	acres
	A_2		acres
	A_3		acres
Drainage Length		5700	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1352	feet
Drainage Area Slope		0.63	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	$\frac{5700}{3 \times 60}$ = 32	minutes
Rainfall Intensity	i	3.75	inches/hour
Runoff Coefficient	C_1		
	C_2		
	C_3		
Weighted Runoff Coefficient	C	0.52	
Peak Discharge Qp = CiA =		123	cfs

Computed by C. Lovely Date 8-8-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 75th St & Miller Rd. above Shea County Maricopa
Location Panc. Pt. 6 So. border parcel 17
Project No. Shea Scottsdale Master Plan Station C.P. 6
Name of Stream Drainage above 10x3 CBC at Shea Blvd.

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	140	acres POST DEVELOPMENT CONDITIONS
	A_2		acres
	A_3		acres
Drainage Length		6000	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1352	feet
Drainage Area Slope		0.60	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	33	minutes
Rainfall Intensity	i	3.70	inches/hour
Runoff Coefficient	C_1	122 ac CN 87	
	C_2	18 ac CN 90	
	C_3	WTD. CN = 87.4	
Weighted Runoff Coefficient	C	0.52	
Peak Discharge Qp = CiA =		269	cfs

Computed by C. Lovely Date 8-8-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

LOCATION DATA:

Highway _____ County Maricopa

Location Area above 10.3 CBC

Project No. Shea Scottsdale Master Plan Station C.P. 6

Name of Stream C.P. 6

DESIGN DATA:

Design Frequency	100	years
Drainage Area	0.22	square miles
Drainage Length	6000	feet
Elevation		
Top of Drainage Area		feet
At Structure		feet
Drainage Area Slope	0.60	%
Drainage Width	1100	feet
Width factor W_f	1.08	
Vegetative Cover Type		
Vegetative Cover Density		%
Soil Group	B	
Precipitation		
P = 6 hour =		inches
P = 24 hour =		inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.47	inches
Curve Number		87	
Runoff	Q =	1.4	inches
Time of Concentration	Tc	.55	hours
Time of Peak	Tp = (Tc)(W_f)	.59	hours
Peak Discharge	$Qp = \frac{484AQ}{Tp} =$	$\frac{484(0.22)1.4}{.59}$	
	=	253	cfs

Computed by C. Lovely Date 8/8/85

6/16

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Shea Scottsdale Master Plan County Maricopa
Location Conc. Pt. 7 SW corner parcel 15
Project No. _____ Station C.P. 7
Name of Stream Drainage above 8x2 CBC at Shea Blvd.

DESIGN DATA

Design Frequency		100 years
Drainage Area	A_1	73.5 acres
	A_2	23.64 acres
	A_3	Total = 97.14 acres
Drainage Length		5180 feet
Elevation		
Top of Drainage Area		1388 feet
At Structure		1350 feet
Drainage Area Slope		0.73 %
Precipitation		
P = 6-hour		_____ inches
P = 24-hour		_____ inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47 inches
Time of Concentration	Tc	38 minutes
Rainfall Intensity	i	3.3 inches/hour
Runoff Coefficient	C_1	73.5 ac CN 87
	C_2	23.6 ac at CN 92
	C_3	Wtd CN 88.0
Weighted Runoff Coefficient	C	0.55
Peak Discharge Qp = CiA =		176 cfs

Computed by C. Lovely Date 8-8-85
Recalculated 9-19-85
C. Lovely

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

LOCATION DATA:

Highway S-S Master Plan County Maricopa
Location Area above 2 x 2 CBC
Project No. Shea Scottsdale Master Plan Station C.P. 7
Name of Stream

DESIGN DATA:

Design Frequency	100	years
Drainage Area	0.15	square miles
Drainage Length	5180	feet
Elevation		
Top of Drainage Area		feet
At Structure		feet
Drainage Area Slope	0.73	%
Drainage Width	650	feet
Width factor W_f	1.1	
Vegetative Cover Type		
Vegetative Cover Density		%
Soil Group	B	
Precipitation		
P = 6 hour =		inches
P = 24 hour =		inches

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.47	inches
Curve Number		88	
Runoff	Q =	1.5	inches
Time of Concentration	Tc	0.63	hours
Time of Peak	$Tp = (Tc)(W_f)$	0.69	hours
Peak Discharge	$Qp = \frac{484\,AQ}{Tp} = \frac{484(0.15)1.5}{0.69}$		
	=	158	cfs

Computed by C. Lovely Date 8-8-85
Recalc. 9-19-85
C. Lovely

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Gold Dust Ave. County Maricopa
Location S.W. corner Parcel 12
Project No. Shea Scottsdale Master Plan Station C.P. 8
Name of Stream Area above proposed CBC at 74th and Gold Dust
Including 1/2 runoff from Windmill Plaza.

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1 C.P.-7	97.14	acres
	A_2 P. 11+12+Windmill Plaza	29.8	acres
	A_3 Total	126.9	acres
Drainage Length		6430	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1343	feet
Drainage Area Slope		0.70	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	45	minutes
Rainfall Intensity	i	3.0	inches/hour
Runoff Coefficient	C_1	97.1 ac CN 88	
	C_2	30 ac CN 92	
	C_3	UTD CN 89	
Weighted Runoff Coefficient	C	.58	
Peak Discharge Qp = CiA =		220	cfs

Computed by C. Lovely Date 8/8/85
Recalc. 9-19-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Mountain View and Scottsdale Rd County Maricopa
Location S.W. corner Parcel 9
Project No. Shea Scottsdale Rd Station C.P. 9
Name of Stream Area above existing Double 8x3' CBC.

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1 C.P. 8	126.9	acres
	A_2 P7-10 + W.P.	53	acres
	A_3 Total	179.9	acres
Drainage Length		8230	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1335	feet
Drainage Area Slope		0.64	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	56	minutes
Rainfall Intensity	i	2.60	inches/hour
Runoff Coefficient	C_1	126.9 ac CN 89	
	C_2	39 ac CN 91 + 14 ac at 98	
	C_3	WTD CN 90	
Weighted Runoff Coefficient	C	0.60	
Peak Discharge Qp = CiA =		281	cfs

Computed by C. Lovely Date 8/2/85
Recalc. 9-19-85

Hydrologic Design Data Sheet CP 10

Recalculation of Peak Q100 at CP 108 and 109 PVSP Report
(Shown as CP10 on Master Drainage Plan)

Contributing subwatershed areas need to be added above CP 108 and 109 to reflect differences in existing conditions from the original assumptions in the PVSP. Without going thru the detailed routing procedure which would regenerate the PVSP study to create a new peak I propose just increasing the design Q by adding a cfs/sq.mi. to reflect the additional contributing area which were not included in the original calculations for CP109 or 108.

Original Q100 at CP108 = 1090 cfs
CP109 = 1251 cfs

Above CP108 areas B-1, B-7, B-8 plus C-5 and C-6 needs to be added: a total of 730 acres. These areas would not be routed thru any basins therefore the "no project" Q100 cfs/sq.mi. will be used to adjust the Q100 at Cp's for the additional drainage area.

In the PVSP a range of Q100/sq.mi. for the areas checked equal 1600-3000 cfs/sq.mi. assume average 2300 csm.

730 acres = 1.14 sq.mi. x 2300 = 2623

Present Condition Q100 at CP108 = 1090 + 2623 = 3713

Realizing peaks are not directly additive, say there is only 2000 cfs added to the 1190 at Q100 at 3090 cfs. This is still almost three times the design capacity of the 71st Street channel.

This is being recalculated using HEC-1 Model and results will be included in the West Side Addendum to be submitted later.

