Federal Emergency Management Agency

Washington, D.C. 20472

FEB 23 1995

FCD 90-65

DEADMAN WASH

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 95-09-196P

Mr. Ron Nevitt
Floodplain Administration
Flood Control District of
Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Community: Maricopa County, Arizona
Community Nos.: 040037, 040050, and 040051

106

Dear Mr. Nevitt:

This is in response to a facsimile transmittal dated February 16, 1995, from Mr. Bailang G. Sun, P.E., Project Manager, Howard Needles Tammen & Bergendoff (HNTB), regarding the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. With his February 16 facsimile transmittal, Mr. Sun submitted additional data in support of your November 5, 1993, request for a revision to the effective FIS report and FIRM for Maricopa County, Arizona and Incorporated Areas. You requested that we revise the FIS report and FIRM to show the effects of detailed hydrologic and hydraulic analyses of Deadman Wash from approximately 4,700 feet upstream of its confluence with the New River to approximately 14,600 feet upstream of Interstate Highway 17, Stream No. 4 from its confluence to approximately 7,600 feet upstream of its confluence with Deadman Wash, and Stream No. 7 from its confluence to approximately 5,300 feet upstream of its confluence with Deadman Wash. Deadman Wash, Stream No. 4, and Stream No. 7 were previously unstudied.

All data required to review this revision were submitted with your November 5 letter; with a letter dated December 27, 1994, from Mr. Tim Murphy, Hydrologist, Flood Control District of Maricopa County; and a letter dated February 14, 1995, from Mr. Sun and his February 16 facsimile transmittal.

We have completed our review of the data submitted and have determined that the items listed below represent the best available data for the flooding sources listed above.

- Volumes 1 and 2 of the report entitled "Deadman Wash Floodplain Delineation Study, FCD 90-65, Technical Data Notebook Hydrology," prepared by HNTB, dated July 1992, revised December 1992

- Volumes 1 and 2 of the report entitled "Deadman Wash Floodplain Delineation Study, FCD 90-65, Technical Data Notebook Hydraulic Analysis," prepared by HNTB, dated July 1992, revised December 1992

- Report entitled "Deadman Wash Floodplain Delineation Study, FCD 90-65, FEMA Forms RSD-1," prepared by Flood Control District of Maricopa County, undated

- Sheets 1 through 13 of the topographic work maps entitled "Flood Control District of Maricopa County, Floodplain Delineation Study of Deadman Wash, F.C.D. Contract No. 90-65," prepared by HNTB, undated

We will include this information in our next physical map revision of the FIRM for Maricopa County, Arizona and Incorporated Areas. The tentative date for the next preliminary FIRM is fall 1996. In the interim, your community may use these data in its floodplain management programs.

If you have any questions regarding this matter, please contact Mr. John Magnotti of our staff in Washington, DC, either by telephone at (202) 646-3932 or by facsimile at (202) 646-4596.

Sincerely,

Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate

cc: The Honorable Ken Forgia
Mayor, City of Peoria

The Honorable Skip Rimsza
Mayor, City of Phoenix

The Honorable Tom Rawles
Chairperson, Maricopa County
Board of Supervisors

Mr. Tim Murphy
Hydrologist
Flood Control District of
Maricopa County

Mr. Bailang G. Sun, P.E.
Project Manager
HNTB

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

June 16, 1995

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 W. Durango Street
Phoenix, Arizona 85009

RE: Deadman Wash Floodplain Delineation Study
Final Submittal
Maricopa County Contract No. FCD 90-65
HNTB Job Number: 15081

Dear Mr. Murphy:

Enclosed are six copies of our FEMA approved Final Technical Data Notebook - Hydrology and Hydraulic Analysis for the Deadman Wash Floodplain Delineation Study. In addition, we are also submitting six copies of Floodplain Delineation Maps with original mylars, and the roadway as-built plans used in the project.

If you have any questions or need additional information regarding the above, please give me a call.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF, INC.

Bailang Sun

Bailang G. Sun, P.E.
Project Manager

Enclosures

DEADMAN5.LTR
bgs/bms

Partners Charles T. Hennigan PE, Daniel J. Soigai PE, John L. Cotton PE, Robert S. Coma PE, Donald A. Dupies PE, James L. Tuttle, Jr. PE, Hugh E. Schell PE, George H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard D. Beckman PE, Richard L. Farnan AIA, Douglas E. Prescott PE, Ronald L. Hartje PE, H. Jerome Butler PE
Associates Kendall T. Lincoln CPA, Roberts W. Smitham PE, Ralph E. Robison PE, Walter Sharko PE, Frank T. Lamm PE, Blaise M. Carriere PE, Michael P. Ingardia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Douglas C. Myhre PE, Carl J. Mellea PE, Daniel F. Becker PE, Donald P. Keuth PE, Thomas L. Williams AIA, John E. Kupke PE, Rodney P. Pello PE, Steven M. Reiss AIA, Robert A. Leick PE, Glenn D. Sadulsky PE, Benjamin A. Whisler PE, Roger S. Austin PE, John D. Brothers PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarossi PE, F. Christopher Dimond ASLA AICP, Roland W. Frerking AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice D. Miller PE, Robert L. Watson AIA, James P. Pitz PE, Robert A. Crist PE, Beth Harmon-Vaughan IBD, F. Roy Madgwick AICP, Keith D. Rosbury AICP, A. James Scherzberg PE, Wayne San Filippo PE, Michael R. Duckett PE RLS, Kenneth R. Graham PE, Gerald H. Styler PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, MA, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN, New York, NY, Oklahoma City, OK, Orlando, FL, Overland Park, KS, Philadelphia, PA, Phoenix, AZ, Raleigh, NC, Seattle, WA, Suffern, NY, Tampa, FL, Tulsa, OK, Wilmington, DE

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

VOLUME 1 OF 2

Prepared For

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501

Prepared By

HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square
40 North Central Avenue
Suite 1100
Phoenix, Arizona 85004
(602) 528-4300

May, 1992
Revised December, 1992

Registered Professional Engineer (Civil)
CERTIFICATE NO.
20957
BAILANG
SUN
Date Signed 12/21/92
ARIZONA, U.S.A.

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Registered Professional Engineer (Civil) CERTIFICATE NO. 20957 BAILANG SUN Date Signed 12/21/92 ARIZONA, U.S.A.

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E. Culvert Hydraulic Calculations
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DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

STUDY DOCUMENTATION ABSTRACT

STUDY DOCUMENTATION ABSTRACT							
INITIAL STUDY	X	RESTUDY		LOMR		OTHER	

SECTION 1: GENERAL INFORMATION		
1 A	COMMUNITY	Maricopa County, Arizona
1 B	COMMUNITY NUMBER	040037
1 C	COUNTY	Maricopa
1 D	STATE	Arizona
1 E	DATE STUDY ACCEPTED	Pending
1 F	STUDY CONTRACTOR	HOWARD NEEDLES TAMMEN & BERGENDOFF
	CONTACTS	Mr. Richard M. Wells, P.E. Mr. B. Gary Sun, P.E.
	ADDRESS	Two Renaissance Square 40 North Central, Suite 1100 Phoenix, Arizona 85004
	PHONE	(602) 528-4300
	SUBCONSULTANTS	Aerial Mapping Company, Inc. McEwen Global Positioning Systems Project Engineering Consultants, Ltd. GIS Consultants of Arizona, Ltd.
1 G	TECH. REVIEWER (FEMA)	PENDING
	PHONE	
1 H	FEMA REGIONAL REVIEWER	PENDING
	PHONE	
1 I	STATE REVIEWER	Mr. David E. Creighton, Jr., P.E. Arizona Department of Water Resources
	PHONE	(602) 542-1541
1 J	LOCAL REVIEWER	Mr. Timothy M. Murphy Flood Control District of Maricopa County(FCDMC)
	PHONE	(602)506-1501
1 K	RIVER OR STREAM NAME	Deadman Wash and its Tributaries

STUDY DOCUMENTATION ABSTRACT			
1 L	REACH DESCRIPTION	a.	Deadman Wash, New River to future 22nd Avenue alignment (Approximately 10.5 miles)
		b.	Unnamed Tributary of Deadman Wash, Confluence with Deadman Wash to 29th Avenue (Approximately 1.5 miles)
		c.	Unnamed Tributary of Deadman Wash, Confluence with Deadman Wash to I-17 East Rest Area (Approximately 1 mile)
1 M	STUDY TYPE	Deadman Wash and two Unnamed Tributaries of Deadman Wash - Riverine Type. Detailed Study	
SECTION 2: MAPPING INFORMATION			
2 A	USGS QUAD SHEETS	a.	Daisy Mountain: 1981 Photo Revised, 1962 Photo Date, 40' Contour Interval (CI), 20' Supplementary Contour Interval (SCI)
		b.	New River SE: 1981 Photo Revised, 1962 Photo Date, 40' CI, 20' SCI
		c.	Biscuit Flat: 1981 Photo Revised, 1962 Photo Date, 20' CI, 10' SCI
		d.	New River: 1981 Photo Revised, 1962 Photo Date, 20' CI, 10' SCI
2 B	MAPPING FOR HYDROLOGIC STUDY		
	TYPE/SOURCE	USGS 7.5 Minutes Quadrangle Maps	
	SCALE	1"=2,000'	
	DATE	1964 & 1965, Photo Revised 1981	
2 C	MAPPING FOR HYDRAULIC STUDY		
	TYPE/SOURCE	Aerial Mapping by Aerial Mapping Company, Inc.	
	SCALE	1"=200' with 2' CI or 4' CI	
	DATE	October 11, 1991	
SECTION 3: HYDROLOGY			
3 A	MODEL OR METHOD USED (including vendor and version description)	U.S. Army Corps of Engineers' HEC-1 Model, Version 4.0, dated September 1, 1990, as implemented by Haestad Methods, Inc.	
3 B	STORM DURATION	6-Hour and 24-Hour Storms	
3 C	HYETOGRAPH TYPE	6 Hour Storm: FCDMC Distributions 24 Hour Storm: SCS Type II Distribution	

STUDY DOCUMENTATION ABSTRACT		
3 D	FREQUENCIES DETERMINED	100 - Year
3 E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	Deadman Wash near New River, AZ, USGS Station No. 09513820, Just west of I-17, 20 Years of Record
3 F	RAINFALL AMOUNTS AND REFERENCE	3.37 inches for a 6-Hour Storm 4.38 inches for a 24-Hour Storm Hydrologic Design Manual for Maricopa County, Arizona by FCDMC
3 G	UNIQUE CONDITIONS AND PROBLEMS	a. A Flow Split Exists at 1 mile north of Carefree Highway b. There are a number of Stock Tanks and the dam structures would likely fail during a 100-Year Storm Event
3 H	COORDINATION OF Q'S (agency, date, comments)	
SECTION 4: HYDRAULICS		
4 A	MODEL OR METHOD USED (including vendor and version description)	U.S. Army Corps of Engineers' HEC-2 Model, Version 4.6.2, dated May 1991, as implemented by Haestad Methods, Inc.
4 B	REGIME	Subcritical Flow
4 C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100 Year
4 D	METHOD OF FLOODWAY CALCULATION	Encroachment Method 1
4 E	UNIQUE CONDITIONS AND PROBLEMS	

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 1.2: Contact (Telephone) Reports

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

RECORD OF TELEPHONE CALL

JOB NO.: 15081
Date: 10-15-91

CALL TO Gary Sun OF HNTB
CALL FROM Tim Murphy OF FCDMC
BY Gary Sun 8:30 a.m.

SUBJECT DISCUSSED	ACTION TO BE TAKEN
Rights of Entry: Tim received one more phone regarding rights of entry. Margaret Hernandez Parcel No. 203-33-011B Phone: 484-9580 Address: Near 25th Ave. Irvine She objected this study. However, she said she'll allow our surveyors to work inside her property.	MJT

COPY TO: RMW

NOTE: This record to be retained in the master file.

GN119-0688

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

RECORD OF TELEPHONE CALL

Job No. 15081
Date: 10-8-91

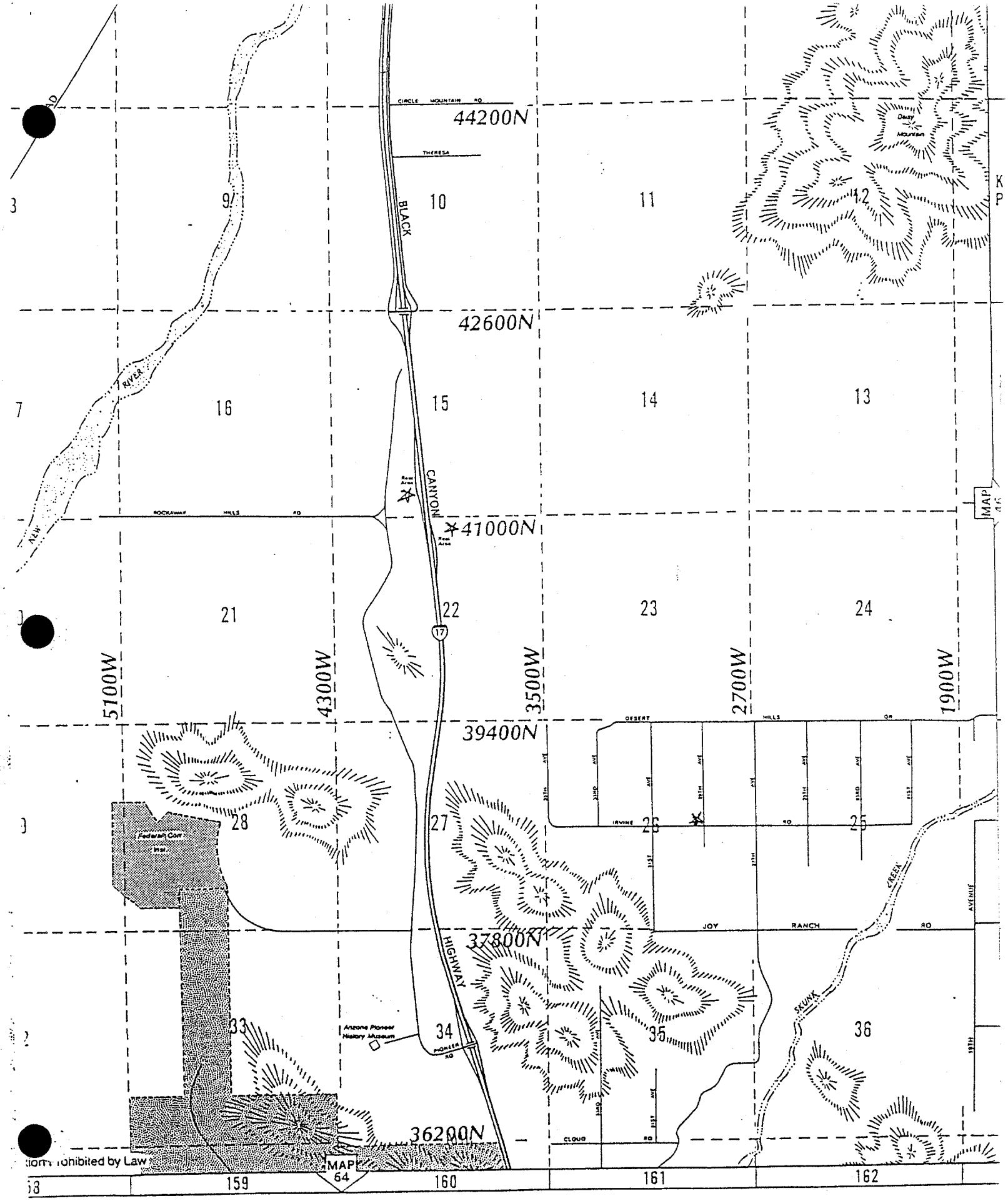
CALL TO Garf Sun OF HNTB
CALL FROM Tim Murphy OF FCDMC
BY Garf Sun 4:30 p.m.

SUBJECT DISCUSSED	ACTION TO BE TAKEN
Deadman Wash Flood Insurance Study Rights of Entry:	
Tim received two more phone calls regarding rights of entry. (See Attached Map)	
1. Avon Manery 2939 West Irvine Road ~~Phone~~ Tel. 581-8012 He has a loose dog.	MJT
2. ADOT Desert Hills Rest Area Contact Ms. Susanna Navarro for permit to conduct survey work in Parcel No. 203-10-7B and ADOT right-of-way. Tel. 255-7522 2140 West Hilton	RMW/MJT

COPY TO: RMW, MJT.

NOTE: This record to be retained in the master file.

GN119-0688


44200N
42600N
41000N
39400N
37800N
36200N
5100W
4300W
3500W
2700W
1900W
CIRCLE MOUNTAIN RD
THERESA
BLACK
CANYON
HIGHWAY
ROCKAWAY HILLS RD
DESERT HILLS DR
IRVINE RD
JOY RANCH RD
PIONEER RD
CLOUD RD
SKUNK CREEK
RIVER
Arizona Pioneer History Museum
Federal Ctr
MAP 64
MAP
159
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161
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DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 1.3: Meeting Minutes and Reports

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Floodplain Delineation Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** November 20, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy, Kofi Awumah
HNTB: Dick Wells, Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and discuss FCDMC review comments on the final floodplain boundaries and report.	BGS
2. Tim made review comments on the final floodplain boundaries and hydraulic analysis report. Items discussed and agreed upon were as follows:	
a. Sheet index for floodplain maps needs to include at least sheet lines, major roadways, and a vicinity map on the cover sheet.	A follow-up meeting is scheduled on 11/24/92 with GCA and FCDMC.
b. The floodplain and floodway lines should be a heavier line weight so they can show out better.	GCA
c. The hydraulic base line drawn did not match the line type shown in the legend.	GCA
d. The SECNO shown on Flood Profiles in Exhibit 1 should be more readable.	BGS
e. It was decided to combine HEC-2 models DM4FW, DM5FW and DM6FW.HC2 for Deadman Wash.	BGS

Authored By: Gary Sun GS **Issue Date:** November 23, 1992

Copy to: Attendees, Afshin Ahouraiyan - FCDMC
Lari Spire - GIS Consultants of Arizona, Ltd.(GCA)

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Floodplain Delineation Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** November 20, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy, Kofi Awumah
HNTB: Dick Wells, Gary Sun

Discussion	Action/Response
3. Gary also made a telephone conversation with Afshin to discuss his review comments on the final hydrology report (See attached review comments). Items discussed and agreed upon were as follows:	
1- agreed.	BGS
2- The sentence will be revised to state that "The following photograph represents the vegetation density transect taken for ....".	BGS
3- The sentence will be revised to read as "However, the Manual recommended that no adjustments of these parameters for the influence of land management should be made within Maricopa County (Reference 2).".	BGS
4- "rainfall pattern" in this sentence will be revised to "rainfall depth".	BGS
5- agreed.	BGS

Authored By: Gary Sun GS **Issue Date:** November 23, 1992

Copy to:

Attendees, Afshin Ahouraiyan - FCDMC
Lari Spire - GIS Consultants of Arizona, Ltd.(GCA)

To: TMM From: AA Subject: Deadman Wash Date: 11-04-92

The following are my comments on the revised copy (dated October 1992) of the Hydrology report for the Deadman Wash Floodplain Delineation Study. There are some minor corrections to the text that needs to be corrected before the final submittal to FEMA for their review.

1-On page 3-6 the underlined portion of the sentence needs to be corrected; " Special considerations were given to delineation of the sub-basins in order <u>to providing</u> discharge.....". The word **providing** should be changed to **provide.**

2-On page 3-11 the sentence reads; "The following vegetation density transect was taken for .....". The vegetation transect is not provided in the following paragraph or the following pages. Please provide the transect taken as part of the report.

3-After reading the Hydrology Manual more carefully I still have a problem with the following statement on page 3-19 of the report; "However, the Manual Recommended that no adjustments of three parameters should be made within Maricopa County." The Manual statement reads; " The procedures for incorporating the effects of soil crusting, ground cover,...., are not recommended for Maricopa County. A simplified procedure to adjust the bare ground hydraulic conductivity is recommended." Therefore the statement in the report is not correct as the Hydrology Manual does recommend that the hydraulic conductivity be adjusted in Maricopa County based on the vegetation cover of the area. Please correct the above mentioned sentence in the report accordingly.

4-On page 3-34 it is mentioned that " the model will select an appropriate rainfall pattern for each sub-basin based upon the drainage area size." This sentence is not clear and needs more clarification.

5-On page 3-48 change the following sentence; " <u>No 100 year, 24-hour flows have been modeled in the CVL's study.</u>" to " **The 100-year 24-hour flows have not been modeled in the CVL's study.**

Please call me if there are any questions.

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Floodplain Delineation Study	Job No.	15081
Meeting Location	FCDMC Conference Room	Meeting Date	October 19, 1992

Subject: Coordination Meeting

Present:

FCDMC: Kofi Awumah, Afshin Ahouraiyan
HNTB: Gary Sun GS

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. Gary submitted one copy of the Final Hydrology Report and two copies of the Final Hydraulic Analysis Report. Items discussed were as follows:	
a. All FCDMC comments have been addressed in the final reports.	
b. The flood profiles were included in Exhibit 1 of the Final Hydraulic Analysis Report and two sets of the floodplain delineation maps were submitted under a separate cover.	
c. Cross section plots were included in Appendix C of the Final Hydraulic Analysis Report. Cross sections for two tributaries modeled were not plotted and will be submitted later.	The remainder of cross-section plots were submitted on 10/27/92.

Authored By: Gary Sun Issue Date: October 27, 1992

Copy to: Attendees, Tim Murphy (FCDMC), Dick Wells

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Floodplain Delineation Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** September 9, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy, Kofi Awumah
HNTB: Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and discuss FCDMC review comments of the preliminary floodplain boundaries and report.	BGS
2. Tim handed out a copy of written review comments on the preliminary hydraulic analysis report. Items discussed and agreed upon were as follows:	
a. No X4 cards were used for Sections 3.639 and 3.648 and the comments will be deleted from the HEC-2 comment cards.	BGS
b. The last station on GR cards will be round off to match the station shown on the NH cards.	BGS
c. Comments will be added to the HEC-2 models where the ET card contains two encroachment information (7.1 and 9.1).	BGS
d. Tim will provide Gary with the New River hydrology so that the time of peak flow at Deadman Wash can be referenced in the report.	TMM/BGS

Authored By: Gary Sun GS **Issue Date:** September 10, 1992

Copy to: Attendees, Dick Wells

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Floodplain Delineation Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** September 9, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy, Kofi Awumah
HNTB: Gary Sun

Discussion	Action/Response
e. Tim will also check on the scale to be used on flood profiles and cross section plots.	TMM/BGS
f. Cross section plots will be prepared for every section used in the HEC-2 models and included in the final report.	TMM/BGS
3. Gary will incorporate these comments and submit the final hydraulic analysis report in the middle of October.	BGS

Authored By: Gary Sun GS **Issue Date:** September 10, 1992

Copy to: Attendees, Dick Wells

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Floodplain Delineation Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** July 22, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy
HNTB: Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and discuss the preliminary floodplain boundaries and report.	BGS
2. Tim handed out a copy of written review comments on the final hydrology report. Gary will discuss and resolve these comments with Afshin.	BGS
3. Gary discussed and reviewed with Tim the contents of the upcoming submittal of the preliminary hydraulic analysis report.	BGS
a. A narrative of the hydraulic analysis report will be submitted on July 28, 1992 to present the results of the preliminary floodplain and floodway delineations.	
b. A copy of the red-lined floodplain boundaries will be included for review. Tim said that flood profiles and cross section plots are not required at this point.	
c. Gary reviewed the report set-up with Tim.	

Authored By: Gary Sun GS **Issue Date:** July 28, 1992

Copy to: Attendees, Dick Wells, Afshin Ahouriyan

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** July 22, 1992

Subject

Present

Discussion	Action/Response
4. Tim made few comments on the floodplain delineations. Gary will incorporate Tim's comments in the upcoming submittal.	BGS
5. Tim will provide an example of the Floodplain and Floodway Boundary Maps for the final submittal.	BGS

Authored By: Gary Sun GS **Issue Date:** July 28, 1992

Copy to: Attendees, Dick Wells, Afshin Ahouriyan

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location HNTB Conference Room **Meeting Date** June 24, 1992

Subject Coordination Meeting

Present FCDMC: Tim Murphy, Afshin Ahouraiyan, Magnus Jolaymei
HNTB: Dick Wells, Doug LaMont, Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and review the preliminary flood plain boundaries.	
2. Magnus Jolayemi has reviewed the preliminary flood plain boundaries and HEC-2 models. Some of his comments were discussed.	BGS
a. The locations of cross sections between the New River and Snodgrass Tank were discussed. The overbank area of Sections 0.202 and 0.299 should be shortened. HNTB will evaluate these sections.	
b. Non-effective flow area was discussed at some areas. An X3 or ET card can be used for these areas, but the flood plain limits are almost the same.	
c. The bridge type, size and dimensions should be added to HEC-2 models for the I-17 bridges.	
d. There is insufficient GR data to confine the flow on Section 7.812.	
3. Gary Sun submitted two copies of final hydrology report and the GPS survey data dump from data collectors on a floppy diskette.	BGS

Authored By: Gary Sun **Issue Date:** June 26, 1992

Copy to: Attendees

HNTB
TWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study Job No. 15081

Meeting Location HNTB Conference Room Meeting Date May 26, 1992

Subject Coordination Meeting

Present FCDMC: Tim Murphy
Afshin Ahouraiyan
Magnus Jolayemi

HNTB: Dick Wells
Doug LaMont
Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and review the preliminary floodplain limits for Deadman Wash.	
2. Gary Sun submitted two copies of the draft hydraulic analysis report for FCDMC review. This report was organized in accordance with the ADWR guidelines. Some subsections were expanded to cover sections in a typical Flood Insurance Study report.	
3. Four special problems and solutions were documented in the report. Six separate HEC-2 models were developed for Deadman Wash.	
4. HNTB is working on the floodplain limits for two tributaries.	

Authored By: Gary Sun Issue Date: May 27, 1992

Copy to: Attendees

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location FCDMC Conference Room **Meeting Date** May 6, 1992

Subject Coordination Meeting

Present FCDMC: Tim Murphy
Afshin Ahouraiyan
Magnus Jolayemi

HNTB: Dick Wells
Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities and review the preliminary hydrology report.	
2. Gary Sun submitted three copies of the preliminary hydrology report for FCDMC review. The report was organized in accordance with the ADWR guidelines. This report consists of two volumes. Volume 1 contains Sections 1 through 7 except Section 4 - Hydraulic Analysis. Six exhibits, HEC-1 models, and the split flow HEC-2 model are also included in Volume 1. Volume 2 consists of Appendices A through F including all back-up materials for the project.	
3. Four calibration checks were performed to the HEC-1 models. The Kn values estimated in the Manning's n Determination Report were adopted to the final HEC-1 models.	
4. The GPS control data dump on a floppy disk will be submitted separately.	BGS
5. The preliminary flood plain limits and HEC-2 natural profile model will be submitted within three weeks.	
6. The GIS consultant is working on the 24"x36" base sheets for flood plain delineations. Tim Murphy requested a set of topographic mylar sheets for all mapping information without any flood plain delineations, when they are ready.	BGS/GCA

Authored By: Gary Sun GS **Issue Date:** May 11, 1992

Copy to: Attendees

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location FCDMC Conference **Meeting Date** April 16, 1992

Subject Hydrology Comment Resolution Meeting

Present FCDMC: Tim Murphy
Afshin Ahouraiyan

HNTB: Gary Sun

Discussion	Action/Response
1. This meeting is a follow up meeting to resolve the Kn values to be used in HEC-1 models.	
2. Gary Sun presented the results of comparisons using two sets of Kn values. The items discussed are as follows:	
a. The HEC-1 outputs for discharge summary tables were submitted using two sets of Kn values. HNTB incorporated all review comments from the previous meeting and finalized the HEC-1 model schematic. Two structure routings (R8A & R11B) were added to the HEC-1 models. Two copies of the HEC-1 model schematic map were submitted.	
b. Two tables were submitted to summarize the Lags and 100-year 24-hour peak flows for two sets of Kn values. Alternative 1 used the higher Kn values determined from the Manning's n report for the floodplain delineation study. Alternative 2 used the lower Kn values estimated from surface characteristics of the sub-basins. Peak flows of Alternative 2 were up to 52 percent higher than the Alternative 1 peak flows.	

Authored By: Gary Sun GS **Issue Date:** April 21, 1992

Copy to: Attendees

Project: Deadman Wash Flood Insurance Study

Job No.: 15081

Meeting location: FCDMC Conference

Meeting Date: April 16, 1992

Discussion	Action/Response
c. The results of 100-year 24-hour peak flows per square mile for both models were plotted in the figure with the FCDMC regression line. The model with lower Kn values (Alternative 2) presents a better fit to the regression line, except at the I-17 bridge location.	
d. Gary Sun also presented the results of peak flows at the I-17 bridge using these HEC-1 models to simulate the March 1, 1991 storm. According to the USGS field survey and calculations, a peak flow of 1,030 cfs was estimated at the gage just downstream of the I-17 bridge. The HEC-1 model with lower Kn values results in a peak flow of 947 cfs versus 609 cfs from the model with higher Kn values. Therefore, HNTB recommended the original HEC-1 model with lower Kn values shall be used for this hydrology study. All attendees agreed.	

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location FCDMC Conference Room **Meeting Date** April 6, 1992

Subject Hydrology Comment Resolution Meeting

Present FCDMC: Tim Murphy
Afshin Ahouraiyan
Amir Motamedi
Magnus Jolayemi

HNTB: Dick Wells
Gary Sun

Discussion | **Action/Response**

1. A meeting was held to discuss the Kn values used in hydrologic analyses.

2. Gary Sun has reviewed the Deadman Wash gage records presented in the USGS publication "Basin Characteristics and Streamflow Statistics in Arizona as of 1989". Since this gage has only 19 years of records from 1960 to 1979, the estimated 100-year discharge of 6,070 cfs in the above reference is unreliable. Gary Sun has discussed this discharge value with David Creighton of ADWR. It was concluded that the actual 100-year discharge will be higher than 6,070 cfs based on an examination of the more reliable records for New River and Skunk Creek areas.

3. Gary Sun made comparisons with CVL's HEC-1 results. Values of Green-Ampt parameters used were quite different. Therefore, it is not suitable to compare peak discharges.

Authored By: Gary Sun GS **Issue Date:** April 21, 1992

Copy to: Attendees, RMW

Project Deadman Wash Flood Insurance Study Job No. 15081

Meeting location FCDMC Conference Room Meeting Date April 6, 1992

Discussion	Action/Response
4. Amir Motamedi suggested that another HEC-1 model should be developed by using the Kn values determined for the floodplain delineation study. The results of this model and the previous model wwould be compared with the FCDMC's regression line from the flood frequency analysis for representative Maricopa County washes. He also recommended that the regression line with slopes greater than 100 ft/mile be used to plot the results. Amir Motamedi also provided a copy of the S-Graph Study repoirt by Dr. George Sabol for the FCDMC, dated November 1987. HNTB will review this report and evaluate the Kn values used for several typical Maricopa County washes.	BGS received a copy of the regression line on 4/6/92.
Afshin Ahouraiyan will provide the precipitation record and estimated peak flow for the March 1, 1991 storm. Gary Sun will model this storm in the HEC-1 models and make comparisons. HNTB will make recommendations on the Kn values to be used for HEC-1 modeling after their further analyses.	BGS received the precipitation record on 4/8/92

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location FCDMC Conference Room **Meeting Date** April 1, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy
Afshin Ahouraiyan
Magnus Jolayemi

HNTB: Dick Wells
Gary Sun

Discussion | **Action/Response**

1. A meeting was held to coordinate project activities.

2. Tim Murphy provided a copy of the New River HEC-2 model on a floppy disk.

3. The survey information data are ready to submit. Tim Murphy said that the data can be submitted with the preliminary hydrologic report.

4. Afshin Ahouraiyan has reviewed a portion of the preliminary HEC-1 models. Some of his comments were discussed.

   a. The top elevation for the routing reach R11G-I should be 1645 feet instead of 1655 feet.

   b. Some of the existing culverts along I-17 have been deleted from the HEC-1 models. Explanations will be provided in the report. For example, the routing through the culvert at DA-8C was eliminated because the distance from the culvert to the concentration point is too short.

Authored By: Dick Wells **Issue Date:** April 3, 1992

Copy to: Attendees

Project: Deadman Wash Flood Insurance Study | Job No. 15081

Meeting location: FCDMC Conference Room | Meeting Date: April 1, 1992

Discussion	Action/Response
c. The Manning's n values used for routing reaches in HEC-1 models were too small compared with the values determined from the Manning's n Determination Report for the floodplain delineation study. Gary Sun said that the Kn values were selected based on the composite Kn values computed from surface characteristics. The values used are comparable to the Kn values shown for New River and Skunk Creek Watershed areas in the "Flood Hydrology Manual", by the Bureau of Reclamation.	
5. Gary Sun will investigate the effects of Manning's n values on peak discharges. A meeting will be set up for April 6, 1992 to resolve this issue.	BGS

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location FCDMC Conference Room **Meeting Date** March 5, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy
Afshin Ahouraiyan
Magnus Jolayemi

HNTB: Dick Wells
Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. There were no questions about the monthly progress report submitted on February 28.	
3. Tim Murphy said that the FCDMC might want HNTB to map approximately two sections of land north of Adobe Dam under a change order to this contract. Three scales (1" = 100', 1" = 200' & 1" = 400') and contour intervals (1',2' & 4') are being considered. Final products would include a semi-rectified photo mylar and separate mylars with contour intervals. Dick Wells said that HNTB could handle this, if requested, and that HNTB would begin investigating costs. Tim Murphy will provide more information next week.	RMW
4. Tim Murphy said that he and Afshin Ahouraiyan have made a few minor comments on the Manning's n Value Determination report submitted on February 24, 1992. He marked his comments on the report and made a copy of Afshin's comments for Gary Sun.	BGS

Authored By: Dick Wells **Issue Date:** March 10, 1992

Copy to: Attendees

Project: Deadman Wash Flood Insurance Study — Job No. 15081

Meeting location: FCDMC Conference Room — Meeting Date: March 5, 1992

Discussion	Action/Response
5. Gary Sun submitted the revised routing report and HEC-1 models for hydrologic analysis. The following items were discussed and delivered:	BGS
a. The routing cross section, plots and locations were revised based on FCDMC comments on February 20, 1992. The Coe & Van Loo's 200 scale topographic maps with 2' contour intervals were utilized to obtain routing cross sections east of I-17.	
b. The routing reach physical data table was submitted for review. This table includes reach lengths, slopes and Manning's n values.	
c. A table for routing reach channel infiltration loss data was also submitted.	
d. A floppy disk consisting of preliminary HEC-1 models for the 100-year 6-hour and 24 hour duration storms and the HEC-2 model for the split flow rating curve was submitted for review. A copy of peak discharges and HEC-1 schematic was also included for review.	
e. A table containing the routing reach hydraulic data for the 24-hour duration storm was submitted. This table was used to determine the number of steps (NSTEPS) for each routing reach.	
f. FHWA's HY-8 Culvert Hydraulics computer program was used to generate the rating curve at existing drainage structures for the HEC-1 input.	Gary Sun will send the HY-8 outputs to FCDMC for review.
g. The flow split has been modeled in the preliminary HEC-1 models. The HEC-2 model was developed to generate the data necessary for the diversion option in the HEC-1 model. A copy of cross section locations on the topographic map for the flow split analysis was also submitted.	

Project: Deadman Wash Flood Insurance Study — Job No. 15081

Meeting location: FCDMC Conference Room — Meeting Date: March 5, 1992

Discussion	Action/Response
h. The warning message in the HEC-1 outputs were presented for the channel routing. Since the calculated peaks were not falling within the warning range, the cross section data were not modified.	
i. The results of the HEC-1 models will be compared with the flood frequency analysis data for the Maricopa County. Tim Murphy made a copy of the USGS data for HNTB use.	BGS

HNTB
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Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location HNTB Conference Room No. 2 **Meeting Date** February 12, 1992

Subject Coordination Meeting

Present

FCDMC: Tim Murphy
Afshin Ahouraiyan

HNTB: Dick Wells
Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. The project schedule was discussed. Review times included in the original project schedule were shorter than required. A revised schedule with increased review times was discussed. This schedule extends an additional month with a completion date of June 5, 1992. No problems were seen with this extended schedule. Tim Murphy agreed to determine if a letter is required to obtain approval of the schedule change.	Tim Murphy determined that the acceptance of the schedule change can be documented in this meeting memo. HNTB understands that the schedule change does not justify any change in the lump sum contract amount.
3. Gary submitted cross-section locations for floodplain mapping and cross-sections of routing reaches for hydrologic analysis. The following points were discussed:	
a. The Manning's "n" determination report will be submitted on February 15, 1992. HNTB will make a separate report for routing channels for hydrologic analysis.	BGS
b. Field verification of cross-sections on topographic maps and surveys of existing structures will be started on February 13, 1992.	BGS/MJT
c. Photographs taken on the last field trip were reviewed.	BGS

Authored By: Dick Wells **Issue Date:** February 18, 1992

Copy to: Attendees

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Flood Insurance	Job No.	15081
Meeting Location	FCDMC Conference Room	Meeting Date	January 13, 1992
Subject	Coordination Meeting		
Present	FCDMC: Tim Murphy, Afshin Ahouriyan HNTB: Gary Sun		

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. Afshin handed out a copy of written review comments on the draft S-graph generation report.	BGS
3. Gary submitted two copies of the revised S-graph lag calculations based on the verbal review comments from Afshin. He reviewed the contents of these revisions.	
a. A revised narrative of the hydrologic analysis is included to describe the determination of soil parameters, surface characteristics, vegetation cover and mean Manning's n values.	BGS will incorporate the additional comments into the hydrology report.
b. A list of items revised in Table 1 is included with the revised Table 1 based on the FCDMC's comments.	BGS received the FCDMC's approval on Table 1 for S-graph lag calculations on 1-15-92.

Authored By:	Gary Sun GS	Issue Date:	January 20, 1992
Copy to:	Attendees, Dick Wells		

Project: Deadman Wash Flood Insurance — Job No. 15081

Meeting location: FCDMC Conference Room — Meeting Date: January 13, 1992

Discussion	Action/Response
c. Gary reviewed the revised table of soils areas within sub-basins from the GIS Consultants. He will submit the revised loss parameters calculation sheets by January 15, 1992.	BGS submitted two copies of the revised loss parameters calculation sheets to FCDMC on 1-15-92.
4. Gary will submit a blueline of the drainage area map to David Creighton of the ADWR for his use.	BGS sent the drainage area map on 1-15-92.
5. Tim made few comments on the topographic maps for floodplain delineations. He pointed out four split flow locations along Deadman Wash. He also suggested to use either a section line or existing roadway for the cross-section at the end of the study for ease of identification for the future study.	BGS
6. Tim will schedule a second field reconnaissance trip around the end of January to review stream channel and overbank area conditions.	RMW/BGS

GS/kjt
Mtg.note

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Flood Insurance Study	Job No.	15081
Meeting Location	FCDMC Conference Room	Meeting Date	December 24, 1991
Subject	Coordination Meeting		
Present	FCDMC: Tim Murphy, Afshin Ahouriyan HNTB: Dick Wells, Gary Sun		

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. Tim Murphy provided a copy of a USGS report prepared for FCDMC titled "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona." A training seminar on use of this report will be held in February or March which probably will be too late to influence the preparation of the Deadman Wash Study. Questions may be referred to Russ Cruff.	BGS
3. Tim Murphy said that a diskette covering sheet layouts will be available in a week or so. This will be useful for this study.	BGS
4. Dick Wells reviewed the status of the topographic mapping and GIS preparation activities.	RMW
a. Mapping.	
(1) Maps for the lower five miles of Deadman Wash were provided by Aerial Mapping to HNTB on December 11.	
(2) The remaining mapping will be available in draft by the end of this week. After HNTB has reviewed these draft topographic maps, a set of bluelines will be submitted to FCDMC for their use.	

Authored By: Richard M. Wells

Issue Date: December 27, 1991

Copy to: Attendees

Project Deadman Wash Flood Insurance Study

Job No. 15081

Meeting location FCDMC Conference Room

Meeting Date December 24, 1991

Discussion	Action/Response
b. GIS Preparation.	
(1) GIS Consultants have completed digitizing the watershed sub-basin boundaries and the SCS soils map, and they have completed the area calculations for sub-basins.	
(2) Topographic data is being translated to Arc/Info by GIS Consultants as it is received from Aerial Mapping.	
5. Gary Sun submitted two copies of the draft precipitation losses report and a draft S-graph generation report for review. He reviewed the contents of these reports.	BGS
a. A brief description of the hydrologic method used and drainage sub-basins is included.	
b. A table is included that shows the IA and Kn coefficients used based on watershed surface characteristics.	
c. A total of 86 drainage sub-basins were delineated and presented in a tabulated form.	
d. Another table shows the drainage basin conversion between Coo & Van Loo (CVL) and HNTB basin numbers.	
e. Based on the results of GIS drainage area calculations, a table was developed to compare the drainage sub-basins between the CVL figures and the digitized area calculations by GIS. The planimeter was used to verify the discrepancies. The GIS areas are accurate and will be used for this study.	
f. Table 1 shows the sub-basin lag time calculations and surface loss parameters. A map was also included to illustrate the parameters used in ths table.	

Project Deadman Wash Flood Insurance Study

Job No. 15081

Meeting location FCDMC Conference Room

Meeting Date December 24, 1991

Discussion

Action/Response

g. Loss parameters were calculated for each sub-basin using the Lotus-123 spread sheet program, SGRAPH.WK1. The calculated soil areas for each sub-basin were inputed and the estimated vegetation cover percentages for different land uses were also entered to adjust the XKSAT values.

h. A drainage basin map and a soils map were also submitted for review.

RMW/kjt
15081.18

HNTB

HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Flood Insurance Study	Job No.	15081
Meeting Location	FCDMC Conference Room	Meeting Date	November 27, 1991
Subject	Coordination Meeting		
Present	FCDMC: Tim Murphy, Afshin Ahouriyan HNTB: Dick Wells, Gary Sun		

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. A monthly progress report was submitted on November 25. There were no questions about information in this report.	
3. The project schedule was discussed. Completion of the topographic mapping has been delayed about six weeks because of problems in developing control data. Approximately three weeks will be gained back during the hydrology phase and it is expected that the project will be completed on schedule. Three weeks will be allowed for review of the hydrology report.	RMW/BGS
4. Afshin Ahouriyan reviewed his observations from a review of the Deadman Wash delineation map drafted by HNTB. The following points were discussed:	BGS
a. Sub-basin 14G was added to provide a concentration point at Snodgrass Tank.	
b. Sub-basins 10Z and 10Y were divided because of the Snodgrass Tank.	
c. Sub-basins 10M, 10O, 10P, 10R, 10S, 4C, 4D and 4E were reviewed and some sub-basins were modified to define boundaries. Old sub-basins 10M and 4D were eliminated. Sub-basins were redesignated beginning with 10M, e.g. old 10N is now 10M, etc.	

Authored By: Dick Wells

Issue Date: December 6, 1991

Copy to: Attendees

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting location FCDMC Conference Room **Meeting Date** November 27, 1991

Discussion	Action/Response
d. Contact prints were used originally to identify the boundary of sub-basin 11K. This will be checked again by HNTB.	
e. The south eastern boundary should be checked. (This boundary was later verified with aerial contact prints and no changes were made).	
f. I-17 is not used as the boundary of old sub-basin 10Q (now 10P).	
g. After the review revisions, there are now 86 sub-basins in the study area.	
5. A questions was raised concerning the 24 hour storm area reduction curve. This is included in the FCDMC computer programs.	BGS
6. Tim Murphy gave HNTB examples from two projects of cover sheets and map sheets.	RMW/BGS
7. A paper was provided to HNTB giving guidance on the soil description table and the texture description table.	BGS
8. Tim Murphy provided format guidance for future billings.	RMW
9. Coordination continues with the Game and Fish Department concerning access to areas controlled by that department.	RMW

RMW/kjt
15081.16

HNTB
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Meeting Documentation

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting Location HNTB Conference Room No. 1 **Meeting Date** October 31, 1991

Subject Coordination Meeting

Present FCDMC: Tim Murphy, Afshin Ahouriyan
HNTB: Dick Wells, Gary Sun

Discussion	Action/Response
1. A meeting was held to coordinate project activities.	
2. A monthly progress report was submitted on October 25. There were no questions about the information in this report.	
3. In response to a study notification letter, the Arizona Game & Fish Department requested additional information prior to granting approval for survey access to their area. HNTB has provided the information requested. No delay to the project is expected.	
4. Section 6.5 in the scope of work refers to provision of final flood study maps prepared by an electrostatic plot on reproducible mylar. Tim Murphy pointed out that this is not acceptable to the District and that either a pen plot or scribe process should be used.	RWM follow-up with GIS Consultants.
5. Tim Murphy provided the New River Floodplain Delineation Maps developed by Coe & Van Loo Consulting Engineers, Inc. (CVL). He will send HNTB the HEC-2 model if it is needed.	BGS
6. Gary Sun presented a preliminary drainage area map and pointed out a few items on the map.	BGS
a. CVL's Santa Re drainage areas were adopted on the map with a few modifications. The modifications of CVL's drainage areas were made to obtain concentration points for use in generating discharges for the floodplain mapping.	

Authored By: Dick Wells **Issue Date:** November 8, 1991

Copy to: Attendees

Project Deadman Wash Flood Insurance Study

Job No. 15081

Meeting location HNTB Conference Room No. 1

Meeting Date October 31, 1991

Discussion

Action/Response

b. A table was included with the map to show the conversion between CVL's and HNTB's drainage area identifications.

c. The cross culverts along I-17 are shown on the map, and a list of the sizes and locations of culverts was provided.

d. The reconnaissance aerial photos and CVL's 200 scale topograhic maps were used to verify the drainage boundaries.

e. A HEC-1 model diagram was provided to illustrate the interrelation of drainage basins and sub-basins.

f. Five concentration points were proposed along Carefree Highway to allow the Maricopa County Highway Department to replace the dip sections with drainage structures.

7. HNTB submitted the preliminary drainage area map and the above mentioned tables and diagram for FCDMC review.

8. A copy of the USGS "n" value study is available at FCDMC for review. HNTB will borrow this study and make a copy for use on this project. — BGS

RMW:cb
07101J.53

Soil types should adhere to SCS coding scheme.

Coverage Name: SOILS
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I
	SOILTYPE	5,5,C
	TEXTURETYPE	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Boundaries	090	0170	0	0	0	0

SOIL DESCRIPTION TABLE:

A table that relates Soil Type Codes with their description should also be supplied.

ITEMS:			
	SOILTYPE	5,5,C	NAME
	DESCRIPTION	50,50,C	– SCS BOOK FROM (REF)

TEXTURE DESCRIPTION TABLE:

A table that relates Texture Type codes with their description should also be supplied.

ITEMS:			
	TEXTURETYPE	4,4,I	SANDY LOAM (ETC...)
	DESCRIPTION	50,50,C	– BLANK

I. FLOODWAY

Coverage Name: FLOODWAY
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Floodway	050	0670				
Floodway Fringe	050	0671				

HNTB

HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Flood Insurance Study	Job No.	15081
Meeting Location	Deadman Wash Watershed	Meeting Date	October 11, 1991

Subject: Field Reconnaissance and Progress Meeting No. 2

Present:
ADWR: David Creighton
FCDMC: Tim Murphy, Amir Motamedi, Afshin Ahouraiyan
HNTB: Dick Wells, Gary Sun, Doug LaMont

Discussion	Action/Response
A reconnaissance field trip of the study area was made to determine conditions of the watershed and the floodplains, types and sizes of hydraulic structures involved, typical channel geometry and stream bed materials, split flow locations, and other parameters needed for the hydrologic and hydraulic analyses. The reconnaissance photograph contact prints and the USGS maps were used during the field trip.	
The following summarizes the field observations and discussion of study issues and concerns. Refer to Exhibit 1 for locations.	
1. Point 1 - 2.2 miles west of I-17 Carefree Highway exit on Carefree Highway existing CSP crossing with inlet and outlet treatment. It is a major Deadman Wash tributary.	
2. Point 2 - On Carefree Highway, 2.8 miles west of I-17. This is the Deadman Wash main crossing, and is in a roadway dip section.	
3. Point 3 - Section 8 T5N, R2E south of Carefree Highway. a. Main wash with 12' bottom, approx. 7' to 8' deep channel with good armoring and steep side slopes (2:1).	

Authored By: Gary Sun GS

Issue Date: October 21, 1991

Copy to: Attendees

Project: Deadman Wash Flood Insurance Study — Job No. 15081

Meeting location: Deadman Wash Watershed — Meeting Date: October 11, 1991

Discussion	Action/Response
b. Secondary wash with physical evidence of overbank flows.	
c. Typical split flow area in secondary wash.	
d. Soil sample was taken in overbank area for David to perform percolation test.	
e. Amir requested that the Muskingum - Cunge routing method may be used in lieu of the normal depth method for flood routing. Gary agreed to make the comparison.	
4. Point 4 - Aso Tank in Section 18, T5N, R2E. It was agreed that the tank will not be considered to provide any retention storage during a 100-year flood due to the lack of physical evidence for maintenance.	Assume no tank exists in HEC-1 model.
5. Point 5 - Maricopa Tank, northeast corner of Section 13, T5N, R2E.	Assume no tank exists in HEC-1 model.
a. Same as Point 4	
b. Channel approximately 8' deep, 15' bottom width and 2:1 steep side slopes.	
6. Point 6 - Snodgrass Tank, Section 13, T5N, R2E, near New River.	Gary to identify the spillway elevations and determine whether or not this tank shall be modeled.
David and Amir requested that the topographic maps for floodplain mapping shall be utilized to verify the spillway elevations and to determine whether or not the tank will breach. Gary agreed to obtain and examine the topographic maps.	
7. Point 7 - Split Flow location, west of Ben Avery Shooting Ranch in Section 5, T5N, R2E.	
The man-made levee approxiamtely 10 feet high is stable. The split flow location is just south of the confluence of Stream No. 9 and the main wash.	
8. Point 8 - Joy Ranch Road	
a. Major cross culverts consist of 2-72" and 2-60" pipes.	

Project: Deadman Wash Flood Insurance Study — Job No. 15081

Meeting location: Deadman Wash Watershed — Meeting Date: October 11, 1991

Discussion	Action/Response
b. A tributary coming from northwest created 5' deep scour hole just upstream of the crossing.	
c. With the gravel streambed at downstream of culverts, the scour hole is approximately 3 feet deep.	
9. Point 9 - Downstream of I-17 Deadman Wash bridges, Section 27, T6N, R2E.	
a. Two stream gage pipes are located approximately 500' west of I-17.	
b. Dense vegetation through I-17 bridges.	
c. Physical evidence of stream flow ponding. The channel about 25' wide, 2' to 3' deep with good armoring.	
10. Point 10 - Stock tank located in Section 26 next to Section 27, T6N, R2E and in Stream No. 4.	Assume no tank exists in HEC-1 model.
11. Point 11 - Stock tank located in Stream No. 4 just west of the previous tank.	Assume no tank exists in HEC-1 model.
12. Point 11 - upstream of I-17 bridges.	
a. Gravel and cobble stream bed with dense vegetation.	
b. Two tributaries join the main wash at this location.	
Tim instructed Gary to call Mr. Jack Moody of Coe & Van Loo to collect hydrology information for Santa Re. Amir said that the LOTUS program for soil classifications will be available in two weeks.	Gary to obtain the information.

GS/kjt
15081.9

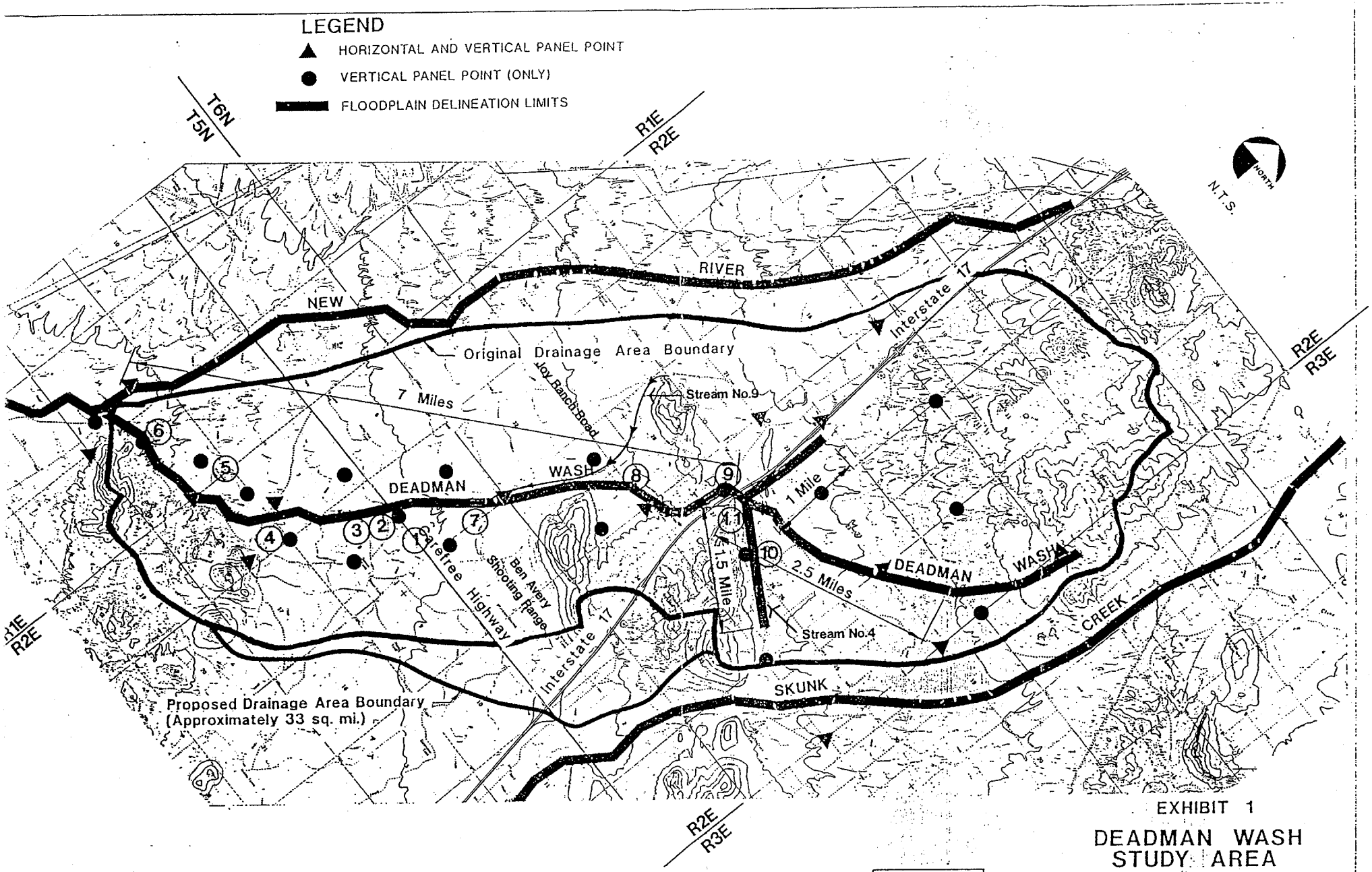

EXHIBIT 1

DEADMAN WASH STUDY AREA

HNTB

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project	Deadman Wash Flood Insurance Study	Job No.	15081
Meeting Location	FCDMC	Meeting Date	September 27, 1991
Subject	Data Collection Coordination		
Present	Tim Murphy - FCDMC Afshin Ahouraiyan - FCDMC Gary Sun - HNTB		

Discussion	Action/Response
1. Tim asked how many section corners HNTB will use to set horizontal control. Gary replied that approximately 11 section corners will be used as identified on Exhibit 1 in the Scope of Work. However, the actual number might be slightly different. Tim requested HNTB to utilize as many section corners as possible. Therefore, the State Plane Section Corners supplied by the FCDMC for the GIS can be easily verified.	MJT/GCA
2. Each ERM will require two photos taken to show the monument itself and the surrounding area for ease of identification in the field.	PEC/MJT
3. Two copies of the September 24, 1991 version of the Appendix A-GIS Data Specification were distributed.	GCA/BGS
4. Determination of Manning's "n" values shall be used the same procedures described in the AGK study. HNTB may contact USGS Mr. H.W. Hjalmarson in Tucson to obtain the preliminary report on Manning's "n" values determination for the FCDMC.	BGS
5. Afshin said that FCDMC is in the process to obtain all Coe & Van Loo hydrologic data for the area east of I-17. FCDMC will provide HNTB a diskette with soil classification data as soon as they are available.	BGS

Authored By: Gary Sun GS

Issue Date: September 30, 1991

Copy to: Attendees

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation Cont'd

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting location FCDMC **Meeting Date** September 27, 1991

Discussion	Action/Response
6. Field reconnaissance is tentatively scheduled on the week of October 7. Approximately 6-8 people from FCDMC adn ADWR will attend the field visit. HNTB will call FCDMC to confirm the date as early as possible to avoid any schedule conflicts with other FIS projects.	RMW/BGS/MJT

BGS/kjt
15081.3

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Meeting Documentation

Project Deadman Wash Flood Insurance Study

Job No. 15081

Meeting Location FCDMC

Meeting Date September 19, 1991

Subject "Kickoff" Meeting

Present

FCDMC: Tim Murphy, Afshin Ahouraiyan, Amir Motamedi, Eric Feldman
HNTB: Dick Wells, Gary Sun, Mike Tholl
AMCI: Richard Cook
GCA: Lari Spire
MGPS: Glen McEwen
PEC: Larry Maldonado

Discussion	Action/Response
1. A "kickoff meeting" was held to review scope and establish points of contact at the beginning of the Deadman Wash Flood Insurance Study. A copy of the attendance sheet is attached.	
2. Tim Murphy is the project manager for this study for the FCDMC. Pedro Calza has been promoted to Chief of the Floodplain Branch.	
3. The Notice to Proceed date for this study is September 17, 1991. Dick Wells received verbal notification from Leanna Cumberland on that date.	
4. Tim Murphy reviewed the items in the Scope of Work. The following points were made during the discussion:	
a. Task 1, Data Collection.	
(1) An initial field reconnaissance will be held in about two weeks when the uncontrolled stereo photography of the area is available. Dick Wells will establish a date as early as possible with Tim Murphy so that Dave Creighton of ADWR can be invited.	RMW

Authored By: Dick Wells

Issue Date: September 24, 1991

Copy to: Attendees

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting location FCDMC **Meeting Date** September 19, 1991

Discussion	Action/Response
(2) Data collection will be accomplished during the first three weeks and a written summary will be submitted to Tim Murphy.	BGS
(3) HNTB received from the FCDMC a diskette with the MCUHP1.EXE and MCUHP2.EXE programs dated 9/1/91. Other information that will be obtained includes Coo & Van Loo HEC-1 model and hydrologic parameters, the map referred to in the site video and soil classification information.	BGS
b. Task 2, Topographic Mapping	
(1) A sample right of entry letter to property owners was given to HNTB by Tim Murphy. HNTB will identify owners and parcel numbers and send out the letters. Copies of the letters will be given to Tim Murphy.	MJT
(2) The first uncontrolled stero photography will be flown before the panels are placed. These reconnaissance photos will be ready for HNTB in approximately a week.	AMCI
(3) Not all section corners will be included in the mapping. Enough ERM's will be included to cover FEMA criteria.	MJT/AMCI
c. Task 3, Hydrology.	BGS
(1) FCDMC will provide HNTB soil parameters as soon as they are available.	
(2) Revisions to the design manual are expected to be completed in early October.	
(3) Meetings at specified points will be held as identified in the contract scope.	
d. Task 4, Field Survey. Planning for surveys between HNTB and the subconsultants is underway. There are no survey questions at the time.	MJT/MGPS/PEC

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting location FCDMC **Meeting Date** September 19, 1991

Discussion	Action/Response
e. Task 5, Floodplain and Floodway Delineations.	BGS
(1) Determination of "n" values was discussed. The USGS is developing a report on "n" value determination for the FCDMC. A copy of an AGK study on "n" values is available for review at the FCDMC.	
(2) HNTB will request as-built highway plans from the county highway department.	
f. Task 6, GIS Preparation.	BGS/GCA
(1) Copies of the July 19, 1991 revision of the Appendix A, GIS Data Specification were distributed. Further revisions during the conduct of the study are expected.	
(2) A document giving the state format for GIS for flood studies is in draft form. This is to be obtained and followed when it is formalized.	
g. Task 7, Coordination and Study Management.	RMW
(1) Progress meetings will be held at an interval of three weeks or less. Where appropriate these will be combined with other specified meetings.	
(2) The monthly progress report should be submitted a week or longer before the monthly billing submittal. HNTB will check with FCDMC to determine the District's billing cycle.	
(3) Tim Murphy provided a sample of a newspaper study announcement. An announcement for the Deadman Wash study will be run on two consecutive Wednesdays in the Arizona Republic and Gazette. No local paper for the Deadman Wash area has been found. A certified copy of the newspaper announcement will be given to Tim Murphy.	

Project Deadman Wash Flood Insurance Study **Job No.** 15081

Meeting location FCDMC **Meeting Date** September 19, 1991

Discussion	Action/Response
h. Task 8, Final Products	RMW/BGS

(1) The final report will include the following information for input to the CRS System:

(a) Area of Floodplain in acres.

(b) Area of Floodway in acres.

(c) Reach length delineated in miles.

(2) HNTB was given a copy of the ADWR publication titled "Instructions for Organizing and Submitting Technical Documentation for Flood Studies", revised September 1991.

(3) Documents submitted to FEMA for review will be in the format of the final product.

(4) There were no other questions about the required final products.

15081.2
RMW/kjt

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 1.4: General Correspondence

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081
Date 4-17-92

TO Mr. Afshin Ahouraiyan
Hydrology Engineering Associate
Flood Control District of
Maricopa County

RE Deadman Wash FIS
Hydrology
FCD 90-65

WE ARE FORWARDING TO YOU:

- ☐ Estimates
- ☐ Plans
- ☐ Shop Drawings
- ☐ Copy of letter
- ☐ Proposals
- ☐ Prints
- ☐ Samples
- ☐ Change order
- ☐ Reports
- ☐ Under separate cover via: _____
- ☐ Specifications
- ☐ _____

NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
2		4-16-92		Summary Table for Sub-basin Lag Time Comparisons
2		4-16-92		Summary of 100-yr 24-hr Peak Flows vs Kn Values

THESE ARE TRANSMITTED

- ☒ For approval
- ☒ For your use
- ☐ As requested
- ☒ For review and comment
- ☐ Resubmit ____ Copies for review
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- ☐ No exceptions taken (NE)
- ☐ Make corrections noted (MCN)
- ☐ Amend and resubmit. (AR)

PLEASE NOTE: The Two Summary Tables will provide you the results of the Kn Value Comparisons.

cc. Dick Wells

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per B. Gary Sun

ME106-1085-(REV.12M

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081
Date 3-10-92

TO Mr. Afshin Ahouraifan
Hydrology Engineering Ass.
3335 W. Durango
Phoenix, AZ 85009

RE FCD 90-65
Deadman Wash FIS
Additional Calc's for
Hydrologic Analysis

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NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		3/10/92		HY-8 Outputs for R10H, R10M, R12A & R11F
1		3/10/92		Cross Section Plots for Reaches R9A-B, R12A-B, R10R-A, R11M-N, R15A-B, R14F-G

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- ☐ Make corrections noted (MCN)
- ☐ Amend and resubmit. (AR)

PLEASE NOTE: _____

CC. Tim Murphy
Dick Wells

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per B. Gary [illegible]

ME106-1085-(REV.)2M

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: TMM From: AA Date:02-28-92
cc: AMM

The following are some comments on the submittal dated 02-24-92 on the manning's n value determination report.

1- Have the name for the routing reaches written on the table.

2- Explain in the documentation why the values chosen for the channel material are in the same range. (e.g. Photo No.2)

3- On the same table the values for the degree of irregularity needs to be moved down one row.

4- The n value for the channel under the degree of irregularity needs to move up one row, for the table representing photo No 12.

5- The same comment applies for the table representing photo No. 13.

If there are any questions, please let me know.

HNTB

HOWARD NEEDLES TAMMEN & BERGENDOFF

Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081

Date 2-24-92

TO Tim Murphy
Project Manager
Flood Control District
of Maricopa County

RE FCD 90-65
Deadman Wash FIS
Manning's n Value
Determination Report

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- [ ] Copy of letter
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- [ ] Prints
- [ ] Samples
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NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
2		2-24-92		Manning's n Value Determination Report

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- [x] For review and comment
- [ ] Resubmit ____ Copies for review
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- [ ] _____
- [ ] No exceptions taken (NE)
- [ ] Make corrections noted (MCN)
- [ ] Amend and resubmit. (AR)

PLEASE NOTE: _____

CC. Dick Wells

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per Bailard Sun

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS **File:** FCD 90-65

To: TMM **From:** AA **Date:** 02-20-92
cc: AMM

The following are some comments on the submittal 02-12-92 on the HEC-1 program and the routing cross sections and locations.

1- Basin 11G is missing from the program. The following routing cross sections are missing from the program: R3a-3b, R5a-5b, R5e-5f, R6a-6b, R7a,7b, R7e-7f, R7f-7g, R8a-8b, R8c-8d, R11a-11b, R11b-11d, R11d-11f, R11f-11g, R11c-11g, R11h-r11i, R11k_111, R111-11m, R14a-14b, R14c-14d, R14e-14f.

2- The following culvert routings are missing from the program: R8A, R8C, R10H, R10M.

3- Mention the dimension for the LAG under the KM card.

4- There are discrepancies in RX measurements for the following reaches. These should be checked again. The reaches are: R10A-B, R10C-D, R10F-G, R4D-4E, R10H-10I, R10J-K, R10R-12A, R10T-U, R10U-V.

5- The RX RY cards for the following x-sections should be checked; R2B-C, R10F-G, R3C-D, R7H-8C. As many of the routing x-sections are missing make sure the RX, RY dimensions are measured correctly.

6- The x-sections should be measured using the convention of starting the measurements from the left overbank, left being the overbank on the left hand side looking downstream. Some of the x-sections are not measured under this convention, R10G-10H, R8B-8C (check the bottom elevation).

7- The diversion card should also be added to the HEC-1 program.

If there are any questions, please let me know.

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081

Date 2-14-92

TO Tim Murphy
Project Manager
Flood Control District
of Maricopa County

RE FCD 90-65
Deadman Wash FIS
Preliminary Manning's n
Determination Report

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- [ ] Estimates
- [ ] Plans
- [ ] Shop Drawings
- [ ] Copy of letter
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- [ ] Change order
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- [ ] _____

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2		2-14-92		Preliminary Manning's n Determination Report

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- [x] For review and comment
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- [ ] _____
- [ ] No exceptions taken (NE)
- [ ] Make corrections noted (MCN)
- [ ] Amend and resubmit. (AR)

PLEASE NOTE:

CC. Dick Wells

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per Bailey

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: TMM From: AA Date:02-05-92
cc: AMM

The following are some comments on the submittal 01-27-92 on the HEC-1 schematic diagram, the MCUHP2 outputs, and the routing parameter calculations.

1- The MCUHP2 outputs were in order. The correct aerial reduction factor is being used and the outputs show the program is being used correctly.

2- The Top Elevation for Reach R11G-11I should read 1645 not 1655. The rest of the Elevation measurements need to be checked for any more possible errors.

3- A legend is needed for the schematic diagram.

4- Explain what is going on between C6B and C7G.

5- Sub-basin 11G needs to be added to C11G.

6- C11G needs to be routed through 11I and then added to C11I.

7- C11F should be routed through a culvert and represented as such on the diagram.

8- On the written portion under the topic Sub-basin Lag Time, the word "as" should be added to the fourth sentence after the word " measured " . (i.e. The variable Lca was measured " as " the length along the watercourse.....)

If there are any questions, please let me know.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: ~~TMM~~ Tmm From: AA Date:01-20-92
CC:AMM

The following are comments on the S-Graph Lag Revisions submittal dated 01-13-92 by HNTB.

1- The calculations are in order and the tables have been corrected. The new soil map unit measurements are correct and also the Lag calculation tables have been modified.

2- Some parts of the written text need to be corrected and these corrections are attached.

3- A reminder that the reason for choosing Phoenix Valley S- Graph vs Phoenix Mountain S-Graph should be included in the final hydrology report.

If there are any questions please let me know.

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

JOB NO. 15081
Date 1-~~13~~ 15-92

TO Tim Murphy
Project Manager
Flood Control District
of Maricopa County

RE FCD 90-65
Deadman Wash FIS
Hydrology - S-Graphs
Revisions for Soils Areas
within Sub-Basins

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- [ ] Estimates
- [ ] Plans
- [ ] Shop Drawings
- [ ] Copy of letter
- [ ] Proposals
- [ ] Prints
- [ ] Samples
- [ ] Change order
- [ ] Reports
- [ ] Under separate cover via: ____
- [ ] Specifications
- [ ] ____

NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		1-15-92		Soils Map Unit Descriptions (1 page)
1		1-15-92		Loss Parameter Summary for Sub-Basins Using the S-Graph Method (2 pages)
1		1-15-92		Revised Loss Parameters for Sub-Basins (86 pages)

THESE ARE TRANSMITTED

- [x] For approval
- [x] For your use
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- [x] For review and comment
- [x] Resubmit 1 Copies for review
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- [ ] Make corrections noted (MCN)
- [ ] Amend and resubmit. (AR)

PLEASE NOTE:

CC. Afshin Ahouriyan - FCDMC
Dick Wells - HNTB
File

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per Bailey S

ME106-1095-(REV.)2M

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: TMM From: AA Date:01-13-92
cc: AMM

The following are some comments on the submittal called Hydrological Analysis, dated 12-24-91.

1- Some of the corrections on the written portion of the report is as follow:
i- Third line of the report should read, " dated September 1,1990.
ii- Eleventh line of the report should read Green and Ampt infiltration...
iii- Under the topic Drainage Sub-basins the word freeway is not necessary.

2- For the final Hydrology report the comparison tables between Coe & Van Loo's study and HNTB's study is not necessary.

3- The Kn values for Desert and Rangeland appear to be low for this area. It is recommended that these values be adjusted. All the assumptions for choosing the Kn values should be documented in the final report.

4- Under Table 1 the word " Composite " should be added to the column titled Kn.

5- There are some discrepancies between FCDMC's and HNTB's sub-basin lag time calculations. These discrepancies have been noted on table 1 and HNTB has been notified of these differences.

6- The reasons behind choosing the Phoenix Valley S-Graphs or the Phoenix Mountain S-Graphs should be explained and documented in the final Hydrology report.

7- Under Soil Loss Parameter calculations the assumptions in choosing the vegetation cover for the sub-basins should be explained and documented in the Hydrology Report.

8- The Map Unit area calculations are not correct. These areas should be checked for all the sub-basins before any further reviews can take place.

If there are any questions, please let me know.

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square - Suite 1100,
40 North Central, Phoenix, Arizona 85004 (602) 528-4300

LETTER OF TRANSMITTAL

Job No. 15081
Date 1-13-92

TO: Tim Murphy
Project Manager
Flood Control District
of Maricopa County

RE: FCD 90-65
Deadman Wash FIS
Hydrology - S-Graph Lag
Revisions

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____ Plans	____ Prints	____ Under separate cover via: ____
____ Shop drawings	____ Samples	____ Specifications
____ Copy of letter	____ Change order	

NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		1-13-92		Brief Description of Methods used for Hydrologic Analysis (3 pages)
1		1-13-92		List of Table 1 Revisions (2 pages)
1		1-13-92		Revised Table 1 for Lag Calc's (3 pages)
1		1-10-92		Revised Table of Soils Areas within Sub-Basins from ~~Aerial Mapping~~ (1 page) GIS Consultants
1		1-13-92		List of Sub-basins that the soils Areas were Changed.

THESE ARE TRANSMITTED

X For approval	____ Resubmit ____ copies for review	____ No exceptions taken (NE)
____ For your use	____ Submit ____ copies for distribution	____ Make corrections noted (MCN)
X As requested	____ Return ____ corrected prints	____ Amend and resubmit (AR)
X For review and comment		

PLEASE NOTE:

COPY TO: Afshin Ahourifan - FCDMC
Dick Wells - HNTB
File

HOWARD NEEDLES TAMMEN & BERGENDOFF

By Bailang Lu

ME106-0790

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081
Date 12-30-91

TO Mr. David Creighton, P.E.
Project Engineer
Flood Management
Arizona Dept. of Water Resources

RE FCD 90-65
Deadman Wash FIS
Stock Tanks

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- [ ] Estimates
- [ ] Plans
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NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		12-30-91		List of Stock Tanks (Total of 17)
1		12-30-91		9 of 17 ~~Stock~~ Stock Tanks Topo Maps (8½"x11", 8 sheets)

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- [ ] For approval
- [x] For your use
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- [ ] ____
- [ ] No exceptions taken (NE)
- [ ] Make corrections noted (MCN)
- [ ] Amend and resubmit. (AR)

PLEASE NOTE: Please find 200 scale topo for 9 stock tanks in Deadman Wash Watershed. If you need more information, please call me at 528-4391.

CC. Tim Murphy - FCDMC
~~Ashkin Aboujiyan - FCDMC~~
Dick Wells
File

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per B. Gary Sun

DEC
10-29-91

DEADMAN WASH WATERSHED.

Stock Tanks.

	No.	Name	Location: Section	T. N.	Range	Dike Height (Yrs)	Height (Ft)	Capac (AF)
✓	1.	Snodgrass Tank.	SW¼ NW¼ 13	5N	1E			
N/A	2.	Maricopa Tank.	NE¼ NE¼, 13	5N	1E.	N/A		
N/A	3.	Milky Way Tank.	NW¼ SE¼ 6	5N	2E	N/A		
N/A	4.	Saguaro Tank.	SE¼ SE¼ 1	5N	1E.	N/A		
✓	5.	Aso Tank.	SE¼ NE¼ 18	5N	2E			
N/A	6.	Gibson Tank.	NW¼ SE¼ 8	5N	2E			
N/A	7.	Pepe Tank	SW¼ SE¼ 9	5N,	2E			
N/A	8.	Biscuit Tank	NW¼ SE¼ 3	5N	2E			
✓	9.	Palo Verde Tank.	SW¼ NW¼ 33	6N	2E			
✓	10.	CF Tank.	SW¼ SW¼ 27	6N	2E.			
N/A	11.	Purcell Tank.	NW¼ NW¼ 28	6N.	2E			
N/A	12.	Cline Tank.	NW¼ NW¼ 22	6N.	2E.			
✓	13.	Unnamed-1	SW¼ SW¼ 26	6N,	2E			
✓	14.	Unnamed-2	SW¼ SW¼ 26	6N.	2E.			
N/A ✓	15.	Unnamed-3	SE¼ NE¼ 24	6N,	2E			
✓	16.	Unnamed-4	NE¼ NE¼ 7	5N	2E			
N/A	17.	Unnamed-5	NW¼ SE¼ 14	6N	2E			

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
Two Renaissance Square, 40 North Central, Suite 1100
Phoenix, Arizona 85004, 602-528-4300

LETTER OF TRANSMITTAL

Job No. 15081
Date 12-30-91

TO Tim Murphy
Project Manager
Flood Control District of Maricopa County

RE FCD 90-65
Deadman Wash Flood Insurance Study

WE ARE FORWARDING TO YOU:

- [ ] Estimates
- [ ] Plans
- [ ] Shop Drawings
- [ ] Copy of letter
- [ ] Proposals
- [x] Prints
- [ ] Samples
- [ ] Change order
- [ ] Reports
- [ ] Under separate cover via: ____
- [ ] Specifications
- [ ] ____

NO. OF COPIES	DRAWING NO.	LAST DATED	CODE	DESCRIPTION
1		12-30-91		200 Scale Draft Topographic Maps, Total 10 blueline Sheets for Deadman Wash Floodplain Mapping.

THESE ARE TRANSMITTED

- [ ] For approval
- [x] For your use
- [x] As requested
- [x] For review and comment
- [ ] Resubmit ____ Copies for review
- [ ] Submit ____ copies for distribution
- [ ] Return ____ corrected prints
- [ ] ____
- [ ] No exceptions taken (NE)
- [ ] Make corrections noted (MCN)
- [ ] Amend and resubmit. (AR)

PLEASE NOTE: Please find 10 topographic maps in draft form which cover a total of 12 miles for floodplain delineation including 9.5 miles of Deadman Wash, 1.5 miles for Stream No. 4 and 1 mile of Stream No. 7.

CC. Dick Wells
File

HOWARD NEEDLES TAMMEN & BERGENDOFF

Per [signature]

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: ~~TMM~~ 12-16-91 From: AA Date:12-12-91
Via: ~~AMM~~ 12/13

The following are comments on the precipitation Calculation Summary dated 12-9-91 by HNTB.

1- Have the reduction factor values for both the 6-hour and 24-hour tabulated for easy reference.

2- The total rainfall calculations are all correct.

3- The reduced rainfall value for 0.5 square mile under the 100 year, 6-hour storm calculations should be 3.34.

4- As noted by HNTB and SDW the value for PC card should be changed from 0.068 to 0.063.

If there are any questions please let me know.

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

December 9, 1991

Mr. Timothy M. Murphy
Project Manager
2801 W. Durango Street
Phoenix, Arizona 85009

RE: Deadman Wash Flood Insurance Study
Precipitation Calculation Summary
HNTB 15081-11
Maricopa County Contract No. FCD 90-65

Dear Mr. Murphy:

Enclosed is a copy of our precipitation calculation summary for the Deadman Wash Flood Insurance Study project.

If you have any questions or need additional information regarding the above, please give me a call.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

Enclosure

cc: Afshin Ahouraiyan - FCDMC
Gary Sun - HNTB

GS/kjt
Murphy2

Partners [illegible]
Associates [illegible]
Offices [illegible]

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

December 9, 1991

Mr. Timothy M. Murphy
Project Manager
2801 W. Durango Street
Phoenix, Arizona 85009

RE: Deadman Wash Flood Insurance Study
Data Collection Summary
HNTB 15081-11
Maricopa County Contract No. FCD 90-65

Dear Mr. Murphy:

Enclosed is a copy of our data collection summary for the Deadman Wash Flood Insurance Study project.

If you have any questions or need additional information regarding the above, please give me a call.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

Enclosure

cc: Gary Sun

GS/kjt
Murphy

Partners [illegible]
Associates [illegible]
Offices [illegible]

DATA COLLECTION SUMMARY
FOR
DEADMAN WASH FLOOD INSURANCE STUDY

The following summarizes the pertinent data collected and results of our review for your information.

1. **Coe & Van Loo (CVL), "Santa Re - Conceptual Master Drainage Report, Maricopa County," April 1991.**

   Precipitation values and S-graph input parameters for existing conditions were also obtained. In addition, topographic maps for Santa Re at 1" = 200' with 2' contour intervals were provided by CVL. These maps were flown approximately two years ago, and no exact flight date is available.

   Review Comments: We will use the CVL's HEC-1 model with some modifications. CVL's basin numbers 15, 200 and 310 will be divided into smaller sub-basins in order to provide peak discharges for floodplain delineation. CVL's basin numbers 475, 480 and 485 for Deadman Wash will not be used in this study.

2. **Coe & Van Loo, HEC-1 computer model input file DWPRE (dated 1-30-91) for existing conditions for Deadman Wash.**

   Review Comments: CVL only simulated a 100-year 6-hour storm using the FCDMC distribution. Therefore, the 100-year 24-hour storm is not included in their study.

3. **Sea, Inc., "Deadman's Wash Area Drainage Master Study for City of Phoenix", Volumes 1 and 2," September 1990.**

   No HEC-1 models were obtained.

   Review Comments: This study did not follow the procedures outlined in the FCDMC Hydrologic Design Manual. A 100-year, 24-hour storm and the kinematic wave option with SCS curve number method for precipitation losses were used in the HEC-1 model. However, the overall watershed boundary and I-17 culvert sizes in this report will be used as references.

4. **Soil Conservation Service (SCS), "Soil Survey of Aguila-Carfree Area, Parts of Maricopa and Pinal Counties, Arizona, " April 1986.**

   Flat and unfolded soil maps were obtained for GIS and hydrologic analysis uses.

   Review Comments: Sheets 10, 11, 22 and 23 in the Soil Survey have been used to identify 13 soil map units within the project watershed.

5. **Arizona Department of Transportation, As-Built Plans.**

   a. Phoenix-Cordes Junction, Maricopa County I-17-1(56), dated 2-1-65.

   b. Phoenix Cordes Junction, Maricopa County I-17-1(57), dated 1-10-67.

   c. Phoenix Cordes Junction, Maricopa County I-17-1(61), dated 6-12-69.

   Review Comments: There are 19 cross culverts and one bridge across the Interstate 17 freeway in the study area.

6. **Maricopa County Highway Department, As-Built Plans.**

   a. Black Mountain Road (Now Carefree Highway west of I-17), Ridge Route to U.S. 69, Maricopa County, dated 8-13-65.

   b. Carefree Road (East of I-17) Black Canyon Freeway to Cave Creek, Maricopa County, dated 8-23-74.

7. **We have received the following items from the FCDMC.**

   a. A disk with the September 1991 version of MCUHP1.EXE and MCUHP2.EXE programs.

   b. A disk with LOTUS-123 spreadsheet programs dated October and November 1991 for calculations of sub-basin loss parameters.

   c. The site video tape with a map showing stream numbers.

   d. A copy of an AGK study on Manning's "n" values from their report titled "Flood Insurance Study for Caterpillar Tank and Twin Buttes Washes," June, 1991.

   e. A sample newspaper study announcement.

   f. A sample right-of-entry letter to property owners.

   g. A copy of the September 24, 1991 version of Appendix A, GIS Data Specification.

   h. A copy of the Arizona Department of Water Resources publication titled "Instructions for Organizing and Submitting Technical Documents for Flood Studies," revised September, 1991.

   i. A copy of NOAA Technical Memorandum NWS HYDRO-40 for the 24-hour aerial rainfall reduction.

j. A copy of "Land Use Categorization and Use for Calculation of Impervious Areas in Urban Maricopa County," September 18, 1991.

k. One set of bluelines for New River Floodplain Delineation, dated April 1988 by CVL.

l. Sample GIS Floodplain Delineation maps for Cline Creek and Wagner Wash.

8. **We will obtain a copy of determination of Manning's "n" values by USGS for FCDMC as soon as it is published.**

GS/kjt
Murphy

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Deadman Wash FDS File: FCD 90-65

To: TMM From: AA Date:11-26-91
Via: AMM

The following are comments on the map of Deadman Wash Delineation done by HNTB.

1- Have a concentration point at Snodgrass Tank rather than on the upstream side of Snodgrass Tank.

2- Explain the reason for dividing sub-basins 10Z and 10Y.

3- There are basins that have no closure lines. Show exactly where these sub-basins end. These sub-basins are scattered throughout the map. The sub-basins are 10M, 10P, 10O, 10R, 10S, 4D, 4C, 4E & 4C.

4- Reason behind choosing the boundary for sub-basin 11K as shown on the map.

5- Check the South Eastern boundary with aerial photos.

6- Is the highway being used as a boundary line for sub-basin 10Q?

If there are any questions please let me know.

RECEIVED
NOV 08 1991
H. N. T. B.

THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4312 (602) 942-3000

Governor
Fife Symington
Commissioners:
Phillip W. Ashcroft, Eagar, Chairman
Gordon K. Whiting, Klondyke
Larry Taylor, Yuma
Elizabeth T. Woodin, Tucson
Arthur Porter, Scottsdale
Director
Duane L. Shroufe
Deputy Director
Thomas W. Spalding

November 6, 1991

Mr. Richard M. Wells, P.E., Project Manager
Howard Needles Tammen & Bergendoff
Architects Engineers Planners
Two Renaissance Square, Suite 1100
40 North Central
Phoenix, Arizona 85004

Dear Mr. Wells:

Re: Survey at Ben Avery Shooting Range

Thank you for your letter of October 28, 1991, requesting permission to enter Commission land to set survey panel points. The location of survey sites is within the Ben Avery Public Shooting Range, a restricted area sub-leased to Maricopa County Parks and Recreation Department for shooting range purposes. A portion of the range is leased by the Commission from the Bureau of Land Management (BLM) for shooting range purposes only. The BLM retains administrative jurisdiction over projects not related to the shooting range. Therefore, the following additional approvals are necessary before we can act on your request.

* A copy of written permission, with land use description, from Maricopa County Parks and Recreation Department must be submitted to this office.

* A copy of written permission, with land use description, from the BLM, for the following land, must be submitted to this office: BLM Recreation and Public Purposes Lease Number A-1232 - Section 28 ($S\frac{1}{2}SW\frac{1}{4}SW\frac{1}{4}$), and Section 33 ($W\frac{1}{2}NW\frac{1}{4}, NW\frac{1}{4}SW\frac{1}{4}$), all in Township 6 north, Range 2 East, G&SRB&M, Maricopa County, AZ.

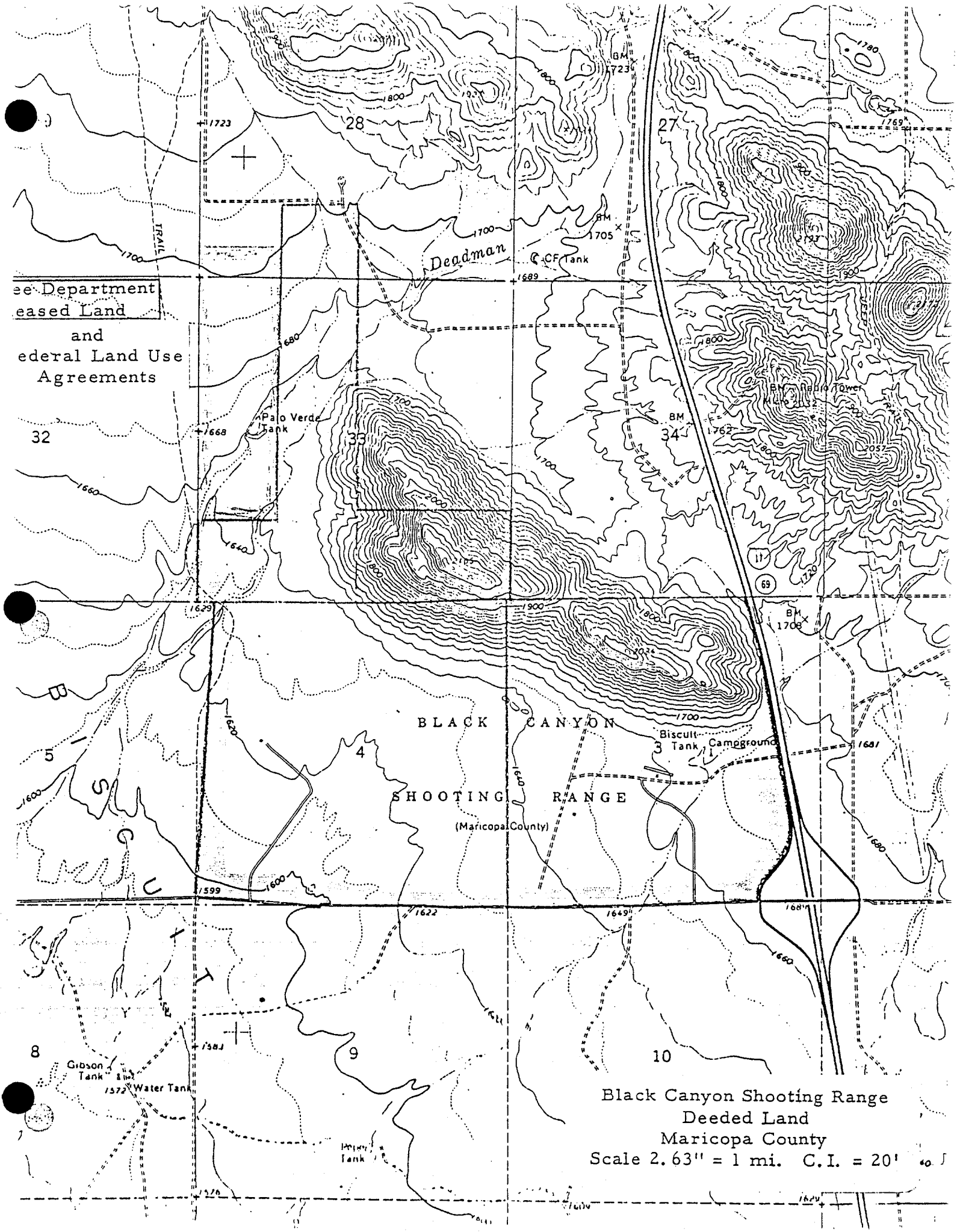
We understand that your request does not involve soil disturbance activities of any kind. Your illustration of Commission land is incorrect and we have enclosed a map which shows Commission land highlighted in yellow and the BLM leased land in blue.

Sincerely,

Gene Sturla

Gene Sturla
Wildlife Land Projects Coordinator

GS:gs
Encl.
cc: Howard Gilmore, Maricopa Co. Parks and Recreation Department
Art Tower, Bureau of Land Management
Tim Murphy, Flood Control District of Maricopa County



Black Canyon Shooting Range
Deeded Land
Maricopa County
Scale 2.63" = 1 mi. C.I. = 20'

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 28, 1991

Mr. Gene Sturla
Wildlife Land Projects Coordinator
GAME & FISH DEPARTMENT
2221 West Greenway Road
Phoenix, Arizona 85023-4312

RE: Survey of Arizona Game & Fish Commission Land

Dear Mr. Sturla:

Per your request, we are forwarding the information needed so we may survey on land owned or controlled by the Commission, near Deadman Wash.

On the attached map, the land outlined in red shows Commission ownership in our study area. Highlighted in yellow is Commission land that our forces will need access to in order to set survey control, as shown with a blue square. The access roads that we wish to use are shown in green.

The survey to be performed consists of setting panel points, (strips of white plastic in a "+" formation), then running horizontal and vertical control to the points in order to establish a base for aerial photogrammetry of the study area. All panel points or any other material placed will be removed upon completion of the study.

We will proceed with our survey immediately upon receiving your approval and it will take us approximately two weeks to finish. We hope you can expedite our request for access as soon as possible. We already have gained permits and/or have been granted access by the other various agencies including the State of Arizona, Maricopa County and the Federal Correctional Institute.

Thank you for your cooperation. If you have any questions or need any additional information is needed please give me a call.

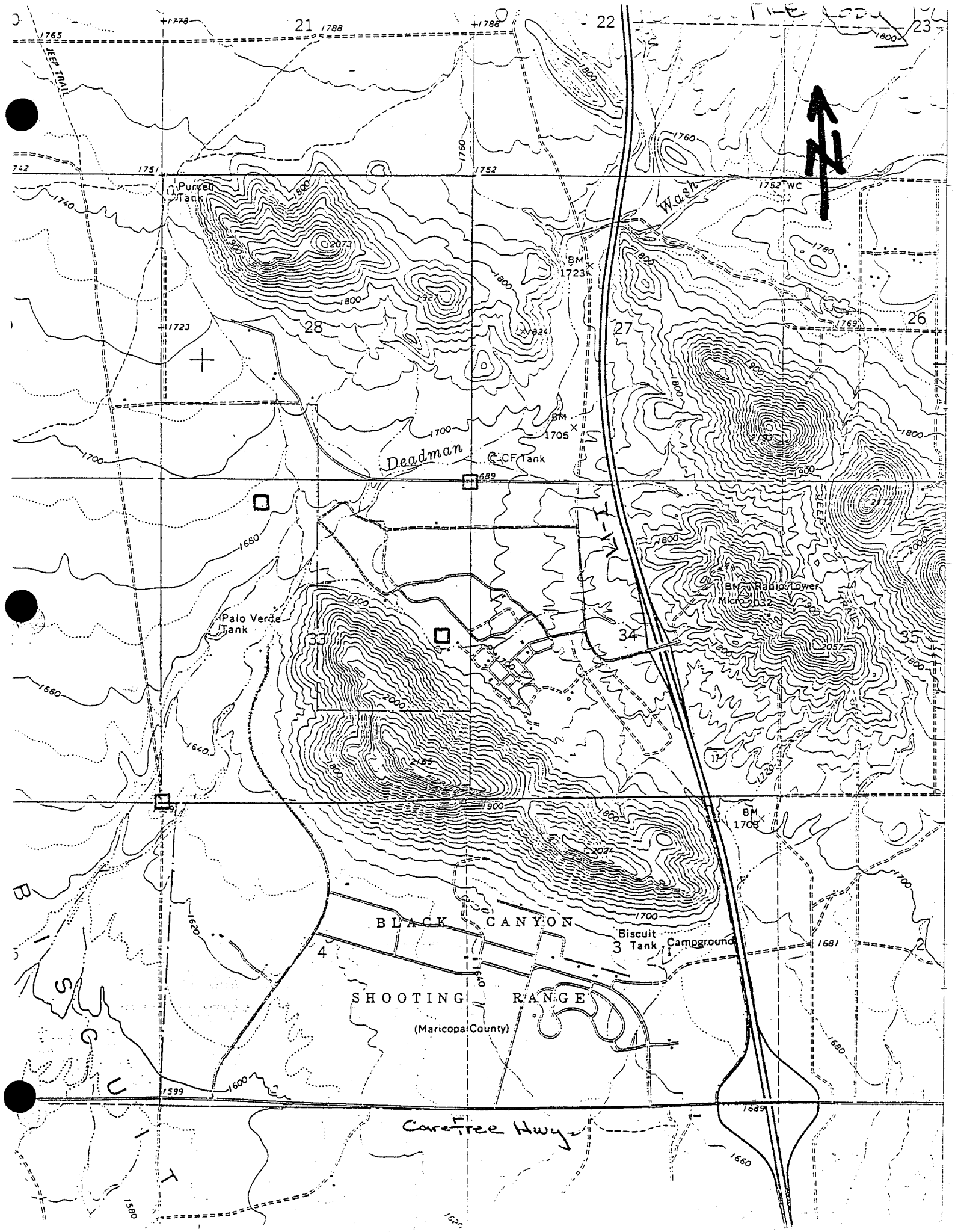
Sincerely,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells
Richard M. Wells
Project Manager

cc: Tim Murphy, FCDMC
FILE COPY
15081.11
MT/kjt

Partners [illegible]
Associates [illegible]
Offices [illegible]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3
2
JEEP TRAIL
Purcell Tank
Wash
WC
BM 1723
BM 1705
Deadman
CF Tank
Palo Verde Tank
BM Radio Tower
Micro 2032
BM 1706
BLACK CANYON
SHOOTING RANGE
(Maricopa County)
Biscuit Tank
Campground
Carefree Hwy
JEEP

THE STATE OF ARIZONA

RECEIVED
OCT 21 1991
H. N. T. B.

GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4312 (602) 942-3000

Governor
Fife Symington
Commissioners:
Phillip W. Ashcroft, Eagar, Chairman
Gordon K. Whiting, Klondyke
Larry Taylor, Yuma
Elizabeth T. Woodin, Tucson
Arthur Porter, Scottsdale
Director
Duane L. Shroufe
Deputy Director
Thomas W. Spalding

October 15, 1991

Mr. Richard M. Wells, P.E., Project Manager
Howard Needles Tammen & Bergendoff
Architects Engineers Planners
Two Renaissance Square, Suite 1100
40 North Central
Phoenix, Arizona 85004

Dear Mr. Wells:

Re: Survey of Arizona Game & Fish Commission Land

We have received your letter of October 1, 1991, which advises the Game and Fish Department of the need for your firm to survey land, some owned or controlled by the Commission, near Deadman Wash.

No approvals are granted or implied at this time for the purposes stated. Please be advised that certain Commission parcels, wildlife and administrative areas, along the Lower Gila River have limited or restricted public access or entry. Prior to granting approval the Game and Fish Department requests the following additional information necessary to review your request.

* submit a map or other illustration indicating the specific Commission parcel(s) which are the subject of your request.
* submit similar map or illustration indicating specific road access, or route preferred, to the subject parcel(s).
* provide specific dates, or period of time, for the survey to be conducted.
* provide complete description of the survey activity proposed.

Please forward the above requested information, and other information that you feel may assist our review, directly to my attention at the address above.

Sincerely,

Gene Sturla

Gene Sturla
Wildlife Land Projects Coordinator

GS:gs
cc: Tim Murphy, Flood Control District of Maricopa County
Richard Staedicke, Manager, Robbins Butte Wildlife Area
Rod Lucas, Habitat Specialist, Mesa Regional Office

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 17, 1991

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
3335 West Durango Street
Phoenix, Arizona 85009

RE: Contract FCD 90-65
Deadman Wash Flood Insurance Study
Mapping Photography

Dear Mr. Murphy:

We are enclosing one complete set of 9" x 9" contact prints of the aerial stero photographs for the above referenced project sequentially numbered and catalogued.

Please call us if you have any questions.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

Enclosures

RMW/kjt
15081.8

Partners Charles T. Hennigan PE, Daniel J. Spigai PE, John L. Cotton PE, Robert S. Coma PE, Donald A. Dudes PE, James L. Tuttle, Jr. PE, Hugh E. Schell PE, Cary C. Goodman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard O. Beckman PE, Richard L. Farnan AIA, Douglas E. Prescott PE, Ronald L. Hertle PE
Associates Kendall T. Lincoln CPA, Roberts W. Smithem PE, Harry O. Bartosse PE, Ralph E. Robison PE, Walter Sharko PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carriere PE, Michael P. Ingardia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Saul A. Jacobs PE, Ewing H. Miller FAIA, Douglas C. Mynre PE, Carl J. Melas PE, Daniel F. Becker PE, Donald P. Keuth PE, Thomas L. Williams AIA, John E. Kucke PE, Rodney P. Pello PE, Steven M. Reiss AIA, Robert A. Leick PE, Glenn D. Sedulsky PE, Benjamin A. Whisler PE, Roger S. Austin PE, John O. Brothers PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Douglas A. Boyd AIA, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarossi PE, F. Christopher Dimond ASLA AICP, Roland W. Frerking AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice D. Miller PE, Robert L. Watson AIA, James P. Pitz PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, KY, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN, New York, NY, Oklahoma City, OK, Orlando, FL, Overland Park, KS, Philadelphia, PA, Phoenix, AZ, Pittsburgh, PA, Seattle, WA, Tampa, FL, Tulsa, OK, Wilmington, DE

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 9, 1991

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
3335 West Durango Street
Phoenix, Arizona 85009

RE: Contract FCD 90-65
Deadman Wash Flood Insurance Study
Study Notification Actions

Dear Mr. Murphy:

We made arrangements to have an "Announcement of Intent to Perform Flood Elevation Study" published in the Arizona Republic/Phoenix Gazette on September 25 and October 2, 1991. We are enclosing a certification from the publisher that this was accomplished.

We identified the landholders within the study area and sent 187 letters to these landholders. Attached are copies of:

a. A list showing the names and addresses of the landholders who were sent letters and the numbers of the parcels that they own.

b. A copy of typical letter to a landholder.

Please contact me if you have any questions.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

Enclosures

RMW/kjt
15081.7

Partners Charles T. Hennigan PE, Daniel J. Soigai PE, John L. Cotton PE, Robert S. Coma PE, Donald A. Dudes PE, James L. Tuttle, Jr. PE, Hugh E. Schell PE, Cary C. Goodman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard D. Beckman PE, Richard L. Farnen AIA, Douglas E. Prescott PE, Ronald L. Hartle PE
Associates Kendall T. Lincoln CPA, Roberta W. Smichem PE, Harry D. Bertosss PE, Ralph E. Robison PE, Walter Sharko PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carriere PE, Michael P. Ingardia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Saul A. Jacobs PE, Ewing H. Miller FAIA, Douglas C. Myhre PE, Carl J. Melles PE, Daniel F. Becker PE, Donald P. Keuth PE, Thomas L. Williams AIA, John E. Kuoke PE, Rodney P. Reid PE, Steven M. Reiss AIA, Robert A. Leick PE, Glenn O. Sadulsky PE, Benjamin A. Whisler PE, Roger S. Austin PE, John D. Brothers PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Douglas A. Boyd AIA, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarossi PE, F. Christopher Dimaio ASLA AICP, Roland W. Frerking AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice D. Miller PE, Robert L. Watson AIA, James P. Ritz PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, KY, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN, New York, NY, Oklahoma City, OK, Orlando, FL, Overland Park, KS, Philadelphia, PA, Phoenix, AZ, Raleigh, NC, Seattle, WA, Tampa, FL, Tulsa, OK, Wilmington, DE

STATE OF ARIZONA
COUNTY OF MARICOPA } ss.

Eileen Basilone, being first duly sworn, upon oath deposes and says:

That he is the agent of Phoenix Newspapers Inc., publishers of

The Arizona Republic
The Phoenix Gazette

a newspaper of general circulation in the County of Maricopa, State of Arizona, published at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper for a period of 2 {days / ~~weeks~~} as follows:

Classified ad appearing in class 965,

ending on October 2, 1991.

10/2/91 Eileen Basilone
Agent

Subscribed and sworn to before me this Second day of October A. D. 19 91

My Commission Expires My Commission Expires March 18, 1993

Claudia J. Sanchez
Notary Public

ANNOUNCEMENT OF INTENT TO PERFORM FLOOD ELEVATION STUDY

The Flood Control District of Maricopa County (FCDMC) has contracted Howard Needles Tammen & Bergendoff (HNTB) to perform a floodplain delineation for the Deadman Wash from the New River to east of Interstate 17.

This study will examine and evaluate the flood hazard areas in the community to determine the flood elevation for those areas. These elevations will then be used to determine the flood insurance rates used by the Federal Emergency Management Agency.

This announcement is intended to inform all interested persons and communities of the commencement of this study so that they may have an opportunity to bring any relevant technical information to the attention of FCDMC/FEMA, so that they could be considered during the course of this study. Your comments should be addressed to Mr. Pedro Calza or Mr. Tim Murphy, Hydrologists at the Flood Control District of Maricopa County.

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 1, 1991

Mr. John Meeker
Lakeview City Inc.
11040 North 19th Avenue
Phoenix, Arizona 85029

Subject: Right of Entry for Surveying Purposes

Parcel No(s): 203-2-1, 203-4-1, 203-6-1, 203-10-7A, 203-10-8, 203-3-1B

Dear Mr. Meeker:

The Flood Control District of Maricopa County has contracted with Howard Needles Tammen & Bergendoff to perform a flood insurance study for Deadman Wash. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcels of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property you must notify Tim Murphy of the Flood Control District at 262-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revision of Flood Insurance Rate Maps. This study should be available to the public in about 12 to 18 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Tim Murphy of the Flood Control District or Richard Wells of Howard Needles Tammen & Bergendoff.

Partners Charles T. Hennigan PE, Daniel J. Solgal PE, John L. Cotton PE, Robert S. Coms PE, Donald A. Dubies PE, James L. Tuttle, Jr. PE, Hugh E. Schell PE, Cary C. Goodman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard O. Beckman PE, Richard L. Farnan AIA, Douglas E. Prescott PE, Ronald L. Hartle PE
Associates Kendall T. Lincoln CPA, Roberta W. Smithem PE, Harry O. Bertossa PE, Rajon E. Rodison PE, Walter Sharko PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carriere PE, Michael P. Ingardia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Saul A. Jacobs PE, Ewing H. Miller FAIA, Douglas C. Mynre PE, Carl J. Melles PE, Daniel F. Becker PE, Donald P. Keuth PE, Thomas L. Williams AIA, John E. Kucke PE, Rodney P. Pello PE, Steven M. Reiss AIA, Robert A. Leick PE, Glenn O. Sadulsky PE, Benjamin A. Whisler PE, Roger S. Austin PE, John D. Brothers PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Douglas A. Boyd AIA, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarcosa PE, E. Christopher Dimond ASLA AICP, Roland W. Frerking AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice O. Miller PE, Robert L. Watson AIA, James P. Ritz PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, KY, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN, New York, NY, Oklahoma City, OK, Orlando, FL, Overland Park, KS, Philadelphia, PA, Phoenix, AZ, Raleigh, NC, Seattle, WA, Tampa, FL, Tulsa, OK, Wilmington, DE

Tim Murphy, Hydrologist, Flood Control District, may be reached at 262-1501. Richard Wells, Project Manager, Howard Needles Tammen & Bergendoff may be reached at 528-4386.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

MT/kjt
deadman

DEADMAN WASH

Name/Address	Parcel No(s).
Mr. John Meeker **Lakeview City Inc.** 11040 North 19th Avenue Phoenix, Arizona 85029	203-2-1, 203-4-1, 203-6-1, 203-10-7A, 203-10-8, 203-3-1B
ADOT 205 South 17th Avenue Phoenix, Arizona 85007	203-10-7B
I-17 5700 Partnership 11040 N. 19th Avenue Phoenix, Arizona 85029	203-1-1, 203-5-1
Arizona Game & Fish Department 2222 W. Greenway Road Phoenix, Arizona 85023	203-10-2, 203-10-3
Arizona Game & Fish Department 2222 W. Greenway Road Phoenix, Arizona 85023	203-10-4, 203-10-5, 103-10-6
Arizona State of TR of Lands 15 S. 15th Avenue, 3rd Floor Phoenix, Arizona 85007	203-10-9
Mountain States Tel & Tel Co. U.S. West Inc. Corporate Tax Department 6300 S. Syracuse Way, Suite 700 Englewood, Colorado	203-10-970

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 7, 1991

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
3335 West Durango Street
Phoenix, Arizona 85009

RE: Contract FCD 90-65
Deadman Wash Flood Insurance Study
Estimate of Quarterly Expenditures

Dear Mr. Murphy:

We are responding to your request to Mr. Gary Sun for an estimate of expenditures by quarter for the Deadman Wash Flood Insurance Study.

We have been advised to submit our billings on the first week of every month. Based upon this, we have calculated our expenditures for the quarter ending December 1991 to include the billings we expect to submit during the first weeks of October, November and December for work performed in September, October and November.

Following are our quarterly estimates for billings submitted through:

December, 1991	$111,000.00
March, 1992	$ 35,000.00
June, 1992	$ 24,900.00
TOTAL	$170,900.00

Please contact me if you have any questions.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

RMW/kjt
15081.6

Partners Charles T. Hennigan PE, Daniel J. Solgal PE, John L. Cotton PE, Robert S. Coma PE, Donald A. Dudles PE, James L. Tuttle, Jr. PE, Hugh E. Schell PE, Gary C. Goodman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard D. Beckman PE, Richard L. Farman AIA, Douglas E. Prescott PE, Ronald L. Hardie PE
Associates Kendall T. Lincoln CPA, Roberta W. Smichem PE, Harry D. Bertossa PE, Rajon E. Rodiech PE, Walter Sharko PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carriere PE, Michael P. Ingardia PE, Bernard L. Prince PE, Stephen S. Quinn PE, Saul A. Jacobs PE, Swing H. Miller FAIA, Douglas C. Mynne PE, Carl J. Melles PE, Daniel F. Becker PE, Donald P. Kauth PE, Thomas L. Williams AIA, John E. Kucke PE, Rodney P. Pello PE, Steven M. Reiss AIA, Robert A. Lack PE, Glenn D. Sadusky PE, Benjamin A. Whitzer PE, Roger S. Austin PE, John D. Brosmans PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Douglas A. Boyd AIA, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarossi PE, F. Dan Scoggner Dimond ASLA AICP, Roland W. Frensing AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice D. Miller PE, Robert L. Watson AIA, James P. Ritz PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, KY, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

October 3, 1991

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
3335 West Durango Street
Phoenix, Arizona 85009

RE: Contract FCD 90-65
Deadman Wash Flood Insurance Study
Reconnaissance Photography

Dear Mr. Murphy:

We are enclosing one set of 9" x 9" contact prints of the 1:24,000, uncontrolled stereo reconnaissance photography developed for the Deadman Wash Flood Insurance Study. This photography was prepared by our subconsultant, Aerial Mapping Company, Inc.

Please contact me if you have questions.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells

Richard M. Wells, P.E.
Project Manager

Enclosures

15081.4
RMW/kjt

Partners Charles T. Hennigan PE, Daniel J. Solgal PE, John L. Cotton PE, Robert S. Coma PE, Donald A. Dubiel PE, James L. Tuttle, Jr. PE, Hugh E. Schall PE, Cary C. Goodman AIA, Gordon H. Sluney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE, Richard D. Beckman PE, Richard L. Farman AIA, Douglas E. Prescott PE, Ronald L. Hartle PE
Associates Kendall T. Lincoln CPA, Roberts W. Smithers PE, Harry O. Bartosse PE, Ralph E. Robison PE, Walter Shorko PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carriere PE, Michael P. Indardia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Saul A. Jacobs PE, Ewing H. Miller FAIA, Douglas C. Mylne PE, Carl J. Melles PE, Daniel F. Bucker PE, Donald P. Keuch PE, Thomas L. Williams AIA, John E. Kucke PE, Rodney P. Reid PE, Steven M. Reiss AIA, Robert A. Leick PE, Glenn D. Sadulsky PE, Benjamin A. Whisler PE, Roger S. Austin PE, John D. Brothers PE, Charles L. O'Reilly, Jr. PE, Robert M. Sloan PE, Douglas A. Boyd AIA, Raymond J. McCabe PE, Thomas A. Skinner PE, Paul A. Yarossi PE, F. Christopher Dimond ASLA AICP, Roland W. Freiking AIA, James T. Kienle AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice D. Miller PE, Robert L. Watson AIA, James P. Pitz PE
Offices Alexandria, VA, Atlanta, GA, Baton Rouge, LA, Boston, MA, Charleston, WV, Chicago, IL, Cleveland, OH, Concord, CA, Dallas, TX, Denver, CO, Fairfield, NJ, Hartford, CT, Houston, TX, Indianapolis, IN, Irvine, CA, Kansas City, MO, Louisville, KY, Lexington, KY, Los Angeles, CA, Miami, FL, Milwaukee, WI, Minneapolis, MN, New York, NY, Oklahoma City, OK, Orlando, FL, Overland Park, KS, Philadelphia, PA, Phoenix, AZ, [illegible] VA, Tampa, FL, [illegible], WV, [illegible] SE

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 1.5: Contract Scope of Work

FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD OF DIRECTORS
Betsey Bayless
James D. Bruner
Carole Carpenter
Tom Freestone
Ed Pastor

RECEIVED
OCT 0 2 1991
HNTB

SEPTEMBER 25 1991

Mr. Donald P. Keuth
Associate
Howard Needles Tammen & Bergendoff
Phoenix, Arizona 85044

SUBJECT: Contract FCD 90-65, Deadman Wash Flood Insurance Study

Dear Mr. Keuth:

This letter will serve as confirmation of the September 17, 1991 verbal Notice To Proceed for the work under the above-referenced contract that was approved by the Board of Directors on September 16, 1991.

A fully executed contract is enclosed for your use. If you have any questions, please do not hesitate to contact Pedro Calza at 262-1501.

Sincerely,

Leanna Cumberland
Chief, Contracting Branch

Enclosure (1)

CS925034

CONTRACT FOR CONSULTANT SERVICES

CONTRACT FCD 90-65

Pursuant to the provisions of the Arizona Revised Statutes (A.R.S.), 48-3603, the Board of Directors has the authority to enter into contracts.

The Flood Control District of Maricopa County, Arizona, hereinafter called the "DISTRICT", is desirous of having certain professional services performed in connection with the Deadman Wash Flood Insurance Study, hereinafter called the "PROJECT" and as more fully described in Exhibit A, Scope of Work, attached, and

HOWARD NEEDLES TAMMEN & BERGENDOFF, hereinafter called "CONSULTANT", is desirous of performing said services;

THEREFORE, the parties hereto mutually agree as follows:

SECTION I - SERVICES OF THE CONSULTANT

The CONSULTANT, under the general supervision of the Chief Hydrologist of the DISTRICT's Hydrology Division, shall prepare studies, reports, surveys, plans, drawings, specifications and cost estimates as are necessary for the PROJECT and according to the directions and designated standards of the DISTRICT and in accordance with Exhibit A. It is understood and agreed that the DISTRICT's authorized representative shall be the Chief Hydrologist or his duly authorized representative, hereinafter called the "AGENT" and that he/she shall be the sole contact for administering this contract.

The CONSULTANT shall meet periodically with the AGENT so as to keep the DISTRICT informed of the progress of the work in accordance with the schedule defined in Exhibit A.

The CONSULTANT shall promptly advise the AGENT of any factors, which may develop during the PROJECT, that would likely result in construction or design costs in excess of budgetary constraints.

SECTION II - PERIOD OF SERVICE

The CONSULTANT shall complete all work per the schedule provided in Exhibit A, Scope of Work within 240 calendar days after receipt of the Notice to Proceed, exclusive of DISTRICT review time. The DISTRICT is expected to require up to 60 calendar days for review time, for a total contract time period of 300 calendar days. Should extension of this contract period be necessary, and any such extension(s) continue the date of contract expiration for a time period of more than one year from the date of contract execution, adjustment(s) of the consultant's fee(s) may, upon agreement by both the DISTRICT and the CONSULTANT, be made in accordance with the Consumer Price Index for Urban Consumers, Western

Division published by the U.S. Department of Labor, Bureau of Labor Statistics, using the published edition coinciding with the initial contract expiration date. Any such fee adjustment shall only apply to the extended contract time period.

SECTION III - PAYMENTS TO THE CONSULTANT

The CONSULTANT shall be paid for work under this Contract a lump sum fee of $170,900.00 plus any adjustments that have been approved in writing in accordance with the Maricopa County Procurement Code.

The DISTRICT shall pay the CONSULTANT upon completion of the work as accepted by the DISTRICT, except that progress payments may be made as billed by the CONSULTANT based on approved monthly progress reports subject to the limitations set forth in Exhibit "A", Scope of Work. Ten percent of all contract payments made on an interim basis shall be retained by the DISTRICT as insurance of proper performance of the contract or, at the option of the CONSULTANT, a substitute security may be provided by the CONSULTANT in an authorized form pursuant to procedures established by the DISTRICT. The CONSULTANT is entitled to all interest from any such substitute security.

When the contract is fifty percent (50%) completed, one-half (1/2) of the amount retained will be paid to the CONSULTANT provided the CONSULTANT is making satisfactory progress on the contract and there is no specific cause or claim requiring a greater amount to be retained. After the contract is fifty percent (50%) completed, no more than five percent (5%) of the amount of any subsequent progress payments shall be retained providing the CONSULTANT is making satisfactory progress on the project, except if at any time the DISTRICT determines satisfactory progress is not being made, ten percent (10%) retention shall be reinstated for all progress payments made under the contract subsequent to the determination.

Any retention monies shall be paid or substitute security returned or released, as applicable, to the CONSULTANT within forty-five (45) calendar days after: (1) Completion of the work in Exhibit A through the submittal of District accepted/ approved documents to FEMA, (2) receipt of a completed "Certificate of Substantial Performance" form, (3) the CONSULTANT's statement that no project disputes exist; and (4) invoicing for any retained monies has been received by the DISTRICT. Upon acceptance and approval of the project by FEMA and the completion of all final work required by the DISTRICT, the CONSULTANT shall submit a final Certificate of Performance and its invoice for any sums remaining due and payable under this Contract.

If the CONSULTANT desires a partial payment in accordance with the provisions above, the CONSULTANT will complete and forward, a DISTRICT provided form, indicating payment distribution to MBE/WBE firms.

SECTION IV - THE DISTRICT'S RESPONSIBILITIES

The DISTRICT shall furnish the CONSULTANT, at no cost to the CONSULTANT, the following information or services for this PROJECT:

A. One copy of on-hand maps, records, survey ties, bench marks or other data pertinent to the PROJECT. This does not, however, relieve the CONSULTANT of the responsibility of searching records for additional information, for requesting specific information or for verification of that information provided. The DISTRICT does not warrant the accuracy or comprehensiveness of any such information.

B. All available information and data relative to policies, standards, criteria, and studies, etc. impacting the PROJECT as identified by the CONSULTANT.

C. Availability of staff for consultation with the CONSULTANT during the performance of studies and plan development in order to identify the problems, needs, and other functional aspects of the PROJECT.

D. Examination of documents submitted by the CONSULTANT and rendering of decisions pertaining thereto promptly, to avoid unreasonable delay in the progress of the work by the CONSULTANT. The DISTRICT will keep the CONSULTANT advised concerning the progress of the DISTRICT's review of work.

SECTION V - ALTERATION IN SCOPE OF WORK

Any alteration in the scope of work that will result in a substantial change in the nature of the PROJECT so as to materially increase or decrease the contract fee will require negotiation of an amendment to the contract to be executed by the DISTRICT and the CONSULTANT. No work shall commence on the change until the contract amendment has been approved by the DISTRICT and the CONSULTANT has been notified to proceed by the AGENT. It is distinctly understood and agreed that no claim for extra work done or materials furnished by the CONSULTANT will be allowed by the DISTRICT except as provided herein, nor shall the CONSULTANT do any work or furnish any materials not covered by this agreement unless such work is first authorized in writing in accordance with the Maricopa County Procurement Code. Any such work or materials furnished by the CONSULTANT without such written authorization first being given shall be at his own risk, cost, and expense, and he hereby agrees that without such written authorization he will make no claim for compensation for such work or materials furnished.

SECTION VI - RECORDS

Records of the CONSULTANT's payroll expense pertaining to this PROJECT and records of accounts between the DISTRICT and the CONSULTANT shall be kept on a generally recognized accounting basis and shall be available upon request to the DISTRICT or its authorized representative for audit during normal business hours. The records shall be subject to audit by appropriate grantor agency if the PROJECT is funded all or in part by a grant.

SECTION VII - PROJECT COMPLETION

If during the course of this contract situations arise which prevent completion within the allotted time, an extension may be granted by the AGENT.

SECTION VIII - TERMINATION

The DISTRICT may terminate this contract at any time upon reimbursement to the CONSULTANT of expenses which include reasonable charges for time and material for the percentage of work satisfactorily completed and turned over to the DISTRICT.

The DISTRICT reserves the right to postpone, terminate or abandon this PROJECT for the CONSULTANT's failure to complete the PROJECT on time, or failure to comply with the provisions of the contract. The DISTRICT also reserves the right to terminate any or all parts of this contract for its own convenience as the DISTRICT may determine at its sole discretion.

The DISTRICT hereby gives notice that pursuant to A.R.S. Section 38-511 "A" this contract may be cancelled without penalty or further obligation within three years after execution if any person significantly involved in initiation, negotiation, securing, drafting, or creating a contract on behalf of the DISTRICT is, at anytime while the contract or any extension of the contract is in effect, an employer, agent, or any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract. Cancellation under this section shall be effective when written notice from the Chief Engineer and General Manager of the DISTRICT is received by all of the parties of the contract. In addition, the DISTRICT may recoup any fee for commission paid or due to any person significantly involved in initiation, negotiation, securing, drafting, or creating the contract on behalf of the DISTRICT from any other party to the contract arising as a result of the contract.

The CONSULTANT may terminate this contract in the event of nonpayment of fees as specified in Section III, PAYMENTS TO THE CONSULTANT.

SECTION IX - OWNERSHIP OF DOCUMENTS

All original documents including, but not limited to studies, reports, tracings, drawings, physical and computer models, estimates, field notes, investigations, design analyses, calculations, computer software, and specifications, prepared in the performance of this Contract are to be and remain the property of the DISTRICT and are to be delivered to the AGENT before final payment is made to the CONSULTANT. The DISTRICT reserves the right to reuse the documents as it sees fit. However, the DISTRICT will not reuse, alter, or modify these documents without noting such alterations, modifications, or intent of their reuse, and will hold the CONSULTANT harmless from any claims arising from the reuse, alteration, or modification of the documents. The CONSULTANT may retain reproducible copies of all such documents delivered to the DISTRICT.

The CONSULTANT hereby releases all Subcontractors/Subconsultants employed for this project from any liability or prior notice and authorization for providing information or copies of records requested by the DISTRICT subsequent to the completion of this Contract.

SECTION X - COMPLIANCE WITH LAWS

The CONSULTANT is required to comply with all Federal, State and local laws, local ordinances and regulations. The CONSULTANT's signature on this contract certifies compliance with the provisions of the I-9 requirements of the Immigration Reform and Control Act of 1986 for all personnel that the CONSULTANT and any subconsultants employ to complete this PROJECT. It is understood that the DISTRICT shall conduct itself in accordance with the provisions of the Maricopa County Procurement Code.

SECTION XI - GENERAL CONSIDERATIONS

A. Prior to beginning the work, the CONSULTANT shall furnish the DISTRICT for approval the names of its key employees, and of its sub-consultants and their key employees to be used on this PROJECT. Any subsequent changes are subject to the written approval of the DISTRICT.

The CONSULTANT in replacing a MBE/WBE subcontractor should attempt to contract with another MBE/WBE.

B. The CONSULTANT agrees during the execution of this contract that no clients other than the DISTRICT, or the Federal Emergency Management Agency, will be retained within the area of the 100-year floodplain for the area without expressed written authority from the chief Engineer and General Manager of the DISTRICT.

C. The failure of either party to enforce any of the provisions of this Contract or to require performance of the other party of any of the provisions hereof shall not be construed to be a waiver of such provisions, nor shall it affect the validity of this Contract or any part thereof, or the right of either party to thereafter enforce each and every provision.

D. The CONSULTANT shall be responsible for the cost of any additional design, field layout, testing, construction and supervision necessary to correct those errors or omissions attributable to the CONSULTANT and for any damage incurred by the DISTRICT as a result of additional construction costs caused by such CONSULTANT errors or omissions.

E. The fact that the DISTRICT has accepted or approved the CONSULTANT's work shall in no way relieve the CONSULTANT's responsibility.

F. It is mutually understood and agreed that this Contract shall be governed by the laws of the State of Arizona, both as to interpretation and performance. Any action at law, suit in equity, or judicial proceeding for the enforcement of this Contract, or any provision thereof, shall be instituted only in the courts of the State of Arizona.

SECTION XII - SUCCESSORS AND ASSIGNS

This Contract shall not be assigned by either party without prior written approval of the other except that the CONSULTANT may use in the performance of this Contract without prior approval of the DISTRICT, personnel or services of its related entities and affiliated companies as if they were an integral part of the CONSULTANT; and it shall extend to and be binding upon the heirs, executors, administrators, successors and assigns of the parties hereto.

SECTION XIII - NO KICK-BACK CERTIFICATION

The CONSULTANT warrants that no person has been employed or retained to solicit or secure this Contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fee; and that no member of the Board of Directors/Supervisors or any employee of the DISTRICT has any interest, financially or otherwise, in the CONSULTANT firm.

For breach or violation of this warranty, the DISTRICT shall have the right to annul this Contract without liability, or at its discretion to deduct from the Contract price or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

SECTION XIV - ANTI-DISCRIMINATION PROVISION

The Flood Control District of Maricopa County will endeavor to ensure in every way possible that minority and women-owned business enterprises shall have every opportunity to participate in providing professional services, purchased goods, and contractual services to the Flood Control District of Maricopa County without being discriminated against on the grounds of race, religion, sex, age, or national origin.

The CONSULTANT agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, or handicap and further agrees not to engage in any unlawful employment practices. The CONSULTANT further agrees to insert the foregoing provisions in all subcontracts hereunder.

SECTION XV - AMENDMENTS

This Contract may be amended by mutual written agreement of the DISTRICT and the CONSULTANT.

SECTION XVI - INDEMNIFICATION AND INSURANCE

A. The CONSULTANT shall provide and maintain the following minimum insurance requirements:

1. Professional Liability. The CONSULTANT shall show evidence of maintaining continuous insurance for the past three (3) years with a minimum coverage limit of $1,000,000.00 each claim and/or in the aggregate.

The CONSULTANT shall provide and maintain Professional Liability Insurance with a minimum single limit of $1,000,000.00 for each claim made and an aggregate limit of $1,000,000.00 for all claims made through this contract's completion date or the policy's life, whichever is longer.

2. Commercial General Liability. Commercial general liability insurance with a minimum single limit of $1,000,000.00 for each coverage/occurrence. The policy shall include coverage for bodily injury and personal injury, broad form property damage and blanket contractual coverage.

3. Automobile Liability. Automobile liability insurance, with an individual single limit for bodily injury and property damage of no less than $1,000,000.00, each occurrence, with respects to CONSULTANT's vehicles (whether owned, hired, non-owned), assigned to or used in the performance of this contract.

4. Workers' Compensation Insurance. This insurance shall be maintained during the life of the contract.

5. Additional Insured. The policies, except professional liability and workers' compensation, required by this section shall name the DISTRICT as Additional Insured, and shall specify that insurance afforded the CONSULTANT shall be primary insurance, and that any insurance coverage carried by the DISTRICT or its employees shall be excess coverage, and not contributory coverage to that provided by the CONSULTANT. No policy issued under this contract shall lapse, be cancelled, allowed to expire, or be materially changed to affect the coverage available to the DISTRICT without thirty (30) days written notice to the DISTRICT.

6. DISTRICT approved documentation outlining the coverages specified in this section shall be filed with the DISTRICT prior to issuance of the Notice to Proceed.

B. The CONSULTANT agrees to indemnify and save harmless the DISTRICT, any of its departments, agencies, officers, or employees from all suits, including attorney's fees and costs of litigation, actions, loss, damage, expense, cost or claims, of any character or any nature arising out of the CONSULTANT's wanton, willful or negligent acts, errors or omissions in the performance of work under this Contract, and any wanton, willful or negligent acts, errors or omissions by any subconsultant or other agent used by the CONSULTANT in the performance of work under this Contract.

IN WITNESS WHEREOF, the parties herein have executed this Contract.

HOWARD NEEDLES TAMMEN & BERGENDOFF

Principal

DONALD P KEUTH

Printed Name

Associate

Title

Date: 8/14/91

44-0290567

Federal Tax Identification Number

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

STANLEY L. SMITH JR., P.E.
DEPUTY CHIEF ENGINEER

D. E. Sagramoso, P.E.
for Chief Engineer and General Manager

Date: 8-15-91

ACCEPTED AND APPROVED:

Chairman, Board of Directors

ATTEST:

Clerk of the Board

Date: 9.16.91

LEGAL REVIEW

Approved as to form and within the powers and authority granted under the laws of the State of Arizona to the Flood Control District of Maricopa County.

General Counsel, District

Date: 8-15-91

EXHIBIT "A"

SCOPE OF WORK

TOPOGRAPHIC MAPPING AND FLOODPLAIN DELINEATION STUDY
FOR DEADMAN WASH
FCD CONTRACT NO. 90-65

I. LOCATION AND DESCRIPTION OF PROJECT

The project consists of topographic mapping and floodplain and floodway delineations for approximately 12 miles along the Deadman Wash and its tributaries in the northwestern part of Maricopa County, Arizona. This project requires the development of the watershed hydrology using the Corps of Engineers' (COE) 1989 or later version of HEC-1 computer model and the delineations of the 100-year floodplain and floodway using the COE 1991 version of HEC-2 computer model for the selected streams. All work must be reviewed and accepted by the Federal Emergency Management Agency (FEMA). In addition, the Public Notification regarding this project is also required.

II. PROJECT SCHEDULE

Following "Notice to Proceed", all work under this Scope of Work will be completed within 240 calendar days, including 60 days for Flood Control District of Maricopa County (FCDMC) reviews. The project schedule is developed using a bar chart to include a schedule for each major task. This project schedule allows for eight months commencing in September, 1991 and ending in May, 1992.

III. STUDY TASKS

The work to be performed under this contract consists of the development of the watershed hydrology for Deadman Wash, approximately 33 square miles. The floodplain and floodway delineations for approximately 12 miles of the Deadman Wash and its tributaries shall be based on the hydrology as developed by Howard Needles Tammen & Bergendoff (HNTB) and approved by the FCDMC. Exhibit 1 shows the watershed boundary and proposed floodplain delineation limits as well as the survey control points.

This project consists of the following seven tasks:

<u>Task 1 Data Collection</u>

1.1 Initial Field Reconnaissance

A field reconnaissance trip prior to the actual start of the project will take place with the FCDMC staff for the purpose of developing the scope of work. The critical points of study within the watershed and problem areas will be identified in the scope.

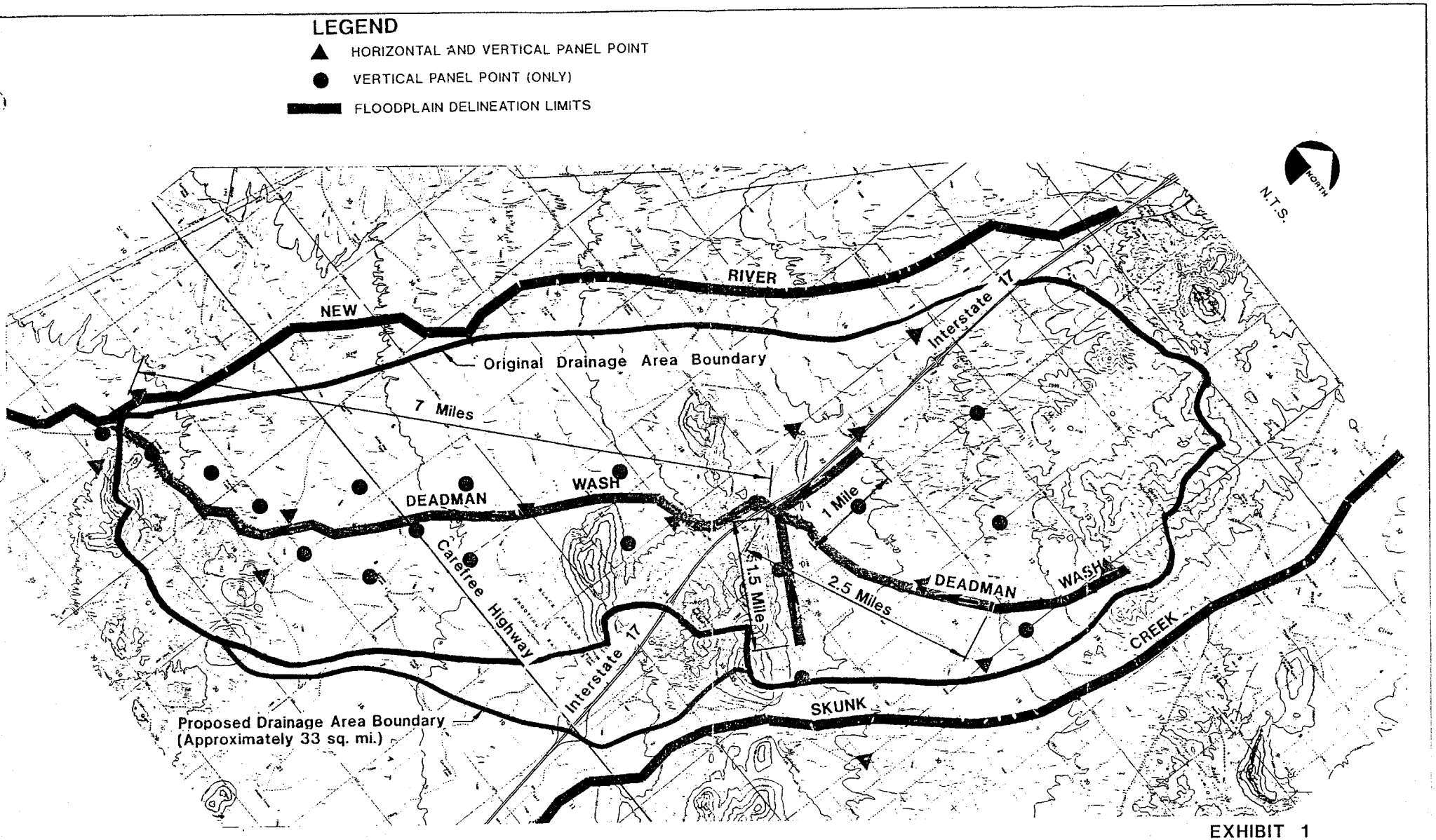
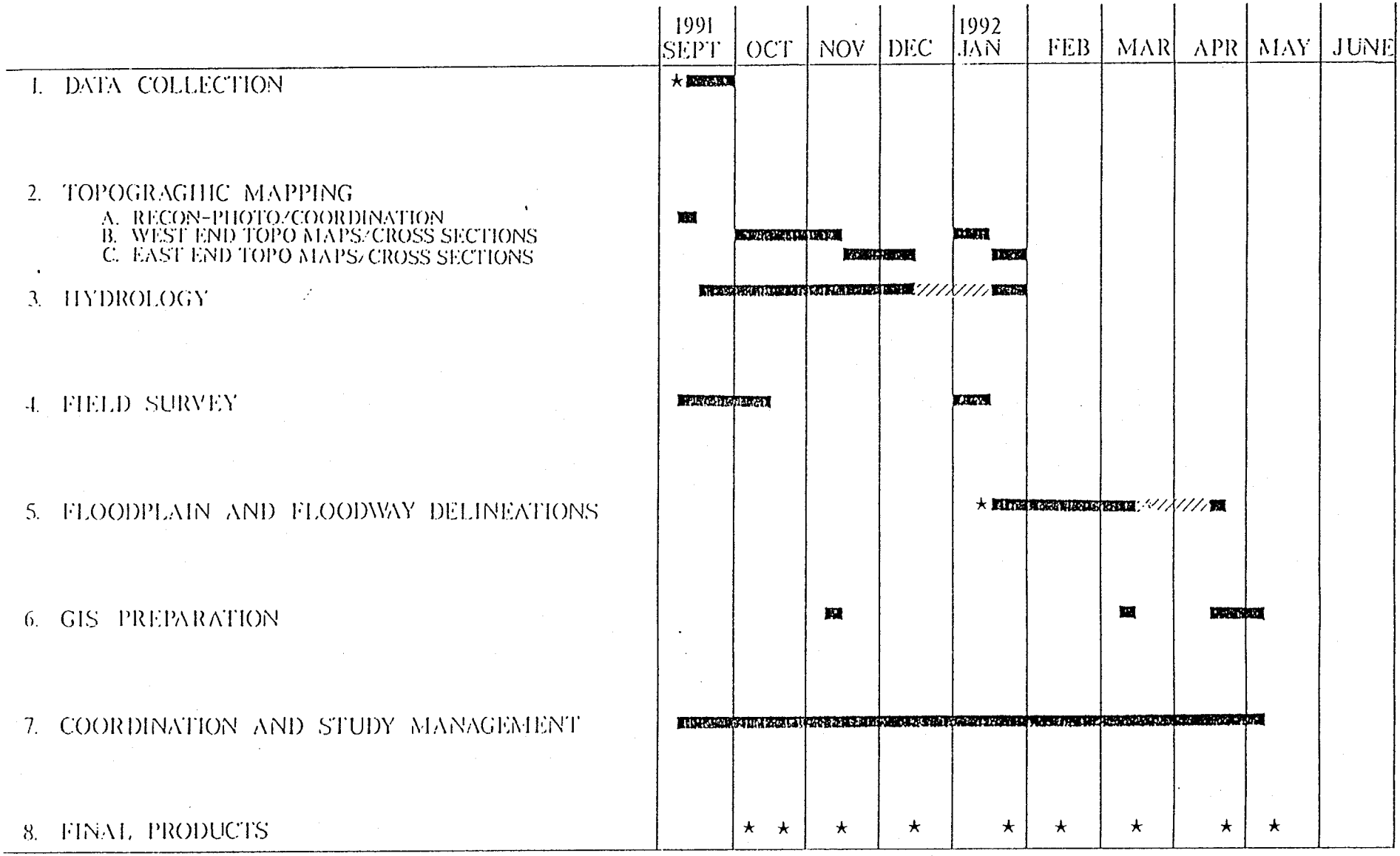


EXHIBIT 1

DEADMAN WASH
STUDY AREA

HNTB

TOPOGRAPHIC MAPPING AND FLOODPLAIN DELINEATION STUDY
FOR DEADMAN WASH
FCD 90-65



LEGEND: ////////// Agency Review ▬▬▬ Work Period ★ Event

1.2 Data Collection and Review

Research for existing information will be made at the outset of the study to assure that all pertinent information required for the various project components is available when needed. Data to be collected and reviewed will include previous master drainage studies and drainage reports; existing topographic maps, aerial photographs, and soil survey; historical flooding information; as-built plans for existing drainage structures; FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions; and other pertinent information.

1.3 Data Collection Summary

A written summary of data collection and review will be submitted to the FCDMC for information purposes.

Task 2 Topographic Mapping

2.1 Rights of Entry

All property owners within the study area will be contacted via certified mail and any necessary Rights of Entry will be obtained. Assistance from the FCDMC may be necessary to complete this task.

2.2 Aerial Survey Subcontractor

Aerial Mapping Company, Inc. has been obtained as part of this contract. We will coordinate all the aerial surveying work with said company to ensure that the specifications of the aerial surveying work is met. Quality control on surveys will be per the FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors. The stereo reconnaissance photos of the project watershed will be used for the hydrologic study.

Topographic mapping for the floodplain delineation areas east of the I-17 will be prepared to a 4-foot contour interval, 1"=200' scale, with spot deviations, while the remainder areas will be prepared at a scale of 1"=200' with a 2-foot contour interval. Topographic mapping will cover the entire 100-year floodplain limits for the study streams.

2.3 Ground Control

a. Survey control will be provided in 1983 NAD.

b. McEwen Global Positioning Systems Inc. has been obtained as part of this contract and GPS surveys will be utilized in setting horizontal and vertical control. The primary control structure for this project will consist of ties to the National Geodetic Survey Triangulation Stations which are numerous through the project. In turn, all surveys will be tied into the State Plane

Coordinate System. In this project area, geoidal undulations are relatively insignificant, making possible excellent vertical solutions using GPS. All of the vertical work will be based on the National Geodetic Vertical Data (NGVD). Network integrity will be evaluated, and geodesy reports for all networks and end line deliverable results of the entire GPS survey, will be provided.

2.4 Control Requirements

The horizontal and vertical control points will be located and marked. The control for the area mapping will be in sufficient numbers and will be in locations compatible with the accuracy of the mapping requirements. A differential level network of at least 3rd order accuracy will establish Elevation Reference Marks (ERMs) and the key mapping control points to NGVD 29 vertical datum. The field control survey will be complete on each phase by GPS methods to establish 2nd order horizontal positions. Any elevations established by GPS methods will be performed dependent on the nearest ERMs as local vertical reference base. Section corners, quarter corners and mid-section points will be used for control points wherever possible.

2.5 Mapping

a. We will provide permanent non-erasable topographic mylar sheets 24" X 36" with a scale of 1-inch equal to 200 feet, with a contour interval of 2 or 4 feet for all mapping. A cover sheet will be provided with the project title, data of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each manuscript shall include a minimum of a north arrow, scale, section corners, existing streets and Highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, description and elevation of control points and ERMs, and reference marks used in ground control. Any section corners and monumentation encountered during the field work will also be identified. The mapping will have an accuracy such that ninety percent (90%) of all contours shall be within one-half contour of the true elevations and the remaining ten percent (10%) of the contours shall not be in error by more than one contour interval.

b. We will provide permanent non-erasable topographic mylars as described above in Section 2.5a with delineated flood plains included. We will also provide the semi-rectified photo transparency to match the final plate windows of the mapping.

c. Hydrologic Work Maps will be at a scale of 1"=2000' and will include three reproducible transparent overlay maps of sub-basins, soil survey information and existing land uses.

Task 3 Hydrology

The hydrologic study will be conducted to develop a hydrologic model for Deadman Wash using the COE HEC-1 computer program (1990 version). All work performed shall be in accordance with the FCDMC Hydrologic Design Manual. The drainage area of Deadman Wash at the New River confluence is approximately 33 square miles. The hydrology will be performed only for the existing watershed conditions. Hence, any future development or proposed drainage improvements within the watershed will not be incorporated into the hydrologic modeling. The Upper Deadman Wash watershed hydrology will be provide by the FCDMC. The necessary modifications are described in Task 3.6.

3.1 Hydrologic Work Map Preparation

The hydrologic work map will be prepared using the current U.S.G.S. 7.5 Minute Series topographic quadrangle maps as the base topographic maps at a scale of 1" = 2000'. Four quadrangle maps will be used to cover the drainage area. They are Daisy Mountain, New River SE, Biscuit Flat and New River. The work maps in conjunction with high level aerial flight photos will be used to delineate the drainage sub-basins, determine the hydrologic parameters, identify split flow locations, and obtain cross sections, as needed. The first overlay map will show the sub-basin delineation, existing drainage patterns, routing reaches, and split flow locations. Geology and soil information will also be shown on these work maps with a separate layer. Sheets 11, 22 and 23 in the Soil Survey of Aguila-Carefree Area, Parts of Maricopa And Pinal Counties, Arizona by Soil Conservation Service will be used to obtain soil information for this project watershed. There are approximately 13 soil map units within the project area.

3.2 Drainage Sub-Basin Delineation

The delineation of drainage sub-basins using aerial, topographic, and soil maps must be as homogeneous as possible. Special considerations will be given to the selection of the sub-basins in order to provide discharge values at all roadway crossings and for future development or improvement needs. The future development within the watershed will be based upon the "Deadman's Wash Area Drainage Master Study," Volumes 1 and 2, dated September, 1990 for the City of Phoenix, by SEA, Inc. and the "Santa Re Conceptual Master Drainage Report," dated April 1991, for Yavapai Resources, Phoenix, Arizona, by Coe & Van Loo Consultants, Inc. (CVL).

The watershed and sub-basin boundaries, soil information, split flow locations, and concentration points will be shown on the work maps and be submitted to the FCDMC for review and approval.

3.3 Hydrologic Parameter Determination

A second field reconnaissance trip will be scheduled after the initial data assembly and review is essentially completed. This field trip will focus on observation of channel conditions; estimation of vegetation cover density; overbank verification of the sub-basin boundaries; observation of possible split flow locations and overflow areas; inspection of levees and stock tanks; and measurement of existing culvert and bridge dimensions. Photographs, slides, and video taping will be used to document the findings during the field trip.

All assumptions and calculations of the hydrologic parameters will be performed based on the information gathered from field trips and data collection, and will be documented in the hydrology report. In addition, the Manning's roughness coefficient estimation along with photographs will be included in the summary of the field inspection which will be submitted to the District for review and approval.

3.4 Hydrologic Modeling

The COE's HEC-1 computer program (1990 version) will be used in accordance with the FCDMC Hydrologic Design Manual and the FEMA Document 37 requirements. The 100-year peak discharges will be generated for the Deadman Wash watershed existing conditions.

The following hydrologic methods will be used to develop the HEC-1 model:

a. Rainfall

The appropriate design storm must be specified. A 100-year storm event using the FCDMC's 6 hour storm distributions will be in the HEC-1 modeling. The 6 hour storm distributions consist of five dimensionless rainfall patterns which will be determined for each subarea based on its drainage area size.

Another design storm, a 100-year, 24-hour storm using SCS Type II distribution, will also be considered. The higher peak flows generated from the two storms will be used for floodplain delineation.

b. Areal Reduction

The rainfall points depth will be selected from the FCDMC Hydrologic Design Manual. The depth-area reduction curve for the Queen Creek area developed by the COE will be used with the 6 hour rainfall. The NOAA HYDRO-40 provided by the FCDMC will be used for the 24-hour rainfall reduction. The JD cards in the HEC-1 model will be used to specify the precipitation depth and the aereal rainfall correction.

c. Rainfall Losses

The Green-Ampt infiltration equation will be used to simulate rainfall losses. Based on the soil texture and vegetation coverage, the Green-Ampt loss rate parameter values will be obtained for each drainage sub-basin. The FCDMC will provide information on each map unit and procedures to calculate the percent imperviousness.

d. Unit Hydrograph Procedures

The Phoenix Mountain and Valley S-graphs shall be used for this project. Program MCUHP2 will be used to compute the required input data for the HEC-1 modeling.

e. Basin Lag

The lag time will be computed for each sub-basin using the S-graph lag equation with the COE 'C' coefficient which is included in the FCDMC Hydrologic Design Manual. The latest version of the Design Manual to be provided by FCDMC will be used to obtain the proper coefficient.

f. Flood Routing

In general, the normal depth storage-outflow channel routing will be used for flood routing. An eight point cross section will be developed for each routing reach from the quadrangle maps and will be field verified. The resulting velocities will be reviewed and assessed for realistic values. For the existing culvert crossings at Interstate 17 (I-17) and roadways, the rating curve will be developed based on the Federal Highway Administration Hydraulic Design Series No. 5 procedures. This rating curve will then be entered to the HEC-1 model for reservoir routing. For spillway and roadway overtopping analysis, the storage routing will be performed.

g. Transmission Loss

A discussion will be conducted with the FCDMC staff at the outset of hydrologic modeling to determine whether or not transmission losses will be applied to the project. If applicable, the FCDMC will provide the percolation

rate to be used in the HEC-1 model. Otherwise, a discussion will be made in the Hydrologic Report for the possible effects on the peak discharges and volumes by not considering the transmission losses.

3.5 Model Calibration

Calibration is a major task for the hydrologic modeling. The results of the HEC-1 models will be carefully examined. Peak discharges and runoff volumes will be evaluated and compared with the previous studies and historic flood information, especially the discharge-frequency curve developed by the FCDMC for the Deadman Wash at I-17 bridge.

The capacity of the channels and culverts will be compared with the calculated peak discharge and adjustment may be needed to obtain more reasonable discharge value. Special attention must be given to the number of routing steps specified for the normal depth routing. Some adjustment can be made to produce realistic routed hydrographs.

3.6 Modifications of Existing HEC-1 Model

The existing HEC-1 model and all pertinent data developed by the CVL will be provided by the FCDMC and incorporated into the overall hydrologic model. The existing HEC-1 model consists of approximately 12.7 square miles in the Upper Deadman Wash watershed on the east side of the I-17.

Based on our reviews of the CVL report and the HEC-1 model, the following modifications to the CVL work are necessary.

1. Additional sub-basins will be delineated and modeled for the existing 15 culverts along the I-17.

2. Additional sub-basins will be required to generate the peak flows for floodplain delineation of the first 1.5 miles on Deadman Wash.

3. Additional sub-basins will be delineated and modeled to obtain peak flows for floodplain delineation along the tributary just south of the main wash.

3.7 Hydrologic Report

A hydrologic report that documents and summarizes the assumptions, procedures, and results of the study will be prepared in accordance with FEMA and ADWR requirements. The report will also include soil and drainage area boundary maps, tables of hydrologic parameters, peak discharges and volumes, and HEC-1 results.

The following steps and interim submittals as directed by the FCDMC will be made during the development of the hydrologic report.

1. A draft hydrologic work map shows the base map with the sub-basin boundaries overlay. This map will be examined and approved by the FCDMC.

2. A draft precipitation calculation summary will be submitted to the FCDMC. This summary will include isopluvial maps, total rainfall to be used, aerial reduction factors, distribution curves, and procedures used.

3. A draft rainfall losses summary includes the parameter estimation for the Green and Ampt losses, soil map units, area averaged parameters and percent imperviousness. A sample calculation of parameters including the base map with the sub-basin and soil map overlays will be included in this submittal.

4. A draft hydrograph generation summary will be submitted and include all information necessary to develop the basin lag for the S-graph method.

5. A draft routing summary will be prepared to include all the routing reach lengths, slopes, typical cross-sections, Manning's "n" values, structure dimensions, transmission infiltration losses and ponding stage-storage-discharge curves.

6. The HEC-1 input files on floppy disk with the schematic diagram will be submitted to the FCDMC.

7. The Preliminary Hydrologic Report including all the above information plus calibration tests and results, comparisons, conclusions and tables.

8. The Final Hydrologic Report will be submitted to the FCDMC at the end of the hydrology task.

Task 4 Field Survey

4.1 Mapping and Control

Topographic mapping and the control network will be established for floodplain/floodway delineation areas as identified in Task 2 and by the FEMA criteria.

4.2 Bench Marks

Field control will be sufficient, at lease one "permanent" point per mile, such point(s) being used as Elevation Reference Marks (ERMs). Surveys will be based on National Geodetic Vertical Datum (NGVD), per FEMA guidelines.

"Permanent" survey points will consist of existing monumentation, such as brass caps or similar survey monuments. Where additional monumentation is needed, survey markers conforming

to Maricopa Association of Governments (MAG) Uniform Standard Detail for Public Works Construction, detail 120-1, Type C, will be placed 2" +/- above grade. Elevation Reference Marks will be labeled on available maps and described in a manner which allow them to be readily located in the field.

4.3 As-builts

"As-built" plans and surveys of all bridges and hydraulic structures will be obtained. Field survey will be conducted to these structures, if no as-built plans exist.

4.4 Cross Sections

We will verify cross-sections for mapped floodplains per ground survey cross-section procedures as described in FEMA Document 37.

Task 5 Floodplain and Floodway Delineations

The hydraulic analysis will be conducted to delineate the 100-year floodplain and floodway for the study reaches of Deadman Wash using the COE HEC-2 computer program in accordance with the FEMA and ADWR requirements. The study reaches, approximately 12 miles, will include 9.5 miles along the Deadman Wash main channel from its mouth and 2.5 miles along the tributaries east of to the I-17 (See Exhibit 1). Flood insurance rate zone will also be determined for these study reaches.

5.1 Work Map Preparation

The initial work map will be prepared using the hydrologic work maps to identify the study reach, cross section locations, existing culvert and bridge structures, existing survey control data, and other pertinent data. This initial work map will be updated as the project progresses and will become the presentation map.

As the aerial mapping is completed, the topographic maps will be used as the work maps to determine the thalweg in the study reach. River miles will be established along the thalweg starting downstream and increasing upstream. River stations will be marked every 0.1 mile and labeled with appropriate mile designations every 0.5 mile of length. The cross section locations will be identified on the work maps for FCDMC review and approval prior to the HEC-2 modeling.

The scale of the work map based on the original scope is called for a 400' scale with a 2 foot contour interval. However, a 200' scale work map with a 2 foot contour interval is proposed and recommended for the floodplain mapping areas west of the I-17. For the area east of the I-17, a 4-foot contour interval will be recommended.

5.2 Cross Section Geometry

Cross sections will be taken approximately every 0.1 mile (500 feet) along the thalweg unless intermediate sections are required. Sections will be labeled according to river miles. Each cross section will be oriented such that it is normal to the direction of flow across the entire channel and floodplain. Cross sections will be bent or doglegged as required. Each cross section's geometric data will cover at least the entire 100-year floodplain.

Significant grade changes will be digitized along a cross-section from left to right looking downstream. The geometric data will be recorded on diskettes in accordance with HEC-2 format. The positional accuracy of these data is anticipated to be the nearest one foot horizontally and to be the nearest 0.5 foot vertically. The channel station center line (thalweg) will be designated as Station 10+000 in compiling cross-sections. Proposed thalweg alignment and cross section locations will be submitted to the FCDMC for review and approval prior to digitizing.

Final cross sections will be plotted using an automated pen plotter. The cross section plots will show water surface profiles, ineffective flow areas, "n" values, encroachments, channel stationing, and other pertinent information. For the interim submittal, cross sections will be printer-plotted for all reviews. A minimum of five percent of the digitized cross sections obtained using photogrammetric methods for HEC-2 input will be field verified with ground survey in accordance with FEMA Document 37.

Cross sections at culverts and other hydraulic structures that affect HEC-2 analyses will be field surveyed to establish existing conditions. The survey data shall include pier widths, channel inverts, roadway elevations, and scour protection. As-built plans for these structures will be used for reference and dimension verification.

5.3 Field Reconnaissance

A follow-up field reconnaissance trip will be conducted for the full study reach. The field work will only focus on floodplain characteristics to supplement the information collected from the previous field trips. Special attention must be given to areas of possible breakouts or split flows, and inspection of levees, stock tanks or other flood control structures.

5.4 HEC-2 Modeling and Refinement

The 100-year floodplain will be delineated using the 1991 version HEC-2 Water Surface Profiles computer program. The discharge values along the selected study reaches will be based upon the results of the hydrologic analysis for this project.

The following additional data and methods will be used to set up the HEC-2 model:

a. Roughness Coefficients

Manning's roughness coefficients for the channel and overbanks will be estimated using field observation data, soil information and aerial photos. Written documentation supplemented with photographs and detailed description of estimating "n" values will be submitted for review and approval prior to the delineation of the floodplain. FCDMC will provide the loss coefficient report.

b. Other Energy Loss Coefficients

Other energy loss coefficients include the contraction and expansion coefficients, and culverts loss coefficients. The contraction and expansion coefficients will be used to evaluate transition losses through bridge sections and transitions. The culvert loss coefficients will be used to calculate energy losses related to pier shape, entrance, and exit conditions. The selection of these coefficients will be based on the values recommended in the HEC-2 User's Manual and the topography in the vicinity of the bridges. These coefficient values will be checked using other methods or equations.

c. Reach Lengths

Reach length between cross sections include channel, left overbank, and right overbank lengths. Channel reach between cross sections are typically measured along the thalweg. Overbank reach lengths will be measured along the anticipated path of the center of mass of the overbank flow. The overbank reach lengths will differ from the channel reach length, where the channel meanders considerably.

d. Starting Water Surface Elevation

The starting water surface elevation at the downstream end of Deadman Wash will be determined by assuming no flow in the New River. The resulting flood profile then will be superimposed with the New River flood water elevation.

e. Bridge Routines

The 1991 HEC-2 program offers three methods for computing head losses through bridge or culvert structures. Three methods include the Normal Bridge Method, the

Special Bridge Method, and the Special Culvert Method. Bridges and culverts will be modeled in conformance with HEC-2 modeling requirements for the selected method. Where multiple bridges occur, each bridge will be handled separately. The effective area near the bridge structure will be defined and a debris clogging factor will be applied to the size of the bridge piers. For skewed bridge or culvert crossings, adjustments to the bridge or culvert dimensions will be made to define an equivalent cross section perpendicular to the flow lines. Another computer program or hydraulic method will be used to check the results.

f. Modeling Ponding Areas

Certain areas along the study reach may be affected by the 100-year flood as ponding areas. For example, a breakout of flows to a low lying area, may form a ponded area behind the major course of the river channel. These ponding areas will be defined as ineffective flow areas. The water surface elevation in the ponded area will be determined using the calculated water surface elevation in the river channel at the respective location.

The delineated ponding area may sometimes be required to be designated as a floodway. The purpose of this floodway is to allow the pond to seek a constant stage throughout the aerial extent of the ponds. The development is not allowed in the pond area even through the placement of fill.

g. Modeling Refinement

The HEC-2 results will be examined carefully and the hydraulic parameters, such as energy slope, top width, water surface elevation, conveyance and velocity, will be verified. Any unreasonably abrupt change in these parameters will be studied carefully. A comparison will be made with the existing studies and reports, if available. Supplemental runs may be needed based on the adjusted geometric data or modification of the input parameters.

Special consideration will be given to areas of breakouts or split flows. Overbank flow conditions downstream of each breakout will be examined. If it appears that the overflow is independent of the channel flow, the breakout discharge will be determined using the HEC-2 split flow option. The bank overflow will be analyzed separately using either HEC-2 or normal depth calculations.

5.5 Floodway Determination

A floodway limit will be determined using equal conveyance encroachment methods in HEC-2. Only Encroachment Method 1 will be used in the final analysis. The difference in water surface elevation between the natural floodplain and the encroached floodplain will not exceed one foot of the water surface elevation or the energy grade line at any cross section. A floodway data table will be prepared to summarize information on floodway widths, mean velocities, and water surface elevations as required for flood insurance studies. Delineations will meet the standards for floodplain delineations as prescribed by FEMA Document 37 and ADWR TR-3.

5.6 Flood Zone Determination

Flood insurance rate zone will be determined in accordance with the FEMA Document 37, dated March, 1991.

5.7 Floodplain Mapping

The 100-year floodplain and floodway delineations will be accomplished after the HEC-2 final results are computed. The profile and flood boundary will be plotted. Engineering judgment will be required to interpret the HEC-2 results and plotting the conditions. Some minor deviations from the program output may be necessary to ensure reasonableness of the flood boundaries. Any significant deviation will be addressed and explained in the accompanying report. Final cross-section plots will match the topographic maps and the flood boundaries.

Upon completion of the floodplain and floodway delineation, a copy of the work map including the HEC-2 input/output flood profile and cross section plots will be submitted for review and comment. This work map will not be digitized into the AutoCAD until the final submittal.

5.8 Floodplain Delineation Report

A report that documents and summarizes the conditions, assumptions, procedures, and results of the study will be prepared in accordance with FEMA and ADWR requirements, after the delineation work has been approved.

Task 6 GIS Preparation

GIS Consultants of Arizona (GCA) have been obtained as part of this contract. We will coordinate all the GIS preparation work with said company to ensure that the FCDMC specifications (See attached Appendix A) of the GIS preparation work is met.

6.1 Project Coordination

a. GCA will meet with the FCDMC and HNTB to obtain existing ARC/INFO data base coverages for this project area. This is necessary to: avoid redundant coverages; update existing control/land corner information and transportation coverages, and to establish a uniform standard basis to build specified project GIS coverages.

b. GCA will coordinate with HNTB and AMCI to plan data collection methods and intermediate data media/format which provide a usable preliminary study tool, uniform data structure, and allow efficient data digitizing, translation or conversion for pre-final output in AutoCAD DXF most readily convertible to final plot/output in ARC/INFO format compatible with current FCDMC standards and specifications.

c. Ongoing project coordination will be necessary throughout the project to discuss required modifications in above methods and formats, and to review preliminary work products with HNTB and FCDMC to ensure conformance, maintain quality control and provide communication of new and revised codes and data specifications.

6.2 Preliminary Data Collection/Translation/Organization

a. Soils Maps

SCS Soils Maps provided by HNTB (in hard copy form) will be direct manually digitized with each individual soil type boundary polygon collected and coded with identifying attributes. A separate Point/Polygon Attribute Table (PAT) will be created to reference alphanumeric SCS soil type description and texture.

b. Control Points

FCDMC GIS for land corner positions will be revised and/or new positions, descriptions and type codes for section corners and mapping control points entered in their assigned Point Attribute Table. All survey/mapping control data will be provided by HNTB in ASCII format, tabular listing with associated reference descriptions to assist in data conversion. ERMs, a separate coverage for FEMA elevation reference marks, will be provided as above.

c. Watershed Basins/Sub-basins

Digitize Rasterscan/vector convert watershed basins/sub-basin boundary polygon and enter each coded reference attribute in appropriate PAT file.

6.3 Check Plot/Edit/Analysis

a. Preliminary check plots will be output in hard copy form. These manuscripts will document GIS data translation progress, assist in quality control and final editing and provide an intermediate record of separate data coverages for client reference.

b. Digital data will be edited to conform with FCDMC specifications and HNTB requirements for finals. Sample coverage files and plots will be informally reviewed with FCDMC GIS department for conformance. Further editing and coding will be performed if necessary.

6.4 Topographic/Flood Map Coverages

Topographic Maps

Translate structure/code topographic maps from AutoCAD to target ARC/INFO environment. Separate coverage layers provided with maps include: Contours, Spot Elevations, Stream Flow Lines, Transportation, and Manmade Features (Structures). These coverages along with related annotation will be assigned with ID and coding for their appropriate coverage layer AAT and PAT tables.

Floodplain, Floodway, Flood Zones, and Flood Elevation Lines provided by HNTB on separate hard copy overlay sheets will be converted to digital form by a combination of raster/vector scanning and direct digitizing. Separate annotation, attributes and codes will be assigned and referenced in each coverage (AAT and PAT).

6.5 Edit, Assemble and Plot Finals

Final flood study maps will be assembled from the above coverages. Final edit in ARC/INFO environment will be performed and a base sheet overlay template coverage prepared with standard legend, sheet index, border, etc.

ARC/Plot files will be created and final Flood Study Maps output in final hard copy form, electrostatic plot on reproducible mylar using a 8836 laser plotter from ARC/INFO ARC/Plot files.

6.6 Archive/Copy and Deliver

Final delivery of Digital FIS map data will be in ARC/INFO EXPORT files on 150MB, 1/2" data cartridges as specified by FCDMC.

6.7 Deliverables

Digital Data for the above project will be structured in Thirteen basic coverages and separate layers/levels as necessary to conform to the preliminary FCDMC specifications for ARC/INFO data (FCDMC Appendix A - GIS Data Specification dated 6/10/91).

Final map plots will be in the following two categories of combined thematic coverages and produced such that final ARC/Plot files may be reproduced on FCDMC target ARC/INFO GIS.

a. Engineer's FIS Study Map/FEMA Floodplain Delineation and Water Surface Elevations

   Each separate water surface elevation and flood zone will be annotated polygons. Transportation, Floodplain, Floodway, Hazard Zones, Elevation Reference Marks, and Flood Elevation lines will be shown (FCDMC coverages A, I, J, K, and L).

   Topographic Mapping

   Contours will be separate 3-D polylines. Spot Elevations will be in the control layer, FCDMC Coverages B, C, D, E, and K will be plotted along with the above final flood study data.

b. Watershed Boundaries & Soils/Watershed Basins & Sub-Watersheds

   Coverages E and G will be shown along with Soils, SCS soils types (FCDMC coverage H). Each soil type boundary to be collected in a separate layer with an associated listing for attributes.

Task 7 Coordination and Study Management

Coordination and study management activities will be required throughout the duration of the study. All submittals shall be through the FCDMC. The following activities will be initiated simultaneously at the beginning of the project:

- Points of contact will be established with the FCDMC staff and the ADWR representative.

- Initiation meetings will be held with the FCDMC's project manager and staff and other groups, as required.

- A detailed project schedule will be developed for the project. This schedule will identify time, durations, and effort requirements for each task and the interrelationship between tasks. The schedule will be submitted to the FCDMC and updated as required.

- Budget cost control data will be entered into the HNTB computerized system for use in tracking costs.

The FCDMC's project manager and staff will be kept informed concerning progress and issues through informal contacts, meetings and reports. Coordination meetings will be held regularly at an interval of three weeks or less, and five milestone meetings including one field review meeting during the hydrologic analysis will be held. One of the milestone meetings will be held with the FCDMC and ADWR. Minutes will be prepared for all meetings and distributed to the FCDMC's project manager and to meeting attendees. Progress reports will be prepared monthly and distributed to the FCDMC's project manager and other parties, as desired.

In addition, the Public Notification through advertisement in the newspapers and letter announcement to the interested groups will be made regarding this project. HNTB will obtain the affidavit of advertisement from the newspapers and submit to the FCDMC.

Task 8 Final Products

The final products consist of reports, maps, computer models, data base, and interim submittals.

a. Mapping

- One complete set of 9" x 9" contact prints of the aerial stereo photographs sequentially numbered and catalogued.
- One complete set of contour maps, blueline, draft copy for the FCDMC reference during the project, delivered immediately following the topographic mapping.
- One complete set of contour maps at 1"=200' scale with the floodplain delineations in reproducible form (mylar) and six blueline copies as outlined in Task 2.
- One set of semi-rectified aerial photo mylar transparency overlays.
- One complete set of mylars for the fold-out maps (no larger than 11" x 17") used in the report.

b. Six (6) hard copies of the HEC-2 and HEC-1 printouts and a copy of the HEC-2 and HEC-1 model input/output on 5-1/4", 1.2 Mb diskettes compatible with an IBM-AT personal computer.

c. Tabular list of control points (ERMs) used with descriptions, elevations, and coordinates.

d. Survey Data

- Field Surveys - copies of all field books and hard copy data dump from data collectors.

- GPS - copies of all field logs and hard cocpy end line data.

e. One (1) copy of all cross sections plotted using a pen plotter. A copy of the cross-sectional data on the 5-1/4" floppy diskettes.

f. Reports-Approved by the Federal Emergency Management Agency (FEMA).

The following summarizes a list of the reports required for this study:

- Hydrologic report
- Floodplain delineation report

The final reports will incorporate the comments of the FCDMC, FEMA and other reviewers. Six (6) copies of the Hydrologic and Floodplain Delineation Reports as described in Tasks 3 and 5, respectively, will be submitted.

g. Documentation for this study will be as outlined in Instructions for Organizing and Submitting Technical Documentation for Flood Studies as required by ADWR, State Standard Attachment SSA-90-1 Sept. 1990.

h. The summary of deliverables for the GIS preparation is included in Task 6.7.

It shall be noted that all the interim submittals for the maps will be a red-lined set for all reviews and the HEC-2 cross section plots for interim submittals will be simply printer-plotted.

We understand that the FCDMC will withhold the final payment pending the acceptance and workability of the GIS module on the FCDMC system.

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APPENDIX A - GIS DATA SPECIFICATION

1. Topographic mapping, floodplain delineation mapping, hydrologic watershed boundaries, and soils group boundaries shall be submitted in a digital format acceptable to the Flood Control District of Maricopa County. The requirement for digital submission is in addition to any requirements for written (hard-copy) data and reports which may be required elsewhere in the scope, in this Appendix, or by law.

2. Data required by this scope of work or by this or other Appendix or Supplement to this scope of work shall be prepared as ESRI Arc-Info coverages in accordance with the instructions in this specification. Hardcopy maps, drawings, renderings, plots, and related items required by this scope or its supplements or be law shall represent final data which as been or is being delivered in fulfillment of the requirements of the scope of work. The maps, drawings, renderings, plots, or related items shall be reproducible at the time of submission and acceptance on the target computer system from the data, AML macros, and other information delivered.

3. Arc-Info coverages shall be prepared in accordance with procedures and practices of Release 5.01 or later of the Arc-Info software running on a Data General Aviion 410 DG/UX workstation or a hardware platform capable of producing coverages and files which can be transferred to the target system without any loss of data or data integrity or reliability modification. Use of single precision m=numbers to allow data development on personal computes systems is permitted if the consultant determines that use of single precision numbers will not adversely affect the quality or reliability of the data.

4. Consultant may develop or manipulate data on any system of his choosing and convert that data to the required Arc-Info coverages. However, the Arc-Info coverages, text, and data shall be the official version of the data submitted in fulfillment of the contract. The District will not consider payment for services rendered by the consultant in the transfer of data from other CAD System to ARC-INFO format unless the consultant can clearly show that original development of the data under the ARC-INFO system is not technical or economically feasible. See paragraph 10 for related stipulations.

5. Features for which there is an entry in an AAT or PAT file must have a User-ID assigned to it. Where coding is required, features in a coverage shall be attributed in the AAT or PAT files with descriptive codes taken from the publication, "Appendix D, Digital Line Graphs from 1:100000 - Scale Maps - Data Users Guide 2, National Mapping Program, Technical Instructions, US Department of Interior, USGS, National Mapping Division". If this scope requires identification of a feature for which no appropriate code exists (such as floodplain limits) the code shall be taken from the Flood Control District which shall assign a code to the feature. Coverages containing codes not obtained through one of these methods will be returned for correction.

6. Consultants shall document the data structure of each coverage provided and shall endeavor to use a similar table structure, column labeling conventions, column data types, and so forth from coverage to coverage. Documentation shall be prepared in accordance with paragraph 1 of this Appendix.

7. Consultant may select or design symbols, line types, annotation style, and fill patterns and colors, Arc Macro Language routines, and the like to produce attractive and useful maps. These elements must be submitted to the FCD in appropriate exchange files such that the provisions of paragraph 3 can be met. Full textural documentation of these elements is required.

