FINAL

DATA COLLECTION REPORT
CAREFREE DRAINAGE MASTER PLAN

Prepared for

Flood Control District of Maricopa County

Seal of the Town of Carefree Arizona

Prepared by

CH2MHILL

November 2002

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Carefree Drainage Master Plan Data Collection Report Update

TO: Flood Control District of Maricopa County

COPIES: File

FROM: Tony Bokich and Rob Lyons

DATE: May 2004

The Carefree Drainage Master Plan Data Collection Report has been updated since November, 2002 to include revisions to the hydrology conducted in April, 2004 The Flow Summary Table, the HEC-1 model reports, and the CD with HEC-1 files have all been updated to reflect the revised hydrology. The updated material is included in Appendix F of the Report.

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ARIZONA, U.S.A.

Technical Memorandum

Final Data Collection Report
Carefree Drainage Master Plan

Prepared for

Flood Control District of Maricopa County

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Attached to Back of Binder – CD Containing HEC-1 Files

Executive Summary

This report presents the results of the data collection phase of the Carefree Drainage Master Plan, prepared for the Flood Control District of Maricopa County. This phase includes data collection, existing conditions analysis, and preparation of hydrologic models for both existing and future conditions.

Information was gathered from existing drainage studies and reports for the study area, existing and proposed improvement plans, existing topographic mapping and aerial photography, field surveys, historical flooding documentation, stream gauging, and interviews with residents, Town personnel, and regulatory personnel. Information on problematic drainage areas within the Town was additionally compiled during this phase of the project.

Hydrology models were created for the 10-year and 100-year frequencies for the 6- and 24-hour duration for both the existing and future condition land usages within the project watershed. The watershed includes a large area previously modeled as part of the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14). This study contains two models, one for Andora Hills Wash and one for Galloway Wash. These previously developed models were updated as part of this study to include additional frequencies and durations, future conditions, and subbasins refinement. The hydrology modeling additionally provides an estimation of peak discharges at road crossing locations within the Town.

Project Description

The Carefree Drainage Master Plan (DMP) project was initiated to identify drainage problems and develop cost-effective solutions for a storm water collection and disposal system. The project encompasses the entire Carefree Town limits, covering approximately 20 square miles in area. A location map is included as Figure 1.

The purpose of the Carefree DMP is to:

- Identify and quantify the extent of existing and future potential flooding problems within the Town of Carefree and develop alternative solutions to reduce flooding and provide emergency access to residents.
- Conduct a Public Involvement Program with the intention of gathering and disseminating pertinent information regarding flooding, sedimentation and vehicle access, and to keep the citizens of Carefree informed on the progress of the study while obtaining acceptance of the study and its findings and recommendations.
- Perform a qualitative evaluation of the erosion and sedimentation patterns and characteristics within the Town of Carefree and upstream contributing areas, where deemed appropriate, to provide a tool for estimating the long-term benefits or effects of proposed improvements.

Data Collection Results

CH2M HILL has collected and reviewed data pertinent to the scope of the project and project area. The categories of data sought include: Existing drainage studies and reports for the study area, existing and proposed improvement plans, existing topographic mapping and aerial photography, field surveys, historical flooding documentation, stream gauging, and interviews with residents, Town personnel, and regulatory personnel. Table 1 in Appendix A contains a summary of the information gathered during the data collection phase of the project.

Research was performed at the Town of Carefree, City of Scottsdale, Flood Control District of Maricopa County, Maricopa County Department of Transportation, United States Geological Survey, Soil Conservation Service, and other public and private enterprises with information on the project area.

Existing and Proposed Improvement Plans

Improvement Plans were obtained from the Town of Carefree. During the research phase of the project, it was determined that the Town is the only entity that currently maintains any improvement plans for the project area, even if the improvements were developed under another jurisdiction and later annexed into the Town. At the time of annexation, all records for the developments were reportedly turned over to the town, and no longer exist at the original governing agency. The exception to this is utility plans and flood control structure plans, which may be found at the utility companies and Flood Control District, respectively.

The locations of many of the drainage related structures that exist within the Town were obtained from the gathered improvement plans. Information taken from the plans included structure type, size, invert elevations, overtopping elevations, and design flows. Plans were not available for many of the improvements within the Town. In areas not covered by improvement plans, a field survey was performed to acquire the necessary information. Reference the Field Survey section, below, for further information.

Improvements are proposed in limited areas, due to the largely developed nature of the Town. Proposed improvement plans were obtained for Canyon Crossings, Ironwood Estates, Carefree Villages, and the Town Center Drainage Improvements (currently under construction). Additional proposed improvements include a shopping center, church, office parks, and a Senior Care facility, although plans were not available for these developments. The locations of these developments are shown on the Existing Facilities Map, Figure 2 in Appendix B.

Existing and Proposed Drainage Studies and Reports

Research was performed at the Town of Carefree, City of Scottsdale, Flood Control District of Maricopa County, Maricopa County Department of Transportation, United States Geological Survey, Soil Conservation Service, and other public and private enterprises with information on the project area. Drainage studies and reports completed in conjunction with land developments were found covering a limited portion of the project area. The *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14) contains existing hydrologic analyses for the northern half of the Town and offsite drainage basins, and

detailed floodplain delineation for the Galloway Wash through the Town. These existing analyses were updated as part of this study, as described below in the Hydrologic Methodology section. Table 1 in Appendix A contains a summary of the existing studies and reports obtained during the data collection phase of the project.

Due to the largely developed nature of the Town, few future improvements are proposed at this time. Drainage reports were obtained for the proposed Canyon Crossings, Carefree Villages, and Ironwood Estates. It should be noted that the development at Carefree Villages, as it is currently proposed, was denied by Town Council, and therefore will not be developed at this time.

Field Surveys

A field survey was performed within the Town limits. The survey consisted of obtaining or verifying the locations of all drainage-related structures, including culverts, bridges, channels, and dip sections. Additionally, areas of excessive erosion and sedimentation, evidence of flooding events, and structural damage were noted. Table 10 in Appendix A contains a drainage structure summary and Appendix G contains a photo log from the field surveys.

Existing Mapping and Aerial Photography

Detailed topographic mapping is not available for a majority of the land within the Town boundaries. Areas of detailed topographic mapping within the Town limits is limited to the area covered by previous floodplain studies, or areas planned for floodplain mapping as a future phase of this project. However, the entire Town and offsite drainage areas are covered by USGS topographic mapping, with a contour interval of 20 feet. The offsite drainage areas within the limits of the City of Scottsdale are covered by topographic mapping with a contour interval of 2 feet.

Aerial photography coverage, taken in January of 2000, exists for the entire drainage area. The City of Scottsdale has additional coverage for the offsite areas within the City boundaries. Additionally, historic aerial photography coverage of the Town exists for 1999, 1994, 1990, and 1963. The historical photography exists in hard copy format, and is on file at the Town.

GIS data for the project area was supplied digitally by the FCDMC. This data includes soils data, land use data, existing hydrologic delineations, and existing section lines for the project area. An existing parcel location map and zoning map in electronic format were obtained from the Town.

Historical Flooding Documentation

Newspaper articles and photographs were previously examined at the Cave Creek Museum by JE Fuller and Associates during *the Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14). Copies of these articles and photographs were obtained. However, during the time of the preparation of this report, the Cave Creek Museum was closed for remodeling, and therefore no further research at the Museum was performed. Flood photos were additionally provided by private citizens, and are included in the Photo Log for the project, attached as Appendix G.

Stream Gauging

According to the Data Collection Summary prepared by JE Fuller Hydrology and Geomorphology Inc. ("JE Fuller") for the Floodplain Delineation Study of Andora Hills and Galloway Washes, no stream gauging records were identified for the project area. Two precipitation gauges are known to exist in Galloway Wash basin, and monthly precipitation statistics were gathered for these two gauges during the Andora Hills and Galloway Washes study.

Interviews

Interviews were performed with Town personnel, regulatory personnel, residents, and others knowledgeable about the project area. Table 2 in Appendix A, contains a summary of the information gathered during the interview process.

Environmental Surveys and Cultural Resources Assessment

The State of Arizona Game and Fish Department and the U.S. Fish and Wildlife Service were contacted for listings of potentially occurring threatened and endangered species within the project area. The response received from the State of Arizona indicates that the project does not occur in the vicinity of any proposed or designated Critical Habitats. Appendix E contains copies of the request and response letters.

A cultural resources assessment, an environmental regulatory records review, and additional ecological assessments will be performed during the Alternative Analysis phase of the project on approved alternative locations.

Multi-Use Opportunities

The natural washes that exist in the Town provide opportunities for trails, and other multi-use opportunities such as recreation areas and open space. Interviews were performed with representatives from the Town of Carefree, Town of Cave Creek, City of Scottsdale, and Sonoran Foothills Land Trust. Summaries of these interviews are found in Table 2 in Appendix A. Additionally, a Trails Component Report was produced for the project, and is included in Appendix I.

In general, the Town of Carefree prefers to see informal trail alignments. The residents of Carefree have historically allowed access to the trails and washes, but most land owners are not amenable to granting easements and right-of-ways. The Town of Cave Creek and the City of Scottsdale have identified important connectivity points between the jurisdictions, which occur at the washes. All jurisdictions indicate that providing horse and trail access to the washes is important in conjunction with any flood control structures or easements.

Existing Conditions

The Carefree area is developed with exclusive residential subdivisions, golf courses, an airport, and neighborhood commercial facilities. Development in the area tends to preserve the natural topography, which is generally undulating with numerous washes and ridges. The naturally occurring sediments tend to be highly mobile, and are composed of silts, sands and small gravel.

Drainage crossings of roadways typically occur at grade (i.e., flows are perpetuated over the pavement section). These at-grade crossings can prevent access to residents during storm events, prohibit emergency access, and pose a hazard to the public.

Development has occurred immediately adjacent to drainage pathways. Several residences and commercial developments have suffered erosion damage, flooding, and sediment deposition. Large amounts of sediment are often deposited upstream of roadway crossings, with erosion located immediately downstream. This deposition of sediments, or aggradation, is evident throughout the Town. A more detailed report for this sedimentation problem is currently being prepared, and will be submitted separately from this Data Collection Report.

Existing Drainage Facilities

Drainage facilities that exist within the town consist of numerous culverts, overland wash crossings, ditches, and bridges. An Existing Facilities map is attached as Figure 2 in Appendix B. This exhibit contains a graphical representation of the drainage improvements that exist in the Town. Additionally, Tables 10 and 11 in Appendix A summarizes the key physical properties of these drainage improvements.

Identified Existing Problem Areas

Numerous areas were discovered within the Town that are associated with drainage problems, whether associated with identified flooding problems, sedimentation, or perceived as a potential future threat by the general public. Table 12 in Appendix A contains a summary of these areas. Information on these areas was obtained from Town personnel, the *Cave Creek/Carefree ADMS Scope* letter by Coe and Van Loo L.L.C., existing reports, interviews with Town residents, comments obtained at the public meeting held on November 13, 2001, and field surveys.

Hydrologic Methodology

Hydrologic analyses were performed for the 10-year and 100-year frequencies for the 6-hour and 24-hour duration for both the existing and future land use conditions. For modeling purposes, the watershed that encompasses the Town boundaries was subdivided into four models. The first two models were previously created as part of the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14), and are referred to as Andora Hills Wash and Galloway Wash. The third model was created as part of the *North Scottsdale Floodplain Delineation Study*, a project currently being performed for the Flood Control District of Maricopa County (Contract No. FCD 2001C009) by DEI Professional Services, LLC, on an unnamed wash. For the purposes of this study, this wash is referred to as the North Scottsdale wash. The remaining model was also created on an unnamed wash, located to the south and east of the Andora Hills and Galloway Washes. For the purposes of the hydrology model, this wash was given the naming convention of Unnamed Central Wash.

The Andora Hills and Galloway Washes existing models were updated for this study by JE Fuller, the preparer of the aforementioned floodplain delineation study on the washes. The procedures, methodology, and results for these models are contained in Appendix C.

The Unnamed Central Wash was modeled in a complimentary manner to the JE Fuller models in order to provide a comprehensive modeling scheme for the Town. The 6-hour duration models were developed for existing and future land uses with the 6-hour storm patterns contained in the Drainage Design Manual for Maricopa County, Arizona (Drainage Design Manual). The 24-hour duration models were created using the Soil Conservation Service (SCS) Type II distribution. Rainfall losses were estimated using the Green and Ampt method, and hydrograph generation was by the Clark unit hydrograph method. Routing of hydrographs through the models was accomplished by normal depth storage routing.

A summary of the North Scottsdale Floodplain Delineation Study methodology is not included in this report, as the study is on-going and had not been finalized by the date that this report was published. However, the flow summary found in Appendix F does contain a summary of the 10-year and 100-year 6-hour future events, and a copy of the schematic showing locations of each identifier. Please note that the flow rates as documented in Appendix F from the North Scottsdale project are preliminary, and should be considered approximate. Final flow rates will be published by the Flood Control District once the study is completed.

HEC-1 Input Parameters

Peak discharge values were determined using the US Army Corps of Engineers (USACE) HEC-1 computer program, version 4.1, dated June of 1998, in accordance with the methodology set forth in the Drainage Design Manual. Figure 6 in Appendix B contains a schematic representation of the models for the Unnamed Central and Eastern Washes. Appendix F contains HEC-1 output files and a disk of the input files.

Basin Boundaries

Basin delineations for the Unnamed Central Wash are shown graphically on Figure 5 in Appendix B. The basin boundaries from JE Fuller's Andora Hills and Galloway Washes and

the North Scottsdale Delineation Study are additionally shown for reference purposes. Basin delineations for the unnamed washes were determined from topographic mapping. As explained above in the Data Collection Results section, the detail of the mapping varied from 20-foot contour intervals to 2-foot intervals for the watershed.

Soils

Digital format soil information for the project area was supplied by the Flood Control District, as derived from SCS and the U.S. Forest Service (USFS). The soil map unit data are based on *Soil Survey of Aguila-Carefree, Parts of Maricopa and Pinal Counties, Arizona* and on *USF, Tonto National Forest, General Ecosystem Survey*. The basin boundaries were overlaid on the soil information in CAD to determine areas of each soil type contained within a basin, as shown on Figure 3 in Appendix B.

Rainfall Losses

Rainfall loss parameters were estimated using the Green and Ampt method. Table 4 in Appendix A contains a summary of the specific loss parameters for each basin.

Land Usages

The unnamed washes generally flow through residential developments, roads, and undeveloped lands. Digital format existing land use information for the watershed was supplied by the Flood Control District. Land use was determined by overlaying the basin boundaries on the existing land uses.

Unit Hydrographs

The MCUHP1 program was used to compute Tc and R values for all of models and flow conditions. A summary of these values is contained in Table 8 of Appendix A.

Flow Splits and Diversions

The Unnamed Central Wash contains four identified flow splits. These occur at the southernmost portion of the basin, near Carefree Highway. In three out of the four flow splits (HEC-1 identifiers D5859, D87, and D84), the flows remain within the watershed, with portions of the flow transferred to different subbasins. In the remaining flow split at D64, a portion of the flow is transferred offsite to the south, out of the studied watershed.

Flow splits were determined by the hydraulic properties of the channels immediately downstream of the split. A rating curve was developed for each flow split. The division of flow at D84, which occurs at Terravita Way immediately south of Carefree Highway (outside the Town limits), occurs at a culvert system with an overland flow component. Appendix D contains the computations associated with the rating curve developments.

Future Conditions

Future conditions hydrologic models were created for the unnamed washes for the 10-year and 100-year frequencies for the 6- and 24-hour durations. Rainfall parameters, soil parameters, and drainage basin boundaries remained unchanged from the existing conditions models.

Future conditions land usages were determined from the master plans and future developments within the watershed. In some cases within the Town boundaries, the future master plan zoning is less dense than the existing developments. In these cases, the more dense, existing usages were used in the future conditions models as a conservative estimate. Vacant areas were assigned the appropriate future land use in accordance with the master plans. Table 7 in Appendix A contains the Kb resistance coefficient values for the future conditions, and Table 3 in Appendix A contains future impervious percentages and urban land usages.

Roadway Crossings and Culverts

Peak flow estimations were made for each of the identified culverts and roadway crossings within the watershed. Flow estimations were made by determining the drainage area contributing to the culvert or crossing, and compared to the total area of the respective subbasin or subbasins contributing to the nearest downstream concentration point. The ratio of the area to total area at the downstream concentration point was determined, and the flow to the culvert reduced by that ratio. Table 11 in Appendix A contains a summary of the calculations and peak flow estimations for the culverts within the watershed.

Hydrology Results

Appendix F contains a summary table and copies of the hydrology models for the Unnamed Central Wash for the 10-year and 100-year frequencies for the 6- and 24-hour durations.

Roadway Crossings and Culverts

Figure 2 in Appendix B shows the locations of the culverts and road crossings within the entire town, including the road crossings in the Andora Hills and Galloway Washes watershed. Peak discharges for each flow event are summarized in Table 11 in Appendix A.

Comparison of Existing and Future Condition Peak Discharges

Table 11 in Appendix A shows the existing and future peak discharges at the crossings for the four flow events. In general, most of the flows at these locations are similar or slightly greater than the existing condition.

Comparison of Results with Regional Regression Equations

The hydrology results were compared with two regional regression equations. These equations were developed as a means to estimate the flood magnitudes on ungauged streams, and use the variables of drainage area, mean basin elevation, and mean annual precipitation. The two methods are the "USGS Method", as found in the Arizona Department of Transportation *Highway Drainage Design Manual Hydrology*, dated March of 1993, and the "ADWR Method", found in the Arizona Department of Water Resources "A Study to Evaluate Existing Methods for Determining Peak Discharges for Ungauged Watersheds in Arizona – Phase II and III Report", dated 1995. Table 13 in Appendix A contains a summary of the equations and results.

References

See Table 1 in Appendix A for further references

Camp, P.D., 1986, *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona*: U.S. Soil Conservation Service.

Sabol, et. Al, 1991, *Drainage Design Manual for Maricopa County, Arizona, Volume 1 Hydrology*: Engineering Division of the Flood Control District of Maricopa County.

HNTB, 1990 with revisions to 1996, *Town of Carefree Master Plan Carefree, Arizona*: Town of Carefree.

Appendix A – Tables

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Floodplain Delineation Study of Andora Hills and Galloway Washes	Floodplain delineation of washes, offsite hydrology, hydraulics, soil mapping	June, 2001	Draft Final	JE Fuller/ Hydrology and Geomorphology, Inc.	FCDMC	Galloway Wash, Andora Hills Wash (northern portion of Town of Carefree)		JE Fuller on 7/9/01	FCD 99-14	Vol. I and II
Flood Insurance Study, Unincorporated Areas of Maricopa County, AZ	Floodplain delineation of Cave Creek Wash, Andora Hills Wash, Galloway Wash, Grapevine Wash	January, 1979	Final	Harris-Toups Associates	U.S. Dept. Of Housing and Urban Development, FIS	Andora Hills Wash, Galloway Wash, Grapevine Wash		JE Fuller on 7/9/01	80.1-00-8-01/79	Only partial copy obtained, may need more info, has elevation BM info, JE Fuller has raw HEC-2 output on file at their office
Final Hydrologic and Hydraulic Report for Cave Creek/Carefree Flood Delineation Study	Floodplain delineation	March, 1990	Final	CH2M HILL	FCDMC	Grapevine Wash, Row Wash, Galloway Wash		JE Fuller on 7/9/01	FCD 88-53, PHXR4.222.50	Entire Report and Draft Report obtained, Appendix A obtained, model info not copied can get from FCD if needed.
Cave Creek Above Carefree Highway Floodplain Delineation Study	Floodplain delineation	July, 1997		George V. Sabol Consulting Engineers, Inc.	FCDMC	Cave Creek above Carefree Hwy		JE Fuller on 7/9/01	FCD 95-28	Very partial copy, may need more info
Flood Insurance Study, Maricopa County, Arizona and Unincorporated Areas, Vol. 1-8	FEMA FIS	December 23, 1997	Draft	FEMA	FEMA	All		JE Fuller on 7/9/01	1302..021	Text and profiles (not maps)
Final Drainage Report for Crossings at Carefree IV	development drainage report	March 19, 1998	Final	Neil/McGill Consultants, Inc.	developer	24.9 acres, imm. South of Grapevine Wash, SW 1/4 of NW 1/4 Sect. 26, T6N, R4E, North of Stevens Road		Carefree, 7/6/01		development is Crossings at Carefree IV (sometimes called Cow Track)
Letter from Erich Korsten on The Summit at Carefree	letter - No drainage report exists	October 24, 1997		Erich Korsten	Town of Carefree	The Summit at Carefree		Carefree, 7/6/01		Letter requesting drainage report, development is the Summit at Carefree
Final Drainage Report for Ridgeview Estates	development drainage report	September 29, 1994	Final	Neil/McGill Consultants, Inc.	developer	NE 1/4 of NE 1/4 Sect 34, South of Cave Creek Road, West of Tom Darlington		Carefree, 7/6/01		development is Ridgeview Estates, revision to below report
Preliminary Drainage Report for Ridgeview Estates	development drainage report	October 20, 1993	Preliminary	Norman Engineering Group, Inc.	developer	NE 1/4 of NE 1/4 Sect 34, South of Cave Creek Road, West of Tom Darlington		Carefree, 7/6/01		development is Ridgeview Estates
Lost Acres Estates Preliminary Hydrology Report, Preliminary Plat Submission	development drainage report	June, 1993	Preliminary	Louis C. Warner and Company's Surveyors, Inc.	developer	SW 1/4 Sect. 4, southwest corner of town, east of Cave Creek Road, North of Carefree Highway		Carefree, 7/6/01		development is Lost Acres Estates

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Final Drainage Report for Canyon Creek Estates Subdivision	development drainage report	June 22, 1998	Final	Paulsell Engineering	developer	SW 1/4 Sect. 4, southwest corner of town, east of Cave Creek Road, North of Carefree Highway, right above Lost Acres		Carefree, 7/6/01		development is Canyon Creek Estates
Final Drainage Report for The Crossings at Carefree II	development drainage report	April 18, 1995	Final	Neil/McGill Consultants, Inc.	Crossings II, 94 LP developer	SE 1/4 of NW 1/4 Sect 26, imm. north Stevens Drive		Carefree, 7/6/01		development is the Crossings at Carefree II (sometimes called Cow Track)
Final Drainage Report for Ocotillo Ridge Estates, Unit 1	development drainage report	March 17, 1998	Final	Neil/McGill Consultants, Inc.	developer	NE 1/4 of Sect 26, adj. to the Crossings at Carefree II		Carefree, 7/6/01		development is Ocotillo Ridge Estates
Carefree Zoning Map	Zoning Map	January 18, 2000		Carefree	Carefree	All of Town	1"=700' (Have Electronic Copy also)	Carefree, 7/3/01		Have .dxf format copy w/o text
Carefree Land Use Plan	Land Use Plan	January 5, 1996		Carefree (HNTB)	Carefree	All of Town	1"=2000'	Carefree, 7/3/01		Hard copy only
Cave Creek/Carefree ADMS Scope	data collection and scope letter report	June 19, 2000	Final	Coe and Van Loo LLC	FCDMC	regional		FCDMC, 4/01		City of Phoenix, Carefree, and Cave Creek sections of report not useful
Proposal for a CIP in the Town of Carefree	improvement proposal for downtown	September 24, 1998	Final	Carefree (Jonathan Pearson)	FCDMC	downtown area				
Digital Aerial Photography	aerial photography	September 30, 1999		M&B Aerial Mapping LLC	FCDMC, JE Fuller	Andora Hills and Gallowahy Wash areas	Electronic Copy	JE Fuller, 4/01		
Aerial Photography	aerial photography	January 14, 1999		Rupp Aerial Photography	Carefree	All of Town	1"=200'	**ON FILE AT TOWN**		Not in our possesion, on file at town, copies may be obtained for a fee from Rupp
Aerial Photography	aerial photography	November 6, 1994		Rupp Aerial Photography	Carefree	All of Town	1"=200'	**ON FILE AT TOWN**		Not in our possesion, on file at town, copies may be obtained for a fee from Rupp
Aerial Photography	aerial photography	June 1, 1990		Rupp Aerial Photography	Carefree	All of Town	1"=200'	Carefree, 7/13/01		Copies of Mylars made, Copies may be obtained for a fee from Rupp
Final Drainage Report for the Crossings at Carefree III	Drainage Report	November 19, 1996	Final	Neil/McGill Consultants, Inc.	developer	SW 1/4 of the NW 1/4 Sect. 26, N of Stevens Road		Carefree, 7/13/01		Development is Crossings at Carefree III
Drainage Report for Los Gemelos Subdivision (Note: now called Los Reales)	Drainage Report	June 1996	?, has redlines from Erich Korsten dated 9/17/99	D.N.A. Inc.	Chino North LLC (developer)	Sect. 4, T5N, R4E, Carefree Hwy and 60th St.		Carefree, 7/13/01		Development is called Los Reales, Includes copies of *Entrada Final Hydrologic and Hydraulic Study (Carefree Mountain Estates Unit One) 10/5/92, Hydrology and Hydraulic Report of Carefree Foothills 8/82, Terravita Master Drainage Report, 6/11/93*

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Final Drainage Report for Tranquil Place	Drainage Report	October 1995	Final	Pinnacle Engineering, Inc.	developer	SW 1/4 Sect. 26, Tranquil Place		Carefree, 7/13/01		Development is Tranquil Place, text is missing, only maps and appendicies, see Plat Narrative for text (below)
Tranquil Place Preliminary Plat Narrative	Plat Narrative	April 1995	?	Pinnace Engineering, Inc.	Carefree Buena LLC	SW 1/4 Sect. 26, Tranquil Place		Carefree, 7/13/01		Development is Tranquil Place
Addendum to Final Hydrology Study for Wachs Desert Condos	hydrology study	April 1998	Addendum to Final	D.N.A. Inc.	Wachs Desert Condos (developer)	Between Sundance Trail and Hum Road, NW 1/4 Sect 35		Carefree, 7/13/01		Development is Wachs Desert Condos
Final Hydrology Study for Wachs Desert Condos	hydrology study	March 1998	Final	D.N.A. Inc.	Wachs Desert Condos (developer)	Between Sundance Trail and Hum Road, NW 1/4 Sect 35		Carefree, 7/13/01		Development is Wachs Desert Condos
Carefree Mountain Estates Preliminary Plat Narrative (devel. Now called Entrada)	Plat Narrative	May 1992, Revised June 1992	Preliminary	Gilbertson Assoc. Inc.	RJL Properties, Inc.	SW 1/4 Sect 4, Entrada		Carefree, 7/13/01		Development now called Entrada, only three pages copied
Entire drainage folder for Carefree Mountain Estates	Final Drainage Report included	October 1992, Revised November 27, 1992	Final	Gilbertson Assoc. Inc.	RJL Properties, Inc.	SW 1/4 Sect. 4, Entrada		Carefree, 7/13/01		Development now called Entrada, copied entire folder
Carefree Sentinel Rock Estates Improvement Plans	Improvement Plans	August 6, 1985	As-Built	Engineering and Surveying of Arizona, Inc.		North 1/2 Sect. 4	1"=100'	Reviewed at Carefree, 7/19/01		Includes grading and drainage
Cave Creek Wash South Study	Plans	August 1996		Willdan Associates	Flood Control District Report	Offsite areas for this report cover offsite and southern drainage in our area	1"=2000'	FCD, 7/10/01	A267.014.001 through 005	Obtained copies of land use map, basins boundary map, soils map, flow path lengths, routing lengths, and culverts map
Carefree Foothills Sewer Plan	Improvement Plans	February 17, 1983	As-Built			Carefree Foothills development, SE 1/4 Sect. 4		Reviewed at Carefree, 7/19/01	Boxes 34 and 37	Culvert Information obtained
Carefree Improvement District	Improvement Plans	July, 1963				Original Carefree		Reviewed at Carefree, 7/18/01	Kept on top of filing cabinet at Town	Old original mylars for town, culvert information obtained
Crossings at Carefree IV	Improvement Plans				developer	NW 1/4 Sect 26, Crossings at Carefree IV development		Reviewed at Carefree, 7/18/01	Marked Box	Culvert Information and design flow information obtained
Ocotillo Ridge Estates	Improvement Plans	June 25, 1997	Appear to be As-Builts		developer	NE 1/4 Sect 26, Ocotillo Ridge Estates development		Reviewed at Carefree, 7/18/01	Marked Box	Culvert Information and design flow information obtained
Final Hydrologic and Hydraulic Study Parcel J South at the Boulders Community	Drainage Report	May 27, 1992	Final	Gilbertson Assoc. Inc.	developer	near Scottsdale Road and Westland Drive, Parcel J		Scottsdale, 7/23/01	58-45	

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Final Hydrologic and Hydraulic Study Parcel L The Boulders Community	Drainage Report	January 23, 1991	Final	Gilbertson Assoc. Inc.	developer	near Scottsdale Road and Westland Drive, Parcel L		Scottsdale, 7/23/01	58-45	
Drainage Report for Fifth Green at the Boulders	Drainage Report	April, 1987	unk.	Collar, Williams and White Engineering	Malouf Brothers Development	near Scottsdale Road and Westland Drive		Scottsdale, 7/23/01	58-45	
Preliminary Hydrologic and Hydraulic Study, Parcel Q, Unit 1 The Boulders	Drainage Report	August 13, 1991	Preliminary	Gilbertson Assoc. , Inc.	developer	The Boulders, just south of Town limits		Scottsdale, 7/23/01	58-45	Some of the 11x17 figures got copies at 8.5x11 - may need to get those correctly
Preliminary Hydrologic and Hydraulic Study, Parcel M, The Boulders	Drainage Report	June 11, 1992	Preliminary	Gilbertson Assoc., Inc.	developer	near Scottsdale Road and Westland Drive		Scottsdale, 7/23/01	58-45	
Drainage Study, The Boulders, Sections 2, 11, 3, and 10, T5N, R4E, Maricopa County, AZ	Master Drainage Report	December 1984	unk.	Bookman-Edmonston Engineering, Inc.	The Boulders Joint Venture and Brooks, Hersey and Associates, Inc.	All of the Boulders development, Sections 2, 11, 3, and 10, T5N, R4E		Scottsdale, 7/23/01	58-45	
The Boulders Hydrologic Report Resort Area	Drainage Report	November, 1982	unk.	Brooks, Hersey and Associates, Inc.	Boulders/Carefree Partners	25 Acres on western edge of Boulders in SW 1/4 of Section 2 and NW 1/4 of Section 11		Scottsdale, 7/23/01	58-45	
Master Drainage Plan for Desert Ranch	Drainage Report	November 16, 1987	unk.	Collar, Williams and White Engineering	Blue Road Properties	NE of Stagecoach Road and Pima Road, Scottsdale		Scottsdale, 7/24/01	58-50	
Drainage Study for Desert Ranch	Drainage Report	December 1983	unk.	Bookman-Edmonston Engineering, Inc.	Desert Ranch Properties, Inc. and Brooks, Hersey and Associates, Inc.	NE of Stagecoach Road and Pima Road, Scottsdale		Scottsdale, 7/24/01	58-50	
Preliminary Drainage Report for Parcel G/H Desert Ranch Development	Drainage Report	October 19, 1993	Preliminary	Coe and Van Loo Consultants, Inc.	Desert Ranch Estates Partnership	NE of Stagecoach Road and Pima Road, Scottsdale		Scottsdale, 7/24/01	58-50	
Preliminary Drainage Report for Parcel I/J Desert Ranch Development	Drainage Report	January 14, 1994	Preliminary	Coe and Van Loo Consultants, Inc.	Desert Ranch Estates Partnership	NE of Stagecoach Road and Pima Road, Scottsdale		Scottsdale, 7/24/01	58-50	
Preliminary Drainage Report for Parcel B/C Desert Ranch Development	Drainage Report	October 21, 1993	Preliminary	Coe and Van Loo Consultants, Inc.	Desert Ranch Estates Partnership	NE of Stagecoach Road and Pima Road, Scottsdale		Scottsdale, 7/24/01	58-50	
Improvement Plans for the Crossings at Carefree II	Improvement Plans	April 1995	unk.	Neil/McGill Consultants, Inc.	developer	Stevens Road at Rising Sun, SW 1/4 of NW 4/1 Sect. 26, T6N, R4E	1"=20'	Carefree, 7/24/01	(not in box)	

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Improvement Plans for the Crossings at Carefree III	Improvement Plans	April 1996	As-Built	Neil/McGill Consultants, Inc.	developer	Stevens Road at Rising Sun, SW 1/4 of NW 4/1 Sect. 26, T6N, R4E	1"=20'	Carefree, 7/24/01	(not in box)	
Improvement Plans for Lost Acres Estates	Improvement Plans	October 1993	unk.	Louis C. Warner and Company's Surveyors, Inc.	developer	Perdido Drive at Cave Creek Road, NW 1/4 of SW 1/4 Sect 4, T5N, R4E	1"=20'	Carefree, 7/24/01	(not in box)	
Sky Ranch Phase II Street Survey	As-Built Survey	February 1987		Gilbertson Associates, Inc.	developer	Sky Ranch next to Airport, north of Cave Creek Road, Sect. 36	1"=20'	Carefree, 7/24/01	(not in box)	
Tranquil Place Improvement Plans	Improvement Plans	January 1996	City Revisions	Pinnacle Engineering, Inc.	developer	Tranquil Place off of Tranquil Trail/Rising Sun Road	1"=20'	Carefree, 7/24/01	(not in box)	
Paving Plans for Cave Creek Road from Pima Road to Desert Mountain Parkway	Paving Plans	March 1986	Submittal for Approval	Collar, Williams and White Engineering	Desert Mountain developer	Cave Creek Road between Pima Road and Desert Mtn Pkwy	1"=40'	Carefree, 7/24/01	Box 51	
Plans for the Construction of Stagecoach Pass - Mule Train to 3/4 mile east of Pima Road	Improvement Plans	1985	Preliminary	Maricopa County Highway Department	Maricopa County	Stagecoach Pass between Mule Train Road and Pima Road	1"=40'	Carefree, 7/24/01	Box 152	
The Crossings at Carefree	Improvement Plans	May 1988	unk.	Stanley/Mettee-McGill-Murphy, Inc.	Custom Quality Comminities Inc.	Rising Sun Road, The Crossings, SW 1/4 Sect. 26	1"=40'	Carefree, 7/24/01	Box 58	
Improvement Plans for Ridgeview Estates	Improvement Plans	November 1997	As Built	Neil/McGill Consultants, Inc.	K.W. Group I, L.L.C.	Ridgeview, SE 1/4 Sect. 27 and NE 1/4 Sect. 34, T6N, R4E	1"=20'	Carefree, 7/24/01	Box 141.3	
Improvement Plans for Carefree Villiage	Improvement Plans	January 1987	Preliminary	Lyon Engineering Inc.	Carefree Villiage Development Corp.	Tranquil Trail, Cave Creek Road, Happy Hollow, NE 1/4 Sect. 35	1"=20'	Carefree, 7/24/01	Box 45	Appears that this subdivision was never built. Information on Culverts not entered.
Orthophotography for Portions of Maricopa County	aerial photography	December 2000		FCDMC	FCDMC	All	pixels for 5 scale and 20 scale	FCDMC, 7/16/2001		
Final Drainage Report for Terravita, Parcel J and V	Drainage Report	March 8, 1996	final	JMI and Associates, Inc.	Del Webb Corporation	Scottsdale Road south of Carefree Highway, Terravita		Scottsdale, 7/27/01	58-44	
General Drainage Plan for North Scottsdale, Arizona	Drainage Report	April 14, 1988 June 7, 1989 (revised)	appears final	Water Resources Associates, Inc.	City of Scottsdale	All of North Scottsdale		unk.		Obtained during proposal phase

Table 1
Data Collection Summary

Name of Reference	Description	Date Prepared	Version	Prepared By	Prepared For	Area Covered	Scale	Obtained From	Reference Number	Notes
Terravita Way at Carefree Highway	Improvement Plans	November 1995	unk.	Kirkham Michael and Associates	Terravita	Terravita Way at Carefree Highway		Scottsdale, 8/7/01	25719	Only have one sheet on Terravita Way (doesn't cover Carefree Highway), has flow estimates for split that occurs south of Carefree Highway
City of Scottsdale Grading Plan of Pacel Q and R Terravita	Grading Plans	May 30, 1995	unk.	JMI and Associates, Inc.	Terravita, City of Scottsdale	Terravita Way at Carefree Highway		Scottsdale, 8/7/01	25608	
USGS 7.5 Minute Series Topographic Maps	topographic maps	Photorevised 1981	photorevised	USGS	public	entire project area	1"=2000', 20' contour interval	USGS		
Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona	soil survey	April 1986		USDA, Soil Conservation Service	public	entire project area		SCS		
Town of Carefree Subdivision Ordinance	development regulations	Adopted 4/29/85, amended 1987 through 1999	amended through 1999	Town of Carefree	public	entire Town limits		Town of Carefree		
Town of Carefree Zoning Ordinance	development regulations	Ninth Publication, February 6, 1996	amended through 1996	Town of Carefree	public	entire Town limits		Town of Carefree		
Computer Aided Drafting and Design (C.A.D.D.) Data Delivery Specifications: Rev. 1.0	report data delivery specifications	January 2000	Rev. 1.0	FCDMC	public			FCDMC		
Preliminary Drainage Study, Town Center, Town of Carefree	Drainage Report	September 26, 2000	Preliminary	Erich E. Korsten	Town of Carefree	downtown area		Town of Carefree, 10/23/2001		
Master Drainage Study for the Tranquil Trail Subdivision and Villages at Carefree	Drainage Report	January 3, 1997	unk.	Brooks, Hersey and Associates, Inc.	developer, White Hawke LLC	NE 1/4 Sect 35, north of Cave Creek Rd., adj. Downtown		Town of Carefree, 10/23/2001		
North Scottsdale Floodplain Delineation Study	Preliminary Drainage Report	On-going	Preliminary	DEI Professional Services, LLC	FCDMC	North Scottsdale and southeast portion of Carefree		FCDMC, DEI		Study is on-going
Final Drainage Report Carefree Ironwood Estates	Drainage Report	March 13, 2001	appears final	United Engineering Group	developer, Monterey Homes	SW 1/4 Sect 4, NE corner Carefree Highwy and Cave Creek Road		Town of Carefree, 10/23/2001		

Table 2
Interview Summary

Name of Interviewee	Affiliation	Date of Interview	Interview Notes	By/Of
Rob Kuhfuss	Maricopa County Planning Department	7/30/01	Call was placed looking for As-Built Plans. According to Mr. Kuhfuss, all records are destroyed after 90 days. Additionally, upon incorporation by the Town, all records are given to the Town. He suggested that we check with MCDOT to see if they have any records. Planning Department has no as-built plans.	L. Johnson/CH2M HILL
Rich Orndoff	Maricopa County Department of Transportation	8/7/2001	Call was placed to MCDOT concerning As-Built plans for Carefree Highway between Cave Creek Road and Tom Darlington, or any other as-built plans they might have for the area. Rich indicated that they have nothing on file for this portion of the roadway, which falls within Carefree and Scottsdale limits. He indicated that even if this roadway was constructed under MCDOT, the plans would have been turned over to the Town upon incorporation.	L. Johnson/CH2M HILL
Fernando Espinoza	Town of Carefree Maintenance Supervisor	7/11/2001	Sediment removal is necessary after rainfall events in some locations around town. Mr. Espinoza identified Short Putt at Pima and Cow Track at Paint Pony as the main sediment-generating locations in the town. He does not recall ever having to unplug a culvert in the town. No underground storm drain systems are reported to exist beyond the numerous culverts.	L. Johnson/CH2M HILL
Paula Pruett	Resident on Galloway Wash at 37200 N. Pima Road	unk.	Provided some photos of floods, discussed erosion of right bank, deposition on Pima Road.	J. Fuller/JE Fuller Hydrology and Geomorphology
Jan Misseri	Resident	Unk. (email dated December 20, 2001)	Jan sent a list of sites with problems: 80th Street at Rising Sun has a gabion wall to stop slope failure, corner of Bloody Basin and Nonchalant is missing a scour pad at the driveway and debris in the wash, Lazy Lane is missing a relocated wash, concerns with the Downtown Center design and construction, flooding at Bloody Basin and Nonchalant, sediment problems at Cave Creek Road between Tom Darlington and Scopa Road, protect channel bypassed by flow at Cave Creek Road, CMP at Elbow Bend has an invert lower than existing wash bed, and lack of slope stabilization and restoration of disturbed areas.	Doug Williams/FCDMC
Erich Korsten	Town Engineer, Town of Carefree	9/5/2001	An all weather access has been created with the construction of the Dream Street Bridge. A new all-weather access should be constructed at Tranquil Trail. A sediment problem exists at Cow Track and Paint Pony. This area also has water over the roadway during storm events, but is still passable. The wash throught the airport causes flooding. The retention basins at the airport are being reshaped, and we should look at the Carefree Village report for the HEC-1 modeling of these basins. The plan for Carefree Village was denied by Town Council. The majority of the problems on the south-eastern end of Town are due to sedimentation and erosion. The downtown area was previously studied by Erich. ERich would like a typical design for a dip crossing including toe down and riprap design as a function of the unit discharge and/or velocity. Flooding problems on the very southwestern portion of the Town may be caused by Cave Creek development in the floodplain. The Boulders	L. Johnson/CH2M HILL

Table 2
Interview Summary

Name of Interviewee	Affiliation	Date of Interview	Interview Notes	By/Of
Erich Korsten, cont.	Town Engineer, Town of Carefree	9/5/2001	can be excluded from our study. Private developments do not need to be included in our study, unless there is a major problem. Sediment excavation occurred in the vicinity of the Dream Street Bridge. Erich believes the sediment problem will be better now that the bridge has been built. An improvement crossing at Father Kino would be beneficial, but does not provide access to many lots. Scopa Road does have some periods of impassible flow during storm events. No major problems have occurred on Cave Creek Road, although Erich indicated that it was not designed for the 100-year event. No good base topographic mapping exists for the town.	L. Johnson/CH2M HILL
Nancy Zeno	Town Clerk, Town of Carefree	various dates	Nancy supplied numerous existing reports and improvement plans for the Town. She also indicated that only a few development items are currently being planned in the Town, including two office parks, a church, a shopping center, and two residential subdivisions. The development of Carefree Village was denied by Town Council. She supplied the master plan for the town.	L. Johnson/CH2M HILL
Scott Hamilton	City of Scottsdale	9/25/2001	Projects immediately to the east of Carefree are Carefree Ranch Homesteads and Scottsdale Road at Carefree Highway. The Carefree Ranch Homesteads are platted in the County, with very rugged terrain and no dedications for trails in either wash. Residents don't want trails and washes and don't need anything from the City, so it is unlikely that those types of facilities will be provided. One wash has a lot of petroglyphs. Desert Hills probably won't plat north of Carefree north boundary Rockway Hills. Desert Foothills trail starts at gatehouse near Joy Ranch Road. At Scottsdale Road and Carefree Highway, trail easements exist on the south side of the highway west to 58th Street. Good connection on anything that intersects with the highway north of 58th Street. Planned grade separated crossing at Pima and Stagecoach. This will accomodate horses, etc. when Pima is rebuilt.	L. Dornfeld/DFD
Vern Willardt, Ian Cordwell, Brian Miller, Wayne Anderson	Town of Cave Creek	10/3/2001	Cave Creek requires 15-foot easements, with design standards for subdivisions includes trails standards. Galloway Wash is an important connectivity point to Cave Creek. Grapevine Wash from Gateway park to Rowe Wash is a major corridor into Carefree.	L. Dornfeld/DFD
Nancy Zeno, Carolyn Bohannan, Dennis Zwaggerman, Erich Korsten	Town of Carefree	10/3/2001	Rowe Wash dead ends at slot canyon, destination to China Wall. Provide access to many horse properties. There are trails in Ocotillo Ridge development. South of Cave Creek Road at Andora Wash there is a good trail opportunity directly into Carefree. This goes to Mule Train. Keep trails informal, people are okay with access, but probably won't want to give right-of-way for trails. Planned park at south side of Cave Creek Road across from airport. Access only by on-street bike trail. The old Ft. McDowell stone mountain historic trail crosses the park site. It used to go to Cave Creek through the McDowell Mountain Park to Verde River. No was connections in Carefree.	L. Dornfeld/DFD
Sonoran Foothills Land Trust	Sonoran Foothills Land Trust	10/3/2001	Part of Galloway Wash at Tranquil Trail and Sundance is part of trust. People use the historic trail next to Ocotillo Ridge. Extension to Ocotillo Ridge is dedicated, there is no direct access to Grapevine. Father Kino provides access. Check with land trust about parking here. Horse properties adjacent to washes make their own entrances. Any flood control structures or ROW need to permit horse and trail access.	L. Dornfeld/DFD

Table 2
Interview Summary

Name of Interviewee	Affiliation	Date of Interview	Interview Notes	By/Of
Public Meeting Comments	General Public	11/13/2001	Public Meeting held on November 13, 2001. Public comments include a sediment problem at the Mule Train crossing of Galloway Wash, erosion at Romping Road at Wildflower, sediment problem at Nevermind Trail, Carefree Highway at Whileaway wash crossing, a drainage feature constructed outside the Town's right-of-way at Nonchalant and Elbow Bend, wash cutoff with improvements at Lazy Lane and Sidewinder, flooding at the airport, and erosion and debris at Carefree Highway near the Albertson's store.	Various members of project team
Marin Holmes	Resident in Velvet Studios	8/16/2001	Water overflow from Desert Mountain reported. Runs for days every few months. No regularity to flows. Starts running down Northview Lane over into Scottsdale	T. Bokich/CH2M HILL

Table 3
Green and Ampt
Soil Parameters

Table Taken from Maricopa County DDMS Manual (Table 4.2) Carefree values extrapolated from Maricopa County DDMS (Figure 4.3)

Green and Ampt Loss rate Parameter values for Bare Ground And Cave Creek Soils					
Soil Texture Classification	XKSAT Inches/Hour	PSIF inches	DTHETA[1]		
			Dry (4)	Normal (5)	Saturated (6)
Loamy Sand & Sand	1.2	2.4	0.35	0.3	0
Sandy Loam	0.4	4.3	0.35	0.25	0
Loamy Sand & Sand	0.25	3.5	0.35	0.25	0
Silty Loam	0.15	6.6	0.4	0.25	0
Silt	0.1	7.5	0.35	0.15	0
Sandy Clay loam	0.06	8.6	0.25	0.15	0
Clay loam	0.04	8.2	0.25	0.15	0
Silty clay loam	0.04	10.8	0.3	0.15	0
Sandy Clay	0.02	9.4	0.2	0.1	0
Silty Clay	0.02	11.5	0.2	0.1	0
Clay	0.01	12.4	0.15	0.05	0
(6)Sandy Loam-V.Gravelly Sandy Loam	0.62	3.4	0.35	0.25	0
(8)Very Cobbly Sandy Loam	0.96	2.7	0.35	0.15	0
(12)Clay	0.01	12.4	0.15	0.05	0
(26)Clay	0.02	11.5	0.2	0.055	0
(28) Clay	0.02	11.5	0.2	0.1	0
(33)Very Gravelly Loam	0.23	5	0.36	0.25	0
(34)Very Gravelly Loam	0.23	5	0.36	0.25	0
(40)V. Gravelly Loam-Gravelly Clay Loam	0.17	3.1	0.35	0.25	0
(41)V. Gravelly Loam-Gravelly Clay Loam	0.17	3.1	0.35	0.25	0
(61)Ext.Gravelly Sandy Clay-Gravelly Sandy Loam	0.15	3.6	0.39	0.25	0
(63)Ext.Gravelly Sandy Clay-Gravelly Sandy Loam-Rock Outcrop	0.14	3.9	0.395	0.23	0
(72)Clay Loam-Rock Outcrop	0.09	7.3	0.33	0.15	0
(93)Gravelly Loam-Loam	0.33	4.3	0.35	0.25	0
(96)Gravelly Clay Loam-Clay Loam	0.07	8	0.3	0.15	0
(104)Rock Outcrop-Gravelly Clay Loam	0.14	6.2	0.395	0.23	0
(121)Clay Loam-Sandy Loam	0.12	6.6	0.37	0.18	0

[1] Selection of DTHETA
Dry = Nonirrigated lands, such as desert rangeland
Normal= Irrigated lawn, turf, and permanent pasture
Saturated = irrigated agricultrual land

Table 3a
Impervious Percentages
Urban Basins

Impervious Percentages, Urban Basins					
*Values estimated from Carefree and Scottsdale Land Use Maps and Aerial Photographs					
Existing Conditions			Future Conditions		
Subbasin	% Impervious	Primarily Urban?	Subbasin	% Impervious	Primarily Urban?
UC8	36	Y	UC8	36	Y
UC9	36	Y	UC9	36	Y
UC18	24	Y	UC18	26	Y
UC19	18	N	UC19	19	N
UC22	14	N	UC22	16	N
UC23	18	N	UC23	20	N
UC28	14	N	UC28	17	N
UC29	12	N	UC29	19	N
UC30	12	N	UC30	18	N
UC31	20	N	UC31	31	Y
UC34	12	N	UC34	21	Y
UC35	24	N	UC35	24	N
UC37	24	N	UC37	24	N
UC45	24	Y	UC45	24	Y
UC46	24	Y	UC46	24	Y
UC47	24	Y	UC47	24	Y
UC48	30	N	UC48	30	N
UC49	30	N	UC49	30	N
UC50	24	N	UC50	24	N
UC51	26	N	UC51	29	Y
UC57	20	N	UC57	20	N
UC58	20	N	UC58	20	N
UC59	14	N	UC59	16	N
UC62	14	N	UC62	14	N
UC63	19	N	UC63	19	N
UC64	14	N	UC64	17	N
UC66	14	N	UC66	15	N
UC74	14	N	UC74	16	N
UC75	14	N	UC75	16	N
UC76	14	N	UC76	15	N
UC77	16	N	UC77	16	N
UC78	17	Y	UC78	17	Y
UC79	18	Y	UC79	19	Y
UC82	14	N	UC82	15	N
UC84	14	N	UC84	15	N
UC87	8	N	UC87	9	N
UC88	14	N	UC88	15	N
UC89	17	Y	UC89	21	Y
UC90	14	N	UC90	20	N
UC91	14	N	UC91	23	N
UC93	13	N	UC93	20	N
UC94	13	N	UC94	18	N
UC95	13	N	UC95	19	N
UC96	13	N	UC96	18	N

Table 4
Existing Soil Percentages

Sub Basin	Area (mi^2)	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	Soil Map Unit # & Area (mi^2)	% of basin	IA inches	Xksat in/hr	PSIF in.	Dtheta (dry cond.)
		6	%	12	%	28	%	33	%	61	%	63	%	72	%	93	%	96	%	34	%				
UC8	0.054		0%		0%		0%	0.05032	93%		0%		0%		0%		0%		0%	0.00389128	7%	0.3	0.26	4.9	0.36
UC9	0.047		0%		0%		0%	0.04739	100%		0%		0%		0%		0%		0%		0%	0.3	0.23	5.0	0.36
UC18	0.040		0%		0%		0%	0.04030	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC19	0.027		0%		0%		0%	0.02713	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC20	0.012	0.00004	0%		0%		0%	0.01216	99%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC22	0.032		0%		0%		0%	0.03185	100%		0%		0%		0%		0%		0%		0%	0.25	0.25	5.0	0.36
UC23	0.013		0%		0%		0%	0.01316	100%		0%		0%		0%		0%		0%		0%	0.25	0.25	4.9	0.36
UC28	0.055		0%		0%		0%	0.05521	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC29	0.035		0%		0%		0%	0.03533	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC30	0.012		0%		0%		0%	0.01219	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC31	0.405		0%		0%		0%	0.15053	37%	0.2378486	59%	0.0170606	4%		0%		0%		0%		0%	0.25	0.18	4.1	0.38
UC34	0.037		0%		0%		0%	0.03378	90%	0.0036166	10%		0%		0%		0%		0%		0%	0.25	0.22	4.9	0.36
UC35	0.261		0%		0%		0%	0.01576	6%	0.1711332	66%		0%	0.00540158	2%	0.06861929	26%		0%		0%	0.25	0.20	3.9	0.38
UC37	0.207		0%		0%		0%		0%	0.20698	100%		0%		0%		0%		0%		0%	0.25	0.16	3.7	0.39
UC45	0.086		0%		0%		0%		0%	0.08567	100%		0%		0%		0%		0%		0%	0.25	0.15	3.6	0.39
UC46	0.034		0%		0%		0%		0%	0.0322793	95%	0.0018707	5%		0%		0%		0%		0%	0.25	0.15	3.6	0.39
UC47	0.031		0%		0%		0%		0%	0.0314921	100%		0%		0%		0%		0%		0%	0.25	0.15	3.6	0.39
UC48	0.197	0.00690	4%		0%		0%		0%	0.1900012	96%		0%		0%		0%		0%		0%	0.25	0.16	3.7	0.39
UC49	0.048	0.00045	1%		0%		0%		0%	0.047772	99%		0%		0%		0%		0%		0%	0.25	0.15	3.6	0.39
UC50	0.019	0.00332	17%		0%		0%	0.00183	10%	0.0065462	34%	0.0073017	38%		0%		0%		0%		0%	0.25	0.24	3.8	0.38
UC51	0.060	0.00335	6%		0%		0%	0.03214	54%	0.0035506	6%	0.0129602	22%		0%		0%	0.00764179	13%		0%	0.25	0.21	5.0	0.36
UC57	0.037	0.01109	30%		0%		0%		0%	0.0120632	33%	0.0088080	24%		0%		0%	0.0049151	13%		0%	0.25	0.28	4.2	0.37
UC58	0.110	0.00131	1%		0%		0%		0%	0.0385834	35%	0.0432166	39%		0%		0%	0.02683554	24%		0%	0.25	0.13	4.8	0.37
UC59	0.034	0.01621	48%		0%		0%		0%		0%		0%		0%		0%	0.017853	52%		0%	0.25	0.33	5.8	0.32
UC62	0.361		0%		0%		0%	0.09464	26%		0%	0.0592769	16%	0.20756044	57%		0%		0%		0%	0.25	0.13	6.1	0.35
UC63	0.117		0%		0%		0%	0.07959	68%		0%	0.0308465	26%		0%		0%	0.00686478	6%		0%	0.25	0.19	5.0	0.37
UC64	0.002	0.00054	24%		0%		0%		0%		0%		0%		0%		0%	0.00174676	76%		0%	0.25	0.20	6.9	0.31
UC66	0.037		0%		0%		0%	0.03702	100%		0%		0%		0%		0%		0%		0%	0.25	0.25	5.0	0.36
UC74	0.151		0%		0%		0%	0.04711	31%		0%		0%	0.10360383	69%		0%		0%		0%	0.25	0.13	6.6	0.34
UC75	0.192	0.00534	3%		0%		0%	0.05887	31%		0%		0%	0.12829076	67%		0%		0%		0%	0.25	0.15	6.5	0.34
UC76	0.041		0%		0%		0%	0.02073	51%		0%		0%	0.02007023	49%		0%		0%		0%	0.25	0.16	6.1	0.35
UC77	0.096	0.00146	2%		0%		0%	0.02217	23%		0%		0%	0.07236204	75%		0%		0%		0%	0.25	0.13	6.7	0.34
UC78	0.177	0.00103	1%		0%		0%	0.10117	57%		0%		0%	0.0748685	42%		0%		0%		0%	0.25	0.17	6.0	0.35
UC79	0.078	0.00460	6%		0%		0%	0.07366	94%		0%		0%		0%		0%		0%		0%	0.25	0.45	4.3	0.36
UC82	0.022	0.02071	95%		0%		0%	0.00112	5%		0%		0%		0%		0%		0%		0%	0.25	0.40	4.3	0.36
UC84	0.013	0.01303	98%		0%		0%	0.00032	2%		0%		0%		0%		0%		0%		0%	0.25	0.35	4.5	0.36
UC87	0.029	0.02863	99%		0%		0%		0%		0%		0%		0%		0%	0.0002069	1%		0%	0.25	0.62	3.4	0.35
UC88	0.108	0.10779	100%		0%		0%	0.00021	0%		0%		0%		0%		0%	0.0002069	0%		0%	0.25	0.62	6.1	0.33
UC89	0.073	0.01204	16%		0%		0%	0.01926	26%		0%		0%	0.00528614	7%		0%	0.0367246	50%		0%	0.25	0.20	6.4	0.33
UC90	0.038	0.03102	82%		0%		0%	0.00624	16%		0%		0%		0%		0%	0.00068343	2%		0%	0.25	0.55	3.7	0.35
UC91	0.073	0.00874	12%		0%		0%		0%		0%		0%		0%		0%	0.06403205	88%		0%	0.25	0.14	7.4	0.31
UC93	0.038		0%		0%		0%	0.00025	1%		0%		0%		0%		0%	0.03729346	99%		0%	0.25	0.07	8.0	0.30
UC94	0.028		0%		0%		0%	0.02840	100%		0%		0%		0%		0%		0%		0%	0.25	0.23	5.0	0.36
UC95	0.024		0%		0%		0%	0.00331	14%		0%		0%		0%		0%	0.02090723	86%		0%	0.25	0.15	3.7	0.39
UC96	0.061		0%		0%		0%	0.02107	34%		0%		0%		0%		0%	0.04035515	66%		0%	0.25	0.12	7.0	0.32
UC100	0.029	0.00065	2%		0%		0%	0.02800	98%		0%		0%		0%		0%		0%		0%	0.25	0.24	5.0	0.36

Table 5
Channel Lengths and Slopes

Subbasin Route	Channel Length (ft)	Channel Length (mi)	Channel High Elevation (ft)	Channel Low Elevation (ft)	Channel Slope (ft/ft)	Channel Slope (ft/mi)
UC 8	5494	1.04	2740	2596	0.02621	138.39
UC 9	4814	0.91	2728	2596	0.02742	144.78
UC 18	2933	0.56	2596	2540	0.01909	100.81
UC 19	2731	0.52	2610	2540	0.02563	135.34
UC 22	4001	0.76	2595	2511	0.02099	110.85
UC 28	3020	0.572	2558	2502	0.01854	97.91
UC 29	2470	0.47	2533	2482	0.02065	109.02
UC 30	1492	0.28	2520	2482	0.02547	134.48
UC 31	10770	2.04	2541	2280	0.02423	127.96
UC 34	1621	0.307	2505	2469	0.02221	117.26
UC 35	6681	1.27	2492	2318	0.02604	137.51
UC 37	10692	2.025	2506	2318	0.01758	92.84
UC 45	2548	0.48	2380	2315	0.02551	134.69
UC 46	1582	0.30	2666	2358	0.19469	1027.96
UC 47	2056	0.39	2740	2315	0.20671	1091.44
UC 48	4858	0.920	3160	2256	0.18608	982.53
UC 49	2502	0.47	2350	2280	0.02798	147.72
UC 50	1408	0.267	2528	2256	0.19318	1020.00
UC 51	2223	0.42	2528	2235	0.13180	695.92
UC 57	2505	0.47	2330	2235	0.03792	200.24
UC 58	3628	0.69	2660	2208	0.12459	657.82
UC 59	2591	0.49	2263	2208	0.02123	112.08
UC 62	7018	1.33	3340	2170	0.16671	880.25
UC 63	4264	0.808	2580	2195	0.09029	476.74
UC 64	803	0.15	2232	2200	0.03985	210.41
UC 66	2838	0.538	2325	2170	0.05462	288.37
UC 74	5963	1.13	3395	2031	0.22874	1207.77
UC 75	7302	1.38	3395	2017	0.18872	996.42
UC 76	3378	0.64	2340	2031	0.09147	482.98
UC 77	4888	0.93	3043	2048	0.20356	1074.80
UC 78	4528	0.86	2718	2054	0.14664	774.28
UC 79	4622	0.875	2280	2054	0.04890	258.17
UC 82	1185	0.224	2202	2150	0.04388	231.70
UC 84	1597	0.302	2220	2138	0.05135	271.11
UC 87	1721	0.33	2194	2161	0.01917	101.24
UC 88	5688	1.077	2161	2041	0.02110	111.39
UC 89	4070	0.77	2134	2037	0.02383	125.84
UC 90	2510	0.48	2080	2008	0.02869	151.46
UC 91	3974	0.75	2090	2008	0.02063	108.95
UC 93	3366	0.64	2127	2041	0.02555	134.90
UC 94	2775	0.53	2135	2078	0.02054	108.45
UC 95	1175	0.22	2090	2038	0.04426	233.67
UC 96	3828	0.73	2120	2038	0.02142	113.10
UC 100	2533	0.48	2668	2611	0.02250	118.82

TABLE 6
Existing Land Use
Kb Values

Resistance Coefficients (K_b) of assorted subbasins for Carefree, AZ

CH2MHILL
P.O. Box 28440 Tempe, AZ
85285-8440 480-966-8188

Equation for Estimating Kb: **Kb=m log A+b** Where: A is drainage area in acres and m and b are Equation parameters dependent upon the landuse type. Type A (minimal roughness) m=-0.00625 and b = 0.04. Type B (moderately low roughness) m = -0.01375 and b = 0.08. Type C (moderately high roughness) m = -0.025 and b = 0.15. Type D (maximum roughness) m = -0.030 and b = 0.20 Values taken from Maicopa County Drainage Design Manual (Table 5.1)

Sub basin	Area (mi^2)	Area (acres)	Large Lot Residential Type A (% Area)	Medium Residential Type A (% Area)	Small Lot Residential Type A (% Area)	Airport Type A (% Area)	Neighborhood Retail Type A (% Area)	Rec. Open Space Type A (% Area)	Hotel Motel Resort Type A (% Area)	Rural Type B (% Area)	Ded. or Non Dev Open Space Type B (% Area)	Vacant Type C (% Area)	Total Percent Type A	Total Percent Type B	Total Percent Type C	Weighted Average for "m"	Weighted Average for "B"	Total Weighted K_b for each subbasin
UC 8	0.05421	34.69440	99%									1%	99%	0%	1%	-0.00644	0.04110	**0.0312**
UC 9	0.05458	34.92800	100%										100%	0%	0%	-0.00625	0.04000	**0.0304**
UC 18	0.04030	25.79200	33%									67%	33%	0%	67%	-0.01881	0.11370	**0.0871**
UC 19	0.02713	17.36040	63%									37%	63%	0%	37%	-0.01319	0.08070	**0.0644**
UC 22	0.03185	20.38400	18%									82%	18%	0%	82%	-0.02163	0.13020	**0.1019**
UC 23	0.01316	8.42240										100%	0%	0%	100%	-0.02500	0.15000	**0.1269**
UC 28	0.05521	35.33440										100%	0%	0%	100%	-0.02500	0.15000	**0.1113**
UC 29	0.03533	22.61120										100%	0%	0%	100%	-0.02500	0.15000	**0.1161**
UC 30	0.01219	7.80402										100%	0%	0%	100%	-0.02500	0.15000	**0.1277**
UC 31	0.40544	259.47922	13%		1%			19%	13%			54%	46%	0%	54%	-0.01638	0.09940	**0.0599**
UC 34	0.03740	23.93600										100%	0%	0%	100%	-0.02500	0.15000	**0.1155**
UC 35	0.26091	166.98240	1%		44%	1%		37%		17%		0%	83%	17%	0%	-0.00760	0.04723	**0.0303**
UC 37	0.20698	132.46720	15%		30%			25%				30%	70%	0%	30%	-0.01188	0.07300	**0.0478**
UC 45	0.08567	54.82880	0%		91%			9%					100%	0%	0%	-0.00625	0.04000	**0.0291**
UC 46	0.03415	21.85600			6%					94%			6%	94%	0%	-0.01330	0.07760	**0.0598**
UC 47	0.03149	20.15494	0%		27%					73%			27%	73%	0%	-0.01173	0.06920	**0.0539**
UC 48	0.19690	126.01600	21%		3%					76%			24%	76%	0%	-0.01195	0.07040	**0.0453**
UC 49	0.04822	30.85907	83%		5%			6%	6%				100%	0%	0%	-0.00625	0.04000	**0.0307**
UC 50	0.01899	12.15360	78%						16%	6%			94%	6%	0%	-0.00670	0.04240	**0.0351**
UC 51	0.05964	38.16768	29%				10%		15%	27%		19%	54%	27%	19%	-0.01184	0.07170	**0.0530**
UC 57	0.03688	23.60156								100%			0%	100%	0%	-0.01375	0.08000	**0.0611**
UC 58	0.10995	70.36715	8%							91%		1%	8%	91%	1%	-0.01326	0.07750	**0.0530**
UC 59	0.03406	21.79757	16%									84%	16%	0%	84%	-0.02200	0.13240	**0.1030**
UC 62	0.35800	229.12000								97%		3%	0%	97%	3%	-0.01409	0.08210	**0.0489**
UC 63	0.11730	75.07200	0%							98%		2%	0%	98%	2%	-0.01398	0.08140	**0.0552**
UC 64	0.00466	2.98400	1%							99%			1%	99%	0%	-0.01368	0.07960	**0.0731**
UC 66	0.03702	23.69088								74%		26%	0%	74%	26%	-0.01668	0.09820	**0.0753**
UC 74	0.15071	96.45650	46%									54%	46%	0%	54%	-0.01638	0.09940	**0.0669**
UC 75	0.19250	123.19692	46%							48%		6%	46%	48%	6%	-0.01098	0.06580	**0.0429**
UC 76	0.04080	26.11251	78%									22%	78%	0%	22%	-0.01038	0.06420	**0.0495**
UC 77	0.09599	61.43388	53%							42%		5%	53%	42%	5%	-0.01034	0.06230	**0.0438**
UC 78	0.17707	113.32309	73%							27%			73%	27%	0%	-0.00828	0.05080	**0.0338**
UC 79	0.07826	50.08640	83%							13%		4%	83%	13%	4%	-0.00798	0.04960	**0.0360**
UC 82	0.02183	13.97120								34%		66%	0%	34%	66%	-0.02118	0.12620	**0.1019**
UC 84	0.01682	10.76500								52%		48%	0%	52%	48%	-0.01915	0.11360	**0.0938**
UC 87	0.02417	15.47100										100%	0%	0%	100%	-0.02500	0.15000	**0.1203**
UC 88	0.10820	69.24800										100%	0%	0%	100%	-0.02500	0.15000	**0.1040**
UC 89	0.07332	46.92215	71%									29%	71%	0%	29%	-0.01169	0.07190	**0.0524**

Carefree DMP
Ex Land Use Kb 031102.xls
08/16/2002 9:22 AM

162944.DP.02
By: RH
Checked: LJ

TABLE 6
Existing Land Use
Kb Values

Sub basin	Area (mi^2)	Area (acres)	Large Lot Residential Type A (% Area)	Medium Residential Type A (% Area)	Small Lot Residential Type A (% Area)	Airport Type A (% Area)	Neighborhood Retail Type A (% Area)	Rec. Open Space Type A (% Area)	Hotel Motel Resort Type A (% Area)	Rural Type B (% Area)	Ded. or Non Dev Open Space Type B (% Area)	Vacant Type C (% Area)	Total Percent Type A	Total Percent Type B	Total Percent Type C	Weighted Average for "m"	Weighted Average for "B"	Total Weighted K_b for each subbasin
UC 90	0.03794	24.28138	17%							2%		81%	17%	2%	81%	-0.02159	0.12990	**0.1000**
UC 91	0.07277	46.57289	1%							3%		96%	1%	3%	96%	-0.02448	0.14680	**0.1060**
UC 93	0.03755	24.02978	32%									68%	32%	0%	68%	-0.01900	0.11480	**0.0886**
UC 94	0.02840	18.17509										100%	0%	0%	100%	-0.02500	0.15000	**0.1185**
UC 95	0.02422	15.50005										100%	0%	0%	100%	-0.02500	0.15000	**0.1202**
UC 96	0.06142	39.30946										100%	0%	0%	100%	-0.02500	0.15000	**0.1101**
UC 100	0.02865	18.33600	100%										100%	0%	0%	-0.00625	0.04000	**0.0321**

Carefree DMP
Future Land Use.xls
08/16/2002 9:24 AM

TABLE 7
Future Land Use
Kb Values

162944.DP.02
By: RH
Checked: LJ

Resistance Coefficients (K_b) of assorted subbasins for Carefree, AZ

CH2MHILL

P.O. Box 28440 Tempe, AZ
85285-8440 480-966-8188

Equation for Estimating Kb: **Kb=m log A+b** Where: A is drainage area in acres and m and b are Equation parameters dependent upon the landuse type. Type A (minimal roughness) m=-0.00625 and b = 0.04. Type B (moderately low roughness) m = -0.01375 and b =

Sub basin	Area (mi^2)	Area (acres)	Large Lot Residential Type A (% Area)	Medium Residential Type A (% Area)	Small Lot Residential Type A (% Area)	Airport Type A (% Area)	Neighborhood Retail Type A (% Area)	Rec. Open Space Type A (% Area)	Hotel Motel Resort Type A (% Area)	Rural Type B (% Area)	Ded. or Non Dev Open Space Type B (% Area)	Vacant Type C (% Area)	Total Percent Type A	Total Percent Type B	Total Percent Type C	Weighted Average for "m"	Weighted Average for "B"	Total Weighted K_b for each subbasin
UC 8	0.05421	34.69440	99%	1%									100%	0%	0%	-0.00625	0.04000	**0.0304**
UC 9	0.05458	34.92800	100%										100%	0%	0%	-0.00625	0.04000	**0.0304**
UC 18	0.04030	25.79200	33%	54%			13%						100%	0%	0%	-0.00625	0.04000	**0.0312**
UC 19	0.02713	17.36040	63%	37%									100%	0%	0%	-0.00625	0.04000	**0.0323**
UC 22	0.03185	20.38400	18%	62%			20%						100%	0%	0%	-0.00625	0.04000	**0.0318**
UC 23	0.01316	8.42240		100%									100%	0%	0%	-0.00625	0.04000	**0.0342**
UC 28	0.05521	35.33440		100%									100%	0%	0%	-0.00625	0.04000	**0.0303**
UC 29	0.03533	22.61120		50%				50%					100%	0%	0%	-0.00625	0.04000	**0.0315**
UC 30	0.01219	7.80402	100%										100%	0%	0%	-0.00625	0.04000	**0.0344**
UC 31	0.40544	259.47922	13%	54%	1%			19%	13%				100%	0%	0%	-0.00625	0.04000	**0.0249**
UC 34	0.03740	23.93600	80%					20%					100%	0%	0%	-0.00625	0.04000	**0.0314**
UC 35	0.26091	166.98240	1%		44%	1%		37%		17%			83%	17%	0%	-0.00753	0.04680	**0.0301**
UC 37	0.20698	132.46720	33%		30%			37%					100%	0%	0%	-0.00625	0.04000	**0.0267**
UC 45	0.08567	54.82880	0%		91%			9%					100%	0%	0%	-0.00625	0.04000	**0.0291**
UC 46	0.03415	21.85600			6%					94%			6%	94%	0%	-0.01330	0.07760	**0.0598**
UC 47	0.03149	20.15494	0%		27%					73%			27%	73%	0%	-0.01173	0.06920	**0.0539**
UC 48	0.19690	126.01600	21%		3%					76%			24%	76%	0%	-0.01195	0.07040	**0.0453**
UC 49	0.04822	30.85907	83%		5%			6%	6%				100%	0%	0%	-0.00625	0.04000	**0.0307**
UC 50	0.01899	12.15360	78%						16%	6%			94%	6%	0%	-0.00670	0.04240	**0.0351**
UC 51	0.05964	38.16768	29%				29%		15%	27%			73%	27%	0%	-0.00828	0.05080	**0.0377**
UC 57	0.03688	23.60156								100%			0%	100%	0%	-0.01375	0.08000	**0.0611**
UC 58	0.10995	70.36715	8%					1%		91%			9%	91%	0%	-0.01308	0.07640	**0.0522**
UC 59	0.03406	21.79757	16%		84%								100%	0%	0%	-0.00625	0.04000	**0.0316**
UC 62	0.35800	229.12000						3%		97%			3%	97%	0%	-0.01353	0.07880	**0.0469**
UC 63	0.11730	75.07200	0%					2%		98%			2%	98%	0%	-0.01360	0.07920	**0.0537**
UC 64	0.00466	2.98400	1%							99%			1%	99%	0%	-0.01368	0.07960	**0.0731**
UC 66	0.03702	23.69088						26%		74%			26%	74%	0%	-0.01180	0.06960	**0.0534**
UC 74	0.15071	96.45650	59%							41%			59%	41%	0%	-0.00933	0.05640	**0.0379**
UC 75	0.19250	123.19692	83%		11%					6%			94%	6%	0%	-0.00670	0.04240	**0.0284**
UC 76	0.04080	26.11251	78%				22%						100%	0%	0%	-0.00625	0.04000	**0.0311**
UC 77	0.09599	61.43388	58%							42%			58%	42%	0%	-0.00940	0.05680	**0.0400**
UC 78	0.17707	113.32309	73%							27%			73%	27%	0%	-0.00828	0.05080	**0.0338**
UC 79	0.07826	50.08640	83%					4%		13%			87%	13%	0%	-0.00723	0.04520	**0.0329**
UC 82	0.02183	13.97120						66%		34%			66%	34%	0%	-0.00880	0.05360	**0.0435**
UC 84	0.01682	10.76500						48%		52%			48%	52%	0%	-0.01015	0.06080	**0.0503**
UC 87	0.02417	15.47100			15%			85%					100%	0%	0%	-0.00625	0.04000	**0.0326**
UC 88	0.10820	69.24800	12%		7%		40%	41%					100%	0%	0%	-0.00625	0.04000	**0.0285**
UC 89	0.07332	46.92215	71%				29%						100%	0%	0%	-0.00625	0.04000	**0.0296**

TABLE 7
Future Land Use
Kb Values

Sub basin	Area (mi^2)	Area (acres)	Large Lot Residential Type A (% Area)	Medium Residential Type A (% Area)	Small Lot Residential Type A (% Area)	Airport Type A (% Area)	Neighborhood Retail Type A (% Area)	Rec. Open Space Type A (% Area)	Hotel Motel Resort Type A (% Area)	Rural Type B (% Area)	Ded. or Non Dev Open Space Type B (% Area)	Vacant Type C (% Area)	Total Percent Type A	Total Percent Type B	Total Percent Type C	Weighted Average for "m"	Weighted Average for "B"	Total Weighted K_b for each subbasin
UC 90	0.03794	24.28138	17%	58%			23%			2%			98%	2%	0%	-0.00640	0.04080	0.0319
UC 91	0.07277	46.57289	1%	39%			57%			3%			97%	3%	0%	-0.00648	0.04120	**0.0304**
UC 93	0.03755	24.02978	32%				68%						100%	0%	0%	-0.00625	0.04000	0.0314
UC 94	0.02840	18.17509	32%				3%	65%					100%	0%	0%	-0.00625	0.04000	**0.0321**
UC 95	0.02422	15.50005		29%			71%						100%	0%	0%	-0.00625	0.04000	0.0326
UC 96	0.06142	39.30946		91%			9%						100%	0%	0%	-0.00625	0.04000	**0.0300**
UC 100	0.02865	18.33600	100%										100%	0%	0%	-0.00625	0.04000	0.0321

Table 8
Tc and R Values

Time of Concentration (T_c) and Storage Coefficient (R) for the Carefree Drainage Study in Carefree, Arizona (Based on the 100 year event).						Existing Conditions								Future Conditions							
Values for Tc were obtained from MCUHP1 program (DDM for Maricopa County, Arizona)						10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr		10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr	
Sub-basin	Length (mi)	Area (mi^2)	Kb	Slope (ft/mi)	Adjusted Slope (ft/mi)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)
UC8	1.04	0.05421	0.031	138	138	0.329	0.587	0.275	0.481	0.304	0.538	0.225	0.385	0.396	0.72	0.275	0.481	0.304	0.538	0.225	0.385
UC9	0.91	0.05458	0.030	145	145	0.296	0.507	0.246	0.413	0.279	0.476	0.208	0.344	0.354	0.619	0.246	0.413	0.279	0.476	0.208	0.344
UC18	0.56	0.04030	0.087	101	101	0.479	0.644	0.438	0.582	0.446	0.595	0.346	0.448	0.329	0.425	0.229	0.284	0.258	0.324	0.192	0.233
UC19	0.52	0.02713	0.064	135	135	0.363	0.557	0.308	0.466	0.338	0.515	0.246	0.362	0.292	0.438	0.204	0.295	0.229	0.335	0.171	0.242
UC22	0.76	0.03185	0.102	111	111	0.613	1.226	0.592	1.18	0.563	1.116	0.446	0.862	0.392	0.747	0.267	0.487	0.296	0.547	0.221	0.395
UC23	0.40	0.01316	0.127	121	121	0.454	0.880	0.408	0.782	0.421	0.808	0.321	0.598	0.262	0.479	0.183	0.321	0.204	0.362	0.154	0.265
UC28	0.57	0.05521	0.111	98	98	0.533	0.463	0.492	0.423	0.488	0.419	0.396	0.334	0.308	0.252	0.213	0.167	0.237	0.189	0.175	0.135
UC29	0.47	0.03533	0.116	109	109	0.500	0.633	0.454	0.569	0.463	0.581	0.354	0.432	0.292	0.348	0.204	0.234	0.229	0.266	0.171	0.192
UC30	0.28	0.01219	0.128	134	134	0.367	0.546	0.317	0.464	0.342	0.505	0.250	0.357	0.213	0.298	0.15	0.202	0.167	0.228	0.125	0.165
UC31	2.04	0.40544	0.060	128	128	0.742	0.786	0.771	0.821	0.692	0.728	0.579	0.598	0.525	0.536	0.4	0.396	0.417	0.415	0.325	0.315
UC34	0.31	0.03740	0.116	117	117	0.387	0.331	0.338	0.284	0.358	0.304	0.262	0.213	0.225	0.181	0.162	0.126	0.179	0.141	0.133	0.101
UC35	1.27	0.26091	0.030	138	138	0.383	0.332	0.338	0.288	0.358	0.308	0.271	0.226	0.45	0.397	0.333	0.285	0.354	0.304	0.267	0.222
UC37	2.03	0.20698	0.048	98	98	1.500	2.509	1.5	2.509	1.375	2.278	1.283	2.106	0.596	0.901	0.463	0.68	0.467	0.687	0.371	0.532
UC45	0.48	0.08567	0.029	135	135	0.208	0.146	0.179	0.123	0.196	0.136	0.150	0.101	0.242	0.172	0.179	0.123	0.196	0.136	0.15	0.101
UC46	0.30	0.03415	0.060	1028	324	0.179	0.144	0.154	0.122	0.171	0.136	0.129	0.100	0.208	0.17	0.154	0.122	0.171	0.136	0.129	0.1
UC47	0.39	0.03149	0.054	1091	324	0.200	0.211	0.171	0.177	0.188	0.197	0.142	0.144	0.229	0.246	0.171	0.177	0.188	0.197	0.142	0.144
UC48	0.92	0.19690	0.045	117	117	0.396	0.312	0.354	0.276	0.375	0.294	0.287	0.219	0.467	0.375	0.354	0.276	0.375	0.294	0.287	0.219
UC49	0.47	0.04822	0.031	148	148	0.208	0.200	0.175	0.165	0.196	0.187	0.150	0.139	0.237	0.232	0.175	0.165	0.196	0.187	0.15	0.139
UC50	0.27	0.01899	0.035	93	93	0.200	0.056	0.171	0.047	0.192	0.053	0.142	0.141	0.237	0.068	0.171	0.047	0.192	0.053	0.142	0.141
UC51	0.42	0.05964	0.053	696	317	0.221	0.172	0.188	0.143	0.208	0.161	0.158	0.119	0.213	0.165	0.154	0.115	0.171	0.129	0.129	0.095
UC57	0.47	0.03688	0.061	200	200	0.283	0.327	0.233	0.263	0.262	0.3	0.196	0.217	0.346	0.408	0.233	0.263	0.262	0.3	0.196	0.217
UC58	0.69	0.10995	0.053	658	317	0.267	0.223	0.225	0.185	0.25	0.208	0.192	0.155	0.308	0.262	0.221	0.181	0.25	0.208	0.188	0.151
UC59	0.49	0.03406	0.103	112	112	0.512	0.684	0.458	0.604	0.463	0.611	0.346	0.442	0.333	0.424	0.213	0.258	0.237	0.291	0.175	0.208
UC62	1.33	0.35800	0.049	880	321	0.433	0.328	0.346	0.256	0.367	0.273	0.275	0.198	0.417	0.314	0.3	0.218	0.329	0.242	0.246	0.175
UC63	0.81	0.11730	0.055	983	322	0.300	0.279	0.25	0.228	0.279	0.258	0.208	0.186	0.35	0.331	0.246	0.224	0.275	0.253	0.204	0.182
UC64	0.15	0.00466	0.073	166	166	0.188	0.437	0.158	0.362	0.175	0.405	0.133	0.303	0.221	0.524	0.158	0.362	0.175	0.405	0.133	0.303
UC66	0.54	0.03702	0.075	1020	324	0.304	0.395	0.25	0.318	0.283	0.365	0.208	0.259	0.279	0.359	0.208	0.259	0.233	0.294	0.171	0.208
UC74	1.13	0.15071	0.067	1208	328	0.404	0.438	0.354	0.379	0.375	0.403	0.283	0.296	0.35	0.374	0.246	0.252	0.275	0.286	0.208	0.21
UC75	1.38	0.19250	0.043	996	322	0.446	0.500	0.4	0.444	0.417	0.464	0.317	0.342	0.342	0.372	0.237	0.249	0.267	0.283	0.2	0.205
UC76	0.64	0.04080	0.050	483	302	0.262	0.362	0.221	0.299	0.246	0.337	0.183	0.243	0.237	0.324	0.171	0.225	0.192	0.256	0.142	0.183
UC77	0.93	0.09599	0.044	1075	324	0.292	0.338	0.246	0.28	0.275	0.317	0.204	0.228	0.325	0.381	0.229	0.259	0.258	0.296	0.196	0.217
UC78	0.86	0.17707	0.034	774	319	0.242	0.182	0.204	0.151	0.229	0.171	0.171	0.124	0.287	0.221	0.204	0.151	0.229	0.171	0.171	0.124
UC79	0.88	0.07826	0.036	258	233	0.321	0.405	0.258	0.318	0.292	0.364	0.225	0.272	0.396	0.511	0.237	0.29	0.271	0.335	0.196	0.234
UC82	0.22	0.02183	0.102	232	220	0.304	0.259	0.246	0.204	0.279	0.235	0.179	0.146	0.208	0.17	0.142	0.111	0.158	0.125	0.112	0.086
UC84	0.30	0.01682	0.094	271	246	0.287	0.421	0.233	0.334	0.267	0.387	0.196	0.276	0.25	0.36	0.167	0.23	0.188	0.262	0.138	0.186
UC87	0.33	0.02417	0.120	101	101	0.529	0.566	0.438	0.458	0.458	0.482	0.317	0.320	0.363	0.372	0.192	0.183	0.217	0.21	0.154	0.144
UC88	1.08	0.10820	0.104	111	111	1.008	1.412	0.771	1.048	0.683	0.917	0.558	0.731	0.463	0.595	0.321	0.396	0.346	0.431	0.25	0.3
UC89	0.77	0.07332	0.052	126	126	0.412	0.499	0.363	0.433	0.383	0.46	0.283	0.329	0.35	0.416	0.242	0.276	0.271	0.313	0.2047	0.229

Table 8
Tc and R Values

Time of Concentration (T_c) and Storage Coefficient (R) for the Carefree Drainage Study in Carefree, Arizona (Based on the 100 year event).						Existing Conditions								Future Conditions							
Values for Tc were obtained from MCUHP1 program (DDM for Maricopa County, Arizona)						10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr		10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr	
Sub-basin	Length (mi)	Area (mi^2)	Kb	Slope (ft/mi)	Adjusted Slope (ft/mi)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)	Tc (hrs)	R (hrs)
UC90	0.48	0.03794	0.100	151	151	0.492	0.603	0.417	0.502	0.433	0.524	0.304	0.354	0.338	0.397	0.188	0.207	0.229	0.259	0.167	0.182
UC91	0.75	0.07277	0.106	109	109	0.738	0.932	0.575	0.707	0.554	0.679	0.442	0.527	0.358	0.418	0.254	0.286	0.283	0.322	0.213	0.234
UC93	0.64	0.03755	0.089	135	135	0.525	0.817	0.408	0.618	0.421	0.639	0.333	0.493	0.287	0.419	0.213	0.299	0.237	0.339	0.183	0.254
UC94	0.53	0.02840	0.119	108	108	0.700	1.150	0.504	0.799	0.5	0.792	0.392	0.604	0.321	0.484	0.221	0.32	0.246	0.36	0.183	0.26
UC95	0.22	0.02422	0.120	234	220	0.300	0.073	0.217	0.051	0.242	0.057	0.179	0.137	0.15	0.034	0.112	0.025	0.125	0.028	0.096	0.021
UC96	0.73	0.06142	0.110	113	113	0.704	0.960	0.554	0.736	0.542	0.717	0.438	0.566	0.333	0.418	0.237	0.287	0.267	0.327	0.2	0.24
UC100	0.48	0.02865	0.032	119	119	0.296	0.400	0.2	0.259	0.225	0.295	0.162	0.206	0.271	0.363	0.196	0.253	0.217	0.283	0.162	0.206

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
RCP13	CPUE1 to CPUE3 through 100	84	106	2668	2611	2533	0.0225	No	0.045	0.035	5	4.9	4
		90	104										
		99	102										
		100	100										
		105	100										
		106	102										
		115	104										
		121	106										
RCP23	CPUE2 to CPUE3 through 100	84	106	2636	2611	1118	0.0224	No	0.045	0.035	5	4.9	2
		90	104										
		99	102										
		100	100										
		105	100										
		106	102										
		115	104										
		121	106										
RCP35	CPUE3 to CPUE5 through 12	81	108	2611	2575	2305	0.0156	No	0.045	0.03	25	6.6	3
		96	104										
		99	102										
		100	100										
		125	100										
		126	102										
		132	106										
		138	180										
R7CP4	Route UE7 through 11	88	106	2637	2614	932	0.0247	No	0.045	0.035	5	4.9	2
		93	104										
		99	102										
		100	100										
		105	100										
		106	102										
		112	104										
		117	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
RCP45	CPUE4 to CPUE5 through 12	81	108	2614	2575	2285	0.0171	No	0.045	0.03	25	6.6	3
		96	104										
		99	102										
		100	100										
		125	100										
		126	102										
		132	106										
		138	180										
RCP5EN	CPUE5 to END through 21	80	106	2575	2490	4246	0.0200	No	0.045	0.03	20	6.5	5
		90	104										
		99	102										
		100	100										
		120	100										
		121	102										
		130	104										
		140	106										
RCP89	CP89 to CP1819 through 18	88	106	2596	2540	2933	0.0191	No	0.045	0.035	8	5.2	5
		90	104										
		99	102										
		100	100										
		108	100										
		109	102										
		120	104										
		132	103										
R1819	CP1819 to CP2223 through 23	72	106	2540	2511	1790	0.0162	No	0.045	0.03	12	6.3	2
		92	104										
		99	102										
		100	100										
		112	100										
		113	102										
		120	104										
		130	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
R2223	CP2223 to CP2930 through 29	88	106	2511	2482	1862	0.0156	No	0.045	0.03	12	6.3	2
		95	104										
		99	102										
		100	100										
		112	100										
		113	102										
		117	104										
		123	106										
R10	Route 10 through 28	75	106	2558	2502	3020	0.0185	No	0.045	0.035	8	5.2	5
		87	104										
		99	102										
		100	100										
		108	100										
		109	102										
		121	104										
		133	106										
R1028	CP1028 to CP2930 through 30	73	106	2502	2482	1296	0.0154	No	0.045	0.035	8	5.2	2
		86	104										
		99	102										
		100	100										
		108	100										
		109	102										
		122	104										
		135	106										
R2930	CP2930 to CP34 through 34	78	106	2482	2469	925	0.0141	No	0.045	0.03	10	6.2	1
		89	104										
		99	102										
		100	100										
		110	100										
		111	102										
		122	104										
		133	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
R34	CP34 to CP3537 through 37	80	106	2469	2318	6475	0.0233	No	0.045	0.035	5	4.9	11
		90	104										
		99	102										
		100	100										
		105	100										
		106	102										
		115	104										
		125	106										
R3537	CP3537 to CP3149 through 49	80	106	2318	2280	1829	0.0208	No	0.045	0.035	5	4.9	3
		90	104										
		99	102										
		100	100										
		105	100										
		106	102										
		115	104										
		125	106										
R3149	CP3149 to CP4850 through 50	90	106	2280	2256	1219	0.0197	No	0.045	0.03	10	6.2	2
		95	104										
		99	102										
		100	100										
		110	100										
		111	102										
		118	104										
		130	106										
R46	Route 46 to CP4547 through 45	82	106	2346	2315	1783	0.0174	No	0.045	0.035	5	4.9	3
		92	104										
		99	102										
		100	100										
		105	100										
		106	102										
		113	104										
		123	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
R4547	CP4547 to CP4850 through 48	81	106	2315	2256	2170	0.0272	No	0.045	0.035	5	4.9	4
		90	104										
		99	102										
		100	100										
		105	100										
		106	102										
		115	104										
		124	106										
R4850	CP4850 to CP5157 through 57	91	106	2256	2235	1509	0.0139	No	0.045	0.03	15	6.4	2
		95	104										
		99	102										
		100	100										
		115	100										
		116	102										
		120	104										
		124	106										
R5157	CP5157 to CP5859 through 59	0	106	2235	2208	1796	0.0150	No	0.045	0.03	20	6.5	2
		60	104										
		99	102										
		100	100										
		120	100										
		121	102										
		160	104										
		220	106										
R5859N	CP5859 (N) to CP63 through 63	0	104	2208	2195	699	0.0186	No	0.045	0.03	10	6.2	1
		50	103										
		99	102										
		100	100										
		110	100										
		111	102										
		160	103										
		210	104										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
R63	CP63 to CP6266 through 66	60	106	2195	2170	1394	0.0179	No	0.045	0.03	25	6.6	2
		80	104										
		99	102										
		100	100										
		125	100										
		126	102										
		145	104										
		165	106										
R6266	CP6266 to CP82 through 82	25	106	2170	2150	1394	0.0143	No	0.045	0.03	20	6.5	2
		85	104										
		99	102										
		100	100										
		120	100										
		121	102										
		135	104										
		195	106										
R5859S	CP5859 (S) to CP64 through 64	0	104	2208	2194	803	0.0174	No	0.045	0.03	25	6.6	1
		50	103										
		99	102										
		100	100										
		125	100										
		126	102										
		175	103										
		225	104										
RD64N	CP64 (N) to CP87 through 87	20	106	2194	2161	1721	0.0192	No	0.045	0.03	12	6.3	2
		60	104										
		99	102										
		100	100										
		112	100										
		113	102										
		152	104										
		192	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
RD87N	CP87 to CP82 through 82	25	106	2161	2150	557	0.0197	No	0.045	0.03	20	6.5	1
		85	104										
		99	102										
		100	100										
		120	100										
		121	102										
		135	104										
		195	106										
R82	CP82 to CP84 through 84	50	106	2150	2138	579	0.0207	No	0.045	0.03	25	6.6	1
		75	104										
		99	102										
		100	100										
		125	100										
		126	102										
		150	104										
		175	106										
R84	CP84 to CP7879 through 79	75	106	2138	2054	3463	0.0243	No	0.045	0.03	10	6.2	5
		94	104										
		99	102										
		100	100										
		110	100										
		111	102										
		116	104										
		135	106										
R7879	CP7879 to CP77 through 77	70	106	2054	2048	256	0.0234	No	0.045	0.03	20	6.5	0
		90	104										
		99	102										
		100	100										
		120	100										
		121	102										
		130	104										
		140	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
R77	CP77 to CP89 through 89	60	106	2048	2037	593	0.0185	No	0.045	0.03	15	6.4	1
		80	104										
		99	102										
		100	100										
		115	100										
		116	102										
		120	104										
		125	106										
R89	CP89 to CP90EN through 90	60	106	2037	2008	1912	0.0152	No	0.045	0.03	15	6.4	2
		80	104										
		99	102										
		100	100										
		115	100										
		116	102										
		135	104										
		155	106										
R7476	CP7476 to CP75 through 75	60	106	2031	2017	524	0.0267	No	0.045	0.03	12	6.3	1
		80	104										
		99	102										
		100	100										
		112	100										
		113	102										
		132	104										
		152	106										
R75	CP75 to CP90EN through 90	60	106	2017	2008	723	0.0124	No	0.045	0.03	15	6.4	1
		80	104										
		99	102										
		100	100										
		115	100										
		116	102										
		135	104										
		155	106										

Table 9
Routing Parameters

Routing Reach	Description	X-Sect. Coordinates X	X-Sect. Coordinates Y	Elevation Upstream (ft)	Elevation Downstream (ft)	Reach Length (ft)	Slope (ft/ft)	Tc Slope Adj.?	Overbank "n" value	Channel "n" value	Average Bottom Width (ft)	Average Velocity (ft/s)	NSTPS ((L/V)/NMIN)
RD87S	CP87 (S) to CP88END through 88	80	106	2161	2041	5688	0.0211	No	0.045	0.03	15	6.4	7
		90	104										
		99	102										
		100	100										
		115	100										
		116	102										
		125	104										
		135	106										
RD84S	CP84 (S) to CP88END through 88	80	106	2138	2041	4843	0.0200	No	0.045	0.03	15	6.4	6
		90	104										
		99	102										
		100	100										
		115	100										
		116	102										
		125	104										
		135	106										
R94	Route 94 through 88 to CP88END	80	106	2078	2041	1924	0.0192	No	0.045	0.03	15	6.4	3
		90	104										
		99	102										
		100	100										
		115	100										
		116	102										
		125	104										
		135	106										

Table 10
Existing Drainage Improvements

#	APPROXIMATE LOCATION	DEVICE SIZE/TYPE	L (ft)	IE(UP)	IE(DWN)	GRND	INFORMATION SOURCE
1	CAVE CREEK RD, 83' N. OF CL OF CAREFREE HWY/CC ROAD	18" CMP	120	2037.00	2035.48	2039.80	AS BUILT PLANS CC RD. IMPROV. 9/6/90
2	CAVE CREEK RD, 557' N. OF CL OF CAREFREE HWY/CC ROAD	49" X 39" CMPA	124	2036.95	2035.07	2042.30	AS BUILT PLANS CC RD. IMPROV. 9/6/90
3	CAVE CREEK RD, 1037' N. OF CL OF CAREFREE HWY/CC ROAD	2-71" X 47" CMPA	136	2038.50	2036.53	2044.80	AS BUILT PLANS CC RD. IMPROV. 9/6/90
4	CAVE CREEK RD, 1690' N. OF CL OF CAREFREE HWY/CC ROAD	42" CMP	126	2039.65	2037.76	2046.40	AS BUILT PLANS CC RD. IMPROV. 9/6/90
5	CAVE CREEK RD, 2465' N. OF CL OF CAREFREE HWY/CC ROAD	36" CMP	122	2042.13	2040.30	2048.40	AS BUILT PLANS CC RD. IMPROV. 9/6/90
6	CAVE CREEK RD, 3552' N. OF CL OF CAREFREE HWY/CC ROAD	3-66" CMP	126	2028.35	2025.47	2036.40	AS BUILT PLANS CC RD. IMPROV. 9/6/90
7	CAVE CREEK RD, 3950' N. OF CL OF CAREFREE HWY/CC ROAD	3-64" X 43" CMPA	144	2034.82	2032.66	2040.00	AS BUILT PLANS CC RD. IMPROV. 9/6/90
8	CAVE CREEK RD, 4857' N. OF CL OF CAREFREE HWY/CC ROAD	2-42" X 29" CMPA	158	2065.87	2063.50	2069.60	AS BUILT PLANS CC RD. IMPROV. 9/6/90
9	CAVE CREEK RD, 5235' N. OF CL OF CAREFREE HWY/CC ROAD	2-49" X 33" CMPA	184	2077.76	2075.00	2082.40	AS BUILT PLANS CC RD. IMPROV. 9/6/90
10	PIMA RD, 616' N. OF CL OF PIMA RD/STAGECOACH PASS	21" CMP	74	2560.86	2559.50	2566.90	IMPROVEMENT PLANS PIMA RD IMPROV. 10/5/92 (REVISED 1/93)
11	PIMA RD, 1115' N. OF CL OF PIMA RD/STAGECOACH PASS	3-57" X 38" CMPA	74	2566.00	2564.52	2572.40	IMPROVEMENT PLANS PIMA RD IMPROV. 10/5/92 (REVISED 1/93)
12	PIMA RD, 1417' N. OF CL OF PIMA RD/STAGECOACH PASS	18" CMP	88	2572.40	2569.85	2576.50	IMPROVEMENT PLANS PIMA RD IMPROV. 10/5/92 (REVISED 1/93)
13	PIMA RD, 88' N. OF CL OF PIMA RD/CAVE CREEK	36" RGRCP	82	2573.63		2579.30	IMPROVEMENT PLANS PIMA RD IMPROV. 10/5/92 (REVISED 1/93)
14	CAREFREE MTN DR	24" Concrete Pipe	108	(B) -9.0	(B) -9.9	(T) -6.2	CAREFREE MTN ESTATES GRADING PLAN, 9/94
15	CAREFREE MTN DR	24" Concrete Pipe	60	(B) -9.0	(B) -9.7	(T) -5.6	CAREFREE MTN ESTATES GRADING PLAN, 9/94
16	AGAVE PL	24" Concrete Pipe	60	(B) -9.5	(B) -9.4	(T) -5.7	CAREFREE MTN ESTATES GRADING PLAN, 9/94
17	CAREFREE MTN DR	24" Concrete Pipe	73	(B) -8.5	(B) -10	(T) -5.5	CAREFREE MTN ESTATES GRADING PLAN, 9/94
18	CANOTIA PL	24" Concrete Pipe	63	(B) -8.7	(B) -9.4	(T) -5.9	CAREFREE MTN ESTATES GRADING PLAN, 9/94
19	CAREFREE MTN DR	24" Concrete Pipe	85	(B) -9.5	(B) -9.6	(T) -5.3	CAREFREE MTN ESTATES GRADING PLAN, 9/94
20	CAREFREE MTN DR	2- 8'x3' CBC	56	2075.00	2073.50	2081.30	CAREFREE MTN ESTATES GRADING PLAN, 9/94
21	DALEA PL	2-24"Concrete Pipes	48	(B)-9.0	(B)-9.6	(T)-5.5	CAREFREE MTN ESTATES GRADING PLAN, 9/94
22	UNNAMED RD	No CULVERT					CAREFREE MTN ESTATES GRADING PLAN, 9/94
23	CAREFREE MTN DR	2-10'x4' CBC	70	(B)-12.5	(B)-14	(T) -6.6	CAREFREE MTN ESTATES GRADING PLAN, 9/94
23a	CAREFREE MTN DRIVE	24" RCP	75	2083.00	2081.00	2084.80	FIELD SURVEY 10/23/01
24	TRANQUIL PL	24" RCP	95	2373.80	2373.00	2376.89	IMPROVEMENT PLANS FOR TRANQUIL PL, 1/96
25	TRANQUIL PL	2-42" RCP	45	2363.50	2362.86	2367.10	IMPROVEMENT PLANS FOR TRANQUIL PL, 1/96
26	TRANQUIL PL	2-42" RCP	45	2358.93	2358.00	2362.00	IMPROVEMENT PLANS FOR TRANQUIL PL, 1/96
27	LOS REALES DR	4-10' X 4' RCB	40	2117.15	2116.45	2123.8	DRAINAGE RPT FOR LOS GEMELOS, 6/96
28	58TH ST	2-24" CMP	60	2069.90	2067.20	2078.2	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
29	58TH ST	2-24" CMP	65	2087.70	2085.70	2091.4	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
30	61ST ST	2-36" CMP	66	2099.92	2097.65	2104.5	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
31	RESTIN RD	18" CMP	70	2107.20	2103.00	2110.0	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
32	RESTIN RD	24" CMP	76	2147.32	2142.00	2150.4	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
33	61ST ST	4-36" CMP	66	2169.25	2164.50	2173.8	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
34	61ST ST	2-36" CMP	94	2188.30	2182.70	2193.5	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
35	LITTLE HOPE PL	30" CMP	74	2216.50	2211.80	2221.1	CAREFREE SENTINEL ROCKESTATES ASBUILT 8/9/85
36	10+20 N. OF CL CAREFREE HWY/SCOTTSDALE RD	3-60" CMP	180	2267.00	2263.00	2274.0	CAREFREE IMPROVEMENT DISTRICT 7/63
37	12+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	60" CMP	128	2268.00	2267.00	2275.0	CAREFREE IMPROVEMENT DISTRICT 7/63
38	31+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	18" CMP	124	2336.00	2331.00	2341.0	CAREFREE IMPROVEMENT DISTRICT 7/63
39	41+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	24" CMP	140	2355.00	2360.00	2363.0	CAREFREE IMPROVEMENT DISTRICT 7/63
40	51+35 N. OF CL CAREFREE HWY/SCOTTSDALE RD	24" CMP	136	2371.50	2369.00	2374.0	CAREFREE IMPROVEMENT DISTRICT 7/63
41	55+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	18" CMP	120	2355.00	2358.00	2361.5	CAREFREE IMPROVEMENT DISTRICT 7/63
41a	59+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD (found 10/23/01)	18" CMP	124	2348.50	2346.00	2353.0	FIELD SURVEY 10/23/01
42	68+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	60" CMP	128	2322.00	2321.00	2328.0	CAREFREE IMPROVEMENT DISTRICT 7/63
43	72+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	24" CMP	124	2321.00	2318.00	2326.0	CAREFREE IMPROVEMENT DISTRICT 7/63
44	77+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	18" CMP	110	2342.00	2338.00	2351.0	CAREFREE IMPROVEMENT DISTRICT 7/63
45	82+70 N. OF CL CAREFREE HWY/SCOTTSDALE RD	24" CMP	136	2340.00	2335.00	2345.5	CAREFREE IMPROVEMENT DISTRICT 7/63
46	86+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD	30" CMP	128	2338.00	2336.00	2346.0	CAREFREE IMPROVEMENT DISTRICT 7/63
47	102+81 N. OF CL CAREFREE HWY/SCOTTSDALE RD	DOWNTOWN SD SYSTEM					SEE DOWNTOWN IMP. PLANS
48	102+48 N. OF CL CAREFREE HWY/SCOTTSDALE RD	SINGLE GRATE CB	36	2342.93(G)	2338.93	2343.0	CAREFREE IMPROVEMENT DISTRICT 7/63
49	RISING SUN RD, 450' N. OF CL RISING SUN/STEVENS	3-36" CMP	63	2367.00	2365.00	2379.5	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95
50	RISING SUN RD, 200' N. OF CL RISING SUN/STEVENS	18" CMP	68	2382.00	2379.00	2386.4	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95
51	RISING SUN	18" CMP	64	2387.00	2380.00	2388.8	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95
52	RISING SUN	18" CMP	64	2384.00	2377.85	2386.8	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95
53	W. RISING STAR CR	18" CMP	66	2377.00	2376.00	2382.0	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95