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Shea-Scottsdale Master Plan County Maricopa
Location Outlet of Channel S.E. Corner-Parcel 12
Project No. 840827-2 Station C.P. 11
Name of Stream POST DEVEL. CONDITIONS

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	140	acres
	A_2	15	acres
	A_3	3	acres
Drainage Length		7250	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1344	feet
Drainage Area Slope		0.62	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	35.5	minutes
Rainfall Intensity	i	3.5	inches/hour
Runoff Coefficient	C_1	140 at 87	
	C_2	15 at 90	
	C_3	3 at 98	
Weighted Runoff Coefficient	WTD CN =	87.5	
	WTD. "C" =	0.52	
Peak Discharge Qp = CiA =		288	cfs

Computed by C. Lovely Date 9-19-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Shea-Scottsdale Master Plan County Maricopa
Location S.E. Corner Parcel # 8
Project No. 840827-2 Station C.P. 12
Name of Stream Channel along side proposed road below Goldust

DESIGN DATA

Design Frequency		5 100	years
Drainage Area	A_1	154	acres
	A_2		acres
	A_3		acres
Drainage Length		7100	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1339.5	feet
Drainage Area Slope		0.68	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		1.34 2.47	inches
Time of Concentration	Tc	47	minutes
Rainfall Intensity	i	1.55 2.90	inches/hour
Runoff Coefficient	C_1		
	C_2		
	C_3		
Weighted Runoff Coefficient	C	0.60	
Peak Discharge Qp = CiA =		Q_5 = 143 Q_{100} = 268	cfs

Computed by C. Lovely Date 9-20-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Shea-Scottsdale Master Plan County Maricopa
Location S.W. Corner Parcel # 8
Project No. 840827-2 Station C.P. 13
Name of Stream Channel between Parcels 8+9

DESIGN DATA

Design Frequency		5 / 100	years
Drainage Area	A_1	164	acres
	A_2		acres
	A_3		acres
Drainage Length		7750	feet
Elevation			
Top of Drainage Area		1328	feet
At Structure		1337	feet
Drainage Area Slope		0.65	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		1.34 / 2.47	inches
Time of Concentration	Tc	50	minutes
Rainfall Intensity	i	1.45 / 2.8	inches/hour
Runoff Coefficient	C_1		
	C_2		
	C_3		
Weighted Runoff Coefficient	C	0.60	
Peak Discharge Qp = CiA =		Q_5 = 143 Q_{100} = 275	cfs

Computed by C. Lovely Date 9-20-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

PRE-DEUELOPMT. CONDITIONS

Highway Shea-Scottsdale Master Plan County Maricopa
Location C.P. 6 South border of Parcel 17
Project No. 240227-2 Station C.P. 6
Name of Stream Area above existing 10x3 CBC

DESIGN DATA

Design Frequency		100 years
Drainage Area	A_1	140 acres
	A_2	acres
	A_3	acres
Drainage Length		6000 feet
Elevation		
Top of Drainage Area		1388 feet
At Structure		1352 feet
Drainage Area Slope		0.60 %
Precipitation		
P = 6-hour		inches
P = 24-hour		inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47 inches
Time of Concentration	Tc	35 minutes
Rainfall Intensity	i	3.5 inches/hour
Runoff Coefficient	C_1	122 ac at 87
	C_2	18 ac at 83
	C_3	WTD CN 96
Weighted Runoff Coefficient	C	WTD "C" = 0.51
Peak Discharge Qp = CiA =		249 cfs

Computed by C. Lovely Date 9-19-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

PRE-DEVEL. CONDITIONS

Highway Shea Scottsdale Master Plan County Maricopa
Location Pre-Development Conditions
Project No. _____ Station CP 7
Name of Stream CP #7

DESIGN DATA

Design Frequency		100 years
Drainage Area	A_1	73.5 acres
	A_2	23.6 acres
	A_3	Total 97.14 acres
Drainage Length		5180 feet
Elevation		
Top of Drainage Area		1388 feet
At Structure		1350 feet
Drainage Area Slope		0.73 %
Precipitation		
P = 6-hour		_____ inches
P = 24-hour		_____ inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47 inches
Time of Concentration	Tc	38 minutes
Rainfall Intensity	i	3.3 inches/hour
Runoff Coefficient	C_1	73.5ac CN 87
	C_2	23.6ac CN 83
	C_3	wtd CN = 86
Weighted Runoff Coefficient	C	WTD "C" 0.50
Peak Discharge Qp = CiA =		160 cfs

Computed by C. Lovely Date 8-12-95

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Pre-Development Conditions County Maricopa
Location S.W. corner of Parcel 12
Project No. Shea Scottsdale Master Plan Station C.D. 8
Name of Stream C.D. 8 -

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	97.14	acres
	A_2	29.80	acres
	A_3	Total 126.9	acres
Drainage Length		[illegible]	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1343	feet
Drainage Area Slope		0.70	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	48	minutes
Rainfall Intensity	i	2.9	inches/hour
Runoff Coefficient	C_1	97.1ac at CN 86	
	C_2	30ac at 83	
	C_3	WtdCN = 85.3	
Weighted Runoff Coefficient	C	C = 0.47	
Peak Discharge Qp = CiA =		173	cfs

Computed by C. Lovely Date 8/12/85
Recalc. 9-19-85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

PRE-DEVEL.

LOCATION DATA

Highway Pre-Development Conditions County Maricopa
Location Double CBC across Scottsdale Rd at Mt. View Road
Project No. Shea Scottsdale Master Plan Station C.P. #9
Name of Stream C.P. 9

DESIGN DATA

Design Frequency		100 years
Drainage Area	A_1	126.9 acres
	A_2	53.0 acres
	A_3	Total 179.9 acres
Drainage Length		8230 feet
Elevation		
Top of Drainage Area		1388 feet
At Structure		1335 feet
Drainage Area Slope		0.64 %
Precipitation		
P = 6-hour		inches
P = 24-hour		inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47 inches
Time of Concentration	Tc	60 minutes
Rainfall Intensity	i	2.47 inches/hour
Runoff Coefficient	C_1	127.9 ac. at CN 86
	C_2	39 ac at 83
	C_3	14 at 98
Weighted Runoff Coefficient	C	Wtd CN = 86.3 C = 0.51
Peak Discharge Qp = CiA =		227 cfs

Computed by C. Lovely Date 8/12/85

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway Shea-Scottsdale Master Plan County Maricopa
Location Outlet of Channel S.E. Corner Parcel 14
Project No. 840827-2 Station C. P. 11
Name of Stream PRE-DEVELOPMENT CONDITIONS

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	140	acres
	A_2	15	acres
	A_3	3	acres
Drainage Length		7050	feet
Elevation			
Top of Drainage Area		1388	feet
At Structure		1344	feet
Drainage Area Slope		0.62	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	37.5	minutes
Rainfall Intensity	i	3.4	inches/hour
Runoff Coefficient	C_1	140ac at 86	
	C_2	15ac at 83	
	C_3	3 at 98	
Weighted Runoff Coefficient	WTD.CN =	86.6	
	WTD. "C" = 0.51		
Peak Discharge Qp = CiA =		274	cfs

Computed by C. Lovely Date 9-19-85

Coller, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929

JOB NO.

JOB Shea-Scottsdale Master Plan

SHEET NO. 1 OF 7

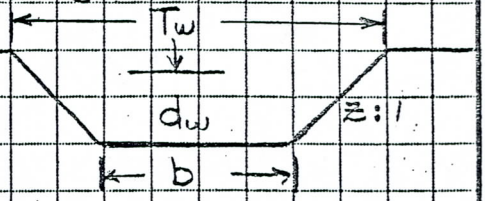
CALCULATED BY C. Lovely DATE 9-20-85

CHECKED BY DATE

SCALE Job No. 840827-2

CHANNEL SIZE CALCULATIONS

LOCATION: Between C.P.-6 and C.P.11 - Parcel 14



Q_{100} = 288 cfs

n = .024 unlined excavated earth

z = 4 : 1

s = 0.0040 will require drop structures to achieve this slope.

b = 20 ft

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} s^{1/2}$ using King's Handbook Tables:

1. $b^{8/3}$ = 2947

2. $s^{1/2}$ = .0632

3. $K' = \frac{Q n}{b^{8/3} s^{1/2}} = \frac{288 \times .024}{2947 \times .0632} = \frac{6.912}{186.2} = .0371$

4. For K' = .0371 and z = 4:1 d/b = 0.10

5. $d_w = b \times d/b$ = 2.0 ft R = 1.534

6. $V = \frac{1.486 R^{2/3} s^{1/2}}{n} = \frac{1.486 (1.534)^{2/3} (.0632)}{.024}$ = 5.2 fps

T_w = 44 ft, with 1 ft. freeboard, channel depth of 3 ft.

The design Q_{100} of 288 is the maximum amount at the mouth of the channel. Upper reaches of this channel will be passing slightly smaller flows transitioning to Q_{100} of 268 entering at Shea Blvd. ∴ channel velocities will also be slightly less.

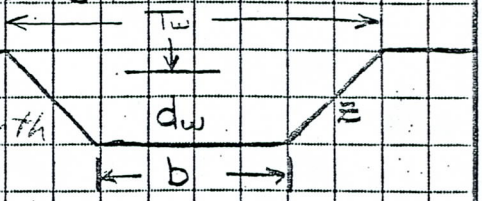
Coller, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2972 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHOENIX—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929

JOB NO.

JOB Shea-Scottsdale Master Plan
SHEET NO. 2 OF 7
CALCULATED BY C. Lovely DATE 9-20-85
CHECKED BY _____ DATE _____
SCALE Job No. 840827-Z

CHANNEL SIZE CALCULATIONS

LOCATION: Between CF 3 and CF 7 - Parcel 15



Q_{100} = 176 cfs
n = .024 unlined excavated earth
z = 4 : 1
s = .0045 (a two foot drop structure is proposed to achieve this slope, if necessary.)
b = 12 ft.