8. Data required by the contract and amendments thereto shall be submitted in the Arc-Info release 5.01 "EXPORT" (.e00) file format. Arc-Info coverages shall be prepared in accordance with Arc-Info Release 5.01 or later running on a Data General Aviion 410 workstation (target system) or on a computer system capable of producing Arc-Info "EXPORT" files which can be transferred to the target system using the Arc-Info "IMPORT" utility. EXPORT files shall be copied to QIC-150 formatted, 150 MB, 1/2-inch data cartridges in a POSIX-compliant TAR format. Floppy disks, reel-to-reel, CD-ROM, and other media are not acceptable.

*** 9. All coverages should be submitted in State Plane Coordinates, NAD27.

10. COVERAGES SPECS

10.1 *GENERAL INFORMATION*

10.1.1 The Arc-Info coverages should have defined spatial relationships. (Built Topology - Area Definition, Connectivity and Contiguity)

10.1.2 The FCDMC will supply a coverage with the State Plane Section Corners and a coverage with the County border. Attributes on the PAT of the Section corners are the type of marker and the source of the point. If more accurate points are located by this study (GPS or surveyed), then the coverage supplied by the FCD should be revised and updated with the new and more accurate information. The new updated section corners should be used as the registration Tics of ALL the coverages. Labeling of the Tics should be done according to the file supplied by the FCD.

10.1.3 Annotation should be placed in different levels depending on the map scale. For example when annotating roads, the main mile road names should be in one level and the minor road names should be in a different level. The AAT and the PAT files should also include an item that identifies the features that have been labeled with annotation. For example, the road.pat should have an item :Road-Name that includes the name of the road.

10.1.4 When digitizing from different map sources, if the source map is using a projection different than State Plane (Transverse Mercator, etc), appropriate steps should be taken to ensure that the digitized lines are projected back to State Plane.

10.2 *COVERAGES:*

A. INDEX

This coverage should have the page layout as presented in the plotted mylars.

Coverage Name:	WTINDEX
Coverage Type:	Polygon

Codes: The following codes should be added to the PAT

Item Name:	Page#
Item Width, Output Width and type	3,3,I
Information:	Page Layout

B. TOPOGRAPHY

Coverage Name: CONTOURS
Coverage Type: Line

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Index Contour	020	0200	020	0600	021	(elev.)
Hidden Indx Cont	020	0200	020	0650	021	(elev.)
Depression Idx Cont	020	0200	020	0611	021	(elev.)
Intermediate Cont	020	0250	020	0600	021	(elev.)
Hidden " "	020	0250	020	0650	021	(elev.)
Depression " "	020	0250	020	0611	021	(elev.)

NOTE: (elev.) should be the contour elevation.

*** Annotation with the elevation of the contour should be placed on top of the contour line. The contour line should not be split to accommodate the elevation. The annotation should be shown several times along the contour line to facilitate its identification. (Approx every 10" - Map Units)

C. CONTROL POINTS

Coverage Name: CONTROLPNTS
Coverage Type: point

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Horizontal Control	300	0050	020	060L	021	(elev.)
Vertical Control	300	0051	020	060L	021	(elev.)
Spot Elevation	020	0300	020	060L	021	(elev.)
Section Corner	300	0001	020	060L	021	(elev.)
Property Corner	300	0052	020	060L	021	(elev.)

NOTE: L=value of the decimal fraction of the spot elevation.
(elev.) = integer part of the elevation

Example: an spot elevation of 1325.8 ft should be coded as follows:

020	0300	020	0608	021	1325

D. TRANSPORTATION

Coverage Name: ROADS
Coverage Type: Line

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I
	RDNAME	23,23,C

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Roads (Conc/Asph)	170	0209*	0	0	0	0
Improved Dirt Rd	170	0250	170	064	0	0
Trails	170	0211	0	0	0	0
Pavement Edge	170	0300	0	0	0	0
Railroads	180	0201	0	0	0	0

*** *NOTE: 209 for Road or Street Class 3 (Main Mile Roads)
210 for Road or Street Class 4 (Minor Roads)

Roads should be annotated in 2 different levels depending on the class type.

If the consultant selects to show the edge of pavement (as 2 different lines) instead of the centerline, then the RDNAME is not required as an attribute of the AAT file. However the road name should still be shown as ANNOTATION.

E. WATER FLOW LINES

Coverage Name: FLOW
Coverage Type: Line

For future modeling of water flow within ARC-INFO it is required that the lines that describe the water flow are digitized in the direction that the water is flowing.

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Water Flow lines	050	0470	0	0	0	0

F. MUNICIPAL BOUNDARIES

Coverage Name: MUNICIPAL
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I
	NAME	23,23,C

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Boundaries	090	0100	0	0	0	0

G. WATERSHEDS BASINS AND SUBWATERSHEDS

Coverage Name: WATERSHED-NAME
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I
	WSNAME	10,10,C

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Boundaries	050	0150	0	0	0	0

The coding scheme of the WSNAME should provide the capability of being able to redefine items in INFO and be able to group the subwatersheds into the watersheds.

H. SOILS

Soil types should adhere to SCS coding scheme.

Coverage Name: SOILS
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I
	SOILTYPE	5,5,C
	TEXTURETYPE	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Boundaries	090	0170	0	0	0	0

SOIL DESCRIPTION TABLE:

A table that relates Soil Type Codes with their description should also be supplied.

ITEMS:		
	SOILTYPE	5,5,C
	DESCRIPTION	50,50,C

TEXTURE DESCRIPTION TABLE:

A table that relates Texture Type codes with their description should also be supplied.

ITEMS:		
	TEXTURETYPE	4,4,I
	DESCRIPTION	50,50,C

I. FLOODWAY/FLOODPLAIN

Coverage Name: FLOODWAY
Coverage Type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Floodway	050	0670				
Floodway Fringe	050	0671				

J. HAZARD ZONES

Coverage Name: ZONES
Coverage Type: Polygon

ITEMS:

MAJOR1	4,4,I
MINOR1	4,4,I
MAJOR2	4,4,I
MINOR2	4,4,I
MAJOR3	4,4,I
MINOR3	4,4,I
ZONENAME	4,4,C

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Zones	050	0170	0	0	0	0

The Zone name should be annotated in level one and also be included in the PAT file.

K. FEMA REFERENCE MARKS

Coverage Name: BM
Coverage Type: Point

ITEMS:

MAJOR1	4,4,I
MINOR1	4,4,I
MAJOR2	4,4,I
MINOR2	4,4,I
MAJOR3	4,4,I
MINOR3	4,4,I
BM-ID	4,5,B

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
Benchmarks	020	0300	020	060L	02N	(elev.)

BENCHMARK DESCRIPTION TABLE:

A table that relates the benchmark to the description and remarks should also be supplied:

ITEMS:

BM-ID	4,5,B
DESCRIPTION	200,200,C

*** L. **FLOOD ELEVATION LINES:**

Coverage Name: SWE
Coverage type: Line

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I
	MAJOR2	4,4,I
	MINOR2	4,4,I
	MAJOR3	4,4,I
	MINOR3	4,4,I

Codes:	Feature		Description		Parameter	
	MAJOR1	MINOR1	MAJOR2	MINOR2	MAJOR3	MINOR3
SWE (As per FIRM)	020	0271	020	060L	02N	(elev.)

Lines should be annotated with the appropriate elevation in the coverage.
The FCD will supply the symbol set file for SWE (As per FIRM) lines, to ensure uniformity at plotting time.

*** M. **MAN MADE FEATURES (bridges/Culverts)**

Coverage Name: PLANOMETRICS
Coverage type: Polygon

ITEMS:		
	MAJOR1	4,4,I
	MINOR1	4,4,I

Codes:	Feature	
	MAJOR1	MINOR1
Bridges	200	010
Culverts	200	020
Other	200	030

*** N. **DEPRESSION TICS**

Coverage Name: DPTICS
Coverage type: Line

This coverage will be seen as annotation (Just for display purposes). No topology is needed. No coding is required.

O. CROSS-SECTIONS

Coverage Name: XSECTIONS
Coverage type: Line

ITEMS:

XSEC-ID	10,10,N,4
Q	10,10,I
FW-ELEV	10,10,N,2
FP-ELEV	10,10,N,2
LABEL-ID	5,5,C

10.3 *NOTES:*

This is a preliminary list that describe 15 different coverages that would cover the total of the information that is presented in Hard copy form. If there is additional information that makes part of the mylar and is not included in this list, then these features should be added to one of the above coverages or to a new one, as coordinated with the District.

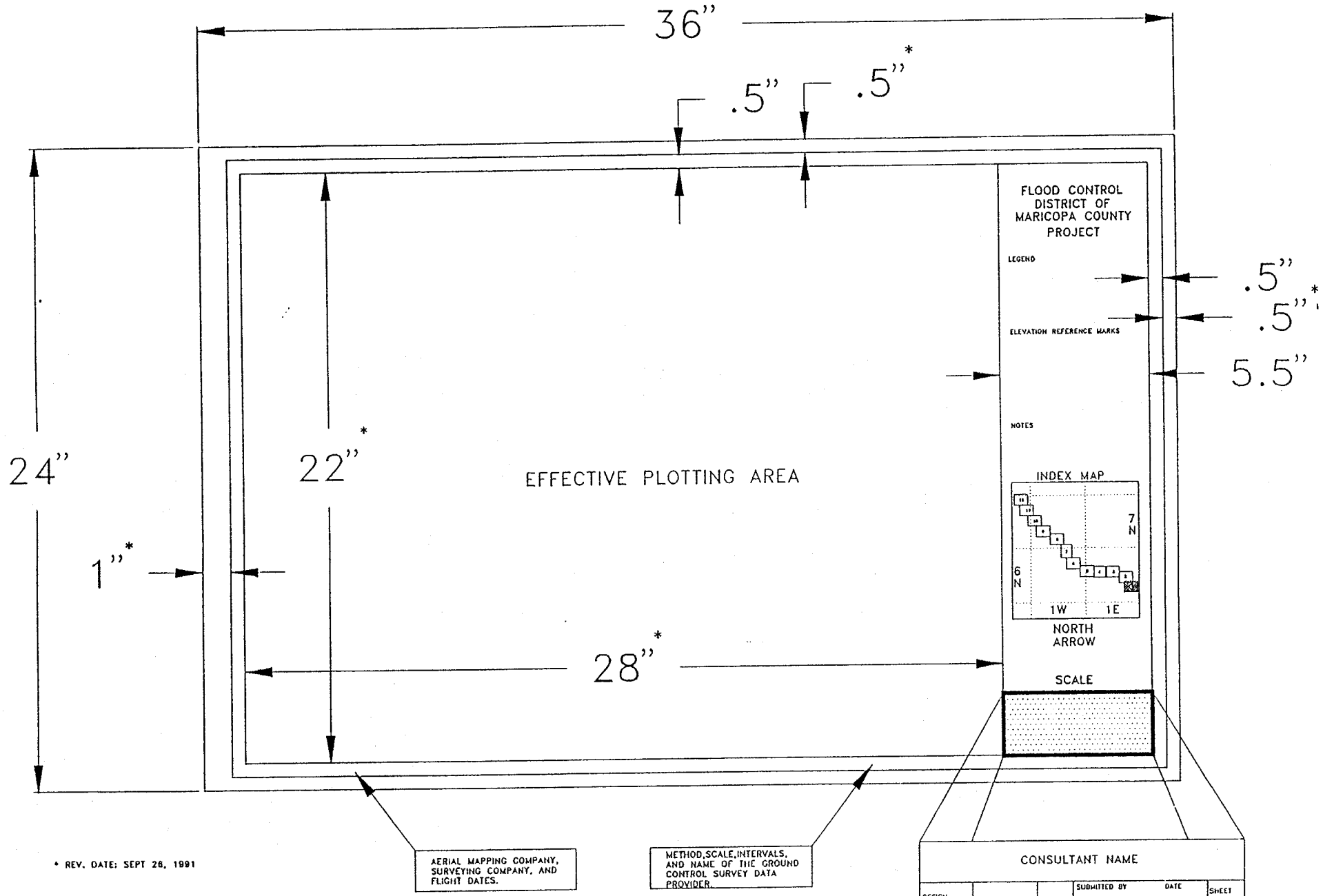
11. Maps should be submitted in 24"x36" pages. The layout of the page should be as shown in Fig.1

    A. The Map Index should be referenced to Township and Range.

    B. Maps should include names of the Aerial mapping company and the surveying company .Flight Dates should also be included.

    C. Maps should include :Method, Scale and Intervals as well as the name of the ground control survey data provider.

*** D. Effective Plotting Area is 22"x28" Page units.



* REV. DATE: SEPT 26, 1991

FIGURE 1

CONSULTANT NAME

DESIGN			SUBMITTED BY DATE	SHEET
DESIGN CHK			RECOMMENDED BY DATE	
PLANS			APPROVED BY DATE	
PLANS CHK			CHIEF ENGINEER AND GENERAL MANAGER	OF

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 2: MAPPING AND SURVEY INFORMATION

SECTION 2: MAPPING AND SURVEY INFORMATION

2.1 General

The mapping and survey information used in the hydrology portion of this project were the USGS 7.5 Minute Series quadrangle maps, stereo reconnaissance aerial photographs, and field surveys. Topographic mapping prepared for the floodplain delineation portion of this project was also used to obtain some cross-section data for reach routing in the hydrologic analysis.

The four USGS quadrangle maps used for the hydrologic study are at a scale of 1" = 2,000' with countour intervals of 20' or 40'. The following are the description of these maps:

Daisy Mountain:	1981 Photo Revised, 1962 Photo Date, 40' Contour Interval, 20' Supplementary Contour Interval.
New River SE:	1981 Photo Revised, 1962 Photo Date, 40' Contour Interval, 20' Supplementary Contour Interval.
Biscuit Flat:	1981 Photo Revised, 1962 Photo Date, 20' Contour Interval, 10' Supplementary Contour Interval.
New River:	1981 Photo Revised, 1962 Photo Date, 20' Contour Interval, 10' Supplementary Contour Interval.

Aerial and topographic mapping was conducted for Deadman Wash and its two tributaries for floodplain delineations. These topographic maps were prepared at a scale of 1" = 200' with 4' contour intervals for the area east of I-17 and 2' contour interval for the area west of I-17.

2.2 Index of Maps

Six exhibits were prepared for the hydrologic analysis. The USGS quadrangle maps were used as the base map for **Exhibit 1** through **Exhibit 4**. The following are the description of these exhibits:

EXHIBIT 1: DRAINAGE BASIN MAP - The watershed and sub-basin boundaries and identifications were shown on this Exhibit.

EXHIBIT 2: DRAINAGE SUB-BASIN SOILS MAP - The SCS soil map unit sheets in the study watershed were digitized, plotted and overlaid on **EXHIBIT 1** to show soil map units in each drainage sub-basin.

EXHIBIT 3: DRAINAGE SUB-BASIN LAND USE MAP - Three types of land use characteristics (Mountain, Hillslope, and desert and rangeland) were presented and overlaid on **EXHIBIT 1.**

EXHIBIT 4: DRAINAGE SUB-BASIN FLOW PATHS AND FLOOD ROUTING MAP - Lag time flow paths, concentration points, top and bottom elevations along routing reaches, and existing major drainage structures were shown on this Exhibit.

EXHIBIT 5: HEC-1 MODEL SCHEMATIC - This Exhibit shows the HEC-1 model schematic including runoff calculation nodes, routing reaches, concentration points, storage routing nodes, and diversion points.

EXHIBIT 6: REACH ROUTING CROSS SECTION PLOTS (2 SHEETS) - Reach routing cross sections used in the hydrologic study were plotted on this Exhibit.

2.3 Survey Field Notes

The field survey work was conducted under the direct supervision of Michael J. Tholl of HNTB, Arizona RLS Number 22283. McEwen Global Positioning System, Inc. was obtained to provide horizontal and vertical control using satellite global positioning. A total of 32 horizontal and vertical panel points were established. 14 supplementary vertical points were used for field surveys. All survey control were provided in the Arizona State Plane Coordinate System on NAD 1983 datum.

Project Engineering Consultants, Ltd. was employed to establish Elevation Reference Marks (ERMs). 16 ERMs were installed based on the National Geodetic Vertical Datum (NGVD) 1929 datum with at least 3rd order accuracy. Survey markers were installed to each ERM per the MAG detail and placed at a maximum of one mile intervals. Ten cross sections were field verified against the topographic mapping per the FEMA guidelines.

Locations of horizontal and vertical control points, and ERMs are shown on the exhibits at the end of this **Section 2.** In addition, control point data, ERMs' decription in a tabulated form, daily report, and all panel data are also included. Survey field notes and the raw data dump on a floppy diskette are included in **Appendix A** of Volume 2 of 2 in the Hydrology Report.

2.4 Watershed and Hydrologic Analysis Maps

Six exhibits were developed for the watershed and hydrologic analysis. These full size maps are included in back pockets of Volume 1 of 2 in the Hydrology Report. Refer to **Section 2.1** for a detailed description of each map.

2.5 Hydraulic Analysis Maps

Aerial and topographic mapping were prepared at a scale of 1" = 200' for the hydraulic analysis portion of this project including 10.5 miles along Deadman Wash, 1.5 miles on Stream No. 4 and one mile on Stream No. 7. Aerial Mapping Company, Inc. was obtained to perform aerial and topographic mapping. Two different contour intervals were applied to the study reaches. A contour interval of 4' was used for the reaches east of the I-17 on topographic maps, while 2'contour intervals was employed to the rest of the reaches. GIS Consultant of Arizona, Ltd was also contracted to provide the GIS ARC/INFO services to this project. The project ARC/INFO data conversion will be completed in accordance with the Maricopa County's "GIS Data Specification," after the FEMA approval of this study.

DEADMAN WASH

ERM #	ELEV.	COORDINATES		DESCRIPTION
	(ft.)	North (Y) Feet	East (X) Feet	
1	1498.531	1009704.637	608932.260	B.C. in granite stamped "SNOD 1991". 300'± S.E. of Snodgrass Tank. In the S.W. 1/4 Sec. 13, T5N R1E.
2	1512.499			B.C. in 6" conc. post stamped "1512.50". 1000'± S.W. of Maricopa Tank in the N.E. 1/4 Sec 13, T5N R1E.
3	1541.933	1013344 ±	615908±	B.C. in 6" conc. post stamped "1541.93". 40' ± N.E. of Jeep Trail inter. 1000'± N.E. S. 1/4 Cor. Sec 7, T5N R2E.
4	1586.849	1017805.779	618653.894	A.D.O.T. P&M B.C. on conc. post stamped "GATE" @ M.P. 28, 3 1/2' ± N. of S. R/W Fence of Carefree Hwy. 900'± East of N.W. Cor. Sec. 8, T5N R2E.
5	1611.458			B.C. in 6" Dia. conc. post stamped "1611.46". 300' ± S.W. of E. 1/4 Cor. Sec. 5, T5N R2E.
6	1632.849	1023191.261	623151.572	U.S.G.L.O. B.C. (S.E. Cor Sec. 32, T6N R2E).
7	1669.324			U.S.G.L.O. B.C. (E. 1/4 Cor Sec. 32, T6N R2E).
8	1688.706			U.S.G.L.O. B.C. (S. 1/4 Cor Sec. 28, T6N R2E), along N-S fence.

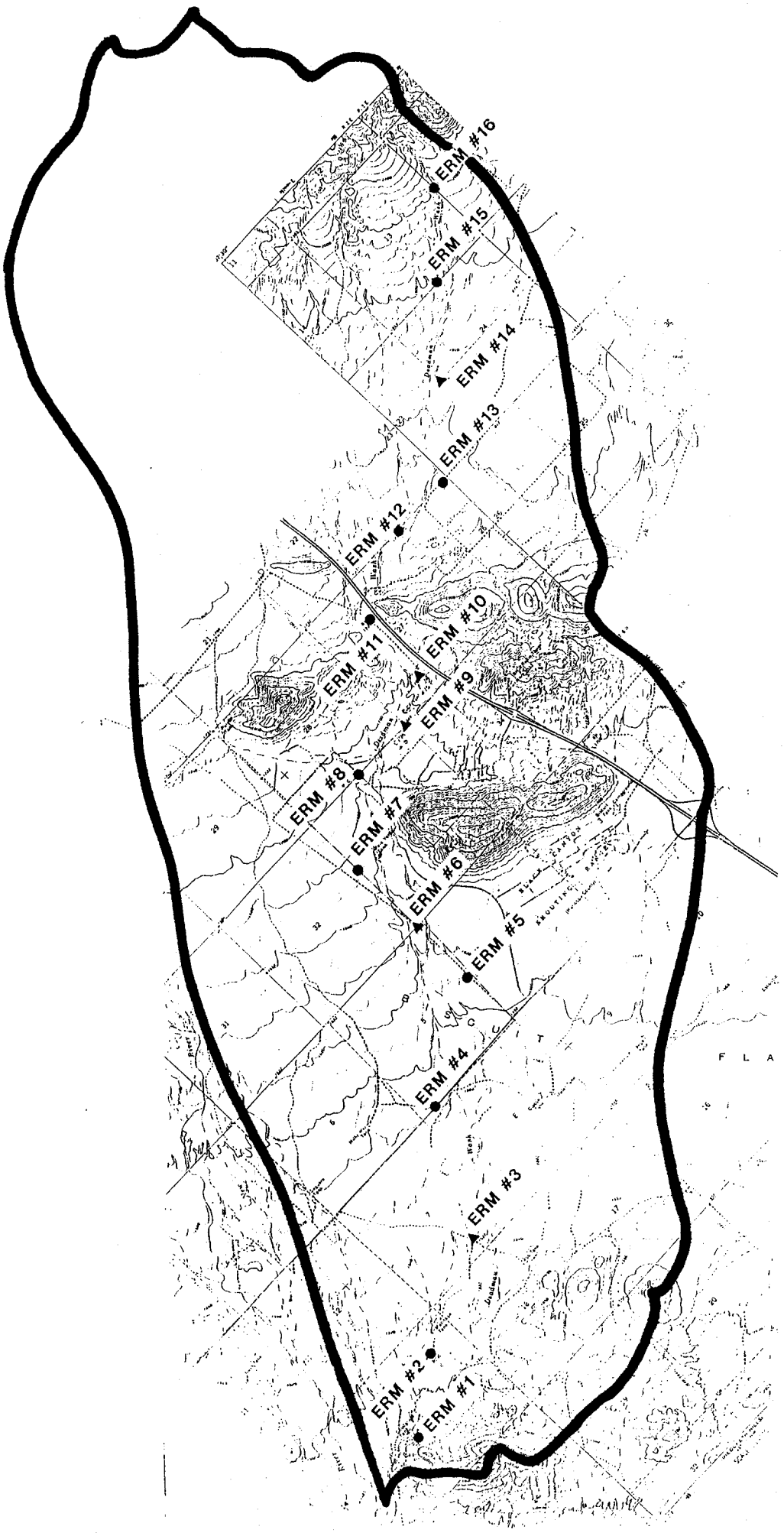
ERM #	ELEV.	COORDINATES		DESCRIPTION
9	1689.700	1028753.635	628447.834	M.C.H.D. B.C. flush in conc. in paved road, (N.W. Cor Sec. 34, T6N R2E).
10	1704.830	1029663.623	630210.216	U.S.G.S. B.C. on 3 1/2" dia. pipe stamped "1705". 150'± W. of dirt rd. (950' ± N. and 1750'± E. of S.W. Cor. Sec. 27, T6N R2E).
11	1722.720	1032470.852	630482.984	U.S. C & G.S. B.C. in rock stamped " U-56 1984" Rec. 1722.720. (2000± E. and 1500' ± S. of N.W. Cor. Sec. 27, T6N R2E).
12	1751.901			U.S. G.L.O. B.C.(WC N.E. Cor. Sec. 27, T6N R2E).
13	1791.558			B.C. in 6" dia. conc. post stamped "1791.56" 1'± N.E. of fence cor. S.W. R/W of 31st Ave. and Desert Hills Drive In N. 1/4 Cor. Sec. 26, T6N R2E.
14	1824.559	1036658.235	639034.828	U.S.G.L.O. B.C. (E. 1/4 Cor. Sec. 23, T6N R2E).
15	1899.660			U.S.G.L.O. B.C. (N.1/4 Cor. Sec. 24, T6N R2E).
16	1996.555			U.S.G.L.O. B.C. (E 1/4 Cor. Sec. 13, T6N R2E).

MJT/bgs DEADMAN.ERM

Ten stream cross sections were obtained by field survey methods. Refer to **Appendix A - Survey Field Notes**, Book 97, pp. 46 through 68. Distribution of the sections is as follows:

Stream

Deadman Wash - 75' South of Split
Deadman Wash - 575' South of Split
Stream No. 12 - Existing Carefree Highway Pipe
Deadman Wash - 146' South of Carefree Highway
Deadman Wash - 175' North of Joy Ranch Road
Deadman Wash - I-17 Bridges
Deadman Wash - Structure #1 through #5, #7 and #8
Stream # 5 -
Stream # 4 - North of Irvine Road on 33rd Avenue
Deadman Wash - 500' West of intersection of 33rd Avenue and Desert Hills Drive


ERM #16
ERM #15
ERM #14
ERM #13
ERM #12
ERM #11
ERM #10
ERM #9
ERM #8
ERM #7
ERM #6
ERM #5
ERM #4
ERM #3
ERM #2
ERM #1
F L A

D002
D003
D007
D008
D004
D011
D014
D010
D009
D005
D016
D015
801
805
#P004
D025
800
806
D019
D017
D006
D012
813
808
#9995
810
804
802
500
D024
D021
D020
D026
812
#P650
D023
811
D022
809
D013
803
D018
#P033
D030

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 3: HYDROLOGIC ANALYSIS
AND
SECTION 3.1: Hydrologic Method Description

SECTION 3: HYDROLOGIC ANALYSIS

3.1 Hydrologic Method Description

3.1.1 Introduction

Howard Needles Tammen & Bergendoff (HNTB) was contracted by the Flood Control District of Maricopa County (FCDMC) to conduct a floodplain delineation study for the Deadman Wash watershed. The study watershed is located in northeastern Maricopa County, Arizona, and is shown on **Figure 1 - Location Map.**

This hydrology report is a part of the study contract for the Deadman Wash Floodplain Delineation Study, Contract No. FCD 90-65. This report describes the development of hydrologic models and peak discharges to be used in the hydraulic analysis and floodplain delineation portions of the contract. This report also identifies potential flood hazards and provides valuable hydrologic data for future developments and improvements in the watershed.

This report contains two volumes. Volume 1 includes all sections required for a hydrology report, HEC-1 model outputs, and exhibits. Volume 2 compiles all appendices and back-up materials. This report is organized in a sequence according to the documentation index numbering system in the Instructions for Organizing and Submitting Technical Documentation for Flood Studies, developed by the Arizona Department of Water Resources (ADWR), Engineering Division, dated August 1990 and revised September 1991 (Reference 1).

The main part of this hydrology report is the **Section 3 - Hydrologic Analysis. Section 3** covers six major components in watershed hydrologic analysis. Hydrologic method description is covered in **Section 3.1**, which describes the purpose of the study, the study area, and methodologies used. **Section 3.2 - Parameter Estimation** is divided into five sub-sections. These sub-sections are Drainage Area Boundaries (**Section 3.2.1**), Physical Parameters (**Section 3.2.2**), Statistical Parameters (**Section 3.2.3**), Precipitation (**Section 3.2.4**), and Gage Data (**Section 3.2.5**). Physical Parameters are presented in the five sub-sections including Sub-Basin Parameters (**Section 3.2.2.1**), S-Graph Method Parameters (**Section 3.2.2.2**), Green-Ampt Parameters (**Section 3.2.2.3**), Reach Routing Parameters (**Section 3.2.2.4**), and Storage Routing Parameters (**Section 3.2.2.5**). **Section 3.3** is Calibration followed by Special Problems/Solutions (**Section 3.4**) and Final Results (**Section 3.5**). **Section 3** is completed by the **Section 3.6** called Final Modeling Results on Diskettes. A list of references can be found in **Section 6.5.1** and Exhibits are included in back pockets.

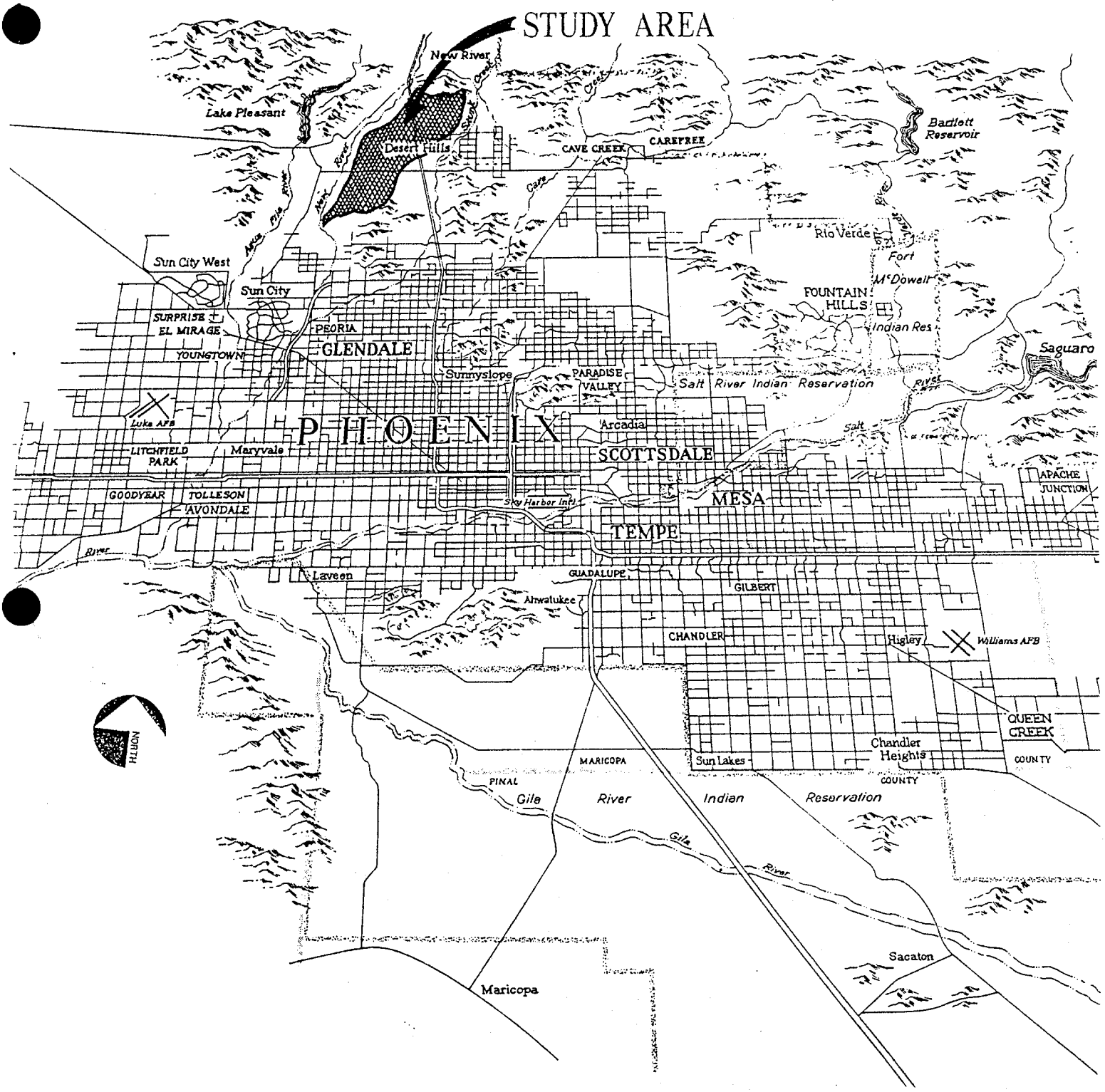


FIGURE 1

LOCATION MAP

HNTB

DEADMAN WASH FLOODPLAIN DELINEATION STUDY

3.1.2 Methodology

The watershed hydrology was developed utilizing procedures and methodologies described in the Hydrologic Design Manual for Maricopa County, Arizona (Manual), by Flood Control District of Maricopa County, dated September 1, 1990 (Reference 2). The hydrologic analysis was performed using the U.S. Army Corps of Engineers' (USCE) HEC-1 computer program, version 4.0, dated September, 1990, as implemented by Haestad Methods, Inc (Reference 3). Peak discharges for the 100-year 6-hour and 100-year 24-hour duration storms were determined for the existing land use conditions in the watershed. The results of hydrologic modeling for these two different duration storms will indicate that which critical duration storm will result in the higher peak flow at various locations in the watershed. The higher discharge of the two duration storms will be adopted in the floodplain delineation study.

The point precipitation values were obtained from isopluvial maps for Maricopa County published in the Manual (Reference 2). These precipitation values were adjusted in accordance with the depth-area reduction curves in the Manual and the National Oceanic and Atmospheric Administration (NOAA) HYDRO-40 (Reference 4). The rainfall distributions used were the rainfall patterns and distributions presented in the Manual for the 6-hour duration storm, and the Soil Conservation Service (SCS) Type II distribution for the 24-hour duration storm. Rainfall losses were estimated using the Green and Ampt infiltration equation with soil texture, vegetation cover, and land uses information. The Phoenix Mountain and Phoenix Valley S-graphs presented in the Manual were used for hydrograph computation.

Hydrographs were routed through the watershed using the normal depth channel routing and reservoir storage routing. For the existing drainage structures at the major concentration points, the rating curves including the roadway overtopping analysis were generated using the Federal Highway Administration (FHWA) HY-8 Culvert Hydraulics computer program, Version 1.1 (Reference 5). The above program was developed based on the FHWA Hydraulic Design Series (HDS) No. 5 procedures (Reference 6). These rating curves were then entered to the HEC-1 models for reservoir routing. The split flow just north of the Carefree Highway was determined using the USCE HEC-2 computer model. The results were then entered into the HEC-1 models for use of the diversion option (References 3 & 7).

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SECTION 3.2.: Parameter Estimation
AND
SECTION 3.2.1: Drainage Sub-Area Boundaries

3.2 Parameter Estimation

3.2.1 Drainage Area Boundaries

The project watershed is located in the northeastern part of Maricopa County, Arizona. The area of study is shown on **Figure 2 - Vicinity Map.** The study watershed area for the Deadman Wash at the New River confluence is approximately 34 square miles. Refer to **Exhibit 1 - Drainage Basin Map** for the watershed boundary. The watershed is bounded on the west by the New River, on the north by the Daisy Mountain, on the east by the Skunk Creek, and on the south by the City limits of Peoria and the Hayden-Rhodes Aqueduct. Daisy Mountain located in the northeast corner of the watershed, is the headwater of Deadman Wash and provides the highest elevation at 3,176 feet above mean sea level (msl). Several other unnamed mountains are located in the center and southern portions of the watershed with a maximum elevation of 2,193 feet above msl.

The watershed is predominantly desert and undeveloped lands, and is divided into two sections by Interstate 17 (I-17). The east section of the watershed is characterized as very rugged mountainous terrain. Stream channels are well-defined in the immediate mountain and hillslope areas. There is some existing residential development between Desert Hills Drive and Irvine Road which consists of single family lots in excess of 1 acre in size.

The west section of the watershed is predominantly desert terrain with scattered mountains and hills. Stream channels in mountain areas are generally well-defined and become braided once the slope decreases. The west section is transverse by the Carefree Highway. The main channel of Deadman Wash become a braided channel just north of Carefree Highway and carries flows across the highway via existing dip sections. The flow pattern in this west section is characterized as a shallow widespread overland flow during major flow events. No developments exist in the area south of Carefree Highway. Some major developments north of Carefree Highway and just east of I-17 in this section include Arizona Pioneer History Museum, Federal Correctional Institute, and Ben Avery Shooting Range and Recreation Area.

The delineation of drainage sub-basins was accomplished using the current U.S. Geological Survey (USGS) 7.5 Minute Series topographic quadrangle maps at a scale of 1" = 2,000' with contour intervals of 20' or 40'. The four USGS quadrangle maps used, in clockwise order, are Daisy Mountain, New River SE, Biscuit Flat, and New River. In addition, aerial photographs, existing topographic maps, and the current SCS soils maps were also utilized in drainage area delineation.

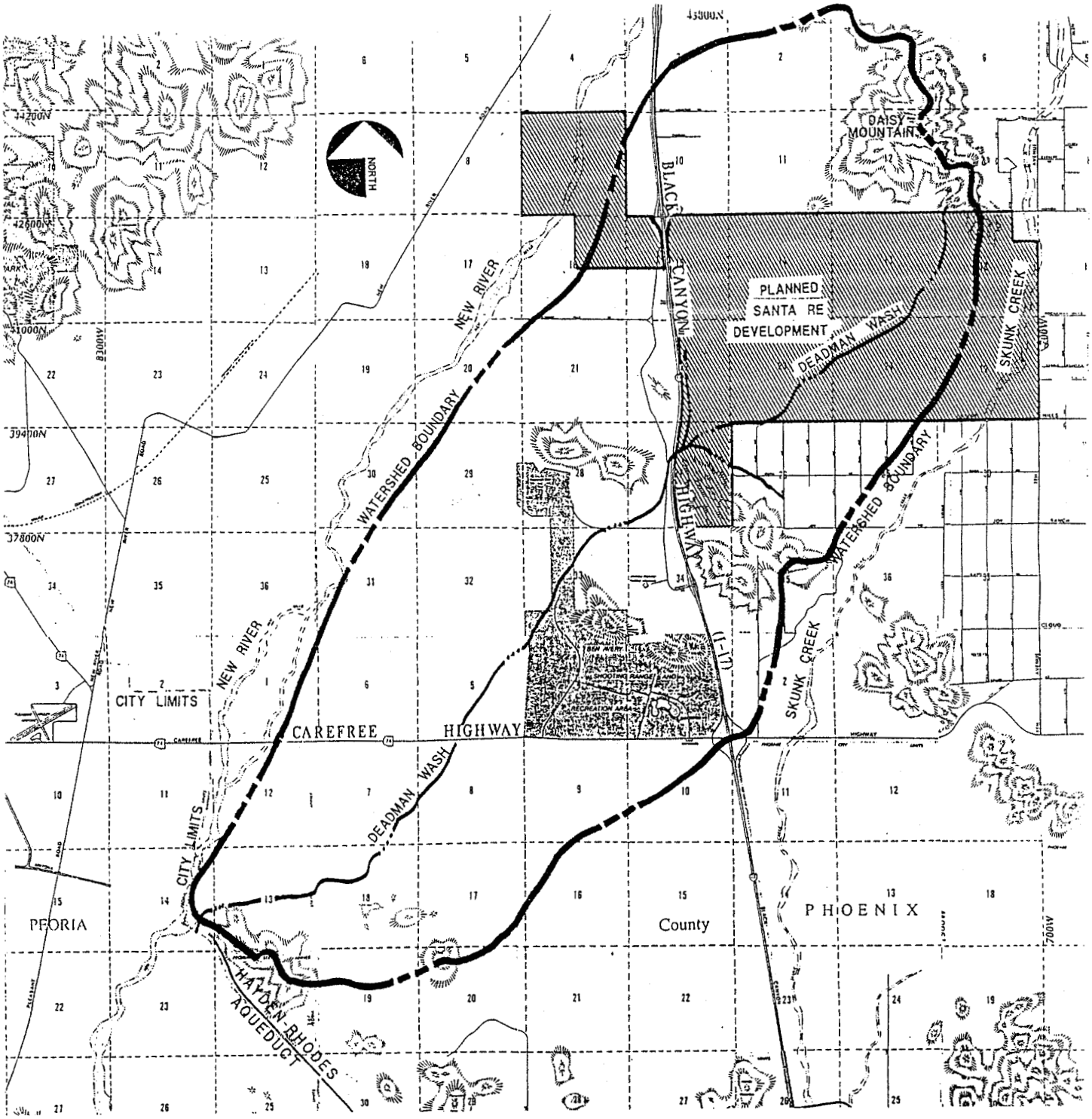

FIGURE 2

VICINITY MAP

HNTB

DEADMAN WASH FLOODPLAIN DELINEATION STUDY

Special considerations were given to delineation of the sub-basins in order to provide discharge values at the major roadway crossings and for future development or improvement needs. Several sub-basins were delineated for future drainage improvements along the Carefree Highway and for future development of the planned community Santa Re, approximately two miles north of Carefree Highway and east of I-17 (References 8 & 9). Several future bridge and culvert structures, and channel improvements were proposed at the south of Carefree Highway in Reference 8. In Reference 9, many land uses were proposed for the planned Santa Re which will be developed over a period of 15 years. This proposed community includes residential, commercial, industrial developments, and recreation amenities.

The watershed was sub-divided into 14 major drainage basins, which were designated by the stream numbers from 1 to 15 excluding number 13. Stream number 10 is the Deadman Wash. There is a total of 86 drainage sub-basins in the watershed. Each sub-basin is designated by the basin (stream) number and an alphabet; i.e., drainage sub-basin 10A. The east section of the watershed consists of drainage sub-basins 1 through 7 and portions of sub-basins 8, 10 and 11. The west section contains drainage sub-basins 9, 12, 14 and 15, and portions of sub-basins 8, 10 and 11. Refer to **Table 1** in **Section 3.2.2.1** for a summary of major basin and sub-basin areas.

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SECTION 3.2.2: Physical Parameters
and
SECTION 3.2.2.1: Sub-Basin Parameters

3.2.2 Physical Parameters

Physical parameters include sub-basin parameters, S-graph method parameters, Green-Ampt loss parameters, reach routing parameters, and storage routing parameters. The following sub-sections describe the procedures and assumptions to obtain required parameters for the HEC-1 modeling using the S-graph method.

3.2.2.1 Sub-Basin Parameters

The sub-basin parameters include a number of necessary pertinent data to obtain S-graph lag times and Green-Ampt parameters. The following segments describe how to estimate these parameters to be used for the hydrologic analysis.

Drainage Sub-Basins

The watershed and sub-basin boundaries were digitized into the GIS ARC-INFO using the drainage area delineations shown on **Exhibit 1 - Drainage Basin Map**. Exhibit 1 consists of USGS 7.5 Minute Series quadrangle maps at a scale of 1" = 2,000' with 40' or 20' contour intervals. The area of each sub-basin and the total area of each major drainage basin are presented in **Table 1**. There are 14 major drainage basins, encompassing 34.01 square miles. A total of 86 sub-basins were delineated and the range of the sub-basin areas are from 21.1 acres (or 0.033 square miles) up to 1,542.6 acres (or 2.410 square miles).

Soils Parameters

Soil textures were obtained from the "Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona," prepared by the U.S. Department of Agriculture, Soil Conservation Service, dated April 1986 (Reference 10). Sheets 10, 11, 22 and 33 in Reference 10 were used to identify 17 soil map units in the study watershed. **Table 2** contains a summary of soils map unit descriptions in the watershed. Soil map units in the study watershed are presented on **Exhibit 2 - Drainage Sub-Basin Soils Map**. From **Exhibit 2**, the dominant soil in the watershed is **Map Unit 12 - Carefree Cobbly Clay Loam**. Three rock outcrop areas are scattered in the north end, mid-section, and south end of the watershed.

Flat and unfolded Soil maps were obtained and digitized for the hydrologic analysis and the GIS uses. Areas of soil map units for each drainage sub-area were calculated by overlaying the drainage area boundaries and the SCS soil layers in the GIS ARC-INFO. These areas of soil map units were then input to the spreadsheet program SGRAPH.WK1 to obtain the Green & Ampt parameters (See **Section 3.2.2.3**). This SGRAPH.WK1 spreadsheet program was written on LOTUS 123 Release 2.3 and was provided by the FCDMC.

Table 1
Summary of Drainage Sub–Basins

No.	Sub–Basin I.D.	Drainage Area (sq. mi.)
1	1A	0.577
	Basin 1 =	0.577
2	2A	0.381
3	2B	0.141
4	2C	0.655
	Basin 2 =	1.177
5	3A	0.116
6	3B	0.234
7	3C	0.112
8	3D	0.355
	Basin 3 =	0.817
9	4A	0.302
10	4B	0.262
11	4C	0.693
12	4D	0.199
13	4E	0.172
	Basin 4 =	1.628
14	5A	0.482
15	5B	0.063
16	5C	0.046
17	5D	0.096
18	5E	0.061
19	5F	0.379
20	5G	0.402
	Basin 5 =	1.529
21	6A	0.503
22	6B	0.190
	Basin 6 =	0.693
23	7A	2.035
24	7B	0.042
25	7C	0.047
26	7D	0.033
27	7E	0.092
28	7F	0.052
29	7G	0.073
30	7H	0.162
	Basin 7 =	2.536
31	8A	0.443
32	8B	0.280
33	8C	0.783
34	8D	0.037
	Basin 8 =	1.543
35	9A	0.975
36	9B	0.696
	Basin 9 =	1.671
	SUB–TOTAL	12.171

No.	Sub–Basin I.D.	Drainage Area (sq. mi.)
37	10A	0.150
38	10B	0.371
39	10C	0.685
40	10D	0.156
41	10E	0.555
42	10F	0.077
43	10G	0.138
44	10H	0.082
45	10I	0.182
46	10J	0.924
47	10K	0.418
48	10L	0.413
49	10M	0.336
50	10N	0.073
51	10O	0.119
52	10P	0.774
53	10Q	0.329
54	10R	0.088
55	10S	1.024
56	10T	0.067
57	10U	0.487
58	10V	0.964
59	10W	0.526
60	10X	0.152
61	10Y	0.068
	Basin 10=	9.158
62	11A	0.158
63	11B	0.220
64	11C	0.054
65	11D	0.109
66	11E	0.424
67	11F	0.264
68	11G	0.349
69	11H	0.172
70	11I	0.528
71	11J	0.839
72	11K	0.427
73	11L	2.222
74	11M	0.782
75	11N	0.229
	Basin 11=	6.777
76	12A	0.078
77	12B	0.149
	Basin 12=	0.227
	SUB–TOTAL	16.162

No.	Sub–Basin I.D.	Drainage Area (sq. mi.)
78	14A	2.410
79	14B	0.819
80	14C	0.726
81	14D	0.242
82	14E	0.665
83	14F	0.275
84	14G	0.086
	Basin 14=	5.223
85	15A	0.064
86	15B	0.386
	Basin 15=	0.450
	TOTAL	34.006

Table 2 - Soil Map Unit Descriptions

NO.	MAP UNIT NO.	SOIL NAME
1	3	ANTHO-CARRIZO-MARIPO COMPLEX
2	10	BRIOS-CARRIZO COMPLEX
3	12	CAREFREE COBBLY CLAY LOAM
4	13	CAREFREE-BEARDSLEY COMPLEX
5	18	CHERIONI-ROCK OUTCROP COMPLEX
6	44	EBON VERY GRAVELLY LOAM
7	52	GACHADO-LOMITAS-ROCK OUTCROP COMPLEX
8	68	GUNSIGHT-CIPRIANO COMPLEX
9	75	MOHALL LOAM
10	98	PINAMT-TREMANT COMPLEX
11	100	QUILOTOSA-VAIVA-ROCK OUTCROP COMPLEX
12	109	SCHENCO-ROCK OUTCROP COMPLEX
13	110	SUNCITY-CIPRIANO COMPLEX
14	112	TREMANT GRAVELLY SANDY LOAMS
15	113	TREMANT GRAVELLY LOAMS
16	118	TREMANT-RILLITO COMPLEX
17	123	VAIVA VERY GRAVELLY LOAM

GS/kjt
SOIL

Land Use Characteristics

In order to determine the surface retention loss and the Phoenix S-graph type for each sub-basin, the limits of land use (or surface) characteristics must be identified. Three major land use characteristics identified for the watershed are desert and rangeland, hillslope, and mountain. Engineering judgement was used to delineate the limits of three different land use characteristics. The judgement was based upon examination of soil and slope conditions using the SCS soil surveys, aerial photographs, USGS quadrangle maps, and field observations.

The hillslope areas were designated where the slope ranges between 5 and 15 percent and the percent impervious value is greater than zero. The mountain areas were assigned where the slope is greater than 10 percent or considerable bare-rock surface is presented. The scattered development in the watershed was designated as desert and rangeland because the effects of the impervious area for these developments are minimal and were assumed to be negligible.

Limits of these land use characteristics are presented on **Exhibit 3 - Drainage Sub-Basin Land Use Map**. The surface retention loss (or initial abstraction, IA) values for desert and rangeland, hillslope and mountain were obtained from Table 4.1 in the Manual (Reference 2). This IA value is one of five required parameters for use of the Green-Ampt infiltration equation. The composite IA value for each sub-basin was obtained from computing the estimated percentage of the sub-basin area for each surface characteristic. The values used were:

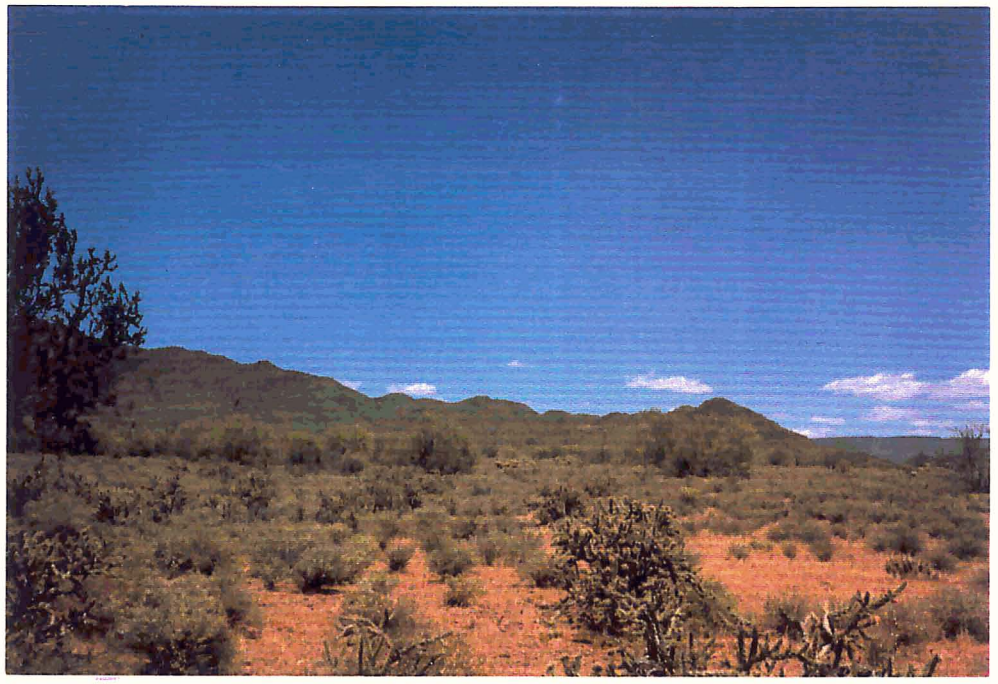
Land Use Characteristics	IA (inches)
Desert and Rangeland	**0.35**
Hillslope	**0.15**
Mountain	**0.25**

Field Reconnaissance and Surveys

Field reconnaissance was conducted with the FCDMC and ADWR representatives to determine conditions of the watershed, typical channel geometry, stream bed materials, spilt flow locations, and conditions of existing structures. Photographs were taken at locations to estimate Manning's n values, and vegetation cover density for channels and floodplains. Several stock tanks, the split flow location, and some overflow areas were also inspected. Field surveys were also performed to obtain as-built data for existing structures and critical routing reaches for hydrologic analysis. Refer to the meeting minutes of Coordination Meeting No. 2 in **Section 1** for the field reconnaissance report. The conclusions of field reconnaissance and surveys will be discussed in the subsequent sections where they are applied.

Vegetation Cover

An average vegetation cover density in percent was estimated for each surface characteristic based on the aerial contact prints, photographs and field observations. The following photograph represents the vegetation density transect for a typical desert and rangeland land use in the study area. The vegetation cover density was estimated to be 25 percent.



Vegetation Cover Density in Sub-basin DA-11L

The average vegetation cover density used for various land use characteristics were:

Land Use Characteristic	Vegetation Cover (%)
Desert and Rangeland	25
Hillslope	40
Mountain	50

The value of the hydraulic conductivity, XKSAT, for each soil map unit in the sub-basin was then adjusted for the effects of vegetation cover. Refer to **Section 3.2.2.3 - Green-Ampt Parameters** for details.

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SECTION 3.2.2.2: S-Graph Method Parameters

3.2.2.2 S-Graph Method Parameters

S-graph method parameters include types of Phoenix S-graphs to be used and the lag time calculations based on the sub-basin parameters determined in the preceding section. A step-by-step procedure is included at the end of this section to illustrate how to calculate the sub-basin lag times.

S-graphs

The S-graph method will be more appropriate than the Clark Unit Hydrograph method for hydrograph computation for this study. For this type of natural desert and undeveloped watershed, the Clark Unit Hydrograph method will yield unrealistic results. The Phoenix Mountain and Phoenix Valley S-graphs for Maricopa County were used (Reference 2). The S-graph type selected for each sub-basin was based on its land use characteristics. The Phoenix Mountain S-graph was used where the basin is predominantly mountainous terrain. If 50 percent or more of the basin area is mountains and/or hillslopes, then the Phoenix Mountain S-graph was used. The Phoenix Valley S-graph was selected if the basin consists of desert and rangeland for 50 percent or more of the area.

The program MCUHP2 was used to convert an S-graph into a unit-graph and the output is a set of UI records for immediate HEC-1 application. This program was written in FORTRAN language by the FCDMC and was furnished with the Manual. The revised version of MCUHP2 dated September 1, 1991 was used for this study.

In order to utilize the program MCUHP2, the lag time and Green-Ampt loss parameters for each sub-basin will need to be determined. **Section 3.2.2.3** presents the procedures to determine Green-Ampt parameters. The required data for the lag time calculations are described in the following segments.

Sub-Basin Lag Times

The lag time of each sub-basin was estimated using Equation 5.11 in the Design Manual. The lag time was computed by:

$$Lag = C\left(\frac{LL_{ca}}{S^{p}}\right)^{m}$$

where Lag = basin lag time in hours.

L	=	length of the longest watercourse in miles
L_{ca}	=	length along the watercourse to a point opposite the centroid in miles
S	=	watercourse slope in feet per mile
C	=	$24K_n$ (from U.S. Army Corps of Engineers, USCE)
K_n	=	estimated mean Manning's value for all channels in the basin.
m	=	0.38 (from USCE)
p	=	0.5

The variable Lca was measured the length along the watercourse from the concentration point to a point opposite the centroid of the basin using engineering judgement. Refer to **Exhibit 4 - Drainage Sub-Basin Flow Paths and Flood Routing Map** which shows the flow paths, concentration points, centroids of sub-basins, and channel routing reaches.

Mean Manning's n (Kn)

The mean Manning's n value (Kn) is required for determining the coefficient (C) in the basin lag calculation for the S-Graph method. The Kn value is a measure of the hydraulic efficiency of the watershed and it is a composite n value for all channels in the basin. The selection of Kn values is very subjective and creates significant uncertainty into the lag time prediction. An appropriate Kn value was given to each sub-basin based on field observations, aerial photographs, soils map, and field photographs. In addition, examination of the available data was made to those Kn values developed from observed flood hydrographs for the watershed basins with similar topography and physical conditions.

Originally, the Kn values were selected based upon surface characteristics from the Flood Hydrology Manual, by the U.S. Department of the Interior, Bureau of Reclamation (USBR), dated 1989 (Reference 11). Table 4-3 in the above manual shows Kn values of 0.035 for the Skunk Creek watershed area and 0.048 for the New River watershed area at New River. These values appear to be too low for Deadman Wash watershed.

The study area generally has sparse to medium vegetation and the terrain varies from rolling to very rugged regions in the mountainous areas. In addition, the overland flow in the overbank areas is the common flow characteristics for this study watershed. Furthermore, Figure 4-8 in Reference 11 shows regional Kn values for the southwest desert states ranging from a high of 0.070 to a low of 0.042 with lag equation coefficient C values of 1.8 to 1.1, respectively. A series of comparisons and calibration was made to select reasonable and representative Kn values for this study watershed. Refer to **Section 3.3 Calibration** for details.

It was concluded that the composite Kn value for each sub-basin was then selected based on the Manning's n value determination report prepared for the floodplain delineation study. Refer to **Appendix B - Manning's n Determination Report** for details. These Manning's n values for representative reaches in the watershed were estimated based upon the procedures outlined in the Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, prepared by the USGS for FCDMC, dated April 1991 (Reference 12). For the area east of I-17 with the mountainous terrain, a composite Kn value of 0.070 was selected for most of the sub-basins. Kn values ranging from 0.060 to 0.050 were computed for the desert terrain. With these Kn values, the lag equation coefficient C values were ranging from 1.68 to 1.2 which were within the reasonable range for the southwest desert as indicated in Reference 11.

Procedure of S-Graph Selection and Lag Time Calculation

The following is the procedure to perform the S-graph selection and lag time calculation for each sub-basin. **Table 3** summarizes the results of sub-basin lag time calculations and surface loss parameters. All sub-basin parameters determined in **Section 3.2.2.1** were utilized to generate these results. The steps taken to tabulate the results in **Table 3** are as follows:

Step 1 : *Enter each sub-basin area and a total area for each major drainage basin from **Table 1**.*

Step 2 : *Input the data of the lag time flow path shown on **Exhibit 4** including top/bottom elevations, watercourse length, and La. Then, the slope is computed for each sub-basin as:*

$$S = \frac{\text{Top Elev. - Bottom Elev.}}{\text{Length}}$$

Step 3 : *Input the percent area of each three surface characteristics from **Exhibit 3**, and compute the composite IA based on the selected values from **Land Use Characteristics**.*

Step 4 : *Enter the composite Kn value based on the Manning's n determination report shown in **Appendix A**.*

Step 5 : *Calculate the lag time using C = 24Kn.*

Step 6 : *Select the S-graph type based on the input data from Step 3. If 50 percent or more basin area is desert and rangeland, the Phoenix Valley S-graph is used. Otherwise, the Phoenix Mountain S-graph is used.*

TABLE 3

SUB-BASIN LAG TIME CALCULATIONS AND SURFACE LOSS PARAMETERS

No.	Sub-Basin I.D.	Drainage Area (sq. mi.)	Top Elev. (ft)	Bottom Elev. (ft)	Length L (miles)	Slope S (ft/mi.)	Surface Characteristics (%)			S-Graph Lag Time			Composite IA (in.)	S-Graph Type
							Range	Hill	Mountain	Lca (mi.)	Composite Kn	Lag* (min.)		
1	1A	0.577	2,035	1,770	2.841	93.3	100			1.553	0.065	69.5	0.350	Valley
	Basin 1 =	0.577												
2	2A	0.381	3,160	1,995	1.496	778.7		10	90	0.795	0.070	30.4	0.240	Mountain
3	2B	0.141	2,720	1,995	0.795	911.9		15	85	0.473	0.070	19.0	0.235	Mountain
4	2C	0.655	1,995	1,750	2.330	105.2	90	5	5	1.042	0.070	58.3	0.335	Valley
	Basin 2 =	1.177												
5	3A	0.116	2,560	1,940	0.682	909.1		40	60	0.303	0.070	15.2	0.210	Mountain
6	3B	0.234	2,060	1,860	0.928	215.5	70	30		0.473	0.070	26.6	0.290	Valley
7	3C	0.112	2,060	1,860	0.682	293.3	60	40		0.303	0.070	18.8	0.270	Valley
8	3D	0.355	1,910	1,745	1.989	83.0	100			1.098	0.070	58.6	0.350	Valley
	Basin 3 =	0.817												
9	4A	0.303	1,875	1,785	1.837	49.0	100			0.871	0.065	53.4	0.350	Valley
10	4B	0.262	2,260	1,785	0.795	597.5	45	20	35	0.473	0.070	20.6	0.275	Mountain
11	4C	0.693	1,850	1,765	1.667	51.0	85	10	5	0.473	0.065	40.5	0.325	Valley
12	4D	0.199	2,172	1,750	0.928	454.7	45	25	30	0.492	0.070	23.4	0.270	Mountain
13	4E	0.172	2,020	1,720	0.758	395.8	50	35	15	0.417	0.060	17.9	0.265	Mountain
	Basin 4 =	1.628												
14	5A	0.482	2,840	1,935	1.477	612.7	25	35	40	0.568	0.070	27.9	0.240	Mountain
15	5B	0.063	2,060	1,870	0.667	284.9	75	25		0.303	0.070	18.8	0.300	Valley
16	5C	0.046	2,200	1,900	0.549	546.4	90	10		0.265	0.070	14.6	0.330	Valley
17	5D	0.095	2,200	1,900	0.568	528.2	90	10		0.227	0.070	14.1	0.330	Valley
18	5E	0.061	1,900	1,870	0.303	99.0	100			0.189	0.070	14.2	0.350	Valley
19	5F	0.379	1,870	1,740	1.837	70.8	100			0.928	0.070	55.0	0.350	Valley
20	5G	0.402	1,945	1,740	2.121	96.7	100			1.136	0.070	59.1	0.350	Valley
	Basin 5 =	1.529												
21	6A	0.503	2,400	1,880	2.008	259.0	75	25		1.004	0.070	45.8	0.300	Valley
22	6B	0.190	1,880	1,795	1.098	77.4	100			0.530	0.070	35.9	0.350	Valley
	Basin 6 =	0.694												
23	7A	2.035	3,160	1,855	3.447	378.6	50	25	25	1.818	0.070	65.5	0.275	Mountain
24	7B	0.042	1,855	1,835	0.341	58.7	100			0.189	0.070	16.4	0.350	Valley
25	7C	0.047	1,955	1,875	0.663	120.7	100			0.208	0.070	19.1	0.350	Valley
26	7D	0.033	1,875	1,835	0.360	111.1	100			0.246	0.070	16.4	0.350	Valley
27	7E	0.092	2,000	1,890	0.852	129.1	100			0.284	0.070	23.3	0.350	Valley
28	7F	0.053	1,890	1,835	0.398	138.2	100			0.227	0.070	15.8	0.350	Valley
29	7G	0.073	1,835	1,795	0.663	60.3	100			0.398	0.070	27.9	0.350	Valley
30	7H	0.162	1,860	1,740	1.326	90.5	100			0.701	0.070	41.7	0.350	Valley
	Basin 7 =	2.536												

TABLE 3

SUB-BASIN LAG TIME CALCULATIONS AND SURFACE LOSS PARAMETERS

No.	Sub-Basin I.D.	Drainage Area (sq. mi.)	Top Elev. (ft)	Bottom Elev. (ft)	Length L (miles)	Slope S (ft/mi.)	Surface Characteristics Range	Hill	Mountain	S-Graph Lag Time Lca (mi.)	Composite Kn	Lag* (min.)	Composite IA (in.)	S-Graph Type
31	8A	0.443	2,100	1,890	1.629	128.9	100			0.871	0.070	45.7	0.350	Valley
32	8B	0.280	1,965	1,860	1.269	82.7	100			0.473	0.070	35.9	0.350	Valley
33	8C	0.783	1,900	1,735	2.424	68.1	95	5		1.326	0.065	65.4	0.340	Valley
34	8D	0.037	1,735	1,720	0.265	56.6	90	10		0.152	0.060	11.8	0.330	Valley
	Basin 8 =	1.544												
35	9A	0.975	1,845	1,700	2.405	60.3	80	20		0.701	0.065	52.4	0.310	Valley
36	9B	0.696	1,700	1,610	1.761	51.1	100			0.985	0.065	54.6	0.350	Valley
	Basin 9 =	1.671												
37	10A	0.150	2,777	2,060	0.663	1081.4		5	95	0.341	0.070	15.2	0.245	Mountain
38	10B	0.371	2,060	1,880	1.098	163.9	95	5		0.625	0.070	33.2	0.340	Valley
39	10C	0.685	2,120	1,805	1.856	169.7	90	10		0.739	0.070	42.9	0.330	Valley
40	10D	0.156	1,860	1,770	0.985	91.4	100			0.455	0.065	29.3	0.350	Valley
41	10E	0.555	2,045	1,770	2.538	108.4	100			1.080	0.065	56.4	0.350	Valley
42	10F	0.078	1,770	1,750	0.492	40.7	100			0.322	0.065	23.0	0.350	Valley
43	10G	0.138	1,800	1,745	0.909	60.5	100			0.341	0.065	27.5	0.350	Valley
44	10H	0.082	1,745	1,720	0.492	50.8	95	5		0.341	0.075	26.0	0.340	Valley
45	10I	0.182	1,810	1,715	1.250	76.0	85	15		0.492	0.065	34.2	0.320	Valley
46	10J	0.924	1,880	1,715	2.367	69.7	90	10		0.625	0.065	48.5	0.330	Valley
47	10K	0.418	2,000	1,690	0.947	327.3	60	35	5	0.473	0.065	23.0	0.275	Valley
48	10L	0.413	2,172	1,690	1.383	348.5	40	40	20	0.909	0.070	36.2	0.250	Mountain
49	10M	0.336	2,073	1,675	0.966	412.0	75	25		0.379	0.065	20.4	0.300	Valley
50	10N	0.073	1,705	1,655	0.814	61.4	100			0.284	0.055	20.8	0.350	Valley
51	10O	0.119	1,730	1,655	0.890	84.3	100			0.473	0.065	29.0	0.350	Valley
52	10P	0.775	2,040	1,655	1.837	209.6	60	25	15	0.814	0.065	39.5	0.285	Valley
53	10Q	0.329	2,160	1,610	1.288	427.0	50	35	15	0.814	0.065	30.2	0.265	Mountain
54	10R	0.088	1,670	1,605	0.871	74.6	100			0.246	0.065	23.0	0.350	Valley
55	10S	1.024	1,825	1,585	4.451	53.9	100			1.799	0.065	96.7	0.350	Valley
56	10T	0.068	1,605	1,565	0.663	60.3	100			0.265	0.048	16.4	0.350	Valley
57	10U	0.487	1,600	1,515	1.856	45.8	100			1.042	0.050	44.7	0.350	Valley
58	10V	0.964	1,760	1,510	1.818	137.5	90	10		0.492	0.060	32.5	0.330	Valley
59	10W	0.526	1,820	1,485	0.909	368.5	80	15	5	0.455	0.065	21.8	0.315	Valley
60	10X	0.152	1,900	1,480	0.928	452.6	30	30	40	0.511	0.070	23.8	0.250	Mountain
61	10Y	0.068	1,800	1,475	0.473	687.1	75	15	10	0.208	0.065	11.2	0.310	Valley
	Basin 10=	9.161												

TABLE 3

SUB-BASIN LAG TIME CALCULATIONS AND SURFACE LOSS PARAMETERS

No.	Sub-Basin I.D.	Drainage Area (sq. mi.)	Top Elev. (ft)	Bottom Elev. (ft)	Length L (miles)	Slope S (ft/mi.)	Surface Characteristics Range	Hill	Mountain	S-Graph Lag Time Lca (mi.)	Composite Kn	Lag* (min.)	Composite IA (in.)	S-Graph Type
62	11A	0.158	2,040	1,710	0.549	601.1	50	35	15	0.246	0.070	14.0	0.265	Mountain
63	11B	0.220	1,890	1,695	0.720	270.8	45	40	15	0.360	0.070	20.8	0.255	Mountain
64	11C	0.054	1,900	1,675	0.303	742.6	10	90		0.170	0.070	9.3	0.170	Mountain
65	11D	0.109	2,040	1,680	1.098	327.9	60	35	5	0.568	0.070	28.0	0.275	Valley
66	11E	0.424	1,950	1,675	1.686	163.1	50	35	15	0.966	0.070	46.1	0.265	Mountain
67	11F	0.264	1,760	1,675	1.023	83.1	100			0.436	0.065	29.7	0.350	Valley
68	11G	0.349	1,900	1,645	0.777	328.2	75	20	5	0.360	0.065	19.2	0.305	Valley
69	11H	0.172	1,695	1,665	0.756	39.7	100			0.322	0.065	27.2	0.350	Valley
70	11I	0.528	1,665	1,590	1.610	46.6	100			0.833	0.055	42.7	0.350	Valley
71	11J	0.839	1,610	1,545	1.894	34.3	100			0.795	0.055	47.3	0.350	Valley
72	11K	0.427	1,600	1,545	1.117	49.2	60	40		0.436	0.065	34.0	0.270	Valley
73	11L	2.223	2,000	1,540	3.504	131.3	80	15	5	2.330	0.055	69.6	0.315	Valley
74	11M	0.783	1,640	1,535	3.106	33.8	80	20		1.326	0.055	69.5	0.310	Valley
75	11N	0.229	1,570	1,515	1.174	46.8	80	20		0.417	0.055	29.1	0.310	Valley
	Basin 11=	6.776												
76	12A	0.078	1,620	1,590	0.852	35.2	100			0.473	0.050	25.9	0.350	Valley
77	12B	0.149	1,605	1,565	0.985	40.6	100			0.246	0.050	20.8	0.350	Valley
	Basin 12=	0.227												
78	14A	2.410	1,880	1,585	5.341	55.2	100			0.481	0.050	48.1	0.350	Valley
79	14B	0.819	1,650	1,520	2.765	47.0	100			1.136	0.050	53.5	0.350	Valley
80	14C	0.726	1,640	1,520	2.746	43.7	100			1.402	0.050	58.6	0.350	Valley
81	14D	0.242	1,565	1,505	1.250	48.0	100			0.455	0.050	27.8	0.350	Valley
82	14E	0.665	1,715	1,565	3.030	49.5	100			1.496	0.050	60.9	0.350	Valley
83	14F	0.275	1,580	1,505	1.591	47.1	100			0.795	0.050	37.9	0.350	Valley
84	14G	0.086	1,520	1,485	0.701	49.9	100			0.398	0.050	21.1	0.350	Valley
	Basin 14=	5.223												
85	15A	0.064	1,590	1,560	0.625	48.0	100			0.303	0.050	18.3	0.350	Valley
86	15B	0.386	1,560	1,480	1.742	45.9	100			0.833	0.050	40.1	0.350	Valley
	Basin 15=	0.450												
	TOTAL	34.010												

* Lag = (24 X Kn X ([L X Lca / S ^ .5] ^ .38)) X 60

DEADMAN WASH
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FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 3.2.2.3: Green-Ampt Parameters

3.2.2.3 Green-Ampt Parameters

Rainfall losses were estimated using the Green-Ampt infiltration equation. The three Green-Ampt infiltration equation parameters are volumetric moisture deficit (DTHETA), wetting front suction (PSIF), and hydraulic conductivity at natural saturation (XKSAT). These parameters are functions of soil characteristics, ground surface characteristics, and land management practices.

Values of these parameters are estimated based on the soil characteristics for bare ground conditions. The effect of ground cover will generally increase the infiltration rate. The hydraulic conductivity, XKSAT, should be adjusted for vegetation. The influence of land management practices, such as various tillages, results in changes to soil porosity. However, the Manual recommended that no adjustments of these parameters should be made for the influence of land management within Maricopa County (Reference 2).

The application of the Green-Ampt infiltration equation to the HEC-1 model requires the estimation of two additional parameters. They are the initial abstraction, IA, and the percent impervious of the sub-basin area, RTIMP. The parameter RTIMP represents only the percent of rock outcrop in the sub-basin since the effects of urban developments were assumed to be negligible.

The following is the procedure using the **SGRAPH.WK1** spreadsheet program to generate loss parameters for each sub-basin for the input values for the MCUHP2 program. Since no irrigated land is within the study area, the dry condition is assumed to select the DTHETA value for different soil textures. Values of IA and vegetation cover were assigned to the spreadsheet based on the numbers determined for different land use characteristics. An example **SGRAPH.WK1** output for sub-basin 1A is shown in **Table 4. Appendix C - SGRAPH.WK1 Outputs of Sub-Basin Loss Parameters** contains the results of loss parameters for all 86 sub-basins. Steps of developing these results using the **SGRAPH.WK1** spreadsheet are as follows:

Step 1 : *Enter the sub-basin identification.*

Step 2 : *Input each soil map unit and the respective area in acres that applies to the sub-basin.*

Step 3 : *Enter the percent of total area for each land use type.*

Step 4 : *Enter the vegetation cover density in percent.*

Step 5 : *Check the total area for accuracy and enter the computed lag time.*

Table 4 Example SGRAPH.WK1 Output of Sub-basin Loss Parameters

LOSS PARAMETERS FOR SUBBASIN: DA-1A

Soil Survey Used AGUILA

XKSAT

Map Unit	AREA ACRES	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
12	167.400	45.37	0.01	-0.907	0.00	0.00
110	114.700	31.08	0.13	-0.275	0.00	0.00
44	71.500	19.38	0.03	-0.295	0.00	0.00
13	12.000	3.25	0.01	-0.065	0.00	0.00
68	2.400	0.65	0.63	-0.001	0.00	0.00
98	1.000	0.27	0.37	-0.001	0.00	0.00

TOTAL = 369.000 ACRES XKSAT = 0.03 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.25	=	10.1
Normal =	0.13		
Wet =	0		

LAND USE

AREA ACRES	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea ACRES	IA in.	Wgtd. IA in.
369.00	DESERT	100.00	DRY	25.00	0.00	0.00	0.35	0.350
0.00	HILLSLOPES	0.00	DRY	40.00	0.00	0.00	0.15	0.000
0.00	MOUNTAIN	0.00	DRY	50.00	0.00	0.00	0.25	0.000

369.000 =TOTAL AREA OK AVERAGE = 25.00 TOTAL = 0.00 AVG. = 0.350
% = 0.00

PERCENT OF SUBBASIN DRY = 100.00 %
NORMAL = 0.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.035

IMPERVIOUS AREA: URBAN @ 100 % effective = 0.00
ROCK OUTCROP @ 100 % effective = 0.00
% EFFECTIVE IMP. = 0.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA sq.mi.	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min
DA-1A	0.577	0.350	0.250	10.10	0.035	0.00	69.5

Another FCDMC's LOTUS-123 program **SGRPHSUM.WK1** was utilized to create a summary table of Green-Ampt parameters and sub-basin lags determined from program **SGRAPH.WK1** and **Table 3**. The program **SGRPHSUM.WK1** compiles the sub-basin **SGRAPH.WK1** files one at a time and forms a summary table for the program **MCUHP2** input data. **Table 5** presents a summary of the Green and Ampt parameters and the calculated basin lags. The smallest lag in all sub-basins was estimated to be 9.3 minutes, while the largest lag was found to be 96.7 minutes. The average basin lag was determined to be 34.1 minutes. Hence, a computation time interval of 5 minutes was selected for the watershed.

Procedure of Converting an S-Graph to a Unit-Graph

From the parameters calculated from **Tables 1, 3,** and **5**, the computer program **MCUHP2** was used to create a set of unit hydrograph records for each sub-basin for the HEC-1 model input. The following is a procedure using the program **MCUHP2** to convert an S-graph to a unit-graph for sub-basin 1A. Since this program runs in an interactive mode, a batch file was created for each sub-basin. **Table 6** presents input and output using the program **MCUHP2** for sub-basin 1A.

Step 1: *Enter an output file name, e.g. 1A.DAT.*

Step 2: *Provide Project name, initials, and date.*

Step 3: *Enter 1 for single basin analysis.*

Step 4: *Enter storm size, 6-hour FCDMC distribution, and enter the point rainfall.*

Step 5: *Input sub-basin name, area, L, Lca, S, and Kn from* ***Table 3.***

Step 6: *Enter 1 to select the Green-Ampt infiltration equation and loss parameters summarized in* ***Table 5.***

Step 7: *Select a Phoenix Valley S-graph type as determined in* ***Table 3.***

Step 8: *Enter calculated lag time of 69.5 minutes and hydrograph calculation time interval of 5 minutes.*

Table 5
Loss Parameter Summary for Sub–Basins Using the S–Graph Method

SUB–BASIN I.D.	AREA sq.mi.	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min
DA–1A	0.577	0.350	0.250	10.10	0.035	0.00	69.5
DA–2A	0.381	0.240	0.350	3.61	0.386	31.14	30.4
DA–2B	0.141	0.235	0.360	4.12	0.327	28.99	19.0
DA–2C	0.655	0.335	0.280	8.28	0.083	0.96	58.3
DA–3A	0.116	0.210	0.360	3.81	0.335	29.33	15.2
DA–3B	0.234	0.290	0.250	10.10	0.036	6.00	26.6
DA–3C	0.112	0.270	0.350	7.50	0.123	7.34	18.8
DA–3D	0.355	0.350	0.150	12.40	0.012	0.00	58.6
DA–4A	0.303	0.350	0.150	12.40	0.012	0.00	53.4
DA–4B	0.262	0.275	0.280	8.28	0.091	8.44	20.6
DA–4C	0.693	0.325	0.150	12.40	0.012	0.48	40.5
DA–4D	0.199	0.270	0.330	7.78	0.116	6.47	23.4
DA–4E	0.172	0.265	0.370	7.14	0.152	5.77	17.9
DA–5A	0.482	0.240	0.350	3.77	0.400	29.57	27.9
DA–5B	0.063	0.300	0.350	7.50	0.121	8.97	18.8
DA–5C	0.046	0.330	0.330	7.78	0.106	8.36	14.6
DA–5D	0.096	0.330	0.400	6.60	0.177	7.83	14.1
DA–5E	0.061	0.350	0.390	5.67	0.210	0.00	14.2
DA–5F	0.379	0.350	0.250	8.40	0.058	0.20	55.0
DA–5G	0.402	0.350	0.200	9.40	0.023	0.00	59.1
DA–6A	0.503	0.300	0.350	3.55	0.314	26.05	45.8
DA–6B	0.190	0.350	0.250	10.10	0.035	0.00	35.9
DA–7A	2.035	0.275	0.350	3.61	0.344	27.66	65.5
DA–7B	0.042	0.350	0.250	10.10	0.035	0.00	16.4
DA–7C	0.047	0.350	0.330	7.78	0.105	0.00	19.1
DA–7D	0.033	0.350	0.150	12.40	0.012	0.00	16.4
DA–7E	0.092	0.350	0.390	6.78	0.163	2.93	23.3
DA–7F	0.052	0.350	0.250	8.40	0.058	0.00	15.8
DA–7G	0.073	0.350	0.250	8.20	0.047	0.00	27.9
DA–7H	0.162	0.350	0.250	8.40	0.058	0.00	41.7
DA–8A	0.443	0.350	0.250	8.60	0.070	0.00	45.7
DA–8B	0.280	0.350	0.150	12.40	0.012	0.00	35.9
DA–8C	0.783	0.340	0.200	9.40	0.023	0.29	65.4
DA–8D	0.037	0.330	0.350	4.03	0.414	7.91	11.8
DA–9A	0.975	0.310	0.200	9.40	0.024	3.58	52.4
DA–9B	0.696	0.350	0.200	9.40	0.023	0.00	54.6
DA–10A	0.150	0.245	0.350	3.71	0.416	32.13	15.2
DA–10B	0.371	0.340	0.200	9.40	0.023	0.50	33.2
DA–10C	0.685	0.330	0.200	9.40	0.024	0.01	42.9
DA–10D	0.156	0.350	0.350	3.50	0.291	0.00	29.3
DA–10E	0.555	0.350	0.200	9.40	0.023	0.00	56.4
DA–10F	0.077	0.350	0.250	8.20	0.047	0.00	23.0
DA–10G	0.138	0.350	0.200	9.40	0.023	0.00	27.5
DA–10H	0.082	0.340	0.350	3.50	0.293	1.54	26.0
DA–10I	0.182	0.320	0.350	7.50	0.119	5.53	34.2

Table 5
Loss Parameter Summary for Sub–Basins Using the S–Graph Method

SUB–BASIN I.D.	AREA sq.mi.	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min
DA–10J	0.924	0.330	0.200	9.40	0.024	2.47	48.5
DA–10K	0.418	0.275	0.350	3.55	0.321	7.22	23.0
DA–10L	0.413	0.250	0.400	6.60	0.193	11.24	36.2
DA–10M	0.336	0.300	0.360	3.81	0.290	9.69	20.4
DA–10N	0.073	0.350	0.400	6.29	0.186	0.00	20.8
DA–10O	0.119	0.350	0.400	6.29	0.186	0.00	29.0
DA–10P	0.774	0.285	0.350	7.50	0.125	7.50	39.5
DA–10Q	0.329	0.265	0.360	4.12	0.291	9.61	30.2
DA–10R	0.088	0.350	0.250	10.10	0.035	0.00	23.0
DA–10S	1.024	0.350	0.150	12.40	0.012	0.00	96.7
DA–10T	0.068	0.350	0.250	8.40	0.058	0.00	16.4
DA–10U	0.487	0.350	0.250	8.40	0.058	0.00	44.7
DA–10V	0.964	0.330	0.370	4.43	0.260	3.14	32.5
DA–10W	0.526	0.315	0.350	3.87	0.385	4.87	21.8
DA–10X	0.152	0.250	0.350	4.23	0.570	14.16	23.8
DA–10Y	0.068	0.310	0.350	4.16	0.560	15.89	11.2
DA–11A	0.158	0.265	0.350	3.50	0.316	22.35	14.0
DA–11B	0.220	0.255	0.350	3.55	0.331	7.62	20.8
DA–11C	0.054	0.170	0.350	4.03	0.460	5.73	9.3
DA–11D	0.109	0.275	0.370	4.74	0.260	14.17	28.0
DA–11E	0.424	0.265	0.380	6.96	0.164	9.64	46.1
DA–11F	0.264	0.350	0.200	9.40	0.023	0.66	29.7
DA–11G	0.349	0.305	0.250	10.10	0.036	2.67	19.2
DA–11H	0.172	0.350	0.150	12.40	0.012	0.00	27.2
DA–11I	0.528	0.350	0.150	12.40	0.012	0.00	42.7
DA–11J	0.839	0.350	0.200	9.40	0.023	0.00	47.3
DA–11K	0.427	0.270	0.330	7.78	0.111	5.54	34.0
DA–11L	2.223	0.315	0.200	9.40	0.024	2.67	69.6
DA–11M	0.783	0.310	0.200	9.40	0.024	1.29	69.5
DA–11N	0.229	0.310	0.200	9.40	0.024	3.23	29.1
DA–12A	0.078	0.350	0.400	6.60	0.175	0.00	25.9
DA–12B	0.149	0.350	0.350	3.98	0.396	0.00	20.8
DA–14A	2.410	0.350	0.150	12.40	0.012	0.00	48.1
DA–14B	0.819	0.350	0.150	12.40	0.012	0.00	53.5
DA–14C	0.726	0.350	0.150	12.40	0.012	0.00	58.6
DA–14D	0.242	0.350	0.250	8.60	0.070	0.00	27.8
DA–14E	0.665	0.350	0.150	12.40	0.012	0.00	60.9
DA–14F	0.275	0.350	0.150	12.40	0.012	0.00	37.9
DA–14G	0.086	0.350	0.390	6.78	0.163	0.00	21.1
DA–15A	0.064	0.350	0.150	12.40	0.012	0.00	18.3
DA–15B	0.386	0.350	0.250	10.10	0.035	0.00	40.1

Notes:

Average IA for the watershed based on sub–basins is..... 0.319
Average XKSAT for the watershed based on sub–basins is.. 0.141
The smallest LAG of the sub–basins in the watershed is..... 9.3
The largest LAG of the sub–basins in the watershed is..... 96.7
The average LAG for the watershed is..... 34.1
The select hydrograph calculated time interval is 5

Table 6 Example Input and Output Using the Program MCUHP2

```
1A.DAT
DEADMAN WASH, BGS, 1-17-92
1
34
1
3.37
DA-1A
0.577
2.841, 1.553, 93.3, 0.065
1
0.350, 0.250, 10.10, 0.035, 0.00
1
69.5
5
2
```

```
ID DEADMAN WASH, BGS, 1-17-92
ID
IT     5                        300
IO     5
KK
KM BASIN DA-1A
KM  THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
KM  L=       2.8  Lca=       1.6    S=    93.3  Kn= .065  LAG=  69.5
KM  PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
BA   .58
IN    15
KM RAINFALL DEPTH OF 3.37 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
KM AN AREAL REDUCTION COEFFICIENT OF .882 WAS USED
PB  2.97
KM THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 3.44
PC  .000    .018    .027    .039    .058    .073    .089    .105    .122    .137
PC  .154    .173    .200    .248    .330    .484    .665    .786    .856    .902
PC  .938    .953    .969    .985   1.000
LG   .35     .25   10.10     .04     .00
UI   28.     28.     28.     79.    105.    131.    145.    161.    177.    200.
UI  223.    268.    336.    357.    299.    261.    234.    213.    187.    168.
UI  148.    133.    111.     81.     53.     49.     46.     44.     28.     28.
UI   28.     10.      9.      9.      9.      9.      9.      9.      9.      9.
UI    9.      0.      0.      0.      0.      0.      0.      0.      0.      0.
UI    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
ZZ
```

HEC-1 Model Set-Up

The outputs of program **MCUHP2** were edited and assembled in the order shown on **Exhibit 5 - HEC-1 Model Schematic.** **Exhibit 5** was developed from **Exhibit 4** to describe the HEC-1 model logic for runoff hydrograph generation, hydrograph combinations, reach routing, storage routing, and diversion components. The HEC-1 simulation proceeds downstream until a concentration point is reached. All flood hydrographs above this point must be computed and routed to this point. The hydrographs are combined and the combined flow is routed downstream to next point. This HEC-1 simulation is completed until the concentration point at New River is reached.