Table 10
Existing Drainage Improvements

#	APPROXIMATE LOCATION	DEVICE SIZE/TYPE	L (ft)	IE(UP)	IE(DWN)	GRND	INFORMATION SOURCE
54	W. RISING STAR CR	18" CMP	52	2371.00	2363.00	2373.2	THE CROSSINGS AT CAREFREE II IMP. PLANS 4/95
55	RISING STAR WAY	4-36" CMP	65	2340.00	2339.00	2346.4	THE CROSSINGS AT CAREFREE III IMP. PLANS 9/96
56	VALLEY VIEW CIRCLE	24" CMP	85	2350.00	2347.50	2353.0	THE CROSSINGS AT CAREFREE III IMP. PLANS 9/96
57	PERDIDO DR - ASSUME 2' COVER	24" X 18" CMPA	78	2052.63	2051.57	2054.6	IMPROVEMENT PLANS FOR LOST ACRES ESTATES. 10/93
58	PERDIDO DR - ASSUME 2' COVER	2-24" X 18" CMPA	73	2058.01	2056.99	2060.0	IMPROVEMENT PLANS FOR LOST ACRES ESTATES. 10/93
59	PERDIDO DR - ASSUME 2' COVER	4-24' X 18"CMPA	75	2067.88	2066.76	2069.9	IMPROVEMENT PLANS FOR LOST ACRES ESTATES. 10/93
60	BLOODY BASIN RD AT SIDEWINDER	24" CMP	84	2367.00	2364.00	2371.0	CAREFREE IMPROVEMENT DISTRICT 7/63
61	BLOODY BASIN RD AT SIDEWINDER	24" CMP	68	2368.00	2376.00	2381.0	CAREFREE IMPROVEMENT DISTRICT 7/63
62	ELBOW BEND BETWEEN SIDEWINDER AND NONCHALANT	30" CMP	75	2370.00	2367.00	2372.0	CAREFREE IMPROVEMENT DISTRICT 7/63
63	TRANQUIL TRAIL AT CAVE CREEK RD	36" CMP	64	2384.50	2385.00	2390.0	CAREFREE IMPROVEMENT DISTRICT 7/63
64	MULE TRAIN JUST SOUTH OF BREATHLESS DR	24" CMP	50	2456.00	2455.00	2461.0	CAREFREE IMPROVEMENT DISTRICT 7/63
65	MULE TRAIN JUST NORTH OF CAVE CREEK RD	24" CMP	110	2452.00	2455.00	2465.0	CAREFREE IMPROVEMENT DISTRICT 7/63
66	MULE TRAIN, 500' SOUTH OF PRIMROSE	24" CMP	96	2457.00	2254.00	2465.0	CAREFREE IMPROVEMENT DISTRICT 7/63
67	MULE TRAIN, 130' SOUTH OF PRIMROSE	30" CMP	100	2449.50	2446.50	2462.0	CAREFREE IMPROVEMENT DISTRICT 7/63
68	MULE TRAIN ROAD AT RAMBLING RD	2-30" CMP	170	2445.00	2445.00	2449.0	CAREFREE IMPROVEMENT DISTRICT 7/63
69	MULE TRAIN ROAD AT SERENE ST	30" CMP	75	2339.5	2337.50	2445.0	CAREFREE IMPROVEMENT DISTRICT 7/63
70	SUNDANCE TRAIL EAST OF CAVE CREEK ROAD	48" CMP	72	2331.00	2330.00	2385.7	CAREFREE IMPROVEMENT DISTRICT 7/63
71	CAREFREE DRIVE WAST OF CAVE CREEK RD	30" CMP	70	2354.00	2351.00	2359.0	CAREFREE IMPROVEMENT DISTRICT 7/63
72	TRANQUIL TRAIL S. OF CAREFREE DR, N. OF HAPPY HOLLOW	24" CMP	92	2383.00	2381.00	2390.0	CAREFREE IMPROVEMENT DISTRICT 7/63
73	TRANQUIL TRAIL 275' S. OF HUM RD	15" CMP	68	2378.50	2377.00	2483.0	CAREFREE IMPROVEMENT DISTRICT 7/63
74	DREAM ST, N. OF PRIMROSE PATH	15" CMP	48	2433.00	2431.00	2436.0	CAREFREE IMPROVEMENT DISTRICT 7/63
75	CROSSINGS AT CAREFREE IV	18" CMP	78	2347.36	2341.01	2350.0	CAREFREE IMPROVEMENT DISTRICT 7/63
76	CROSSINGS AT CAREFREE IV	18" CMP	52	2347.96	2342.85	2354.0	CAREFREE IMPROVEMENT DISTRICT 7/63
77	CROSSINGS AT CAREFREE IV	18" CMP	95	2353.97	2346.08	2357.0	CAREFREE IMPROVEMENT DISTRICT 7/63
78	CRESTED QUAIL RUN CUL DE SAC	2-30" CMP	60	2443.04	2441.26	2450.5	OCOTTILO RIDGE, APPEAR TO BE ASBUILT STAMPED 10/14/97
79	CRESTED QUAIL RUN CUL DE SAC, 145' FROM CL OCOTILLO RIDGE	15" RGRCP	60	2461.00	2458.50	2465.7	OCOTILLO RIDGE, APPEAR TO BE ASBUILT STAMPED 10/14/97
80	CAVE CREEK RD AND AUTOPLANE DR.	2-42" SD	65	2476	2471.7	2481.9	ASSUMED FROM CONTOURS
81	SUNSET TRAIL N. OF CAREFREE HWY, BEFORE OLD PAINT TRAIL	24" CMP	74	(T) -8.3	(T) -11	(T) -6.0	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83. 2" sediment (10/23/01)
82	OLD PAINT TRAIL EAST OF SUNSET TRAIL	21" CMP	68	(T) -7.9	(B) - 8.0	(T)-5.2	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
83	HIDDEN CANYON CUL DE SAC - ASSUME 1% SLOPE	27" CMP	100	(B) -13.5	(B) -14.5	(T) -6.5	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/8. Rock & Concrete Sediment
84	CAREFREE HWY E. OF SUNSET TRAIL	30" CMP	82	2167.30	2161.50	2171.0	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
85	CAREFREE HWY E. OF SUNSET TRAIL	48" CMP	58	2171.82	2169.52	2173.6	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
86	CAREFREE HWY E. OF ARROYO RD	36" CMP	40	2185.68	2185.62	2189.4	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
87	CAREFREE HWY E. OF ARROYO RD	48" CMP	75	2198.32	2196.77	2199.1	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
88	CAREFREE HWY JUST W. OF N. RIDGEWAY DR	48" CMP	70	2198.32	2196.77	2203.6	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
89	CAREFREE HWY JUST E. OF N. RIDGEWAY DR	48" CMP	70	2198.82	2196.38	2198.9	CAREFREE FOOTHILLS IMPROVEMENT PLANS 2/17/83
90	NONCHALANT AT BLOODY BASIN	30"CMP	70	2379.50	2377.00	2385.0	CAREFREE IMPROVEMENT DISTRICT 7/63
91	LANGUID LN AND SCOTTSDALE RD.	24" CMP	48	2281.00	2279.50	2284.5	CAREFREE IMPROVEMENT DISTRICT 7/63
92	PEACEFUL PL AT STAGE COACH PASS	24" CMP	56	2373.00	2372.00	2376.5	CAREFREE IMPROVEMENT DISTRICT 7/63
93	CAREFREE DRIVE JUST BEFORE EASY ST - ASSUME 1% SLOPE	30" CMP	100	2349.00	2348.00	2360.0	CAREFREE IMPROVEMENT DISTRICT 7/63
94	SIDEWINDER RD JUST S. OF LAZY LANE	24" CMP	92	2366.00	2365.00	2371.0	CAREFREE IMPROVEMENT DISTRICT 7/63
95	SIDEWINDER RD JUST S. OF BLOODY BASIN	24" CMP	92	2370.50	2368.00	2375.0	CAREFREE IMPROVEMENT DISTRICT 7/63
96	NONCHALANT AVE BETWEEN BLOODY BASIN AND ELBOW BEND	30" CMP	65	2379.50	2377.00	2385.0	CAREFREE IMPROVEMENT DISTRICT 7/63
97	CROSSINGS AT CAREFREE IV	RIPRAP CHANNEL					CAREFREE IMPROVEMENT DISTRICT 7/63
98	CROSSINGS AT CAREFREE IV	RIPRAP CHANNEL					CAREFREE IMPROVEMENT DISTRICT 7/63
99	CRESTED QUAIL RUN CUL DE SAC	24" CMP	79	2444.51	2441.26	2450.5	OCOTILLO RIDGE ESTATES IMP. PLANS, APPEAR TO BE AS BUILT STAMPED 10/14/9
100	STAGECOACH PASS - ASSUME 1% SLOPE	24" CULVERT	54	2455.80	2455.25	2460.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
101	STAGECOACH PASS - ASSUME 1% SLOPE	2-24" CMP	60	2469.40	2468.80	2471.7	STAGECOACH PASS PRELIMINARY PLANS 1/85
102	STAGECOACH PASS - ASSUME 1% SLOPE	24" CMP	70	2479.86	2479.16	2482.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
103	STAGECOACH PASS - ASSUME 1% SLOPE	18" CMP	75	2485.45	2484.70	2488.3	STAGECOACH PASS PRELIMINARY PLANS 1/85
104	STAGECOACH PASS - ASSUME 1% SLOPE	3-48" CMP	80	2490.64	2489.84	2494.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
105	STAGECOACH PASS - ASSUME 1% SLOPE	18" X 27" CMPA	60	2507.79	2507.19	2510.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
106	STAGECOACH PASS - ASSUME 1% SLOPE	24" CMP	67	2520.21	2519.54	2523.2	STAGECOACH PASS PRELIMINARY PLANS 1/85
107	STAGECOACH PASS - ASSUME 1% SLOPE	18" CMP	65	2531.83	2531.18	2534.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
108	STAGECOACH PASS - ASSUME 1% SLOPE	18" X 27" CMPA	63	2539.33	2539.70	2540.8	STAGECOACH PASS PRELIMINARY PLANS 1/85

Table 10
Existing Drainage Improvements

#	APPROXIMATE LOCATION	DEVICE SIZE/TYPE	L (ft)	IE(UP)	IE(DWN)	GRND	INFORMATION SOURCE
109	STAGECOACH PASS - ASSUME 1% SLOPE	18" RCP	65	2559.00	2558.35	2562.0	STAGECOACH PASS PRELIMINARY PLANS 1/85
110	STAGECOACH PASS - ASSUME 1% SLOPE	36" RCP	55	2560.92	2560.37	2563.8	STAGECOACH PASS PRELIMINARY PLANS 1/85
111	STAGECOACH PASS	36"	108	2560.00	2559.00	2566.8	STAGECOACH PASS PRELIMINARY PLANS 1/85
112	STAGECOACH PASS	24"	54	2576.20	2575.80	2580.4	STAGECOACH PASS PRELIMINARY PLANS 1/85
113	STAGECOACH PASS	24"	73	2591.00	2586.00	2596.2	STAGECOACH PASS PRELIMINARY PLANS 1/85
114	STAGECOACH PASS	24"	74	2593.50	2591.00	2598.4	STAGECOACH PASS PRELIMINARY PLANS 1/85
115	STAGECOACH PASS	24"	68	2600.00	2597.50	2606.6	STAGECOACH PASS PRELIMINARY PLANS 1/85
116	STAGECOACH PASS	2-8' X 4'	67	2602.42	2601.00	2608.5	STAGECOACH PASS PRELIMINARY PLANS 1/85
117	STAGECOACH PASS	24"	88	2615.00	2611.00	2620.8	STAGECOACH PASS PRELIMINARY PLANS 1/85
118	STAGECOACH PASS	18"	22	Cattle Guard			STAGECOACH PASS PRELIMINARY PLANS 1/85
119	STAGECOACH PASS	18"	20	Cattle Guard			STAGECOACH PASS PRELIMINARY PLANS 1/85
120	STAGECOACH PASS	24"	48	2631.48	2631.00	2635.2	STAGECOACH PASS PRELIMINARY PLANS 1/85
121	STAGECOACH PASS - ASSUME 1% SLOPE	24"	60	2638.94	2638.34	2644.8	STAGECOACH PASS PRELIMINARY PLANS 1/85
122	STAGECOACH PASS	24"	45	2578.50	2577.00	2582.2	STAGECOACH PASS PRELIMINARY PLANS 1/85
123	BRIDGE OVER GALLOWAY WASH	30' W X 12' H					SURVEY OF CON-ARCH BRIDGE OVER GALLOWAY WASH AT DREAM ST
124	SKYRANCH	24"	155.98	2533.01	2532.40	2537.0	SKY RANCH PHASE II STREET SURVEY 2/87
125	SKYRANCH	18"	194.73	2536.88	2533.37	2541.0	SKY RANCH PHASE II STREET SURVEY 2/87
126	SKYRANCH	18"	231.99	2542.33	2536.88	2548.7	SKY RANCH PHASE II STREET SURVEY 2/87
127	RISING SUN	1-58" + 1-36" CMP	60	2374.50	2574.00	2582.6	CROSSINGS AT CAREFREE PAVING PLAN 5/88
128	RISING SUN	4-42" CMP	60	2361.10	2559.9	2569.0	CROSSINGS AT CAREFREE PAVING PLAN 5/88
129	CL WEST TRAVOIS TRAIL	24" RGRCP	555		2345.70		CROSSINGS AT CAREFREE PAVING PLAN 5/88
130	RIDGELINE RD	20 SY RIPRAP					CROSSINGS AT CAREFREE PAVING PLAN 5/88
131	TRANQUIL TRAIL	2-58" X 36" CMPA	40	2379.19	2378.79	2383.7	CROSSINGS AT CAREFREE PAVING PLAN 5/88
132	LAZY BURRO RD	2-10' X 4' CBC	78	2273.82	2273.55	2278.7	RIDGEVIEW ESTATES IMPROVEMENT PLANS 9/94
133	TERRACE ESTATES CIRCLE (SAME AS 210)	18" CMP	50	2329.25	2326.75	2321.0	RIDGEVIEW ESTATES IMPROVEMENT PLANS 9/94
134	TERRACE ESTATES CIRCLE	18" CMP	61	2310.35	2301.95	2312.5	RIDGEVIEW ESTATES IMPROVEMENT PLANS 9/94
135	RIDGEVIEW ESTATES	2-21" X 15" CMPA	55	2306.50	2304.45	2308.2	RIDGEVIEW ESTATES IMPROVEMENT PLANS 9/94
136	DRIVEWAY CULVERT AT NORTHVIEW LANE	2-18"CMP	25	-8.7	-9.9	-5.8	FIELD SURVEY 8/15/01
137	CAVE CREEK RD/ LUTHERAN CHURCH	3' X 2' CMPA	38	-10.6	-10.8	-4.8	FIELD SURVEY 8/15/01
138	QUAIL TRAIL AND ROMPING RD	AT GRADE X-ING					FIELD SURVEY 8/15/01
139	WILDFLOWER AT STAGECOACH PASS	24" CMP	56	-8.3	-10.0	-5.1	FIELD SURVEY 8/15/01
140	WILDFLOWER AT ROMPING RD	AT GRADE X-ING					FIELD SURVEY 8/15/01
141	WILDFLOWER BETWEEN QUAIL AND ROMPING	24" CMP	40	-9.7	-11.4	-7.0	FIELD SURVEY 8/15/01
142	WILDFLOWER JUST N. OF QUAIL	AT GRADE X-ING					FIELD SURVEY 8/15/01
143	WILDFLOWER S. OF HERETOTHERE	30" CMP	66	-11.8	-12.9	-8.0	FIELD SURVEY 8/15/01
144	WILDFLOWER AT HERETOTHERE	AT GRADE X-ING					FIELD SURVEY 8/15/01
145	WILDFLOWER N. OF TREELINED TRAIL	Ditch					FIELD SURVEY 8/15/01
146	WILDFLOWER AT TREELINED TRAIL	24" CMP	40	-8.8	-10.5	-5.3	FIELD SURVEY 8/15/01
147	WILDFLOWER AT TREELINED TRAIL	3-30" CMP	90	-7.5	-9.1	-5.2	FIELD SURVEY 8/15/01
148	DRIVEWAY WASH CROSSING - 2 DRIVEWAYS	3-30" CMP	90	-7.5	-9.1	-5.2	FIELD SURVEY 8/15/01 - ASSUME SAME AS #147
149	ROMPING AT HERETOTHERE	24" CMP	72	-10.7	-12.9	-8.1	FIELD SURVEY 8/15/01
150	ROMPING AT HERETOTHERE	24" CMP	72	-6.6	-7.4	-3.6	FIELD SURVEY 8/15/01
151	ROMPING N. OF HERETOTHERE	2-36" CMP	70	-7.4	-10.5	-5.1	FIELD SURVEY 8/15/01
152	ROMPING N. OF HERETOTHERE	24" CMP	70	-7.7	-9.9	-5.2	FIELD SURVEY 8/15/01
153	ROMPING AT WILDFLOWER	2-36" CMP	96	-9.8	-12.2	-6.2	FIELD SURVEY 8/15/01
154	ROMPING AT TREELINED TRAIL	24" CMP	70	-9.0	-9.7	-5.6	FIELD SURVEY 8/15/01 - ASSUME LENGTH AND 1% SLOPE
155	TREELINED TRAIL	24" CMP	52	-7.9	-8.9	-6.0	FIELD SURVEY 8/15/01
156	TREELINED TRAIL BETWEEN STARDUST AND WILDLFOWER	OVERLAND CROSSING					FIELD SURVEY 8/15/01
157	TREELINED TRAIL S. OF STARDUST	24" CMP	80	-8.3	-10.5	-6.0	FIELD SURVEY 8/15/01
158	TWILIGHT TRAIL S. OF STARDUST	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
159	TWILIGHT TRAIL S. OF VENUS VIEW	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
160	MILKYWAY AT TRAIL DRIVE	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
161	PLACID PLACE	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
162	VENUS DRIVE	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
163	MILKYWAY AT CAVE CREEK	24" CMP	82	-10.4	-11.9	-5.3	FIELD SURVEY 8/16/01

Table 10
Existing Drainage Improvements

#	APPROXIMATE LOCATION	DEVICE SIZE/TYPE	L (ft)	IE(UP)	IE(DWN)	GRND	INFORMATION SOURCE
164	MILKYWAY N. OF LAZYWOOD	30" CMP	60	-7.7	-10.9	-6.3	FIELD SURVEY 8/16/01
165	TWILIGHT TRAIL N. OF LAZYWOOD	CONC. AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
166	TWILIGHT TRAIL S. OF CAVE CREEK	CONC. AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
167	TWILIGHT TRAIL S. OF LAZYWOOD	CONC. AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
168	TWILIGHT TRAIL N. OF STARDUST	18" CMP	55	-9.5	(T) -9.4	-5.8	FIELD SURVEY 8/16/01
169	CAREFREE DRIVE JUST W. OF FOREMORE CIRCLE	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
170	DOUBLE EAGLE DRIVE W. OF PIMA ROAD	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
171	CAREFREE DRIVE E. OF FOURSOME WAY	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
172	80TH ST S. OF PLEASANT PL	AT GRADE DIP X-ING					FIELD SURVEY 8/16/01
173	MULE TRAIN AT DEAD END	30" CMP	65	2439.0	2436.0	2444.0	FIELD SURVEY 8/16/01 - ASSUME LENGTH AND ELEV'S FROM CONTOURS
174	SERENE ST	24" CMP	80	-9.1	-11.2	-5.1	FIELD SURVEY 8/16/01
175	SERENE ST W. OF FOURSOME	18" CMP	80	-9.6	-12.3	-5.5	FIELD SURVEY 8/16/01
176	FOURSOME WAY CUL DE SAC	18" CMP	155	(T) -7.3	(T) -12.4	-5.4	FIELD SURVEY 8/16/01
177	FOURSOME WAY N. OF SERENE ST	18" CMP	140	-12.8	(T) -11.0	-4.4	FIELD SURVEY 8/16/01
178	SERENE ST W. OF END	24" CMP	78	(T) -9.8	-14.0	-5.3	FIELD SURVEY 8/16/01
179	CONCHO DR AT PAINT PONY DR	2-36" CMP	69	-8.7	-10.7	-4.2	FIELD SURVEY 8/16/01
180	SOMBRERO RD	18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
181	SILVER SADDLE	18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
182	SILVER SADDLE	18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
183	SILVER SADDLE AT GOLDEN SPUR	2-18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
184	SILVER SADDLE N. OF CONCHO	18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
185	SILVER SADDLE	18" CMP W/ GRATE INLET					FIELD SURVEY 8/16/01
186	CORONADO @SPANISH ROOT	18" HDPE	60	-7.7	-10.5	-6.0	FIELD SURVEY 8/16/01
187	HORIZON DR	18" CMP	45	-6.0	-8.9	-4.9	FIELD SURVEY 8/16/01
188	HORIZON DR NEAR TURN	18" CMP	48	-6.9	-8.7	-5.5	FIELD SURVEY 8/16/01
189	HORIZON DR AT END	18" CMP	45	-7.1	-8.1	-5.0	FIELD SURVEY 8/16/01
190	RISING SUN RD	60" X 36" CMPA + 54" CMP	50	(T) -7.4/-8.2	(T) -8.6	-5.1	FIELD SURVEY 8/16/01
191	RISING SUN W. OF 80TH ST	18" CMP	64	-7.4	-10.0	-4.5	FIELD SURVEY 8/16/01
192	STAGECOACH PASS AT LANGUID LANE	24" CMP	75	-7.6	-9.2	-5.1	FIELD SURVEY 8/20/01
193	STAGECOACH PASS NEAR RESTIN RD	18" CMP	70	(T) -5.7	(B)-8.1	-5.4	FIELD SURVEY 8/20/01
194	STAGECOACH PASS AT CAREFREE HWY	24" CMP	62	-8.6	-8.7	-5.5	FIELD SURVEY 8/20/01
195	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	15" CMP	68	-9.2	-10.4	-5.4	FIELD SURVEY 8/20/01
196	CANYON CREEK COURT	15" CMP	75	-8.0	-8.3	-5.5	FIELD SURVEY 8/20/01
197	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	24" CMP	75	-9.6	-10.5	-5.5	FIELD SURVEY 8/20/01
198	CANYON CREEK CIRCLE CUL DE SAC	15" CMP	108	-7.6	(T) -8.9	-5.9	FIELD SURVEY 8/20/01
199	CANYON CREEK CIRCLE W. OF CAVE CREEK RD	15" CMP ELLIPTICAL	72	-7.8	-10.0	-5.5	FIELD SURVEY 8/20/01
200	LEISURE LANE	2-36" CMP	105	(T) -8.4	(T) -10.9	-5.0	FIELD SURVEY 8/20/01
201	LEISURE LANE S. OF SENTINEL ROCK RD	2-36" CMP	130	-9.8	-18.1	-4.8	FIELD SURVEY 8/20/01
202	PALO VERDE (59TH ST)	18" CMP	65	-6.4	-9.0	-5.3	FIELD SURVEY 8/20/01
203	CHINO LANE	2-36" CMP	75	-12.0	-13.1	-5.0	FIELD SURVEY 8/20/01
204	EL SENDERO RD S. OF HIDDEN CANYON RD	36" CMP	68	-10.7	-15.3	-4.6	FIELD SURVEY 8/20/01
205	EL SENDERO RD	15" CMP	65	(T) -7.9	-11.7	-5.0	FIELD SURVEY 8/20/01
206	EL SENDERO RD	36" CMP	65	-11.6	(T) -12.7	-4.9	FIELD SURVEY 8/20/01
207	ARROYO RD @ CASSANDRA WAY	18" CMP	320	NO CONTOURS			FIELD SURVEY 8/20/01, TOO LONG TO OBTAIN INVERTS IN FIELD
208	NEVER MIND TRAIL AT PEDRA GRANDE DR	18" X 30" CMPA	34	-10.2	-10.9	-6.0	FIELD SURVEY 8/23/01
209	NEVER MIND TRAIL	18" X 30" CMPA	34	-9.7	-11.0	-6.2	FIELD SURVEY 8/23/01
210	LAZY BURRO RD AT TERRACE ESTATES CIRCLE	2-10' X 4' CBC	78	(T) -5.7	(T) -6.5	-5.4	FIELD SURVEY 8/23/01
211	STEVENS RD	15" CMP	120	(T) -4.1	(T) -7.7	-3.3	FIELD SURVEY 8/23/01
212	TRANQUIL TRAIL S. OF RISING SUN RD	18" X 30" CMPA	48	-8.8	-9.3	-4.9	FIELD SURVEY 8/23/01
213	TRANQUIL TRAIL AT CAREFREE DR	2-30" CMP	26	-8.3	(T) -8.1	-4.3	FIELD SURVEY 8/23/01
214	STAGECOACH PASS AT TOM DARLINGTON	24" CMP	60	-7.9	-9.5	-4.6	FIELD SURVEY 8/23/01
215	BLOODY BASIN RD AT CAVE CREEK RD	24" CMP	64	2384.5	2385.0	2390.0	FIELD SURVEY 8/23/01 - ASSUME EVERYTHING SAME AS #63
216	TOM DARLINGTON AT CAREFREE HWY	20" X 27" CMPA	130	(T)-6.1	(T) -6.9	(T) -4.8	FIELD SURVEY 8/23/01 - ASSUME LENGTH FROM CONTOURS
217	LOS REALES DR AT CAREFREE HWY	18" RCP	62	-8.0	-8.6	-5.8	FIELD SURVEY 8/23/01
218	CAREFREE HWY	36" CMP	74	-6.5	-6.8	-2.5	FIELD SURVEY 8/23/01 - ASSUME COVER

Table 10
Existing Drainage Improvements

#	APPROXIMATE LOCATION	DEVICE SIZE/TYPE	L (ft)	IE(UP)	IE(DWN)	GRND	INFORMATION SOURCE
219	NOT USED						
220	RISING SUN RD AT TRANQUIL TRAIL	4" PVC SLEEVE	45				CROSSINGS AT CAREFREE PAVING PLAN 5/88
221	VILLA CASSANDRA WAY AT NORTH RIDGEWAY DRIVE	24" CMP	146				FIELD SURVEY 10/26/01
222	EL SENDERO AT 66TH PLACE	2 - 36" RCP	46				FIELD SURVEY 10/26/01
223	VILLA CASSANDRA WAY NEAR SHOTGUN CIRCLE	30" CMP	52				FIELD SURVEY 10/26/01
224	VILLA CASSANDRA WAY	36" CMP	56				FIELD SURVEY 10/26/01
225	OLD PAINT TRAIL NEAR SHOTGUN CIRCLE	30" CMP	60				FIELD SURVEY 10/26/01
226	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE	30" CMP	58				FIELD SURVEY 10/26/01
227	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE	30" CMP	92				FIELD SURVEY 10/26/01
228	OLD PAINT TRAIL SOUTH OF LANGUID LANE	30" CMP	105				FIELD SURVEY 10/26/01
229	SKY RANCH	36" CMP	360	58.70	56.00	63.0	SKY RANCH PHASE II STREET SURVEY 2/87, S=0.76%
230	SKY RANCH	DITCH					SKY RANCH PHASE II STREET SURVEY 2/87
231	RIDGEWAY AT EL SENDERO (PRIVATE)	CULVERT					SEEN IN AERIALS, GATED COMMUNITY
232	RIDGEWAY DRIVE (PRIVATE)	CULVERT					SEEN IN AERIALS, GATED COMMUNITY
233	66TH PLACE (PRIVATE)	CULVERT					SEEN IN AERIALS, GATED COMMUNITY
234	EL SENDERO (PRIVATE)	CULVERT					SEEN IN AERIALS, GATED COMMUNITY
235	ROMPING AT WILDFLOWER	OVERLAND CROSSING					SEEN IN TOPO
236	CAREFREE HIGHWAY	OVERLAND CROSSING					SEEN IN TOPO
237	CAREFREE HIGHWAY	CULVERT					SEEN IN TOPO
238	CANYON CREEK CIRCLE	CULVERT					FIELD SURVEY
239	CAREFREE HIGHWAY NEAR SUNSET TRAIL	OVERLAND CROSSING					FIELD SURVEY
240	CAREFREE HIGHWAY NEAR WHILEAWAY	OVERLAND CROSSING					FIELD SURVEY
241	STORM DRAIN SYSTEM NEAR CAVE CREEK ROAD AT HUM RD.	ARCH PIPE					FIELD SURVEY
242	IRONWOOD ESTATES	4 - 36" RCP					FIELD SURVEY, 10/8/02
243	DRIVEWAY CULVERT ON STARDUST LANE	DRIVEWAY CULVERT					FIELD SURVEY
244	DRIVEWAT CULVERT ON CAVE CREEK RD.	DRIVEWAY CULVERT					FIELD SURVEY
245	DRIVEWAY CULVERT NEAR LAZYWOOD PLACE	DRIVEWAY CULVERT					FIELD SURVEY

Table 11
Culvert and Road Crossing Flows
Existing Conditions

#	APPROXIMATE LOCATION	Area (Square Feet)	Area (Sq. Miles)	Total Area of Subbasin	Contribution %		Basin or CP	Total Existing Basin or CP Flows (cfs) 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Contribution %		Basin or CP	Total Basin or CP Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Total Existing Culvert/Crossing Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Comments
1	CAVE CREEK RD, 83' N. OF CL OF CAREFREE HWY/CC ROAD	1700582	0.061	0.061	100.00%	of	UC96	33	39	72	76								33	39	72	76	
2	CAVE CREEK RD, 557' N. OF CL OF CAREFREE HWY/CC ROAD	669082	0.024	0.024	100.00%	of	UC95	33	37	63	53								33	37	63	53	
3	CAVE CREEK RD, 1037' N. OF CL OF CAREFREE HWY/CC ROAD				100.00%	of	CP88END	36	62	351	868								36	62	351	868	
4	CAVE CREEK RD, 1690' N. OF CL OF CAREFREE HWY/CC ROAD	1059379	0.038	0.038	100.00%	of	UC93	27	31	53	56								27	31	53	56	
5	CAVE CREEK RD, 2465' N. OF CL OF CAREFREE HWY/CC ROAD	1171838	0.042034	0.073	57.58%	of	UC91	38	46	86	92								22	26	50	53	
6	CAVE CREEK RD, 3552' N. OF CL OF CAREFREE HWY/CC ROAD	403347	0.014468	0.038	38.07%	of	UC90	16	24	46	52	100.00%	of	CP89	1150	1477	1638	1990	1156	1486	1656	2010	
7	CAVE CREEK RD, 3950' N. OF CL OF CAREFREE HWY/CC ROAD	2409319	0.086422	0.192	45.01%	of	UC75	175	325	369	362								79	146	166	163	
8	CAVE CREEK RD, 4857' N. OF CL OF CAREFREE HWY/CC ROAD	900349	0.032296	0.041	78.77%	of	UC76	40	50	83	78								32	39	65	61	
9	CAVE CREEK RD, 5235' N. OF CL OF CAREFREE HWY/CC ROAD	3729902	0.133792	0.151	88.60%	of	UC74	65	155	265	270								58	137	235	239	
10	PIMA RD, 616' N. OF CL OF PIMA RD/STAGECOACH PASS	453578	0.01627	0.027	60.26%	of	UC19	18	11	41	40								11	7	25	24	
11	PIMA RD, 1115' N. OF CL OF PIMA RD/STAGECOACH PASS	718572	0.025775	0.04	64.44%	of	UC18	24	13	54	59	100.00%	of	CPC8	87	97	156	165	102	105	191	203	
12	PIMA RD, 1417' N. OF CL OF PIMA RD/STAGECOACH PASS	155744	0.005587	0.032	17.46%	of	UC22	10	13	26	29								2	2	5	5	
13	PIMA RD, 88' N. OF CL OF PIMA RD/CAVE CREEK																						Not Calculated (Fuller)
14	CAREFREE MTN DR	469860	0.016854	0.108	15.61%	of	UC88	37	38	69	66								6	6	11	10	
15	CAREFREE MTN DR	150658	0.005404	0.038	14.22%	of	UC93	27	31	53	56								4	4	8	8	
16	AGAVE PL	82076	0.002944	0.038	7.75%	of	UC93	27	31	53	56								2	2	4	4	
17	CAREFREE MTN DR	241282	0.008655	0.073	11.86%	of	UC89	52	69	119	124								6	8	14	15	
18	CANOTIA PL	264594	0.009491	0.073	13.00%	of	UC89	52	69	119	124								7	9	15	16	
19	CAREFREE MTN DR	105546	0.003786	0.073	5.19%	of	UC89	52	69	119	124								3	4	6	6	
20	CAREFREE MTN DR	1818997	0.065248	0.078	83.65%	of	UC79	56	78	138	135	100.00%	of	CP84	969	1157	1240	1354	1016	1222	1355	1467	
21	DALEA PL	578315	0.020744	0.073	28.42%	of	UC89	52	69	119	124								15	20	34	35	
22	UNNAMED RD																						Does not exist
23	CAREFREE MTN DR	4198257	0.150592	0.177	85.08%	of	UC78	268	293	103	392								228	249	88	334	
23a	CAREFREE MTN DRIVE	164542	0.005902	0.177	3.33%	of	UC78	268	293	103	392								9	10	3	13	
24	TRANQUIL PL	769224	0.027592	1.004	2.75%		GVW1_4	682	646	1229	1170								19	18	34	32	
25	TRANQUIL PL	2632951	0.094444	1.004	9.41%		GVW1_4	682	646	1229	1170								64	61	116	110	Fuller's #58
26	TRANQUIL PL	2698783	0.096806	1.004	9.65%		GVW1_4	682	646	1229	1170								66	62	119	113	Fuller's #59
27	LOS REALES DR	850542	0.030509	0.078	39.11%	of	UC79	56	78	138	135	100.00%	of	CP84	969	1157	1240	1354	991	1188	1294	1407	
28	58TH ST	188751	0.006771	0.192	3.53%	of	UC75	175	325	369	362								6	11	13	13	
29	58TH ST	742603	0.026637	0.041	64.97%	of	UC76	40	50	83	78								26	32	54	51	
30	61ST ST	3345230	0.119994	0.151	79.47%	of	UC74	65	155	265	270								52	123	211	215	
31	RESTIN RD	570031	0.020447	0.041	49.87%	of	UC76	40	50	83	78								20	25	41	39	
32	RESTIN RD	268980	0.009648	0.041	23.53%	of	UC76	40	50	83	78								9	12	20	18	
33	61ST ST	2565774	0.092034	0.192	47.93%	of	UC75	175	325	369	362								84	156	177	174	
34	61ST ST	2821181	0.101196	0.151	67.02%	of	UC74	65	155	265	270								44	104	178	181	
35	LITTLE HOPE PL	1919191	0.068842	0.151	45.59%	of	UC74	65	155	265	270								30	71	121	123	
36	10+20 N. OF CL CAREFREE HWY/SCOTTSDALE RD	490396	0.017591	0.019	92.58%	of	UC50	27	30	504	412	100.00%	of	CP3149	697	821	1296	1524	722	849	1763	1905	
37	12+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1354348	0.048581	0.197	24.66%	of	UC48	220	248	419	396	100.00%	of	CP4547	272	270	446	348	326	331	549	446	
38	31+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	617287	0.022142	0.031	71.43%	of	UC47	49	53	87	70								35	38	62	50	
39	41+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	888236	0.031861	0.034	93.71%	of	UC46	61	64	107	79								57	60	100	74	
40	51+35 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1494571	0.05361	0.4164	12.87%	of	AHW1	698	553	1255	811								90	71	162	104	
41	55+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	706174	0.025331	0.4164	6.08%	of	AHW1	698	553	1255	811								42	34	76	49	
41a	59+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD (found 10/23/01)	538995	0.019334	0.4164	4.64%	of	AHW1	698	553	1255	811								32	26	58	38	
42	68+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	83801	0.003006	0.2784	1.08%	of	AHW3	326	265	666	464	100.00%	of	AHW1	698	553	1255	811	702	556	1262	816	Fuller's #4
43	72+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	112046	0.004019	0.0653	6.15%	of	AHW2	105	82	181	117	100.00%	of	AHW1	698	553	1255	811	704	558	1266	818	
44	77+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1229563	0.044105	0.0613	71.95%	of	AHW2	105	82	181	117								76	59	130	84	
45	82+70 N. OF CL CAREFREE HWY/SCOTTSDALE RD	66010	0.002368	0.1639	1.44%	of	AHW4	212	168	388	262								3	2	6	4	
46	86+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD	4504111	0.161563	0.1639	98.57%	of	AHW4	212	168	388	262								209	166	382	258	Fuller's #20
47	102+81 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1587992	0.056961	0.983	5.79%	of	GVW1_5	801	739	1345	1258								46	43	78	73	
48	102+48 N. OF CL CAREFREE HWY/SCOTTSDALE RD	862980	0.030955	0.983	3.15%	of	GVW1_5	801	739	1345	1258								25	23	42	40	
49	RISING SUN RD, 450' N. OF CL RISING SUN/STEVENS	203199	0.007289	0.5926	1.23%	of	GVW1_6	503	439	899	794								6	5	11	10	Fuller's #66
50	RISING SUN RD, 200' N. OF CL RISING SUN/STEVENS	367401	0.013179	0.5926	2.22%	of	GVW1_6	503	439	899	794								11	10	20	18	
51	RISING SUN	150875	0.005412	0.5926	0.91%	of	GVW1_6	503	439	899	794								5	4	8	7	
52	RISING SUN	223239	0.008008	1.043	0.77%	of	GVW3_1	656	633	1227	1178								5	5	9	9	
53	W. RISING STAR CR	367401	0.013179	0.5926	2.22%	of	GVW1_6	503	439	899	794								11	10	20	18	
54	W. RISING STAR CR	473308	0.016978	0.5926	2.86%	of	GVW1_6	503	439	899	794								14	13	26	23	
55	RISING STAR WAY	786155	0.028199	0.5926	4.76%	of	GVW1_6	503	439	899	794								24	21	43	38	Fuller's #67
56	VALLEY VIEW CIRCLE	598401	0.021465	1.043	2.06%	of	GVW3_1	656	633	1227	1178								14	13	25	24	
57	PERDIDO DR	92687	0.003325	0.073	4.55%	of	UC91	38	46	86	92								2	2	4	4	
58	PERDIDO DR	326702	0.011719	0.073	16.05%	of	UC91	38	46	86	92								6	7	14	15	
59	PERDIDO DR	818135	0.029347	0.073	40.20%	of	UC89	52	69	119	124								21	28	48	50	
60	BLOODY BASIN RD AT SIDEWINDER	482855	0.01732	0.0613	28.25%	of	AHW2	105	82	181	117								30	23	51	33	
61	BLOODY BASIN RD AT SIDEWINDER	92687	0.003325	0.0613	5.42%	of	AHW2	105	82	181	117								6	4	10	6	
62	ELBOW BEND BETWEEN SIDEWINDER AND NONCHALANT	3888042	0.139464	0.1639	85.09%	of	AHW4	212	168	388	262								180	143	330	223	Fuller's #18
63	TRANQUIL TRAIL AT CAVE CREEK RD	6310343	0.226352	0.983	23.03%	of	GVW1_5	801	739	1345	1258								184	170	310	290	Fuller's #26
64	MULE TRAIN JUST SOUTH OF BREATHLESS DR	524808	0.018825	0.261	7.21%	of	UC35	275	325	591	519								20	23	43	37	
65	MULE TRAIN JUST NORTH OF CAVE CREEK RD	4219838	0.151366	0.983	15.40%	of	GVW1_5	801	739	1345	1258								123	114	207	194	
66	MULE TRAIN, 500' SOUTH OF PRIMROSE	4819241	0.172866	0.983	17.59%	of	GVW1_5	801	739	1345	1258								141	130	237	221	
67	MULE TRAIN, 130' SOUTH OF PRIMROSE	4819241	0.172866	0.983	17.59%	of	GVW1_5	801	739	1345	1258								141	130	237	221	Fuller's #23
68	MULE TRAIN ROAD AT RAMBLING RD	5573560	0.199924	0.983	20.34%	of	GVW1_5	801	739	1345	1258								163	150	274	256	
69	MULE TRAIN ROAD AT SERENE ST	674927	0.02421	1.518	1.59%	of	GVW1_3	1026	1068	1876	1916				1026	1068	1876	1916	16	17	30	31	
70	SUNDANCE TRAIL EAST OF CAVE CREEK ROAD	23720864	0.850869	0.983	86.56%	of	GVW1_5	801	739	1345	1258								693	640	1164	1089	
71	CAREFREE DRIVE WEST OF CAVE CREEK RD	22770635	0.816784	0.983	83.09%	of	GVW1_5	801	739	1345	1258								666	614	1118	1045	
72	TRANQUIL TRAIL S. OF CAREFREE DR, N. OF HAPPY HOLLOW	9996679	0.358582	0.983	36.48%	of	GVW1_5	801	739	1345	1258								292	270	491	459	
73	TRANQUIL TRAIL 275' S. OF HUM RD	384837	0.013804	0.983	1.40%	of	GVW1_5	801	739	1345	1258								11	10	19	18	
74	DREAM ST, N. OF PRIMROSE PATH	272294	0.009767	0.983	0.99%	of	GVW1_5	801	739	1345	1258								8	7	13	12	
75	CROSSINGS AT CAREFREE IV	73802	0.002647	0.5926	0.45%	of	GVW1_6	503	439	899	794								2	2	4	4	
76	CROSSINGS AT CAREFREE IV	29989	0.001076	0.5926	0.18%	of	GVW1_6	503	439	899	794								1	1	2	1	
77	CROSSINGS AT CAREFREE IV	47697	0.001711	0.5926	0.29%	of	GVW1_6	503	439	899	794								1	1	3	2	
78	CRESTED QUAIL RUN CUL DE SAC	105026	0.003767	0.5926	0.64%	of	GVW1_6	503	439	899	794								3	3	6	5	
79	CRESTED QUAIL RUN CUL DE SAC, 145' FROM CL OCOTILLO RIDG	444612	0.015948	0.5926	2.69%	of	GVW1_6	503	439	899	794								14	12	24	21	
80	CAVE CREEK RD AND AUTOPLANE DR.	262056	0.0094	0.983	0.96%	of	GVW1_5	801	739	1345	1258								8	7	13	12	
81	SUNSET TRAIL N. OF CAREFREE HWY, BEFORE OLD PAINT TRAIL	315309	0.01131	0.078	14.50%	of	UC79	56	78	138	135								8	11	20	20	
82	OLD PAINT TRAIL EAST OF SUNSET TRAIL	181466	0.006509	0.078	8.35%	of	UC79	56	78	138	135								5	7	12	11	

Table 11
Culvert and Road Crossing Flows
Existing Conditions

#	APPROXIMATE LOCATION	Area (Square Feet)	Area (Sq. Miles)	Total Area of Subbasin	Contribution %		Basin or CP	Total Existing Basin or CP Flows (cfs) 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Contribution %		Basin or CP	Total Basin or CP Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Total Existing Culvert/Crossing Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Comments
83	HIDDEN CANYON CUL DE SAC	137340	0.004926	0.177	2.78%	of	UC78	268	293	103	392								7	8	3	11	
84	CAREFREE HWY E. OF SUNSET TRAIL	265919	0.009539	0.013	73.37%	of	UC84	14	14	24	23								10	10	18	17	
85	CAREFREE HWY E. OF SUNSET TRAIL	115543	0.004145	0.022	18.84%	of	UC82	22	28	50	43								4	5	9	8	
86	CAREFREE HWY E. OF ARROYO RD	303509	0.010887	0.037	29.42%	of	UC66	30	40	68	73								9	12	20	21	
87	CAREFREE HWY E. OF ARROYO RD	460655	0.016524	0.037	44.66%	of	UC66	30	40	68	73								13	18	30	33	
88	CAREFREE HWY JUST W. OF N. RIDGEWAY DR	528245	0.018948	0.117	16.20%	of	UC63	128	157	260	238								21	25	42	39	
89	CAREFREE HWY JUST E. OF N. RIDGEWAY DR	2603366	0.093383	0.117	79.81%	of	UC63	128	157	260	238								102	125	208	190	
90	NONCHALANT AT BLOODY BASIN	3608952	0.129453	0.1639	78.98%	of	AHW4	212	168	388	262								167	133	306	207	Fuller's #17
91	LANGUID LN AND SCOTTSDALE RD.	1741892	0.062482	0.197	31.72%	of	UC48	220	248	419	396								70	79	133	126	
92	PEACEFUL PL AT STAGE COACH PASS	1337449	0.047974	0.417	11.50%	of	AHW1	698	553	1255	811								80	64	144	93	
93	CAREFREE DRIVE JUST BEFORE EASY ST	4296088	0.154101	0.1639	94.02%	of	AHW4	212	168	388	262								199	158	365	246	Fuller's #19
94	SIDEWINDER RD JUST S. OF LAZY LANE	119492	0.004286	0.4164	1.03%	of	AHW1	698	553	1255	811								7	6	13	8	
95	SIDEWINDER RD JUST S. OF BLOODY BASIN	482855	0.01732	0.1639	10.57%	of	AHW4	212	168	388	262								22	18	41	28	
96	NONCHALANT AVE BETWEEN BLOODY BASIN AND ELBOW BEND	112608	0.004039	0.1639	2.46%	of	AHW4	212	168	388	262								5	4	10	6	
97	CROSSINGS AT CAREFREE IV					of													0	0	0	0	CHANNEL
98	CROSSINGS AT CAREFREE IV					of													0	0	0	0	CHANNEL
99	CRESTED QUAIL RUN CUL DE SAC	2047284	0.073436	0.5926	12.39%	of	GVW1_6	503	439	899	794								62	54	111	98	
100	STAGECOACH PASS	628157	0.022532	0.261	8.63%	of	UC35	275	325	591	519								24	28	51	45	
101	STAGECOACH PASS	387900	0.013914	0.207	6.72%	of	UC37	98	107	208	218								7	7	14	15	
102	STAGECOACH PASS	225405	0.008085	0.037	21.85%	of	UC34	32	34	71	70								7	7	16	15	
103	STAGECOACH PASS	25085	0.0009	0.037	2.43%	of	UC34	32	34	71	70								1	1	2	2	
104	STAGECOACH PASS	937056	0.033612	0.035	96.04%	of	UC29	18	24	45	48	100.00%	of	CP2223	150	162	277	301	167	185	320	347	
105	STAGECOACH PASS	186664	0.006696	0.09	7.44%	of	UC28	32	44	79	83								2	3	6	6	
106	STAGECOACH PASS	144626	0.005188	0.09	5.76%	of	UC28	32	44	79	83								2	3	5	5	
107	STAGECOACH PASS	57708	0.00207	0.09	2.30%	of	UC28	32	44	79	83								1	1	2	2	
108	STAGECOACH PASS	332633	0.011932	0.09	13.26%	of	UC28	32	44	79	83								4	6	10	11	
109	STAGECOACH PASS	12748	0.000457	0.09	0.51%	of	UC28	32	44	79	83								0	0	0	0	
110	STAGECOACH PASS	268183	0.00962	0.158	6.09%	of	UC10	145	158	259	272								9	10	16	17	
111	STAGECOACH PASS	4091319	0.146756	0.158	92.88%	of	UC10	145	158	259	272								135	147	241	253	
112	STAGECOACH PASS	60379	0.002166	0.128	1.69%	of	UE21	80	44	131	150								1	1	2	3	
113	STAGECOACH PASS	41914	0.001503	0.019	7.91%	of	UE13	21	17	29	31								2	1	2	2	
114	STAGECOACH PASS	58796	0.002109	0.019	11.10%	of	UE13	21	17	29	31								2	2	3	3	
115	STAGECOACH PASS	97854	0.00351	0.019	18.47%	of	UE13	21	17	29	31								4	3	5	6	
116	STAGECOACH PASS	205384	0.007367	0.042	17.54%	of	UE12	39	31	55	61	100.00%	of	CPUE3	375	242	509	620	382	247	519	631	
117	STAGECOACH PASS	12717	0.000456	0.013	3.51%	of	UE11	20	17	29	26								1	1	1	1	
118	STAGECOACH PASS	151646	0.00544				No Name																Cattle Guard
119	STAGECOACH PASS	137238	0.004923				No Name																Cattle Guard
120	STAGECOACH PASS	44994	0.001614	0.013	12.41%	of	UE11	20	17	29	26								2	2	4	3	
121	STAGECOACH PASS	587862	0.021087	0.024	87.86%	of	UE7	28	23	39	41								25	20	34	36	
122	STAGECOACH PASS	41374	0.001484	0.128	1.16%	of	UE21	80	44	131	150								1	1	2	2	
123	BRIDGE OVER GALLOWAY WASH	16147912	0.579227	1.52	38.15%	of	GVW1_3	1026	1068	1876	1916	100.00%	of	GVW1_2	609	593	1155	1110	1000	1000	1871	1841	Bridge over Galloway Wash, Fuller's #34
124	SKYRANCH	126020	0.00452	0.98	0.46%	of	GVW1_5	801	739	1345	1258								4	3	6	6	
125	SKYRANCH	71295	0.002557	0.98	0.26%	of	GVW1_5	801	739	1345	1258								2	2	3	3	
126	SKYRANCH	39970	0.001434	0.98	0.15%	of	GVW1_5	801	739	1345	1258								1	1	2	2	
127	RISING SUN	2517537	0.090304	1.004	9.00%	of	GVW1_4	682	646	1229	1170								61	58	111	105	
128	RISING SUN	4499325	0.161391	0.59	27.23%	of	GVW1_6	503	439	899	794								137	120	245	216	Fuller's #64
129	CL WEST TRAVOIS TRAIL	4492678	0.161153	0.59	27.19%	of	GVW1_6	503	439	899	794								137	119	244	216	
130	RIDGELINE RD	4507796	0.161695	0.59	27.28%	of	GVW1_6	503	439	899	794								137	120	245	217	
131	TRANQUIL TRAIL	2427402	0.087071	1.004	8.68%	of	GVW1_4	682	646	1229	1170								59	56	107	102	Fuller's #56
132	LAZY BURRO RD	1102344	0.039541	0.161	24.50%	of	AHW5	240	191	447	289								59	47	110	71	Fuller's #11
133	TERRACE ESTATES CIRCLE	40465	0.001451	0.161	0.90%	of	AHW5	240	191	447	289								2	2	4	3	
134	TERRACE ESTATES CIRCLE	87088	0.003124	0.161	1.94%	of	AHW5	240	191	447	289								5	4	9	6	
135	RIDGEVIEW ESTATES	519599	0.018638	0.58	3.22%	of	AHW6	381	329	896	716								12	11	29	23	
136	DRIVEWAY CULVERT AT NORTHVIEW LANE	655120	0.023499	0.98	2.39%	of	GVW1_5	801	739	1345	1258								19	18	32	30	Fuller's #21
137	CAVE CREEK RD/ LUTHERAN CHURCH	825859	0.029624	0.054	54.86%	of	UC8	38	24	81	85								21	13	44	47	
138	QUAIL TRAIL AND ROMPING RD	2086596	0.074846	0.098	76.37%	of	UE3	62	47	92	105								47	36	70	80	
139	WILDFLOWER AT STAGECOACH PASS	526152	0.018873	0.024	78.64%	of	UE7	28	23	39	41								22	18	31	32	
140	WILDFLOWER AT ROMPING RD	14541730	0.521613	0.546	95.53%	of	UE1	202	125	285	324								193	119	272	310	
141	WILDFLOWER BETWEEN QUAIL AND ROMPING	213286	0.007651	0.546	1.40%	of	UE1	202	125	285	324								3	2	4	5	
142	WILDFLOWER JUST N. OF QUAIL	40152	0.00144	0.029	4.97%	of	UE100	42	35	59	56								2	2	3	3	
143	WILDFLOWER S. OF HERETOTHERE	662611	0.023768	0.027	88.03%	of	UE6	29	24	39	43								26	21	34	38	
144	WILDFLOWER AT HERETOTHERE	132780	0.004763	0.029	16.42%	of	UE100	42	35	59	56	100.00%	of	CPUE1	39	32	55	61	46	38	65	70	
145	WILDFLOWER N. OF TREELINED TRAIL	5421414	0.194466	0.235	82.75%	of	UE2	80	59	129	145								66	49	107	120	SAME AS 147
146	WILDFLOWER AT TREELINED TRAIL	766653	0.0275	0.235	11.70%	of	UE2	80	59	129	145								9	7	15	17	
147	WILDFLOWER AT TREELINED TRAIL	5432500	0.194864	0.235	82.92%	of	UE2	80	59	129	145								66	49	107	120	
148	DRIVEWAY WASH CROSSING - 2 DRIVEWAYS	5464264	0.196004	0.235	83.41%	of	UE2	80	59	129	145								67	49	108	121	
149	ROMPING AT HERETOTHERE	383356	0.013751	0.027	50.93%	of	UE6	29	24	39	43								15	12	20	22	
150	ROMPING AT HERETOTHERE	346313	0.012422	0.027	46.01%	of	UE6	29	24	39	43								13	11	18	20	
151	ROMPING N. OF HERETOTHERE	659622	0.023661	0.029	81.59%	of	UE4	25	21	36	40								20	17	29	33	
152	ROMPING N. OF HERETOTHERE	153423	0.005503	0.012	45.86%	of	UE5	17	14	23	23								8	6	11	11	
153	ROMPING AT WILDFLOWER	4461728	0.160042	0.235	68.10%	of	UE2	80	59	129	145								54	40	88	99	
154	ROMPING AT TREELINED TRAIL	726194	0.026049	0.054	48.24%	of	UC8	38	24	81	85								18	12	39	41	
155	TREELINED TRAIL	421880	0.015133	0.047	32.20%	of	UC9	48	31	84	82								15	10	27	26	
156	TREELINED TRAIL BETWEEN STARDUST AND WILDLFOWER	167272	0.006	0.158	3.80%	of	UC10	145	155	259	272								6	6	10	10	
157	TREELINED TRAIL S. OF STARDUST	23493	0.000843	0.235	0.36%	of	UE2	80	59	129	145								0	0	0	1	
158	TWILIGHT TRAIL S. OF STARDUST	6067892	0.217656	0.235	92.62%	of	UE2	80	59	129	145								74	55	119	134	
159	TWILIGHT TRAIL S. OF VENUS VIEW				100.00%	of	CPUE3	297	74	255	620	MINUS FLOWS	of	UE2	0	0	129	145	297	74	126	475	
160	MILKYWAY AT TRAIL DRIVE	1891558	0.06785	0.158	42.94%	of	UC10	145	155	259	272								62	67	111	117	
161	PLACID PLACE	3799191	0.136277	0.158	86.25%	of	UC10	145	155	259	272								125	134	223	235	
162	VENUS DRIVE	3398147	0.121892	0.158	77.15%	of	UC10	145	155	259	272								112	120	200	210	
163	MILKYWAY AT CAVE CREEK	1419436	0.050915	0.054	94.29%	of	UC8	38	24	81	85								36	23	76	80	
164	MILKYWAY N. OF LAZYWOOD	1205421	0.043239	0.047	92.00%	of	UC9	48	31	84	82								44	29	77	75	
165	TWILIGHT TRAIL N. OF LAZYWOOD	866686	0.031088	0.047	66.14%	of	UC9	48	31	84	82								32	21	56	54	
166	TWILIGHT TRAIL S. OF CAVE CREEK	1173302	0.042086	0.054	77.94%	of	UC8	38	24	81	85								30	19	63	66	

Table 11
Culvert and Road Crossing Flows
Existing Conditions

#	APPROXIMATE LOCATION	Area	Area	Total Area of	Contribution		Basin or	Total Existing Basin or CP Flows (cfs)				Contribution		Basin or	Total Basin or CP Flows				Total Existing Culvert/Crossing Flows				Comments	
		(Square Feet)	(Sq. Miles)	Subbasin	%		CP	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	%		CP	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr		
167	TWILIGHT TRAIL S. OF LAZYWOOD	1180074	0.042329	0.158	26.79%	of	UC10	145	155	259	272								39	42	69	73		
168	TWILIGHT TRAIL N. OF STARDUST	64155	0.002301	0.158	1.46%	of	UC10	145	155	259	272								2	2	4	4		
169	CAREFREE DRIVE JUST W. OF FOREMORE CIRCLE	7004939	0.251268	1.52	16.55%	of	GVW1_3	1026	1068	1876	1916								170	177	310	317	Fuller's #39	
170	DOUBLE EAGLE DRIVE W. OF PIMA ROAD	6446170	0.231225	1.52	15.23%	of	GVW1_3	1026	1068	1876	1916								156	163	286	292	Fuller's #38	
171	CAREFREE DRIVE E. OF FOURSOME WAY	6099585	0.218793	1.52	14.41%	of	GVW1_3	1026	1068	1876	1916								148	154	270	276		
172	80TH ST S. OF PLEASANT PL	6641251	0.238222	1.52	15.69%	of	GVW1_3	1026	1068	1876	1916								161	168	294	301		
173	MULE TRAIN AT DEAD END	2466949	0.08849	1.52	5.83%	of	GVW1_3	1026	1068	1876	1916								60	62	109	112		
174	SERENE ST	539830	0.019364	1.52	1.28%	of	GVW1_3	1026	1068	1876	1916								13	14	24	24		
175	SERENE ST W. OF FOURSOME	4434029	0.159049	1.52	10.47%	of	GVW1_3	1026	1068	1876	1916								107	112	196	201		
176	FOURSOME WAY CUL DE SAC	1977492	0.070933	1.52	4.67%	of	GVW1_3	1026	1068	1876	1916								48	50	88	90		
177	FOURSOME WAY N. OF SERENE ST	4104607	0.147233	1.52	9.70%	of	GVW1_3	1026	1068	1876	1916								99	104	182	186		
178	SERENE ST W. OF END	3815376	0.136858	1.52	9.01%	of	GVW1_3	1026	1068	1876	1916								92	96	169	173		
179	CONCHO DR AT PAINT PONY DR	3594324	0.128929	1.52	8.49%	of	GVW1_3	1026	1068	1876	1916								87	91	159	163		
180	SOMBRERO RD	72661	0.002606	1.52	0.17%	of	GVW1_3	1026	1068	1876	1916								2	2	3	3		
181	SILVER SADDLE	152951	0.005486	1.004	0.55%	of	GVW1_4	682	646	1229	1170								4	4	7	6		
182	SILVER SADDLE	116382	0.004175	1.004	0.42%	of	GVW1_4	682	646	1229	1170								3	3	5	5		
183	SILVER SADDLE AT GOLDEN SPUR	122986	0.004412	1.004	0.44%	of	GVW1_4	682	646	1229	1170								3	3	5	5		
184	SILVER SADDLE N. OF CONCHO	1401287	0.050264	1.004	5.01%	of	GVW1_4	682	646	1229	1170								34	32	62	59		
185	SILVER SADDLE	404528	0.01451	1.004	1.45%	of	GVW1_4	682	646	1229	1170								10	9	18	17		
186	CORONADO @ SPANISH ROOT	937553	0.03363	6.02	0.56%	of	GVW2	2564	3256	4686	5492								14	18	26	31		
187	HORIZON DR	1707438	0.061246	1.004	6.10%	of	GVW1_4	682	646	1229	1170								42	39	75	71		
188	HORIZON DR NEAR TURN	995453	0.035707	1.004	3.56%	of	GVW1_4	682	646	1229	1170								24	23	44	42		
189	HORIZON DR AT END	72544	0.002602	1.004	0.26%	of	GVW1_4	682	646	1229	1170								2	2	3	3		
190	RISING SUN RD	1916688	0.068752	1.004	6.85%	of	GVW1_4	682	646	1229	1170								47	44	84	80		
191	RISING SUN W. OF 80TH ST	1102817	0.039558	1.004	3.94%	of	GVW1_4	682	646	1229	1170								27	25	48	46		
192	STAGECOACH PASS AT LANGUID LANE	255492	0.009165	0.197	4.65%	of	UC48	220	248	419	396								10	12	19	18		
193	STAGECOACH PASS NEAR RESTIN RD	41358	0.001484	0.034	4.36%	of	UC46	61	64	107	79								3	3	5	3		
194	STAGECOACH PASS AT CAREFREE HWY	1263450	0.04532	0.11	41.20%	of	UC58	152	171	284	242								63	70	117	100		
195	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	171001	0.006134	0.073	8.40%	of	UC91	38	46	86	92								3	4	7	8		
196	CANYON CREEK COURT	273481	0.00981	0.073	13.44%	of	UC91	38	46	86	92								5	6	12	12		
197	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	75868	0.002721	0.073	3.73%	of	UC91	38	46	86	92								1	2	3	3		
198	CANYON CREEK CIRCLE CUL DE SAC	428962	0.015387	0.073	21.08%	of	UC91	38	46	86	92								8	10	18	19		
199	CANYON CREEK CIRCLE W. OF CAVE CREEK RD	44916	0.001611	0.038	4.24%	of	UC90	16	24	46	52								1	1	2	2		
200	LEISURE LANE	2049973	0.073533	0.096	76.60%	of	UC77	106	127	208	205								81	97	159	157		
201	LEISURE LANE S. OF SENTINEL ROCK RD	1535933	0.055094	0.096	57.39%	of	UC77	106	127	208	205								61	73	119	118		
202	PALO VERDE (59TH ST)	156051	0.005598	0.073	7.67%	of	UC89	52	69	119	124								4	5	9	10		
203	CHINO LANE	2115176	0.075871	0.177	42.87%	of	UC78	268	293	103	392								115	126	44	168		
204	EL SENDERO RD S. OF HIDDEN CANYON RD	165446	0.005935	0.177	3.35%	of	UC78	268	293	103	392								9	10	3	13		
205	EL SENDERO RD	372418	0.013359	0.177	7.55%	of	UC78	268	293	103	392								20	22	8	30		
206	EL SENDERO RD	774288	0.027774	0.177	15.69%	of	UC78	268	293	103	392								42	46	16	62		
207	ARROYO RD @ CASSANDRA WAY	40550	0.001455	0.013	11.19%	of	UC84	14	14	24	23								2	2	3	3		
208	NEVER MIND TRAIL AT PEDRA GRANDE DR	479465	0.017198	0.161	10.66%	of	AHW5	240	191	447	289								26	20	48	31		
209	NEVER MIND TRAIL	971527	0.034849	0.58	6.03%	of	AHW6	381	329	896	716								23	20	54	43		
210	LAZY BURRO RD AT TERRACE ESTATES CIRCLE	2336829	0.083822	0.161	51.94%	of	AHW5	240	191	447	289								125	99	232	150	Fuller's #12	
211	STEVENS RD	1577413	0.056582	0.59	9.55%	of	GVW1_6	503	439	899	794								48	42	86	76		
212	TRANQUIL TRAIL S. OF RISING SUN RD	279743	0.010034	1.004	1.00%	of	GVW1_4	682	646	1229	1170								7	6	12	12		
213	TRANQUIL TRAIL AT CAREFREE DR	5947880	0.213351	0.98	21.70%	of	GVW1_5	801	739	1345	1258								174	160	292	273		
214	STAGECOACH PASS AT TOM DARLINGTON	1199644	0.043031	0.4164	10.33%	of	AHW1	698	553	1255	811								72	57	130	84		
215	BLOODY BASIN RD AT CAVE CREEK RD	3380757	0.121268	0.1639	73.99%	of	AH4	212	168	388	262								157	124	287	194		
216	TOM DARLINGTON AT CAREFREE HWY	694489	0.024911	0.06	41.52%	of	UC51	92	101	170	134								38	42	71	56		
217	LOS REALES DR AT CAREFREE HWY	37713	0.001353	0.073	1.85%	of	UC89	52	69	119	124								1	1	2	2	POSSIBILITY OF FLOW CONT. FROM SPLIT D84	
218	CAREFREE HWY	368665	0.013224	0.108	12.24%	of	UC88	37	38	69	66								5	5	8	8	POSSIBILITY OF FLOW CONT. FROM SPLIT D84	
219	DREAM ST	Not Used																					Not Calculated (Fuller)	
220	RISING SUN RD AT TRANQUIL TRAIL	1337806	0.047987	1.004	4.78%	of	GVW1_4	682	646	1229	1170								33	31	59	56	NOT A DRAINAGE STRUCTURE	
221	VILLA CASSANDRA WAY AT NORTH RIDGEWAY DRIVE	127867	0.004587	0.117	3.92%	of	UC63	128	157	260	238								5	6	10	9		
222	EL SENDERO AT 66TH PLACE	5521216	0.198046	0.361	54.86%	of	UC62	396	475	792	743								217	261	434	408		
223	VILLA CASSANDRA WAY NEAR SHOTGUN CIRCLE	399608	0.014334	0.361	3.97%	of	UC62	396	475	792	743								16	19	31	30		
224	VILLA CASSANDRA WAY	158530	0.005686	0.361	1.58%	of	UC62	396	475	792	743								6	7	12	12		
225	OLD PAINT TRAIL NEAR SHOTGUN CIRCLE	295890	0.010614	0.037	28.69%	of	UC66	30	40	68	73								9	11	20	21		
226	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE		0	0.117	0.00%	of	UC63	128	157	260	238								0	0	0	0		
227	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE	385804	0.013839	0.117	11.83%	of	UC63	128	157	260	238								15	19	31	28		
228	OLD PAINT TRAIL SOUTH OF LANGUID LANE	1528762	0.054837	0.117	46.87%	of	UC63	128	157	260	238								60	74	122	112		
229	SKY RANCH	5101079	0.182976	0.98	18.61%	of	GVW1_5	801	739	1345	1258								149	138	250	234		
230	SKY RANCH	1694157	0.06077	0.98	6.18%	of	GVW1_5	801	739	1345	1258								50	46	83	78		
231	RIDGEWAY AT EL SENDERO (PRIVATE)	546000	0.019585	0.117	16.74%	of	UC63	128	157	260	238								21	26	44	40		
232	RIDGEWAY DRIVE (PRIVATE)	338877	0.012156	0.361	3.37%	of	UC62	396	475	792	743								13	16	27	25		
233	66TH PLACE (PRIVATE)	884830	0.031739	0.361	8.79%	of	UC62	396	475	792	743								35	42	70	65		
234	EL SENDERO (PRIVATE)	494558	0.01774	0.361	4.91%	of	UC62	396	475	792	743								19	23	39	37		
235	ROMPING AT WILDFLOWER	509721	0.018284	0.235	7.78%	of	UE2	80	59	129	145	OVERTOPPING	of	153					80	59	129	145		
236	CAREFREE HIGHWAY	899496	0.032265	0.108	29.87%	of	UC88	37	38	69	66	100.00%	of	D84S AND D87S	148	718	857	1478	159	729	878	1498		
237	CAREFREE HIGHWAY	163912	0.00588	0.024	24.50%	of	UC95	33	37	63	53								8	9	15	13		
238		36316	0.001303	0.038	3.43%	of	UC90	16	24	46	52								1	1	2	2		

Table 11
Culvert and Road Crossing Flows
Future Conditions

#	APPROXIMATE LOCATION	Area (Square Feet)	Area (Sq. Miles)	Total Area of Subbasin	Contribution %		Basin or CP	Total Future Basin or CP Flows (cfs) 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Contribution %		Basin or CP	Total Future Basin or CP Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Total Future Culvert/Crossing Flows 10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Comments
	CAVE CREEK RD, 83' N. OF CL OF CAREFREE HWY/CC ROAD	1700582	0.061	0.061	100.00%	of	UC96	64	77	128	121								64	76	123	119	
2	CAVE CREEK RD, 557' N. OF CL OF CAREFREE HWY/CC ROAD	669082	0.024	0.024	100.00%	of	UC95	48	48	83	56								48	48	83	56	
3	CAVE CREEK RD, 1037' N. OF CL OF CAREFREE HWY/CC ROAD				100.00%	of	CP88END	36	177	478	925								36	177	478	925	
4	CAVE CREEK RD, 1690' N. OF CL OF CAREFREE HWY/CC ROAD	1059379	0.038	0.038	100.00%	of	UC93	43	14	82	76								43	14	82	76	
5	CAVE CREEK RD, 2465' N. OF CL OF CAREFREE HWY/CC ROAD	1171838	0.042034	0.073	57.58%	of	UC91	74	91	153	144								43	52	88	83	
6	CAVE CREEK RD, 3552' N. OF CL OF CAREFREE HWY/CC ROAD	403347	0.014468	0.038	38.07%	of	UC90	32	42	79	70	100.00%	of	CP89	1178	1477	1692	1976	1190	1493	1722	2003	
7	CAVE CREEK RD, 3950' N. OF CL OF CAREFREE HWY/CC ROAD	2409319	0.086422	0.192	45.01%	of	UC75	213	260	431	393								96	117	194	177	
8	CAVE CREEK RD, 4857' N. OF CL OF CAREFREE HWY/CC ROAD	900349	0.032296	0.041	78.77%	of	UC76	49	58	97	85								39	46	76	67	
9	CAVE CREEK RD, 5235' N. OF CL OF CAREFREE HWY/CC ROAD	3729902	0.133792	0.151	88.60%	of	UC74	166	201	331	307								147	178	293	272	
10	PIMA RD, 616' N. OF CL OF PIMA RD/STAGECOACH PASS	453578	0.01627	0.027	60.26%	of	UC19	26	32	54	51								16	19	33	31	
11	PIMA RD, 1115' N. OF CL OF PIMA RD/STAGECOACH PASS	718572	0.025775	0.04	64.44%	of	UC18	42	51	85	79	100.00%	of	CPC8	74	97	156	165	101	130	211	216	
12	PIMA RD, 1417' N. OF CL OF PIMA RD/STAGECOACH PASS	155744	0.005587	0.032	17.46%	of	UC22	21	28	47	49								4	5	8	9	
13	PIMA RD, 88' N. OF CL OF PIMA RD/CAVE CREEK																						
14	CAREFREE MTN DR	469860	0.016854	0.108	15.61%	of	UC88	37	38	69	66								6	6	11	10	
15	CAREFREE MTN DR	150658	0.005404	0.038	14.22%	of	UC93	43	14	82	76								6	2	12	11	
16	AGAVE PL	82076	0.002944	0.038	7.75%	of	UC93	43	14	82	76								3	1	6	6	
17	CAREFREE MTN DR	241282	0.008655	0.073	11.86%	of	UC89	72	91	153	143								9	11	18	17	
18	CANOTIA PL	264594	0.009491	0.073	13.00%	of	UC89	72	91	153	143								9	12	20	19	
19	CAREFREE MTN DR	105546	0.003786	0.073	5.19%	of	UC89	72	91	153	143								4	5	8	7	
20	CAREFREE MTN DR	1818997	0.065248	0.078	83.65%	of	UC79	59	81	145	138	100.00%	of	CP84	1004	1205	1286	1440	1053	1273	1407	1555	
21	DALEA PL	578315	0.020744	0.073	28.42%	of	UC89	72	91	153	143								20	26	43	41	
22	UNNAMED RD																						Does not exist
23	CAREFREE MTN DR	4198257	0.150592	0.177	85.08%	of	UC78	258	293	491	392								220	249	418	334	
23a	CAREFREE MTN DRIVE	164542	0.005902	0.177	3.33%	of	UC78	258	293	491	392								9	10	16	13	
24	TRANQUIL PL	769224	0.027592	1.004	2.75%	of	GVW1_4	686	649	1233	1173								19	18	34	32	Not Calculated (Fuller)
25	TRANQUIL PL	2632951	0.094444	1.004	9.41%	of	GVW1_4	686	649	1233	1173								54	51	96	91	Fuller's #58
26	TRANQUIL PL	2698783	0.096806	1.004	9.65%	of	GVW1_4	686	649	1233	1173								65	62	117	111	Fuller's #59
27	LOS REALES DR	850542	0.030509	0.078	39.11%	of	UC79	59	81	145	138	100.00%	of	CP84	1004	1205	1286	1434	1027	1237	1343	1488	
28	58TH ST	188751	0.006771	0.192	3.53%	of	UC75	213	260	431	393								8	9	15	14	
29	58TH ST	742603	0.026637	0.041	64.97%	of	UC76	49	58	97	85								32	38	63	55	
30	61ST ST	3345230	0.119994	0.151	79.47%	of	UC74	166	201	331	307								132	160	263	244	
31	RESTIN RD	570031	0.020447	0.041	49.87%	of	UC76	49	58	97	85								24	29	48	42	
32	RESTIN RD	268980	0.009648	0.041	23.53%	of	UC76	49	58	97	85								12	14	23	20	
33	61ST ST	2565774	0.092034	0.192	47.93%	of	UC75	213	260	431	393								102	125	207	188	
34	61ST ST	2821181	0.101196	0.151	67.02%	of	UC74	166	201	331	307								111	135	222	206	
35	LITTLE HOPE PL	1919191	0.068842	0.151	45.59%	of	UC74	166	201	331	307								76	92	151	140	
36	10+20 N. OF CL CAREFREE HWY/SCOTTSDALE RD	490396	0.017591	0.019	92.58%	of	UC50	268	296	504	412	100.00%	of	CP3149	862	1190	1704	2120	1110	1464	2171	2501	
7	12+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1354348	0.048581	0.197	24.66%	of	UC48	220	248	410	396	100.00%	of	CP4547	253	270	446	348	307	331	547	446	
5	31+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	617287	0.022142	0.031	71.43%	of	UC47	49	53	87	70								35	38	62	50	
39	41+90 N. OF CL CAREFREE HWY/SCOTTSDALE RD	888236	0.031861	0.034	93.71%	of	UC46	61	64	107	79								57	60	100	74	
	51+35 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1494571	0.05361	0.4164	12.87%	of	AHW1	708	561	1258	814								91	72	162	105	
	55+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	706174	0.025331	0.4164	6.08%	of	AHW1	708	561	1258	814								43	34	77	50	
41a	59+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD (found 10/23/01)	538995	0.019334	0.4164	4.64%	of	AHW1	708	561	1258	814								33	26	58	38	
42	68+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	83801	0.003006	0.2784	1.08%	of	AHW3	422	337	781	520								708	561	1258	814	Fuller's #4
43	72+85 N. OF CL CAREFREE HWY/SCOTTSDALE RD	112046	0.004019	0.0653	6.15%	of	AHW2	105	82	177	121								6	5	11	7	
44	77+50 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1229563	0.044105	0.0613	71.95%	of	AHW2	105	82	177	121								76	59	127	87	
45	82+70 N. OF CL CAREFREE HWY/SCOTTSDALE RD	66010	0.002368	0.1639	1.44%	of	AHW4	214	169	382	271								3	2	6	4	
46	86+25 N. OF CL CAREFREE HWY/SCOTTSDALE RD	4504111	0.161563	0.1639	98.57%	of	AHW4	214	169	382	271								214	169	382	271	Fuller's #20
47	102+81 N. OF CL CAREFREE HWY/SCOTTSDALE RD	1587992	0.056961	0.983	5.79%	of	GVW1_5	914	837	1497	1400								53	49	87	81	
48	102+48 N. OF CL CAREFREE HWY/SCOTTSDALE RD	862980	0.030955	0.983	3.15%	of	GVW1_5	914	837	1497	1400								29	26	47	44	
49	RISING SUN RD, 450' N. OF CL RISING SUN/STEVENS	203199	0.007289	0.5926	1.23%	of	GVW1_6	509	443	904	797								43	37	76	67	Fuller's #66
50	RISING SUN RD, 200' N. OF CL RISING SUN/STEVENS	367401	0.013179	0.5926	2.22%	of	GVW1_6	509	443	904	797								11	10	20	18	
51	RISING SUN	150875	0.005412	0.5926	0.91%	of	GVW1_6	509	443	904	797								5	4	8	7	
52	RISING SUN	223239	0.008008	1.043	0.77%	of	GVW3_1	694	677	1294	1254								5	5	10	10	
53	W. RISING STAR CR	367401	0.013179	0.5926	2.22%	of	GVW1_6	509	443	904	797								11	10	20	18	
54	W. RISING STAR CR	473308	0.016978	0.5926	2.86%	of	GVW1_6	509	443	904	797								15	13	26	23	
55	RISING STAR WAY	786155	0.028199	0.5926	4.76%	of	GVW1_6	509	443	904	797								71	62	126	111	Fuller's #67
56	VALLEY VIEW CIRCLE	598401	0.021465	1.043	2.06%	of	GVW3_1	694	677	1294	1254								14	14	27	26	
57	PERDIDO DR	92687	0.003325	0.073	4.55%	of	UC91	74	91	153	144								3	4	7	7	
58	PERDIDO DR	326702	0.011719	0.073	16.05%	of	UC91	74	91	153	144								12	15	25	23	
59	PERDIDO DR	818135	0.029347	0.073	40.20%	of	UC89	72	91	153	143								29	37	62	57	
60	BLOODY BASIN RD AT SIDEWINDER	482855	0.01732	0.0613	28.25%	of	AHW2	105	82	177	121								30	23	50	34	
61	BLOODY BASIN RD AT SIDEWINDER	92687	0.003325	0.0613	5.42%	of	AHW2	105	82	177	121								6	4	10	7	
62	ELBOW BEND BETWEEN SIDEWINDER AND NONCHALANT	3888042	0.139464	0.1639	85.09%	of	AHW4	214	169	382	271								182	143	324	230	Fuller's #18
63	TRANQUIL TRAIL AT CAVE CREEK RD	6310343	0.226352	0.983	23.03%	of	GVW1_5	914	837	1497	1400								578	529	947	886	Fuller's #26
64	MULE TRAIN JUST SOUTH OF BREATHLESS DR	524808	0.018825	0.261	7.21%	of	UC35	275	325	550	519								20	23	40	37	
65	MULE TRAIN JUST NORTH OF CAVE CREEK RD	4219838	0.151366	0.983	15.40%	of	GVW1_5	914	837	1497	1400								141	129	231	216	
66	MULE TRAIN, 500' SOUTH OF PRIMROSE	4819241	0.172866	0.983	17.59%	of	GVW1_5	914	837	1497	1400								161	147	263	246	
67	MULE TRAIN, 130' SOUTH OF PRIMROSE	4819241	0.172866	0.983	17.59%	of	GVW1_5	914	837	1497	1400								500	458	819	766	Fuller's #23
68	MULE TRAIN ROAD AT RAMBLING RD	5573560	0.199924	0.983	20.34%	of	GVW1_5	914	837	1497	1400								186	170	304	285	
69	MULE TRAIN ROAD AT SERENE ST	674927	0.02421	1.518	1.59%	of	GVW1_3	914	837	1497	1400								15	13	24	22	
70	SUNDANCE TRAIL EAST OF CAVE CREEK ROAD	23720864	0.850869	0.983	86.56%	of	GVW1_5	914	837	1497	1400								791	724	1296	1212	
71	CAREFREE DRIVE WAST OF CAVE CREEK RD	22770635	0.816784	0.983	83.09%	of	GVW1_5	914	837	1497	1400								759	695	1244	1163	
72	TRANQUIL TRAIL S. OF CAREFREE DR, N. OF HAPPY HOLLOW	9996679	0.358582	0.983	36.48%	of	GVW1_5	914	837	1497	1400								333	305	546	511	
73	TRANQUIL TRAIL 275' S. OF HUM RD	384837	0.013804	0.983	1.40%	of	GVW1_5	914	837	1497	1400								13	12	21	20	
74	DREAM ST, N. OF PRIMROSE PATH	272294	0.009767	0.983	0.99%	of	GVW1_5	914	837	1497	1400								9	8	15	14	
75	CROSSINGS AT CAREFREE IV	73802	0.002647	0.5926	0.45%	of	GVW1_6	509	443	904	797								2	2	4	4	
76	CROSSINGS AT CAREFREE IV	29989	0.001076	0.5926	0.18%	of	GVW1_6	509	443	904	797								1	1	2	1	
	CROSSINGS AT CAREFREE IV	47697	0.001711	0.5926	0.29%	of	GVW1_6	509	443	904	797								1	1	3	2	
	CRESTED QUAIL RUN CUL DE SAC	105026	0.003767	0.5926	0.64%	of	GVW1_6	509	443	904	797								3	3	6	5	
79	CRESTED QUAIL RUN CUL DE SAC, 145' FROM CL OCOTILLO RIDG	444612	0.015948	0.5926	2.69%	of	GVW1_6	509	443	904	797								14	12	24	21	
	CAVE CREEK RD AND AUTOPLANE DR	26205647	0.939998	0.983	95.63%	of	GVW1_5	914	837	1497	1400								874	800	1432	1339	
	SUNSET TRAIL N. OF CAREFREE HWY, BEFORE OLD PAINT TRAIL	315309	0.01131	0.078	14.50%	of	UC79	59	81	145	138								9	12	21	20	
82	OLD PAINT TRAIL EAST OF SUNSET TRAIL	181466	0.006509	0.078	8.35%	of	UC79	59	81	145	138								5	7	12	12	

Table 11
Culvert and Road Crossing Flows
Future Conditions

#	APPROXIMATE LOCATION	Area	Area	Total Area of	Contribution		Basin or	Total Future Basin or CP Flows (cfs)				Contribution		Basin or	Total Future Basin or CP Flows				Total Future Culvert/Crossing Flows				Comments	
		(Square Feet)	(Sq. Miles)	Subbasin	%		CP	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	%		CP	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr		
167	TWILIGHT TRAIL S. OF LAZYWOOD	1180074	0.042329	0.158	26.79%	of	UC10	125	158	265	276								33	42	71	74		
168	TWILIGHT TRAIL N. OF STARDUST	64155	0.002301	0.158	1.46%	of	UC10	125	158	265	276								2	2	4	4		
169	CAREFREE DRIVE JUST W. OF FOREMORE CIRCLE	7004939	0.251268	1.52	16.55%	of	GVW1_3	1026	1068	1876	1916								220	229	401	410	Fuller's #39	
170	DOUBLE EAGLE DRIVE W. OF PIMA ROAD	6446170	0.231225	1.52	15.23%	of	GVW1_3	1026	1068	1876	1916								202	210	370	377	Fuller's #38	
171	CAREFREE DRIVE E. OF FOURSOME WAY	6099585	0.218793	1.52	14.41%	of	GVW1_3	1026	1068	1876	1916								148	154	270	276		
172	80TH ST S. OF PLEASANT PL	6641251	0.238222	1.52	15.69%	of	GVW1_3	1026	1068	1876	1916								161	168	294	301		
173	MULE TRAIN AT DEAD END	2466949	0.08849	1.52	5.83%	of	GVW1_3	1026	1068	1876	1916								60	62	109	112		
174	SERENE ST	539830	0.019364	1.52	1.28%	of	GVW1_3	1026	1068	1876	1916								13	14	24	24		
175	SERENE ST W. OF FOURSOME	4434029	0.159049	1.52	10.47%	of	GVW1_3	1026	1068	1876	1916								107	112	196	201		
176	FOURSOME WAY CUL DE SAC	1977492	0.070933	1.52	4.67%	of	GVW1_3	1026	1068	1876	1916								48	50	88	90		
177	FOURSOME WAY N. OF SERENE ST	4104607	0.147233	1.52	9.70%	of	GVW1_3	1026	1068	1876	1916								99	104	182	186		
178	SERENE ST W. OF END	3815376	0.136858	1.52	9.01%	of	GVW1_3	1026	1068	1876	1916								92	96	169	173		
179	CONCHO DR AT PAINT PONY DR	3594324	0.128929	1.52	8.49%	of	GVW1_3	1026	1068	1876	1916								87	91	159	163		
180	SOMBRERO RD	72661	0.002606	1.52	0.17%	of	GVW1_3	1026	1068	1876	1916								2	2	3	3		
181	SILVER SADDLE	152951	0.005486	1.004	0.55%	of	GVW1_4	686	649	1233	1173								4	4	7	6		
182	SILVER SADDLE	116382	0.004175	1.004	0.42%	of	GVW1_4	686	649	1233	1173								3	3	5	5		
183	SILVER SADDLE AT GOLDEN SPUR	122986	0.004412	1.004	0.44%	of	GVW1_4	686	649	1233	1173								3	3	5	5		
184	SILVER SADDLE N. OF CONCHO	1401287	0.050264	1.004	5.01%	of	GVW1_4	686	649	1233	1173								34	33	62	59		
185	SILVER SADDLE	404528	0.01451	1.004	1.45%	of	GVW1_4	686	649	1233	1173								10	9	18	17		
186	CORONADO @SPANISH ROOT	937553	0.03363	6.02	0.56%	of	GVW2	3164	3937	5447	6408								18	22	30	36		
187	HORIZON DR	1707438	0.061246	1.004	6.10%	of	GVW1_4	686	649	1233	1173								42	40	75	72		
188	HORIZON DR NEAR TURN	995453	0.035707	1.004	3.56%	of	GVW1_4	686	649	1233	1173								24	23	44	42		
189	HORIZON DR AT END	72544	0.002602	1.004	0.26%	of	GVW1_4	686	649	1233	1173								2	2	3	3		
190	RISING SUN RD	1916688	0.068752	1.004	6.85%	of	GVW1_4	686	649	1233	1173								47	44	84	80		
191	RISING SUN W. OF 80TH ST	1102817	0.039558	1.004	3.94%	of	GVW1_4	686	649	1233	1173								27	26	49	46		
192	STAGECOACH PASS AT LANGUID LANE	255492	0.009165	0.197	4.65%	of	UC48	220	248	410	396								10	12	19	18		
193	STAGECOACH PASS NEAR RESTIN RD	41358	0.001484	0.034	4.36%	of	UC46	61	64	107	79								3	3	5	3		
194	STAGECOACH PASS AT CAREFREE HWY	1263450	0.04532	0.11	41.20%	of	UC58	153	173	284	243								63	71	117	100		
195	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	171001	0.006134	0.073	8.40%	of	UC91	74	91	153	144								6	8	13	12		
196	CANYON CREEK COURT	273481	0.00981	0.073	13.44%	of	UC91	74	91	153	144								10	12	21	19		
197	CANYON CREEK CIRCLE E. OF CANYON CREEK COURT	75868	0.002721	0.073	3.73%	of	UC91	74	91	153	144								3	3	6	5		
198	CANYON CREEK CIRCLE CUL DE SAC	428962	0.015387	0.073	21.08%	of	UC91	74	91	153	144								16	19	32	30		
199	CANYON CREEK CIRCLE W. OF CAVE CREEK RD	44916	0.001611	0.038	4.24%	of	UC90	32	42	79	70								1	2	3	3		
200	LEISURE LANE	2049973	0.073533	0.096	76.60%	of	UC77	110	132	215	197								84	101	165	151		
201	LEISURE LANE S. OF SENTINEL ROCK RD	1535933	0.055094	0.096	57.39%	of	UC77	110	132	215	197								63	76	123	113		
202	PALO VERDE (59TH ST)	156051	0.005598	0.073	7.67%	of	UC89	72	91	153	143								6	7	12	11		
203	CHINO LANE	2115176	0.075871	0.177	42.87%	of	UC78	258	293	491	392								111	126	210	168		
204	EL SENDERO RD S. OF HIDDEN CANYON RD	165446	0.005935	0.177	3.35%	of	UC78	258	293	491	392								9	10	16	13		
205	EL SENDERO RD	372418	0.013359	0.177	7.55%	of	UC78	258	293	491	392								19	22	37	30		
206	EL SENDERO RD	774288	0.027774	0.177	15.69%	of	UC78	258	293	491	392								40	46	77	62		
207	ARROYO RD @ CASSANDRA WAY	40550	0.001455	0.013	11.19%	of	UC84	19	17	30	26								2	2	3	3		
208	NEVER MIND TRAIL AT PEDRA GRANDE DR	479465	0.017198	0.161	10.66%	of	AHW5	299	239	514	321								32	25	55	34		
209	NEVER MIND TRAIL	971527	0.034849	0.58	6.03%	of	AHW6	704	595	1344	986								42	36	81	59		
210	LAZY BURRO RD AT TERRACE ESTATES CIRCLE	2336829	0.083822	0.161	51.94%	of	AHW5	299	239	514	321								1269	1191	2293	1938	Fuller's #12	
211	STEVENS RD	1577413	0.056582	0.59	9.55%	of	GVW1_6	509	443	904	797								49	42	86	76		
212	TRANQUIL TRAIL S. OF RISING SUN RD	279743	0.010034	1.004	1.00%	of	GVW1_4	686	649	1233	1173								7	6	12	12		
213	TRANQUIL TRAIL AT CAREFREE DR	5947880	0.213351	0.98	21.70%	of	GVW1_5	914	837	1497	1400								198	182	325	304		
214	STAGECOACH PASS AT TOM DARLINGTON	1199644	0.043031	0.4164	10.33%	of	AHW1	708	561	1258	914								73	58	130	84		
215	BLOODY BASIN RD AT CAVE CREEK RD	3380757	0.121268	0.1639	73.99%	of	AHW4	214	169	382	271								158	125	283	201		
216	TOM DARLINGTON AT CAREFREE HWY	694489	0.024911	0.06	41.52%	of	UC51	103	109	190	136								43	45	79	56		
217	LOS REALES DR AT CAREFREE HWY	37713	0.001353	0.073	1.85%	of	UC89	72	91	153	143								1	2	3	3	POSSIBILITY OF FLOW CONT. FROM SPLIT D84	
218	CAREFREE HWY	368665	0.013224	0.108	12.24%	of	UC88	37	38	69	66								5	5	8	8	POSSIBILITY OF FLOW CONT. FROM SPLIT D84	
219	DREAM ST	Not Used																						
220	RISING SUN RD AT TRANQUIL TRAIL	1337806	0.047987	1.004	4.78%	of	GVW1_4	686	649	1233	1173								33	31	59	56	NOT A DRAINAGE STRUCTURE	
221	VILLA CASSANDRA WAY AT NORTH RIDGEWAY DRIVE	127867	0.004587	0.117	3.92%	of	UC63	130	158	262	240								5	6	10	9		
222	EL SENDERO AT 66TH PLACE	5521216	0.198046	0.361	54.86%	of	UC62	405	484	819	753								222	266	449	413		
223	VILLA CASSANDRA WAY NEAR SHOTGUN CIRCLE	399608	0.014334	0.361	3.97%	of	UC62	405	484	819	753								16	19	33	30		
224	VILLA CASSANDRA WAY	158530	0.005686	0.361	1.58%	of	UC62	405	484	819	753								6	8	13	12		
225	OLD PAINT TRAIL NEAR SHOTGUN CIRCLE	295890	0.010614	0.037	28.69%	of	UC66	36	45	78	72								10	13	22	21		
226	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE		0	0.117	0.00%	of	UC63	130	158	262	240													
227	OLD PAINT TRAIL AT NORTH RIDGEWAY DRIVE	385804	0.013839	0.117	11.83%	of	UC63	130	158	262	240								15	19	31	28		
228	OLD PAINT TRAIL SOUTH OF LANGUID LANE	1528762	0.054837	0.117	46.87%	of	UC63	130	158	262	240								61	74	123	112		
229	SKY RANCH	5101079	0.182976	0.98	18.61%	of	GVW1_5	914	837	1497	1400								170	156	279	261		
230	SKY RANCH	1694157	0.06077	0.98	6.18%	of	GVW1_5	914	837	1497	1400								57	52	93	87		
231	RIDGEWAY AT EL SENDERO (PRIVATE)	546000	0.019585	0.117	16.74%	of	UC63	130	158	262	240								22	26	44	40		
232	RIDGEWAY DRIVE (PRIVATE)	338877	0.012156	0.361	3.37%	of	UC62	405	484	819	753								14	16	28	25		
233	66TH PLACE (PRIVATE)	884830	0.031739	0.361	8.79%	of	UC62	405	484	819	753								36	43	72	66		
234	EL SENDERO (PRIVATE)	494558	0.01774	0.361	4.91%	of	UC62	405	484	819	753								20	24	40	37		
235	ROMPING AT WILDFLOWER	509721	0.018284	0.235	7.78%	of	UE2	99	277	245	277	OVERTOPPING	of	153					99	277	245	277		
236	CAREFREE HIGHWAY	899496	0.032265	0.108	29.87%	of	UC88	37	38	69	66	100.00%	of	D84S AND D87S	214	718	1133	1985	225	729	1154	2005		
237	CAREFREE HIGHWAY	163912	0.00588	0.024	24.50%	of	UC95	48	48	83	56								12	12	20	14		
238		36316	0.001303	0.038	3.43%	of	UC90	32	42	79	70								1	1	3	2		

Table 12
Identified Problem Areas

Location	Item	Description	Source
Carefree Highway, in three locations	Dip Crossings (3)	Wash flows over road three times, impassable during 100-year event	Field visits, residents
Pima Road south of Short Putt	Dip Crossing	Flooding, and extensive damage of roadway section and adjacent property. Wash downstream has erosion of banks. Sediment deposition on road, impassable during 100-year event	Field visits, residents
Pima Road south of Short Putt	Bank Protection	Pruett Residence - potential reflective scour on left bank, home in former avulsive channel path, flow split around home (but outside the 100-year floodplain per most recent FIS)	Field visit, resident
Pima Road south of Short Putt	Bank Protection	Left Bank - gunite bank protection undercutting and flanking	Field visit
Pima Road south of Short Putt	Bank Protection	Other residence on right bank, home above cut bank, no setback or erosion protection	Field visit
Carefree Mountain Drive	Culvert	Impassable during 100-yr. Event	Hydraulic Analysis
Galloway Wash between Tranquil Trail and Scopa Road	Bank Protection	Unprotected earthen berm blocks former active braid, large headcut and active bank erosion, vertical cut banks, homes located in former avulsive channel path and former active channel braid, houses encroach into natural floodplain	Field visit, JE Fuller report
Lazy Burro Road	Culvert	Impassable during 100-yr. Event, scour from overtopping and flanking	Field visit, hydraulic analysis
Residences along Galloway Wash on Rocking Chair Road	Bank Protection	Homes built within SS 5-96 Level 1 setback near cutbanks, homes built in former avulsion area, near aggrading reach	Field visit, JE Fuller report
Galloway Wash between Pima Road and Scopa Trail (entire wash reach in Carefree)	Bank Protection	Many homes within SS 5-96 Level 1 setback (33 - 59 ft.), subject to erosion. Lateral bank erosion anticipated during large floods.	Field visit, JE Fuller report
Wildflower north of Quail	Dip Crossing	Severe damage to concrete erosion control on downstream side. In danger of failure.	Field visit
Wildflower near Romping	Ditch	Ditch forced to other side of street	Field visit
Cave Creek Road between Bloody Basin and Tom Darlington	Ditch	Appears to have potential for flooding, debris in ditch, apartment complex built adjacent ditch	Field visit

Table 12
Identified Problem Areas

Location	Item	Description	Source
Wildflower at Romping	Dip Crossing	Impassable during 100-year event, Erosion has caused structural damage to erosion control features (concrete, rock)	Field visit, hydraulic analysis
Cow Track at Paint Pony	Dip Crossing	Extensive sediment deposition upstream and along road, impassable during 100-year event, downstream scour, undercutting of grouted riprap along road embankment	Resident, field visit, hydraulic analysis
Dream Street at Galloway Wash	Bridge	Dream Street Bridge - New bridge shows signs of aggradation. Several headcuts progressing upstream of bridge, downstream scour. Channel excavation oversteepened, devegetated, destabilized banks.	Resident, field visit, JE Fuller report
Culvert near Footbridge	Culvert	Sedimentation/aggradation of wash - Culvert end buried by sediment (no positive drainage for culvert). Recent excavation of wash has exposed end of culvert and allowed for drainage. Aggradation in area expected to continue and eventually bury end of culvert	Resident, field visit, JE Fuller report
36500 block of Nevermind Trail	Dip Crossing	Impassable during 100-year event, Sediment requires clearing after every storm	Field visit, resident
E. Bivouac Trail	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Bivouac Trail	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Carefree Drive	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Lazy Burro Rd.	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Lazy Burro Rd.	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Holiday Lane	Dip Crossing	Impassable during 100-yr. Event, upstream deposition and downstream scour at crossing	Hydraulic Analysis, field visit
N. Piedra Grande Dr.	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Long Rifle Road	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Primrose Path	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Hum Road	Dip Crossing	Impassable during 100-yr. Event, wash downstream of this crossing contains debris	Hydraulic Analysis, field visit
E. Sundance Trail	Dip Crossing	Impassable during 100-yr, event, sediment over road complaint	Hydraulic Analysis, Resident
N. Scopa Trail	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Carefree Drive	Dip Crossing	Impassable during 100-yr. Event, some upstream deposition and minor scour downstream	Hydraulic Analysis, field visit
N. Tranquil Trail	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Scopa Trail	Dip Crossing	Impassable during 100-yr. Event, Downstream scour, undercutting road section, upstream block retaining wall flanking on upstream end	Hydraulic Analysis, field visit
E. Cow Track Drive	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
N. Sombrero Road	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
E. Cow Track Drive	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
Celestial St & Dream Street	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis

Table 12
Identified Problem Areas

Location	Item	Description	Source
Father Kino Trail at Grapevine Wash	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
Rising Sun Road	Dip Crossing and Culvert	Impassable during 100-year event, extreme grade differential between upsteam and downstream. Road acts as dam. Nuisance flow culverts exist, with sedimentation compromising culvert capacity. Downstream protected with concrete, retaining walls, and rocks.	Hydraulic Analysis, field visit
CAREFREE DRIVE	Culvert	Impassable during 100-yr. Event	Hydraulic Analysis
Tranquil Trail at Cave Creek Road	Culvert	Impassable during 100-yr. Event	Hydraulic Analysis
Galloway Wash between Pima Road and Carefree Drive	Stream Bank	Golf Course has slumping failure of grass lined bank, flanking and scour of timber pole bank protection, lateral bank erosion at tennis club outside of bend with cutbanks, earthen berm at well site constructed of loose sand and is vulnerable to erosion	Field visit, JE Fuller report
Cave Creek Rd. near	Culvert	Impassable during 100-yr. Event	Hydraulic Analysis
Twilight Trail south of Venus View	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
Quail at Romping	Dip Crossing	Deposition upstream, erosion downstream. Erosion has been stabilized with riprap and concrete.	Field visit
Double Eagle west of Pima	Dip Crossing	Impassable during 100-year event. Sediment deposition on upstream, erosion at downsteam. Protected with concrete and riprap, damage to concrete. Grade differential is approximately 8 feet.	Hydraulic Analysis, field visit
80th Street, Rising Sun, Cow Track, Paint Pony	Stream Bank	Gabions protect a house on a small ridge overlooking wash. Unstable, unvegetated slope above gabion bank protection, flanking of downstream end of gabion baskets.	Field visit, residents, Town personnel
Unnamed, far northern part of town	Dip Crossing	Impassable during 100-yr. Event	Hydraulic Analysis
Carefree west of Dog Leg	Dip Crossing	Impassable during 100-year event, extreme grade differential between upstream and downstream. Downstream protected by riprap, minor damage	Hydraulic analysis, field visit
Twilight south of Stardust	Dip Crossing	Sediment deposition	Field visit, residents
Wildflower at driveways	Triple CMP culverts	Sedimentation has caused approximately 90% blockage of culverts across driveways	Hydraulic Analysis
Airport runways	Ditch	Wash through the airport causes flooding and erosion. Retention basins are being cleaned out, although they only retain a small portion of runoff due to development over natural state.	Residents, Airport personnel
Driveway at 8131	Driveway Culvert	localized erosion	Field visit
Lutheran Church at	Driveway Culvert	Erosion undermining unprotected culvert end	Field visit
Los Reales Way	Culvert	Impassable during 100-year event	Hydraulic Analysis

Table 12
Identified Problem Areas

Location	Item	Description	Source
Tom Darlington	Culvert	Impassable during 100-year event	Hydraulic Analysis
Tom Darlington	Culvert	Impassable during 100-year event	Hydraulic Analysis
80th Street at	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Concho Lane	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Silver Saddle Drive	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Stagecoach Pass	Culvert	Impassable during 100-year event	Hydraulic Analysis
Stagecoach Pass	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Piedra Grande Dr.	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Tranquil Trail	Culvert	Impassable during 100-year event	Hydraulic Analysis
Carefree Drive at Foremore Circle	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Golden Spur Lane	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Grapevine Road	Dip Crossing	Impassable during 100-year event	Hydraulic Analysis
Mule Train near Rambling Road	Culvert	Undersized, Impassable during 100-year event	Hydraulic Analysis
Carefree Drive at Tranquil Trail	Culvert	Undersized, Impassable during 100-year event	Hydraulic Analysis

Table 13
Regression Equations

UC Basins

USGS Method	ADWR Method
$Q_{10} = 74.7A^{0.638}(E/1000)^{-1.00}p^{0.971}$ A = 3.65 Area (mi^2) E= 2375 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_{10} = **672 Peak Flow (cfs)**	$Q_{10} = 479A^{0.661}(E/1000)^{-0.398}$ A = 3.65 Area (mi^2) E = 2375 Elevation (ft) Q_{10} = **799 Peak Flow (cfs)**
Comparison to HEC-1 Model: *Q_{10} = 1706 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	*Q_{10} = 1706 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*
$Q_{100} = 553A^{0.610}(E/1000)^{-1.30}p^{0.915}$ A = 3.65 Area (mi^2) E = 2375 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_{100} = **3254 Peak Flow (cfs)**	$Q_{100} = 10^{(6.55 - 3.17A^{-0.11})}(E/1000)^{-0.454}$ A = 3.65 Area (mi^2) E = 2375 Elevation (ft) Q_{100} = **4268 Peak Flow (cfs)**
Comparison to HEC-1 Model: *Q_{100} = 3132 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	*Q_{100} = 3132 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*

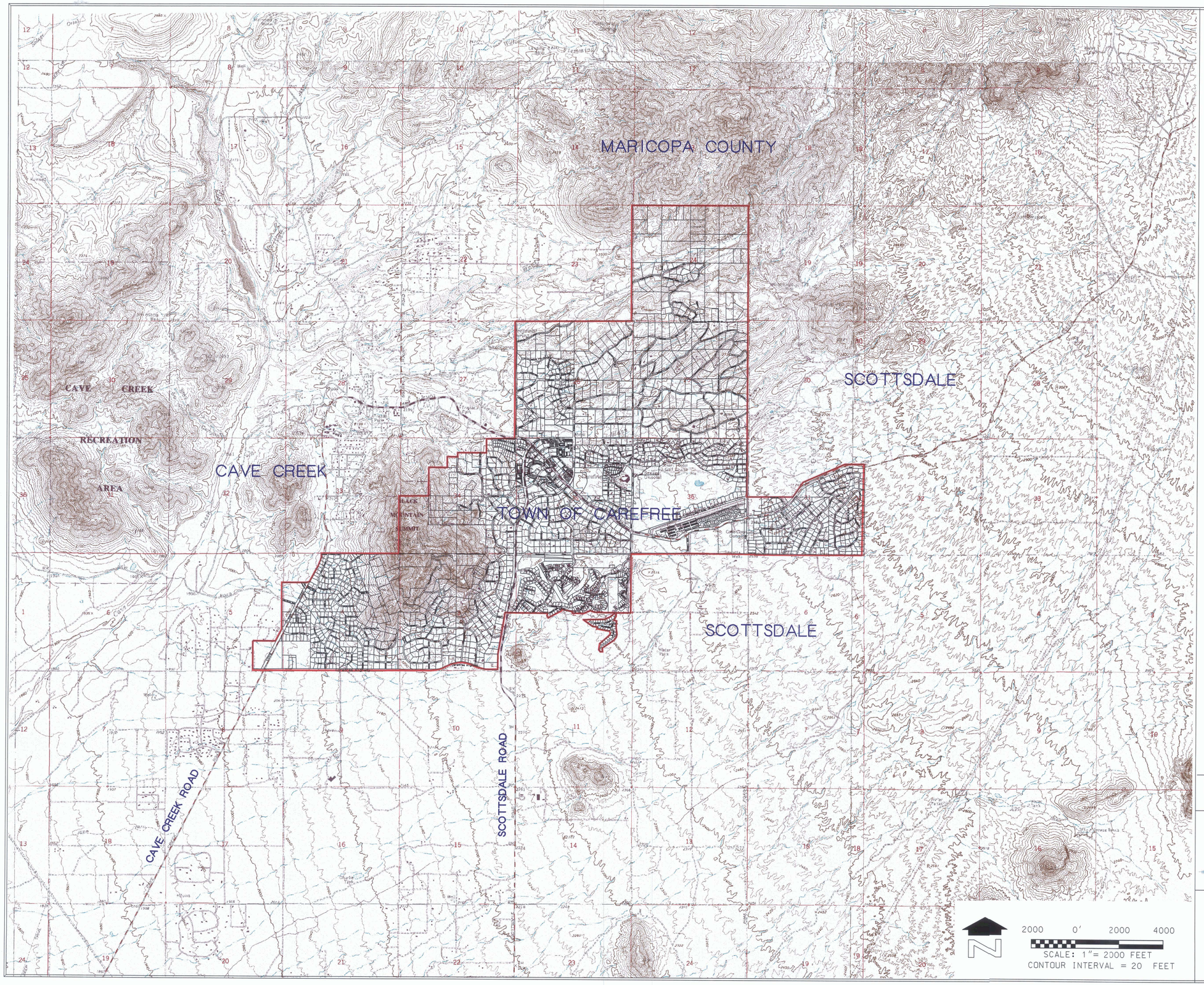
Galloway Wash Basins

USGS Method	ADWR Method
$Q_{10} = 74.7A^{0.638}(E/1000)^{-1.00}p^{0.971}$ A = 20.98 Area (mi^2) E= 2375 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_2 = **2051 Peak Flow (cfs)**	$Q_{10} = 479A^{0.661}(E/1000)^{-0.398}$ A = 20.98 Area (mi^2) E = 2375 Elevation (ft) Q_{10} = **2538 Peak Flow (cfs)**
Comparison to HEC-1 Model: *Q_{10} = 7906 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	*Q_{10} = 7906 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*
$Q_{100} = 553A^{0.610}(E/1000)^{-1.30}p^{0.915}$ A = 20.98 Area (mi^2) E = 2375 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_{100} = 9455 Peak Flow (cfs)	$Q_{100} = 10^{(6.55 - 3.17A^{-0.11})}(E/1000)^{-0.454}$ A = 20.98 Area (mi^2) E = 2375 Elevation (ft) Q_{100} = 12923 Peak Flow (cfs)
Comparison to HEC-1 Model: *Q_{100} = 13541 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	*Q_{100} = 13541 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*

Table 13
Regression Equations

Andora Hills Wash Basins	
USGS Method	**ADWR Method**
$Q_{10} = 74.7A^{0.638}(E/1000)^{-1.00}p^{0.971}$ A = 2.77 Area (mi^2) E= 2820 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_{10} = 475 Peak Flow (cfs)	$Q_{10} = 479A^{0.661}(E/1000)^{-0.398}$ A = 2.77 Area (mi^2) E = 2820 Elevation (ft) Q_{10} = 622 Peak Flow (cfs)
Comparison to HEC-1 Model: Q_{10} = *1870 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	Q_{10} = *1870 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*
$Q_{100} = 553A^{0.610}(E/1000)^{-1.30}p^{0.915}$ A = 2.77 Area (mi^2) E = 2820 Elevation (ft) p = 10 Mean Annual Precipitation (in) Q_{100} = 2199 Peak Flow (cfs)	$Q_{100} = 10^{(6.55 - 3.17A^{-0.11})}(E/1000)^{-0.454}$ A = 2.77 Area (mi^2) E = 2820 Elevation (ft) Q_{100} = 3248 Peak Flow (cfs)
Comparison to HEC-1 Model: Q_{100} = *3635 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*	Q_{100} = *3635 Peak Flow (cfs)* *HEC-1 model, existing, 24-hr.*

Appendix B – Figures



LEGEND

STUDY AREA AND TOWN BOUNDARIES

NOTES

BASE MAP TAKEN FROM USGS 7.5-MINUTE QUADRANGLE MAPS (WILDCAT HILL, CAVE CREEK, HUMBOLDT MTN., AND NEW RIVER BASIN QUADRANGLE MAPS).