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} s^{1/2}$ using King's Handbook Tables:

1. $b^{8/3}$ = 755

2. $s^{1/2}$ = .0671

3. $K' = \frac{Qn}{b^{8/3} s^{1/2}} = \frac{176 \times .024}{755 \times .06} = .0834$

4. For $K' = .0834$ and $z = 4:1$ $d/b = .153$

5. $d_w = b \times d/b = 12 \times 0.153 = \underline{1.84 \text{ ft}}$

6. $V = \frac{1.486 R^{2/3} s^{1/2}}{n} = \frac{1.486 (1.31)^{2/3} (.0671)}{.024} = \underline{4.97 \text{ fps}}$

Add: 1 ft. Freeboard ; Channel depth = 2.84 ft ≈ 3.0

(T_w) Topwidth = 24.8 ft ≈ 36 ft

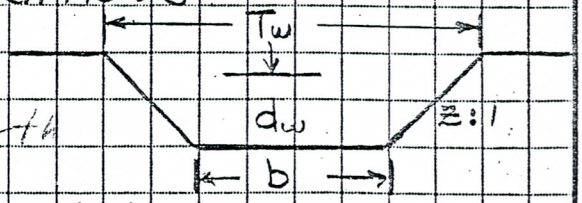
FORM 204-1

Collar, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
9972 NORTH 90TH STREET
SCOTTSDALE, ARIZONA 85251
PINETOP–LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
JOB NO.

JOB Shea-Scottsdale Master Plan
SHEET NO. 3 OF 7
CALCULATED BY C. Lovely DATE 9-20-85
CHECKED BY DATE
SCALE Job No. 840827-Z

CHANNEL SIZE CALCULATIONS

LOCATION: CP 7 to CP 8 Panels 1 / 4 12



Q_{100} = 220 cfs
n = .024 unlined excav. earth
Z = 4 : 1
S = .0043 will require one 2 ft drop structure to achieve this slope.
b = 16 ft.

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} S^{1/2}$ using King's Handbook Tables:

1. $b^{8/3} = 1625$

2. $S^{1/2} = 0.0656$

3. $K' = \frac{Q n}{b^{8/3} S^{1/2}} = \frac{220 \times .024}{1625 \times .0656} = \frac{5.28}{106.6} = .0495$

4. For $K' = .0495$ and $Z = 4:1$ $d/b = .116$

5. $d_w = b \times d/b = 16 \times .116 = \underline{1.86 \text{ ft}}$ $R = 1.39$

6. $V = \frac{1.486 R^{2/3} S^{1/2}}{n} = \frac{1.486 (1.39)^{2/3} (.0656)}{.024} = \underline{5.06 \text{ fps}}$

Velocities will only be this high at the extreme lower end of this channel, as the design Q_{100} of 220 is the maximum Q at the channel outlet. Flows entering this channel at Shea Blvd, Q_{100} = 176 cfs, significantly less than the outlet Q.

Add: 1 ft freeboard, channel depth 2.86 ≈ 3.0 ft.
T_w = 38.9 ft
$T_w \approx 40$ ft

FORM 204-1

Coller, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2929 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 945-8481
PHOENIX-LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 537-4870

JOB NO.

JOB Shea-Scottsdale Master Plan

SHEET NO. 4 OF 7

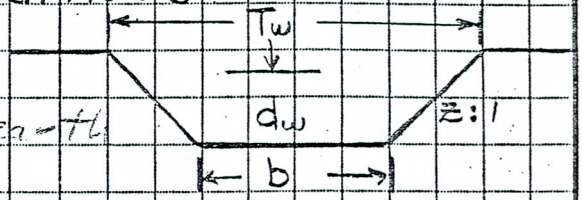
CALCULATED BY C. Lovely DATE 9-20-85

CHECKED BY DATE

SCALE Job No. 840827-2

CHANNEL SIZE CALCULATIONS

LOCATION: C.P. 8 to C.P. 12 - Parcel 8



Q_{100} = 220 cfs

n = .024 Unlined excav. earth

Z = 4:1

S = 0.0034 will require 1 ft. drop structure to obtain this slope

b = 16 ft

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} S^{1/2}$ using King's Handbook Tables:

1. $b^{8/3}$ = 1625

2. $S^{1/2}$ = .0587

3. $K' = \frac{Qn}{b^{8/3} S^{1/2}} = \frac{220 \times .024}{1625 \times .0587} = \frac{5.28}{95.39} = .0554$

4. For K' = .0554 and Z = 4:1 d/b = .123

5. $d_w = b \times d/b = 16 \times .123 = 1.97$ ft. R = 1.46

6. $V = \frac{1.486 R^{2/3} S^{1/2}}{n} = \frac{1.486 (1.46)^{2/3} .0587}{.024} = 4.6$ f.p.s.

Add ± 1 ft Freeboard, channel depth 2.97 ≈ 3.0 ft

T_w = 40 ft

FORM 204-1

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JOB NO.

JOB Shea-Scottsdale Master Plan

SHEET NO. 5 OF 7

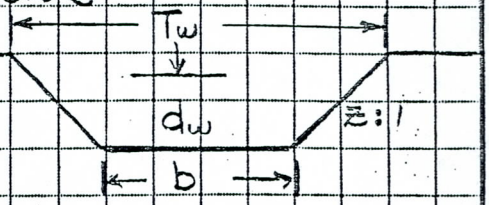
CALCULATED BY C. Lovely DATE 9-20-85

CHECKED BY DATE

SCALE Job No. 840827-2

CHANNEL SIZE CALCULATIONS

LOCATION: C.P. 12 to 13 Bethany Parcel 58+7



Q_{100} = 275 c.f.s.

n = .024 unlined excav. earth

z = 4:1

s = 0.0029

b = 20 ft

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} s^{1/2}$ using King's Handbook Tables:

1. $b^{8/3}$ = 2947

2. $s^{1/2}$ = .0539

3. $K' = \frac{Q n}{b^{8/3} s^{1/2}} = \frac{275 \times .024}{2947 \times .0539} = \frac{6.6}{158.8} = .0416$

4. For K' = .0416 and z = 4:1 d/b = .105

5. $d_w = b \times d/b = 20 \times .105 = \underline{2.1 \text{ ft}}$ R = 1.598

6. $V = \frac{1.486}{n} R^{2/3} s^{1/2} = \frac{1.486}{.024}(1.598)^{2/3}(.0539) = \underline{4.56 \text{ fps}}$

Add 1 ft Freeboard channel depth = 3.1 ft

Top width = 44.8 ft ≈ 45 ft

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2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-5458
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 224-4170

JOB NO.

JOB Shea-Scottsdale Master Plan

SHEET NO. 6 OF 7

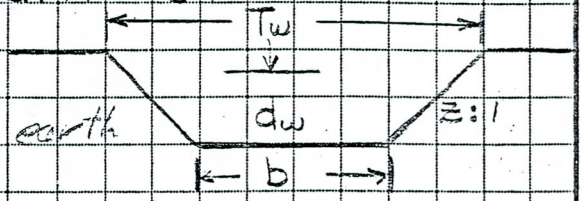
CALCULATED BY C. Lovelu DATE 9-20-85

CHECKED BY _____ DATE _____

SCALE Job No. 840827-2

CHANNEL SIZE CALCULATIONS

LOCATION: C.P. 13 to C.P. 9 - Panel 9



Q_{100} = 281 cfs

n = .024 cfs unlined excav. earth

z = 4:1

S = .0029 ft./ft. will require a one ft drop structure to obtain this slope

b = 20 ft

Solve for d_w and V based on $Q = \frac{K'}{n} b^{8/3} S^{1/2}$ using King's Handbook Tables:

1. $b^{8/3}$ = 2947

2. $S^{1/2}$ = .0539

3. $K' = \frac{Q n}{b^{8/3} S^{1/2}} = \frac{281 \times .024}{2947 \times .0539} = \frac{6.74}{158.8} = .0425$

4. For K' = .0425 and z = 4:1 d/b = .107

5. $d_w = b \times d/b = 20 \times .107 = \underline{2.14 \text{ ft}}$ R = 1.62

6. $V = \frac{1.486 R^{2/3} S^{1/2}}{n} = \frac{1.486 (1.62)^{2/3} (.0539)}{.024} = \underline{4.6 \text{ fps}}$

Add: 1 ft. Freeboard, channel depth = 3.14 ft

Top width = 45 ft.

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Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-8433
PINETOP-LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 536-4270

JOB NO. 840827

JOB Shea-Scottsdale Master Plan

SHEET NO. 7 OF 7

CALCULATED BY C. Lovely DATE 10-8-85

CHECKED BY _____ DATE _____

SCALE _____

Channel Design Assumptions

Channel sizes are based on preliminary site plans as currently proposed and design discharges under fully developed conditions.

Trapezoidal shapes are proposed in all cases with 4:1 side slopes. Excavated unlined earthen channels were assumed for design purposes. Straight, uniform channels in clean condition after weathering with gravel or short grass as cover was assumed in selection of the Manning's "n" value.