The HEC-1 model uses the JD and PC cards to simulate the rainfall depths, aerial reduction, and rainfall distributions. Hence, only the BA, LG, and UI records from the sub-basin MCUHP2 output remained in the HEC-1 models. In addition, the above remaining HEC-1 input data are independent of the duration of storm when the S-graph method is used. Therefore, the HEC-1 models for the 100-year 6-hour and 24-hour storm events are the same except for the JD and PC cards.

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

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TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 3.2.2.4: Reach Routing Parameters

3.2.2.4 Reach Routing Parameters

Flood routing of the runoff hydrographs was performed using the normal depth storage-outflow channel routing option in HEC-1. The routing reach paths and flow elevations at upstream and downstream ends of the reaches are shown on **Exhibit 4**. Refer to **Exhibit 5** for the HEC-1 model schematic for the routing logic.

Normal Depth Channel Routing

Channel routing introduces time lag and peak flow attenuation of the flood hydrographs. The peak flow attenuation is accomplished through flow volume reduction from channel storage and outflow data computed based on channel characteristics. These channel characteristics include cross-section data, Manning's roughness coefficient, length, slope, channel infiltration, and average invert elevation of the routing reach. The normal depth channel routing uses an eight-point cross section which is representative for the routing reach. Channel storage is computed from the product of cross sectional area and reach length. Outflow is calculated for the normal depth using the Manning's equation. It should be noted that the routing proceeds on an independent reach basis from upstream to downstream and backwater or tailwater effects are not considered.

Reach Cross Sections

The routing cross sections were developed from field surveys, aerial photographs, topographic maps, and field photographs. These cross sections are selected to represent average conditions in the routing reaches. The 1" = 200' scale topographic maps for the floodplain delineation portion of the project were utilized to obtain the reach cross section data on Deadman Wash and some of its tributaries (Reference 13). The topographic maps for the CVL's Santa Re study were also used to develop the reach cross section data for Deadman Wash tributaries east of I-17 (Reference 14). The cross section data for Stream Numbers 8, 11 and portions of 14 and 15 were obtained from the USGS quadrangle maps, field photographs and engineering judgement. Locations and topography of these routing reaches are presented in **Appendix D - Routing Reach Cross Section Locations**. The cross section data were then input to the HEC-2 model and plotted with Manning's n values. **Exhibit 6** shows the cross section plots of reaches in the HEC-1 routing logic order.

Manning's n Values

Values of Manning's roughness coefficients for overbank areas and channels were obtained from the Manning's n Determination Report in **Appendix B.** This report only covers the reaches which will be delineated for floodplain and floodway limits in the hydraulic analysis portion of this project. Additional manning's n values for other routing reaches were obtained based on field estimates, aerial photographs, and field photographs. **Table 7** shows the routing reach physical data including lengths, slopes and Manning's n values.

Channel Transmission Losses

Channel transmission losses or infiltration losses were included in the normal depth channel routing using the RL card. The RL card takes the percolation rate (PERCRT) for the wetted area of channel. Due to the lack of observed inflow-outflow data, the estimation of effective hydraulic conductivity is needed to predict infiltration losses.

The infiltration loss rate for each routing reach was determined by examining the SCS soil maps. The XKSAT values for the overbank areas and channels were obtained for each soil map unit. The composite loss rate was calculated from an average XKSAT value for each routing reach. **Table 8** summarizes the channel infiltration loss data for all routing reaches. The smallest loss rate in all reaches was estimated to be 0.010 cfs per acre, while the highest loss rate was computed at 0.940 cfs per acre. The results fall in low to moderate loss rates in Table 19-1 of the SCS National Engineering Handbook, Section 4, Hydrology, Chapter 19 (Reference 15).

An additional check was made by examining the ADWR's percolation tests done on overbank and channel soil samples taken in Deadman Wash at I-17. The test results showed cumulative mean infiltration rates of 2.8 and 3.6 cfs per acre for the overbank and channel soil samples, respectively. It appears that these values were significantly higher than the values shown in **Table 8.** There is insufficient streamflow gage data with associated precipitation data available to justify the increase of the infiltration loss rates.

Table 7
Routing Reach Physical Data

Reach I.D.	In Sub-Basin I.D.	Top Elev. (ft)	Bottom Elev. (ft)	Length L (ft)	Slope S (ft/ft)	Manning's n		
						nL	nC	nR
R10A-B	10B	2,060	1,880	5,800	0.0310	0.090	0.070	0.090
R10B-C	10C	1,880	1,805	5,000	0.0150	0.090	0.070	0.090
R10C-D	10D	1,805	1,770	2,650	0.0132	0.080	0.065	0.080
R10E-F	10F	1,770	1,750	2,500	0.0080	0.080	0.065	0.080
R2B-C	2C	1,995	1,750	12,300	0.0199	0.090	0.070	0.090
R10F-G	10G	1,750	1,745	900	0.0056	0.080	0.065	0.080
R3A-B	3B	1,940	1,860	3,900	0.0205	0.090	0.070	0.090
R3C-D	3D	1,860	1,745	8,900	0.0129	0.090	0.070	0.090
R10G-H	10G	1,745	1,720	2,600	0.0096	0.095	0.075	0.095
R4B-C	4C	1,785	1,765	3,850	0.0052	0.058	0.040	0.058
R4C-D	4D	1,765	1,750	900	0.0167	0.058	0.040	0.058
R4D-E	4E	1,750	1,720	3,100	0.0097	0.060	0.048	0.060
R5A-B	5B	1,935	1,870	2,900	0.0224	0.090	0.070	0.090
R5D-E	5E	1,900	1,870	1,600	0.0188	0.090	0.070	0.090
R5E-F	5F	1,870	1,740	9,700	0.0134	0.090	0.070	0.090
R6A-B	6B	1,880	1,795	5,800	0.0147	0.090	0.070	0.090
R7A-B	7B	1,855	1,835	1,800	0.0111	0.090	0.070	0.090
R7C-D	7D	1,875	1,835	1,900	0.0211	0.090	0.070	0.090
R7E-F	7F	1,890	1,835	2,100	0.0262	0.090	0.070	0.090
R7F-G	7G	1,835	1,795	3,500	0.0114	0.090	0.070	0.090
R7G-H	7H	1,795	1,740	5,100	0.0108	0.085	0.070	0.085
R7H-C	8C	1,735	1,735	500	0.0009	0.085	0.070	0.085
R8A-B	8B	1,890	1,860	3,100	0.0097	0.090	0.070	0.090
R8B-C	8C	1,860	1,735	11,000	0.0114	0.080	0.065	0.080
R8C-D	8D	1,735	1,720	1,400	0.0107	0.095	0.060	0.095
R10H-I	10I	1,720	1,715	1,000	0.0050	0.070	0.055	0.070
R10J-K	10K	1,715	1,690	4,800	0.0052	0.080	0.065	0.080
R10L-M	10M	1,690	1,675	1,500	0.0100	0.070	0.045	0.070
R10M-N	10N	1,675	1,655	2,400	0.0083	0.070	0.055	0.070
R10P-Q	10Q	1,655	1,610	6,700	0.0067	0.080	0.065	0.080
R9A-B	9B	1,700	1,610	9,300	0.0097	0.080	0.065	0.080
R10Q-R	10R	1,610	1,605	600	0.0083	0.080	0.065	0.080
R10R-S	10S	1,605	1,585	4,200	0.0048	0.065	0.048	0.065
R10S-T	10T	1,585	1,565	1,900	0.0105	0.065	0.048	0.065
R10R-A	12A	1,605	1,590	3,800	0.0039	0.080	0.065	0.080
R12A-B	12B	1,590	1,565	3,200	0.0078	0.070	0.050	0.070
R10T-U	10U	1,565	1,515	7,400	0.0068	0.065	0.050	0.065
R11A-B	11B	1,710	1,695	1,700	0.0088	0.090	0.070	0.090
R11B-D	11D	1,695	1,680	1,500	0.0100	0.080	0.065	0.080
R11D-F	11F	1,680	1,675	1,000	0.0050	0.080	0.065	0.080
R11F-G	11G	1,675	1,655	3,900	0.0051	0.080	0.065	0.080
R11C-G	11G	1,675	1,655	4,500	0.0044	0.080	0.065	0.080
R11G-I	11I	1,645	1,590	6,900	0.0080	0.065	0.055	0.065
R11H-I	11I	1,665	1,590	8,500	0.0088	0.065	0.055	0.065
R11I-J	11J	1,590	1,545	7,800	0.0058	0.065	0.055	0.065
R11K-L	11L	1,545	1,540	1,400	0.0036	0.070	0.055	0.065
R11L-M	11M	1,540	1,535	1,500	0.0033	0.070	0.055	0.065
R11M-N	11N	1,535	1,515	1,900	0.0105	0.070	0.050	0.065
R10U-V	10V	1,515	1,510	3,200	0.0016	0.065	0.038	0.065
R10V-W	10W	1,510	1,485	3,900	0.0064	0.065	0.038	0.065
R14A-B	14B	1,585	1,520	8,300	0.0078	0.065	0.050	0.065
R14C-D	14D	1,520	1,505	2,200	0.0068	0.065	0.050	0.065
R14E-F	14F	1,565	1,505	7,000	0.0086	0.065	0.050	0.065
R14F-G	14G	1,505	1,485	2,700	0.0074	0.065	0.045	0.065
R10W-X	10X	1,485	1,480	1,400	0.0036	0.085	0.060	0.085
R15A-B	15B	1,560	1,480	9,200	0.0087	0.065	0.050	0.065
R10X-Y	10Y	1,480	1,475	1,200	0.0042	0.085	0.060	0.085

Table 8
Routing Reach Channel Infiltration Loss Data

Reach I.D.	In Sub-Basin I.D.	SCS Soil Map Unit			XKSAT			Composite Loss Rate (cfs/ac)
		Lt O/B	Channel	Rt O/B	Lt O/B (in/hr)	Channel (in/hr)	Rt O/B (in/hr)	
R10A-B	10B	44 & 12	44 & 12	44 & 12	0.024	0.024	0.024	0.024
R10B-C	10C	12	12	12	0.010	0.010	0.010	0.010
R10C-D	10D	110 & 98	110 & 98	110 & 98	0.226	0.226	0.226	0.226
R10E-F	10F	12	12	12	0.010	0.010	0.010	0.010
R2B-C	2C	98	98	98	0.370	0.370	0.370	0.370
R10F-G	10G	12 & 98	12 & 98	12 & 98	0.298	0.298	0.298	0.298
R3A-B	3B	12 & 98	12 & 98	12 & 98	0.226	0.226	0.226	0.226
R3C-D	3D	12	12	12	0.010	0.010	0.010	0.010
R10G-H	10G	98 & 110	98 & 110	98 & 110	0.250	0.250	0.250	0.250
R4B-C	4C	12	12	12	0.010	0.010	0.010	0.010
R4C-D	4D	12	12	12	0.010	0.010	0.010	0.010
R4D-E	4E	12 & 98	12 & 98	12 & 98	0.190	0.190	0.190	0.190
R5A-B	5B	12 & 110	12 & 110	12 & 110	0.094	0.094	0.094	0.094
R5D-E	5E	98	98	98	0.370	0.370	0.370	0.370
R5E-F	5F	12 & 98	12 & 98	12 & 98	0.298	0.298	0.298	0.298
R6A-B	6B	12	12	12	0.010	0.010	0.010	0.010
R7A-B	7B	12 & 98	12 & 98	12 & 98	0.190	0.190	0.190	0.190
R7C-D	7D	12	12	12	0.010	0.010	0.010	0.010
R7E-F	7F	12 & 110	12 & 110	12 & 110	0.058	0.058	0.058	0.058
R7F-G	7G	12 & 98	12 & 98	12 & 98	0.208	0.208	0.208	0.208
R7G-H	7H	98	98	98	0.370	0.370	0.370	0.370
R7H-C	8C	18	18	18	0.330	0.330	0.330	0.330
R8A-B	8B	12 & 13	12 & 13	12 & 13	0.010	0.010	0.010	0.010
R8B-C	8C	12 & 98	12 & 98	12 & 98	0.154	0.154	0.154	0.154
R8C-D	8D	18 & 98	18 & 98	18 & 98	0.354	0.354	0.354	0.354
R10H-I	10I	98	98	98	0.370	0.370	0.370	0.370
R10J-K	10K	98	98	98	0.370	0.370	0.370	0.370
R10L-M	10M	98	98	98	0.370	0.370	0.370	0.370
R10M-N	10N	98	98	98	0.370	0.370	0.370	0.370
R10P-Q	10Q	18 & 112	18 & 112	18 & 112	0.366	0.366	0.366	0.366
R9A-B	9B	12 & 112	12 & 112	12 & 112	0.162	0.162	0.162	0.162
R10Q-R	10R	112	112	112	0.390	0.390	0.390	0.390
R10R-S	10S	12 & 112	12 & 112	12 & 112	0.200	0.200	0.200	0.200
R10S-T	10T	112	112	112	0.390	0.390	0.390	0.390
R10R-A	12A	112	112	112	0.390	0.390	0.390	0.390
R12A-B	12B	112	112	112	0.390	0.390	0.390	0.390
R10T-U	10U	112	112	112	0.390	0.390	0.390	0.390
R11A-B	11B	112	112	112	0.390	0.390	0.390	0.390
R11B-D	11D	110	110	110 & 112	0.234	0.234	0.234	0.234
R11D-F	11F	12	12	12	0.010	0.010	0.010	0.010
R11F-G	11G	12	12	12	0.010	0.010	0.010	0.010
R11C-G	11G	12	12	12	0.010	0.010	0.010	0.010
R11G-I	11I	12	12	12	0.010	0.010	0.010	0.010
R11H-I	11I	12	12	12	0.010	0.010	0.010	0.010
R11I-J	11J	12	12	12	0.010	0.010	0.010	0.010
R11K-L	11L	12	12	12	0.010	0.010	0.010	0.010
R11L-M	11M	12	12	12	0.010	0.010	0.010	0.010
R11M-N	11N	12	12	12	0.010	0.010	0.010	0.010
R10U-V	10V	75	75	75	0.230	0.230	0.230	0.230
R10V-W	10W	75	75	75	0.230	0.230	0.230	0.230
R14A-B	14B	12	12	12	0.010	0.010	0.010	0.010
R14C-D	14D	98 & 112	98 & 112	98 & 112	0.380	0.380	0.380	0.380
R14E-F	14F	12	12	12	0.010	0.010	0.010	0.010
R14F-G	14G	75 &112	75 &112	75 &112	0.318	0.318	0.318	0.318
R10W-X	10X	10	10	10	0.940	0.940	0.940	0.940
R15A-B	15B	12	12	12	0.010	0.010	0.010	0.010
R10X-Y	10Y	10 & 100	10 & 100	10 & 100	0.670	0.670	0.670	0.670

Reach Routing Steps and Channel Hydraulics

The normal depth routing method will require the input of an appropriate reach storage routing step number (NSTEPS) on the RS card. The number of steps for routing reaches were determined through an iteration process. An initial routing step was estimated for each reach with a mean velocity of 3 feet per second. The HEC-1 models for 6-hour and 24-hour duration storms were run to generate peak discharges based on the assumed numbers of steps. Channel hydraulics using the Manning's equation were performed based on the eight-point cross section data, Manning's n values, and the calculated peak flows. New NSTEPS were obtained based on the reach travel times from the computed average velocities. The HEC-1 models were revised and run with new NSTEPS. After three iterations, the final NSTEPS were obtained.

The following is the iterative process to determine appropriate NSTEPS for all reaches. **Table 9** shows the results of routing reach hydraulic data and the NSTEPS used. It should be noted that peak discharges and hydraulic data were slightly different than the final results.

Step 1: *Enter reach I.D., length and slope.*

Step 2: *Input peak flows of 6-hour and 24-hour duration storms from the HEC-1 models with an initial guess on NSTEPS.*

Step 3: *Compute channel hydraulic data including top widths, flow depths, flow areas, composite n values, and average velocities based on the initial peak flows.*

Step 4: *Obtain the reach travel time from the reach length and average velocity, and calculate new NSTEPS from dividing the travel time by the computational time interval of 5 minutes.*

Step 5: *Enter new NSTEPS values into the HEC-1 models to obtain new peak flows.*

Step 6: *Return to Step 3 until the peak flows did not change more than 2 percent from the previous HEC-1 run to the current run.*

The final NSTEPS for both duration storms are shown in **Table 9** with the largest NSTEPS of 13 for Reach R8B-C with a reach length of 11,000 feet. Significant overland flows occur throughout the entire watershed, and the average velocity is approximately at 3 feet per second.

Table 9
Routing Reach Hydraulic Data and NSTEPS

Reach I.D.	Length L (ft)	Slope S (ft/ft)	Discharge (cfs) 6-hr Storm	Discharge (cfs) 24-hr Storm	Channel Hydraulic Data 100-year 6-hr storm T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	Channel Hydraulic Data 100-year 24-hr storm T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	NSTEPS 6-HR Storm	NSTEPS 24-hr Storm
R10A-B	5,800	0.0310	294	199	36	2.0	58	0.070	5.1	33	1.6	45	0.070	4.5	4	4
R10B-C	5,000	0.0150	940	666	104	3.4	222	0.071	4.2	97	2.9	174	0.070	3.8	4	4
R10C-D	2,650	0.0132	1,759	1,440	366	4.1	579	0.076	3.0	331	3.8	492	0.076	2.9	3	3
R10E-F	2,500	0.0080	2,717	2,470	397	6.6	906	0.077	3.0	369	6.4	829	0.076	3.0	3	3
R2B-C	12,300	0.0199	690	507	45	3.5	122	0.070	5.7	42	3.0	98	0.070	5.2	7	8
R10F-G	900	0.0056	3,637	3,462	484	6.2	1,294	0.076	2.8	475	6.1	1,246	0.076	2.8	1	1
R3A-B	3,900	0.0205	232	164	35	1.9	56	0.070	4.1	33	1.6	44	0.070	3.7	3	4
R3C-D	8,900	0.0129	804	583	121	3.3	235	0.077	3.4	108	2.9	182	0.075	3.2	9	9
R10G-H	2,600	0.0096	4,388	4,261	343	9.3	1,212	0.093	3.6	339	9.2	1,185	0.093	3.6	2	2
R4B-C	3,850	0.0052	681	527	335	3.8	352	0.057	1.9	300	3.6	288	0.057	1.8	7	7
R4C-D	900	0.0167	1,640	1,368	301	4.2	401	0.057	4.1	289	4.1	354	0.057	3.9	1	1
R4D-E	3,100	0.0097	1,714	1,449	212	4.2	422	0.057	4.1	196	3.9	369	0.057	3.9	3	3
R5A-B	2,900	0.0224	767	521	50	3.7	130	0.070	5.9	44	3.1	98	0.070	5.3	2	2
R5D-E	1,600	0.0188	362	235	35	3.1	76	0.070	4.8	31	2.5	55	0.070	4.2	1	1
R5E-F	9,700	0.0134	962	750	97	4.1	242	0.079	4.0	87	3.6	197	0.078	3.8	8	9
R6A-B	5,800	0.0147	650	471	54	3.6	138	0.070	4.7	50	3.1	109	0.070	4.3	4	4
R7A-B	1,800	0.0111	1,462	1,313	209	5.2	463	0.084	3.2	204	5.0	429	0.084	3.1	2	2
R7C-D	1,900	0.0211	100	72	94	0.9	50	0.070	2.0	84	0.8	39	0.070	1.9	3	3
R7E-F	2,100	0.0262	175	124	53	1.5	52	0.070	3.4	47	1.3	40	0.070	3.1	2	2
R7F-G	3,500	0.0114	1,519	1,372	201	4.6	447	0.079	3.4	194	4.4	414	0.079	3.3	3	4
R7G-H	5,100	0.0108	2,030	1,884	319	5.0	653	0.080	3.1	312	4.9	619	0.080	3.1	5	5
R7H-C	500	0.0009	3,192	3,077	374	11.1	1,967	0.083	1.6	370	10.9	1,915	0.083	1.6	1	1
R8A-B	3,100	0.0097	621	476	71	3.9	173	0.073	3.6	65	3.5	141	0.072	3.4	3	3
R8B-C	11,000	0.0114	861	693	174	4.1	293	0.076	2.9	154	3.8	244	0.076	2.8	12	13
R8C-D	1,400	0.0107	4,292	4,233	475	10.3	1,310	0.092	3.3	472	10.3	1,296	0.092	3.3	1	1
R10H-I	1,000	0.0050	8,775	9,381	731	10.6	2,525	0.069	3.5	752	10.8	2,658	0.069	3.5	1	1
R10J-K	4,800	0.0052	9,158	9,747	496	10.9	2,350	0.078	3.9	508	11.1	2,464	0.078	4.0	4	4
R10L-M	1,500	0.0100	9,140	9,698	795	9.7	2,164	0.069	4.2	816	9.9	2,267	0.069	4.3	1	1
R10M-N	2,400	0.0083	8,934	9,469	1,245	9.4	2,719	0.069	3.3	1,277	9.5	2,845	0.069	3.3	2	2
R10P-Q	6,700	0.0067	8,642	9,073	937	10.2	2,745	0.079	3.2	981	10.3	2,879	0.079	3.2	7	7
R9A-B	9,300	0.0097	1,229	1,015	223	4.4	417	0.075	3.0	158	3.9	318	0.073	3.2	10	10
R10Q-R	600	0.0083	9,028	9,518	851	7.6	2,531	0.078	3.6	868	7.7	2,634	0.078	3.6	1	1
R10R-S	4,200	0.0048	4,889	5,163	807	3.0	1,663	0.057	2.9	816	3.1	1,728	0.057	3.0	5	5
R10S-T	1,900	0.0105	5,205	5,537	563	5.6	1,246	0.062	4.2	592	5.7	1,321	0.062	4.2	2	2
R10R-A	3,800	0.0039	3,470	4,115	1,379	6.7	2,187	0.080	1.6	1,470	6.9	2,486	0.080	1.7	8	7

Note: Peak discharges shown in this table are not the same as the final results.

Table 9
Routing Reach Hydraulic Data and NSTEPS

Reach I.D.	Length L (ft)	Slope S (ft/ft)	Discharge (cfs) 6-hr Storm	Discharge (cfs) 24-hr Storm	Channel Hydraulic Data 100-year 6-hr storm T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	Channel Hydraulic Data 100-year 24-hr storm T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	NSTEPS 6-HR Storm	NSTEPS 24-hr Storm
R12A-B	3,200	0.0078	4,763	4,414	867	5.9	1,641	0.069	2.9	840	5.8	1,547	0.069	2.9	4	4
R10T-U	7,400	0.0068	8,174	8,926	871	8.6	2,259	0.064	3.6	904	8.7	2,419	0.064	3.7	7	7
R11A-B	1,700	0.0088	367	238	46	4.8	117	0.082	3.1	34	3.8	79	0.079	3.0	2	2
R11B-D	1,500	0.0100	507	405	61	4.2	142	0.072	3.6	51	3.7	114	0.070	3.6	1	1
R11D-F	1,000	0.0050	688	537	97	5.7	258	0.075	2.7	84	5.1	209	0.074	2.6	1	1
R11F-G	3,900	0.0051	1,316	1,153	123	7.2	420	0.076	3.1	116	6.9	378	0.076	3.1	4	4
R11C-G	4,500	0.0044	90	64	19	2.9	39	0.065	2.3	18	2.4	30	0.065	2.1	7	7
R11G-I	6,900	0.0094	1,408	1,272	135	7.6	337	0.062	4.2	119	7.3	301	0.062	4.2	6	5
R11H-I	8,500	0.0088	343	248	31	2.9	76	0.055	4.5	29	2.4	61	0.055	4.0	6	7
R11I-J	7,800	0.0058	2,138	1,936	304	6.6	696	0.064	3.1	289	6.4	643	0.064	3.0	8	9
R11K-L	1,400	0.0036	2,669	2,431	656	2.8	1,207	0.061	2.2	649	2.7	1,135	0.060	2.1	2	2
R11L-M	1,500	0.0033	4,514	4,326	699	3.7	1,751	0.061	2.6	695	3.6	1,702	0.061	2.5	2	2
R11M-N	1,900	0.0105	5,119	4,982	823	3.0	1,405	0.060	3.6	815	3.0	1,376	0.060	3.6	2	2
R10U-V	3,200	0.0016	8,494	9,488	1,198	10.4	4,071	0.064	2.1	1,250	10.7	4,426	0.064	2.1	5	5
R10V-W	3,900	0.0064	8,381	9,372	889	7.0	2,355	0.064	3.6	928	7.2	2,564	0.064	3.7	4	4
R14A-B	8,300	0.0078	2,913	2,566	510	6.9	945	0.064	3.1	481	6.7	856	0.064	3.0	9	9
R14C-D	2,200	0.0068	4,016	3,659	604	7.5	1,279	0.064	3.1	580	7.3	1,191	0.064	3.1	2	2
R14E-F	7,000	0.0086	835	673	105	5.0	223	0.060	3.8	91	4.6	183	0.059	3.7	6	6
R14F-G	2,700	0.0074	4,668	4,357	654	6.4	1,382	0.062	3.4	630	6.3	1,305	0.062	3.3	3	3
R10W-X	1,400	0.0036	8,842	9,688	905	12.1	3,430	0.084	2.6	939	12.3	3,678	0.084	2.6	2	2
R15A-B	9,200	0.0087	139	100	37	1.3	45	0.050	3.1	36	1.1	36	0.050	2.8	10	11
R10X-Y	1,200	0.0042	8,823	9,592	1,006	10.0	3,365	0.082	2.6	1,041	10.2	3,591	0.082	2.7	2	1

Note: Peak discharges shown in this table are not the same as the final results.

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SECTION 3.2.2.5: Storage Routing Parameters

3.2.2.5 Storage Routing Parameters

Reservoir storage routing was performed for drainage structures at the major concentration points. The rating curves including the roadway overtopping analysis were generated using the FHWA HY-8 Culvert Hydraulics computer program (Reference 6). Field surveys and inspections were conducted to obtain the as-built data and structure conditions. **Exhibit 4** shows a list of major drainage structures in the watershed. The survey information are contained in **Appendix A - Survey Field Notes.** The resulting rating curves were then entered to the HEC-1 models for reservoir routing. The results of culvert hydraulic computations with the respective field survey notes were included in **Appendix E - Culvert Hydraulic Calculations.** It should be noted that only six structures were used in reservoir routing because some of I-17 culverts were too small to impact the hydrology. The structure near the concentration point R8C at I-17 was not modeled because it makes the routing reach between the structure and R8C unreasonably short.

The effects of storage upstream of drainage structures were calculated based on the area and stage relation obtained from available topographic maps and the USGS quadrangle maps. These area-stage relations were then entered into the HEC-1 models. No percolation loss rates were included for the reservoir routing.

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SECTION 3.2.3: Statistical Parameters
AND
SECTION 3.2.4: Precipitation

3.2.3 Statistical Parameters

The statistical parameters used for this study were based on the data provided in the Manual (Reference 2). These parameters were obtained from extensive study and analyses of historical record data by the FCDMC, ADWR, and consulting engineers. These parameters were based on assumptions of randomness, non-climatic variability and non-cyclic behavior of precipitation and runoff. The validity of these assumptions for frequency analysis in Arizona is questionable. As discussed in the paper "Cyclic Streamflow Test for Validity of Randomness," by the ADWR (Reference 16), it is possible that climatic patterns in Arizona may be cyclic, and frequency analysis data used may not cover both rising and declining cycles. Therefore, these parameters may be biased and misleading. As more data are collected, these parameters will be more representative and reliable for Arizona. Refer to **Section 3.3 - Calibration** for descriptions of how the results of Statistical analysis for the USGS streamflow gage stations were used to calibrate the HEC-1 models.

3.2.4 Precipitation

3.2.4.1 Rainfall Distributions

The design storms specified for hydrologic analysis in this study are the 100-year 6-hour and 24-hour duration storms. The 6-hour rainfall distribution contains five dimensionless rainfall patterns. All dimensionless rainfall patterns were selected from Table 2.3 in the Manual for direct input to the HEC-1 models using PC cards (Reference 2). Each rainfall pattern is valid up to a certain drainage area size. The appropriate area size for each pattern were selected from Figure 2.18 in the Manual and entered into the HEC-1 models using JD cards. Hence, the model will select an appropriate rainfall depth for each sub-basin based upon the drainage area size.

The 24-hour rainfall distribution storm using the SCS Type II distribution, will also be considered. The higher peak discharges generated from the two storms will be used for floodplain delineations.

3.2.4.2 Precipitation Data

The mean rainfall point depths were obtained from the isopluvial maps in the Manual for 2-, 5-, 10-, 25-, 50-, and 100-year return periods for 6-hour and 24-hour durations. The point precipitation value for the 100-year 6-hour storm is 3.37 inches, while the point precipitation value for the 100-year 24-hour storm is 4.38 inches.

Appendix F shows the precipitation calculation summary including the HEC-1 precipitation data files for 6-hour and 24-hour distributions. The JD and PC cards were used to provide precipitation depths with respective areas, and rainfall distribution patterns.

3.2.4.3 Aerial Reduction Factors

The precipitation reduction for the 100-year 6-hour duration storm was accomplished based on the depth-area reduction curve developed from the historic storm of 1954 over the Queen Creek area. This curve was developed by the USCE and is shown on Figure 2.1 in the Manual (Reference 2). **Table 10** presents depth-area reduction factors for a 6-hour duration rainfall, which is adopted from Table 2.1 in the Manual. The total precipitation value for each respective drainage area size was adjusted based on the reduction factors and is shown in **Table 10**. The resulting precipitation values were entered into the HEC-1 model using the JD cards.

The precipitation reduction factors used for the 24-hour duration storm were obtained from the depth-area curve shown in Figure 15 within the NOAA Technical Memorandum NWS HYDRO-40 (Reference 4). **Table 10** also shows the reduction factors used to adjust the precipitation values for the 24-hour storm.

Table 10
Depth–Area Reduction Factors

For 6–Hour Duration Rainfall
(FROM HYDROLOGIC DESIGN MANUAL TABLE 2.1)

Area Sq. Mi.	Ratio to Point of Rainfall
0	1.000
0.01	1.000
0.50	0.994
1.00	0.987
2.80	0.980
10	0.940
16	0.920
20	0.910
30	0.890
40	0.870
50	0.860
90	0.810
100	0.800
200	0.720
300	0.660
400	0.610
500	0.570

For 24–Hour Duration Rainfall
(NOAA TM NWS HYDRO–40)

Area Sq. Mi.	Ratio to Point of Rainfall
0.01	1.000
5	0.97
10	0.95
50	0.88
100	0.85
500	0.78

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SECTION 3.2.5: Gage Data

3.2.5 Gage Data

The streamflow gage data in Arizona were compiled in a state-wide report entitled "Basin Characteristics and Streamflow Statistics in Arizona, as of 1989", by the USGS (Reference 17). This report contains the data from streamflow gage stations. The FCDMC performed a Log Pearson III statistical analysis for the gage data of major washes in Maricopa County. **Table 11** shows the results of the statistical analysis.

An USGS streamflow gage station is located on Deadman Wash near New River, gage number 09513820. The gage is located in Section 27, Township 6 North, Range 2 East, just west of I-17. This gage was operated from 1960 to 1979 for a period of 20 years and was reinstated in 1991. **Table 12** presents the streamflow and statistical data for the Deadman Wash gage station from Reference 17.

Three FCDMC operating precipitation gage stations are located in the vicinity of the watershed. There is no precipitation data available from 1960 to 1979 when the streamflow data were collected at the Deadman Wash streamflow gage station. However, the precipitation data were obtained for calibration from these gages for the March 1, 1991 storm. Refer to **Section 3.3. Calibration** for details.

The following is a description of locations of these gage stations.

FCDMC #2630: Skunk Creek near New River precipitation gage station is located in Section 5, Township 6 North, Range 3 East, just northeast of the study watershed.

FCDMC #2605: Sunup Ranch precipitation gage station is located just outside the Deadman Wash watershed near Ben Avery Shooting Range, and is located in Section 3, Township 6 North, Range 2 East.

FCDMC #2700: New River Dam precipitation gage station is located just in Section 35, Township 5 North, Range 1 East, just southwest of the watershed.

Table 11 - Log Pearson III Analysis Summary for Washes in Arizona

NO.	GAGE	GAGE STATION NAME	DRAINAGE AREA (sm)	AVG SLOPE ft/mile	RECORD LENGTH (years)	QMAX (cfs)	Q-100 (cfs)	Q100/A cfs/sm
1	*09510070	West Sycamore Creek McFarland	4.58	260.00	14	1,700	5,530	1,207
2	*09510080	West Sycamore Creek Sunflower	9.80	353.00	15	3,480	8,030	819
3	*09510100	East Sycamore Creek Sunflower	4.49	370.00	26	1,940	2,670	595
4	09510150	Sycamore Sunflower	52.30	58.60	15	16,100	42,700	816
5	*09510170	Camp Creek Sunflower	2.60	498.00	17	402	950	365
6	*09510180	Rock Creek Sunflower	15.20	412.00	10	1,900	5,790	381
7	*09510200	Sycamore Near Ft. McDowell	164.00	116.00	30	24,200	51,400	313
8	09512100	Indian Bend Wash at AZ Canal	139.00	60.00	24	21,000	16,800	121
9	*09512200	Salt River Trib. South Mtn.	1.75	244.00	29	670	3,220	1,840
10	*09512300	Cave Creek Near Cave Creek	121.00	123.00	31	12,400	20,000	165
11	*09512700	Agua Fria Trib # 2, Rock Springs	1.07	173.00	18	1,200	1,730	1,617
12	*09513780	New River Near Rock Springs	67.30	140.00	28	18,600	34,600	514
13	*09513800	New River at New River	83.30	105.00	22	19,500	37,500	450
14	*09513820	Deadman Wash Near New River	11.10	124.00	20	1,850	6,070	547
15	09513860	Skunk Creek at I-17	64.60	49.20	30	11,500	31,000	480

Table 11 - Log Pearson III Analysis Summary for Washes in Arizona

NO.	GAGE	GAGE STATION NAME	DRAINAGE AREA (sm)	AVG SLOPE ft/mile	RECORD LENGTH (years)	QMAX (cfs)	Q-100 (cfs)	Q100/A cfs/sm
16	09514200	Waterman Wash, 2.4 Above Gila	420.00	21.20	25	6,300	7,840	19
17	09515500	Hassayampa at Box Damsite	417.00	71.00	41	58,000	43,000	103
18	09515800	Hartman Wash at US 60	5.57	71.60	16	2,600	7,450	1,338
19	09516500	Hassayampa at Morristown	796.00	84.90	36	47,500	43,900	55
20	*09516600	Ox Wash at US 60	6.31	101.00	18	2,900	5,330	845
21	09516800	Jackrabbit Wash (Wick-Tono)	137.00	34.40	16	6,840	32,900	240
22	09517000	Hassayampa Old Us 80	1,470.00	39.90	27	39,000	49,300	34
23	09517280	Tiger Wash Near Aguila	85.20	35.20	17	4,550	6,910	81
24	09517400	Winters Wash DS of Airline Rd	47.80	83.70	18	3,640	4,560	95
25	09519600	Rainbow Wash Trib. at US 80	2.43	34.40	17	1,430	1,670	687
26	09519750	Bender Wash Along I-8	68.80	73.90	17	2,670	12,600	183
27	09519760	Sauceda Wash at State 85	126.00	46.70	17	3,150	11,400	90
28	09519780	Windmill Wash Near Gila Bend	12.90	64.40	15	4,430	27,600	2,140
29	09520100	Military Wash at State 80	8.70	56.00	17	1,530	5,220	600
30	09520200	Black Gap Wash at State 85	12.10	21.80	18	940	1,490	123
31	09520230	Crater Range Wash at State 85	1.49	64.00	17	590	2,130	1,430

NOTE: An "*" denotes that the average slope of the wash is greater than 100 feet per mile and the wash is representative of the Deadman Wash Area.

Table 12 - Deadman Wash Gage Streamflow and Statistical Data

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GILA RIVER BASIN

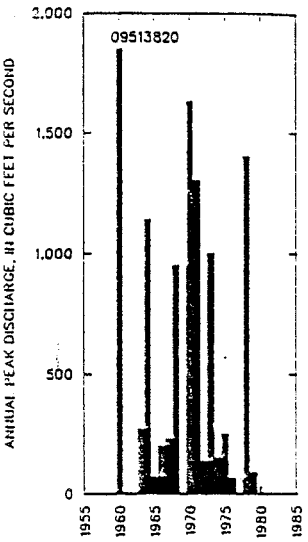
09513820 DEADMAN WASH NEAR NEW RIVER, AZ

LOCATION.--Lat 33°50'30", long 112°08'40", in NW¼ sec.27, T.6 N., R.2 E., Maricopa County, Hydrologic Unit 15070102, at State Highway 69, 4.5 mi south of New River.

DRAINAGE AREA.--11.1 mi^2.

ANNUAL PEAK DISCHARGE

WATER YEAR	DATE	ANNUAL PEAK DISCHARGE (FT^3/S)	DISCHARGE CODES
1960	12-25-59	1,850	
1961	00-00-61	0	
1962	00-00-62	0	
1963	08-00-63	270	
1964	07-30-64	1,140	
1965	04-04-65	70	ES
1966	12-22-65	200	ES
1967	09-00-67	230	
1968	12-19-67	950	
1969	00-00-69	0	
1970	09-05-70	1,630	
1971	08-21-71	1,300	
1972	07-17-72	135	
1973	10-07-72	1,000	ES
1974	09-19-74	150	
1975	10-28-74	250	ES
1976	08-31-76	64	
1977	00-00-77	0	
1978	03-02-78	1,400	
1979	11-11-78	88	



MAGNITUDE AND PROBABILITY OF INSTANTANEOUS PEAK FLOW BASED ON PERIOD OF RECORD 1960-79

DISCHARGE, IN FT^3/S, FOR INDICATED RECURRENCE INTERVAL IN YEARS, AND EXCEEDANCE PROBABILITY, IN PERCENT					
2	5	10	25	50†	100†
50%	20%	10%	4%	2%	1%
250	846	1,550	2,900	4,300	6,070

WEIGHTED SKEW (LOGS)= -0.22
MEAN (LOGS)= 2.38
STANDARD DEV. (LOGS)= 0.65

† Reliability of values in column is uncertain, and potential errors are large.

BASIN CHARACTERISTICS

MAIN CHANNEL SLOPE (FT/MI)	STREAM LENGTH (MI)	MEAN BASIN ELEVATION (FT)	FORESTED AREA (PERCENT)	SOIL INDEX	MEAN ANNUAL PRECIPITATION (IN)	RAINFALL INTENSITY, 24-HOUR 2-YEAR (IN)	50-YEAR (IN)
124	4.2	1,980	0.0	1.0	11.0	1.8	4.0

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SECTION 3.3: Calibration

3.3 Calibration

Calibration of the HEC-1 model parameters was performed to insure that the model results are reasonable. The model calibration efforts were concentrated on peak flows, because there is not sufficient data to calibrate the runoff volumes. Four separate calibration checks were made using the available hydrologic and statistical data. The first check was to compare the HEC-1 results with the statistical data at the USGS Deadman Wash streamflow gage station, gage number 09513820. Other gage data in the region were also used for comparison. The second check involved selection of different basin reach Manning's n values (Kn) and comparing the results with statistical data for representative washes shown in **Table 11**. The third check was to simulate the March 1, 1991 storm using the different Kn values and compared with the USGS estimated flow. The fourth check was to compare the HEC-1 peak flows at key locations with the results of CVL and SEA conceptual drainage reports.

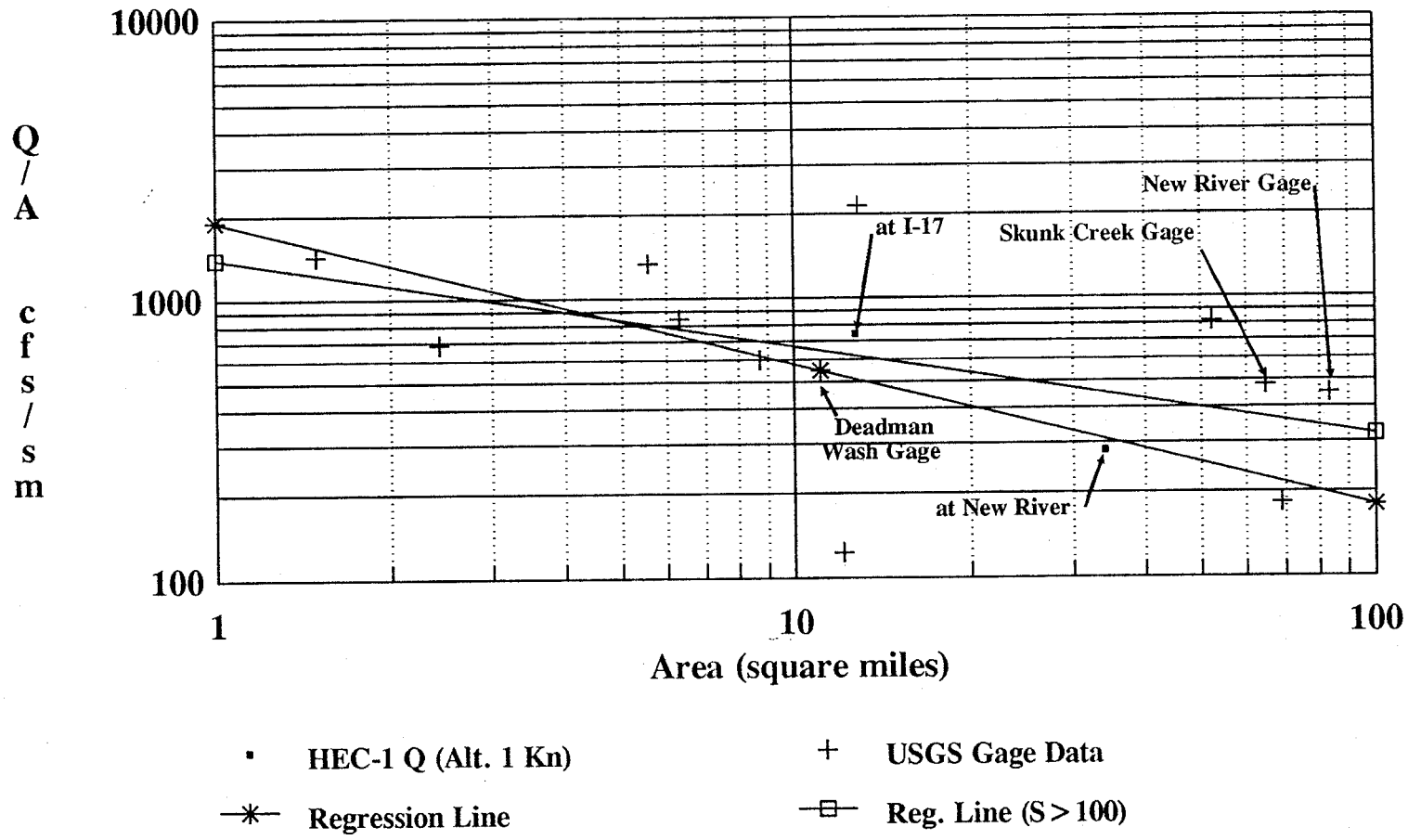
Check No. 1 - USGS Gage Data

The first calibration check was to compare the 100-year peak discharge at I-17 calculated from the HEC-1 models with the estimated 100-year flow from the USGS Deadman Wash gage station. From **Table 12**, the maximum annual peak discharge recorded was 1,850 cfs. The Log Pearson III analysis showed the estimated 100-year peak discharge of 6,070 cfs for a drainage area of 11.1 square miles in **Table 11**. It yields a flow-to-area ratio of 547 cfs per square mile (cfs/sm). The HEC-1 model results showed a peak flow of 9,437 cfs (at C10H) for an area of 12.72 square miles. A flow-to-area ratio is 742 cfs/sm which is significantly higher, approximately 36 percent higher than the gage data.

Since the Deadman Wash gage station only contains 20 years of streamflow data from 1960 to 1979, there is insufficient data to estimate a reliable 100-year peak flow. As indicated in **Table 12**, the potential errors on peak flows are large.

A thorough review of **Table 12** was performed to evaluate the HEC-1 results. The flow-to-area ratios of the HEC-1 results and the USGS Deadman Wash gage data were plotted on **Figure 3**. **Figure 3** is a logarithmic chart with the logarithmic scale for Q/A and A. Other gage data in the region were also included in **Figure 3** for comparison. Two USGS gage stations in the vicinity of the watershed were identified on the figure for ease of comparison. They are New River at New River (Gage No. 09513800) and Skunk Creek at I-17 (Gage No. 09513860). Two trend of regression lines drawn on **Figure 3** were obtained based on all gage data and gage data with a slope greater than 100 feet per mile (ft/mile) as shown in **Table 11**. It appeared that the peak flow from the HEC-1 model with Alternative 1 Kn values yielded a higher Q/A value as the Skunk Creek and New River gages did. However, the Q/A value at New River form the model falls very close to the regression line.

Q/A vs. A for Gage Data Calibration
LOG PEARSON III ANALYSIS



Deadman Wash Flood Delineation Study

Figure 3

Check No. 2 - Basin Kn Values

The sensitivity of basin Kn values were performed to evaluate the HEC-1 models. Originally, Kn values were determined from surface characteristics of sub-basins. Based on this assumption, the following typical Kn values were assigned to different land use areas.

Surface Characteristics	Kn
Desert and Rangeland	**0.035**
Hillslope	**0.040**
Mountain	**0.050**

The composite Kn values were computed based on the extent of surface characteristics shown on **Table 3**. Two HEC-1 models were developed with two Kn alternatives. Alternative 1 used the Kn values that were determined from the field observations and the procedures outlined in **Reference 12**, and Alternative 2 used the Kn values that were computed based on surface characteristics. It appears that the Alternative 2 Kn values were only approximately 55 percent of Alternative 1 Kn values. Results were in same order of magnitude for the lag times; i.e. Alternative 2 Kn values result in smaller lag times. Therefore, the HEC-1 model with Alternative 2 Kn values will generate higher peak flows.

Table 13 represents the lag times and 100-year peak flows for the two alternative Kn values. The results showed that Alternative 2 Kn values yield higher peak flows, up to 59 percent more, than Alternative 1. The ratios of flow-to-area at concentration points for two alternatives were plotted on **Figure 4**. The trend regression lines on **Figure 4** is the same as **Figure 3**. From **Figure 4**, Alternative 1 yields a better fit to the two regression lines. However, Alternative 2 provides slightly better results for drainage areas less than 3 square miles.

At the I-17 bridge, both alternatives yield relatively high values when compared with the Log Pearson III estimate made at the USGS Deadman Wash gage station. Alternative 1 showed a better result when it compared with the regression line with a slope greater than 100 ft/mile. For the drainage areas downstream of I-17, Alternative 1 yields relatively good results to the regular regression line. It was then determined that Alternative 1 Kn values estimated for the floodplain delineation study were adopted in the final HEC-1 models.

Table 13
Summary of Peak Flows Versus Kn Values

No.	Sub–Basin I.D.	Drainage Area (sq. mi.)	Alt. 1 Compos. Kn	Alt. 1 Lag (min.)	Alt. 1 Q1 (cfs)	Alt. 2 Compos. Kn	Alt. 2 Lag (min.)	Alt. 2 Q2 (cfs)	% Diff (Q2–Q1)/Q1
1	1A	0.577	0.065	69.5	508	0.035	37.4	750	47.6
	Basin 1 =	0.577							
2	2A	0.381	0.070	30.4	415	0.049	21.3	505	21.7
3	2B	0.141	0.070	19.0	201	0.049	13.2	225	11.9
4	2C	0.655	0.070	58.3	604	0.036	30.0	918	52.0
	Basin 2 =	1.177			1,095			1,490	36.1
5	3A	0.116	0.070	15.2	179	0.046	10.0	199	11.2
6	3B	0.234	0.070	26.6	373	0.037	13.8	456	22.3
7	3C	0.112	0.070	18.8	190	0.037	9.9	206	8.4
8	3D	0.355	0.070	58.6	380	0.035	29.3	560	47.4
	Basin 3 =	0.817			952			1,309	37.5
9	4A	0.303	0.065	53.4	343	0.035	28.8	483	40.8
10	4B	0.262	0.070	20.6	390	0.041	12.2	464	19.0
11	4C	0.693	0.065	40.5	915	0.036	22.6	1,220	33.3
12	4D	0.199	0.070	23.4	266	0.041	13.6	329	23.7
13	4E	0.172	0.060	17.9	252	0.039	11.6	288	14.3
	Basin 4 =	1.628			1,489			1,881	26.3
14	5A	0.482	0.070	27.9	546	0.043	17.0	691	26.6
15	5B	0.063	0.070	18.8	108	0.036	9.7	117	8.3
16	5C	0.046	0.070	14.6	84	0.036	7.4	87	3.6
17	5D	0.095	0.070	14.1	162	0.036	7.1	167	3.1
18	5E	0.061	0.070	14.2	100	0.035	7.1	104	4.0
19	5F	0.379	0.070	55.0	382	0.035	27.5	574	50.3
20	5G	0.402	0.070	59.1	420	0.035	29.5	623	48.3
	Basin 5 =	1.529			1,527			2,194	43.7
21	6A	0.503	0.070	45.8	499	0.036	23.7	738	47.9
22	6B	0.190	0.070	35.9	255	0.035	18.0	350	37.3
	Basin 6 =	0.694			611			970	58.8
23	7A	2.035	0.070	65.5	1,326	0.040	37.4	1,940	46.3
24	7B	0.042	0.070	16.4	80	0.035	8.2	84	5.0
25	7C	0.047	0.070	19.1	81	0.035	9.5	88	8.6
26	7D	0.033	0.070	16.4	65	0.035	8.2	68	4.6
27	7E	0.092	0.070	23.3	134	0.035	11.7	160	19.4
28	7F	0.053	0.070	15.8	98	0.035	7.9	102	4.1
29	7G	0.073	0.070	27.9	113	0.035	13.9	143	26.5
30	7H	0.162	0.070	41.7	195	0.035	20.8	284	45.6
	Basin 7 =	2.536							
31	8A	0.443	0.070	45.7	492	0.035	22.9	722	46.7
32	8B	0.280	0.070	35.9	397	0.035	17.9	536	35.0
33	8C	0.783	0.065	65.4	762	0.035	35.5	1,093	43.4
34	8D	0.037	0.060	11.8	58	0.036	7.0	59	1.7
	Basin 8 =	1.544							
35	9A	0.975	0.065	52.4	1,088	0.036	29.0	1,517	39.4
36	9B	0.696	0.065	54.6	759	0.035	29.4	1,076	41.8
	Basin 9 =	1.671			1,519			2,258	48.7

Table 13
Summary of Peak Flows Versus Kn Values

No.	Sub–Basin I.D.	Drainage Area (sq. mi.)	Alt. 1 Compos. Kn	Alt. 1 Lag (min.)	Alt. 1 Q1 (cfs)	Alt. 2 Compos. Kn	Alt. 2 Lag (min.)	Alt. 2 Q2 (cfs)	% Diff (Q2–Q1)/Q1
37	10A	0.150	0.070	15.2	224	0.050	10.7	247	10.3
38	10B	0.371	0.070	33.2	540	0.035	16.7	708	31.1
39	10C	0.685	0.070	42.9	861	0.036	21.7	1,220	41.7
40	10D	0.156	0.065	29.3	193	0.035	15.8	249	29.0
41	10E	0.555	0.065	56.4	593	0.035	30.4	844	42.3
42	10F	0.078	0.065	23.0	130	0.035	12.4	152	16.9
43	10G	0.138	0.065	27.5	222	0.035	14.8	273	23.0
44	10H	0.082	0.075	26.0	111	0.035	12.2	139	25.2
45	10I	0.182	0.065	34.2	226	0.036	18.8	305	35.0
46	10J	0.924	0.065	48.5	1,080	0.036	26.5	1,502	39.1
47	10K	0.418	0.065	23.0	585	0.038	13.2	690	17.9
48	10L	0.413	0.070	36.2	396	0.040	20.7	548	38.4
49	10M	0.336	0.065	20.4	512	0.036	11.4	570	11.3
50	10N	0.073	0.055	20.8	109	0.035	13.2	122	11.9
51	10O	0.119	0.065	29.0	148	0.035	15.6	190	28.4
52	10P	0.775	0.065	39.5	861	0.039	23.4	1,165	35.3
53	10Q	0.329	0.065	30.2	347	0.039	18.1	457	31.7
54	10R	0.088	0.065	23.0	149	0.035	12.4	173	16.1
55	10S	1.024	0.065	96.7	787	0.035	52.1	1,164	47.9
56	10T	0.068	0.048	16.4	127	0.035	11.9	133	4.7
57	10U	0.487	0.050	44.7	559	0.035	31.3	689	23.3
58	10V	0.964	0.060	32.5	1,090	0.036	19.2	1,446	32.7
59	10W	0.526	0.065	21.8	710	0.037	12.2	816	14.9
60	10X	0.152	0.070	23.8	156	0.043	14.4	191	22.4
61	10Y	0.068	0.065	11.2	99	0.037	6.4	100	1.0
	Basin 10=	9.161							
62	11A	0.158	0.070	14.0	248	0.039	7.8	277	11.7
63	11B	0.220	0.070	20.8	285	0.039	11.7	347	21.8
64	11C	0.054	0.070	9.3	81	0.040	5.2	83	2.5
65	11D	0.109	0.070	28.0	143	0.038	15.0	182	27.3
66	11E	0.424	0.070	46.1	353	0.039	25.7	517	46.5
67	11F	0.264	0.065	29.7	409	0.035	16.0	510	24.7
68	11G	0.349	0.065	19.2	633	0.037	10.8	690	9.0
69	11H	0.172	0.065	27.2	282	0.035	14.6	344	22.0
70	11I	0.528	0.055	42.7	677	0.035	27.2	859	26.9
71	11J	0.839	0.055	47.3	992	0.035	30.1	1,280	29.0
72	11K	0.427	0.065	34.0	538	0.037	19.3	718	33.5
73	11L	2.223	0.055	69.6	2,067	0.037	46.2	2,656	28.5
74	11M	0.783	0.055	69.5	734	0.036	45.5	952	29.7
75	11N	0.229	0.055	29.1	360	0.036	19.0	430	19.4
	Basin 11=	6.776			5,030			6,657	32.3
76	12A	0.078	0.050	25.9	106	0.035	18.1	124	17.0
77	12B	0.149	0.050	20.8	200	0.035	14.5	219	9.5
	Basin 12=	0.227							

Table 13
Summary of Peak Flows Versus Kn Values

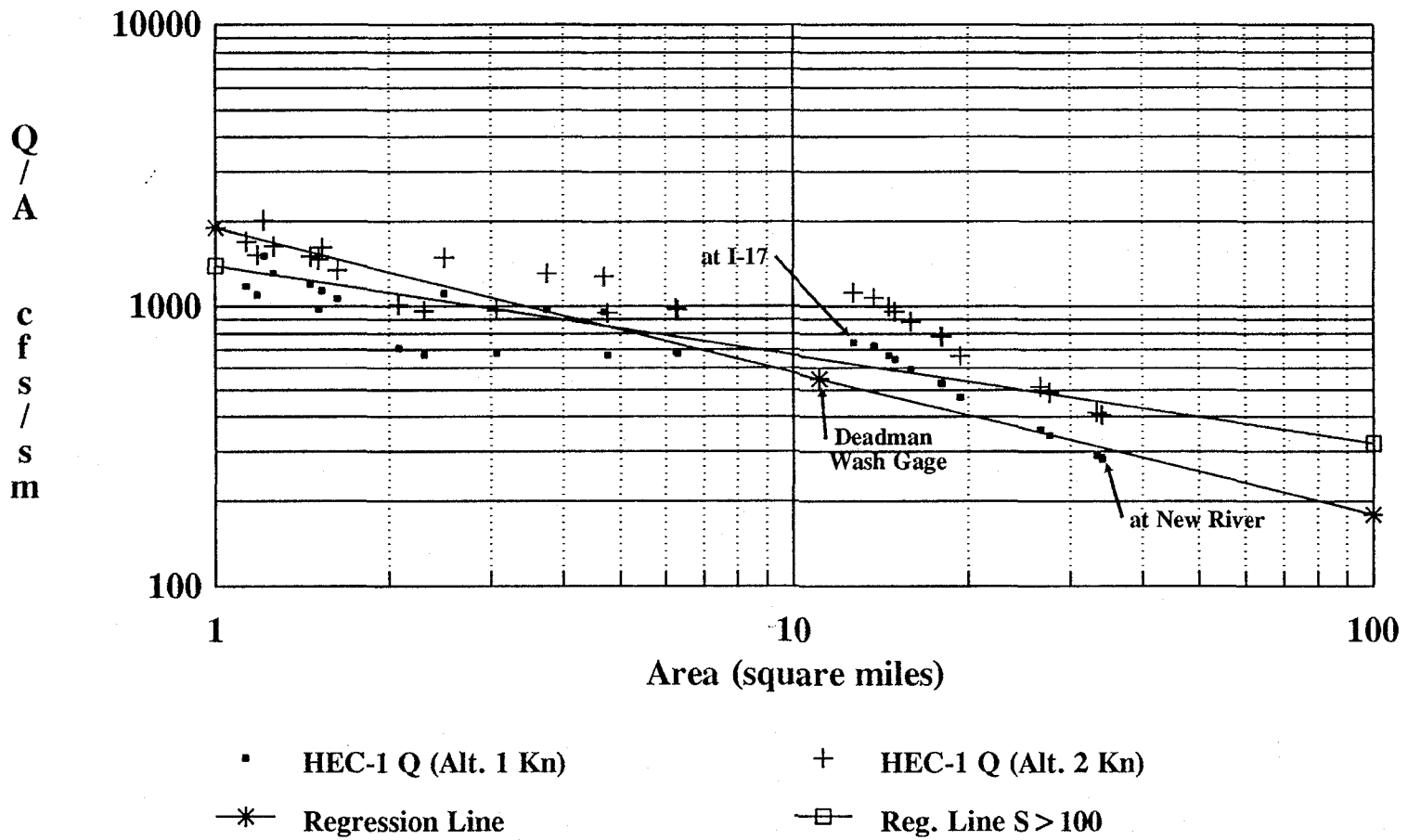
No.	Sub–Basin I.D.	Drainage Area (sq. mi.)	Alt. 1 Compos. Kn	Alt. 1 Lag (min.)	Alt. 1 Q1 (cfs)	Alt. 2 Compos. Kn	Alt. 2 Lag (min.)	Alt. 2 Q2 (cfs)	% Diff (Q2–Q1)/Q1
78	14A	2.410	0.050	48.1	2,855	0.035	33.7	3,483	22.0
79	14B	0.819	0.050	53.5	920	0.035	37.5	1,124	22.2
80	14C	0.726	0.050	58.6	773	0.035	41.0	950	22.9
81	14D	0.242	0.050	27.8	362	0.035	19.5	426	17.7
82	14E	0.665	0.050	60.9	691	0.035	42.6	852	23.3
83	14F	0.275	0.050	37.9	379	0.035	26.5	457	20.6
84	14G	0.086	0.050	21.1	132	0.035	14.8	144	9.1
	Basin 14=	5.223			4,334			5,412	24.9
85	15A	0.064	0.050	18.3	124	0.035	12.8	131	5.6
86	15B	0.386	0.050	40.1	485	0.035	28.1	591	21.9
	Basin 15=	0.450			521			634	21.7
	TOTAL	34.010			9,579			13,762	43.7

Notes:

Alt. 1: Higher Kn values estimated from field investigations.

Alt. 2: Lower Kn values determined based on surface characteristics.

Q/A vs. A for Kn Value Calibration
LOG PEARSON III ANALYSIS



Deadman Wash Flood Delineation Study

Figure 4

Check No. 3 - March 1, 1991 Storm

The HEC-1 models with two Kn value alternatives were also used to simulate the March 1, 1991 storm. The precipitation data were obtained from the FCDMC. The data collected from the Sunup Ranch precipitation gage station were used in the HEC-1 models because it is located just outside the watershed near Ben Avery Shooting Range. A total precipitation depth of 2.60 inches was recorded for a period of 44 hours. The models were run up to downstream of I-17 (at the routing reach R10H-I), where the streamflow gage is located. The iteration process was also conducted to the routing step numbers (NSTEPS). **Table 14** shows routing reach hydraulic data, peak flows, and NSTEPS for both alternatives. The HEC-1 models were developed using two Kn value alternatives with the SCS 24 hour rainfall distribution. The HEC-1 input files are included on the floppy diskette in **Section 3.6.**

The USGS conducted a field survey on June 7, 1991. The USGS estimated a peak flow of 1,030 cfs with a channel Manning's n value of 0.040 and flow area of 152 square feet. It appeared that the flow almost reached its bank full capacity with a top width of 59 feet as the USGS used in their estimation. In **Table 14**, the HEC-1 model with Alternative 1 Kn values computed a peak flow of 601 cfs near the gage station (at R10H-I) with a composite n value of 0.064 and a flow area of 245 square feet. The HEC-1 model with Alternative 2 Kn values estimated a peak flow of 1,112 cfs with a composite n value of 0.050 and a flow area of 343 square feet. Alternative 2 provides a better result. However, the USGS estimated flow is questionable since the high water mark was not surveyed immediately after the channel flow receded. In addition, the overbank flow exists based on the results of top widths from both HEC-1 models. The runoff volume at this gage station is not available for the March 1, 1991 storm. Hence, the runoff volume can not be used to calibrate the HEC-1 models. It is very difficult to select a better hydrologic model from this storm record data, because no other reliable data are available for calibration.

Check No. 4 - Comparison With Other Studies

The results of HEC-1 models were also compared with the SEA and CVL conceptual drainage studies in the watershed (References 8 and 9). The SEA's study included a HEC-1 model for the entire watershed using the kinematic wave method to generate runoff for the 100-year, 24-hour storm event. The CVL's study create a HEC-1 model in accordance with the FCDMC Manual for a 100-year 6-hour storm. No 100 year 24-hour flows have been modeled in the CVL's study. The model only covers the drainage area east of I-17. There is no parameter calibration and NSTEPS iteration done. **Table 15** presents the comparison of the HEC-1 models.

Table 14
Routing Reach Hydraulic Data for March 1, 1991 Storm

Alternative 1 – Kn Values from Flood Delineation Study

Reach I.D.	Length L (ft)	Slope S (ft/ft)	Q (cfs)	Channel Hydraulic Data March 1, 1991 storm					NSTEPS
				T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	
R10A–B	5,800	0.0310	10	24	0.30	6.4	0.070	1.6	12
R10B–C	5,000	0.0150	48	43	0.80	25.9	0.070	1.9	9
R10C–D	2,650	0.0132	121	65	1.21	52.6	0.065	2.3	4
R10E–F	2,500	0.0080	196	65	1.88	84.0	0.065	2.4	3
R2B–C	12,300	0.0199	25	27	0.50	12.8	0.065	2.0	21
R10F–G	900	0.0056	214	92	1.92	110.0	0.065	1.9	2
R3A–B	3,900	0.0205	7	25	0.26	6.2	0.070	1.2	11
R3C–D	8,900	0.0129	24	37	0.60	16.0	0.065	1.5	20
R10G–H	2,600	0.0096	263	50	3.12	95.9	0.082	2.7	3
R4B–C	3,850	0.0052	61	18	1.41	20.9	0.040	2.9	4
R4C–D	900	0.0167	179	19	1.86	29.2	0.040	6.1	1
R4D–E	3,100	0.0097	153	65	1.30	57.0	0.049	2.7	4
R5A–B	2,900	0.0224	28	25	0.60	14.0	0.070	2.1	5
R5D–E	1,600	0.0188	6	16	0.30	4.5	0.070	1.2	4
R5E–F	9,700	0.0134	24	36	0.50	16.6	0.070	1.5	22
R6A–B	5,800	0.0147	22	27	0.56	13.7	0.070	1.6	12
R7A–B	1,800	0.0111	81	39	1.37	37.3	0.070	2.2	3
R7C–D	1,900	0.0211	3	33	0.15	4.0	0.070	0.8	8
R7E–F	2,100	0.0262	1	18	0.10	1.7	0.070	0.7	10
R7F–G	3,500	0.0114	81	54	1.14	42.3	0.070	1.9	6
R7G–H	5,100	0.0108	101	57	1.30	50.2	0.070	2.0	8
R7H–C	500	0.0009	156	56	3.80	136.6	0.070	1.1	1
R8A–B	3,100	0.0097	10	22	0.48	8.9	0.070	1.1	9
R8B–C	11,000	0.0114	36	30	0.82	20.6	0.070	1.8	20
R8C–D	1,400	0.0107	250	28	2.93	60.3	0.060	4.2	1
R10H–I	1,000	0.0050	601	131	5.08	244.5	0.064	2.5	1

Alternative 2 – Kn Values from Surface Characteristics

Reach I.D.	Length L (ft)	Slope S (ft/ft)	Q (cfs)	Channel Hydraulic Data March 1, 1991 storm					NSTEPS
				T/W (ft)	Depth (ft)	Area (ft^2)	Comp. n	Avg. V (fps)	
R10A–B	5,800	0.0310	12	24	0.25	5.7	0.050	2.0	10
R10B–C	5,000	0.0150	77	41	0.72	22.5	0.036	3.4	5
R10C–D	2,650	0.0132	199	63	1.16	49.4	0.036	4.0	2
R10E–F	2,500	0.0080	356	64	1.83	80.8	0.035	4.4	2
R2B–C	12,300	0.0199	33	27	0.50	12.8	0.049	2.6	16
R10F–G	900	0.0056	431	94	2.00	117.3	0.035	3.7	1
R3A–B	3,900	0.0205	9	24	0.22	5.2	0.046	1.7	8
R3C–D	8,900	0.0129	28	33	0.48	11.9	0.037	2.3	13
R10G–H	2,600	0.0096	514	51	3.20	99.9	0.044	5.2	2
R4B–C	3,850	0.0052	83	19	1.70	26.2	0.041	3.2	4
R4C–D	900	0.0167	225	106	2.65	73.0	0.048	3.1	1
R4D–E	3,100	0.0097	215	68	1.45	65.3	0.043	3.3	3
R5A–B	2,900	0.0224	31	24	0.48	10.5	0.043	3.0	3
R5D–E	1,600	0.0188	5	15	0.20	2.9	0.036	1.9	3
R5E–F	9,700	0.0134	32	35	0.39	12.7	0.035	2.5	13
R6A–B	5,800	0.0147	30	26	0.45	10.8	0.036	2.8	7
R7A–B	1,800	0.0111	103	35	1.16	29.6	0.040	3.5	2
R7C–D	1,900	0.0211	5	31	0.13	3.3	0.035	1.4	5
R7E–F	2,100	0.0262	1	17	0.06	1.0	0.035	1.0	7
R7F–G	3,500	0.0114	111	48	0.94	32.1	0.035	3.5	3
R7G–H	5,100	0.0108	147	52	1.11	39.9	0.035	3.7	5
R7H–C	500	0.0009	299	55	3.72	132.0	0.035	2.3	1
R8A–B	3,100	0.0097	53	27	0.82	17.3	0.035	3.1	3
R8B–C	11,000	0.0114	45	28	0.63	15.1	0.035	3.0	12
R8C–D	1,400	0.0107	467	29	3.11	65.4	0.036	7.1	1
R10H–I	1,000	0.0050	1,112	179	5.72	343.0	0.050	3.2	1

Table 15 - 100 Year Peak Flows Comparison

LOCATION	SEA / 1990		CVL / 1991		HNTB / 1992	
	A (sm)	Q (cfs)	A (sm)	Q* (cfs)	A (sm)	Q (cfs)
At I-17	12.73	16,962	12.75	8,971	12.72	9,437
At New River	32.56	27,884	N/A	N/A	34.01	9,599

NOTE: An "*" denotes 100-year 6-hour peak flows.

The SEA discharges were significantly higher because the hydrology was derived from kinematic wave method for a natural watershed. In **Table 15**, the CVL 6-hr peak flow was slightly lower than the HNTB 24-hr peak flow at I-17. If the 100-year 6-hour discharges were compared, the HNTB flow of 8,829 cfs is only 1.6 percent lower than the CVL flow of 8,971 cfs.

Since SEA and CVL studies were conducted for conceptual drainage master planning, it is not a detailed watershed hydrology for typical flood control projects. Therefore, the results of this hydrologic study should be used as a guide or modified HEC-1 models to reflect any future development or drainage improvements in the watershed.

Results of the calibration checks showed that the HEC-1 model with Alternative 1 Kn values results in reasonable peak flows for the Deadman Wash watershed. Kn values for Alternative 1 were estimated based on field observations and procedures outlined in Reference 12. In general, Kn values of 0.070 and 0.065 were used in the mountainous areas and valley plains of the watershed, respectively. Although the peak flow determined at I-17 is 36 percent higher than the estimated value from the limited USGS statistical data, the flow at the New River yield a good result while it compared with the other USGS streamflow data in the region.

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FLOODPLAIN DELINEATION STUDY

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TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 3.4: Special Problems and Solutions

3.4 Special Problems and Solutions

3.4.1 Split Flow at North of Carefree Highway

There are numerous overland flow areas in the study watershed, especially the south half of the watershed area. The channels and floodplains in this area are very shallow and broad. Several small flow splits were identified and evaluated. Typically, the splits have occurred near the confluence of washes where the slope decreases. In this area, a single and well-defined channel becomes a braided channel or splits into smaller washes. In general, these splits will not cause any flows to divert into separate sub-basins.

One significant flow split is identified on the 1" = 200' topographic maps approximately 4,200 feet north of Carefree Highway. The existing floodplain upstream from Carefree Highway is relatively flat and broad and it is a sheet flow area. There is a man-made dike, approximately 700 feet long, which divides Deadman Wash into its main channel and Stream Number 12. The flow split occurs at this dike (at the concentration point C10R in HEC-1 models), and spreads over a broad floodplain area between Deadman Wash and Stream Number 12. The flows then cross the Carefree Highway through a dip section and gradually converge into the Deadman Wash at 1,800 feet south of Carefree Highway where Stream No. 12 joins the wash.

The main channel is a well-defined channel at the split location, and becomes a shallow, broad channel from downstream of the dike to the confluence with Stream Number 12. Stream Number 12 is a narrow, meandering, and well-defined channel. There is a 72-inch by 68-inch corrugated metal pipe across the Carefree Highway to carry the flow of this stream.

A HEC-2 model, DMSPLIT, was set up to generate the split flow data to be used for the diversion option in the HEC-1 models. Six discharges ranging from 7,500 cfs to 10,000 cfs were modeled. The HEC-2 model output and cross section locations are included in the end of **Section 3.4**. The results showed that overland flows occur prior to the flow split location and the split is approximately 55 percent of the total flow that remains in the Deadman Wash. Therefore, the diversion was used in the HEC-1 models at node DIV10R, the value shown on DQ card was 45 percent of the respective values used on DI card.

3.4.2 Stock Tanks

There are 17 stock tanks presented in the study watershed. Some of the stock tanks were inspected during the field reconnaissance trips. It was concluded that these tanks will not provide any significant retention storage during a 100-year flood event due to the lack of physical evidence for maintenance. The Snodgrass Tank located on the main channel of Deadman Wash near New River may create a physical barrier to the floodwaters. A preliminary HEC-2 run showed that there is approximately six feet of freeboard provided by the dam and dike structure at the tank. The flow approaching the tank is an overland sheet flow and crosses the 106 foot wide opening located northeast of the tank with a water depth of 9.0 feet and a velocity of 13.6 feet per second. Therefore, the dam and dike structure will be stable during a 100-year flood. The HEC-2 model output is included in the end of **Section 3.4** and SECNO 0.516 in the HEC-2 model is the section at the Snodgrass Tank.

3.4.3 HEC-1 Warnings

There are warning messages in the HEC-1 outputs. These warnings were related to reach routing and storage routing processes. All the warnings were carefully examined and compared with the final results. It appears that the warnings were encountered during the routing to generate peak discharges for respective drainage area sizes specified on JD cards. A warning occurred when the flows exceeded the reach and ponding area capacities. It should be noted that the resulting peak flows are outside the range of flows which causes the warning messages.

HEC2 S/N: 1126460209 HMVersion: 6.40 Data File: dmtank.hc2

```
*******************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    11OCT92    TIME   17:03:29 *
*******************************************
```

```
****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
```

```
X     X  XXXXXXX   XXXXX            XXXXX
X     X  X       X     X          X     X
X     X  X       X                      X
XXXXXXX  XXXX     X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX   XXXXX           XXXXXXX
```

```
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
:::                                       :::
:::   FULL MICRO-COMPUTER IMPLEMENTATION   :::
:::                                       :::
:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
```

```
============================
H A E S T A D   M E T H O D S
============================
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS RUN EXECUTED 11OCT92 17:03:29

```
************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


T1      Deadman Wash Floodplain Delineation Study
T2      Natural Profile Run for Deadman Wash, SECNO 0.092 to SECNO 0.721
T3      Deadman Wash 100-year Q   Subcritical Flow,  October 1992

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           -1                                    1482.72

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1                  -1                                      -1                            15


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38        43         1         8        42         3         2        26         5        39
    53         4        54       110       200

QT        1       9600
NC                                     .1        .3
NH        5       .085     9947.2     .060     10030.1     .085     10365.6     .060     10419.8     .085
NH   10572.
          ************************************************************
          Deadman Wash Floodplain Delineation Study prepared for
          FCDMC by Howard Needles Tammen & Bergendoff (HNTB), 1992.

          This floodplain delineation study begins at the New River,
          and the water surface elevation starts at critical depth.
          The higher water suface elevation in New River was not used
          to start the HEC-2 runs due to the difference in time of peak.

          NC cards were used where majority of flow expected to remain
          in the channel, while NH cards were used for the braided
          channel or at the confluence of washes.

          The control line on the thalweg of Deadman Wash is
          Station 10,000, and all cross section data were stationed
          looking downstream.