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

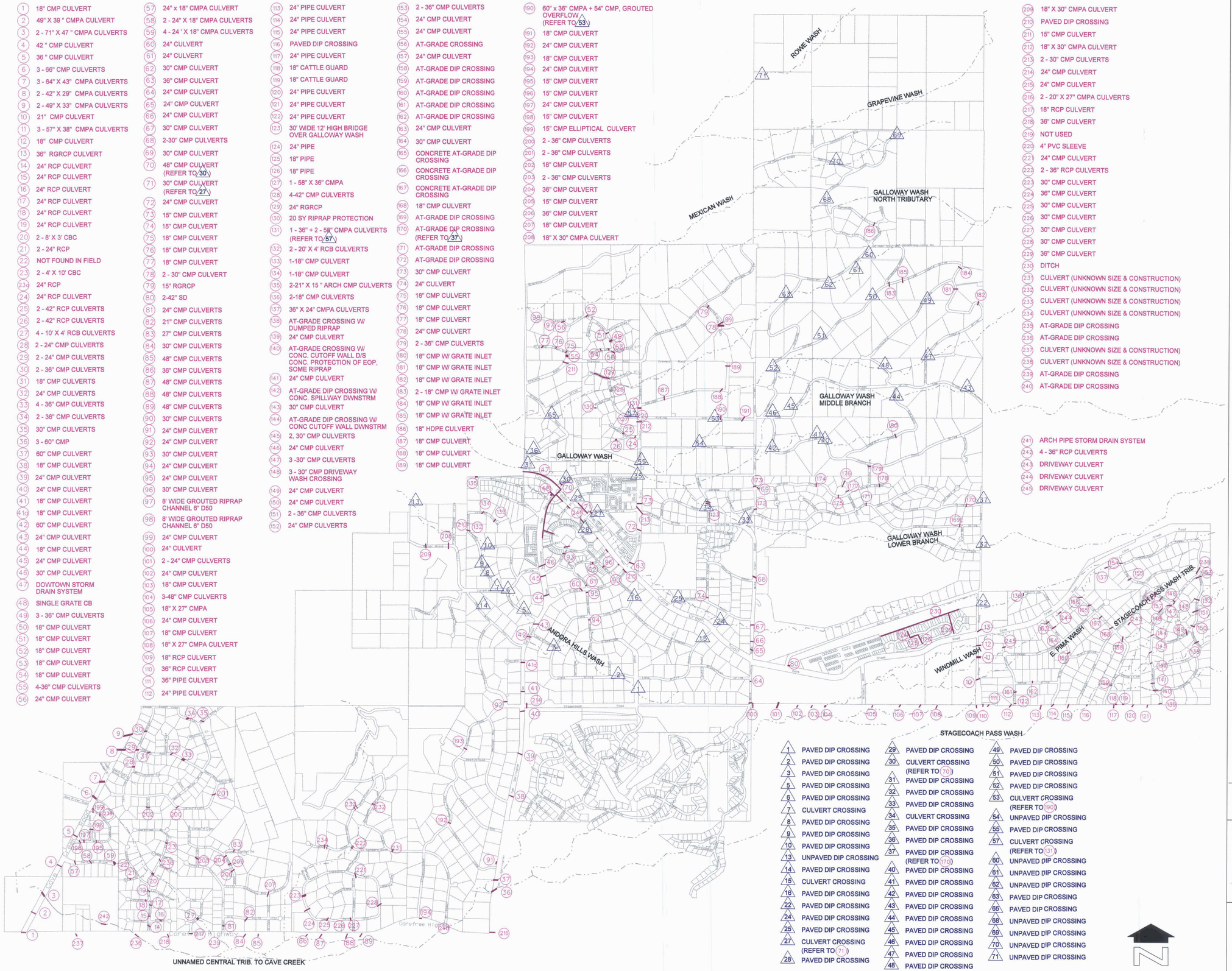
CH2MHILL

FIGURE 1 - LOCATION MAP

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

1. 18" CMP CULVERT
2. 49" X 39 " CMPA CULVERT
3. 2 - 71" X 47 " CMPA CULVERTS
4. 42 " CMP CULVERT
5. 36 " CMP CULVERT
6. 3 - 66" CMP CULVERTS
7. 3 - 64" X 43" CMPA CULVERTS
8. 2 - 42" X 29" CMPA CULVERTS
9. 2 - 49" X 33" CMPA CULVERTS
10. 21" CMP CULVERT
11. 3 - 57" X 38" CMPA CULVERTS
12. 18" CMP CULVERT
13. 36" RGRCP CULVERT
14. 24" RCP CULVERT
15. 24" RCP CULVERT
16. 24" RCP CULVERT
17. 24" RCP CULVERT
18. 24" RCP CULVERT
19. 24" RCP CULVERT
20. 2 - 8' X 3' CBC
21. 2 - 24" RCP
22. NOT FOUND IN FIELD
23. 2 - 4' X 10' CBC
23a. 24" RCP
24. 24" RCP CULVERT
25. 2 - 42" RCP CULVERTS
26. 2 - 42" RCP CULVERTS
27. 4 - 10' X 4' RCB CULVERTS
28. 2 - 24" CMP CULVERTS
29. 2 - 24" CMP CULVERTS
30. 2 - 36" CMP CULVERTS
31. 18" CMP CULVERTS
32. 24" CMP CULVERTS
33. 4 - 36" CMP CULVERTS
34. 2 - 36" CMP CULVERTS
35. 30" CMP CULVERTS
36. 3 - 60" CMP
37. 60" CMP CULVERT
38. 18" CMP CULVERT
39. 24" CMP CULVERT
40. 24" CMP CULVERT
41. 18" CMP CULVERT
41a. 18" CMP CULVERT
42. 60" CMP CULVERT
43. 24" CMP CULVERT
44. 18" CMP CULVERT
45. 24" CMP CULVERT
46. 30" CMP CULVERT
47. DOWTOWN STORM DRAIN SYSTEM
48. SINGLE GRATE CB
49. 3 - 36" CMP CULVERTS
50. 18" CMP CULVERT
51. 18" CMP CULVERT
52. 18" CMP CULVERT
53. 18" CMP CULVERT
54. 18" CMP CULVERT
55. 4-36" CMP CULVERTS
56. 24" CMP CULVERT
57. 24" x 18" CMPA CULVERT
58. 2 - 24" X 18" CMPA CULVERTS
59. 4 - 24 ' X 18" CMPA CULVERTS
60. 24" CULVERT
61. 24" CULVERT
62. 30" CMP CULVERT
63. 36" CMP CULVERT
64. 24" CMP CULVERT
65. 24" CMP CULVERT
66. 24" CMP CULVERT
67. 30" CMP CULVERT
68. 2-30" CMP CULVERTS
69. 30" CMP CULVERT
70. 48" CMP CULVERT (REFER TO 30)
71. 30" CMP CULVERT (REFER TO 27)
72. 24" CMP CULVERT
73. 15" CMP CULVERT
74. 15" CMP CULVERT
75. 18" CMP CULVERT
76. 18" CMP CULVERT
77. 18" CMP CULVERT
78. 2 - 30" CMP CULVERT
79. 15" RGRCP
80. 2-42" SD
81. 24" CMP CULVERTS
82. 21" CMP CULVERTS
83. 27" CMP CULVERTS
84. 30" CMP CULVERTS
85. 48" CMP CULVERTS
86. 36" CMP CULVERTS
87. 48" CMP CULVERTS
88. 48" CMP CULVERTS
89. 48" CMP CULVERTS
90. 30" CMP CULVERTS
91. 24" CMP CULVERT
92. 24" CMP CULVERT
93. 30" CMP CULVERT
94. 24" CMP CULVERT
95. 24" CMP CULVERT
96. 30" CMP CULVERT
97. 8' WIDE GROUTED RIPRAP CHANNEL 6" D50
98. 8' WIDE GROUTED RIPRAP CHANNEL 6" D50
99. 24" CMP CULVERT
100. 24" CULVERT
101. 2 - 24" CMP CULVERTS
102. 24" CMP CULVERT
103. 18" CMP CULVERT
104. 3-48" CMP CULVERTS
105. 18" X 27" CMPA
106. 24" CMP CULVERT
107. 18" CMP CULVERT
108. 18" X 27" CMPA CULVERT
109. 18" RCP CULVERT
110. 36" RCP CULVERT
111. 36" PIPE CULVERT
112. 24" PIPE CULVERT
113. 24" PIPE CULVERT
114. 24" PIPE CULVERT
115. 24" PIPE CULVERT
116. PAVED DIP CROSSING
117. 24" PIPE CULVERT
118. 18" CATTLE GUARD
119. 18" CATTLE GUARD
120. 24" PIPE CULVERT
121. 24" PIPE CULVERT
122. 24" PIPE CULVERT
123. 30' WIDE 12' HIGH BRIDGE OVER GALLOWAY WASH
124. 24" PIPE
125. 18" PIPE
126. 18" PIPE
127. 1 - 58" X 36" CMPA
128. 4-42" CMP CULVERTS
129. 24" RGRCP
130. 20 SY RIPRAP PROTECTION
131. 1 - 36" + 2 - 58" CMPA CULVERTS (REFER TO 57)
132. 2 - 20' X 4' RCB CULVERTS
133. 1-18" CMP CULVERT
134. 1-18" CMP CULVERT
135. 2-21" X 15 " ARCH CMP CULVERTS
136. 2-18" CMP CULVERTS
137. 36" X 24" CMPA CULVERTS
138. AT-GRADE CROSSING W/ DUMPED RIPRAP
139. 24" CMP CULVERT
140. AT-GRADE CROSSING W/ CONC. CUTOFF WALL D/S CONC. PROTECTION OF EOP, SOME RIPRAP
141. 24" CMP CULVERT
142. AT-GRADE DIP CROSSING W/ CONC. SPILLWAY DWNSTRM
143. 30" CMP CULVERT
144. AT-GRADE DIP CROSSING W/ CONC CUTOFF WALL DWNSTRM
145. 2, 30" CMP CULVERTS
146. 24" CMP CULVERT
147. 3 -30" CMP CULVERTS
148. 3 - 30" CMP DRIVEWAY WASH CROSSING
149. 24" CMP CULVERT
150. 24" CMP CULVERT
151. 2 - 36" CMP CULVERTS
152. 24" CMP CULVERTS
153. 2 - 36" CMP CULVERTS
154. 24" CMP CULVERT
155. 24" CMP CULVERT
156. AT-GRADE CROSSING
157. 24" CMP CULVERT
158. AT-GRADE DIP CROSSING
159. AT-GRADE DIP CROSSING
160. AT-GRADE DIP CROSSING
161. AT-GRADE DIP CROSSING
162. AT-GRADE DIP CROSSING
163. 24" CMP CULVERT
164. 30" CMP CULVERT
165. CONCRETE AT-GRADE DIP CROSSING
166. CONCRETE AT-GRADE DIP CROSSING
167. CONCRETE AT-GRADE DIP CROSSING
168. 18" CMP CULVERT
169. AT-GRADE DIP CROSSING
170. AT-GRADE DIP CROSSING (REFER TO 37)
171. AT-GRADE DIP CROSSING
172. AT-GRADE DIP CROSSING
173. 30" CMP CULVERT
174. 24" CULVERT
175. 18" CMP CULVERT
176. 18" CMP CULVERT
177. 18" CMP CULVERT
178. 24" CMP CULVERT
179. 2 - 36" CMP CULVERTS
180. 18" CMP W/ GRATE INLET
181. 18" CMP W/ GRATE INLET
182. 18" CMP W/ GRATE INLET
183. 2 - 18" CMP W/ GRATE INLET
184. 18" CMP W/ GRATE INLET
185. 18" CMP W/ GRATE INLET
186. 18" HDPE CULVERT
187. 18" CMP CULVERT
188. 18" CMP CULVERT
189. 18" CMP CULVERT
190. 60" x 36" CMPA + 54" CMP, GROUTED OVERFLOW (REFER TO 53)
191. 18" CMP CULVERT
192. 24" CMP CULVERT
193. 18" CMP CULVERT
194. 24" CMP CULVERT
195. 15" CMP CULVERT
196. 15" CMP CULVERT
197. 24" CMP CULVERT
198. 15" CMP CULVERT
199. 15" CMP ELLIPTICAL CULVERT
200. 2 - 36" CMP CULVERTS
201. 2 - 36" CMP CULVERTS
202. 18" CMP CULVERT
203. 2 - 36" CMP CULVERTS
204. 36" CMP CULVERT
205. 15" CMP CULVERT
206. 36" CMP CULVERT
207. 18" CMP CULVERT
208. 18" X 30" CMPA CULVERT
209. 18" X 30" CMPA CULVERT
210. PAVED DIP CROSSING
211. 15" CMP CULVERT
212. 18" X 30" CMPA CULVERT
213. 2 - 30" CMP CULVERTS
214. 24" CMP CULVERT
215. 24" CMP CULVERT
216. 2 - 20" X 27" CMPA CULVERTS
217. 18" RCP CULVERT
218. 36" CMP CULVERT
219. NOT USED
220. 4" PVC SLEEVE
221. 24" CMP CULVERT
222. 2 - 36" RCP CULVERTS
223. 30" CMP CULVERT
224. 36" CMP CULVERT
225. 30" CMP CULVERT
226. 30" CMP CULVERT
227. 30" CMP CULVERT
228. 30" CMP CULVERT
229. 36" CMP CULVERT
230. DITCH
231. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
232. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
233. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
234. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
235. AT-GRADE DIP CROSSING
236. AT-GRADE DIP CROSSING
237. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
238. CULVERT (UNKNOWN SIZE & CONSTRUCTION)
239. AT-GRADE DIP CROSSING
240. AT-GRADE DIP CROSSING
241. ARCH PIPE STORM DRAIN SYSTEM
242. 4 - 36" RCP CULVERTS
243. DRIVEWAY CULVERT
244. DRIVEWAY CULVERT
245. DRIVEWAY CULVERT



1. PAVED DIP CROSSING
2. PAVED DIP CROSSING
3. PAVED DIP CROSSING
5. PAVED DIP CROSSING
6. PAVED DIP CROSSING
7. CULVERT CROSSING
8. PAVED DIP CROSSING
9. PAVED DIP CROSSING
10. PAVED DIP CROSSING
13. UNPAVED DIP CROSSING
14. PAVED DIP CROSSING
15. CULVERT CROSSING
16. PAVED DIP CROSSING
22. PAVED DIP CROSSING
24. PAVED DIP CROSSING
25. PAVED DIP CROSSING
27. CULVERT CROSSING (REFER TO 71)
28. PAVED DIP CROSSING
29. PAVED DIP CROSSING
30. CULVERT CROSSING (REFER TO 70)
31. PAVED DIP CROSSING
32. PAVED DIP CROSSING
33. PAVED DIP CROSSING
34. CULVERT CROSSING
35. PAVED DIP CROSSING
36. PAVED DIP CROSSING
37. PAVED DIP CROSSING (REFER TO 170)
40. PAVED DIP CROSSING
41. PAVED DIP CROSSING
42. PAVED DIP CROSSING
43. PAVED DIP CROSSING
44. PAVED DIP CROSSING
45. PAVED DIP CROSSING
46. PAVED DIP CROSSING
47. PAVED DIP CROSSING
48. PAVED DIP CROSSING
49. PAVED DIP CROSSING
50. PAVED DIP CROSSING
51. PAVED DIP CROSSING
52. PAVED DIP CROSSING
53. CULVERT CROSSING (REFER TO 190)
54. UNPAVED DIP CROSSING
55. PAVED DIP CROSSING
57. CULVERT CROSSING (REFER TO 131)
60. UNPAVED DIP CROSSING
61. UNPAVED DIP CROSSING
62. UNPAVED DIP CROSSING
63. PAVED DIP CROSSING
65. PAVED DIP CROSSING
68. UNPAVED DIP CROSSING
69. UNPAVED DIP CROSSING
70. UNPAVED DIP CROSSING
71. UNPAVED DIP CROSSING

NOT TO SCALE

LEGEND

153 DRAINAGE FEATURE AND NUMBER IDENTIFIER

10 DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

CULVERT LOCATIONS TAKEN FROM VARIOUS IMPROVEMENT PLANS, AS-BUILT PLANS, REPORTS, AND FIELD SURVEYS.

ACRONYMNS:

CBC = CONCRETE BOX CULVERT
CMP = CORREGATED METAL PIPE
CMPA = CORREGATED METAL PIPE ARCH
HDPE = HIGH DENSITY POLYETHYLENE
PVC = POLYVINYL CHLORIDE
RCP = REINFORCED CONCRETE PIPE
RGRCP = RUBBER GASKETED REINFORCED CONCRETE PIPE

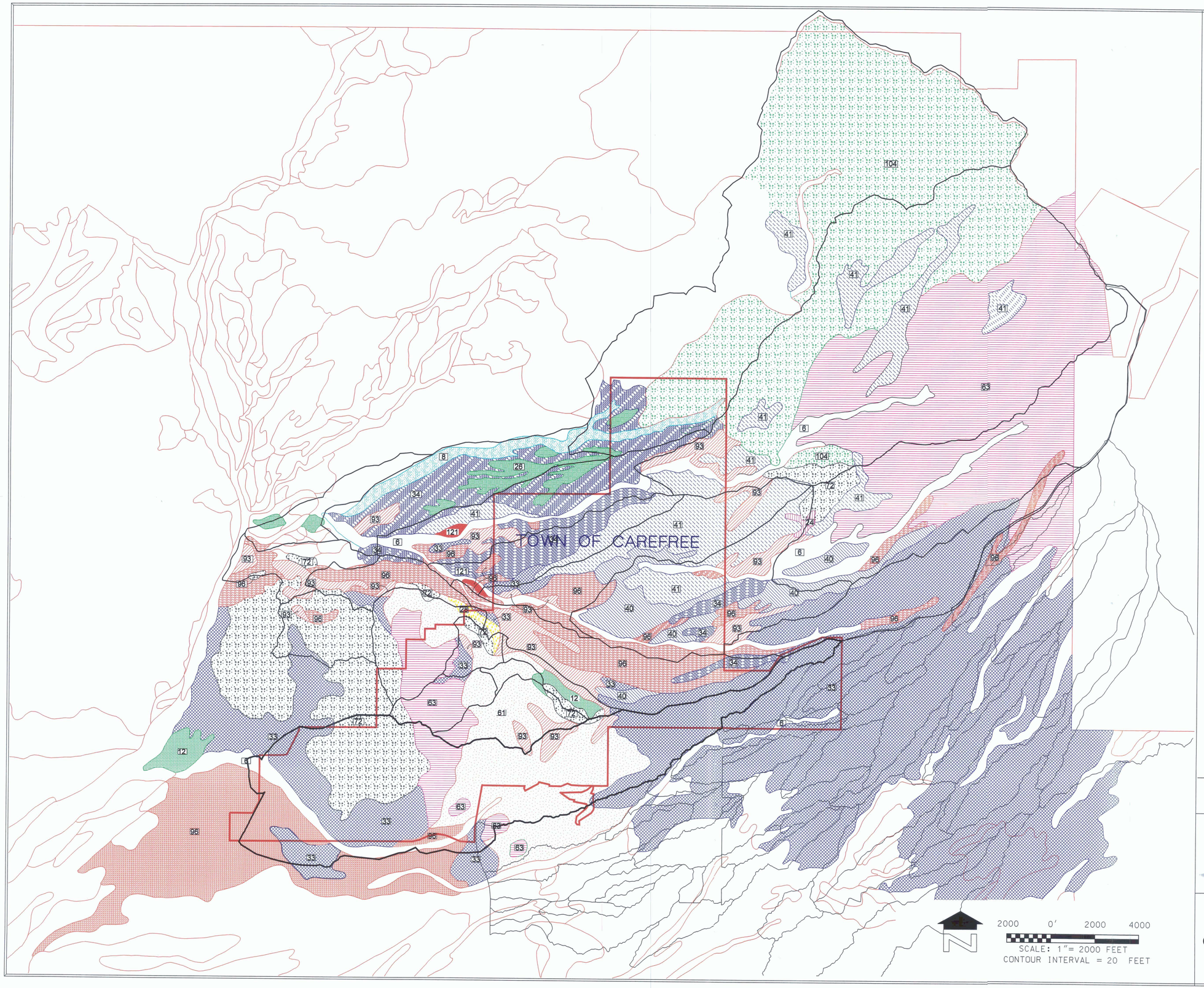
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2 - EXISTING FACILITIES

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

- STUDY AREA AND TOWN BOUNDARIES
- 6 SANDY LOAM - VERY GRAVELLY SANDY LOAM
- 8 VERY COBBLY SANDY LOAM
- 12 CLAY
- 26 CLAY
- 28 CLAY
- 33 VERY GRAVELLY LOAM
- 34 VERY GRAVELLY LOAM
- 40 VERY GRAVELLY LOAM - GRAVELLY CLAY LOAM
- 41 VERY GRAVELLY LOAM - GRAVELLY CLAY LOAM
- 61 EXT. GRAVELLY SANDY - GRAVELLY SANDY LOAM
- 63 EXT. GRAVELLY SANDY CLAY - GRAVELLY SANDY LOAM - ROCK OUTCROP
- 72 CLAY LOAM - ROCK OUTCROP
- 93 GRAVELLY LOAM - LOAM
- 96 GRAVELLY CLAY LOAM - CLAY LOAM
- 104 ROCK OUTCROP - GRAVELLY CLAY LOAM
- 121 CLAY LOAM - SANDY LOAM

NOTES

TAKEN FROM DIGITAL INFORMATION SUPPLIED BY THE FCDMC AND THE USDA/SCS "SOIL SURVEY OF AGUILA-CAREFREE AREA, PARTS OF MARICOPA AND PINAL COUNTIES, ARIZONA".

SEE REFERENCES CITED ABOVE AND REPORT FOR FURTHER SOIL UNIT INFORMATION.

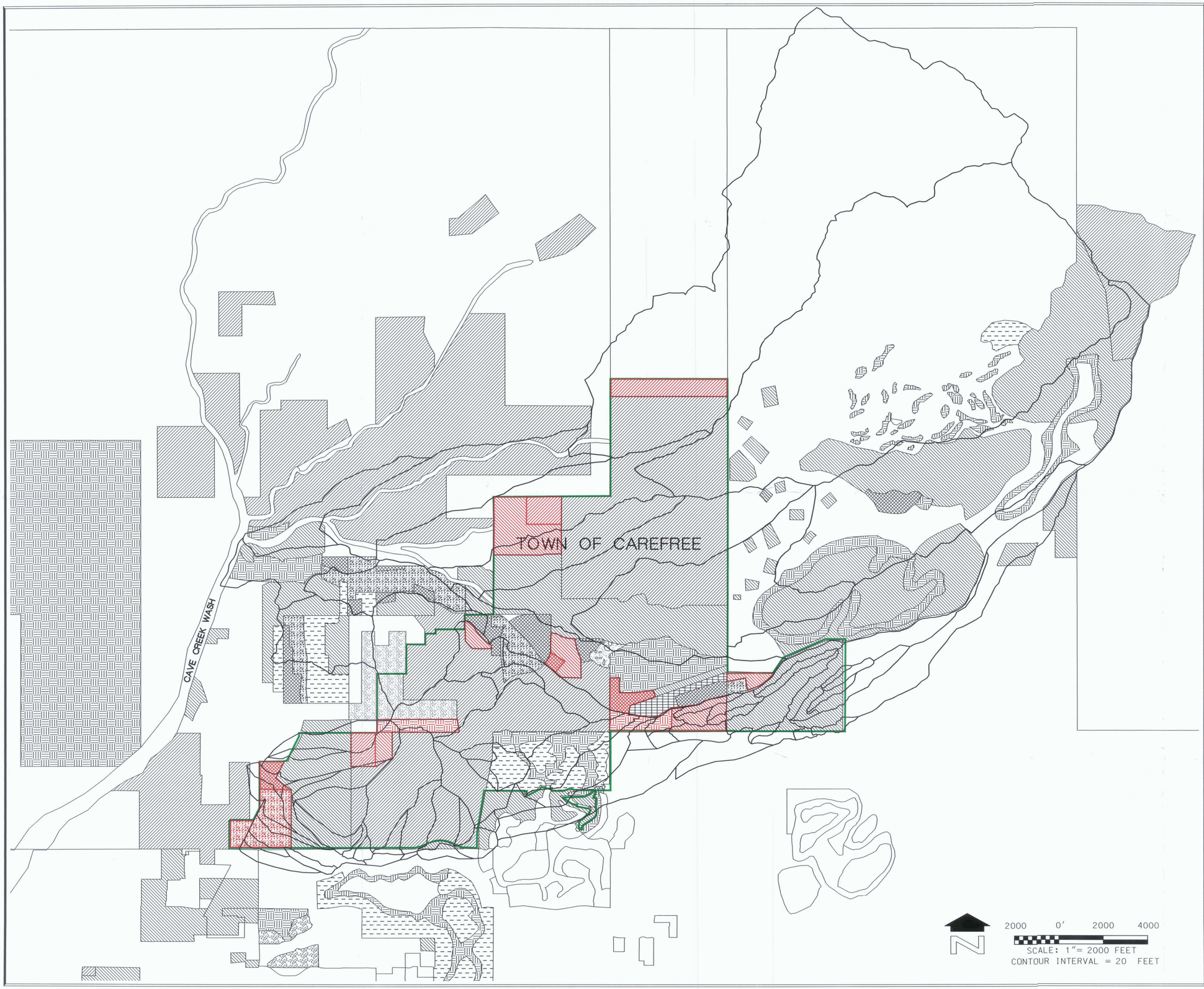
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 3 - SOILS MAP

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

EXISTING LAND USAGES (BLACK)

- STUDY AREA AND TOWN BOUNDARIES
- RURAL (1 DWELLING OR LESS)
- LARGE LOT RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- SMALL LOT RESIDENTIAL
- RECREATIONAL OPEN SPACE
- EDUCATIONAL
- VACANT (*FUTURE LAND USE SHOWN)
- AIRPORT
- HOTEL, MOTEL AND RESORT
- DEDICATED OR NON-DEVELOPABLE OPEN SPACE
- NEIGHBORHOOD RETAIL CENTER

FUTURE LAND USAGES (RED)

- FUTURE RURAL (1 DWELLING OR LESS)
- FUTURE LARGE LOT RESIDENTIAL
- FUTURE MEDIUM DENSITY RESIDENTIAL
- FUTURE RECREATIONAL OPEN SPACE
- SPECIAL PLANNING

NOTES

EXISTING LAND USE TAKEN FROM: DIGITAL INFORMATION AND AERIAL PHOTOGRAPHS SUPPLIED BY FCDMC, DATED 2000

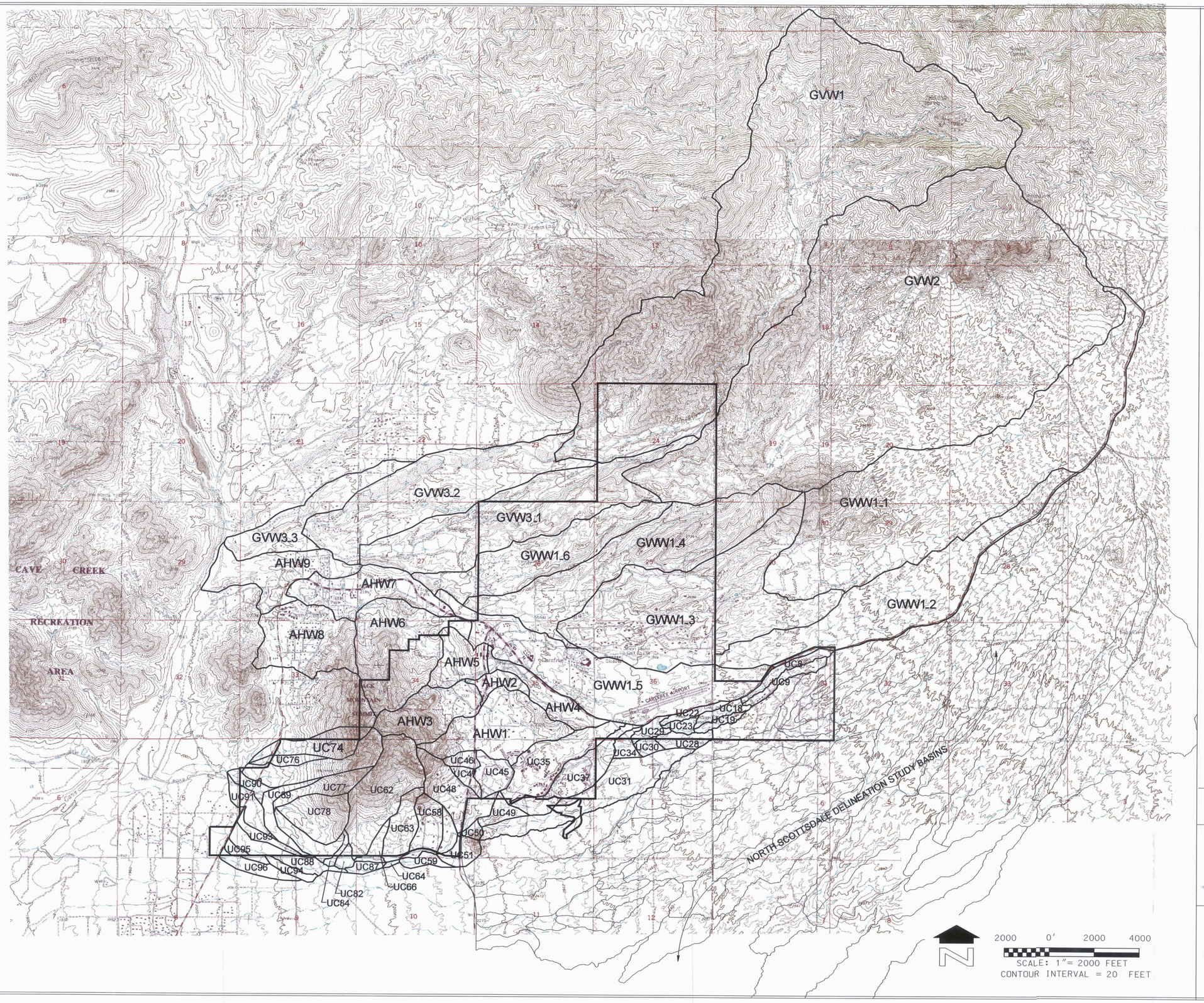
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 4 - EXISTING AND FUTURE LAND USE

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

- STUDY AREA AND TOWN BOUNDARIES
- UC21 BASIN NAME
- BASIN BOUNDARIES
- FLOW PATH, WATERCOURSE, OR ROUTING REACH
- NORTH SCOTTSDALE BASIN BOUNDARIES (BY OTHERS)

NOTES

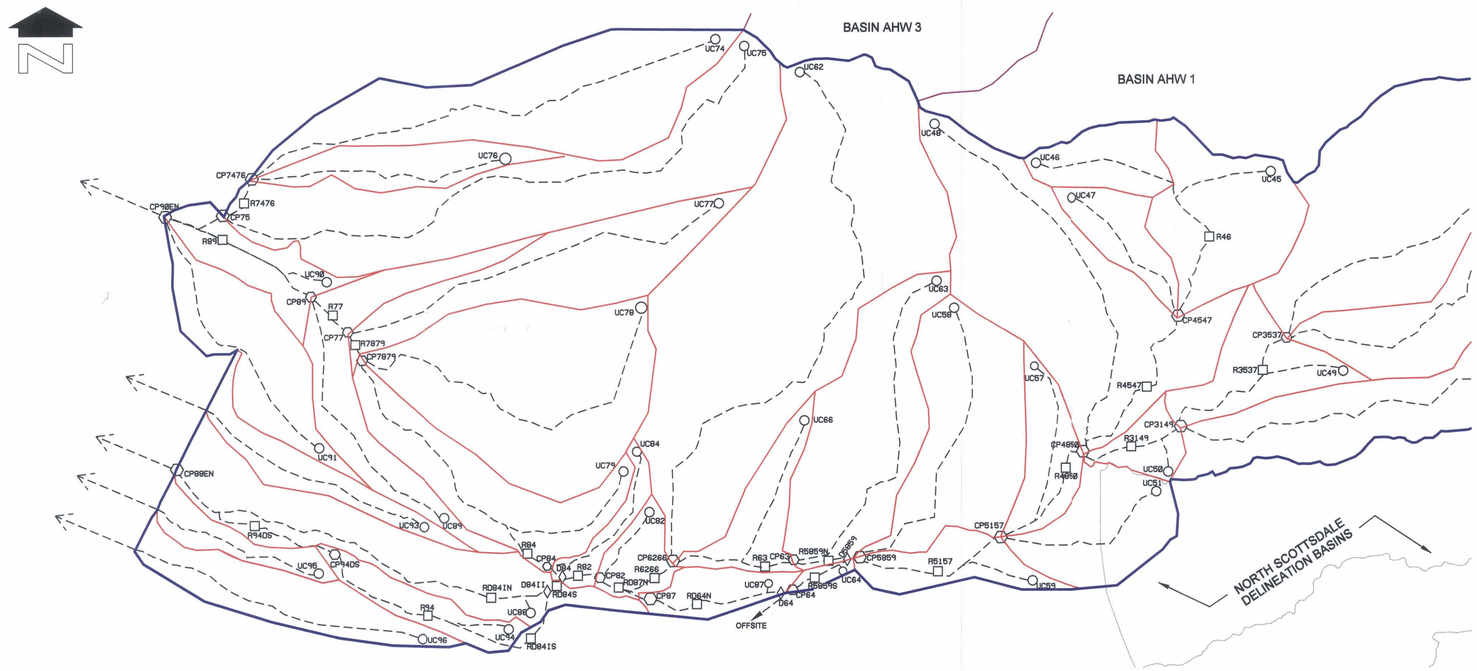
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

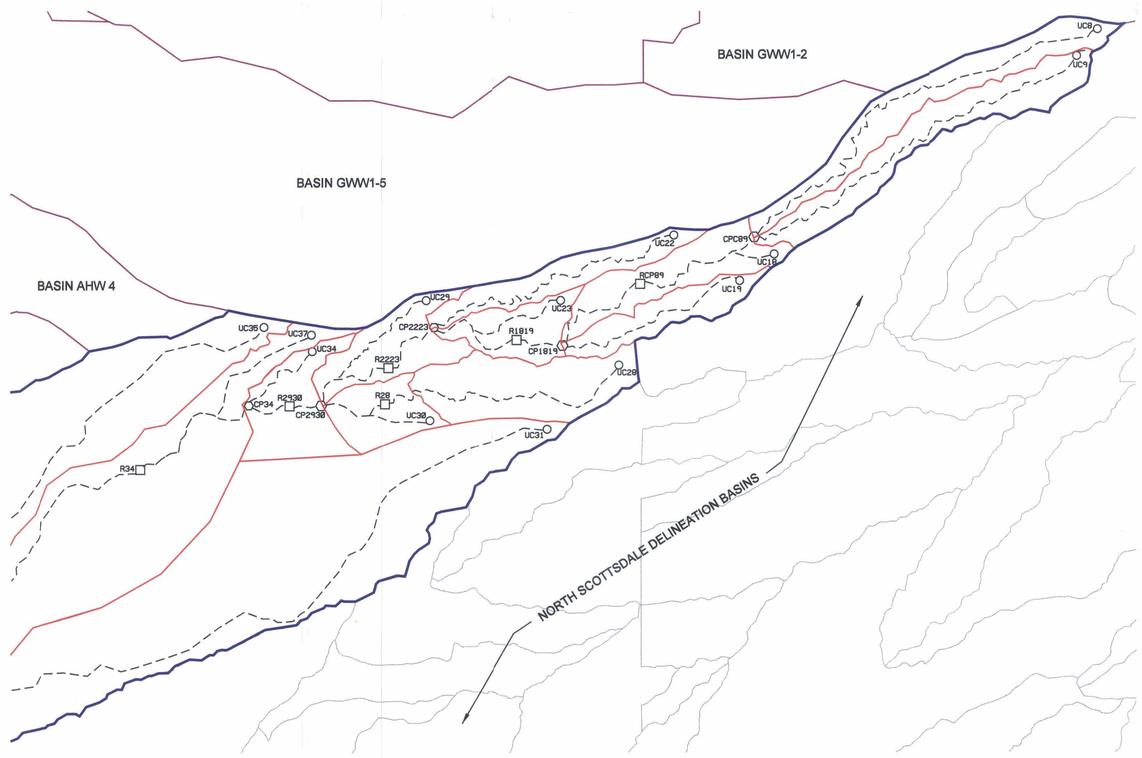
CH2MHILL

FIGURE 5 - HYDROLOGY BASINS

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037





LEGEND

UC30	SUBBASIN
R28	ROUTING
D84	DIVERSION
CP2930	COMBINE
	HEC-1 IDENTIFIER
	FLOW PATH (APPROXIMATE)

NOTES

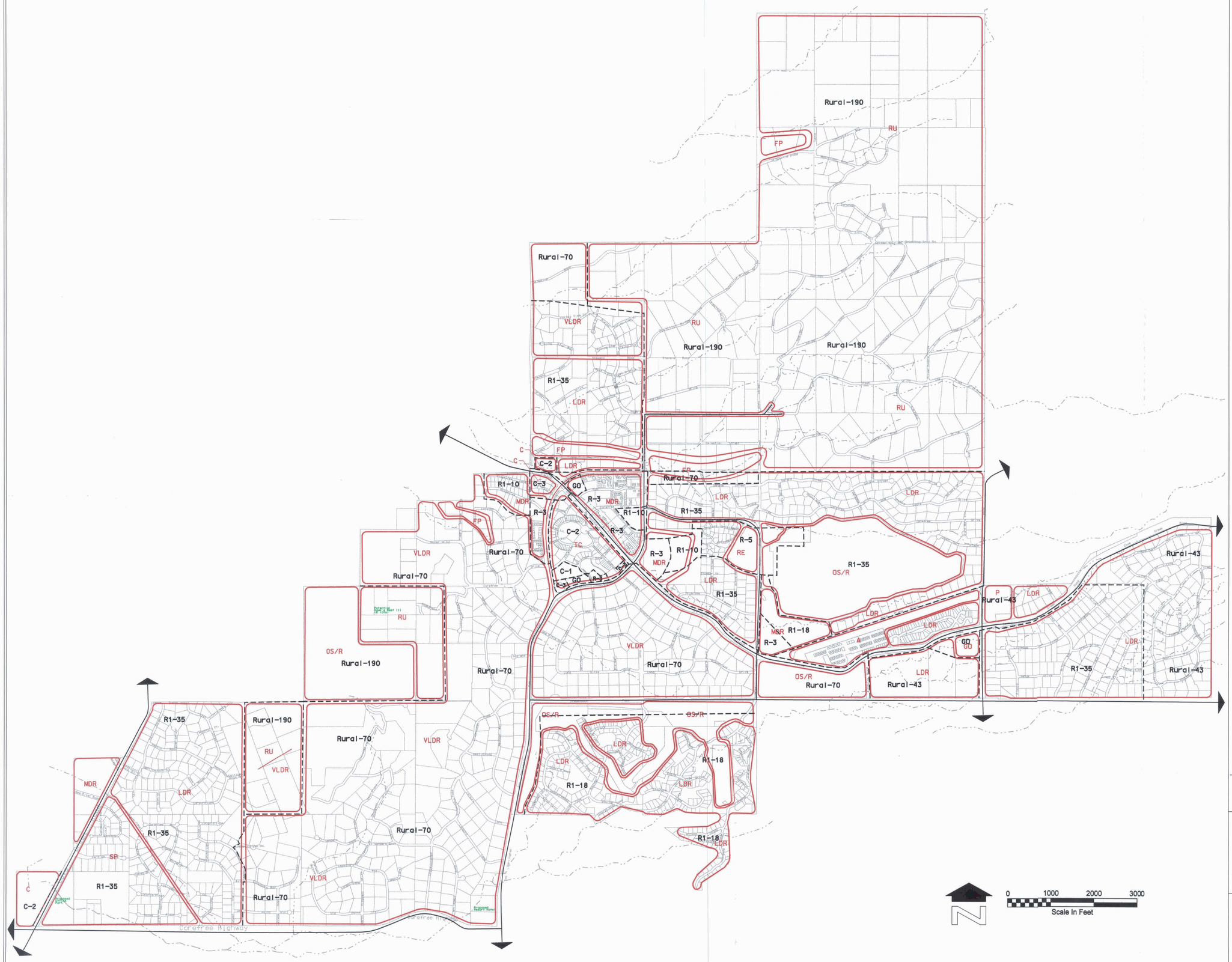
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

CH2MHILL

FIGURE 6 - HEC1 SCHEMATIC

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

LAND USE PLAN

RU	RURAL RESIDENTIAL - 5 ACRES MINIMUM
VLDR	VERY LOW DENSITY RESIDENTIAL - 2 ACRES MINIMUM
LDR	LOW DENSITY RESIDENTIAL - 1 ACRE MINIMUM
MDR	MODERATE DENSITY RESIDENTIAL - 6,000 SQ FT/UNIT MINIMUM
TC	TOWN CENTER
C	COMMERCIAL
RE	RESORT HOTEL / RESORT DEVELOPMENT
GO	GARDEN OFFICE
OS/R	OPEN SPACE / RECREATION
A	AIRPORT
FP	FLOOD / WASH TO BE CONSERVED
P	PUBLIC / SEMI PUBLIC
SP	SPECIAL PLANNING AREA
←	THOROUGHFARE
—	LAND USE PLAN BOUNDARY

ZONING

Rural-190	RURAL ZONING DISTRICT--190,000 SQUARE FEET PER DWELLING UNIT
Rural-70	RURAL ZONING DISTRICT--70,000 SQUARE FEET PER DWELLING UNIT
Rural-43	RURAL ZONING DISTRICT--ONE (1) ACRE PER DWELLING UNIT
R1-35	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--35,000 SQUARE FEET PER DWELLING UNIT
R1-18	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--18,000 SQUARE FEET PER DWELLING UNIT
R1-10	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--10,000 SQUARE FEET PER DWELLING UNIT
R-3	MULTIPLE-FAMILY RESIDENTIAL ZONING DISTRICT--6,000 SQUARE FEET LOT AREA PER DWELLING UNIT
R-5	MULTIPLE-FAMILY RESIDENTIAL ZONING DISTRICT--6,000 SQUARE FEET LOT AREA PER DWELLING UNIT
C-1	NEIGHBORHOOD COMMERCIAL ZONING DISTRICT
C-2	INTERMEDIATE COMMERCIAL ZONING DISTRICT
C-3	GENERAL COMMERCIAL ZONING DISTRICT
GO	GARDEN OFFICE ZONING DISTRICT
- - - -	ZONING DISTRICTS BOUNDARY

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

CH2MHILL

FIGURE 7 - MASTER PLAN AND ZONING

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

Appendix C – JE Fuller Memorandum for Andora Hills and Galloway Washes

Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: December 5, 2001, revised October 23, 2002

TO: Linda Johnson, P.E., CH2M Hill

FROM: Ted Lehman, P.E.

RE: Hydrologic modeling for Carefree DMP for Andora Hills and Galloway Washes

CC: File

Registered Professional Engineer (Civil) CERTIFICATE NO. 35895 TED W. LEHMAN Date Signed 10-23-02 ARIZONA U.S.A.

This memorandum is a revision to an original memorandum dated December 5, 2001. The revisions are based on comments received from FEMA during review of the Floodplain Delineation Study for Andora Hills and Galloway Washes. The revisions requested by FEMA involved further subdivision of original subbasin GWW1_3 into three new subbasins (GWW131, GWW132, and GWW133) to provide greater resolution of discharges on Galloway Wash. The tables, text, and figures of the original memorandum have been modified to include and reflect these revisions.

1. Introduction

This memorandum describes the procedures and results of hydrologic analyses for Andora Hills and Galloway Washes performed by JE Fuller / Hydrology & Geomorphology, Inc. for the Carefree Area Drainage Master Plan. The analyses include 10-year and 100-year frequencies for the 6- and 24-hour duration for both the existing condition and future condition land uses in the subject watersheds.

The primary purpose of this modeling is to compute peak discharges at road crossing locations in the two watersheds within the Town of Carefree.

2. Description of Hydrologic Methods

2.1 Existing Conditions

2.1.1 Andora Hills Wash

The hydrologic modeling for the current study is based on modeling originally produced by George V. Sabol Consulting Engineers (GVSCE) for the *Cave Creek Above Carefree Highway Floodplain Delineation Study, FCD 95-28.* The GVSCE model was used to generate 100-year peak discharge values for Andora Hills Wash. The HEC-1 modeling performed by GVSCE to obtain these earlier results was done using the methodology set forth in the *Drainage Design Manual for Maricopa County, Volume I, Hydrology.*

The 100-year 6-hour duration HEC-1 model was developed for Andora Hills Wash for existing conditions land uses with the 6-hour storm patterns published in the Drainage Design Manual. Additionally, a 24-hour model was constructed using the SCS Type II distribution HEC-1 rainfall losses for the Andora Hills Wash watershed were estimated using the Green and Ampt method. The Clark unit hydrograph was used to generate hydrographs in the small, urban

subbasins of the Andora Hills Wash watershed. Normal depth storage routing was used for the channel routings to route hydrographs through the watershed.

The GVSCE model was revised to include a minor shift in subbasin boundaries between AHW1 and AHW3. Also, an additional combination block was added to separate hydrographs at one location. The 100-year 24-hour and 100-year 6-hour peak discharges were determined using the revised model. Additional models were created to determine 10-year 24-hour and 10-year 6-hour peak discharges.

2.1.2 Galloway Wash

The hydrologic modeling for Galloway Wash was based on the previous modeling done in for the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14) (JEF, 2001). In that study, 100-year 6-hour and 100-year 24-hour peak discharge values were determined using the US Army Corps of Engineers (COE) HEC-1 Computer Program, version 4.0.1E, dated May, 1991, in accordance with the methodology set forth in the FCDMC *Drainage Design Manual, Vol. I.*

The Galloway Wash HEC-1 model was developed for existing conditions using the 100-year 24-hour rainfall depth and the SCS Type II distribution. Additionally, a 6-hour HEC-1 model was developed using the 6-hour storm patterns in the Drainage Design Manual. HEC-1 rainfall losses for the Galloway Wash watershed were estimated using the Green and Ampt method. The Phoenix Mountain and Desert/Rangeland S-graphs were used to generate unit hydrographs. The normal depth storage routing routine was used for all channel reaches. Representative 8-point cross sections were obtained from previous FIS study model results and 2 foot contour interval topographic mapping.

For the current study, additional models for the Galloway Wash watershed were created to for the 10-year 24-hour and 10-year 6-hour peak discharges. The 10-year models were based on the 100-year models. Only the rainfall depth was modified from the 100-year models.

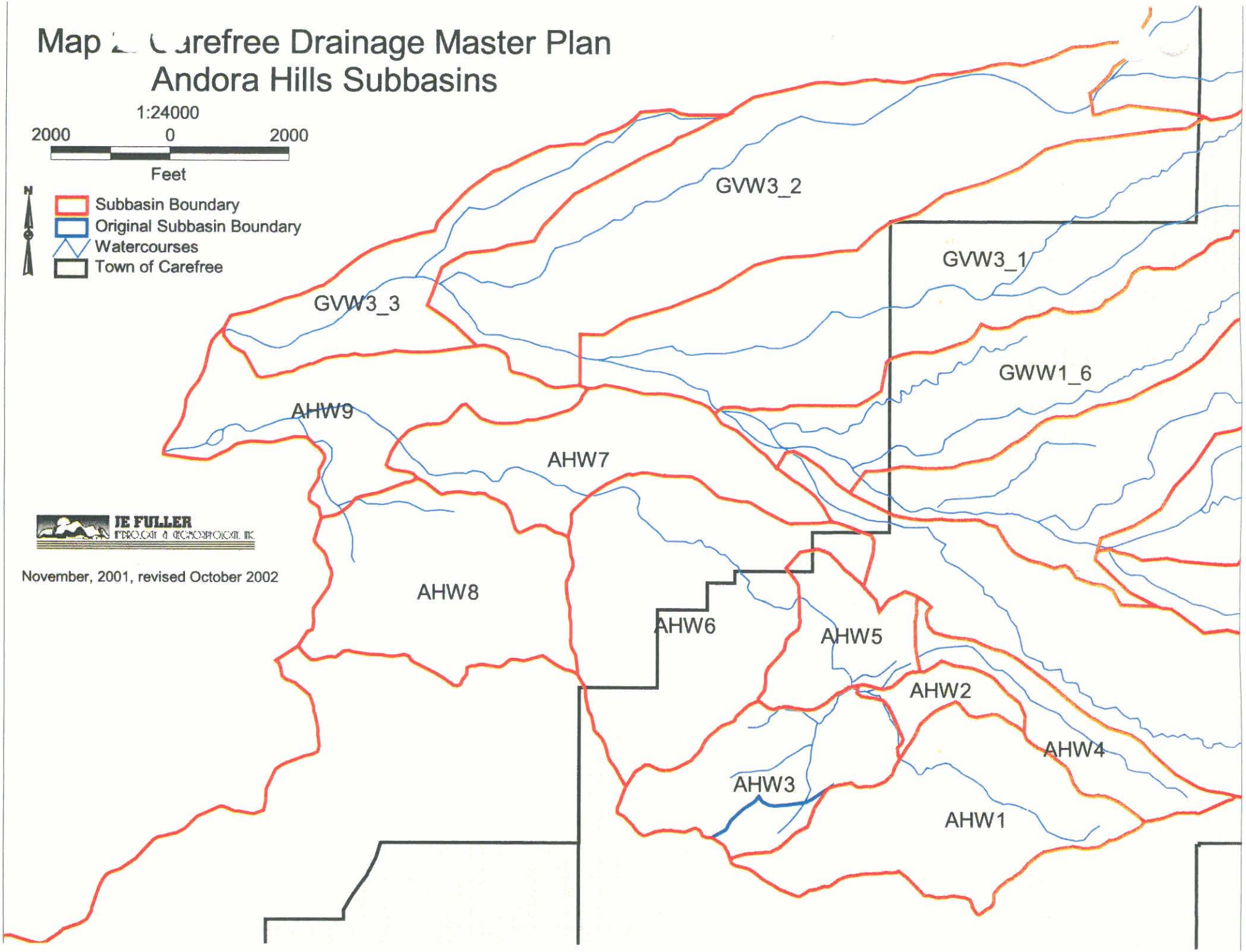
2.2 Physical Parameters

2.2.1 Drainage Area Boundaries

Map 1 shows the drainage boundaries used in the HEC-1 modeling of Andora Hills and Galloway Washes for the current study. The Andora Hills watershed is approximately 2.8 square miles. The elevation of the watershed at the confluence with Cave Creek is approximately 2000 feet. The elevation of the highest point in the watershed is 3398 feet at Black Mountain located in the southern part of the watershed.

Subbasin boundaries used in the Andora Hills Wash models were originally established by GVSCE for the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28), with the exception of the shared boundary between subbasins AHW1 (S320) and AHW3 (S340L). The boundary between subbasins AHW1 and AHW3 was moved based on examination of the 2001 orthophotos provided by the Flood Control District of Maricopa County (FCDMC). The shift in boundary was made to incorporate drainage that flowed into AHW3 rather than AHW1. The boundary shift involved an area of 24.2 acres (Map 2).

Map 2 Carefree Drainage Master Plan
Andora Hills Subbasins



Ma .. Carefree Drainage Master Pl
Andora Hills & Galloway Washes Subbasins

SCALE 1:63360

1 0 1

Miles

N

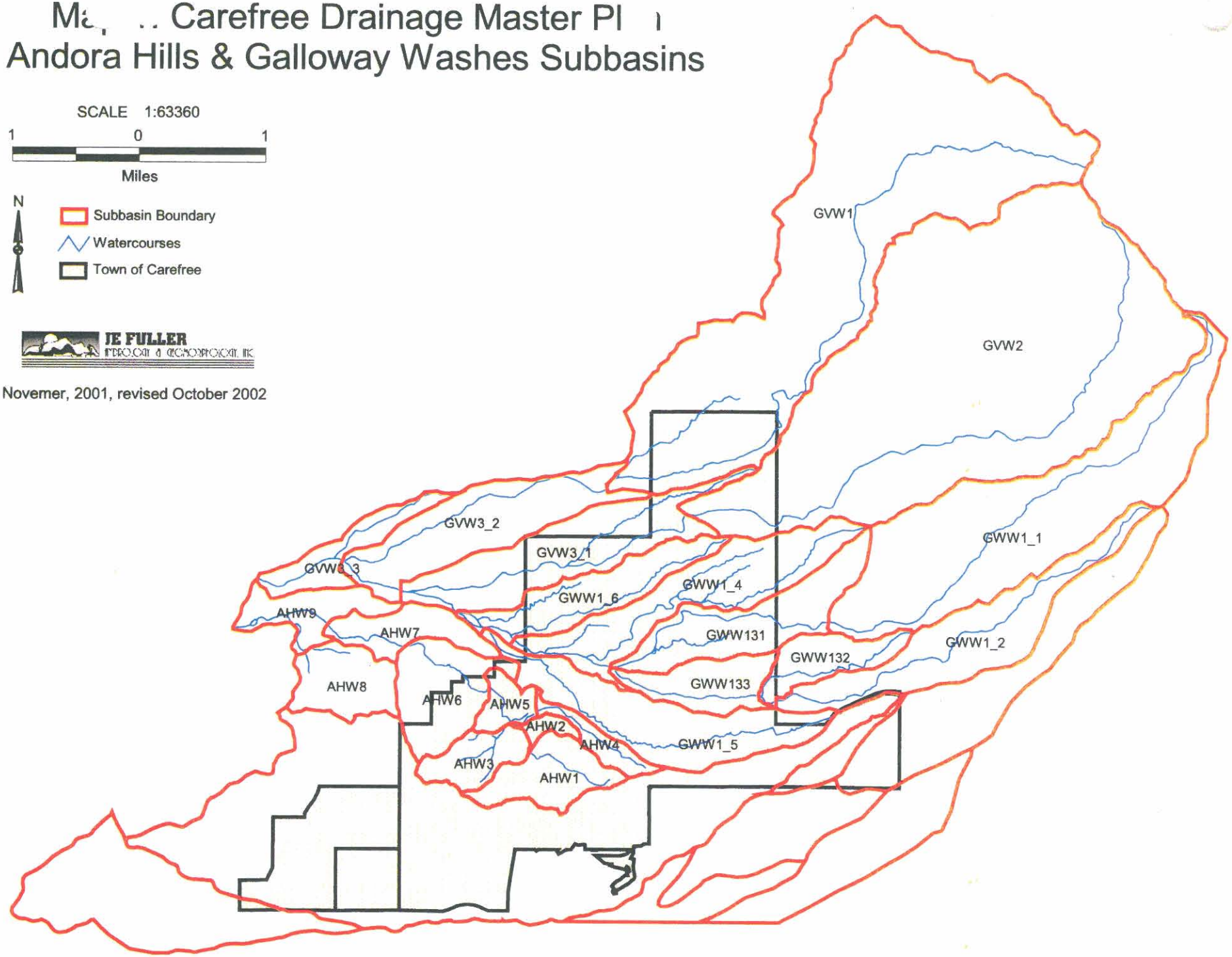
Subbasin Boundary

Watercourses

Town of Carefree

JE FULLER

November, 2001, revised October 2002



The Galloway Wash watershed, including the Grapevine Wash tributary, is approximately 17.4 square miles. Galloway Wash is also referred to as "Rowler Wash" in a street map published by the Town of Carefree. The elevation of the watershed outlet at the Cave Creek confluence is approximately 2025 feet, and the elevation of the highest point in the watershed is approximately 4890 feet at Butte Peak located in the northeast part of the watershed.

Subbasin boundaries (Map 1) in the Galloway Wash model remained the same as the HEC-1 model established by JE Fuller Hydrology & Geomorphology, Inc. (JEF), in the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14).

2.2.2 Rainfall

Rainfall data for the 100-year 6-hour and 100-year 24-hour storms were taken directly from the previous GVSCE (1997) and JEF (2001) models. The 10-year point rainfall statistics were derived using 4 input PREFRE analyses. The PREFRE output are provided in Appendix A.

Areal reduction of point rainfall for the JD records in the 10-year HEC-1 models were computed using the same reduction factors as for the 100-year analyses in GVSCE (1997) for Andora Hills Wash and JEF (2001) for Galloway Wash.

The SCS Type II temporal distribution was used for the 24-hour models for both washes. The necessary FCDMC 6-hour patterns for the modeled index storms were used in the 6-hour models.

2.2.3 Rainfall Losses

Parameters for rainfall losses, including those parameters related to soils and land use classifications, were generated in prior studies. Rainfall loss parameters in the Galloway Wash watershed were determined by JEF (2001) and reported in *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14). Rainfall loss parameters in the Andora Hills Wash watershed were determined by GVSCE (1997) and reported in *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28). Rainfall losses for both studies were estimated using the Green and Ampt method in HEC-1.

Revisions to the subbasin boundaries in the Andora Hills Wash watershed required the recalculation of rainfall loss parameters for two subbasins (AHW1 and AHW3). The original methods outlined by GVSCE in the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28) were used to determine the new rainfall loss parameters for these two subbasins.

2.2.3.1 Soils

The revised Andora Hills Wash watershed subbasin boundaries were overlaid on a digital soils map in ArcView. The digital soils map was derived from the Soil Conservation Service (SCS) (Camp, 1986) and the US Forest Service (USFS) and was provided by the FCDMC as ArcView shapefiles for the project area. The digital soil map unit data are based on *Soil Survey of Aguila-*

Carefree, Parts of Maricopa and Pinal Counties, Arizona (Camp, 1986) and on *USFS, Tonto National Forest, General Ecosystem Survey,* 1989.

The boundary change between subbasins AHW1 and AHW3 resulted in 24.2 acres of Gran-Wickenburg soil (Soil type 63) shifting to AHW3 from AHW1. Determining the soil-related rainfall loss parameters for the subbasins was accomplished by following the procedures outlined by GVSCE in the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28), *Technical Data Notebook, Book 2 of 2*. The resulting soil distributions and rainfall loss parameters in the affected subbasins are shown in Table B.1 in Appendix B.

2.2.3.2 Land Use

Both study watersheds are covered by the Upper Sonoran plant community and span across multiple jurisdictions, including Maricopa County, the City of Scottsdale, and the Towns of Cave Creek and Carefree. Most of the Galloway Wash watershed falls under the vacant land, rural and large-lot-residential land use categories. Most of the Andora Hills Wash watershed is split between natural and large-lot-residential land use categories, with small areas of commercial and high-density residential land uses.

The "existing conditions" land use for the Galloway Wash watershed is based on September 1999 aerial photographs as described in the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14) (JEF, 2001). For Andora Hills Wash, the existing land use conditions represent conditions as of 1995 as described in the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28) (GVSCE, 1997).

The revised Andora Hills Wash watershed subbasin boundaries were overlaid on the digital orthophotos provided by FCDMC. The photos demonstrated that only natural areas were affected by the boundary change, resulting in 24.2 acres of natural land use shifting to AHW3 from AHW1. The land use-related rainfall loss parameters for these subbasins were determined following the procedures outlined by GVSCE in the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28). The resulting land use distributions and rainfall loss parameters in the affected subbasins are shown in Table B.2 in Appendix B.

The final rainfall loss parameters for all subbasins for the existing condition, including the revised subbasins AHW1 and AHW3, are presented in Table 1.

Table 1. Summary of basin area and Green and Ampt method HEC-1 input parameters Existing Condition							
Subbasin ID	**HEC-1 ID**	**Area sq. mi.**	**IA inches**	**DTHETA**	**PSIF inches**	**XKSAT in/hr**	**RTIMP %**
Galloway Wash (source JEF, 2001, revised April 2002)							
GWW1_1	GWW1_1	2.552	0.19	0.25	5.3	0.26	9
GWW1_2	GWW1_2	1.043	0.20	0.25	5.2	0.28	2
GWW131	GWW131	0.774	0.20	0.25	5.4	0.23	3
GWW132	GWW132	0.347	0.20	0.25	5.3	0.26	1
GWW133	GWW133	0.397	0.18	0.25	5.8	0.22	12
GWW1_4	GWW1_4	1.004	0.20	0.25	5.8	0.20	1
GWW1_5	GWW1_5	0.983	0.16	0.23	6.2	0.19	24
GWW1_6	GWW1_6	0.593	0.20	0.25	5.3	0.24	0
GVW1	GVW1	4.905	0.20	0.17	6.8	0.13	17
GVW2	GVW2	6.023	0.20	0.23	6.2	0.18	12
GVW3_1	GVW3_1	1.043	0.20	0.25	5.2	0.26	0
GVW3_2	GVW3_2	0.972	0.20	0.25	5.3	0.24	0
GVW3_3	GVW3_3	0.341	0.20	0.25	6.0	0.19	2
Andora Hills Wash (source GVSCE, 1996)							
AHW1	S320	0.417*	0.16*	0.26*	6.00*	0.19*	23*
AHW4	S330	0.164	0.14	0.16	8.00	0.08	36
AHW3	S340L	0.278*	0.18*	0.33*	6.20*	0.18*	14*
AHW2	S340R	0.065	0.13	0.19	6.60	0.14	43
AHW5	S350	0.161	0.16	0.28	6.00	0.18	23
AHW6	S360	0.578	0.18	0.32	6.40	0.16	15
AHW7	S370	0.341	0.11	0.21	7.00	0.11	49
AHW8	S380	0.415	0.18	0.21	7.00	0.12	15
AHW9	S390	0.347	0.15	0.28	6.60	0.15	15
* Revised from original GVSCE study based on boundary change.							

2.2.4 Unit Hydrographs

2.2.4.1 Andora Hills Wash

The MCUHP1 program was used to compute new Tc and R values and develop HEC-1 KK blocks for subbasins AHW1 and AHW3 for the 100-year models. Maximum and minimum basin elevations and concentration path lengths did not change from the original GVSCE model (Table 2). Input for the rainfall loss parameters was modified from the original values to reflect the change in subbasin boundaries.

Table 2. Existing Condtion Time of Concentration Parameters for Andora Hills Wash							
Subbasin ID	HEC-1 ID	Tc Path miles	Slope Ft/mile	Adjusted Slope ft/mile	Kb	Surface Roughness Type*	Time-Area Relation
AHW1	S320	0.9470	201	201	0.05	B	Default
AHW4	S330	1.2121	111	111	0.04	A/B	Urban
AHW3	S340L	0.9659	999	350	0.10	C	Default
AHW2	S340R	0.6439	217	217	0.06	B	Urban
AHW5	S350	0.6629	219	219	0.08	A/B	Default
AHW6	S360	1.5909	141	141	0.09	C	Default
AHW7	S370	1.4962	137	137	0.04	A/B	Urban
AHW8	S380	0.9848	584	317	0.04	A/B	Urban
AHW9	S390	1.5152	158	158	0.04	AB	Urban
*See GVSCE (1997) for computation of intermediate Kb types.							

The MCUHP1 program was also used to compute Tc and R values and develop HEC-1 KK blocks for all Andora Hills Wash subbasins for the two 10-year models. Input for the rainfall loss parameters were identical to the values used for the 100-year models, including the revised subbasins. Table 3 summarizes the Clark method time of concentration results for all subbasins for Andora Hills Wash.

Table 3. Existing Condition Tc and R Values for Andora Hills Wash									
		10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr	
Subbasin ID	HEC-1 ID	Tc hrs	R hrs	Tc hrs	R hrs	Tc Hrs	R hrs	Tc hrs	R Hrs
AHW1	S320	0.287	0.146	.300	.153	0.233*	0.116*	0.242*	0.121*
AHW4	S330	0.350	0.377	.363	.392	0.275	0.288	0.321	0.342
AHW3	S340L	0.387	0.261	.396	.267	0.296*	0.193*	0.313*	0.205*
AHW2	S340R	0.237	0.251	.250	.265	0.196	0.201	0.233	0.244
AHW5	S350	0.300	0.198	.313	.207	0.238	0.152	0.279	0.182
AHW6	S360	0.783	0.559	.771	.549	0.550	0.377	0.550	0.377
AHW7	S370	0.371	0.314	.383	.325	0.292	0.241	0.333	0.279
AHW8	S380	0.217	0.111	.225	.115	0.179	0.089	0.213	0.108
AHW9	S390	0.371	0.314	.383	.325	0.283	0.233	0.329	0.275
* Revised from original GVSCE study based on boundary change									

2.2.4.2 Galloway Wash

The unit hydrograph parameters (Table 4) in the Galloway Wash model were not altered from their original form as established by JEF in *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14). It was assumed that Kn values for the 100-year and 10-year storms were similar. The computation interval also remained the same. Therefore, the lag time estimates and unit hydrographs did not require modification. Table 4 summarizes the lag time and S-graph parameters for Galloway Wash for all four models.

Table 4. Existing Condition Lag Parameters for Galloway Wash						
Subbasin	S-Graph Type	Kn	L Miles	Lca Miles	Slope ft/mile	Lag Minutes
GWW1_1	Desert/Rangeland	0.039	4.64	2.04	196.1	48.4
GWW1_2	Desert/Rangeland	0.039	3.88	1.87	164.9	45.2
GWW131	Desert/Rangeland	0.040	2.58	1.28	158.9	34.6
GWW132	Desert/Rangeland	0.039	1.56	0.70	141.0	22.7
GWW133	Desert/Rangeland	0.037	1.59	0.90	157.2	23.4
GWW1_4	Desert/Rangeland	0.040	3.64	2.11	274.7	43.0
GWW1_5	Desert/Rangeland	0.034	3.57	1.89	112.6	41.2
GWW1_6	Desert/Rangeland	0.039	2.61	1.31	164.8	34.8
GVW1	Mountain	0.045	6.19	3.56	298.9	71.1
GVW2	Mountain	0.043	5.51	2.77	371.1	56.7
GVW3_1	Desert/Rangeland	0.043	3.31	1.51	184.3	42.3
GVW3_2	Desert/Rangeland	0.043	2.42	1.26	144.6	36.8
GVW3_3	Desert/Rangeland	0.040	1.88	0.95	135.6	28.2

2.2.5 Hydrograph Combinations

The combination of hydrographs in the Andora Hills Wash model was altered to incorporate an additional concentration point to further divide the combination of subbasins AHW1, AHW2, AHW3, and AHW4. In the original model the discharges from the four subbasins were combined at a single concentration point. The revised model combines AHW1, AHW2, and AHW 3 prior to combining with the discharge from AHW4.

The combination of hydrographs in the Galloway Wash model was also altered to provide for additional concentration points at the confluence of North Galloway Wash and Galloway Wash. These new combination points were CP286L (Galloway Wash just upstream of the North Galloway Wash confluence) and CP286R (North Galloway Wash just upstream of the Galloway Wash confluence). An additional concentration point, CP295A, was also added to provide peak discharges for Grapevine Wash at its confluence with Galloway Wash.

2.3 Existing Condition Peak Discharges at Road Crossings

Map 3 shows the location of road crossings within the Andora Hills and Galloway Wash watersheds. Peak discharges at each of these road crossings were determined in the following manner. The drainage area contributing to the road crossing was determined and compared to the total area of the subbasin or subbasins contributing to the nearest downstream concentration point. The ratio of the area at the road crossing to the area at the downstream concentration point was applied to the peak discharge at the downstream concentration point in the HEC-1 model to calculate the peak discharge at the road crossing.

In one instance, peak discharge was determined by using the nearest upstream concentration point. In this cases the peak discharge at the road crossing was greater than 100 percent of the upstream concentration point, due to the drainage area contributing to the road crossing being larger than the modeled subbasin. This technique was used when the downstream concentration

point included discharge from subbasins that did not affect the discharge at the road crossing. Specifically this situation occurred in the Galloway Wash model for estimation of the discharge at N. Tranquil Trail.

The results of these calculations for each crossing are presented in Table 5.

2.4 Problems encountered

The original subbasin delineations for the Andora Hills watershed from GVSCE were made available by the FCDMC in digital format. However, the subbasin boundaries do not match exactly the digital base maps (USGS digital quarter quads and 2001 digital orthophotos) provided by the FCDMC. JEF adjusted the basin boundaries to match the base data in the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14). The subsequent divisions of the Andora Hills subbasins for the calculation of road crossing discharges were based on the USGS digital quarter quads and 2001 orthophotographs provided by the FCDMC. The subbasin boundary offsets are approximately 70 feet to the east and 100 feet to the south. This offset potentially results in slight errors in the peak discharges at road crossings internal to the Andora Hills Wash subbasins. The errors are considered negligible for planning purposes.

2.5 Future Conditions

Future conditions hydrologic models were created for Andora Hills and Galloway Washes for the 100-year 6-hour, 100-year 24-hour, 10-year 6-hour, and 10-year 24-hour storms. Rainfall parameters for all future conditions models remained the same as in the existing condition models. Similarly, the drainage basin boundaries and soil parameters remained the same.

Future land use conditions for the Andora Hills and Galloway Washes subbasins were derived from examination of data provided in the *Upper Cave Creek-Apache Wash WCMP* (TetraTech, 2001).

Future land use for the Andora Hills Wash subbasins, with comparison to the existing land use, is presented in Table C.1 in Appendix C. Hydrologic parameters for each land use category in Andora Hills Wash were taken from the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (FCD 95-28).

For Galloway Wash, existing vacant land use areas shown in the digital land use maps developed for the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (JEF 2001) were compared to the built-out land use map shown in the *Upper Cave Creek-Apache Wash WCMP* (TetraTech, 2001). Vacant areas were assigned the appropriate future land use to based on comparison with Exhibit B from the TetraTech (2001) report. Future land use for the subbasins in the Galloway Wash watersheds, with comparison to the existing land use, is presented in Table C.2 in Appendix C. Hydrologic parameters for each land use category in Galloway Wash were taken from the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (JEF 2001). A High Density Residential (HDR) land use category was added for Galloway Wash for

Map 3: C efree DMP
Road Crossings

1:24000

2000 0 2000

Feet

N

- Road Crossings
- Subbasin Boundary
- Road Crossings
- Watercourses
- Town of Carefree

JE FULLER
HYDROLOGY & GEOMORPHOLOGY INC

November, 2001, revised October 2002

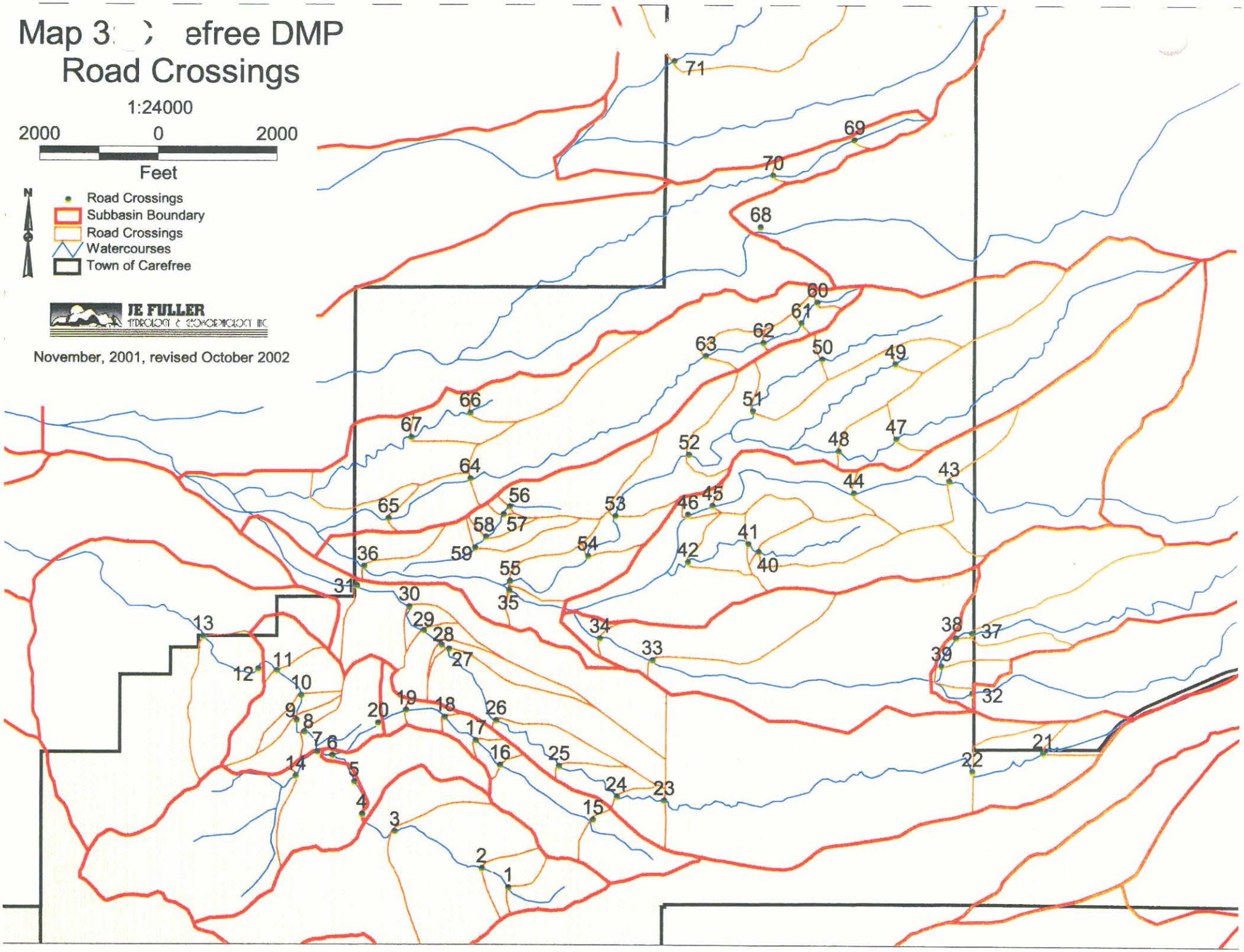


Table 5. Existing Condition Peak Discharges at Road Crossings, Galloway and Andora Hills Washes										
ROAD CROSSING						Drainage Area	EXISTING CONDITIONS PEAK DISCHARGES (CFS)			
ID Number	Road	Surface	Width	Crossing	Wash	(sq. miles)	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
1	N. Sidewinder Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.04	61	48	109	71
2	E. Long Rifle Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.06	100	79	179	116
3	E. Long Rifle Rd. & N. Long Rifle Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.21	355	281	638	412
4	N. Tom Darlington Dr.	paved	4-lane d	culvert?	Tributary 1 to Andora Hills Wash	0.42	698	553	1255	811
5	E. Bivouc Tr.	paved	2-lane	dip?	Tributary 1 to Andora Hills Wash	0.42	698	553	1255	811
6	E. Bivouac Tr.	paved	2-lane	dip	Andora Hills Wash	0.65	900	759	1630	1163
7	E. Carefree Dr.	paved	2-lane	culvert?	Andora Hills Wash	0.92	1096	1020	2048	1625
8	N. Lazy Burro Rd.	paved	2-lane	dip	Andora Hills Wash	0.97	1153	1073	2154	1710
9	N. Lazy Burro Rd.	paved	2-lane	dip	Andora Hills Wash	0.99	1183	1101	2210	1753
10	N. Holiday Ln.	paved	2-lane	dip	Andora Hills Wash	1.01	1198	1115	2238	1776
11	N. Terrace	paved	2-lane	culvert	Andora Hills Wash	1.06	1257	1170	2349	1864
12	N. Piedra Grande Dr.	paved	2-lane	dip	Andora Hills Wash	1.09	1201	1138	2240	1862
13	private drive	dirt	1-lane	dip	Andora Hills Wash	1.17	1286	1219	2399	1994
14	N. Never Mind Tr.	paved	2-lane	dip	Tributary 2 to Andora Hills Wash	0.21	243	198	497	346
15	E. Long Rifle Rd.	paved	2-lane	culvert?	Andora Hills Wash	0.05	62	49	113	77
16	E. Nonchalant Av.	paved	2-lane	dip	Andora Hills Wash	0.11	148	118	272	183
17	N. Bloody Basin Rd. & E. Nonchalant Av.	paved	2-lane	culvert?	Andora Hills Wash	0.12	163	129	298	201
18	E. Elbow Bend	paved	2-lane	dip?	Andora Hills Wash	0.14	180	143	329	222
19	E. Carefree Dr.	paved	2-lane	dip?	Andora Hills Wash	0.15	195	154	357	241
20	N. Tom Darlington Dr.	paved	4-lane d	dip?	Andora Hills Wash	0.16	212	168	388	262
21	E. Northview Ln	paved	2-lane	dip	South Trib to Galloway Wash	0.02	19	18	32	30
22	N. Pima Rd.	paved	2-lane	dip?	South Trib to Galloway Wash	0.10	78	72	131	122
23	N. Mule Train Rd.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.54	438	404	736	688
24	E. Long Rifle Rd.	paved	2-lane	dip	South Trib to Galloway Wash	0.56	457	422	768	718
25	E. Primrose Path	paved	2-lane	dip	South Trib to Galloway Wash	0.59	478	441	803	751
26	N. Tranquil Tr.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.62	507	467	851	796
27	E. Carefree Dr.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.72	591	545	992	928
28	private drive	paved	2-lane	?	South Trib to Galloway Wash	0.74	607	560	1020	954
29	E. Hum Rd.	paved	2-lane	dip?	South Trib to Galloway Wash	0.77	630	581	1058	990
30	E. Sundance Tr.	paved	2-lane	dip?	South Trib to Galloway Wash	0.78	640	590	1074	1005
31	N. Scopa Trail	paved	2-lane	dip	South Trib to Galloway Wash	0.94	766	707	1287	1204
32	N. Pima Rd.	paved	2-lane	dip	Galloway Wash	1.04	609	593	1155	1110
33	N. Carefree Dr.	paved	2-lane	dip	Galloway Wash	1.68	797	839	1612	1643
34	N. Dream St.	paved	2-lane	culvert	Galloway Wash	1.78	846	891	1712	1745
35	N. Tranquil Tr.	paved	2-lane	dip	Galloway Wash	5.14	1710	1997	3250	3460
36	N. Scopa Trail	paved	2-lane	dip	Galloway Wash	6.07	2012	2475	3931	4386
37	N. Pima Rd. & E. Double Eagle Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.19	226	190	391	335
38	E. Double Eagle Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.30	359	302	622	534
39	E. Carefree Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.32	390	328	676	579
40	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.05	42	39	75	70
41	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.15	127	116	226	209
42	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.18	150	138	267	247
43	E. Cow Track Dr.	paved	2-lane	dip	North Galloway Wash	2.87	1036	1136	2002	2094
44	N. Sombrero Rd.	paved	2-lane	dip	North Galloway Wash	2.95	1065	1168	2059	2153
45	E. Cow Track Dr.	paved	2-lane	dip	North Galloway Wash	3.02	1091	1195	2107	2204
46	E. Celestial St. & E. Paint Pony Dr.	paved	2-lane	dip	North Galloway Wash	3.03	1094	1199	2113	2210
47	N. Silver Saddle Dr. & E. Maverick Cir.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.25	167	158	301	287

Table 5. Existing Condition Peak Discharges at Road Crossings, Galloway and Andora Hills Washes										
ROAD CROSSING						Drainage Area	EXISTING CONDITIONS PEAK DISCHARGES (CFS)			
ID Number	*Road*	*Surface*	*Width*	*Crossing*	*Wash*	*(sq. miles)*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*
48	N. Sombrero Rd.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.28	190	180	343	326
49	N. Concho Ln.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.02	11	10	20	19
50	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.13	91	87	165	157
51	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.18	121	115	219	208
52	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.61	413	391	745	709
53	E. Rising Sun Rd.	paved	2-lane	culvert?	Trib 2 to Galloway Wash	0.68	461	437	831	791
54	E. Celestial St. & N. Dream St.	dirt	2-lane	dip	Trib 2 to Galloway Wash	0.70	478	453	862	820
55	N. Tranquil Tr.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.75	510	483	919	875
56	E. Horizon Dr.	paved	2-lane	dip?	Trib 3 to Galloway Wash	0.06	43	41	77	74
57	N. Rising Sun Rd.	paved	2-lane	culvert	Trib 3 to Galloway Wash	0.07	45	43	81	77
58	unnamed culdesac	paved	2-lane	dip	Trib 3 to Galloway Wash	0.08	53	50	96	91
59	unnamed culdesac	paved	2-lane	dip	Trib 3 to Galloway Wash	0.10	65	61	117	111
60	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.01	7	6	13	11
61	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.02	16	14	28	25
62	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.03	24	21	43	38
63	N. Spanish Boot Rd.	paved	2 lane	dip	Trib 4 to Galloway Wash	0.05	40	35	71	63
64	N. Rising Sun Rd.	paved	2-lane	culvert	Trib 4 to Galloway Wash	0.29	246	215	439	388
65	E. Grapevine Rd.	paved	2-lane	dip	Trib 4 to Galloway Wash	0.32	276	241	493	436
66	N. Rising Sun Rd.	paved	2-lane	dip	Trib 5 to Galloway Wash	0.05	42	37	76	67
67	W. Rising Star Wy.	paved	2-lane	culvert?	Trib 5 to Galloway Wash	0.08	70	61	125	111
68	N. Father Kino Tr.	dirt	2 lane	dip	Grapevine Wash	6.02	2564	3256	4686	5492
69	N. Father Kino Tr.	dirt	2 lane	dip	Tributary to Grapevine Wash	0.02	10	9	18	18
70	E. Montezuma Rd.	dirt	2 lane	dip	Tributary to Grapevine Wash	0.04	24	23	45	44
71	unnamed road	dirt	2-lane	dip	Tributary to Rowe Wash	0.79	354	406	604	667

the future condition. The hydrologic parameters for the HDR category were taken from the *Cave Creek Above Carefree Highway Floodplain Delineation Study* (GVSCE, 1997).

Hydrologic parameters for the Green & Ampt method were recomputed for each subbasin using the same methods as in the original studies. Table 6 summarizes the future conditions LG record parameters for Andora Hills and Galloway Washes.

Table 6. Summary of basin area and Green and Ampt method HEC-1 input parameters Future Condition

Subbasin ID	HEC-1 ID	Area sq. mi.	IA Inches	DTHETA	PSIF inches	XKSAT in/hr	RTIMP %
Galloway Wash							
GWW1_1	GWW1_1	2.552	0.19	0.25	5.3	0.26	10
GWW1_2	GWW1_2	1.043	0.19	0.25	5.2	0.28	9
GWW131	GWW131	0.774	0.20	0.25	5.4	0.23	3
GWW132	GWW132	0.347	0.20	0.25	5.3	0.26	1
GWW133	GWW133	0.397	0.18	0.25	5.8	0.22	12
GWW1_4	GWW1_4	1.004	0.20	0.25	5.8	0.20	2
GWW1_5	GWW1_5	0.983	0.15	0.23	6.2	0.19	33
GWW1_6	GWW1_6	0.593	0.20	0.25	5.3	0.24	2
GVW1	GVW1	4.905	0.20	0.17	6.8	0.13	18
GVW2	GVW2	6.023	0.17	0.23	6.2	0.17	26
GVW3_1	GVW3_1	1.043	0.20	0.25	5.2	0.26	0
GVW3_2	GVW3_2	0.972	0.20	0.25	5.3	0.24	0
GVW3_3	GVW3_3	0.341	0.20	0.25	6.0	0.19	2
Andora Hills Wash							
AHW1	S320	0.417*	0.16	0.25	6.00	0.19	24
AHW4	S330	0.164	0.14	0.15	8.00	0.08	39
AHW3	S340L	0.278*	0.17	0.27	6.20	0.17	20
AHW2	S340R	0.065	0.13	0.19	6.60	0.14	43
AHW5	S350	0.161	0.16	0.25	6.00	0.18	28
AHW6	S360	0.578	0.16	0.24	6.40	0.16	23
AHW7	S370	0.341	0.10	0.15	7.00	0.11	61
AHW8	S380	0.415	0.18	0.16	7.00	0.13	16
AHW9	S390	0.347	0.16	0.19	6.60	0.15	26

* Revised from original GVSCE study based on boundary change.

Since the Clark unit hydrograph method was used in the original Andora Hills Wash modeling, Tc and R were recomputed with MCUHP1 using the future conditions LG parameters. Table 7 shows the future condition Kb values. The future condition Tc and R values for the four storms for Andora Hills Wash are summarized in Table 8.

Table 7. Future Condition Time of Concentration Parameters for Andora Hills Wash

Subbasin ID	HEC-1 ID	Tc Path miles	Slope Ft/mile	Adjusted Slope ft/mile	Kb	Surface Roughness Type*	Time-Area Relation
AHW1	S320	0.9470	201	201	0.05	B	Default
AHW4	S330	1.2121	111	111	0.04	A/B	Urban
AHW3	S340L	0.9659	999	350	0.07	B/C	Default
AHW2	S340R	0.6439	217	217	0.06	B	Urban
AHW5	S350	0.6629	219	219	0.05	B	Urban
AHW6	S360	1.5909	141	141	0.04	B	Default
AHW7	S370	1.4962	137	137	0.04	A/B	Urban
AHW8	S380	0.9848	584	317	0.04	A/B	Urban
AHW9	S390	1.5152	158	158	0.04	AB	Urban

*See GVSCE (1997) for computation of intermediate Kb types.

Table 8. Future Condition Tc and R Values for Andora Hills Wash

		10-yr 6-hr		10-yr 24-hr		100-yr 6-hr		100-yr 24-hr	
Subbasin ID	HEC-1 ID	Tc Hrs	R hrs	Tc hrs	R hrs	Tc hrs	R hrs	Tc Hrs	R hrs
AHW1	S320	.283	.144	.296	.151	.233	.116	.242	.121
AHW4	S330	.350	.377	.363	.392	.283	.298	.300	.318
AHW3	S340L	.292	.190	.304	.199	.233	.148	.246	.157
AHW2	S340R	.237	.251	.250	.265	.204	.212	.213	.221
AHW5	S350	.225	.144	.233	.150	.188	.118	.196	.123
AHW6	S360	.408	.271	.408	.271	.321	.208	.333	.217
AHW7	S370	.367	.310	.379	.321	.296	.244	.317	.263
AHW8	S380	.217	.111	.225	.115	.183	.092	.192	.096
AHW9	S390	.363	.306	.375	.317	.287	.236	.304	.252

For Galloway Wash, lag time calculations were recomputed based on changes to basin average Kn (basin roughness) resulting from the change to future conditions land use. The future conditions Kn and lag times for Galloway Wash are summarized in Table 9.

Table 9. Future Condition Lag Parameters for Galloway Wash						
Subbasin	S-Graph Type	Kn	L miles	Lca Miles	Slope ft/mile	Lag Minutes
GWW1_1	Desert/Rangeland	0.038	4.64	2.04	196.1	47.2
GWW1_2	Desert/Rangeland	0.036	3.88	1.87	164.9	41.7
GWW131	Desert/Rangeland	0.040	2.58	1.28	158.9	34.6
GWW132	Desert/Rangeland	0.039	1.56	0.70	141.0	22.7
GWW133	Desert/Rangeland	0.037	1.59	0.90	157.2	23.4
GWW1_4	Desert/Rangeland	0.040	3.64	2.11	274.7	43.0
GWW1_5	Desert/Rangeland	0.030	3.57	1.89	112.6	36.4
GWW1_6	Desert/Rangeland	0.040	2.61	1.31	164.8	34.8
GVW1	Mountain	0.043	6.19	3.56	298.9	67.9
GVW2	Mountain	0.037	5.51	2.77	371.1	48.8
GVW3_1	Desert/Rangeland	0.040	3.31	1.51	184.3	39.4
GVW3_2	Desert/Rangeland	0.041	2.42	1.26	144.6	35.0
GVW3_3	Desert/Rangeland	0.039	1.88	0.95	135.6	27.5

No retention was considered for modeling of the future conditions due to the nature of development, undulating topography, and a desire to make conservative hydrologic assumptions about the future condition in the area. This assumption is considered appropriate to a planning level study.

2.6 Future Condition Peak Discharges at Road Crossings

The results of the future condition calculations for peak discharge at road crossings in the area are presented in Table 10. Again, the locations of each crossing are shown on Map 3.

3. Comparison of Existing and Future Condition Peak Discharges

Table 11 shows a comparison of the existing and future condition peak discharges at the road crossing locations for the four modeled storms. In general, at most of the road crossings in the Town of Carefree the peak discharges for the future condition are similar to or slightly greater than the existing condition. Differences are greater for the 10-year events as compared to the 100-year events. The larges differences are in subbasin AHW3 at N. Never Trail (ID# 14), crossings within GWW1_5 (ID's 21-31), along Galloway Wash between CP284 and CP286L (ID's 32-34, and CP280 (ID 68). Effective impervious area (RTIMP) increases in AHW3 from 14 to 20 percent in the future condition. In GWW1_5, RTIMP increases from 24 to 33 as the result of built-out conditions.