If in the final development of individual parcels, the owners wish to modify any channel as to location, shape, slope, size, landscaping, etc., the necessary provisions or adjustments shall be made to maintain the design flow capacity, the required freeboard, and nonerodible velocities.

Designs are based on velocities of less than 5 fps. during the 100 year event, therefore we are not recommending channel bed or bank protection in any of the relatively straight uniform sections of channels. Bank protection at the outside of bends and at constrictions shall be provided.

PROJECT: Briarwood North Shea-Scottsdale Master Plan DESIGNER: C. Lovely

74th Street Box Culvert C.P.3 DATE: 7/31/85

HYDROLOGIC AND CHANNEL INFORMATION

(3)

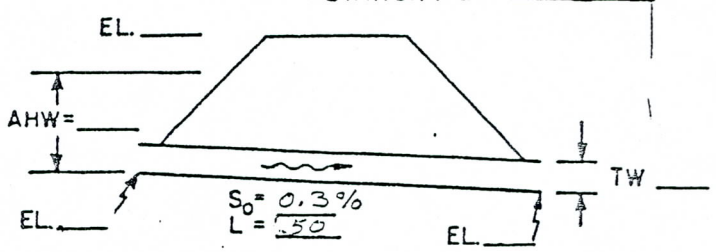
Q_{100} = 101 TW_1 = ____

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: ____



MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q Q_{100}/B_3	SIZE D	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING H W	OUTLET VELOCITY	COST	COMMENTS
10 x 2.5 CBC	10.1	2.5	0.93	2.33												HW ≤ D ∴ Inlet Control

SUMMARY & RECOMMENDATIONS:

Q_{100} = 101 cfs is based on existing conditions if a thru north south street were put thru between Cholla and Cactus along 73rd St align. Tc could be reduced significantly and Q_{100} increased, however, this culvert is oversized.

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DESIGN DATA

Design Frequency			years
Drainage Area	A		acres
Drainage Length			feet
Elevation			
Top of Drainage Area			feet
At Structure			feet
Drainage Area Slope			%

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour			inches
Time of Concentration	Tc		minutes
Rainfall Intensity	i		inches/hour
Weighted Runoff Coefficient			
Fully Developed	C		
Peak Discharge Qp = CIA =			

From Calc Sheet 3

PROJECT: Briarwood North
Shea-Scottsdale Master Plan-Between C.P. 5 and 6

DESIGNER: C. Loudy

DATE: 8-1-85

HYDROLOGIC AND CHANNEL INFORMATION

(4) 75th Place 10×3 CBC

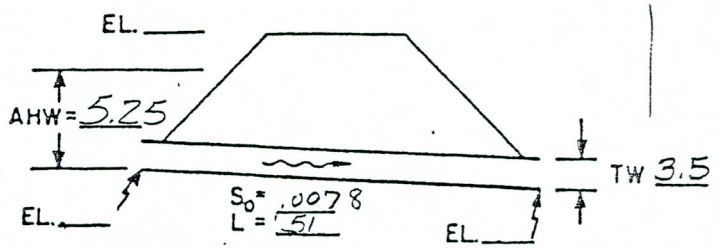
Q_{100} = .303 TW_1 = _____

Q_2 = _____ TW_2 = _____

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

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H+h_o-LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
10×3 CBC	303	10×3	2.0	6.0	0.4	2.4	3.0	3.0	3.3	3.3	0.21	5.49	6.0			HW too high
10×3.5 CBC	303	3.5	1.5	5.25	0.4	1.7	3.1	3.3	3.5	3.5	0.4	4.8	5.25			Use

SUMMARY & RECOMMENDATIONS:
Wingwall Flare 30-75°

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DESIGN DATA

Design Frequency		years
Drainage Area	A	acres
Drainage Length		feet
Elevation		
Top of Drainage Area		feet
At Structure		feet
Drainage Area Slope		%

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		inches
Time of Concentration	Tc	minutes
Rainfall Intensity	i	inches/hour
Weighted Runoff Coefficient		
Fully Developed	C	
Peak Discharge Qp = CIA =		

From Calc Sheet 3

PROJECT: Shea Scottsdale M.P. DESIGNER: C. Lovell

Existing: 10x3 Box 500 ft west of Miller Road DATE: 8/20

HYDROLOGIC AND CHANNEL INFORMATION

(6) C.P. 6

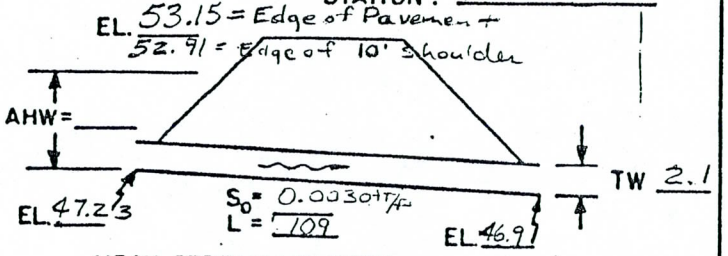
Q_{100} = 269 TW_1 = _____

Q_2 = _____ TW_2 = _____

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

SKETCH

STATION: 82+00



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q / Q_B	SIZE D	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
10x3 CBC	269/10 26.9	3'0	1.73	5.19	0.3	2.1	2.8	2.9	2.1	2.9	0.33	4.57	5.19			Handles Q O.K.

SUMMARY & RECOMMENDATIONS:

HW of 5.19 is Elev. of 52.42 ∴ water will not top road and be less than the elev. of the edge of 10 ft. shoulder.

FIGURE 3-42

PROJECT: SHEA BLVD DESIGNER: C. Lovey

Existing: 8 x 2 Box Just E. of Windmill Plaza DATE: 8/20

HYDROLOGIC AND CHANNEL INFORMATION

(7.) Concentration Pt. 7

Q_1 = 126 existing capacity TW_1 = _____

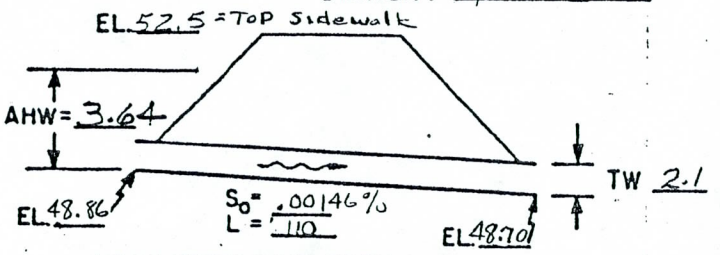
Q_2 = 197 - Q_{100} (8/8/85) TW_2 = _____

Q_3 = 176 - recalculated Q_{100} (8/20/85)

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

SKETCH

STATION: 70+07



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o-LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
8x2 CBC	15.7/ft	GIVEN 2.0	1.82	GIVEN 3.64	0.4	1.8		Q = 12 8 cfs		2.0	.16	3.64			126 cfs	CAPACITY TO TOP CURB
8x2 CBC	197/8 24.6	2.0	3.64	7.28	0.3	4.7			2.1	2.1	.16	6.64	7.28			OVERTOPS ROAD
Q/B must be		less	than	or	equal	to	15.7	cfs/ft								
therefore for			Q = 176		B = 11.2		round	to	12	feet						
Adding an additional 4x2 CBC	15.7	2.0	1.82	3.64											62 cfs	Additional capacity
															188	Total capacity

SUMMARY & RECOMMENDATIONS:

Add an additional 4x2 section to increase the capacity to 188 c.f.s. to prevent overtopping of Shea Blvd.

FIGURE 3-42

PROJECT: Shea-Scottsdale Master Plan

DESIGNER: C. Lovely

DATE: 9-20-85

HYDROLOGIC AND CHANNEL INFORMATION

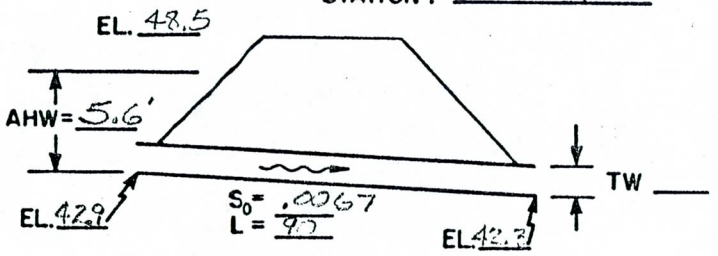
C.P. 8
Proposed culvert across Golddust + Ave.

Q_1 = 220 cfs TW_1 = _____
Q_2 = _____ TW_2 = _____

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

SKETCH

STATION: C.P. 8



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q 220/2	SIZE	HEADWATER COMPUTATION										CONTROLLING H W	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL HW = H + h_o − LS_o										
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
8x3 CBC	27.5	3'	1.7	5.1											HW Below AHW ∴ O.K.
10x3 CBC	22	3	1.4	4.2											Allows more Freeboard and not
10x2 CBC	11	2	1.3	2.16											as much backwater effect above culv.