          Cross section numbers indicate in river miles above the mouth.
```

Q of 9,600 cfs at New River (C10Y) was used.

NH cards were used for SECNO 0.092 through SECNO 0.299.
****

```
X1   0.092      48   9947.2  10030.1       0       0       0
GR  1495.0  9861.4  1494.3   9888.1  1493.6  9909.2  1489.2  9931.7  1483.5  9947.2
GR  1475.3  9958.1  1474.4   9969.2  1473.9  9982.3  1473.9  9993.1  1472.6 10000.0
GR  1472.6 10007.8  1472.7  10011.0  1478.0 10022.7  1479.6 10030.1  1479.9 10043.5
GR  1479.9 10059.8  1480.9  10078.5  1481.1 10100.3  1481.0 10116.7  1481.2 10134.9
GR  1481.4 10149.7  1481.3  10163.9  1481.4 10181.9  1481.1 10194.4  1481.5 10214.4
GR  1481.5 10225.6  1481.1  10242.2  1481.2 10269.9  1481.9 10293.6  1481.6 10319.2
GR  1481.5 10341.0  1481.8  10356.9  1480.9 10365.6  1479.2 10374.2  1478.6 10382.6
GR  1478.7 10387.2  1479.7  10390.2  1479.2 10395.7  1477.9 10400.0  1478.1 10404.2
GR  1480.2 10411.0  1480.9  10419.8  1482.3 10435.5  1482.5 10462.4  1482.5 10494.5
GR  1482.9 10531.7  1483.0  10571.5  1483.1 10572.0

NH      5    .085  9974.0    .060 10052.6    .085 10500.0    .065 10538.0    .085
NH  10840.
X1   0.159      32   9974.0  10052.6     340     400     354
GR  1501.2  9937.3  1492.2   9953.1  1482.8  9974.0  1475.5  9981.8  1474.4  9991.3
GR  1474.2 10000.0  1475.8  10010.0  1477.0 10024.3  1478.5 10032.7  1480.9 10043.1
GR  1483.3 10052.6  1483.3  10064.2  1481.6 10081.9  1482.2 10099.6  1482.4 10120.1
GR  1483.1 10135.6  1482.5  10156.1  1482.5 10177.0  1482.8 10193.4  1483.2 10204.5
GR  1484.1 10218.5  1482.6  10233.1  1483.0 10240.1  1482.9 10257.7  1483.1 10289.8
GR  1483.5 10301.8  1485.0  10360.0  1484.0 10500.0  1484.1 10538.0  1486.0 10590.0
GR  1487.0 10650.0  1488.0  10840.0

NH      5    .085  9967.9    .060 10037.3    .085 10106.0    .065 10356.5    .085
NH  10820.
X1   0.202      49   9967.9  10037.3     210     240     227
GR  1495.7  9951.0  1483.4   9967.9  1476.4  9982.3  1473.2  9990.6  1472.7  9997.4
GR  1473.1 10000.0  1474.5  10004.2  1478.9 10012.8  1482.0 10024.4  1484.4 10037.3
GR  1484.4 10052.1  1483.8  10066.8  1482.5 10072.0  1482.2 10081.6  1483.6 10092.0
GR  1483.5 10106.0  1481.9  10117.3  1480.3 10128.1  1476.7 10139.1  1475.8 10146.9
GR  1475.5 10156.7  1477.0  10161.3  1481.6 10175.0  1483.7 10183.4  1483.5 10188.8
GR  1480.1 10201.8  1478.9  10209.1  1480.5 10213.9  1482.8 10229.0  1484.1 10244.9
GR  1484.5 10267.9  1483.7  10280.8  1482.0 10289.5  1482.1 10304.7  1479.9 10311.3
GR  1479.0 10315.9  1480.6  10323.1  1482.7 10337.5  1484.6 10356.5  1484.5 10379.2
GR  1484.9 10412.7  1485.0  10443.5  1485.1 10481.5  1485.4 10515.7  1485.5 10555.8
GR  1486.3 10577.1  1487.0  10650.0  1487.8 10740.0  1488.7 10820.0

NH      5    .085  9970.1    .060 10031.1    .085 10214.4    .060 10267.1    .085
NH  10950.
X1   0.299      53   9970.1  10031.1     520     400     512
GR  1499.7  9701.1  1498.1   9730.5  1496.9  9754.1  1496.2  9772.4  1493.2  9802.5
GR  1491.1  9836.3  1489.3   9857.8  1485.1  9876.7  1484.3  9890.5  1484.6  9918.2
GR  1485.0  9944.8  1485.0   9970.1  1484.5  9981.5  1481.8  9988.3  1474.0  9993.9
GR  1473.8 10000.0  1474.3  10006.9  1483.3 10015.9  1485.1 10031.1  1484.0 10043.9
GR  1479.2 10053.6  1480.3  10066.1  1482.3 10080.6  1482.0 10082.8  1484.0 10096.2
GR  1484.3 10117.2  1484.9  10138.4  1483.9 10146.3  1484.9 10170.4  1485.9 10184.6
GR  1485.7 10203.1  1483.5  10214.4  1480.5 10225.2  1478.4 10231.7  1478.8 10242.0
GR  1481.9 10254.5  1484.7  10267.1  1485.9 10286.7  1486.2 10311.4  1486.2 10337.6
GR  1486.1 10368.8  1486.2  10392.8  1485.7 10417.9  1485.5 10434.3  1483.1 10446.6
```

```
GR   1484.7    10455.1     1485.7    10472.9     1486.1    10496.0     1486.2    10505.0     1487.0    10800.0
GR   1488.0    10828.0     1489.0    10900.0     1489.6    10950.0

NC     .085       .085       .065        .3         .5
          NC card was used, channel = .065 and overbank = .085
          Contraction and expansion coefficients changed to 0.3 and
          0.5 for the dam and dike structures at Snodgrass Tank.
X1    0.382         41     9958.6    10015.2         400        550        438
GR   1492.1     9781.2     1489.1     9807.0     1488.7     9838.6     1488.6     9852.4     1488.2     9869.9
GR   1487.6     9881.8     1485.3     9897.6     1482.2     9909.8     1480.7     9926.6     1481.5     9940.4
GR   1484.0     9951.7     1485.3     9958.6     1482.8     9965.5     1481.8     9980.0     1480.8     9992.8
GR   1479.3    10000.0     1480.5    10007.6     1485.2    10015.2     1487.8    10025.5     1487.9    10046.7
GR   1486.6    10069.7     1485.3    10082.1     1483.2    10095.7     1483.1    10106.6     1484.3    10125.5
GR   1485.5    10148.8     1486.2    10172.8     1486.3    10196.8     1486.5    10217.4     1487.9    10241.4
GR   1488.5    10265.8     1488.6    10292.1     1489.3    10312.8     1489.2    10333.8     1489.4    10363.4
GR   1489.9    10400.6     1490.8    10433.1     1490.9    10465.9     1490.9    10496.3     1492.1    10528.1
GR   1492.5    10560.0

NC     .065       .065       .040
          The area of the stock tank (Snodgrass Tank) is ineffective,
          and it's ignored. However, the dam and dike structures act
          as a constriction to the flow.
          NC card was used, channel = .040 and overbank = .065
X1    0.516         80     9828.1    10114.2         680        750        708
GR   1507.2     9207.8     1505.8     9230.3     1503.4     9252.4     1498.7     9271.8     1497.6     9281.0
GR   1498.4     9290.6     1500.5     9298.4     1501.8     9323.6     1501.6     9353.2     1500.5     9391.1
GR   1500.2     9427.1     1501.1     9459.8     1500.7     9484.2     1500.9     9496.9     1500.7     9517.7
GR   1500.6     9520.3     1500.6     9554.9     1500.4     9580.2     1500.3     9623.0     1501.4     9668.8
GR   1501.4     9709.7     1501.2     9754.3     1501.3     9792.3     1500.1     9828.1     1497.9     9858.1
GR   1498.0     9913.8     1497.2     9950.6     1496.0     9959.7     1487.5     9977.9     1485.2    10000.0
GR   1485.8    10027.2     1486.8    10043.6     1491.3    10066.6     1498.5    10077.7     1500.1    10114.2
GR   1500.5    10146.6     1500.8    10177.7     1500.7    10216.3     1499.4    10257.3     1500.6    10299.3
GR   1500.0    10332.7     1499.8    10379.3     1499.7    10431.0     1500.4    10476.0     1501.4    10502.3
GR   1502.0    10526.2     1500.5    10527.7     1501.0    10560.9     1500.7    10591.6     1500.0    10617.6
GR   1500.3    10651.5     1499.7    10692.0     1499.8    10725.7     1500.0    10743.3     1499.0    10755.2
GR   1497.0    10777.6     1495.9    10795.0     1495.7    10815.0     1496.5    10849.1     1497.5    10896.8
GR   1498.1    10946.7     1498.3    10989.5     1498.0    11020.9     1497.6    11052.9     1496.6    11071.7
GR   1496.7    11088.7     1497.7    11117.7     1498.6    11147.7     1498.6    11171.4     1498.9    11205.5
GR   1499.1    11241.7     1498.9    11270.8     1497.1    11300.9     1496.3    11333.3     1496.3    11374.1
GR   1497.2    11413.7     1496.9    11450.9     1499.7    11489.6     1500.0    11540.6     1500.2    11541.3

QT        1       9670
NC     .065       .065       .038
ET                 7.1                                                 9690       10420
          Meandering channel around the tank was straightened for modeling.
          Q changed to 9,670 cfs at C10W (the confluence with Stream No.
          14).  CCHV = 0.3 for abrupt contraction.
          ET card (Fields 7 & 8 ) was used to model ineffective area.
          NC card was used, channel = .038 and overbanks = .065.
X1    0.618         68     9961.3    10051.6         600        490        539
GR   1500.0     9590.0     1496.4     9645.0     1496.1     9673.6     1495.1     9706.2     1496.2     9726.3
GR   1497.9     9750.4     1498.2     9775.2     1497.9     9800.0     1497.4     9820.1     1496.7     9831.4
GR   1495.0     9850.6     1493.9     9879.2     1493.2     9905.1     1492.4     9924.2     1492.9     9943.9
GR   1493.2     9961.3     1492.3     9972.4     1490.8     9983.7     1490.1     9995.7     1489.9    10000.0
```

GR	1490.5	10011.3	1491.8	10017.3	1493.5	10029.8	1493.7	10051.6	1493.5	10072.4
GR	1493.2	10102.0	1493.1	10134.2	1492.8	10166.9	1492.6	10200.5	1492.6	10233.7
GR	1492.3	10257.9	1492.4	10277.4	1492.2	10303.5	1492.6	10335.6	1493.1	10365.8
GR	1494.1	10389.1	1494.1	10420.1	1493.4	10461.6	1492.8	10502.8	1493.0	10539.0
GR	1492.6	10577.9	1492.7	10616.2	1492.7	10661.3	1492.8	10704.4	1493.3	10746.6
GR	1493.8	10778.5	1495.6	10809.6	1495.9	10854.0	1496.8	10897.3	1496.6	10937.4
GR	1495.9	10958.7	1496.9	10992.7	1497.1	11034.2	1497.8	11081.1	1498.4	11119.0
GR	1498.8	11148.5	1498.5	11191.7	1496.5	11233.4	1495.4	11258.3	1496.0	11294.9
GR	1496.5	11331.5	1496.7	11366.1	1497.0	11403.2	1497.4	11441.2	1497.6	11477.4
GR	1498.7	11509.9	1499.0	11511.3	1499.2	11520.0				
NC				.1	.3					
X1	0.721	79	9989.4	10022.5	400	400	544			
GR	1499.5	9788.0	1498.0	9807.3	1498.3	9822.1	1496.7	9838.2	1495.9	9854.4
GR	1495.6	9875.0	1495.9	9884.3	1495.1	9896.1	1495.1	9921.8	1494.7	9944.9
GR	1495.4	9968.0	1496.0	9983.3	1495.0	9989.4	1492.4	9993.1	1492.1	9999.8
GR	1492.2	10000.0	1492.6	10009.6	1494.2	10022.5	1494.4	10035.5	1494.9	10060.3
GR	1495.3	10092.1	1496.1	10120.5	1495.3	10130.4	1494.0	10138.7	1495.2	10148.9
GR	1494.9	10172.3	1494.9	10196.6	1494.7	10234.0	1494.6	10271.8	1494.3	10305.8
GR	1494.1	10328.1	1494.0	10345.3	1494.7	10365.8	1494.5	10398.4	1494.8	10432.3
GR	1495.3	10465.5	1495.1	10499.1	1495.0	10540.3	1494.8	10579.6	1494.8	10614.1
GR	1495.2	10651.1	1495.3	10659.0	1495.3	10680.3	1495.4	10697.8	1494.9	10724.5
GR	1494.8	10762.6	1494.3	10786.7	1494.8	10797.4	1494.6	10813.2	1495.1	10836.1
GR	1495.0	10871.3	1495.9	10897.4	1496.6	10922.8	1496.6	10946.7	1497.2	10973.7
GR	1498.6	10996.4	1498.8	11014.4	1497.9	11041.4	1497.9	11070.3	1498.1	11103.5
GR	1498.1	11136.8	1498.6	11166.9	1500.6	11200.6	1501.4	11215.4	1501.3	11249.2
GR	1500.3	11283.6	1500.6	11322.6	1501.2	11356.1	1501.2	11390.1	1500.9	11417.4
GR	1500.2	11436.4	1499.3	11454.1	1499.3	11463.1	1501.9	11477.9	1501.9	11496.8
GR	1501.3	11523.2	1500.3	11548.6	1499.9	11564.7	1500.6	11577.5		

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV= .100 CEHV= .300
1490 NH CARD USED
*SECNO .092
3720 CRITICAL DEPTH ASSUMED

****

Deadman Wash Floodplain Delineation Study prepared for
FCDMC by Howard Needles Tammen & Bergendoff (HNTB), 1992.

This floodplain delineation study begins at the New River,
and the water surface elevation starts at critical depth.
The higher water suface elevation in New River was not used
to start the HEC-2 runs due to the difference in time of peak.

NC cards were used where majority of flow expected to remain
in the channel, while NH cards were used for the braided
channel or at the confluence of washes.

The control line on the thalweg of Deadman Wash is
Station 10,000, and all cross section data were stationed
looking downstream.

Cross section numbers indicate in river miles above the mouth.

Q of 9,600 cfs at New River (C10Y) was used.

NH cards were used for SECNO 0.092 through SECNO 0.299.

****

.092	10.13	1482.73	1482.73	1482.72	1484.09	1.37	.00	.00	1483.50
9600.0	.0	6789.8	2810.2	.0	623.7	745.0	.0	.0	1479.60
.00	.00	10.89	3.77	.000	.060	.074	.000	1472.60	9948.23
.013727	0.	0.	0.	0	4	0	.00	567.28	10515.51

FLOW DISTRIBUTION FOR SECNO= .09 CWSEL= 1482.73

STA=	9948.	10030.	10060.	10117.	10194.	10270.	10374.	10387.	10400.	10411.	10516.
PER Q=	70.7	3.7	3.6	3.1	3.0	3.8	3.8	3.3	3.4	1.5	
AREA=	623.7	85.9	108.6	113.5	109.6	130.6	50.9	46.6	44.2	55.2	
VEL=	10.9	4.2	3.2	2.6	2.6	2.8	7.2	6.8	7.3	2.7	
DEPTH=	7.6	2.9	1.9	1.5	1.5	1.3	3.9	3.6	4.0	.5	

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

1490 NH CARD USED
*SECNO .159

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.64

.159	12.35	1486.55	1485.25	.00	1487.10	.55	2.93	.08	1482.80
9600.0	28.0	5444.9	4127.1	15.6	722.7	1536.9	16.0	5.5	1483.30
.02	1.79	7.53	2.69	.085	.060	.084	.000	1474.20	9965.66
.005119	340.	354.	400.	3	8	0	.00	657.40	10623.06

FLOW DISTRIBUTION FOR SECNO= .16 CWSEL= 1486.55

STA=	9966.	9974.	10053.	10082.	10120.	10156.	10193.	10233.	10290.	10360.	10500.	10590.	10623.
PER Q=	.3	56.7	3.5	6.0	4.3	4.9	3.6	6.2	4.2	6.0	4.3	.1	
AREA=	15.6	722.7	110.3	169.5	135.8	148.6	126.8	203.6	172.9	287.1	173.1	9.1	
VEL=	1.8	7.5	3.0	3.4	3.0	3.1	2.7	2.9	2.3	2.0	2.4	.5	
DEPTH=	1.9	9.2	3.8	4.4	3.8	4.0	3.2	3.6	2.5	2.1	1.9	.3	

1490 NH CARD USED
*SECNO .202

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.69

.202	14.93	1487.63	1483.70	.00	1487.80	.17	.66	.04	1483.40
9600.0	12.9	2899.6	6687.5	12.2	647.7	2461.7	30.7	9.4	1484.40
.04	1.06	4.48	2.72	.085	.060	.069	.000	1472.70	9962.10
.001797	210.	227.	240.	2	14	0	.00	757.57	10719.68

FLOW DISTRIBUTION FOR SECNO= .20 CWSEL= 1487.63

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

STA=	9962.	9968.	10037.	10082.	10117.	10139.	10147.	10157.	10175.	10202.	10214.	10245.	10290.
PER Q=	.1	30.2	3.4	3.8	6.7	4.5	6.2	7.1	4.2	3.9	4.7	3.9	
AREA=	12.2	647.7	173.2	161.6	170.7	88.7	117.3	166.3	139.1	97.3	156.4	163.2	
VEL=	1.1	4.5	1.9	2.3	3.8	4.9	5.1	4.1	2.9	3.8	2.9	2.3	
DEPTH=	2.1	9.3	3.9	4.5	7.8	11.4	12.0	9.1	5.2	8.0	5.0	3.7	

STA=	10290.	10311.	10323.	10357.	10444.	10556.	10720.
PER Q=	4.2	3.7	4.7	3.9	3.7	1.0	
AREA=	128.3	93.9	161.4	249.7	265.7	128.9	
VEL=	3.1	3.8	2.8	1.5	1.3	.8	
DEPTH=	5.9	8.0	4.8	2.9	2.4	.8	

1490 NH CARD USED
*SECNO .299

.299	14.79	1488.59	1485.96	.00	1488.74	.15	.94	.00	1485.00
9600.0	832.2	2262.8	6505.0	387.3	485.4	2588.1	62.9	17.8	1485.10
.08	2.15	4.66	2.51	.085	.060	.077	.000	1473.80	9861.00
.002648	520.	512.	400.	2	12	0	.00	1009.42	10870.42

FLOW DISTRIBUTION FOR SECNO= .30 CWSEL= 1488.59

STA=	9861.	9918.	9970.	10031.	10054.	10066.	10081.	10117.	10170.	10225.	10232.	10242.	10255.
PER Q=	4.4	4.3	23.6	3.4	4.4	3.7	5.0	5.3	6.2	3.3	6.3	5.5	
AREA=	195.7	191.6	485.4	119.5	110.5	105.7	182.3	218.6	213.1	59.4	102.9	103.0	
VEL=	2.1	2.1	4.7	2.7	3.8	3.4	2.6	2.3	2.8	5.4	5.9	5.1	
DEPTH=	3.4	3.7	8.0	5.3	8.8	7.3	5.0	4.1	3.9	9.1	10.0	8.2	

STA=	10255.	10287.	10369.	10434.	10473.	10800.	10870.
PER Q=	4.0	3.4	3.1	3.6	10.2	.4	
AREA=	131.1	201.4	173.8	152.9	670.9	43.0	
VEL=	2.9	1.6	1.7	2.3	1.5	.8	
DEPTH=	4.1	2.5	2.7	4.0	2.1	.6	

CCHV= .300 CEHV= .500
*SECNO .382
NC card was used, channel = .065 and overbank = .085
Contraction and expansion coefficients changed to 0.3 and
0.5 for the dam and dike structures at Snodgrass Tank.

.382	10.94	1490.24	1487.65	.00	1490.60	.36	1.75	.10	1485.30
9600.0	2760.0	3180.4	3659.6	666.0	480.4	1164.7	96.3	27.5	1485.20
.11	4.14	6.62	3.14	.085	.065	.085	.000	1479.30	9797.20
.005084	400.	438.	550.	2	11	0	.00	615.68	10412.88

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= .38 CWSEL= 1490.24

STA=	9797.	9898.	9910.	9927.	9940.	9952.	9959.	10015.	10070.	10096.	10107.	10126.	10149.
PER Q=	4.2	3.5	8.1	7.2	4.1	1.6	33.1	4.2	5.3	3.7	5.6	4.9	
AREA=	189.8	79.2	147.7	126.1	84.6	38.6	480.4	158.0	134.7	77.3	123.6	124.4	
VEL=	2.1	4.2	5.3	5.4	4.7	3.9	6.6	2.6	3.8	4.6	4.4	3.8	
DEPTH=	1.9	6.5	8.8	9.1	7.5	5.6	8.5	2.9	5.2	7.1	6.5	5.3	

STA=	10149.	10173.	10197.	10241.	10401.	10413.
PER Q=	3.7	3.1	4.5	3.1	.0	
AREA=	105.4	95.8	152.1	191.5	2.1	
VEL=	3.3	3.1	2.8	1.5	.4	
DEPTH=	4.4	4.0	3.4	1.2	.2	

*SECNO .516

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .67

The area of the stock tank (Snodgrass Tank) is ineffective,
and it's ignored. However, the dam and dike structures act
as a constriction to the flow.
NC card was used, channel = .040 and overbank = .065

.516	8.95	1494.15	1493.78	.00	1497.01	2.86	5.16	1.25	1500.10
9600.0	.0	9600.0	.0	.0	707.8	.0	121.2	33.5	1500.10
.12	.00	13.56	.00	.000	.040	.000	.000	1485.20	9963.65
.011172	680.	708.	750.	2	15	0	.00	107.35	10071.00

FLOW DISTRIBUTION FOR SECNO= .52 CWSEL= 1494.15

STA=	9964.	10114.
PER Q=	100.0	
AREA=	707.8	
VEL=	13.6	
DEPTH=	6.6	

*SECNO .618

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.42

3470 ENCROACHMENT STATIONS= 9690.0 10420.0 TYPE= 1 TARGET= 730.000
Meandering channel around the tank was straightened for modeling.
Q changed to 9,670 cfs at C10W (the confluence with Stream No.
14). CCHV = 0.3 for abrupt contraction.
ET card (Fields 7 & 8) was used to model ineffective area.
NC card was used, channel = .038 and overbanks = .065.

.618	9.01	1498.91	1495.29	.00	1499.05	.14	1.23	.81	1493.20
9670.0	1751.7	2793.1	5125.2	922.6	629.8	2192.5	148.1	38.7	1493.70
.18	1.90	4.43	2.34	.065	.038	.065	.000	1489.90	9690.00
.000971	600.	539.	490.	2	14	0	.00	730.00	10420.00

FLOW DISTRIBUTION FOR SECNO= .62 CWSEL= 1498.91

STA=	9690.	9831.	9879.	9905.	9944.	9961.	10052.	10102.	10134.	10167.	10201.	10234.	10258.
PER Q=	3.2	3.4	3.1	5.9	2.4	28.9	6.3	4.4	4.7	5.2	5.3	4.0	
AREA=	256.2	186.0	138.7	239.8	101.9	629.8	274.7	185.3	194.7	208.5	209.3	156.2	
VEL=	1.2	1.8	2.2	2.4	2.3	4.4	2.2	2.3	2.3	2.4	2.4	2.5	
DEPTH=	1.8	3.9	5.4	6.2	5.9	7.0	5.5	5.8	6.0	6.2	6.3	6.5	

STA=	10258.	10277.	10304.	10336.	10366.	10420.
PER Q=	3.3	4.5	5.4	4.5	5.6	
AREA=	127.8	172.4	208.8	182.8	272.0	
VEL=	2.5	2.5	2.5	2.4	2.0	
DEPTH=	6.6	6.6	6.5	6.1	5.0	

CCHV= .100 CEHV= .300
*SECNO .721

3265 DIVIDED FLOW

.721	7.29	1499.39	1496.66	.00	1499.45	.06	.39	.01	1495.00
9670.0	1068.9	844.4	7756.7	660.0	214.6	4401.5	190.9	48.7	1494.20
.24	1.62	3.93	1.76	.065	.038	.065	.000	1492.10	9789.45
.000869	400.	544.	400.	3	8	0	.00	1401.95	11463.60

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= .72 CWSEL= 1499.39

STA=	9789.	9884.	9945.	9989.	10023.	10060.	10121.	10172.	10234.	10272.	10306.	10345.	10398.
PER Q=	3.1	4.8	3.2	8.7	3.7	4.3	4.2	5.4	3.5	3.4	4.4	5.2	
AREA=	219.9	259.7	180.3	214.6	183.6	241.1	226.2	280.6	179.1	167.9	207.5	259.4	
VEL=	1.3	1.8	1.7	3.9	1.9	1.7	1.8	1.9	1.9	2.0	2.0	1.9	
DEPTH=	2.3	4.3	4.1	6.5	4.9	4.0	4.4	4.5	4.7	4.9	5.3	4.9	

STA=	10398.	10432.	10499.	10540.	10580.	10614.	10651.	10698.	10763.	10797.	10836.	10897.	10996.
PER Q=	3.2	5.2	3.3	3.3	3.0	3.0	3.4	5.4	3.4	3.4	4.6	3.3	
AREA=	160.6	284.7	178.7	176.4	158.3	162.3	190.4	286.0	168.4	178.0	255.5	247.3	
VEL=	1.9	1.8	1.8	1.8	1.9	1.8	1.7	1.8	1.9	1.9	1.7	1.3	
DEPTH=	4.7	4.3	4.3	4.5	4.6	4.4	4.1	4.4	4.8	4.6	4.2	2.5	

STA=	10996.	11464.
PER Q=	1.7	
AREA=	209.7	
VEL=	.8	
DEPTH=	.4	

THIS RUN EXECUTED 11OCT92 17:03:40

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

Deadman Wash 100-year Q

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	DEPTH	ELMIN	EG	CRIWS	VCH	10*KS	XLCH	SSTA	TOPWID	ENDST
*	.092	9600.00	1482.73	10.13	1472.60	1484.09	1482.73	10.89	137.27	.00	9948.23	567.28	10515.51
*	.159	9600.00	1486.55	12.35	1474.20	1487.10	1485.25	7.53	51.19	354.00	9965.66	657.40	10623.06
*	.202	9600.00	1487.63	14.93	1472.70	1487.80	1483.70	4.48	17.97	227.00	9962.10	757.57	10719.68
	.299	9600.00	1488.59	14.79	1473.80	1488.74	1485.96	4.66	26.48	512.00	9861.00	1009.42	10870.42
	.382	9600.00	1490.24	10.94	1479.30	1490.60	1487.65	6.62	50.84	438.00	9797.20	615.68	10412.88
*	.516	9600.00	1494.15	8.95	1485.20	1497.01	1493.78	13.56	111.72	708.00	9963.65	107.35	10071.00
*	.618	9670.00	1498.91	9.01	1489.90	1499.05	1495.29	4.43	9.71	539.00	9690.00	730.00	10420.00
	.721	9670.00	1499.39	7.29	1492.10	1499.45	1496.66	3.93	8.69	544.00	9789.45	1401.95	11463.60

Deadman Wash 100-year Q

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	.092	1482.73	.01	1484.09	567.28	.00	6789.83	2810.17	.00	.00	9947.20	10030.10	.00
*	.159	1486.55	.00	1487.10	657.40	27.98	5444.94	4127.07	.00	.00	9974.00	10052.60	.00
*	.202	1487.63	.00	1487.80	757.57	12.94	2899.57	6687.49	.00	.00	9967.90	10037.30	.00
	.299	1488.59	.00	1488.74	1009.42	832.25	2262.76	6504.99	.00	.00	9970.10	10031.10	.00
	.382	1490.24	.00	1490.60	615.68	2759.97	3180.39	3659.64	.00	.00	9958.60	10015.20	.00
*	.516	1494.15	.00	1497.01	107.35	.00	9600.00	.00	.00	.00	9828.10	10114.20	.00
*	.618	1498.91	.00	1499.05	730.00	1751.68	2793.14	5125.18	730.00	9690.00	9961.30	10051.60	10420.00
	.721	1499.39	.00	1499.45	1401.95	1068.85	844.43	7756.72	.00	.00	9989.40	10022.50	.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=      .092  PROFILE=  1  CRITICAL DEPTH ASSUMED

WARNING SECNO=      .159  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .202  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .516  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .618  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

Normal program termination
```

Q100= 9600cfs
C
0.202
FD= 1487.6
FW= 1488.5
Q100=9600cfs
B
0.159
Q100= 9600cfs
A
0.092
E
0.382
D
0.299
C
0.202
B
0.159
M0.3
M0.2
M20.6
M20.7
RIVER
NEW
1490
1500
1510
1480
28925
1492.00

SEE NOTE NO. 3
DEADMAN
MO.7
MO.6
MO.5
MO.4
MO.3
STOCKGRASS
TANK
ERM #1
1499
1498
1497
1496
1490
1520
1510
0.721
FW= 1499.8
Q100= 9670cfs
G
0.618
FD= 1498.9
FW= 1499.1
Q100= 9600cfs
F
0.516
FD= 1494.2
FW= 1494.9
Q100= 9600cfs
E
0.382
FD= 1490.2
FW= 1491.2
Q100= 9600cfs
D
0.299
FD= 1488.6
FW= 1489.4
Q100= 9600cfs
C
0.202
FD= 1487.6
FW= 1488.5
Q100=9600cfs
B
0.159
FD= 1486.6
FW= 1487.6

HEC2 S/N: 1126460209 HMVersion: 6.40 Daca File: dmsplit.hc2

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*********************************************
*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE     5MAY92    TIME    4:43:01   *
*********************************************
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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:::::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::::
:::                                       :::
:::   FULL MICRO-COMPUTER IMPLEMENTATION   :::
:::                                       :::
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:::::::::::::::::::::::::::::::::::::::::::::
```

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============================
H A E S T A D   M E T H O D S
============================
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS RUN EXECUTED 5MAY92 4:43:01

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**************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
**************************************


T1      Deadman Wash Flood Insurance Study
T2      Hydraulic Analysis of Deadman Wash
T3      Deadman Wash Q=7500 cfs

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                                                                  1601.73

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1                  -1                                      -1                            15


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38        8         1         2         3         42        26        4         13        14
     15        23        24

QT       6       7500      8000      8500      9000      9500      10000
NC                         .1        .3
NH       5       .080    8467.6      .065    8500.9      .065    9162.2      .048    10127.8      .065
NH   10423.
X1    4.058       91     9162.2   10127.8       275       206       206
GR   1604.0    7899.7    1603.5    7978.4    1603.6    8030.4    1603.3    8087.2    1603.2    8123.6
GR   1602.3    8144.1    1601.9    8168.1    1602.0    8206.0    1601.9    8236.2    1600.8    8264.8
GR   1601.1    8285.5    1600.1    8295.3    1601.2    8306.2    1600.7    8320.6    1600.7    8350.7
GR   1600.7    8388.2    1600.9    8413.3    1600.3    8439.6    1600.4    8460.7    1601.3    8467.6
GR   1600.9    8479.1    1598.1    8486.8    1598.5    8490.4    1601.3    8500.9    1600.9    8512.1
GR   1600.8    8521.4    1601.9    8529.6    1601.0    8538.1    1597.8    8545.3    1598.9    8551.9
GR   1598.9    8557.1    1597.4    8562.8    1597.6    8566.0    1601.4    8582.5    1601.5    8602.9
GR   1600.9    8629.5    1601.0    8666.2    1600.0    8704.6    1600.9    8732.5    1601.0    8740.2
GR   1599.6    8747.6    1600.5    8754.4    1600.4    8774.3    1600.4    8792.9    1598.4    8801.6
GR   1598.9    8805.0    1601.0    8812.2    1600.7    8834.7    1600.8    8889.9    1601.0    8905.0
GR   1600.9    8960.1    1600.9    9019.3    1600.9    9068.2    1601.0    9108.0    1601.0    9142.0
GR   1602.1    9162.2    1601.9    9170.0    1600.9    9188.7    1600.8    9211.5    1600.7    9246.1
GR   1600.8    9279.6    1600.9    9322.6    1600.5    9354.6    1600.0    9384.1    1599.9    9434.9
GR   1599.3    9490.1    1599.5    9545.7    1599.5    9603.4    1600.2    9654.0    1600.6    9697.3
GR   1600.6    9763.3    1600.7    9795.9    1601.1    9851.4    1600.6    9894.4    1600.5    9916.0
GR   1601.0    9949.7    1600.6    9987.3    1600.0    9998.7    1599.8   10000.0    1600.4   10023.8
GR   1600.1   10051.9    1600.0   10073.6    1600.9   10088.7    1602.2   10127.8    1603.5   10172.8
GR   1603.5   10213.1    1603.5   10263.2    1604.1   10305.5    1604.9   10355.1    1605.1   10405.4
GR   1605.6   10422.7
```

NH	5	.080	8854.1	.065	9010.0	.065	9449.2	.048	10097.7	.065
NH	10208.									
X1	4.146	74	9449.2	10097.7	330	465	465			
GR	1606.1	8262.8	1605.9	8317.5	1605.2	8377.2	1605.2	8434.6	1604.6	8484.9
GR	1603.2	8532.5	1603.4	8574.2	1602.6	8596.0	1601.5	8617.1	1601.9	8641.7
GR	1602.7	8661.9	1603.7	8686.4	1603.5	8712.5	1603.4	8750.8	1603.5	8786.4
GR	1603.4	8826.8	1603.4	8854.1	1602.6	8880.3	1602.3	8890.8	1602.0	8900.5
GR	1603.8	8909.4	1603.7	8921.9	1604.3	8949.4	1604.2	8968.0	1604.3	8974.0
GR	1603.8	8976.6	1602.8	8977.3	1602.9	8977.9	1603.6	8979.5	1602.9	8980.5
GR	1600.9	8981.5	1600.9	8982.1	1601.9	8982.6	1603.4	8983.2	1603.8	8984.3
GR	1603.4	8984.5	1603.6	9010.0	1603.5	9027.4	1602.2	9035.8	1600.4	9043.2
GR	1600.4	9049.0	1603.6	9057.7	1603.8	9080.4	1604.1	9118.9	1603.6	9166.0
GR	1603.1	9220.5	1603.6	9293.7	1603.5	9348.5	1603.4	9373.0	1604.0	9414.5
GR	1604.4	9449.2	1603.3	9486.5	1602.6	9519.8	1602.9	9565.5	1602.7	9605.4
GR	1602.6	9621.6	1602.7	9677.4	1603.2	9740.2	1603.6	9781.0	1603.6	9837.1
GR	1603.8	9883.9	1603.1	9928.3	1602.6	9937.9	1603.9	9949.7	1602.7	9963.8
GR	1603.7	9983.1	1603.3	10000.0	1603.5	10018.8	1603.3	10051.1	1603.1	10071.2
GR	1605.2	10097.7	1605.4	10121.7	1606.9	10161.0	1608.1	10208.0		
NH	5	.080	9242.8	.065	9282.0	.065	9761.0	.048	10144.5	.065
NH	10299.									
X1	4.197	60	9761.0	10144.5	350	269	269			
GR	1607.8	8478.4	1607.8	8526.8	1608.0	8575.9	1606.6	8625.7	1607.1	8671.6
GR	1606.0	8730.5	1606.3	8769.7	1606.3	8812.3	1605.7	8846.6	1605.9	8862.1
GR	1603.5	8880.5	1602.6	8889.7	1603.2	8906.1	1603.1	8917.0	1604.5	8950.7
GR	1605.9	8987.8	1605.7	9013.7	1605.0	9026.2	1604.6	9042.5	1605.1	9069.1
GR	1605.5	9110.9	1606.1	9144.1	1606.3	9162.8	1604.8	9173.5	1606.5	9179.5
GR	1606.6	9191.8	1605.0	9195.7	1606.5	9203.3	1607.3	9218.4	1606.9	9236.8
GR	1605.7	9242.8	1601.3	9252.8	1601.1	9261.2	1601.3	9269.9	1606.3	9282.0
GR	1606.6	9305.1	1605.8	9317.9	1606.3	9333.9	1605.6	9389.6	1605.6	9443.8
GR	1605.9	9491.3	1605.8	9555.3	1605.3	9622.7	1605.6	9682.2	1606.0	9720.0
GR	1606.1	9761.0	1604.3	9805.8	1604.8	9853.3	1605.2	9896.2	1605.0	9940.3
GR	1604.6	10000.0	1604.3	10040.8	1604.3	10071.8	1604.3	10090.9	1605.2	10106.9
GR	1606.6	10144.5	1608.0	10188.7	1608.3	10240.5	1610.2	10293.7	1609.9	10299.2
NH	5	.080	9395.6	.065	9441.3	.065	9691.5	.048	10199.9	.065
NH	10352.									
X1	4.262	49	9691.5	10199.9	480	343	343			
GR	1612.0	8620.0	1612.6	8700.2	1611.1	8783.9	1611.7	8832.6	1611.3	8887.9
GR	1610.7	8923.6	1611.0	8972.1	1610.2	9029.1	1610.5	9075.0	1608.9	9111.6
GR	1608.4	9159.9	1608.5	9206.9	1607.2	9232.5	1607.7	9262.9	1608.3	9295.9
GR	1608.8	9328.9	1608.9	9367.8	1609.4	9395.6	1603.3	9410.1	1603.0	9417.5
GR	1603.3	9429.7	1609.1	9441.3	1609.2	9452.4	1609.0	9485.6	1608.5	9522.5
GR	1607.8	9580.6	1607.8	9631.6	1608.5	9655.2	1609.0	9691.5	1608.1	9726.6
GR	1608.4	9730.7	1608.6	9770.6	1608.2	9813.6	1608.1	9870.0	1607.5	9926.9
GR	1607.2	9965.0	1605.9	9997.2	1605.7	10000.0	1607.8	10020.4	1608.9	10034.4
GR	1607.6	10054.8	1606.9	10075.9	1607.4	10108.7	1607.2	10137.5	1607.0	10169.8
GR	1608.9	10199.9	1610.6	10257.5	1611.8	10302.6	1612.7	10352.5		

NH	5	.080	9483.7	.065	9536.3	.065	9949.0	.048	10294.4	.065
NH	10432.									
X1	4.333	66	9949.0	10294.4	370	375	375			
GR	1615.2	8836.3	1614.8	8913.3	1614.1	8964.0	1613.7	9024.3	1613.2	9088.0
GR	1612.7	9117.4	1612.2	9139.0	1612.2	9169.4	1611.6	9199.6	1611.4	9242.8
GR	1610.2	9285.1	1610.3	9311.6	1610.5	9347.0	1609.9	9370.9	1609.4	9394.1
GR	1609.4	9407.8	1609.7	9429.3	1609.4	9449.2	1609.6	9456.4	1610.3	9466.8
GR	1610.1	9483.7	1605.0	9497.4	1604.4	9515.6	1610.4	9536.3	1610.5	9554.5
GR	1609.7	9586.4	1609.1	9614.5	1609.6	9635.6	1610.3	9648.9	1611.4	9662.0
GR	1611.4	9679.1	1611.5	9679.8	1611.2	9705.3	1610.7	9733.0	1609.4	9762.7
GR	1609.3	9788.9	1609.2	9831.9	1609.3	9857.0	1609.4	9882.9	1609.3	9910.3
GR	1609.4	9929.2	1609.3	9940.5	1611.4	9949.0	1609.1	9963.3	1608.1	9980.2
GR	1607.9	9993.7	1607.4	10000.0	1607.1	10006.8	1609.9	10019.9	1609.6	10033.7
GR	1608.7	10040.5	1609.6	10055.2	1609.6	10080.2	1609.5	10104.0	1609.3	10130.6
GR	1609.3	10152.9	1609.1	10175.3	1609.2	10196.0	1609.6	10220.0	1609.8	10244.6
GR	1610.1	10267.6	1611.8	10294.4	1613.2	10326.1	1613.6	10364.5	1614.2	10407.0
GR	1614.6	10431.6								
NH	5	.080	9688.2	.065	9753.4	.065	9952.9	.048	10450.7	.065
NH	10590.									
X1	4.390	68	9952.9	10450.7	330	301	301			
GR	1616.3	9100.2	1615.9	9120.3	1615.1	9141.5	1613.7	9151.5	1613.0	9163.5
GR	1612.6	9179.8	1612.7	9194.3	1614.1	9210.1	1614.2	9224.6	1613.6	9251.8
GR	1614.6	9272.7	1614.5	9300.4	1613.5	9333.7	1613.1	9368.5	1612.3	9406.2
GR	1612.3	9437.1	1612.6	9470.3	1613.1	9495.4	1612.6	9513.8	1612.4	9543.1
GR	1611.9	9576.6	1611.2	9608.3	1611.4	9632.6	1611.4	9664.0	1611.4	9678.9
GR	1611.1	9688.2	1607.2	9701.3	1607.6	9718.1	1606.9	9733.6	1608.8	9745.3
GR	1610.1	9753.4	1610.3	9764.0	1610.3	9782.2	1611.6	9798.2	1612.4	9811.7
GR	1612.3	9835.9	1612.1	9860.8	1611.7	9869.3	1611.7	9886.1	1612.6	9904.9
GR	1612.4	9923.4	1611.9	9940.0	1616.0	9952.9	1613.0	9964.9	1611.9	9975.7
GR	1609.3	9985.9	1609.0	9989.2	1608.5	10000.0	1609.2	10009.9	1611.3	10019.8
GR	1612.7	10032.8	1612.5	10062.1	1613.2	10097.6	1613.6	10123.4	1612.3	10146.7
GR	1611.8	10176.5	1612.0	10205.4	1611.9	10234.1	1612.5	10266.7	1612.7	10305.7
GR	1613.8	10334.7	1614.8	10361.7	1615.4	10398.5	1616.7	10450.7	1617.6	10482.7
GR	1619.2	10520.8	1620.1	10565.1	1620.4	10590.2				
NC	.065	.065	.048							
X1	4.492	52	9967.1	10162.8	380	539	539			
GR	1617.0	9063.6	1617.1	9135.2	1617.1	9187.2	1617.1	9240.0	1617.0	9284.4
GR	1616.4	9310.3	1616.0	9332.5	1615.3	9349.3	1613.7	9359.4	1612.9	9367.8
GR	1613.1	9376.1	1613.3	9381.5	1614.7	9389.0	1615.1	9397.8	1615.3	9416.8
GR	1615.2	9434.0	1615.0	9461.0	1614.9	9490.4	1614.5	9519.6	1614.7	9539.1
GR	1615.7	9561.4	1614.8	9580.4	1614.7	9601.8	1615.0	9636.8	1615.0	9669.6
GR	1615.2	9699.9	1614.9	9737.6	1614.5	9779.3	1614.5	9817.1	1614.0	9861.9
GR	1613.3	9888.1	1613.6	9914.4	1614.6	9931.0	1614.5	9949.1	1615.3	9967.1
GR	1610.9	9982.1	1611.6	10000.0	1611.6	10025.5	1610.3	10029.5	1612.5	10040.4
GR	1613.8	10056.5	1614.3	10077.2	1614.7	10109.7	1615.9	10162.8	1617.3	10211.3
GR	1618.6	10273.9	1620.1	10332.2	1620.8	10371.8	1622.0	10412.7	1622.9	10447.7
GR	1623.5	10495.5	1623.8	10506.8						

NC	.080	.080	.065							
X1	4.567	43	9944.0	10041.6	350	396	396			
GR	1620.4	8928.3	1619.2	8993.5	1619.3	9033.5	1619.7	9086.7	1619.8	9142.5
GR	1619.8	9222.5	1619.9	9305.1	1620.1	9361.0	1620.3	9396.4	1619.7	9436.7
GR	1618.3	9457.9	1617.4	9471.6	1615.9	9483.6	1616.8	9492.3	1616.5	9507.2
GR	1616.8	9542.0	1617.0	9556.8	1617.4	9581.7	1617.7	9610.1	1617.4	9623.6
GR	1617.4	9649.3	1618.0	9686.8	1618.0	9709.7	1617.2	9730.8	1617.8	9755.3
GR	1617.8	9790.2	1617.5	9814.9	1617.2	9853.3	1616.3	9914.4	1616.3	9944.0
GR	1615.9	9966.1	1613.8	9985.8	1612.3	10000.0	1611.9	10012.9	1615.4	10026.8
GR	1617.7	10041.6	1618.5	10056.3	1618.8	10072.4	1619.1	10085.7	1620.5	10107.6
GR	1621.6	10160.9	1623.4	10246.6	1623.3	10248.2				
X1	4.662	44	9945.8	10146.8	330	502	502			
GR	1621.3	9254.5	1621.6	9318.5	1621.6	9384.8	1621.6	9444.8	1621.2	9507.7
GR	1621.5	9567.5	1621.4	9609.9	1621.8	9620.2	1622.0	9672.2	1622.0	9714.0
GR	1621.9	9753.1	1621.9	9781.0	1620.2	9814.4	1619.1	9841.4	1618.7	9857.3
GR	1620.0	9883.2	1621.2	9912.3	1621.1	9945.8	1619.6	9966.0	1614.0	9991.3
GR	1614.3	10000.0	1614.1	10008.0	1619.1	10034.9	1620.2	10048.4	1619.5	10069.2
GR	1619.1	10091.2	1620.2	10116.4	1620.4	10138.7	1620.5	10146.8	1619.5	10181.1
GR	1618.8	10211.4	1618.8	10227.1	1619.6	10241.0	1618.7	10254.4	1615.8	10266.3
GR	1616.2	10273.4	1617.9	10287.3	1618.5	10310.6	1619.3	10336.3	1620.6	10363.9
GR	1622.6	10397.9	1623.4	10425.6	1623.9	10471.2	1625.6	10503.6		
X1	4.756	54	9963.0	10072.3	520	496	496			
GR	1624.0	9366.4	1625.1	9372.7	1623.9	9376.7	1624.3	9461.0	1624.1	9523.7
GR	1624.0	9555.6	1624.2	9603.5	1625.2	9653.0	1625.8	9699.1	1625.9	9744.5
GR	1625.4	9793.3	1624.4	9826.1	1623.7	9847.0	1623.8	9882.6	1624.0	9914.4
GR	1623.5	9940.3	1623.5	9963.0	1623.2	9977.2	1621.4	9984.2	1616.9	9991.7
GR	1616.7	10000.0	1616.3	10013.0	1619.9	10022.8	1618.9	10035.9	1619.0	10049.5
GR	1619.9	10061.8	1621.7	10072.3	1621.7	10087.0	1621.9	10116.7	1621.8	10130.0
GR	1622.4	10136.5	1622.5	10151.9	1622.9	10173.7	1624.6	10199.9	1624.4	10253.4
GR	1624.5	10291.1	1624.6	10306.9	1624.2	10354.9	1623.1	10421.3	1622.2	10485.2
GR	1622.1	10519.5	1621.0	10545.3	1619.9	10566.7	1620.0	10577.5	1619.4	10583.6
GR	1618.4	10589.6	1618.4	10591.5	1619.4	10594.8	1620.1	10606.3	1624.5	10620.7
GR	1626.3	10631.8	1627.4	10660.9	1628.5	10700.2	1629.7	10740.5		

THIS RUN EXECUTED 5MAY92 4:44:21

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

Deadman Wash Q=7500 cfs

SUMMARY PRINTOUT

SECNO	DEPTH	CWSEL	CRIWS	EG	ELMIN	VCH	TOPWID	QLOB	QCH	QROB	XLBEL	RBEL
4.058	4.33	1601.73	1601.29	1601.92	1597.40	3.88	1852.40	2534.73	4965.27	.00	1602.10	1602.20
4.058	4.38	1601.78	1601.28	1601.98	1597.40	3.98	1857.90	2716.06	5283.94	.00	1602.10	1602.20
4.058	4.44	1601.84	1601.38	1602.05	1597.40	4.05	1864.50	2901.38	5598.62	.00	1602.10	1602.20
4.058	4.48	1601.88	1601.40	1602.10	1597.40	4.17	1868.90	3082.89	5917.11	.00	1602.10	1602.20
4.058	4.52	1601.92	1601.43	1602.15	1597.40	4.27	1887.70	3266.33	6233.67	.00	1602.10	1602.20
4.058	4.57	1601.97	1601.46	1602.21	1597.40	4.35	1929.06	3455.17	6544.83	.00	1602.10	1602.20
4.146	4.56	1604.96	1604.12	1605.10	1600.40	3.45	1640.40	3648.65	3851.35	.00	1604.40	1605.20
4.146	4.63	1605.03	1604.17	1605.18	1600.40	3.54	1646.86	3894.35	4105.64	.00	1604.40	1605.20
4.146	4.69	1605.09	1604.26	1605.24	1600.40	3.64	1652.43	4140.32	4359.68	.00	1604.40	1605.20
4.146	4.76	1605.16	1604.25	1605.32	1600.40	3.72	1658.76	4387.26	4612.74	.00	1604.40	1605.20
4.146	4.83	1605.23	1604.29	1605.39	1600.40	3.80	1724.63	4634.40	4865.60	.00	1604.40	1605.20
4.146	4.88	1605.28	1604.33	1605.46	1600.40	3.88	1736.36	4881.13	5118.80	.07	1604.40	1605.20
4.197	5.85	1606.95	1606.19	1607.14	1601.10	4.24	1498.39	4118.99	3379.82	1.18	1606.10	1606.60
4.197	5.93	1607.03	1606.24	1607.22	1601.10	4.35	1518.77	4409.97	3588.06	1.97	1606.10	1606.60
4.197	6.00	1607.10	1606.30	1607.30	1601.10	4.45	1539.41	4703.57	3793.41	3.02	1606.10	1606.60
4.197	6.07	1607.17	1606.34	1607.37	1601.10	4.53	1549.37	5000.74	3994.88	4.38	1606.10	1606.60
4.197	6.13	1607.23	1606.38	1607.45	1601.10	4.63	1557.89	5296.99	4197.18	5.83	1606.10	1606.60
4.197	6.20	1607.30	1606.42	1607.52	1601.10	4.72	1566.09	5594.89	4397.57	7.54	1606.10	1606.60
4.262	6.82	1609.82	1609.04	1610.04	1603.00	4.24	1140.22	3009.49	4474.33	16.19	1609.00	1608.90
4.262	6.90	1609.90	1609.09	1610.14	1603.00	4.35	1144.84	3205.45	4774.22	20.33	1609.00	1608.90
4.262	6.98	1609.98	1609.14	1610.22	1603.00	4.47	1149.20	3402.40	5072.75	24.85	1609.00	1608.90
4.262	7.04	1610.04	1609.19	1610.30	1603.00	4.58	1153.14	3600.25	5370.21	29.54	1609.00	1608.90
4.262	7.12	1610.12	1609.27	1610.39	1603.00	4.68	1157.43	3798.54	5666.42	35.04	1609.00	1608.90
4.262	7.19	1610.19	1609.31	1610.47	1603.00	4.78	1161.55	3997.50	5961.58	40.92	1609.00	1608.90
4.333	7.50	1611.90	1610.65	1612.06	1604.40	3.72	1112.92	4272.79	3227.18	.03	1611.40	1611.80
4.333	7.60	1612.00	1610.68	1612.16	1604.40	3.83	1119.70	4555.14	3444.71	.15	1611.40	1611.80
4.333	7.69	1612.09	1610.70	1612.27	1604.40	3.94	1126.30	4838.34	3661.25	.41	1611.40	1611.80
4.333	7.78	1612.18	1610.74	1612.36	1604.40	4.03	1132.86	5122.31	3876.85	.83	1611.40	1611.80
4.333	7.87	1612.27	1610.85	1612.46	1604.40	4.13	1168.77	5407.30	4091.29	1.41	1611.40	1611.80
4.333	7.95	1612.35	1610.84	1612.55	1604.40	4.22	1174.61	5693.41	4304.35	2.24	1611.40	1611.80

	SECNO	DEPTH	CWSEL	CRIWS	EG	ELMIN	VCH	TOPWID	QLOB	QCH	QROB	XLBEL	RBEL
*	4.390	6.83	1613.73	1613.01	1613.98	1606.90	3.88	1053.76	5273.70	2226.30	.00	1616.00	1616.70
	4.390	6.93	1613.83	1613.07	1614.08	1606.90	4.00	1068.46	5561.88	2438.12	.00	1616.00	1616.70
	4.390	7.02	1613.92	1613.14	1614.18	1606.90	4.11	1082.72	5850.26	2649.74	.00	1616.00	1616.70
	4.390	7.11	1614.01	1613.19	1614.28	1606.90	4.21	1096.52	6138.83	2861.17	.00	1616.00	1616.70
	4.390	7.21	1614.11	1613.25	1614.37	1606.90	4.30	1111.05	6425.00	3075.00	.00	1616.00	1616.70
	4.390	7.29	1614.19	1613.31	1614.46	1606.90	4.41	1133.14	6718.78	3281.21	.00	1616.00	1616.70
	4.492	6.52	1616.82	1615.91	1617.08	1610.30	5.19	902.73	4140.70	3343.98	15.31	1615.30	1615.90
	4.492	6.62	1616.92	1615.99	1617.19	1610.30	5.31	910.08	4458.98	3521.07	19.94	1615.30	1615.90
	4.492	6.71	1617.01	1616.06	1617.29	1610.30	5.43	926.72	4778.29	3696.53	25.18	1615.30	1615.90
	4.492	6.80	1617.10	1616.12	1617.39	1610.30	5.55	1032.03	5099.18	3869.81	31.01	1615.30	1615.90
	4.492	6.88	1617.18	1616.19	1617.49	1610.30	5.66	1143.56	5423.11	4039.59	37.30	1615.30	1615.90
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	4.567	7.79	1619.69	1618.88	1620.14	1611.90	7.06	776.99	4372.05	3514.14	113.81	1616.30	1617.70
	4.567	7.90	1619.80	1618.97	1620.26	1611.90	7.17	929.69	4722.07	3645.16	132.77	1616.30	1617.70
	4.567	8.00	1619.90	1619.05	1620.37	1611.90	7.27	1027.38	5077.72	3769.98	152.29	1616.30	1617.70
	4.567	8.10	1620.00	1619.12	1620.47	1611.90	7.36	1069.20	5439.03	3888.84	172.13	1616.30	1617.70
	4.567	8.20	1620.10	1619.29	1620.57	1611.90	7.46	1107.65	5801.58	4006.59	191.83	1616.30	1617.70
*	4.662	8.72	1622.72	1620.72	1622.87	1614.00	3.84	1147.54	1700.99	3188.51	2610.50	1621.10	1620.50
*	4.662	8.83	1622.83	1620.90	1622.99	1614.00	3.91	1151.51	1907.97	3343.72	2748.31	1621.10	1620.50
*	4.662	8.94	1622.94	1621.02	1623.11	1614.00	3.99	1155.34	2118.58	3496.55	2884.87	1621.10	1620.50
*	4.662	9.05	1623.05	1621.08	1623.22	1614.00	4.07	1158.98	2330.85	3648.19	3020.96	1621.10	1620.50
*	4.662	9.15	1623.15	1621.10	1623.33	1614.00	4.14	1162.44	2544.61	3798.72	3156.67	1621.10	1620.50
*	4.662	9.25	1623.25	1621.29	1623.43	1614.00	4.21	1165.83	2761.48	3947.13	3291.39	1621.10	1620.50
	4.756	8.79	1625.09	1623.51	1625.34	1616.30	5.32	1101.65	622.00	3242.48	3635.52	1623.50	1621.70
	4.756	8.91	1625.21	1623.64	1625.47	1616.30	5.39	1112.79	745.83	3360.53	3893.64	1623.50	1621.70
	4.756	9.03	1625.33	1623.66	1625.59	1616.30	5.46	1126.35	875.98	3474.10	4149.92	1623.50	1621.70
	4.756	9.14	1625.44	1623.86	1625.70	1616.30	5.53	1141.97	1010.81	3584.27	4404.91	1623.50	1621.70
	4.756	9.25	1625.55	1624.06	1625.82	1616.30	5.59	1161.77	1150.63	3691.01	4658.37	1623.50	1621.70
	4.756	9.35	1625.65	1624.25	1625.93	1616.30	5.65	1180.90	1294.20	3795.32	4910.48	1623.50	1621.70

SUMMARY OF ERRORS AND SPECIAL NOTES

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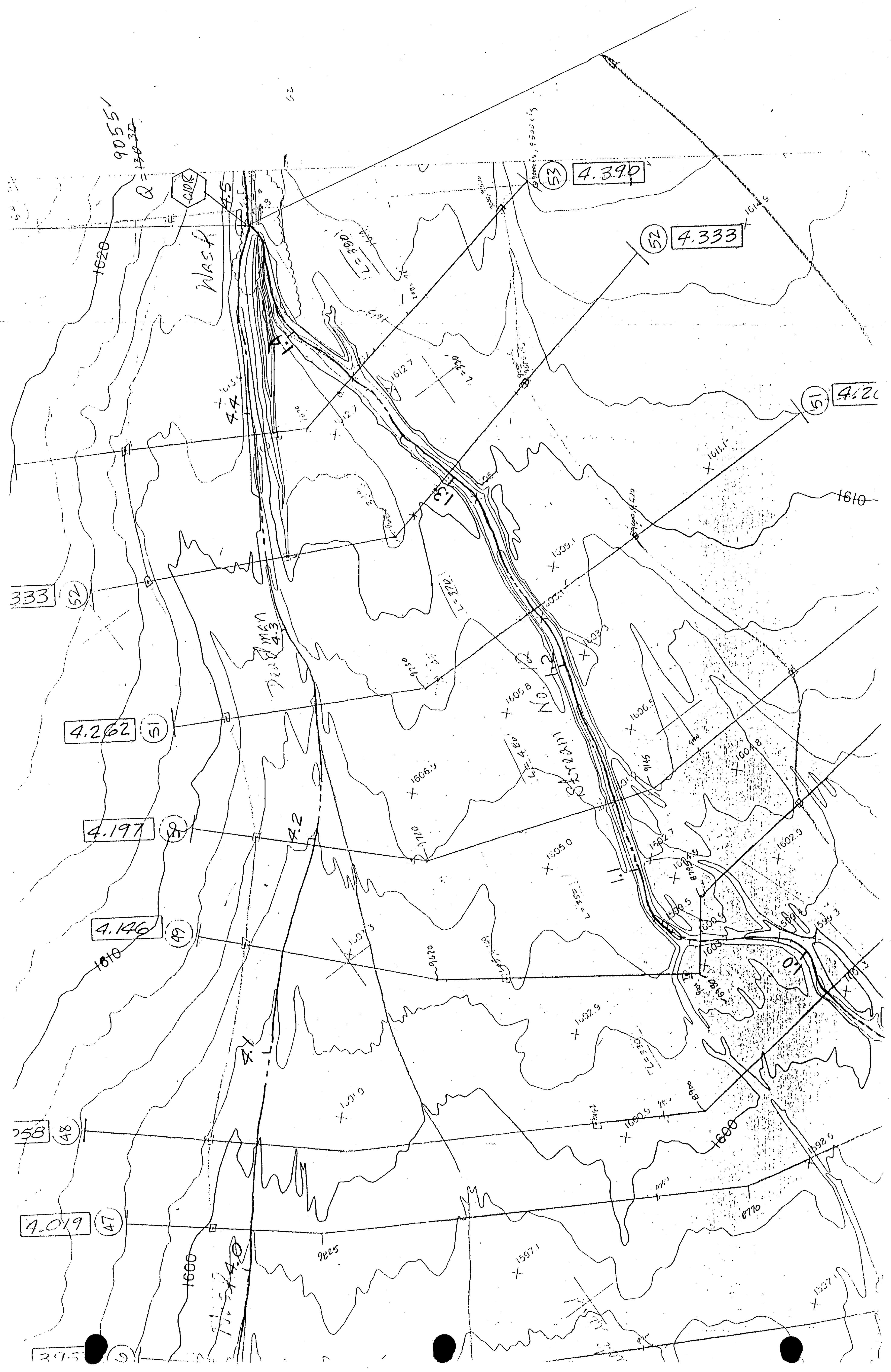
Normal program termination



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1599.5
1603
1600.9
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1597.1
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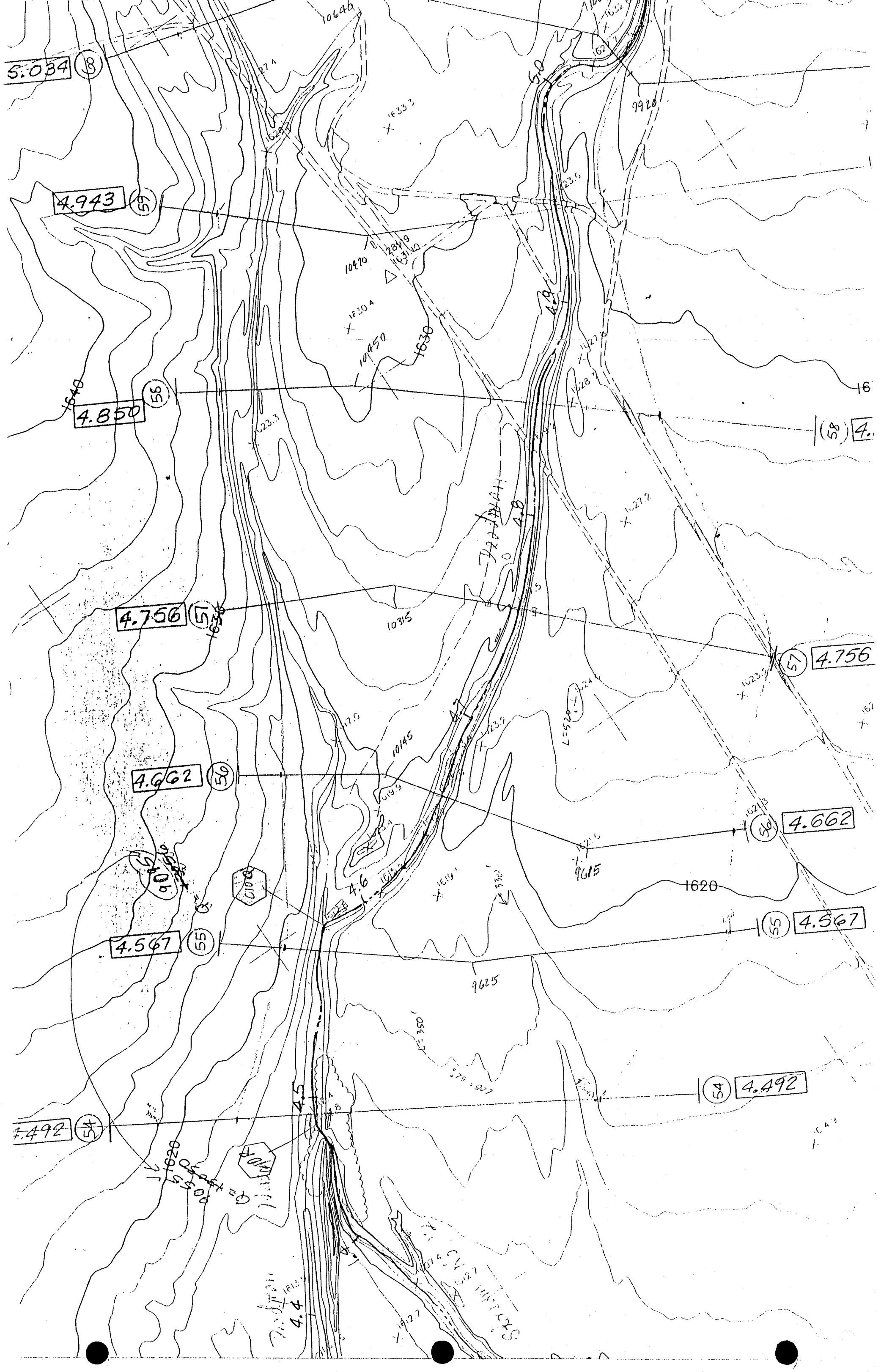
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9615
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1630
1620
16

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 3.5: Final Results

3.5 Final Results

The watershed hydrology for Deadman Wash was developed using the HEC-1 models for the 100-year 6-hour and 24-hour duration storms. The results of the 100-year peak flows at concentration points are presented in **Table 16**. **Table 17** summarizes 100-year peak discharges at key locations in the watershed.

Evaluation of the HEC-1 model results indicated that the higher peak flows were computed from the 6-hour duration storm for basin areas smaller than 10 square miles. For basins larger than 10 square miles, peak flows for a 24-hour duration storm are higher than the flows computed for the 6-hour duration storm. For a smaller basin area, the 6-hour storm will generate higher flows than the 24-hour storm, because the 6-hour storm is the higher intensity storm and the effects of channel routing losses are minimal due to a shorter time of concentration. On the contrary, the longer lag times and significant losses in channel routing for larger basins will minimize the effect of higher intensities of a 6-hour duration storm.

Calibration of the HEC-1 models were performed for peak flows only because of lack of sufficient data to calibrate the runoff volumes. Two sets of basin reach Kn values were modeled and compared with the results of the Log Pearson III analysis of washes in Maricopa County. It was concluded that the higher Kn values determined from field estimation for the floodplain delineation study should be used in the final HEC-1 models in lieu of Kn values computed from surface characteristics. The transmission losses were included in the normal depth routing option. The loss rates were based on the hydraulic conductivity, XKSAT, for the soils in routing reaches. No verification of transmission losses was conducted due to the lack of physical data.

From **Table 16**, a peak flow of 9,437 cfs for a drainage area of 12.72 square miles at the I-17 was computed from the HEC-1 models. The 100-year peak discharge for the entire Deadman Wash (34.01 square mile watershed) is 9,599 cfs, only a 1.7 percent increase in peak flows. Significant attenuation of peak flows occurs at the split flow reach, 4,200 feet north of Carefree Highway to 1,800 feet south of the highway. This is due to significant losses encountered through a sheet flow area.

The results of HEC-1 models were compared with two other studies developed for the conceptual drainage master planning in the watershed. These studies were not a typical flood control study and did not completely follow the current FCDMC methodology for hydrologic analysis. Therefore, the hydrology of this project should be used as a guide for any future development and drainage improvements in the watershed.

Table 16
Summary of 100–Year Peak Flows

Concentration Point	Drainage Area (sq. mi.)	100–Year Floods				Critical Duration (hr)	Critical Q100 (cfs)
		6–hr Event		24–hr Event			
		Q1 (cfs)	Q1/A (cfs/sm)	Q2 (cfs)	Q2/A (cfs/sm)		
C10B	0.52	1,018	1,957.7	729	1,401.9	6–hr	1,018
C10C	1.21	1,837	1,518.2	1,496	1,236.4	6–hr	1,837
C10E	2.49	2,767	1,111.2	2,525	1,014.1	6–hr	2,767
C2B	0.52	854	1,642.3	600	1,153.8	6–hr	854
C2C	1.18	1,301	1,102.5	1,095	928.0	6–hr	1,301
C10F	3.75	3,649	973.1	3,490	930.7	6–hr	3,649
C3C	0.46	1,011	2,197.8	699	1,519.6	6–hr	1,011
C3D	0.82	1,218	1,485.4	952	1,161.0	6–hr	1,218
C10G	4.70	4,475	952.1	4,380	931.9	6–hr	4,475
C4B	0.56	768	1,371.4	571	1,019.6	6–hr	768
C4C	1.26	1,661	1,318.3	1,380	1,095.2	6–hr	1,661
C4D	1.46	1,757	1,203.4	1,472	1,008.2	6–hr	1,757
C4E	1.63	1,739	1,066.9	1,489	913.5	6–hr	1,739
C5B	0.55	854	1,552.7	605	1,100.0	6–hr	854
C5D	0.14	395	2,821.4	244	1,742.9	6–hr	395
C5E	0.75	1,147	1,529.3	875	1,166.7	6–hr	1,147
C5F	1.13	1,334	1,180.5	1,120	991.2	6–hr	1,334
C5G	1.53	1,746	1,141.2	1,527	998.0	6–hr	1,746
C6B	0.69	786	1,139.1	611	885.5	6–hr	786
C7B	2.08	1,471	707.2	1,319	634.1	6–hr	1,471
C7D	0.08	162	2,025.0	118	1,475.0	6–hr	162
C7F	2.30	1,544	671.3	1,405	610.9	6–hr	1,544
C7G	3.07	2,085	679.2	1,954	636.5	6–hr	2,085
C7H	4.76	3,170	666.0	3,088	648.7	6–hr	3,170
C8B	0.72	949	1,318.1	781	1,084.7	6–hr	949
C8C1	1.51	1,473	975.5	1,260	834.4	6–hr	1,473
C8C2	6.26	4,301	687.1	4,273	682.6	6–hr	4,301
C8D	6.30	4,263	676.7	4,223	670.3	6–hr	4,263
C10H	12.72	8,829	694.1	9,437	741.9	24–hr	9,437
C10J	13.82	9,339	675.8	9,980	722.1	24–hr	9,980
C10L	14.65	9,142	624.0	9,762	666.3	24–hr	9,762
C10M	14.99	9,077	605.5	9,673	645.3	24–hr	9,673
C10P	15.96	8,893	557.2	9,479	593.9	24–hr	9,479
C9B	1.67	1,767	1,058.1	1,519	909.6	6–hr	1,767
C10Q	17.96	8,949	498.3	9,520	530.1	24–hr	9,520
C10R	18.04	8,946	495.9	9,506	526.9	24–hr	9,506
C10S*	19.07	5,223	N/A	5,548	N/A	24–hr	5,548
C12A*	0.08	4,864	N/A	4,494	N/A	6–hr	4,864
C12B*	0.23	4,801	N/A	4,427	N/A	6–hr	4,801
C10T	19.36	8,355	431.6	9,110	470.6	24–hr	9,110

* Split flow location between Deadman Wash and Stream No. 12.

Table 16
Summary of 100–Year Peak Flows

Concentration Point	Drainage Area (sq. mi.)	100–Year Floods				Critical Duration (hr)	Critical Q100 (cfs)
		6–hr Event		24–hr Event			
		Q1 (cfs)	Q1/A (cfs/sm)	Q2 (cfs)	Q2/A (cfs/sm)		
C11B	0.38	794	2,089.5	519	1,365.8	6–hr	794
C11D	0.49	698	1,424.5	540	1,102.0	6–hr	698
C11F	1.17	1,479	1,264.1	1,271	1,086.3	6–hr	1,479
C11G	1.58	1,437	909.5	1,299	822.2	6–hr	1,437
C11I	2.28	2,270	995.6	2,075	910.1	6–hr	2,270
C11K	3.54	2,686	758.8	2,453	692.9	6–hr	2,686
C11L	5.77	4,546	787.9	4,375	758.2	6–hr	4,546
C11M	6.55	5,141	784.9	5,011	765.0	6–hr	5,141
C11N	6.78	5,156	760.5	5,030	741.9	6–hr	5,156
C10U	26.63	8,594	322.7	9,563	359.1	24–hr	9,563
C10V	27.59	8,487	307.6	9,449	342.5	24–hr	9,449
C14C	3.96	4,085	1,031.6	3,695	933.1	6–hr	4,085
C14D	4.20	4,005	953.6	3,662	871.9	6–hr	4,005
C14F	5.14	4,722	918.7	4,392	854.5	6–hr	4,722
C14G	5.22	4,671	894.8	4,334	830.3	6–hr	4,671
C10W	33.34	8,841	265.2	9,665	289.9	24–hr	9,665
C15B	0.45	705	1,566.7	521	1,157.8	6–hr	705
C10X	33.94	8,834	260.3	9,663	284.7	24–hr	9,663
C10Y	34.01	8,810	259.0	9,599	282.2	24–hr	9,599

Table 17

Summary of Peak Discharges at Key Locations

HEC–1 Node I.D.	Location	Drainage Area (sm)	100–Year Peak Discharges (cfs)
C4B	Stream Number 4 at 29th Avenue	0.56	768
C4C	Stream Number 4 at Irvine Road	1.26	1,661
C7H	Stream Number 7 just upstream of I–17 East Rest Area	4.76	3,170
C8C2	Stream Number 8 at the confluence with Stream Number 7	6.26	4,301
C10B	Deadman Wash along future 22nd Avenue, in Section 24, T6N, R2E	0.52	1,018
C10C	Deadman Wash north of 29th Avenue, in Section 23, T6N, R2E	1.21	1,837
C10H	Deadman Wash at I–17	12.72	9,437
C10M	Deadman Wash at Joy Ranch Road near the Federal Correctional Institute	14.99	9,673
C10R	Deadman Wash at the split flow location	18.04	9,506
C10T	Deadman Wash at the confluence with Stream Number 12	19.36	9,110
C10W	Deadman Wash at Snodgrass Tank	33.34	9,665
C10Y	Deadman Wash at the confluence with New River	34.01	9,599
C11G	Stream Number 11 at Carefree Highway	1.58	1,437

HEC1 S/N: HMVersion: 6.00 Data File: DM6HRR1.hc1

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*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  08/06/1992  TIME  13:32:38 *
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*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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:::                                  :::
:::  Full Microcomputer Implementation :::
:::                by                :::
:::        Haestad Methods, Inc.     :::
:::                                  :::
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37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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  3           ID
  4           ID        100-YEAR, 6-HOUR STORM,  FCDMD DISTRIBUTION
  5           ID        Kn VALUES USED FROM MANNING'S n DETERMINATION REPORT
  6           ID
  7           ID        HOWARD NEEDLES TAMMEN & BERGENDOFF
  8           ID        HNTB PROJECT NO. 15081
  9           ID        JUNE, 1992
 10           ID        FILE:  DM6HRR1.HC1     CREATED BY: BGS
 11           ID
 12           ID
              *DIAGRAM
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 15           IN     15
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 17           PC   .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 18           PC   .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 19           PC   .962    .972    .983    .991   1.000
 20           JD   3.35    0.50
 21           JD   3.30    2.80
 22           PC   .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
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 27           PC   .135    .152    .175    .222    .304    .472    .670    .796    .868    .912
 28           PC   .946    .960    .973    .987   1.000
 29           JD   2.73    90.0
 30           PC   .000    .021    .035    .051    .071    .087    .105    .125    .143    .160
 31           PC   .179    .201    .232    .281    .364    .500    .658    .773    .841    .888
 32           PC   .927    .945    .964    .982   1.000
 33           JD   1.92   500.0
 34           PC   .000    .024    .043    .059    .078    .098    .119    .141    .162    .186
 35           PC   .212    .239    .271    .321    .408    .515    .627    .735    .814    .864
 36           PC   .907    .930    .954    .977   1.000

 37           KK     10A
 38           KM    SUB-BASIN DA-10A
 39           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 40           KM    L= .663 mi.  Lca= .341 mi.   S= 1081.4 ft/mi.  Kn= .070   LAG=  15.2 min.
 41           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 42           BA    .150
 43           LG     .25     .35    3.71     .42   32.13
 44           UI     54.    199.    318.    194.    137.     88.     60.     39.     26.     16.
 45           UI     10.      6.      6.      6.      0.      0.      0.      0.      0.      0.
 46           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 47           KK  R10A-B
 48           KM    ROUTE FLOWS FROM DA-10A TO DA-10B
 49           RS      4    FLOW      -1
 50           RL                   .024    1948
 51           RC   .090    .070    .090    5800   0.031
 52           RX    600     976     978     988    1010    1042    1050    1152
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  53          RY    1962    1958    1954    1948    1948    1954    1958    1962

  54          KK     10B
  55          KM    SUB-BASIN DA-10B
  56          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  57          KM    L= 1.098 mi. Lca= .625 mi.   S=  163.9 ft/mi.  Kn= .070  LAG=  33.2 min.
  58          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  59          BA    .371
  60          LG     .34     .20    9.40     .02     .50
  61          UI     38.     78.    165.    214.    266.    368.    457.    345.    276.    215.
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  63          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  64          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  65          KK    C10B
  66          KM    COMBINE HYDROGRAPHS AT DA-10B
  67          HC       2

  68          KK  R10B-C
  69          KM    ROUTE FLOWS FROM DA-10B TO DA-10C
  70          RS       4    FLOW      -1
  71          RL                     .01    1834
  72          RC    .090    .070    .090    5000   0.015
  73          RX     500     925     978     988    1010    1080    1090    1545
  74          RY    1842    1839    1838    1834    1834    1837    1838    1842

  75          KK     10C
  76          KM    SUB-BASIN DA-10C
  77          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  78          KM    L= 1.856 mi. Lca= .739 mi.   S=  169.7 ft/mi.  Kn= .070  LAG=  42.9 min.
  79          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  80          BA    .685
  81          LG     .33     .20    9.40     .02     .01
  82          UI     54.     57.    189.    253.    303.    359.    434.    599.    654.    510.
  83          UI    430.    355.    294.    239.    159.     95.     88.     61.     54.     23.
  84          UI     16.     16.     16.     16.     16.      0.      0.      0.      0.      0.
  85          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  86          KK    C10C
  87          KM    COMBINE HYDROGRAPHS AT DA-10C
  88          HC       2

  89          KK  R10C-D
  90          KM    ROUTE FLOWS FROM DA-10C TO DA-10D
  91          RS       3    FLOW      -1
  92          RL                    .226    1782
  93          RC    .080    .065    .080    2650  0.0132
  94          RX     645     860     935     990    1012    1028    1080    1560
  95          RY    1790    1785    1784    1782    1782    1784    1785    1790
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 96           KK     1A
 97           KM    SUB-BASIN DA-1A
 98           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 99           KM    L= 2.841 mi. Lca= 1.533 mi.  S=   93.3 ft/mi.  Kn= .065  LAG=  69.5 min.
100           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
101           KM    This is a total flow from the Stream No. 1 watershed area.
102           BA    .577
103           LG     .35     .25   10.10     .04     .00
104           UI     28.     28.     28.     79.    105.    131.    145.    161.    177.    200.
105           UI    223.    268.    336.    357.    299.    261.    234.    213.    187.    168.
106           UI    148.    133.    111.     81.     53.     49.     46.     44.     28.     28.
107           UI     28.     10.      9.      9.      9.      9.      9.      9.      9.      9.
108           UI      9.      0.      0.      0.      0.      0.      0.      0.      0.      0.
109           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

110           KK     10D
111           KM    SUB-BASIN DA-10D
112           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
113           KM    L= .985 mi.  Lca= .455 mi.   S=   91.4 ft/mi.  Kn= .065  LAG=  29.3 min.
114           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
115           BA    .156
116           LG     .35     .35    3.50     .29     .00
117           UI     18.     47.     87.    112.    150.    218.    170.    131.     99.     69.
118           UI     35.     27.     18.      7.      5.      5.      5.      0.      0.      0.
119           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

120           KK     10E
121           KM    SUB-BASIN DA-10E
122           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
123           KM    L= 2.538 mi. Lca= 1.080 mi.  S=  108.4 ft/mi.  Kn= .065  LAG=  56.4 min.
124           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
125           BA    .555
126           LG     .35     .20    9.40     .02     .00
127           UI     33.     33.     64.    120.    155.    178.    200.    230.    264.    340.
128           UI    419.    375.    313.    275.    241.    208.    179.    157.    117.     80.
129           UI     59.     55.     47.     33.     33.     15.     10.     10.     10.     10.
130           UI     10.     10.     10.      0.      0.      0.      0.      0.      0.      0.
131           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

132           KK    C10E
133           KM    COMBINE HYDROGRAPHS AT DA-10E
134           KM    This hydrograph is the flow in Deadman Wash just downstream of it's
135           KM    confluence with Stream No. 1.
136           HC       4

137           KK  R10E-F
138           KM    ROUTE FLOWS FROM DA-10E TO DA-10F
139           RS       3    FLOW      -1
140           RL                     .01    1766
141           RC    .080    .065    .080    2500  0.0080
142           RX     875     920     956     988    1012    1046    1095    1500
143           RY    1780    1770    1769    1766    1766    1769    1771    1774
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 144          KK     10F
 145          KM    SUB-BASIN DA-10F
 146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 147          KM    L= .492 mi.  Lca= .322 mi.   S=   40.7 ft/mi.  Kn= .065  LAG=  23.0 min.
 148          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 149          BA    .078
 150          LG     .35     .25    8.20     .05     .00
 151          UI     11.     43.     65.     94.    133.     94.     66.     42.     19.     13.
 152          UI      6.      3.      3.      0.      0.      0.      0.      0.      0.      0.
 153          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 154          KK      2A
 155          KM    SUB-BASIN DA-2A
 156          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 157          KM    L= 1.496 mi. Lca= .795 mi.   S=  778.7 ft/mi.  Kn= .070  LAG=  30.4 min.
 158          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 159          BA    .381
 160          LG     .24     .35    3.61     .39   31.14
 161          UI     42.     94.    210.    296.    391.    417.    267.    226.    191.    158.
 162          UI    122.    101.     88.     65.     53.     46.     34.     32.     21.     21.
 163          UI     18.      8.      8.      8.      8.      8.      8.      8.      0.      0.
 164          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 165          KK      2B
 166          KM    SUB-BASIN DA-2B
 167          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 168          KM    L= .795 mi.  Lca= .473 mi.   S=  911.9 ft/mi.  Kn= .070  LAG=  19.0 min.
 169          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 170          BA    .141
 171          LG     .23     .36    4.12     .33   28.99
 172          UI     31.    117.    200.    231.    140.    107.     75.     57.     38.     29.
 173          UI     20.     14.     12.      5.      5.      5.      5.      0.      0.      0.
 174          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 175          KK     C2B
 176          KM    COMBINE HYDROGRAPHS AT DA-2B
 177          HC      2

 178          KK   R2B-C
 179          KM    ROUTE FLOWS FROM DA-2B TO DA-2C
 180          RS      7    FLOW      -1
 181          RL                    .37    1898
 182          RC    .090    .070    .090   12300  0.0199
 183          RX     865     950     962     988    1012    1035    1045    1120
 184          RY    1913    1910    1906    1898    1898    1906    1910    1914

 185          KK      2C
 186          KM    SUB-BASIN DA-2C
 187          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 188          KM    L= 2.330 mi. Lca= 1.042 mi.  S=  105.2 ft/mi.  Kn= .070  LAG=  58.3min.
 189          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 190          BA    .655
 191          LG     .34     .28    8.28     .08     .96
 192          UI     38.     38.     65.    135.    171.    198.    223.    252.    290.    350.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 193          UI    456.    466.    382.    330.    295.    255.    223.    191.    163.    120.
 194          UI     77.     66.     62.     47.     38.     38.     13.     12.     12.     12.
 195          UI     12.     12.     12.     12.      0.      0.      0.      0.      0.      0.
 196          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 197          KK     C2C
 198          KM    COMBINE HYDROGRAPHS AT DA-2C
 199          KM    This hydrograph is a total flow from the Stream No. 2 watershed area.
 200          HC       2

 201          KK    C10F
 202          KM    COMBINE HYDROGRAPHS AT DA-10F
 203          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 204          KM    confluence with Stream No. 2.
 205          HC       3

 206          KK  R10F-G
 207          KM    ROUTE FLOWS FROM DA-10F TO DA-10G
 208          RS       1    FLOW      -1
 209          RL                    .298    1746
 210          RC    .080    .065    .080     900  0.0056
 211          RX     532     830     920     992    1015    1050    1112    1475
 212          RY    1760    1750    1749    1746    1746    1749    1750    1756

 213          KK     10G
 214          KM    SUB-BASIN DA-10G
 215          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 216          KM    L= .909 mi.  Lca= .341 mi.   S=   60.5 ft/mi.  Kn= .065  LAG=  27.5 min.
 217          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 218          BA    .138
 219          LG     .35     .20    9.40     .02     .00
 220          UI     17.     49.     86.    112.    161.    199.    144.    108.     79.     42.
 221          UI     28.     17.      9.      5.      5.      5.      0.      0.      0.      0.
 222          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 223          KK      3A
 224          KM    SUB-BASIN DA-3A
 225          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 226          KM    L= .682 mi.  Lca= .303 mi.   S=  909.1 ft/mi.  Kn= .070  LAG=  15.2 min.
 227          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 228          BA    .116
 229          LG     .21     .36    3.81     .34   29.33
 230          UI     42.    154.    246.    150.    106.     68.     47.     30.     20.     13.
 231          UI      8.      5.      5.      5.      0.      0.      0.      0.      0.      0.
 232          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 233          KK   R3A-B
 234          KM    ROUTE FLOWS FROM DA-3A TO DA-3B
 235          RS       3    FLOW      -1
 236          RL                    .226    1894
 237          RC    .090    .070    .090    3900  0.0205
 238          RX     845     968     974     988    1011    1022    1028    1325
 239          RY    1910    1900    1898    1894    1894    1898    1900    1910
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

240           KK      3B
241           KM    SUB-BASIN DA-3B
242           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
243           KM    L= .928 mi.  Lca= .473 mi.   S=  215.5 ft/mi.  Kn= .070  LAG=  26.6 min.
244           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
245           BA    .234
246           LG     .29     .25   10.10     .04    6.00
247           UI     30.     91.    155.    204.    306.    329.    237.    176.    121.     60.
248           UI     42.     27.      9.      9.      9.      0.      0.      0.      0.      0.
249           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

250           KK      3C
251           KM    SUB-BASIN DA-3C
252           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
253           KM    L= .682 mi.  Lca=  .303 mi.  S=  293.3 ft/mi.  Kn= .070  LAG=  18.8 min.
254           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
255           BA    .112
256           LG     .27     .35    7.50     .12    7.34
257           UI     26.     91.    140.    229.    167.    110.     52.     27.     12.      6.
258           UI      6.      0.      0.      0.      0.      0.      0.      0.      0.      0.
259           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

260           KK     C3C
261           KM    COMBINE HYDROGRAPHS AT DA-3C
262           HC       3

263           KK   R3C-D
264           KM    ROUTE FLOWS FROM DA-3C TO DA-3D
265           RS       9    FLOW      -1
266           RL                     .01    1806
267           RC    .090    .070    .090    8900  0.0129
268           RX     875     938     948     991    1008    1030    1078    1310
269           RY    1820    1810    1808    1806    1806    1808    1810    1820

270           KK      3D
271           KM    SUB-BASIN DA-3D
272           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
273           KM    L= 1.989 mi. Lca= 1.098 mi.  S=   83.0 ft/mi.  Kn= .070  LAG=  58.6 min.
274           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
275           BA    .355
276           LG     .35     .15   12.40     .01     .00
277           UI     20.     20.     35.     72.     92.    107.    120.    135.    156.    186.
278           UI    243.    254.    208.    180.    160.    139.    122.    104.     90.     67.
279           UI     44.     36.     34.     27.     20.     20.      9.      6.      6.      6.
280           UI      6.      6.      6.      6.      0.      0.      0.      0.      0.      0.
281           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

282           KK     C3D
283           KM    COMBINE HYDROGRAPHS AT DA-3D
284           KM    This hydrograph is a total flow from the Stream No. 3 watershed area.
285           HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 286          KK    C10G
 287          KM    COMBINE HYDROGRAPHS AT DA-10G
 288          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 289          KM    confluence with Stream No. 3.
 290          HC       3

 291          KK  R10G-H
 292          KM    ROUTE FLOWS FROM DA-10G TO DA-10H
 293          RS       2    FLOW      -1
 294          RL                     .25    1736
 295          RC    .095    .075    .095    2600  0.0096
 296          RX     540     980     988     996    1011    1022    1042    1135
 297          RY    1750    1740    1738    1736    1736    1738    1740    1750

 298          KK      4A
 299          KM    SUB-BASIN DA-4A
 300          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 301          KM    L= 1.837 mi. Lca= .871 mi.   S=   49.0 ft/mi.  Kn= .065  LAG=  53.4 min.
 302          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 303          BA    .303
 304          LG     .35     .15   12.40     .01     .00
 305          UI     19.     19.     43.     73.     92.    107.    121.    141.    168.    223.
 306          UI    237.    191.    164.    144.    122.    106.     91.     68.     45.     34.
 307          UI     31.     24.     19.     18.      6.      6.      6.      6.      6.      6.
 308          UI      6.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 309          UI      .0      0.      0.      0.      0.      0.      0.      0.      0.      0.

 310          KK      4B
 311          KM    SUB-BASIN DA-4B
 312          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 313          KM    L= .795 mi.  Lca= .473 mi.   S=  597.5 ft/mi.  Kn= .070  LAG=  20.6 min.
 314          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 315          BA    .262
 316          LG     .28     .28    8.28     .09    8.44
 317          UI     47.    183.    313.    434.    266.    207.    157.    110.     87.     60.
 318          UI     46.     33.     23.     21.      9.      8.      8.      8.      8.      0.
 319          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 320          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 321          KK     C4B
 322          KM    COMBINE HYDROGRAPHS AT DA-4B
 323          HC       2

 324          KK   R4B-C
 325          KM    ROUTE FLOWS FROM DA-4B TO DA-4C
 326          RS       7    FLOW      -1
 327          RL                     .01    1768
 328          RC    .058    .040    .058    3850  0.0052
 329          RX     475     810     992     996    1008    1012    1180    1380
 330          RY    1780    1772    1770    1768    1768    1770    1772    1780
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 331          KK     4C
 332          KM    SUB-BASIN DA-4C
 333          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 334          KM    L= 1.667 mi. Lca= .473 mi.   S=   51.0 ft/mi.  Kn= .065  LAG=  40.5 min.
 335          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 336          BA    .693
 337          LG     .32     .15   12.40     .01     .48
 338          UI     58.     76.    211.    284.    338.    410.    517.    720.    611.    493.
 339          UI    411.    336.    273.    188.    106.     95.     67.     58.     22.     18.
 340          UI     18.     18.     18.     18.      0.      0.      0.      0.      0.      0.
 341          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 342          KK     C4C
 343          KM    COMBINE HYDROGRAPHS AT DA-4C
 344          HC      2

 345          KK   R4C-D
 346          KM    ROUTE FLOWS FROM DA-4C TO DA-4D
 347          RS      1    FLOW      -1
 348          RL                    .01    1764
 349          RC   .058    .040    .058     900  0.0167
 350          RX    624     820     994     998    1010    1014    1105    1195
 351          RY   1772    1768    1766    1764    1764    1766    1768    1772

 352          KK     4D
 353          KM    SUB-BASIN DA-4D
 354          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 355          KM    L= .928 mi.  Lca= .492 mi.   S=  454.7 ft/mi.  Kn= .070  LAG=  23.4 min.
 356          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 357          BA    .199
 358          LG     .27     .33    7.78     .12    6.47
 359          UI     29.    100.    190.    274.    238.    162.    131.    102.     74.     61.
 360          UI     43.     34.     26.     20.     14.     14.      6.      5.      5.      5.
 361          UI      5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 362          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 363          KK     C4D
 364          KM    COMBINE HYDROGRAPHS AT DA-4D
 365          HC      2

 366          KK   R4D-E
 367          KM    ROUTE FLOWS FROM DA-4D TO DA-4E
 368          RS      3    FLOW      -1
 369          RL                    .19    1746
 370          RC   .060    .048    .060    3100  0.0097
 371          RX    740     955     972     988    1004    1030    1035    1555
 372          RY   1760    1748    1747    1746    1746    1747    1748    1760

 373          KK     4E
 374          KM    SUB-BASIN DA-4E
 375          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 376          KM    L= .758 mi.  Lca= .417 mi.   S=  395.8 ft/mi.  Kn= .060  LAG=  17.9 min.
 377          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 378          BA    .172
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 379          LG     .26     .37    7.14     .15    5.77
 380          UI     43.    163.    282.    264.    169.    125.     84.     63.     41.     30.
 381          UI     21.     16.      9.      6.      6.      6.      0.      0.      0.      0.
 382          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 383          KK     C4E
 384          KM    COMBINE HYDROGRAPHS AT DA-4E
 385          KM    This hydrograph is a total flow from the Stream No. 4 watershed area.
 386          HC       2

 387          KK      5A
 388          KM    SUB-BASIN DA-5A
 389          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 390          KM    L= 1.477 mi. Lca= .568 mi.   S=  612.7 ft/mi.  Kn= .070  LAG=  27.9 min.
 391          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 392          BA    .482
 393          LG     .24     .35    3.77     .40   29.57
 394          UI     58.    151.    321.    437.    628.    431.    331.    278.    229.    176.
 395          UI    141.    120.     87.     70.     60.     45.     36.     28.     28.     13.
 396          UI     11.     11.     11.     11.     11.      0.      0.      0.      0.      0.
 397          UI      0.      0.      0.      0.      .0      0.      0.      0.      0.      0.