For crossings in one basin (AHW4, ID's 15-20), future discharges for the 100-year 6-hour show a slight decrease. Examination of the Tc and R values show that the original GVSCE (1997) model had slightly smaller Tc and R values than those computed with MCUHP1 for the future condition. A separate MCUHP1 analysis was run using the original parameters as reported in the HEC-1 model for AHW4 for the GVSCE existing condition and the current study's future condition. The result was identical Tc and R values for each condition. The only differences in

Table 10. Future Condtions Peak Discharges at Road Crossings, Galloway and Andora Hills Washes										
ROAD CROSSING						Drainage Area	FUTURE CONDITIONS PEAK DISCHARGES (CFS)			
ID Number	Road	Surface	Width	Crossing	Wash	(sq. miles)	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
1	N. Sidewinder Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.04	62	49	109	71
2	E. Long Rifle Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.06	101	80	180	116
3	E. Long Rifle Rd. & N. Long Rifle Rd.	paved	2-lane	dip	Tributary 1 to Andora Hills Wash	0.21	360	285	639	414
4	N. Tom Darlington Dr.	paved	4-lane d	culvert?	Tributary 1 to Andora Hills Wash	0.42	708	561	1258	814
5	E. Bivouc Tr.	paved	2-lane	dip?	Tributary 1 to Andora Hills Wash	0.42	708	561	1258	814
6	E. Bivouac Tr.	paved	2-lane	dip	Andora Hills Wash	0.65	909	767	1626	1180
7	E. Carefree Dr.	paved	2-lane	culvert?	Andora Hills Wash	0.92	1187	1097	2135	1695
8	N. Lazy Burro Rd.	paved	2-lane	dip	Andora Hills Wash	0.97	1249	1154	2246	1783
9	N. Lazy Burro Rd.	paved	2-lane	dip	Andora Hills Wash	0.99	1281	1184	2304	1829
10	N. Holiday Ln.	paved	2-lane	dip	Andora Hills Wash	1.01	1297	1199	2334	1853
11	N. Terrace	paved	2-lane	culvert	Andora Hills Wash	1.06	1361	1258	2449	1944
12	N. Piedra Grande Dr.	paved	2-lane	dip	Andora Hills Wash	1.09	1269	1191	2293	1938
13	private drive	dirt	1-lane	dip	Andora Hills Wash	1.17	1359	1276	2456	2076
14	N. Never Mind Tr.	paved	2-lane	dip	Tributary 2 to Andora Hills Wash	0.21	315	251	583	388
15	E. Long Rifle Rd.	paved	2-lane	culvert?	Andora Hills Wash	0.05	62	49	112	79
16	E. Nonchalant Av.	paved	2-lane	dip	Andora Hills Wash	0.11	150	118	267	190
17	N. Bloody Basin Rd. & E. Nonchalant Av.	paved	2-lane	culvert?	Andora Hills Wash	0.12	165	130	294	208
18	E. Elbow Bend	paved	2-lane	dip?	Andora Hills Wash	0.14	182	143	324	230
19	E. Carefree Dr.	paved	2-lane	dip?	Andora Hills Wash	0.15	197	155	351	249
20	N. Tom Darlington Dr.	paved	4-lane d	dip?	Andora Hills Wash	0.16	214	169	382	271
21	E. Northview Ln	paved	2-lane	dip	South Trib to Galloway Wash	0.02	22	20	36	34
22	N. Pima Rd.	paved	2-lane	dip?	South Trib to Galloway Wash	0.10	89	81	145	136
23	N. Mule Train Rd.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.54	500	458	819	766
24	E. Long Rifle Rd.	paved	2-lane	dip	South Trib to Galloway Wash	0.56	522	478	855	799
25	E. Primrose Path	paved	2-lane	dip	South Trib to Galloway Wash	0.59	546	500	894	836
26	N. Tranquil Tr.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.62	578	529	947	886
27	E. Carefree Dr.	paved	2-lane	culvert?	South Trib to Galloway Wash	0.72	674	617	1104	1032
28	private drive	paved	2-lane	?	South Trib to Galloway Wash	0.74	693	635	1135	1062
29	E. Hum Rd.	paved	2-lane	dip?	South Trib to Galloway Wash	0.77	719	658	1178	1101
30	E. Sundance Tr.	paved	2-lane	dip?	South Trib to Galloway Wash	0.78	730	668	1196	1118
31	N. Scopa Trail	paved	2-lane	dip	South Trib to Galloway Wash	0.94	875	801	1432	1340
32	N. Pima Rd.	paved	2-lane	dip	Galloway Wash	1.04	688	660	1259	1206
33	N. Carefree Dr.	paved	2-lane	dip	Galloway Wash	1.68	888	931	1724	1783
34	N. Dream St.	paved	2-lane	culvert	Galloway Wash	1.78	943	988	1830	1893
35	N. Tranquil Tr.	paved	2-lane	dip	Galloway Wash	5.14	1806	2112	3383	3635
36	N. Scopa Trail	paved	2-lane	dip	Galloway Wash	6.07	2116	2599	4074	4560
37	N. Pima Rd. & E. Double Eagle Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.19	226	190	391	335
38	E. Double Eagle Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.30	359	302	622	534
39	E. Carefree Dr.	paved	2-lane	dip	Trib 1 to Galloway Wash	0.32	390	328	676	579
40	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.05	42	39	75	70
41	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.15	127	116	226	209
42	E. Paint Pony Dr.	paved	2-lane	dip	Tributary to North Galloway Wash	0.18	150	138	267	247
43	E. Cow Track Dr.	paved	2-lane	dip	North Galloway Wash	2.87	1060	1158	2040	2126
44	N. Sombrero Rd.	paved	2-lane	dip	North Galloway Wash	2.95	1090	1191	2097	2186
45	E. Cow Track Dr.	paved	2-lane	dip	North Galloway Wash	3.02	1116	1219	2147	2237
46	E. Celestial St. & E. Paint Pony Dr.	paved	2-lane	dip	North Galloway Wash	3.03	1119	1222	2153	2244
47	N. Silver Saddle Dr. & E. Maverick Cir.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.25	168	159	302	287
48	N. Sombrero Rd.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.28	191	181	344	327

Table 10. Future Condtions Peak Discharges at Road Crossings, Galloway and Andora Hills Washes										
ROAD CROSSING						Drainage Area	FUTURE CONDITIONS PEAK DISCHARGES (CFS)			
ID Number	*Road*	*Surface*	*Width*	*Crossing*	*Wash*	*(sq. miles)*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*
49	N. Concho Ln.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.02	11	10	20	19
50	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.13	92	87	165	157
51	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.18	122	116	219	209
52	E. Golden Spur Ln.	paved	2 lane	dip	Trib 2 to Galloway Wash	0.61	416	393	747	711
53	E. Rising Sun Rd.	paved	2-lane	culvert?	Trib 2 to Galloway Wash	0.68	464	439	834	793
54	E. Celestial St. & N. Dream St.	dirt	2-lane	dip	Trib 2 to Galloway Wash	0.70	481	455	864	822
55	N. Tranquil Tr.	paved	2-lane	dip	Trib 2 to Galloway Wash	0.75	513	485	922	877
56	E. Horizon Dr.	paved	2-lane	dip?	Trib 3 to Galloway Wash	0.06	43	41	78	74
57	N. Rising Sun Rd.	paved	2-lane	culvert	Trib 3 to Galloway Wash	0.07	45	43	81	77
58	unnamed culdesac	paved	2-lane	dip	Trib 3 to Galloway Wash	0.08	54	51	96	91
59	unnamed culdesac	paved	2-lane	dip	Trib 3 to Galloway Wash	0.10	65	62	117	111
60	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.01	7	6	13	11
61	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.02	16	14	28	25
62	private drive	dirt	1-lane	dip	Trib 4 to Galloway Wash	0.03	24	21	43	38
63	N. Spanish Boot Rd.	paved	2 lane	dip	Trib 4 to Galloway Wash	0.05	40	35	72	63
64	N. Rising Sun Rd.	paved	2-lane	culvert	Trib 4 to Galloway Wash	0.29	249	217	442	390
65	E. Grapevine Rd.	paved	2-lane	dip	Trib 4 to Galloway Wash	0.32	279	243	496	437
66	N. Rising Sun Rd.	paved	2-lane	dip	Trib 5 to Galloway Wash	0.05	43	37	76	67
67	W. Rising Star Wy.	paved	2-lane	culvert?	Trib 5 to Galloway Wash	0.08	71	62	126	111
68	N. Father Kino Tr.	dirt	2 lane	dip	Grapevine Wash	6.02	3164	3937	5447	6408
69	N. Father Kino Tr.	dirt	2 lane	dip	Tributary to Grapevine Wash	0.02	10	10	19	19
70	E. Montezuma Rd.	dirt	2 lane	dip	Tributary to Grapevine Wash	0.04	26	25	48	46
71	unnamed road	dirt	2-lane	dip	Tributary to Rowe Wash	0.79	365	416	621	683

Table 11. Comparison of Existing and Future Peak Discharges at Roadway Crossings															
											(Future - Existing) / Existing				
		Drainage Area	EXISTING CONDITIONS PEAK DISCHARGES (CFS)				FUTURE CONDITIONS PEAK DISCHARGES (CFS)				% diff	% diff	% diff	% diff
ID Number	Road	(sq. miles)	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
1	N. Sidewinder Rd.	0.04	61	48	109	71	62	49	109	71	1	2	0	0
2	E. Long Rifle Rd.	0.06	100	79	179	116	101	80	180	116	1	2	0	0
3	E. Long Rifle Rd. & N. Long Rifle Rd.	0.21	355	281	638	412	360	285	639	414	1	1	0	0
4	N. Tom Darlington Dr.	0.42	698	553	1255	811	708	561	1258	814	1	1	0	0
5	E. Bivouc Tr.	0.42	698	553	1255	811	708	561	1258	814	1	1	0	0
6	E. Bivouac Tr.	0.65	900	759	1630	1163	909	767	1626	1180	1	1	0	1
7	E. Carefree Dr.	0.92	1096	1020	2048	1625	1187	1097	2135	1695	8	8	4	4
8	N. Lazy Burro Rd.	0.97	1153	1073	2154	1710	1249	1154	2246	1783	8	8	4	4
9	N. Lazy Burro Rd.	0.99	1183	1101	2210	1753	1281	1184	2304	1829	8	8	4	4
10	N. Holiday Ln.	1.01	1198	1115	2238	1776	1297	1199	2334	1853	8	8	4	4
11	N. Terrace	1.06	1257	1170	2349	1864	1361	1258	2449	1944	8	8	4	4
12	N. Piedra Grande Dr.	1.09	1201	1138	2240	1862	1269	1191	2293	1938	6	5	2	4
13	private drive	1.17	1286	1219	2399	1994	1359	1276	2456	2076	6	5	2	4
14	N. Never Mind Tr.	0.21	243	198	497	346	315	251	583	388	30	27	17	12
15	E. Long Rifle Rd.	0.05	62	49	113	77	62	49	112	79	1	1	-1	3
16	E. Nonchalant Av.	0.11	148	118	272	183	150	118	267	190	1	0	-2	4
17	N. Bloody Basin Rd. & E. Nonchalant Av.	0.12	163	129	298	201	165	130	294	208	1	1	-1	4
18	E. Elbow Bend	0.14	180	143	329	222	182	143	324	230	1	0	-1	4
19	E. Carefree Dr.	0.15	195	154	357	241	197	155	351	249	1	1	-2	3
20	N. Tom Darlington Dr.	0.16	212	168	388	262	214	169	382	271	1	1	-2	3
21	E. Northview Ln	0.02	19	18	32	30	22	20	36	34	16	11	13	13
22	N. Pima Rd.	0.10	78	72	131	122	89	81	145	136	14	13	11	11
23	N. Mule Train Rd.	0.54	438	404	736	688	500	458	819	766	14	13	11	11
24	E. Long Rifle Rd.	0.56	457	422	768	718	522	478	855	799	14	13	11	11
25	E. Primrose Path	0.59	478	441	803	751	546	500	894	836	14	13	11	11
26	N. Tranquil Tr.	0.62	507	467	851	796	578	529	947	886	14	13	11	11
27	E. Carefree Dr.	0.72	591	545	992	928	674	617	1104	1032	14	13	11	11
28	private drive	0.74	607	560	1020	954	693	635	1135	1062	14	13	11	11
29	E. Hum Rd.	0.77	630	581	1058	990	719	658	1178	1101	14	13	11	11
30	E. Sundance Tr.	0.78	640	590	1074	1005	730	668	1196	1118	14	13	11	11
31	N. Scopa Trail	0.94	766	707	1287	1204	875	801	1432	1340	14	13	11	11
32	N. Pima Rd.	1.04	609	593	1155	1110	688	660	1259	1206	13	11	9	9
33	N. Carefree Dr.	1.72	797	839	1612	1643	888	931	1724	1783	11	11	7	9
34	N. Dream St.	1.83	846	891	1712	1745	943	988	1830	1893	11	11	7	8
35	N. Tranquil Tr.	5.14	1710	1997	3250	3460	1806	2112	3383	3635	6	6	4	5
36	N. Scopa Trail	6.07	2012	2475	3931	4386	2116	2599	4074	4560	5	5	4	4
37	N. Pima Rd. & E. Double Eagle Dr.	0.19	226	190	391	335	226	190	391	335	0	0	0	0
38	E. Double Eagle Dr.	0.30	359	302	622	534	359	302	622	534	0	0	0	0
39	E. Carefree Dr.	0.33	390	328	676	579	390	328	676	579	0	0	0	0
40	E. Paint Pony Dr.	0.07	42	39	75	70	42	39	75	70	0	0	0	0
41	E. Paint Pony Dr.	0.09	127	116	226	209	127	116	226	209	0	0	0	0
42	E. Paint Pony Dr.	0.12	150	138	267	247	150	138	267	247	0	0	0	0
43	E. Cow Track Dr.	3.23	1036	1136	2002	2094	1060	1158	2040	2126	2	2	2	2
44	N. Sombrero Rd.	3.42	1065	1168	2059	2153	1090	1191	2097	2186	2	2	2	2
45	E. Cow Track Dr.	3.58	1091	1195	2107	2204	1116	1219	2147	2237	2	2	2	1
46	E. Celestial St. & E. Paint Pony Dr.	3.60	1094	1199	2113	2210	1119	1222	2153	2244	2	2	2	2
47	N. Silver Saddle Dr. & E. Maverick Cir.	0.25	167	158	301	287	168	159	302	287	1	1	0	0
48	N. Sombrero Rd.	0.28	190	180	343	326	191	181	344	327	1	1	0	0
49	N. Concho Ln.	0.02	11	10	20	19	11	10	20	19	0	0	0	0
50	E. Golden Spur Ln.	0.13	91	87	165	157	92	87	165	157	1	0	0	0
51	E. Golden Spur Ln.	0.18	121	115	219	208	122	116	219	209	1	1	0	0
52	E. Golden Spur Ln.	0.61	413	391	745	709	416	393	747	711	1	1	0	0
53	E. Rising Sun Rd.	0.68	461	437	831	791	464	439	834	793	1	0	0	0

Table 11. Comparison of Existing and Future Peak Discharges at Roadway Crossings															
											(Future - Existing) / Existing				
		Drainage Area	EXISTING CONDITIONS PEAK DISCHARGES (CFS)				FUTURE CONDITIONS PEAK DISCHARGES (CFS)				% diff	% diff	% diff	% diff
ID Number	*Road*	*(sq. miles)*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*
54	E. Celestial St. & N. Dream St.	0.70	478	453	862	820	481	455	864	822	1	0	0	0
55	N. Tranquil Tr.	0.75	510	483	919	875	513	485	922	877	1	0	0	0
56	E. Horizon Dr.	0.06	43	41	77	74	43	41	78	74	0	0	1	0
57	N. Rising Sun Rd.	0.07	45	43	81	77	45	43	81	77	0	0	0	0
58	unnamed culdesac	0.08	53	50	96	91	54	51	96	91	2	2	0	0
59	unnamed culdesac	0.10	65	61	117	111	65	62	117	111	0	2	0	0
60	private drive	0.01	7	6	13	11	7	6	13	11	0	0	0	0
61	private drive	0.02	16	14	28	25	16	14	28	25	0	0	0	0
62	private drive	0.03	24	21	43	38	24	21	43	38	0	0	0	0
63	N. Spanish Boot Rd.	0.05	40	35	71	63	40	35	72	63	0	0	1	0
64	N. Rising Sun Rd.	0.29	246	215	439	388	249	217	442	390	1	1	1	1
65	E. Grapevine Rd.	0.32	276	241	493	436	279	243	496	437	1	1	1	0
66	N. Rising Sun Rd.	0.05	42	37	76	67	43	37	76	67	2	0	0	0
67	W. Rising Star Wy.	0.08	70	61	125	111	71	62	126	111	1	2	1	0
68	N. Father Kino Tr.	6.02	2564	3256	4686	5492	3164	3937	5447	6408	23	21	16	17
69	N. Father Kino Tr.	0.02	10	9	18	18	10	10	19	19	0	11	6	6
70	E. Montezuma Rd.	0.04	24	23	45	44	26	25	48	46	8	9	7	5
71	unnamed road	0.79	354	406	604	667	365	416	621	683	3	2	3	2

parameters between the conditions is DTHETA = 0.16 vs. 0.15 and RTIMP = 36 vs. 39. The reason for the different Tc and R results in the GVSCE model is therefore not clear. Perhaps the precision of data input to MCUHP1 in the original study is the cause (e.g. Kb = 0.0355 vs. 0.04). Regardless the absolute differences are very small (1-2 %).

Table 12 shows a comparison of existing and future peak discharges at the outlets of Andora Hills and Galloway Washes at Cave Creek. The percent difference for the entire watersheds are greater for the 10-year storms than the 100-year events. Also, as compared to the results at the road crossings the cumulative differences are generally larger than in individual subbasins. That is, small differences throughout the watersheds lead to larger differences at their outlets. Table 12 also shows that the effects of full build out are greater in Andora Hills Wash than Galloway Wash. This is due in part to the total portion of the watersheds that will ultimately be developed as well as the nature of the development (i.e. density).

Table 12.
Existing vs. Future Condition Peak Discharge at Confluence with Cave Creek

KK ID	Wash Name	Condition	10-yr 6-hr (cfs)	10-yr 24-hr (cfs)	100-yr 6-hr (cfs)	100-yr 24-hr (cfs)
C390L	Andora Hills	Existing	1779	1870	3485	3635
		Future	2165	2388	3848	4175
CP310	Galloway	Existing	5698	7906	11341	13541
		Future	6496	8915	12296	14895
C390L	Andora Hills	% diff	21.7%	27.7%	10.4%	14.9%
CP310	Galloway	% diff	14.0%	12.8%	8.4%	10.0%

4. References

Camp, P.D., 1986, *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona*: U.S. Soil Conservation Service Report, 306 p., 53 maps, scale 1:24,000.

George V. Sabol Consulting Engineers (GVSCE). 1997. *Cave Creek Above Carefree Highway Floodplain Delineation Study, Technical Data Notebook, Existing Conditions.* Prepared for Flood Control District of Maricopa County, contract FCD 95-28. 2 volumes.

JE Fuller/ Hydrology & Geomorphology, Inc. (JEF). 2001. *Floodplain Delineation Study of Andora Hills and Galloway Washes, Technical Data Notebook.* Prepared for Flood Control District of Maricopa County, contract FCD 99-14. 2 volumes, as revised based on FEMA comments April 2002.

Tetra Tech, Inc. 2001. *Upper Cave Creek/Apache Wash Watercourse Master Plan, Attachment 3: Hydrology Report.* Prepared for Flood Control District of Maricopa County.

Appendix A

Precipitation Data

*** O U T P U T D A T A ***

REVISED JUNE 1988 TO UPDATE COMPUTATION OF SHORT-DURATION VALUES

PRECIPITATION FREQUENCY VALUES FOR Andora Hills Wash,
PRIMARY ZONE NUMBER= 7
SHORT-DURATION ZONE NUMBER= 8

POINT VALUES

RETURN PERIOD

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-MIN	.38	.45	.51	.59	.65	.72	.86	5-MIN
10-MIN	.56	.69	.77	.90	1.00	1.10	1.33	10-MIN
15-MIN	.68	.85	.97	1.14	1.28	1.41	1.72	15-MIN
30-MIN	.91	1.14	1.31	1.55	1.73	1.91	2.34	30-MIN
1-HR	1.10	1.41	1.62	1.92	2.16	2.39	2.93	1-HR
2-HR	1.24	1.60	1.84	2.19	2.47	2.74	3.36	2-HR
3-HR	1.33	1.72	1.99	2.37	2.67	2.97	3.65	3-HR
6-HR	1.50	1.96	2.27	2.71	3.06	3.40	4.19	6-HR
12-HR	1.70	2.26	2.64	3.17	3.59	4.00	4.95	12-HR
24-HR	1.90	2.56	3.01	3.63	4.12	4.60	5.71	24-HR

* IF YOUR SITE IS IN ARIZONA OR NEW MEXICO, PLEASE CONSULT THE FOLLOWING PAPER FOR REVISED DEPTH-AREA VALUES:
DEPTH-AREA RATIOS IN THE SEMI-ARID SOUTHWEST UNITED STATES
NOAA TECHNICAL MEMORANDUM NWS HYDRO-40
ZEHR AND MYERS
AUGUST 1984

INPUT DATA

PROJECT NAME=Andora Hills Wash,
ZONE= 7 SHORT-DURATION ZONE= 8
LATITUDE= .00 LONGITUDE= 100.00 ELEVATION= 0
2-YR, 6-HR PCPN= 1.50 100-YR, 6-HR PCPN= 3.40
2-YR, 24-HR PCPN= 1.90 100-YR, 24-HR PCPN= 4.60

* * * * E N D O F R U N * * * *

*** O U T P U T D A T A ***

REVISED JUNE 1988 TO UPDATE COMPUTATION OF SHORT-DURATION VALUES

PRECIPITATION FREQUENCY VALUES FOR Galloway Wash,
PRIMARY ZONE NUMBER= 7
SHORT-DURATION ZONE NUMBER= 8

POINT VALUES

RETURN PERIOD

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-MIN	.37	.45	.51	.59	.66	.73	.88	5-MIN
10-MIN	.55	.68	.78	.91	1.01	1.11	1.35	10-MIN
15-MIN	.67	.85	.98	1.15	1.29	1.43	1.75	15-MIN
30-MIN	.89	1.14	1.31	1.56	1.75	1.94	2.37	30-MIN
1-HR	1.09	1.41	1.63	1.94	2.18	2.42	2.98	1-HR
2-HR	1.26	1.63	1.88	2.23	2.51	2.79	3.43	2-HR
3-HR	1.38	1.77	2.05	2.43	2.74	3.03	3.73	3-HR
6-HR	1.60	2.05	2.37	2.81	3.16	3.50	4.29	6-HR
12-HR	1.90	2.44	2.81	3.33	3.74	4.15	5.09	12-HR
24-HR	2.20	2.82	3.25	3.86	4.33	4.80	5.89	24-HR

* IF YOUR SITE IS IN ARIZONA OR NEW MEXICO, PLEASE CONSULT THE FOLLOWING PAPER FOR REVISED DEPTH-AREA VALUES:
DEPTH-AREA RATIOS IN THE SEMI-ARID SOUTHWEST UNITED STATES
NOAA TECHNICAL MEMORANDUM NWS HYDRO-40
ZEHR AND MYERS
AUGUST 1984

INPUT DATA

PROJECT NAME= ,
ZONE= 7 SHORT-DURATION ZONE= 8
LATITUDE= .00 LONGITUDE= 100.00 ELEVATION= 0
2-YR, 6-HR PCPN= 1.60 100-YR, 6-HR PCPN= 3.50
2-YR, 24-HR PCPN= 2.20 100-YR, 24-HR PCPN= 4.80

* * * * E N D O F R U N * * * *

Appendix B

Hydrologic Parameters

Existing Condition

Table B.1

Soils, Vegetation Cover, and RTIMP for rainfall losses by Green & Ampt method for revised subbasins S320 (AHW1) and S340L (AHW3)

AHW1 (S320)	Soil Map Unit No.	12	61	63	72	93
	Sub-Area (acres)	3.8	171.6	33.3	19.5	38.4
	XKSAT (bare ground)	0.01	0.15	0.14	0.09	0.33
	RTIMP (rock)	0%	0%	10%	15%	0%
	XKSAT log avg (bare ground)	**0.15**				
	PSIF	**6.00** *				
	DTHETA (dry)	**0.40** *				
	DTHETA (normal)	**0.25** *				
	RTIMP avg	**2.35%**				
						Total Subbasin Area in sq. miles = 0.42
AHW3 (S340L)	Soil Map Unit No.	33	61	63	72	
	Sub-Area (acres)	6.9	47.8	108.2	15.0	
	XKSAT (bare ground)	0.23	0.15	0.14	0.09	
	RTIMP (rock)	0%	0%	10%	15%	
	XKSAT log avg (bare ground)	**0.14**				
	PSIF	**6.20** *				
	DTHETA (dry)	**0.39** *				
	DTHETA (normal)	**0.23** *				
	RTIMP avg	**7.35%**				
						Total Subbasin Area in sq. miles = 0.28

* referenced from Table A-1 in *Cave Creek Above Carefree Highway Floodplain Delineation Study FCD 95-28* (GVSCE, 1997)

Table B.2
Existing conditions land use characteristics for rainfall losses for revised subbasins S320 (AHW1) and S340L (AHW3)

AHW1 (S320)	Land Use ID	GC	LDR-25	MDR	N
	Natural or Developed	D	D	D	N
	Sub-Area (acres)	17.1	229.4	10.0	10.0
	RTIMP (Developed)	10%	25%	30%	---
	Veg Cover (Developed)	81%	30%	28%	---
	IA (developed)	0.19	0.16	0.16	---
	Natural Area	**3.8%**			
	Developed Area	**96.2%**			
	RTIMP (Dev.) avg.	**24.19%**			
	Veg Cover (Dev.) avg.	**33.32%**			
	IA (Dev.) avg.	**0.16**			

Total Subbasin Area in sq. miles = 0.42

AHW3 (S340L)	Land Use ID	LDR-25	N
	Natural or Developed	D	N
	Sub-Area (acres)	70.3	107.5
	RTIMP (Developed)	25%	---
	Veg Cover (Developed)	30%	---
	IA (developed)	0.16	---
	Natural Area	**60.5%**	
	Developed Area	**39.5%**	
	RTIMP (Dev.) avg.	**25.00%**	
	Veg Cover (Dev.) avg.	**30.00%**	
	IA (Dev.) avg.	**0.16**	

Total Subbasin Area in sq. miles = 0.28

Table B.3
Existing conditions rainfall loss parameters for Green & Ampt method for revised subbasins S320 (AHW1) and S340L (AHW3)

Sub-basin ID (1)	HEC-1 ID (2)	Total sq. mi. (3)	Area Nat. % (4)	Area Dev. % (5)	IA, in inches Nat. (6)	IA, in inches Dev. (7)	IA, in inches Wghtd. (8)	RTIMP, in % Nat. (9)	RTIMP, in % Dev. (10)	RTIMP, in % Wghtd. (11)	Veg. Cover, in % Nat. (12)	Veg. Cover, in % Dev. (13)	Veg. Cover, in % Wghtd. (14)	XKSAT Bare Ground in/hr (15)	PSIF inches (16)	DTHETA Nat. dry (17)	DTHETA Dev. normal (18)	DTHETA Wghtd. (19)	XKSAT Corrected for Veg. in/hr (20)
AHW1	S320	0.4166	3.8	96.2	0.15	0.16	0.16	2	24	23	30	33	33	0.15	6.00	0.40	0.25	0.26	0.19
AHW3	S340L	0.2780	60.5	39.5	0.20	0.16	0.18	7	25	14	35	30	33	0.14	6.20	0.39	0.23	0.33	0.18

Appendix C

Hydrologic Parameters

Future Condition

Table C.1
Comparison of existing and future land use characteristics for Andora Hills Wash subbasins

Existing Conditions (based on GVSCE 1997)

AHW1 (S320)*					
	Land Use ID	**GC**	**LDR-25**	**MDR**	**N**
	Natural or Developed	D	D	D	N
	Sub-Area (acres)	17.1	229.4	10.0	10.0
	RTIMP (Developed)	10%	25%	30%	---
	Veg Cover (Developed)	81%	30%	28%	---
	IA (developed)	0.19	0.16	0.16	---
	Natural Area	**3.8%**			
	Developed Area	**96.2%**			
	RTIMP (Dev.) avg.	**24.19%**			
	Veg Cover (Dev.) avg.	**33.32%**			
	IA (Dev.) avg.	**0.16**			
				Total Subbasin Area in sq. miles =	0.42

AHW4 (S330)				
	Land Use ID	**C**	**LDR-25**	**N**
	Natural or Developed	D	D	D
	Sub-Area (acres)	22.0	79.0	3.7
	RTIMP (Developed)	80%	25%	---
	Veg Cover (Developed)	10%	30%	---
	IA (developed)	0.07	0.16	---
	Natural Area	**3.5%**		
	Developed Area	**96.5%**		
	RTIMP (Dev.) avg.	**36.98%**		
	Veg Cover (Dev.) avg.	**25.64%**		
	IA (Dev.) avg.	**0.14**		
			Total Subbasin Area in sq. miles =	0.16

AHW3 (S340L)*				
	Land Use ID	**LDR-25**	**N**	
	Natural or Developed	D	N	
	Sub-Area (acres)	70.3	107.5	
	RTIMP (Developed)	25%	---	
	Veg Cover (Developed)	30%	---	
	IA (developed)	0.16	---	
	Natural Area	**60.5%**		
	Developed Area	**39.5%**		
	RTIMP (Dev.) avg.	**25.00%**		
	Veg Cover (Dev.) avg.	**30.00%**		
	IA (Dev.) avg.	**0.16**		
			Total Subbasin Area in sq. miles =	0.28

* Basin boundary revised from original GVSCE, 1997 study.

Future Conditions (interpreted from Tetra Tech, 2001)

AHW1 (S320)					
	Land Use ID	**GC**	**LDR-25**	**MDR**	**N**
	Natural or Developed	D	D	D	N
	Sub-Area (acres)	17.1	236.3	10.0	3.1
	RTIMP (Developed)	10%	25%	30%	---
	Veg Cover (Developed)	81%	30%	28%	---
	IA (developed)	0.19	0.16	0.16	---
	Natural Area	**1.2%**			
	Developed Area	**98.8%**			
	RTIMP (Dev.) avg.	**24.22%**			
	Veg Cover (Dev.) avg.	**33.24%**			
	IA (Dev.) avg.	**0.16**			
				Total Subbasin Area in sq. miles =	0.42

AHW4 (S330)				
	Land Use ID	**C**	**LDR-25**	**N**
	Natural or Developed	D	D	D
	Sub-Area (acres)	25.7	79.0	0.0
	RTIMP (Developed)	80%	25%	---
	Veg Cover (Developed)	10%	30%	---
	IA (developed)	0.07	0.16	---
	Natural Area	**0.0%**		
	Developed Area	**100.0%**		
	RTIMP (Dev.) avg.	**38.50%**		
	Veg Cover (Dev.) avg.	**25.09%**		
	IA (Dev.) avg.	**0.14**		
				Total Subbasin Area in sq. miles = 0.16

AHW3 (S340L)				
	Land Use ID	**LDR-25**	**N**	
	Natural or Developed	D	N	
	Sub-Area (acres)	127.3	50.5	
	RTIMP (Developed)	25%	---	
	Veg Cover (Developed)	30%	---	
	IA (developed)	0.16	---	
	Natural Area	**28.4%**		
	Developed Area	**71.6%**		
	RTIMP (Dev.) avg.	**25.00%**		
	Veg Cover (Dev.) avg.	**30.00%**		
	IA (Dev.) avg.	**0.16**		
				Total Subbasin Area in sq. miles = 0.28

Table C.1
Comparison of existing and future land use characteristics for Andora Hills Wash subbasins

Existing Conditions (based on GVSCE 1997)

AHW2 (S340R)	Land Use ID	C	LDR-25
	Natural or Developed	D	D
	Sub-Area (acres)	13.9	27.6
	RTIMP (Developed)	80%	25%
	Veg Cover (Developed)	10%	30%
	IA (developed)	0.07	16%
	Natural Area	**0.0%**	
	Developed Area	**100.0%**	
	RTIMP (Dev.) avg.	**43.42%**	
	Veg Cover (Dev.) avg.	**23.30%**	
	IA (Dev.) avg.	**0.13**	
	Total Subbasin Area in sq. miles =		0.06

AHW5 (S350)	Land Use ID	C	HDR	LDR-25	N
	Natural or Developed	D	D	D	N
	Sub-Area (acres)	3.1	5.5	71.3	22.9
	RTIMP (Developed)	80%	45%	25%	---
	Veg Cover (Developed)	10%	22%	30%	---
	IA (developed)	0.07	0.13	0.16	---
	Natural Area	**22.3%**			
	Developed Area	**77.7%**			
	RTIMP (Dev.) avg.	**28.51%**			
	Veg Cover (Dev.) avg.	**28.67%**			
	IA (Dev.) avg.	**0.15**			
	Total Subbasin Area in sq. miles =				0.16

AHW6 (S360)	Land Use ID	C	HDR	LDR-25	N
	Natural or Developed	D	D	D	N
	Sub-Area (acres)	11.4	0.6	115.8	242.2
	RTIMP (Developed)	80%	45%	25%	---
	Veg Cover (Developed)	10%	22%	30%	---
	IA (developed)	0.07	0.13	0.16	---
	Natural Area	**65.5%**			
	Developed Area	**34.5%**			
	RTIMP (Dev.) avg.	**30.00%**			
	Veg Cover (Dev.) avg.	**28.18%**			
	IA (Dev.) avg.	**0.15**			
	Total Subbasin Area in sq. miles =				0.58

Future Conditions (interpreted from Tetra Tech, 2001)

AHW2 (S340R)	Land Use ID	C	LDR-25
	Natural or Developed	D	D
	Sub-Area (acres)	13.9	27.6
	RTIMP (Developed)	80%	25%
	Veg Cover (Developed)	10%	30%
	IA (developed)	0.07	16%
	Natural Area	**0.0%**	
	Developed Area	**100.0%**	
	RTIMP (Dev.) avg.	**43.42%**	
	Veg Cover (Dev.) avg.	**23.30%**	
	IA (Dev.) avg.	**0.13**	
	Total Subbasin Area in sq. miles =		0.06

AHW5 (S350)	Land Use ID	C	HDR	LDR-25	MDR	N
	Natural or Developed	D	D	D	D	N
	Sub-Area (acres)	3.1	5.5	80.4	13.8	0.0
	RTIMP (Developed)	80%	45%	25%	30%	---
	Veg Cover (Developed)	10%	22%	30%	28%	---
	IA (developed)	0.07	0.13	0.16	0.16	---
	Natural Area	**0.0%**				
	Developed Area	**86.6%**				
	RTIMP (Dev.) avg.	**28.15%**				
	Veg Cover (Dev.) avg.	**28.81%**				
	IA (Dev.) avg.	**0.16**				
	Total Subbasin Area in sq. miles =					0.16

AHW6 (S360)	Land Use ID	C	HDR	LDR-25	LDR-15	N
	Natural or Developed	D	D	D	D	N
	Sub-Area (acres)	11.4	0.6	255.9	28.1	74.0
	RTIMP (Developed)	80%	45%	25%	15%	---
	Veg Cover (Developed)	10%	22%	30%	34%	---
	IA (developed)	0.07	0.13	0.16	0.18	---
	Natural Area	**9.5%**				
	Developed Area	**90.5%**				
	RTIMP (Dev.) avg.	**27.39%**				
	Veg Cover (Dev.) avg.	**29.13%**				
	IA (Dev.) avg.	**0.16**				
	Total Subbasin Area in sq. miles =					0.58

Table C.1
Comparison of existing and future land use characteristics for Andora Hills Wash subbasins

Existing Conditions (based on GVSCE 1997)

AHW7 (S370)	**Land Use ID**	**C**	**HDR**	**LDR-15**	**N**		
	Natural or Developed	D	D	D	N		
	Sub-Area (acres)	123.5	12.5	18.2	64.2		
	RTIMP (Developed)	80%	45%	15%	---		
	Veg Cover (Developed)	10%	22%	34%	---		
	IA (developed)	0.07	0.13	0.18	---		
	Natural Area	**29.4%**					
	Developed Area	**70.6%**					
	RTIMP (Dev.) avg.	**69.49%**					
	Veg Cover (Dev.) avg.	**13.81%**					
	IA (Dev.) avg.	**0.09**					
				Total Subbasin Area in sq. miles =		0.34	
AHW8 (S380)	**Land Use ID**	**C**	**LDR-15**	**N**			
	Natural or Developed	D	D	D			
	Sub-Area (acres)	4.7	175.0	86.1			
	RTIMP (Developed)	80%	15%	---			
	Veg Cover (Developed)	10%	34%	---			
	IA (developed)	0.07	0.18	---			
	Natural Area	**32.4%**					
	Developed Area	**67.6%**					
	RTIMP (Dev.) avg.	**16.70%**					
	Veg Cover (Dev.) avg.	**33.37%**					
	IA (Dev.) avg.	**0.18**					
				Total Subbasin Area in sq. miles =		0.42	
AHW9 (S390)	**Land Use ID**	**C**	**GC**	**HDR**	**LDR-15**	**RSRT**	**N**
	Natural or Developed	D	D	D	D	D	N
	Sub-Area (acres)	11.4	23.5	15.4	47.2	8.90	115.8
	RTIMP (Developed)	80%	10%	45%	15%	60%	---
	Veg Cover (Developed)	10%	81%	22%	34%	32%	---
	IA (developed)	0.07	0.19	0.13	0.18	0.11	---
	Natural Area	**52.1%**					
	Developed Area	**47.9%**					
	RTIMP (Dev.) avg.	**28.97%**					
	Veg Cover (Dev.) avg.	**39.91%**					
	IA (Dev.) avg.	**0.16**					
				Total Subbasin Area in sq. miles =			0.35

Future Conditions (interpreted from Tetra Tech, 2001)

AHW7 (S370)	**Land Use ID**	**C**	**HDR**	**LDR-15**	**N**		
	Natural or Developed	D	D	D	N		
	Sub-Area (acres)	148.0	12.5	57.9	0.0		
	RTIMP (Developed)	80%	45%	15%	---		
	Veg Cover (Developed)	10%	22%	34%	---		
	IA (developed)	0.07	0.13	0.18	---		
	Natural Area	**0.0%**					
	Developed Area	**100.0%**					
	RTIMP (Dev.) avg.	**60.76%**					
	Veg Cover (Dev.) avg.	**17.05%**					
	IA (Dev.) avg.	**0.10**					
				Total Subbasin Area in sq. miles =		0.34	
AHW8 (S380)	**Land Use ID**	**C**	**LDR-15**	**N**			
	Natural or Developed	D	D	D			
	Sub-Area (acres)	4.7	241.2	19.9			
	RTIMP (Developed)	80%	15%	---			
	Veg Cover (Developed)	10%	34%	---			
	IA (developed)	0.07	0.18	---			
	Natural Area	**7.5%**					
	Developed Area	**92.5%**					
	RTIMP (Dev.) avg.	**16.24%**					
	Veg Cover (Dev.) avg.	**33.54%**					
	IA (Dev.) avg.	**0.18**					
				Total Subbasin Area in sq. miles =		0.42	
AHW9 (S390)	**Land Use ID**	**C**	**GC**	**HDR**	**LDR-15**	**RSRT**	**N**
	Natural or Developed	D	D	D	D	D	N
	Sub-Area (acres)	11.4	23.5	30.1	137.2	20.00	0.0
	RTIMP (Developed)	80%	10%	45%	15%	60%	---
	Veg Cover (Developed)	10%	81%	22%	34%	32%	---
	IA (developed)	0.07	0.19	0.13	0.18	0.11	---
	Natural Area	**0.0%**					
	Developed Area	**100.0%**					
	RTIMP (Dev.) avg.	**25.92%**					
	Veg Cover (Dev.) avg.	**35.93%**					
	IA (Dev.) avg.	**0.16**					
				Total Subbasin Area in sq. miles =			0.35

Table C.2

Comparison of Existing and Future Land Use Conditions for Galloway Wash Subbasins

Subbasin	Land Use											
	Airport (sq. mi.)	DedOpSpc (sq. mi.)	HiDRes (sq. mi.)	LgLotRes (sq. mi.)	MedDRes (sq. mi.)	NRC (sq. mi.)	RecOpSpc (sq. mi.)	Resort (sq. mi.)	Rural (sq. mi.)	SmLotRes (sq. mi.)	Vacant (sq. mi.)	Water (sq. mi.)
GWW1_1 Existing	0.000	0.011	0.000	0.281	0.000	0.000	0.359	0.015	1.508	0.124	0.250	0.003
	0.0%	0.4%	0.0%	11.0%	0.0%	0.0%	14.1%	0.6%	59.1%	4.9%	9.8%	0.1%
GWW1_1 Future	0.000	0.011	0.000	0.374	0.000	0.000	0.402	0.015	1.564	0.182	0.000	0.003
	0.0%	0.4%	0.0%	14.7%	0.0%	0.0%	15.8%	0.6%	61.3%	7.1%	0.0%	0.1%
GWW1_2 Existing	0.000	0.007	0.000	0.007	0.000	0.007	0.215	0.000	0.588	0.025	0.194	0.000
	0.0%	0.7%	0.0%	0.7%	0.0%	0.7%	20.6%	0.0%	56.4%	2.4%	18.6%	0.0%
GWW1_2 Future	0.000	0.007	0.000	0.007	0.000	0.088	0.246	0.000	0.638	0.055	0.000	0.000
	0.0%	0.7%	0.0%	0.7%	0.0%	8.5%	23.6%	0.0%	61.3%	5.3%	0.0%	0.0%
GWW131 Existing	0.000	0.000	0.000	0.128	0.000	0.000	0.001	0.000	0.637	0.000	0.008	0.000
	0.0%	0.0%	0.0%	16.5%	0.0%	0.0%	0.1%	0.0%	82.3%	0.0%	1.1%	0.0%
GWW131 Future	0.000	0.000	0.000	0.128	0.000	0.000	0.001	0.000	0.645	0.000	0.000	0.000
	0.0%	0.0%	0.0%	16.5%	0.0%	0.0%	0.1%	0.0%	83.4%	0.0%	0.0%	0.0%
GWW132 Existing	0.000	0.000	0.000	0.034	0.000	0.000	0.032	0.000	0.280	0.000	0.002	0.000
	0.0%	0.0%	0.0%	9.7%	0.0%	0.0%	9.1%	0.0%	80.5%	0.0%	0.7%	0.0%
GWW132 Future	0.000	0.000	0.000	0.034	0.000	0.000	0.032	0.000	0.282	0.000	0.000	0.000
	0.0%	0.0%	0.0%	9.7%	0.0%	0.0%	9.1%	0.0%	81.2%	0.0%	0.0%	0.0%
GWW133 Existing	0.000	0.000	0.000	0.290	0.002	0.000	0.094	0.009	0.002	0.000	0.000	0.000
	0.0%	0.0%	0.0%	73.0%	0.6%	0.0%	23.6%	2.3%	0.5%	0.0%	0.0%	0.0%
GWW133 Future	0.000	0.000	0.000	0.290	0.002	0.000	0.094	0.009	0.002	0.000	0.000	0.000
	0.0%	0.0%	0.0%	73.0%	0.6%	0.0%	23.6%	2.3%	0.5%	0.0%	0.0%	0.0%
GWW1_4 Existing	0.000	0.000	0.000	0.026	0.011	0.000	0.000	0.000	0.905	0.000	0.062	0.000
	0.0%	0.0%	0.0%	2.6%	1.1%	0.0%	0.0%	0.0%	90.1%	0.0%	6.2%	0.0%
GWW1_4 Future	0.000	0.000	0.000	0.070	0.011	0.002	0.000	0.000	0.916	0.000	0.005	0.000
	0.0%	0.0%	0.0%	7.0%	1.1%	0.2%	0.0%	0.0%	91.2%	0.0%	0.5%	0.0%
GWW1_5 Existing	0.080	0.000	0.000	0.168	0.162	0.090	0.204	0.026	0.002	0.014	0.237	0.000
	8.1%	0.0%	0.0%	17.1%	16.5%	9.2%	20.8%	2.6%	0.2%	1.4%	24.1%	0.0%
GWW1_5 Future	0.080	0.000	0.059	0.192	0.176	0.164	0.204	0.026	0.064	0.018	0.000	0.000
	8.1%	0.0%	6.0%	19.5%	17.9%	16.7%	20.8%	2.6%	6.5%	1.8%	0.0%	0.0%
GWW1_6 Existing	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.538	0.000	0.054	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	90.9%	0.0%	9.1%	0.0%
GWW1_6 Future	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.556	0.000	0.023	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	93.8%	0.0%	3.9%	0.0%
GVW1 Existing	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	4.854	0.000
	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.0%	0.0%
GVW1 Future	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.000	2.081	0.000	2.790	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	42.4%	0.0%	56.9%	0.0%
GVW2 Existing	0.000	0.000	0.000	0.000	0.000	0.003	0.452	0.000	1.166	0.121	4.270	0.011
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.5%	0.0%	19.4%	2.0%	70.9%	0.2%
GVW2 Future	0.000	0.000	0.000	0.056	2.141	0.345	0.000	0.000	1.781	0.000	1.700	0.000
	0.0%	0.0%	0.0%	0.9%	35.5%	5.7%	0.0%	0.0%	29.6%	0.0%	28.2%	0.0%
GVW3_1 Existing	0.000	0.000	0.000	0.003	0.000	0.002	0.000	0.000	0.434	0.000	0.604	0.000
	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	41.6%	0.0%	57.9%	0.0%
GVW3_1 Future	0.000	0.000	0.000	0.003	0.000	0.002	0.000	0.000	0.984	0.000	0.054	0.000
	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	94.3%	0.0%	5.2%	0.0%
GVW3_2 Existing	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.401	0.000	0.571	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	41.3%	0.0%	58.7%	0.0%
GVW3_2 Future	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.810	0.000	0.161	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.4%	0.0%	16.6%	0.0%
GVW3_3 Existing	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.196	0.018	0.094	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.7%	0.0%	57.5%	5.3%	27.6%	0.0%
GVW3_3 Future	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.261	0.018	0.029	0.000
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.7%	0.0%	76.5%	5.3%	8.5%	0.0%

Table C.3
Future conditions rainfall loss parameters for Green & Ampt method for Andora Hills Wash

Sub-basin ID (1)	HEC-1 ID (2)	Total sq. mi. (3)	Area Nat. % (4)	Area Dev. % (5)	IA, in inches Nat. (6)	IA, in inches Dev. (7)	IA, in inches Wghtd. (8)	RTIMP, in % Nat. (9)	RTIMP, in % Dev. (10)	RTIMP, in % Wghtd. (11)	Veg. Cover, in % Nat. (12)	Veg. Cover, in % Dev. (13)	Veg. Cover, in % Wghtd. (14)	XKSAT Bare Ground in/hr (15)	PSIF inches (16)	DTHETA Nat. dry (17)	DTHETA Dev. normal (18)	DTHETA Wghtd. (19)	XKSAT Corrected for Veg. in/hr (20)
AHW1	S320	0.417	1.2	98.8	0.15	0.16	0.16	2	24	24	30	33	33	0.15	6.00	0.40	0.25	0.25	0.19
AHW4	S330	0.164	0.0	100.0	0.15	0.14	0.14	3	39	39	30	25	25	0.07	8.00	0.30	0.15	0.15	0.08
AHW3	S340L	0.278	28.4	71.6	0.20	0.16	0.17	7	25	20	35	30	31	0.14	6.20	0.39	0.23	0.27	0.17
AHW2	S340R	0.065	0.0	100.0	0.15	0.13	0.13	0	43	43	30	23	23	0.12	6.60	0.37	0.19	0.19	0.14
AHW5	S350	0.161	0.0	100.0	0.15	0.16	0.16	4	28	28	35	29	29	0.15	6.00	0.40	0.25	0.25	0.18
AHW6	S360	0.578	20.0	80.0	0.20	0.16	0.16	7	27	23	35	29	30	0.13	6.40	0.38	0.21	0.24	0.16
AHW7	S370	0.341	0.0	100.0	0.15	0.10	0.10	1	61	61	30	17	17	0.10	7.00	0.35	0.15	0.15	0.11
AHW8	S380	0.415	7.5	92.5	0.20	0.18	0.18	12	16	16	30	34	33	0.10	7.00	0.35	0.15	0.16	0.13
AHW9	S390	0.347	0.0	100.0	0.15	0.16	0.16	2	26	26	30	36	36	0.12	6.60	0.37	0.19	0.19	0.15

LOSS PARAMETERS FOR SUBBASIN: GWW1_1

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.317	12.4	0.62	0
A_24	0.010	0.4	0.02	0
A_33	0.135	5.3	0.23	0
A_40	0.183	7.2	0.17	0
A_41	0.102	4.0	0.17	0
A_61	0.083	3.3	0.15	0
A_63	1.146	44.9	0.14	25
A_72	0.096	3.8	0.09	30
A_93	0.007	0.3	0.33	0
A_96	0.079	3.1	0.07	0
T_301	0.393	15.4	0.40	0

TOTAL = 2.551 Sq.Miles XKSAT = 0.20 %Rock = 12

DTHETA

Dry = 0.37 PSIF = 5.30
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
0.011	DedOpSpc	0.4	NORMAL	35	0	0.20	0.05	Hi	0.13
0.374	LgLotRes	14.7	NORMAL	35	15	0.18	0.04	Low	0.05
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
	NRC		NORMAL	10	80	0.07	0.02	Min	
0.402	RecOpSc	15.8	NORMAL	75	0	0.20	0.03	Low	0.05
0.015	Resort	0.6	NORMAL	32	60	0.11	0.03	Low	0.07
1.564	Rural	61.3	NORMAL	30	0	0.20	0.04	Low	0.04
0.182	SmLotRes	7.1	NORMAL	30	25	0.15	0.04	Low	0.05
0.000	Vacant	0.0	NORMAL	30	0	0.20	0.05	Hi	
0.003	Water	0.1	NORMAL	0	10	0.00	0.00	Min	0.04
2.551 = Total Area			Avg. =	38	4%	0.190			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.26

IMPERVIOUS AREA: URBAN @ 100 % effective = 4
ROCK OUTCROP @ 50 % effective = 12
% EFFECTIVE IMP. = 10

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW1_1	2.552	4.64	2.04	0.04	196.1	0.19	0.25	5.30	0.26	10	47

LOSS PARAMETERS FOR SUBBASIN: GWW1_2

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.060	5.8	0.62	0
A_33	0.781	74.9	0.23	0
A_34	0.014	1.3	0.23	0
A_40	0.011	1.1	0.17	0
A_63	0.076	7.3	0.14	25
A_93	0.007	0.7	0.33	0
A_96	0.092	8.8	0.07	0
T_301	0.002	0.2	0.40	0

TOTAL = 1.043 Sq.Miles XKSAT = 0.21 %Rock = 2

DTHETA

Dry = 0.37 PSIF = 5.20
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
0.007	DedOpSpc	0.7	NORMAL	35	0	0.20	0.05	Hi	0.13
0.007	LgLotRes	0.7	NORMAL	35	15	0.18	0.04	Low	0.07
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
0.088	NRC	8.5	NORMAL	10	80	0.07	0.02	Min	0.03
0.246	RecOpSc	23.6	NORMAL	75	0	0.20	0.03	Low	0.05
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.638	Rural	61.3	NORMAL	30	0	0.20	0.04	Low	0.04
0.055	SmLotRes	5.3	NORMAL	30	25	0.15	0.04	Low	0.06
0.000	Vacant	0.0	NORMAL	30	0	0.20	0.05	Hi	
	Water		NORMAL	0	10	0.00	0.00	Min	

1.041 = Total Area Avg. = 41 8% 0.190

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.28

IMPERVIOUS AREA: URBAN @ 100 % effective = 8
ROCK OUTCROP @ 50 % effective = 2
% EFFECTIVE IMP. = 9

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW1_2	1.043	3.88	1.87	0.04	164.9	0.19	0.25	5.20	0.28	9	42

LOSS PARAMETERS FOR SUBBASIN: GWW131

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.074	9.6	0.62	0
A_24	0.015	1.9	0.02	0
A_34	0.028	3.6	0.23	0
A_40	0.180	23.3	0.17	0
A_41	0.337	43.5	0.17	0
A_72	0.019	2.5	0.09	30
A_93	0.086	11.1	0.33	0
A_96	0.035	4.5	0.07	0

TOTAL = 0.774 Sq.Miles XKSAT = 0.19 %Rock = 1

DTHETA

Dry = 0.38 PSIF = 5.40
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.128	LgLotRes	16.5	NORMAL	35	15	0.18	0.04	Low	0.05
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
	NRC		NORMAL	10	80	0.07	0.02	Min	
0.001	RecOpSc	0.1	NORMAL	75	0	0.20	0.03	Low	0.08
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.637	Rural	82.3	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.008	Vacant	1.0	NORMAL	30	0	0.20	0.05	Hi	0.13
	Water		NORMAL	0	10	0.00	0.00	Min	

0.774 = Total Area Avg. = 31 2% 0.200

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.23

IMPERVIOUS AREA: URBAN @ 100 % effective = 2
ROCK OUTCROP @ 100 % effective = 1
% EFFECTIVE IMP. = 3

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW131	0.774	2.58	1.28	0.04	158.9	0.20	0.25	5.40	0.23	3	35

LOSS PARAMETERS FOR SUBBASIN: GWW132

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.008	2.3	0.62	0
A_33	0.085	24.5	0.23	0
A_34	0.031	8.9	0.23	0
A_40	0.110	31.7	0.17	0
A_93	0.075	21.6	0.33	0
A_96	0.038	10.9	0.07	0

TOTAL = 0.347 Sq.Miles XKSAT = 0.20 %Rock = 0

DTHETA

Dry = 0.37 PSIF = 5.30
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.034	LgLotRes	9.8	NORMAL	35	15	0.18	0.04	Low	0.06
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
	NRC		NORMAL	10	80	0.07	0.02	Min	
0.032	RecOpSc	9.2	NORMAL	75	0	0.20	0.03	Low	0.06
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.280	Rural	80.7	NORMAL	30	0	0.20	0.04	Low	0.05
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.001	Vacant	0.3	NORMAL	30	0	0.20	0.05	Hi	0.15
	Water		NORMAL	0	10	0.00	0.00	Min	

0.347 = Total Area Avg. = 35 1% 0.200

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.26

IMPERVIOUS AREA: URBAN @ 100 % effective = 1
ROCK OUTCROP @ 100 % effective = 0
% EFFECTIVE IMP. = 1

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW132	0.347	1.56	0.70	0.04	141.0	0.20	0.25	5.30	0.26	1	23

LOSS PARAMETERS FOR SUBBASIN: GWW133

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.051	12.9	0.62	0
A_34	0.056	14.1	0.23	0
A_40	0.168	42.3	0.17	0
A_93	0.001	0.3	0.33	0
A_96	0.121	30.5	0.07	0

TOTAL = 0.397 Sq.Miles XKSAT = 0.16 %Rock = 0

DTHETA

Dry = 0.39 PSIF = 5.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.290	LgLotRes	73.1	NORMAL	35	15	0.18	0.04	Low	0.05
0.002	MedDRes	0.5	NORMAL	25	30	0.15	0.03	Low	0.08
	NRC		NORMAL	10	80	0.07	0.02	Min	
0.094	RecOpSc	23.7	NORMAL	75	0	0.20	0.03	Low	0.06
0.009	Resort	2.3	NORMAL	32	60	0.11	0.03	Low	0.07
0.002	Rural	0.5	NORMAL	30	0	0.20	0.04	Low	0.08
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
	Vacant		NORMAL	30	0	0.20	0.05	Hi	
	Water		NORMAL	0	10	0.00	0.00	Min	
0.397 = Total Area			Avg. =	46	12%	0.180			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.22

IMPERVIOUS AREA: URBAN @ 100 % effective = 12
ROCK OUTCROP @ 100 % effective = 0
% EFFECTIVE IMP. = 12

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW133	0.397	1.59	0.90	0.04	157.2	0.18	0.25	5.80	0.22	12	23

LOSS PARAMETERS FOR SUBBASIN: GWW1_4

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.039	3.9	0.62	0
A_33	0.034	3.4	0.23	0
A_40	0.084	8.4	0.17	0
A_41	0.579	57.7	0.17	0
A_72	0.001	0.1	0.09	30
A_93	0.084	8.4	0.33	0
A_96	0.181	18.0	0.07	0
A_121	0.002	0.2	0.12	0

TOTAL = 1.004 Sq.Miles XKSAT = 0.16 %Rock = 0

DTHETA

Dry = 0.39 PSIF = 5.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.070	LgLotRes	7.0	NORMAL	35	15	0.18	0.04	Low	0.06
0.011	MedDRes	1.1	NORMAL	25	30	0.15	0.03	Low	0.07
0.002	NRC	0.2	NORMAL	10	80	0.07	0.02	Min	0.04
	RecOpSc		NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.916	Rural	91.2	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.005	Vacant	0.5	NORMAL	30	0	0.20	0.05	Hi	0.14
	Water		NORMAL	0	10	0.00	0.00	Min	

1.004 = Total Area Avg. = 30 2% 0.200

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.20

IMPERVIOUS AREA: URBAN @ 100 % effective = 2
ROCK OUTCROP @ 50 % effective = 0

% EFFECTIVE IMP. = 2

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW1_4	1.004	3.64	2.11	0.04	274.7	0.20	0.25	5.80	0.20	2	43

LOSS PARAMETERS FOR SUBBASIN: GWW1_5

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.014	1.4	0.62	0
A_28	0.010	1.0	0.02	0
A_33	0.187	19.0	0.23	0
A_34	0.063	6.4	0.23	0
A_40	0.044	4.5	0.17	0
A_72	0.005	0.5	0.09	30
A_93	0.192	19.5	0.33	0
A_96	0.468	47.6	0.07	0

TOTAL = 0.983 Sq.Miles XKSAT = 0.14 %Rock = 0

DTHETA

Dry = 0.39 PSIF = 6.20
Normal = 0.23
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
0.080	Airport	8.1	NORMAL	8	85	0.07	0.02	Min	0.03
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.192	LgLotRes	19.5	NORMAL	35	15	0.18	0.04	Low	0.05
0.176	MedDRes	17.9	NORMAL	25	30	0.15	0.03	Low	0.05
0.164	NRC	16.7	NORMAL	10	80	0.07	0.02	Min	0.03
0.204	RecOpSc	20.8	NORMAL	75	0	0.20	0.03	Low	0.05
0.026	Resort	2.6	NORMAL	32	60	0.11	0.03	Low	0.06
0.064	Rural	6.5	NORMAL	30	0	0.20	0.04	Low	0.06
0.018	SmLotRes	1.8	NORMAL	30	25	0.15	0.04	Low	0.07
	Vacant		NORMAL	30	0	0.20	0.05	Hi	
	Water		NORMAL	0	10	0.00	0.00	Min	
0.059	HDR	6.0	NORMAL	22	45	0.13	0.03	Min	0.03

0.983 = Total Area Avg. = 43 33% 0.150

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.23

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.19

IMPERVIOUS AREA: URBAN @ 100 % effective = 33
ROCK OUTCROP @ 50 % effective = 0
% EFFECTIVE IMP. = 33

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW1_5	0.983	3.57	1.89	0.03	112.6	0.15	0.23	6.20	0.19	33	36

LOSS PARAMETERS FOR SUBBASIN: GWW1_6

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.019	3.2	0.62	0
A_33	0.034	5.7	0.23	0
A_34	0.306	51.6	0.23	0
A_41	0.175	29.5	0.17	0
A_93	0.007	1.2	0.33	0
A_96	0.044	7.4	0.07	0
A_121	0.008	1.3	0.12	0

TOTAL = 0.593 Sq.Miles XKSAT = 0.20 %Rock = 0

DTHETA

Dry = 0.37 PSIF = 5.30
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
	LgLotRes		NORMAL	35	15	0.18	0.04	Low	
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
0.014	NRC	2.4	NORMAL	10	80	0.07	0.02	Min	0.03
	RecOpSc		NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.556	Rural	93.8	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.023	Vacant	3.9	NORMAL	30	0	0.20	0.05	Hi	0.12
	Water		NORMAL	0	10	0.00	0.00	Min	
0.593 = Total Area			Avg. =	30	2%	0.200			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.24

IMPERVIOUS AREA: URBAN @ 100 % effective = 2
ROCK OUTCROP @ 50 % effective = 0
% EFFECTIVE IMP. = 2

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GWW1_6	0.593	2.61	1.31	0.04	164.8	0.20	0.25	5.30	0.24	2	35

LOSS PARAMETERS FOR SUBBASIN: GVW2

Soil Survey Used Custom

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_8	0.217	3.6	0.00	0
A_26	0.000	0.0	0.01	0
A_34	0.016	0.3	0.23	0
A_41	0.738	12.2	0.17	0
A_61	0.047	0.8	0.15	0
A_63	2.518	41.8	0.14	25
A_72	2.050	34.0	0.09	30
A_93	0.153	2.5	0.33	0
A_104	0.081	1.3	0.14	60
T_301	0.201	3.3	0.40	0
T_303	0.002	0.0	0.40	15

TOTAL = 6.023 Sq.Miles XKSAT = 0.14 %Rock = 21

DTHETA

Dry = 0.39 PSIF = 6.20
Normal = 0.23
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.056	LgLotRes	0.9	NORMAL	35	15	0.18	0.04	Low	0.06
2.141	MedDRes	35.5	NORMAL	25	30	0.15	0.03	Low	0.04
0.345	NRC	5.7	NORMAL	10	80	0.07	0.02	Min	0.03
0.000	RecOpSc	0.0	NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
1.781	Rural	29.6	NORMAL	30	0	0.20	0.04	Low	0.04
0.000	SmLotRes	0.0	NORMAL	30	25	0.15	0.04	Low	
1.700	Vacant	28.2	NORMAL	30	0	0.20	0.05	Hi	0.07
0.000	Water	0.0	NORMAL	0	10	0.00	0.00	Min	
6.023 = Total Area			Avg. =	28	15%	0.170			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.23

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.17

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 50 % effective = 21
% EFFECTIVE IMP. = 26

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GVW2	6.023	5.51	2.77	0.04	371.1	0.17	0.23	6.20	0.17	26	49

LOSS PARAMETERS FOR SUBBASIN: GVW3_1

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.113	10.8	0.62	0
A_8	0.054	5.2	0.96	0
A_26	0.069	6.6	0.01	0
A_33	0.017	1.6	0.23	0
A_34	0.541	51.9	0.23	0
A_41	0.120	11.5	0.17	0
A_93	0.067	6.4	0.33	0
A_96	0.045	4.3	0.07	0
A_121	0.017	1.6	0.12	0

TOTAL = 1.043 Sq.Miles XKSAT = 0.21 %Rock = 0

DTHETA

Dry = 0.37 PSIF = 5.20
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
0.003	LgLotRes	0.3	NORMAL	35	15	0.18	0.04	Low	0.08
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
0.002	NRC	0.2	NORMAL	10	80	0.07	0.02	Min	0.04
	RecOpSc		NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.984	Rural	94.3	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.054	Vacant	5.2	NORMAL	30	0	0.20	0.05	Hi	0.11
	Water		NORMAL	0	10	0.00	0.00	Min	
1.043 = Total Area			Avg. =	30	0%	0.200			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.26

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 50 % effective = 0
% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GVW3_1	1.043	3.31	1.51	0.04	184.3	0.20	0.25	5.20	0.26	0	39

LOSS PARAMETERS FOR SUBBASIN: GVW1

Soil Survey Used Custom

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.064	1.3	0.62	0
A_8	0.118	2.4	0.96	0
A_26	0.048	1.0	0.01	0
A_33	0.001	0.0	0.23	0
A_34	0.224	4.6	0.23	0
A_41	0.109	2.2	0.17	0
A_72	3.262	66.5	0.09	30
A_93	0.009	0.2	0.33	0
A_104	1.014	20.7	0.14	60
T_303	0.055	1.1	0.40	15

TOTAL = 4.904 Sq.Miles XKSAT = 0.11 %Rock = 33

DTHETA

Dry = 0.36 PSIF = 6.80
Normal = 0.17
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
0.000	DedOpSpc	0.0	NORMAL	35	0	0.20	0.05	Hi	
	LgLotRes		NORMAL	35	15	0.18	0.04	Low	
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
0.033	NRC	0.7	NORMAL	10	80	0.07	0.02	Min	0.03
	RecOpSc		NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
2.081	Rural	42.4	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
2.790	Vacant	56.9	NORMAL	30	0	0.20	0.05	Hi	0.07
	Water		NORMAL	0	10	0.00	0.00	Min	
4.904 = Total Area			Avg. =	30	1%	0.200			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.17

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.13

IMPERVIOUS AREA: URBAN @ 100 % effective = 1
ROCK OUTCROP @ 50 % effective = 33
% EFFECTIVE IMP. = 18

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GVW1	4.905	6.19	3.56	0.04	298.9	0.20	0.17	6.80	0.13	18	68

LOSS PARAMETERS FOR SUBBASIN: GVW3_2

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.044	4.5	0.62	0
A_8	0.216	22.2	0.96	0
A_26	0.165	17.0	0.01	0
A_33	0.074	7.6	0.23	0
A_34	0.429	44.1	0.23	0
A_41	0.000	0.0	0.17	0
A_93	0.044	4.5	0.33	0

TOTAL = 0.972 Sq.Miles XKSAT = 0.20 %Rock = 0

DTHETA

Dry = 0.37 PSIF = 5.30
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
	LgLotRes		NORMAL	35	15	0.18	0.04	Low	
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
	NRC		NORMAL	10	80	0.07	0.02	Min	
	RecOpSc		NORMAL	75	0	0.20	0.03	Low	
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.810	Rural	83.4	NORMAL	30	0	0.20	0.04	Low	0.04
	SmLotRes		NORMAL	30	25	0.15	0.04	Low	
0.161	Vacant	16.6	NORMAL	30	0	0.20	0.05	Hi	0.10
	Water		NORMAL	0	10	0.00	0.00	Min	

0.971 = Total Area Avg. = 30 0% 0.200

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.24

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 50 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GVW3_2	0.972	2.42	1.26	0.04	144.6	0.20	0.25	5.30	0.24	0	35

LOSS PARAMETERS FOR SUBBASIN: GVW3_3

Soil Survey Used Maricopa

XKSAT

Map Unit	AREA Sq.Miles	% Area	XKSAT	% Rock Outcrop
A_6	0.001	0.3	0.62	0
A_8	0.031	9.1	0.96	0
A_12	0.022	6.5	0.01	0
A_26	0.029	8.5	0.01	0
A_33	0.178	52.2	0.23	0
A_34	0.019	5.6	0.23	0
A_72	0.016	4.7	0.09	30
A_93	0.029	8.5	0.33	0
A_96	0.016	4.7	0.07	0

TOTAL = 0.341 Sq.Miles XKSAT = 0.15 %Rock = 1

DTHETA

Dry = 0.40 PSIF = 6.00
Normal = 0.25
Wet = 0.00

LAND USE

AREA Sq.Miles	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Airport		NORMAL	8	85	0.07	0.02	Min	
	DedOpSpc		NORMAL	35	0	0.20	0.05	Hi	
	LgLotRes		NORMAL	35	15	0.18	0.04	Low	
	MedDRes		NORMAL	25	30	0.15	0.03	Low	
	NRC		NORMAL	10	80	0.07	0.02	Min	
0.033	RecOpSc	9.7	NORMAL	75	0	0.20	0.03	Low	0.06
	Resort		NORMAL	32	60	0.11	0.03	Low	
0.261	Rural	76.5	NORMAL	30	0	0.20	0.04	Low	0.05
0.018	SmLotRes	5.3	NORMAL	30	25	0.15	0.04	Low	0.07
0.029	Vacant	8.5	NORMAL	30	0	0.20	0.05	Hi	0.12
	Water		NORMAL	0	10	0.00	0.00	Min	
0.341 = Total Area			Avg. =	34	1%	0.200			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.19

IMPERVIOUS AREA: URBAN @ 100 % effective = 1
ROCK OUTCROP @ 50 % effective = 1
% EFFECTIVE IMP. = 2

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
GVW3_3	0.341	1.88	0.95	0.04	135.6	0.20	0.25	6.00	0.19	2	28

Appendix D

Road Crossing Peak Discharge Calculations

Existing and Future Conditions

Andora Hills Wash

And

Galloway Wash

Table D.1 Existing Condition Road Crossing Discharge Calculations

	ROAD CROSSING		RATIO		MODEL	EXISTING CONDITIONS MODEL PEAK DISCHARGES (CFS)				ROAD CROSSING PEAK DISCHARGES (CFS)				Model CP	Road Xing
ID	Road	Wash	CALCULATION		KK ID	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Area (sq.mi.)	Area (sq.mi.)
1	N. Sidewinder Rd.	Tributary 1 to Andora Hills Wash	8.7	% of AHW1 Q	S320	698	553	1255	811	61	48	109	71	0.42	0.04
2	E. Long Rifle Rd.	Tributary 1 to Andora Hills Wash	14.3	% of AHW1 Q	S320	698	553	1255	811	100	79	179	116	0.42	0.06
3	E. Long Rifle Rd. & N. Long Rifle Rd.	Tributary 1 to Andora Hills Wash	50.8	% of AHW1 Q	S320	698	553	1255	811	355	281	638	412	0.42	0.21
4	N. Tom Darlington Dr.	Tributary 1 to Andora Hills Wash	100.0	% of AHW1 Q	S320	698	553	1255	811	698	553	1255	811	0.42	0.42
5	E. Bivouc Tr.	Tributary 1 to Andora Hills Wash	100.0	% of AHW1 Q	S320	698	553	1255	811	698	553	1255	811	0.42	0.42
6	E. Bivouac Tr.	Andora Hills Wash	100.0	% of C340R Q	C340R	900	759	1630	1163	900	759	1630	1163	0.65	0.65
7	E. Carefree Dr.	Andora Hills Wash	100.0	% of C340 Q	C340	1096	1020	2048	1625	1096	1020	2048	1625	0.92	0.92
8	N. Lazy Burro Rd.	Andora Hills Wash	105.2	% of C340 Q	C340	1096	1020	2048	1625	1153	1073	2154	1710	0.92	0.97
9	N. Lazy Burro Rd.	Andora Hills Wash	107.9	% of C340 Q	C340	1096	1020	2048	1625	1183	1101	2210	1753	0.92	0.99
10	N. Holiday Ln.	Andora Hills Wash	109.3	% of C340 Q	C340	1096	1020	2048	1625	1198	1115	2238	1776	0.92	1.01
11	N. Terrace	Andora Hills Wash	114.7	% of C340 Q	C340	1096	1020	2048	1625	1257	1170	2349	1864	0.92	1.06
12	N. Piedra Grande Dr.	Andora Hills Wash	100.0	% of C350 Q	C350	1201	1138	2240	1862	1201	1138	2240	1862	1.09	1.09
13	private drive	Andora Hills Wash	107.1	% of C350 Q	C350	1201	1138	2240	1862	1286	1219	2399	1994	1.09	1.17
14	N. Never Mind Tr.	Tributary 2 to Andora Hills Wash	74.6	% of AHW3 Q	S340L	326	265	666	464	243	198	497	346	0.28	0.21
15	E. Long Rifle Rd.	Andora Hills Wash	29.2	% of AHW4 Q	S330	212	168	388	262	62	49	113	77	0.16	0.05
16	E. Nonchalant Av.	Andora Hills Wash	70.0	% of AHW4 Q	S330	212	168	388	262	148	118	272	183	0.16	0.11
17	N. Bloody Basin Rd. & E. Nonchalant Av.	Andora Hills Wash	76.9	% of AHW4 Q	S330	212	168	388	262	163	129	298	201	0.16	0.12
18	E. Elbow Bend	Andora Hills Wash	84.9	% of AHW4 Q	S330	212	168	388	262	180	143	329	222	0.16	0.14
19	E. Carefree Dr.	Andora Hills Wash	91.9	% of AHW4 Q	S330	212	168	388	262	195	154	357	241	0.16	0.15
20	N. Tom Darlington Dr.	Andora Hills Wash	100.0	% of AHW4 Q	S330	212	168	388	262	212	168	388	262	0.16	0.16
21	E. Northview Ln	South Trib to Galloway Wash	2.4	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	19	18	32	30	0.98	0.02
22	N. Pima Rd.	South Trib to Galloway Wash	9.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	78	72	131	122	0.98	0.10
23	N. Mule Train Rd.	South Trib to Galloway Wash	54.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	438	404	736	688	0.98	0.54
24	E. Long Rifle Rd.	South Trib to Galloway Wash	57.1	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	457	422	768	718	0.98	0.56
25	E. Primrose Path	South Trib to Galloway Wash	59.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	478	441	803	751	0.98	0.59
26	N. Tranquil Tr.	South Trib to Galloway Wash	63.3	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	507	467	851	796	0.98	0.62
27	E. Carefree Dr.	South Trib to Galloway Wash	73.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	591	545	992	928	0.98	0.72
28	private drive	South Trib to Galloway Wash	75.8	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	607	560	1020	954	0.98	0.74
29	E. Hum Rd.	South Trib to Galloway Wash	78.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	630	581	1058	990	0.98	0.77
30	E. Sundance Tr.	South Trib to Galloway Wash	79.9	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	640	590	1074	1005	0.98	0.78
31	N. Scopa Trail	South Trib to Galloway Wash	95.7	% of GWW1_5 Q	GWW1_5	801	739	1345	1258	766	707	1287	1204	0.98	0.94
32	N. Pima Rd.	Galloway Wash	100.0	% of conc. pt. 284 Q	GWW1_2	609	593	1155	1110	609	593	1155	1110	1.04	1.04
33	N. Carefree Dr.	Galloway Wash	93.9	% of conc. pt. 286L Q	CP286L	849	894	1717	1750	797	839	1612	1643	1.79	1.68
34	N. Dream St.	Galloway Wash	99.7	% of conc. pt. 286L Q	CP286L	849	894	1717	1750	846	891	1712	1745	1.79	1.78
35	N. Tranquil Tr.	Galloway Wash	100.6	% of conc. pt. 286 Q	CP286	1700	1985	3231	3439	1710	1997	3250	3460	5.11	5.14
36	N. Scopa Trail	Galloway Wash	99.4	% of conc. pt. 287 Q	CP287	2024	2490	3955	4412	2012	2475	3931	4386	6.11	6.07
37	N. Pima Rd. & E. Double Eagle Dr.	Trib 1 to Galloway Wash	53.7	% of GWW132 Q	GWW132	420	353	728	624	226	190	391	335	0.347	0.19
38	E. Double Eagle Dr.	Trib 1 to Galloway Wash	85.5	% of GWW132 Q	GWW132	420	353	728	624	359	302	622	534	0.347	0.30
39	E. Carefree Dr.	Trib 1 to Galloway Wash	92.8	% of GWW132 Q	GWW132	420	353	728	624	390	328	676	579	0.347	0.32
40	E. Paint Pony Dr.	Tributary to North Galloway Wash	6.6	% of GWW131 Q	GWW131	641	588	1141	1054	42	39	75	70	0.774	0.05
41	E. Paint Pony Dr.	Tributary to North Galloway Wash	19.8	% of GWW131 Q	GWW131	641	588	1141	1054	127	116	226	209	0.774	0.15
42	E. Paint Pony Dr.	Tributary to North Galloway Wash	23.4	% of GWW131 Q	GWW131	641	588	1141	1054	150	138	267	247	0.774	0.18
43	E. Cow Track Dr.	North Galloway Wash	86.4	% of conc. pt. 286R Q	CP286R	1199	1314	2317	2423	1036	1136	2002	2094	3.32	2.87
44	N. Sombrero Rd.	North Galloway Wash	88.9	% of conc. pt. 286R Q	CP286R	1199	1314	2317	2423	1065	1168	2059	2153	3.32	2.95
45	E. Cow Track Dr.	North Galloway Wash	91.0	% of conc. pt. 286R Q	CP286R	1199	1314	2317	2423	1091	1195	2107	2204	3.32	3.02
46	E. Celestial St. & E. Paint Pony Dr.	North Galloway Wash	91.2	% of conc. pt. 286R Q	CP286R	1199	1314	2317	2423	1094	1199	2113	2210	3.32	3.03
47	N. Silver Saddle Dr. & E. Maverick Cir.	Trib 2 to Galloway Wash	24.5	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	167	158	301	287	1.00	0.25
48	N. Sombrero Rd.	Trib 2 to Galloway Wash	27.9	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	190	180	343	326	1.00	0.28
49	N. Concho Ln.	Trib 2 to Galloway Wash	1.6	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	11	10	20	19	1.00	0.02
50	E. Golden Spur Ln.	Trib 2 to Galloway Wash	13.4	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	91	87	165	157	1.00	0.13
51	E. Golden Spur Ln.	Trib 2 to Galloway Wash	17.8	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	121	115	219	208	1.00	0.18
52	E. Golden Spur Ln.	Trib 2 to Galloway Wash	60.6	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	413	391	745	709	1.00	0.61
53	E. Rising Sun Rd.	Trib 2 to Galloway Wash	67.6	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	461	437	831	791	1.00	0.68
54	E. Celestial St. & N. Dream St.	Trib 2 to Galloway Wash	70.1	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	478	453	862	820	1.00	0.70
55	N. Tranquil Tr.	Trib 2 to Galloway Wash	74.8	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	510	483	919	875	1.00	0.75
56	E. Horizon Dr.	Trib 3 to Galloway Wash	6.3	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	43	41	77	74	1.00	0.06
57	N. Rising Sun Rd.	Trib 3 to Galloway Wash	6.6	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	45	43	81	77	1.00	0.07
58	unnamed culdesac	Trib 3 to Galloway Wash	7.8	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	53	50	96	91	1.00	0.08
59	unnamed culdesac	Trib 3 to Galloway Wash	9.5	% of GWW1_4 Q	GWW1_4	682	646	1229	1170	65	61	117	111	1.00	0.10
60	private drive	Trib 4 to Galloway Wash	1.4	% of GWW1_6 Q	GWW1_6	503	439	899	794	7	6	13	11	0.59	0.01
61	private drive	Trib 4 to Galloway Wash	3.2	% of GWW1_6 Q	GWW1_6	503	439	899	794	16	14	28	25	0.59	0.02
62	private drive	Trib 4 to Galloway Wash	4.8	% of GWW1_6 Q	GWW1_6	503	439	899	794	24	21	43	38	0.59	0.03
63	N. Spanish Boot Rd.	Trib 4 to Galloway Wash	7.9	% of GWW1_6 Q	GWW1_6	503	439	899	794	40	35	71	63	0.59	0.05

Table D.1 Existing Condition Road Crossing Discharge Calculations															
	ROAD CROSSING		RATIO		MODEL	EXISTING CONDITIONS MODEL PEAK DISCHARGES (CFS)				ROAD CROSSING PEAK DISCHARGES (CFS)				Model CP	Road Xing
ID	*Road*	*Wash*	CALCULATION		KK ID	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*Area (sq.mi.)*	*Area (sq.mi.)*
64	N. Rising Sun Rd.	Trib 4 to Galloway Wash	48.9	% of GWW1_6 Q	GWW1_6	503	439	899	794	246	215	439	388	0.59	0.29
65	E. Grapevine Rd.	Trib 4 to Galloway Wash	54.9	% of GWW1_6 Q	GWW1_6	503	439	899	794	276	241	493	436	0.59	0.32
66	N. Rising Sun Rd.	Trib 5 to Galloway Wash	8.4	% of GWW1_6 Q	GWW1_6	503	439	899	794	42	37	76	67	0.59	0.05
67	W. Rising Star Wy.	Trib 5 to Galloway Wash	14.0	% of GWW1_6 Q	GWW1_6	503	439	899	794	70	61	125	111	0.59	0.08
68	N. Father Kino Tr.	Grapevine Wash	100.0	% of conc. pt. 280 Q	GVW2	2564	3256	4686	5492	2564	3256	4686	5492	6.02	6.02
69	N. Father Kino Tr.	Tributary to Grapevine Wash	1.5	% of GVW3_1 Q	GVW3_1	656	633	1227	1178	10	9	18	18	1.04	0.02
70	E. Montezuma Rd.	Tributary to Grapevine Wash	3.7	% of GVW3_1 Q	GVW3_1	656	633	1227	1178	24	23	45	44	1.04	0.04
71	unnamed road	Tributary to Rowe Wash	16.1	% of conc. pt. 270 Q	GVW1	2199	2522	3749	4141	354	406	604	667	4.9	0.79

Table D.2 Future Conditions Road Crossing Discharge Calculations

ROAD CROSSING			RATIO CALCULATION		MODEL KK ID	FUTURE CONDITIONS MODEL PEAK DISCHARGES (CFS)				ROAD CROSSING PEAK DISCHARGES (CFS)				Model CP	Road Xing
ID	Road	Wash				10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	Area (sq.mi.)	Area (sq.mi.)
1	N. Sidewinder Rd.	Tributary 1 to Andora Hills Wash	8.7	% of AHW1 Q	S320	708	561	1258	814	62	49	109	71	0.42	0.04
2	E. Long Rifle Rd.	Tributary 1 to Andora Hills Wash	14.3	% of AHW1 Q	S320	708	561	1258	814	101	80	180	116	0.42	0.06
3	E. Long Rifle Rd. & N. Long Rifle Rd.	Tributary 1 to Andora Hills Wash	50.8	% of AHW1 Q	S320	708	561	1258	814	360	285	639	414	0.42	0.21
4	N. Tom Darlington Dr.	Tributary 1 to Andora Hills Wash	100.0	% of AHW1 Q	S320	708	561	1258	814	708	561	1258	814	0.42	0.42
5	E. Bivouc Tr.	Tributary 1 to Andora Hills Wash	100.0	% of AHW1 Q	S320	708	561	1258	814	708	561	1258	814	0.42	0.42
6	E. Bivouac Tr.	Andora Hills Wash	100.0	% of C340R Q	C340R	909	767	1626	1180	909	767	1626	1180	0.65	0.65
7	E. Carefree Dr.	Andora Hills Wash	100.0	% of C340 Q	C340	1187	1097	2135	1695	1187	1097	2135	1695	0.92	0.92
8	N. Lazy Burro Rd.	Andora Hills Wash	105.2	% of C340 Q	C340	1187	1097	2135	1695	1249	1154	2246	1783	0.92	0.97
9	N. Lazy Burro Rd.	Andora Hills Wash	107.9	% of C340 Q	C340	1187	1097	2135	1695	1281	1184	2304	1829	0.92	0.99
10	N. Holiday Ln.	Andora Hills Wash	109.3	% of C340 Q	C340	1187	1097	2135	1695	1297	1199	2334	1853	0.92	1.01
11	N. Terrace	Andora Hills Wash	114.7	% of C340 Q	C340	1187	1097	2135	1695	1361	1258	2449	1944	0.92	1.06
12	N. Piedra Grande Dr.	Andora Hills Wash	100.0	% of C350 Q	C350	1269	1191	2293	1938	1269	1191	2293	1938	1.09	1.09
13	private drive	Andora Hills Wash	107.1	% of C350 Q	C350	1269	1191	2293	1938	1359	1276	2456	2076	1.09	1.17
14	N. Never Mind Tr.	Tributary 2 to Andora Hills Wash	74.6	% of AHW3 Q	S340L	422	337	781	520	315	251	583	388	0.28	0.21
15	E. Long Rifle Rd.	Andora Hills Wash	29.2	% of AHW4 Q	S330	214	169	382	271	62	49	112	79	0.16	0.05
16	E. Nonchalant Av.	Andora Hills Wash	70.0	% of AHW4 Q	S330	214	169	382	271	150	118	267	190	0.16	0.11
17	N. Bloody Basin Rd. & E. Nonchalant Av.	Andora Hills Wash	76.9	% of AHW4 Q	S330	214	169	382	271	165	130	294	208	0.16	0.12
18	E. Elbow Bend	Andora Hills Wash	84.9	% of AHW4 Q	S330	214	169	382	271	182	143	324	230	0.16	0.14
19	E. Carefree Dr.	Andora Hills Wash	91.9	% of AHW4 Q	S330	214	169	382	271	197	155	351	249	0.16	0.15
20	N. Tom Darlington Dr.	Andora Hills Wash	100.0	% of AHW4 Q	S330	214	169	382	271	214	169	382	271	0.16	0.16
21	E. Northview Ln	South Trib to Galloway Wash	2.4	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	22	20	36	34	0.98	0.02
22	N. Pima Rd.	South Trib to Galloway Wash	9.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	89	81	145	136	0.98	0.10
23	N. Mule Train Rd.	South Trib to Galloway Wash	54.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	500	458	819	766	0.98	0.54
24	E. Long Rifle Rd.	South Trib to Galloway Wash	57.1	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	522	478	855	799	0.98	0.56
25	E. Primrose Path	South Trib to Galloway Wash	59.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	546	500	894	836	0.98	0.59
26	N. Tranquil Tr.	South Trib to Galloway Wash	63.3	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	578	529	947	886	0.98	0.62
27	E. Carefree Dr.	South Trib to Galloway Wash	73.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	674	617	1104	1032	0.98	0.72
28	private drive	South Trib to Galloway Wash	75.8	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	693	635	1135	1062	0.98	0.74
29	E. Hum Rd.	South Trib to Galloway Wash	78.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	719	658	1178	1101	0.98	0.77
30	E. Sundance Tr.	South Trib to Galloway Wash	79.9	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	730	668	1196	1118	0.98	0.78
31	N. Scopa Trail	South Trib to Galloway Wash	95.7	% of GWW1_5 Q	GWW1_5	914	837	1497	1400	875	801	1432	1340	0.98	0.94
32	N. Pima Rd.	Galloway Wash	100.0	% of conc. pt. 284 Q	GWW1_2	688	660	1259	1206	688	660	1259	1206	1.04	1.04
33	N. Carefree Dr.	Galloway Wash	93.9	% of conc. pt. 286L Q	CP286L	946	991	1836	1899	888	931	1724	1783	1.79	1.68
34	N. Dream St.	Galloway Wash	99.7	% of conc. pt. 286L Q	CP286L	946	991	1836	1899	943	988	1830	1893	1.79	1.78
35	N. Tranquil Tr.	Galloway Wash	100.6	% of conc. pt. 286 Q	CP286	1795	2099	3363	3613	1806	2112	3383	3635	5.11	5.14
36	N. Scopa Trail	Galloway Wash	99.4	% of conc. pt. 287 Q	CP287	2129	2615	4099	4588	2116	2599	4074	4560	6.11	6.07
37	N. Pima Rd. & E. Double Eagle Dr.	Trib 1 to Galloway Wash	53.7	% of GWW132 Q	GWW132	420	353	728	624	226	190	391	335	0.35	0.19
38	E. Double Eagle Dr.	Trib 1 to Galloway Wash	85.5	% of GWW132 Q	GWW132	420	353	728	624	359	302	622	534	0.35	0.30
39	E. Carefree Dr.	Trib 1 to Galloway Wash	92.8	% of GWW132 Q	GWW132	420	353	728	624	390	328	676	579	0.35	0.32
40	E. Paint Pony Dr.	Tributary to North Galloway Wash	6.6	% of GWW131 Q	GWW131	641	588	1141	1054	42	39	75	70	0.77	0.05
41	E. Paint Pony Dr.	Tributary to North Galloway Wash	19.8	% of GWW131 Q	GWW131	641	588	1141	1054	127	116	226	209	0.77	0.15
42	E. Paint Pony Dr.	Tributary to North Galloway Wash	23.4	% of GWW131 Q	GWW131	641	588	1141	1054	150	138	267	247	0.77	0.18
43	E. Cow Track Dr.	North Galloway Wash	86.4	% of conc. pt. 286R Q	CP286R	1227	1340	2360	2460	1060	1158	2040	2126	3.32	2.87
44	N. Sombrero Rd.	North Galloway Wash	88.9	% of conc. pt. 286R Q	CP286R	1227	1340	2360	2460	1090	1191	2097	2186	3.32	2.95
45	E. Cow Track Dr.	North Galloway Wash	91.0	% of conc. pt. 286R Q	CP286R	1227	1340	2360	2460	1116	1219	2147	2237	3.32	3.02
46	E. Celestial St. & E. Paint Pony Dr.	North Galloway Wash	91.2	% of conc. pt. 286R Q	CP286R	1227	1340	2360	2460	1119	1222	2153	2244	3.32	3.03
47	N. Silver Saddle Dr. & E. Maverick Cir.	Trib 2 to Galloway Wash	24.5	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	168	159	302	287	1.00	0.25
48	N. Sombrero Rd.	Trib 2 to Galloway Wash	27.9	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	191	181	344	327	1.00	0.28
49	N. Concho Ln.	Trib 2 to Galloway Wash	1.6	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	11	10	20	19	1.00	0.02
50	E. Golden Spur Ln.	Trib 2 to Galloway Wash	13.4	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	92	87	165	157	1.00	0.13
51	E. Golden Spur Ln.	Trib 2 to Galloway Wash	17.8	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	122	116	219	209	1.00	0.18
52	E. Golden Spur Ln.	Trib 2 to Galloway Wash	60.6	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	416	393	747	711	1.00	0.61
53	E. Rising Sun Rd.	Trib 2 to Galloway Wash	67.6	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	464	439	834	793	1.00	0.68
54	E. Celestial St. & N. Dream St.	Trib 2 to Galloway Wash	70.1	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	481	455	864	822	1.00	0.70
55	N. Tranquil Tr.	Trib 2 to Galloway Wash	74.8	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	513	485	922	877	1.00	0.75
56	E. Horizon Dr.	Trib 3 to Galloway Wash	6.3	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	43	41	78	74	1.00	0.06
57	N. Rising Sun Rd.	Trib 3 to Galloway Wash	6.6	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	45	43	81	77	1.00	0.07
58	unnamed culdesac	Trib 3 to Galloway Wash	7.8	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	54	51	96	91	1.00	0.08
59	unnamed culdesac	Trib 3 to Galloway Wash	9.5	% of GWW1_4 Q	GWW1_4	686	649	1233	1173	65	62	117	111	1.00	0.10
60	private drive	Trib 4 to Galloway Wash	1.4	% of GWW1_6 Q	GWW1_6	509	443	904	797	7	6	13	11	0.59	0.01
61	private drive	Trib 4 to Galloway Wash	3.2	% of GWW1_6 Q	GWW1_6	509	443	904	797	16	14	28	25	0.59	0.02
62	private drive	Trib 4 to Galloway Wash	4.8	% of GWW1_6 Q	GWW1_6	509	443	904	797	24	21	43	38	0.59	0.03

Table D.2 Future Conditions Road Crossing Discharge Calculations

	ROAD CROSSING		RATIO		MODEL	FUTURE CONDITIONS MODEL PEAK DISCHARGES (CFS)				ROAD CROSSING PEAK DISCHARGES (CFS)				Model CP	Road Xing
ID	*Road*	*Wash*	CALCULATION		KK ID	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*10-yr 6-hr*	*10-yr 24-hr*	*100-yr 6-hr*	*100-yr 24-hr*	*Area (sq.mi.)*	*Area (sq.mi.)*
63	N. Spanish Boot Rd.	Trib 4 to Galloway Wash	7.9	% of GWW1_6 Q	GWW1_6	509	443	904	797	40	35	72	63	0.59	0.05
64	N. Rising Sun Rd.	Trib 4 to Galloway Wash	48.9	% of GWW1_6 Q	GWW1_6	509	443	904	797	249	217	442	390	0.59	0.29
65	E. Grapevine Rd.	Trib 4 to Galloway Wash	54.9	% of GWW1_6 Q	GWW1_6	509	443	904	797	279	243	496	437	0.59	0.32
66	N. Rising Sun Rd.	Trib 5 to Galloway Wash	8.4	% of GWW1_6 Q	GWW1_6	509	443	904	797	43	37	76	67	0.59	0.05
67	W. Rising Star Wy.	Trib 5 to Galloway Wash	14.0	% of GWW1_6 Q	GWW1_6	509	443	904	797	71	62	126	111	0.59	0.08
68	N. Father Kino Tr.	Grapevine Wash	100.0	% of conc. pt. 280 Q	GVW2	3164	3937	5447	6408	3164	3937	5447	6408	6.02	6.02
69	N. Father Kino Tr.	Tributary to Grapevine Wash	1.5	% of GVW3_1 Q	GVW3_1	694	677	1294	1254	10	10	19	19	1.04	0.02
70	E. Montezuma Rd.	Tributary to Grapevine Wash	3.7	% of GVW3_1 Q	GVW3_1	694	677	1294	1254	26	25	48	46	1.04	0.04
71	unnamed road	Tributary to Rowe Wash	16.1	% of conc. pt. 270 Q	GVW1	2270	2586	3860	4242	365	416	621	683	4.90	0.79

Appendix E

CD-ROM with HEC-1 Models
and
Shapefiles of Road Crossing Locations and Drainage Basins

October 23, 2002

This CD contains HEC-1 files for the Andora Hills and Galloway Wash watersheds. These models reflect revisions made in response to FEMA comments on the Andora Hills/Galloway Wash FDS.

The models were constructed for the Carefree DMP by:

JE Fuller/ Hydrology & Geomorphology, Inc.
6101 S. Rural Road, Suite 110
Tempe, AZ 85283
(480) 752-2124

under subcontract to CH2M Hill.

Four models for each watershed are included:

100-year 6-hour
100-year 24-hour
10-year 6-hour
10-year 24-hour

An example of the file naming convention:

aw10024e.dat = andora hills wash 100-year 24-hour existing condition

The existing directory contains the existing conditions input and output files. Also in the existing directory are MCUHP1 input files for Andora Hills Wash. These files were used to compute Tc and R for revised basins AHW1 and AHW3 for the
100-year models and for all basins for the 10-year models.

The future directory contains the future condition input and output files. It also contains the ddms files modified from FCD 99-14 files for galloway wash for the future condition land use.

Also on this CD are two ArcView shapefiles of the road crossing locations and subbasin boundaries to each crossing.

Appendix D – Flow Split Estimations

Terravita Way Boundary Conditions and Flow Split Determination

TO: File

COPIES: File

FROM: Tony Bokich

DATE: April 30, 2003 (Revised (3/19/04)

A hydraulic analysis was performed on Terravita Way to determine the downstream boundary condition for the Unnamed Central Tributary to Cave Creek and to determine the direction flow would travel. Flow could travel north through 4-10'x4' RCBC's, or north, south or west over Terravita Way.

The Haestad CulvertMaster program was used to determine the maximum water surface elevation at Terravita Way of 2141.45 and used as the boundary condition. This information was used to determine the maximum flow through the box culverts and overtopping flows at 4 low points along the roadway profile. Culvert and channel analyses generated a flow-rating table of box culvert and overtopping flows at four low points on the roadway profile. The analysis determined that 1,578 cfs flows through the box culvert while 142 cfs, 562 cfs, and 514 cfs will flow to the south, west, and north, respectively, of Terravita Way.

The total flow used in the analysis is 2,849 cfs. This figure omits the small side channel flow that enters the north side of the main stream about 70 feet upstream of the culvert. This wash (UC84 in the HEC-1 output) was combined at this location after the initial flow split of 2092 to the north and 704 to the south. It increased the north peak to 2116 cfs. The difference in peak flows between the overtopping analysis and the HEC-RAS flows at Terravita Way is a total of 24 cfs or 1.1% of the total flow.

The results of the flow split analysis produced rating curves that determine the flow split quantitatively. These rating curves were incorporated into the HEC-1 model. The peak flow entering the Unnamed Central Tributary to Cave Creek - North Branch is taken from concentration point CP84. The peak flow entering the South Branch is taken from RD84S and then D84IIN. Refer to the Summary of HEC-RAS Model Flow Changes table in the TDN.

Terravita Way Flow Split Estimation
03/19/2004
Carefree DMP
162944.DP.15.03

A total flow of cfs arrives at Terravita Way. The 2849 cfs flow will split at Terravita Way and will go:

1. Through the culvert to the North
2. Over the Road to the North
3. Over the Road to the West and
4. Over the Road and to the South.

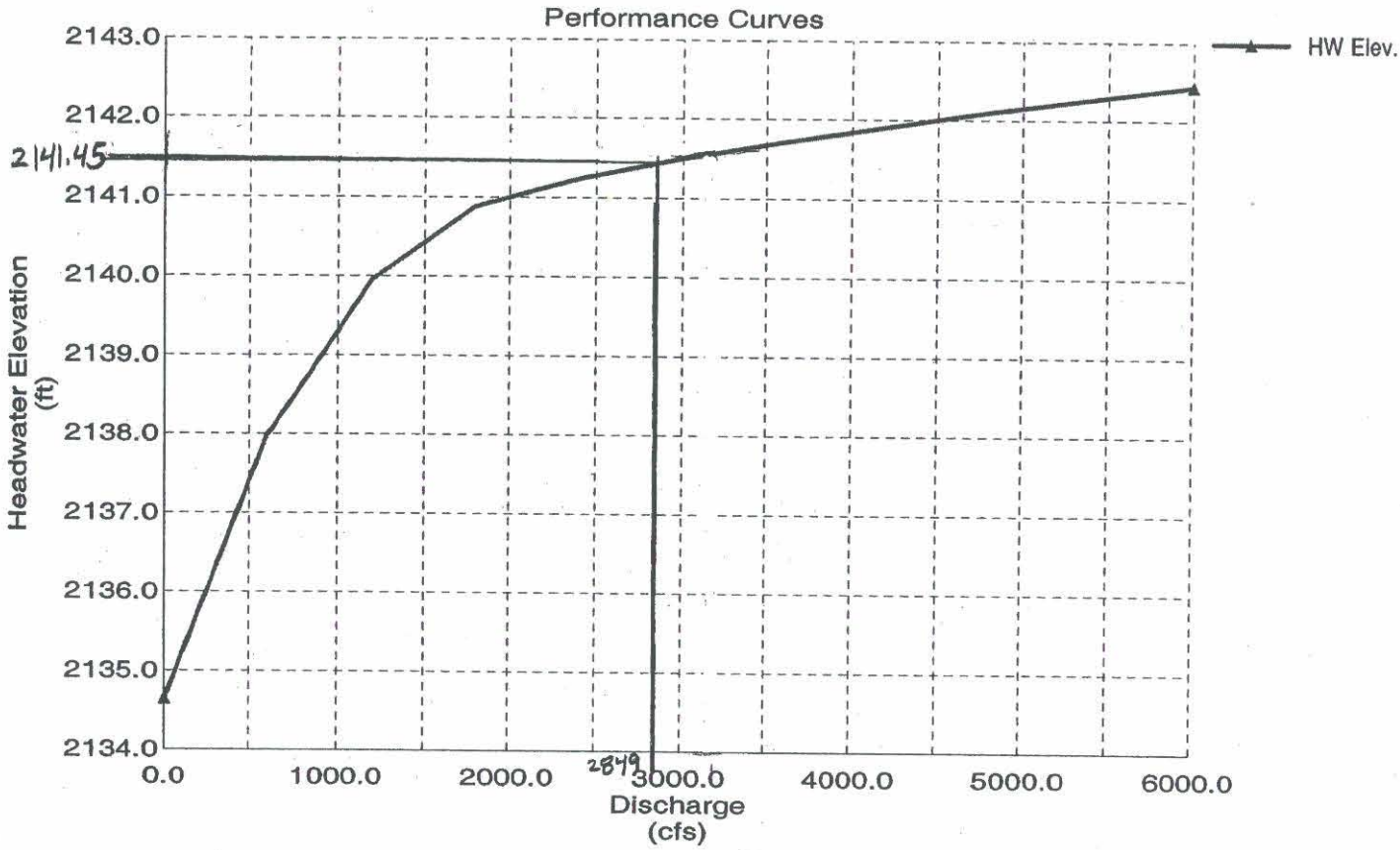
Culvert capacity was analyzed using both Culvert Master and HY-8 and the results were identical. A rating curve was developed that takes into account the headwater depths. Rating curves were developed for the total flow, culvert and overtopping and just for the culvert. The flow split was further analyzed with the Culvertmaster program at the centerline of overtopping (see attached map). This is the line at which overtopping will occur, it is not the centerline of the roadway. Using the 5 existing low points on the centerline profile, the centerline was divided into individual sections to determine the amount of flow that will go North, South, or West. A rating table was determined for each section to yield total flow for each section.