SUMMARY & RECOMMENDATIONS:

Assume inlet control; and 2.6 ft of fill above top of culvert which results in AHW of D + 2.6 = 5.6'
Recommend 10 x 3 CBC instead of 8 x 3 because of lower HW.

FIGURE 3-42

PROJECT: Shea - Scottsdale Rd Master Plan

DESIGNER: C. Lovely

DATE: 9-20-85

HYDROLOGIC AND CHANNEL INFORMATION

C.P. 9 Existing Double 8 x 3 CBC under Scottsdale Rd.

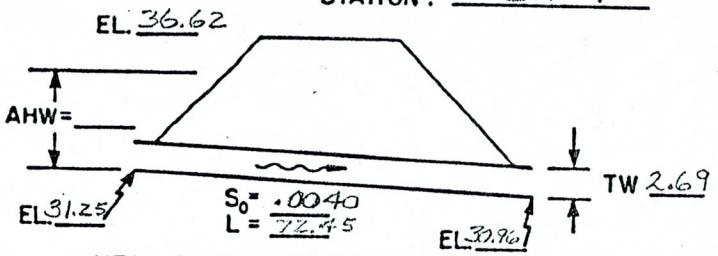
Q_{100} = 281 TW_1 = _____

Q_2 = _____ TW_2 = _____

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

SKETCH

STATION: C.P. 9



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q / Q/B	SIZE D	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL K_e	OUTLET CONTROL H	OUTLET CONTROL d_c	OUTLET CONTROL $\frac{d_c+D}{2}$	OUTLET CONTROL TW	OUTLET CONTROL h_o	OUTLET CONTROL LS_o	OUTLET CONTROL HW	CONTROLLING H W	OUTLET VELOCITY	COMMENTS
2 x 8 x 3	17.6	3	1.12	3.36	.4	.3	2.2	2.6	2.7	2.7	.29	2.7	3.4		OK without sediment
2 x 8 x 3	17.6	1.5	4.5	6.75	.4	3.4	2.2	1.85	2.7	2.7	.29	5.8	6.7		with sediment plugging 1/2 culv. road would be overtopped by 1.3 ft.

SUMMARY & RECOMMENDATIONS:

1.5 feet of sediment in bottom of culvert, if it remained during 100 year - Q the HW would top Scottsdale Rd., although sed. would probably be flushed out during large peak flows. Problem is extremely flat slope downstream. Sediment deposition will continue to be a problem during lower flow events clogging it. Only solution would be to raise inverts of culvert to provide a smooth transition into the existing culvert with adequate slope to carry sediment all the way through the culvert.

FIGURE 3-42

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Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-8433
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 536-4170

JOB NO.

JOB Shea Scottsdale Master Plan

SHEET NO. _____ OF _____

CALCULATED BY C. Lovely DATE 10-2-85

CHECKED BY _____ DATE _____

~~SCALE~~ STREET FLOW CALCS.

Summary Street Flow Calcs
East of Scottsdale Road.

All catch basin inlets and scuppers were sized to meet street flow spread criteria of less than 12 ft on local residential streets and to maintain a 12 ft wide dry lane on major collectors and arterial streets. In addition all inlets were sized so depths would no exceed 8" during the 100 year event.

Attached are: the discharge capacity calcs for inlets (A) thru (I); flow spread calcs for (A) thru (I); and the peak discharge calc sheets for street flow over above inlets (A) thru (I).

The calculations are based on preliminary street locations and designs as presently proposed. The values are general in nature and may be subject to revision if final site plans and design change any of basic information such as: right of way size; street size or type; longitudinal slope; length or location.

Collar, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-3482
PINETOP-LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 334-4270

JOB NO.

JOB: Shea-Scottsdale Master Plan
SHEET NO. 1 OF 15
CALCULATED BY C. Lovely DATE 10-7-85
CHECKED BY DATE
SCALE: STREET FLOW CALCS

DISCHARGE CAPACITY AT CATCH BASIN INLETS

A.) Grate Inlet in Top of Box Culvert on 75 place just North of Shea and above C.P. 6.

These grate inlets will collect street flow coming down the east and west gutters at 75 place.

GIVEN: The largest flow is in the East gutter

$Q_{25} = 0.8$ $Q_{100} = 1.5$ $Q_{100} = 2.2$ cfs

The inlet will be in a sump.

The ponding depth must be less than 8" or 0.66 ft.

FIND: If proposed grate size of 2'11" by 1'9" will pass 2.2 cfs without exceeding max. depth limit of 0.66 ft.

SOLUTION: Using Curve-A Fig. 3-48 at d = .66 ft

$$\frac{Q_i}{P} = 1.7 \text{ cfs per ft.}$$

$$P = \frac{Q_i}{1.7} = \frac{2.2}{1.7} = 1.83 \text{ ft.}$$

To compensate for clogging $2 \times P = 3.76$ ft

For 2.92' x 1.75 grate with 2.92' side against curb the minimum effective length = $3.76 - (2 \times 1.75)$

$= 0.26$ ft

Assume 60% clear space actual length = $\frac{0.26}{0.60}$

Minimum effective "P" = **0.43 ft**

Since proposed grate is 1.75 ft and greater the 0.43 ft it is more than adequate size.

B.) Length of Gutter Opening at 74 St. Catch Basins No. of Shea

Given: $Q_2 = 2.0$ cfs $Q_{100} = 5.75$ cfs per gutter

Gutter in Sump condition; 2" depressed at inlet

Gutter opening h = 5" Max depth Flow = 8" = 0.66'

$y_p/h = 8/5 = 1.6$ Fig. 3-47 capacity = 1.5 cfs/ft

length needed for 5.75 cfs = 5.75/1.5 = 3.8 ft

use 1.25 x 3.8 ft for clogging and length = **4.75 feet**

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Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-3432
PINETOP-LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 536-4179

JOB NO.

JOB Shea - Scottsdale Master Plans
SHEET NO. 2 OF 15
CALCULATED BY Q. Lovely DATE 10-8-85
CHECKED BY DATE
~~SCALE~~ STREET FLOW CALCS.

DISCHARGE CAPACITY AT CATCH BASIN INLETS CONT.

C.) Length of Gutter opening at C.B.'s on 74 St at transitions into Gold Dust at C.D. No. 8, east side of Box Culvert

Given: Q_{25} = 2.9 cfs Q_{100} = 8 cfs per gutter
Max. depth = 8" Sump condition 2" depressed inlet
Gutter opening h = 5"
y/h = 8"/5" = 1.6 Fig. 3-47 capacity = 1.5 cfs/ft
length for 8 cfs = 8/1.5 = 5.3 ft
clogging factor 1.25 x 5.3 = 6.7 feet each gutter

D) Length of Gutter Opening in No. Gutter of Gold Dust below Windmill Plaza

Q_{25} = 16.6 Q_{100} = 47 cfs of ½ E ½ Windmill Plaza
Assume Sump condition 2" depressed inlet
Gutter Opening 5" Max depth water = 8"
y/h = 1.6 Fig. 3-47 capacity = 1.5 cfs/ft
length 47 cfs = 47/1.5 = 11.3 ft
clogging factor 1.25 x 11.3 = 14.2 ft of opening

E) Length of Gutter Opening on So. side Gold Dust below Windmill Plaza.

Q_{25} = 1.0 Q_{100} = 2.6 cfs off So ½ Gold Dust
Sump condition 2" depressed inlet
Gutter opening 5" Max depth water 8"
y/h = 1.6 Capacity 1.5 cfs/ft
length for 2.6 cfs = 2.6/1.5 = 1.73 ft
clogging factor 1.25 x 1.73 = 2.2 ft
Needed length of opening = 2.2 feet

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Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-8433
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 536-4478

JOB NO.

JOB Shea - Scottsdale M.D.
SHEET NO. 3 OF 15
CALCULATED BY C. Lovely DATE 10-8-85
CHECKED BY DATE
SCALE STREET FLOW CALCS

DISCHARGE CAPACITY AT CATCH BASINS CON'T

E) Length of Gutter for C.B. in No. Gutter of Mountain View at Scottsdale Road

Given: $Q_2 = 7.5$ $Q_{100} = 21.2$ c.f.s.
Sump condition 2" depressed inlet
gutter opening 5" Max depth water 8"

$Y_o/h = 1.6$ Capacity 1.5 cfs/ft

length = 21.2/1.5 = 14.1
clogging factor = 1.25 x 14.1 = 17.7 ft
Opening needed = 17.7 ft

2) Length of gutter opening C.B. in east gutter of Scottsdale Road at Mt. View

Given: $Q_2 = 19$ $Q_{100} = 53$ cfs off W½ Windmill Plaza plus E½ Scottsdale Rd
Sump condition 2" depressed inlet
Gutter opening 5" max Water Depth 8"
$Y_o/h = 1.6$ Capacity 1.5 cfs/ft
9.5 cfs picked up a scupper near C.P. 13* 600 ft North ∴ 53 - 9.5 = 42.5 cfs
Length for 42.5 cfs = 42.5/1.5 = 28.3 ft
Clogging factor 1.25 x 28.3 = 35.5 ft
* see street flow spread edes. for (E)

4) Length of Curb opening for scupper at C.P. 12 along proposed 73rd St, West Gutter.