 398          KK   R5A-B
 399          KM    ROUTE FLOWS FROM DA-5A TO DA-5B
 400          RS       2    FLOW      -1
 401          RL                   .094    1894
 402          RC    .090    .070    .090    2900  0.0224
 403          RX     720     938     950     988    1008    1018    1034    1050
 404          RY    1910    1902    1900    1894    1894    1900    1905    1910

 405          KK      5B
 406          KM    SUB-BASIN DA-5B
 407          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 408          KM    L= .667 mi.  Lca= .303 mi.   S=  284.9 ft/mi.  Kn= .070  LAG=  18.8 min.
 409          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 410          BA    .063
 411          LG     .30     .35    7.50     .12    8.97
 412          UI     15.     51.     79.    129.     94.     62.     29.     15.      7.      3.
 413          UI      3.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 414          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 415          KK     C5B
 416          KM    COMBINE HYDROGRAPHS AT DA-5B
 417          HC       2

 418          KK      5C
 419          KM    SUB-BASIN DA-5C
 420          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 421          KM    L= .549 mi.  Lca= .265 mi.   S=  546.4 ft/mi.  Kn= .070  LAG=  14.6 min.
 422          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 423          BA    .046
 424          LG     .33     .33    7.78     .11    8.36
 425          UI     19.     59.    109.     89.     49.     18.      7.      3.      0.      0.
 426          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

427           KK      5D
428           KM   BASIN DA-5D
429           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
430           KM    L= .568 mi.  Lca= .227 mi.   S=  528.2 ft/mi.  Kn= .070  LAG=  14.1 min.
431           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
432           BA    .095
433           LG     .33     .40    6.60     .18    7.83
434           UI     43.    132.    242.    179.     92.     33.     12.      7.      0.      0.
435           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

436           KK     C5D
437           KM    COMBINE HYDROGRAPHS AT DA-5D
438           HC       2

439           KK   R5D-E
440           KM    ROUTE FLOWS FROM DA-5D TO DA-5E
441           RS       1    FLOW      -1
442           RL                     .37    1888
443           RC    .090    .070    .090    1600  0.0188
444           RX     785     855     989     996    1010    1030    1058    1190
445           RY    1900    1896    1892    1888    1888    1892    1896    1900

446           KK      5E
447           KM    SUB-BASIN DA-5E
448           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
449           KM    L= .303 mi.  Lca= .189 mi.   S=   99.0 ft/mi.  Kn= .070  LAG=  14.2 min.
450           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
451           BA    .061
452           LG     .35     .39    5.67     .21     .00
453           UI     27.     83.    152.    115.     60.     21.      8.      4.      0.      0.
454           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

455           KK     C5E
456           KM    COMBINE HYDROGRAPHS AT DA-5E
457           HC       3

458           KK   R5E-F
459           KM    ROUTE FLOWS FROM DA-5E TO DA-5F
460           RS       8    FLOW      -1
461           RL                    .298    1842
462           RC    .090    .070    .090    9700  0.0134
463           RX     952     960     975     985    1015    1030    1080    1165
464           RY    1850    1848    1844    1842    1842    1844    1847    1850

465           KK      5F
466           KM    SUB-BASIN DA-5F
467           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
468           KM    L= 1.837 mi. Lca= .928 mi.   S=   70.8 ft/mi.  Kn= .070  LAG=  55.0 min.
469           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
470           BA    .379
471           LG     .35     .25    8.40     .06     .20
472           UI     23.     23.     48.     86.    110.    127.    143.    166.    192.    250.
473           UI    299.    247.    209.    185.    159.    139.    117.     99.     72.     44.
474           UI     40.     38.     24.     23.     17.      7.      7.      7.      7.      7.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 475          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
 476          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 477          KK     C5F
 478          KM    COMBINE HYDROGRAPHS AT DA-5F
 479          HC       2

 480          KK      5G
 481          KM    SUB-BASIN DA-5G
 482          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 483          KM    L= 2.121 mi. Lca= 1.136 mi.  S=   96.7 ft/mi.  Kn= .070  LAG=  59.1 min.
 484          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 485          BA    .402
 486          LG     .35     .20    9.40     .02     .00
 487          UI     23.     23.     38.     81.    102.    119.    134.    151.    173.    205.
 488          UI    266.    290.    238.    205.    183.    159.    139.    120.    105.     78.
 489          UI     54.     41.     38.     33.     23.     23.     14.      7.      7.      7.
 490          UI      7.      7.      7.      7.      7.      0.      0.      0.      0.      0.
 491          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 492          KK     C5G
 493          KM    COMBINE HYDROGRAPHS AT DA-5G
 494          KM    This hydrograph is a total flow from the Stream No. 5 watershed area.
 495          HC       2

 496          KK      6A
 497          KM    SUB-BASIN DA-6A
 498          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 499          KM    L= 2.008 mi. Lca= 1.004 mi.  S=  259.0 ft/mi.  Kn= .070  LAG=  45.8 min.
 500          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 501          BA    .503
 502          LG     .30     .35    3.55     .31   26.05
 503          UI     37.     37.    118.    164.    199.    231.    275.    347.    468.    402.
 504          UI    329.    283.    235.    196.    161.    108.     65.     61.     46.     37.
 505          UI     24.     11.     11.     11.     11.     11.     11.      0.      0.      0.
 506          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 507          KK   R6A-B
 508          KM    ROUTE FLOWS FROM DA-6A TO DA-6B
 509          RS      4    FLOW      -1
 510          RL                    .01    1856
 511          RC    .090    .070    .090    5800  0.0147
 512          RX     800     955     968     988    1010    1026    1036    1270
 513          RY    1870    1862    1860    1856    1856    1860    1862    1870

 514          KK      6B
 515          KM    SUB-BASIN DA-6B
 516          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 517          KM    L= 1.098 mi. Lca=  .530 mi.  S=   77.4 ft/mi.  Kn= .070  LAG=  35.9 min.
 518          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 519          BA    .190
 520          LG     .35     .25   10.10     .04     .00
 521          UI     18.     32.     73.     96.    116.    147.    214.    191.    151.    122.
 522          UI     97.     73.     41.     30.     22.     18.      6.      5.      5.      5.
 523          UI      5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 524          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 525          KK     C6B
 526          KM    COMBINE HYDROGRAPHS AT DA-6B
 527          KM    This hydrograph is a total flow from the Stream No. 6 watershed area.
 528          HC       2

 529          KK      7A
 530          KM    SUB-BASIN DA-7A
 531          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 532          KM    L= 3.447 mi. Lca= 1.818 mi.  S=  378.6 ft/mi.  Kn= .070  LAG=  65.5 min.
 533          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 534          BA   2.035
 535          LG     .28     .35    3.61     .34   27.66
 536          UI    105.    105.    105.    298.    407.    541.    649.    736.    805.    917.
 537          UI   1134.   1201.    802.    694.    626.    589.    542.    505.    466.    428.
 538          UI    393.    348.    308.    272.    256.    241.    226.    208.    172.    157.
 539          UI    134.    133.    115.    115.    105.     80.     80.     80.     70.     51.
 540          UI     51.     51.     51.     51.     45.     20.     20.     20.     20.     20.
 541          UI     20.     20.     20.     20.     20.     20.     20.     20.     20.     20.
 542          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 543          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 544          KK   R7A-B
 545          KM    ROUTE FLOWS FROM DA-7A TO DA-7B
 546          RS       2    FLOW      -1
 547          RL                     .19    1852
 548          RC    .090    .070    .090    1800  0.0111
 549          RX     860     960     970     991    1007    1035    1130    1228
 550          RY    1862    1856    1855    1852    1852    1855    1856    1862

 551          KK      7B
 552          KM    SUB-BASIN DA-7B
 553          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 554          KM    L= .341 mi.  Lca= .189 mi.  S=   58.7 ft/mi.  Kn= .070  LAG=  16.4 min.
 555          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 556          BA    .042
 557          LG     .35     .25   10.10     .04     .00
 558          UI     14.     44.     74.     91.     55.     27.     12.      5.      3.      0.
 559          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 560          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 561          KK     C7B
 562          KM    COMBINE HYDROGRAPHS AT DA-7B
 563          HC       2

 564          KK      7C
 565          KM    SUB-BASIN DA-7C
 566          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 567          KM    L= .663 mi.  Lca= .208 mi.   S=  120.7 ft/mi.  Kn= .070  LAG=  19.1 min.
 568          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 569          BA    .047
 570          LG     .35     .33    7.78     .10     .00
 571          UI     11.     37.     57.     94.     71.     47.     24.     12.      6.      3.
 572          UI      3.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 573          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 574          KK   R7C-D
 575          KM    ROUTE FLOWS FROM DA-7C TO DA-7D
 576          RS       3    FLOW      -1
 577          RL                     .01    1864
 578          RC    .090    .070    .090    1900  0.0211
 579          RX     710     830     950     990    1010    1055    1140    1350
 580          RY    1870    1866    1865    1864    1864    1865    1867    1870

 581          KK      7D
 582          KM    SUB-BASIN DA-7D
 583          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 584          KM    L= .360 mi.  Lca= .246 mi.   S=  111.1 ft/mi.  Kn= .070  LAG=  16.4 min.
 585          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 586          BA    .033
 587          LG     .35     .15   12.40     .01     .00
 588          UI     11.     34.     58.     71.     43.     21.      9.      4.      2.      0.
 589          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 590          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 591          KK     C7D
 592          KM    COMBINE HYDROGRAPHS AT DA-7D
 593          HC       2

 594          KK      7E
 595          KM    SUB-BASIN DA-7E
 596          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 597          KM    L= .852 mi.  Lca= .284 mi.   S=  129.1 ft/mi.  Kn= .070  LAG=  23.3 min.
 598          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 599          BA    .092
 600          LG     .35     .39    6.78     .16    2.93
 601          UI     13.     50.     76.    109.    157.    113.     81.     53.     24.     16.
 602          UI      8.      4.      4.      0.      0.      0.      0.      0.      0.      0.
 603          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 604          KK   R7E-F
 605          KM    ROUTE FLOWS FROM DA-7E TO DA-7F
 606          RS       2    FLOW      -1
 607          RL                     .058    1864
 608          RC    .090    .070    .090    2100  0.0262
 609          RX     852     920     960     994    1010    1075    1110    1195
 610          RY    1876    1870    1868    1864    1864    1868    1870    1876

 611          KK      7F
 612          KM    SUB-BASIN DA-7F
 613          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 614          KM    L= .398 mi.  Lca= .227 mi.   S=  138.2 ft/mi.  Kn= .070  LAG=  15.8 min.
 615          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 616          BA    .053
 617          LG     .35     .25    8.40     .06     .00
 618          UI     18.     58.    103.    109.     65.     28.     13.      4.      3.      0.
 619          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 620          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

621           KK     C7F
622           KM    COMBINE HYDROGRAPHS AT DA-7F
623           HC       4

624           KK   R7F-G
625           KM    ROUTE FLOWS FROM DA-7F TO DA-7G
626           RS       3    FLOW      -1
627           RL                    .208    1830
628           RC    .090    .070    .090    3500  0.0114
629           RX     745     942     960     995    1015    1070    1120    1170
630           RY    1840    1834    1833    1830    1830    1833    1834    1840

631           KK      7G
632           KM    SUB-BASIN DA-7G
633           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
634           KM    L= .663 mi.  Lca= .398 mi.   S=   60.3 ft/mi.  Kn= .070  LAG=  27.9 min.
635           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
636           BA    .073
637           LG     .35     .25    8.20     .05     .00
638           UI      9.     25.     45.     58.     82.    105.     77.     58.     43.     24.
639           UI     15.     10.      6.      3.      3.      3.      0.      0.      0.      0.
640           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

641           KK     C7G
642           KM    COMBINE HYDROGRAPHS AT DA-7G
643           KM    This hydrograph is the flow in Stream No. 7 just downstream of it's
644           KM    confluence with Stream No. 6.
645           HC       3

646           KK   R7G-H
647           KM    ROUTE FLOWS FROM DA-7G TO DA-7H
648           RS       5    FLOW      -1
649           RL                     .37    1784
650           RC    .085    .070    .085    5100  0.0108
651           RX     700     780     920     990    1010    1026    1035    1290
652           RY    1794    1788    1787    1784    1784    1787    1788    1793

653           KK      7H
654           KM    SUB-BASIN DA-7H
655           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
656           KM    L= 1.326 mi. Lca= .701 mi.   S=   90.5 ft/mi.  Kn= .070  LAG=  41.7 min.
657           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
658           BA    .162
659           LG     .35     .25    8.40     .06     .00
660           UI     13.     16.     47.     63.     75.     90.    111.    157.    149.    118.
661           UI     99.     81.     67.     51.     30.     22.     19.     13.     10.      4.
662           UI      4.      4.      4.      4.      0.      0.      0.      0.      0.      0.
663           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 664          KK     C7H
 665          KM    COMBINE HYDROGRAPHS AT DA-7H
 666          KM    This hydrograph is the flow in Stream No. 7 just downstream of it's
 667          KM    confluence with Stream No. 5.
 668          HC       3

 669          KK   R7H-C
 670          KM    ROUTE FLOWS FROM DA-7H TO DA-8C
 671          RS       1    FLOW      -1
 672          RL                     .33    1742
 673          RC    .085    .070    .085     500  0.0009
 674          RX     940     970     980     992    1008    1038    1160    1415
 675          RY    1760    1748    1746    1742    1742    1746    1747    1756

 676          KK      8A
 677          KM    SUB-BASIN DA-8A
 678          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 679          KM    L= 1.629 mi. Lca= .871 mi.   S=  128.9 ft/mi.  Kn= .070  LAG=  45.7 min.
 680          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 681          BA    .443
 682          LG     .35     .25    8.60     .07     .00
 683          UI     33.     33.    104.    145.    176.    204.    244.    309.    412.    353.
 684          UI    289.    248.    206.    172.    141.     93.     58.     54.     40.     33.
 685          UI     20.     10.     10.     10.     10.     10.     10.      0.      0.      0.
 686          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 687          KK     R8A
 688          KM    ROUTE FLOWS THROUGH DOUBLE 6' X 5' RCBCs AT I-17
 689          KM    This rating curve was developed for 2-6' X 5' X 370' RCBCs at I-17.
 690          KM    U.S. Inv. = 1891.7; Top of Roadway = 1899.3
 691          RS       1    ELEV  1891.7
 692          SA       0      .1     0.3     0.5     1.2     1.5     2.0     2.5
 693          SE  1891.7  1895.8  1897.7  1898.9  1899.6  1899.8  1900.1  1900.3
 694          SQ       0     300     500     600     700     800     900    1000

 695          KK   R8A-B
 696          KM    ROUTE FLOWS FROM DA-8A TO DA-8B
 697          RS       3    FLOW      -1
 698          RL                     .01    1875
 699          RC    .090    .070    .090    3100  0.0097
 700          RX     930     968     974     995    1010    1034    1040    1100
 701          RY    1886    1879    1878    1875    1875    1878    1879    1886

 702          KK      8B
 703          KM   BASIN DA-8B
 704          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 705          KM    L= 1.269 mi. Lca= .473 mi.   S=   82.7 ft/mi.  Kn= .070  LAG=  35.9 min.
 706          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 707          BA    .280
 708          LG     .35     .15   12.40     .01     .00
 709          UI     26.     47.    107.    141.    171.    217.    316.    282.    222.    179.
 710          UI    143.    108.     60.     44.     33.     26.      9.      8.      8.      8.
 711          UI      8.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 712          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 713          KK     C8B
 714          KM    COMBINE HYDROGRAPHS AT DA-8B
 715          HC       2

 716          KK   R8B-C
 717          KM    ROUTE FLOWS FROM DA-8B TO DA-8C
 718          RS      12    FLOW      -1
 719          RL                    .154    1846
 720          RC    .080    .065    .080   11000  0.0114
 721          RX     760     864     968     988    1008    1013    1030    1240
 722          RY    1854    1850    1848    1846    1846    1848    1850    1854

 723          KK      8C
 724          KM    SUB-BASIN DA-8C
 725          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 726          KM    L= 2.424 mi. Lca= 1.326 mi.  S=   68.1 ft/mi.  Kn= .065  LAG=  65.4 min.
 727          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 728          BA    .783
 729          LG     .34     .20    9.40     .02     .29
 730          UI     40.     40.     40.    133.    164.    193.    220.    242.    272.    308.
 731          UI    360.    455.    524.    442.    380.    339.    306.    267.    238.    206.
 732          UI    184.    141.    103.     71.     68.     66.     46.     40.     40.     19.
 733          UI     12.     12.     12.     12.     12.     12.     12.     12.     12.      0.
 734          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 735          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 736          KK    C8C1
 737          KM    COMBINE HYDROGRAPHS AT DA-8C DOWNSTREAM OF 2 - 8' X 6' RCB
 738          HC       2

 739          KK    C8C2
 740          KM    COMBINE HYDROGRAPHS AT DA-8C WITH FLOWS FROM STREAM NO. 7
 741          KM    This hydrograph is the flow in Stream No. 8 just downstream of it's
 742          KM    confluence with Stream No. 7.
 743          HC       2

 744          KK   R8C-D
 745          KM    ROUTE FLOWS FROM DA-8C TO DA-8D
 746          RS       1    FLOW      -1
 747          RL                    .354    1728
 748          RC    .095    .060    .095    1400  0.0107
 749          RX     820     912     978     995    1008    1022    1100    1430
 750          RY    1739    1736    1734    1728    1728    1734    1735    1740

 751          KK      8D
 752          KM    SUB-BASIN DA-8D
 753          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 754          KM    L= .265 mi.  Lca= .152 mi.   S=   56.6 ft/mi.  Kn= .060  LAG=  11.8 min.
 755          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 756          BA    .037
 757          LG     .33     .35    4.03     .41    7.91
 758          UI     25.     72.    109.     55.     17.      5.      3.      0.      0.      0.
 759          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 760          KK     C8D
 761          KM    COMBINE HYDROGRAPHS AT DA-8D
 762          KM    This hydrograph is the flow in Stream No. 8 just upstream of it's
 763          KM    confluence with Deadman Wash.
 764          HC       2

 765          KK     10H
 766          KM    SUB-BASIN DA-10H
 767          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 768          KM    L= .492 mi.  Lca= .341 mi.   S=   50.8 ft/mi.  Kn= .075  LAG=  26.0 min.
 769          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 770          BA    .082
 771          LG     .34     .35    3.50     .29    1.54
 772          UI     11.     34.     56.     75.    116.    112.     82.     60.     39.     19.
 773          UI     14.      8.      3.      3.      3.      0.      0.      0.      0.      0.
 774          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 775          KK    C10H
 776          KM    COMBINE HYDROGRAPHS AT DA-10H
 777          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 778          KM    confluence with Stream No. 4 and Stream No. 8 (upstream of the I-17
 779          KM    Northbound bridge).
 780          HC       4

 781          KK    R10H
 782          KM    ROUTE FLOWS THROUGH I-17 BRIDGE
 783          KM    This rating curve was developed using the I-17 Southbound bridge.
 784          KM    U.S. Inv. = 1719.7; Top of Roadway = 1732.8
 785          RS       1    ELEV  1719.7
 786          SA       0      .4     1.3     3.7     4.2     5.5     7.0     8.5
 787          SE  1719.7  1724.6  1727.3  1729.6  1730.7  1731.7  1732.6  1733.6
 788          SQ       0    3200    6400    9600   11200   12800   14400   16000

 789          KK  R10H-I
 790          KM    ROUTE FLOWS FROM DA-10H TO DA-10I
 791          RS       1    FLOW      -1
 792          RL                     .37    1720
 793          RC    .070    .055    .070    1000  0.0050
 794          RX     490     930     975     989    1011    1026    1130    1620
 795          RY    1734    1726    1724    1720    1720    1724    1726    1734

 796          KK     10I
 797          KM    SUB-BASIN DA-10I
 798          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 799          KM    L= 1.250 mi. Lca= .492 mi.   S=   76.0 ft/mi.  Kn= .065  LAG=  34.2 min.
 800          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 801          BA    .182
 802          LG     .32     .35    7.50     .12    5.53
 803          UI     18.     35.     77.     99.    123.    163.    222.    174.    139.    110.
 804          UI     86.     55.     31.     26.     18.      9.      5.      5.      5.      5.
 805          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 806          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

807           KK     10J
808           KM    SUB-BASIN DA-10J
809           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
810           KM    L= 2.367 mi. Lca= .625 mi.   S=   69.7 ft/mi.  Kn= .065  LAG=  48.5 min.
811           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
812           BA    .924
813           LG     .33     .20    9.40     .02    2.47
814           UI     64.     64.    180.    271.    333.    382.    450.    533.    719.    799.
815           UI    635.    539.    465.    391.    329.    270.    177.    113.    106.     83.
816           UI     64.     50.     20.     20.     20.     20.     20.     20.      0.      0.
817           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

818           KK    C10J
819           KM    COMBINE HYDROGRAPHS AT DA-10J
820           HC       3

821           KK  R10J-K
822           KM    ROUTE FLOWS FROM DA-10J TO DA-10K
823           RS       4    FLOW      -1
824           RL                     .37    1708
825           RC    .080    .065    .080    4800  0.0052
826           RX     635     845     950     984    1016    1035    1085    1190
827           RY    1720    1714    1712    1708    1708    1712    1714    1720

828           KK     10K
829           KM    SUB-BASIN DA-10K
830           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
831           KM    L= .947 mi.  Lca= .473 mi.   S=  327.3 ft/mi.  Kn= .065  LAG=  23.0 min.
832           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
833           BA    .418
834           LG     .28     .35    3.55     .32    7.22
835           UI     61.    232.    355.    510.    722.    510.    360.    229.    105.     70.
836           UI     31.     19.     19.      0.      0.      0.      0.      0.      0.      0.
837           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

838           KK     10L
839           KM    SUB-BASIN DA-10L
840           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
841           KM    L= 1.383 mi. Lca= .909 mi.   S=  348.5 ft/mi.  Kn= .070  LAG=  36.2 min.
842           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
843           BA    .413
844           LG     .25     .40    6.60     .19   11.24
845           UI     38.     63.    148.    234.    286.    372.    392.    253.    217.    190.
846           UI    164.    140.    111.     94.     85.     69.     54.     47.     42.     32.
847           UI     29.     23.     19.     19.     16.      7.      7.      7.      7.      7.
848           UI      7.      7.      7.      0.      0.      0.      0.      0.      0.      0.
849           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

850           KK    C10L
851           KM    COMBINE HYDROGRAPHS AT DA-10L
852           HC       3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

853           KK  R10L-M
854           KM    ROUTE FLOWS FROM DA-10L TO DA-10M
855           RS      1    FLOW      -1
856           RL                     .37    1680
857           RC   .070    .045    .070    1500    0.01
858           RX     30     910     979     987    1015    1030    1075    1208
859           RY   1692    1686    1684    1680    1680    1684    1686    1692

860           KK     10M
861           KM    SUB-BASIN DA-10M
862           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
863           KM    L= .966 mi.  Lca= .379 mi.   S=  412.0 ft/mi.  Kn= .065  LAG=  20.4 min.
864           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
865           BA    .336
866           LG     .30     .36    3.81     .29    9.69
867           UI     63.    237.    358.    589.    539.    366.    229.    100.     62.     22.
868           UI     17.     17.      0.      0.      0.      0.      0.      0.      0.      0.
869           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

870           KK    C10M
871           KM    COMBINE HYDROGRAPHS AT DA-10M
872           HC      2

873           KK    R10M
874           KM    ROUTE FLOWS THROUGH EXISTING 4-RCP AT JOY RANCH ROAD
875           KM    This rating curve was developed using the existing 2-72", 1-60",
876           KM    and 1-48" X 45' RCPs at Joy Ranch Road.
877           KM    U.S. Inv. = 1671.8  ;  Top of Roadway L.P. = 1680.4
878           RS      1    ELEV  1671.8
879           SA      0     1.0     1.8     3.7     4.2     5.0     5.7     6.2
880           SE  1671.8  1680.9  1682.1  1683.3  1683.6  1683.8  1684.0  1684.4
881           SQ      0    1000    3200    8000    9600   11200   12800   16000

882           KK  R10M-N
883           KM    ROUTE FLOWS FROM DA-10M TO DA-10N
884           RS      2    FLOW      -1
885           RL                     .37    1656
886           RC   .070    .055    .070    2400  0.0083
887           RX    430     910     968     990    1015    1028    1048    1870
888           RY   1666    1662    1660    1656    1656    1660    1662    1666

889           KK     10N
890           KM    SUB-BASIN DA-10N
891           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
892           KM    L= .814 mi.  Lca= .284 mi.   S=   61.4 ft/mi.  Kn= .055  LAG=  20.8 min.
893           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
894           BA    .073
895           LG     .35     .40    6.29     .19     .00
896           UI     13.     50.     75.    121.    120.     81.     53.     23.     14.      6.
897           UI      4.      4.      0.      0.      0.      0.      0.      0.      0.      0.
898           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

899           KK     100
900           KM    SUB-BASIN DA-100
901           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
902           KM    L= .890 mi.  Lca= .473 mi.   S=   84.3 ft/mi.  Kn= .065  LAG=  29.0 min.
903           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
904           BA    .119
905           LG     .35     .40    6.29     .19     .00
906           UI     14.     37.     68.     87.    118.    168.    129.     99.     75.     50.
907           UI     25.     19.     14.      4.      4.      4.      4.      0.      0.      0.
908           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

909           KK     10P
910           KM    SUB-BASIN DA-10P
911           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
912           KM    L= 1.837 mi. Lca= .814 mi.   S=  209.6 ft/mi.  Kn= .065  LAG=  39.5 min.
913           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
914           BA    .775
915           LG     .28     .35    7.50     .13    7.50
916           UI     66.     94.    247.    331.    396.    481.    637.    821.    663.    543.
917           UI    445.    362.    288.    174.    115.    102.     66.     51.     20.     20.
918           UI     20.     20.     20.      0.      0.      0.      0.      0.      0.      0.
919           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

920           KK    C10P
921           KM    COMBINE HYDROGRAPHS AT DA-10P
922           HC       4

923           KK  R10P-Q
924           KM    ROUTE FLOWS FROM DA-10P TO DA-10Q
925           RS       7    FLOW      -1
926           RL                    .366    1620
927           RC    .080    .065    .080    6700  0.0067
928           RX     300     960     968     988    1014    1030    1410    1815
929           RY    1632    1626    1624    1620    1620    1624    1630    1632

930           KK     10Q
931           KM    SUB-BASIN DA-10Q
932           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
933           KM    L= 1.288 mi. Lca= .814 mi.   S=  427.0 ft/mi.  Kn= .065  LAG=  30.2 min.
934           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
935           BA    .329
936           LG     .26     .36    4.12     .29    9.61
937           UI     37.     83.    184.    259.    344.    357.    230.    194.    164.    136.
938           UI    104.     87.     75.     56.     45.     40.     28.     26.     18.     18.
939           UI     14.      7.      7.      7.      7.      7.      7.      0.      0.      0.
940           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

941           KK      9A
942           KM    SUB-BASIN DA-9A
943           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
944           KM    L= 2.405 mi. Lca= .701 mi.   S=   60.3 ft/mi.  Kn= .065  LAG=  52.4 min.
945           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
946           BA    .975
947           LG     .31     .20    9.40     .02    3.58
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 948          UI     63.     63.    147.    246.    307.    353.    404.    470.    574.    768.
 949          UI    741.    603.    522.    454.    386.    330.    279.    201.    124.    107.
 950          UI    103.     64.     63.     38.     19.     19.     19.     19.     19.     19.
 951          UI     19.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 952          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 953          KK   R9A-B
 954          KM    ROUTE FLOWS FROM DA-9A TO DA-9B
 955          RS     10    FLOW      -1
 956          RL                   .162    1626
 957          RC   .080    .065    .080    9300  0.0097
 958          RX    180     922     960     988    1012    1034    1084    1198
 959          RY   1636    1630    1628    1626    1626    1628    1630    1636

 960          KK     9B
 961          KM    SUB-BASIN DA-9B
 962          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 963          KM    L= 1.761 mi. Lca= .985 mi.   S=   51.1 ft/mi.  Kn= .065  LAG=  54.6 min.
 964          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 965          BA    .696
 966          LG     .35     .20    9.40     .02     .00
 967          UI     43.     43.     91.    160.    204.    237.    266.    309.    359.    472.
 968          UI    550.    450.    383.    338.    290.    251.    214.    179.    125.     76.
 969          UI     73.     68.     43.     43.     26.     13.     13.     13.     13.     13.
 970          UI     13.     13.      0.      0.      0.      0.      0.      0.      0.      0.
 971          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 972          KK     C9B
 973          KM    COMBINE HYDROGRAPHS AT DA-9B
 974          KM    This hydrograph is a total flow from the Stream No. 9 watershed area.
 975          HC      2

 976          KK    C10Q
 977          KM    COMBINE HYDROGRAPHS AT DA-10Q
 978          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 979          KM    confluence with Stream No. 9.
 980          HC      3

 981          KK  R10Q-R
 982          KM    ROUTE FLOWS FROM DA-10Q TO DA-10R
 983          RS      1    FLOW      -1
 984          RL                    .39    1606
 985          RC   .080    .065    .080     600  0.0083
 986          RX    300     740     955     982    1025    1046    1070    1280
 987          RY   1614    1610    1609    1606    1606    1609    1610    1616

 988          KK     10R
 989          KM    SUB-BASIN DA-10R
 990          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 991          KM    L= .871 mi.  Lca= .246 mi.   S=   74.6 ft/mi.  Kn= .065  LAG=  23.0 min.
 992          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 993          BA    .088
 994          LG     .35     .25   10.10     .04     .00
 995          UI     13.     49.     75.    107.    152.    107.     76.     48.     22.     15.
 996          UI      7.      4.      4.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 997          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 998          KK    C10R
 999          KM    COMBINE HYDROGRAPHS AT DA-10R
1000          KM    This hydrograph is the flow in Deadman Wash at the split location
1001          KM    with Stream No. 12.
1002          HC       2

1003          KK  DIV10R
1004          KM    DIVERT FLOW TO EAST TO STREAM NO. 12
1005          KM    DIV10R: Flow in Deadman Wash Continuing South to Carefree Highway
1006          KM    DIV12A: Flow Diverted to DA-12A Continuing South to Carefree Highway
1007          DT  DIV12A
1008          DI       0    7500    8000    8500    9000    9500   10000
1009          DQ       0    3375    3600    3825    4050    4275    4500

1010          KK  R10R-S
1011          KM    ROUTE FLOWS FROM DA-10R TO DA-10S
1012          RS       5    FLOW      -1
1013          RL                     .20    1592
1014          RC    .065    .048    .065    4200  0.0048
1015          RX     300     550     800     900    1180    1209    1238    1450
1016          RY    1598    1594    1593    1592    1592    1593    1594    1598

1017          KK     10S
1018          KM    SUB-BASIN DA-10S
1019          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1020          KM    L= 4.451 mi. Lca= 1.799 mi.  S=   53.9 ft/mi.  Kn= .065  LAG=  96.7 min.
1021          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1022          BA   1.024
1023          LG     .35     .15   12.40     .01     .00
1024          UI     36.     36.     36.     36.     81.    121.    138.    165.    177.    194.
1025          UI    206.    220.    240.    262.    279.    316.    377.    430.    472.    412.
1026          UI    368.    334.    309.    288.    268.    244.    223.    209.    189.    173.
1027          UI    160.    137.    103.     86.     63.     63.     59.     59.     54.     36.
1028          UI     36.     36.     36.     17.     11.     11.     11.     11.     11.     11.
1029          UI     11.     11.     11.     11.     11.     11.     11.      0.      0.      0.
1030          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1031          KK    C10S
1032          KM    COMBINE HYDROGRAPHS AT DA-10S
1033          KM    This hydrograph is the flow in Deadman Wash at the Carefree Highway.
1034          HC       2

1035          KK  R10S-T
1036          KM    ROUTE FLOWS FROM DA-10S TO DA-10T
1037          RS       2    FLOW      -1
1038          RL                     .39    1574
1039          RC    .065    .048    .065    1900  0.0105
1040          RX     410     920     960     990    1020    1070    1310    1510
1041          RY    1582    1579    1578    1574    1574    1576    1578    1582
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1042          KK  DIV12A
1043          KM    RETRIEVE FLOW DIVERTED FROM C10R TO DA-12A
1044          KM    Retrieve Flow at Split Flow Location
1045          DR  DIV12A

1046          KK  R10R-A
1047          KM    ROUTE DIVERTED FLOW FROM DA-10R TO DA-12A
1048          RS      1    FLOW      -1
1049          RL                     .39    1602
1050          RC    .080    .065    .080    3800  0.0039
1051          RX      0     590     975     995    1010    1022    1225    1505
1052          RY   1609    1607    1606    1602    1602    1606    1607    1609

1053          KK     12A
1054          KM    SUB-BASIN DA-12A
1055          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1056          KM    L= .852 mi.  Lca= .473 mi.   S=   35.2 ft/mi.  Kn= .050  LAG=  25.9 min.
1057          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1058          BA    .078
1059          LG     .35     .40    6.60     .17     .00
1060          UI     10.     32.     54.     72.    111.    106.     77.     57.     37.     18.
1061          UI     13.      7.      3.      3.      3.      0.      0.      0.      0.      0.
1062          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1063          KK    R12A
1064          KM    ROUTE FLOWS THROUGH EXISTING CULVERT AT CAREFREE HIGHWAY
1065          KM    This rating curve was developed using the existing oval CMP culvert
1066          KM    at Carefree Highway.
1067          KM    U.S. Inv. = 1586.4 ;  Top of Roadway L.P. = 1594.1
1068          RS      1    ELEV  1586.4
1069          SA      0     0.1     0.3     0.5     0.7     0.9     1.0     1.2
1070          SE  1586.4  1589.1  1590.3  1591.3  1591.8  1592.3  1592.7  1593.2
1071          SQ      0      40      80     120     140     160     180     200

1072          KK    C12A
1073          KM    COMBINE HYDROGRAPHS AT DA-12A
1074          KM    This hydrograph is a total flow just downstream of existing culvert
1075          KM    on Stream No. 12 at Carefree Highway.
1076          HC      2

1077          KK  R12A-B
1078          KM    ROUTE FLOWS FROM DA-12A TO DA-12B
1079          RS      4    FLOW      -1
1080          RL                     .39    1574
1081          RC    .070    .050    .070    3200  0.0078
1082          RX     520     930     980     990    1010    1020    1180    1410
1083          RY    1580    1577    1576    1574    1574    1576    1578    1580

1084          KK     12B
1085          KM    SUB-BASIN DA-12B
1086          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1087          KM    L= .985 mi.  Lca= .246 mi.   S=   40.6 ft/mi.  Kn= .050  LAG=  20.8 min.
1088          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1089          BA    .149
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1090          LG     .35     .35    3.98     .40     .00
1091          UI     27.    102.    153.    248.    244.    166.    107.     48.     29.     12.
1092          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1093          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1094          KK    C12B
1095          KM    COMBINE HYDROGRAPHS AT DA-12B
1096          KM    This hydrograph is a total flow from the Stream No. 12 watershed area.
1097          HC       2

1098          KK     10T
1099          KM    SUB-BASIN DA-10T
1100          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1101          KM    L= .663 mi.  Lca= .265 mi.   S=   60.3 ft/mi.  Kn= .048  LAG=  16.4 min.
1102          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1103          BA    .068
1104          LG     .35     .25    8.40     .06     .00
1105          UI     22.     71.    120.    147.     89.     44.     19.      8.      4.      0.
1106          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1107          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1108          KK    C10T
1109          KM    COMBINE HYDROGRAPHS AT DA-10T
1110          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1111          KM    confluence with Stream No. 12.
1112          HC       3

1113          KK  R10T-U
1114          KM    ROUTE FLOWS FROM DA-10T TO DA-10U
1115          RS       7    FLOW      -1
1116          RL                     .39    1548
1117          RC    .065    .050    .065    7400  0.0068
1118          RX     360     920     970     988    1014    1036    1050    1500
1119          RY    1558    1553    1552    1548    1548    1551    1552    1558

1120          KK     10U
1121          KM    SUB-BASIN DA-10U
1122          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1123          KM    L= 1.856 mi. Lca= 1.042 mi.  S=   45.8 ft/mi.  Kn= .050  LAG=  44.7 min.
1124          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1125          BA    .487
1126          LG     .35     .25    8.40     .06     .00
1127          UI     37.     37.    122.    166.    202.    235.    280.    372.    460.    378.
1128          UI    313.    267.    222.    183.    141.     86.     63.     59.     37.     36.
1129          UI     11.     11.     11.     11.     11.     11.      0.      0.      0.      0.
1130          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1131          KK     11A
1132          KM    SUB-BASIN DA-11A
1133          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1134          KM    L= .549 mi.  Lca= .246 mi.   S=  601.1 ft/mi.  Kn= .070  LAG=  14.0 min.
1135          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1136          BA    .158
1137          LG     .26     .35    3.50     .32   22.35
1138          UI     68.    247.    347.    200.    133.     86.     52.     34.     21.     14.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1139          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1140          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1141          KK  R11A-B
1142          KM    ROUTE FLOWS FROM DA-11A TO DA-11B
1143          RS       2    FLOW      -1
1144          RL                     .39    1702
1145          RC    .090    .070    .090    1700  0.0088
1146          RX     968     982     990     995    1005    1010    1018    1030
1147          RY    1708    1706    1704    1702    1702    1704    1706    1708

1148          KK     11B
1149          KM    SUB-BASIN DA-11B
1150          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1151          KM    L= .720 mi.  Lca= .360 mi.   S=  270.8 ft/mi.  Kn= .070  LAG=  20.8 min.
1152          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1153          BA    .220
1154          LG     .25     .35    3.55     .33    7.62
1155          UI     38.    150.    258.    363.    224.    174.    133.     94.     74.     51.
1156          UI     40.     28.     20.     17.      9.      7.      7.      7.      7.      0.
1157          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1158          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1159          KK    C11B
1160          KM    COMBINE HYDROGRAPHS AT DA-11B
1161          HC       2

1162          KK    R11B
1163          KM    ROUTE FLOWS THROUGH 6' X 7' RCBC AT I-17
1164          KM    This rating curve was developed for the 6' X 7' X 228' RCBC at I-17.
1165          KM    U.S. Inv. = 1692.0  ;  Top of Roadway = 1700.8
1166          RS       1    ELEV  1692.0
1167          SA       0     0.4     0.8     1.7     3.2     5.5     7.0     8.5
1168          SE  1692.0  1697.1  1698.7  1700.8  1702.2  1704.5  1707.3  1710.5
1169          SQ       0     200     300     400     500     600     700     800

1170          KK  R11B-D
1171          KM    ROUTE FLOWS FROM DA-11B TO DA-11D
1172          RS       1    FLOW      -1
1173          RL                    .234    1688
1174          RC    .080    .065    .080    1500  0.0100
1175          RX     950     970     982     988    1010    1016    1028    1070
1176          RY    1696    1692    1691    1688    1688    1691    1692    1696

1177          KK     11D
1178          KM    SUB-BASIN DA-11D
1179          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1180          KM    L= 1.098 mi.  Lca= .568 mi.   S=  327.9 ft/mi.  Kn= .070  LAG=  28.0 min.
1181          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1182          BA    .109
1183          LG     .28     .37    4.74     .26   14.17
1184          UI     13.     37.     66.     86.    121.    156.    115.     87.     65.     37.
1185          UI     22.     15.      9.      4.      4.      4.      0.      0.      0.      0.
1186          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1187          KK    C11D
1188          KM    COMBINE HYDROGRAPHS AT DA-11D
1189          HC       2

1190          KK  R11D-F
1191          KM    ROUTE FLOWS FROM DA-11D TO DA-11F
1192          RS       1    FLOW      -1
1193          RL                     .01    1678
1194          RC    .080    .065    .080    1000  0.0050
1195          RX     900     970     982     988    1010    1016    1028    1100
1196          RY    1688    1682    1681    1678    1678    1681    1682    1688

1197          KK     11E
1198          KM    SUB-BASIN DA-11E
1199          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1200          KM    L= 1.686 mi. Lca= .966 mi.   S=  163.1 ft/mi.  Kn= .070  LAG=  46.1 min.
1201          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1202          BA    .424
1203          LG     .26     .38    6.96     .16    9.64
1204          UI     31.     31.     86.    137.    190.    224.    261.    351.    281.    206.
1205          UI    181.    163.    147.    130.    115.     98.     80.     74.     68.     58.
1206          UI     49.     40.     37.     34.     28.     24.     24.     17.     15.     15.
1207          UI     15.     11.      6.      6.      6.      6.      6.      6.      6.      6.
1208          UI      6.      6.      0.      0.      0.      0.      0.      0.      0.      0.
1209          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1210          KK     11F
1211          KM    SUB-BASIN DA-11F
1212          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1213          KM    L= 1.023 mi. Lca= .436 mi.   S=   83.1 ft/mi.  Kn= .065  LAG=  29.7 min.
1214          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1215          BA    .264
1216          LG     .35     .20    9.40     .02     .66
1217          UI     30.     77.    144.    185.    245.    362.    292.    225.    171.    123.
1218          UI     63.     48.     30.     15.      9.      9.      9.      0.      0.      0.
1219          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1220          KK    C11F
1221          KM    COMBINE HYDROGRAPHS AT DA-11F
1222          KM    This hydrograph is the flow just upstream of I-17 3 - 8' X 7' RCB.
1223          HC       3

1224          KK    R11F
1225          KM    ROUTE FLOWS THROUGH EXISTING BOX CULVERT AT I-17
1226          KM    This rating curve was developed using the 3 - 8' X 7' X 195' RCBC at I-17.
1227          KM    U.S. Inv. = 1675.9 ;  Top of Roadway = 1684.9
1228          RS       1    ELEV  1675.9
1229          SA       0     1.0     2.3     3.5     5.7     6.9     9.0    12.2
1230          SE  1675.9  1679.6  1681.8  1683.9  1685.1  1686.4  1687.9  1689.6
1231          SQ       0     520    1040    1560    1820    2080    2340    2600
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1232          KK  R11F-G
1233          KM    ROUTE FLOWS FROM DA-11F TO DA-11G
1234          RS      4    FLOW      -1
1235          RL                    .01    1665
1236          RC   .080    .065    .080    3900  0.0051
1237          RX    900     970     982     988    1010    1016    1028    1100
1238          RY   1676    1669    1668    1665    1665    1668    1669    1676

1239          KK     11C
1240          KM    SUB-BASIN DA-11C
1241          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1242          KM    L= .303 mi.  Lca= .170 mi.   S=  742.6 ft/mi.  Kn= .070  LAG=   9.3 min.
1243          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1244          BA    .054
1245          LG     .17     .35    4.03     .46    5.73
1246          UI     59.    168.     94.     49.     24.     12.      6.      4.      0.      0.
1247          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1248          KK  R11C-G
1249          KM    ROUTE FLOWS FROM DA-11C TO DA-11G
1250          RS      7    FLOW      -1
1251          RL                    .01    1665
1252          RC   .080    .065    .080    4500  0.0044
1253          RX    970     980     990     996    1004    1010    1020    1030
1254          RY   1672    1670    1668    1665    1665    1668    1670    1672

1255          KK     11G
1256          KM    SUB-BASIN DA-11G
1257          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1258          KM    L= .777 mi.  Lca= .360 mi.   S=  328.2 ft/mi.  Kn= .065  LAG=  19.2 min.
1259          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1260          BA    .349
1261          LG     .31     .25   10.10     .04    2.67
1262          UI     78.    274.    417.    692.    531.    350.    180.     90.     44.     19.
1263          UI     19.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1264          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1265          KK    C11G
1266          KM    COMBINE HYDROGRAPHS AT DA-11G
1267          HC      3

1268          KK  R11G-I
1269          KM    ROUTE FLOWS FROM DA-11G TO DA-11I
1270          RS      6    FLOW      -1
1271          RL                    .01    1622
1272          RC   .065    .055    .065    6900  0.0080
1273          RX    800     978     984     990    1012    1018    1024    1180
1274          RY   1634    1628    1626    1622    1622    1626    1628    1634
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1275          KK     11H
1276          KM    SUB-BASIN DA-11H
1277          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1278          KM    L= .756 mi.  Lca= .322 mi.   S=   39.7 ft/mi.  Kn= .065  LAG=  27.2 min.
1279          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1280          BA    .172
1281          LG     .35     .15   12.40     .01     .00
1282          UI     21.     63.    110.    143.    208.    247.    177.    133.     96.     48.
1283          UI     34.     21.      9.      7.      7.      7.      0.      0.      0.      0.
1284          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1285          KK  R11H-I
1286          KM    ROUTE FLOWS FROM DA-11H TO DA-11I
1287          RS       6    FLOW      -1
1288          RL                     .01    1628
1289          RC    .065    .055    .065    8500  0.0088
1290          RX     800     978     984     990    1012    1018    1024    1200
1291          RY    1640    1634    1632    1628    1628    1632    1634    1640

1292          KK     11I
1293          KM    SUB-BASIN DA-11I
1294          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1295          KM    L= 1.610 mi. Lca= .833 mi.   S=   46.6 ft/mi.  Kn= .055  LAG=  42.7 min.
1296          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1297          BA    .528
1298          LG     .35     .15   12.40     .01     .00
1299          UI     42.     45.    147.    197.    236.    280.    339.    470.    501.    391.
1300          UI    330.    273.    225.    182.    117.     73.     68.     45.     42.     16.
1301          UI     13.     13.     13.     13.     13.      0.      0.      0.      0.      0.
1302          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1303          KK    C11I
1304          KM    COMBINE HYDROGRAPHS AT DA-11I
1305          HC       3

1306          KK  R11I-J
1307          KM    ROUTE FLOWS FROM DA-11I TO DA-11J
1308          RS       8    FLOW      -1
1309          RL                     .01    1568
1310          RC    .065    .055    .065    7800  0.0058
1311          RX     660     960     984     990    1012    1018    1050    1240
1312          RY    1578    1572    1570    1568    1568    1570    1572    1578

1313          KK     11J
1314          KM    SUB-BASIN DA-11J
1315          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1316          KM    L= 1.894 mi. Lca= .795 mi.   S=   34.3 ft/mi.  Kn= .055  LAG=  47.3 min.
1317          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1318          BA    .839
1319          LG     .35     .20    9.40     .02     .00
1320          UI     60.     60.    178.    258.    315.    363.    430.    521.    715.    704.
1321          UI    563.    483.    408.    344.    289.    214.    134.    103.     97.     60.
1322          UI     60.     25.     18.     18.     18.     18.     18.     18.      0.      0.
1323          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1324          KK     11K
1325          KM    SUB-BASIN DA-11K
1326          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1327          KM    L= 1.117 mi. Lca= .436 mi.   S=   49.2 ft/mi.  Kn= .065  LAG=  34.0 min.
1328          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1329          BA    .427
1330          LG     .27     .33    7.78     .11    5.54
1331          UI     42.     84.    182.    235.    292.    392.    521.    405.    325.    256.
1332          UI    199.    123.     73.     60.     42.     19.     13.     13.     13.     13.
1333          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1334          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1335          KK    C11K
1336          KM    COMBINE HYDROGRAPHS AT DA-11K
1337          HC       3

1338          KK  R11K-L
1339          KM    ROUTE FLOWS FROM DA-11K TO DA-11L
1340          RS       2    FLOW      -1
1341          RL                     .01    1542
1342          RC    .070    .055    .065    1400  0.0036
1343          RX     620     830     912     995    1038    1270    1430    1620
1344          RY    1550    1544    1543    1542    1542    1543    1544    1550

1345          KK     11L
1346          KM    SUB-BASIN DA-11L
1347          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1348          KM    L= 3.504 mi. Lca= 2.330 mi.  S=  131.3 ft/mi.  Kn= .055  LAG=  69.6 min.
1349          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1350          BA   2.223
1351          LG     .31     .20    9.40     .02    2.67
1352          UI    108.    108.    108.    304.    402.    503.    559.    618.    682.    770.
1353          UI    855.   1028.   1288.   1377.   1152.   1006.    904.    821.    723.    647.
1354          UI    572.    511.    430.    314.    210.    190.    177.    171.    108.    108.
1355          UI    108.     42.     33.     33.     33.     33.     33.     33.     33.     33.
1356          UI     33.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1357          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1358          KK    C11L
1359          KM    COMBINE HYDROGRAPHS AT DA-11L
1360          HC       2

1361          KK  R11L-M
1362          KM    ROUTE FLOWS FROM DA-11L TO DA-11M
1363          RS       2    FLOW      -1
1364          RL                     .01    1536
1365          RC    .070    .055    .065    1500  0.0033
1366          RX     520     830     912     995    1038    1270    1430    1600
1367          RY    1546    1538    1537    1536    1536    1537    1538    1546
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1368          KK     11M
1369          KM    SUB-BASIN DA-11M
1370          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1371          KM    L= 3.106 mi. Lca= 1.326 mi.  S=   33.8 ft/mi.  Kn= .055  LAG=  69.5 min.
1372          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1373          BA    .783
1374          LG     .31     .20    9.40     .02    1.29
1375          UI     38.     38.     38.    108.    142.    178.    197.    218.    241.    272.
1376          UI    302.    364.    456.    484.    405.    354.    318.    289.    254.    228.
1377          UI    201.    180.    151.    110.     73.     67.     62.     59.     38.     38.
1378          UI     38.     14.     12.     12.     12.     12.     12.     12.     12.     12.
1379          UI     12.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1380          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1381          KK    C11M
1382          KM    COMBINE HYDROGRAPHS AT DA-11M
1383          HC       2

1384          KK  R11M-N
1385          KM    ROUTE FLOWS FROM DA-11M TO DA-11N
1386          RS       2    FLOW      -1
1387          RL                     .01    1530
1388          RC    .070    .050    .065    1900  0.0105
1389          RX     400     830     912     995    1038    1270    1430    2310
1390          RY    1538    1532    1531    1530    1530    1531    1532    1538

1391          KK     11N
1392          KM    SUB-BASIN DA-11N
1393          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1394          KM    L= 1.174 mi. Lca= .417 mi.   S=   46.8 ft/mi.  Kn= .055  LAG=  29.1 min.
1395          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1396          BA    .229
1397          LG     .31     .20    9.40     .02    3.23
1398          UI     26.     70.    129.    167.    225.    323.    248.    192.    145.     98.
1399          UI     49.     38.     26.      8.      8.      8.      8.      0.      0.      0.
1400          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1401          KK    C11N
1402          KM    COMBINE HYDROGRAPHS AT DA-11N
1403          KM    This hydrograph is a total flow from the Stream No. 11 watershed area.
1404          HC       2

1405          KK    C10U
1406          KM    COMBINE HYDROGRAPHS AT DA-10U
1407          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1408          KM    confluence with Stream No. 11.
1409          HC       3

1410          KK  R10U-V
1411          KM    ROUTE FLOWS FROM DA-10U TO DA-10V
1412          RS       5    FLOW      -1
1413          RL                     .23    1510
1414          RC    .065    .038    .065    3200  0.0016
1415          RX     200     690     988     992    1010    1020    1105    1690
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1416          RY    1522    1516    1514    1510    1510    1514    1516    1522

1417          KK     10V
1418          KM    SUB-BASIN DA-10V
1419          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1420          KM    L= 1.818 mi. Lca= .492 mi.   S=  137.5 ft/mi.  Kn= .060  LAG=  32.5 min.
1421          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1422          BA    .964
1423          LG     .33     .37    4.43     .26    3.14
1424          UI    100.    218.    445.    575.    723.   1026.   1185.    881.    700.    543.
1425          UI    390.    208.    166.    102.     68.     31.     31.     31.     31.      0.
1426          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1427          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1428          KK    C10V
1429          KM    COMBINE HYDROGRAPHS AT DA-10V
1430          HC       2

1431          KK  R10V-W
1432          KM    ROUTE FLOWS FROM DA-10V TO DA-10W
1433          RS       4    FLOW      -1
1434          RL                     .23    1500
1435          RC    .065    .038    .065    3900  0.0064
1436          RX     440     908     982     988    1012    1020    1282    1850
1437          RY    1510    1504    1502    1500    1500    1502    1504    1510

1438          KK     14A
1439          KM    SUB-BASIN DA-14A
1440          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1441          KM    L= 5.341 mi. Lca= .481 mi.   S=   55.2 ft/mi.  Kn= .050  LAG=  48.1 min.
1442          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1443          BA   2.410
1444          LG     .35     .15   12.40     .01     .00
1445          UI    169.    169.    483.    719.    880.   1011.   1193.   1423.   1935.   2069.
1446          UI   1641.   1402.   1197.   1015.    843.    681.    429.    297.    277.    201.
1447          UI    169.    111.     52.     52.     52.     52.     52.     52.      0.      0.
1448          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1449          KK  R14A-B
1450          KM    ROUTE FLOWS FROM DA-14A TO DA-14B
1451          RS       9    FLOW      -1
1452          RL                     .01    1552
1453          RC    .065    .050    .065    8300  0.0078
1454          RX     500     970     985     992    1006    1012    1030    1500
1455          RY    1562    1556    1554    1552    1552    1554    1556    1562

1456          KK     14B
1457          KM    SUB-BASIN DA-14B
1458          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1459          KM    L= 2.765 mi. Lca= 1.136 mi.  S=   47.0 ft/mi.  Kn= .050  LAG=  53.5 min.
1460          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1461          BA    .819
1462          LG     .35     .15   12.40     .01     .00
1463          UI     52.     52.    115.    198.    249.    288.    325.    379.    451.    598.
1464          UI    641.    517.    444.    391.    331.    287.    246.    187.    124.     91.
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1465          UI     85.     67.     52.     49.     16.     16.     16.     16.     16.     16.
1466          UI     16.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1467          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1468          KK     14C
1469          KM    SUB-BASIN DA-14C
1470          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1471          KM    L= 2.746 mi. Lca= 1.402 mi.  S=   43.7 ft/mi.  Kn= .050  LAG=  58.6 min.
1472          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1473          BA    .726
1474          LG     .35     .15   12.40     .01     .00
1475          UI     42.     42.     71.    148.    187.    218.    245.    277.    318.    381.
1476          UI    496.    520.    425.    367.    328.    283.    249.    213.    184.    136.
1477          UI     90.     73.     69.     55.     42.     42.     19.     13.     13.     13.
1478          UI     13.     13.     13.     13.      0.      0.      0.      0.      0.      0.
1479          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1480          KK    C14C
1481          KM    COMBINE HYDROGRAPHS AT DA-14C
1482          HC      3

1483          KK  R14C-D
1484          KM    ROUTE FLOWS FROM DA-14C TO DA-14D
1485          RS      2    FLOW      -1
1486          RL                    .38    1512
1487          RC    .065    .050    .065    2200  0.0068
1488          RX     500     970     985     992    1006    1012    1030    1500
1489          RY    1522    1516    1514    1512    1512    1514    1516    1522

1490          KK     14D
1491          KM    SUB-BASIN DA-14D
1492          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1493          KM    L= 1.250 mi. Lca= .455 mi.   S=   48.0 ft/mi.  Kn= .050  LAG=  27.8 min.
1494          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1495          BA    .242
1496          LG     .35     .25    8.60     .07     .00
1497          UI     29.     83.    149.    193.    275.    347.    254.    192.    142.     79.
1498          UI     50.     32.     18.      9.      9.      9.      0.      0.      0.      0.
1499          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1500          KK    C14D
1501          KM    COMBINE HYDROGRAPHS AT DA-14D
1502          HC      2

1503          KK     14E
1504          KM    SUB-BASIN DA-14E
1505          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1506          KM    L= 3.030 mi. Lca= 1.496 mi.  S=   49.5 ft/mi.  Kn= .050  LAG=  60.9 min.
1507          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1508          BA    .665
1509          LG     .35     .15   12.40     .01     .00
1510          UI     37.     37.     53.    128.    158.    187.    210.    235.    270.    309.
1511          UI    398.    474.    408.    347.    307.    274.    237.    209.    181.    153.
1512          UI    112.     71.     64.     60.     47.     37.     37.     17.     11.     11.
1513          UI     11.     11.     11.     11.     11.     11.      0.      0.      0.      0.
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1514          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1515          KK  R14E-F
1516          KM    ROUTE FLOWS FROM DA-14E TO DA-14F
1517          RS      6    FLOW      -1
1518          RL                    .01    1535
1519          RC    .065    .050    .065    7000  0.0086
1520          RX     800     950     985     992    1012    1020    1055    1160
1521          RY    1544    1540    1538    1535    1535    1538    1540    1544

1522          KK     14F
1523          KM    SUB-BASIN DA-14F
1524          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1525          KM    L= 1.591 mi. Lca= .795 mi.   S=   47.1 ft/mi.  Kn= .050  LAG=  37.9 min.
1526          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1527          BA    .275
1528          LG     .35     .15   12.40     .01     .00
1529          UI     24.     39.     95.    126.    151.    187.    259.    297.    227.    187.
1530          UI    151.    121.     85.     48.     41.     28.     24.      7.      7.      7.
1531          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1532          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1533          KK    C14F
1534          KM    COMBINE HYDROGRAPHS AT DA-14F
1535          HC      3

1536          KK  R14F-G
1537          KM    ROUTE FLOWS FROM DA-14F TO DA-14G
1538          RS      3    FLOW      -1
1539          RL                   .318    1494
1540          RC    .065    .045    .065    2700  0.0074
1541          RX     430     930     975     990    1015    1070    1100    1400
1542          RY    1502    1498    1496    1494    1494    1496    1498    1502

1543          KK     14G
1544          KM    SUB-BASIN DA-14G
1545          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1546          KM    L= .701 mi.  Lca= .398 mi.   S=   49.9 ft/mi.  Kn= .050  LAG=  21.1 min.
1547          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1548          BA    .086
1549          LG     .35     .39    6.78     .16     .00
1550          UI     15.     57.     86.    137.    143.     97.     65.     29.     18.      8.
1551          UI      4.      4.      0.      0.      0.      0.      0.      0.      0.      0.
1552          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1553          KK    C14G
1554          KM    COMBINE HYDROGRAPHS AT DA-14G
1555          KM    This hydrograph is a total flow from the Stream No. 14 watershed area.
1556          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1557          KK     10W
1558          KM    SUB-BASIN DA-10W
1559          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1560          KM    L= .909 mi.  Lca= .455 mi.   S=  368.5 ft/mi.  Kn= .065  LAG=  21.8 min.
1561          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1562          BA    .526
1563          LG     .31     .35    3.87     .38    4.87
1564          UI     81.    329.    494.    754.    904.    613.    422.    212.    122.     67.
1565          UI     25.     25.     25.      0.      0.      0.      0.      0.      0.      0.
1566          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1567          KK    C10W
1568          KM    COMBINE HYDROGRAPHS AT DA-10W
1569          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1570          KM    confluence with Stream No. 14.
1571          HC       3

1572          KK  R10W-X
1573          KM    ROUTE FLOWS FROM DA-10W TO DA-10X
1574          RS       2    FLOW      -1
1575          RL                     .94    1480
1576          RC    .085    .060    .085    1400  0.0036
1577          RX     720     970     980     989    1011    1020    1100    1980
1578          RY    1500    1486    1484    1480    1480    1484    1486    1494

1579          KK     15A
1580          KM    SUB-BASIN DA-15A
1581          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1582          KM    L= .625 mi.  Lca= .303 mi.   S=   48.0 ft/mi.  Kn= .050  LAG=  18.3 min.
1583          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1584          BA    .064
1585          LG     .35     .15   12.40     .01     .00
1586          UI     16.     55.     85.    135.     93.     60.     26.     14.      5.      4.
1587          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1588          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1589          KK  R15A-B
1590          KM    ROUTE FLOWS FROM DA-15A TO DA-15B
1591          RS      13    FLOW      -1
1592          RL                     .01    1482
1593          RC    .065    .050    .065    9200  0.0087
1594          RX     820     870     985     990    1020    1032    1305    1590
1595          RY    1487    1486    1484    1482    1482    1486    1487    1488

1596          KK     15B
1597          KM    SUB-BASIN DA-15B
1598          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1599          KM  L= 1.742 mi. Lca= .833 mi.   S=   45.9 ft/mi.  Kn= .050  LAG=  40.1 min.
1600          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1601          BA    .386
1602          LG     .35     .25   10.10     .04     .00
1603          UI     32.     44.    120.    161.    192.    233.    297.    408.    336.    274.
1604          UI    226.    185.    148.     99.     57.     53.     34.     31.     10.     10.
1605          UI     10.     10.     10.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1606          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1607          KK    C15B
1608          KM    COMBINE HYDROGRAPHS AT DA-15B
1609          KM    This hydrograph is a total flow from the Stream No. 15 watershed area.
1610          HC       2

1611          KK     10X
1612          KM    SUB-BASIN DA-10X
1613          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1614          KM    L= .928 mi.  Lca= .511 mi.   S=  452.6 ft/mi.  Kn= .070  LAG=  23.8 min.
1615          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1616          BA    .152
1617          LG     .25     .35    4.23     .57   14.16
1618          UI     22.     73.    141.    199.    189.    124.    101.     79.     58.     48.
1619          UI     34.     26.     21.     16.     11.     11.      6.      4.      4.      4.
1620          UI      4.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1621          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1622          KK    C10X
1623          KM    COMBINE HYDROGRAPHS AT DA-10X
1624          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1625          KM    confluence with Stream No. 15.
1626          HC       3

1627          KK  R10X-Y
1628          KM    ROUTE FLOWS FROM DA-10X TO DA-10Y
1629          RS       2    FLOW      -1
1630          RL                     .67    1475
1631          RC    .085    .060    .085    1200  0.0042
1632          RX     710     770     930     978    1022    1052    1310    1880
1633          RY    1486    1482    1480    1475    1475    1480    1482    1486

1634          KK     10Y
1635          KM    SUB-BASIN DA-10Y
1636          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1637          KM    L= .473 mi.  Lca= .208 mi.   S=  687.1 ft/mi.  Kn= .065  LAG=  11.2 min.
1638          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1639          BA    .068
1640          LG     .31     .35    4.16     .56   15.89
1641          UI     50.    151.    198.     89.     27.      6.      0.      0.      0.      0.
1642          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1643          KK    C10Y
1644          KM    COMBINE HYDROGRAPHS AT DA-10Y
1645          KM    This hydrograph is the total flow from the entire Deadman Wash watershed
1646          KM    area just upstream of it's confluence with New River.
1647          HC       2
1648          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  37         10A
              V
              V
  47      R10A-B
              .
              .
  54          .         10B
              .           .
              .           .
  65        C10B............
              V
              V
  68      R10B-C
              .
              .
  75          .         10C
              .           .
              .           .
  86        C10C............
              V
              V
  89      R10C-D
              .
              .
  96          .          1A
              .           .
              .           .
 110          .           .        10D
              .           .         .
              .           .         .
 120          .           .         .        10E
              .           .         .         .
              .           .         .         .
 132        C10E...................................
              V
              V
 137      R10E-F
              .
              .
 144          .         10F
              .           .
              .           .
 154          .           .         2A
              .           .         .
              .           .         .
 165          .           .         .         2B
              .           .         .         .
              .           .         .         .
 175          .           .       C2B............
              .           .         V
              .           .         V
 178          .           .     R2B-C
              .           .         .
              .           .         .
 185          .           .         .         2C
              .           .         .         .
              .           .         .         .
 197          .           .       C2C............
              .           .         .
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                .          .          .
201         C10F.......................
                V
                V
206       R10F-G
                .
                .
213             .        10G
                .          .
                .          .
223             .          .         3A
                .          .          V
                .          .          V
233             .          .      R3A-B
                .          .          .
                .          .          .
240             .          .          .        3B
                .          .          .         .
                .          .          .         .
250             .          .          .         .        3C
                .          .          .         .         .
                .          .          .         .         .
260             .          .        C3C.......................
                .          .          V
                .          .          V
263             .          .      R3C-D
                .          .          .
                .          .          .
270             .          .          .        3D
                .          .          .         .
                .          .          .         .
282             .          .        C3D............
                .          .          .
                .          .          .
286         C10G.......................
                V
                V
291       R10G-H
                .
                .
298             .         4A
                .          .
                .          .
310             .          .         4B
                .          .          .
                .          .          .
321             .        C4B............
                .          V
                .          V
324             .      R4B-C
                .          .
                .          .
331             .          .         4C
                .          .          .
                .          .          .
342             .        C4C............
                .          V
                .          V
345             .      R4C-D
                .          .
                .          .
352             .          .         4D
                .          .          .
                .          .          .
363             .        C4D............
                .          V
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                .          V
366             .      R4D-E
                .          .
                .          .
373             .          .          4E
                .          .           .
                .          .           .
383             .       C4E............
                .          .
                .          .
387             .          .          5A
                .          .           V
                .          .           V
398             .          .       R5A-B
                .          .           .
                .          .           .
405             .          .           .          5B
                .          .           .           .
                .          .           .           .
415             .          .        C5B............
                .          .           .
                .          .           .
418             .          .           .          5C
                .          .           .           .
                .          .           .           .
427             .          .           .           .          5D
                .          .           .           .           .
                .          .           .           .           .
436             .          .           .        C5D............
                .          .           .           V
                .          .           .           V
439             .          .           .      R5D-E
                .          .           .           .
                .          .           .           .
446             .          .           .           .          5E
                .          .           .           .           .
                .          .           .           .           .
455             .          .        C5E........................
                .          .           V
                .          .           V
458             .          .       R5E-F
                .          .           .
                .          .           .
465             .          .           .          5F
                .          .           .           .
                .          .           .           .
477             .          .        C5F............
                .          .           .
                .          .           .
480             .          .           .          5G
                .          .           .           .
                .          .           .           .
492             .          .        C5G............
                .          .           .
                .          .           .
496             .          .           .          6A
                .          .           .           V
                .          .           .           V
507             .          .           .      R6A-B
                .          .           .           .
                .          .           .           .
514             .          .           .           .          6B
                .          .           .           .           .
                .          .           .           .           .
525             .          .           .        C6B............
                .          .           .           .
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529
                                  7A
                                  V
                                  V
544                            R7A-B
                                  .
                                  .
551                               .        7B
                                  .         .
                                  .         .
561                            C7B...........
                                  .
                                  .
564                               .        7C
                                  .         V
                                  .         V
574                               .      R7C-D
                                  .         .
                                  .         .
581                               .         .        7D
                                  .         .         .
                                  .         .         .
591                               .      C7D...........
                                  .         .
                                  .         .
594                               .         .        7E
                                  .         .         V
                                  .         .         V
604                               .         .      R7E-F
                                  .         .         .
                                  .         .         .
611                               .         .         .        7F
                                  .         .         .         .
                                  .         .         .         .
621                            C7F..................................
                                  V
                                  V
624                            R7F-G
                                  .
                                  .
631                               .        7G
                                  .         .
                                  .         .
641                          C7G........................
                                  V
                                  V
646                          R7G-H
                                  .
                                  .
653                               .        7H
                                  .         .
                                  .         .
664                       C7H........................
                                  V
                                  V
669                       R7H-C
                                  .
                                  .
676                               .        8A
                                  .         V
                                  .         V
687                               .       R8A
                                  .         V
                                  .         V
695                               .      R8A-B
                                  .         .
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                .          .          .          .
702             .          .          .          .          8B
                .          .          .          .           .
                .          .          .          .           .
713             .          .          .        C8B............
                .          .          .          V
                .          .          .          V
716             .          .          .      R8B-C
                .          .          .          .
                .          .          .          .
723             .          .          .          .          8C
                .          .          .          .           .
                .          .          .          .           .
736             .          .          .      C8C1............
                .          .          .          .
                .          .          .          .
739             .          .      C8C2............
                .          .         V
                .          .         V
744             .          .     R8C-D
                .          .          .
                .          .          .
751             .          .          .         8D
                .          .          .          .
                .          .          .          .
760             .          .       C8D............
                .          .          .
                .          .          .
765             .          .          .        10H
                .          .          .          .
                .          .          .          .
775          C10H...................................
                V
                V
781          R10H
                V
                V
789         R10H-I
                .
                .
796             .       10I
                .          .
                .          .
807             .          .       10J
                .          .          .
                .          .          .
818          C10J......................
                V
                V
821         R10J-K
                .
                .
828             .       10K
                .          .
                .          .
838             .          .       10L
                .          .          .
                .          .          .
850          C10L......................
                V
                V
853         R10L-M
                .
                .
860             .       10M
                .          .
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                .          .
870          C10M............
                V
                V
873          R10M
                V
                V
882         R10M-N
                .
                .
889             .         10N
                .          .
                .          .
899             .          .        10O
                .          .         .
                .          .         .
909             .          .         .        10P
                .          .         .         .
                .          .         .         .
920          C10P...................................
                V
                V
923         R10P-Q
                .
                .
930             .         10Q
                .          .
                .          .
941             .          .         9A
                .          .         V
                .          .         V
953             .          .       R9A-B
                .          .         .
                .          .         .
960             .          .         .         9B
                .          .         .         .
                .          .         .         .
972             .          .        C9B............
                .          .         .
                .          .         .
976          C10Q........................
                V
                V
981         R10Q-R
                .
                .
988             .         10R
                .          .
                .          .
998          C10R............
                .
                .
1007            .-------> DIV12A
1003        DIV10R
                V
                V
1010        R10R-S
                .
                .
1017            .         10S
                .          .
                .          .
1031         C10S............
                V
                V
1035        R10S-T
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            .
            .
1045        .          .<-------  DIV12A
1042        .     DIV12A
            .          V
            .          V
1046        .     R10R-A
            .          .
            .          .
1053        .          .        12A
            .          .          V
            .          .          V
1063        .          .       R12A
            .          .          .
            .          .          .
1072        .       C12A............
            .          V
            .          V
1077        .     R12A-B
            .          .
            .          .
1084        .          .        12B
            .          .          .
            .          .          .
1094        .       C12B............
            .          .
            .          .
1098        .          .        10T
            .          .          .
            .          .          .
1108      C10T........................
            V
            V
1113    R10T-U
            .
            .
1120        .        10U
            .          .
            .          .
1131        .          .        11A
            .          .          V
            .          .          V
1141        .          .     R11A-B
            .          .          .
            .          .          .
1148        .          .          .        11B
            .          .          .          .
            .          .          .          .
1159        .          .       C11B............
            .          .          V
            .          .          V
1162        .          .       R11B
            .          .          V
            .          .          V
1170        .          .     R11B-D
            .          .          .
            .          .          .
1177        .          .          .        11D
            .          .          .          .
            .          .          .          .
1187        .          .       C11D............
            .          .          V
            .          .          V
1190        .          .     R11D-F
            .          .          .
            .          .          .
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1197    .       .       .       11E
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        .       .       .        .
1210    .       .       .        .       11F
        .       .       .        .        .
        .       .       .        .        .
1220    .       .     C11F.......................
        .       .       V
        .       .       V
1224    .       .     R11F
        .       .       V
        .       .       V
1232    .       .   R11F-G
        .       .       .
        .       .       .
1239    .       .       .       11C
        .       .       .        V
        .       .       .        V
1248    .       .       .     R11C-G
        .       .       .        .
        .       .       .        .
1255    .       .       .        .       11G
        .       .       .        .        .
        .       .       .        .        .
1265    .       .     C11G.......................
        .       .       V
        .       .       V
1268    .       .   R11G-I
        .       .       .
        .       .       .
1275    .       .       .       11H
        .       .       .        V
        .       .       .        V
1285    .       .       .     R11H-I
        .       .       .        .
        .       .       .        .
1292    .       .       .        .       11I
        .       .       .        .        .
        .       .       .        .        .
1303    .       .     C11I.......................
        .       .       V
        .       .       V
1306    .       .   R11I-J
        .       .       .
        .       .       .
1313    .       .       .       11J
        .       .       .        .
        .       .       .        .
1324    .       .       .        .       11K
        .       .       .        .        .
        .       .       .        .        .
1335    .       .     C11K.......................
        .       .       V
        .       .       V
1338    .       .   R11K-L
        .       .       .
        .       .       .
1345    .       .       .       11L
        .       .       .        .
        .       .       .        .
1358    .       .     C11L............
        .       .       V
        .       .       V
1361    .       .   R11L-M
        .       .       .
        .       .       .
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1368          .           .           .         11M
              .           .           .           .
              .           .           .           .
1381          .           .       C11M............
              .           .          V
              .           .          V
1384          .           .     R11M-N
              .           .           .
              .           .           .
1391          .           .           .         11N
              .           .           .           .
              .           .           .           .
1401          .           .       C11N............
              .           .           .
              .           .           .
1405        C10U........................
              V
              V
1410      R10U-V
              .
              .
1417          .         10V
              .           .
              .           .
1428        C10V............
              V
              V
1431      R10V-W
              .
              .
1438          .         14A
              .           V
              .           V
1449          .      R14A-B
              .           .
              .           .
1456          .           .         14B
              .           .           .
              .           .           .
1468          .           .           .         14C
              .           .           .           .
              .           .           .           .
1480          .        C14C........................
              .           V
              .           V
1483          .      R14C-D
              .           .
              .           .
1490          .           .         14D
              .           .           .
              .           .           .
1500          .        C14D............
              .           .
              .           .
1503          .           .         14E
              .           .           V
              .           .           V
1515          .           .     R14E-F
              .           .           .
              .           .           .
1522          .           .           .         14F
              .           .           .           .
              .           .           .           .
1533          .        C14F........................
              .           V
              .           V
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1536          .      R14F-G
              .          .
              .          .
1543          .          .         14G
              .          .          .
              .          .          .
1553          .        C14G............
              .          .
              .          .
1557          .          .         10W
              .          .          .
              .          .          .
1567        C10W........................
              V
              V
1572      R10W-X
              .
              .
1579          .         15A
              .          V
              .          V
1589          .      R15A-B
              .          .
              .          .
1596          .          .         15B
              .          .          .
              .          .          .
1607          .        C15B............
              .          .
              .          .
1611          .          .         10X
              .          .          .
              .          .          .
1622        C10X........................
              V
              V
1627      R10X-Y
              .
              .
1634          .         10Y
              .          .
              .          .
1643        C10Y............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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HEC1 S/N:                    HMVersion: 6.00    Data File: DM6HRR1.hc1

****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*            SEPTEMBER 1990            *                    *   HYDROLOGIC ENGINEERING CENTER      *
*             VERSION 4.0              *                    *          609 SECOND STREET           *
*                                      *                    *       DAVIS, CALIFORNIA 95616        *
* RUN DATE  08/06/1992  TIME  13:32:38 *                    *           (916) 756-1104             *
*                                      *                    *                                      *
****************************************                    ****************************************


                         DEADMAN WASH FLOOD INSURANCE STUDY

                         100-YEAR, 6-HOUR STORM,  FCDMD DISTRIBUTION
                         Kn VALUES USED FROM MANNING'S n DETERMINATION REPORT

                         HOWARD NEEDLES TAMMEN & BERGENDOFF
                         HNTB PROJECT NO. 15081
                         JUNE, 1992
                         FILE:  DM6HRR1.HC1     CREATED BY: BGS


 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

 16 JD          INDEX STORM NO. 1
                       STRM       3.37  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA

 17 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
```

```
                .03      .01      .01      .01      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

20 JD        INDEX STORM NO. 2
                STRM        3.35  PRECIPITATION DEPTH
                TRDA         .50  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .01      .01      .01      .01      .01      .01      .03
                .03      .03      .05      .05      .05      .15      .15      .15      .03      .03
                .03      .01      .01      .01      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

21 JD        INDEX STORM NO. 3
                STRM        3.30  PRECIPITATION DEPTH
                TRDA        2.80  TRANSPOSITION DRAINAGE AREA

22 PI          PRECIPITATION PATTERN
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .01      .01      .01      .01      .01      .01      .03
                .03      .03      .07      .07      .07      .08      .08      .08      .05      .05
                .05      .02      .02      .02      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

25 JD        INDEX STORM NO. 4
                STRM        3.10  PRECIPITATION DEPTH
                TRDA       16.00  TRANSPOSITION DRAINAGE AREA

26 PI          PRECIPITATION PATTERN
                .01      .01      .00      .00      .00      .00      .00      .00      .00      .01
                .01      .01      .00      .01      .00      .00      .00      .00      .00      .00
                .00      .00      .01      .00      .00      .00      .00      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .02      .02      .02      .03
                .03      .03      .06      .06      .06      .07      .07      .07      .04      .04
                .04      .02      .02      .02      .01      .01      .01      .01      .01      .01
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

29 JD        INDEX STORM NO. 5
                STRM        2.73  PRECIPITATION DEPTH
                TRDA       90.00  TRANSPOSITION DRAINAGE AREA

30 PI          PRECIPITATION PATTERN
                .01      .01      .01      .00      .00      .00      .01      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .02      .02      .02      .03
                .03      .03      .05      .05      .05      .05      .05      .05      .04      .04
                .04      .02      .02      .02      .02      .02      .02      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                .01      .01

33 JD        INDEX STORM NO. 6
                STRM        1.92  PRECIPITATION DEPTH
                TRDA      500.00  TRANSPOSITION DRAINAGE AREA