The resulting Rating Table is as follows:

WSE	Total Flow	Road	Culvert	North (Road & Culvert)	South	West
2134.64	0	0	0	0	0	0
2135.5	79.7	0	79.7	79.7	0	0
2136.55	255	0	255	255	0	0
2137.59	490	0	490	490	0	0
2138.98	880	0	880	880	0	0
2140.08	1250	50	1200	1250	0	0
2140.67	1550	175	1375	1550	0	0
2141	1964	514	1450	1839	0	125
2141.28	2475	950	1525	2090	10	375
2141.45	2849	1271	1578	2116	142	562
2141.52	3043	1443	1600	2270	150	663

Performance Curves Report
terravita way

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	6,000.00	600.00 cfs



Culvert Analysis Report
Terravita Way

ponent:Culvert-1

Culvert Summary			
Computed Headwater Elevation	2,141.45 ft	Discharge	1,577.80 cfs
Inlet Control HW Elev	2,141.45 ft	Tailwater Elevation	2,133.70 ft
Outlet Control HW Elev	2,140.83 ft	Control Type	Inlet Control
Headwater Depth/ Height	1.70		

Grades			
Upstream Invert	2,134.64 ft	Downstream Invert	2,133.70 ft
Length	90.00 ft	Constructed Slope	0.010444 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.79 ft
Slope Type	Steep	Normal Depth	2.43 ft
Flow Regime	Supercritical	Critical Depth	3.64 ft
Velocity Downstream	14.12 ft/s	Critical Slope	0.003320 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 4 ft	Rise	4.00 ft
Number Sections	4		

t Control Properties			
Outlet Control HW Elev	2,140.83 ft	Upstream Velocity Head	1.82 ft
Ke	0.40	Entrance Loss	0.73 ft

Inlet Control Properties			
Inlet Control HW Elev	2,141.45 ft	Flow Control	Submerged
Inlet Type 3/4" chamfers; 45 ° skewed headwall		Area Full	160.0 ft²
K	0.52200	HDS 5 Chart	11
M	0.66700	HDS 5 Scale	1
C	0.04020	Equation Form	2
Y	0.73000		

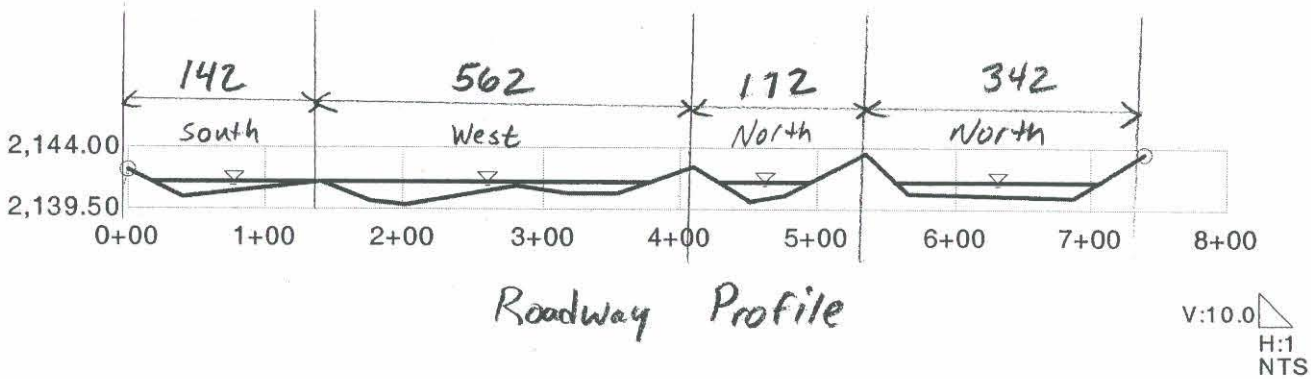
Cross Section
Cross Section for Irregular Channel

TERRAVITA WAY FLOW SPLIT ESTIMATION

Project Description	
Worksheet	Overall Roadway Section
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data	
Mannings Coefficient	0.035
Slope	0.005919 ft/ft
Water Surface Elevation	2,141.45 ft
Elevation Range	2,139.80 to 2,143.56
Discharge	1,271.07 cfs

Total Flow = 2849 cfs
Culvert = 1578 cfs
Road = 1271 cfs
WSE = 2141.45 ft



Roadway Profile

Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Overall Roadway Section
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.005919	ft/ft
Water Surface Elevation	2,141.45	ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.035	
Elevation Range	2,139.80 to 2,143.56	
Discharge	1,271.07	cfs
Flow Area	453.2	ft²
Wetted Perimeter	569.63	ft
Top Width	569.39	ft
Actual Depth	1.65	ft
Critical Elevation	2,141.15	ft
Critical Slope	0.021377	ft/ft
Velocity	2.80	ft/s
Velocity Head	0.12	ft
Specific Energy	2,141.57	ft
Froude Number	0.55	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00	7+40	0.035

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00	2,142.30
0+40	2,140.35
1+40	2,141.50
1+75	2,140.05
2+01	2,139.80
2+81	2,141.14
3+17	2,140.62
3+54	2,140.62
4+10	2,142.62
4+51	2,140.08
4+76	2,140.49

Worksheet
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
5+35	2,143.56
5+65	2,140.58
6+88	2,140.38
7+40	2,143.50

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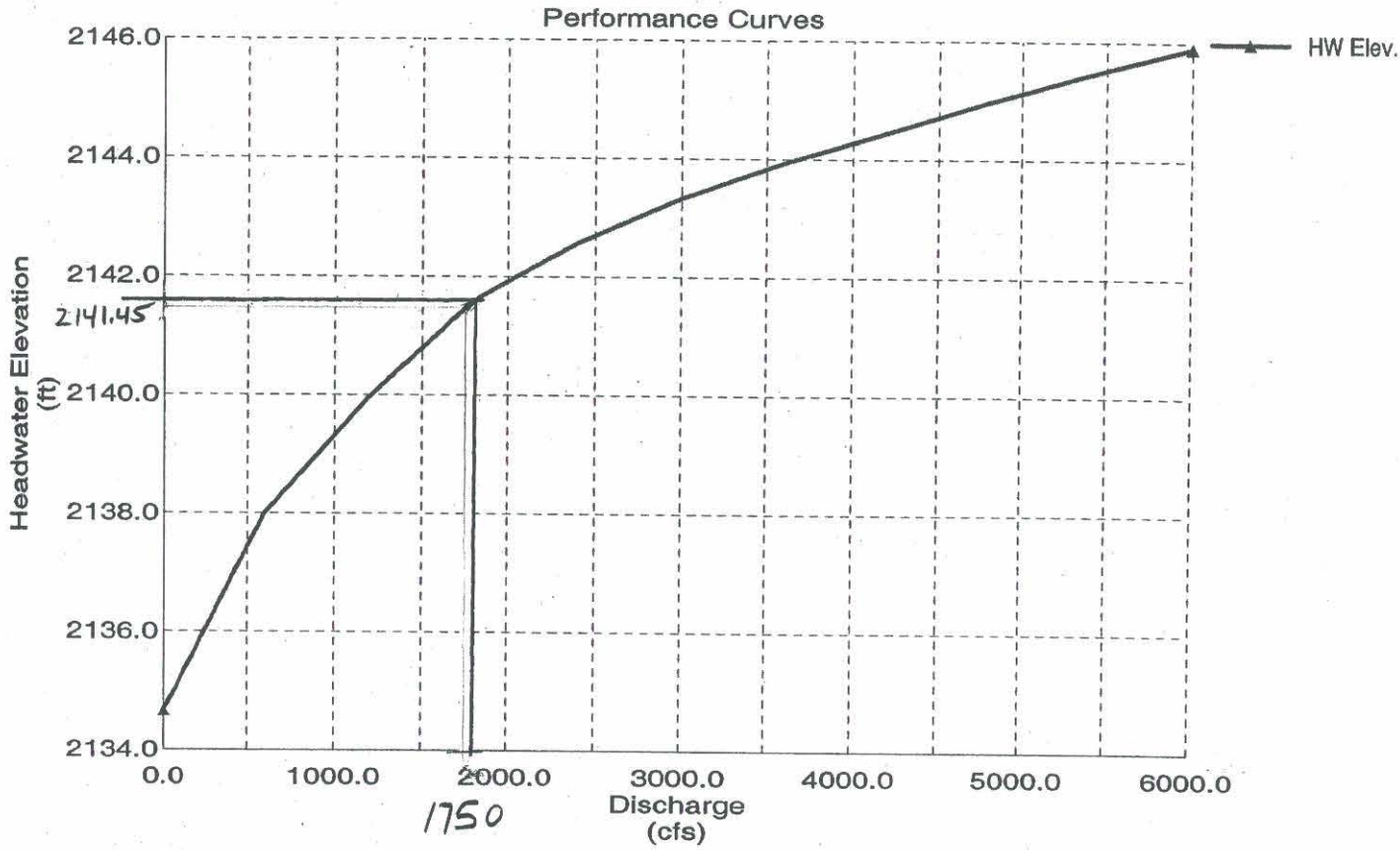
CH2M HILL
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Performance Curves Report
terravita way <north 1>

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	6,000.00	600.00 cfs



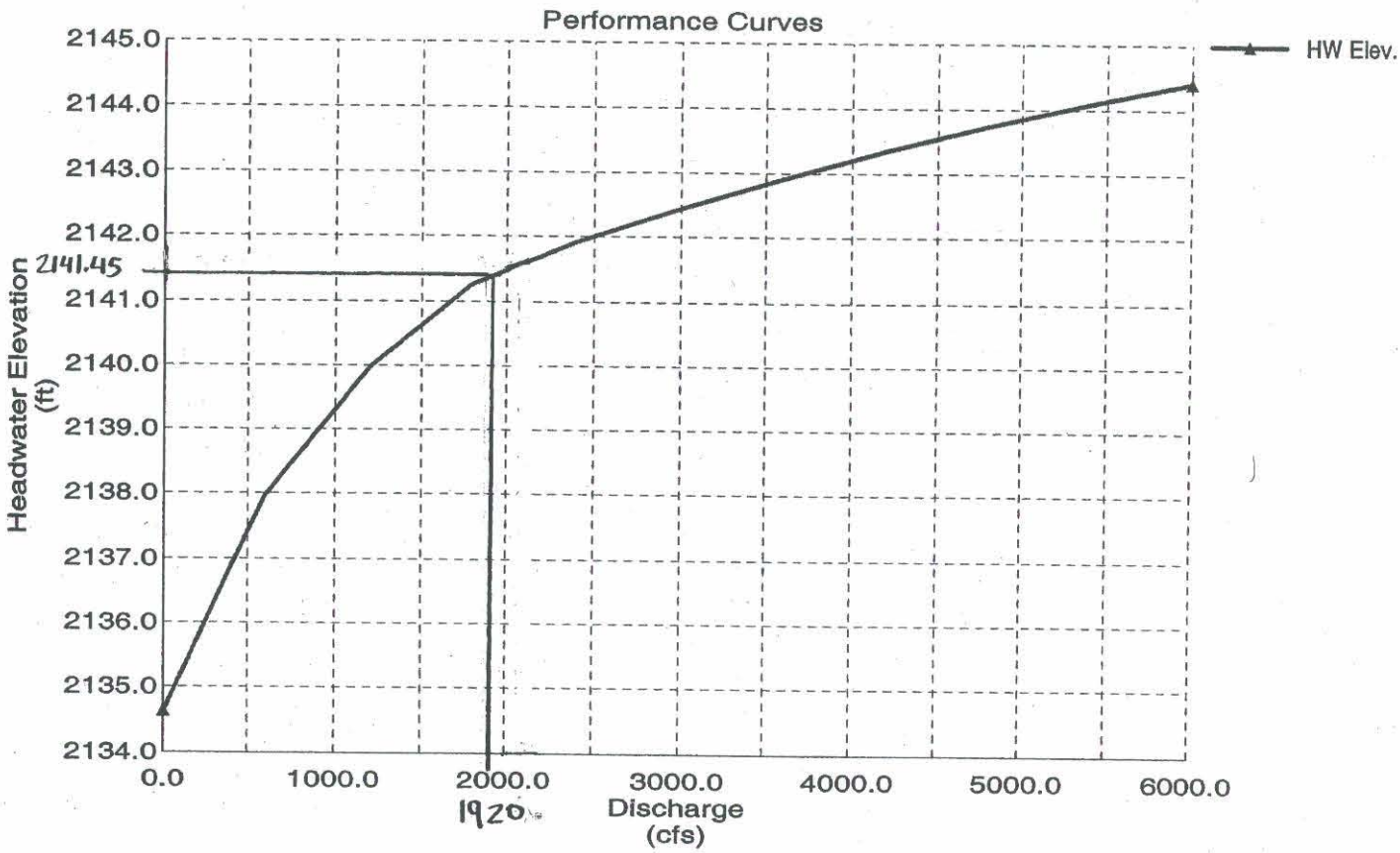
1750 - 1578 = 172 cfs

CULVERT FLOW

OVERTOPPING

Performance Curves Report
terravita way <north 2>

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	6,000.00	600.00	cfs



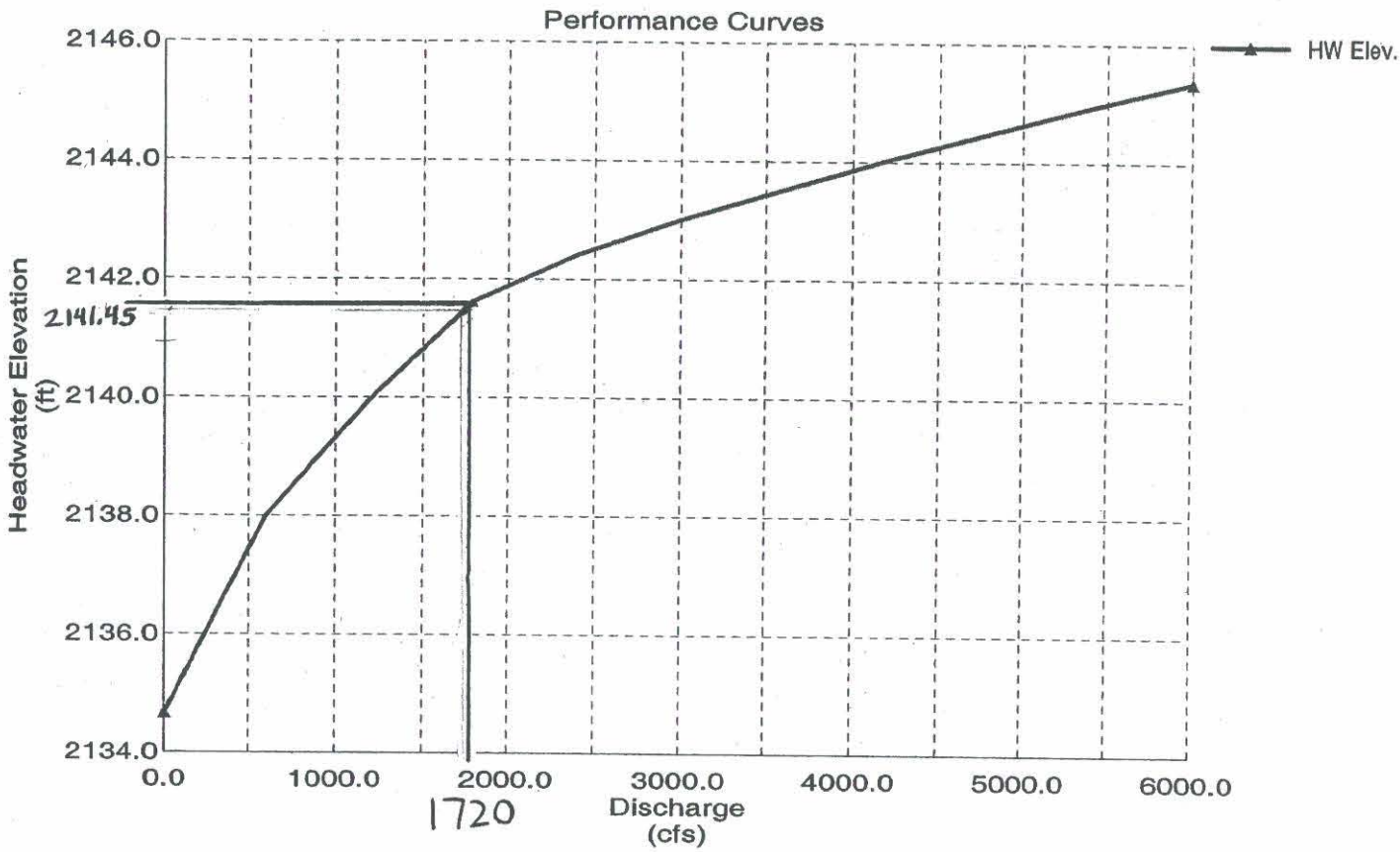
1920 - 1578 = 342 cfs

↑ CULVERT FLOW

↑ OVERTOPPING

Performance Curves Report
terravita way <south>

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	6,000.00	600.00	cfs



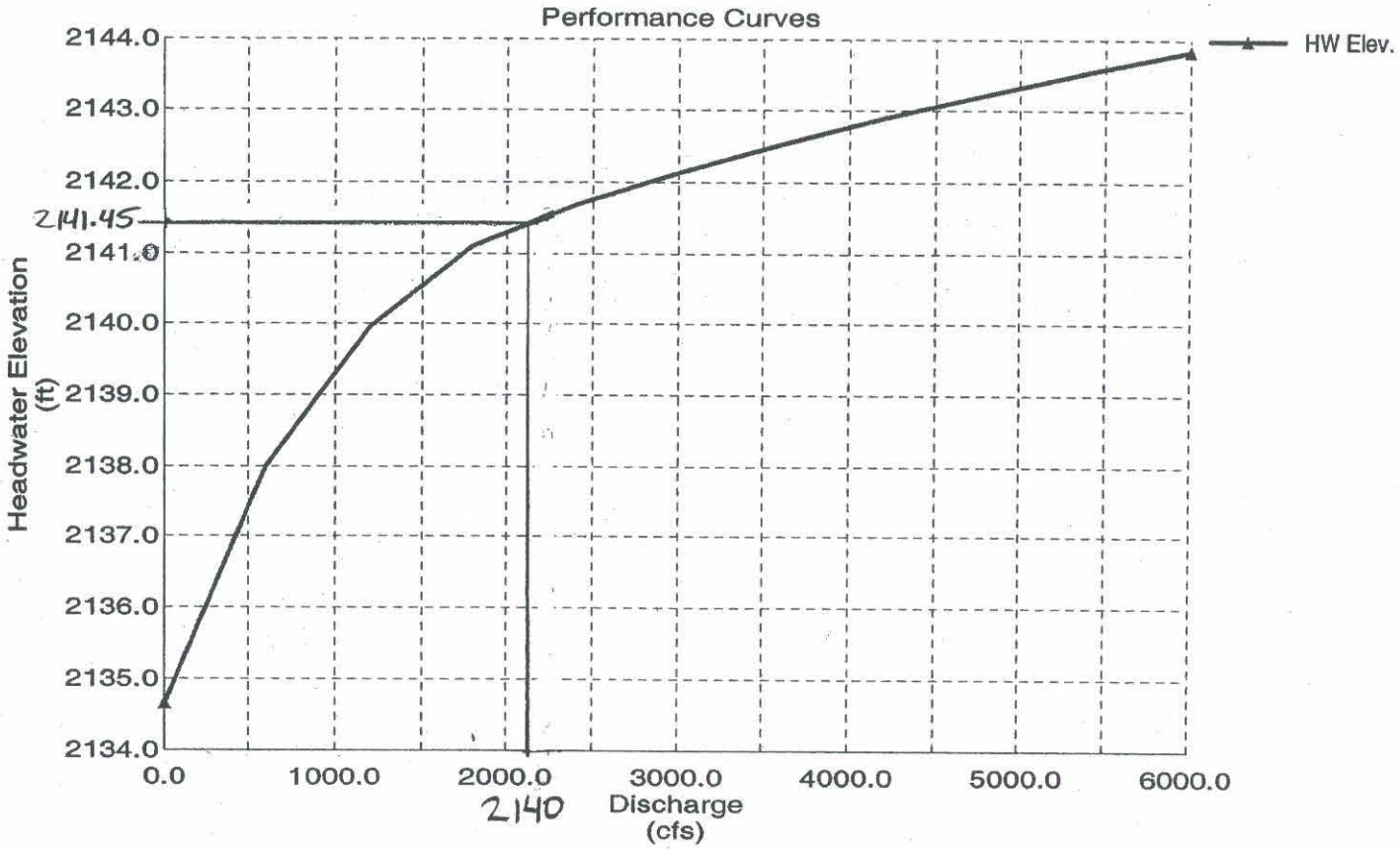
1720 - 1578 = 142 cfs

culvert flow

overtopping

Performance Curves Report
terravita way <west>

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	6,000.00	600.00 cfs



2140 − 1578 = 562 cfs

culvert flow

overtopping

HY-8, Culvert Flows only

CURRENT DATE: 05-13-2002
CURRENT TIME: 12:43:49

FILE DATE: 05-13-2002
FILE NAME: TERREV

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2134.64	2133.70	90.00	4 RCB	10.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SITE DATA

CULVERT SHAPE, MATERIAL, INLET

SUMMARY OF CULVERT FLOWS (cfs) FILE: TERREV DATE: 05-13-2002

culvert Rating Curve:

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2134.64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2136.57	325.0	325.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2137.74	650.0	650.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2138.76	975.0	975.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2139.88	1300.0	1297.1	0.0	0.0	0.0	0.0	0.0	0.26	5
2140.62	1625.0	1481.8	0.0	0.0	0.0	0.0	0.0	132.87	4
2140.91	1950.0	1547.3	0.0	0.0	0.0	0.0	0.0	384.87	4
2140.95	2000.0	1556.0	0.0	0.0	0.0	0.0	0.0	429.41	3
2141.30	2600.0	1622.0	0.0	0.0	0.0	0.0	0.0	971.22	4
2141.45	2925.0	1620.4	0.0	0.0	0.0	0.0	0.0	1282.37	3
2141.64	3250.0	1606.4	0.0	0.0	0.0	0.0	0.0	1709.23	12
2139.80	1275.3	1275.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

Hance WSE w/ culvert WS

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: TERREV DATE: 05-13-2002

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2134.64	0.000	0.00	0.00	0.00
2136.57	0.000	325.00	0.00	0.00
2137.74	0.000	650.00	0.00	0.00
2138.76	0.000	975.00	0.00	0.00
2139.88	-0.005	1300.00	2.64	0.20
2140.62	-0.010	1625.00	10.30	0.63
2140.91	-0.009	1950.00	17.79	0.91
2140.95	-0.006	2000.00	14.55	0.73
2141.30	-0.003	2600.00	6.80	0.26
2141.45	-0.008	2925.00	22.22	0.76
2141.64	0.000	3250.00	-65.61	-2.02

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-13-2002
CURRENT TIME: 12:43:49

FILE DATE: 05-13-2002
FILE NAME: TERREV

PERFORMANCE CURVE FOR CULVERT 1 - 4(10.00 (ft) BY 4.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	2134.64	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
325.00	2136.57	1.93	1.93	1-S2n	0.81	1.27	0.86	1.57	9.42	9.09
650.00	2137.74	3.10	3.10	1-S2n	1.27	2.02	1.42	2.31	11.44	11.27
975.00	2138.76	4.12	4.12	5-S2n	1.66	2.65	1.93	2.88	12.64	12.72

1297.10	2139.87	5.23	5.23	5-S2n	2.01	3.20	2.38	3.35	13.61	13.82
1481.83	2140.62	5.98	5.98	5-S2n	2.20	3.50	2.63	3.77	14.08	14.73
1547.33	2140.90	6.26	5.57	4-FFt	2.27	3.60	2.27	4.14	17.05	15.50
1556.04	2140.94	6.30	5.65	4-FFt	2.28	3.62	2.28	4.19	17.08	15.61
1621.99	2141.24	6.60	6.46	4-FFt	2.34	3.72	2.34	4.79	17.30	16.78
1620.40	2141.38	6.59	6.74	4-FFt	2.34	3.72	4.00	5.08	10.13	17.33
1606.37	2141.61	6.53	6.97	4-FFt	2.33	3.69	4.00	5.35	10.04	17.83

ÄÄ

El. inlet face invert 2134.64 ft El. outlet invert 2133.70 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

ÄÄ

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION	0.00 ft
INLET ELEVATION	2134.64 ft
OUTLET STATION	90.00 ft
OUTLET ELEVATION	2133.70 ft
NUMBER OF BARRELS	4
SLOPE (V/H)	0.0104
CULVERT LENGTH ALONG SLOPE	90.00 ft

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

ÄÄ

CURRENT DATE: 05-13-2002 FILE DATE: 05-13-2002
CURRENT TIME: 12:43:49 FILE NAME: TERREV

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ TAILWATER ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	18.00 ft
SIDE SLOPE H/V (X:1)	3.0
CHANNEL SLOPE V/H (ft/ft)	0.033
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	2133.70 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	2133.70 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	2133.70	0.000	0.00	0.00	0.00
325.00	2135.27	1.277	1.57	9.09	3.24
650.00	2136.01	1.307	2.31	11.27	4.76
975.00	2136.58	1.321	2.88	12.72	5.93
1300.00	2137.05	1.331	3.35	13.82	6.90
1625.00	2137.47	1.338	3.77	14.73	7.75
1950.00	2137.84	1.343	4.14	15.50	8.52
2000.00	2137.89	1.344	4.19	15.61	8.63
2600.00	2138.49	1.351	4.79	16.78	9.86
2925.00	2138.78	1.355	5.08	17.33	10.46
3250.00	2139.05	1.358	5.35	17.83	11.02

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ROADWAY OVERTOPPING DATA ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	60.00 ft

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X ft	Y ft
1	0.00	2142.30

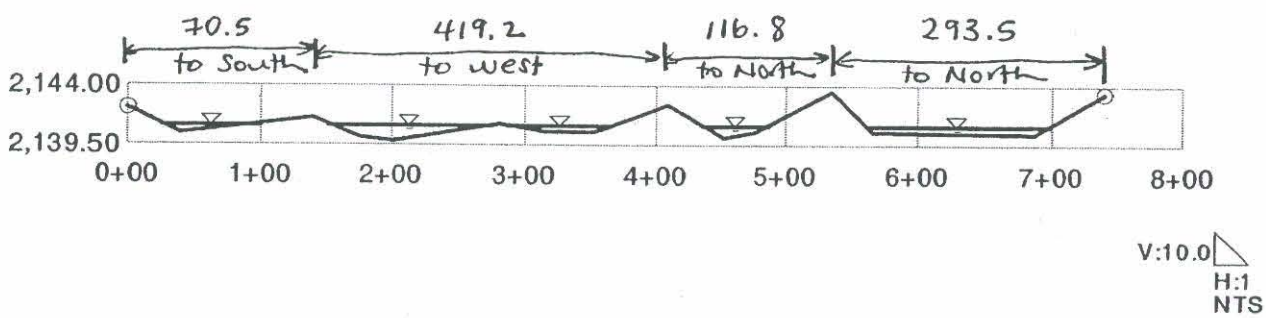
2	40.00	2140.35
3	140.47	2141.50
4	175.37	2140.05
5	201.41	2139.80
6	280.79	2141.14
7	316.66	2140.62
8	353.87	2140.62
9	410.23	2142.62
10	450.84	2140.08
11	475.62	2140.49
12	535.16	2143.56
13	564.61	2140.58
14	687.72	2140.38
15	740.28	2143.50

Cross Section
Cross Section for Irregular Channel

Total Flow = 2475 cfs
Culvert = 1575 cfs
Road = 900 cfs
WSE = 2141.04

Project Description	
Worksheet	Overall Roadway S
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

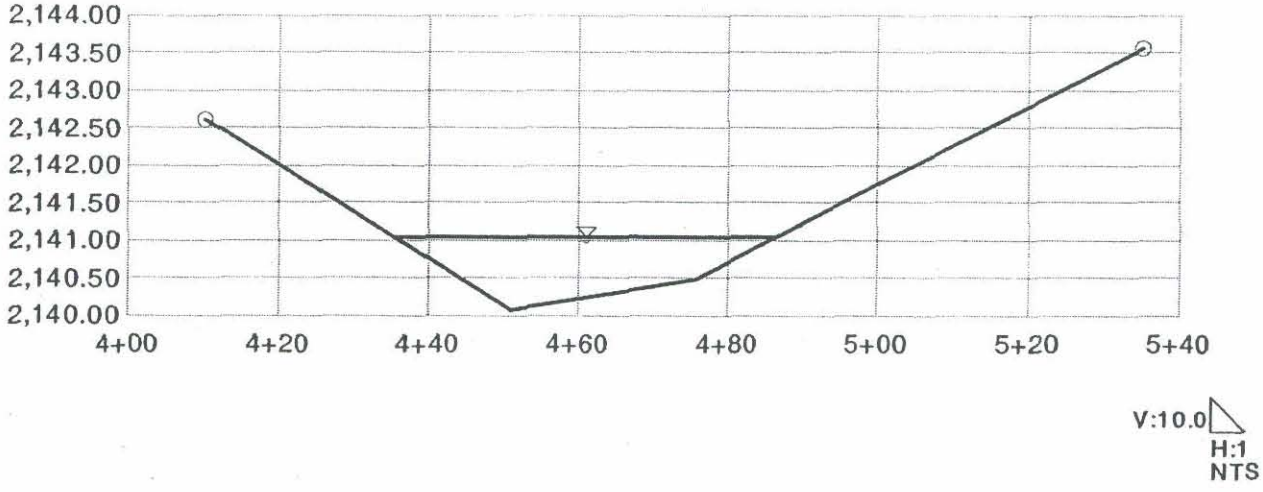
Section Data		
Mannings Coefficie	0.035	
Slope	0.019000	ft/ft
Water Surface Elev.	2,141.04	ft
Elevation Range	39.80 to 2,143.56	
Discharge	900.00	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to North
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

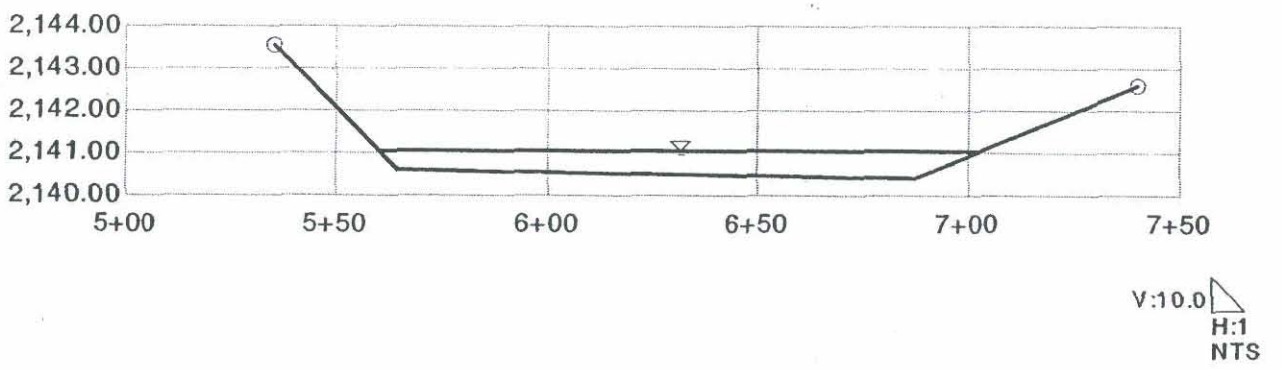
Section Data		
Mannings Coefficie	0.035	
Slope	0.019000	ft/ft
Water Surface Elev.	2,141.04	ft
Elevation Range	40.08 to 2,143.56	
Discharge	116.78	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	north
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

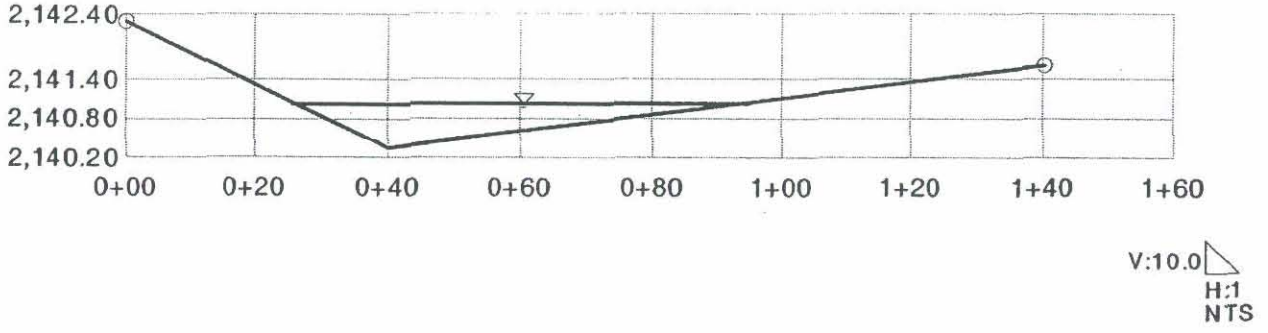
Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev.	2,141.04	ft
Elevation Range	40.38 to 2,143.56	
Discharge	293.52	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to South
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev.	2,141.04	ft
Elevation Range	10.35 to 2,142.30	
Discharge	70.47	cfs

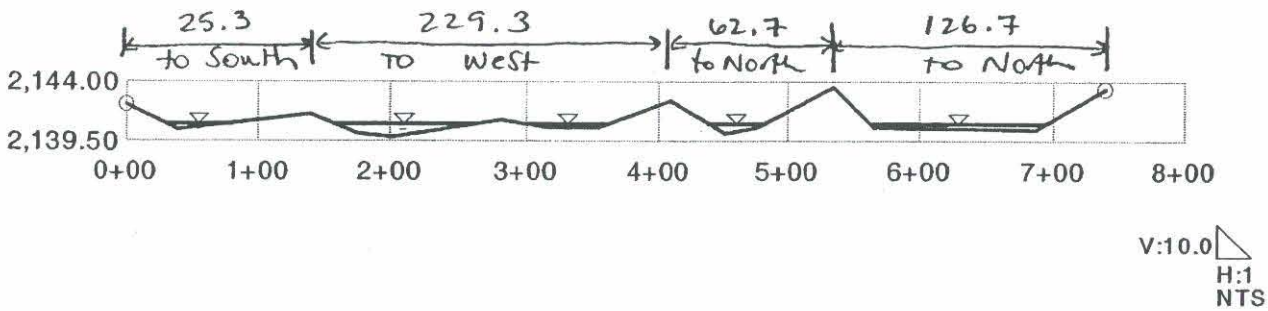


Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	Overall Roadway S
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficie	0.035
Slope	0.019000 ft/ft
Water Surface Elev.	2,140.82 ft
Elevation Range	39.80 to 2,143.56
Discharge	444.00 cfs

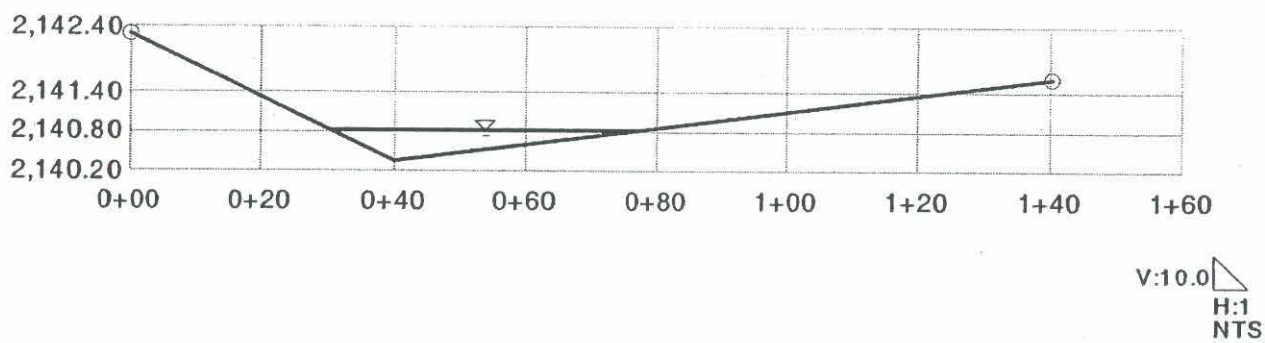
Total Flow = 1964 cfs
Culvert = 1520 cfs
Road = 444 cfs
WSE = 2140.82



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to South
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

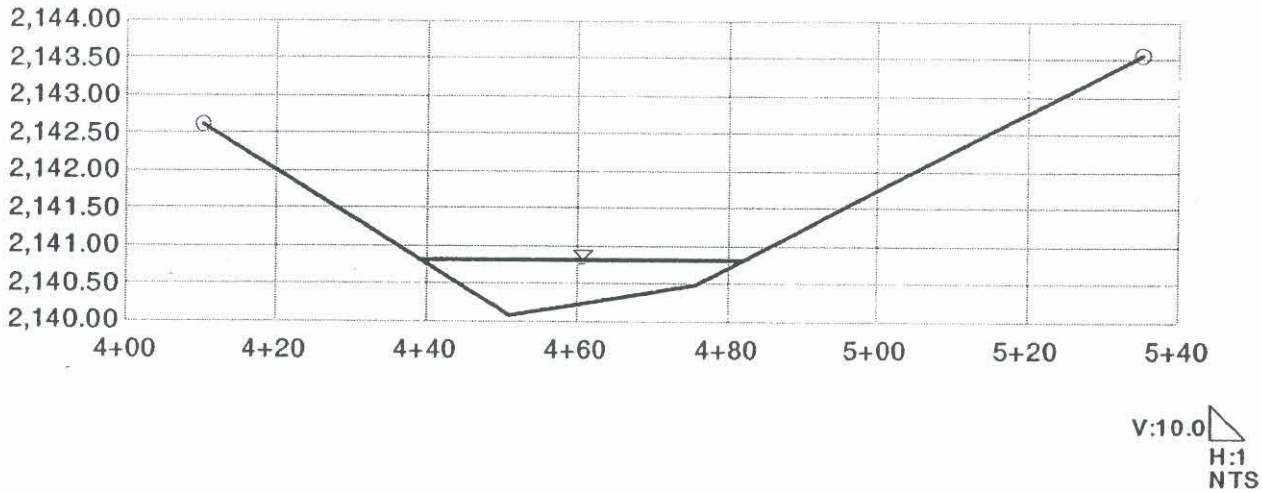
Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev	2,140.82	ft
Elevation Range	10.35 to 2,142.30	
Discharge	25.31	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to North
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

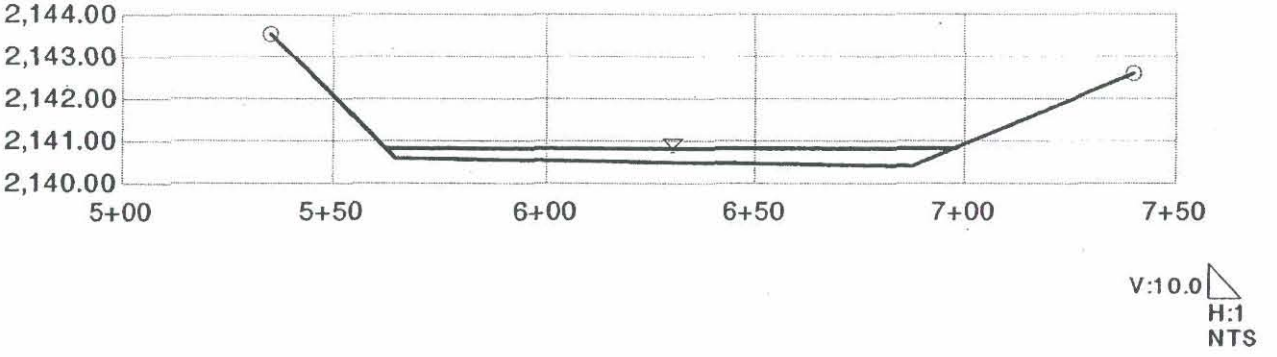
Section Data		
Mannings Coefficie	0.035	
Slope	0.019000	ft/ft
Water Surface Elev	2,140.82	ft
Elevation Range	10.08 to 2,143.56	
Discharge	62.72	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	north
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev.	2,140.82	ft
Elevation Range	10.38 to 2,143.56	
Discharge	126.67	cfs

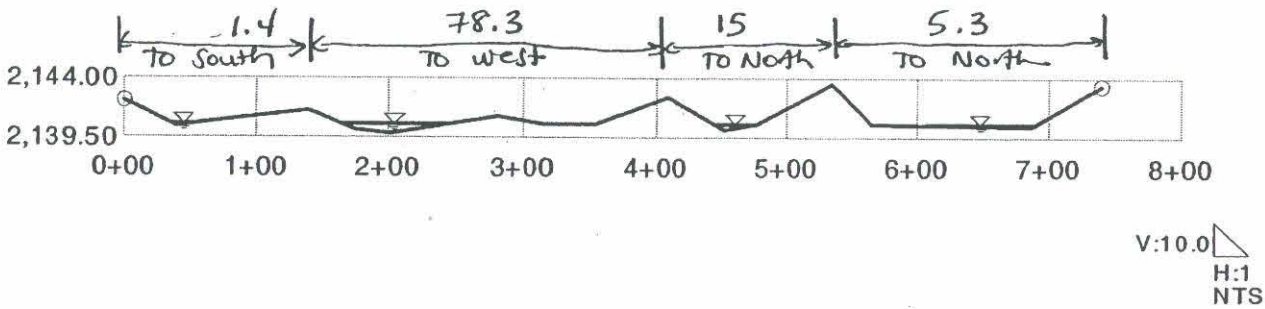


Cross Section
Cross Section for Irregular Channel

Total Flow = 1550 cfs
Culvert = 1450 cfs
Road = 100 cfs
WSE = 2140.51±

Project Description	
Worksheet	Overall Roadway S
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

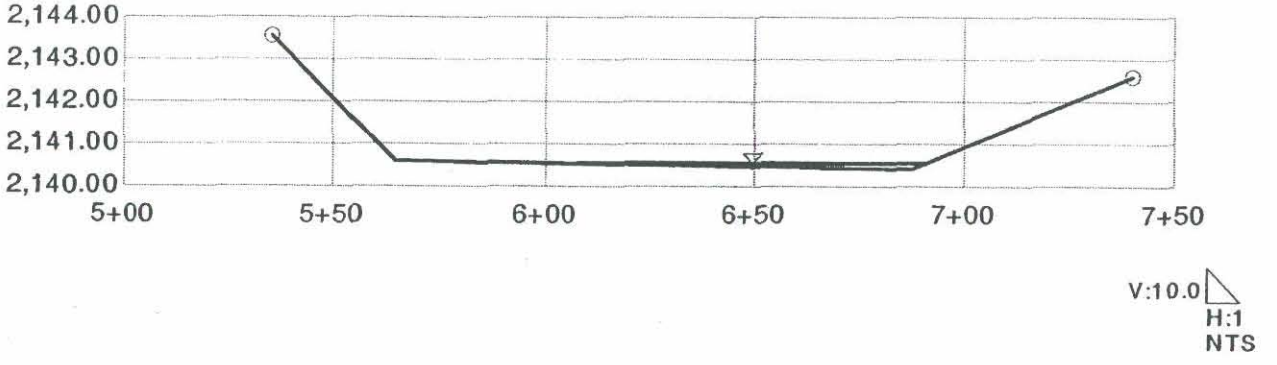
Section Data		
Mannings Coefficie	0.035	
Slope	0.019000	ft/ft
Water Surface Elev	2,140.51	ft
Elevation Range	39.80 to 2,143.56	
Discharge	100.00	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	north
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

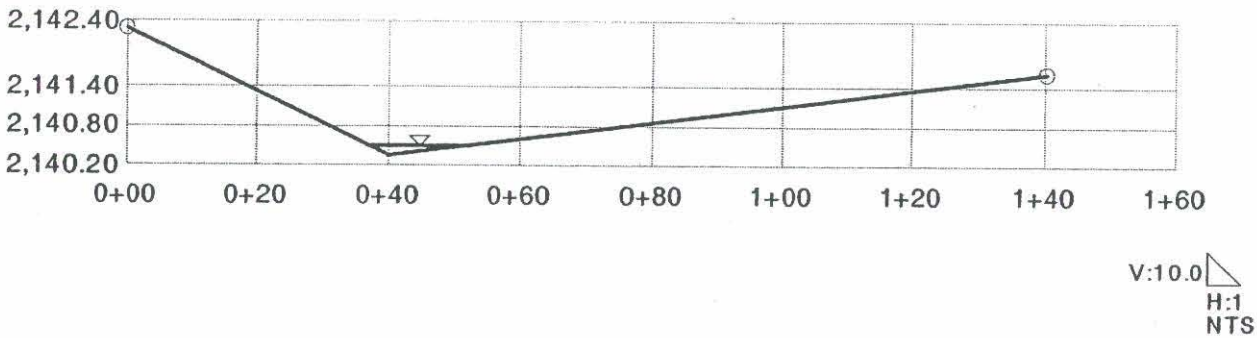
Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev	2,140.51	ft
Elevation Range	10.38 to 2,143.56	
Discharge	5.25	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to South
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

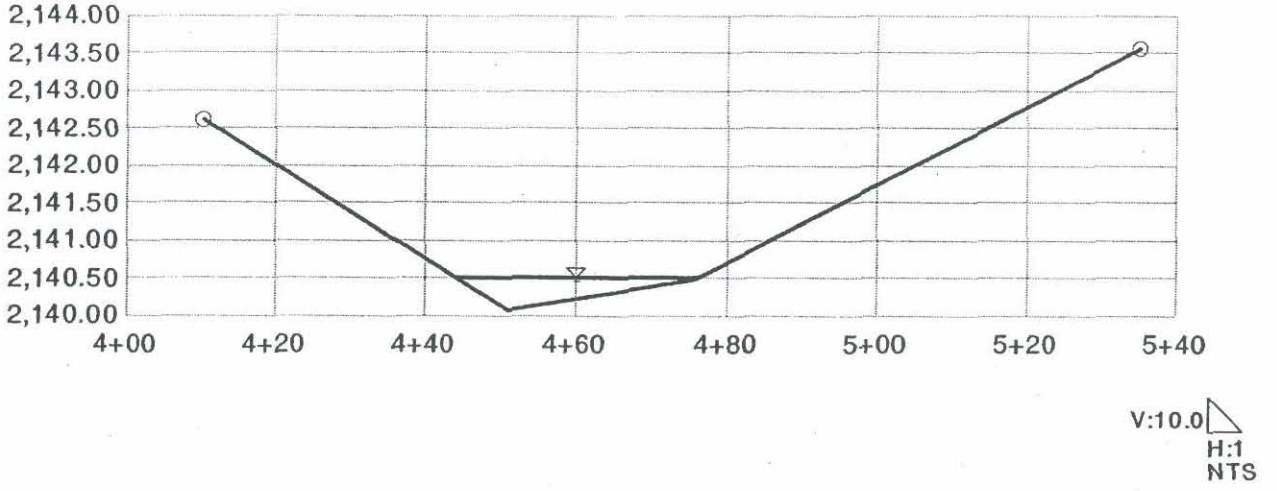
Section Data		
Mannings Coefficie	0.035	
Slope	0.020000	ft/ft
Water Surface Elev.	2,140.51	ft
Elevation Range	10.35 to 2,142.30	
Discharge	1.43	cfs

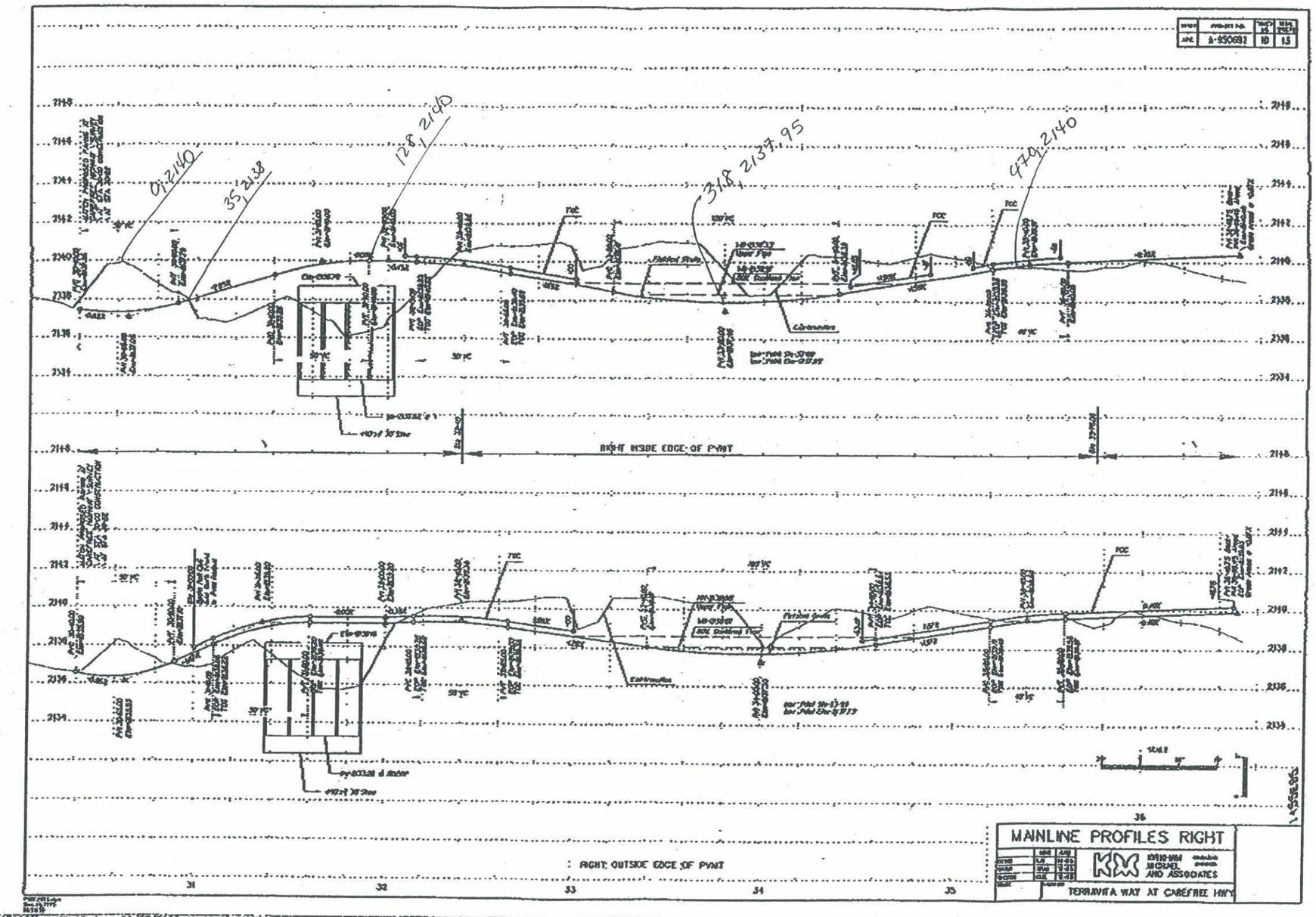


Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	West to North
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.035	
Slope	0.019000	ft/ft
Water Surface Elev	2,140.51	ft
Elevation Range	10.08 to 2,143.56	
Discharge	15.06	cfs





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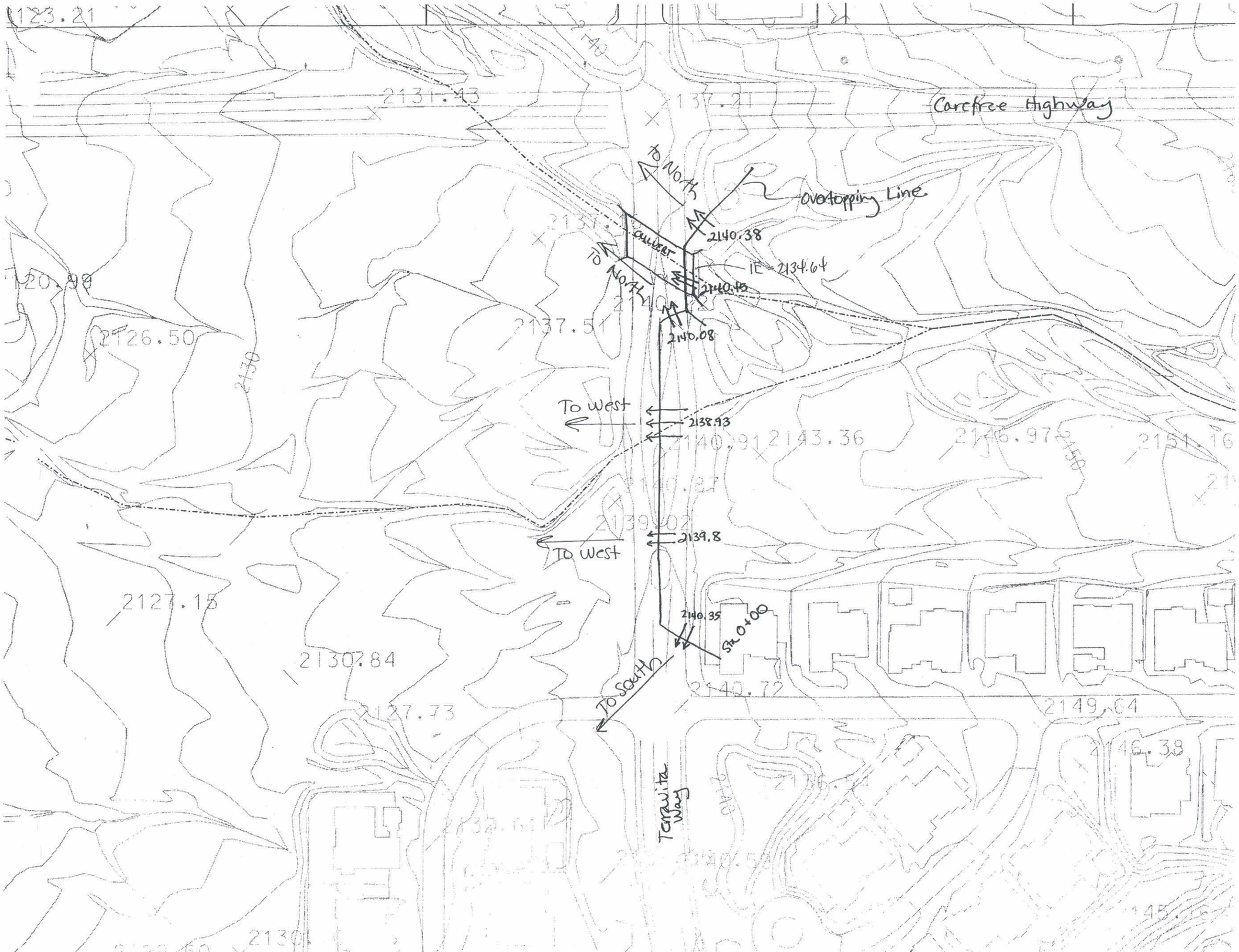


Overtopping

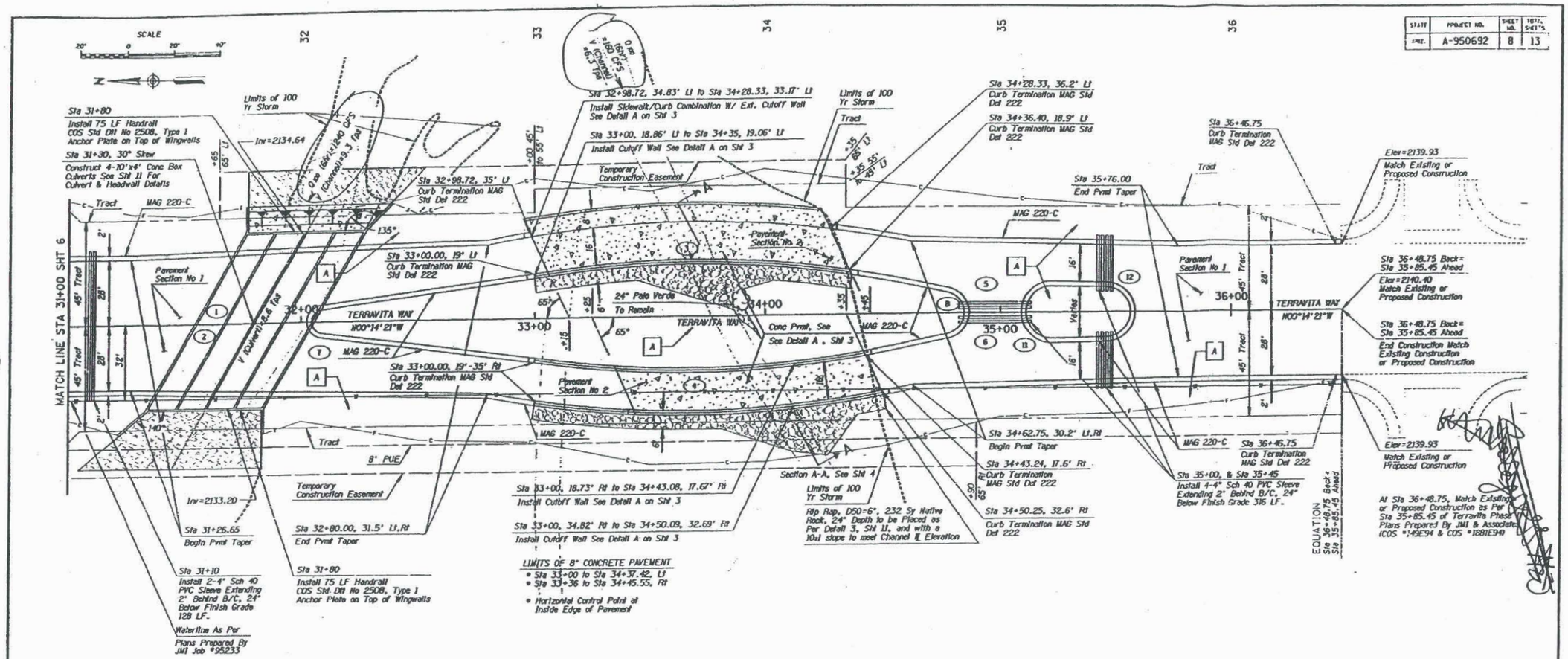
Legend

2139.8 Low Point & Low Point Elevation for overtopping

N

1" = 100'

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
ARIZ.	A-950692	8	13



HORIZONTAL CONTROL-TERRAVITA WAY (All Locations At Inside EOP)					
No	Rad	Length	Tangent	Delta	PI Sta	PI Off
1	450'	58.62'	29.35'	07°27'48.58"	31+56.00	0' Lt
2	450'	58.62'	29.35'	07°27'48.58"	31+56.00	0' Lt
3	450'	150.43'	75.92'	19°09'10.30"	33+85.00	30' Lt
4	450'	150.43'	75.92'	19°09'10.30"	33+85.00	30' Rt
5	450'	91.81'	46.06'	11°41'21.80"	35+30.00	0' Lt
6	450'	91.81'	46.06'	11°41'12.80"	35+30.00	0' Lt
7	7'	18.34'	-	-	32+09.44	0' Lt
8	11'	30.18'	-	-	34+75.71	0' Lt
9	30'	47.14'	-	-	30+82.00	60' Lt
10	30'	47.14'	-	-	30+94.00	60' Rt
11	13.1'	41.85'	-	-	35+22.09	0' Lt
12	12.6'	39.10'	-	-	35+45.38	0' Lt

SURVEY MARKER Type B, MAG 120-1			
Sta	Off	Lt	Rt
31+26.65	0'	X	
31+85.35	3.84'	X	X
33+09.72	20.14'	X	X
34+55.65	14.62'	X	X
34+84.89	9.33'	X	X
35+76.06	0'	X	

SURVEY MARKER Type A, MAG 120-1			
Sta	Off	Lt	Rt
31+56.00	0'	X	
33+85.00	30'	X	X
35+30.00	0'	X	

LIST OF QUANTITIES		
Roadway Excavation	Cu Yd	2977
Aggregate Base Course (6" ABC)	Ton	842
3" Asphaltic Concrete (C-¾)	Sq Yd	2344
8" Concrete Pvmt	Sq Yd	429
Rip Rap	Sq Yd	253
Survey Marker, Type A	Each	4
Survey Marker, Type B	Each	10
Cutoff Wall	Lin Ft	560
Structure Excavation	Cu Yd	831
4" Schedule 40 PVC	Lin Ft	444
Roll Curb & Gutter, Type C	Lin Ft	1266

A See Landscape Plans for Complete Median and Roadside Design Information

Notes: 1. Transition Low Flow Crossing Grading to Natural Ground In 50' Each Side. Mesquite Trees Identified on Landscape Plans To Remain Shall Not Be Disturbed on Upstream Side.

2. DRAINAGE EASEMENT CORRIDOR as Defined Under Plat No. 553E95.

3. All Q Quantities are for 100 Year Return Storm-6 Hour Duration.

25719

1455E95

STA 31+00 TO 36+48.75

	NAME	DATE
DESIGN	LR	11-95
DRAWN	JFM	11-95
CHECKED	BJL	11-95

KIRKHAM MICHAEL AND ASSOCIATES CONSULTING ENGINEERS

ROUTE | LOCATION: TERRAVITA WAY AT CAREFREE HWY

Registered Professional Engineer (Civil) Brian J. Lee Date Expires 6-30-96 Arizona, U.S.A.

D5859N, S

SHEET NO. 1 of 1 DATE 1/2/02
PROJECT NO. 162944.OP.02

D5859S = 858.82 cfs bankfull capacity
D5859N = 868.83 cfs " "

→ see attached Flow Master printouts

Total cfs = 858.82 + 868.83 = 1727.65

$$\text{North} = \frac{868.83}{1727.65} = 50.3\%$$

$$\text{South} = \frac{858.82}{1727.65} = 49.7\%$$

∴ Flow split is 50.3% North, 49.7% South

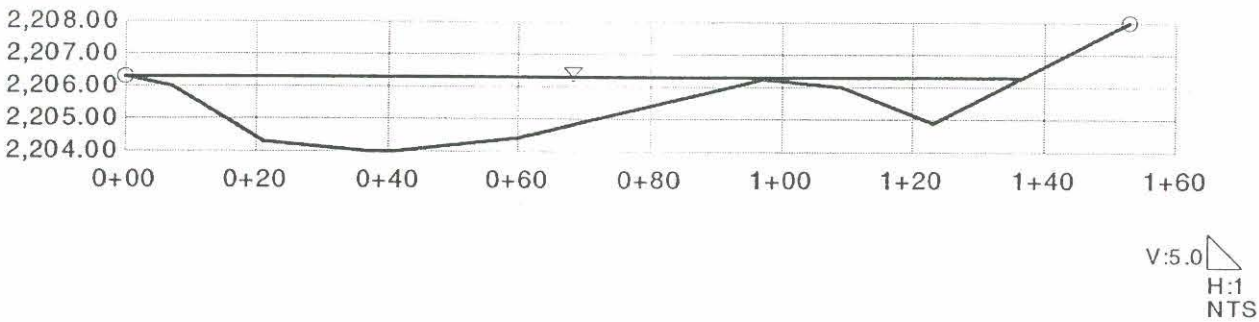
Diversion Curve

Inflow	0	50	100	500	10000
Diversion (to South)	0	24.9	49.7	248.5	4970

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D5859S
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

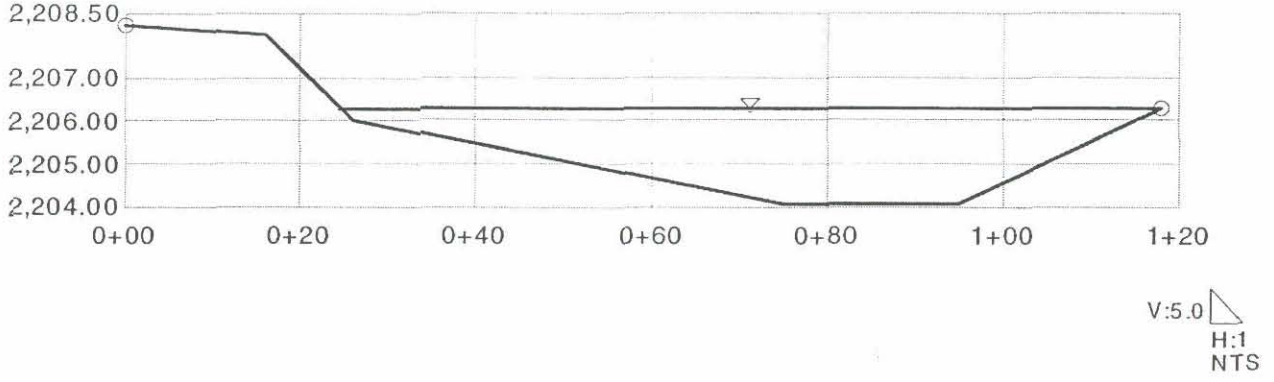
Section Data		
Mannings Coefficie	0.038	
Slope	0.014800	ft/ft
Water Surface Elev	2,206.30	ft
Elevation Range	04.00 to 2,208.00	
Discharge	858.82	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D5859N
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.038	
Slope	0.018500	ft/ft
Water Surface Elev	2,206.30	ft
Elevation Range	04.10 to 2,208.20	
Discharge	868.83	cfs



D5859N, S

40 scale

D64N, S

SHEET NO. 1 of 1 DATE 1/2/02

PROJECT NO. 162944. DP. 02

D64N = 218.38 cfs bankfull capacity
D64S = 178.71 cfs bankfull capacity

→ see attached Flow Master printouts

Total cfs = 218.38 + 178.71 = 397.09 cfs

$$\text{North} = \frac{218.38}{397.09} = 55.0\%$$

$$\text{South} = \frac{178.71}{397.09} = 45.0\%$$

∴ Flow split is 55% North, 45% South

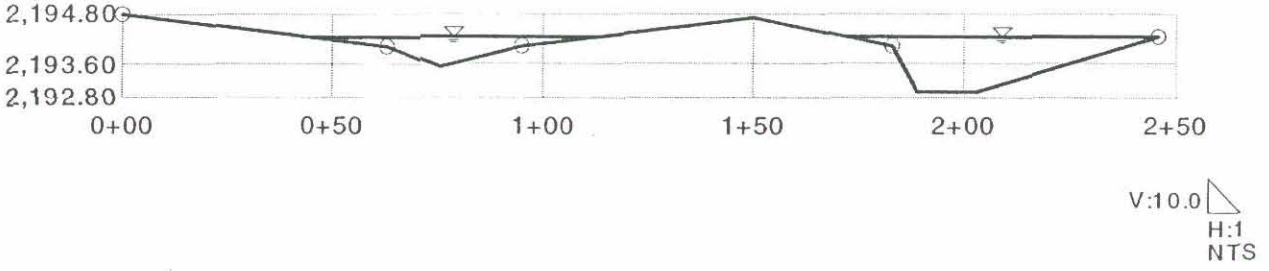
Diversion Card

INFLOW	0	50	100	500	10000
DIVERSION (to South)	0	22.5	45	225	4500

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D64N
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

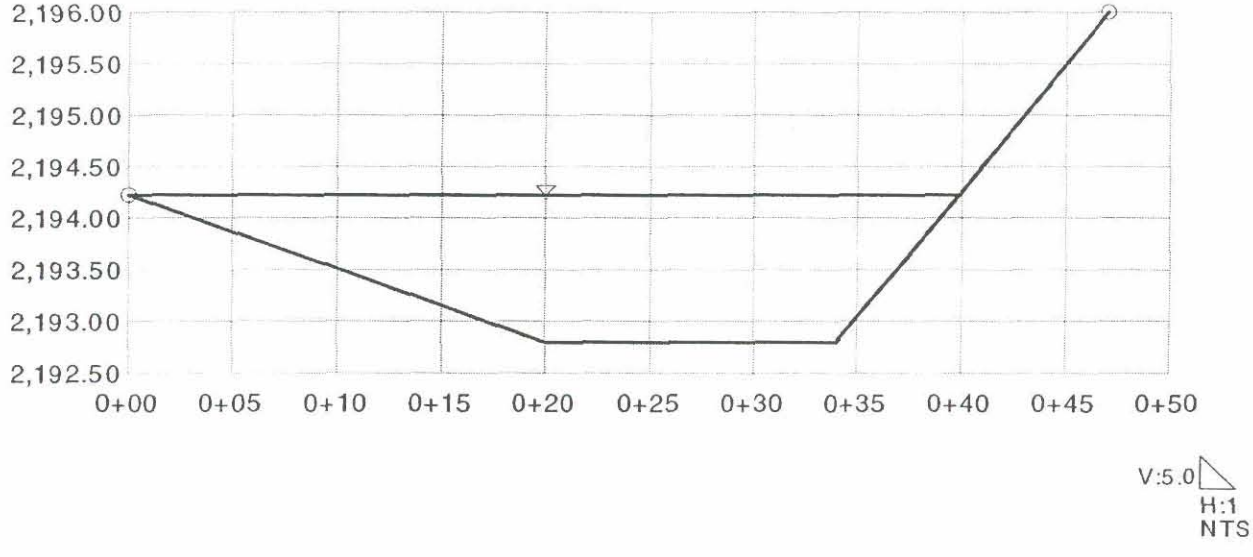
Section Data		
Mannings Coefficie	0.038	
Slope	0.014800	ft/ft
Water Surface Elev	2,194.23	ft
Elevation Range	92.90 to 2,194.80	
Discharge	218.38	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D64S
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.038	
Slope	0.014800	ft/ft
Water Surface Elev	2,194.23	ft
Elevation Range	92.80 to 2,196.00	
Discharge	178.71	cfs



D64

N
2196
2194
2192
0, 2194.8
63, 2194
76, 2193.5
95, 2194
150, 2194.7
193, 2194
189, 2192.9
203, 2192.9
0, 2194.23
S=0.0148
S = 0.0148
20, 2192.8
246, 2194.23
34, 2192.8
39, 2194
47, 2196

40 scale

D87N, S

SHEET NO. 1 of 1 DATE 1/2/02

PROJECT NO. 162944. OP. 02

D87N = 117.56 cfs bankfull capacity

D87S = 3.12 cfs " "

→ see attached Flow Master Printouts

Total cfs = 117.56 + 3.12 = 120.68 cfs

$$\text{North} = \frac{117.56}{120.68} = 97.4\%$$

$$\text{South} = \frac{3.12}{120.68} = 2.6\%$$

∴ Flow Split is 97.4% North, 2.6% South

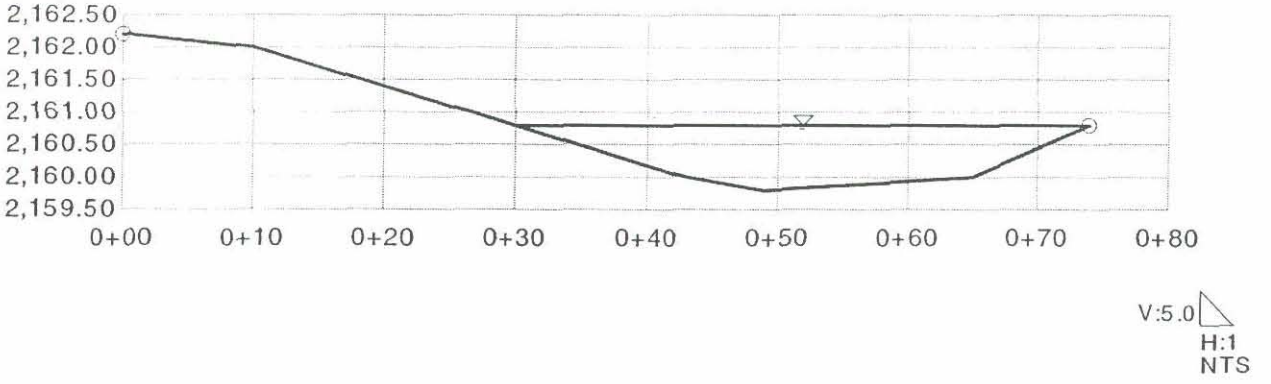
Diversion Card

INFLOW	0	50	100	500	10000
DIVERSION (to South)	0	1.3	2.6	13	260

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D87N
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

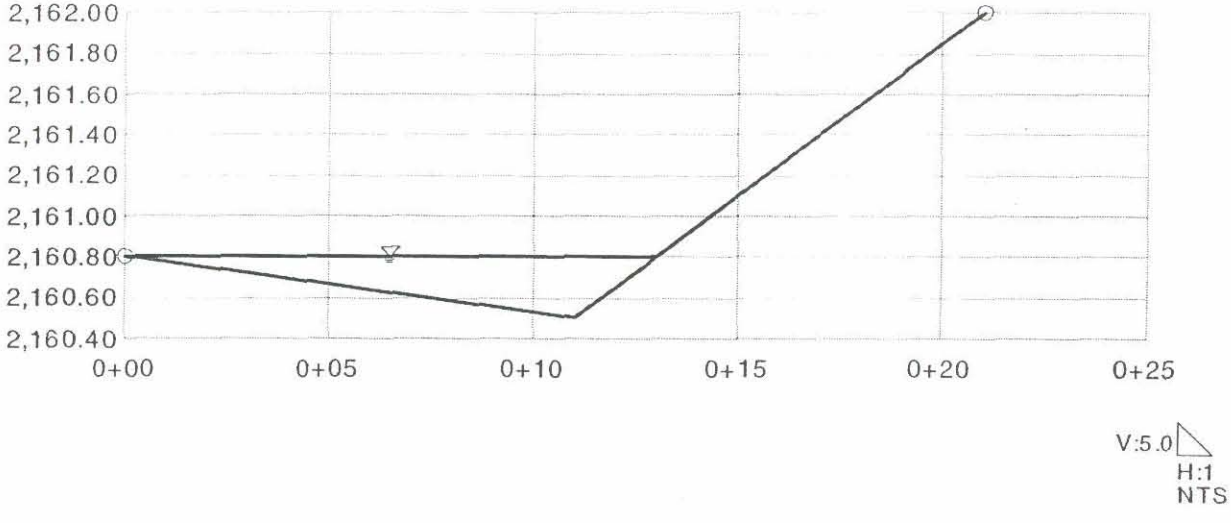
Section Data		
Mannings Coefficie	0.038	
Slope	0.019600	ft/ft
Water Surface Elev	2,160.80	ft
Elevation Range	59.80 to 2,162.20	
Discharge	117.56	cfs



Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	D87S
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data		
Mannings Coefficie	0.038	
Slope	0.021100	ft/ft
Water Surface Elev	2,160.80	ft
Elevation Range	30.50 to 2,162.00	
Discharge	3.12	cfs



D87 N, S
40 scale

Appendix E – Habitat Letters

CH2M HILL
1620 W. Fountainhead Parkway
Suite 550
Tempe, AZ
85282-1843
Mailing address:
P.O. Box 28440
Tempe, AZ
85285-8440
Tel 602.966.8188
Fax 602.966.9450

November 16, 2001

Bob Broscheid
Arizona Department of Game and Fish
Project Evaluation Program Coordinator
2221 West Greenway Road
Phoenix, AZ 85023

Dear Mr. Broscheid:

Subject: Request for Project Review and List of Potentially Occurring Threatened and Endangered Species; Carefree, AZ (Cave Creek U.S.G.S. Quadrangle Map)

CH2M HILL has contracted with the Flood Control District of Maricopa County to prepare a drainage master plan for the Town of Carefree, AZ in Maricopa County, Arizona. As part of the project evaluation, I would like to request a project review to address wildlife issues. I also request information on the status of any protected species or species of concern occurring or potentially occurring within the proposed project area, which is defined by the town limits of the Town of Carefree. This information will be used for evaluating potential environmental impacts of our final drainage management recommendations.

A project location map is enclosed for your review. Thank you for your assistance in this matter. Please do not hesitate to call me at (480) 966-8188 if you require further information.

Sincerely,

CH2M HILL

Monique M. Chaisson

Monique Chaisson
Environmental Scientist

Enclosure: Project Location Map

cc: Tony Bokich/CH2M HILL
Linda Johnson/CH2M HILL

CH2M HILL
1620 W. Fountainhead Parkway
Suite 550
Tempe, AZ
85282-1843
Mailing address:
P.O. Box 28440
Tempe, AZ
85285-8440
Tel 602.966.8188
Fax 602.966.9450

November 16, 2001

Dave Harlow
Field Supervisor
U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, AZ 85021

Dear Mr. Harlow:

Subject: Request for Project Review and List of Potentially Occurring Threatened and Endangered Species; Carefree, AZ (Cave Creek U.S.G.S. Quadrangle Map)

CH2M HILL has contracted with the Flood Control District of Maricopa County to prepare a drainage master plan for the Town of Carefree, AZ in Maricopa County, Arizona. As part of the project evaluation, I would like to request a project review to address wildlife issues. I also request information on the status of any protected species or species of concern occurring or potentially occurring within the proposed project area, which is defined by the town limits of the Town of Carefree. This information will be used for evaluating potential environmental impacts of our final drainage management recommendations.

A project location map is enclosed for your review. Thank you for your assistance in this matter. Please do not hesitate to call me at (480) 966-8188 if you require further information.

Sincerely,

CH2M HILL

Monique N. Chaisson

Monique Chaisson
Environmental Scientist

Enclosure: Project Location Map

cc: Tony Bokich/CH2M HILL
Linda Johnson/CH2M HILL

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
2221 WEST GREENWAY ROAD, PHOENIX, AZ 85023-4399
(602) 942-3000 • WWW.AZGFD.COM

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W. HAYS GILSTRAP, PHOENIX
DIRECTOR
DUANE L. SHROUFE
DEPUTY DIRECTOR
STEVE K. FERRELL

December 6, 2001

Ms. Monique Chaisson
CHWM HILL
1620 W. Fountainhead Parkway
Suite 550
Tempe, AZ 85282-1843

Re: Special Status Species Information for **Township 6 North, Range 4 East, Sections 24-26, 34-36; Township 5 North, Range 4 East, Sections 2-5; Township 6 North, Range 5 East, Sections 31 and 32; Drainage Master Plan for the Town of Carefree.**

Dear Ms. Chaisson:

The Arizona Game and Fish Department (Department) has reviewed your request, dated November 16, 2001, regarding special status species information associated with the above-referenced project area. The Department's Heritage Data Management System (HDMS) has been accessed and current records show that the special status species listed on the attachment have been documented as occurring in the project area. In addition, the project does not occur in the vicinity of any proposed or designated Critical Habitats.

The Department's HDMS data are not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity.

Making available this information does not substitute for the Department's review of project proposals, and should not decrease our opportunities to review and evaluate new project proposals and sites. The Department is also concerned about other resource values, such as other wildlife, including game species, and wildlife-related recreation. The Department would appreciate the opportunity to provide an evaluation of impacts to wildlife or wildlife habitats associated with project activities occurring in the subject area, when specific details become available.

If you have any questions regarding the attached species list, please contact me at (602) 789-3618. General status information and county distribution lists for special status species are also available on our web site at: http://www.azgfd.com/frames/fishwild/hdms_site/Home.htm.

Sincerely,

Sabra S. Schwartz
Heritage Data Management System, Coordinator

SSS:ss

Attachment

cc: Bob Broscheid, Project Evaluation Program Supervisor
Russ Haughey, Habitat Program Manager, Region VI

AGFD #11-29-01(02)

Special Status Species within 3 Miles of T6N,R4E Sec 24-26, 34-36; T5N,R4E Sec 2-5; T6N,R5E Sec 31-32

Arizona Game and Fish Department, Heritage Data Management System

December 6, 2001

Scientific Name	Common Name	ESA	USFS	BLM	WSCA	NPL
GOPHERUS AGASSIZII (SONORAN POPULATION)	SONORAN DESERT TORTOISE	SC			WC	

No Critical Habitat in project area. AGFD #11-29-01(02), Drainage Master Plan for the Town of Carefree.

GUIDELINES FOR HANDLING SONORAN DESERT TORTOISES
ENCOUNTERED ON DEVELOPMENT PROJECTS
Arizona Game and Fish Department
Revised January 17, 1997

The Arizona Game and Fish Department (Department) has developed the following guidelines to reduce potential impacts to desert tortoises, and to promote the continued existence of tortoises throughout the state. These guidelines apply to short-term and/or small-scale projects, depending on the number of affected tortoises and specific type of project.

Desert tortoises of the Sonoran population are those occurring south and east of the Colorado River. Tortoises encountered in the open should be moved out of harm's way to adjacent appropriate habitat. If an occupied burrow is determined to be in jeopardy of destruction, the tortoise should be relocated to the nearest appropriate alternate burrow or other appropriate shelter, as determined by a qualified biologist. Tortoises should be moved less than 48 hours in advance of the habitat disturbance so they do not return to the area in the interim. Tortoises should be moved quickly, kept in an upright position at all times and placed in the shade. Separate disposable gloves should be worn for each tortoise handled to avoid potential transfer of disease between tortoises. Tortoises must not be moved if the ambient air temperature exceeds 105 degrees fahrenheit unless an alternate burrow is available or the tortoise is in imminent danger.

A tortoise may be moved up to two miles, but no further than necessary from its original location. If a release site, or alternate burrow, is unavailable within this distance, and ambient air temperature exceeds 105 degrees fahrenheit, the Department should be contacted to place the tortoise into a Department-regulated desert tortoise adoption program. Tortoises salvaged from projects which result in substantial permanent habitat loss (e.g. housing and highway projects), or those requiring removal during long-term (longer than one week) construction projects, will also be placed in desert tortoise adoption programs. *Managers of projects likely to affect desert tortoises should obtain a scientific collecting permit from the Department to facilitate temporary possession of tortoises.* Likewise, if large numbers of tortoises (>5) are expected to be displaced by a project, the project manager should contact the Department for guidance and/or assistance.

Please keep in mind the following points:

- These guidelines do not apply to the Mohave population of desert tortoises (north and west of the Colorado River). Mohave desert tortoises are specifically protected under the Endangered Species Act, as administered by the U.S. Fish and Wildlife Service.

- These guidelines are subject to revision at the discretion of the Department. We recommend that the Department be contacted during the planning stages of any project that may affect desert tortoises.

- Take, possession, or harassment of wild desert tortoises is prohibited by state law. Unless specifically authorized by the Department, or as noted above, project personnel should avoid disturbing any tortoise.

RAC:NLO:rc

Arizona Game and Fish Department
Habitat Branch – Heritage Data Management System (HDMS)
External Customer Survey

The Arizona Game and Fish Department is committed to providing quality products and services. The Habitat Branch's HDMS and Project Evaluation Program work cooperatively to develop HDMS and project evaluation/environmental compliance-related products that are specific to proposed projects and land planning efforts. These products and services may include lists of sensitive species that have been documented as occurring in proximity to proposed projects, biological abstracts or other general ecological and biological information, and environmental compliance-related document review.

We are asking your assistance in providing feedback on how the HDMS can improve our products and services. Please take a few minutes to complete the following survey, and return it by mail to Phyllis McKeska, AGFD-WMHB, 2221 West Greenway Road, Phoenix, 85023 or by fax at (602) 789-3366.

HDMS service/product provided:_____

Please circle the number that best describes the assistance you received from the Habitat Branch.

1. How would you rate Habitat Branch staff politeness?

   1 2 3 4 5 6 7 8 9 10
   Poor Excellent

2. How would you rate Habitat Branch staff helpfulness?

   1 2 3 4 5 6 7 8 9 10
   Poor Excellent

3. How would you rate timeliness of service/product completion?

   1 2 3 4 5 6 7 8 9 10
   Poor Excellent

4. How would you rate the completeness of the service/product provided?

   1 2 3 4 5 6 7 8 9 10
   Poor Excellent

5. How would you rate your overall satisfaction with this service/product?

   1 2 3 4 5 6 7 8 9 10
   Poor Excellent

How can we improve our service to you?_____

_____

Date completed:_____

Thank you for taking the time to complete this survey.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arizona Ecological Services Field Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In Reply Refer To:
AESO/SE
2-21-02-I-056

December 31, 2001

Ms. Monique Chaisson
Environmental Scientist
CH2MHill
1620 West Fountainhead Parkway, Suite 550
Tempe, Arizona 85282-1843

RE: Drainage Master Plan for Town of Carefree

Dear Ms. Chaisson:

This letter responds to your November 16, 2001, request for an inventory of threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may potentially occur in your project area (Maricopa County). The enclosed list may include candidate species as well. We hope the enclosed county list of species will be helpful. In future communications regarding this project, please refer to consultation number 2-21-02-I-056.

The enclosed list of the endangered, threatened, proposed, and candidate species includes all those potentially occurring anywhere in the county, or counties, where your project occurs. Please note that your project area may not necessarily include all or any of these species. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Also on the enclosed list is the Code of Federal Regulations (CFR) citation for each list and is available at most public libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency must request formal consultation with the Service. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency must enter into a section 7 conference with the Service. Candidate species are those which are being considered for addition to the list of threatened or endangered species. Candidate species are those for which there is sufficient information to support a

proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, the Service recommends the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways or excavation in waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

The State of Arizona protects some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species in your project area.

The Service appreciates your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Tom Gatz (x240).

Sincerely,

Jacqueline Hanson

for David L. Harlow
Field Supervisor

Enclosure

cc: John Kennedy, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: MARICOPA

10/11/2001

1) LISTED

TOTAL= 14

NAME: **ARIZONA AGAVE** *AGAVE ARIZONICA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 49 FR 21055, 05-18-1984

DESCRIPTION: HAS ATTRACTIVE ROSETTES OF BRIGHT GREEN LEAVES WITH DARK MAHOGANY MARGINS. FLOWER: BORNE ON SUB-UMBELLATE INFLORESCENCES.

ELEVATION RANGE: 3000-6000 FT.

COUNTIES: GILA, YAVAPAI, MARICOPA

HABITAT: TRANSITION ZONE BETWEEN OAK-JUNIPER WOODLAND & MOUNTAIN MAHOGANY-OAK SCRUB

SCATTERED CLONES IN NEW RIVER MOUNTAINS AND SIERRA ANCHA. USUALLY FOUND ON STEEP, ROCKY SLOPES. POSSIBLY MAZATAL MOUNTAINS. SHOULD BE LOOKED FOR WHEREVER THE RANGES OF Agave toumeyana var. bella AND Agave chrystantha OVERLAP.

NAME: **ARIZONA CLIFFROSE** *PURSHIA SUBINTEGRA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 49 FR 22326 5-29-84

DESCRIPTION: EVERGREEN SHRUB OF THE ROSE FAMILY (ROSEACEAE). BARK PALE SHREDDY. YOUNG TWIGS WITH DENSE HAIRS. LEAVES 1-5 LOBES AND EDGES CURL DOWNWARD (REVOLUTE). FLOWERS: 5 WHITE OR YELLOW PETALS <0.5 INCH LONG.

ELEVATION RANGE: <4000 FT.

COUNTIES: GRAHAM YAVAPAI MARICOPA MOHAVE

HABITAT: CHARACTERISTIC WHITE SOILS OF TERTIARY LIMESTONE LAKEBED DEPOSITS.

WHITE SOILS OF TERITIARY LIMESTONE LAKEBED DEPOSITS CAN BE SEEN FROM A DISTANCE.

NAME: **ARIZONA HEDGEHOG CACTUS** *ECHINOCEREUS TRIGLOCHIDIATUS ARIZONICUS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 44 FR 61556,10-15-1979

DESCRIPTION: DARK GREEN CYLINDROID 2.5-12 INCHES TALL, 2-10 INCHES IN DIAMETER, SINGLE OR IN CLUSTERS. 1-3 GRAY OR PINKISH CENTRAL SPINES LARGEST DEFLEXED AND 5-11 SHORTER RADIAL SPINES. FLOWER: BRILLIANT RED, SIDE OF STEM IN APRIL- MAY

ELEVATION RANGE: 3700-5200 FT.

COUNTIES: MARICOPA, GILA, PINAL

HABITAT: ECOTONE BETWEEN INTERIOR CHAPPARAL AND MADREAN EVERGREEN WOODLAND

OPEN SLOPES, IN NARROW CRACKS BETWEEN BOULDERS, AND IN UNDERSTORY OF SHRUBS. THIS VARIETY IS BELIEVED TO INTERGRADE AT THE EDGES OF ITS DISTRIBUTION WITH VARIETIES MELANCANTHUS AND NEOMEXICANUS CAUSING SOME CONFUSION IN IDENTIFICATION.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **MARICOPA**

10/11/2001

NAME: **GILA TOPMINNOW** *POECILIOPSIS OCCIDENTALIS OCCIDENTALIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-1967

DESCRIPTION: SMALL (2 INCHES), GUPPY-LIKE, LIVE BEARING, LACKS DARK SPOTS ON ITS FINS. BREEDING MALES ARE JET BLACK WITH YELLOW FINS.

ELEVATION RANGE: <4500 FT.

COUNTIES: GILA, PINAL, GRAHAM, YAVAPAI, SANTA CRUZ, PIMA, MARICOPA, LA PAZ

HABITAT: SMALL STREAMS, SPRINGS, AND CIENEGAS VEGETATED SHALLOWS

SPECIES HISTORICALLY OCCURRED IN BACKWATERS OF LARGE RIVERS BUT IS CURRENTLY ISOLATED TO SMALL STREAMS AND SPRINGS

NAME: **RAZORBACK SUCKER** *XYRAUCHEN TEXANUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 56 FR 54957 10-23-1991; 59 FR 13374, 03-21-1994

DESCRIPTION: LARGE (UP TO 3 FEET AND UP TO 6 POUNDS) LONG, HIGH SHARP-EDGED KEEL-LIKE HUMP BEHIND THE HEAD. HEAD FLATTENED ON TOP. OLIVE-BROWN ABOVE TO YELLOWISH BELOW.

ELEVATION RANGE: <6000 FT.

COUNTIES: GREENLEE, MOHAVE, PINAL, YAVAPAI, YUMA, LA PAZ, MARICOPA (REFUGIA), GILA, COCONINO, GRAHAM

HABITAT: RIVERINE & LACUSTRINE AREAS, GENERALLY NOT IN FAST MOVING WATER AND MAY USE BACKWATERS

SPECIES IS ALSO FOUND IN HORSESHOE RESERVOIR (MARICOPA COUNTY).CRITICAL HABITAT INCLUDES THE 100-YEAR FLOODPLAIN OF THE RIVER THROUGH GRAND CANYON FROM CONFLUENCE WITH PARIA RIVER TO HOOVER DAM; HOOVER DAM TO DAVIS DAM; PARKER DAM TO IMPERIAL DAM. ALSO GILA RIVER FROM AZ/NM BORDER TO COOLIDGE DAM; AND SALT RIVER FROM HWY 60/SR 77 BRIDGE TO ROOSEVELT DAM; VERDE RIVER FROM FS BOUNDARY TO HORSESHOE LAKE.

NAME: **BALD EAGLE** *HALIAEETUS LEUCOCEPHALUS*

STATUS: THREATENED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 60 FR 35999, 07-12-95

DESCRIPTION: LARGE, ADULTS HAVE WHITE HEAD AND TAIL. HEIGHT 28 - 38"; WINGSPAN 66 - 96". 1-4 YRS DARK WITH VARYING DEGREES OF MOTTLED BROWN PLUMAGE. FEET BARE OF FEATHERS.

ELEVATION RANGE: VARIES FT.

COUNTIES: YUMA, LA PAZ, MOHAVE, YAVAPAI, MARICOPA, PINAL, COCONINO, NAVAJO, APACHE, SANTA CRUZ, PIMA, GILA, GRAHAM, COCHISE

HABITAT: LARGE TREES OR CLIFFS NEAR WATER (RESERVOIRS, RIVERS AND STREAMS) WITH ABUNDANT PREY

SOME BIRDS ARE NESTING RESIDENTS WHILE A LARGER NUMBER WINTERS ALONG RIVERS AND RESERVOIRS. AN ESTIMATED 200 TO 300 BIRDS WINTER IN ARIZONA. ONCE ENDANGERED (32 FR 4001, 03-11-1967; 43 FR 6233, 02-14-78) BECAUSE OF REPRODUCTIVE FAILURES FROM PESTICIDE POISONING AND LOSS OF HABITAT, THIS SPECIES WAS DOWN LISTED TO THREATENED ON AUGUST 11, 1995. ILLEGAL SHOOTING, DISTURBANCE, LOSS OF HABITAT CONTINUES TO BE A PROBLEM. SPECIES HAS BEEN PROPOSED FOR DELISTING (64 FR 36454) BUT STILL RECEIVES FULL PROTECTION UNDER ESA.

NAME: **SOUTHWESTERN WILLOW FLYCATCHER** *EMPIDONAX TRAILLII EXTIMUS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 60 FR 10694, 02-27-95

DESCRIPTION: SMALL PASSERINE (ABOUT 6") GRAYISH-GREEN BACK AND WINGS, WHITISH THROAT, LIGHT OLIVE-GRAY BREAST AND PALE YELLOWISH BELLY. TWO WINGBARS VISIBLE. EYE-RING FAINT OR ABSENT.

ELEVATION RANGE: <8500 FT.

COUNTIES: YAVAPAI, GILA, MARICOPA, MOHAVE, COCONINO, NAVAJO, APACHE, PINAL, LA PAZ, GREENLEE, GRAHAM, YUMA, PIMA, COCHISE, SANTA CRUZ

HABITAT: COTTONWOOD/WILLOW & TAMARISK VEGETATION COMMUNITIES ALONG RIVERS & STREAMS

MIGRATORY RIPARIAN OBLIGATE SPECIES THAT OCCUPIES BREEDING HABITAT FROM LATE APRIL TO SEPTEMBER. DISTRIBUTION WITHIN ITS RANGE IS RESTRICTED TO RIPARIAN CORRIDORS. DIFFICULT TO DISTINGUISH FROM OTHER MEMBERS OF THE EMPIDONAX COMPLEX BY SIGHT ALONE. TRAINING SEMINAR REQUIRED FOR THOSE CONDUCTING FLYCATCHER SURVEYS. CRITICAL HABITAT WAS SET ASIDE BY THE 10TH CIRCUIT COURT OF APPEALS (5/17/01).

NAME: **YUMA CLAPPER RAIL** *RALLUS LONGIROSTRIS YUMANENSIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67; 48 FR 34182, 07-27-83

DESCRIPTION: WATER BIRD WITH LONG LEGS AND SHORT TAIL. LONG SLENDER DECURVED BILL. MOTTLED BROWN ON GRAY ON ITS RUMP. FLANKS AND UNDERSIDES ARE DARK GRAY WITH NARROW VERTICAL STRIPES PRODUCING A BARRING EFFECT.

ELEVATION RANGE: <4500 FT.

COUNTIES: YUMA, LA PAZ, MARICOPA, PINAL, MOHAVE

HABITAT: FRESH WATER AND BRACKISH MARSHES

SPECIES IS ASSOCIATED WITH DENSE EMERGENT RIPARIAN VEGETATION. REQUIRES WET SUBSTRATE (MUDFLAT, SANDBAR) WITH DENSE HERBACEOUS OR WOODY VEGETATION FOR NESTING AND FORAGING. CHANNELIZATION AND MARSH DEVELOPMENT ARE PRIMARY SOURCES OF HABITAT LOSS.

STATUS DEFINITIONS

ARIZONA GAME AND FISH DEPARTMENT (AGFD)
HERITAGE DATA MANAGEMENT SYSTEM (HDMS)

FEDERAL US STATUS

ESA **Endangered Species Act** (1973 as amended)
US Department of Interior, Fish and Wildlife Service (http://arizonaes.fws.gov)

Listed

- **LE** Listed Endangered: imminent jeopardy of extinction.
- **LT** Listed Threatened: imminent jeopardy of becoming Endangered.
- **XN** Experimental Nonessential population.

Proposed for Listing

- **PE** Proposed Endangered.
- **PT** Proposed Threatened.

Candidate (Notice of Review: 1999)

- **C** Candidate. Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.
- **SC** Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife Service, but neither term has official status (currently all former C2 species).

Critical Habitat (check with state or regional USFWS office for location details)

- **Y** Yes: Critical Habitat has been designated.
- **P** Proposed: Critical Habitat has been proposed.

[\N No Status: certain populations of this taxon do not have designated status (check with state or regional USFWS office for details about which populations have designated status)].

USFS **US Forest Service** (1999 Animals, 1999 Plants: corrected 2000)
US Department of Agriculture, Forest Service, Region 3 (http://www.fs.fed.us/r3/)

- **S** Sensitive: those taxa occurring on National Forests in Arizona which are considered sensitive by the Regional Forester.

BLM **US Bureau of Land Management** (2000 Animals, 2000 Plants)
US Department of Interior, Bureau of Land Management, Arizona State Office (http://azwww.az.blm.gov)

- **S** Sensitive: those taxa occurring on BLM Field Office Lands in Arizona which are considered sensitive by the Arizona State Office.
- **P** Population: only those populations of Banded Gila monster (*Heloderma suspectum cinctum*) that occur north and west of the Colorado River, are considered sensitive by the Arizona State Office.

STATE STATUS

NPL **Arizona Native Plant Law** (1999)
Arizona Department of Agriculture (http://agriculture.state.az.us/PSD/nativeplants.htm)

- **HS** Highly Safeguarded: no collection allowed.
- **SR** Salvage Restricted: collection only with permit.
- **ER** Export Restricted: transport out of State prohibited.
- **SA** Salvage Assessed: permits required to remove live trees.
- **HR** Harvest Restricted: permits required to remove plant by-products.