$Q_2 = 0.5$ cfs $Q_{100} = 1.3$ cfs
$S_L = 0.0049$ ft/ft $S_x = 0.02$ ft/ft $n = .016$
$a = 2$ inches

$$d = \left(\frac{Q n}{.56 Z S_o^{1/2}}\right)^{3/8} = \left(\frac{1.3(.016)}{.56(50)(.0049)^{1/2}}\right)^{3/8} = 0.18 \text{ ft}$$

$Q_a/L_a = .12$ cfs/ft $L_a = \frac{1.3}{.12} = 10.8$

No flow by is desired therefore 10.8 x 1.25 clogging factor and curb opening length need = 13.5 feet
$T = Zd = 50 \times .18 = 9$ ft which is less than 12' so OK.

Collar, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-8433
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 536-4270

JOB NO.

JOB Shea-Scottsdale Master Plan
SHEET NO. 4 OF 15
CALCULATED BY C. Lovely DATE 10-8-85
CHECKED BY DATE
SCALE STREET FLOW CALCS

(I) Curb opening for scuppers each side 74 St. at proposed 10 x 2.5 CBC at N.W. corner Parcel 15 near C.P. 3.

Given: $Q_{24} = 1.1$ $Q_{100} = 3.16$ cfs for gutter 2" depressed inlet gutter opening 5" maximum ponding depth 8"

$z = .004$ ft/ft $n = .016$ $S_x = .02$ ft/ft

$$d = \left(\frac{Q n}{.56 z S_o^{1/2}}\right)^{3/8} = \left(\frac{3.16 \times .016}{.56 \times 50 \times .004^{1/2}}\right)^{3/8} = 0.26 \text{ ft}$$

Fig 3-46a $d = .26$ $a = 0.167$ ft

$$\frac{Q_a}{L_a} = .175 \text{ cfs/ft} \qquad L_a = \frac{3.16}{.175} = \underline{18 \text{ ft}}$$

Need 18 ft to intercept all flow plus 1.25 clogging factor $1.25 \times 18 = \underline{22.6 \text{ ft}}$ each gutter

(J) See (J) page 5 of 15 for 15' x 5' scupper intercepting 9.5 cfs with flow by of 9.5 cfs.

Collar, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
2922 NORTH 70TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE: 947-8433
PINETOP—LAKESIDE OFFICE
LAKESIDE, ARIZONA 85929
PHONE: 334-4278

JOB NO.

JOB Shea Scottsdale Master-Plan
SHEET NO. 5 OF 15
CALCULATED BY R. Lovely DATE 10-8-85
CHECKED BY DATE
SCALE STREET FLOW CALCS

SPREAD OF STREET FLOW CALCS

Assume minimum cross slope 2%

using $d = \left(\frac{Qn}{.56 Z S_o^{1/2}}\right)^{3/8}$ and $T = Z d$

$Z = \frac{1}{s} = \frac{1}{.02} = 50$ ft @ 2% $n = .016$ Q = 2 year storm

$d = \left(\frac{Q(.016)}{28 S_o^{1/2}}\right)^{3/8} = \left(\frac{Q(.0006)}{S^{1/2}}\right)^{.375}$

Street

(A) 75 Place $d = \left(\frac{0.8(.016)}{28(.004)^{1/2}}\right)^{.375} = .16$ ft $T = 50 \times .16 = 7.9$ ft

(B) 74th St $d = \left(\frac{2.00 \quad .0006}{(.004)^{1/2}}\right)^{.375} = .23$ ft $T = 11.3$ ft

(C) 74th St $d = \left(\frac{2.88 \times .0006}{(.005 2)^{1/2}}\right)^{.375} = .10$ ft $T = 5.2$ ft

(D) N/A use Parkway catch basin to collect offsite flow from Windmill Plaza.

(E) Gold Dust S.½ $d = \left(\frac{1.00 \times .0006}{.004^{1/2}}\right)^{.375} = .17$ ft $T = 8.7$ ft

(F) Mt. View $d = \left(\frac{7.5 \times .0006}{.004^{1/2}}\right)^{.375} = .37$ ft $T = 18.6$ ft.

(G) Scottsdale Rd $d = \left(\frac{19 \times .0006}{.004^{1/2}}\right)^{.375} = .52$ $T = 26$ ft

(J) Intercept part of flow down Scottsdale Road via scupper into roadside channel near C.P. 13. 15' by 5" opening

for $d = .52$ $a = 0.167$ (2") use Fig 3-46a

$Q_a = 19$ $\frac{Q_a}{L_a} = .375$ $L_a = \frac{19}{.375} = 50.7$ ft

Fig 3-46b $\frac{a}{d} = \frac{.167}{.52} = 0.32$ $\frac{L}{L_a} = \frac{15'}{50.7} = .30$

$\frac{Q}{Q_a} = 0.50$ $Q = 19(0.50) = 9.5$ cfs

19 cfs - 9.5 = 9.5 cfs will bypass and be picked up at (G) Scottsdale Rd and Mt View.

(I) 74 St $d = \left(\frac{.1 \times .016}{28 \times .004^{1/2}}\right)^{3/8} = 0.18$ $T = 50 \times .18 = 8.9$ ft

(H) $\left(\frac{10.5 \times .0006}{10.5 \times .0006}\right)^{.375} = .09$ $T = 50 \times .09 = 4.36$ ft

6/15

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

(A)

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway E ½ 75 Pl. Street Flow County Maricopa
Location E. Gutter Flow above C.B. at 75 Pl. N. of Shea
Project No. Shea-Scottsdale M.P. Station (A)
Name of Stream Street flow 75 Pl. from Desert Cove to Shea

DESIGN DATA

Design Frequency		2-10-100	years
Drainage Area	A_1	14' x 1060'	acres
	A_2	0.34	acres
Drainage Length		1060	feet
Elevation			
Top of Drainage Area		57.22	feet
At Structure		53.30	feet
Drainage Area Slope		0.37	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 1.65 2.47	inches
Time of Concentration	Tc	10	minutes 14
Rainfall Intensity	i	2.4 4.6 6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.95 Pavement	
Peak Discharge Qp = CiA =		0.8 1.5 2.2	cfs

Computed by C. Lovely Date 10-4-85

FIGURE 2-22

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(A)

LOCATION DATA

Highway W ± 75 ft. Street Flow County Maricopa
Location W. Gutter Flow above C.B. ± 75 ft N. of Shea
Project No. Shea 5-a-th-dale M.P Station (A)
Name of Stream Street Flow From Parker To Shea Blvd

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	14' x 240'	acres
	A_2	.077	acres
Drainage Length		200	feet
Elevation			
Top of Drainage Area			feet
At Structure			feet
Drainage Area Slope		0.50	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.95	
Peak Discharge Qp = CiA =		0.50	cfs

Computed by C. Lovely Date 10-4-85

FIGURE 2-22

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(B)

LOCATION DATA

Highway 74 st N. of Shea County ______
Location Gutter above C.B. at 74 st Shea
Project No. Shea Scottsdale M.P. Station (B)
Name of Stream Street Flow from 10x2.5 CBC To SHEA

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	2x 45' x 1360	acres
	A_2	2.8	acres
Drainage Length		1360	feet
Elevation			
Top of Drainage Area		59.0	feet
At Structure		53.5	feet
Drainage Area Slope		0.40	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4 6.8	inches/hour
Curve Numbers	CN_1	C = .95 for 40 ft pavement + concrete	
	CN_2	C = .30 for 50 ft dirt .1667	
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.60	
Peak Discharge Qp = CiA =		4.0 11.5	cfs 5.75 per gutter 2.00 per gutter

Computed by C. Lovely Date 10-2-85

FIGURE 2-22

9/15

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(C)

LOCATION DATA

Highway 74 St. County _____
Location South at Shea No. + So. Gutter E. of CBC at CP 8
Project No. _____ Station (C)
Name of Stream Street flows from Shea to Gold Dust

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	90 x 1940	acres
	A_2	4	acres
Drainage Length		1940	feet
Elevation			
Top of Drainage Area		1353	feet
At Structure		1247	feet
Drainage Area Slope		0.52	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4 6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.60 WTD	see 74th above Shea
Peak Discharge Qp = CiA =		5.76 16	cfs 8 cfs/gutter

Computed by C. Lovely Date 10-7-85

FIGURE 2-22

10/15

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(D)

LOCATION DATA

Highway 74 St S. Shea County
Location Runoff from E½ Windmill Plaza at S.E corner
Project No. Station Near CP 8 (D)
Name of Stream Gutter Inlet along No. Gutter of Gold Dust Below Windmill Plaza.