34 PI          PRECIPITATION PATTERN
                .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
```

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.03
.03	.03	.04	.04	.04	.04	.04	.04	.04	.04
.04	.03	.03	.03	.02	.02	.02	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01								

WARNING EXCESS AT PONDING LESS THAN ZERO FOR PERIOD. EXCESS SET TO ZERO

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10A	358.	4.08	34.	9.	8.	.15		
ROUTED TO	R10A-B	292.	4.33	34.	9.	8.	.15		
HYDROGRAPH AT	10B	750.	4.42	100.	25.	24.	.37		
2 COMBINED AT	C10B	1018.	4.33	133.	33.	32.	.52		
ROUTED TO	R10B-C	938.	4.58	133.	33.	32.	.52		
HYDROGRAPH AT	10C	1123.	4.58	183.	46.	44.	.69		
2 COMBINED AT	C10C	1837.	4.58	312.	78.	75.	1.21		
ROUTED TO	R10C-D	1749.	4.75	311.	78.	75.	1.21		
HYDROGRAPH AT	1A	644.	5.00	138.	34.	33.	.58		
HYDROGRAPH AT	10D	276.	4.33	29.	7.	7.	.16		
HYDROGRAPH AT	10E	781.	4.75	148.	37.	36.	.56		
4 COMBINED AT	C10E	2767.	4.75	608.	152.	146.	2.49		
ROUTED TO	R10E-F	2720.	4.92	608.	152.	146.	2.49		
HYDROGRAPH AT	10F	184.	4.25	18.	5.	4.	.08		
HYDROGRAPH AT	2A	607.	4.25	87.	22.	21.	.38		
HYDROGRAPH AT	2B	298.	4.17	32.	8.	8.	.14		
2 COMBINED AT	C2B	854.	4.25	119.	30.	29.	.52		
ROUTED TO	R2B-C	691.	4.67	115.	29.	28.	.52		
HYDROGRAPH AT	2C	771.	4.83	143.	36.	34.	.65		
2 COMBINED AT	C2C	1301.	4.75	248.	62.	60.	1.18		
3 COMBINED AT	C10F	3649.	4.83	841.	211.	203.	3.75		
ROUTED TO	R10F-G	3626.	4.92	840.	211.	203.	3.75		
HYDROGRAPH AT	10G	310.	4.33	37.	9.	9.	.14		
HYDROGRAPH AT	3A	283.	4.08	27.	7.	6.	.12		
ROUTED TO	R3A-B	236.	4.25	26.	7.	6.	.12		
HYDROGRAPH AT	3B	517.	4.25	59.	15.	14.	.23		
HYDROGRAPH AT	3C	280.	4.17	24.	6.	6.	.11		
3 COMBINED AT	C3C	1011.	4.25	109.	27.	26.	.46		
ROUTED TO	R3C-D	808.	4.75	109.	27.	26.	.46		

HYDROGRAPH AT	3D	503.	4.83	101.	25.	24.	.35
2 COMBINED AT	C3D	1218.	4.75	206.	52.	50.	.82
3 COMBINED AT	C10G	4475.	4.92	1053.	264.	254.	4.70
ROUTED TO	R10G-H	4364.	5.08	1052.	264.	254.	4.70
HYDROGRAPH AT	4A	458.	4.75	86.	22.	21.	.30
HYDROGRAPH AT	4B	567.	4.17	61.	15.	15.	.26
2 COMBINED AT	C4B	768.	4.17	146.	37.	35.	.56
ROUTED TO	R4B-C	677.	4.67	146.	37.	35.	.56
HYDROGRAPH AT	4C	1212.	4.50	198.	50.	48.	.69
2 COMBINED AT	C4C	1661.	4.58	340.	85.	82.	1.26
ROUTED TO	R4C-D	1639.	4.58	340.	85.	82.	1.26
HYDROGRAPH AT	4D	385.	4.17	43.	11.	10.	.20
2 COMBINED AT	C4D	1757.	4.58	379.	95.	91.	1.46
ROUTED TO	R4D-E	1710.	4.75	378.	95.	91.	1.46
HYDROGRAPH AT	4E	371.	4.08	35.	9.	8.	.17
2 COMBINED AT	C4E	1739.	4.75	409.	102.	99.	1.63
HYDROGRAPH AT	5A	800.	4.25	108.	27.	26.	.48
ROUTED TO	R5A-B	766.	4.33	107.	27.	26.	.48
HYDROGRAPH AT	5B	158.	4.17	14.	3.	3.	.06
2 COMBINED AT	C5B	854.	4.33	120.	30.	29.	.55
HYDROGRAPH AT	5C	131.	4.08	10.	2.	2.	.05
HYDROGRAPH AT	5D	264.	4.08	19.	5.	5.	.09
2 COMBINED AT	C5D	395.	4.08	29.	7.	7.	.14
ROUTED TO	R5D-E	365.	4.17	28.	7.	7.	.14
HYDROGRAPH AT	5E	164.	4.08	11.	3.	3.	.06
3 COMBINED AT	C5E	1147.	4.25	155.	39.	38.	.75
ROUTED TO	R5E-F	958.	4.67	152.	38.	37.	.75
HYDROGRAPH AT	5F	505.	4.75	87.	22.	21.	.38
2 COMBINED AT	C5F	1334.	4.75	233.	58.	56.	1.13
HYDROGRAPH AT	5G	551.	4.83	108.	27.	26.	.40
2 COMBINED AT	C5G	1746.	4.75	334.	84.	81.	1.53
HYDROGRAPH AT	6A	704.	4.58	114.	29.	28.	.50
ROUTED TO	R6A-B	645.	4.83	114.	29.	28.	.50

HYDROGRAPH AT	6B	348.	4.42	46.	11.	11.	.19
2 COMBINED AT	C6B	786.	4.75	157.	39.	38.	.69
HYDROGRAPH AT	7A	1499.	4.75	410.	105.	101.	2.04
ROUTED TO	R7A-B	1467.	4.83	409.	105.	101.	2.04
HYDROGRAPH AT	7B	118.	4.17	10.	3.	2.	.04
2 COMBINED AT	C7B	1471.	4.83	418.	107.	103.	2.08
HYDROGRAPH AT	7C	117.	4.17	10.	2.	2.	.05
ROUTED TO	R7C-D	98.	4.33	10.	2.	2.	.05
HYDROGRAPH AT	7D	96.	4.17	9.	2.	2.	.03
2 COMBINED AT	C7D	162.	4.25	19.	5.	5.	.08
HYDROGRAPH AT	7E	192.	4.25	18.	4.	4.	.09
ROUTED TO	R7E-F	175.	4.33	17.	4.	4.	.09
HYDROGRAPH AT	7F	147.	4.08	12.	3.	3.	.05
4 COMBINED AT	C7F	1544.	4.83	460.	118.	113.	2.30
ROUTED TO	R7F-G	1512.	5.00	459.	117.	113.	2.30
HYDROGRAPH AT	7G	156.	4.33	17.	4.	4.	.07
3 COMBINED AT	C7G	2085.	4.92	607.	155.	149.	3.07
ROUTED TO	R7G-H	2022.	5.17	604.	154.	148.	3.07
HYDROGRAPH AT	7H	263.	4.50	37.	9.	9.	.16
3 COMBINED AT	C7H	3170.	5.00	923.	234.	225.	4.76
ROUTED TO	R7H-C	3159.	5.00	922.	234.	225.	4.76
HYDROGRAPH AT	8A	664.	4.58	100.	25.	24.	.44
ROUTED TO	R8A	648.	4.67	100.	25.	24.	.44
ROUTED TO	R8A-B	620.	4.75	100.	25.	24.	.44
HYDROGRAPH AT	8B	551.	4.42	79.	20.	19.	.28
2 COMBINED AT	C8B	949.	4.50	178.	44.	43.	.72
ROUTED TO	R8B-C	852.	5.33	176.	44.	42.	.72
HYDROGRAPH AT	8C	953.	4.92	209.	52.	50.	.78
2 COMBINED AT	C8C1	1473.	5.17	380.	95.	92.	1.51
2 COMBINED AT	C8C2	4301.	5.08	1254.	317.	306.	6.26
ROUTED TO	R8C-D	4263.	5.17	1254.	317.	306.	6.26
HYDROGRAPH AT	8D	104.	4.08	6.	2.	2.	.04
2 COMBINED AT	C8D	4263.	5.17	1258.	318.	307.	6.30

HYDROGRAPH AT	10H	157.	4.25	15.	4.	4.	.08
4 COMBINED AT	C10H	8829.	5.08	2528.	637.	614.	12.72
ROUTED TO	R10H	8829.	5.08	2528.	637.	614.	12.72
ROUTED TO	R10H-I	8777.	5.17	2527.	637.	614.	12.72
HYDROGRAPH AT	10I	315.	4.42	38.	10.	9.	.18
HYDROGRAPH AT	10J	1352.	4.67	248.	62.	60.	.92
3 COMBINED AT	C10J	9339.	5.08	2759.	695.	670.	13.82
ROUTED TO	R10J-K	9131.	5.33	2753.	694.	668.	13.82
HYDROGRAPH AT	10K	871.	4.25	81.	20.	20.	.42
HYDROGRAPH AT	10L	564.	4.33	83.	21.	20.	.41
3 COMBINED AT	C10L	9142.	5.33	2846.	719.	692.	14.65
ROUTED TO	R10L-M	9077.	5.42	2844.	718.	692.	14.65
HYDROGRAPH AT	10M	753.	4.17	67.	17.	16.	.34
2 COMBINED AT	C10M	9077.	5.42	2886.	729.	703.	14.99
ROUTED TO	R10M	9045.	5.42	2881.	728.	702.	14.99
ROUTED TO	R10M-N	8893.	5.58	2878.	728.	701.	14.99
HYDROGRAPH AT	10N	156.	4.17	13.	3.	3.	.07
HYDROGRAPH AT	10O	209.	4.33	21.	5.	5.	.12
HYDROGRAPH AT	10P	1120.	4.50	159.	40.	38.	.77
4 COMBINED AT	C10P	8893.	5.58	3001.	760.	732.	15.96
ROUTED TO	R10P-Q	8594.	6.08	2989.	757.	729.	15.96
HYDROGRAPH AT	10Q	505.	4.25	65.	16.	16.	.33
HYDROGRAPH AT	9A	1352.	4.67	265.	66.	64.	.98
ROUTED TO	R9A-B	1231.	5.25	263.	66.	63.	.98
HYDROGRAPH AT	9B	975.	4.75	186.	46.	45.	.70
2 COMBINED AT	C9B	1767.	5.00	444.	111.	107.	1.67
3 COMBINED AT	C10Q	8949.	6.00	3364.	854.	823.	17.96
ROUTED TO	R10Q-R	8949.	6.08	3363.	854.	822.	17.96
HYDROGRAPH AT	10R	210.	4.25	21.	5.	5.	.09
2 COMBINED AT	C10R	8946.	6.08	3378.	858.	826.	18.04
DIVERSION TO	DIV12A	4024.	6.08	1519.	386.	372.	18.04
HYDROGRAPH AT	DIV10R	4918.	6.08	1857.	472.	454.	18.04
ROUTED TO	R10R-S	4849.	6.33	1842.	468.	451.	18.04

HYDROGRAPH AT	10S	932.	5.42	288.	72.	70.	1.02
2 COMBINED AT	C10S	5223.	6.25	2071.	528.	509.	19.07
ROUTED TO	R10S-T	5206.	6.33	2068.	528.	508.	19.07
HYDROGRAPH AT	DIV12A	4024.	6.08	1519.	386.	372.	18.04
ROUTED TO	R10R-A	3459.	6.50	1508.	384.	370.	18.04
HYDROGRAPH AT	12A	148.	4.25	14.	4.	3.	.08
ROUTED TO	R12A	131.	4.42	14.	4.	3.	.08
2 COMBINED AT	C12A	4864.	6.33	1922.	488.	470.	.08
ROUTED TO	R12A-B	4801.	6.58	1917.	487.	469.	.08
HYDROGRAPH AT	12B	296.	4.17	24.	6.	6.	.15
2 COMBINED AT	C12B	4801.	6.58	1934.	493.	475.	.23
HYDROGRAPH AT	10T	188.	4.17	16.	4.	4.	.07
3 COMBINED AT	C10T	8355.	6.50	3575.	915.	881.	19.36
ROUTED TO	R10T-U	8182.	6.92	3563.	912.	878.	19.36
HYDROGRAPH AT	10U	755.	4.58	112.	28.	27.	.49
HYDROGRAPH AT	11A	401.	4.08	35.	9.	8.	.16
ROUTED TO	R11A-B	368.	4.17	35.	9.	8.	.16
HYDROGRAPH AT	11B	426.	4.17	43.	11.	10.	.22
2 COMBINED AT	C11B	794.	4.17	77.	19.	19.	.38
ROUTED TO	R11B	511.	4.33	77.	19.	19.	.38
ROUTED TO	R11B-D	506.	4.42	77.	19.	19.	.38
HYDROGRAPH AT	11D	205.	4.33	22.	6.	5.	.11
2 COMBINED AT	C11D	698.	4.33	99.	25.	24.	.49
ROUTED TO	R11D-F	682.	4.42	99.	25.	24.	.49
HYDROGRAPH AT	11E	497.	4.50	87.	22.	21.	.42
HYDROGRAPH AT	11F	571.	4.33	71.	18.	17.	.26
3 COMBINED AT	C11F	1479.	4.42	244.	61.	59.	1.17
ROUTED TO	R11F	1380.	4.50	244.	61.	59.	1.17
ROUTED TO	R11F-G	1322.	4.75	244.	61.	59.	1.17
HYDROGRAPH AT	11C	143.	4.00	9.	2.	2.	.05
ROUTED TO	R11C-G	94.	4.42	9.	2.	2.	.05
HYDROGRAPH AT	11G	920.	4.17	86.	21.	21.	.35
3 COMBINED AT	C11G	1437.	4.67	329.	83.	80.	1.58

ROUTED TO	R11G-I	1410.	4.92	329.	83.	80.	1.58
HYDROGRAPH AT	11H	394.	4.33	49.	12.	12.	.17
ROUTED TO	R11H-I	340.	4.67	49.	12.	12.	.17
HYDROGRAPH AT	11I	918.	4.58	150.	37.	36.	.53
3 COMBINED AT	C11I	2270.	4.67	517.	130.	125.	2.28
ROUTED TO	R11I-J	2130.	5.25	515.	130.	125.	2.28
HYDROGRAPH AT	11J	1255.	4.58	223.	56.	54.	.84
HYDROGRAPH AT	11K	756.	4.42	92.	23.	22.	.43
3 COMBINED AT	C11K	2686.	5.08	797.	201.	194.	3.54
ROUTED TO	R11K-L	2666.	5.17	796.	201.	194.	3.54
HYDROGRAPH AT	11L	2317.	5.00	595.	149.	144.	2.22
2 COMBINED AT	C11L	4546.	5.08	1334.	336.	324.	5.77
ROUTED TO	R11L-M	4522.	5.17	1333.	336.	324.	5.77
HYDROGRAPH AT	11M	915.	5.00	212.	53.	51.	.78
2 COMBINED AT	C11M	5141.	5.17	1518.	383.	369.	6.55
ROUTED TO	R11M-N	5122.	5.25	1517.	383.	369.	6.55
HYDROGRAPH AT	11N	504.	4.33	63.	16.	15.	.23
2 COMBINED AT	C11N	5156.	5.25	1569.	397.	382.	6.78
3 COMBINED AT	C10U	8594.	6.83	4836.	1246.	1200.	26.63
ROUTED TO	R10U-V	8507.	7.17	4821.	1245.	1199.	26.63
HYDROGRAPH AT	10V	1381.	4.42	168.	42.	40.	.96
2 COMBINED AT	C10V	8487.	7.17	4875.	1268.	1221.	27.59
ROUTED TO	R10V-W	8401.	7.33	4850.	1263.	1216.	27.59
HYDROGRAPH AT	14A	3154.	4.67	672.	168.	162.	2.41
ROUTED TO	R14A-B	2894.	5.17	672.	168.	162.	2.41
HYDROGRAPH AT	14B	1166.	4.75	231.	58.	56.	.82
HYDROGRAPH AT	14C	985.	4.83	205.	51.	49.	.73
3 COMBINED AT	C14C	4085.	5.08	1080.	270.	260.	3.96
ROUTED TO	R14C-D	4001.	5.25	1079.	270.	260.	3.96
HYDROGRAPH AT	14D	505.	4.33	54.	14.	13.	.24
2 COMBINED AT	C14D	4005.	5.25	1125.	281.	271.	4.20
HYDROGRAPH AT	14E	893.	4.83	188.	47.	45.	.67
ROUTED TO	R14E-F	836.	5.17	188.	47.	45.	.67

HYDROGRAPH AT	14F	522.	4.50	78.	20.	19.	.28
3 COMBINED AT	C14F	4722.	5.17	1366.	342.	329.	5.14
ROUTED TO	R14F-G	4671.	5.33	1364.	341.	329.	5.14
HYDROGRAPH AT	14G	186.	4.25	16.	4.	4.	.09
2 COMBINED AT	C14G	4671.	5.33	1376.	344.	332.	5.22
HYDROGRAPH AT	10W	1049.	4.25	92.	23.	22.	.53
3 COMBINED AT	C10W	8841.	5.83	5879.	1541.	1484.	33.34
ROUTED TO	R10W-X	8811.	5.92	5868.	1539.	1482.	33.34
HYDROGRAPH AT	15A	181.	4.17	18.	5.	4.	.06
ROUTED TO	R15A-B	141.	4.75	18.	5.	4.	.06
HYDROGRAPH AT	15B	659.	4.50	92.	23.	22.	.39
2 COMBINED AT	C15B	705.	4.58	110.	28.	27.	.45
HYDROGRAPH AT	10X	239.	4.17	26.	6.	6.	.15
3 COMBINED AT	C10X	8834.	5.92	5932.	1559.	1502.	33.94
ROUTED TO	R10X-Y	8812.	6.00	5927.	1558.	1500.	33.94
HYDROGRAPH AT	10Y	186.	4.08	12.	3.	3.	.07
2 COMBINED AT	C10Y	8810.	6.00	5927.	1559.	1501.	34.01

*** NORMAL END OF HEC-1 ***
Elapsed Time - 00:08:08.07 (488.07 Seconds)
NORMAL END OF HEC-1

HEC1 S/N: HMVersion: 6.00 Data File: DM24HRR1.hc1

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
* RUN DATE  08/06/1992  TIME  13:56:08 *
*                                      *
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*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::
:::                                  :::
:::  Full Microcomputer Implementation :::
:::                by                :::
:::       Haestad Methods, Inc.      :::
:::                                  :::
::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::
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37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID
  2           ID        DEADMAN WASH FLOOD INSURANCE STUDY
  3           ID
  4           ID        100-YEAR, 24-HOUR STORM,  SCS TYPE II DISTRIBUTION
  5           ID        Kn VALUES USED FROM MANNING'S n DETERMINATION REPORT
  6           ID
  7           ID        HOWARD NEEDLES TAMMEN & BERGENDOFF
  8           ID        HNTB PROJECT NO. 15081
  9           ID        JUNE, 1992
 10           ID        FILE:  DM24HRR1.HC1     CREATED BY: BGS
 11           ID
 12           ID
              *DIAGRAM
 13           IT       5                    300
 14           IO       5
 15           IN      30
 16           JD    4.38    0.01
 17           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 18           PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 19           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 20           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 21           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 22           JD    4.25    0.50
 23           JD    4.16    10.0
 24           JD    3.85    50.0
 25           JD    3.72   100.0
 26           JD    3.42   500.0

 27           KK     10A
 28           KM    SUB-BASIN DA-10A
 29           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 30           KM    L= .663 mi.  Lca= .341 mi.   S= 1081.4 ft/mi.  Kn= .070   LAG=  15.2 min.
 31           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 32           BA    .150
 33           LG     .25     .35    3.71     .42   32.13
 34           UI     54.    199.    318.    194.    137.     88.     60.     39.     26.     16.
 35           UI     10.      6.      6.      6.      0.      0.      0.      0.      0.      0.
 36           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 37           KK  R10A-B
 38           KM    ROUTE FLOWS FROM DA-10A TO DA-10B
 39           RS       4    FLOW      -1
 40           RL                    .024    1948
 41           RC    .090    .070    .090    5800   0.031
 42           RX     600     976     978     988    1010    1042    1050    1152
 43           RY    1962    1958    1954    1948    1948    1954    1958    1962

 44           KK     10B
 45           KM    SUB-BASIN DA-10B
 46           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 47           KM    L= 1.098 mi. Lca= .625 mi.   S=  163.9 ft/mi.  Kn= .070  LAG=  33.2 min.
 48           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 49           BA    .371
 50           LG     .34     .20    9.40     .02     .50
 51           UI     38.     78.    165.    214.    266.    368.    457.    345.    276.    215.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  52          UI    164.     88.     64.     45.     34.     12.     12.     12.     12.      0.
  53          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  54          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  55          KK    C10B
  56          KM    COMBINE HYDROGRAPHS AT DA-10B
  57          HC      2

  58          KK  R10B-C
  59          KM    ROUTE FLOWS FROM DA-10B TO DA-10C
  60          RS      4    FLOW      -1
  61          RL                    .01    1834
  62          RC   .090    .070    .090    5000   0.015
  63          RX    500     925     978     988    1010    1080    1090    1545
  64          RY   1842    1839    1838    1834    1834    1837    1838    1842

  65          KK     10C
  66          KM    SUB-BASIN DA-10C
  67          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  68          KM    L= 1.856 mi. Lca= .739 mi.   S=  169.7 ft/mi.  Kn= .070  LAG=  42.9 min.
  69          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  70          BA    .685
  71          LG     .33     .20    9.40     .02     .01
  72          UI     54.     57.    189.    253.    303.    359.    434.    599.    654.    510.
  73          UI    430.    355.    294.    239.    159.     95.     88.     61.     54.     23.
  74          UI     16.     16.     16.     16.     16.      0.      0.      0.      0.      0.
  75          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

  76          KK    C10C
  77          KM    COMBINE HYDROGRAPHS AT DA-10C
  78          HC      2

  79          KK  R10C-D
  80          KM    ROUTE FLOWS FROM DA-10C TO DA-10D
  81          RS      3    FLOW      -1
  82          RL                   .226    1782
  83          RC   .080    .065    .080    2650  0.0132
  84          RX    645     860     935     990    1012    1028    1080    1560
  85          RY   1790    1785    1784    1782    1782    1784    1785    1790

  86          KK      1A
  87          KM    SUB-BASIN DA-1A
  88          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  89          KM    L= 2.841 mi. Lca= 1.533 mi.  S=   93.3 ft/mi.  Kn= .065  LAG=  69.5 min.
  90          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  91          KM    This is a total flow from the Stream No. 1 watershed area.
  92          BA    .577
  93          LG     .35     .25   10.10     .04     .00
  94          UI     28.     28.     28.     79.    105.    131.    145.    161.    177.    200.
  95          UI    223.    268.    336.    357.    299.    261.    234.    213.    187.    168.
  96          UI    148.    133.    111.     81.     53.     49.     46.     44.     28.     28.
  97          UI     28.     10.      9.      9.      9.      9.      9.      9.      9.      9.
  98          UI      9.      0.      0.      0.      0.      0.      0.      0.      0.      0.
  99          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 100          KK     10D
 101          KM    SUB-BASIN DA-10D
 102          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 103          KM    L= .985 mi.  Lca= .455 mi.   S=   91.4 ft/mi.  Kn= .065  LAG=  29.3 min.
 104          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 105          BA    .156
 106          LG     .35     .35    3.50     .29     .00
 107          UI     18.     47.     87.    112.    150.    218.    170.    131.     99.     69.
 108          UI     35.     27.     18.      7.      5.      5.      5.      0.      0.      0.
 109          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 110          KK     10E
 111          KM    SUB-BASIN DA-10E
 112          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 113          KM    L= 2.538 mi. Lca= 1.080 mi.  S=  108.4 ft/mi.  Kn= .065  LAG=  56.4 min.
 114          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 115          BA    .555
 116          LG     .35     .20    9.40     .02     .00
 117          UI     33.     33.     64.    120.    155.    178.    200.    230.    264.    340.
 118          UI    419.    375.    313.    275.    241.    208.    179.    157.    117.     80.
 119          UI     59.     55.     47.     33.     33.     15.     10.     10.     10.     10.
 120          UI     10.     10.     10.      0.      0.      0.      0.      0.      0.      0.
 121          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 122          KK    C10E
 123          KM    COMBINE HYDROGRAPHS AT DA-10E
 124          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 125          KM    confluence with Stream No. 1.
 126          HC       4

 127          KK  R10E-F
 128          KM    ROUTE FLOWS FROM DA-10E TO DA-10F
 129          RS       3    FLOW      -1
 130          RL                     .01    1766
 131          RC    .080    .065    .080    2500  0.0080
 132          RX     875     920     956     988    1012    1046    1095    1500
 133          RY    1780    1770    1769    1766    1766    1769    1771    1774

 134          KK     10F
 135          KM    SUB-BASIN DA-10F
 136          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 137          KM    L= .492 mi.  Lca= .322 mi.   S=   40.7 ft/mi.  Kn= .065  LAG=  23.0 min.
 138          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 139          BA    .078
 140          LG     .35     .25    8.20     .05     .00
 141          UI     11.     43.     65.     94.    133.     94.     66.     42.     19.     13.
 142          UI      6.      3.      3.      0.      0.      0.      0.      0.      0.      0.
 143          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 144          KK     2A
 145          KM    SUB-BASIN DA-2A
 146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 147          KM    L= 1.496 mi. Lca= .795 mi.   S=  778.7 ft/mi.  Kn= .070  LAG=  30.4 min.
 148          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 149          BA    .381
 150          LG     .24     .35    3.61     .39   31.14
 151          UI     42.     94.    210.    296.    391.    417.    267.    226.    191.    158.
 152          UI    122.    101.     88.     65.     53.     46.     34.     32.     21.     21.
 153          UI     18.      8.      8.      8.      8.      8.      8.      8.      0.      0.
 154          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 155          KK     2B
 156          KM    SUB-BASIN DA-2B
 157          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 158          KM    L= .795 mi.  Lca= .473 mi.   S=  911.9 ft/mi.  Kn= .070  LAG=  19.0 min.
 159          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 160          BA    .141
 161          LG     .23     .36    4.12     .33   28.99
 162          UI     31.    117.    200.    231.    140.    107.     75.     57.     38.     29.
 163          UI     20.     14.     12.      5.      5.      5.      5.      0.      0.      0.
 164          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 165          KK     C2B
 166          KM    COMBINE HYDROGRAPHS AT DA-2B
 167          HC      2

 168          KK   R2B-C
 169          KM    ROUTE FLOWS FROM DA-2B TO DA-2C
 170          RS      8    FLOW      -1
 171          RL                     .37    1898
 172          RC    .090    .070    .090   12300  0.0199
 173          RX     865     950     962     988    1012    1035    1045    1120
 174          RY    1913    1910    1906    1898    1898    1906    1910    1914

 175          KK     2C
 176          KM    SUB-BASIN DA-2C
 177          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 178          KM    L= 2.330 mi. Lca= 1.042 mi.  S=  105.2 ft/mi.  Kn= .070  LAG=  58.3min.
 179          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 180          BA    .655
 181          LG     .34     .28    8.28     .08     .96
 182          UI     38.     38.     65.    135.    171.    198.    223.    252.    290.    350.
 183          UI    456.    466.    382.    330.    295.    255.    223.    191.    163.    120.
 184          UI     77.     66.     62.     47.     38.     38.     13.     12.     12.     12.
 185          UI     12.     12.     12.     12.      0.      0.      0.      0.      0.      0.
 186          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 187          KK     C2C
 188          KM    COMBINE HYDROGRAPHS AT DA-2C
 189          KM    This hydrograph is a total flow from the Stream No. 2 watershed area.
 190          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 191          KK    C10F
 192          KM    COMBINE HYDROGRAPHS AT DA-10F
 193          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 194          KM    confluence with Stream No. 2.
 195          HC       3

 196          KK  R10F-G
 197          KM    ROUTE FLOWS FROM DA-10F TO DA-10G
 198          RS       1    FLOW      -1
 199          RL                    .298    1746
 200          RC    .080    .065    .080     900  0.0056
 201          RX     532     830     920     992    1015    1050    1112    1475
 202          RY    1760    1750    1749    1746    1746    1749    1750    1756

 203          KK     10G
 204          KM    SUB-BASIN DA-10G
 205          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 206          KM    L= .909 mi.  Lca= .341 mi.   S=   60.5 ft/mi.  Kn= .065  LAG=  27.5 min.
 207          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 208          BA    .138
 209          LG     .35     .20    9.40     .02     .00
 210          UI     17.     49.     86.    112.    161.    199.    144.    108.     79.     42.
 211          UI     28.     17.      9.      5.      5.      5.      0.      0.      0.      0.
 212          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 213          KK      3A
 214          KM    SUB-BASIN DA-3A
 215          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 216          KM    L= .682 mi.  Lca= .303 mi.   S=  909.1 ft/mi.  Kn= .070  LAG=  15.2 min.
 217          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 218          BA    .116
 219          LG     .21     .36    3.81     .34   29.33
 220          UI     42.    154.    246.    150.    106.     68.     47.     30.     20.     13.
 221          UI      8.      5.      5.      5.      0.      0.      0.      0.      0.      0.
 222          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 223          KK   R3A-B
 224          KM    ROUTE FLOWS FROM DA-3A TO DA-3B
 225          RS       4    FLOW      -1
 226          RL                    .226    1894
 227          RC    .090    .070    .090    3900  0.0205
 228          RX     845     968     974     988    1011    1022    1028    1325
 229          RY    1910    1900    1898    1894    1894    1898    1900    1910

 230          KK      3B
 231          KM    SUB-BASIN DA-3B
 232          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 233          KM    L= .928 mi.  Lca= .473 mi.   S=  215.5 ft/mi.  Kn= .070  LAG=  26.6 min.
 234          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 235          BA    .234
 236          LG     .29     .25   10.10     .04    6.00
 237          UI     30.     91.    155.    204.    306.    329.    237.    176.    121.     60.
 238          UI     42.     27.      9.      9.      9.      0.      0.      0.      0.      0.
 239          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 240          KK      3C
 241          KM    SUB-BASIN DA-3C
 242          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 243          KM    L= .682 mi.  Lca=  .303 mi.  S=  293.3 ft/mi.  Kn= .070  LAG=  18.8 min.
 244          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 245          BA    .112
 246          LG     .27     .35    7.50     .12    7.34
 247          UI     26.     91.    140.    229.    167.    110.     52.     27.     12.      6.
 248          UI      6.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 249          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 250          KK     C3C
 251          KM    COMBINE HYDROGRAPHS AT DA-3C
 252          HC       3

 253          KK   R3C-D
 254          KM    ROUTE FLOWS FROM DA-3C TO DA-3D
 255          RS       9    FLOW      -1
 256          RL                     .01    1806
 257          RC    .090    .070    .090    8900  0.0129
 258          RX     875     938     948     991    1008    1030    1078    1310
 259          RY    1820    1810    1808    1806    1806    1808    1810    1820

 260          KK      3D
 261          KM    SUB-BASIN DA-3D
 262          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 263          KM    L= 1.989 mi. Lca= 1.098 mi.  S=   83.0 ft/mi.  Kn= .070  LAG=  58.6 min.
 264          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 265          BA    .355
 266          LG     .35     .15   12.40     .01     .00
 267          UI     20.     20.     35.     72.     92.    107.    120.    135.    156.    186.
 268          UI    243.    254.    208.    180.    160.    139.    122.    104.     90.     67.
 269          UI     44.     36.     34.     27.     20.     20.      9.      6.      6.      6.
 270          UI      6.      6.      6.      6.      0.      0.      0.      0.      0.      0.
 271          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 272          KK     C3D
 273          KM    COMBINE HYDROGRAPHS AT DA-3D
 274          KM    This hydrograph is a total flow from the Stream No. 3 watershed area.
 275          HC       2

 276          KK    C10G
 277          KM    COMBINE HYDROGRAPHS AT DA-10G
 278          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 279          KM    confluence with Stream No. 3.
 280          HC       3

 281          KK  R10G-H
 282          KM    ROUTE FLOWS FROM DA-10G TO DA-10H
 283          RS       2    FLOW      -1
 284          RL                     .25    1736
 285          RC    .095    .075    .095    2600  0.0096
 286          RX     540     980     988     996    1011    1022    1042    1135
 287          RY    1750    1740    1738    1736    1736    1738    1740    1750
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 288          KK      4A
 289          KM    SUB-BASIN DA-4A
 290          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 291          KM    L= 1.837 mi. Lca= .871 mi.   S=   49.0 ft/mi.  Kn= .065  LAG=  53.4 min.
 292          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 293          BA    .303
 294          LG     .35     .15   12.40     .01     .00
 295          UI     19.     19.     43.     73.     92.    107.    121.    141.    168.    223.
 296          UI    237.    191.    164.    144.    122.    106.     91.     68.     45.     34.
 297          UI     31.     24.     19.     18.      6.      6.      6.      6.      6.      6.
 298          UI      6.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 299          UI      .0      0.      0.      0.      0.      0.      0.      0.      0.      0.

 300          KK      4B
 301          KM    SUB-BASIN DA-4B
 302          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 303          KM    L= .795 mi.  Lca= .473 mi.   S=  597.5 ft/mi.  Kn= .070  LAG=  20.6 min.
 304          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 305          BA    .262
 306          LG     .28     .28    8.28     .09    8.44
 307          UI     47.    183.    313.    434.    266.    207.    157.    110.     87.     60.
 308          UI     46.     33.     23.     21.      9.      8.      8.      8.      8.      0.
 309          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 310          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 311          KK     C4B
 312          KM    COMBINE HYDROGRAPHS AT DA-4B
 313          HC       2

 314          KK   R4B-C
 315          KM    ROUTE FLOWS FROM DA-4B TO DA-4C
 316          RS       7    FLOW      -1
 317          RL                     .01    1768
 318          RC    .058    .040    .058    3850  0.0052
 319          RX     475     810     992     996    1008    1012    1180    1380
 320          RY    1780    1772    1770    1768    1768    1770    1772    1780

 321          KK      4C
 322          KM    SUB-BASIN DA-4C
 323          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 324          KM    L= 1.667 mi. Lca= .473 mi.   S=   51.0 ft/mi.  Kn= .065  LAG=  40.5 min.
 325          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 326          BA    .693
 327          LG     .32     .15   12.40     .01     .48
 328          UI     58.     76.    211.    284.    338.    410.    517.    720.    611.    493.
 329          UI    411.    336.    273.    188.    106.     95.     67.     58.     22.     18.
 330          UI     18.     18.     18.     18.      0.      0.      0.      0.      0.      0.
 331          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 332          KK     C4C
 333          KM    COMBINE HYDROGRAPHS AT DA-4C
 334          HC       2

 335          KK   R4C-D
 336          KM    ROUTE FLOWS FROM DA-4C TO DA-4D
 337          RS       1    FLOW      -1
 338          RL                     .01    1764
 339          RC    .058    .040    .058     900  0.0167
 340          RX     624     820     994     998    1010    1014    1105    1195
 341          RY    1772    1768    1766    1764    1764    1766    1768    1772

 342          KK      4D
 343          KM    SUB-BASIN DA-4D
 344          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 345          KM    L= .928 mi.  Lca= .492 mi.   S=  454.7 ft/mi.  Kn= .070  LAG=  23.4 min.
 346          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 347          BA    .199
 348          LG     .27     .33    7.78     .12    6.47
 349          UI     29.    100.    190.    274.    238.    162.    131.    102.     74.     61.
 350          UI     43.     34.     26.     20.     14.     14.      6.      5.      5.      5.
 351          UI      5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 352          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 353          KK     C4D
 354          KM    COMBINE HYDROGRAPHS AT DA-4D
 355          HC       2

 356          KK   R4D-E
 357          KM    ROUTE FLOWS FROM DA-4D TO DA-4E
 358          RS       3    FLOW      -1
 359          RL                     .19    1746
 360          RC    .060    .048    .060    3100  0.0097
 361          RX     740     955     972     988    1004    1030    1035    1555
 362          RY    1760    1748    1747    1746    1746    1747    1748    1760

 363          KK      4E
 364          KM    SUB-BASIN DA-4E
 365          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 366          KM    L= .758 mi.  Lca= .417 mi.   S=  395.8 ft/mi.  Kn= .060  LAG=  17.9 min.
 367          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 368          BA    .172
 369          LG     .26     .37    7.14     .15    5.77
 370          UI     43.    163.    282.    264.    169.    125.     84.     63.     41.     30.
 371          UI     21.     16.      9.      6.      6.      6.      0.      0.      0.      0.
 372          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 373          KK     C4E
 374          KM    COMBINE HYDROGRAPHS AT DA-4E
 375          KM    This hydrograph is a total flow from the Stream No. 4 watershed area.
 376          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 377          KK      5A
 378          KM    SUB-BASIN DA-5A
 379          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 380          KM    L= 1.477 mi. Lca= .568 mi.   S=  612.7 ft/mi.  Kn= .070  LAG=  27.9 min.
 381          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
 382          BA    .482
 383          LG     .24     .35    3.77     .40   29.57
 384          UI     58.    151.    321.    437.    628.    431.    331.    278.    229.    176.
 385          UI    141.    120.     87.     70.     60.     45.     36.     28.     28.     13.
 386          UI     11.     11.     11.     11.     11.      0.      0.      0.      0.      0.
 387          UI      0.      0.      0.      0.      .0      0.      0.      0.      0.      0.

 388          KK   R5A-B
 389          KM    ROUTE FLOWS FROM DA-5A TO DA-5B
 390          RS       2    FLOW      -1
 391          RL                    .094    1894
 392          RC    .090    .070    .090    2900  0.0224
 393          RX     720     938     950     988    1008    1018    1034    1050
 394          RY    1910    1902    1900    1894    1894    1900    1905    1910

 395          KK      5B
 396          KM    SUB-BASIN DA-5B
 397          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 398          KM    L= .667 mi.  Lca= .303 mi.   S=  284.9 ft/mi.  Kn= .070  LAG=  18.8 min.
 399          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 400          BA    .063
 401          LG     .30     .35    7.50     .12    8.97
 402          UI     15.     51.     79.    129.     94.     62.     29.     15.      7.      3.
 403          UI      3.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 404          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 405          KK     C5B
 406          KM    COMBINE HYDROGRAPHS AT DA-5B
 407          HC       2

 408          KK      5C
 409          KM    SUB-BASIN DA-5C
 410          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 411          KM    L= .549 mi.  Lca= .265 mi.   S=  546.4 ft/mi.  Kn= .070  LAG=  14.6 min.
 412          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 413          BA    .046
 414          LG     .33     .33    7.78     .11    8.36
 415          UI     19.     59.    109.     89.     49.     18.      7.      3.      0.      0.
 416          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 417          KK      5D
 418          KM   BASIN DA-5D
 419          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 420          KM    L= .568 mi.  Lca= .227 mi.   S=  528.2 ft/mi.  Kn= .070  LAG=  14.1 min.
 421          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 422          BA    .095
 423          LG     .33     .40    6.60     .18    7.83
 424          UI     43.    132.    242.    179.     92.     33.     12.      7.      0.      0.
 425          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 426          KK     C5D
 427          KM    COMBINE HYDROGRAPHS AT DA-5D
 428          HC       2

 429          KK   R5D-E
 430          KM    ROUTE FLOWS FROM DA-5D TO DA-5E
 431          RS       1    FLOW      -1
 432          RL                     .37    1888
 433          RC    .090    .070    .090    1600  0.0188
 434          RX     785     855     989     996    1010    1030    1058    1190
 435          RY    1900    1896    1892    1888    1888    1892    1896    1900

 436          KK      5E
 437          KM    SUB-BASIN DA-5E
 438          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 439          KM    L= .303 mi.  Lca= .189 mi.   S=   99.0 ft/mi.  Kn= .070  LAG=  14.2 min.
 440          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 441          BA    .061
 442          LG     .35     .39    5.67     .21     .00
 443          UI     27.     83.    152.    115.     60.     21.      8.      4.      0.      0.
 444          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 445          KK     C5E
 446          KM    COMBINE HYDROGRAPHS AT DA-5E
 447          HC       3

 448          KK   R5E-F
 449          KM    ROUTE FLOWS FROM DA-5E TO DA-5F
 450          RS       9    FLOW      -1
 451          RL                    .298    1842
 452          RC    .090    .070    .090    9700  0.0134
 453          RX     952     960     975     985    1015    1030    1080    1165
 454          RY    1850    1848    1844    1842    1842    1844    1847    1850

 455          KK      5F
 456          KM    SUB-BASIN DA-5F
 457          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 458          KM    L= 1.837 mi. Lca= .928 mi.   S=   70.8 ft/mi.  Kn= .070  LAG=  55.0 min.
 459          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 460          BA    .379
 461          LG     .35     .25    8.40     .06     .20
 462          UI     23.     23.     48.     86.    110.    127.    143.    166.    192.    250.
 463          UI    299.    247.    209.    185.    159.    139.    117.     99.     72.     44.
 464          UI     40.     38.     24.     23.     17.      7.      7.      7.      7.      7.
 465          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
 466          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 467          KK     C5F
 468          KM    COMBINE HYDROGRAPHS AT DA-5F
 469          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

470           KK     5G
471           KM    SUB-BASIN DA-5G
472           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
473           KM    L= 2.121 mi. Lca= 1.136 mi.  S=   96.7 ft/mi.  Kn= .070  LAG=  59.1 min.
474           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
475           BA    .402
476           LG     .35     .20    9.40     .02     .00
477           UI     23.     23.     38.     81.    102.    119.    134.    151.    173.    205.
478           UI    266.    290.    238.    205.    183.    159.    139.    120.    105.     78.
479           UI     54.     41.     38.     33.     23.     23.     14.      7.      7.      7.
480           UI      7.      7.      7.      7.      7.      0.      0.      0.      0.      0.
481           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

482           KK     C5G
483           KM    COMBINE HYDROGRAPHS AT DA-5G
484           KM    This hydrograph is a total flow from the Stream No. 5 watershed area.
485           HC       2

486           KK     6A
487           KM    SUB-BASIN DA-6A
488           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
489           KM    L= 2.008 mi. Lca= 1.004 mi.  S=  259.0 ft/mi.  Kn= .070  LAG=  45.8 min.
490           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
491           BA    .503
492           LG     .30     .35    3.55     .31   26.05
493           UI     37.     37.    118.    164.    199.    231.    275.    347.    468.    402.
494           UI    329.    283.    235.    196.    161.    108.     65.     61.     46.     37.
495           UI     24.     11.     11.     11.     11.     11.     11.      0.      0.      0.
496           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

497           KK   R6A-B
498           KM    ROUTE FLOWS FROM DA-6A TO DA-6B
499           RS       4    FLOW      -1
500           RL                     .01    1856
501           RC    .090    .070    .090    5800  0.0147
502           RX     800     955     968     988    1010    1026    1036    1270
503           RY    1870    1862    1860    1856    1856    1860    1862    1870

504           KK      6B
505           KM    SUB-BASIN DA-6B
506           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
507           KM    L= 1.098 mi. Lca=  .530 mi.  S=   77.4 ft/mi.  Kn= .070  LAG=  35.9 min.
508           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
509           BA    .190
510           LG     .35     .25   10.10     .04     .00
511           UI     18.     32.     73.     96.    116.    147.    214.    191.    151.    122.
512           UI     97.     73.     41.     30.     22.     18.      6.      5.      5.      5.
513           UI      5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
514           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

515           KK     C6B
516           KM    COMBINE HYDROGRAPHS AT DA-6B
517           KM    This hydrograph is a total flow from the Stream No. 6 watershed area.
518           HC       2

519           KK      7A
520           KM    SUB-BASIN DA-7A
521           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
522           KM    L= 3.447 mi. Lca= 1.818 mi.  S=  378.6 ft/mi.  Kn= .070  LAG=  65.5 min.
523           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
524           BA   2.035
525           LG     .28     .35    3.61     .34   27.66
526           UI    105.    105.    105.    298.    407.    541.    649.    736.    805.    917.
527           UI   1134.   1201.    802.    694.    626.    589.    542.    505.    466.    428.
528           UI    393.    348.    308.    272.    256.    241.    226.    208.    172.    157.
529           UI    134.    133.    115.    115.    105.     80.     80.     80.     70.     51.
530           UI     51.     51.     51.     51.     45.     20.     20.     20.     20.     20.
531           UI     20.     20.     20.     20.     20.     20.     20.     20.     20.     20.
532           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
533           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

534           KK   R7A-B
535           KM    ROUTE FLOWS FROM DA-7A TO DA-7B
536           RS       2    FLOW      -1
537           RL                     .19    1852
538           RC    .090    .070    .090    1800  0.0111
539           RX     860     960     970     991    1007    1035    1130    1228
540           RY    1862    1856    1855    1852    1852    1855    1856    1862

541           KK      7B
542           KM    SUB-BASIN DA-7B
543           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
544           KM    L= .341 mi.  Lca= .189 mi.  S=   58.7 ft/mi.  Kn= .070  LAG=  16.4 min.
545           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
546           BA    .042
547           LG     .35     .25   10.10     .04     .00
548           UI     14.     44.     74.     91.     55.     27.     12.      5.      3.      0.
549           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
550           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

551           KK     C7B
552           KM    COMBINE HYDROGRAPHS AT DA-7B
553           HC       2

554           KK      7C
555           KM    SUB-BASIN DA-7C
556           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
557           KM    L= .663 mi.  Lca= .208 mi.   S=  120.7 ft/mi.  Kn= .070  LAG=  19.1 min.
558           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
559           BA    .047
560           LG     .35     .33    7.78     .10     .00
561           UI     11.     37.     57.     94.     71.     47.     24.     12.      6.      3.
562           UI      3.      0.      0.      0.      0.      0.      0.      0.      0.      0.
563           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 564          KK   R7C-D
 565          KM    ROUTE FLOWS FROM DA-7C TO DA-7D
 566          RS      3    FLOW      -1
 567          RL                    .01    1864
 568          RC   .090    .070    .090    1900  0.0211
 569          RX    710     830     950     990    1010    1055    1140    1350
 570          RY   1870    1866    1865    1864    1864    1865    1867    1870

 571          KK     7D
 572          KM    SUB-BASIN DA-7D
 573          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 574          KM    L= .360 mi.  Lca= .246 mi.   S=  111.1 ft/mi.  Kn= .070  LAG=  16.4 min.
 575          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 576          BA    .033
 577          LG     .35     .15   12.40     .01     .00
 578          UI     11.     34.     58.     71.     43.     21.      9.      4.      2.      0.
 579          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 580          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 581          KK     C7D
 582          KM    COMBINE HYDROGRAPHS AT DA-7D
 583          HC      2

 584          KK     7E
 585          KM    SUB-BASIN DA-7E
 586          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 587          KM    L= .852 mi.  Lca= .284 mi.   S=  129.1 ft/mi.  Kn= .070  LAG=  23.3 min.
 588          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 589          BA    .092
 590          LG     .35     .39    6.78     .16    2.93
 591          UI     13.     50.     76.    109.    157.    113.     81.     53.     24.     16.
 592          UI      8.      4.      4.      0.      0.      0.      0.      0.      0.      0.
 593          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 594          KK   R7E-F
 595          KM    ROUTE FLOWS FROM DA-7E TO DA-7F
 596          RS      2    FLOW      -1
 597          RL                   .058    1864
 598          RC   .090    .070    .090    2100  0.0262
 599          RX    852     920     960     994    1010    1075    1110    1195
 600          RY   1876    1870    1868    1864    1864    1868    1870    1876

 601          KK     7F
 602          KM    SUB-BASIN DA-7F
 603          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 604          KM    L= .398 mi.  Lca= .227 mi.   S=  138.2 ft/mi.  Kn= .070  LAG=  15.8 min.
 605          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 606          BA    .053
 607          LG     .35     .25    8.40     .06     .00
 608          UI     18.     58.    103.    109.     65.     28.     13.      4.      3.      0.
 609          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 610          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

611           KK     C7F
612           KM    COMBINE HYDROGRAPHS AT DA-7F
613           HC       4

614           KK   R7F-G
615           KM    ROUTE FLOWS FROM DA-7F TO DA-7G
616           RS       4    FLOW      -1
617           RL                    .208    1830
618           RC    .090    .070    .090    3500  0.0114
619           RX     745     942     960     995    1015    1070    1120    1170
620           RY    1840    1834    1833    1830    1830    1833    1834    1840

621           KK      7G
622           KM    SUB-BASIN DA-7G
623           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
624           KM    L= .663 mi.  Lca= .398 mi.   S=   60.3 ft/mi.  Kn= .070  LAG=  27.9 min.
625           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
626           BA    .073
627           LG     .35     .25    8.20     .05     .00
628           UI      9.     25.     45.     58.     82.    105.     77.     58.     43.     24.
629           UI     15.     10.      6.      3.      3.      3.      0.      0.      0.      0.
630           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

631           KK     C7G
632           KM    COMBINE HYDROGRAPHS AT DA-7G
633           KM    This hydrograph is the flow in Stream No. 7 just downstream of it's
634           KM    confluence with Stream No. 6.
635           HC       3

636           KK   R7G-H
637           KM    ROUTE FLOWS FROM DA-7G TO DA-7H
638           RS       5    FLOW      -1
639           RL                     .37    1784
640           RC    .085    .070    .085    5100  0.0108
641           RX     700     780     920     990    1010    1026    1035    1290
642           RY    1794    1788    1787    1784    1784    1787    1788    1793

643           KK      7H
644           KM    SUB-BASIN DA-7H
645           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
646           KM    L= 1.326 mi. Lca= .701 mi.   S=   90.5 ft/mi.  Kn= .070  LAG=  41.7 min.
647           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
648           BA    .162
649           LG     .35     .25    8.40     .06     .00
650           UI     13.     16.     47.     63.     75.     90.    111.    157.    149.    118.
651           UI     99.     81.     67.     51.     30.     22.     19.     13.     10.      4.
652           UI      4.      4.      4.      4.      0.      0.      0.      0.      0.      0.
653           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 654          KK     C7H
 655          KM    COMBINE HYDROGRAPHS AT DA-7H
 656          KM    This hydrograph is the flow in Stream No. 7 just downstream of it's
 657          KM    confluence with Stream No. 5.
 658          HC       3

 659          KK   R7H-C
 660          KM    ROUTE FLOWS FROM DA-7H TO DA-8C
 661          RS       1    FLOW      -1
 662          RL                     .33    1742
 663          RC    .085    .070    .085     500  0.0009
 664          RX     940     970     980     992    1008    1038    1160    1415
 665          RY    1760    1748    1746    1742    1742    1746    1747    1756

 666          KK      8A
 667          KM    SUB-BASIN DA-8A
 668          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 669          KM    L= 1.629 mi. Lca= .871 mi.   S=  128.9 ft/mi.  Kn= .070  LAG=  45.7 min.
 670          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 671          BA    .443
 672          LG     .35     .25    8.60     .07     .00
 673          UI     33.     33.    104.    145.    176.    204.    244.    309.    412.    353.
 674          UI    289.    248.    206.    172.    141.     93.     58.     54.     40.     33.
 675          UI     20.     10.     10.     10.     10.     10.     10.      0.      0.      0.
 676          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 677          KK     R8A
 678          KM    ROUTE FLOWS THROUGH DOUBLE 6' X 5' RCBCs AT I-17
 679          KM    This rating curve was developed for 2-6' X 5' X 370' RCBCs at I-17.
 680          KM    U.S. Inv. = 1891.7; Top of Roadway = 1899.3
 681          RS       1    ELEV  1891.7
 682          SA       0      .1     0.3     0.5     1.2     1.5     2.0     2.5
 683          SE  1891.7  1895.8  1897.7  1898.9  1899.6  1899.8  1900.1  1900.3
 684          SQ       0     300     500     600     700     800     900    1000

 685          KK   R8A-B
 686          KM    ROUTE FLOWS FROM DA-8A TO DA-8B
 687          RS       3    FLOW      -1
 688          RL                     .01    1875
 689          RC    .090    .070    .090    3100  0.0097
 690          RX     930     968     974     995    1010    1034    1040    1100
 691          RY    1886    1879    1878    1875    1875    1878    1879    1886

 692          KK      8B
 693          KM   BASIN DA-8B
 694          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 695          KM    L= 1.269 mi. Lca= .473 mi.   S=   82.7 ft/mi.  Kn= .070  LAG=  35.9 min.
 696          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 697          BA    .280
 698          LG     .35     .15   12.40     .01     .00
 699          UI     26.     47.    107.    141.    171.    217.    316.    282.    222.    179.
 700          UI    143.    108.     60.     44.     33.     26.      9.      8.      8.      8.
 701          UI      8.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 702          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 703          KK     C8B
 704          KM    COMBINE HYDROGRAPHS AT DA-8B
 705          HC       2

 706          KK   R8B-C
 707          KM    ROUTE FLOWS FROM DA-8B TO DA-8C
 708          RS      13    FLOW      -1
 709          RL                    .154    1846
 710          RC    .080    .065    .080   11000  0.0114
 711          RX     760     864     968     988    1008    1013    1030    1240
 712          RY    1854    1850    1848    1846    1846    1848    1850    1854

 713          KK      8C
 714          KM    SUB-BASIN DA-8C
 715          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 716          KM    L= 2.424 mi. Lca= 1.326 mi.  S=   68.1 ft/mi.  Kn= .065  LAG=  65.4 min.
 717          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 718          BA    .783
 719          LG     .34     .20    9.40     .02     .29
 720          UI     40.     40.     40.    133.    164.    193.    220.    242.    272.    308.
 721          UI    360.    455.    524.    442.    380.    339.    306.    267.    238.    206.
 722          UI    184.    141.    103.     71.     68.     66.     46.     40.     40.     19.
 723          UI     12.     12.     12.     12.     12.     12.     12.     12.     12.      0.
 724          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 725          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 726          KK    C8C1
 727          KM    COMBINE HYDROGRAPHS AT DA-8C DOWNSTREAM OF 2 - 8' X 6' RCB
 728          HC       2

 729          KK    C8C2
 730          KM    COMBINE HYDROGRAPHS AT DA-8C WITH FLOWS FROM STREAM NO. 7
 731          KM    This hydrograph is the flow in Stream No. 8 just downstream of it's
 732          KM    confluence with Stream No. 7.
 733          HC       2

 734          KK   R8C-D
 735          KM    ROUTE FLOWS FROM DA-8C TO DA-8D
 736          RS       1    FLOW      -1
 737          RL                    .354    1728
 738          RC    .095    .060    .095    1400  0.0107
 739          RX     820     912     978     995    1008    1022    1100    1430
 740          RY    1739    1736    1734    1728    1728    1734    1735    1740

 741          KK      8D
 742          KM    SUB-BASIN DA-8D
 743          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 744          KM    L= .265 mi.  Lca= .152 mi.   S=   56.6 ft/mi.  Kn= .060  LAG=  11.8 min.
 745          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 746          BA    .037
 747          LG     .33     .35    4.03     .41    7.91
 748          UI     25.     72.    109.     55.     17.      5.      3.      0.      0.      0.
 749          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 750          KK     C8D
 751          KM    COMBINE HYDROGRAPHS AT DA-8D
 752          KM    This hydrograph is the flow in Stream No. 8 just upstream of it's
 753          KM    confluence with Deadman Wash.
 754          HC       2

 755          KK     10H
 756          KM    SUB-BASIN DA-10H
 757          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 758          KM    L= .492 mi.  Lca= .341 mi.   S=   50.8 ft/mi.  Kn= .075  LAG=  26.0 min.
 759          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 760          BA    .082
 761          LG     .34     .35    3.50     .29    1.54
 762          UI     11.     34.     56.     75.    116.    112.     82.     60.     39.     19.
 763          UI     14.      8.      3.      3.      3.      0.      0.      0.      0.      0.
 764          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 765          KK    C10H
 766          KM    COMBINE HYDROGRAPHS AT DA-10H
 767          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
 768          KM    confluence with Stream No. 4 and Stream No. 8 (upstream of the I-17
 769          KM    Northbound bridge).
 770          HC       4

 771          KK    R10H
 772          KM    ROUTE FLOWS THROUGH I-17 BRIDGE
 773          KM    This rating curve was developed using the I-17 Southbound bridge.
 774          KM    U.S. Inv. = 1719.7; Top of Roadway = 1732.8
 775          RS       1    ELEV  1719.7
 776          SA       0      .4     1.3     3.7     4.2     5.5     7.0     8.5
 777          SE  1719.7  1724.6  1727.3  1729.6  1730.7  1731.7  1732.6  1733.6
 778          SQ       0    3200    6400    9600   11200   12800   14400   16000

 779          KK  R10H-I
 780          KM    ROUTE FLOWS FROM DA-10H TO DA-10I
 781          RS       1    FLOW      -1
 782          RL                     .37    1720
 783          RC    .070    .055    .070    1000  0.0050
 784          RX     490     930     975     989    1011    1026    1130    1620
 785          RY    1734    1726    1724    1720    1720    1724    1726    1734

 786          KK     10I
 787          KM    SUB-BASIN DA-10I
 788          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 789          KM    L= 1.250 mi. Lca= .492 mi.   S=   76.0 ft/mi.  Kn= .065  LAG=  34.2 min.
 790          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 791          BA    .182
 792          LG     .32     .35    7.50     .12    5.53
 793          UI     18.     35.     77.     99.    123.    163.    222.    174.    139.    110.
 794          UI     86.     55.     31.     26.     18.      9.      5.      5.      5.      5.
 795          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 796          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

797           KK    10J
798           KM    SUB-BASIN DA-10J
799           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
800           KM    L= 2.367 mi. Lca= .625 mi.   S=   69.7 ft/mi.  Kn= .065  LAG=  48.5 min.
801           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
802           BA    .924
803           LG     .33     .20    9.40     .02    2.47
804           UI     64.     64.    180.    271.    333.    382.    450.    533.    719.    799.
805           UI    635.    539.    465.    391.    329.    270.    177.    113.    106.     83.
806           UI     64.     50.     20.     20.     20.     20.     20.     20.      0.      0.
807           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

808           KK    C10J
809           KM    COMBINE HYDROGRAPHS AT DA-10J
810           HC      3

811           KK  R10J-K
812           KM    ROUTE FLOWS FROM DA-10J TO DA-10K
813           RS      4    FLOW      -1
814           RL                    .37    1708
815           RC    .080    .065    .080    4800  0.0052
816           RX     635     845     950     984    1016    1035    1085    1190
817           RY    1720    1714    1712    1708    1708    1712    1714    1720

818           KK     10K
819           KM    SUB-BASIN DA-10K
820           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
821           KM    L= .947 mi.  Lca= .473 mi.   S=  327.3 ft/mi.  Kn= .065  LAG=  23.0 min.
822           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
823           BA    .418
824           LG     .28     .35    3.55     .32    7.22
825           UI     61.    232.    355.    510.    722.    510.    360.    229.    105.     70.
826           UI     31.     19.     19.      0.      0.      0.      0.      0.      0.      0.
827           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

828           KK     10L
829           KM    SUB-BASIN DA-10L
830           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
831           KM    L= 1.383 mi. Lca= .909 mi.   S=  348.5 ft/mi.  Kn= .070  LAG=  36.2 min.
832           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
833           BA    .413
834           LG     .25     .40    6.60     .19   11.24
835           UI     38.     63.    148.    234.    286.    372.    392.    253.    217.    190.
836           UI    164.    140.    111.     94.     85.     69.     54.     47.     42.     32.
837           UI     29.     23.     19.     19.     16.      7.      7.      7.      7.      7.
838           UI      7.      7.      7.      0.      0.      0.      0.      0.      0.      0.
839           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

840           KK    C10L
841           KM    COMBINE HYDROGRAPHS AT DA-10L
842           HC      3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 843          KK  R10L-M
 844          KM    ROUTE FLOWS FROM DA-10L TO DA-10M
 845          RS      1    FLOW      -1
 846          RL                    .37    1680
 847          RC    .070    .045    .070    1500    0.01
 848          RX      30     910     979     987    1015    1030    1075    1208
 849          RY    1692    1686    1684    1680    1680    1684    1686    1692

 850          KK     10M
 851          KM    SUB-BASIN DA-10M
 852          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 853          KM    L= .966 mi.  Lca= .379 mi.   S=  412.0 ft/mi.  Kn= .065  LAG=  20.4 min.
 854          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 855          BA    .336
 856          LG     .30     .36    3.81     .29    9.69
 857          UI     63.    237.    358.    589.    539.    366.    229.    100.     62.     22.
 858          UI     17.     17.      0.      0.      0.      0.      0.      0.      0.      0.
 859          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 860          KK    C10M
 861          KM    COMBINE HYDROGRAPHS AT DA-10M
 862          HC      2

 863          KK    R10M
 864          KM    ROUTE FLOWS THROUGH EXISTING 4-RCP AT JOY RANCH ROAD
 865          KM    This rating curve was developed using the existing 2-72", 1-60",
 866          KM    and 1-48" X 45' RCPs at Joy Ranch Road.
 867          KM    U.S. Inv. = 1671.8  ;  Top of Roadway L.P. = 1680.4
 868          RS      1    ELEV  1671.8
 869          SA      0     1.0     1.8     3.7     4.2     5.0     5.7     6.2
 870          SE  1671.8  1680.9  1682.1  1683.3  1683.6  1683.8  1684.0  1684.4
 871          SQ      0    1000    3200    8000    9600   11200   12800   16000

 872          KK  R10M-N
 873          KM    ROUTE FLOWS FROM DA-10M TO DA-10N
 874          RS      2    FLOW      -1
 875          RL                    .37    1656
 876          RC    .070    .055    .070    2400  0.0083
 877          RX     430     910     968     990    1015    1028    1048    1870
 878          RY    1666    1662    1660    1656    1656    1660    1662    1666

 879          KK     10N
 880          KM    SUB-BASIN DA-10N
 881          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 882          KM    L= .814 mi.  Lca= .284 mi.   S=   61.4 ft/mi.  Kn= .055  LAG=  20.8 min.
 883          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 884          BA    .073
 885          LG     .35     .40    6.29     .19     .00
 886          UI     13.     50.     75.    121.    120.     81.     53.     23.     14.      6.
 887          UI      4.      4.      0.      0.      0.      0.      0.      0.      0.      0.
 888          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

889           KK     100
890           KM    SUB-BASIN DA-100
891           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
892           KM    L= .890 mi.  Lca= .473 mi.   S=   84.3 ft/mi.  Kn= .065  LAG=  29.0 min.
893           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
894           BA    .119
895           LG     .35     .40    6.29     .19     .00
896           UI     14.     37.     68.     87.    118.    168.    129.     99.     75.     50.
897           UI     25.     19.     14.      4.      4.      4.      4.      0.      0.      0.
898           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

899           KK     10P
900           KM    SUB-BASIN DA-10P
901           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
902           KM    L= 1.837 mi. Lca= .814 mi.   S=  209.6 ft/mi.  Kn= .065  LAG=  39.5 min.
903           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
904           BA    .775
905           LG     .28     .35    7.50     .13    7.50
906           UI     66.     94.    247.    331.    396.    481.    637.    821.    663.    543.
907           UI    445.    362.    288.    174.    115.    102.     66.     51.     20.     20.
908           UI     20.     20.     20.      0.      0.      0.      0.      0.      0.      0.
909           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

910           KK    C10P
911           KM    COMBINE HYDROGRAPHS AT DA-10P
912           HC       4

913           KK  R10P-Q
914           KM    ROUTE FLOWS FROM DA-10P TO DA-10Q
915           RS       7    FLOW      -1
916           RL                    .366    1620
917           RC    .080    .065    .080    6700  0.0067
918           RX     300     960     968     988    1014    1030    1410    1815
919           RY    1632    1626    1624    1620    1620    1624    1630    1632

920           KK     10Q
921           KM    SUB-BASIN DA-10Q
922           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
923           KM    L= 1.288 mi. Lca= .814 mi.   S=  427.0 ft/mi.  Kn= .065  LAG=  30.2 min.
924           KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
925           BA    .329
926           LG     .26     .36    4.12     .29    9.61
927           UI     37.     83.    184.    259.    344.    357.    230.    194.    164.    136.
928           UI    104.     87.     75.     56.     45.     40.     28.     26.     18.     18.
929           UI     14.      7.      7.      7.      7.      7.      7.      0.      0.      0.
930           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

931           KK      9A
932           KM    SUB-BASIN DA-9A
933           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
934           KM    L= 2.405 mi. Lca= .701 mi.   S=   60.3 ft/mi.  Kn= .065  LAG=  52.4 min.
935           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
936           BA    .975
937           LG     .31     .20    9.40     .02    3.58
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

938           UI     63.     63.    147.    246.    307.    353.    404.    470.    574.    768.
939           UI    741.    603.    522.    454.    386.    330.    279.    201.    124.    107.
940           UI    103.     64.     63.     38.     19.     19.     19.     19.     19.     19.
941           UI     19.      0.      0.      0.      0.      0.      0.      0.      0.      0.
942           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

943           KK   R9A-B
944           KM    ROUTE FLOWS FROM DA-9A TO DA-9B
945           RS      10    FLOW      -1
946           RL                    .162    1626
947           RC    .080    .065    .080    9300  0.0097
948           RX     180     922     960     988    1012    1034    1084    1198
949           RY    1636    1630    1628    1626    1626    1628    1630    1636

950           KK      9B
951           KM    SUB-BASIN DA-9B
952           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
953           KM    L= 1.761 mi. Lca= .985 mi.   S=   51.1 ft/mi.  Kn= .065  LAG=  54.6 min.
954           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
955           BA    .696
956           LG     .35     .20    9.40     .02     .00
957           UI     43.     43.     91.    160.    204.    237.    266.    309.    359.    472.
958           UI    550.    450.    383.    338.    290.    251.    214.    179.    125.     76.
959           UI     73.     68.     43.     43.     26.     13.     13.     13.     13.     13.
960           UI     13.     13.      0.      0.      0.      0.      0.      0.      0.      0.
961           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

962           KK     C9B
963           KM    COMBINE HYDROGRAPHS AT DA-9B
964           KM    This hydrograph is a total flow from the Stream No. 9 watershed area.
965           HC       2

966           KK    C10Q
967           KM    COMBINE HYDROGRAPHS AT DA-10Q
968           KM    This hydrograph is the flow in Deadman Wash just downstream of it's
969           KM    confluence with Stream No. 9.
970           HC       3

971           KK   R10Q-R
972           KM    ROUTE FLOWS FROM DA-10Q TO DA-10R
973           RS       1    FLOW      -1
974           RL                    .39    1606
975           RC    .080    .065    .080     600  0.0083
976           RX     300     740     955     982    1025    1046    1070    1280
977           RY    1614    1610    1609    1606    1606    1609    1610    1616

978           KK     10R
979           KM    SUB-BASIN DA-10R
980           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
981           KM    L= .871 mi.  Lca= .246 mi.   S=   74.6 ft/mi.  Kn= .065  LAG=  23.0 min.
982           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
983           BA    .088
984           LG     .35     .25   10.10     .04     .00
985           UI     13.     49.     75.    107.    152.    107.     76.     48.     22.     15.
986           UI      7.      4.      4.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 987          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 988          KK    C10R
 989          KM    COMBINE HYDROGRAPHS AT DA-10R
 990          KM    This hydrograph is the flow in Deadman Wash at the split location
 991          KM    with Stream No. 12.
 992          HC       2

 993          KK  DIV10R
 994          KM    DIVERT FLOW TO EAST TO STREAM NO. 12
 995          KM    DIV10R: Flow in Deadman Wash Continuing South to Carefree Highway
 996          KM    DIV12A: Flow Diverted to DA-12A Continuing South to Carefree Highway
 997          DT  DIV12A
 998          DI       0    7500    8000    8500    9000    9500   10000
 999          DQ       0    3375    3600    3825    4050    4275    4500

1000          KK  R10R-S
1001          KM    ROUTE FLOWS FROM DA-10R TO DA-10S
1002          RS       5    FLOW      -1
1003          RL                     .20    1592
1004          RC    .065    .048    .065    4200  0.0048
1005          RX     300     550     800     900    1180    1209    1238    1450
1006          RY    1598    1594    1593    1592    1592    1593    1594    1598

1007          KK     10S
1008          KM    SUB-BASIN DA-10S
1009          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1010          KM    L= 4.451 mi. Lca= 1.799 mi.  S=   53.9 ft/mi.  Kn= .065  LAG=  96.7 min.
1011          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1012          BA   1.024
1013          LG     .35     .15   12.40     .01     .00
1014          UI     36.     36.     36.     36.     81.    121.    138.    165.    177.    194.
1015          UI    206.    220.    240.    262.    279.    316.    377.    430.    472.    412.
1016          UI    368.    334.    309.    288.    268.    244.    223.    209.    189.    173.
1017          UI    160.    137.    103.     86.     63.     63.     59.     59.     54.     36.
1018          UI     36.     36.     36.     17.     11.     11.     11.     11.     11.     11.
1019          UI     11.     11.     11.     11.     11.     11.     11.      0.      0.      0.
1020          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1021          KK    C10S
1022          KM    COMBINE HYDROGRAPHS AT DA-10S
1023          KM    This hydrograph is the flow in Deadman Wash at the Carefree Highway.
1024          HC       2

1025          KK  R10S-T
1026          KM    ROUTE FLOWS FROM DA-10S TO DA-10T
1027          RS       2    FLOW      -1
1028          RL                     .39    1574
1029          RC    .065    .048    .065    1900  0.0105
1030          RX     410     920     960     990    1020    1070    1310    1510
1031          RY    1582    1579    1578    1574    1574    1576    1578    1582
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1032          KK  DIV12A
1033          KM    RETRIEVE FLOW DIVERTED FROM C10R TO DA-12A
1034          KM    Retrieve Flow at Split Flow Location
1035          DR  DIV12A

1036          KK  R10R-A
1037          KM    ROUTE DIVERTED FLOW FROM DA-10R TO DA-12A
1038          RS      7    FLOW      -1
1039          RL                    .39    1602
1040          RC   .080    .065    .080    3800  0.0039
1041          RX      0     590     975     995    1010    1022    1225    1505
1042          RY   1609    1607    1606    1602    1602    1606    1607    1609

1043          KK     12A
1044          KM    SUB-BASIN DA-12A
1045          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1046          KM    L= .852 mi.  Lca= .473 mi.   S=   35.2 ft/mi.  Kn= .050  LAG=  25.9 min.
1047          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1048          BA    .078
1049          LG     .35     .40    6.60     .17     .00
1050          UI     10.     32.     54.     72.    111.    106.     77.     57.     37.     18.
1051          UI     13.      7.      3.      3.      3.      0.      0.      0.      0.      0.
1052          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1053          KK    R12A
1054          KM    ROUTE FLOWS THROUGH EXISTING CULVERT AT CAREFREE HIGHWAY
1055          KM    This rating curve was developed using the existing oval CMP culvert
1056          KM    at Carefree Highway.
1057          KM    U.S. Inv. = 1586.4 ;  Top of Roadway L.P. = 1594.1
1058          RS      1    ELEV  1586.4
1059          SA      0     0.1     0.3     0.5     0.7     0.9     1.0     1.2
1060          SE  1586.4  1589.1  1590.3  1591.3  1591.8  1592.3  1592.7  1593.2
1061          SQ      0      40      80     120     140     160     180     200

1062          KK    C12A
1063          KM    COMBINE HYDROGRAPHS AT DA-12A
1064          KM    This hydrograph is a total flow just downstream of existing culvert
1065          KM    on Stream No. 12 at Carefree Highway.
1066          HC      2

1067          KK  R12A-B
1068          KM    ROUTE FLOWS FROM DA-12A TO DA-12B
1069          RS      4    FLOW      -1
1070          RL                    .39    1574
1071          RC   .070    .050    .070    3200  0.0078
1072          RX    520     930     980     990    1010    1020    1180    1410
1073          RY   1580    1577    1576    1574    1574    1576    1578    1580

1074          KK     12B
1075          KM    SUB-BASIN DA-12B
1076          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1077          KM    L= .985 mi.  Lca= .246 mi.   S=   40.6 ft/mi.  Kn= .050  LAG=  20.8 min.
1078          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1079          BA    .149
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1080          LG     .35     .35    3.98     .40     .00
1081          UI     27.    102.    153.    248.    244.    166.    107.     48.     29.     12.
1082          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1083          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1084          KK    C12B
1085          KM    COMBINE HYDROGRAPHS AT DA-12B
1086          KM    This hydrograph is a total flow from the Stream No. 12 watershed area.
1087          HC       2

1088          KK     10T
1089          KM    SUB-BASIN DA-10T
1090          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1091          KM    L= .663 mi.  Lca= .265 mi.   S=   60.3 ft/mi.  Kn= .048  LAG=  16.4 min.
1092          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1093          BA    .068
1094          LG     .35     .25    8.40     .06     .00
1095          UI     22.     71.    120.    147.     89.     44.     19.      8.      4.      0.
1096          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1097          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1098          KK    C10T
1099          KM    COMBINE HYDROGRAPHS AT DA-10T
1100          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1101          KM    confluence with Stream No. 12.
1102          HC       3

1103          KK  R10T-U
1104          KM    ROUTE FLOWS FROM DA-10T TO DA-10U
1105          RS       7    FLOW      -1
1106          RL                     .39    1548
1107          RC    .065    .050    .065    7400  0.0068
1108          RX     360     920     970     988    1014    1036    1050    1500
1109          RY    1558    1553    1552    1548    1548    1551    1552    1558

1110          KK     10U
1111          KM    SUB-BASIN DA-10U
1112          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1113          KM    L= 1.856 mi. Lca= 1.042 mi.  S=   45.8 ft/mi.  Kn= .050  LAG=  44.7 min.
1114          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1115          BA    .487
1116          LG     .35     .25    8.40     .06     .00
1117          UI     37.     37.    122.    166.    202.    235.    280.    372.    460.    378.
1118          UI    313.    267.    222.    183.    141.     86.     63.     59.     37.     36.
1119          UI     11.     11.     11.     11.     11.     11.      0.      0.      0.      0.
1120          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1121          KK     11A
1122          KM    SUB-BASIN DA-11A
1123          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1124          KM    L= .549 mi.  Lca= .246 mi.   S=  601.1 ft/mi.  Kn= .070  LAG=  14.0 min.
1125          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1126          BA    .158
1127          LG     .26     .35    3.50     .32   22.35
1128          UI     68.    247.    347.    200.    133.     86.     52.     34.     21.     14.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1129          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1130          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1131          KK  R11A-B
1132          KM    ROUTE FLOWS FROM DA-11A TO DA-11B
1133          RS      2    FLOW      -1
1134          RL                    .39    1702
1135          RC    .090    .070    .090    1700  0.0088
1136          RX     968     982     990     995    1005    1010    1018    1030
1137          RY    1708    1706    1704    1702    1702    1704    1706    1708

1138          KK     11B
1139          KM    SUB-BASIN DA-11B
1140          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1141          KM    L= .720 mi.  Lca= .360 mi.   S=  270.8 ft/mi.  Kn= .070  LAG=  20.8 min.
1142          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1143          BA    .220
1144          LG     .25     .35    3.55     .33    7.62
1145          UI     38.    150.    258.    363.    224.    174.    133.     94.     74.     51.
1146          UI     40.     28.     20.     17.      9.      7.      7.      7.      7.      0.
1147          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1148          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1149          KK    C11B
1150          KM    COMBINE HYDROGRAPHS AT DA-11B
1151          HC      2

1152          KK    R11B
1153          KM    ROUTE FLOWS THROUGH 6' X 7' RCBC AT I-17
1154          KM    This rating curve was developed for the 6' X 7' X 228' RCBC at I-17.
1155          KM    U.S. Inv. = 1692.0  ;  Top of Roadway = 1700.8
1156          RS      1    ELEV  1692.0
1157          SA      0     0.4     0.8     1.7     3.2     5.5     7.0     8.5
1158          SE  1692.0  1697.1  1698.7  1700.8  1702.2  1704.5  1707.3  1710.5
1159          SQ      0     200     300     400     500     600     700     800

1160          KK  R11B-D
1161          KM    ROUTE FLOWS FROM DA-11B TO DA-11D
1162          RS      1    FLOW      -1
1163          RL                    .234    1688
1164          RC    .080    .065    .080    1500  0.0100
1165          RX     950     970     982     988    1010    1016    1028    1070
1166          RY    1696    1692    1691    1688    1688    1691    1692    1696

1167          KK     11D
1168          KM    SUB-BASIN DA-11D
1169          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1170          KM    L= 1.098 mi.  Lca= .568 mi.   S=  327.9 ft/mi.  Kn= .070  LAG=  28.0 min.
1171          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1172          BA    .109
1173          LG     .28     .37    4.74     .26   14.17
1174          UI     13.     37.     66.     86.    121.    156.    115.     87.     65.     37.
1175          UI     22.     15.      9.      4.      4.      4.      0.      0.      0.      0.
1176          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1177          KK    C11D
1178          KM    COMBINE HYDROGRAPHS AT DA-11D
1179          HC       2

1180          KK  R11D-F
1181          KM    ROUTE FLOWS FROM DA-11D TO DA-11F
1182          RS       1    FLOW      -1
1183          RL                     .01    1678
1184          RC    .080    .065    .080    1000  0.0050
1185          RX     900     970     982     988    1010    1016    1028    1100
1186          RY    1688    1682    1681    1678    1678    1681    1682    1688

1187          KK     11E
1188          KM    SUB-BASIN DA-11E
1189          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1190          KM    L= 1.686 mi. Lca= .966 mi.   S=  163.1 ft/mi.  Kn= .070  LAG=  46.1 min.
1191          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1192          BA    .424
1193          LG     .26     .38    6.96     .16    9.64
1194          UI     31.     31.     86.    137.    190.    224.    261.    351.    281.    206.
1195          UI    181.    163.    147.    130.    115.     98.     80.     74.     68.     58.
1196          UI     49.     40.     37.     34.     28.     24.     24.     17.     15.     15.
1197          UI     15.     11.      6.      6.      6.      6.      6.      6.      6.      6.
1198          UI      6.      6.      0.      0.      0.      0.      0.      0.      0.      0.
1199          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1200          KK     11F
1201          KM    SUB-BASIN DA-11F
1202          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1203          KM    L= 1.023 mi. Lca= .436 mi.   S=   83.1 ft/mi.  Kn= .065  LAG=  29.7 min.
1204          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1205          BA    .264
1206          LG     .35     .20    9.40     .02     .66
1207          UI     30.     77.    144.    185.    245.    362.    292.    225.    171.    123.
1208          UI     63.     48.     30.     15.      9.      9.      9.      0.      0.      0.
1209          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1210          KK    C11F
1211          KM    COMBINE HYDROGRAPHS AT DA-11F
1212          KM    This hydrograph is the flow just upstream of I-17 3 - 8' X 7' RCB.
1213          HC       3

1214          KK    R11F
1215          KM    ROUTE FLOWS THROUGH EXISTING BOX CULVERT AT I-17
1216          KM    This rating curve was developed using the 3 - 8' X 7' X 195' RCBC at I-17.
1217          KM    U.S. Inv. = 1675.9 ;  Top of Roadway = 1684.9
1218          RS       1    ELEV  1675.9
1219          SA       0     1.0     2.3     3.5     5.7     6.9     9.0    12.2
1220          SE  1675.9  1679.6  1681.8  1683.9  1685.1  1686.4  1687.9  1689.6
1221          SQ       0     520    1040    1560    1820    2080    2340    2600
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1222          KK  R11F-G
1223          KM    ROUTE FLOWS FROM DA-11F TO DA-11G
1224          RS      4    FLOW      -1
1225          RL                    .01    1665
1226          RC   .080    .065    .080    3900  0.0051
1227          RX    900     970     982     988    1010    1016    1028    1100
1228          RY   1676    1669    1668    1665    1665    1668    1669    1676

1229          KK     11C
1230          KM    SUB-BASIN DA-11C
1231          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1232          KM    L= .303 mi.  Lca= .170 mi.   S=  742.6 ft/mi.  Kn= .070  LAG=   9.3 min.
1233          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1234          BA    .054
1235          LG     .17     .35    4.03     .46    5.73
1236          UI     59.    168.     94.     49.     24.     12.      6.      4.      0.      0.
1237          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1238          KK  R11C-G
1239          KM    ROUTE FLOWS FROM DA-11C TO DA-11G
1240          RS      7    FLOW      -1
1241          RL                    .01    1665
1242          RC   .080    .065    .080    4500  0.0044
1243          RX    970     980     990     996    1004    1010    1020    1030
1244          RY   1672    1670    1668    1665    1665    1668    1670    1672

1245          KK     11G
1246          KM    SUB-BASIN DA-11G
1247          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1248          KM    L= .777 mi.  Lca= .360 mi.   S=  328.2 ft/mi.  Kn= .065  LAG=  19.2 min.
1249          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1250          BA    .349
1251          LG     .31     .25   10.10     .04    2.67
1252          UI     78.    274.    417.    692.    531.    350.    180.     90.     44.     19.
1253          UI     19.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1254          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1255          KK    C11G
1256          KM    COMBINE HYDROGRAPHS AT DA-11G
1257          HC      3

1258          KK  R11G-I
1259          KM    ROUTE FLOWS FROM DA-11G TO DA-11I
1260          RS      5    FLOW      -1
1261          RL                    .01    1622
1262          RC   .065    .055    .065    6900  0.0080
1263          RX    800     978     984     990    1012    1018    1024    1180
1264          RY   1634    1628    1626    1622    1622    1626    1628    1634
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1265          KK     11H
1266          KM    SUB-BASIN DA-11H
1267          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1268          KM    L= .756 mi.  Lca= .322 mi.   S=   39.7 ft/mi.  Kn= .065  LAG=  27.2 min.
1269          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1270          BA    .172
1271          LG     .35     .15   12.40     .01     .00
1272          UI     21.     63.    110.    143.    208.    247.    177.    133.     96.     48.
1273          UI     34.     21.      9.      7.      7.      7.      0.      0.      0.      0.
1274          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1275          KK  R11H-I
1276          KM    ROUTE FLOWS FROM DA-11H TO DA-11I
1277          RS       7    FLOW      -1
1278          RL                     .01    1628
1279          RC    .065    .055    .065    8500  0.0088
1280          RX     800     978     984     990    1012    1018    1024    1200
1281          RY    1640    1634    1632    1628    1628    1632    1634    1640

1282          KK     11I
1283          KM    SUB-BASIN DA-11I
1284          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1285          KM    L= 1.610 mi. Lca= .833 mi.   S=   46.6 ft/mi.  Kn= .055  LAG=  42.7 min.
1286          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1287          BA    .528
1288          LG     .35     .15   12.40     .01     .00
1289          UI     42.     45.    147.    197.    236.    280.    339.    470.    501.    391.
1290          UI    330.    273.    225.    182.    117.     73.     68.     45.     42.     16.
1291          UI     13.     13.     13.     13.     13.      0.      0.      0.      0.      0.
1292          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1293          KK    C11I
1294          KM    COMBINE HYDROGRAPHS AT DA-11I
1295          HC       3

1296          KK  R11I-J
1297          KM    ROUTE FLOWS FROM DA-11I TO DA-11J
1298          RS       9    FLOW      -1
1299          RL                     .01    1568
1300          RC    .065    .055    .065    7800  0.0058
1301          RX     660     960     984     990    1012    1018    1050    1240
1302          RY    1578    1572    1570    1568    1568    1570    1572    1578

1303          KK     11J
1304          KM    SUB-BASIN DA-11J
1305          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1306          KM    L= 1.894 mi. Lca= .795 mi.   S=   34.3 ft/mi.  Kn= .055  LAG=  47.3 min.
1307          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1308          BA    .839
1309          LG     .35     .20    9.40     .02     .00
1310          UI     60.     60.    178.    258.    315.    363.    430.    521.    715.    704.
1311          UI    563.    483.    408.    344.    289.    214.    134.    103.     97.     60.
1312          UI     60.     25.     18.     18.     18.     18.     18.     18.      0.      0.
1313          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1314          KK     11K
1315          KM    SUB-BASIN DA-11K
1316          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1317          KM    L= 1.117 mi. Lca= .436 mi.   S=   49.2 ft/mi.  Kn= .065  LAG=  34.0 min.
1318          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1319          BA    .427
1320          LG     .27     .33    7.78     .11    5.54
1321          UI     42.     84.    182.    235.    292.    392.    521.    405.    325.    256.
1322          UI    199.    123.     73.     60.     42.     19.     13.     13.     13.     13.
1323          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1324          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1325          KK    C11K
1326          KM    COMBINE HYDROGRAPHS AT DA-11K
1327          HC       3

1328          KK  R11K-L
1329          KM    ROUTE FLOWS FROM DA-11K TO DA-11L
1330          RS       2    FLOW      -1
1331          RL                     .01    1542
1332          RC    .070    .055    .065    1400  0.0036
1333          RX     620     830     912     995    1038    1270    1430    1620
1334          RY    1550    1544    1543    1542    1542    1543    1544    1550

1335          KK     11L
1336          KM    SUB-BASIN DA-11L
1337          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1338          KM    L= 3.504 mi. Lca= 2.330 mi.  S=  131.3 ft/mi.  Kn= .055  LAG=  69.6 min.
1339          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1340          BA   2.223
1341          LG     .31     .20    9.40     .02    2.67
1342          UI    108.    108.    108.    304.    402.    503.    559.    618.    682.    770.
1343          UI    855.   1028.   1288.   1377.   1152.   1006.    904.    821.    723.    647.
1344          UI    572.    511.    430.    314.    210.    190.    177.    171.    108.    108.
1345          UI    108.     42.     33.     33.     33.     33.     33.     33.     33.     33.
1346          UI     33.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1347          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1348          KK    C11L
1349          KM    COMBINE HYDROGRAPHS AT DA-11L
1350          HC       2

1351          KK  R11L-M
1352          KM    ROUTE FLOWS FROM DA-11L TO DA-11M
1353          RS       2    FLOW      -1
1354          RL                     .01    1536
1355          RC    .070    .055    .065    1500  0.0033
1356          RX     520     830     912     995    1038    1270    1430    1600
1357          RY    1546    1538    1537    1536    1536    1537    1538    1546
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1358          KK     11M
1359          KM    SUB-BASIN DA-11M
1360          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1361          KM    L= 3.106 mi. Lca= 1.326 mi.  S=   33.8 ft/mi.  Kn= .055  LAG=  69.5 min.
1362          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1363          BA    .783
1364          LG     .31     .20    9.40     .02    1.29
1365          UI     38.     38.     38.    108.    142.    178.    197.    218.    241.    272.
1366          UI    302.    364.    456.    484.    405.    354.    318.    289.    254.    228.
1367          UI    201.    180.    151.    110.     73.     67.     62.     59.     38.     38.
1368          UI     38.     14.     12.     12.     12.     12.     12.     12.     12.     12.
1369          UI     12.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1370          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1371          KK    C11M
1372          KM    COMBINE HYDROGRAPHS AT DA-11M
1373          HC       2

1374          KK  R11M-N
1375          KM    ROUTE FLOWS FROM DA-11M TO DA-11N
1376          RS       2    FLOW      -1
1377          RL                     .01    1530
1378          RC    .070    .050    .065    1900  0.0105
1379          RX     400     830     912     995    1038    1270    1430    2310
1380          RY    1538    1532    1531    1530    1530    1531    1532    1538

1381          KK     11N
1382          KM    SUB-BASIN DA-11N
1383          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1384          KM    L= 1.174 mi. Lca= .417 mi.   S=   46.8 ft/mi.  Kn= .055  LAG=  29.1 min.
1385          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1386          BA    .229
1387          LG     .31     .20    9.40     .02    3.23
1388          UI     26.     70.    129.    167.    225.    323.    248.    192.    145.     98.
1389          UI     49.     38.     26.      8.      8.      8.      8.      0.      0.      0.
1390          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1391          KK    C11N
1392          KM    COMBINE HYDROGRAPHS AT DA-11N
1393          KM    This hydrograph is a total flow from the Stream No. 11 watershed area.
1394          HC       2

1395          KK    C10U
1396          KM    COMBINE HYDROGRAPHS AT DA-10U
1397          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1398          KM    confluence with Stream No. 11.
1399          HC       3

1400          KK  R10U-V
1401          KM    ROUTE FLOWS FROM DA-10U TO DA-10V
1402          RS       5    FLOW      -1
1403          RL                     .23    1510
1404          RC    .065    .038    .065    3200  0.0016
1405          RX     200     690     988     992    1010    1020    1105    1690
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1406          RY    1522    1516    1514    1510    1510    1514    1516    1522

1407          KK     10V
1408          KM    SUB-BASIN DA-10V
1409          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1410          KM    L= 1.818 mi. Lca= .492 mi.   S=  137.5 ft/mi.  Kn= .060  LAG=  32.5 min.
1411          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1412          BA    .964
1413          LG     .33     .37    4.43     .26    3.14
1414          UI    100.    218.    445.    575.    723.   1026.   1185.    881.    700.    543.
1415          UI    390.    208.    166.    102.     68.     31.     31.     31.     31.      0.
1416          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1417          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1418          KK    C10V
1419          KM    COMBINE HYDROGRAPHS AT DA-10V
1420          HC       2

1421          KK  R10V-W
1422          KM    ROUTE FLOWS FROM DA-10V TO DA-10W
1423          RS       4    FLOW      -1
1424          RL                     .23    1500
1425          RC    .065    .038    .065    3900  0.0064
1426          RX     440     908     982     988    1012    1020    1282    1850
1427          RY    1510    1504    1502    1500    1500    1502    1504    1510

1428          KK     14A
1429          KM    SUB-BASIN DA-14A
1430          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1431          KM    L= 5.341 mi. Lca= .481 mi.   S=   55.2 ft/mi.  Kn= .050  LAG=  48.1 min.
1432          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1433          BA   2.410
1434          LG     .35     .15   12.40     .01     .00
1435          UI    169.    169.    483.    719.    880.   1011.   1193.   1423.   1935.   2069.
1436          UI   1641.   1402.   1197.   1015.    843.    681.    429.    297.    277.    201.
1437          UI    169.    111.     52.     52.     52.     52.     52.     52.      0.      0.
1438          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1439          KK  R14A-B
1440          KM    ROUTE FLOWS FROM DA-14A TO DA-14B
1441          RS       9    FLOW      -1
1442          RL                     .01    1552
1443          RC    .065    .050    .065    8300  0.0078
1444          RX     500     970     985     992    1006    1012    1030    1500
1445          RY    1562    1556    1554    1552    1552    1554    1556    1562

1446          KK     14B
1447          KM    SUB-BASIN DA-14B
1448          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1449          KM    L= 2.765 mi. Lca= 1.136 mi.  S=   47.0 ft/mi.  Kn= .050  LAG=  53.5 min.
1450          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1451          BA    .819
1452          LG     .35     .15   12.40     .01     .00
1453          UI     52.     52.    115.    198.    249.    288.    325.    379.    451.    598.
1454          UI    641.    517.    444.    391.    331.    287.    246.    187.    124.     91.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1455          UI     85.     67.     52.     49.     16.     16.     16.     16.     16.     16.
1456          UI     16.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1457          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1458          KK     14C
1459          KM    SUB-BASIN DA-14C
1460          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1461          KM    L= 2.746 mi. Lca= 1.402 mi.  S=   43.7 ft/mi.  Kn= .050  LAG=  58.6 min.
1462          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1463          BA    .726
1464          LG     .35     .15   12.40     .01     .00
1465          UI     42.     42.     71.    148.    187.    218.    245.    277.    318.    381.
1466          UI    496.    520.    425.    367.    328.    283.    249.    213.    184.    136.
1467          UI     90.     73.     69.     55.     42.     42.     19.     13.     13.     13.
1468          UI     13.     13.     13.     13.      0.      0.      0.      0.      0.      0.
1469          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1470          KK    C14C
1471          KM    COMBINE HYDROGRAPHS AT DA-14C
1472          HC      3

1473          KK  R14C-D
1474          KM    ROUTE FLOWS FROM DA-14C TO DA-14D
1475          RS      2    FLOW      -1
1476          RL                    .38    1512
1477          RC   .065    .050    .065    2200  0.0068
1478          RX    500     970     985     992    1006    1012    1030    1500
1479          RY   1522    1516    1514    1512    1512    1514    1516    1522

1480          KK     14D
1481          KM    SUB-BASIN DA-14D
1482          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1483          KM    L= 1.250 mi. Lca= .455 mi.   S=   48.0 ft/mi.  Kn= .050  LAG=  27.8 min.
1484          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1485          BA    .242
1486          LG     .35     .25    8.60     .07     .00
1487          UI     29.     83.    149.    193.    275.    347.    254.    192.    142.     79.
1488          UI     50.     32.     18.      9.      9.      9.      0.      0.      0.      0.
1489          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1490          KK    C14D
1491          KM    COMBINE HYDROGRAPHS AT DA-14D
1492          HC      2

1493          KK     14E
1494          KM    SUB-BASIN DA-14E
1495          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1496          KM    L= 3.030 mi. Lca= 1.496 mi.  S=   49.5 ft/mi.  Kn= .050  LAG=  60.9 min.
1497          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1498          BA    .665
1499          LG     .35     .15   12.40     .01     .00
1500          UI     37.     37.     53.    128.    158.    187.    210.    235.    270.    309.
1501          UI    398.    474.    408.    347.    307.    274.    237.    209.    181.    153.
1502          UI    112.     71.     64.     60.     47.     37.     37.     17.     11.     11.
1503          UI     11.     11.     11.     11.     11.     11.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1504          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1505          KK  R14E-F
1506          KM    ROUTE FLOWS FROM DA-14E TO DA-14F
1507          RS      6    FLOW      -1
1508          RL                    .01    1535
1509          RC    .065    .050    .065    7000  0.0086
1510          RX     800     950     985     992    1012    1020    1055    1160
1511          RY    1544    1540    1538    1535    1535    1538    1540    1544

1512          KK     14F
1513          KM    SUB-BASIN DA-14F
1514          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1515          KM    L= 1.591 mi. Lca= .795 mi.   S=   47.1 ft/mi.  Kn= .050  LAG=  37.9 min.
1516          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1517          BA    .275
1518          LG     .35     .15   12.40     .01     .00
1519          UI     24.     39.     95.    126.    151.    187.    259.    297.    227.    187.
1520          UI    151.    121.     85.     48.     41.     28.     24.      7.      7.      7.
1521          UI      7.      7.      0.      0.      0.      0.      0.      0.      0.      0.
1522          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1523          KK    C14F
1524          KM    COMBINE HYDROGRAPHS AT DA-14F
1525          HC      3

1526          KK  R14F-G
1527          KM    ROUTE FLOWS FROM DA-14F TO DA-14G
1528          RS      3    FLOW      -1
1529          RL                   .318    1494
1530          RC    .065    .045    .065    2700  0.0074
1531          RX     430     930     975     990    1015    1070    1100    1400
1532          RY    1502    1498    1496    1494    1494    1496    1498    1502

1533          KK     14G
1534          KM    SUB-BASIN DA-14G
1535          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1536          KM    L= .701 mi.  Lca= .398 mi.   S=   49.9 ft/mi.  Kn= .050  LAG=  21.1 min.
1537          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1538          BA    .086
1539          LG     .35     .39    6.78     .16     .00
1540          UI     15.     57.     86.    137.    143.     97.     65.     29.     18.      8.
1541          UI      4.      4.      0.      0.      0.      0.      0.      0.      0.      0.
1542          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1543          KK    C14G
1544          KM    COMBINE HYDROGRAPHS AT DA-14G
1545          KM    This hydrograph is a total flow from the Stream No. 14 watershed area.
1546          HC      2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1547          KK     10W
1548          KM    SUB-BASIN DA-10W
1549          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1550          KM    L= .909 mi.  Lca= .455 mi.   S=  368.5 ft/mi.  Kn= .065  LAG=  21.8 min.
1551          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1552          BA    .526
1553          LG     .31     .35    3.87     .38    4.87
1554          UI     81.    329.    494.    754.    904.    613.    422.    212.    122.     67.
1555          UI     25.     25.     25.      0.      0.      0.      0.      0.      0.      0.
1556          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1557          KK    C10W
1558          KM    COMBINE HYDROGRAPHS AT DA-10W
1559          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1560          KM    confluence with Stream No. 14.
1561          HC       3

1562          KK  R10W-X
1563          KM    ROUTE FLOWS FROM DA-10W TO DA-10X
1564          RS       2    FLOW      -1
1565          RL                     .94    1480
1566          RC    .085    .060    .085    1400  0.0036
1567          RX     720     970     980     989    1011    1020    1100    1980
1568          RY    1500    1486    1484    1480    1480    1484    1486    1494

1569          KK     15A
1570          KM    SUB-BASIN DA-15A
1571          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1572          KM    L= .625 mi.  Lca= .303 mi.   S=   48.0 ft/mi.  Kn= .050  LAG=  18.3 min.
1573          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1574          BA    .064
1575          LG     .35     .15   12.40     .01     .00
1576          UI     16.     55.     85.    135.     93.     60.     26.     14.      5.      4.
1577          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1578          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1579          KK  R15A-B
1580          KM    ROUTE FLOWS FROM DA-15A TO DA-15B
1581          RS      11    FLOW      -1
1582          RL                     .01    1482
1583          RC    .065    .050    .065    9200  0.0087
1584          RX     820     870     985     990    1020    1032    1305    1590
1585          RY    1487    1486    1484    1482    1482    1486    1487    1488

1586          KK     15B
1587          KM    SUB-BASIN DA-15B
1588          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1589          KM  L= 1.742 mi. Lca= .833 mi.   S=   45.9 ft/mi.  Kn= .050  LAG=  40.1 min.
1590          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1591          BA    .386
1592          LG     .35     .25   10.10     .04     .00
1593          UI     32.     44.    120.    161.    192.    233.    297.    408.    336.    274.
1594          UI    226.    185.    148.     99.     57.     53.     34.     31.     10.     10.
1595          UI     10.     10.     10.      0.      0.      0.      0.      0.      0.      0.
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1596          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1597          KK    C15B
1598          KM    COMBINE HYDROGRAPHS AT DA-15B
1599          KM    This hydrograph is a total flow from the Stream No. 15 watershed area.
1600          HC       2

1601          KK     10X
1602          KM    SUB-BASIN DA-10X
1603          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1604          KM    L= .928 mi.  Lca= .511 mi.   S=  452.6 ft/mi.  Kn= .070  LAG=  23.8 min.
1605          KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
1606          BA    .152
1607          LG     .25     .35    4.23     .57   14.16
1608          UI     22.     73.    141.    199.    189.    124.    101.     79.     58.     48.
1609          UI     34.     26.     21.     16.     11.     11.      6.      4.      4.      4.
1610          UI      4.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1611          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1612          KK    C10X
1613          KM    COMBINE HYDROGRAPHS AT DA-10X
1614          KM    This hydrograph is the flow in Deadman Wash just downstream of it's
1615          KM    confluence with Stream No. 15.
1616          HC       3

1617          KK  R10X-Y
1618          KM    ROUTE FLOWS FROM DA-10X TO DA-10Y
1619          RS       1    FLOW      -1
1620          RL                     .67    1475
1621          RC    .085    .060    .085    1200  0.0042
1622          RX     710     770     930     978    1022    1052    1310    1880
1623          RY    1486    1482    1480    1475    1475    1480    1482    1486

1624          KK     10Y
1625          KM    SUB-BASIN DA-10Y
1626          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1627          KM    L= .473 mi.  Lca= .208 mi.   S=  687.1 ft/mi.  Kn= .065  LAG=  11.2 min.
1628          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1629          BA    .068
1630          LG     .31     .35    4.16     .56   15.89
1631          UI     50.    151.    198.     89.     27.      6.      0.      0.      0.      0.
1632          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1633          KK    C10Y
1634          KM    COMBINE HYDROGRAPHS AT DA-10Y
1635          KM    This hydrograph is the total flow from the entire Deadman Wash watershed
1636          KM    area just upstream of it's confluence with New River.
1637          HC       2
1638          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  27         10A
              V
              V
  37      R10A-B
              .
              .
  44          .         10B
              .           .
              .           .
  55        C10B............
              V
              V
  58      R10B-C
              .
              .
  65          .         10C
              .           .
              .           .
  76        C10C............
              V
              V
  79      R10C-D
              .
              .
  86          .          1A
              .           .
              .           .
 100          .           .        10D
              .           .         .
              .           .         .
 110          .           .         .        10E
              .           .         .         .
              .           .         .         .
 122        C10E.................................
              V
              V
 127      R10E-F
              .
              .
 134          .         10F
              .           .
              .           .
 144          .           .         2A
              .           .         .
              .           .         .
 155          .           .         .         2B
              .           .         .         .
              .           .         .         .
 165          .           .       C2B............
              .           .         V
              .           .         V
 168          .           .      R2B-C
              .           .         .
              .           .         .
 175          .           .         .         2C
              .           .         .         .
              .           .         .         .
 187          .           .       C2C............
              .           .         .
```

```
                .          .          .
191          C10F.......................
                V
                V
196        R10F-G
                .
                .
203             .        10G
                .          .
                .          .
213             .          .         3A
                .          .          V
                .          .          V
223             .          .       R3A-B
                .          .          .
                .          .          .
230             .          .          .        3B
                .          .          .         .
                .          .          .         .
240             .          .          .         .         3C
                .          .          .         .          .
                .          .          .         .          .
250             .          .        C3C.......................
                .          .          V
                .          .          V
253             .          .       R3C-D
                .          .          .
                .          .          .
260             .          .          .        3D
                .          .          .         .
                .          .          .         .
272             .          .        C3D............
                .          .          .
                .          .          .
276          C10G.......................
                V
                V
281        R10G-H
                .
                .
288             .         4A
                .          .
                .          .
300             .          .         4B
                .          .          .
                .          .          .
311             .        C4B............
                .          V
                .          V
314             .      R4B-C
                .          .
                .          .
321             .          .         4C
                .          .          .
                .          .          .
332             .        C4C............
                .          V
                .          V
335             .      R4C-D
                .          .
                .          .
342             .          .         4D
                .          .          .
                .          .          .
353             .        C4D............
                .          V
```

```
                 .          V
356              .      R4D-E
                 .          .
                 .          .
363              .          .          4E
                 .          .           .
                 .          .           .
373              .       C4E............
                 .          .
                 .          .
377              .          .          5A
                 .          .           V
                 .          .           V
388              .          .       R5A-B
                 .          .           .
                 .          .           .
395              .          .           .          5B
                 .          .           .           .
                 .          .           .           .
405              .          .         C5B............
                 .          .           .
                 .          .           .
408              .          .           .          5C
                 .          .           .           .
                 .          .           .           .
417              .          .           .           .          5D
                 .          .           .           .           .
                 .          .           .           .           .
426              .          .           .         C5D............
                 .          .           .           V
                 .          .           .           V
429              .          .           .       R5D-E
                 .          .           .           .
                 .          .           .           .
436              .          .           .           .          5E
                 .          .           .           .           .
                 .          .           .           .           .
445              .          .         C5E........................
                 .          .           V
                 .          .           V
448              .          .       R5E-F
                 .          .           .
                 .          .           .
455              .          .           .          5F
                 .          .           .           .
                 .          .           .           .
467              .          .         C5F............
                 .          .           .
                 .          .           .
470              .          .           .          5G
                 .          .           .           .
                 .          .           .           .
482              .          .         C5G............
                 .          .           .
                 .          .           .
486              .          .           .          6A
                 .          .           .           V
                 .          .           .           V
497              .          .           .       R6A-B
                 .          .           .           .
                 .          .           .           .
504              .          .           .           .          6B
                 .          .           .           .           .
                 .          .           .           .           .
515              .          .           .         C6B............
                 .          .           .           .
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519                                  7A
                                      V
                                      V
534                               R7A-B
                                      .
                                      .
541                                   .        7B
                                      .         .
                                      .         .
551                                 C7B...........
                                      .
                                      .
554                                   .        7C
                                      .         V
                                      .         V
564                                   .      R7C-D
                                      .         .
                                      .         .
571                                   .         .        7D
                                      .         .         .
                                      .         .         .
581                                   .       C7D..........
                                      .         .
                                      .         .
584                                   .         .        7E
                                      .         .         V
                                      .         .         V
594                                   .         .      R7E-F
                                      .         .         .
                                      .         .         .
601                                   .         .         .         7F
                                      .         .         .          .
                                      .         .         .          .
611                                 C7F...................................
                                      V
                                      V
614                               R7F-G
                                      .
                                      .
621                                   .        7G
                                      .         .
                                      .         .
631                                 C7G......................
                                      V
                                      V
636                               R7G-H
                                      .
                                      .
643                                   .        7H
                                      .         .
                                      .         .
654                            C7H......................
                                 V
                                 V
659                            R7H-C
                                 .
                                 .
666                                 8A
                                     V
                                     V
677                                 R8A
                                     V
                                     V
685                                 R8A-B
                                     .
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692                                                  8B
                                                      .
                                                      .
703                                          C8B............
                                                      V
                                                      V
706                                         R8B-C
                                                      .
                                                      .
713                                                  8C
                                                      .
                                                      .
726                                         C8C1...........
                                                      .
                                                      .
729                                     C8C2...........
                                                  V
                                                  V
734                                     R8C-D
                                                  .
                                                  .
741                                                 8D
                                                      .
                                                      .
750                                         C8D...........
                                                  .
                                                  .
755                                                 10H
                                                      .
                                                      .
765                 C10H...................................
                        V
                        V
771                 R10H
                        V
                        V
779                 R10H-I
                        .
                        .
786                         10I
                            .
                            .
797                             10J
                                .
                                .
808                 C10J......................
                        V
                        V
811                 R10J-K
                        .
                        .
818                         10K
                            .
                            .
828                             10L
                                .
                                .
840                 C10L......................
                        V
                        V
843                 R10L-M
                        .
                        .
850                         10M
                            .
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                .          .
860           C10M............
                V
                V
863           R10M
                V
                V
872         R10M-N
                .
                .
879             .        10N
                .          .
                .          .
889             .          .        10O
                .          .          .
                .          .          .
899             .          .          .        10P
                .          .          .          .
                .          .          .          .
910           C10P...................................
                V
                V
913         R10P-Q
                .
                .
920             .        10Q
                .          .
                .          .
931             .          .         9A
                .          .          V
                .          .          V
943             .          .      R9A-B
                .          .          .
                .          .          .
950             .          .          .         9B
                .          .          .          .
                .          .          .          .
962             .          .       C9B............
                .          .          .
                .          .          .
966           C10Q........................
                V
                V
971         R10Q-R
                .
                .
978             .        10R
                .          .
                .          .
988           C10R............
                .
                .
997             .-------> DIV12A
993         DIV10R
                V
                V
1000        R10R-S
                .
                .
1007            .        10S
                .          .
                .          .
1021          C10S............
                V
                V
1025        R10S-T
```

```
                .
                .
1035            .          .<-------  DIV12A
1032            .     DIV12A
                .          V
                .          V
1036            .     R10R-A
                .          .
                .          .
1043            .          .        12A
                .          .         V
                .          .         V
1053            .          .       R12A
                .          .          .
                .          .          .
1062            .       C12A............
                .          V
                .          V
1067            .     R12A-B
                .          .
                .          .
1074            .          .        12B
                .          .          .
                .          .          .
1084            .       C12B............
                .          .
                .          .
1088            .          .        10T
                .          .          .
                .          .          .
1098         C10T........................
                V
                V
1103        R10T-U
                .
                .
1110            .        10U
                .          .
                .          .
1121            .          .        11A
                .          .         V
                .          .         V
1131            .          .     R11A-B
                .          .          .
                .          .          .
1138            .          .          .        11B
                .          .          .          .
                .          .          .          .
1149            .          .      C11B............
                .          .         V
                .          .         V
1152            .          .      R11B
                .          .         V
                .          .         V
1160            .          .     R11B-D
                .          .          .
                .          .          .
1167            .          .          .        11D
                .          .          .          .
                .          .          .          .
1177            .          .      C11D............
                .          .         V
                .          .         V
1180            .          .     R11D-F
                .          .          .
                .          .          .
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```
1187    .       .       .       11E
        .       .       .        .
        .       .       .        .
1200    .       .       .        .       11F
        .       .       .        .        .
        .       .       .        .        .
1210    .       .     C11F.......................
        .       .       V
        .       .       V
1214    .       .     R11F
        .       .       V
        .       .       V
1222    .       .   R11F-G
        .       .       .
        .       .       .
1229    .       .       .       11C
        .       .       .        V
        .       .       .        V
1238    .       .       .    R11C-G
        .       .       .        .
        .       .       .        .
1245    .       .       .        .       11G
        .       .       .        .        .
        .       .       .        .        .
1255    .       .     C11G.......................
        .       .       V
        .       .       V
1258    .       .   R11G-I
        .       .       .
        .       .       .
1265    .       .       .       11H
        .       .       .        V
        .       .       .        V
1275    .       .       .    R11H-I
        .       .       .        .
        .       .       .        .
1282    .       .       .        .       11I
        .       .       .        .        .
        .       .       .        .        .
1293    .       .     C11I.......................
        .       .       V
        .       .       V
1296    .       .   R11I-J
        .       .       .
        .       .       .
1303    .       .       .       11J
        .       .       .        .
        .       .       .        .
1314    .       .       .        .       11K
        .       .       .        .        .
        .       .       .        .        .
1325    .       .     C11K.......................
        .       .       V
        .       .       V
1328    .       .   R11K-L
        .       .       .
        .       .       .
1335    .       .       .       11L
        .       .       .        .
        .       .       .        .
1348    .       .     C11L............
        .       .       V
        .       .       V
1351    .       .   R11L-M
        .       .       .
        .       .       .
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```
1358          .          .          .        11M
              .          .          .          .
              .          .          .          .
1371          .          .       C11M............
              .          .          V
              .          .          V
1374          .          .     R11M-N
              .          .          .
              .          .          .
1381          .          .          .        11N
              .          .          .          .
              .          .          .          .
1391          .          .       C11N............
              .          .          .
              .          .          .
1395       C10U........................
              V
              V
1400     R10U-V
              .
              .
1407          .        10V
              .          .
              .          .
1418       C10V............
              V
              V
1421     R10V-W
              .
              .
1428          .        14A
              .          V
              .          V
1439          .     R14A-B
              .          .
              .          .
1446          .          .        14B
              .          .          .
              .          .          .
1458          .          .          .        14C
              .          .          .          .
              .          .          .          .
1470          .       C14C........................
              .          V
              .          V
1473          .     R14C-D
              .          .
              .          .
1480          .          .        14D
              .          .          .
              .          .          .
1490          .       C14D............
              .          .
              .          .
1493          .          .        14E
              .          .          V
              .          .          V
1505          .          .     R14E-F
              .          .          .
              .          .          .
1512          .          .          .        14F
              .          .          .          .
              .          .          .          .
1523          .       C14F........................
              .          V
              .          V
```

```
1526          .      R14F-G
              .          .
              .          .
1533          .          .        14G
              .          .          .
              .          .          .
1543          .       C14G............
              .          .
              .          .
1547          .          .        10W
              .          .          .
              .          .          .
1557       C10W........................
              V
              V
1562      R10W-X
              .
              .
1569          .        15A
              .          V
              .          V
1579          .      R15A-B
              .          .
              .          .
1586          .          .        15B
              .          .          .
              .          .          .
1597          .       C15B............
              .          .
              .          .
1601          .          .        10X
              .          .          .
              .          .          .
1612       C10X........................
              V
              V
1617      R10X-Y
              .
              .
1624          .        10Y
              .          .
              .          .
1633       C10Y............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

HEC1 S/N: HMVersion: 6.00 Data File: DM24HRR1.hc1

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
*  RUN DATE  08/06/1992  TIME  13:56:08 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

DEADMAN WASH FLOOD INSURANCE STUDY

100-YEAR, 24-HOUR STORM, SCS TYPE II DISTRIBUTION
Kn VALUES USED FROM MANNING'S n DETERMINATION REPORT

HOWARD NEEDLES TAMMEN & BERGENDOFF
HNTB PROJECT NO. 15081
JUNE, 1992
FILE: DM24HRR1.HC1 CREATED BY: BGS