WSCA **Wildlife of Special Concern in Arizona** (1996 in prep)
Arizona Game and Fish Department (http://www.azgfd.com)

- **WC** Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and Fish Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep). Species indicated on printouts as WC are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

Appendix F – HEC-1 Files
(Attached to Back of Binder)

Appendix F
Flow Summary

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
UC8	39	22	81	82	40	45	82	83
UC9	49	28	83	82	42	46	83	82
CPC8	88	49	163	162	82	90	164	164
RCP89	87	49	161	159	81	87	162	160
UC18	25	12	54	56	43	46	85	82
UC19	19	10	41	39	27	29	54	53
CP1819	131	70	256	250	143	151	287	277
R1819	129	69	254	248	141	148	285	274
UC22	11	12	26	27	22	25	47	48
UC23	13	7	28	27	23	22	41	36
CP2223	150	86	304	295	175	182	356	340
R2223	149	86	301	292	173	180	354	337
UC28	33	39	79	79	66	70	135	126
R28	33	39	79	78	66	69	133	124
UC29	19	22	45	45	38	41	79	76
UC30	8	9	17	18	15	15	29	28
CP2930	204	141	438	427	278	284	573	534
R2930	204	140	436	423	276	280	566	530
UC34	33	31	71	71	59	57	112	99
CP34	232	155	496	477	309	310	630	580
R34	228	152	478	455	300	299	593	551
UC37	101	96	207	197	138	141	276	267
UC35	283	291	591	528	283	291	549	528
CP3537	453	387	917	877	610	644	1152	1158
R3537	450	384	911	872	603	636	1146	1147
UC49	78	74	134	123	78	74	134	123
UC31	215	211	473	814	361	365	748	716
CP3149	623	591	1305	1608	862	987	1668	1802
R3149	622	591	1303	1598	861	984	1663	1797
UC46	63	59	107	94	63	59	107	94
R46	62	57	104	92	62	57	104	92
UC45	157	147	266	235	157	147	266	235
UC47	50	48	87	79	50	48	87	79
CP4547	265	247	451	402	265	247	451	402
R4547	259	240	439	390	259	240	440	390
UC48	226	224	418	397	226	224	410	397
UC50	28	27	51	47	28	27	51	47
CP4850	821	954	1689	2335	1095	1309	2120	2467
R4850	821	948	1683	2308	1091	1298	2113	2449
UC51	95	92	170	156	105	99	190	164
UC57	36	40	74	72	36	40	74	72
CP5157	865	1031	1761	2447	1126	1345	2189	2551
R5157	860	1016	1756	2422	1121	1336	2180	2532
UC58	156	156	284	262	157	157	284	264
UC59	15	18	39	41	30	34	67	67
CP5859	929	1130	1881	2622	1190	1426	2315	2719
D5859S	462	562	935	1303	591	709	1151	1351
D5859N	467	569	946	1319	599	717	1164	1368
R5859N	466	562	944	1311	597	713	1160	1362
UC63	132	141	259	248	134	142	262	251
CP63	533	663	1064	1489	661	794	1285	1528
R63	532	661	1063	1480	660	793	1283	1522
UC66	31	36	68	79	37	41	78	76
UC62	408	423	791	762	417	431	819	775
CP6266	787	1065	1528	2173	906	1182	1742	2199

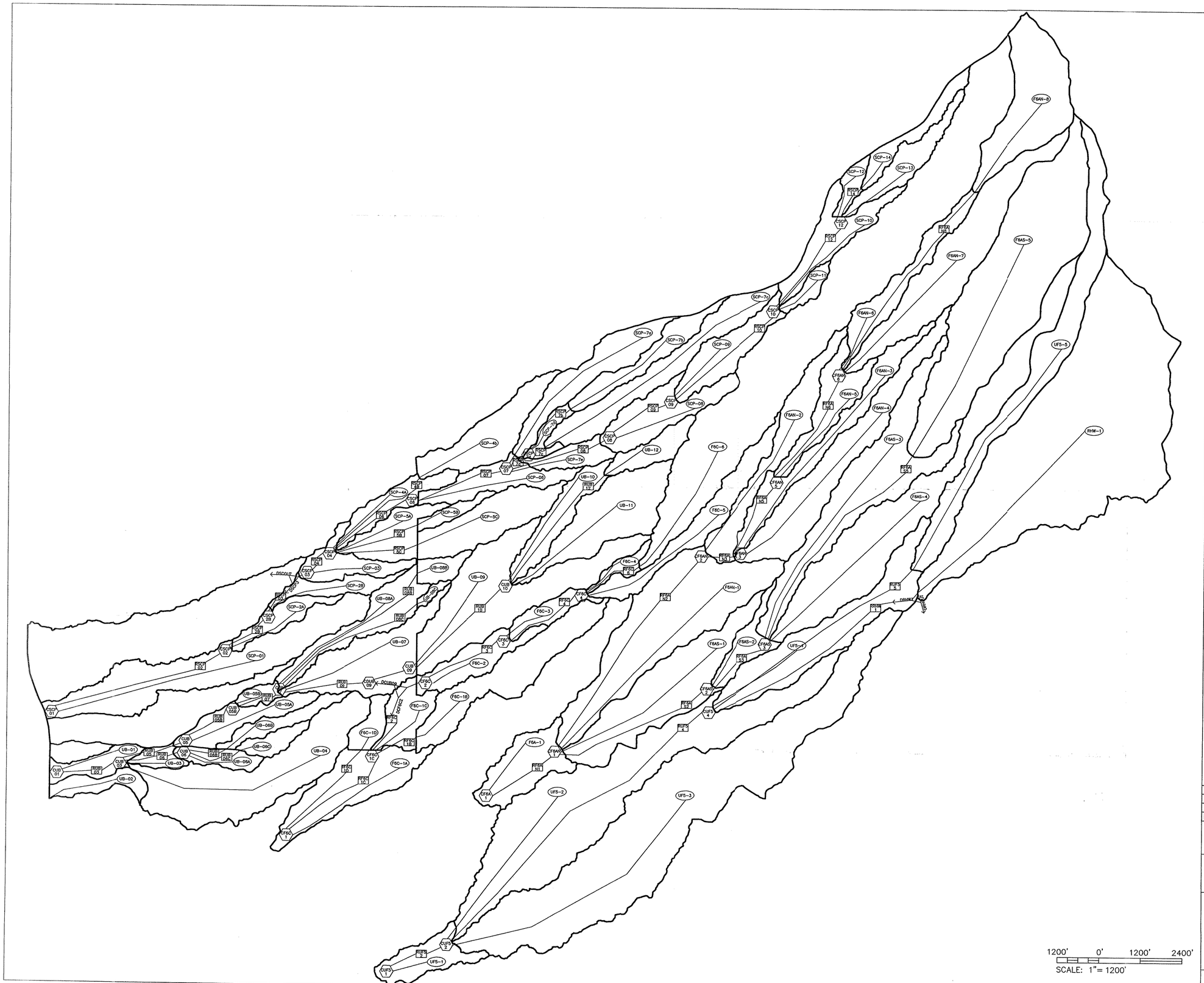
Appendix F
Flow Summary

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
R6266	786	1060	1527	2164	906	1177	1740	2187
D5859S	462	562	935	1303	591	709	1151	1351
R5859S	462	561	933	1288	591	707	1147	1342
UC64	6	6	5	5	6	3	12	11
CP64	465	564	935	1290	593	708	1152	1348
D64S	209	254	421	580	267	318	519	606
D64N	256	310	514	709	326	389	634	741
RD64N	255	307	512	697	325	387	630	730
UC87	9	12	24	30	19	28	50	49
CP87	259	317	527	723	331	395	643	743
RD87N	259	318	526	721	330	394	643	743
UC82	23	25	50	48	32	32	63	56
CP82	1030	1382	2017	2849	1216	1554	2343	2882
R82	1030	1380	2015	2842	1216	1550	2340	2875
D84S	93	30	279	686	9	82	432	703
D84N	938	1350	1736	2157	1208	1467	1908	2172
UC84	14	13	24	24	20	15	30	29
CP84	945	1359	1747	2174	1210	1474	1919	2183
R84	941	1329	1738	2153	1200	1454	1909	2163
UC79	58	68	138	139	61	71	145	142
UC78	275	263	103	449	266	263	491	449
CP7879	1019	1411	1837	2328	1265	1531	2076	2331
R7879	1019	1410	1837	2327	1265	1532	2075	2329
UC77	109	115	208	225	113	119	215	205
CP77	1068	1464	1913	2417	1304	1582	2169	2432
R77	1067	1460	1912	2416	1304	1580	2165	2429
UC89	54	61	119	122	74	81	153	148
CP89	1097	1500	1972	2500	1330	1613	2233	2505
R89	1094	1482	1965	2491	1323	1598	2223	2493
UC74	67	139	265	264	171	180	331	317
UC76	42	45	83	81	51	53	97	91
CP7476	81	179	342	339	219	230	426	406
R7476	81	179	341	339	219	230	424	404
UC75	180	292	368	365	220	233	431	410
CP75	246	426	699	692	434	453	852	808
R75	246	424	696	684	432	452	841	795
UC90	16	21	46	50	33	37	78	76
UC91	39	41	86	84	76	82	153	147
CP90EN	1263	1706	2383	3132	1517	1838	2692	3188
D84S	93	30	279	686	9	82	432	703
RD84S	83	31	279	685	9	84	432	706
D84iiN	80	30	249	576	9	82	372	592
D84iiS	4	1	31	110	1	3	60	114
RD84iS	2	0	21	79	0	1	47	85
UC94	12	11	22	18	12	11	22	18
CP94DS	10	10	37	94	9	10	63	101
R94DS	10	9	36	89	8	10	61	96
D84iiN	80	30	249	576	9	82	372	592
RD84iN	53	6	203	445	5	29	320	471
UC88	38	33	69	58	38	33	69	58
CP88EN	88	43	280	566	39	64	416	603
UC95	34	34	63	58	50	44	82	71
UC93	27	29	53	53	44	12	82	78
UC96	34	35	72	70	65	70	128	124

North Scottsdale Delineation - from DEI Professional Services

Appendix F
Flow Summary

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
SCP-7c					154		315	
SCP-7b					87		173	
SCP-7a					131		263	
RSCP7b					82		164	
SCP-7d					42		76	
RSCP7c					150		306	
CSCP7d					256		517	
RSCP7d					256		517	
SCP-4b					182		343	
CSCP07					580		1116	
RSCP07					576		1234	
RSCP4B					165		317	
SCP-4A					97		178	
CSCP06					620		1308	
RSCP06					617		1305	
CSCP04					884		1752	
Andora Hills and Galloway Washes Subbasin Flows - From JE Fuller (Appendix C of this report)								
GVW1	2199	2522	3749	4141	2270	2586	3860	4242
GVW2	2564	3256	4686	5492	3164	3937	5447	6408
GWW1_1	1269	1431	2427	2571	1301	1472	2473	2634
GWW1_2	609	593	1155	1110	688	660	1259	1206
GWW1_3	1026	1068	1876	1916	1026	1068	1876	1916
GWW1_4	682	646	1229	1170	686	649	1233	1173
GWW1_5	801	739	1345	1258	914	837	1497	1400
GWW1_6	503	439	899	794	509	443	904	797
GVW3_1	656	633	1227	1178	694	677	1294	1254
GVW3_2	716	682	1303	1248	739	711	1340	1294
GVW3_3	376	318	643	551	385	325	657	562
AHW1	698	553	1255	811	708	561	1258	814
AHW2	105	82	181	117	105	82	177	121
AHW3	326	265	666	464	422	337	781	520
AHW4	212	168	388	262	214	169	382	271
AHW5	240	191	447	289	299	239	514	321
AHW6	381	329	896	716	704	595	1344	986
AHW7	478	378	862	584	499	393	872	607
AHW8	845	678	1419	849	855	685	1416	862
AHW9	419	337	829	554	458	366	853	595

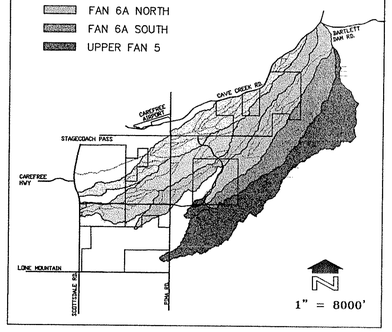


LEGEND

- SUB-BASIN BOUNDARY
- SUB-BASIN INDENTIFICATION
- ROUTE HYDROGRAPH
- COMBINE HYDROGRAPH
- DIVERT HYDROGRAPH

WATERSHED KEY MAP AND SHEET INDEX

- STAGECOACH PASS WASH
- UPPER BOULDERS WASH
- FAN 6C
- FAN 6A
- FAN 6A NORTH
- FAN 6A SOUTH
- UPPER FAN 5



NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH SCOTTSDALE FLOODPLAIN DELINEATION STUDY
FCD 2001 C009 WORK ORDER #2

	BY	DATE
DESIGNED		
DRAWN		
CHECKED		

1982-2002 20 YEARS OF EXCELLENCE

DEI Engineering Services, L.L.C.
6223 N. 24th St., Ste. 200
Phoenix, AZ 85016
Phone: (602)954-6025
Fax: (602)954-6033

DRAWING NO. 01131HEC-1

HEC-1 SCHEMATIC

SHEET 1 OF 1

Existing

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1*************************************                    *************************************
                                     *                    *                                   *
    FLOOD HYDROGRAPH PACKAGE  (HEC-1)*                    *   U.S. ARMY CORPS OF ENGINEERS    *
              JUN  1998              *                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.1              *                    *         609 SECOND STREET         *
*                                    *                    *      DAVIS, CALIFORNIA 95616      *
* RUN DATE   16MAR04  TIME  08:42:05 *                    *          (916) 756-1104           *
*                                    *                    *                                   *
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X     X  XXXXXXX   XXXXX         XXX

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

1                                                    HEC-1 INPUT
PAGE  1

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

    1           ID         UC MODEL - UNNAMED WASH, CENTRAL
    2           ID         10-YEAR 6-HOUR MODEL  FILENAME: UC106E.DAT
    3           ID         EXISTING CONDITIONS
    4           ID         CAREFREE DRAINAGE MASTER PLAN
    5           ID         FCD 2000C037
    6           ID         BY CH2M HILL
    7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
    8           ID         DECEMBER 2001 (Final Revision March 2004)
    9           ID    ******************************************************************
   10           ID         10 YEAR ANALYSIS 6-HOUR STORM
   11           ID
   12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
   13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
   14           ID    ******************************************************************
   15           ID      DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
   16           ID
   17           ID      THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
   18           ID
   19           ID
                *DIAGRAM
   20           IT       2                    2000
   21           IO       5
   22           IN      15
   23           JD    2.32    0.01
   24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   26           PC   0.962   0.972   0.983   0.991   1.000
   27           JD   2.305    0.50
   28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   30           PC   0.962   0.972   0.983   0.991   1.000
   31           JD   2.262    2.80
   32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
   33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
   34           PC   0.950   0.963   0.975   0.988   1.000
   35           JD   2.139    16.0
   36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
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 37          PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 38          PC   0.946   0.960   0.973   0.987   1.000
 39          JD   1.884    90.0
 40          PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
 41          PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
 42          PC   0.927   0.945   0.964   0.982   1.000
 43          JD   1.322   500.0
 44          PC   0.000   0.024   0.043   0.059   0.078   0.098   0.119   0.141   0.162   0.186
 45          PC   0.212   0.239   0.271   0.321   0.408   0.515   0.627   0.735   0.814   0.864
 46          PC   0.907   0.930   0.954   0.977   1.000
             *

 47          KK     UC8
 48          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 49          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 50          KM    L= 1.04   Kb= 0.031   S=138.0
 51          BA    .054
 52          LG     .30     .36     4.9     .26    36.0
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 53          UC    .383    .694
 54          UA       0       5      16      30      65      77      84      90      94      97
 55          UA     100
             *

 56          KK     UC9
 57          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 58          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 59          KM    L= 0.91   Kb= 0.031   S=145.0
 60          BA    .055
 61          LG     .30     .36     5.0     .23    36.0
 62          UC    .338    .540
 63          UA       0       5      16      30      65      77      84      90      94      97
 64          UA     100
             *

 65          KK    CPC89
 66          KM    CONCENTRATION POINT 89
 67          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 68          HC       2
             *

 69          KK   RCP89
 70          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 71          KM    NORMAL DEPTH CHANNEL ROUTING
 72          KM    ENDPOINTS WERE EXTENDED
 73          KM    SLOPE = (2596-2540)/2933
 74          RS       5    FLOW      -1
 75          RC   0.045   0.035   0.045    2933  0.0191
 76          RX       0      90      99     100     108     109     120     200
 77          RY     108     104     102     100     100     102     104     108
 78          RL                    0.15     100
             *

 79          KK    UC18
 80          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 81          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 82          KM    L= 0.56   Kb= 0.091   S=101.0
 83          BA    .040
 84          LG     .25     .36     5.0     .23   24.00
 85          UC    .563    .761
 86          UA       0       5      16      30      65      77      84      90      94      97
 87          UA     100
             *

 88          KK    UC19
 89          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 90          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
 91          KM    L= 0.52   Kb= 0.069   S=135.0
 92          BA    .027
 93          LG     .25     .36    5.00     .23   18.00
 94          UC    .412    .638
             *
```


HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 95          KK  CP1819
 96          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
 97          HC       3
             *

 98          KK   R1819
 99          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
100          KM    ENDPOINTS WERE EXTENDED
101          KM    SLOPE = (2540-2511)/1790
102          RS       2    FLOW      -1
103          RC   0.045   0.030   0.045    1790  0.0162
104          RX       0      92      99     100     112     113     120     200
105          RY     108     104     102     100     100     102     104     108
106          RL                    0.25     100
             *

107          KK    UC22
108          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
109          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
110          KM    L= .76   Kb= .104   S=111.0
111          BA    .032
112          LG     .25     .36    5.00     .23   14.00
113          UC    .746   1.527
             *

114          KK    UC23
115          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
116          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
117          KM    L= .40   Kb= 0.125   S=121.0
118          BA    .013
119          LG     .25     .36    5.00     .23   18.00
120          UC    .554    .290
             *

121          KK  CP2223
122          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
123          HC       3
             *

124          KK   R2223
125          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
126          KM    ENDPOINTS WERE EXTENDED
127          KM    SLOPE = (2511-2482)/1862
128          RS       2    FLOW      -1
129          RC   0.045    0.03   0.045    1862  0.0156
130          RX       0      95      99     100     112     113     117     200
131          RY     108     104     102     100     100     102     104     108
132          RL                    0.25     100
             *
```


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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

133          KK    UC28
134          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
135          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
136          KM    L= .57   Kb= 0.106   S=109.0
137          BA    .055
```

```
138          LG     .25     .36    4.90     .25   14.00
139          UC    .692    .619
             *
             *

140          KK     R28
141          KM    ROUTING REACH FROM CP28 TO CP2930 THROUGH SUBBASIN 30
142          KM    ENDPOINTS WERE EXTENDED
143          KM    SLOPE = (2502-2482)/1296
144          RS       2    FLOW      -1
145          RC   0.045   0.035   0.045    1296  0.0154
146          RX       0      86      99     100     108     109     122     200
147          RY     108     104     102     100     100     102     104     108
148          RL                    0.15     100
             *

149          KK    UC29
150          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
151          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
152          KM    L= .47   Kb= 0.116      09.0
153          BA    .035
154          LG     .25     .36    5.00     .23   12.00
155          UC    .617    .792
             *

156          KK   UC30
157          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
158          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
159          KM    L= .28   Kb= 0.126   S=134.0
160          BA    .012
161          LG     .25     .36    5.00     .23   12.00
162          UC    .450    .685
             *

163          KK  CP2930
164          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
165          KM    CP2223
166          HC       4
             *

167          KK   R2930
168          KM   Routing flow from CP2930 to CP34 through subbasin 34
169          KM    SLOPE = (2482-2469)/925
170          KM    ENDPOINTS WERE EXTENDED
171          RS       1    FLOW      -1
172          RC   0.045   0.030   0.045     925  0.0141
173          RX       0      89      99     100     110     111     122     200
174          RY     108     104     102     100     100     102     104     108
175          RL                    0.15     100
             *
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

176          KK    UC34
177          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
178          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
179          KM    L= .31   Kb = 0.116   S= 117.0
180          BA    .037
181          LG     .25     .36    4.90     .22   12.00
182          UC    .463    .398
             *

183          KK    CP34
184          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
185          KM   R2930
186          HC       2
             *
```

```
187          KK     R34
188          KM   Routing flow from CP34 to CP3537 through subbasin 37
189          KM    ENDPOINTS WERE EXTENDED
190          KM    SLOPE = (2469-2318)/6475
191          RS      11    FLOW      -1
192          RC   0.045   0.035   0.045    6475   .0233
193          RX       0      90      99     100     105     106     115     200
194          RY     108     104     102     100     100     102     104     108
195          RL                    0.15     100
             *

196          KK    UC37
197          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
198          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
199          KM    L= 2.03   Kb= 0.160   S= 98.0
200          BA    .207
201          LG     .25     .39    3.70     .16   24.00
202          UC    .767   1.189
             *

203          KK    UC35
204          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
205          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
206          KM    L= 1.27   Kb= 0.035   S=138.0
207          BA    .261
208          LG     .25     .38    3.90     .20   24.00
209          UC    .408    .355
             *

210          KK  CP3537
211          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
212          KM    R34
213          HC       3
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

214          KK   R3537
215          KM   Routing flow from CP3537 to CP3149 through subbasin 49
216          KM    ENDPOINTS WERE EXTENDED
217          KM    SLOPE = (2318-2280)/1829
218          RS       3    FLOW      -1
219          RC   0.045   0.035   0.045    1829  0.0208
220          RX       0      90      99     100     105     106     115     200
221          RY     108     104     102     100     100     102     104     108
222          RL                    0.15     100
             *

223          KK    UC49
224          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
225          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
226          KM    L= .47   Kb= 0.032   S=148.0
227          BA    .048
228          LG     .25     .39    3.60     .15   30.00
229          UC    .225    .219
             *

230          KK    UC31
231          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
232          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
233          KM    L= 2.04   Kb= 0.066   S= 128.0
234          BA    .405
235          LG     .25     .38    4.10     .18   20.00
236          UC    .846    .909
             *

237          KK  CP3149
238          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
```

```
 239          KM     R3537
 240          HC       3
              *

 241          KK   R3149
 242          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
 243          KM    ENDPOINTS WERE EXTENDED
 244          KM    SLOPE = (2280-2256)/1219
 245          RS       2    FLOW      -1
 246          RC   0.045   0.030   0.045    1219  0.0197
 247          RX       0      95      99     100     110     111     118     200
 248          RY     110     104     102     100     100     102     104     110
 249          RL                    0.15     100
              *

 250          KK    UC46
 251          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
 252          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 253          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
 254          BA    .034
 255          LG     .25     .39    3.60     .15   24.00
 256          UC    .200    .162
 257          UA       0       5      16      30      65      77      84      90      94      97
1
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 258          UA     100
              *

 259          KK     R46
 260          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
 261          KM    ENDPOINTS WERE EXTENDED
 262          KM    SLOPE = (2346-2315)/1783
 263          RS       3    FLOW      -1
 264          RC   0.045   0.035   0.045    1783  0.0174
 265          RX       0      92      99     100     105     106     113     200
 266          RY     108     104     102     100     100     102     104     108
 267          RL                    0.15     100
              *

 268          KK    UC45
 269          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
 270          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 271          KM    L= .48   Kb= 0.030   S= 135.0
 272          BA    .086
 273          LG     .25     .39    3.60     .15   24.00
 274          UC    .233    .167
 275          UA       0       5      16      30      65      77      84      90      94      97
 276          UA     100
              *

 277          KK    UC47
 278          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
 279          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 280          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
 281          BA    .031
 282          LG     .25     .39    3.60     .15   24.00
 283          UC    .217    .229
 284          UA       0       5      16      30      65      77      84      90      94      97
 285          UA     100
              *

 286          KK  CP4547
 287          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
 288          KM    R46
 289          HC       3
              *

 290          KK   R4547
```

```
291          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
292          KM   ENDPOINTS WERE EXTENDED
293          KM    SLOPE = (2315-2256)/2170
294          RS       4    FLOW      -1
295          RC   0.045   0.035   0.045    2170   .0272
296          RX       0      90      99     100     105     106     115     200
297          RY     108     104     102     100     100     102     104     108
298          RL                    0.15     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

299          KK    UC48
300          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
301          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
302          KM    L= .92   Kb= 0.048   S= 117.0
303          BA    .197
304          LG     .25     .39    3.70     .16   30.00
305          UC    .438    .349
             *

306          KK    UC50
307          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
308          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
309          KM    L= .27   Kb= 0.037   S= 93.0
310          BA    .019
311          LG     .25     .38    3.80     .24   24.00
312          UC    .221    .230
             *

313          KK  CP4850
314          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
315          KM    R3149 AND R4547
316          HC       4
             *

317          KK   R4850
318          KM   Routing flow from CP4850 to CP5157 through subbasin 57
319          KM    ENDPOINTS WERE EXTENDED
320          KM    SLOPE = (2256-2235)/1509
321          RS       2    FLOW      -1
322          RC   0.045   0.030   0.045    1509  0.0139
323          RX       0      95      99     100     115     116     120     200
324          RY     106     104     102     100     100     102     104     106
325          RL                    0.25     100
             *

326          KK    UC51
327          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
328          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
329          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
330          BA    .060
331          LG     .25     .36    5.00     .21   26.00
332          UC    .237    .187
             *

333          KK    UC57
334          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
335          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
336          KM    L= .47   Kb= 0.061   S= 200.0
337          BA    .037
338          LG     .25     .37    4.20     .28   20.00
339          UC    .333    .395
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
340          KK  CP5157
341          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
342          KM     R4850
343          HC       3
             *

344          KK   R5157
345          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
346          KM    ENDPOINTS WERE EXTENDED
347          KM    SLOPE = (2235-2208)/1796
348          RS       2    FLOW      -1
349          RC   0.045   0.030   0.045    1796  0.0150
350          RX       0      60      99     100     100     121     160     220
351          RY     110     104     102     100     100     102     104     110
352          RL                    0.35     100
             *

353          KK    UC58
354          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
355          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
356          KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
357          BA    .110
358          LG     .25     .37    4.80     .13   20.00
359          UC    .296    .250
             *

360          KK    UC59
361          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
362          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
363          KM    L= .49   Kb= 0.105   S= 112.0
364          BA    .034
365          LG     .25     .32    5.80     .33   14.00
366          UC    .658    .904
             *

367          KK  CP5859
368          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
369          KM     R5157
370          HC       3
             *

371          KK  D5859N
372          KM    DIVERSION OF FLOWS AT FLOW SPLIT
373          DT  D5859S
374          DI       0      50     100     500   10000
375          DQ       0    24.9    49.5   248.5    4970
             *

376          KK  R5859N
377          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
378          KM   ENDPOINTS WERE EXTENDED
379          KM    SLOPE = (2208-2195)/699
380          RS       1    FLOW      -1
381          RC   0.045   0.030   0.045     699  0.0186
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

382          RX       0      50      99     100     110     111     160     210
383          RY     104     103     102     100     100     102     103     104
384          RL                    0.15     100
             *

385          KK    UC63
386          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
387          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
388          KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
389          BA    .117
```

```
390          LG     .25     .36    5.00     .19   19.00
391          UC    .346    .326
             *

392          KK    CP63
393          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
394          KM   FROM RD5859N
395          HC       2
             *

396          KK     R63
397          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
398          KM    SLOPE = (2195-2170)/1394
399          RS       2    FLOW      -1
400          RC   0.045   0.030   0.045    1394  0.0179
401          RX      60      80      99     100     125     126     145     165
402          RY     106     104     102     100     100     102     104     106
403          RL                    0.35     100
             *

404          KK    UC66
405          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
406          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
407          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
408          BA    .037
409          LG     .25     .36    5.00     .25   14.00
410          UC    .350    .460
             *

411          KK    UC62
412          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
413          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
414          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
415          BA    .361
416          LG     .25     .35    6.10     .13   14.00
417          UC    .417    .316
             *

418          KK  CP6266
419          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
420          KM   FROM R63
421          HC       3
             *
```

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

422          KK   R6266
423          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
424          KM    SLOPE = (2170-2150)/990
425          RS       2    FLOW      -1
426          RC   0.045   0.030   0.045     990  0.0202
427          RX      25      85      99     100     100     121     135     195
428          RY     106     104     102     100     100     102     104     106
429          RL                    0.35     100
             *

430          KK  D5859S
431          KM   RECALL DIVERTED FLOW FROM D5859N
432          DR  D5859S
             *

433          KK  R5859S
434          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
435          KM    SLOPE = (2208-2194)/803
436          RS       1    FLOW      -1
437          RC   0.045   0.030   0.045     803  0.0174
438          RX       0      50      99     100     125     126     175     225
439          RY     104     103     102     100     100     102     103     104
```

```
440          RL                    0.15     100
             *

441          KK    UC64
442          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
443          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
444          KM    L= .15   Kb= 0.078   S= 166.0
445          BA    .005
446          LG     .25     .31    6.90     .20   14.00
447          UC    .213    .313
             *

448          KK    CP64
449          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
450          KM    DIVERSION RD5859N
451          HC       2    1.88
             *

452          KK    D64N
453          KM   DIVERSION OF FLOWS AT FLOW SPLIT
454          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
455          DT    D64S
456          DI       0      50     100     500   10000
457          DQ       0    22.5      45     225    4500
             *

458          KK   RD64N
459          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
460          KM   ENDPOINTS WERE EXTENDED
461          KM    SLOPE = (2194-2161)/1721
462          RS       2    FLOW      -1
463          RC   0.045   0.030   0.045    1721  0.0192
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

464          RX       0      60      99     100     112     113     152     200
465          RY     106     104     102     100     100     102     104     106
466          RL                    0.25     100
             *

467          KK    UC87
468          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
469          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
470          KM    L= .33   Kb= 0.118   S= 101.0
471          BA    .029
472          LG     .25     .35    3.40     .62    8.00
473          UC    .846   1.046
             *

474          KK    CP87
475          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
476          KM    DIVERSION RD64N
477          HC       2
             *
             * erase this
             * KK  D87N
             * KM DIVERSION OF FLOWS AT FLOW SPLIT 87
             * DT  D87S
             * DI     0      50     100     500   10000
             * DQ     0     1.3     2.6      13     260
             *

478          KK   RD87N
479          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
480          KM    SLOPE = (2161-2150)/557
481          RS       1    FLOW      -1
482          RC   0.045   0.030   0.045     557  0.0197
483          RX      25      85      99     100     120     121     135     195
484          RY     106     104     102     100     100     102     104     106
```

```
485          RL                    0.35     100
             *

486          KK    UC82
487          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
488          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
489          KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
490          BA    .022
491          LG     .25     .36    4.30    .400   14.00
492          UC    .321    .280
             *

493          KK    CP82
494          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
495          KM   SUBBASIN 82
496          HC       3    2.45
             *
1                                          HEC-1 INPUT
PAGE 13

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

497          KK     R82
498          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
499          KM    SLOPE = (2150-2138)/579
500          RS       1    FLOW      -1
501          RC   0.045   0.030   0.045     579  0.0207
502          RX      50      75      99     100     125     126     150     175
503          RY     106     104     102     100     100     102     104     106
504          RL                   0.35     100
             *

505          KK    D84N
506          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
507          DT    D84S
508          DI       0     500    1000    1500    2000    3000
509          DQ       0       0      72     395     782    1633
             *

510          KK    UC84
511          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
512          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
513          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
514          BA    .017
515          LG     .25     .36    4.50     .35   14.00
516          UC    .338    .436
             *

517          KK    CP84
518          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
519          KM    FROM D84N
520          HC       2
             *

521          KK     R84
522          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
523          KM   ENDPOINTS WERE EXTENDED
524          KM    SLOPE = (2138-2054)/3463
525          RS       5    FLOW      -1
526          RC   0.045   0.030   0.045    3463  0.0243
527          RX       0      94      99     100     110     111     116     200
528          RY     106     104     102     100     100     102     104     106
529          RL                   0.15     100
             *

530          KK    UC79
531          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
532          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
533          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
534          BA    .078
```

```
535          LG     .25     .35    4.30     .45   18.00
536          UC    .383    .490
537          UA       0       5      16      30      65      77      84      90      94      97
538          UA     100
             *
```


HEC-1 INPUT

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

539          KK    UC78
540          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
541          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
542          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
543          BA    .177
544          LG     .25     .35    6.00     .17   17.00
545          UC    .217    .206
546          UA       0       5      16      30      65      77      84      90      94      97
547          UA     100
             *

548          KK  CP7879
549          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
550          KM    FROM R84
551          HC       3
             *

552          KK   R7879
553          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
554          KM   ENDPOINTS WERE EXTENDED
555          KM    SLOPE = (2054-2048)/256
556          RS       1    FLOW      -1
557          RC   0.045   0.030   0.045     256   .0234
558          RX       0      90      99     100     120     121     130     200
559          RY     106     104     102     100     100     102     104     106
560          RL                    0.35     100
             *

561          KK    UC77
562          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
563          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
564          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
565          BA    .096
566          LG     .25     .34    6.70     .13   16.00
567          UC    .317    .369
568          UA       0       5      16      30      65      77      84      90      94      97
569          UA     100
             *

570          KK    CP77
571          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
572          KM    FROM R7879
573          HC       2
             *

574          KK     R77
575          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
576          KM   ENDPOINTS WERE EXTENDED
577          KM    SLOPE = (2048-2037)/593
578          RS       1    FLOW      -1
579          RC   0.045   0.030   0.045     593  0.0185
580          RX       0      80      99     100     115     116     120     200
581          RY     106     104     102     100     100     102     104     106
582          RL                    0.25     100
             *
```


HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
583          KK    UC89
584          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
585          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
586          KM    L= .77   Kb= 0.057   S= 126.0
587          BA    .073
588          LG     .25     .33    6.40     .20   17.00
589          UC    .471    .577
590          UA       0       5      16      30      65      77      84      90      94      97
591          UA     100
             *

592          KK    CP89
593          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
594          KM    FROM R77
595          HC       2
             *

596          KK     R89
597          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
598          KM   CHANNEL ENDS WERE EXTENDED
599          KM    SLOPE = (2037-2008)/1912
600          RS       2    FLOW      -1
601          RC   0.045   0.030   0.045    1912  0.0152
602          RX       0      80      99     100     115     116     135     200
603          RY     106     104     102     100     100     102     104     106
604          RL                    0.25     100
             *

605          KK    UC74
606          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
607          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
608          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
609          BA    .151
610          LG     .25     .34    6.60     .13   14.00
611          UC   1.000   1.088
             *

612          KK    UC76
613          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
614          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
615          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
616          BA    .041
617          LG     .25     .35    6.10     .16   14.00
618          UC    .292    .408
             *

619          KK  CP7476
620          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
621          HC       2
             *
```



```
                                        HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

622          KK   R7476
623          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
624          KM   END POINTS WERE EXTENDED
625          KM    SLOPE = (2031-2017)/524
626          RS       1    FLOW      -1
627          RC   0.045   0.030   0.045     524  0.0267
628          RX       0      80      99     100     112     113     132     200
629          RY     106     104     102     100     100     102     104     106
630          RL                    0.25     100
             *

631          KK    UC75
632          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
633          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
634          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
635          BA    .192
636          LG     .25      .34     6.50      .15   14.00
637          UC    .404     .449
638          UA       0        5       16       30       65       77       84       90       94       97
639          UA     100
             *

640          KK    CP75
641          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
642          KM    FROM R7476
643          HC       2
             *

644          KK     R75
645          KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
646          KM   END POINTS WERE EXTENDED
647          KM    SLOPE = (2017-2008)/723
648          RS       1    FLOW      -1
649          RC   0.045   0.030   0.045     723  0.0124
650          RX       0      80      99     100     115     116     135     200
651          RY     106     104     102     100     100     102     104     106
652          RL                    0.25     100
             *

653          KK    UC90
654          KM   SUBBASIN 90, UNNAMED WASH CENTRAL
655          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
656          KM    L= .48   Kb= 0.103   S= 151.0
657          BA    .038
658          LG     .25      .35     3.70      .55   14.00
659          UC    .675     .851
             *

660          KK    UC91
661          KM   SUBBASIN 91, UNNAMED WASH CENTRAL
662          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
663          KM    L= .75   Kb= 0.107   S= 109.0
664          BA    .073
665          LG     .25      .31     7.40      .14   14.00
1                                                HEC-1 INPUT
PAGE 17

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

666          UC    .712     .901
             *
             *

667          KK  CP90EN
668          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
669          KM    FROM R89 AND R75
670          HC       4
             *
             *

671          KK    D84S
672          KM   RETREVIAL OF DIVERTED FLOW FROM D84S
673          DR    D84S
             *

674          KK   RD84S
675          KM   ROUTING FLOW FROM CP84 (D84S) TO CP88END THROUGH SUBBASIN 88
676          KM    SLOPE = (2138-2041)/4843
677          RS       6    FLOW      -1
678          RC   0.045   0.030   0.045    4843  0.0200
679          RX       0      50      99     100     125     126     175     225
680          RY     106     104     102     100     100     102     104     106
681          RL                    0.35     100
             *
```

```
682          KK  D84IIS
683          KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
684          KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
685          DT  D84IIN
686          DI       0    79.7     255     490     880    1250
687          DQ       0    78.3     229     419     732    1000
             *

688          KK  RD84IS
689          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
690          KM   SLOPE = (2140-2078)/3225
691          RS       1    FLOW      -1
692          RC   0.045   0.030   0.045    3225  0.0192
693          RX       0      50      99     100     125     126     175     225
694          RY     106     104     102     100     100     102     104     106
695          RL                    0.25     100
             *
             *

696          KK    UC94
697          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
698          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
699          KM    L= .53   Kb= 0.119   S= 108.0
700          BA    .028
701          LG     .25     .36    5.00     .23   13.00
702          UC    .671   1.082
             *
```



```
                                          HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

703          KK  CP94DS
704          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
705          KM   FROM RD84IS
706          HC       2
             *

707          KK   R94DS
708          KM   ROUTING FLOW FROM CP94DS TO CP88EN
709          KM   SLOPE = (2078-2041)/1950
710          RS       1    FLOW      -1
711          RC   0.045   0.030   0.045    1950  0.0189
712          RX      60      85      99     100     108     109     123     148
713          RY     106     104     102     100     100     102     104     106
714          RL                    0.25     100
             *

715          KK  D84IIN
716          KM   RECALL DIVERTED FLOW FROM D84II
717          DR  D84IIN
             *

718          KK  RD84IN
719          KM   ROUTING FLOW FROM D84II TO CP88EN
720          KM   SLOPE = (2140-2041)/5175
721          RS       1    FLOW      -1
722          RC   0.045   0.030   0.045    5175  0.0191
723          RX      60      78      90     100     125     132     135     150
724          RY     106     104     102     100     100     102     104     106
725          RL                    0.25     100
             *

726          KK    UC88
727          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
728          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
729          KM    L= 1.08   Kb= 0.104   S=111.0
730          BA    .108
731          LG     .25     .33    6.10     .20   14.00
732          UC    .962   1.337
```

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                 *
 733             KK  CP88EN
 734             KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
 735             KM    FROM R94DS AND RD84IN
 736             HC       3
                 *
                 *

 737             KK    UC95
 738             KM   SUBBASIN 95, UNNAMED WASH CENTRAL
 739             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 740             KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
 741             BA    .024
 742             LG     .25     .39    3.70     .15    5.00
 743             UC    .287    .233
                 *
```



```
                                          HEC-1 INPUT

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 744             KK    UC93
 745             KM   SUBBASIN 93, UNNAMED WASH CENTRAL
 746             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 747             KM    L= .64   Kb= 0.093   S= 135.0
 748             BA    .038
 749             LG     .25     .30    8.00     .07   13.00
 750             UC    .496    .770
                 *

 751             KK    UC96
 752             KM   SUBBASIN 96, UNNAMED WASH CENTRAL
 753             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 754             KM    L= .73   Kb= 0.110  S= 113.0
 755             BA    .061
 756             LG     .25     .32    7.00     .12   13.00
 757             UC    .683    .920
                 *
                 *
 758             ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  47        UC8
              .
              .
  56          .         UC9
              .           .
              .           .
  65       CPC8............
              V
              V
  69      RCP89
              .
              .
  79          .        UC18
              .           .
              .           .
  88          .           .        UC19
              .           .           .
              .           .           .
  95    CP1819......................
              V
              V
  98      R1819
              .
              .
 107          .        UC22
              .           .
              .           .
 114          .           .        UC23
              .           .           .
              .           .           .
 121    CP2223......................
              V
              V
 124      R2223
              .
              .
 133          .        UC28
              .           V
              .           V
 140          .         R28
              .           .
              .           .
 149          .           .        UC29
              .           .           .
              .           .           .
 156          .           .           .       UC30
              .           .           .           .
              .           .           .           .
 163    CP2930.................................
              V
              V
 167      R2930
              .
              .
 176          .        UC34
              .           .
              .           .
 183       CP34............
              V
              V
 187        R34
              .
              .
 196          .        UC37
```

```
                .           .
                .           .
203             .           .        UC35
                .           .           .
                .           .           .
210       CP3537.......................
               V
               V
214        R3537
                .
                .
223             .        UC49
                .           .
                .           .
230             .           .        UC31
                .           .           .
                .           .           .
237       CP3149.......................
               V
               V
241        R3149
                .
                .
250             .        UC46
                .           V
                .           V
259             .         R46
                .           .
                .           .
268             .           .        UC45
                .           .           .
                .           .           .
277             .           .           .        UC47
                .           .           .           .
                .           .           .           .
286             .      CP4547........................
                .           V
                .           V
290             .       R4547
                .           .
                .           .
299             .           .        UC48
                .           .           .
                .           .           .
306             .           .           .        UC50
                .           .           .           .
                .           .           .           .
313       CP4850.....................................
               V
               V
317        R4850
                .
                .
326             .        UC51
                .           .
                .           .
333             .           .        UC57
                .           .           .
                .           .           .
340       CP5157.......................
               V
               V
344        R5157
                .
                .
353             .        UC58
                .           .
                .           .
360             .           .        UC59
                .           .           .
                .           .           .
```

```
367      CP5859.......................
              .
              .
373           .-------> D5859S
371      D5859N
              V
              V
376      R5859N
              .
              .
385           .        UC63
              .           .
              .           .
392        CP63............
              V
              V
396         R63
              .
              .
404           .        UC66
              .           .
              .           .
411           .           .        UC62
              .           .           .
              .           .           .
418      CP6266......................
              V
              V
422       R6266
              .
              .
432           .           .<-------  D5859S
430           .      D5859S
              .           V
              .           V
433           .      R5859S
              .           .
              .           .
441           .           .        UC64
              .           .           .
              .           .           .
448           .        CP64............
              .           .
              .           .
455           .           .------->    D64S
452           .        D64N
              .           V
              .           V
458           .       RD64N
              .           .
              .           .
467           .           .        UC87
              .           .           .
              .           .           .
474           .        CP87............
              .           V
              .           V
478           .       RD87N
              .           .
              .           .
486           .           .        UC82
              .           .           .
              .           .           .
493        CP82........................
              V
              V
497         R82
              .
              .
 07           .------->    D84S
505        D84N
```

```
                .
                .
510             .        UC84
                .           .
                .           .
517         CP84............
               V
               V
521          R84
                .
                .
530             .        UC79
                .           .
                .           .
539             .           .        UC78
                .           .           .
                .           .           .
548       CP7879........................
               V
               V
552        R7879
                .
                .
561             .        UC77
                .           .
                .           .
570         CP77............
               V
               V
574          R77
                .
                .
583             .        UC89
                .           .
                .           .
592         CP89............
               V
               V
596          R89
                .
                .
605             .        UC74
                .           .
                .           .
612             .           .        UC76
                .           .           .
                .           .           .
619             .      CP7476............
                .           V
                .           V
622             .       R7476
                .           .
                .           .
631             .           .        UC75
                .           .           .
                .           .           .
640             .        CP75............
                .           V
                .           V
644             .         R75
                .           .
                .           .
653             .           .        UC90
                .           .           .
                .           .           .
660             .           .           .        UC91
                .           .           .           .
                .           .           .           .
667       CP90EN..................................
                .
                .
```

```
673          .           .<-------    D84S
671          .        D84S
             .           V
             .           V
674          .       RD84S
             .           .
             .           .
685          .           .------->  D84IIN
682          .      D84IIS
             .           V
             .           V
688          .      RD84IS
             .           .
             .           .
696          .           .        UC94
             .           .           .
             .           .           .
703          .      CP94DS............
             .           V
             .           V
707          .       R94DS
             .           .
             .           .
717          .           .           .<-------  D84IIN
715          .           .      D84IIN
             .           .           V
             .           .           V
718          .           .      RD84IN
             .           .           .
             .           .           .
726          .           .           .        UC88
             .           .           .           .
             .           .           .           .
733          .      CP88EN......................
             .           .
             .           .
737          .           .        UC95
             .           .           .
             .           .           .
744          .           .           .        UC93
             .           .           .           .
             .           .           .           .
751          .           .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	39.	4.20	8.	2.	1.	.05
+	HYDROGRAPH AT	UC9	49.	4.13	8.	2.	1.	.05
+	2 COMBINED AT	CPC8	88.	4.17	16.	4.	1.	.11
+	ROUTED TO	RCP89	87.	4.27	16.	4.	1.	.11
+	HYDROGRAPH AT	UC18	25.	4.27	5.	1.	0.	.04
+	HYDROGRAPH AT	UC19	19.	4.27	3.	1.	0.	.03
+	3 COMBINED AT	CP1819	131.	4.27	24.	6.	2.	.18
+	ROUTED TO	R1819	129.	4.30	24.	6.	2.	.18
+	HYDROGRAPH AT	UC22	11.	4.60	4.	1.	0.	.03
+	HYDROGRAPH AT	UC23	13.	4.30	2.	0.	0.	.01
+	3 COMBINED AT	CP2223	150.	4.33	29.	7.	3.	.22
+	ROUTED TO	R2223	149.	4.37	29.	7.	3.	.22
+	HYDROGRAPH AT	UC28	33.	4.47	6.	2.	1.	.05
+	ROUTED TO	R28	33.	4.53	6.	2.	1.	.05
+	HYDROGRAPH AT	UC29	19.	4.43	4.	1.	0.	.04
+	HYDROGRAPH AT	UC30	8.	4.30	1.	0.	0.	.01
+	4 COMBINED AT	CP2930	204.	4.40	41.	10.	4.	.32
+	ROUTED TO	R2930	204.	4.43	41.	10.	4.	.32
+	HYDROGRAPH AT	UC34	33.	4.27	4.	1.	0.	.04
+	2 COMBINED AT	CP34	232.	4.40	45.	11.	4.	.36
+	ROUTED TO	R34	228.	4.60	45.	11.	4.	.36

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT	UC37	101.	4.60	30.	8.	3.	.21
+	HYDROGRAPH AT	UC35	283.	4.23	37.	9.	3.	.26
+	3 COMBINED AT	CP3537	453.	4.47	106.	27.	10.	.83
+	ROUTED TO	R3537	450.	4.57	106.	27.	10.	.83
+	HYDROGRAPH AT	UC49	78.	4.10	8.	2.	1.	.05
+	HYDROGRAPH AT	UC31	215.	4.63	55.	14.	5.	.41
+	3 COMBINED AT	CP3149	623.	4.57	160.	41.	15.	1.28
+	ROUTED TO	R3149	622.	4.57	160.	41.	15.	1.28
+	HYDROGRAPH AT	UC46	63.	4.07	5.	1.	0.	.03
+	ROUTED TO	R46	62.	4.10	5.	1.	0.	.03
+	HYDROGRAPH AT	UC45	157.	4.07	13.	3.	1.	.09
	HYDROGRAPH AT	UC47	50.	4.07	5.	1.	0.	.03
+	3 COMBINED AT	CP4547	265.	4.07	23.	6.	2.	.15
+	ROUTED TO	R4547	259.	4.13	23.	6.	2.	.15
+	HYDROGRAPH AT	UC48	226.	4.23	31.	8.	3.	.20
+	HYDROGRAPH AT	UC50	28.	4.10	3.	1.	0.	.02
+	4 COMBINED AT	CP4850	821.	4.40	207.	53.	19.	1.65
+	ROUTED TO	R4850	821.	4.43	206.	53.	19.	1.65
+	HYDROGRAPH AT	UC51	95.	4.10	8.	2.	1.	.06
+	HYDROGRAPH AT	UC57	36.	4.20	5.	1.	0.	.04
+	3 COMBINED AT	CP5157	865.	4.40	217.	56.	20.	1.75
+	ROUTED TO	R5157	860.	4.47	216.	56.	20.	1.75
	HYDROGRAPH AT	UC58	156.	4.13	16.	4.	1.	.11
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC59	15.	4.50	4.	1.	0.	.03
+	3 COMBINED AT	CP5859	929.	4.43	232.	59.	21.	1.89
+	DIVERSION TO	D5859S	462.	4.43	115.	30.	11.	1.89
+	HYDROGRAPH AT	D5859N	467.	4.43	117.	30.	11.	1.89
+	ROUTED TO	R5859N	466.	4.47	117.	30.	11.	1.89
+	HYDROGRAPH AT	UC63	132.	4.20	15.	4.	1.	.12
+	2 COMBINED AT	CP63	533.	4.40	129.	33.	12.	2.01
+	ROUTED TO	R63	532.	4.40	129.	33.	12.	2.01
+	HYDROGRAPH AT	UC66	31.	4.20	4.	1.	0.	.04
+	HYDROGRAPH AT	UC62	408.	4.23	48.	12.	4.	.36
+	3 COMBINED AT	CP6266	787.	4.33	171.	44.	16.	2.40
+	ROUTED TO	R6266	786.	4.37	171.	44.	16.	2.40
+	HYDROGRAPH AT	D5859S	462.	4.43	115.	30.	11.	1.89
+	ROUTED TO	R5859S	462.	4.43	115.	30.	11.	1.89
+	HYDROGRAPH AT	UC64	6.	4.10	1.	0.	0.	.00
+	2 COMBINED AT	CP64	465.	4.43	116.	30.	11.	1.88
+	DIVERSION TO	D64S	209.	4.43	52.	13.	5.	1.88
+	HYDROGRAPH AT	D64N	256.	4.43	64.	16.	6.	1.88
+	ROUTED TO	RD64N	255.	4.47	63.	16.	6.	1.88
+	HYDROGRAPH AT	UC87	9.	4.63	2.	1.	0.	.03
+	2 COMBINED AT	CP87	259.	4.47	65.	17.	6.	1.91
+	ROUTED TO	RD87N	259.	4.50	65.	17.	6.	1.91
+	HYDROGRAPH AT	UC82	23.	4.17	2.	1.	0.	.02
+	3 COMBINED AT	CP82	1030.	4.37	235.	60.	22.	2.45

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	1030.	4.40	235.	60.	22.	2.45
+	DIVERSION TO	D84S	93.	4.37	9.	2.	1.	2.45
+	HYDROGRAPH AT	D84N	938.	4.40	226.	58.	21.	2.45
+	HYDROGRAPH AT	UC84	14.	4.20	2.	0.	0.	.02
+	2 COMBINED AT	CP84	945.	4.40	227.	58.	21.	2.47
+	ROUTED TO	R84	941.	4.50	227.	58.	21.	2.47
+	HYDROGRAPH AT	UC79	58.	4.17	8.	2.	1.	.08
+	HYDROGRAPH AT	UC78	275.	4.07	23.	6.	2.	.18
+	3 COMBINED AT	CP7879	1019.	4.43	250.	64.	23.	2.72
+	ROUTED TO	R7879	1019.	4.47	250.	64.	23.	2.72
+	HYDROGRAPH AT	UC77	109.	4.13	13.	3.	1.	.10
+	2 COMBINED AT	CP77	1068.	4.43	260.	67.	24.	2.82
+	ROUTED TO	R77	1067.	4.43	260.	67.	24.	2.82
+	HYDROGRAPH AT	UC89	54.	4.20	9.	2.	1.	.07
+	2 COMBINED AT	CP89	1097.	4.43	267.	68.	25.	2.89
+	ROUTED TO	R89	1094.	4.50	266.	68.	25.	2.89
+	HYDROGRAPH AT	UC74	67.	4.77	20.	5.	2.	.15
+	HYDROGRAPH AT	UC76	42.	4.17	5.	1.	0.	.04
+	2 COMBINED AT	CP7476	81.	4.63	25.	6.	2.	.19
+	ROUTED TO	R7476	81.	4.63	25.	6.	2.	.19
+	HYDROGRAPH AT	UC75	180.	4.17	25.	6.	2.	.19
+	2 COMBINED AT	CP75	246.	4.20	49.	12.	4.	.38
+	ROUTED TO	R75	246.	4.20	49.	12.	4.	.38
	HYDROGRAPH AT	UC90	16.	4.50	4.	1.	0.	.04

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC91	39.	4.53	9.	2.	1.	.07
+	4 COMBINED AT	CP90EN	1263.	4.47	312.	80.	29.	3.39
+	HYDROGRAPH AT	D84S	93.	4.37	9.	2.	1.	2.45
+	ROUTED TO	RD84S	83.	4.57	9.	2.	1.	2.45
+	DIVERSION TO	D84IIN	80.	4.57	9.	2.	1.	2.45
+	HYDROGRAPH AT	D84IIS	4.	4.47	0.	0.	0.	2.45
+	ROUTED TO	RD84IS	2.	4.67	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC94	12.	4.50	3.	1.	0.	.03
+	2 COMBINED AT	CP94DS	10.	4.60	3.	1.	0.	2.48
+	ROUTED TO	R94DS	10.	4.73	3.	1.	0.	2.48
+	HYDROGRAPH AT	D84IIN	80.	4.57	9.	2.	1.	2.45
+	ROUTED TO	RD84IN	53.	4.87	8.	2.	1.	2.45
+	HYDROGRAPH AT	UC88	38.	4.77	13.	3.	1.	.11
+	3 COMBINED AT	CP88EN	88.	4.87	21.	5.	2.	2.59
+	HYDROGRAPH AT	UC95	34.	4.13	3.	1.	0.	.02
+	HYDROGRAPH AT	UC93	27.	4.37	6.	1.	1.	.04
+	HYDROGRAPH AT	UC96	34.	4.50	8.	2.	1.	.06

*** NORMAL END OF HEC-1 ***

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1*****************************************
                                         *
    FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
              JUN   1998                 *
            VERSION 4.1                  *
*                                        *
*  RUN DATE   16MAR04  TIME  08:41:26    *
*                                        *
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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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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

1
PAGE 1

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         10-YEAR 24-HOUR MODEL  FILENAME: UC1024E.DAT
  3           ID         EXISTING CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         DECEMBER 2001 (Final Revision April 2004)
  9           ID    ******************************************************************
 10           ID         10 YEAR ANALYSIS 24-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID   ******************************************************************
 15           ID     DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID     THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    3.16    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   2.970   10.00
 35           JD   2.844   30.00
 36           JD   2.718   60.00
 37           JD   2.673   90.00
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 38          JD   2.635  120.00
 39          JD   2.607  150.00
 40          JD   2.528  300.00
 41          JD   2.465  500.00
             *

 42          KK     UC8
 43          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 44          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 45          KM    L= 1.04   Kb= 0.031   S=138.0
 46          BA    .054
 47          LG     .30     .36     4.9     .26    36.0
 48          UC    .608   1.159
 49          UA       0       5      16      30      65      77      84      90      94      97
 50          UA     100
             *
1                                          HEC-1 INPUT
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       LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 51          KK     UC9
 52          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 53          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 54          KM    L= 0.91   Kb= 0.031   S=145.0
 55          BA    .054
 56          LG     .30     .36     5.0     .23    36.0
 57          UC    .525    .882
 58          UA       0       5      16      30      65      77      84      90      94      97
 59          UA     100
             *

 60          KK    CPC89
 61          KM    CONCENTRATION POINT 89
 62          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 63          HC       2
             *

 64          KK   RCP89
 65          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 66          KM    NORMAL DEPTH CHANNEL ROUTING
 67          KM    ENDPOINTS WERE EXTENDED
 68          KM    SLOPE = (2596-2540)/2933
 69          RS       5    FLOW      -1
 70          RC   0.045   0.035   0.045    2933  0.0191
 71          RX       0      90      99     100     108     109     120     200
 72          RY     108     104     102     100     100     102     104     108
 73          RL                    0.15     100
             *

 74          KK    UC18
 75          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 76          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 77          KM    L= 0.56   Kb= 0.091   S=101.0
 78          BA    .040
 79          LG     .25     .36     5.0     .23   24.00
 80          UC   1.046   1.514
 81          UA       0       5      16      30      65      77      84      90      94      97
 82          UA     100
             *

 83          KK    UC19
 84          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 85          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 86          KM    L= 0.52   Kb= 0.069   S=135.0
 87          BA    .027
 88          LG     .25     .36    5.00     .23   18.00
 89          UC    .683   1.118
             *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  90          KK  CP1819
  91          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
  92          HC       3
              *

  93          KK   R1819
  94          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
  95          KM    ENDPOINTS WERE EXTENDED
  96          KM    SLOPE = (2540-2511)/1790
  97          RS       2    FLOW      -1
  98          RC   0.045   0.030   0.045    1790  0.0162
  99          RX       0      92      99     100     112     113     120     200
 100          RY     108     104     102     100     100     102     104     108
 101          RL                    0.25     100
              *

 102          KK    UC22
 103          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
 104          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 105          KM    L= .76   Kb= .104   S=111.0
 106          BA    .032
 107          LG     .25     .36    5.00     .23   14.00
 108          UC    .579   1.153
              *

 109          KK    UC23
 110          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
 111          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 112          KM    L= .40   Kb= 0.125   S=121.0
 113          BA    .013
 114          LG     .25     .36    5.00     .23   18.00
 115          UC    .408    .782
              *

 116          KK  CP2223
 117          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
 118          HC       3
              *

 119          KK   R2223
 120          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
 121          KM    ENDPOINTS WERE EXTENDED
 122          KM    SLOPE = (2511-2482)/1862
 123          RS       2    FLOW      -1
 124          RC   0.045    0.03   0.045    1862  0.0156
 125          RX       0      95      99     100     112     113     117     200
 126          RY     108     104     102     100     100     102     104     108
 127          RL                    0.25     100
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 128          KK    UC28
 129          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
 130          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 131          KM    L= .57   Kb= 0.106   S=109.0
 132          BA    .055
 133          LG     .25     .36    4.90     .25   14.00
 134          UC    .492    .423
              *

 135          KK     R28
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136          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
137          KM    ENDPOINTS WERE EXTENDED
138          KM    SLOPE = (2502-2482)/1296
139          RS       2    FLOW      -1
140          RC   0.045   0.035   0.045    1296  0.0154
141          RX       0      86      99     100     108     109     122     200
142          RY     108     104     102     100     100     102     104     108
143          RL                    0.15     100
             *

144          KK    UC29
145          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
147          KM    L= .47   Kb= 0.116   S=109.0
148          BA    .035
149          LG     .25     .36    5.00     .23   12.00
150          UC    .454    .564
             *

151          KK   UC30
152          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
153          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
154          KM    L= .28   Kb= 0.126   S=134.0
155          BA    .012
156          LG     .25     .36    5.00     .23   12.00
157          UC    .317    .464
             *

158          KK  CP2930
159          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
160          KM    CP2223
161          HC       4
             *

162          KK   R2930
163          KM   Routing flow from CP2930 to CP34 through subbasin 34
164          KM    SLOPE = (2482-2469)/925
165          KM    ENDPOINTS WERE EXTENDED
166          RS       1    FLOW      -1
167          RC   0.045   0.030   0.045     925  0.0141
168          RX       0      89      99     100     110     111     122     200
169          RY     108     104     102     100     100     102     104     108
170          RL                    0.15     100
             *
1                                          HEC-1 INPUT
PAGE  5

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

171          KK    UC34
172          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
173          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
174          KM    L= .31   Kb = 0.116   S= 117.0
175          BA    .031
176          LG     .25     .36    4.90     .22   12.00
177          UC    .333    .277
             *

178          KK    CP34
179          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
180          KM   R2930
181          HC       2
             *

182          KK     R34
183          KM   Routing flow from CP34 to CP3537 through subbasin 37
184          KM    ENDPOINTS WERE EXTENDED
185          KM    SLOPE = (2469-2318)/6475
186          RS      11    FLOW      -1
187          RC   0.045   0.035   0.045    6475   .0233
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188          RX       0      90      99     100     105     106     115     200
189          RY     108     104     102     100     100     102     104     108
190          RL                    0.15     100
             *

191          KK    UC37
192          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
193          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
194          KM    L= 2.03   Kb= 0.160   S= 98.0
195          BA    .203
196          LG     .25     .39    3.70     .16   24.00
197          UC    .654    .997
             *

198          KK    UC35
199          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
200          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
201          KM    L= 1.27   Kb= 0.035   S=138.0
202          BA    .261
203          LG     .25     .38    3.90     .20   24.00
204          UC    .304    .256
             *

205          KK  CP3537
206          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
207          KM    R34
208          HC       3
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

209          KK   R3537
210          KM   Routing flow from CP3537 to CP3149 through subbasin 49
211          KM    ENDPOINTS WERE EXTENDED
212          KM    SLOPE = (2318-2280)/1829
213          RS       3    FLOW      -1
214          RC   0.045   0.035   0.045    1829  0.0208
215          RX       0      90      99     100     105     106     115     200
216          RY     108     104     102     100     100     102     104     108
217          RL                    0.15     100
             *

218          KK    UC49
219          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
220          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
221          KM    L= .47   Kb= 0.032   S=148.0
222          BA    .048
223          LG     .25     .39    3.60     .15   30.00
224          UC    .175    .166
             *

225          KK    UC31
226          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
227          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
228          KM    L= 2.04   Kb= 0.066   S= 128.0
229          BA    .405
230          LG     .25     .38    4.10     .18   20.00
231          UC    .712    .752
             *

232          KK  CP3149
233          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
234          KM     R3537
235          HC       3
             *

236          KK   R3149
237          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
```

```
 238          KM    ENDPOINTS WERE EXTENDED
 239          KM    SLOPE = (2280-2256)/1219
 240          RS       2    FLOW      -1
 241          RC   0.045   0.030   0.045    1219  0.0197
 242          RX       0      95      99     100     110     111     118     200
 243          RY     110     104     102     100     100     102     104     110
 244          RL                    0.15     100
              *

 245          KK    UC46
 246          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
 247          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 248          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
 249          BA    .034
 250          LG     .25     .39    3.60     .15   24.00
 251          UC    .154    .121
 252          UA       0       5      16      30      65      77      84      90      94      97
1                                            HEC-1 INPUT
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      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 253          UA     100
              *

 254          KK     R46
 255          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
 256          KM    ENDPOINTS WERE EXTENDED
 257          KM    SLOPE = (2346-2315)/1783
 258          RS       3    FLOW      -1
 259          RC   0.045   0.035   0.045    1783  0.0174
 260          RX       0      92      99     100     105     106     113     200
 261          RY     108     104     102     100     100     102     104     108
 262          RL                    0.15     100
              *

 263          KK    UC45
 264          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
 265          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 266          KM    L= .48   Kb= 0.030   S= 135.0
 267          BA    .086
 268          LG     .25     .39    3.60     .15   24.00
 269          UC    .175    .121
 270          UA       0       5      16      30      65      77      84      90      94      97
 271          UA     100
              *

 272          KK    UC47
 273          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
 274          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 275          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
 276          BA    .031
 277          LG     .25     .39    3.60     .15   24.00
 278          UC    .167    .171
 279          UA       0       5      16      30      65      77      84      90      94      97
 280          UA     100
              *

 281          KK  CP4547
 282          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
 283          KM    R46
 284          HC       3
              *

 285          KK   R4547
 286          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
 287          KM   ENDPOINTS WERE EXTENDED
 288          KM    SLOPE = (2315-2256)/2170
 289          RS       4    FLOW      -1
 290          RC   0.045   0.035   0.045    2170   .0272
 291          RX       0      90      99     100     105     106     115     200
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 292          RY     108     104     102     100     100     102     104     108
 293          RL                    0.15     100
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 294          KK    UC48
 295          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 296          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 297          KM    L= .92   Kb= 0.048   S= 117.0
 298          BA    .197
 299          LG     .25     .39    3.70     .16   30.00
 300          UC    .342    .265
              *

 301          KK    UC50
 302          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 303          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 304          KM    L= .27   Kb= 0.037   S= 93.0
 305          BA    .019
 306          LG     .25     .38    3.80     .24   24.00
 307          UC    .167    .169
              *

 308          KK  CP4850
 309          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 310          KM    R3149 AND R4547
 311          HC       4
              *

 312          KK   R4850
 313          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 314          KM    ENDPOINTS WERE EXTENDED
 315          KM    SLOPE = (2256-2235)/1509
 316          RS       2    FLOW      -1
 317          RC   0.045   0.030   0.045    1509  0.0139
 318          RX       0      95      99     100     115     116     120     200
 319          RY     106     104     102     100     100     102     104     106
 320          RL                    0.25     100
              *

 321          KK    UC51
 322          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 323          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 324          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
 325          BA    .060
 326          LG     .25     .36    5.00     .21   26.00
 327          UC    .175    .133
              *

 328          KK    UC57
 329          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
 330          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 331          KM    L= .47   Kb= 0.061   S= 200.0
 332          BA    .037
 333          LG     .25     .37    4.20     .28   20.00
 334          UC    .233    .266
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 335          KK  CP5157
 336          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
 337          KM     R4850
 338          HC       3
```

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                *
339             KK   R5157
340             KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
341             KM    ENDPOINTS WERE EXTENDED
342             KM    SLOPE = (2235-2208)/1796
343             RS       2    FLOW      -1
344             RC   0.045   0.030   0.045    1796  0.0150
345             RX       0      60      99     100     100     121     160     220
346             RY     110     104     102     100     100     102     104     110
347             RL                    0.35     100
                *

348             KK    UC58
349             KM   SUBBASIN 58, UNNAMED WASH CENTRAL
350             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
351             KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
352             BA    .110
353             LG     .25     .37    4.80     .13   20.00
354             UC    .221    .180
                *

355             KK    UC59
356             KM   SUBBASIN 59, UNNAMED WASH CENTRAL
357             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
358             KM    L= .49   Kb= 0.105   S= 112.0
359             BA    .034
360             LG     .25     .32    5.80     .33   14.00
361             UC    .454    .599
                *

362             KK  CP5859
363             KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
364             KM     R5157
365             HC       3
                *

366             KK  D5859N
367             KM    DIVERSION OF FLOWS AT FLOW SPLIT
368             DT  D5859S
369             DI       0      50     100     500   10000
370             DQ       0    24.9    49.5   248.5    4970
                *

371             KK  R5859N
372             KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
373             KM   ENDPOINTS WERE EXTENDED
374             KM    SLOPE = (2208-2195)/699
375             RS       1    FLOW      -1
376             RC   0.045   0.030   0.045     699  0.0186
1                                            HEC-1 INPUT
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

377             RX       0      50      99     100     110     111     160     210
378             RY     104     103     102     100     100     102     103     104
379             RL                    0.15     100
                *

380             KK    UC63
381             KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
382             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
383             KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
384             BA    .117
385             LG     .25     .36    5.00     .19   19.00
386             UC    .246    .223
                *

387             KK    CP63
388             KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
```

```
389          KM   FROM RD5859N
390          HC       2
             *

391          KK     R63
392          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
393          KM    SLOPE = (2195-2170)/1394
394          RS       2    FLOW      -1
395          RC   0.045   0.030   0.045    1394  0.0179
396          RX      60      80      99     100     125     126     145     165
397          RY     106     104     102     100     100     102     104     106
398          RL                   0.35     100
             *

399          KK    UC66
400          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
401          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
402          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
403          BA    .037
404          LG     .25     .36    5.00     .25   14.00
405          UC    .242    .305
             *

406          KK    UC62
407          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
408          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
409          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
410          BA    .361
411          LG     .25     .35    6.10     .13   14.00
412          UC    .308    .226
             *

413          KK  CP6266
414          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
415          KM   FROM R63
416          HC       3
             *
```


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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

417          KK   R6266
418          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
419          KM    SLOPE = (2170-2150)/990
420          RS       2    FLOW      -1
421          RC   0.045   0.030   0.045     990  0.0202
422          RX      25      85      99     100     100     121     135     195
423          RY     106     104     102     100     100     102     104     106
424          RL                   0.35     100
             *

425          KK  D5859S
426          KM   RECALL DIVERTED FLOW FROM D5859N
427          DR  D5859S
             *

428          KK  R5859S
429          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
430          KM    SLOPE = (2208-2194)/803
431          RS       1    FLOW      -1
432          RC   0.045   0.030   0.045     803  0.0174
433          RX       0      50      99     100     125     126     175     225
434          RY     104     103     102     100     100     102     103     104
435          RL                   0.15     100
             *

436          KK    UC64
437          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
438          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
439          KM    L= .15   Kb= 0.078   S= 166.0
440          BA    .005
441          LG     .25      .31    6.90      .20   14.00
442          UC    .154     .219
             *

443          KK    CP64
444          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
445          KM    DIVERSION RD5859N
446          HC       2    1.88
             *

447          KK    D64N
448          KM   DIVERSION OF FLOWS AT FLOW SPLIT
449          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
450          DT    D64S
451          DI       0      50     100     500   10000
452          DQ       0    22.5      45     225    4500
             *

453          KK   RD64N
454          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
455          KM   ENDPOINTS WERE EXTENDED
456          KM    SLOPE = (2194-2161)/1721
457          RS       2    FLOW      -1
458          RC   0.045   0.030   0.045    1721  0.0192
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

459          RX       0      60      99     100     112     113     152     200
460          RY     106     104     102     100     100     102     104     106
461          RL                    0.25     100
             *

462          KK    UC87
463          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
464          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
465          KM    L= .33   Kb= 0.118   S= 101.0
466          BA    .024
467          LG     .25      .35    3.40      .62    8.00
468          UC    .438     .503
             *

469          KK    CP87
470          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
471          KM    DIVERSION RD64N
472          HC       2
             *

473          KK   RD87N
474          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
475          KM    SLOPE = (2161-2150)/557
476          RS       1    FLOW      -1
477          RC   0.045   0.030   0.045     557  0.0197
478          RX      25      85      99     100     120     121     135     195
479          RY     106     104     102     100     100     102     104     106
480          RL                    0.35     100
             *

481          KK    UC82
482          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
483          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
484          KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
485          BA    .022
486          LG     .25      .36    4.30     .400   14.00
487          UC    .213     .177
             *

488          KK    CP82
```

```
 489          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 490          KM   SUBBASIN 82
 491          HC       3    2.45
              *

 492          KK     R82
 493          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 494          KM    SLOPE = (2150-2138)/579
 495          RS       1    FLOW      -1
 496          RC   0.045   0.030   0.045     579  0.0207
 497          RX      50      75      99     100     125     126     150     175
 498          RY     106     104     102     100     100     102     104     106
 499          RL                    0.35     100
              *
1                                                HEC-1 INPUT
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       LINE   ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 500          KK    D84N
 501          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 502          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 503          DT    D84S
 504          DI       0     500    1275    1550    1964    2475    3223    4000
 505          DQ       0       0       0    79.7     255     490     888    1250
              *

 506          KK    UC84
 507          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 508          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 509          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
 510          BA    .013
 511          LG     .25     .36    4.50     .35   14.00
 512          UC    .225    .278
              *

 513          KK    CP84
 514          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 515          KM    FROM D84N
 516          HC       2
              *

 517          KK     R84
 518          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 519          KM   ENDPOINTS WERE EXTENDED
 520          KM    SLOPE = (2138-2054)/3463
 521          RS       5    FLOW      -1
 522          RC   0.045   0.030   0.045    3463  0.0243
 523          RX       0      94      99     100     110     111     116     200
 524          RY     106     104     102     100     100     102     104     106
 525          RL                    0.15     100
              *

 526          KK    UC79
 527          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
 528          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 529          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
 530          BA    .078
 531          LG     .25     .35    4.30     .45   18.00
 532          UC    .242    .294
 533          UA       0       5      16      30      65      77      84      90      94      97
 534          UA     100
              *

 535          KK    UC78
 536          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
 537          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 538          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
 539          BA    .177
 540          LG     .25     .35    6.00     .17   17.00
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541          UC    .196    .144
542          UA       0       5      16      30      65      77      84      90      94      97
543          UA     100
             *
```


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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

544          KK  CP7879
545          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
546          KM    FROM R84
547          HC       3
             *

548          KK   R7879
549          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
550          KM   ENDPOINTS WERE EXTENDED
551          KM    SLOPE = (2054-2048)/256
552          RS       1    FLOW      -1
553          RC   0.045   0.030   0.045     256   .0234
554          RX       0      90      99     100     120     121     130     200
555          RY     106     104     102     100     100     102     104     106
556          RL                    0.35     100
             *

557          KK    UC77
558          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
559          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
560          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
561          BA    .096
562          LG     .25     .34    6.70     .13   16.00
563          UC    .233    .263
564          UA       0       5      16      30      65      77      84      90      94      97
565          UA     100
             *

566          KK    CP77
567          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
568          KM    FROM R7879
569          HC       2
             *

570          KK     R77
571          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
572          KM   ENDPOINTS WERE EXTENDED
573          KM    SLOPE = (2048-2037)/593
574          RS       1    FLOW      -1
575          RC   0.045   0.030   0.045     593  0.0185
576          RX       0      80      99     100     115     116     120     200
577          RY     106     104     102     100     100     102     104     106
578          RL                    0.25     100
             *

579          KK    UC89
580          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
581          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
582          KM    L= .77   Kb= 0.057   S= 126.0
583          BA    .073
584          LG     .25     .33    6.40     .20   17.00
585          UC    .342    .405
586          UA       0       5      16      30      65      77      84      90      94      97
587          UA     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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588          KK    CP89
589          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
590          KM    FROM R77
591          HC       2
             *

592          KK     R89
593          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
594          KM   CHANNEL ENDS WERE EXTENDED
595          KM    SLOPE = (2037-2008)/1912
596          RS       2    FLOW      -1
597          RC   0.045   0.030   0.045    1912  0.0152
598          RX       0      80      99     100     115     116     135     200
599          RY     106     104     102     100     100     102     104     106
600          RL                    0.25     100
             *

601          KK    UC74
602          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
603          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
604          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
605          BA    .151
606          LG     .25     .34    6.60     .13   14.00
607          UC    .342    .364
             *

608          KK    UC76
609          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
610          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
611          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
612          BA    .041
613          LG     .25     .35    6.10     .16   14.00
614          UC    .213    .287
             *

615          KK  CP7476
616          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
617          HC       2
             *

618          KK   R7476
619          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
620          KM   END POINTS WERE EXTENDED
621          KM    SLOPE = (2031-2017)/524
622          RS       1    FLOW      -1
623          RC   0.045   0.030   0.045     524  0.0267
624          RX       0      80      99     100     112     113     132     200
625          RY     106     104     102     100     100     102     104     106
626          RL                    0.25     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

627          KK    UC75
628          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
629          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
630          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
631          BA    .192
632          LG     .25     .34    6.50     .15   14.00
633          UC    .150    .149
634          UA       0       5      16      30      65      77      84      90      94      97
635          UA     100
             *

636          KK    CP75
637          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
638          KM    FROM R7476
639          HC       2
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                 *

640              KK     R75
641              KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
642              KM   END POINTS WERE EXTENDED
643              KM    SLOPE = (2017-2008)/723
644              RS       1    FLOW      -1
645              RC   0.045   0.030   0.045     723  0.0124
646              RX       0      80      99     100     115     116     135     200
647              RY     106     104     102     100     100     102     104     106
648              RL                    0.25     100
                 *

649              KK    UC90
650              KM   SUBBASIN 90, UNNAMED WASH CENTRAL
651              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
652              KM    L= .48   Kb= 0.103   S= 151.0
653              BA    .038
654              LG     .25     .35    3.70     .55   14.00
655              UC    .404    .482
                 *

656              KK    UC91
657              KM   SUBBASIN 91, UNNAMED WASH CENTRAL
658              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
659              KM    L= .75   Kb= 0.107   S= 109.0
660              BA    .073
661              LG     .25     .31    7.40     .14   14.00
662              UC    .571    .705
                 *
                 *

663              KK  CP90EN
664              KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
665              KM    FROM R89 AND R75
666              HC       4
                 *
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LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

667              KK    D84S
668              KM   RETREIVAL OF DIVERTED FLOW FROM D84S
669              DR    D84S
                 *

670              KK   RD84S
671              KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
672              KM    SLOPE = (2144-2140)/303
673              RS       6    FLOW      -1
674              RC   0.045   0.030   0.045     303  0.0132
675              RX       0      50      99     100     125     126     175     225
676              RY     106     104     102     100     100     102     104     106
677              RL                    0.35     100
                 *

678              KK  D84IIS
679              KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
680              KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
681              DT  D84IIN
682              DI       0    79.7     255     490     880    1250
683              DQ       0    78.3     229     419     732    1000
                 *

684              KK  RD84IS
685              KM   ROUTING FLOWS FROM D84IIS TO CP94DS
686              KM   SLOPE = (2140-2078)/3225
687              RS       1    FLOW      -1
688              RC   0.045   0.030   0.045    3225  0.0192
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689          RX       0      50      99     100     125     126     175     225
690          RY     106     104     102     100     100     102     104     106
691          RL                    0.25     100
             *

692          KK    UC94
693          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
694          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
695          KM    L= .53   Kb= 0.119   S= 108.0
696          BA    .028
697          LG     .25     .36    5.00     .23   13.00
698          UC    .671   1.082
             *

699          KK  CP94DS
700          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
701          KM   FROM RD84IS
702          HC       2
             *

703          KK   R94DS
704          KM   ROUTING FLOW FROM CP94DS TO CP88EN
705          KM   SLOPE = (2078-2041)/1950
706          RS       1    FLOW      -1
707          RC   0.045   0.030   0.045    1950  0.0189
708          RX      60      85      99     100     108     109     123     148
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                                          HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

709          RY     106     104     102     100     100     102     104     106
710          RL                    0.25     100
             *

711          KK  D84IIN
712          KM   RECALL DIVERTED FLOW FROM D84II
713          DR  D84IIN
             *

714          KK  RD84IN
715          KM   ROUTING FLOW FROM D84II TO CP88EN
716          KM   SLOPE = (2140-2041)/5175
717          RS       1    FLOW      -1
718          RC   0.045   0.030   0.045    5175  0.0191
719          RX      60      78      90     100     125     132     135     150
720          RY     106     104     102     100     100     102     104     106
721          RL                    0.25     100
             *

722          KK    UC88
723          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
724          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
725          KM    L= 1.08   Kb= 0.104   S=111.0
726          BA    .108
727          LG     .25     .33    6.10     .20   14.00
728          UC    .962   1.337
             *

729          KK  CP88EN
730          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
731          KM    FROM R94DS AND RD84IN
732          HC       3
             *

733          KK    UC95
734          KM   SUBBASIN 95, UNNAMED WASH CENTRAL
735          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
736          KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
737          BA    .024
738          LG     .25     .39    3.70     .15    5.00
```

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739          UC    .217    .170
             *

740          KK    UC93
741          KM   SUBBASIN 93, UNNAMED WASH CENTRAL
742          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
743          KM    L= .64   Kb= 0.093   S= 135.0
744          BA    .038
745          LG     .25     .30    8.00     .07   13.00
746          UC    .392    .592
             *
1                                          HEC-1 INPUT
PAGE 19

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

747          KK    UC96
748          KM   SUBBASIN 96, UNNAMED WASH CENTRAL
749          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
750          KM    L= .73   Kb= 0.110  S= 113.0
751          BA    .061
752          LG     .25     .32    7.00     .12   13.00
753          UC    .550    .723
             *
             *
754          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  42        UC8
             .
             .
  51         .         UC9
             .           .
             .           .
  60      CPC8............
             V
             V
  64     RCP89
             .
             .
  74         .       UC18
             .           .
             .           .
  83         .           .       UC19
             .           .          .
             .           .          .
  90   CP1819........................
             V
             V
  93     R1819
             .
             .
 102         .       UC22
             .           .
             .           .
 109         .           .       UC23
             .           .          .
             .           .          .
 116   CP2223........................
             V
             V
 119     R2223
             .
             .
 128         .       UC28
             .          V
             .          V
 135         .        R28
             .           .
             .           .
 144         .           .       UC29
             .           .          .
             .           .          .
 151         .           .          .       UC30
             .           .          .          .
             .           .          .          .
 158   CP2930.......................................
             V
             V
 162    R2930
             .
             .
 171         .       UC34
             .           .
             .           .
 178     CP34............
             V
             V
 182      R34
             .
             .
 191         .       UC37
```

```
                .           .
                .           .
198             .           .        UC35
                .           .           .
                .           .           .
205       CP3537.......................
                V
                V
209        R3537
                .
                .
218             .        UC49
                .           .
                .           .
225             .           .        UC31
                .           .           .
                .           .           .
232       CP3149.......................
                V
                V
236        R3149
                .
                .
245             .        UC46
                .           V
                .           V
254             .         R46
                .           .
                .           .
263             .           .        UC45
                .           .           .
                .           .           .
272             .           .           .        UC47
                .           .           .           .
                .           .           .           .
281             .      CP4547.......................
                .           V
                .           V
285             .       R4547
                .           .
                .           .
294             .           .        UC48
                .           .           .
                .           .           .
301             .           .           .        UC50
                .           .           .           .
                .           .           .           .
308        CP4850.....................................
                V
                V
312         R4850
                .
                .
321             .        UC51
                .           .
                .           .
328             .           .        UC57
                .           .           .
                .           .           .
335        CP5157.......................
                V
                V
339         R5157
                .
                .
348             .        UC58
                .           .
                .           .
355             .           .        UC59
                .           .           .
                .           .           .
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362     CP5859.......................
             .
             .
368          .-------->  D5859S
366     D5859N
             V
             V
371     R5859N
             .
             .
380          .        UC63
             .           .
             .           .
387       CP63............
             V
             V
391       R63
             .
             .
399          .        UC66
             .           .
             .           .
406          .           .        UC62
             .           .           .
             .           .           .
413     CP6266......................
             V
             V
417     R6266
             .
             .
427          .           .<-------  D5859S
425          .      D5859S
             .           V
             .           V
428          .      R5859S
             .           .
             .           .
436          .           .        UC64
             .           .           .
             .           .           .
443          .        CP64............
             .           .
             .           .
450          .           .-------->    D64S
447          .        D64N
             .           V
             .           V
453          .      RD64N
             .           .
             .           .
462          .           .        UC87
             .           .           .
             .           .           .
469          .        CP87............
             .           V
             .           V
473          .      RD87N
             .           .
             .           .
481          .           .        UC82
             .           .           .
             .           .           .
488     CP82......................
             V
             V
492     R82
             .
             .
503          .-------->    D84S
500     D84N
```

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                .
                .
506             .        UC84
                .           .
                .           .
513         CP84............
                V
                V
517          R84
                .
                .
526             .        UC79
                .           .
                .           .
535             .           .        UC78
                .           .           .
                .           .           .
544       CP7879........................
                V
                V
548        R7879
                .
                .
557             .        UC77
                .           .
                .           .
566          CP77............
                V
                V
570           R77
                .
                .
579             .        UC89
                .           .
                .           .
588          CP89............
                V
                V
592           R89
                .
                .
601             .        UC74
                .           .
                .           .
608             .           .        UC76
                .           .           .
                .           .           .
615             .      CP7476............
                .           V
                .           V
618             .      R7476
                .           .
                .           .
627             .           .        UC75
                .           .           .
                .           .           .
636             .       CP75............
                .           V
                .           V
640             .        R75
                .           .
                .           .
649             .           .        UC90
                .           .           .
                .           .           .
656             .           .           .        UC91
                .           .           .           .
                .           .           .           .
663       CP90EN.......................................
                .
                .
```

```
669          .          .<-------    D84S
667          .       D84S
             .          V
             .          V
670          .      RD84S
             .          .
             .          .
681          .          .-------> D84IIN
678          .     D84IIS
             .          V
             .          V
684          .     RD84IS
             .          .
             .          .
692          .          .        UC94
             .          .           .
             .          .           .
699          .     CP94DS............
             .          V
             .          V
703          .      R94DS
             .          .
             .          .
713          .          .           .<-------  D84IIN
711          .          .     D84IIN
             .          .          V
             .          .          V
714          .          .     RD84IN
             .          .           .
             .          .           .
722          .          .           .        UC88
             .          .           .           .
             .          .           .           .
729          .     CP88EN......................
             .          .
             .          .
733          .          .       UC95
             .          .           .
             .          .           .
740          .          .           .        UC93
             .          .           .           .
             .          .           .           .
747          .          .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	22.	12.37	7.	2.	1.	.05
+	HYDROGRAPH AT	UC9	28.	12.27	7.	2.	1.	.05
+	2 COMBINED AT	CPC8	49.	12.30	15.	5.	2.	.11
+	ROUTED TO	RCP89	49.	12.40	15.	5.	2.	.11
+	HYDROGRAPH AT	UC18	12.	12.63	5.	1.	1.	.04
+	HYDROGRAPH AT	UC19	10.	12.50	3.	1.	0.	.03
+	3 COMBINED AT	CP1819	70.	12.47	22.	7.	2.	.18
+	ROUTED TO	R1819	69.	12.50	22.	7.	2.	.18
+	HYDROGRAPH AT	UC22	12.	12.43	3.	1.	0.	.03
+	HYDROGRAPH AT	UC23	7.	12.27	2.	0.	0.	.01
+	3 COMBINED AT	CP2223	86.	12.47	27.	8.	3.	.22
+	ROUTED TO	R2223	86.	12.53	27.	8.	3.	.22
+	HYDROGRAPH AT	UC28	39.	12.30	6.	2.	1.	.05
+	ROUTED TO	R28	39.	12.33	6.	2.	1.	.05
+	HYDROGRAPH AT	UC29	22.	12.30	4.	1.	0.	.04
+	HYDROGRAPH AT	UC30	9.	12.20	1.	0.	0.	.01
+	4 COMBINED AT	CP2930	141.	12.43	37.	11.	4.	.32
+	ROUTED TO	R2930	140.	12.47	37.	11.	4.	.32
+	HYDROGRAPH AT	UC34	31.	12.17	3.	1.	0.	.03
+	2 COMBINED AT	CP34	155.	12.43	40.	12.	4.	.35
+	ROUTED TO	R34	152.	12.60	40.	11.	4.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT	UC37	96.	12.47	27.	8.	3.	.20
+	HYDROGRAPH AT	UC35	291.	12.13	33.	10.	4.	.26
+	3 COMBINED AT	CP3537	387.	12.23	98.	29.	10.	.82
+	ROUTED TO	R3537	384.	12.30	98.	29.	10.	.82
+	HYDROGRAPH AT	UC49	74.	12.07	7.	2.	1.	.05
+	HYDROGRAPH AT	UC31	211.	12.50	50.	14.	5.	.41
+	3 COMBINED AT	CP3149	591.	12.33	153.	45.	16.	1.27
+	ROUTED TO	R3149	591.	12.37	153.	45.	16.	1.27
+	HYDROGRAPH AT	UC46	59.	12.03	5.	1.	0.	.03
+	ROUTED TO	R46	57.	12.07	5.	1.	0.	.03
+	HYDROGRAPH AT	UC45	147.	12.03	12.	3.	1.	.09
	HYDROGRAPH AT	UC47	48.	12.03	4.	1.	0.	.03
+	3 COMBINED AT	CP4547	247.	12.03	21.	6.	2.	.15
+	ROUTED TO	R4547	240.	12.10	21.	6.	2.	.15
+	HYDROGRAPH AT	UC48	224.	12.17	28.	8.	3.	.20
+	HYDROGRAPH AT	UC50	27.	12.07	2.	1.	0.	.02
+	4 COMBINED AT	CP4850	954.	12.17	202.	59.	21.	1.64
+	ROUTED TO	R4850	948.	12.20	201.	59.	21.	1.64
+	HYDROGRAPH AT	UC51	92.	12.03	8.	2.	1.	.06
+	HYDROGRAPH AT	UC57	40.	12.10	4.	1.	0.	.04
+	3 COMBINED AT	CP5157	1031.	12.17	213.	63.	23.	1.73
+	ROUTED TO	R5157	1016.	12.23	212.	62.	23.	1.73
+	HYDROGRAPH AT	UC58	156.	12.07	15.	4.	1.	.11
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC59	18.	12.30	3.	1.	0.	.03
+	3 COMBINED AT	CP5859	1130.	12.20	229.	67.	24.	1.88
+	DIVERSION TO	D5859S	562.	12.20	114.	33.	12.	1.88
+	HYDROGRAPH AT	D5859N	569.	12.20	115.	34.	12.	1.88
+	ROUTED TO	R5859N	562.	12.27	115.	34.	12.	1.88
+	HYDROGRAPH AT	UC63	141.	12.10	14.	4.	1.	.12
+	2 COMBINED AT	CP63	663.	12.23	129.	38.	14.	2.00
+	ROUTED TO	R63	661.	12.23	128.	37.	13.	2.00
+	HYDROGRAPH AT	UC66	36.	12.13	4.	1.	0.	.04
+	HYDROGRAPH AT	UC62	423.	12.13	43.	12.	4.	.36
+	3 COMBINED AT	CP6266	1065.	12.20	173.	50.	18.	2.39
+	ROUTED TO	R6266	1060.	12.20	173.	50.	18.	2.39
+	HYDROGRAPH AT	D5859S	562.	12.20	114.	33.	12.	1.88
+	ROUTED TO	R5859S	561.	12.23	114.	33.	12.	1.88
+	HYDROGRAPH AT	UC64	6.	12.07	1.	0.	0.	.00
+	2 COMBINED AT	CP64	564.	12.23	114.	33.	12.	1.88
+	DIVERSION TO	D64S	254.	12.23	51.	15.	5.	1.88
+	HYDROGRAPH AT	D64N	310.	12.23	63.	18.	7.	1.88
+	ROUTED TO	RD64N	307.	12.30	63.	18.	7.	1.88
+	HYDROGRAPH AT	UC87	12.	12.27	2.	0.	0.	.02
+	2 COMBINED AT	CP87	317.	12.27	64.	19.	7.	1.90
+	ROUTED TO	RD87N	318.	12.30	64.	19.	7.	1.90
+	HYDROGRAPH AT	UC82	25.	12.07	2.	1.	0.	.02
+	3 COMBINED AT	CP82	1382.	12.23	239.	69.	25.	2.45

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
ROUTED TO	R82	1380.	12.23	239.	69.	25.	2.45
+ DIVERSION TO	D84S	30.	12.23	1.	0.	0.	2.45
+ HYDROGRAPH AT	D84N	1350.	12.23	238.	69.	25.	2.45
+ HYDROGRAPH AT	UC84	13.	12.10	1.	0.	0.	.01
+ 2 COMBINED AT	CP84	1359.	12.23	239.	69.	25.	2.46
+ ROUTED TO	R84	1329.	12.37	239.	69.	25.	2.46
+ HYDROGRAPH AT	UC79	68.	12.10	7.	2.	1.	.08
+ HYDROGRAPH AT	UC78	263.	12.03	21.	6.	2.	.18
+ 3 COMBINED AT	CP7879	1411.	12.33	265.	77.	28.	2.72
+ ROUTED TO	R7879	1410.	12.33	265.	77.	28.	2.72
+ HYDROGRAPH AT	UC77	115.	12.07	12.	3.	1.	.10
+ 2 COMBINED AT	CP77	1464.	12.33	276.	80.	29.	2.81
+ ROUTED TO	R77	1460.	12.37	276.	80.	29.	2.81
+ HYDROGRAPH AT	UC89	61.	12.13	8.	2.	1.	.07
+ 2 COMBINED AT	CP89	1500.	12.37	284.	82.	30.	2.89
+ ROUTED TO	R89	1482.	12.40	284.	82.	29.	2.89
+ HYDROGRAPH AT	UC74	139.	12.20	18.	5.	2.	.15
+ HYDROGRAPH AT	UC76	45.	12.10	5.	1.	0.	.04
+ 2 COMBINED AT	CP7476	179.	12.17	23.	6.	2.	.19
+ ROUTED TO	R7476	179.	12.17	23.	6.	2.	.19
+ HYDROGRAPH AT	UC75	292.	12.03	22.	6.	2.	.19
+ 2 COMBINED AT	CP75	426.	12.07	44.	12.	4.	.38
+ ROUTED TO	R75	424.	12.07	44.	12.	4.	.38
HYDROGRAPH AT	UC90	21.	12.27	3.	1.	0.	.04

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC91	41.	12.40	9.	2.	1.	.07
+	4 COMBINED AT	CP90EN	1706.	12.37	337.	96.	35.	3.38
+	HYDROGRAPH AT	D84S	30.	12.23	1.	0.	0.	2.45
+	ROUTED TO	RD84S	31.	12.27	1.	0.	0.	2.45
+	DIVERSION TO	D84IIN	30.	12.27	1.	0.	0.	2.45
+	HYDROGRAPH AT	D84IIS	1.	12.27	0.	0.	0.	2.45
+	ROUTED TO	RD84IS	0.	.00	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC94	11.	12.50	3.	1.	0.	.03
+	2 COMBINED AT	CP94DS	10.	12.50	3.	1.	0.	2.48
+	ROUTED TO	R94DS	9.	12.63	3.	1.	0.	2.48
+	HYDROGRAPH AT	D84IIN	30.	12.27	1.	0.	0.	2.45
+	ROUTED TO	RD84IN	6.	12.37	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC88	33.	12.73	11.	3.	1.	.11
+	3 COMBINED AT	CP88EN	43.	12.67	14.	4.	1.	2.59
+	HYDROGRAPH AT	UC95	34.	12.07	3.	1.	0.	.02
+	HYDROGRAPH AT	UC93	29.	12.27	5.	1.	1.	.04
+	HYDROGRAPH AT	UC96	35.	12.37	7.	2.	1.	.06

*** NORMAL END OF HEC-1 ***

```
1****************************************
                                        *
     FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
               JUN   1998               *
             VERSION 4.1                *
 *                                      *
 *  RUN DATE   16MAR04  TIME  08:40:40  *
 *                                      *
 ****************************************
```

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

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

1
PAGE 1

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         100-YEAR 6-HOUR MODEL  FILENAME: UC1006E.DAT
  3           ID         EXISTING CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         DECEMBER 2001 (Final Revision March 2004)
  9           ID    ******************************************************************
 10           ID         100 YEAR ANALYSIS 6-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID    ******************************************************************
 15           ID     DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID     THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    3.40    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD   3.378    0.50
 28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 30           PC   0.962   0.972   0.983   0.991   1.000
 31           JD   3.314    2.80
 32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 34           PC   0.950   0.963   0.975   0.988   1.000
 35           JD   3.135    16.0
 36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
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 37          PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 38          PC   0.946   0.960   0.973   0.987   1.000
 39          JD   2.761    90.0
 40          PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
 41          PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
 42          PC   0.927   0.945   0.964   0.982   1.000
 43          JD   1.938   500.0
 44          PC   0.000   0.024   0.043   0.059   0.078   0.098   0.119   0.141   0.162   0.186
 45          PC   0.212   0.239   0.271   0.321   0.408   0.515   0.627   0.735   0.814   0.864
 46          PC   0.907   0.930   0.954   0.977   1.000
             *

 47          KK    UC8
 48          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 49          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 50          KM    L= 1.04   Kb= 0.031   S=138.0
 51          BA    .054
 52          LG     .30     .36     4.9     .26    36.0
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 53          UC    .300    .529
 54          UA       0       5      16      30      65      77      84      90      94      97
 55          UA     100
             *

 56          KK    UC9
 57          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 58          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 59          KM    L= 0.91   Kb= 0.031   S=145.0
 60          BA    .047
 61          LG     .30     .36     5.0     .23    36.0
 62          UC    .267    .416
 63          UA       0       5      16      30      65      77      84      90      94      97
 64          UA     100
             *

 65          KK    CPC89
 66          KM    CONCENTRATION POINT 89
 67          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 68          HC       2
             *

 69          KK   RCP89
 70          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 71          KM    NORMAL DEPTH CHANNEL ROUTING
 72          KM    ENDPOINTS WERE EXTENDED
 73          KM    SLOPE = (2596-2540)/2933
 74          RS       5    FLOW      -1
 75          RC   0.045   0.035   0.045    2933  0.0191
 76          RX       0      90      99     100     108     109     120     200
 77          RY     108     104     102     100     100     102     104     108
 78          RL                    0.15     100
             *

 79          KK    UC18
 80          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 81          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 82          KM    L= 0.56   Kb= 0.091   S=101.0
 83          BA    .040
 84          LG     .25     .36     5.0     .23   24.00
 85          UC    .425    .557
 86          UA       0       5      16      30      65      77      84      90      94      97
 87          UA     100
             *

 88          KK    UC19
 89          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 90          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
 91          KM    L= 0.52   Kb= 0.069   S=135.0
 92          BA    .027
 93          LG     .25     .36    5.00     .23   18.00
 94          UC    .313    .469
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 95          KK  CP1819
 96          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
 97          HC       3
             *

 98          KK   R1819
 99          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
100          KM    ENDPOINTS WERE EXTENDED
101          KM    SLOPE = (2540-2511)/1790
102          RS       2    FLOW      -1
103          RC   0.045   0.030   0.045    1790  0.0162
104          RX       0      92      99     100     112     113     120     200
105          RY     108     104     102     100     100     102     104     108
106          RL                    0.25     100
             *

107          KK    UC22
108          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
109          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
110          KM    L= .76   Kb= .104   S=111.0
111          BA    .032
112          LG     .25     .36    5.00     .23   14.00
113          UC    .538   1.061
             *

114          KK    UC23
115          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
116          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
117          KM    L= .40   Kb= 0.125   S=121.0
118          BA    .013
119          LG     .25     .36    5.00     .23   18.00
120          UC    .412    .209
             *

121          KK  CP2223
122          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
123          HC       3
             *

124          KK   R2223
125          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
126          KM    ENDPOINTS WERE EXTENDED
127          KM    SLOPE = (2511-2482)/1862
128          RS       2    FLOW      -1
129          RC   0.045    0.03   0.045    1862  0.0156
130          RX       0      95      99     100     112     113     117     200
131          RY     108     104     102     100     100     102     104     108
132          RL                    0.25     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

133          KK    UC28
134          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
135          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
136          KM    L= .57   Kb= 0.106   S=109.0
137          BA    .055
```

```
138          LG     .25     .36    4.90     .25   14.00
139          UC    .496    .428
             *

140          KK     R28
141          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
142          KM    ENDPOINTS WERE EXTENDED
143          KM    SLOPE = (2502-2482)/1296
144          RS       2    FLOW      -1
145          RC   0.045   0.035   0.045    1296  0.0154
146          RX       0      86      99     100     108     109     122     200
147          RY     108     104     102     100     100     102     104     108
148          RL                    0.15     100
             *

149          KK    UC29
150          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
151          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
152          KM    L= .47   Kb= 0.116   S=109.0
153          BA    .035
154          LG     .25     .36    5.00     .23   12.00
155          UC    .450    .558
             *

156          KK   UC30
157          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
158          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
159          KM    L= .28   Kb= 0.126   S=134.0
160          BA    .012
161          LG     .25     .36    5.00     .23   12.00
162          UC    .338    .498
             *

163          KK  CP2930
164          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
165          KM    CP2223
166          HC       4
             *

167          KK   R2930
168          KM   Routing flow from CP2930 to CP34 through subbasin 34
169          KM    SLOPE = (2482-2469)/925
170          KM    ENDPOINTS WERE EXTENDED
171          RS       1    FLOW      -1
172          RC   0.045   0.030   0.045     925  0.0141
173          RX       0      89      99     100     110     111     122     200
174          RY     108     104     102     100     100     102     104     108
175          RL                    0.15     100
             *
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

176          KK    UC34
177          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
178          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
179          KM    L= .31   Kb = 0.116   S= 117.0
180          BA    .037
181          LG     .25     .36    4.90     .22   12.00
182          UC    .346    .288
             *

183          KK    CP34
184          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
185          KM   R2930
186          HC       2
             *

187          KK     R34
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188          KM   Routing flow from CP34 to CP3537 through subbasin 37
189          KM    ENDPOINTS WERE EXTENDED
190          KM    SLOPE = (2469-2318)/6475
191          RS      11    FLOW      -1
192          RC   0.045   0.035   0.045    6475   .0233
193          RX       0      90      99     100     105     106     115     200
194          RY     108     104     102     100     100     102     104     108
195          RL                    0.15     100
             *

196          KK    UC37
197          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
198          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
199          KM    L= 2.03   Kb= 0.160   S= 98.0
200          BA    .207
201          LG     .25     .39    3.70     .16   24.00
202          UC    .600    .906
             *

203          KK    UC35
204          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
205          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
206          KM    L= 1.27   Kb= 0.035   S=138.0
207          BA    .261
208          LG     .25     .38    3.90     .20   24.00
209          UC    .325    .226
             *

210          KK  CP3537
211          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
212          KM    R34
213          HC       3
             *
1                                        HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

214          KK   R3537
215          KM   Routing flow from CP3537 to CP3149 through subbasin 49
216          KM    ENDPOINTS WERE EXTENDED
217          KM    SLOPE = (2318-2280)/1829
218          RS       3    FLOW      -1
219          RC   0.045   0.035   0.045    1829  0.0208
220          RX       0      90      99     100     105     106     115     200
221          RY     108     104     102     100     100     102     104     108
222          RL                    0.15     100
             *

223          KK    UC49
224          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
225          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
226          KM    L= .47   Kb= 0.032   S=148.0
227          BA    .048
228          LG     .25     .39    3.60     .15   30.00
229          UC    .188    .179
             *

230          KK    UC31
231          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
232          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
233          KM    L= 2.04   Kb= 0.066   S= 128.0
234          BA    .406
235          LG     .25     .38    4.10     .18   20.00
236          UC    .633    .659
             *

237          KK  CP3149
238          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
239          KM     R3537
```

```
 240          HC       3
              *

 241          KK   R3149
 242          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
 243          KM    ENDPOINTS WERE EXTENDED
 244          KM    SLOPE = (2280-2256)/1219
 245          RS       2    FLOW      -1
 246          RC   0.045   0.030   0.045    1219  0.0197
 247          RX       0      95      99     100     110     111     118     200
 248          RY     110     104     102     100     100     102     104     110
 249          RL                    0.15     100
              *

 250          KK    UC46
 251          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
 252          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 253          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
 254          BA    .034
 255          LG     .25     .39    3.60     .15   24.00
 256          UC    .169    .132
 257          UA       0       5      16      30      65      77      84      90      94      97
1                                          HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 258          UA     100
              *

 259          KK     R46
 260          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
 261          KM    ENDPOINTS WERE EXTENDED
 262          KM    SLOPE = (2346-2315)/1783
 263          RS       3    FLOW      -1
 264          RC   0.045   0.035   0.045    1783  0.0174
 265          RX       0      92      99     100     105     106     113     200
 266          RY     108     104     102     100     100     102     104     108
 267          RL                    0.15     100
              *

 268          KK    UC45
 269          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
 270          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 271          KM    L= .48   Kb= 0.030   S= 135.0
 272          BA    .086
 273          LG     .25     .39    3.60     .15   24.00
 274          UC    .192    .134
 275          UA       0       5      16      30      65      77      84      90      94      97
 276          UA     100
              *

 277          KK    UC47
 278          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
 279          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 280          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
 281          BA    .031
 282          LG     .25     .39    3.60     .15   24.00
 283          UC    .179    .185
 284          UA       0       5      16      30      65      77      84      90      94      97
 285          UA     100
              *

 286          KK  CP4547
 287          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
 288          KM    R46
 289          HC       3
              *

 290          KK   R4547
 291          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
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```
 292          KM   ENDPOINTS WERE EXTENDED
 293          KM    SLOPE = (2315-2256)/2170
 294          RS       4    FLOW      -1
 295          RC   0.045   0.035   0.045    2170   .0272
 296          RX       0      90      99     100     105     106     115     200
 297          RY     108     104     102     100     100     102     104     108
 298          RL                    0.15     100
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 299          KK    UC48
 300          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 301          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 302          KM    L= .92   Kb= 0.048   S= 117.0
 303          BA    .197
 304          LG     .25     .39    3.70     .16   30.00
 305          UC    .354    .276
              *

 306          KK    UC50
 307          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 308          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 309          KM    L= .27   Kb= 0.037   S= 93.0
 310          BA    .019
 311          LG     .25     .38    3.80     .24   24.00
 312          UC    .179    .183
              *

 313          KK  CP4850
 314          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 315          KM    R3149 AND R4547
 316          HC       4
              *

 317          KK   R4850
 318          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 319          KM    ENDPOINTS WERE EXTENDED
 320          KM    SLOPE = (2256-2235)/1509
 321          RS       2    FLOW      -1
 322          RC   0.045   0.030   0.045    1509  0.0139
 323          RX       0      95      99     100     115     116     120     200
 324          RY     106     104     102     100     100     102     104     106
 325          RL                    0.25     100
              *

 326          KK    UC51
 327          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 328          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 329          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
 330          BA    .060
 331          LG     .25     .36    5.00     .21   26.00
 332          UC    .192    .148
              *

 333          KK    UC57
 334          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
 335          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 336          KM    L= .47   Kb= 0.061   S= 200.0
 337          BA    .037
 338          LG     .25     .37    4.20     .28   20.00
 339          UC    .258    .297
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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340          KK  CP5157
341          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
342          KM     R4850
343          HC       3
             *

344          KK   R5157
345          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
346          KM    ENDPOINTS WERE EXTENDED
347          KM    SLOPE = (2235-2208)/1796
348          RS       2    FLOW      -1
349          RC   0.045   0.030   0.045    1796  0.0150
350          RX       0      60      99     100     100     121     160     220
351          RY     110     104     102     100     100     102     104     110
352          RL                    0.35     100
             *

353          KK    UC58
354          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
355          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
356          KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
357          BA    .110
358          LG     .25     .37    4.80     .13   20.00
359          UC    .237    .196
             *

360          KK    UC59
361          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
362          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
363          KM    L= .49   Kb= 0.105   S= 112.0
364          BA    .034
365          LG     .25     .32    5.80     .33   14.00
366          UC    .446    .587
             *

367          KK  CP5859
368          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
369          KM     R5157
370          HC       3
             *

371          KK  D5859N
372          KM    DIVERSION OF FLOWS AT FLOW SPLIT
373          DT  D5859S
374          DI       0      50     100     500   10000
375          DQ       0    24.9    49.5   248.5    4970
             *

376          KK  R5859N
377          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
378          KM   ENDPOINTS WERE EXTENDED
379          KM    SLOPE = (2208-2195)/699
380          RS       1    FLOW      -1
381          RC   0.045   0.030   0.045     699  0.0186
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

382          RX       0      50      99     100     110     111     160     210
383          RY     104     103     102     100     100     102     103     104
384          RL                    0.15     100
             *

385          KK    UC63
386          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
387          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
388          KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
389          BA    .117
390          LG     .25     .36    5.00     .19   19.00
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391          UC    .271    .248
             *

392          KK    CP63
393          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
394          KM   FROM RD5859N
395          HC       2
             *

396          KK     R63
397          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
398          KM    SLOPE = (2195-2170)/1394
399          RS       2    FLOW      -1
400          RC   0.045   0.030   0.045    1394  0.0179
401          RX      60      80      99     100     125     126     145     165
402          RY     106     104     102     100     100     102     104     106
403          RL                   0.35     100
             *

404          KK    UC66
405          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
406          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
407          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
408          BA    .037
409          LG     .25     .36    5.00     .25   14.00
410          UC    .262    .334
             *

411          KK    UC62
412          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
413          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
414          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
415          BA    .361
416          LG     .25     .35    6.10     .13   14.00
417          UC    .329    .243
             *

418          KK  CP6266
419          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
420          KM   FROM R63
421          HC       3
             *
```


HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

422          KK   R6266
423          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
424          KM    SLOPE = (2170-2150)/990
425          RS       2    FLOW      -1
426          RC   0.045   0.030   0.045     990  0.0202
427          RX      25      85      99     100     100     121     135     195
428          RY     106     104     102     100     100     102     104     106
429          RL                   0.35     100
             *

430          KK  D5859S
431          KM   RECALL DIVERTED FLOW FROM D5859N
432          DR  D5859S
             *

433          KK  R5859S
434          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
435          KM    SLOPE = (2208-2194)/803
436          RS       1    FLOW      -1
437          RC   0.045   0.030   0.045     803  0.0174
438          RX       0      50      99     100     125     126     175     225
439          RY     104     103     102     100     100     102     103     104
440          RL                   0.15     100
```

```
                 *

441              KK    UC64
442              KM   SUBBASIN 64, UNNAMED WASH CENTRAL
443              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
444              KM    L= .15   Kb= 0.078   S= 166.0
445              BA    .002
446              LG     .25     .31    6.90     .20   14.00
447              UC    .167    .239
                 *

448              KK    CP64
449              KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
450              KM    DIVERSION RD5859N
451              HC       2    1.88
                 *

452              KK    D64N
453              KM   DIVERSION OF FLOWS AT FLOW SPLIT
454              KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
455              DT    D64S
456              DI       0      50     100     500   10000
457              DQ       0    22.5      45     225    4500
                 *

458              KK   RD64N
459              KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
460              KM   ENDPOINTS WERE EXTENDED
461              KM    SLOPE = (2194-2161)/1721
462              RS       2    FLOW      -1
463              RC   0.045   0.030   0.045    1721  0.0192
                                              HEC-1 INPUT
```

1
PAGE 12

```
LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

464              RX       0      60      99     100     112     113     152     200
465              RY     106     104     102     100     100     102     104     106
466              RL                    0.25     100
                 *

467              KK    UC87
468              KM   SUBBASIN 87, UNNAMED WASH CENTRAL
469              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
470              KM    L= .33   Kb= 0.118   S= 101.0
471              BA    .024
472              LG     .25     .35    3.40     .62    8.00
473              UC    .446    .574
                 *

474              KK    CP87
475              KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
476              KM    DIVERSION RD64N
477              HC       2
                 *

478              KK   RD87N
479              KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
480              KM    SLOPE = (2161-2150)/557
481              RS       1    FLOW      -1
482              RC   0.045   0.030   0.045     557  0.0197
483              RX      25      85      99     100     120     121     135     195
484              RY     106     104     102     100     100     102     104     106
485              RL                    0.35     100
                 *

486              KK    UC82
487              KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
488              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
489              KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
490              BA    .022
```

```
 491          LG     .25     .36    4.30    .400   14.00
 492          UC    .233    .197
              *

 493          KK    CP82
 494          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 495          KM   SUBBASIN 82
 496          HC       3    2.45
              *

 497          KK     R82
 498          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 499          KM    SLOPE = (2150-2138)/579
 500          RS       1    FLOW      -1
 501          RC   0.045   0.030   0.045     579  0.0207
 502          RX      50      75      99     100     125     126     150     175
 503          RY     106     104     102     100     100     102     104     106
 504          RL                    0.35     100
              *
1                                          HEC-1 INPUT
PAGE 13

      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 505          KK    D84N
 506          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 507          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 508          DT    D84S
 509          DI       0     500    1275    1550    1964    2475    3223    4000
 510          DQ       0       0       0    79.7     255     490     888    1250
              *

 511          KK    UC84
 512          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 513          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 514          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
 515          BA    .013
 516          LG     .25     .36    4.50     .35   14.00
 517          UC    .246    .307
              *

 518          KK    CP84
 519          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 520          KM    FROM D84N
 521          HC       2
              *

 522          KK     R84
 523          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 524          KM   ENDPOINTS WERE EXTENDED
 525          KM    SLOPE = (2138-2054)/3463
 526          RS       5    FLOW      -1
 527          RC   0.045   0.030   0.045    3463  0.0243
 528          RX       0      94      99     100     110     111     116     200
 529          RY     106     104     102     100     100     102     104     106
 530          RL                    0.15     100
              *

 531          KK    UC79
 532          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
 533          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 534          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
 535          BA    .078
 536          LG     .25     .35    4.30     .45   18.00
 537          UC    .267    .328
 538          UA       0       5      16      30      65      77      84      90      94      97
 539          UA     100
              *

 540          KK    UC78
```

```
541          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
542          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
543          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
544          BA    .177
545          LG     .25      .35    6.00      .17   17.00
546          UC   1.500   1.377
547          UA       0       5      16       30      65      77      84      90      94      97
548          UA     100
             *
```


HEC-1 INPUT

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

549          KK  CP7879
550          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
551          KM    FROM R84
552          HC       3
             *

553          KK   R7879
554          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
555          KM   ENDPOINTS WERE EXTENDED
556          KM    SLOPE = (2054-2048)/256
557          RS       1    FLOW      -1
558          RC   0.045   0.030   0.045     256   .0234
559          RX       0      90      99     100     120     121     130     200
560          RY     106     104     102     100     100     102     104     106
561          RL                    0.35     100
             *

562          KK    UC77
563          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
564          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
565          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
566          BA    .096
567          LG     .25      .34    6.70      .13   16.00
568          UC    .254     .289
569          UA       0       5      16       30      65      77      84      90      94      97
570          UA     100
             *

571          KK    CP77
572          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
573          KM    FROM R7879
574          HC       2
             *

575          KK     R77
576          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
577          KM   ENDPOINTS WERE EXTENDED
578          KM    SLOPE = (2048-2037)/593
579          RS       1    FLOW      -1
580          RC   0.045   0.030   0.045     593  0.0185
581          RX       0      80      99     100     115     116     120     200
582          RY     106     104     102     100     100     102     104     106
583          RL                    0.25     100
             *

584          KK    UC89
585          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
586          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
587          KM    L= .77   Kb= 0.057   S= 126.0
588          BA    .073
589          LG     .25      .33    6.40      .20   17.00
590          UC    .354     .421
591          UA       0       5      16       30      65      77      84      90      94      97
592          UA     100
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 593          KK    CP89
 594          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
 595          KM    FROM R77
 596          HC       2
              *

 597          KK     R89
 598          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
 599          KM   CHANNEL ENDS WERE EXTENDED
 600          KM    SLOPE = (2037-2008)/1912
 601          RS       2    FLOW      -1
 602          RC   0.045   0.030   0.045    1912  0.0152
 603          RX       0      80      99     100     115     116     135     200
 604          RY     106     104     102     100     100     102     104     106
 605          RL                    0.25     100
              *

 606          KK    UC74
 607          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
 608          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 609          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
 610          BA    .151
 611          LG     .25     .34    6.60     .13   14.00
 612          UC    .354    .379
              *

 613          KK    UC76
 614          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
 615          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 616          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
 617          BA    .041
 618          LG     .25     .35    6.10     .16   14.00
 619          UC    .229    .312
              *

 620          KK  CP7476
 621          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
 622          HC       2
              *

 623          KK   R7476
 624          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
 625          KM   END POINTS WERE EXTENDED
 626          KM    SLOPE = (2031-2017)/524
 627          RS       1    FLOW      -1
 628          RC   0.045   0.030   0.045     524  0.0267
 629          RX       0      80      99     100     112     113     132     200
 630          RY     106     104     102     100     100     102     104     106
 631          RL                    0.25     100
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 632          KK    UC75
 633          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
 634          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 635          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
 636          BA    .192
 637          LG     .25     .34    6.50     .15   14.00
 638          UC    .313    .337
 639          UA       0       5      16      30      65      77      84      90      94      97
 640          UA     100
```

```
                *

641             KK    CP75
642             KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
643             KM    FROM R7476
644             HC       2
                *

645             KK     R75
646             KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
647             KM   END POINTS WERE EXTENDED
648             KM    SLOPE = (2017-2008)/723
649             RS       1    FLOW      -1
650             RC   0.045   0.030   0.045     723  0.0124
651             RX       0      80      99     100     115     116     135     200
652             RY     106     104     102     100     100     102     104     106
653             RL                    0.25     100
                *

654             KK    UC90
655             KM   SUBBASIN 90, UNNAMED WASH CENTRAL
656             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
657             KM    L= .48   Kb= 0.103   S= 151.0
658             BA    .038
659             LG     .25      .35    3.70      .55   14.00
660             UC    .412     .493
                *

661             KK    UC91
662             KM   SUBBASIN 91, UNNAMED WASH CENTRAL
663             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
664             KM    L= .75   Kb= 0.107   S= 109.0
665             BA    .073
666             LG     .25      .31    7.40      .14   14.00
667             UC    .538     .659
                *

668             KK  CP90EN
669             KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
670             KM    FROM R89 AND R75
671             HC       4
                *
1                                          HEC-1 INPUT
PAGE 17

      LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


672             KK    D84S
673             KM   RETREVIAL OF DIVERTED FLOW FROM D84S
674             DR    D84S
                *

675             KK   RD84S
676             KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
677             KM    SLOPE = (2144-2140)/303
678             RS       6    FLOW      -1
679             RC   0.045   0.030   0.045     303  0.0132
680             RX       0      50      99     100     125     126     175     225
681             RY     106     104     102     100     100     102     104     106
682             RL                    0.35     100
                *

683             KK  D84IIS
684             KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
685             KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
686             DT  D84IIN
687             DI       0    79.7     255     490     880    1250
688             DQ       0    78.3     229     419     732    1000
                *
```

```
 689          KK  RD84IS
 690          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
 691          KM   SLOPE = (2140-2078)/3225
 692          RS       1    FLOW      -1
 693          RC   0.045   0.030   0.045    3225  0.0192
 694          RX       0      50      99     100     125     126     175     225
 695          RY     106     104     102     100     100     102     104     106
 696          RL                    0.25     100
              *

 697          KK    UC94
 698          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
 699          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 700          KM    L= .53   Kb= 0.119   S= 108.0
 701          BA    .028
 702          LG     .25     .36    5.00     .23   13.00
 703          UC    .671   1.082
              *

 704          KK  CP94DS
 705          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
 706          KM   FROM RD84IS
 707          HC       2
              *

 708          KK   R94DS
 709          KM   ROUTING FLOW FROM CP94DS TO CP88EN
 710          KM   SLOPE = (2078-2041)/1950
 711          RS       1    FLOW      -1
 712          RC   0.045   0.030   0.045    1950  0.0189
 713          RX      60      85      99     100     108     109     123     148
1                                          HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 714          RY     106     104     102     100     100     102     104     106
 715          RL                    0.25     100
              *

 716          KK  D84IIN
 717          KM   RECALL DIVERTED FLOW FROM D84II
 718          DR  D84IIN
              *

 719          KK  RD84IN
 720          KM   ROUTING FLOW FROM D84II TO CP88EN
 721          KM   SLOPE = (2140-2041)/5175
 722          RS       1    FLOW      -1
 723          RC   0.045   0.030   0.045    5175  0.0191
 724          RX      60      78      90     100     125     132     135     150
 725          RY     106     104     102     100     100     102     104     106
 726          RL                    0.25     100
              *

 727          KK    UC88
 728          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
 729          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 730          KM    L= 1.08   Kb= 0.104   S=111.0
 731          BA    .108
 732          LG     .25     .33    6.10     .20   14.00
 733          UC    .962   1.337
              *

 734          KK  CP88EN
 735          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
 736          KM    FROM R94DS AND RD84IN
 737          HC       3
              *

 738          KK    UC95
```

```
739          KM   SUBBASIN 95, UNNAMED WASH CENTRAL
740          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
741          KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
742          BA    .024
743          LG     .25     .39    3.70     .15    5.00
744          UC    .233    .183
             *

745          KK    UC93
746          KM   SUBBASIN 93, UNNAMED WASH CENTRAL
747          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
748          KM    L= .64   Kb= 0.093   S= 135.0
749          BA    .038
750          LG     .25     .30    8.00     .07   13.00
751          UC    .400    .606
             *
```


HEC-1 INPUT

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

752          KK    UC96
753          KM   SUBBASIN 96, UNNAMED WASH CENTRAL
754          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
755          KM    L= .73   Kb= 0.110  S= 113.0
756          BA    .061
757          LG     .25     .32    7.00     .12   13.00
758          UC    .525    .686
             *
             *
759          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  47        UC8
              .
              .
  56          .         UC9
              .           .
              .           .
  65       CPC8............
              V
              V
  69      RCP89
              .
              .
  79          .       UC18
              .           .
              .           .
  88          .           .        UC19
              .           .           .
              .           .           .
  95    CP1819........................
             V
             V
  98      R1819
             .
             .
 107          .       UC22
              .           .
              .           .
 114          .           .        UC23
              .           .           .
              .           .           .
 121    CP2223........................
             V
             V
 124      R2223
             .
             .
 133          .       UC28
              .          V
              .          V
 140          .        R28
              .           .
              .           .
 149          .           .        UC29
              .           .           .
              .           .           .
 156          .           .           .       UC30
              .           .           .           .
              .           .           .           .
 163    CP2930.....................................
             V
             V
 167     R2930
             .
             .
 176          .       UC34
              .           .
              .           .
 183      CP34............
             V
             V
 187       R34
             .
             .
 196          .       UC37
```

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                .           .
                .           .
203             .           .        UC35
                .           .          .
                .           .          .
210        CP3537.......................
                V
                V
214         R3537
                .
                .
223             .        UC49
                .           .
                .           .
230             .           .        UC31
                .           .          .
                .           .          .
237        CP3149.......................
                V
                V
241         R3149
                .
                .
250             .        UC46
                .           V
                .           V
259             .         R46
                .           .
                .           .
268             .           .        UC45
                .           .          .
                .           .          .
277             .           .          .        UC47
                .           .          .          .
                .           .          .          .
286             .      CP4547.......................
                .           V
                .           V
290             .       R4547
                .           .
                .           .
299             .           .        UC48
                .           .          .
                .           .          .
306             .           .          .        UC50
                .           .          .          .
                .           .          .          .
313        CP4850.....................................
                V
                V
317         R4850
                .
                .
326             .        UC51
                .           .
                .           .
333             .           .        UC57
                .           .          .
                .           .          .
340        CP5157.......................
                V
                V
344         R5157
                .
                .
353             .        UC58
                .           .
                .           .
360             .           .        UC59
                .           .          .
                .           .          .
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367     CP5859.......................
             .
             .
373          .-------->  D5859S
371     D5859N
             V
             V
376     R5859N
             .
             .
385          .        UC63
             .           .
             .           .
392       CP63............
             V
             V
396        R63
             .
             .
404          .        UC66
             .           .
             .           .
411          .           .        UC62
             .           .           .
             .           .           .
418     CP6266.......................
             V
             V
422      R6266
             .
             .
432          .           .<-------  D5859S
430          .      D5859S
             .           V
             .           V
433          .      R5859S
             .           .
             .           .
441          .           .        UC64
             .           .           .
             .           .           .
448          .        CP64............
             .           .
             .           .
455          .           .-------->    D64S
452          .        D64N
             .           V
             .           V
458          .       RD64N
             .           .
             .           .
467          .           .        UC87
             .           .           .
             .           .           .
474          .        CP87............
             .           V
             .           V
478          .       RD87N
             .           .
             .           .
486          .           .        UC82
             .           .           .
             .           .           .
493       CP82.......................
             V
             V
497        R82
             .
             .
508          .-------->    D84S
505     D84N
```

```
                .
                .
511             .        UC84
                .           .
                .           .
518         CP84............
                V
                V
522          R84
                .
                .
531             .        UC79
                .           .
                .           .
540             .           .        UC78
                .           .           .
                .           .           .
549       CP7879........................
                V
                V
553        R7879
                .
                .
562             .        UC77
                .           .
                .           .
571         CP77............
                V
                V
575          R77
                .
                .
584             .        UC89
                .           .
                .           .
593         CP89............
                V
                V
597          R89
                .
                .
606             .        UC74
                .           .
                .           .
613             .           .        UC76
                .           .           .
                .           .           .
620             .      CP7476............
                .           V
                .           V
623             .       R7476
                .           .
                .           .
632             .           .        UC75
                .           .           .
                .           .           .
641             .        CP75............
                .           V
                .           V
645             .         R75
                .           .
                .           .
654             .           .        UC90
                .           .           .
                .           .           .
661             .           .           .        UC91
                .           .           .           .
                .           .           .           .
668       CP90EN.......................................
                .
                .
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674          .           .<-------    D84S
672          .       D84S
             .          V
             .          V
675          .      RD84S
             .          .
             .          .
686          .          .------->  D84IIN
683          .     D84IIS
             .          V
             .          V
689          .     RD84IS
             .          .
             .          .
697          .          .       UC94
             .          .          .
             .          .          .
704          .     CP94DS............
             .          V
             .          V
708          .      R94DS
             .          .
             .          .
718          .          .          .<-------  D84IIN
716          .          .     D84IIN
             .          .          V
             .          .          V
719          .          .     RD84IN
             .          .          .
             .          .          .
727          .          .          .       UC88
             .          .          .          .
             .          .          .          .
734          .     CP88EN........................
             .          .
             .          .
738          .          .       UC95
             .          .          .
             .          .          .
745          .          .          .       UC93
             .          .          .          .
             .          .          .          .
752          .          .          .          .       UC96
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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	81.	4.13	13.	3.	1.	.05
+	HYDROGRAPH AT	UC9	83.	4.10	12.	3.	1.	.05
+	2 COMBINED AT	CPC8	163.	4.13	25.	6.	2.	.10
+	ROUTED TO	RCP89	161.	4.20	25.	6.	2.	.10
+	HYDROGRAPH AT	UC18	54.	4.20	9.	2.	1.	.04
+	HYDROGRAPH AT	UC19	41.	4.20	6.	1.	1.	.03
+	3 COMBINED AT	CP1819	256.	4.20	40.	10.	4.	.17
+	ROUTED TO	R1819	254.	4.23	40.	10.	4.	.17
+	HYDROGRAPH AT	UC22	26.	4.40	7.	2.	1.	.03
+	HYDROGRAPH AT	UC23	28.	4.20	3.	1.	0.	.01
+	3 COMBINED AT	CP2223	304.	4.23	49.	12.	4.	.21
+	ROUTED TO	R2223	301.	4.27	49.	12.	4.	.21
+	HYDROGRAPH AT	UC28	79.	4.30	12.	3.	1.	.05
+	ROUTED TO	R28	79.	4.33	12.	3.	1.	.05
+	HYDROGRAPH AT	UC29	45.	4.30	7.	2.	1.	.04
+	HYDROGRAPH AT	UC30	17.	4.20	3.	1.	0.	.01
+	4 COMBINED AT	CP2930	438.	4.30	70.	18.	6.	.31
+	ROUTED TO	R2930	436.	4.30	70.	18.	6.	.31
+	HYDROGRAPH AT	UC34	71.	4.17	8.	2.	1.	.04
+	2 COMBINED AT	CP34	496.	4.30	78.	20.	7.	.35
+	ROUTED TO	R34	478.	4.53	78.	20.	7.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC37	207.	4.43	51.	13.	5.	.21
+	HYDROGRAPH AT	UC35	591.	4.13	63.	16.	6.	.26
+	3 COMBINED AT	CP3537	917.	4.30	184.	47.	17.	.82
+	ROUTED TO	R3537	911.	4.40	184.	47.	17.	.82
+	HYDROGRAPH AT	UC49	134.	4.07	13.	3.	1.	.05
+	HYDROGRAPH AT	UC31	473.	4.43	95.	24.	9.	.41
+	3 COMBINED AT	CP3149	1305.	4.40	282.	72.	26.	1.27
+	ROUTED TO	R3149	1303.	4.43	282.	71.	26.	1.27
+	HYDROGRAPH AT	UC46	107.	4.03	9.	2.	1.	.03
+	ROUTED TO	R46	104.	4.07	9.	2.	1.	.03
+	HYDROGRAPH AT	UC45	266.	4.03	22.	5.	2.	.09
	HYDROGRAPH AT	UC47	87.	4.03	8.	2.	1.	.03
+	3 COMBINED AT	CP4547	451.	4.03	38.	10.	3.	.15
+	ROUTED TO	R4547	439.	4.10	38.	10.	3.	.15
+	HYDROGRAPH AT	UC48	418.	4.17	51.	13.	5.	.20
+	HYDROGRAPH AT	UC50	51.	4.07	4.	1.	0.	.02
+	4 COMBINED AT	CP4850	1689.	4.30	365.	93.	33.	1.64
+	ROUTED TO	R4850	1683.	4.37	365.	93.	33.	1.64
+	HYDROGRAPH AT	UC51	170.	4.07	14.	4.	1.	.06
+	HYDROGRAPH AT	UC57	74.	4.13	8.	2.	1.	.04
+	3 COMBINED AT	CP5157	1761.	4.33	384.	97.	35.	1.74
+	ROUTED TO	R5157	1756.	4.40	384.	97.	35.	1.74
	HYDROGRAPH AT	UC58	284.	4.10	27.	7.	2.	.11

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC59	39.	4.30	7.	2.	1.	.03
+	3 COMBINED AT	CP5859	1881.	4.37	413.	105.	38.	1.88
+	DIVERSION TO	D5859S	935.	4.37	205.	52.	19.	1.88
+	HYDROGRAPH AT	D5859N	946.	4.37	208.	53.	19.	1.88
+	ROUTED TO	R5859N	944.	4.40	208.	53.	19.	1.88
+	HYDROGRAPH AT	UC63	259.	4.13	27.	7.	2.	.12
+	2 COMBINED AT	CP63	1064.	4.33	231.	59.	21.	2.00
+	ROUTED TO	R63	1063.	4.37	231.	59.	21.	2.00
+	HYDROGRAPH AT	UC66	68.	4.13	8.	2.	1.	.04
+	HYDROGRAPH AT	UC62	791.	4.17	83.	21.	8.	.36
+	3 COMBINED AT	CP6266	1528.	4.27	311.	79.	28.	2.40
+	ROUTED TO	R6266	1527.	4.30	311.	79.	28.	2.40
+	HYDROGRAPH AT	D5859S	935.	4.37	205.	52.	19.	1.88
+	ROUTED TO	R5859S	933.	4.40	205.	52.	19.	1.88
+	HYDROGRAPH AT	UC64	5.	4.07	0.	0.	0.	.00
+	2 COMBINED AT	CP64	935.	4.40	205.	52.	19.	1.88
+	DIVERSION TO	D64S	421.	4.40	92.	23.	8.	1.88
+	HYDROGRAPH AT	D64N	514.	4.40	113.	29.	10.	1.88
+	ROUTED TO	RD64N	512.	4.43	113.	29.	10.	1.88
+	HYDROGRAPH AT	UC87	24.	4.30	4.	1.	0.	.02
+	2 COMBINED AT	CP87	527.	4.43	116.	29.	11.	1.90
+	ROUTED TO	RD87N	526.	4.47	116.	29.	11.	1.90
+	HYDROGRAPH AT	UC82	50.	4.10	4.	1.	0.	.02
+	3 COMBINED AT	CP82	2017.	4.33	428.	109.	39.	2.45

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	2015.	4.37	428.	108.	39.	2.45
+	DIVERSION TO	D84S	279.	4.33	24.	6.	2.	2.45
+	HYDROGRAPH AT	D84N	1736.	4.37	404.	102.	37.	2.45
+	HYDROGRAPH AT	UC84	24.	4.13	3.	1.	0.	.01
+	2 COMBINED AT	CP84	1747.	4.37	406.	103.	37.	2.46
+	ROUTED TO	R84	1738.	4.47	406.	103.	37.	2.46
+	HYDROGRAPH AT	UC79	138.	4.10	15.	4.	1.	.08
+	HYDROGRAPH AT	UC78	103.	4.77	39.	10.	4.	.18
+	3 COMBINED AT	CP7879	1837.	4.47	450.	115.	41.	2.72
+	ROUTED TO	R7879	1837.	4.50	450.	115.	41.	2.72
+	HYDROGRAPH AT	UC77	208.	4.10	22.	6.	2.	.10
	2 COMBINED AT	CP77	1913.	4.47	470.	120.	43.	2.81
+	ROUTED TO	R77	1912.	4.47	470.	120.	43.	2.81
+	HYDROGRAPH AT	UC89	119.	4.13	16.	4.	1.	.07
+	2 COMBINED AT	CP89	1972.	4.47	482.	123.	44.	2.89
+	ROUTED TO	R89	1965.	4.53	482.	123.	44.	2.89
+	HYDROGRAPH AT	UC74	265.	4.20	35.	9.	3.	.15
+	HYDROGRAPH AT	UC76	83.	4.10	9.	2.	1.	.04
+	2 COMBINED AT	CP7476	342.	4.17	44.	11.	4.	.19
+	ROUTED TO	R7476	341.	4.20	44.	11.	4.	.19
+	HYDROGRAPH AT	UC75	368.	4.13	43.	11.	4.	.19
+	2 COMBINED AT	CP75	699.	4.13	87.	22.	8.	.38
	ROUTED TO	R75	696.	4.17	87.	22.	8.	.38
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC90	46.	4.27	7.	2.	1.	.04
+	HYDROGRAPH AT	UC91	86.	4.37	16.	4.	1.	.07
+	4 COMBINED AT	CP90EN	2383.	4.43	573.	146.	53.	3.38
+	HYDROGRAPH AT	D84S	279.	4.33	24.	6.	2.	2.45
+	ROUTED TO	RD84S	279.	4.37	24.	6.	2.	2.45
+	DIVERSION TO	D84IIN	249.	4.37	22.	5.	2.	2.45
+	HYDROGRAPH AT	D84IIS	31.	4.33	2.	1.	0.	2.45
+	ROUTED TO	RD84IS	21.	4.53	2.	1.	0.	2.45
+	HYDROGRAPH AT	UC94	22.	4.50	6.	1.	1.	.03
+	2 COMBINED AT	CP94DS	37.	4.53	7.	2.	1.	2.48
+	ROUTED TO	R94DS	36.	4.60	7.	2.	1.	2.48
+	HYDROGRAPH AT	D84IIN	249.	4.37	22.	5.	2.	2.45
+	ROUTED TO	RD84IN	203.	4.53	21.	5.	2.	2.45
+	HYDROGRAPH AT	UC88	69.	4.77	23.	6.	2.	.11
+	3 COMBINED AT	CP88EN	280.	4.57	47.	12.	4.	2.59
+	HYDROGRAPH AT	UC95	63.	4.10	5.	1.	0.	.02
+	HYDROGRAPH AT	UC93	53.	4.27	9.	2.	1.	.04
+	HYDROGRAPH AT	UC96	72.	4.37	14.	4.	1.	.06

*** NORMAL END OF HEC-1 ***

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1****************************************
                                        *
     FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
               JUN   1998               *
 *            VERSION 4.1               *
 *                                      *
 *  RUN DATE   16MAR04  TIME  08:39:50  *
 *                                      *
 ****************************************
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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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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

1
PAGE 1

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         100-YEAR 24-HOUR MODEL  FILENAME: UC10024E.DAT
  3           ID         EXISTING CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         DECEMBER 2001 (Final Revision March 2004)
  9           ID    ****************************************************************
 10           ID         100 YEAR ANALYSIS 24-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID    ****************************************************************
 15           ID      DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID      THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    4.60    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   4.324   10.00
 35           JD   4.140   30.00
 36           JD   3.956   60.00
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 37          JD   3.892   90.00
 38          JD   3.836  120.00
 39          JD   3.795  150.00
 40          JD   3.680  300.00
 41          JD   3.588  500.00
             *

 42          KK     UC8
 43          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 44          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 45          KM    L= 1.04   Kb= 0.031   S=138.0
 46          BA    .054
 47          LG     .30     .36     4.9     .26    36.0
 48          UC    .229    .392
 49          UA       0       5      16      30      65      77      84      90      94      97
 50          UA     100
             *
1                                          HEC-1 INPUT
PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 51          KK     UC9
 52          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 53          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 54          KM    L= 0.91   Kb= 0.031   S=145.0
 55          BA    .047
 56          LG     .30     .36     5.0     .23    36.0
 57          UC    .208    .316
 58          UA       0       5      16      30      65      77      84      90      94      97
 59          UA     100
             *

 60          KK    CPC89
 61          KM    CONCENTRATION POINT 89
 62          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 63          HC       2
             *

 64          KK   RCP89
 65          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 66          KM    NORMAL DEPTH CHANNEL ROUTING
 67          KM    ENDPOINTS WERE EXTENDED
 68          KM    SLOPE = (2596-2540)/2933
 69          RS       5    FLOW      -1
 70          RC   0.045   0.035   0.045    2933  0.0191
 71          RX       0      90      99     100     108     109     120     200
 72          RY     108     104     102     100     100     102     104     108
 73          RL                    0.15     100
             *

 74          KK    UC18
 75          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 76          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 77          KM    L= 0.56   Kb= 0.091   S=101.0
 78          BA    .040
 79          LG     .25     .36     5.0     .23   24.00
 80          UC    .300    .426
 81          UA       0       5      16      30      65      77      84      90      94      97
 82          UA     100
             *

 83          KK    UC19
 84          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 85          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 86          KM    L= 0.52   Kb= 0.069   S=135.0
 87          BA    .027
 88          LG     .25     .36    5.00     .23   18.00
 89          UC    .237    .400
             *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  90          KK  CP1819
  91          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
  92          HC       3
              *

  93          KK   R1819
  94          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
  95          KM    ENDPOINTS WERE EXTENDED
  96          KM    SLOPE = (2540-2511)/1790
  97          RS       2    FLOW      -1
  98          RC   0.045   0.030   0.045    1790  0.0162
  99          RX       0      92      99     100     112     113     120     200
 100          RY     108     104     102     100     100     102     104     108
 101          RL                    0.25     100
              *

 102          KK    UC22
 103          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
 104          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 105          KM    L= .76   Kb= .104   S=111.0
 106          BA    .032
 107          LG     .25     .36    5.00     .23   14.00
 108          UC    .438    .845
              *

 109          KK    UC23
 110          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
 111          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 112          KM    L= .40   Kb= 0.125   S=121.0
 113          BA    .013
 114          LG     .25     .36    5.00     .23   18.00
 115          UC    .321    .158
              *

 116          KK  CP2223
 117          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
 118          HC       3
              *

 119          KK   R2223
 120          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
 121          KM    ENDPOINTS WERE EXTENDED
 122          KM    SLOPE = (2511-2482)/1862
 123          RS       2    FLOW      -1
 124          RC   0.045    0.03   0.045    1862  0.0156
 125          RX       0      95      99     100     112     113     117     200
 126          RY     108     104     102     100     100     102     104     108
 127          RL                    0.25     100
              *
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 128          KK    UC28
 129          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
 130          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 131          KM    L= .57   Kb= 0.106   S=109.0
 132          BA    .055
 133          LG     .25     .36    4.90     .25   14.00
 134          UC    .396    .333
              *
              *
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135          KK     R28
136          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
137          KM    ENDPOINTS WERE EXTENDED
138          KM    SLOPE = (2502-2482)/1296
139          RS       2    FLOW      -1
140          RC   0.045   0.035   0.045    1296  0.0154
141          RX       0      86      99     100     108     109     122     200
142          RY     108     104     102     100     100     102     104     108
143          RL                    0.15     100
             *

144          KK    UC29
145          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
147          KM    L= .47   Kb= 0.116   S=109.0
148          BA    .035
149          LG     .25     .36    5.00     .23   12.00
150          UC    .354    .428
             *

151          KK   UC30
152          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
153          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
154          KM    L= .28   Kb= 0.126   S=134.0
155          BA    .012
156          LG     .25     .36    5.00     .23   12.00
157          UC    .250    .357
             *

158          KK  CP2930
159          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
160          KM    CP2223
161          HC       4
             *

162          KK   R2930
163          KM   Routing flow from CP2930 to CP34 through subbasin 34
164          KM    SLOPE = (2482-2469)/925
165          KM    ENDPOINTS WERE EXTENDED
166          RS       1    FLOW      -1
167          RC   0.045   0.030   0.045     925  0.0141
168          RX       0      89      99     100     110     111     122     200
169          RY     108     104     102     100     100     102     104     108
170          RL                    0.15     100
             *
```



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                                          HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

171          KK    UC34
172          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
173          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
174          KM    L= .31   Kb = 0.116   S= 117.0
175          BA    .037
176          LG     .25     .36    4.90     .22   12.00
177          UC    .262    .212
             *

178          KK    CP34
179          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
180          KM   R2930
181          HC       2
             *

182          KK     R34
183          KM   Routing flow from CP34 to CP3537 through subbasin 37
184          KM    ENDPOINTS WERE EXTENDED
185          KM    SLOPE = (2469-2318)/6475
```

```
186          RS      11    FLOW      -1
187          RC   0.045   0.035   0.045    6475   .0233
188          RX       0      90      99     100     105     106     115     200
189          RY     108     104     102     100     100     102     104     108
190          RL                    0.15     100
             *

191          KK    UC37
192          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
193          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
194          KM    L= 2.03   Kb= 0.160   S= 98.0
195          BA    .207
196          LG     .25     .39    3.70     .16   24.00
197          UC    .504    .747
             *

198          KK    UC35
199          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
200          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
201          KM    L= 1.27   Kb= 0.035   S=138.0
202          BA    .261
203          LG     .25     .38    3.90     .20   24.00
204          UC    .246    .202
             *

205          KK  CP3537
206          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
207          KM    R34
208          HC       3
             *
```



```
                                        HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

209          KK   R3537
210          KM   Routing flow from CP3537 to CP3149 through subbasin 49
211          KM    ENDPOINTS WERE EXTENDED
212          KM    SLOPE = (2318-2280)/1829
213          RS       3    FLOW      -1
214          RC   0.045   0.035   0.045    1829  0.0208
215          RX       0      90      99     100     105     106     115     200
216          RY     110     104     102     100     100     102     104     110
217          RL                    0.15     100
             *

218          KK    UC49
219          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
220          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
221          KM    L= .47   Kb= 0.032   S=148.0
222          BA    .048
223          LG     .25     .39    3.60     .15   30.00
224          UC    .146    .135
             *

225          KK    UC31
226          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
227          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
228          KM    L= 2.04   Kb= 0.066   S= 128.0
229          BA    .405
230          LG     .25     .38    4.10     .18   20.00
231          UC    .225    .209
             *

232          KK  CP3149
233          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
234          KM     R3537
235          HC       3
             *
```

```
236          KK   R3149
237          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
238          KM    ENDPOINTS WERE EXTENDED
239          KM    SLOPE = (2280-2256)/1219
240          RS       2    FLOW      -1
241          RC   0.045   0.030   0.045    1219  0.0197
242          RX       0      95      99     100     110     111     118     200
243          RY     110     104     102     100     100     102     104     110
244          RL                    0.15     100
             *

245          KK    UC46
246          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
247          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
248          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
249          BA    .034
250          LG     .25     .39    3.60     .15   24.00
251          UC    .129    .100
252          UA       0       5      16      30      65      77      84      90      94      97
1                                                HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

253          UA     100
             *

254          KK     R46
255          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
256          KM    ENDPOINTS WERE EXTENDED
257          KM    SLOPE = (2346-2315)/1783
258          RS       3    FLOW      -1
259          RC   0.045   0.035   0.045    1783  0.0174
260          RX       0      92      99     100     105     106     113     200
261          RY     108     104     102     100     100     102     104     108
262          RL                    0.15     100
             *

263          KK    UC45
264          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
265          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
266          KM    L= .48   Kb= 0.030   S= 135.0
267          BA    .086
268          LG     .25     .39    3.60     .15   24.00
269          UC    .150    .102
270          UA       0       5      16      30      65      77      84      90      94      97
271          UA     100
             *

272          KK    UC47
273          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
274          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
275          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
276          BA    .031
277          LG     .25     .39    3.60     .15   24.00
278          UC    .142    .143
279          UA       0       5      16      30      65      77      84      90      94      97
280          UA     100
             *

281          KK  CP4547
282          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
283          KM    R46
284          HC       3
             *

285          KK   R4547
286          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
287          KM   ENDPOINTS WERE EXTENDED
288          KM    SLOPE = (2315-2256)/2170
289          RS       4    FLOW      -1
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```
 290          RC   0.045   0.035   0.045    2170   .0272
 291          RX       0      90      99     100     105     106     115     200
 292          RY     108     104     102     100     100     102     104     108
 293          RL                    0.15     100
              *
```



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                                          HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 294          KK    UC48
 295          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 296          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 297          KM    L= .92   Kb= 0.048   S= 117.0
 298          BA    .197
 299          LG     .25     .39    3.70     .16   30.00
 300          UC    .275    .209
              *

 301          KK    UC50
 302          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 303          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 304          KM    L= .27   Kb= 0.037   S= 93.0
 305          BA    .019
 306          LG     .25     .38    3.80     .24   24.00
 307          UC    .138    .136
              *

 308          KK  CP4850
 309          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 310          KM    R3149 AND R4547
 311          HC       4
              *

 312          KK   R4850
 313          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 314          KM    ENDPOINTS WERE EXTENDED
 315          KM    SLOPE = (2256-2235)/1509
 316          RS       2    FLOW      -1
 317          RC   0.045   0.030   0.045    1509  0.0139
 318          RX       0      95      99     100     115     116     120     200
 319          RY     110     104     102     100     100     102     104     110
 320          RL                    0.25     100
              *

 321          KK    UC51
 322          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 323          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 324          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
 325          BA    .060
 326          LG     .25     .36    5.00     .21   26.00
 327          UC    .146    .109
              *

 328          KK    UC57
 329          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
 330          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 331          KM    L= .47   Kb= 0.061   S= 200.0
 332          BA    .037
 333          LG     .25     .37    4.20     .28   20.00
 334          UC    .196    .219
              *
```



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                                          HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 335          KK  CP5157
 336          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
```

```
 337          KM     R4850
 338          HC       3
              *

 339          KK   R5157
 340          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
 341          KM    ENDPOINTS WERE EXTENDED
 342          KM    SLOPE = (2235-2208)/1796
 343          RS       2    FLOW      -1
 344          RC   0.045   0.030   0.045    1796  0.0150
 345          RX       0      60      99     100     100     121     160     220
 346          RY     112     104     102     100     100     102     104     112
 347          RL                    0.35     100
              *

 348          KK    UC58
 349          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
 350          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 351          KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
 352          BA    .110
 353          LG     .25     .37    4.80     .13   20.00
 354          UC    .188    .150
              *

 355          KK    UC59
 356          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
 357          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 358          KM    L= .49   Kb= 0.105   S= 112.0
 359          BA    .034
 360          LG     .25     .32    5.80     .33   14.00
 361          UC    .342    .437
              *

 362          KK  CP5859
 363          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
 364          KM     R5157
 365          HC       3
              *

 366          KK  D5859N
 367          KM    DIVERSION OF FLOWS AT FLOW SPLIT
 368          DT  D5859S
 369          DI       0      50     100     500   10000
 370          DQ       0    24.9    49.5   248.5    4970
              *

 371          KK  R5859N
 372          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
 373          KM   ENDPOINTS WERE EXTENDED
 374          KM    SLOPE = (2208-2195)/699
 375          RS       1    FLOW      -1
 376          RC   0.045   0.030   0.045     699  0.0186
1                                          HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 377          RX       0      50      99     100     110     111     160     210
 378          RY     108     103     102     100     100     102     103     108
 379          RL                    0.15     100
              *

 380          KK    UC63
 381          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
 382          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 383          KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
 384          BA    .117
 385          LG     .25     .36    5.00     .19   19.00
 386          UC    .208    .186
              *
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```
387          KK    CP63
388          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
389          KM   FROM RD5859N
390          HC       2
             *

391          KK     R63
392          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
393          KM    SLOPE = (2195-2170)/1394
394          RS       2    FLOW      -1
395          RC   0.045   0.030   0.045    1394  0.0179
396          RX      60      80      99     100     125     126     145     165
397          RY     108     104     102     100     100     102     104     108
398          RL                   0.35     100
             *

399          KK    UC66
400          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
401          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
402          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
403          BA    .037
404          LG     .25     .36    5.00     .25   14.00
405          UC    .154    .185
             *

406          KK    UC62
407          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
408          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
409          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
410          BA    .361
411          LG     .25     .35    6.10     .13   14.00
412          UC    .250    .179
             *

413          KK  CP6266
414          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
415          KM   FROM R63
416          HC       3
             *
```

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

417          KK   R6266
418          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
419          KM    SLOPE = (2170-2150)/990
420          RS       2    FLOW      -1
421          RC   0.045   0.030   0.045     990  0.0202
422          RX      25      85      99     100     100     121     135     195
423          RY     110     104     102     100     100     102     104     110
424          RL                   0.35     100
             *

425          KK  D5859S
426          KM   RECALL DIVERTED FLOW FROM D5859N
427          DR  D5859S
             *

428          KK  R5859S
429          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
430          KM    SLOPE = (2208-2194)/803
431          RS       1    FLOW      -1
432          RC   0.045   0.030   0.045     803  0.0174
433          RX       0      50      99     100     125     126     175     225
434          RY     104     103     102     100     100     102     103     104
435          RL                   0.15     100
             *

436          KK    UC64
```

```
437          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
438          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
439          KM    L= .15   Kb= 0.078   S= 166.0
440          BA    .002
441          LG     .25     .31    6.90     .20   14.00
442          UC    .129    .180
             *

443          KK    CP64
444          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
445          KM    DIVERSION RD5859N
446          HC       2    1.88
             *

447          KK    D64N
448          KM   DIVERSION OF FLOWS AT FLOW SPLIT
449          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
450          DT    D64S
451          DI       0      50     100     500   10000
452          DQ       0    22.5      45     225    4500
             *

453          KK   RD64N
454          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
455          KM   ENDPOINTS WERE EXTENDED
456          KM    SLOPE = (2194-2161)/1721
457          RS       2    FLOW      -1
458          RC   0.045   0.030   0.045    1721  0.0192
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

459          RX       0      60      99     100     112     113     152     200
460          RY     106     104     102     100     100     102     104     106
461          RL                    0.25     100
             *

462          KK    UC87
463          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
464          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
465          KM    L= .33   Kb= 0.118   S= 101.0
466          BA    .025
467          LG     .25     .35    3.40     .62    8.00
468          UC    .317    .352
             *

469          KK    CP87
470          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
471          KM    DIVERSION RD64N
472          HC       2
             *

473          KK   RD87N
474          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
475          KM    SLOPE = (2161-2150)/557
476          RS       1    FLOW      -1
477          RC   0.045   0.030   0.045     557  0.0197
478          RX      25      85      99     100     120     121     135     195
479          RY     106     104     102     100     100     102     104     106
480          RL                    0.35     100
             *

481          KK    UC82
482          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
483          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
484          KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
485          BA    .022
486          LG     .25     .36    4.30    .400   14.00
487          UC    .175    .143
             *
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488          KK    CP82
489          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
490          KM   SUBBASIN 82
491          HC       3    2.45
             *

492          KK     R82
493          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
494          KM    SLOPE = (2150-2138)/579
495          RS       1    FLOW      -1
496          RC   0.045   0.030   0.045     579  0.0207
497          RX      50      75      99     100     125     126     150     175
498          RY     110     104     102     100     100     102     104     110
499          RL                   0.35     100
             *
1                                                HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

500          KK    D84N
501          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
502          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
503          DT    D84S
504          DI       0     500    1275    1550    1964    2475    3223    4000
505          DQ       0       0       0    79.7     255     490     888    1250
             *

506          KK    UC84
507          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
508          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
509          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
510          BA    .013
511          LG     .25     .36    4.50     .35   14.00
512          UC    .188    .227
             *

513          KK    CP84
514          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
515          KM    FROM D84N
516          HC       2
             *

517          KK     R84
518          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
519          KM   ENDPOINTS WERE EXTENDED
520          KM    SLOPE = (2138-2054)/3463
521          RS       5    FLOW      -1
522          RC   0.045   0.030   0.045    3463  0.0243
523          RX       0      94      99     100     110     111     116     200
524          RY     108     104     102     100     100     102     104     108
525          RL                   0.15     100
             *

526          KK    UC79
527          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
528          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
529          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
530          BA    .078
531          LG     .25     .35    4.30     .45   18.00
532          UC    .196    .233
533          UA       0       5      16      30      65      77      84      90      94      97
534          UA     100
             *

535          KK    UC78
536          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
537          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
538          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
```

```
539          BA    .177
540          LG     .25     .35    6.00     .17   17.00
541          UC    .167    .120
542          UA       0       5      16      30      65      77      84      90      94      97
543          UA     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

544          KK  CP7879
545          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
546          KM    FROM R84
547          HC       3
             *

548          KK   R7879
549          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
550          KM   ENDPOINTS WERE EXTENDED
551          KM    SLOPE = (2054-2048)/256
552          RS       1    FLOW      -1
553          RC   0.045   0.030   0.045     256   .0234
554          RX       0      90      99     100     120     121     130     200
555          RY     108     104     102     100     100     102     104     108
556          RL                    0.35     100
             *

557          KK    UC77
558          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
559          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
560          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
561          BA    .096
562          LG     .25     .34    6.70     .13   16.00
563          UC    .158    .171
564          UA       0       5      16      30      65      77      84      90      94      97
565          UA     100
             *

566          KK    CP77
567          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
568          KM    FROM R7879
569          HC       2
             *

570          KK     R77
571          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
572          KM   ENDPOINTS WERE EXTENDED
573          KM    SLOPE = (2048-2037)/593
574          RS       1    FLOW      -1
575          RC   0.045   0.030   0.045     593  0.0185
576          RX       0      80      99     100     115     116     120     200
577          RY     110     104     102     100     100     102     104     110
578          RL                    0.25     100
             *

579          KK    UC89
580          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
581          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
582          KM    L= .77   Kb= 0.057   S= 126.0
583          BA    .073
584          LG     .25     .33    6.40     .20   17.00
585          UC    .267    .307
586          UA       0       5      16      30      65      77      84      90      94      97
587          UA     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
588          KK    CP89
589          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
590          KM    FROM R77
591          HC       2
             *

592          KK     R89
593          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
594          KM   CHANNEL ENDS WERE EXTENDED
595          KM    SLOPE = (2037-2008)/1912
596          RS       2    FLOW      -1
597          RC   0.045   0.030   0.045    1912  0.0152
598          RX       0      80      99     100     115     116     135     200
599          RY     110     104     102     100     100     102     104     110
600          RL                    0.25     100
             *

601          KK    UC74
602          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
603          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
604          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
605          BA    .151
606          LG     .25     .34    6.60     .13   14.00
607          UC    .271    .281
             *

608          KK    UC76
609          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
610          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
611          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
612          BA    .041
613          LG     .25     .35    6.10     .16   14.00
614          UC    .179    .238
             *

615          KK  CP7476
616          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
617          HC       2
             *

618          KK   R7476
619          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
620          KM   END POINTS WERE EXTENDED
621          KM    SLOPE = (2031-2017)/524
622          RS       1    FLOW      -1
623          RC   0.045   0.030   0.045     524  0.0267
624          RX       0      80      99     100     112     113     132     200
625          RY     106     104     102     100     100     102     104     106
626          RL                    0.25     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

627          KK    UC75
628          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
629          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
630          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
631          BA    .192
632          LG     .25     .34    6.50     .15   14.00
633          UC    .237    .249
634          UA       0       5      16      30      65      77      84      90      94      97
635          UA     100
             *

636          KK    CP75
637          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
```

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638          KM    FROM R7476
639          HC       2
             *

640          KK     R75
641          KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
642          KM   END POINTS WERE EXTENDED
643          KM    SLOPE = (2017-2008)/723
644          RS       1    FLOW      -1
645          RC   0.045   0.030   0.045     723  0.0124
646          RX       0      80      99     100     115     116     135     200
647          RY     106     104     102     100     100     102     104     106
648          RL                    0.25     100
             *

649          KK    UC90
650          KM   SUBBASIN 90, UNNAMED WASH CENTRAL
651          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
652          KM    L= .48   Kb= 0.103   S= 151.0
653          BA    .038
654          LG     .25     .35    3.70     .55   14.00
655          UC    .296    .341
             *

656          KK    UC91
657          KM   SUBBASIN 91, UNNAMED WASH CENTRAL
658          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
659          KM    L= .75   Kb= 0.107   S= 109.0
660          BA    .073
661          LG     .25     .31    7.40     .14   14.00
662          UC    .442    .530
             *
             *

663          KK  CP90EN
664          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
665          KM    FROM R89 AND R75
666          HC       4
             *
1                                        HEC-1 INPUT
PAGE 17

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

667          KK    D84S
668          KM   RETREVIAL OF DIVERTED FLOW FROM D84S
669          DR    D84S
             *

670          KK   RD84S
671          KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
672          KM    SLOPE = (2144-2140)/303
673          RS       6    FLOW      -1
674          RC   0.045   0.030   0.045     303  0.0132
675          RX       0      50      99     100     125     126     175     225
676          RY     106     104     102     100     100     102     104     106
677          RL                    0.35     100
             *

678          KK  D84IIS
679          KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
680          KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
681          DT  D84IIN
682          DI       0    79.7     255     490     880    1250
683          DQ       0    78.3     229     419     732    1000
             *

684          KK  RD84IS
685          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
686          KM   SLOPE = (2140-2078)/3225
```

```
687          RS       1    FLOW      -1
688          RC   0.045   0.030   0.045    3225  0.0192
689          RX       0      50      99     100     125     126     175     225
690          RY     106     104     102     100     100     102     104     106
691          RL                    0.25     100
             *

692          KK    UC94
693          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
694          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
695          KM    L= .53   Kb= 0.119   S= 108.0
696          BA    .028
697          LG     .25     .36    5.00     .23   13.00
698          UC    .671   1.082
             *

699          KK  CP94DS
700          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
701          KM   FROM RD84IS
702          HC       2
             *

703          KK   R94DS
704          KM   ROUTING FLOW FROM CP94DS TO CP88EN
705          KM   SLOPE = (2078-2041)/1950
706          RS       1    FLOW      -1
707          RC   0.045   0.030   0.045    1950  0.0189
708          RX      60      85      99     100     108     109     123     148
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

709          RY     106     104     102     100     100     102     104     106
710          RL                    0.25     100
             *

711          KK  D84IIN
712          KM   RECALL DIVERTED FLOW FROM D84II
713          DR  D84IIN
             *

714          KK  RD84IN
715          KM   ROUTING FLOW FROM D84II TO CP88EN
716          KM   SLOPE = (2140-2041)/5175
717          RS       1    FLOW      -1
718          RC   0.045   0.030   0.045    5175  0.0191
719          RX      60      78      90     100     125     132     135     150
720          RY     106     104     102     100     100     102     104     106
721          RL                    0.25     100
             *

722          KK    UC88
723          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
724          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
725          KM    L= 1.08   Kb= 0.104   S=111.0
726          BA    .108
727          LG     .25     .33    6.10     .20   14.00
728          UC    .962   1.337
             *

729          KK  CP88EN
730          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
731          KM    FROM R94DS AND RD84IN
732          HC       3
             *

733          KK    UC95
734          KM   SUBBASIN 95, UNNAMED WASH CENTRAL
735          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
736          KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
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```
 737          BA    .024
 738          LG     .25     .39    3.70     .15    5.00
 739          UC    .183    .141
              *

 740          KK    UC93
 741          KM   SUBBASIN 93, UNNAMED WASH CENTRAL
 742          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 743          KM    L= .64   Kb= 0.093   S= 135.0
 744          BA    .038
 745          LG     .25     .30    8.00     .07   13.00
 746          UC    .321    .475
              *
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                                   HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 747          KK    UC96
 748          KM   SUBBASIN 96, UNNAMED WASH CENTRAL
 749          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 750          KM    L= .73   Kb= 0.110  S= 113.0
 751          BA    .061
 752          LG     .25     .32    7.00     .12   13.00
 753          UC    .433    .555
              *
              *
 754          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  42         UC8
              .
              .
  51          .         UC9
              .           .
              .           .
  60       CPC8............
              V
              V
  64      RCP89
              .
              .
  74          .        UC18
              .           .
              .           .
  83          .           .        UC19
              .           .           .
              .           .           .
  90    CP1819........................
             V
             V
  93     R1819
             .
             .
 102         .        UC22
             .           .
             .           .
 109         .           .        UC23
             .           .           .
             .           .           .
 116   CP2223........................
             V
             V
 119     R2223
             .
             .
 128         .        UC28
             .           V
             .           V
 135         .         R28
             .           .
             .           .
 144         .           .        UC29
             .           .           .
             .           .           .
 151         .           .           .        UC30
             .           .           .           .
             .           .           .           .
 158   CP2930.......................................
             V
             V
 162     R2930
             .
             .
 171         .        UC34
             .           .
             .           .
 178      CP34............
             V
             V
 182      R34
             .
             .
 191         .        UC37
```

```
                .           .
                .           .
198             .           .        UC35
                .           .           .
                .           .           .
205       CP3537.......................
               V
               V
209        R3537
                .
                .
218             .        UC49
                .           .
                .           .
225             .           .        UC31
                .           .           .
                .           .           .
232       CP3149.......................
               V
               V
236        R3149
                .
                .
245             .        UC46
                .           V
                .           V
254             .         R46
                .           .
                .           .
263             .           .        UC45
                .           .           .
                .           .           .
272             .           .           .        UC47
                .           .           .           .
                .           .           .           .
281             .      CP4547.......................
                .           V
                .           V
285             .       R4547
                .           .
                .           .
294             .           .        UC48
                .           .           .
                .           .           .
301             .           .           .        UC50
                .           .           .           .
                .           .           .           .
308        CP4850.....................................
               V
               V
312        R4850
                .
                .
321             .        UC51
                .           .
                .           .
328             .           .        UC57
                .           .           .
                .           .           .
335        CP5157.......................
               V
               V
339        R5157
                .
                .
348             .        UC58
                .           .
                .           .
355             .           .        UC59
                .           .           .
                .           .           .
```

```
362     CP5859.......................
             .
             .
368          .-------> D5859S
366     D5859N
             V
             V
371     R5859N
             .
             .
380          .        UC63
             .           .
             .           .
387       CP63............
             V
             V
391        R63
             .
             .
399          .        UC66
             .           .
             .           .
406          .           .        UC62
             .           .           .
             .           .           .
413     CP6266.......................
             V
             V
417     R6266
             .
             .
427          .           .<-------  D5859S
425          .      D5859S
             .           V
             .           V
428          .      R5859S
             .           .
             .           .
436          .           .        UC64
             .           .           .
             .           .           .
443          .        CP64............
             .           .
             .           .
450          .           .------->    D64S
447          .        D64N
             .           V
             .           V
453          .       RD64N
             .           .
             .           .
462          .           .        UC87
             .           .           .
             .           .           .
469          .        CP87............
             .           V
             .           V
473          .       RD87N
             .           .
             .           .
481          .           .        UC82
             .           .           .
             .           .           .
488     CP82.......................
           V
           V
492      R82
           .
           .
503        .------->    D84S
500     D84N
```

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                .
                .
506             .        UC84
                .           .
                .           .
513         CP84............
                V
                V
517          R84
                .
                .
526             .        UC79
                .           .
                .           .
535             .           .        UC78
                .           .           .
                .           .           .
544       CP7879........................
                V
                V
548        R7879
                .
                .
557             .        UC77
                .           .
                .           .
566         CP77............
                V
                V
570          R77
                .
                .
579             .        UC89
                .           .
                .           .
588         CP89............
                V
                V
592          R89
                .
                .
601             .        UC74
                .           .
                .           .
608             .           .        UC76
                .           .           .
                .           .           .
615             .      CP7476............
                .           V
                .           V
618             .       R7476
                .           .
                .           .
627             .           .        UC75
                .           .           .
                .           .           .
636             .        CP75............
                .           V
                .           V
640             .         R75
                .           .
                .           .
649             .           .        UC90
                .           .           .
                .           .           .
656             .           .           .        UC91
                .           .           .           .
                .           .           .           .
663       CP90EN.......................................
                .
                .
```

```
669          .           .<-------    D84S
667          .        D84S
             .           V
             .           V
670          .       RD84S
             .           .
             .           .
681          .           .------->  D84IIN
678          .      D84IIS
             .           V
             .           V
684          .      RD84IS
             .           .
             .           .
692          .           .        UC94
             .           .           .
             .           .           .
699          .      CP94DS............
             .           V
             .           V
703          .       R94DS
             .           .
             .           .
713          .           .           .<-------  D84IIN
711          .           .      D84IIN
             .           .           V
             .           .           V
714          .           .      RD84IN
             .           .           .
             .           .           .
722          .           .           .        UC88
             .           .           .           .
             .           .           .           .
729          .      CP88EN......................
             .           .
             .           .
733          .           .        UC95
             .           .           .
             .           .           .
740          .           .           .        UC93
             .           .           .           .
             .           .           .           .
747          .           .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	82.	12.10	12.	4.	1.	.05
+	HYDROGRAPH AT	UC9	82.	12.07	11.	3.	1.	.05
+	2 COMBINED AT	CPC8	162.	12.07	22.	7.	2.	.10
+	ROUTED TO	RCP89	159.	12.17	22.	7.	2.	.10
+	HYDROGRAPH AT	UC18	56.	12.13	8.	2.	1.	.04
+	HYDROGRAPH AT	UC19	39.	12.13	5.	1.	1.	.03
+	3 COMBINED AT	CP1819	250.	12.13	36.	11.	4.	.17
+	ROUTED TO	R1819	248.	12.20	35.	10.	4.	.17
+	HYDROGRAPH AT	UC22	27.	12.30	6.	2.	1.	.03
+	HYDROGRAPH AT	UC23	27.	12.13	3.	1.	0.	.01
+	3 COMBINED AT	CP2223	295.	12.20	44.	13.	5.	.21
+	ROUTED TO	R2223	292.	12.23	43.	13.	5.	.21
+	HYDROGRAPH AT	UC28	79.	12.20	10.	3.	1.	.05
+	ROUTED TO	R28	78.	12.27	10.	3.	1.	.05
+	HYDROGRAPH AT	UC29	45.	12.20	6.	2.	1.	.04
+	HYDROGRAPH AT	UC30	18.	12.13	2.	1.	0.	.01
+	4 COMBINED AT	CP2930	427.	12.23	61.	18.	6.	.31
+	ROUTED TO	R2930	423.	12.23	61.	18.	6.	.31
+	HYDROGRAPH AT	UC34	71.	12.10	7.	2.	1.	.04
+	2 COMBINED AT	CP34	477.	12.23	68.	19.	7.	.35
+	ROUTED TO	R34	455.	12.47	68.	19.	7.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC37	197.	12.37	46.	13.	5.	.21
+	HYDROGRAPH AT	UC35	528.	12.10	55.	16.	6.	.26
+	3 COMBINED AT	CP3537	877.	12.27	166.	48.	17.	.82
+	ROUTED TO	R3537	872.	12.33	166.	48.	17.	.82
+	HYDROGRAPH AT	UC49	123.	12.03	11.	3.	1.	.05
+	HYDROGRAPH AT	UC31	814.	12.10	83.	24.	9.	.41
+	3 COMBINED AT	CP3149	1608.	12.13	258.	74.	27.	1.27
+	ROUTED TO	R3149	1598.	12.17	258.	74.	27.	1.27
+	HYDROGRAPH AT	UC46	94.	12.00	8.	2.	1.	.03
+	ROUTED TO	R46	92.	12.07	8.	2.	1.	.03
+	HYDROGRAPH AT	UC45	235.	12.03	19.	6.	2.	.09
	HYDROGRAPH AT	UC47	79.	12.03	7.	2.	1.	.03
+	3 COMBINED AT	CP4547	402.	12.03	34.	10.	4.	.15
+	ROUTED TO	R4547	390.	12.07	34.	10.	3.	.15
+	HYDROGRAPH AT	UC48	397.	12.10	45.	13.	5.	.20
+	HYDROGRAPH AT	UC50	47.	12.03	4.	1.	0.	.02
+	4 COMBINED AT	CP4850	2335.	12.13	338.	97.	35.	1.64
+	ROUTED TO	R4850	2308.	12.17	338.	97.	35.	1.64
+	HYDROGRAPH AT	UC51	156.	12.03	13.	4.	1.	.06
+	HYDROGRAPH AT	UC57	72.	12.07	7.	2.	1.	.04
+	3 COMBINED AT	CP5157	2447.	12.17	356.	102.	37.	1.74
+	ROUTED TO	R5157	2422.	12.20	356.	102.	37.	1.74
	HYDROGRAPH AT	UC58	262.	12.07	24.	7.	2.	.11

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC59	41.	12.20	6.	2.	1.	.03
+	3 COMBINED AT	CP5859	2622.	12.20	385.	110.	40.	1.88
+	DIVERSION TO	D5859S	1303.	12.20	191.	55.	20.	1.88
+	HYDROGRAPH AT	D5859N	1319.	12.20	193.	55.	20.	1.88
+	ROUTED TO	R5859N	1311.	12.20	193.	55.	20.	1.88
+	HYDROGRAPH AT	UC63	248.	12.07	24.	7.	2.	.12
+	2 COMBINED AT	CP63	1489.	12.20	216.	62.	22.	2.00
+	ROUTED TO	R63	1480.	12.20	216.	62.	22.	2.00
+	HYDROGRAPH AT	UC66	79.	12.07	7.	2.	1.	.04
+	HYDROGRAPH AT	UC62	762.	12.10	73.	20.	7.	.36
+	3 COMBINED AT	CP6266	2173.	12.17	293.	83.	30.	2.40
+	ROUTED TO	R6266	2164.	12.17	293.	83.	30.	2.40
+	HYDROGRAPH AT	D5859S	1303.	12.20	191.	55.	20.	1.88
+	ROUTED TO	R5859S	1288.	12.23	191.	55.	20.	1.88
+	HYDROGRAPH AT	UC64	5.	12.03	0.	0.	0.	.00
+	2 COMBINED AT	CP64	1290.	12.23	191.	55.	20.	1.88
+	DIVERSION TO	D64S	580.	12.23	86.	25.	9.	1.88
+	HYDROGRAPH AT	D64N	709.	12.23	105.	30.	11.	1.88
+	ROUTED TO	RD64N	697.	12.27	105.	30.	11.	1.88
+	HYDROGRAPH AT	UC87	30.	12.17	4.	1.	0.	.03
+	2 COMBINED AT	CP87	723.	12.27	108.	31.	11.	1.90
+	ROUTED TO	RD87N	721.	12.30	108.	31.	11.	1.90
+	HYDROGRAPH AT	UC82	48.	12.07	4.	1.	0.	.02
+	3 COMBINED AT	CP82	2849.	12.20	404.	114.	41.	2.45

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	2842.	12.20	404.	114.	41.	2.45
+	DIVERSION TO	D84S	686.	12.20	41.	10.	4.	2.45
+	HYDROGRAPH AT	D84N	2157.	12.20	363.	104.	38.	2.45
+	HYDROGRAPH AT	UC84	24.	12.07	2.	1.	0.	.01
+	2 COMBINED AT	CP84	2174.	12.20	365.	105.	38.	2.46
+	ROUTED TO	R84	2153.	12.30	365.	104.	38.	2.46
+	HYDROGRAPH AT	UC79	139.	12.07	13.	4.	1.	.08
+	HYDROGRAPH AT	UC78	449.	12.03	35.	10.	4.	.18
+	3 COMBINED AT	CP7879	2328.	12.27	411.	117.	42.	2.72
+	ROUTED TO	R7879	2327.	12.27	411.	117.	42.	2.72
+	HYDROGRAPH AT	UC77	225.	12.03	20.	6.	2.	.10
	2 COMBINED AT	CP77	2417.	12.27	430.	123.	44.	2.81
+	ROUTED TO	R77	2416.	12.27	430.	123.	44.	2.81
+	HYDROGRAPH AT	UC89	122.	12.10	14.	4.	1.	.07
+	2 COMBINED AT	CP89	2500.	12.27	443.	126.	46.	2.89
+	ROUTED TO	R89	2491.	12.30	443.	126.	45.	2.89
+	HYDROGRAPH AT	UC74	264.	12.13	31.	8.	3.	.15
+	HYDROGRAPH AT	UC76	81.	12.07	8.	2.	1.	.04
+	2 COMBINED AT	CP7476	339.	12.10	39.	11.	4.	.19
+	ROUTED TO	R7476	339.	12.13	38.	11.	4.	.19
+	HYDROGRAPH AT	UC75	365.	12.07	38.	10.	4.	.19
+	2 COMBINED AT	CP75	692.	12.10	75.	21.	7.	.38
+	ROUTED TO	R75	684.	12.10	75.	21.	7.	.38
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC90	50.	12.17	6.	2.	1.	.04
+	HYDROGRAPH AT	UC91	84.	12.27	15.	4.	1.	.07
+	4 COMBINED AT	CP90EN	3132.	12.20	535.	151.	55.	3.38
+	HYDROGRAPH AT	D84S	686.	12.20	41.	10.	4.	2.45
+	ROUTED TO	RD84S	685.	12.23	41.	10.	4.	2.45
+	DIVERSION TO	D84IIN	576.	12.23	35.	9.	3.	2.45
+	HYDROGRAPH AT	D84IIS	110.	12.23	6.	1.	1.	2.45
+	ROUTED TO	RD84IS	79.	12.33	6.	1.	0.	2.45
+	HYDROGRAPH AT	UC94	18.	12.50	5.	1.	1.	.03
+	2 COMBINED AT	CP94DS	94.	12.33	10.	3.	1.	2.48
+	ROUTED TO	R94DS	89.	12.40	10.	3.	1.	2.48
+	HYDROGRAPH AT	D84IIN	576.	12.23	35.	9.	3.	2.45
+	ROUTED TO	RD84IN	445.	12.33	35.	9.	3.	2.45
+	HYDROGRAPH AT	UC88	58.	12.77	20.	6.	2.	.11
+	3 COMBINED AT	CP88EN	566.	12.37	64.	17.	6.	2.59
+	HYDROGRAPH AT	UC95	58.	12.07	5.	1.	0.	.02
+	HYDROGRAPH AT	UC93	53.	12.20	9.	2.	1.	.04
+	HYDROGRAPH AT	UC96	70.	12.27	13.	3.	1.	.06

*** NORMAL END OF HEC-1 ***

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1*************************************
 *                                   *
    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
              JUN   1998              *
           VERSION 4.1                *
 *                                   *
 *  RUN DATE   16MAR04  TIME  08:42:22  *
 *                                   *
 *************************************
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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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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

1
PAGE 1

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         10-YEAR 6-HOUR MODEL  FILENAME: UC106F.DAT
  3           ID         FUTURE CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         DECEMBER 2001 (Final Revision March 2004)
  9           ID    ***************************************************************
 10           ID         10 YEAR ANALYSIS 6-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID    ***************************************************************
 15           ID      DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID      THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    2.32    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD   2.305    0.50
 28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 30           PC   0.962   0.972   0.983   0.991   1.000
 31           JD   2.262    2.80
 32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 34           PC   0.950   0.963   0.975   0.988   1.000
 35           JD   2.139    16.0
 36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
 37           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
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 38          PC   0.946   0.960   0.973   0.987   1.000
 39          JD   1.884    90.0
 40          PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
 41          PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
 42          PC   0.927   0.945   0.964   0.982   1.000
 43          JD   1.322   500.0
 44          PC   0.000   0.024   0.043   0.059   0.078   0.098   0.119   0.141   0.162   0.186
 45          PC   0.212   0.239   0.271   0.321   0.408   0.515   0.627   0.735   0.814   0.864
 46          PC   0.907   0.930   0.954   0.977   1.000
             *
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 47          KK    UC8
 48          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 49          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 50          KM    L= 1.04   Kb= 0.031   S=138.0
 51          BA    .054
 52          LG     .30     .36     4.9     .26    36.0
 53          UC    .379    .686
 54          UA      0       5      16      30      65      77      84      90      94      97
 55          UA    100
             *

 56          KK    UC9
 57          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 58          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 59          KM    L= 0.91   Kb= 0.031   S=145.0
 60          BA    .047
 61          LG     .30     .36     5.0     .23    36.0
 62          UC    .338    .540
 63          UA      0       5      16      30      65      77      84      90      94      97
 64          UA    100
             *

 65          KK    CPC89
 66          KM    CONCENTRATION POINT 89
 67          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 68          HC      2
             *

 69          KK   RCP89
 70          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 71          KM    NORMAL DEPTH CHANNEL ROUTING
 72          KM    ENDPOINTS WERE EXTENDED
 73          KM    SLOPE = (2596-2540)/2933
 74          RS      5    FLOW      -1
 75          RC   0.045   0.035   0.045    2933  0.0191
 76          RX      0      90      99     100     108     109     120     200
 77          RY    108     104     102     100     100     102     104     108
 78          RL                   0.15     100
             *

 79          KK    UC18
 80          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 81          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 82          KM    L= 0.56   Kb= 0.091   S=101.0
 83          BA    .040
 84          LG     .25     .36     5.0     .23   24.00
 85          UC    .300    .379
 86          UA      0       5      16      30      65      77      84      90      94      97
 87          UA    100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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 88          KK    UC19
 89          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 90          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 91          KM    L= 0.52   Kb= 0.069   S=135.0
 92          BA    .027
 93          LG     .25     .36    5.00     .23   18.00
 94          UC    .271    .400
             *

 95          KK  CP1819
 96          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
 97          HC       3
             *

 98          KK   R1819
 99          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
100          KM    ENDPOINTS WERE EXTENDED
101          KM    SLOPE = (2540-2511)/1790
102          RS       2    FLOW      -1
103          RC   0.045   0.030   0.045    1790  0.0162
104          RX       0      92      99     100     112     113     120     200
105          RY     108     104     102     100     100     102     104     108
106          RL                    0.25     100
             *

107          KK    UC22
108          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
109          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
110          KM    L= .76   Kb= .104   S=111.0
111          BA    .032
112          LG     .25     .36    5.00     .23   14.00
113          UC    .363    .658
             *

114          KK    UC23
115          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
116          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
117          KM    L= .40   Kb= 0.125   S=121.0
118          BA    .013
119          LG     .25     .36    5.00     .23   18.00
120          UC    .250    .120
             *

121          KK  CP2223
122          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
123          HC       3
             *

124          KK   R2223
125          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
126          KM    ENDPOINTS WERE EXTENDED
127          KM    SLOPE = (2511-2482)/1862
128          RS       2    FLOW      -1
129          RC   0.045    0.03   0.045    1862  0.0156
1                                          HEC-1 INPUT
PAGE  4

     LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

130          RX       0      95      99     100     112     113     117     200
131          RY     108     104     102     100     100     102     104     108
132          RL                    0.25     100
             *

133          KK    UC28
134          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
135          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
136          KM    L= .57   Kb= 0.106   S=109.0
137          BA    .055
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138          LG     .25     .36    4.90     .25   14.00
139          UC    .308    .253
             *

140          KK     R28
141          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
142          KM    ENDPOINTS WERE EXTENDED
143          KM    SLOPE = (2502-2482)/1296
144          RS       2    FLOW      -1
145          RC   0.045   0.035   0.045    1296  0.0154
146          RX       0      86      99     100     108     109     122     200
147          RY     108     104     102     100     100     102     104     108
148          RL                    0.15     100
             *

149          KK    UC29
150          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
151          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
152          KM    L= .47   Kb= 0.116   S=109.0
153          BA    .035
154          LG     .25     .36    5.00     .23   12.00
155          UC    .275    .323
             *

156          KK   UC30
157          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
158          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
159          KM    L= .28   Kb= 0.126   S=134.0
160          BA    .012
161          LG     .25     .36    5.00     .23   12.00
162          UC    .208    .291
             *

163          KK  CP2930
164          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
165          KM    CP2223
166          HC       4
             *

167          KK   R2930
168          KM   Routing flow from CP2930 to CP34 through subbasin 34
169          KM    SLOPE = (2482-2469)/925
170          KM    ENDPOINTS WERE EXTENDED
171          RS       1    FLOW      -1
172          RC   0.045   0.030   0.045     925  0.0141
1                                          HEC-1 INPUT
PAGE  5

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

173          RX       0      89      99     100     110     111     122     200
174          RY     108     104     102     100     100     102     104     108
175          RL                    0.15     100
             *

176          KK    UC34
177          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
178          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
179          KM    L= .31   Kb = 0.116   S= 117.0
180          BA    .037
181          LG     .25     .36    4.90     .22   12.00
182          UC    .213    .168
             *

183          KK    CP34
184          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
185          KM   R2930
186          HC       2
             *

187          KK     R34
```

```
188          KM   Routing flow from CP34 to CP3537 through subbasin 37
189          KM    ENDPOINTS WERE EXTENDED
190          KM    SLOPE = (2469-2318)/6475
191          RS      11    FLOW      -1
192          RC   0.045   0.035   0.045    6475   .0233
193          RX       0      90      99     100     105     106     115     200
194          RY     108     104     102     100     100     102     104     108
195          RL                    0.15     100
             *

196          KK    UC37
197          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
198          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
199          KM    L= 2.03   Kb= 0.160   S= 98.0
200          BA    .207
201          LG     .25     .39    3.70     .16   24.00
202          UC    .542    .809
             *

203          KK    UC35
204          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
205          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
206          KM    L= 1.27   Kb= 0.035   S=138.0
207          BA    .261
208          LG     .25     .38    3.90     .20   24.00
209          UC    .408    .355
             *

210          KK  CP3537
211          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
212          KM    R34
213          HC       3
             *
1                                        HEC-1 INPUT
PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

214          KK   R3537
215          KM   Routing flow from CP3537 to CP3149 through subbasin 49
216          KM    ENDPOINTS WERE EXTENDED
217          KM    SLOPE = (2318-2280)/1829
218          RS       3    FLOW      -1
219          RC   0.045   0.035   0.045    1829  0.0208
220          RX       0      90      99     100     105     106     115     200
221          RY     108     104     102     100     100     102     104     108
222          RL                    0.15     100
             *

223          KK    UC49
224          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
225          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
226          KM    L= .47   Kb= 0.032   S=148.0
227          BA    .048
228          LG     .25     .39    3.60     .15   30.00
229          UC    .225    .219
             *

230          KK    UC31
231          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
232          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
233          KM    L= 2.04   Kb= 0.066   S= 128.0
234          BA    .405
235          LG     .25     .38    4.10     .18   20.00
236          UC    .475    .479
             *

237          KK  CP3149
238          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
239          KM     R3537
```

```
240          HC       3
             *

241          KK   R3149
242          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
243          KM    ENDPOINTS WERE EXTENDED
244          KM    SLOPE = (2280-2256)/1219
245          RS       2    FLOW      -1
246          RC   0.045   0.030   0.045    1219  0.0197
247          RX       0      95      99     100     110     111     118     200
248          RY     110     104     102     100     100     102     104     110
249          RL                    0.15     100
             *

250          KK    UC46
251          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
252          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
253          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
254          BA    .034
255          LG     .25     .39    3.60     .15   24.00
256          UC    .200    .162
257          UA       0       5      16      30      65      77      84      90      94      97
1                                          HEC-1 INPUT
PAGE  7

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

258          UA     100
             *

259          KK     R46
260          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
261          KM    ENDPOINTS WERE EXTENDED
262          KM    SLOPE = (2346-2315)/1783
263          RS       3    FLOW      -1
264          RC   0.045   0.035   0.045    1783  0.0174
265          RX       0      92      99     100     105     106     113     200
266          RY     108     104     102     100     100     102     104     108
267          RL                    0.15     100
             *

268          KK    UC45
269          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
270          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
271          KM    L= .48   Kb= 0.030   S= 135.0
272          BA    .086
273          LG     .25     .39    3.60     .15   24.00
274          UC    .233    .167
275          UA       0       5      16      30      65      77      84      90      94      97
276          UA     100
             *

277          KK    UC47
278          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
279          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
280          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
281          BA    .031
282          LG     .25     .39    3.60     .15   24.00
283          UC    .217    .229
284          UA       0       5      16      30      65      77      84      90      94      97
285          UA     100
             *

286          KK  CP4547
287          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
288          KM    R46
289          HC       3
             *

290          KK   R4547
291          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
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```
 292          KM   ENDPOINTS WERE EXTENDED
 293          KM    SLOPE = (2315-2256)/2170
 294          RS       4    FLOW      -1
 295          RC   0.045   0.035   0.045    2170   .0272
 296          RX       0      90      99     100     105     106     115     200
 297          RY     108     104     102     100     100     102     104     108
 298          RL                    0.15     100
              *
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HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 299          KK    UC48
 300          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 301          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 302          KM    L= .92   Kb= 0.048   S= 117.0
 303          BA    .197
 304          LG     .25     .39    3.70     .16   30.00
 305          UC    .438    .349
              *

 306          KK    UC50
 307          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 308          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 309          KM    L= .27   Kb= 0.037   S= 93.0
 310          BA    .019
 311          LG     .25     .38    3.80     .24   24.00
 312          UC    .221    .230
              *

 313          KK  CP4850
 314          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 315          KM    R3149 AND R4547
 316          HC       4
              *

 317          KK   R4850
 318          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 319          KM    ENDPOINTS WERE EXTENDED
 320          KM    SLOPE = (2256-2235)/1509
 321          RS       2    FLOW      -1
 322          RC   0.045   0.030   0.045    1509  0.0139
 323          RX       0      95      99     100     115     116     120     200
 324          RY     106     104     102     100     100     102     104     106
 325          RL                    0.25     100
              *

 326          KK    UC51
 327          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 328          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 329          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
 330          BA    .060
 331          LG     .25     .36    5.00     .21   26.00
 332          UC    .196    .151
              *

 333          KK    UC57
 334          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
 335          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 336          KM    L= .47   Kb= 0.061   S= 200.0
 337          BA    .037
 338          LG     .25     .37    4.20     .28   20.00
 339          UC    .333    .395
              *
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HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
340          KK  CP5157
341          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
342          KM     R4850
343          HC       3
             *

344          KK   R5157
345          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
346          KM    ENDPOINTS WERE EXTENDED
347          KM    SLOPE = (2235-2208)/1796
348          RS       2    FLOW      -1
349          RC   0.045   0.030   0.045    1796  0.0150
350          RX       0      60      99     100     100     121     160     220
351          RY     110     104     102     100     100     102     104     110
352          RL                    0.35     100
             *

353          KK    UC58
354          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
355          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
356          KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
357          BA    .110
358          LG     .25     .37    4.80     .13   20.00
359          UC    .292    .246
             *

360          KK    UC59
361          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
362          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
363          KM    L= .49   Kb= 0.105   S= 112.0
364          BA    .034
365          LG     .25     .32    5.80     .33   14.00
366          UC    .308    .389
             *

367          KK  CP5859
368          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
369          KM     R5157
370          HC       3
             *

371          KK  D5859N
372          KM    DIVERSION OF FLOWS AT FLOW SPLIT
373          DT  D5859S
374          DI       0      50     100     500   10000
375          DQ       0    24.9    49.5   248.5    4970
             *

376          KK  R5859N
377          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
378          KM   ENDPOINTS WERE EXTENDED
379          KM    SLOPE = (2208-2195)/699
380          RS       1    FLOW      -1
381          RC   0.045   0.030   0.045     699  0.0186
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

382          RX       0      50      99     100     110     111     160     210
383          RY     104     103     102     100     100     102     103     104
384          RL                    0.15     100
             *

385          KK    UC63
386          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
387          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
388          KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
389          BA    .117
390          LG     .25     .36    5.00     .19   19.00
```

```
391          UC    .338    .317
             *

392          KK    CP63
393          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
394          KM   FROM RD5859N
395          HC       2
             *

396          KK     R63
397          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
398          KM    SLOPE = (2195-2170)/1394
399          RS       2    FLOW      -1
400          RC   0.045   0.030   0.045    1394  0.0179
401          RX      60      80      99     100     125     126     145     165
402          RY     106     104     102     100     100     102     104     106
403          RL                   0.35     100
             *

404          KK    UC66
405          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
406          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
407          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
408          BA    .037
409          LG     .25     .36    5.00     .25   14.00
410          UC    .283    .364
             *

411          KK    UC62
412          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
413          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
414          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
415          BA    .361
416          LG     .25     .35    6.10     .13   14.00
417          UC    .404    .305
             *

418          KK  CP6266
419          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
420          KM   FROM R63
421          HC       3
             *
```


HEC-1 INPUT

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

422          KK   R6266
423          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
424          KM    SLOPE = (2170-2150)/990
425          RS       2    FLOW      -1
426          RC   0.045   0.030   0.045     990  0.0202
427          RX      25      85      99     100     100     121     135     195
428          RY     106     104     102     100     100     102     104     106
429          RL                   0.35     100
             *

430          KK  D5859S
431          KM   RECALL DIVERTED FLOW FROM D5859N
432          DR  D5859S
             *

433          KK  R5859S
434          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
435          KM    SLOPE = (2208-2194)/803
436          RS       1    FLOW      -1
437          RC   0.045   0.030   0.045     803  0.0174
438          RX       0      50      99     100     125     126     175     225
439          RY     104     103     102     100     100     102     103     104
440          RL                   0.15     100
```

```
                 *
441              KK    UC64
442              KM   SUBBASIN 64, UNNAMED WASH CENTRAL
443              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
444              KM    L= .15   Kb= 0.078   S= 166.0
445              BA    .005
446              LG     .25      .31    6.90     .20   14.00
447              UC    .208     .307
                 *

448              KK    CP64
449              KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
450              KM    DIVERSION RD5859N
451              HC       2     1.88
                 *

452              KK    D64N
453              KM   DIVERSION OF FLOWS AT FLOW SPLIT
454              KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
455              DT    D64S
456              DI       0       50     100     500   10000
457              DQ       0     22.5      45     225    4500
                 *

458              KK   RD64N
459              KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
460              KM   ENDPOINTS WERE EXTENDED
461              KM    SLOPE = (2194-2161)/1721
462              RS       2    FLOW      -1
463              RC   0.045   0.030   0.045    1721  0.0192
1                                             HEC-1 INPUT
PAGE 12

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

464              RX       0       60      99     100     112     113     152     200
465              RY     106      104     102     100     100     102     104     106
466              RL                     0.25     100
                 *

467              KK    UC87
468              KM   SUBBASIN 87, UNNAMED WASH CENTRAL
469              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
470              KM    L= .33   Kb= 0.118   S= 101.0
471              BA    .025
472              LG     .25      .35    3.40     .62    8.00
473              UC    .329     .367
                 *

474              KK    CP87
475              KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
476              KM    DIVERSION RD64N
477              HC       2
                 *

478              KK   RD87N
479              KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
480              KM    SLOPE = (2161-2150)/557
481              RS       1    FLOW      -1
482              RC   0.045   0.030   0.045     557  0.0197
483              RX      25      85      99     100     120     121     135     195
484              RY     106     104     102     100     100     102     104     106
485              RL                     0.35     100
                 *

486              KK    UC82
487              KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
488              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
489              KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
490              BA    .022
```

```
 491          LG     .25     .36    4.30    .400   14.00
 492          UC    .196    .162
              *

 493          KK    CP82
 494          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 495          KM   SUBBASIN 82
 496          HC       3    2.45
              *

 497          KK     R82
 498          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 499          KM    SLOPE = (2150-2138)/579
 500          RS       1    FLOW      -1
 501          RC   0.045   0.030   0.045     579  0.0207
 502          RX      50      75      99     100     125     126     150     175
 503          RY     106     104     102     100     100     102     104     106
 504          RL                    0.35     100
              *
1                                                HEC-1 INPUT
PAGE 13

      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 505          KK    D84N
 506          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 507          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 508          DT    D84S
 509          DI       0     500    1275    1550    1964    2475    3223    4000
 510          DQ       0       0       0    79.7     255     490     888    1250
              *

 511          KK    UC84
 512          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 513          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 514          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
 515          BA    .013
 516          LG     .25     .36    4.50     .35   14.00
 517          UC    .142    .166
              *

 518          KK    CP84
 519          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 520          KM    FROM D84N
 521          HC       2
              *

 522          KK     R84
 523          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 524          KM   ENDPOINTS WERE EXTENDED
 525          KM    SLOPE = (2138-2054)/3463
 526          RS       5    FLOW      -1
 527          RC   0.045   0.030   0.045    3463  0.0243
 528          RX       0      94      99     100     110     111     116     200
 529          RY     106     104     102     100     100     102     104     106
 530          RL                    0.15     100
              *

 531          KK    UC79
 532          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
 533          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 534          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
 535          BA    .078
 536          LG     .25     .35    4.30     .45   18.00
 537          UC    .358    .455
 538          UA       0       5      16      30      65      77      84      90      94      97
 539          UA     100
              *

 540          KK    UC78
```

```
541          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
542          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
543          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
544          BA    .177
545          LG     .25     .35    6.00     .17   17.00
546          UC    .271    .206
547          UA       0       5      16      30      65      77      84      90      94      97
548          UA     100
             *
1                                                HEC-1 INPUT
PAGE 14

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


549          KK  CP7879
550          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
551          KM    FROM R84
552          HC       3
             *

553          KK   R7879
554          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
555          KM   ENDPOINTS WERE EXTENDED
556          KM    SLOPE = (2054-2048)/256
557          RS       1    FLOW      -1
558          RC   0.045   0.030   0.045     256   .0234
559          RX       0      90      99     100     120     121     130     200
560          RY     106     104     102     100     100     102     104     106
561          RL                    0.35     100
             *

562          KK    UC77
563          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
564          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
565          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
566          BA    .096
567          LG     .25     .34    6.70     .13   16.00
568          UC    .300    .348
569          UA       0       5      16      30      65      77      84      90      94      97
570          UA     100
             *

571          KK    CP77
572          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
573          KM    FROM R7879
574          HC       2
             *

575          KK     R77
576          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
577          KM   ENDPOINTS WERE EXTENDED
578          KM    SLOPE = (2048-2037)/593
579          RS       1    FLOW      -1
580          RC   0.045   0.030   0.045     593  0.0185
581          RX       0      80      99     100     115     116     120     200
582          RY     106     104     102     100     100     102     104     106
583          RL                    0.25     100
             *

584          KK    UC89
585          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
586          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
587          KM    L= .77   Kb= 0.057   S= 126.0
588          BA    .073
589          LG     .25     .33    6.40     .20   17.00
590          UC    .329    .388
591          UA       0       5      16      30      65      77      84      90      94      97
592          UA     100
             *
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 593          KK    CP89
 594          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
 595          KM    FROM R77
 596          HC       2
              *

 597          KK     R89
 598          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
 599          KM   CHANNEL ENDS WERE EXTENDED
 600          KM    SLOPE = (2037-2008)/1912
 601          RS       2    FLOW      -1
 602          RC   0.045   0.030   0.045    1912  0.0152
 603          RX       0      80      99     100     115     116     135     200
 604          RY     106     104     102     100     100     102     104     106
 605          RL                    0.25     100
              *

 606          KK    UC74
 607          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
 608          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 609          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
 610          BA    .151
 611          LG     .25     .34    6.60     .13   14.00
 612          UC    .325    .344
              *

 613          KK    UC76
 614          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
 615          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 616          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
 617          BA    .041
 618          LG     .25     .35    6.10     .16   14.00
 619          UC    .225    .306
              *

 620          KK  CP7476
 621          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
 622          HC       2
              *

 623          KK   R7476
 624          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
 625          KM   END POINTS WERE EXTENDED
 626          KM    SLOPE = (2031-2017)/524
 627          RS       1    FLOW      -1
 628          RC   0.045   0.030   0.045     524  0.0267
 629          RX       0      80      99     100     112     113     132     200
 630          RY     106     104     102     100     100     102     104     106
 631          RL                    0.25     100
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 632          KK    UC75
 633          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
 634          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 635          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
 636          BA    .192
 637          LG     .25     .34    6.50     .15   14.00
 638          UC    .317    .342
 639          UA       0       5      16      30      65      77      84      90      94      97
 640          UA     100
```

```
                 *

641              KK    CP75
642              KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
643              KM    FROM R7476
644              HC       2
                 *

645              KK     R75
646              KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
647              KM   END POINTS WERE EXTENDED
648              KM    SLOPE = (2017-2008)/723
649              RS       1    FLOW      -1
650              RC   0.045   0.030   0.045     723  0.0124
651              RX       0      80      99     100     115     116     135     200
652              RY     106     104     102     100     100     102     104     106
653              RL                    0.25     100
                 *

654              KK    UC90
655              KM   SUBBASIN 90, UNNAMED WASH CENTRAL
656              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
657              KM    L= .48   Kb= 0.103   S= 151.0
658              BA    .038
659              LG     .25     .35    3.70     .55   14.00
660              UC    .296    .341
                 *

661              KK    UC91
662              KM   SUBBASIN 91, UNNAMED WASH CENTRAL
663              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
664              KM    L= .75   Kb= 0.107   S= 109.0
665              BA    .073
666              LG     .25     .31    7.40     .14   14.00
667              UC    .333    .388
                 *
                 .