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	8.6	acres
	A_2		acres
Drainage Length		1250	feet
Elevation			
Top of Drainage Area		1350	feet
At Structure		1342.5	feet
Drainage Area Slope		0.60	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	14	minutes
Rainfall Intensity	i	2.1 5.9	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	.92	
Peak Discharge Qp = CiA =		16.6 47	cfs

Computed by C. Lovely Date 10-7-85

FIGURE 2-22

11/15

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD (E)

LOCATION DATA

Highway Gold Dust E. of Scottsdale Rd County _____
Location C.B. on So. Side Gold Dust Below C.D. 8 West of CBC.
Project No. _____ Station CD 8 (E)
Name of Stream Street Runoff S. ½ Gold Dust E. of Scottsdale Rd

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	45' x 620'	acres
	A_2	0.64	acres
Drainage Length		620	feet
Elevation			
Top of Drainage Area		44.9	feet
At Structure		42.4	feet
Drainage Area Slope		0.4	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4 6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	.60 WTD	
Peak Discharge Qp = CiA =		0.92 2.6	cfs

Computed by C. Lovely Date 10-7-85

FIGURE 2-22

12/15

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD (F)

LOCATION DATA

Highway Mountain View + Scottsdale Rd County _____
Location C.B. at No. Gutter Mtn. View just E. S.R.
Project No. _____ Station Near C.P. 9 (F)
Name of Stream Street Runoff from 74St to Scottsdale Rd and from 73rd St. So. of C.P. 12 and Interior streets in So. 1/2 of Parcel 10.

DESIGN DATA

Design Frequency		2	100 years
Drainage Area	A_1	60 x 3200	acres
	A_2	4.4	acres
Drainage Length		1480	feet
Elevation			
Top of Drainage Area		1341	feet
At Structure		1335	feet
Drainage Area Slope		0.4	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88	2.47 inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4	6.8 inches/hour
Curve Numbers	CN_1	38 Ft C=.95	.60
	CN_2	22 Ft C=.30	
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.71 WTD	
Peak Discharge Qp = CiA =		7.5	21.2 cfs

Computed by C. Lovely Date 10-7-85

FIGURE 2-22

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(G)

LOCATION DATA

Highway Scottsdale Rd + Mt View County _____
Location CB East Gutter East No. of Mt. View
Project No. _____ Station Near C.P. 9 (G)
Name of Stream Street Drainage from E½ Scotts. Rd from Shea to Mt. View plus W½ Windmill Plaza

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	2500' x 65'	acres-3.7
	A_2	W. ½ WINDMILL PLAZA	acres-8.6ac 12.3ac
Drainage Length		2500	feet
Elevation			
Top of Drainage Area		1350	feet
At Structure		1335	feet
Drainage Area Slope		0.60	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.83 2.47	inches
Time of Concentration	Tc	1250 at 1.6 fps 1250 at 4 fps 13+5 = 18	minutes
Rainfall Intensity	i	1.9 5.2	inches/hour
Curve Numbers	CN_1	8.6 ac at 92	
	CN_2	3.7 " at 60	
Weighted Curve Number	CN_W		
Runoff Coefficient	C	.82 WTD	
Peak Discharge Qp = CiA =		19 53	cfs

Computed by C. Lowery Date 10-7-85

FIGURE 2-22

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(H)

LOCATION DATA

Highway Proposed 73rd St County
Location Gold Dust to Grade break near C.P. 12
Project No. Station (H)
Name of Stream Street flow above C.P. 12 and Sewer in lot from Gold Dust to C.P. 12 and interior streets No. 1/2 Parcel 10.

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	55'x60'	acres
	A_2	94'x90' = .19	acres
Drainage Length		94	feet
Elevation			
Top of Drainage Area		1344	feet
At Structure		1339.8	feet
Drainage Area Slope		4.47	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4 6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	.95	
Peak Discharge Qp = CiA =		0.5 1.3	cfs

Computed by C. Lovell Date 10-7-85

FIGURE 2-22

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

(I)

LOCATION DATA

Highway 74 S+ No. of Shea County _____
Location Southern at Proposed 10x2.5 CBC at C.D. 3
Project No. _____ Station (I)
Name of Stream Street Runoff from G.B. E. of Scottsdale Rd. to 10x2.5 CBC. - All offsite Runoff -

DESIGN DATA

Design Frequency		2 100	years
Drainage Area	A_1	750' x 90'	acres
	A_2	1.55	acres
Drainage Length		750	feet
Elevation			
Top of Drainage Area			feet
At Structure			feet
Drainage Area Slope		0.4	%
Precipitation			
P = 6-hour			inches
P = 24-hour			inches

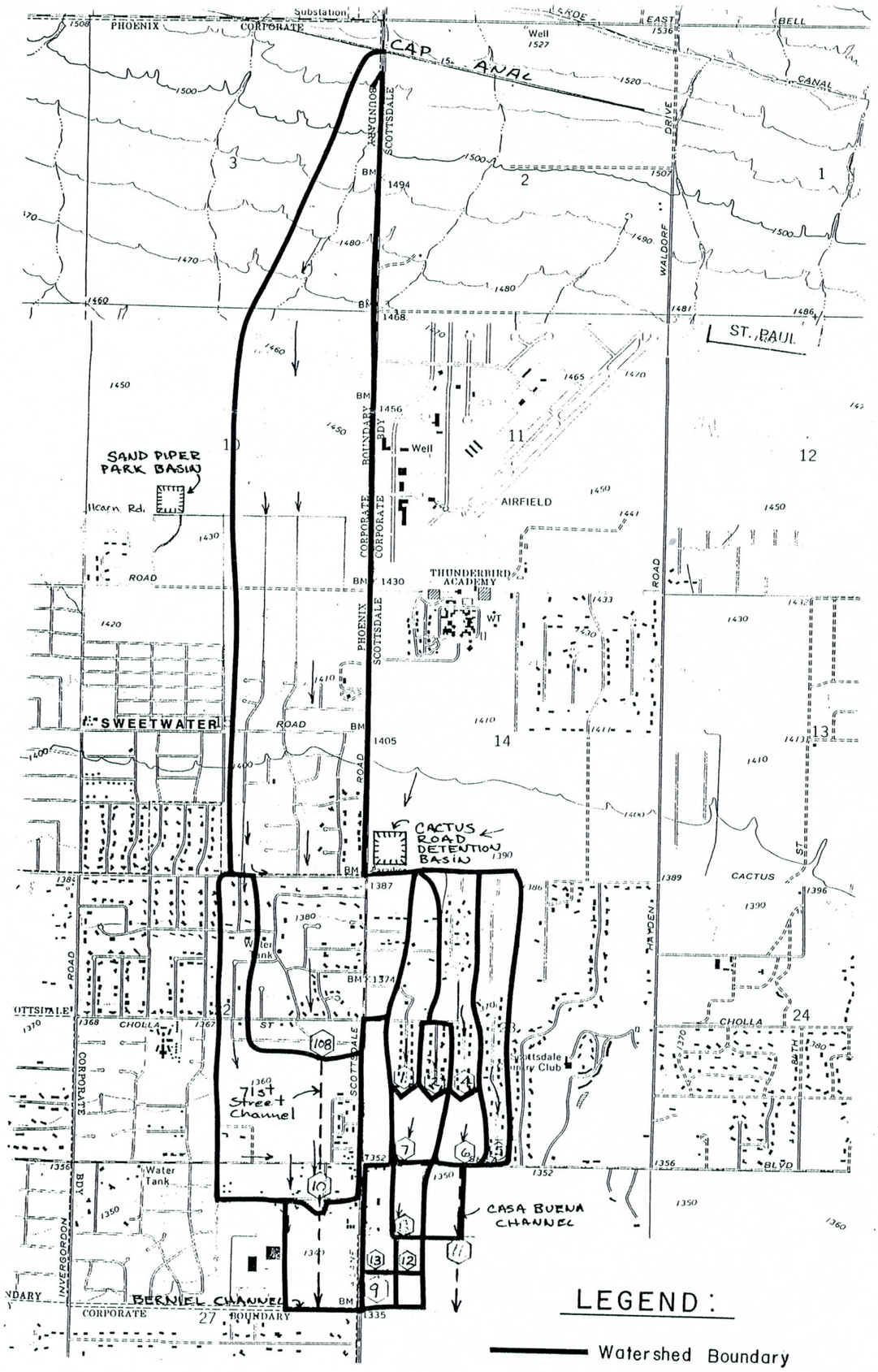
DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		0.88 2.47	inches
Time of Concentration	Tc	10	minutes
Rainfall Intensity	i	2.4 6.8	inches/hour
Curve Numbers	CN_1		
	CN_2		
Weighted Curve Number	CN_W		
Runoff Coefficient	C	0.60	