```
14 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2    0  ENDING DATE
                  NDTIME        0055  ENDING TIME
                   ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

16 JD         INDEX STORM NO. 1
                    STRM        4.38  PRECIPITATION DEPTH
                    TRDA         .01  TRANSPOSITION DRAINAGE AREA

17 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

```
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .01    .01    .01    .01
.01    .01    .01    .01    .01    .01    .01    .01    .06    .06
.06    .06    .06    .06    .01    .01    .01    .01    .01    .01
.01    .01    .01    .01    .01    .01    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
.00    .00    .00    .00    .00    .00    .00    .00    .00    .00
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22 JD INDEX STORM NO. 2

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STRM        4.25  PRECIPITATION DEPTH
TRDA         .50  TRANSPOSITION DRAINAGE AREA
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0 PI PRECIPITATION PATTERN

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23 JD INDEX STORM NO. 3

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STRM        4.16  PRECIPITATION DEPTH
TRDA       10.00  TRANSPOSITION DRAINAGE AREA
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0 PI PRECIPITATION PATTERN

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24 JD INDEX STORM NO. 4

STRM 3.85 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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25 JD INDEX STORM NO. 5

STRM 3.72 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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26 JD INDEX STORM NO. 6

STRM 3.42 PRECIPITATION DEPTH

TRDA 500.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10A	224.	12.08	29.	9.	8.	.15		
ROUTED TO	R10A-B	198.	12.25	29.	9.	8.	.15		
HYDROGRAPH AT	10B	540.	12.33	100.	26.	25.	.37		
2 COMBINED AT	C10B	729.	12.25	128.	35.	33.	.52		
ROUTED TO	R10B-C	667.	12.58	127.	34.	33.	.52		
HYDROGRAPH AT	10C	861.	12.50	183.	48.	46.	.69		
2 COMBINED AT	C10C	1496.	12.50	307.	82.	79.	1.21		
ROUTED TO	R10C-D	1436.	12.67	306.	81.	78.	1.21		
HYDROGRAPH AT	1A	508.	12.92	127.	32.	31.	.58		
HYDROGRAPH AT	10D	193.	12.25	22.	6.	5.	.16		
HYDROGRAPH AT	10E	593.	12.67	148.	39.	37.	.56		
4 COMBINED AT	C10E	2525.	12.75	597.	155.	149.	2.49		
ROUTED TO	R10E-F	2472.	12.83	596.	155.	149.	2.49		
HYDROGRAPH AT	10F	130.	12.17	17.	4.	4.	.08		
HYDROGRAPH AT	2A	415.	12.17	72.	22.	21.	.38		
HYDROGRAPH AT	2B	201.	12.08	27.	8.	8.	.14		
2 COMBINED AT	C2B	600.	12.17	99.	30.	29.	.52		
ROUTED TO	R2B-C	506.	12.67	96.	27.	26.	.52		
HYDROGRAPH AT	2C	604.	12.75	122.	31.	30.	.65		
2 COMBINED AT	C2C	1095.	12.67	216.	57.	55.	1.18		
3 COMBINED AT	C10F	3490.	12.83	824.	215.	207.	3.75		
ROUTED TO	R10F-G	3459.	12.83	823.	215.	207.	3.75		
HYDROGRAPH AT	10G	222.	12.17	37.	10.	9.	.14		
HYDROGRAPH AT	3A	179.	12.08	22.	7.	6.	.12		
ROUTED TO	R3A-B	163.	12.25	22.	6.	6.	.12		
HYDROGRAPH AT	3B	373.	12.17	54.	14.	13.	.23		
HYDROGRAPH AT	3C	190.	12.08	20.	5.	5.	.11		
3 COMBINED AT	C3C	699.	12.17	95.	25.	24.	.46		
ROUTED TO	R3C-D	581.	12.67	95.	25.	24.	.46		

HYDROGRAPH AT	3D	380.	12.75	102.	29.	28.	.35
2 COMBINED AT	C3D	952.	12.67	195.	53.	51.	.82
3 COMBINED AT	C10G	4380.	12.83	1047.	276.	266.	4.70
ROUTED TO	R10G-H	4248.	13.00	1046.	276.	265.	4.70
HYDROGRAPH AT	4A	343.	12.67	87.	24.	24.	.30
HYDROGRAPH AT	4B	390.	12.08	51.	14.	13.	.26
2 COMBINED AT	C4B	571.	12.17	138.	38.	36.	.56
ROUTED TO	R4B-C	524.	12.67	137.	38.	36.	.56
HYDROGRAPH AT	4C	915.	12.42	200.	56.	54.	.69
2 COMBINED AT	C4C	1380.	12.50	335.	93.	90.	1.26
ROUTED TO	R4C-D	1370.	12.58	335.	93.	90.	1.26
HYDROGRAPH AT	4D	266.	12.17	35.	9.	9.	.20
2 COMBINED AT	C4D	1472.	12.58	369.	102.	98.	1.46
ROUTED TO	R4D-E	1447.	12.67	368.	101.	98.	1.46
HYDROGRAPH AT	4E	252.	12.08	28.	7.	7.	.17
2 COMBINED AT	C4E	1489.	12.67	395.	109.	105.	1.63
HYDROGRAPH AT	5A	546.	12.17	89.	27.	26.	.48
ROUTED TO	R5A-B	523.	12.25	89.	27.	26.	.48
HYDROGRAPH AT	5B	108.	12.08	11.	3.	3.	.06
2 COMBINED AT	C5B	605.	12.25	100.	30.	29.	.55
HYDROGRAPH AT	5C	84.	12.00	8.	2.	2.	.05
HYDROGRAPH AT	5D	162.	12.00	15.	4.	4.	.09
2 COMBINED AT	C5D	244.	12.00	24.	6.	6.	.14
ROUTED TO	R5D-E	234.	12.08	23.	6.	6.	.14
HYDROGRAPH AT	5E	100.	12.00	9.	2.	2.	.06
3 COMBINED AT	C5E	875.	12.17	131.	38.	36.	.75
ROUTED TO	R5E-F	746.	12.67	128.	35.	34.	.75
HYDROGRAPH AT	5F	382.	12.67	78.	19.	19.	.38
2 COMBINED AT	C5F	1120.	12.67	204.	54.	52.	1.13
HYDROGRAPH AT	5G	420.	12.75	108.	28.	27.	.40
2 COMBINED AT	C5G	1527.	12.67	310.	82.	79.	1.53
HYDROGRAPH AT	6A	499.	12.50	94.	28.	27.	.50
ROUTED TO	R6A-B	470.	12.75	94.	28.	27.	.50

HYDROGRAPH AT	6B	255.	12.33	42.	11.	10.	.19
2 COMBINED AT	C6B	611.	12.67	135.	38.	37.	.69
HYDROGRAPH AT	7A	1326.	12.58	373.	112.	108.	2.04
ROUTED TO	R7A-B	1311.	12.75	372.	112.	107.	2.04
HYDROGRAPH AT	7B	80.	12.00	10.	2.	2.	.04
2 COMBINED AT	C7B	1319.	12.75	381.	114.	110.	2.08
HYDROGRAPH AT	7C	81.	12.08	8.	2.	2.	.05
ROUTED TO	R7C-D	71.	12.33	8.	2.	2.	.05
HYDROGRAPH AT	7D	65.	12.00	10.	3.	3.	.03
2 COMBINED AT	C7D	118.	12.17	18.	5.	5.	.08
HYDROGRAPH AT	7E	134.	12.17	14.	4.	4.	.09
ROUTED TO	R7E-F	123.	12.33	14.	4.	3.	.09
HYDROGRAPH AT	7F	98.	12.00	11.	3.	3.	.05
4 COMBINED AT	C7F	1405.	12.67	422.	124.	120.	2.30
ROUTED TO	R7F-G	1376.	12.92	421.	123.	119.	2.30
HYDROGRAPH AT	7G	113.	12.25	16.	4.	4.	.07
3 COMBINED AT	C7G	1954.	12.83	568.	164.	158.	3.07
ROUTED TO	R7G-H	1879.	13.08	565.	162.	156.	3.07
HYDROGRAPH AT	7H	195.	12.42	33.	8.	8.	.16
3 COMBINED AT	C7H	3088.	12.83	900.	250.	241.	4.76
ROUTED TO	R7H-C	3068.	12.92	899.	250.	241.	4.76
HYDROGRAPH AT	8A	492.	12.50	87.	22.	21.	.44
ROUTED TO	R8A	490.	12.58	87.	22.	21.	.44
ROUTED TO	R8A-B	477.	12.67	87.	22.	21.	.44
HYDROGRAPH AT	8B	397.	12.33	81.	23.	22.	.28
2 COMBINED AT	C8B	781.	12.50	166.	44.	42.	.72
ROUTED TO	R8B-C	690.	13.33	165.	43.	42.	.72
HYDROGRAPH AT	8C	762.	12.83	208.	54.	52.	.78
2 COMBINED AT	C8C1	1260.	13.00	369.	97.	93.	1.51
2 COMBINED AT	C8C2	4273.	12.92	1260.	345.	332.	6.26
ROUTED TO	R8C-D	4223.	13.08	1260.	344.	332.	6.26
HYDROGRAPH AT	8D	58.	12.00	5.	1.	1.	.04
2 COMBINED AT	C8D	4223.	13.08	1264.	346.	333.	6.30

HYDROGRAPH AT	10H	111.	12.17	12.	3.	3.	.08
4 COMBINED AT	C10H	9437.	12.92	2654.	715.	689.	12.72
ROUTED TO	R10H	9437.	13.00	2654.	715.	689.	12.72
ROUTED TO	R10H-I	9360.	13.00	2653.	715.	688.	12.72
HYDROGRAPH AT	10I	226.	12.33	31.	8.	8.	.18
HYDROGRAPH AT	10J	1080.	12.58	247.	65.	63.	.92
3 COMBINED AT	C10J	9980.	13.00	2903.	781.	752.	13.82
ROUTED TO	R10J-K	9721.	13.25	2897.	777.	748.	13.82
HYDROGRAPH AT	10K	585.	12.17	63.	17.	16.	.42
HYDROGRAPH AT	10L	396.	12.25	67.	18.	18.	.41
3 COMBINED AT	C10L	9762.	13.25	3008.	807.	777.	14.65
ROUTED TO	R10L-M	9673.	13.33	3006.	806.	776.	14.65
HYDROGRAPH AT	10M	512.	12.08	53.	14.	14.	.34
2 COMBINED AT	C10M	9673.	13.33	3054.	819.	789.	14.99
ROUTED TO	R10M	9663.	13.33	3051.	818.	788.	14.99
ROUTED TO	R10M-N	9472.	13.50	3048.	816.	786.	14.99
HYDROGRAPH AT	10N	109.	12.08	11.	3.	3.	.07
HYDROGRAPH AT	10O	148.	12.25	17.	4.	4.	.12
HYDROGRAPH AT	10P	861.	12.42	133.	35.	34.	.77
4 COMBINED AT	C10P	9479.	13.50	3184.	852.	821.	15.96
ROUTED TO	R10P-Q	9077.	14.00	3175.	847.	816.	15.96
HYDROGRAPH AT	10Q	347.	12.17	51.	14.	13.	.33
HYDROGRAPH AT	9A	1088.	12.67	262.	70.	67.	.98
ROUTED TO	R9A-B	1014.	13.17	259.	68.	66.	.98
HYDROGRAPH AT	9B	759.	12.67	185.	48.	47.	.70
2 COMBINED AT	C9B	1519.	13.00	438.	116.	112.	1.67
3 COMBINED AT	C10Q	9520.	13.92	3603.	962.	927.	17.96
ROUTED TO	R10Q-R	9506.	14.00	3602.	962.	926.	17.96
HYDROGRAPH AT	10R	149.	12.17	20.	5.	5.	.09
2 COMBINED AT	C10R	9506.	14.00	3617.	966.	930.	18.04
DIVERSION TO	DIV12A	4278.	14.00	1628.	435.	419.	18.04
HYDROGRAPH AT	DIV10R	5228.	14.00	1989.	531.	512.	18.04
ROUTED TO	R10R-S	5146.	14.25	1976.	524.	505.	18.04

HYDROGRAPH AT	10S	787.	13.33	291.	82.	79.	1.02
2 COMBINED AT	C10S	5548.	14.17	2230.	599.	577.	19.07
ROUTED TO	R10S-T	5525.	14.25	2228.	597.	576.	19.07
HYDROGRAPH AT	DIV12A	4278.	14.00	1628.	435.	419.	18.04
ROUTED TO	R10R-A	4113.	14.50	1621.	432.	416.	18.04
HYDROGRAPH AT	12A	106.	12.17	12.	3.	3.	.08
ROUTED TO	R12A	100.	12.25	12.	3.	3.	.08
2 COMBINED AT	C12A	4494.	14.42	1780.	476.	459.	.08
ROUTED TO	R12A-B	4427.	14.67	1776.	474.	457.	.08
HYDROGRAPH AT	12B	200.	12.08	19.	5.	5.	.15
2 COMBINED AT	C12B	4427.	14.67	1787.	479.	462.	.23
HYDROGRAPH AT	10T	127.	12.00	14.	4.	3.	.07
3 COMBINED AT	C10T	9110.	14.50	3859.	1035.	997.	19.36
ROUTED TO	R10T-U	8919.	14.92	3848.	1029.	991.	19.36
HYDROGRAPH AT	10U	559.	12.50	99.	25.	24.	.49
HYDROGRAPH AT	11A	248.	12.00	29.	8.	8.	.16
ROUTED TO	R11A-B	238.	12.08	28.	8.	8.	.16
HYDROGRAPH AT	11B	285.	12.08	33.	9.	9.	.22
2 COMBINED AT	C11B	519.	12.08	61.	17.	16.	.38
ROUTED TO	R11B	415.	12.25	61.	17.	16.	.38
ROUTED TO	R11B-D	408.	12.33	61.	17.	16.	.38
HYDROGRAPH AT	11D	143.	12.25	18.	5.	5.	.11
2 COMBINED AT	C11D	540.	12.25	79.	22.	21.	.49
ROUTED TO	R11D-F	532.	12.33	79.	22.	21.	.49
HYDROGRAPH AT	11E	353.	12.42	71.	19.	18.	.42
HYDROGRAPH AT	11F	409.	12.25	71.	19.	18.	.26
3 COMBINED AT	C11F	1271.	12.33	219.	59.	57.	1.17
ROUTED TO	R11F	1204.	12.42	219.	59.	57.	1.17
ROUTED TO	R11F-G	1149.	12.67	218.	59.	56.	1.17
HYDROGRAPH AT	11C	81.	12.00	7.	2.	2.	.05
ROUTED TO	R11C-G	62.	12.42	7.	2.	2.	.05
HYDROGRAPH AT	11G	633.	12.08	79.	20.	19.	.35
3 COMBINED AT	C11G	1299.	12.58	302.	80.	77.	1.58

ROUTED TO	R11G-I	1274.	12.83	301.	80.	77.	1.58
HYDROGRAPH AT	11H	282.	12.17	50.	14.	14.	.17
ROUTED TO	R11H-I	250.	12.58	50.	14.	13.	.17
HYDROGRAPH AT	11I	677.	12.50	152.	42.	41.	.53
3 COMBINED AT	C11I	2075.	12.58	496.	135.	130.	2.28
ROUTED TO	R11I-J	1940.	13.17	496.	134.	129.	2.28
HYDROGRAPH AT	11J	992.	12.58	223.	58.	56.	.84
HYDROGRAPH AT	11K	538.	12.33	75.	20.	19.	.43
3 COMBINED AT	C11K	2453.	13.08	785.	210.	202.	3.54
ROUTED TO	R11K-L	2435.	13.17	784.	210.	202.	3.54
HYDROGRAPH AT	11L	2067.	12.92	591.	156.	151.	2.22
2 COMBINED AT	C11L	4375.	13.00	1365.	363.	350.	5.77
ROUTED TO	R11L-M	4343.	13.08	1363.	363.	350.	5.77
HYDROGRAPH AT	11M	734.	12.92	210.	55.	53.	.78
2 COMBINED AT	C11M	5011.	13.00	1566.	417.	401.	6.55
ROUTED TO	R11M-N	4980.	13.17	1565.	416.	401.	6.55
HYDROGRAPH AT	11N	360.	12.25	62.	17.	16.	.23
2 COMBINED AT	C11N	5030.	13.08	1622.	432.	416.	6.78
3 COMBINED AT	C10U	9563.	14.83	5339.	1430.	1378.	26.63
ROUTED TO	R10U-V	9459.	15.17	5320.	1427.	1375.	26.63
HYDROGRAPH AT	10V	1090.	12.25	139.	36.	34.	.96
2 COMBINED AT	C10V	9449.	15.17	5392.	1458.	1404.	27.59
ROUTED TO	R10V-W	9376.	15.33	5373.	1453.	1399.	27.59
HYDROGRAPH AT	14A	2855.	12.58	684.	191.	184.	2.41
ROUTED TO	R14A-B	2574.	13.17	684.	190.	183.	2.41
HYDROGRAPH AT	14B	920.	12.67	234.	66.	63.	.82
HYDROGRAPH AT	14C	773.	12.75	208.	58.	56.	.73
3 COMBINED AT	C14C	3695.	13.00	1116.	311.	299.	3.96
ROUTED TO	R14C-D	3637.	13.17	1115.	310.	299.	3.96
HYDROGRAPH AT	14D	362.	12.25	48.	12.	11.	.24
2 COMBINED AT	C14D	3662.	13.17	1161.	321.	310.	4.20
HYDROGRAPH AT	14E	691.	12.75	191.	53.	51.	.67
ROUTED TO	R14E-F	667.	13.08	190.	53.	51.	.67

HYDROGRAPH AT	14F	379.	12.42	80.	22.	21.	.28
3 COMBINED AT	C14F	4392.	13.17	1422.	394.	380.	5.14
ROUTED TO	R14F-G	4334.	13.25	1420.	393.	378.	5.14
HYDROGRAPH AT	14G	132.	12.08	13.	3.	3.	.09
2 COMBINED AT	C14G	4334.	13.25	1433.	396.	381.	5.22
HYDROGRAPH AT	10W	710.	12.08	72.	19.	18.	.53
3 COMBINED AT	C10W	9665.	13.58	6597.	1813.	1747.	33.34
ROUTED TO	R10W-X	9620.	13.75	6584.	1810.	1743.	33.34
HYDROGRAPH AT	15A	124.	12.08	19.	5.	5.	.06
ROUTED TO	R15A-B	95.	12.75	19.	5.	5.	.06
HYDROGRAPH AT	15B	485.	12.42	85.	21.	21.	.39
2 COMBINED AT	C15B	521.	12.58	103.	26.	25.	.45
HYDROGRAPH AT	10X	156.	12.17	21.	6.	6.	.15
3 COMBINED AT	C10X	9663.	13.75	6669.	1836.	1769.	33.94
ROUTED TO	R10X-Y	9599.	13.83	6661.	1833.	1766.	33.94
HYDROGRAPH AT	10Y	99.	12.00	10.	3.	3.	.07
2 COMBINED AT	C10Y	9599.	13.83	6662.	1835.	1768.	34.01

*** NORMAL END OF HEC-1 ***
Elapsed Time - 00:08:47.61 (527.61 Seconds)
NORMAL END OF HEC-1

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY
FCD 90-65

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HYDROLOGY

SECTION 3.6: Final Modeling Results on Diskettes

3.6 Final Modeling Results on Diskettes

Two HEC-1 models were developed for the Deadman Wash watershed hydrology to determine peak discharges for the 100-year 6-hour and 100-year 24-hour duration storms. In addition, two other HEC-2 models were created to determine the hydraulic characteristics at the Snodgrass Tank and the flow ratio in the split flow reach, respectively. **Table 18** is a description of the models used and included on the diskette.

Table 18
HEC-1 and HEC-2 Models

Input File	Description
DM6HRR1.HC1	Deadman Wash HEC-1 model for a 100-year 6-hour storm
DM24HRR1.HC1	Deadman Wash HEC-1 model for a 100-year 24-hour storm
DMTANK.HC2	Hydraulic analysis at the Snodgrass Tank
DMSPLIT.HC2	Split flow analysis using HEC-2 Model

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

FCD 90-65

TECHNICAL DATA NOTEBOOK
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SECTION 5: EROSION AND SEDIMENT TRANSPORT

SECTION 5: EROSION AND SEDIMENT TRANSPORT

No erosion and sediment transport analyses have been conducted for this project.

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

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TECHNICAL DATA NOTEBOOK
HYDROLOGY

SECTION 6: REFERENCE MATERIALS

SECTION 6: REFERENCE MATERIALS

6.5 Referenced Technical Papers and Documents

6.5.1 References

1. Arizona Department of Water Resources, "Instructions for Organizing and Submitting Technical Documentation for Flood Studies," Engineering Division, August 1991, revised September 1991.

2. Flood Control District of Maricopa County, "Hydrologic Design Manual for Maricopa County, Arizona," September 1, 1990.

3. Haestad Methods, Inc., "HEC-1 Flood Hydrograph Package, User's Manual and Computer Model, Version 4.0," developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, September 1990.

4. National Weather Service, "NOAA Technical Memorandum NWS Hydro-40, Depth-Area Ratios in the Semi-Arid Southwest United States," August 1984.

5. Federal Highway Administration, "HY-8 Culvert Hydraulics Computer Program, Version 1.1," 1985.

6. Federal Highway Administration, "Hydraulic Design of Highway Culverts," Hydraulic Design Series No. 5, September 1985.

7. Haestad Methods, Inc., "HEC-2 Water Surface Profiles, User's Manual and Computer Model, Version 4.6.2," developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, May 1991.

8. Sea, Inc., "Deadman's Wash Area Drainage Master Study for City of Phoenix", Volumes 1 and 2," September 1990.

9. Coe & Van Loo Consultants, Inc., "Santa Re - Conceptual Master Drainage Report, Maricopa County," April 1991.

10. Soil Conservation Service, "Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona," April 1986.

11. Bureau of Reclamation, "Flood Hydrology Manual," U.S. Department of the Interior, first edition, 1989.

12. Flood Control District of Maricopa County, "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona," prepared by U.S. Geological Survey, April 1991.

13. Aerial Mapping Company, Inc., Topographic maps, Scale 1" = 200', 2' contour intervals and 4' contour intervals, 1991.

14. Topographic Maps for Santa Re, Scale 1" = 200', 2' contour intervals, undated (aerial company name unknown).

15. Soil Conservation Service, "National Engineering Handbook, Section 4, Hydrology," March, 1985.

16. Creighton, David E., Jr., "Cyclic Streamflow Test for Validity of Randomness," in Hydraulic/Hydrology of Arid Lands, ASCE, Hydraulics Division, Proc International Symposium, New York, N.Y., 1990.

17. U.S. Geological Survey, "Basin Characteristics and Streamflow Statistics in Arizona, as of 1989," Water-Resources Investigations Report 91-4041.

18. Federal Emergency Management Agency, "Flood Insurance Study Guidelines and Specifications for Study Contractors," FEMA 37, March, 1991.

6.5.2 As-Built Plans

1. Arizona Department of Transportation, As-Built Plans.

   a. Phoenix-Cordes Junction, Maricopa County I-17-1(56), dated 2-1-65.

   b. Phoenix Cordes Junction, Maricopa County I-17-1(57), dated 1-10-67.

   c. Phoenix Cordes Junction, Maricopa County I-17-1(61), dated 6-12-69.

2. Maricopa County Highway Department, As-Built Plans.

   a. Black Mountain Road (Now Carefree Highway west of I-17), Ridge Route to U.S. 69, Maricopa County, dated 8-13-65.

   b. Carefree Road (East of I-17) Black Canyon Freeway to Cave Creek, Maricopa County, dated 8-23-74.

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FLOODPLAIN DELINEATION STUDY

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TECHNICAL DATA NOTEBOOK
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SECTION 7: CROSS-REFERENCING AND LABELING INFORMATION

SECTION 7.1: Other Studies Impacted

SECTION 7: CROSS-REFERENCING AND LABELING INFORMATION

7.1 Other Studies Impacted

No existing FEMA studies are available for this watershed. Two other drainage studies in the watershed would be affected by the results of this study. The Deadman's Wash Area Drainage Master Study by Sea, Inc. was only a conceptual master drainage plan for the City of Phoenix. The other study is the Santa Re Conceptual Master Drainage Report for a portion of Deadman Wash watershed east of I-17 by the CVL. Since both studies were not a standard FEMA flood study, the hydrology of this project should be used as a guide for any future improvements in the watershed. Refer to **Section 3.3 - Calibration** for a discussion of the results of this study as compared with the above studies.

The New River floodplain delineation from New River Dam Reservoir to Rock Spring's by the CVL, dated April 1988 was used in the hydraulic analysis portion of this project.

DEADMAN WASH
FLOODPLAIN DELINEATION STUDY

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TECHNICAL DATA NOTEBOOK
HYDRAULIC ANALYSIS

SECTION 7.2: Key to Cross-Section Labeling

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	A	0.092		
	B	0.159		
	C	0.202		
	D	0.299		
	E	0.382		
	F	0.516		
	G	0.618		
	H	0.721		
	I	0.803		
	J	0.909		
	K	0.988		
	L	1.079		
	M	1.199		
	N	1.313		
	O	1.419		
	P	1.527		
	Q	1.620		
	R	1.717		
	S	1.811		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	T	1.909		
	U	2.004		
	V	2.060		
	W	2.142		
	X	2.233		
	Y	2.326		
	Z	2.406		
	AA	2.500		
	AB	2.595		
	AC	2.689		
	AD	2.777		
	AE	2.872		
	AF	2.947		
	AG	3.023		
	AH	3.117		
	AI	3.209		
	AJ	3.284		
	AK	3.347		
	AL	3.385		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	AM	3.481		
	AN	3.546		
	AO	3.639		
		3.648		
	AP	3.651		
	AQ	3.710		
	AR	3.804		
	AS	3.881		
	AT	3.957		
	AU	4.019		
	AV	4.058		
	AW	4.146		
	AX	4.197		
	AY	4.262		
	AZ	4.333		
	BA	4.390		
	BB	4.492		
	BC	4.567		
	BD	4.662		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	BE	4.756		
	BF	4.850		
	BG	4.943		
	BH	5.034		
	BI	5.113		
	BJ	5.189		
	BK	5.284		
	BL	5.379		
	BM	5.473		
	BN	5.552		
	BO	5.646		
	BP	5.741		
	BQ	5.835		
	BR	5.928		
	BS	6.021		
	BT	6.108		
	BU	6.205		
	BV	6.280		
	BW	6.362		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
		6.363		
		6.371		
	BX	6.372		
	BY	6.467		
	BZ	6.558		
	CA	6.654		
	CB	6.751		
	CC	6.849		
	CD	6.945		
	CE	7.042		
	CF	7.133		
	CG	7.228		
	CH	7.323		
	CI	7.417		
	CJ	7.513		
	CK	7.587		
	CL	7.663		
	CM	7.738		
	CN	7.766		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
		7.769		
		7.778		
	CO	7.785		
		7.792		
		7.800		
	CP	7.812		
	CQ	7.872		
	CR	7.921		
	CS	8.016		
	CT	8.111		
	CU	8.187		
	CV	8.278		
	CW	8.373		
	CX	8.485		
	CY	8.574		
	CZ	8.670		
	DA	8.763		
	DB	8.853		
	DC	8.939		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Stream Name: Deadman Wash
Run Date: October 16, 1992

Prepared By: B. Gary Sun, HNTB

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	DD	9.021		
	DE	9.114		
	DF	9.210		
	DG	9.304		
	DH	9.400		
	DI	9.492		
	DJ	9.586		
	DK	9.682		
	DL	9.776		
	DM	9.872		
	DN	9.966		
	DO	10.058		
	DP	10.151		
	DQ	10.230		
	DR	10.325		
	DS	10.419		
	DT	10.544		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Prepared By: B. Gary Sun, HNTB

Stream Name: Deadman Wash Tributary - Stream Number 4
Run Date: October 16, 1992

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
		0.000		
		0.054		
		0.145		
	A	0.231		
	B	0.327		
	C	0.423		
	D	0.520		
	E	0.592		
	F	0.782		
	G	0.876		
	H	0.971		
	I	1.072		
	J	1.172		
	K	1.272		
	L	1.367		
	M	1.436		

KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Prepared By: B. Gary Sun, HNTB

Stream Name: Deadman Wash Tributary - Stream Numbers 7 & 8
Run Date: October 16, 1992

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
		0.025		
		0.075		
		0.080		
	A	0.170		
	B	0.266		
	C	0.323		
	D	0.403		
	E	0.482		
	F	0.591		
	G	0.700		
	H	0.805		
	I	0.903		
	J	1.002		

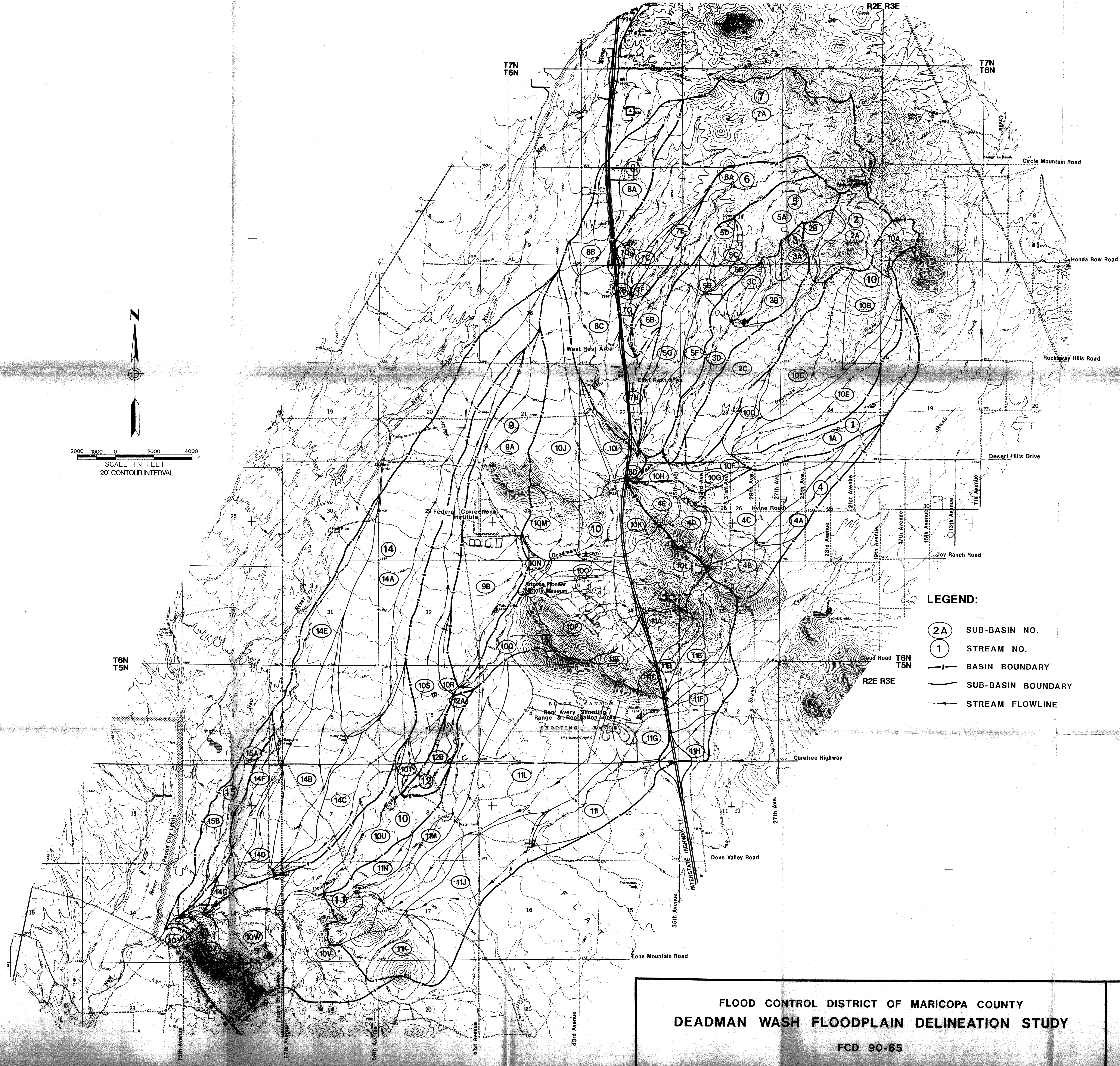
KEY TO CROSS-SECTION (XS) LABELING

Community Name: N/A
County: Maricopa County
State: Arizona

Prepared By: B. Gary Sun, HNTB

Stream Name: Deadman Wash Tributary - Stream Number 12
Run Date: October 16, 1992

Field Survey Section No.	XS Letter Draft FIS	Computer Stationing	XS Letter Final FIS	EPA Reach No.
	STR12-1	0.434		
	STR12-2	0.529		
	STR12-3	0.624		



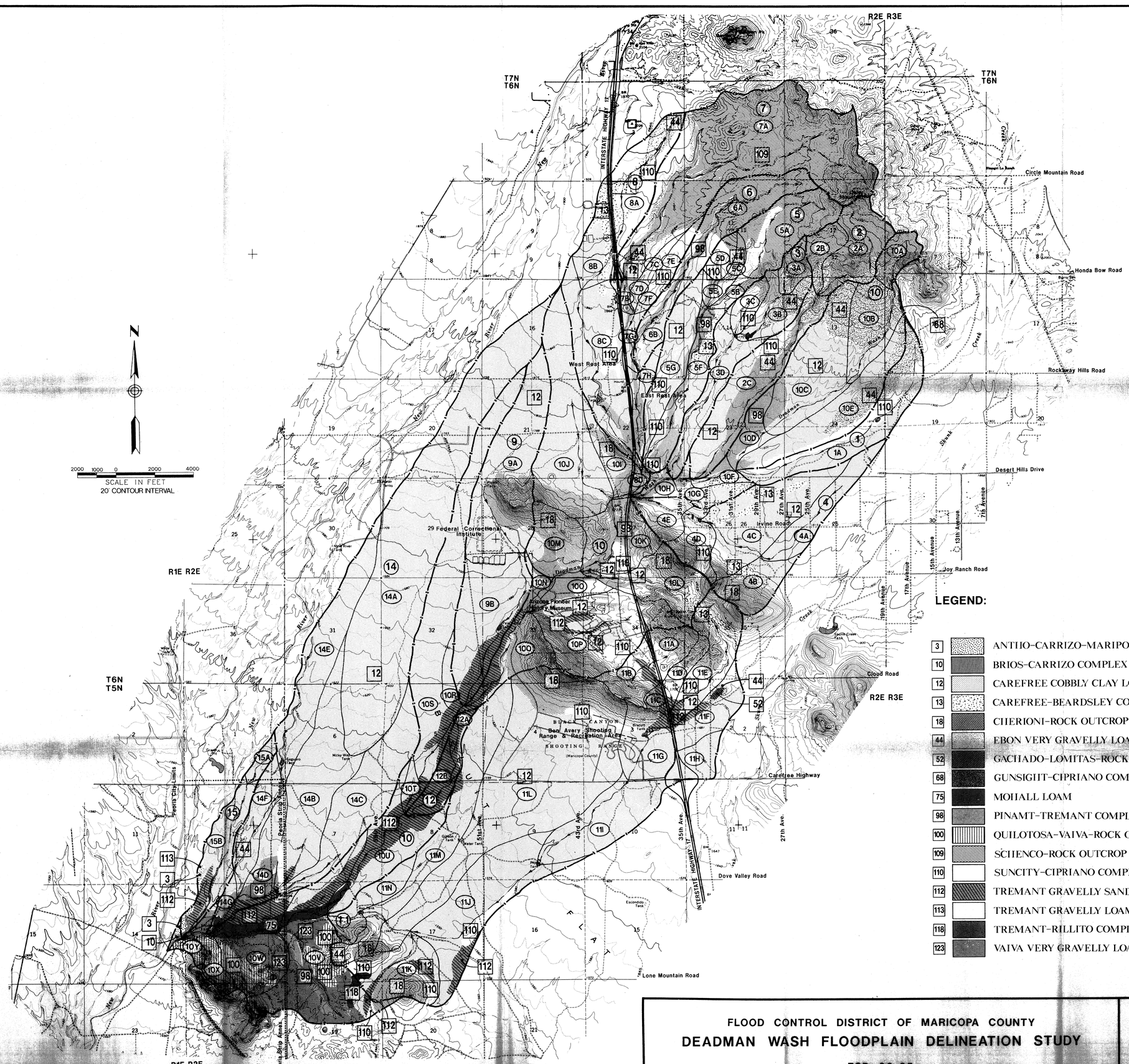
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DEADMAN WASH FLOODPLAIN DELINEATION STUDY

FCD 90-65

EXHIBIT 1

DRAINAGE BASIN MAP



LEGEND:

3	ANTHO-CARRIZO-MARIPO COMPLEX
10	BRIOS-CARRIZO COMPLEX
12	CAREFREE COBBLY CLAY LOAM
13	CAREFREE-BEARDSLEY COMPLEX
18	CHERIONI-ROCK OUTCROP COMPLEX
44	EBON VERY GRAVELLY LOAM
52	GACHADO-LOMITAS-ROCK OUTCROP COMPLEX
68	GUNSIGHT-CIPRIANO COMPLEX
75	MOHALL LOAM
98	PINAMT-TREMANT COMPLEX
100	QUILOTOSA-VAIVA-ROCK OUTCROP COMPLEX
109	SCHENCO-ROCK OUTCROP COMPLEX
110	SUNCITY-CIPRIANO COMPLEX
112	TREMANT GRAVELLY SANDY LOAMS
113	TREMANT GRAVELLY LOAMS
118	TREMANT-RILLITO COMPLEX
123	VAIVA VERY GRAVELLY LOAM

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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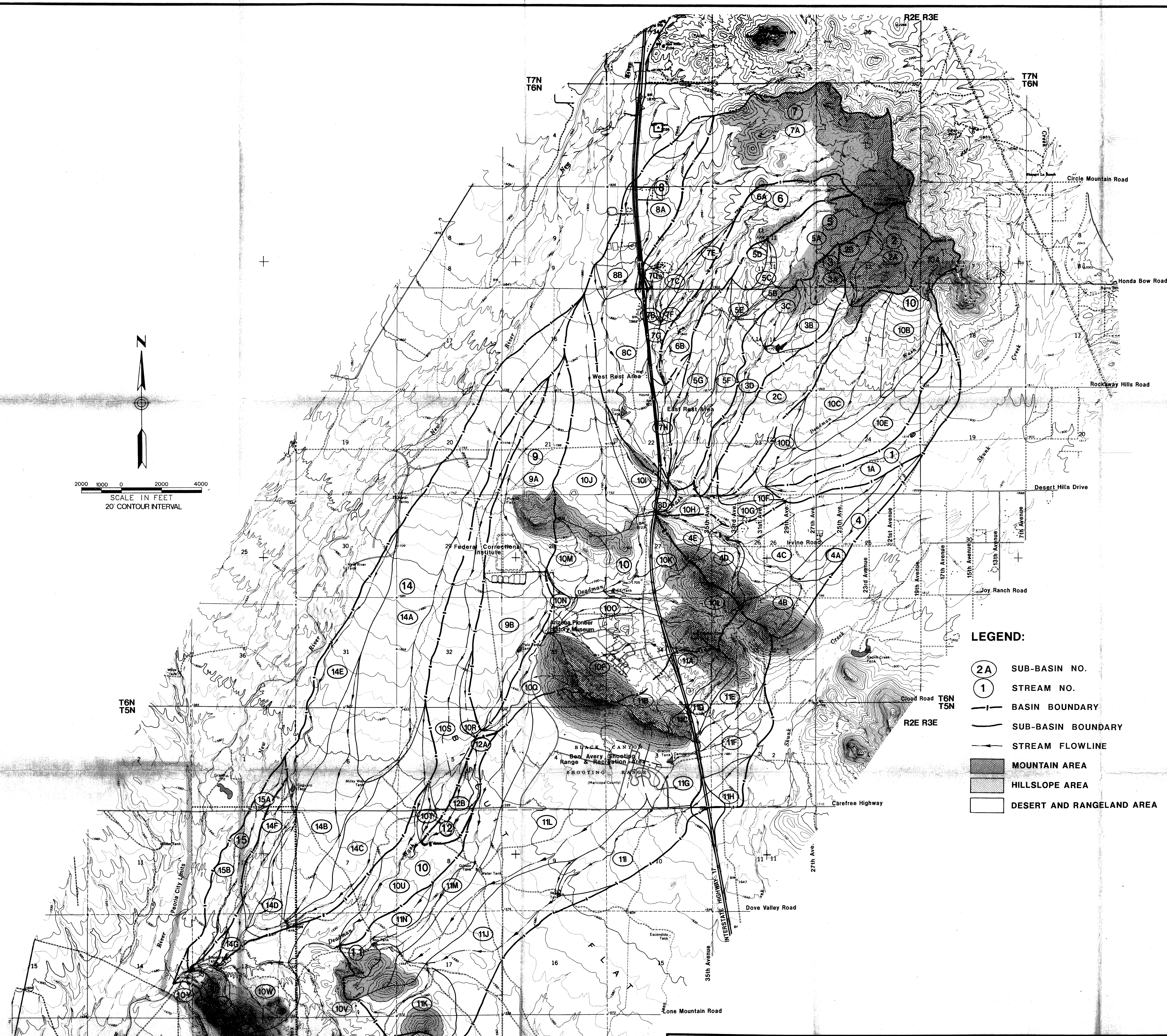
EXHIBIT 2

DRAINAGE SUB-BASIN SOILS MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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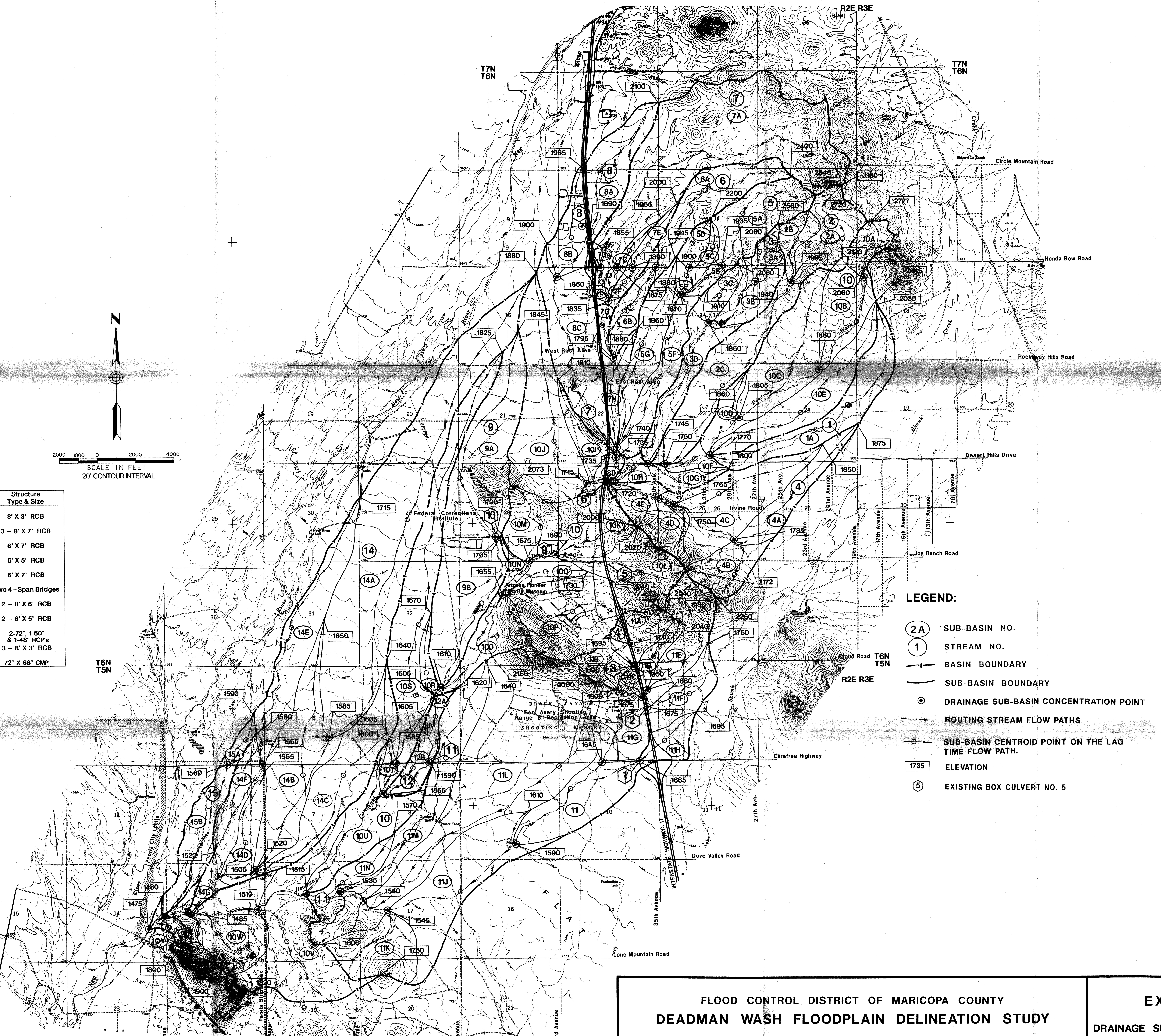
EXHIBIT 3

DRAINAGE SUB-BASIN LAND USE MAP

SUMMARY OF EXISTING CULVERTS

Culvert No.	Stream No.	Location	Structure Type & Size
1	11	Carefree Hwy Interchange	8' X 3' RCB
2	11	I–17 Crossing at Shooting Range	3 – 8' X 7' RCB
3	11	I–17 Crossing at Concentration Point 11B	6' X 7' RCB
4	11	I–17 Crossing to Drainage Sub–Basin 11B	6' X 5' RCB
5	No Name	I–17 Crossing in Drainage Sub–Basin 10L	6' X 7' RCB
6	Deadman	Deadman Wash Two I–17 Bridge Crossings	Two 4–Span Bridges
7	8	I–17 Crossing North of Desert Hills Road	2 – 8' X 6' RCB
8	8	I–17 Crossing North of New River Road	2 – 6' X 5' RCB
9	Deadman	Deadman Wash Crossing at Joy Ranch Road	2-72", 1-60" & 1-48" RCP's
10	9	Roadway Crossing inside Federal Correct. Inst.	3 – 8' X 3' RCB
11	Deadman	Deadman Wash Carefree Hwy Crossing	72" X 68" CMP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DEADMAN WASH FLOODPLAIN DELINEATION STUDY

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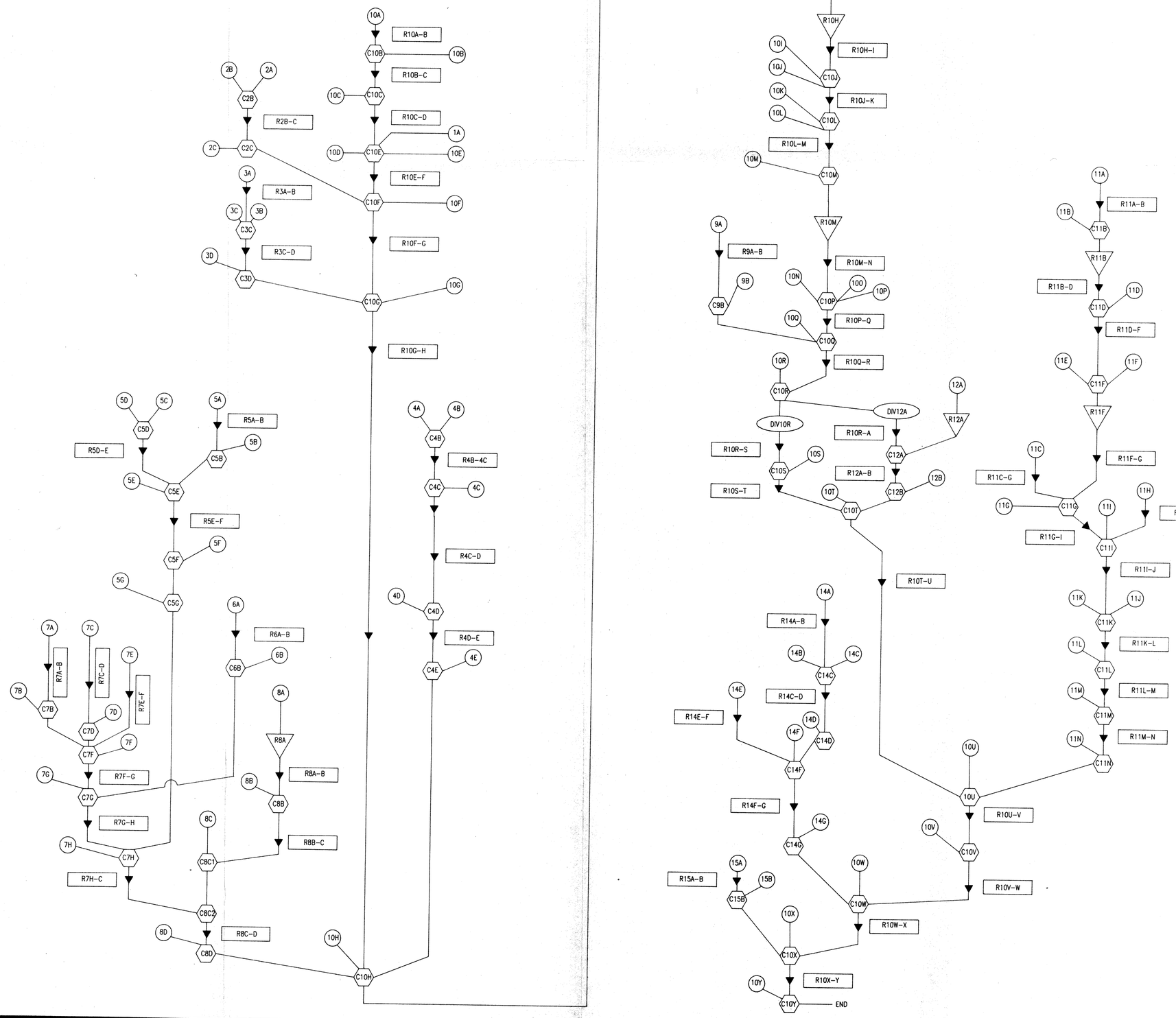
EXHIBIT 4

DRAINAGE SUB-BASIN FLOW PATHS AND FLOOD ROUTING MAP



LEGEND

10A	COMPUTE RUNOFF FROM SUB-BASIN 10A
R10A-B	CHANNEL ROUTING FROM SUB-BASIN 10A TO 10B
C10B	COMBINE HYDROGRAPHS OR CONCENTRATION POINT AT SUB-BASIN 10B
R10M	ROUTE HYDROGRAPH THROUGH STRUCTURE IN SUB-BASIN 10M
DIV10R	DIVERT HYDROGRAPH FROM MAIN CHANNEL AT SUB-BASIN 10R

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EXHIBIT 5

HEC-1 MODEL SCHEMATIC

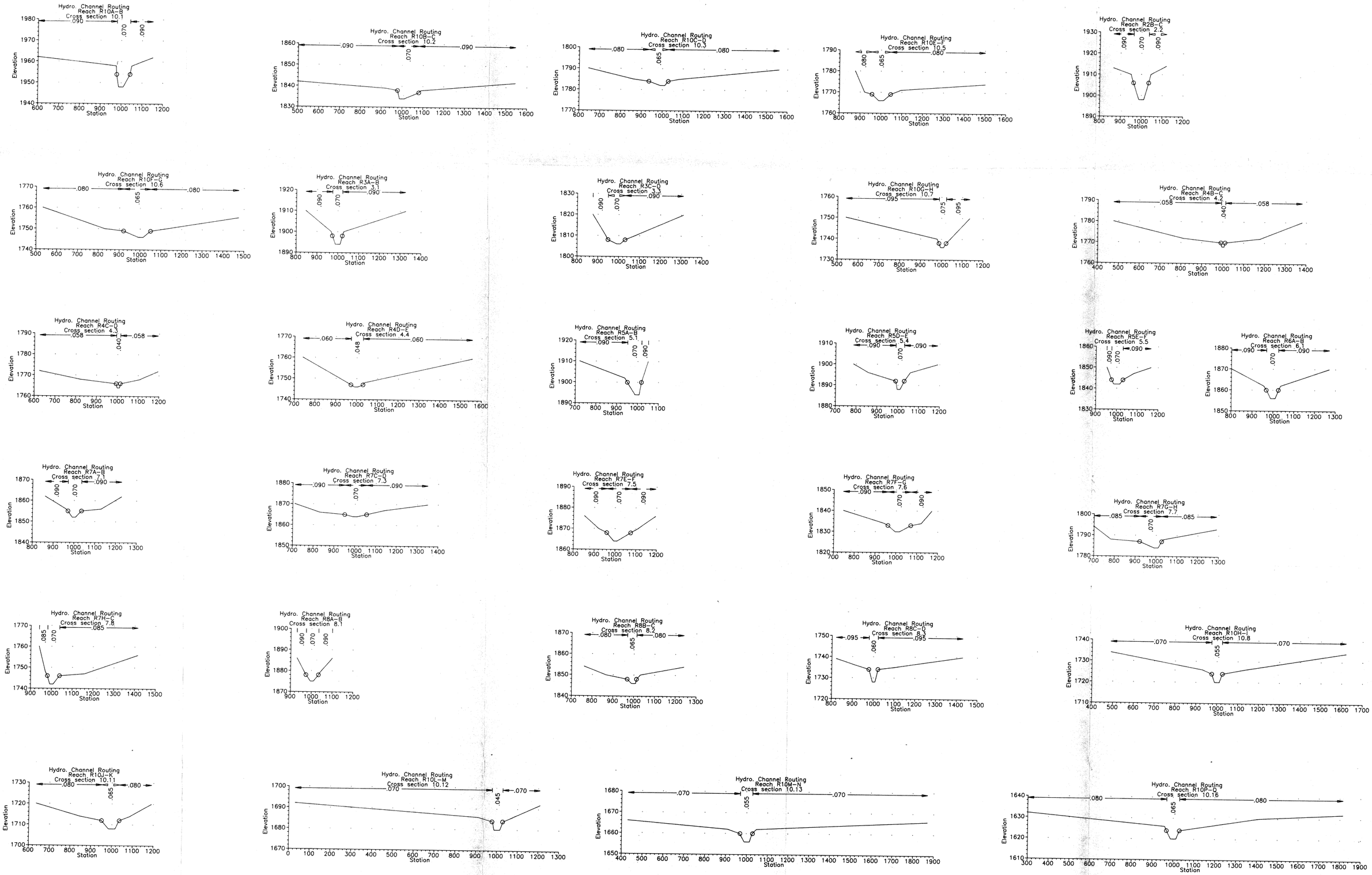

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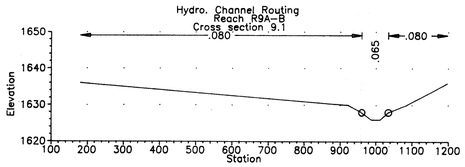
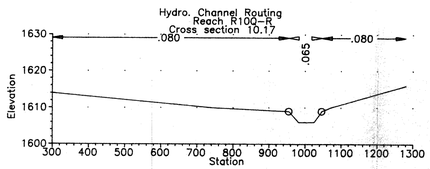
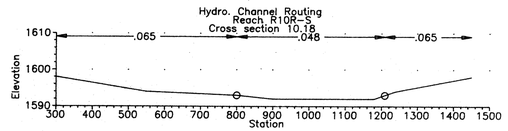
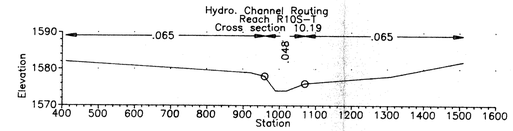
EXHIBIT 6

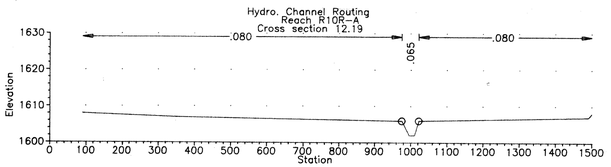
REACH ROUTING
CROSS SECTION PLOTS

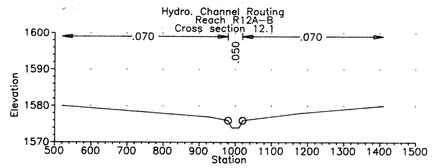


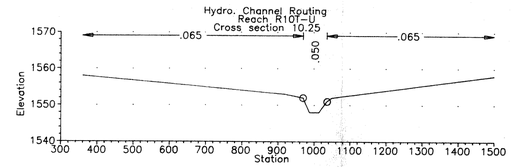


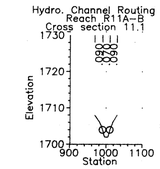


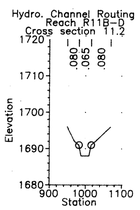


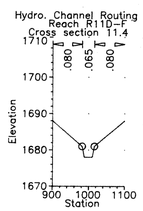


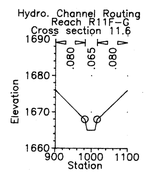


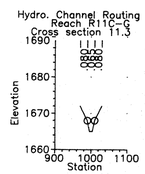


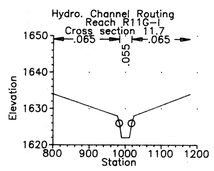


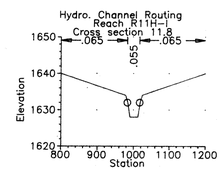


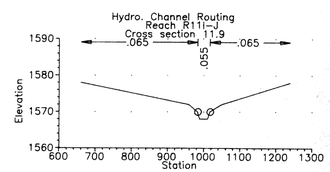


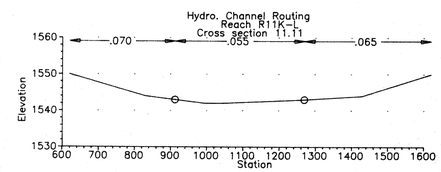


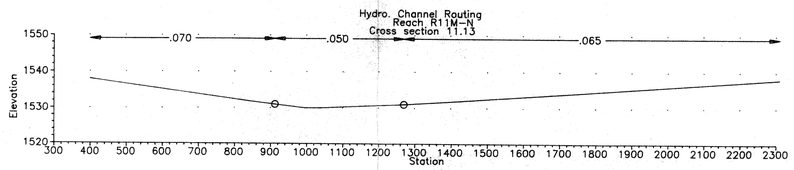


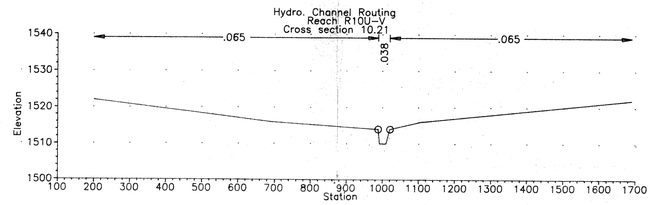


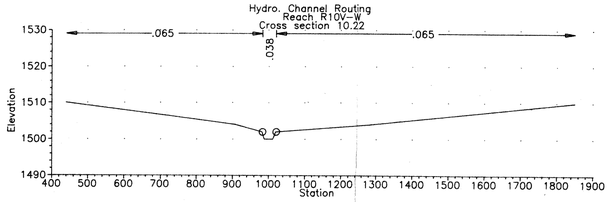


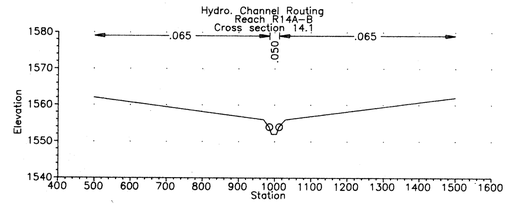


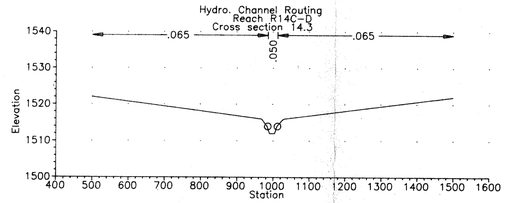


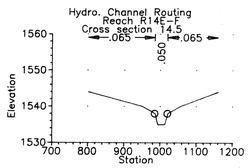


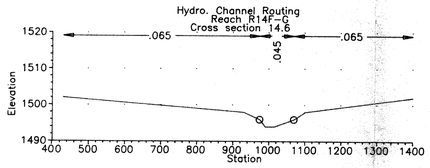


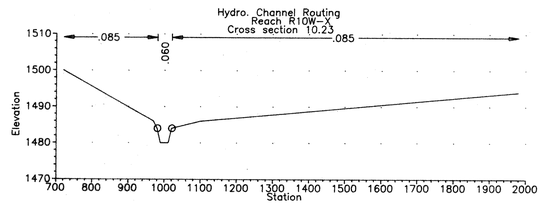


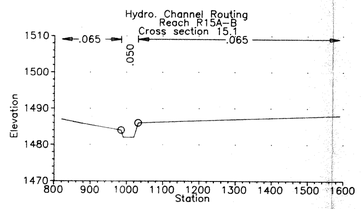












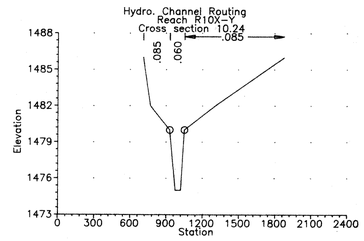


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EXHIBIT 6

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