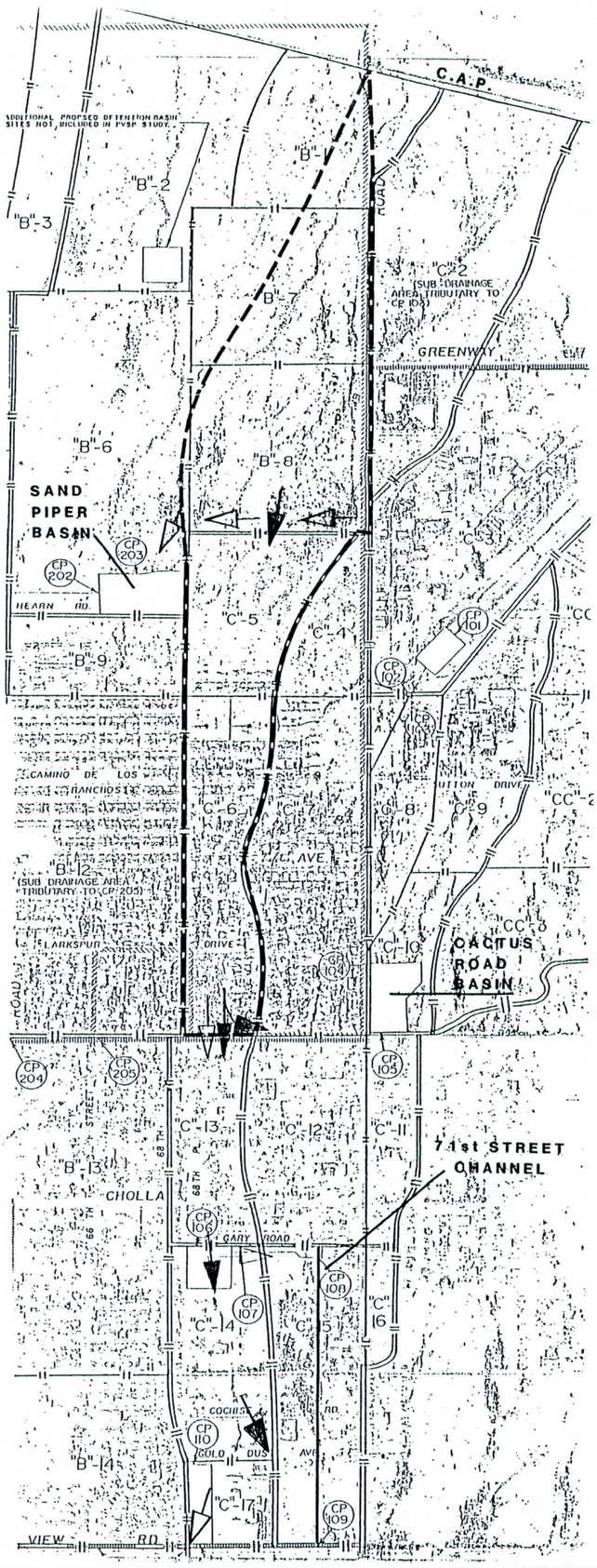
Peak Discharge Qp = CiA = 2.2 6.32 cfs
1.1 cfs 3.16 per gutter

Computed by C. Lovely Date 10-2-85

FIGURE 2-22



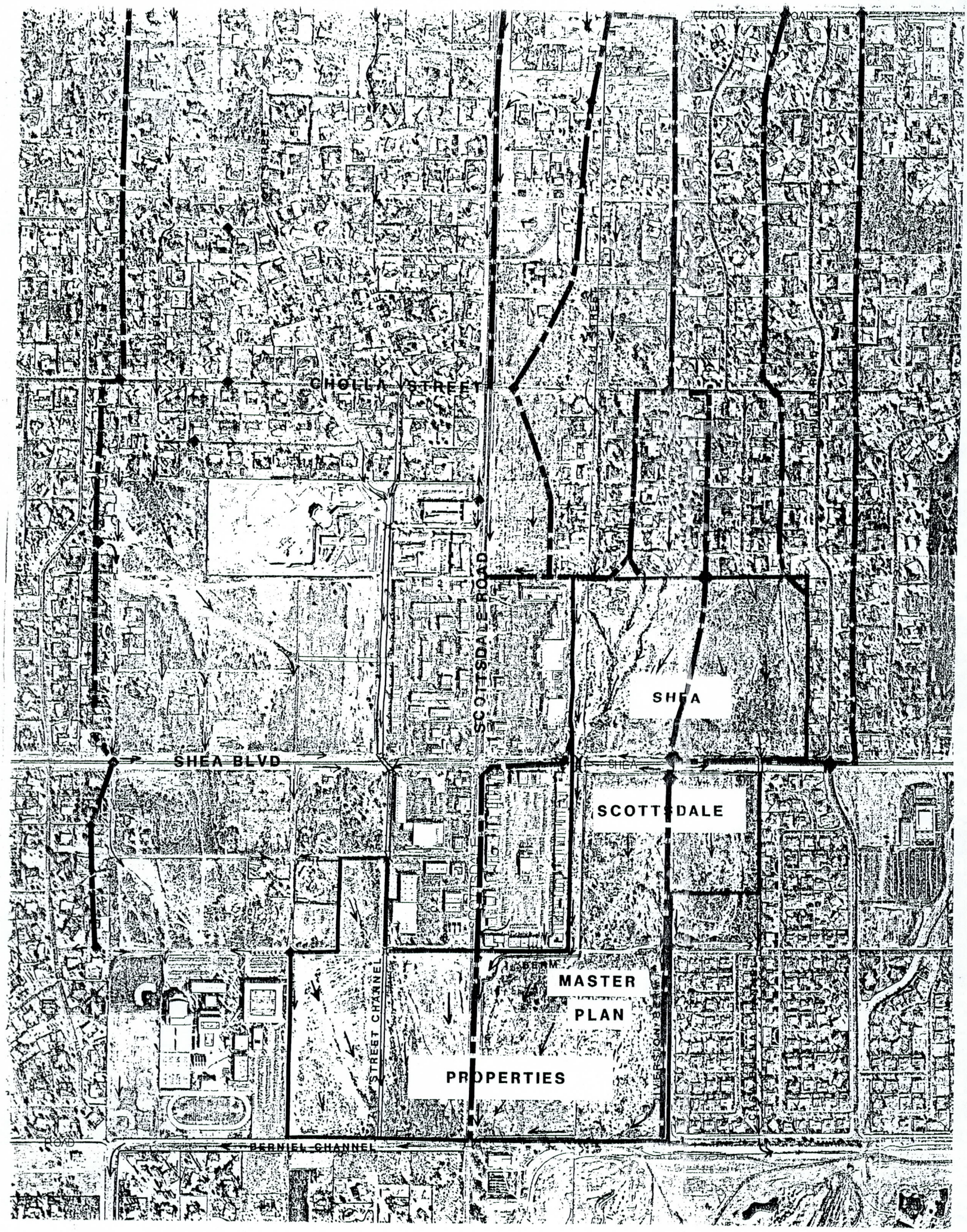
WATERSHED BOUNDARY MAP



LEGEND:

- ASSUMED DESIGN FLOW DIRECTION
- ACTUAL FLOW DIRECTION
- ADDITIONAL DRAINAGE AREA ABOVE C.P. 108
- WATERSHED BOUNDARY
- "C"-6 SUBWATERSHED AREA
- CP 106 DRAINAGE CONCENTRATION POINT

COPY OF DRAINAGE MAP FROM PVSP REPORT



LEGEND

- DIRECTION OF FLOW
- GRADE BREAK
- DRAINAGE AREA BOUNDARY

EXISTING FLOW CONDITIONS

SHEA - SCOTTSDALE

MASTER DRAINAGE PLAN

LEGEND

- DRAINAGE CONCENTRATION POINT
- PROPOSED DIRECTION OF FLOW
- EXISTING DIRECTION OF FLOW
- PROPOSED CATCH BASIN
- EXISTING CATCH BASIN
- PARCEL NUMBER
- PROPOSED GRADE BREAK
- EXISTING GRADE BREAK
- EXISTING DRAINAGE EASEMENT OR CHANNEL
- PROPOSED CHANNEL
- (A) LETTER CORRESPONDS TO HEADING LETTERS OF THE SECTION LABLED STREET FLOW CALCS. IN THE REPORT.
- PROPOSED SCUPPER

DATE 10-8-85

Collar, Williams & White Engineering, Inc.
Consulting Engineers and Land Surveyors
3912 NORTH 75TH STREET
SCOTTSDALE, ARIZONA 85251
PHONE 947-1422

JOB NO 840 827-2