668              KK  CP90EN
669              KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
670              KM    FROM R89 AND R75
671              HC       4
                 *
1                                                HEC-1 INPUT
PAGE 17

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


672              KK    D84S
673              KM   RETREVIAL OF DIVERTED FLOW FROM D84S
674              DR    D84S
                 *

675              KK   RD84S
676              KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
677              KM    SLOPE = (2144-2140)/303
678              RS       6    FLOW      -1
679              RC   0.045   0.030   0.045     303  0.0132
680              RX       0      50      99     100     125     126     175     225
681              RY     106     104     102     100     100     102     104     106
682              RL                    0.35     100
                 *

683              KK  D84IIS
684              KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
685              KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
686              DT  D84IIN
687              DI       0    79.7     255     490     880    1250
688              DQ       0    78.3     229     419     732    1000
                 *
```

```
689          KK  RD84IS
690          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
691          KM   SLOPE = (2140-2078)/3225
692          RS       1    FLOW      -1
693          RC   0.045   0.030   0.045    3225  0.0192
694          RX       0      50      99     100     125     126     175     225
695          RY     106     104     102     100     100     102     104     106
696          RL                    0.25     100
             *

697          KK    UC94
698          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
699          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
700          KM    L= .53   Kb= 0.119   S= 108.0
701          BA    .028
702          LG     .25     .36    5.00     .23   13.00
703          UC    .671   1.082
             *

704          KK  CP94DS
705          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
706          KM   FROM RD84IS
707          HC       2
             *

708          KK   R94DS
709          KM   ROUTING FLOW FROM CP94DS TO CP88EN
710          KM   SLOPE = (2078-2041)/1950
711          RS       1    FLOW      -1
712          RC   0.045   0.030   0.045    1950  0.0189
713          RX      60      85      99     100     108     109     123     148
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                                          HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

714          RY     106     104     102     100     100     102     104     106
715          RL                    0.25     100
             *

716          KK  D84IIN
717          KM   RECALL DIVERTED FLOW FROM D84II
718          DR  D84IIN
             *

719          KK  RD84IN
720          KM   ROUTING FLOW FROM D84II TO CP88EN
721          KM   SLOPE = (2140-2041)/5175
722          RS       1    FLOW      -1
723          RC   0.045   0.030   0.045    5175  0.0191
724          RX      60      78      90     100     125     132     135     150
725          RY     106     104     102     100     100     102     104     106
726          RL                    0.25     100
             *

727          KK    UC88
728          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
729          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
730          KM    L= 1.08   Kb= 0.104   S=111.0
731          BA    .108
732          LG     .25     .33    6.10     .20   14.00
733          UC    .962   1.337
             *

734          KK  CP88EN
735          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
736          KM    FROM R94DS AND RD84IN
737          HC       3
             *

738          KK    UC95
```

```
 739          KM   SUBBASIN 95, UNNAMED WASH CENTRAL
 740          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 741          KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
 742          BA    .024
 743          LG     .25     .39    3.70     .15    5.00
 744          UC    .142    .106
              *

 745          KK    UC93
 746          KM   SUBBASIN 93, UNNAMED WASH CENTRAL
 747          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 748          KM    L= .64   Kb= 0.093   S= 135.0
 749          BA    .038
 750          LG     .25     .30    8.00     .07   13.00
 751          UC    .275    .400
              *
1                                          HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 752          KK    UC96
 753          KM   SUBBASIN 96, UNNAMED WASH CENTRAL
 754          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 755          KM    L= .73   Kb= 0.110  S= 113.0
 756          BA    .061
 757          LG     .25     .32    7.00     .12   13.00
 758          UC    .317    .392
              *
              *
 759          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 47          UC8
              .
              .
 56           .         UC9
              .           .
              .           .
 65        CPC8............
              V
              V
 69       RCP89
              .
              .
 79           .        UC18
              .           .
              .           .
 88           .           .        UC19
              .           .           .
              .           .           .
 95     CP1819........................
              V
              V
 98      R1819
              .
              .
 107          .        UC22
              .           .
              .           .
 114          .           .        UC23
              .           .           .
              .           .           .
 121    CP2223........................
              V
              V
 124     R2223
              .
              .
 133          .        UC28
              .           V
              .           V
 140          .         R28
              .           .
              .           .
 149          .           .        UC29
              .           .           .
              .           .           .
 156          .           .           .       UC30
              .           .           .           .
              .           .           .           .
 163    CP2930.......................................
              V
              V
 167     R2930
              .
              .
 176          .        UC34
              .           .
              .           .
 183      CP34............
              V
              V
 187       R34
              .
              .
 196          .        UC37
```

```
                .           .
                .           .
203             .           .        UC35
                .           .           .
                .           .           .
210       CP3537.......................
                V
                V
214        R3537
                .
                .
223             .        UC49
                .           .
                .           .
230             .           .        UC31
                .           .           .
                .           .           .
237       CP3149.......................
                V
                V
241        R3149
                .
                .
250             .        UC46
                .           V
                .           V
259             .         R46
                .           .
                .           .
268             .           .        UC45
                .           .           .
                .           .           .
277             .           .           .        UC47
                .           .           .           .
                .           .           .           .
286             .      CP4547.......................
                .           V
                .           V
290             .       R4547
                .           .
                .           .
299             .           .        UC48
                .           .           .
                .           .           .
306             .           .           .        UC50
                .           .           .           .
                .           .           .           .
313       CP4850.....................................
                V
                V
317        R4850
                .
                .
326             .        UC51
                .           .
                .           .
333             .           .        UC57
                .           .           .
                .           .           .
340       CP5157.......................
                V
                V
344        R5157
                .
                .
353             .        UC58
                .           .
                .           .
360             .           .        UC59
                .           .           .
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367     CP5859.......................
             .
             .
373          .-------> D5859S
371     D5859N
             V
             V
376     R5859N
             .
             .
385          .        UC63
             .           .
             .           .
392       CP63............
             V
             V
396        R63
             .
             .
404          .        UC66
             .           .
             .           .
411          .           .        UC62
             .           .           .
             .           .           .
418     CP6266........................
             V
             V
422      R6266
             .
             .
432          .           .<-------  D5859S
430          .      D5859S
             .           V
             .           V
133          .      R5859S
             .           .
             .           .
441          .           .        UC64
             .           .           .
             .           .           .
448          .        CP64............
             .           .
             .           .
455          .           .-------->    D64S
452          .        D64N
             .           V
             .           V
458          .       RD64N
             .           .
             .           .
467          .           .        UC87
             .           .           .
             .           .           .
474          .        CP87............
             .           V
             .           V
478          .       RD87N
             .           .
             .           .
486          .           .        UC82
             .           .           .
             .           .           .
493     CP82........................
           V
           V
497      R82
           .
           .
508        .-------->    D84S
505     D84N
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                .
                .
511             .        UC84
                .           .
                .           .
518         CP84............
                V
                V
522          R84
                .
                .
531             .        UC79
                .           .
                .           .
540             .           .        UC78
                .           .           .
                .           .           .
549       CP7879........................
                V
                V
553        R7879
                .
                .
562             .        UC77
                .           .
                .           .
571         CP77............
                V
                V
575          R77
                .
                .
584             .        UC89
                .           .
                .           .
593         CP89............
                V
                V
597          R89
                .
                .
606             .        UC74
                .           .
                .           .
613             .           .        UC76
                .           .           .
                .           .           .
620             .      CP7476............
                .           V
                .           V
623             .       R7476
                .           .
                .           .
632             .           .        UC75
                .           .           .
                .           .           .
641             .        CP75............
                .           V
                .           V
645             .         R75
                .           .
                .           .
654             .           .        UC90
                .           .           .
                .           .           .
661             .           .           .        UC91
                .           .           .           .
                .           .           .           .
668       CP90EN.................................
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674          .           .<-------    D84S
672          .        D84S
             .           V
             .           V
675          .       RD84S
             .           .
             .           .
686          .           .------->  D84IIN
683          .      D84IIS
             .           V
             .           V
689          .      RD84IS
             .           .
             .           .
697          .           .        UC94
             .           .           .
             .           .           .
704          .      CP94DS............
             .           V
             .           V
708          .       R94DS
             .           .
             .           .
718          .           .           .<-------  D84IIN
716          .           .      D84IIN
             .           .           V
             .           .           V
719          .           .      RD84IN
             .           .           .
             .           .           .
727          .           .           .        UC88
             .           .           .           .
             .           .           .           .
734          .      CP88EN........................
             .           .
             .           .
738          .           .        UC95
             .           .           .
             .           .           .
745          .           .           .        UC93
             .           .           .           .
             .           .           .           .
752          .           .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1

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
+	HYDROGRAPH AT	UC8	40.	4.17	8.	2.	1.	.05
+	HYDROGRAPH AT	UC9	42.	4.13	7.	2.	1.	.05
+	2 COMBINED AT	CPC8	82.	4.17	15.	4.	1.	.10
+	ROUTED TO	RCP89	81.	4.27	15.	4.	1.	.10
+	HYDROGRAPH AT	UC18	43.	4.13	5.	1.	0.	.04
+	HYDROGRAPH AT	UC19	27.	4.17	3.	1.	0.	.03
+	3 COMBINED AT	CP1819	143.	4.20	23.	6.	2.	.17
+	ROUTED TO	R1819	141.	4.27	23.	6.	2.	.17
+	HYDROGRAPH AT	UC22	22.	4.23	4.	1.	0.	.03
+	HYDROGRAPH AT	UC23	23.	4.07	2.	0.	0.	.01
+	3 COMBINED AT	CP2223	175.	4.23	28.	7.	3.	.21
+	ROUTED TO	R2223	173.	4.27	28.	7.	3.	.21
+	HYDROGRAPH AT	UC28	66.	4.13	6.	2.	1.	.05
+	ROUTED TO	R28	66.	4.20	6.	2.	1.	.05
+	HYDROGRAPH AT	UC29	38.	4.13	4.	1.	0.	.04
+	HYDROGRAPH AT	UC30	15.	4.10	1.	0.	0.	.01
+	4 COMBINED AT	CP2930	278.	4.23	40.	10.	4.	.31
+	ROUTED TO	R2930	276.	4.27	40.	10.	4.	.31
+	HYDROGRAPH AT	UC34	59.	4.07	4.	1.	0.	.04
+	2 COMBINED AT	CP34	309.	4.23	44.	11.	4.	.35
+	ROUTED TO	R34	300.	4.40	44.	11.	4.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT	UC37	138.	4.40	31.	8.	3.	.21
+	HYDROGRAPH AT	UC35	283.	4.23	37.	9.	3.	.26
+	3 COMBINED AT	CP3537	610.	4.37	106.	27.	10.	.82
+	ROUTED TO	R3537	603.	4.43	106.	27.	10.	.82
+	HYDROGRAPH AT	UC49	78.	4.10	8.	2.	1.	.05
+	HYDROGRAPH AT	UC31	361.	4.30	56.	14.	5.	.41
+	3 COMBINED AT	CP3149	862.	4.40	161.	41.	15.	1.27
+	ROUTED TO	R3149	861.	4.40	161.	41.	15.	1.27
+	HYDROGRAPH AT	UC46	63.	4.07	5.	1.	0.	.03
+	ROUTED TO	R46	62.	4.10	5.	1.	0.	.03
+	HYDROGRAPH AT	UC45	157.	4.07	13.	3.	1.	.09
	HYDROGRAPH AT	UC47	50.	4.07	5.	1.	0.	.03
+	3 COMBINED AT	CP4547	265.	4.07	23.	6.	2.	.15
+	ROUTED TO	R4547	259.	4.13	23.	6.	2.	.15
+	HYDROGRAPH AT	UC48	226.	4.23	31.	8.	3.	.20
+	HYDROGRAPH AT	UC50	28.	4.10	3.	1.	0.	.02
+	4 COMBINED AT	CP4850	1095.	4.37	208.	53.	19.	1.64
+	ROUTED TO	R4850	1091.	4.40	208.	53.	19.	1.64
+	HYDROGRAPH AT	UC51	105.	4.07	8.	2.	1.	.06
+	HYDROGRAPH AT	UC57	36.	4.20	5.	1.	0.	.04
+	3 COMBINED AT	CP5157	1126.	4.37	218.	55.	20.	1.74
+	ROUTED TO	R5157	1121.	4.43	218.	55.	20.	1.74
+	HYDROGRAPH AT	UC58	157.	4.13	16.	4.	1.	.11
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC59	30.	4.17	4.	1.	0.	.03
+	3 COMBINED AT	CP5859	1190.	4.40	234.	59.	21.	1.88
+	DIVERSION TO	D5859S	591.	4.40	116.	29.	11.	1.88
+	HYDROGRAPH AT	D5859N	599.	4.40	118.	30.	11.	1.88
+	ROUTED TO	R5859N	597.	4.43	118.	30.	11.	1.88
+	HYDROGRAPH AT	UC63	134.	4.17	15.	4.	1.	.12
+	2 COMBINED AT	CP63	661.	4.40	130.	33.	12.	2.00
+	ROUTED TO	R63	660.	4.43	130.	33.	12.	2.00
+	HYDROGRAPH AT	UC66	37.	4.17	4.	1.	0.	.04
+	HYDROGRAPH AT	UC62	417.	4.23	48.	12.	4.	.36
+	3 COMBINED AT	CP6266	906.	4.37	173.	44.	16.	2.40
+	ROUTED TO	R6266	906.	4.37	173.	44.	16.	2.40
+	HYDROGRAPH AT	D5859S	591.	4.40	116.	29.	11.	1.88
+	ROUTED TO	R5859S	591.	4.43	116.	29.	11.	1.88
+	HYDROGRAPH AT	UC64	6.	4.10	1.	0.	0.	.00
+	2 COMBINED AT	CP64	593.	4.43	117.	30.	11.	1.88
+	DIVERSION TO	D64S	267.	4.43	52.	13.	5.	1.88
+	HYDROGRAPH AT	D64N	326.	4.43	64.	16.	6.	1.88
+	ROUTED TO	RD64N	325.	4.47	64.	16.	6.	1.88
+	HYDROGRAPH AT	UC87	19.	4.20	2.	1.	0.	.03
+	2 COMBINED AT	CP87	331.	4.47	65.	17.	6.	1.90
+	ROUTED TO	RD87N	330.	4.47	65.	16.	6.	1.90
+	HYDROGRAPH AT	UC82	32.	4.07	2.	1.	0.	.02
+	3 COMBINED AT	CP82	1216.	4.40	237.	60.	22.	2.45

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	1216.	4.40	237.	60.	22.	2.45
+	DIVERSION TO	D84S	9.	4.33	0.	0.	0.	2.45
+	HYDROGRAPH AT	D84N	1208.	4.40	237.	60.	22.	2.45
+	HYDROGRAPH AT	UC84	20.	4.03	1.	0.	0.	.01
+	2 COMBINED AT	CP84	1210.	4.40	238.	60.	22.	2.46
+	ROUTED TO	R84	1200.	4.53	238.	60.	22.	2.46
+	HYDROGRAPH AT	UC79	61.	4.17	8.	2.	1.	.08
+	HYDROGRAPH AT	UC78	266.	4.07	23.	6.	2.	.18
+	3 COMBINED AT	CP7879	1265.	4.50	260.	66.	24.	2.72
+	ROUTED TO	R7879	1265.	4.50	260.	66.	24.	2.72
+	HYDROGRAPH AT	UC77	113.	4.10	13.	3.	1.	.10
+	2 COMBINED AT	CP77	1304.	4.50	270.	68.	25.	2.81
+	ROUTED TO	R77	1304.	4.50	270.	68.	25.	2.81
+	HYDROGRAPH AT	UC89	74.	4.13	9.	2.	1.	.07
+	2 COMBINED AT	CP89	1330.	4.50	277.	70.	25.	2.89
+	ROUTED TO	R89	1323.	4.57	276.	70.	25.	2.89
+	HYDROGRAPH AT	UC74	171.	4.17	20.	5.	2.	.15
+	HYDROGRAPH AT	UC76	51.	4.10	5.	1.	0.	.04
+	2 COMBINED AT	CP7476	219.	4.17	25.	6.	2.	.19
+	ROUTED TO	R7476	219.	4.17	25.	6.	2.	.19
+	HYDROGRAPH AT	UC75	220.	4.13	25.	6.	2.	.19
+	2 COMBINED AT	CP75	434.	4.13	50.	12.	4.	.38
+	ROUTED TO	R75	432.	4.17	50.	12.	4.	.38
	HYDROGRAPH AT	UC90	33.	4.17	4.	1.	0.	.04

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC91	76.	4.20	9.	2.	1.	.07
+	4 COMBINED AT	CP90EN	1517.	4.47	322.	82.	29.	3.38
+	HYDROGRAPH AT	D84S	9.	4.33	0.	0.	0.	2.45
+	ROUTED TO	RD84S	9.	4.33	0.	0.	0.	2.45
+	DIVERSION TO	D84IIN	9.	4.33	0.	0.	0.	2.45
+	HYDROGRAPH AT	D84IIS	1.	4.33	0.	0.	0.	2.45
+	ROUTED TO	RD84IS	0.	4.47	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC94	12.	4.50	3.	1.	0.	.03
+	2 COMBINED AT	CP94DS	9.	4.57	3.	1.	0.	2.48
+	ROUTED TO	R94DS	8.	4.73	2.	1.	0.	2.48
+	HYDROGRAPH AT	D84IIN	9.	4.33	0.	0.	0.	2.45
+	ROUTED TO	RD84IN	5.	4.53	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC88	38.	4.77	13.	3.	1.	.11
+	3 COMBINED AT	CP88EN	39.	4.73	13.	3.	1.	2.59
+	HYDROGRAPH AT	UC95	50.	4.03	3.	1.	0.	.02
+	HYDROGRAPH AT	UC93	44.	4.17	6.	1.	1.	.04
+	HYDROGRAPH AT	UC96	65.	4.17	8.	2.	1.	.06

*** NORMAL END OF HEC-1 ***

```
1*************************************
 *                                   *
     FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
              JUN   1998               *
            VERSION 4.1                *
 *                                   *
 *  RUN DATE   16MAR04  TIME  08:41:44  *
 *                                   *
 *************************************
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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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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

1
PAGE 1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         10-YEAR 24-HOUR MODEL  FILENAME: UC1024F.DAT
  3           ID         EXISTING CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         DECEMBER 2001 (Final Revision March 2004)
  9           ID    ******************************************************************
 10           ID         10 YEAR ANALYSIS 24-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID    ******************************************************************
 15           ID     DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID     THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    3.16    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   2.970   10.00
 35           JD   2.844   30.00
 36           JD   2.718   60.00
 37           JD   2.673   90.00
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 38          JD   2.635  120.00
 39          JD   2.607  150.00
 40          JD   2.528  300.00
 41          JD   2.465  500.00
             *
             *

 42          KK     UC8
 43          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 44          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 45          KM    L= 1.04   Kb= 0.031   S=138.0
 46          BA    .054
 47          LG     .30     .36     4.9     .26    36.0
 48          UC    .271    .472
 49          UA       0       5      16      30      65      77      84      90      94      97
 50          UA     100
             *
1                                          HEC-1 INPUT
PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 51          KK     UC9
 52          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 53          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 54          KM    L= 0.91   Kb= 0.031   S=145.0
 55          BA    .047
 56          LG     .30     .36     5.0     .23    36.0
 57          UC    .246    .380
 58          UA       0       5      16      30      65      77      84      90      94      97
 59          UA     100
             *

 60          KK    CPC89
 61          KM    CONCENTRATION POINT 89
 62          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 63          HC       2
             *

 64          KK   RCP89
 65          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 66          KM    NORMAL DEPTH CHANNEL ROUTING
 67          KM    ENDPOINTS WERE EXTENDED
 68          KM    SLOPE = (2596-2540)/2933
 69          RS       5    FLOW      -1
 70          RC   0.045   0.035   0.045    2933  0.0191
 71          RX       0      90      99     100     108     109     120     200
 72          RY     108     104     102     100     100     102     104     108
 73          RL                    0.15     100
             *

 74          KK    UC18
 75          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 76          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 77          KM    L= 0.56   Kb= 0.091   S=101.0
 78          BA    .040
 79          LG     .25     .36     5.0     .23   24.00
 80          UC    .217    .264
 81          UA       0       5      16      30      65      77      84      90      94      97
 82          UA     100
             *

 83          KK    UC19
 84          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 85          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 86          KM    L= 0.52   Kb= 0.069   S=135.0
 87          BA    .027
 88          LG     .25     .36    5.00     .23   18.00
 89          UC    .196    .279
             *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  90          KK  CP1819
  91          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
  92          HC       3
              *

  93          KK   R1819
  94          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
  95          KM    ENDPOINTS WERE EXTENDED
  96          KM    SLOPE = (2540-2511)/1790
  97          RS       2    FLOW      -1
  98          RC   0.045   0.030   0.045    1790  0.0162
  99          RX       0      92      99     100     112     113     120     200
 100          RY     108     104     102     100     100     102     104     108
 101          RL                    0.25     100
              *

 102          KK    UC22
 103          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
 104          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 105          KM    L= .76   Kb= .104   S=111.0
 106          BA    .032
 107          LG     .25     .36    5.00     .23   14.00
 108          UC    .254    .462
              *

 109          KK    UC23
 110          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
 111          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 112          KM    L= .40   Kb= 0.125   S=121.0
 113          BA    .013
 114          LG     .25     .36    5.00     .23   18.00
 115          UC    .183    .085
              *

 116          KK  CP2223
 117          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
 118          HC       3
              *

 119          KK   R2223
 120          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
 121          KM    ENDPOINTS WERE EXTENDED
 122          KM    SLOPE = (2511-2482)/1862
 123          RS       2    FLOW      -1
 124          RC   0.045    0.03   0.045    1862  0.0156
 125          RX       0      95      99     100     112     113     117     200
 126          RY     108     104     102     100     100     102     104     108
 127          RL                    0.25     100
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 128          KK    UC28
 129          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
 130          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 131          KM    L= .57   Kb= 0.106   S=109.0
 132          BA    .055
 133          LG     .25     .36    4.90     .25   14.00
 134          UC    .217    .171
              *

 135          KK     R28
```

```
136          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
137          KM    ENDPOINTS WERE EXTENDED
138          KM    SLOPE = (2502-2482)/1296
139          RS       2    FLOW      -1
140          RC   0.045   0.035   0.045    1296  0.0154
141          RX       0      86      99     100     108     109     122     200
142          RY     108     104     102     100     100     102     104     108
143          RL                    0.15     100
             *

144          KK    UC29
145          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
147          KM    L= .47   Kb= 0.116   S=109.0
148          BA    .035
149          LG     .25     .36    5.00     .23   12.00
150          UC    .200    .227
             *

151          KK   UC30
152          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
153          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
154          KM    L= .28   Kb= 0.126   S=134.0
155          BA    .012
156          LG     .25     .36    5.00     .23   12.00
157          UC    .150    .202
             *

158          KK  CP2930
159          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
160          KM    CP2223
161          HC       4
             *

162          KK   R2930
163          KM   Routing flow from CP2930 to CP34 through subbasin 34
164          KM    SLOPE = (2482-2469)/925
165          KM    ENDPOINTS WERE EXTENDED
166          RS       1    FLOW      -1
167          RC   0.045   0.030   0.045     925  0.0141
168          RX       0      89      99     100     110     111     122     200
169          RY     108     104     102     100     100     102     104     108
170          RL                    0.15     100
             *
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

171          KK    UC34
172          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
173          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
174          KM    L= .31   Kb = 0.116   S= 117.0
175          BA    .037
176          LG     .25     .36    4.90     .22   12.00
177          UC    .154    .118
             *

178          KK    CP34
179          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
180          KM   R2930
181          HC       2
             *

182          KK     R34
183          KM   Routing flow from CP34 to CP3537 through subbasin 37
184          KM    ENDPOINTS WERE EXTENDED
185          KM    SLOPE = (2469-2318)/6475
186          RS      11    FLOW      -1
187          RC   0.045   0.035   0.045    6475   .0233
```

```
188          RX       0      90      99     100     105     106     115     200
189          RY     108     104     102     100     100     102     104     108
190          RL                    0.15     100
             *

191          KK    UC37
192          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
193          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
194          KM    L= 2.03   Kb= 0.160   S= 98.0
195          BA    .207
196          LG     .25     .39    3.70     .16   24.00
197          UC    .429    .624
             *

198          KK    UC35
199          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
200          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
201          KM    L= 1.27   Kb= 0.035   S=138.0
202          BA    .261
203          LG     .25     .38    3.90     .20   24.00
204          UC    .304    .256
             *

205          KK  CP3537
206          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
207          KM    R34
208          HC       3
             *
```



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                                    HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

209          KK   R3537
210          KM   Routing flow from CP3537 to CP3149 through subbasin 49
211          KM    ENDPOINTS WERE EXTENDED
212          KM    SLOPE = (2318-2280)/1829
213          RS       3    FLOW      -1
214          RC   0.045   0.035   0.045    1829  0.0208
215          RX       0      90      99     100     105     106     115     200
216          RY     108     104     102     100     100     102     104     108
217          RL                    0.15     100
             *

218          KK    UC49
219          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
220          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
221          KM    L= .47   Kb= 0.032   S=148.0
222          BA    .048
223          LG     .25     .39    3.60     .15   30.00
224          UC    .175    .166
             *

225          KK    UC31
226          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
227          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
228          KM    L= 2.04   Kb= 0.066   S= 128.0
229          BA    .405
230          LG     .25     .38    4.10     .18   20.00
231          UC    .371    .364
             *

232          KK  CP3149
233          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
234          KM     R3537
235          HC       3
             *

236          KK   R3149
237          KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
```

```
238          KM    ENDPOINTS WERE EXTENDED
239          KM    SLOPE = (2280-2256)/1219
240          RS       2    FLOW      -1
241          RC   0.045   0.030   0.045    1219  0.0197
242          RX       0      95      99     100     110     111     118     200
243          RY     110     104     102     100     100     102     104     110
244          RL                    0.15     100
             *

245          KK    UC46
246          KM   SUBBASIN 46, UNNAMED WASH CENTRAL
247          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
248          KM    L= .30  Kb= 0.060   Adj. Slope= 324.0
249          BA    .034
250          LG     .25     .39    3.60     .15   24.00
251          UC    .154    .121
252          UA       0       5      16      30      65      77      84      90      94      97
```



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                                        HEC-1 INPUT

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

253          UA     100
             *

254          KK     R46
255          KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
256          KM    ENDPOINTS WERE EXTENDED
257          KM    SLOPE = (2346-2315)/1783
258          RS       3    FLOW      -1
259          RC   0.045   0.035   0.045    1783  0.0174
260          RX       0      92      99     100     105     106     113     200
261          RY     108     104     102     100     100     102     104     108
262          RL                    0.15     100
             *

263          KK    UC45
264          KM   SUBBASIN 45, UNNAMED WASH CENTRAL
265          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
266          KM    L= .48   Kb= 0.030   S= 135.0
267          BA    .086
268          LG     .25     .39    3.60     .15   24.00
269          UC    .175    .121
270          UA       0       5      16      30      65      77      84      90      94      97
271          UA     100
             *

272          KK    UC47
273          KM   SUBBASIN 47, UNNAMED WASH CENTRAL
274          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
275          KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
276          BA    .031
277          LG     .25     .39    3.60     .15   24.00
278          UC    .167    .171
279          UA       0       5      16      30      65      77      84      90      94      97
280          UA     100
             *

281          KK  CP4547
282          KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
283          KM    R46
284          HC       3
             *

285          KK   R4547
286          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
287          KM   ENDPOINTS WERE EXTENDED
288          KM    SLOPE = (2315-2256)/2170
289          RS       4    FLOW      -1
290          RC   0.045   0.035   0.045    2170   .0272
291          RX       0      90      99     100     105     106     115     200
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292          RY     108     104     102     100     100     102     104     108
293          RL                    0.15     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

294          KK    UC48
295          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
296          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
297          KM    L= .92   Kb= 0.048   S= 117.0
298          BA    .197
299          LG     .25     .39    3.70     .16   30.00
300          UC    .342    .265
             *

301          KK    UC50
302          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
303          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
304          KM    L= .27   Kb= 0.037   S= 93.0
305          BA    .019
306          LG     .25     .38    3.80     .24   24.00
307          UC    .167    .169
             *

308          KK  CP4850
309          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
310          KM    R3149 AND R4547
311          HC       4
             *

312          KK   R4850
313          KM   Routing flow from CP4850 to CP5157 through subbasin 57
314          KM    ENDPOINTS WERE EXTENDED
315          KM    SLOPE = (2256-2235)/1509
316          RS       2    FLOW      -1
317          RC   0.045   0.030   0.045    1509  0.0139
318          RX       0      95      99     100     115     116     120     200
319          RY     106     104     102     100     100     102     104     106
320          RL                    0.25     100
             *

321          KK    UC51
322          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
323          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
324          KM    L= .42   Kb= 0.061   Adj. Slope= 317.0
325          BA    .060
326          LG     .25     .36    5.00     .21   26.00
327          UC    .146    .109
             *

328          KK    UC57
329          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
330          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
331          KM    L= .47   Kb= 0.061   S= 200.0
332          BA    .037
333          LG     .25     .37    4.20     .28   20.00
334          UC    .233    .266
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

335          KK  CP5157
336          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
337          KM     R4850
338          HC       3
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                *
339             KK   R5157
340             KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
341             KM    ENDPOINTS WERE EXTENDED
342             KM    SLOPE = (2235-2208)/1796
343             RS       2    FLOW      -1
344             RC   0.045   0.030   0.045    1796  0.0150
345             RX       0      60      99     100     100     121     160     220
346             RY     110     104     102     100     100     102     104     110
347             RL                    0.35     100
                *

348             KK    UC58
349             KM   SUBBASIN 58, UNNAMED WASH CENTRAL
350             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
351             KM    L= .69   Kb= 0.055  Adj. Slope= 317.0
352             BA    .110
353             LG     .25     .37    4.80     .13   20.00
354             UC    .217    .177
                *

355             KK    UC59
356             KM   SUBBASIN 59, UNNAMED WASH CENTRAL
357             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
358             KM    L= .49   Kb= 0.105   S= 112.0
359             BA    .034
360             LG     .25     .32    5.80     .33   14.00
361             UC    .208    .252
                *

362             KK  CP5859
363             KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
364             KM     R5157
365             HC       3
                *

366             KK  D5859N
367             KM    DIVERSION OF FLOWS AT FLOW SPLIT
368             DT  D5859S
369             DI       0      50     100     500   10000
370             DQ       0    24.9    49.5   248.5    4970
                *

371             KK  R5859N
372             KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
373             KM   ENDPOINTS WERE EXTENDED
374             KM    SLOPE = (2208-2195)/699
375             RS       1    FLOW      -1
376             RC   0.045   0.030   0.045     699  0.0186
1                                            HEC-1 INPUT
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

377             RX       0      50      99     100     110     111     160     210
378             RY     104     103     102     100     100     102     103     104
379             RL                    0.15     100
                *

380             KK    UC63
381             KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
382             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
383             KM    L= .81   Kb= 0.056   Adj. Slope= 322.0
384             BA    .117
385             LG     .25     .36    5.00     .19   19.00
386             UC    .242    .219
                *

387             KK    CP63
388             KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
```

```
389          KM   FROM RD5859N
390          HC       2
             *

391          KK     R63
392          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
393          KM    SLOPE = (2195-2170)/1394
394          RS       2    FLOW      -1
395          RC   0.045   0.030   0.045    1394  0.0179
396          RX      60      80      99     100     125     126     145     165
397          RY     106     104     102     100     100     102     104     106
398          RL                   0.35     100
             *

399          KK    UC66
400          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
401          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
402          KM    L= .54   Kb= 0.081   Adj. Slope= 324.0
403          BA    .037
404          LG     .25     .36    5.00     .25   14.00
405          UC    .200    .247
             *

406          KK    UC62
407          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
408          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
409          KM    L= 1.33   Kb= 0.057   Adj. Slope= 321.0
410          BA    .361
411          LG     .25     .35    6.10     .13   14.00
412          UC    .300    .219
             *

413          KK  CP6266
414          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
415          KM   FROM R63
416          HC       3
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

417          KK   R6266
418          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
419          KM    SLOPE = (2170-2150)/990
420          RS       2    FLOW      -1
421          RC   0.045   0.030   0.045     990  0.0202
422          RX      25      85      99     100     100     121     135     195
423          RY     106     104     102     100     100     102     104     106
424          RL                   0.35     100
             *

425          KK  D5859S
426          KM   RECALL DIVERTED FLOW FROM D5859N
427          DR  D5859S
             *

428          KK  R5859S
429          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
430          KM    SLOPE = (2208-2194)/803
431          RS       1    FLOW      -1
432          RC   0.045   0.030   0.045     803  0.0174
433          RX       0      50      99     100     125     126     175     225
434          RY     104     103     102     100     100     102     103     104
435          RL                   0.15     100
             *

436          KK    UC64
437          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
438          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
 439          KM    L= .15   Kb= 0.078   S= 166.0
 440          BA    .002
 441          LG     .25     .31    6.90     .20   14.00
 442          UC    .154    .219
              *

 443          KK    CP64
 444          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
 445          KM    DIVERSION RD5859N
 446          HC       2    1.88
              *

 447          KK    D64N
 448          KM   DIVERSION OF FLOWS AT FLOW SPLIT
 449          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
 450          DT    D64S
 451          DI       0      50     100     500   10000
 452          DQ       0    22.5      45     225    4500
              *

 453          KK   RD64N
 454          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
 455          KM   ENDPOINTS WERE EXTENDED
 456          KM    SLOPE = (2194-2161)/1721
 457          RS       2    FLOW      -1
 458          RC   0.045   0.030   0.045    1721  0.0192
1                                           HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 459          RX       0      60      99     100     112     113     152     200
 460          RY     106     104     102     100     100     102     104     106
 461          RL                    0.25     100
              *

 462          KK    UC87
 463          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
 464          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 465          KM    L= .33   Kb= 0.118   S= 101.0
 466          BA    .029
 467          LG     .25     .35    3.40     .62    8.00
 468          UC    .179    .187
              *

 469          KK    CP87
 470          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
 471          KM    DIVERSION RD64N
 472          HC       2
              *

 473          KK   RD87N
 474          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
 475          KM    SLOPE = (2161-2150)/557
 476          RS       1    FLOW      -1
 477          RC   0.045   0.030   0.045     557  0.0197
 478          RX      25      85      99     100     120     121     135     195
 479          RY     106     104     102     100     100     102     104     106
 480          RL                    0.35     100
              *

 481          KK    UC82
 482          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
 483          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 484          KM    L= .22   Kb= 0.136   Adj. Slope= 220.0
 485          BA    .022
 486          LG     .25     .36    4.30    .400   14.00
 487          UC    .133    .106
              *

 488          KK    CP82
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```
 489          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 490          KM   SUBBASIN 82
 491          HC       3    2.45
              *

 492          KK     R82
 493          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 494          KM    SLOPE = (2150-2138)/579
 495          RS       1    FLOW      -1
 496          RC   0.045   0.030   0.045     579  0.0207
 497          RX      50      75      99     100     125     126     150     175
 498          RY     106     104     102     100     100     102     104     106
 499          RL                    0.35     100
              *
1                                                HEC-1 INPUT
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      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 500          KK    D84N
 501          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 502          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 503          DT    D84S
 504          DI       0     500    1275    1550    1964    2475    3223    4000
 505          DQ       0       0       0    79.7     255     490     888    1250
              *

 506          KK    UC84
 507          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 508          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 509          KM    L= .30   Kb= 0.102   Adj. Slope= 246.0
 510          BA    .013
 511          LG     .25     .36    4.50     .35   14.00
 512          UC    .162    .194
              *

 513          KK    CP84
 514          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 515          KM    FROM D84N
 516          HC       2
              *

 517          KK     R84
 518          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 519          KM   ENDPOINTS WERE EXTENDED
 520          KM    SLOPE = (2138-2054)/3463
 521          RS       5    FLOW      -1
 522          RC   0.045   0.030   0.045    3463  0.0243
 523          RX       0      94      99     100     110     111     116     200
 524          RY     106     104     102     100     100     102     104     106
 525          RL                    0.15     100
              *

 526          KK    UC79
 527          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
 528          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 529          KM    L= .88   Kb= 0.040   Adj. Slope= 233.0
 530          BA    .078
 531          LG     .25     .35    4.30     .45   18.00
 532          UC    .229    .277
 533          UA       0       5      16      30      65      77      84      90      94      97
 534          UA     100
              *

 535          KK    UC78
 536          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
 537          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 538          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
 539          BA    .177
 540          LG     .25     .35    6.00     .17   17.00
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541          UC    .196    .144
542          UA       0       5      16      30      65      77      84      90      94      97
543          UA     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

544          KK  CP7879
545          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
546          KM    FROM R84
547          HC       3
             *

548          KK   R7879
549          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
550          KM   ENDPOINTS WERE EXTENDED
551          KM    SLOPE = (2054-2048)/256
552          RS       1    FLOW      -1
553          RC   0.045   0.030   0.045     256   .0234
554          RX       0      90      99     100     120     121     130     200
555          RY     106     104     102     100     100     102     104     106
556          RL                    0.35     100
             *

557          KK    UC77
558          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
559          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
560          KM    L= .93   Kb= 0.048  Adj. Slope= 324.0
561          BA    .096
562          LG     .25     .34    6.70     .13   16.00
563          UC    .221    .247
564          UA       0       5      16      30      65      77      84      90      94      97
565          UA     100
             *

566          KK    CP77
567          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
568          KM    FROM R7879
569          HC       2
             *

570          KK     R77
571          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
572          KM   ENDPOINTS WERE EXTENDED
573          KM    SLOPE = (2048-2037)/593
574          RS       1    FLOW      -1
575          RC   0.045   0.030   0.045     593  0.0185
576          RX       0      80      99     100     115     116     120     200
577          RY     106     104     102     100     100     102     104     106
578          RL                    0.25     100
             *

579          KK    UC89
580          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
581          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
582          KM    L= .77   Kb= 0.057   S= 126.0
583          BA    .073
584          LG     .25     .33    6.40     .20   17.00
585          UC    .233    .265
586          UA       0       5      16      30      65      77      84      90      94      97
587          UA     100
             *
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HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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588          KK    CP89
589          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
590          KM    FROM R77
591          HC       2
             *

592          KK     R89
593          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
594          KM   CHANNEL ENDS WERE EXTENDED
595          KM    SLOPE = (2037-2008)/1912
596          RS       2    FLOW      -1
597          RC   0.045   0.030   0.045    1912  0.0152
598          RX       0      80      99     100     115     116     135     200
599          RY     106     104     102     100     100     102     104     106
600          RL                    0.25     100
             *

601          KK    UC74
602          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
603          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
604          KM    L= 1.13   Kb= 0.071   Adj. Slope= 328.0
605          BA    .151
606          LG     .25     .34    6.60     .13   14.00
607          UC    .237    .243
             *

608          KK    UC76
609          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
610          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
611          KM    L= .64   Kb= 0.053   Adj. Slope= 302.0
612          BA    .041
613          LG     .25     .35    6.10     .16   14.00
614          UC    .167    .219
             *

615          KK  CP7476
616          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
617          HC       2
             *

618          KK   R7476
619          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
620          KM   END POINTS WERE EXTENDED
621          KM    SLOPE = (2031-2017)/524
622          RS       1    FLOW      -1
623          RC   0.045   0.030   0.045     524  0.0267
624          RX       0      80      99     100     112     113     132     200
625          RY     106     104     102     100     100     102     104     106
626          RL                    0.25     100
             *
```


HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

627          KK    UC75
628          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
629          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
630          KM    L= 1.38   Kb= 0.068   Adj. Slope= 322.0
631          BA    .192
632          LG     .25     .34    6.50     .15   14.00
633          UC    .229    .239
634          UA       0       5      16      30      65      77      84      90      94      97
635          UA     100
             *

636          KK    CP75
637          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
638          KM    FROM R7476
639          HC       2
```

```
                 *

640              KK     R75
641              KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
642              KM   END POINTS WERE EXTENDED
643              KM    SLOPE = (2017-2008)/723
644              RS       1    FLOW      -1
645              RC   0.045   0.030   0.045     723  0.0124
646              RX       0      80      99     100     115     116     135     200
647              RY     106     104     102     100     100     102     104     106
648              RL                    0.25     100
                 *

649              KK    UC90
650              KM   SUBBASIN 90, UNNAMED WASH CENTRAL
651              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
652              KM    L= .48   Kb= 0.103   S= 151.0
653              BA    .038
654              LG     .25     .35    3.70     .55   14.00
655              UC    .192    .210
                 *

656              KK    UC91
657              KM   SUBBASIN 91, UNNAMED WASH CENTRAL
658              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
659              KM    L= .75   Kb= 0.107   S= 109.0
660              BA    .073
661              LG     .25     .31    7.40     .14   14.00
662              UC    .242    .271
                 *
                 *

663              KK  CP90EN
664              KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
665              KM    FROM R89 AND R75
666              HC       4
                 *
1                                          HEC-1 INPUT
PAGE 17

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

667              KK    D84S
668              KM   RETREVIAL OF DIVERTED FLOW FROM D84S
669              DR    D84S
                 *

670              KK   RD84S
671              KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
672              KM    SLOPE = (2144-2140)/303
673              RS       6    FLOW      -1
674              RC   0.045   0.030   0.045     303  0.0132
675              RX       0      50      99     100     125     126     175     225
676              RY     106     104     102     100     100     102     104     106
677              RL                    0.35     100
                 *

678              KK  D84IIS
679              KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
680              KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
681              DT  D84IIN
682              DI       0    79.7     255     490     880    1250
683              DQ       0    78.3     229     419     732    1000
                 *

684              KK  RD84IS
685              KM   ROUTING FLOWS FROM D84IIS TO CP94DS
686              KM   SLOPE = (2140-2078)/3225
687              RS       1    FLOW      -1
688              RC   0.045   0.030   0.045    3225  0.0192
```

```
689          RX       0      50      99     100     125     126     175     225
690          RY     106     104     102     100     100     102     104     106
691          RL                    0.25     100
             *

692          KK    UC94
693          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
694          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
695          KM    L= .53   Kb= 0.119   S= 108.0
696          BA    .028
697          LG     .25     .36    5.00     .23   13.00
698          UC    .671   1.082
             *

699          KK  CP94DS
700          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
701          KM   FROM RD84IS
702          HC       2
             *

703          KK   R94DS
704          KM   ROUTING FLOW FROM CP94DS TO CP88EN
705          KM   SLOPE = (2078-2041)/1950
706          RS       1    FLOW      -1
707          RC   0.045   0.030   0.045    1950  0.0189
708          RX      60      85      99     100     108     109     123     148
1                                          HEC-1 INPUT
PAGE 18

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

709          RY     106     104     102     100     100     102     104     106
710          RL                    0.25     100
             *

711          KK  D84IIN
712          KM   RECALL DIVERTED FLOW FROM D84II
713          DR  D84IIN
             *

714          KK  RD84IN
715          KM   ROUTING FLOW FROM D84II TO CP88EN
716          KM   SLOPE = (2140-2041)/5175
717          RS       1    FLOW      -1
718          RC   0.045   0.030   0.045    5175  0.0191
719          RX      60      78      90     100     125     132     135     150
720          RY     106     104     102     100     100     102     104     106
721          RL                    0.25     100
             *

722          KK    UC88
723          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
724          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
725          KM    L= 1.08   Kb= 0.104   S=111.0
726          BA    .108
727          LG     .25     .33    6.10     .20   14.00
728          UC    .962   1.337
             *

729          KK  CP88EN
730          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
731          KM    FROM R94DS AND RD84IN
732          HC       3
             *

733          KK    UC95
734          KM   SUBBASIN 95, UNNAMED WASH CENTRAL
735          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
736          KM    L= 0.22   Kb= 0.120   Adj.Slope= 220
737          BA    .024
738          LG     .25     .39    3.70     .15    5.00
```

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 739          UC    .108    .079
              *

 740          KK    UC93
 741          KM   SUBBASIN 93, UNNAMED WASH CENTRAL
 742          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 743          KM    L= .64   Kb= 0.093   S= 135.0
 744          BA    .038
 745          LG     .25     .30    8.00     .07   13.00
 746          UC   1.000   1.677
              *
```


HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 747          KK    UC96
 748          KM   SUBBASIN 96, UNNAMED WASH CENTRAL
 749          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 750          KM    L= .73   Kb= 0.110  S= 113.0
 751          BA    .061
 752          LG     .25     .32    7.00     .12   13.00
 753          UC    .233    .279
              *
              *
 754          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  42        UC8
              .
              .
  51          .         UC9
              .           .
              .           .
  60       CPC8............
              V
              V
  64      RCP89
              .
              .
  74          .       UC18
              .           .
              .           .
  83          .           .        UC19
              .           .           .
              .           .           .
  90    CP1819........................
             V
             V
  93     R1819
             .
             .
 102         .       UC22
             .           .
             .           .
 109         .           .        UC23
             .           .           .
             .           .           .
 116    CP2223........................
             V
             V
 119     R2223
             .
             .
 128         .       UC28
             .          V
             .          V
 135         .        R28
             .           .
             .           .
 144         .           .        UC29
             .           .           .
             .           .           .
 151         .           .           .       UC30
             .           .           .           .
             .           .           .           .
 158    CP2930.......................................
             V
             V
 162     R2930
             .
             .
 171         .       UC34
             .           .
             .           .
 178      CP34............
             V
             V
 182       R34
             .
             .
 191         .       UC37
```

```
                .           .
                .           .
198             .           .        UC35
                .           .           .
                .           .           .
205        CP3537.......................
                V
                V
209         R3537
                .
                .
218             .        UC49
                .           .
                .           .
225             .           .        UC31
                .           .           .
                .           .           .
232        CP3149.......................
                V
                V
236         R3149
                .
                .
245             .        UC46
                .           V
                .           V
254             .         R46
                .           .
                .           .
263             .           .        UC45
                .           .           .
                .           .           .
272             .           .           .        UC47
                .           .           .           .
                .           .           .           .
281             .      CP4547.......................
                .           V
                .           V
285             .       R4547
                .           .
                .           .
294             .           .        UC48
                .           .           .
                .           .           .
301             .           .           .        UC50
                .           .           .           .
                .           .           .           .
308         CP4850.................................
                V
                V
312         R4850
                .
                .
321             .        UC51
                .           .
                .           .
328             .           .        UC57
                .           .           .
                .           .           .
335        CP5157.......................
                V
                V
339         R5157
                .
                .
348             .        UC58
                .           .
                .           .
355             .           .        UC59
                .           .           .
                .           .           .
```

```
362     CP5859.......................
             .
             .
368          .-------->  D5859S
366     D5859N
             V
             V
371     R5859N
             .
             .
380          .        UC63
             .           .
             .           .
387       CP63............
             V
             V
391        R63
             .
             .
399          .        UC66
             .           .
             .           .
406          .           .        UC62
             .           .           .
             .           .           .
413     CP6266.......................
             V
             V
417     R6266
             .
             .
427          .           .<-------  D5859S
425          .      D5859S
             .           V
             .           V
428          .      R5859S
             .           .
             .           .
436          .           .        UC64
             .           .           .
             .           .           .
443          .        CP64............
             .           .
             .           .
450          .           .-------->    D64S
447          .        D64N
             .           V
             .           V
453          .       RD64N
             .           .
             .           .
462          .           .        UC87
             .           .           .
             .           .           .
469          .        CP87............
             .           V
             .           V
473          .       RD87N
             .           .
             .           .
481          .           .        UC82
             .           .           .
             .           .           .
488     CP82.......................
             V
             V
492        R82
             .
             .
503          .-------->    D84S
500     D84N
```

```
                .
                .
506             .        UC84
                .           .
                .           .
513         CP84............
                V
                V
517          R84
                .
                .
526             .        UC79
                .           .
                .           .
535             .           .        UC78
                .           .           .
                .           .           .
544       CP7879........................
                V
                V
548        R7879
                .
                .
557             .        UC77
                .           .
                .           .
566         CP77............
                V
                V
570          R77
                .
                .
579             .        UC89
                .           .
                .           .
588         CP89............
                V
                V
592          R89
                .
                .
601             .        UC74
                .           .
                .           .
608             .           .        UC76
                .           .           .
                .           .           .
615             .      CP7476............
                .           V
                .           V
618             .       R7476
                .           .
                .           .
627             .           .        UC75
                .           .           .
                .           .           .
636             .        CP75............
                .           V
                .           V
640             .         R75
                .           .
                .           .
649             .           .        UC90
                .           .           .
                .           .           .
656             .           .           .        UC91
                .           .           .           .
                .           .           .           .
663       CP90EN.......................................
                .
                .
```

```
669          .           .<-------    D84S
667          .        D84S
             .           V
             .           V
670          .       RD84S
             .           .
             .           .
681          .           .------->  D84IIN
678          .      D84IIS
             .           V
             .           V
684          .      RD84IS
             .           .
             .           .
692          .           .        UC94
             .           .           .
             .           .           .
699          .      CP94DS............
             .           V
             .           V
703          .       R94DS
             .           .
             .           .
713          .           .           .<-------  D84IIN
711          .           .      D84IIN
             .           .           V
             .           .           V
714          .           .      RD84IN
             .           .           .
             .           .           .
722          .           .           .        UC88
             .           .           .           .
             .           .           .           .
729          .      CP88EN......................
             .           .
             .           .
733          .           .        UC95
             .           .           .
             .           .           .
740          .           .           .        UC93
             .           .           .           .
             .           .           .           .
747          .           .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	45.	12.10	7.	2.	1.	.05
+	HYDROGRAPH AT	UC9	46.	12.10	7.	2.	1.	.05
+	2 COMBINED AT	CPC8	90.	12.10	14.	4.	2.	.10
+	ROUTED TO	RCP89	87.	12.20	14.	4.	2.	.10
+	HYDROGRAPH AT	UC18	46.	12.07	5.	1.	1.	.04
+	HYDROGRAPH AT	UC19	29.	12.10	3.	1.	0.	.03
+	3 COMBINED AT	CP1819	151.	12.13	22.	7.	2.	.17
+	ROUTED TO	R1819	148.	12.20	21.	6.	2.	.17
+	HYDROGRAPH AT	UC22	25.	12.13	3.	1.	0.	.03
+	HYDROGRAPH AT	UC23	22.	12.03	2.	0.	0.	.01
+	3 COMBINED AT	CP2223	182.	12.17	26.	8.	3.	.21
+	ROUTED TO	R2223	180.	12.20	26.	8.	3.	.21
+	HYDROGRAPH AT	UC28	70.	12.07	6.	2.	1.	.05
+	ROUTED TO	R28	69.	12.13	6.	2.	1.	.05
+	HYDROGRAPH AT	UC29	41.	12.07	4.	1.	0.	.04
+	HYDROGRAPH AT	UC30	15.	12.07	1.	0.	0.	.01
+	4 COMBINED AT	CP2930	284.	12.17	36.	11.	4.	.31
+	ROUTED TO	R2930	280.	12.20	36.	10.	4.	.31
+	HYDROGRAPH AT	UC34	57.	12.03	4.	1.	0.	.04
+	2 COMBINED AT	CP34	310.	12.17	40.	12.	4.	.35
+	ROUTED TO	R34	299.	12.33	40.	11.	4.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT	UC37	141.	12.27	28.	8.	3.	.21
+	HYDROGRAPH AT	UC35	291.	12.13	33.	10.	4.	.26
+	3 COMBINED AT	CP3537	644.	12.27	100.	29.	10.	.82
+	ROUTED TO	R3537	636.	12.33	100.	29.	10.	.82
+	HYDROGRAPH AT	UC49	74.	12.07	7.	2.	1.	.05
+	HYDROGRAPH AT	UC31	365.	12.20	50.	14.	5.	.41
+	3 COMBINED AT	CP3149	987.	12.27	155.	45.	16.	1.27
+	ROUTED TO	R3149	984.	12.30	155.	45.	16.	1.27
+	HYDROGRAPH AT	UC46	59.	12.03	5.	1.	0.	.03
+	ROUTED TO	R46	57.	12.07	5.	1.	0.	.03
+	HYDROGRAPH AT	UC45	147.	12.03	12.	3.	1.	.09
	HYDROGRAPH AT	UC47	48.	12.03	4.	1.	0.	.03
+	3 COMBINED AT	CP4547	247.	12.03	21.	6.	2.	.15
+	ROUTED TO	R4547	240.	12.10	21.	6.	2.	.15
+	HYDROGRAPH AT	UC48	224.	12.17	28.	8.	3.	.20
+	HYDROGRAPH AT	UC50	27.	12.07	2.	1.	0.	.02
+	4 COMBINED AT	CP4850	1309.	12.20	204.	59.	21.	1.64
+	ROUTED TO	R4850	1298.	12.27	204.	59.	21.	1.64
+	HYDROGRAPH AT	UC51	99.	12.03	8.	2.	1.	.06
+	HYDROGRAPH AT	UC57	40.	12.10	4.	1.	0.	.04
+	3 COMBINED AT	CP5157	1345.	12.27	215.	63.	23.	1.74
+	ROUTED TO	R5157	1336.	12.30	215.	63.	23.	1.74
+	HYDROGRAPH AT	UC58	157.	12.07	15.	4.	1.	.11
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC59	34.	12.10	3.	1.	0.	.03
+	3 COMBINED AT	CP5859	1426.	12.27	232.	67.	24.	1.88
+	DIVERSION TO	D5859S	709.	12.27	115.	33.	12.	1.88
+	HYDROGRAPH AT	D5859N	717.	12.27	117.	34.	12.	1.88
+	ROUTED TO	R5859N	713.	12.30	117.	34.	12.	1.88
+	HYDROGRAPH AT	UC63	142.	12.10	14.	4.	1.	.12
+	2 COMBINED AT	CP63	794.	12.27	130.	38.	14.	2.00
+	ROUTED TO	R63	793.	12.30	130.	37.	13.	2.00
+	HYDROGRAPH AT	UC66	41.	12.10	4.	1.	0.	.04
+	HYDROGRAPH AT	UC62	431.	12.13	43.	12.	4.	.36
+	3 COMBINED AT	CP6266	1182.	12.20	175.	50.	18.	2.40
+	ROUTED TO	R6266	1177.	12.23	175.	50.	18.	2.40
+	HYDROGRAPH AT	D5859S	709.	12.27	115.	33.	12.	1.88
+	ROUTED TO	R5859S	707.	12.30	115.	33.	12.	1.88
+	HYDROGRAPH AT	UC64	3.	12.07	0.	0.	0.	.00
+	2 COMBINED AT	CP64	708.	12.30	115.	33.	12.	1.88
+	DIVERSION TO	D64S	318.	12.30	52.	15.	5.	1.88
+	HYDROGRAPH AT	D64N	389.	12.30	63.	18.	7.	1.88
+	ROUTED TO	RD64N	387.	12.37	63.	18.	7.	1.88
+	HYDROGRAPH AT	UC87	28.	12.07	2.	1.	0.	.03
+	2 COMBINED AT	CP87	395.	12.33	65.	19.	7.	1.91
+	ROUTED TO	RD87N	394.	12.37	65.	19.	7.	1.91
+	HYDROGRAPH AT	UC82	32.	12.03	2.	1.	0.	.02
+	3 COMBINED AT	CP82	1554.	12.23	241.	69.	25.	2.45

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	1550.	12.27	241.	69.	25.	2.45
+	DIVERSION TO	D84S	82.	12.27	3.	1.	0.	2.45
+	HYDROGRAPH AT	D84N	1467.	12.27	238.	68.	25.	2.45
+	HYDROGRAPH AT	UC84	15.	12.07	1.	0.	0.	.01
+	2 COMBINED AT	CP84	1474.	12.23	239.	69.	25.	2.46
+	ROUTED TO	R84	1454.	12.37	239.	68.	25.	2.46
+	HYDROGRAPH AT	UC79	71.	12.07	7.	2.	1.	.08
+	HYDROGRAPH AT	UC78	263.	12.03	21.	6.	2.	.18
+	3 COMBINED AT	CP7879	1531.	12.37	265.	76.	27.	2.72
+	ROUTED TO	R7879	1532.	12.37	265.	76.	27.	2.72
+	HYDROGRAPH AT	UC77	119.	12.07	12.	3.	1.	.10
+	2 COMBINED AT	CP77	1582.	12.33	277.	79.	29.	2.81
+	ROUTED TO	R77	1580.	12.37	276.	79.	29.	2.81
+	HYDROGRAPH AT	UC89	81.	12.07	8.	2.	1.	.07
+	2 COMBINED AT	CP89	1613.	12.37	284.	81.	29.	2.89
+	ROUTED TO	R89	1598.	12.43	284.	81.	29.	2.89
+	HYDROGRAPH AT	UC74	180.	12.10	18.	5.	2.	.15
+	HYDROGRAPH AT	UC76	53.	12.07	5.	1.	0.	.04
+	2 COMBINED AT	CP7476	230.	12.10	23.	6.	2.	.19
+	ROUTED TO	R7476	230.	12.10	23.	6.	2.	.19
+	HYDROGRAPH AT	UC75	233.	12.07	22.	6.	2.	.19
+	2 COMBINED AT	CP75	453.	12.10	44.	12.	4.	.38
+	ROUTED TO	R75	452.	12.10	44.	12.	4.	.38
	HYDROGRAPH AT	UC90	37.	12.07	3.	1.	0.	.04

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC91	82.	12.10	9.	2.	1.	.07
+	4 COMBINED AT	CP90EN	1838.	12.33	337.	96.	35.	3.38
+	HYDROGRAPH AT	D84S	82.	12.27	3.	1.	0.	2.45
+	ROUTED TO	RD84S	84.	12.27	3.	1.	0.	2.45
+	DIVERSION TO	D84IIN	82.	12.27	3.	1.	0.	2.45
+	HYDROGRAPH AT	D84IIS	3.	12.27	0.	0.	0.	2.45
+	ROUTED TO	RD84IS	1.	12.37	0.	0.	0.	2.45
+	HYDROGRAPH AT	UC94	11.	12.50	3.	1.	0.	.03
+	2 COMBINED AT	CP94DS	10.	12.47	3.	1.	0.	2.48
+	ROUTED TO	R94DS	10.	12.60	3.	1.	0.	2.48
+	HYDROGRAPH AT	D84IIN	82.	12.27	3.	1.	0.	2.45
+	ROUTED TO	RD84IN	29.	12.43	3.	1.	0.	2.45
+	HYDROGRAPH AT	UC88	33.	12.73	11.	3.	1.	.11
+	3 COMBINED AT	CP88EN	64.	12.50	17.	5.	2.	2.59
+	HYDROGRAPH AT	UC95	44.	12.00	3.	1.	0.	.02
+	HYDROGRAPH AT	UC93	12.	12.80	5.	1.	1.	.04
+	HYDROGRAPH AT	UC96	70.	12.10	7.	2.	1.	.06

*** NORMAL END OF HEC-1 ***

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1****************************************
*                                      *
    FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
              JUN   1998                *
           VERSION 4.1                  *
*                                      *
*  RUN DATE   16MAR04  TIME  08:41:05   *
*                                      *
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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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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

1
PAGE 1

HEC-1 INPUT

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         UC MODEL - UNNAMED WASH, CENTRAL
  2           ID         100-YEAR 6-HOUR MODEL  FILENAME: UC1006F.DAT
  3           ID         FUTURE CONDITIONS
  4           ID         CAREFREE DRAINAGE MASTER PLAN
  5           ID         FCD 2000C037
  6           ID         BY CH2M HILL
  7           ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  8           ID         JANUARY 2002 (Final Revision March 2004)
  9           ID    ******************************************************************
 10           ID         100 YEAR ANALYSIS 6-HOUR STORM
 11           ID
 12           ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
 13           ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
 14           ID    ******************************************************************
 15           ID      DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
 16           ID
 17           ID      THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
 18           ID
 19           ID
              *DIAGRAM
 20           IT       2                    2000
 21           IO       5
 22           IN      15
 23           JD    3.40    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD   3.378    0.50
 28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 30           PC   0.962   0.972   0.983   0.991   1.000
 31           JD   3.314    2.80
 32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 34           PC   0.950   0.963   0.975   0.988   1.000
 35           JD   3.135    16.0
 36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
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 37          PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 38          PC   0.946   0.960   0.973   0.987   1.000
 39          JD   2.761    90.0
 40          PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
 41          PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
 42          PC   0.927   0.945   0.964   0.982   1.000
 43          JD   1.938   500.0
 44          PC   0.000   0.024   0.043   0.059   0.078   0.098   0.119   0.141   0.162   0.186
 45          PC   0.212   0.239   0.271   0.321   0.408   0.515   0.627   0.735   0.814   0.864
 46          PC   0.907   0.930   0.954   0.977   1.000
             *
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 47          KK    UC8
 48          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 49          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 50          KM    L= 1.04   Kb= 0.031   S=138.0
 51          BA    .054
 52          LG     .30     .36     4.9     .26    36.0
 53          UC    .296    .521
 54          UA       0       5      16      30      65      77      84      90      94      97
 55          UA     100
             *

 56          KK    UC9
 57          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 58          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 59          KM    L= 0.91   Kb= 0.031   S=145.0
 60          BA    .047
 61          LG     .30     .36     5.0     .23    36.0
 62          UC    .267    .416
 63          UA       0       5      16      30      65      77      84      90      94      97
 64          UA     100
             *

 65          KK    CPC89
 66          KM    CONCENTRATION POINT 89
 67          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 68          HC       2
             *

 69          KK   RCP89
 70          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 71          KM    NORMAL DEPTH CHANNEL ROUTING
 72          KM    ENDPOINTS WERE EXTENDED
 73          KM    SLOPE = (2596-2540)/2933
 74          RS       5    FLOW      -1
 75          RC   0.045   0.035   0.045    2933  0.0191
 76          RX       0      90      99     100     108     109     120     200
 77          RY     108     104     102     100     100     102     104     108
 78          RL                    0.15     100
             *

 79          KK    UC18
 80          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 81          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 82          KM    L= 0.56   Kb= 0.034   S=101.0
 83          BA    .040
 84          LG     .25     .36     5.0     .23   26.00
 85          UC    .237    .292
 86          UA       0       5      16      30      65      77      84      90      94      97
 87          UA     100
             *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  88          KK    UC19
  89          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
  90          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  91          KM    L= 0.52   Kb= 0.034   S=135.0
  92          BA    .027
  93          LG     .25     .36    5.00     .23   19.00
  94          UC    .217    .312
              *

  95          KK  CP1819
  96          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
  97          HC       3
              *

  98          KK   R1819
  99          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
 100          KM    ENDPOINTS WERE EXTENDED
 101          KM    SLOPE = (2540-2511)/1790
 102          RS       2    FLOW      -1
 103          RC   0.045   0.030   0.045    1790  0.0162
 104          RX       0      92      99     100     112     113     120     200
 105          RY     108     104     102     100     100     102     104     108
 106          RL                    0.25     100
              *

 107          KK    UC22
 108          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
 109          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 110          KM    L= .76   Kb= .034   S=111.0
 111          BA    .032
 112          LG     .25     .36    5.00     .23   16.00
 113          UC    .279    .513
              *

 114          KK    UC23
 115          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
 116          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 117          KM    L= .40   Kb= 0.034   S=121.0
 118          BA    .013
 119          LG     .25     .36    5.00     .23   20.00
 120          UC    .200    .094
              *

 121          KK  CP2223
 122          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
 123          HC       3
              *

 124          KK   R2223
 125          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
 126          KM    ENDPOINTS WERE EXTENDED
 127          KM    SLOPE = (2511-2482)/1862
 128          RS       2    FLOW      -1
 129          RC   0.045    0.03   0.045    1862  0.0156
1                                          HEC-1 INPUT
PAGE  4

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 130          RX       0      95      99     100     112     113     117     200
 131          RY     108     104     102     100     100     102     104     108
 132          RL                    0.25     100
              *

 133          KK    UC28
 134          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
 135          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 136          KM    L= .57   Kb= 0.029   S=109.0
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137          BA    .055
138          LG     .25     .36    4.90     .25   17.00
139          UC    .237    .189
             *

140          KK     R28
141          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
142          KM    ENDPOINTS WERE EXTENDED
143          KM    SLOPE = (2502-2482)/1296
144          RS       2    FLOW      -1
145          RC   0.045   0.035   0.045    1296  0.0154
146          RX       0      86      99     100     108     109     122     200
147          RY     108     104     102     100     100     102     104     108
148          RL                    0.15     100
             *

149          KK    UC29
150          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
151          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
152          KM    L= .47   Kb= 0.033   S=109.0
153          BA    .035
154          LG     .25     .36    5.00     .23   19.00
155          UC    .217    .248
             *

156          KK   UC30
157          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
158          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
159          KM    L= .28   Kb= 0.034   S=134.0
160          BA    .012
161          LG     .25     .36    5.00     .23   18.00
162          UC    .167    .227
             *

163          KK  CP2930
164          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
165          KM    CP2223
166          HC       4
             *

167          KK   R2930
168          KM   Routing flow from CP2930 to CP34 through subbasin 34
169          KM    SLOPE = (2482-2469)/925
170          KM    ENDPOINTS WERE EXTENDED
171          RS       1    FLOW      -1
172          RC   0.045   0.030   0.045     925  0.0141
1                                          HEC-1 INPUT
PAGE  5

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

173          RX       0      89      99     100     110     111     122     200
174          RY     108     104     102     100     100     102     104     108
175          RL                    0.15     100
             *

176          KK    UC34
177          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
178          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
179          KM    L= .31   Kb = 0.033   S= 117.0
180          BA    .037
181          LG     .25     .36    4.90     .22   21.00
182          UC    .171    .132
183          UA       0       5      16      30      65      77      84      90      94      97
184          UA     100
             *

185          KK    CP34
186          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
187          KM   R2930
188          HC       2
```

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                 *
 189             KK     R34
 190             KM   Routing flow from CP34 to CP3537 through subbasin 37
 191             KM    ENDPOINTS WERE EXTENDED
 192             KM    SLOPE = (2469-2318)/6475
 193             RS      11    FLOW      -1
 194             RC   0.045   0.035   0.045    6475   .0233
 195             RX       0      90      99     100     105     106     115     200
 196             RY     108     104     102     100     100     102     104     108
 197             RL                    0.15     100
                 *

 198             KK    UC37
 199             KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
 200             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 201             KM    L= 2.03   Kb= 0.030   S= 98.0
 202             BA    .207
 203             LG     .25     .39    3.70     .16   24.00
 204             UC    .429    .624
                 *

 205             KK    UC35
 206             KM   SUBBASIN 35, UNNAMED WASH CENTRAL
 207             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 208             KM    L= 1.27   Kb= 0.034   S=138.0
 209             BA    .261
 210             LG     .25     .38    3.90     .20   24.00
 211             UC    .321    .272
                 *
1                                          HEC-1 INPUT
PAGE  6

      LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 212             KK  CP3537
 213             KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
 214             KM    R34
 215             HC       3
                 *

 216             KK   R3537
 217             KM   Routing flow from CP3537 to CP3149 through subbasin 49
 218             KM    ENDPOINTS WERE EXTENDED
 219             KM    SLOPE = (2318-2280)/1829
 220             RS       3    FLOW      -1
 221             RC   0.045   0.035   0.045    1829  0.0208
 222             RX       0      90      99     100     105     106     115     200
 223             RY     108     104     102     100     100     102     104     108
 224             RL                    0.15     100
                 *

 225             KK    UC49
 226             KM   SUBBASIN 49, UNNAMED WASH CENTRAL
 227             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 228             KM    L= .47   Kb= 0.032   S=148.0
 229             BA    .048
 230             LG     .25     .39    3.60     .15   30.00
 231             UC    .188    .179
                 *

 232             KK    UC31
 233             KM   SUBBASIN 31, UNNAMED WASH CENTRAL
 234             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 235             KM    L= 2.04   Kb= 0.028   S= 128.0
 236             BA    .405
 237             LG     .25     .38    4.10     .18   31.00
 238             UC    .379    .373
 239             UA       0       5      16      30      65      77      84      90      94      97
 240             UA     100
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                 *

241              KK  CP3149
242              KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
243              KM     R3537
244              HC       3
                 *

245              KK   R3149
246              KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
247              KM    ENDPOINTS WERE EXTENDED
248              KM    SLOPE = (2280-2256)/1219
249              RS       2    FLOW      -1
250              RC   0.045   0.030   0.045    1219  0.0197
251              RX       0      95      99     100     110     111     118     250
252              RY     110     104     102     100     100     102     104     110
253              RL                    0.15     100
                 *
1                                                HEC-1 INPUT
PAGE  7

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

254              KK    UC46
255              KM   SUBBASIN 46, UNNAMED WASH CENTRAL
256              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
257              KM    L= .30  Kb= 0.061   Adj. Slope= 324.0
258              BA    .034
259              LG     .25     .39    3.60     .15   24.00
260              UC    .167    .132
261              UA       0       5      16      30      65      77      84      90      94      97
262              UA     100
                 *

263              KK     R46
264              KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
265              KM    ENDPOINTS WERE EXTENDED
266              KM    SLOPE = (2346-2315)/1783
267              RS       3    FLOW      -1
268              RC   0.045   0.035   0.045    1783  0.0174
269              RX       0      92      99     100     105     106     113     200
270              RY     108     104     102     100     100     102     104     108
271              RL                    0.15     100
                 *

272              KK    UC45
273              KM   SUBBASIN 45, UNNAMED WASH CENTRAL
274              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
275              KM    L= .48   Kb= 0.030   S= 135.0
276              BA    .086
277              LG     .25     .39    3.60     .15   24.00
278              UC    .192    .134
279              UA       0       5      16      30      65      77      84      90      94      97
280              UA     100
                 *

281              KK    UC47
282              KM   SUBBASIN 47, UNNAMED WASH CENTRAL
283              KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
284              KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
285              BA    .031
286              LG     .25     .39    3.60     .15   24.00
287              UC    .179    .185
288              UA       0       5      16      30      65      77      84      90      94      97
289              UA     100
                 *

290              KK  CP4547
291              KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
292              KM    R46
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 293          HC       3
              *
                                        HEC-1 INPUT
.GE  8

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 294          KK   R4547
 295          KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
 296          KM   ENDPOINTS WERE EXTENDED
 297          KM    SLOPE = (2315-2256)/2170
 298          RS       4    FLOW      -1
 299          RC   0.045   0.035   0.045    2170   .0272
 300          RX       0      90      99     100     105     106     115     200
 301          RY     108     104     102     100     100     102     104     108
 302          RL                    0.15     100
              *

 303          KK    UC48
 304          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 305          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 306          KM    L= .92   Kb= 0.048   S= 117.0
 307          BA    .197
 308          LG     .25     .39    3.70     .16   30.00
 309          UC    .394    .276
              *

 310          KK    UC50
 311          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 312          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 313          KM    L= .27   Kb= 0.037   S= 93.0
 314          BA    .019
 315          LG     .25     .38    3.80     .24   24.00
 316          UC    .179    .183
              *

 317          KK  CP4850
 318          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 319          KM    R3149 AND R4547
 320          HC       4
              *

 321          KK   R4850
 322          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 323          KM    ENDPOINTS WERE EXTENDED
 324          KM    SLOPE = (2256-2235)/1509
 325          RS       2    FLOW      -1
 326          RC   0.045   0.030   0.045    1509  0.0139
 327          RX       0      95      99     100     115     116     120     250
 328          RY     110     104     102     100     100     102     104     110
 329          RL                    0.25     100
              *

 330          KK    UC51
 331          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 332          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 333          KM    L= .42   Kb= 0.042   Adj. Slope= 317.0
 334          BA    .060
 335          LG     .25     .36    5.00     .21   29.00
 336          UC    .158    .119
 337          UA       0       5      16      30      65      77      84      90      94      97
1
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                                        HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 338          UA     100
              *

 339          KK    UC57
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340          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
341          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
342          KM    L= .47   Kb= 0.061   S= 200.0
343          BA    .037
344          LG     .25     .37    4.20     .28   20.00
345          UC    .258    .297
             *

346          KK  CP5157
347          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
348          KM     R4850
349          HC       3
             *

350          KK   R5157
351          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
352          KM    ENDPOINTS WERE EXTENDED
353          KM    SLOPE = (2235-2208)/1796
354          RS       2    FLOW      -1
355          RC   0.045   0.030   0.045    1796  0.0150
356          RX       0      60      99     100     100     121     160     250
357          RY     112     104     102     100     100     102     104     112
358          RL                    0.35     100
             *

359          KK    UC58
360          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
361          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
362          KM    L= .69   Kb= 0.054  Adj. Slope= 317.0
363          BA    .110
364          LG     .25     .37    4.80     .13   20.00
365          UC    .237    .196
             *

366          KK    UC59
367          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
368          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
369          KM    L= .49   Kb= 0.033   S= 112.0
370          BA    .034
371          LG     .25     .32    5.80     .33   16.00
372          UC    .229    .280
             *

373          KK  CP5859
374          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
375          KM     R5157
376          HC       3
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

377          KK  D5859N
378          KM    DIVERSION OF FLOWS AT FLOW SPLIT
379          DT  D5859S
380          DI       0      50     100     500   10000
381          DQ       0    24.9    49.5   248.5    4970
             *

382          KK  R5859N
383          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
384          KM   ENDPOINTS WERE EXTENDED
385          KM    SLOPE = (2208-2195)/699
386          RS       1    FLOW      -1
387          RC   0.045   0.030   0.045     699  0.0186
388          RX       0      50      99     100     110     111     160     250
389          RY     104     103     102     100     100     102     103     104
390          RL                    0.15     100
             *
```

```
391          KK    UC63
392          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
393          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
394          KM    L= .81   Kb= 0.054   Adj. Slope= 322.0
395          BA    .117
396          LG     .25     .36    5.00     .19   19.00
397          UC    .267    .244
             *

398          KK    CP63
399          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
400          KM   FROM RD5859N
401          HC       2
             *

402          KK     R63
403          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
404          KM    SLOPE = (2195-2170)/1394
405          RS       2    FLOW      -1
406          RC   0.045   0.030   0.045    1394  0.0179
407          RX      60      80      99     100     125     126     145     165
408          RY     106     104     102     100     100     102     104     106
409          RL                    0.35     100
             *

410          KK    UC66
411          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
412          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
413          KM    L= .54   Kb= 0.056   Adj. Slope= 324.0
414          BA    .037
415          LG     .25     .36    5.00     .25   15.00
416          UC    .211    .276
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

417          KK    UC62
418          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
419          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
420          KM    L= 1.33   Kb= 0.047   Adj. Slope= 321.0
421          BA    .361
422          LG     .25     .35    6.10     .13   14.00
423          UC    .321    .226
             *

424          KK  CP6266
425          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
426          KM   FROM R63
427          HC       3
             *

428          KK   R6266
429          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
430          KM    SLOPE = (2170-2150)/990
431          RS       2    FLOW      -1
432          RC   0.045   0.030   0.045     990  0.0202
433          RX       0      85      99     100     100     121     135     225
434          RY     106     104     102     100     100     102     104     106
435          RL                    0.35     100
             *

436          KK  D5859S
437          KM   RECALL DIVERTED FLOW FROM D5859N
438          DR  D5859S
             *

439          KK  R5859S
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440          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
441          KM    SLOPE = (2208-2194)/803
442          RS       1    FLOW      -1
443          RC   0.045   0.030   0.045     803  0.0174
444          RX       0      50      99     100     125     126     175     225
445          RY     104     103     102     100     100     102     103     104
446          RL                    0.15     100
             *

447          KK    UC64
448          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
449          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
450          KM    L= .15   Kb= 0.078   S= 166.0
451          BA    .005
452          LG     .25     .31    6.90     .20   17.00
453          UC    .167    .239
             *
1                                          HEC-1 INPUT
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

454          KK    CP64
455          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
456          KM    DIVERSION RD5859N
457          HC       2    1.88
             *

458          KK    D64N
459          KM   DIVERSION OF FLOWS AT FLOW SPLIT
460          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
461          DT    D64S
462          DI       0      50     100     500   10000
463          DQ       0    22.5      45     225    4500
             *

464          KK   RD64N
465          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
466          KM   ENDPOINTS WERE EXTENDED
467          KM    SLOPE = (2194-2161)/1721
468          RS       2    FLOW      -1
469          RC   0.045   0.030   0.045    1721  0.0192
470          RX       0      60      99     100     112     113     152     200
471          RY     106     104     102     100     100     102     104     106
472          RL                    0.25     100
             *

473          KK    UC87
474          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
475          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
476          KM    L= .33   Kb= 0.033   S= 101.0
477          BA    .025
478          LG     .25     .35    3.40     .62    9.00
479          UC    .208    .221
             *

480          KK    CP87
481          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
482          KM    DIVERSION RD64N
483          HC       2
             *

484          KK   RD87N
485          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
486          KM    SLOPE = (2161-2150)/557
487          RS       1    FLOW      -1
488          RC   0.045   0.030   0.045     557  0.0197
489          RX      25      85      99     100     120     121     135     195
490          RY     106     104     102     100     100     102     104     106
491          RL                    0.35     100
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                    *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 492          KK    UC82
 493          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
 494          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 495          KM    L= .22   Kb= 0.047   Adj. Slope= 220.0
 496          BA    .022
 497          LG     .25     .36    4.30    .400   15.00
 498          UC    .150    .120
              *

 499          KK    CP82
 500          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 501          KM   SUBBASIN 82
 502          HC       3    2.45
              *

 503          KK     R82
 504          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 505          KM    SLOPE = (2150-2138)/579
 506          RS       1    FLOW      -1
 507          RC   0.045   0.030   0.045     579  0.0207
 508          RX       0      75      99     100     125     126     150     225
 509          RY     108     104     102     100     100     102     104     108
 510          RL                    0.35     100
              *

 511          KK    D84N
 512          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 513          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 514          DT    D84S
 515          DI       0     500    1275    1550    1964    2475    3223    4000
 516          DQ       0       0       0    79.7     255     490     888    1250
              *

 517          KK    UC84
 518          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 519          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 520          KM    L= .30   Kb= 0.054   Adj. Slope= 246.0
 521          BA    .013
 522          LG     .25     .36    4.50     .35   15.00
 523          UC    .179    .216
              *

 524          KK    CP84
 525          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 526          KM    FROM D84N
 527          HC       2
              *

 528          KK     R84
 529          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 530          KM   ENDPOINTS WERE EXTENDED
 531          KM    SLOPE = (2138-2054)/3463
 532          RS       5    FLOW      -1
 533          RC   0.045   0.030   0.045    3463  0.0243
1                                           HEC-1 INPUT
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 534          RX       0      94      99     100     110     111     116     200
 535          RY     106     104     102     100     100     102     104     106
 536          RL                    0.15     100
              *
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```
537          KK    UC79
538          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
539          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
540          KM    L= .88   Kb= 0.035   Adj. Slope= 233.0
541          BA    .078
542          LG     .25     .35    4.30     .45   19.00
543          UC    .250    .305
544          UA       0       5      16      30      65      77      84      90      94      97
545          UA     100
             *

546          KK    UC78
547          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
548          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
549          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
550          BA    .177
551          LG     .25     .35    6.00     .17   17.00
552          UC    .217    .161
553          UA       0       5      16      30      65      77      84      90      94      97
554          UA     100
             *

555          KK  CP7879
556          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
557          KM    FROM R84
558          HC       3
             *

559          KK   R7879
560          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
561          KM   ENDPOINTS WERE EXTENDED
562          KM    SLOPE = (2054-2048)/256
563          RS       1    FLOW      -1
564          RC   0.045   0.030   0.045     256   .0234
565          RX       0      90      99     100     120     121     130     200
566          RY     106     104     102     100     100     102     104     106
567          RL                    0.35     100
             *

568          KK    UC77
569          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
570          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
571          KM    L= .93   Kb= 0.043  Adj. Slope= 324.0
572          BA    .096
573          LG     .25     .34    6.70     .13   16.00
574          UC    .242    .274
575          UA       0       5      16      30      65      77      84      90      94      97
576          UA     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

577          KK    CP77
578          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
579          KM    FROM R7879
580          HC       2
             *

581          KK     R77
582          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
583          KM   ENDPOINTS WERE EXTENDED
584          KM    SLOPE = (2048-2037)/593
585          RS       1    FLOW      -1
586          RC   0.045   0.030   0.045     593  0.0185
587          RX       0      80      99     100     115     116     120     250
588          RY     106     104     102     100     100     102     104     106
589          RL                    0.25     100
             *
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590          KK    UC89
591          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
592          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
593          KM    L= .77   Kb= 0.031   S= 126.0
594          BA    .073
595          LG     .25     .33    6.40     .20   21.00
596          UC    .254    .291
597          UA       0       5      16      30      65      77      84      90      94      97
598          UA     100
             *

599          KK    CP89
600          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
601          KM    FROM R77
602          HC       2
             *

603          KK     R89
604          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
605          KM   CHANNEL ENDS WERE EXTENDED
606          KM    SLOPE = (2037-2008)/1912
607          RS       2    FLOW      -1
608          RC   0.045   0.030   0.045    1912  0.0152
609          RX       0      80      99     100     115     116     135     250
610          RY     108     104     102     100     100     102     104     108
611          RL                    0.25     100
             *

612          KK    UC74
613          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
614          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
615          KM    L= 1.13   Kb= 0.041   Adj. Slope= 328.0
616          BA    .151
617          LG     .25     .34    6.60     .13   16.00
618          UC    .258    .267
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

619          KK    UC76
620          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
621          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
622          KM    L= .64   Kb= 0.033   Adj. Slope= 302.0
623          BA    .041
624          LG     .25     .35    6.10     .16   15.00
625          UC    .179    .238
             *

626          KK  CP7476
627          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
628          HC       2
             *

629          KK   R7476
630          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
631          KM   END POINTS WERE EXTENDED
632          KM    SLOPE = (2031-2017)/524
633          RS       1    FLOW      -1
634          RC   0.045   0.030   0.045     524  0.0267
635          RX       0      80      99     100     112     113     132     200
636          RY     108     104     102     100     100     102     104     108
637          RL                    0.25     100
             *

638          KK    UC75
639          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
640          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
641          KM    L= 1.38   Kb= 0.031   Adj. Slope= 322.0
642          BA    .192
643          LG     .25      .34    6.50      .15   16.00
644          UC    .250     .263
645          UA       0        5      16       30      65      77      84      90      94      97
646          UA     100
             *

647          KK    CP75
648          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
649          KM    FROM R7476
650          HC       2
             *

651          KK     R75
652          KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
653          KM   END POINTS WERE EXTENDED
654          KM    SLOPE = (2017-2008)/723
655          RS       1    FLOW      -1
656          RC   0.045   0.030   0.045     723  0.0124
657          RX       0      80      99     100     115     116     135     200
658          RY     108     104     102     100     100     102     104     108
659          RL                    0.25     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

660          KK    UC90
661          KM   SUBBASIN 90, UNNAMED WASH CENTRAL
662          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
663          KM    L= .48   Kb= 0.035   S= 151.0
664          BA    .038
665          LG     .25      .35    3.70      .55   20.00
666          UC    .213     .236
             *

667          KK    UC91
668          KM   SUBBASIN 91, UNNAMED WASH CENTRAL
669          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
670          KM    L= .75   Kb= 0.033   S= 109.0
671          BA    .073
672          LG     .25      .31    7.40      .14   23.00
673          UC    .262     .298
             *
             *

674          KK  CP90EN
675          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
676          KM    FROM R89 AND R75
677          HC       4
             *

678          KK    D84S
679          KM   RETREVIAL OF DIVERTED FLOW FROM D84S
680          DR    D84S
             *

681          KK   RD84S
682          KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
683          KM    SLOPE = (2144-2140)/303
684          RS       6    FLOW      -1
685          RC   0.045   0.030   0.045     303  0.0132
686          RX       0      50      99     100     125     126     175     225
687          RY     106     104     102     100     100     102     104     106
688          RL                    0.35     100
             *

689          KK  D84IIS
```

```
690          KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
691          KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
692          DT  D84IIN
693          DI       0    79.7     255     490     880    1250
694          DQ       0    78.3     229     419     732    1000
             *

695          KK  RD84IS
696          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
697          KM   SLOPE = (2140-2078)/3225
698          RS       1    FLOW      -1
699          RC   0.045   0.030   0.045    3225  0.0192
700          RX       0      50      99     100     125     126     175     225
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

701          RY     106     104     102     100     100     102     104     106
702          RL                    0.25     100
             *

703          KK    UC94
704          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
705          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
706          KM    L= .53   Kb= 0.119   S= 108.0
707          BA    .028
708          LG     .25     .36    5.00     .23   13.00
709          UC    .671   1.082
             *

710          KK  CP94DS
711          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
712          KM   FROM RD84IS
713          HC       2
             *

714          KK   R94DS
715          KM   ROUTING FLOW FROM CP94DS TO CP88EN
716          KM   SLOPE = (2078-2041)/1950
717          RS       1    FLOW      -1
718          RC   0.045   0.030   0.045    1950  0.0189
719          RX      60      85      99     100     108     109     123     148
720          RY     106     104     102     100     100     102     104     106
721          RL                    0.25     100
             *

722          KK  D84IIN
723          KM   RECALL DIVERTED FLOW FROM D84II
724          DR  D84IIN
             *

725          KK  RD84IN
726          KM   ROUTING FLOW FROM D84II TO CP88EN
727          KM   SLOPE = (2140-2041)/5175
728          RS       1    FLOW      -1
729          RC   0.045   0.030   0.045    5175  0.0191
730          RX      60      78      90     100     125     132     135     150
731          RY     106     104     102     100     100     102     104     106
732          RL                    0.25     100
             *

733          KK    UC88
734          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
735          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
736          KM    L= 1.08   Kb= 0.104   S=111.0
737          BA    .108
738          LG     .25     .33    6.10     .20   14.00
739          UC    .962   1.337
             *
```

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  740         KK  CP88EN
  741         KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
  742         KM    FROM R94DS AND RD84IN
  743         HC       3
              *

  744         KK    UC95
  745         KM   SUBBASIN 95, UNNAMED WASH CENTRAL
  746         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  747         KM    L= 0.22   Kb= 0.034   Adj.Slope= 220
  748         BA    .024
  749         LG     .25     .39    3.70     .15   19.00
  750         UC    .117    .086
              *

  751         KK    UC93
  752         KM   SUBBASIN 93, UNNAMED WASH CENTRAL
  753         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  754         KM    L= .64   Kb= 0.033   S= 135.0
  755         BA    .038
  756         LG     .25     .30    8.00     .07   20.00
  757         UC    .225    .320
              *

  758         KK    UC96
  759         KM   SUBBASIN 96, UNNAMED WASH CENTRAL
  760         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  761         KM    L= .73   Kb= 0.031  S= 113.0
  762         BA    .061
  763         LG     .25     .32    7.00     .12   18.00
  764         UC    .250    .307
              *
              *
  765         ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  47        UC8
            .
            .
  56        .         UC9
            .           .
            .           .
  65      CPC8............
            V
            V
  69     RCP89
            .
            .
  79        .        UC18
            .           .
            .           .
  88        .           .        UC19
            .           .           .
            .           .           .
  95    CP1819......................
            V
            V
  98     R1819
            .
            .
 107        .        UC22
            .           .
            .           .
 114        .           .        UC23
            .           .           .
            .           .           .
 121    CP2223......................
            V
            V
 124     R2223
            .
            .
 133        .        UC28
            .           V
            .           V
 140        .         R28
            .           .
            .           .
 149        .           .        UC29
            .           .           .
            .           .           .
 156        .           .           .       UC30
            .           .           .           .
            .           .           .           .
 163    CP2930.................................
            V
            V
 167     R2930
            .
            .
 176        .        UC34
            .           .
            .           .
 185      CP34............
            V
            V
 189       R34
            .
            .
 198        .        UC37
```

```
                .           .
                .           .
205             .           .        UC35
                .           .           .
                .           .           .
212       CP3537.......................
                V
                V
216        R3537
                .
                .
225             .        UC49
                .           .
                .           .
232             .           .        UC31
                .           .           .
                .           .           .
241       CP3149.......................
                V
                V
245        R3149
                .
                .
254             .        UC46
                .           V
                .           V
263             .         R46
                .           .
                .           .
272             .           .        UC45
                .           .           .
                .           .           .
281             .           .           .        UC47
                .           .           .           .
                .           .           .           .
290             .      CP4547.......................
                .           V
                .           V
294             .       R4547
                .           .
                .           .
303             .           .        UC48
                .           .           .
                .           .           .
310             .           .           .        UC50
                .           .           .           .
                .           .           .           .
317       CP4850.................................
                V
                V
321        R4850
                .
                .
330             .        UC51
                .           .
                .           .
339             .           .        UC57
                .           .           .
                .           .           .
346       CP5157.......................
                V
                V
350        R5157
                .
                .
359             .        UC58
                .           .
                .           .
366             .           .        UC59
                .           .           .
                .           .           .
```

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373      CP5859.......................
              .
              .
379           .-------->  D5859S
377      D5859N
              V
              V
382      R5859N
              .
              .
391           .        UC63
              .           .
              .           .
398        CP63............
              V
              V
402         R63
              .
              .
410           .        UC66
              .           .
              .           .
417           .           .        UC62
              .           .           .
              .           .           .
424      CP6266.......................
              V
              V
428       R6266
              .
              .
438           .           .<-------  D5859S
436           .      D5859S
              .           V
              .           V
439           .      R5859S
              .           .
              .           .
447           .           .        UC64
              .           .           .
              .           .           .
454           .        CP64............
              .           .
              .           .
461           .           .-------->    D64S
458           .        D64N
              .           V
              .           V
464           .       RD64N
              .           .
              .           .
473           .           .        UC87
              .           .           .
              .           .           .
480           .        CP87............
              .           V
              .           V
484           .       RD87N
              .           .
              .           .
492           .           .        UC82
              .           .           .
              .           .           .
499        CP82........................
              V
              V
503         R82
              .
              .
514           .-------->    D84S
511        D84N
```

```
                .
                .
517             .        UC84
                .           .
                .           .
524         CP84............
                V
                V
528          R84
                .
                .
537             .        UC79
                .           .
                .           .
546             .           .        UC78
                .           .           .
                .           .           .
555       CP7879........................
                V
                V
559        R7879
                .
                .
568             .        UC77
                .           .
                .           .
577         CP77............
                V
                V
581          R77
                .
                .
590             .        UC89
                .           .
                .           .
599         CP89............
                V
                V
603          R89
                .
                .
612             .        UC74
                .           .
                .           .
619             .           .        UC76
                .           .           .
                .           .           .
626             .      CP7476............
                .           V
                .           V
629             .       R7476
                .           .
                .           .
638             .           .        UC75
                .           .           .
                .           .           .
647             .        CP75............
                .           V
                .           V
651             .         R75
                .           .
                .           .
660             .           .        UC90
                .           .           .
                .           .           .
667             .           .           .        UC91
                .           .           .           .
                .           .           .           .
674       CP90EN.................................
                .
                .
```

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680          .          .<-------    D84S
678          .       D84S
             .          V
             .          V
681          .      RD84S
             .          .
             .          .
692          .          .-------> D84IIN
689          .     D84IIS
             .          V
             .          V
695          .     RD84IS
             .          .
             .          .
703          .          .        UC94
             .          .           .
             .          .           .
710          .     CP94DS............
             .          V
             .          V
714          .      R94DS
             .          .
             .          .
724          .          .           .<-------  D84IIN
722          .          .      D84IIN
             .          .           V
             .          .           V
725          .          .      RD84IN
             .          .           .
             .          .           .
733          .          .           .        UC88
             .          .           .           .
             .          .           .           .
740          .     CP88EN.......................
             .          .
             .          .
744          .          .        UC95
             .          .           .
             .          .           .
751          .          .           .        UC93
             .          .           .           .
             .          .           .           .
758          .          .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	82.	4.13	13.	3.	1.	.05
+	HYDROGRAPH AT	UC9	83.	4.10	12.	3.	1.	.05
+	2 COMBINED AT	CPC8	164.	4.10	25.	6.	2.	.10
+	ROUTED TO	RCP89	162.	4.20	25.	6.	2.	.10
+	HYDROGRAPH AT	UC18	85.	4.07	9.	2.	1.	.04
+	HYDROGRAPH AT	UC19	54.	4.10	6.	2.	1.	.03
+	3 COMBINED AT	CP1819	287.	4.13	40.	10.	4.	.17
+	ROUTED TO	R1819	285.	4.20	40.	10.	4.	.17
+	HYDROGRAPH AT	UC22	47.	4.17	7.	2.	1.	.03
+	HYDROGRAPH AT	UC23	41.	4.03	3.	1.	0.	.01
+	3 COMBINED AT	CP2223	356.	4.17	50.	12.	4.	.21
+	ROUTED TO	R2223	354.	4.20	50.	12.	4.	.21
+	HYDROGRAPH AT	UC28	135.	4.10	12.	3.	1.	.05
+	ROUTED TO	R28	133.	4.13	12.	3.	1.	.05
+	HYDROGRAPH AT	UC29	79.	4.10	8.	2.	1.	.04
+	HYDROGRAPH AT	UC30	29.	4.07	3.	1.	0.	.01
+	4 COMBINED AT	CP2930	573.	4.17	72.	18.	6.	.31
+	ROUTED TO	R2930	566.	4.20	71.	18.	6.	.31
+	HYDROGRAPH AT	UC34	112.	4.03	8.	2.	1.	.04
+	2 COMBINED AT	CP34	630.	4.17	80.	20.	7.	.35
+	ROUTED TO	R34	593.	4.40	80.	20.	7.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC37	276.	4.30	51.	13.	5.	.21
+	HYDROGRAPH AT	UC35	549.	4.17	63.	16.	6.	.26
+	3 COMBINED AT	CP3537	1152.	4.27	187.	47.	17.	.82
+	ROUTED TO	R3537	1146.	4.33	187.	47.	17.	.82
+	HYDROGRAPH AT	UC49	134.	4.07	13.	3.	1.	.05
+	HYDROGRAPH AT	UC31	748.	4.13	102.	26.	9.	.41
+	3 COMBINED AT	CP3149	1668.	4.27	292.	74.	27.	1.27
+	ROUTED TO	R3149	1663.	4.30	292.	74.	27.	1.27
+	HYDROGRAPH AT	UC46	107.	4.03	9.	2.	1.	.03
+	ROUTED TO	R46	104.	4.07	9.	2.	1.	.03
+	HYDROGRAPH AT	UC45	266.	4.03	22.	5.	2.	.09
+	HYDROGRAPH AT	UC47	87.	4.03	8.	2.	1.	.03
+	3 COMBINED AT	CP4547	451.	4.03	38.	10.	3.	.15
+	ROUTED TO	R4547	440.	4.10	38.	10.	3.	.15
+	HYDROGRAPH AT	UC48	410.	4.20	51.	13.	5.	.20
+	HYDROGRAPH AT	UC50	51.	4.07	4.	1.	0.	.02
+	4 COMBINED AT	CP4850	2120.	4.27	376.	95.	34.	1.64
+	ROUTED TO	R4850	2113.	4.30	376.	95.	34.	1.64
+	HYDROGRAPH AT	UC51	190.	4.03	15.	4.	1.	.06
+	HYDROGRAPH AT	UC57	74.	4.13	8.	2.	1.	.04
+	3 COMBINED AT	CP5157	2189.	4.30	396.	100.	36.	1.74
+	ROUTED TO	R5157	2180.	4.33	396.	100.	36.	1.74
	HYDROGRAPH AT	UC58	284.	4.10	27.	7.	2.	.11

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC59	67.	4.10	7.	2.	1.	.03
+	3 COMBINED AT	CP5859	2315.	4.30	425.	107.	39.	1.88
+	DIVERSION TO	D5859S	1151.	4.30	211.	53.	19.	1.88
+	HYDROGRAPH AT	D5859N	1164.	4.30	214.	54.	19.	1.88
+	ROUTED TO	R5859N	1160.	4.33	214.	54.	19.	1.88
+	HYDROGRAPH AT	UC63	262.	4.13	27.	7.	2.	.12
+	2 COMBINED AT	CP63	1285.	4.33	237.	60.	22.	2.00
+	ROUTED TO	R63	1283.	4.33	237.	60.	22.	2.00
+	HYDROGRAPH AT	UC66	78.	4.10	8.	2.	1.	.04
+	HYDROGRAPH AT	UC62	819.	4.13	83.	21.	8.	.36
+	3 COMBINED AT	CP6266	1742.	4.27	318.	80.	29.	2.40
+	ROUTED TO	R6266	1740.	4.30	318.	80.	29.	2.40
+	HYDROGRAPH AT	D5859S	1151.	4.30	211.	53.	19.	1.88
+	ROUTED TO	R5859S	1147.	4.33	211.	53.	19.	1.88
+	HYDROGRAPH AT	UC64	12.	4.07	1.	0.	0.	.00
+	2 COMBINED AT	CP64	1152.	4.33	212.	54.	19.	1.88
+	DIVERSION TO	D64S	519.	4.33	95.	24.	9.	1.88
+	HYDROGRAPH AT	D64N	634.	4.33	117.	29.	11.	1.88
+	ROUTED TO	RD64N	630.	4.40	117.	29.	11.	1.88
+	HYDROGRAPH AT	UC87	50.	4.10	4.	1.	0.	.03
+	2 COMBINED AT	CP87	643.	4.40	120.	30.	11.	1.90
+	ROUTED TO	RD87N	643.	4.40	120.	30.	11.	1.90
+	HYDROGRAPH AT	UC82	63.	4.03	4.	1.	0.	.02
	3 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CP82	2343.	4.33	439.	111.	40.	2.45
	ROUTED TO	R82	2340.	4.33	439.	111.	40.	2.45
+	DIVERSION TO	D84S	432.	4.33	38.	9.	3.	2.45
+	HYDROGRAPH AT	D84N	1908.	4.33	401.	101.	36.	2.45
+	HYDROGRAPH AT	UC84	30.	4.07	3.	1.	0.	.01
+	2 COMBINED AT	CP84	1919.	4.33	403.	102.	37.	2.46
+	ROUTED TO	R84	1909.	4.47	403.	102.	37.	2.46
+	HYDROGRAPH AT	UC79	145.	4.10	15.	4.	1.	.08
+	HYDROGRAPH AT	UC78	491.	4.07	40.	10.	4.	.18
+	3 COMBINED AT	CP7879	2076.	4.37	450.	114.	41.	2.72
+	ROUTED TO	R7879	2075.	4.37	450.	114.	41.	2.72
+	HYDROGRAPH AT	UC77	215.	4.07	22.	6.	2.	.10
	2 COMBINED AT	CP77	2169.	4.37	470.	119.	43.	2.81
+	ROUTED TO	R77	2165.	4.40	470.	119.	43.	2.81
+	HYDROGRAPH AT	UC89	153.	4.10	17.	4.	1.	.07
+	2 COMBINED AT	CP89	2233.	4.37	484.	122.	44.	2.89
+	ROUTED TO	R89	2223.	4.43	483.	122.	44.	2.89
+	HYDROGRAPH AT	UC74	331.	4.13	35.	9.	3.	.15
+	HYDROGRAPH AT	UC76	97.	4.07	9.	2.	1.	.04
+	2 COMBINED AT	CP7476	426.	4.10	44.	11.	4.	.19
+	ROUTED TO	R7476	424.	4.13	44.	11.	4.	.19
+	HYDROGRAPH AT	UC75	431.	4.07	44.	11.	4.	.19
+	2 COMBINED AT	CP75	852.	4.10	88.	22.	8.	.38
	ROUTED TO	R75	841.	4.13	88.	22.	8.	.38

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC90	78.	4.10	7.	2.	1.	.04
+	HYDROGRAPH AT	UC91	153.	4.13	18.	4.	2.	.07
+	4 COMBINED AT	CP90EN	2692.	4.37	578.	146.	53.	3.38
+	HYDROGRAPH AT	D84S	432.	4.33	38.	9.	3.	2.45
+	ROUTED TO	RD84S	432.	4.33	38.	9.	3.	2.45
+	*DIVERSION TO*	D84IIN	372.	4.33	33.	8.	3.	2.45
+	HYDROGRAPH AT	D84IIS	60.	4.33	4.	1.	0.	2.45
+	ROUTED TO	RD84IS	47.	4.50	4.	1.	0.	2.45
+	HYDROGRAPH AT	UC94	22.	4.50	6.	1.	1.	.03
+	2 COMBINED AT	CP94DS	63.	4.50	9.	2.	1.	2.48
+	ROUTED TO	R94DS	61.	4.57	9.	2.	1.	2.48
+	HYDROGRAPH AT	D84IIN	372.	4.33	33.	8.	3.	2.45
+	ROUTED TO	RD84IN	320.	4.50	33.	8.	3.	2.45
+	HYDROGRAPH AT	UC88	69.	4.77	23.	6.	2.	.11
+	3 COMBINED AT	CP88EN	416.	4.53	61.	15.	6.	2.59
+	HYDROGRAPH AT	UC95	82.	4.00	6.	1.	1.	.02
+	HYDROGRAPH AT	UC93	82.	4.10	10.	2.	1.	.04
+	HYDROGRAPH AT	UC96	128.	4.13	15.	4.	1.	.06

*** NORMAL END OF HEC-1 ***

```
1*************************************
 *                                   *
    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
              JUN  1998               *
            VERSION 4.1               *
 *                                   *
 * RUN DATE   16MAR04  TIME  08:40:22 *
 *                                   *
 *************************************
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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
```

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

1
PAGE 1

HEC-1 INPUT

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID         UC MODEL - UNNAMED WASH, CENTRAL
   2          ID         100-YEAR 24-HOUR MODEL  FILENAME: UC10024F.DAT
   3          ID         FUTURE CONDITIONS
   4          ID         CAREFREE DRAINAGE MASTER PLAN
   5          ID         FCD 2000C037
   6          ID         BY CH2M HILL
   7          ID         FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
   8          ID         JANUARY 2002 (Final Revision March 2004)
   9          ID    ****************************************************************
  10          ID         100 YEAR ANALYSIS 24-HOUR STORM
  11          ID
  12          ID         GREEN AND AMPT LOSS RATE METHOD, NMIN=2
  13          ID         CLARK UNIT HYDROGRAPH, NORMAL DEPTH CHANNEL ROUTING
  14          ID    ****************************************************************
  15          ID      DEPTH-AREA REDUCT FACTORS BASED ON TABLE 2.1a OF FCDMC MANUAL
  16          ID
  17          ID      THE RAINFALL WAS PRODUCED BY DDMSW v 2.1
  18          ID
  19          ID
              *DIAGRAM
  20          IT       2                    2000
  21          IO       5
  22          IN      15
  23          JD    4.60    0.01
  24          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  25          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  26          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  27          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  28          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  29          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  30          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
  31          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
  32          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
  33          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
  34          JD   4.324   10.00
  35          JD   4.140   30.00
  36          JD   3.956   60.00
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 37          JD   3.892   90.00
 38          JD   3.836  120.00
 39          JD   3.795  150.00
 40          JD   3.680  300.00
 41          JD   3.588  500.00
             *

 42          KK     UC8
 43          KM   SUB-BASIN 8, UNNAMED WASH CENTRAL
 44          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 45          KM    L= 1.04   Kb= 0.031   S=138.0
 46          BA    .054
 47          LG     .30     .36     4.9     .26    36.0
 48          UC    .225    .384
 49          UA       0       5      16      30      65      77      84      90      94      97
 50          UA     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 51          KK     UC9
 52          KM    SUBBASIN 9, UNNAMED WASH CENTRAL
 53          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 54          KM    L= 0.91   Kb= 0.031   S=145.0
 55          BA    .047
 56          LG     .30     .36     5.0     .23    36.0
 57          UC    .208    .316
 58          UA       0       5      16      30      65      77      84      90      94      97
 59          UA     100
             *

 60          KK    CPC8
 61          KM    CONCENTRATION POINT 89
 62          KM    COMBINES RUNOFF FROM SUBBASINS UC8 AND UC9
 63          HC       2
             *

 64          KK   RCP89
 65          KM    ROUTING REACH FROM CP89 TO CP1819 THROUGH SUBBASIN 18
 66          KM    NORMAL DEPTH CHANNEL ROUTING
 67          KM    ENDPOINTS WERE EXTENDED
 68          KM    SLOPE = (2596-2540)/2933
 69          RS       5    FLOW      -1
 70          RC   0.045   0.035   0.045    2933  0.0191
 71          RX       0      90      99     100     108     109     120     200
 72          RY     108     104     102     100     100     102     104     108
 73          RL                    0.15     100
             *

 74          KK    UC18
 75          KM    SUBBASIN 18, UNNAMED WASH CENTRAL
 76          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 77          KM    L= 0.56   Kb= 0.034   S=101.0
 78          BA    .040
 79          LG     .25     .36     5.0     .23   26.00
 80          UC    .183    .219
 81          UA       0       5      16      30      65      77      84      90      94      97
 82          UA     100
             *

 83          KK    UC19
 84          KM    SUBBASIN 19, UNNAMED WASH CENTRAL
 85          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 86          KM    L= 0.52   Kb= 0.034   S=135.0
 87          BA    .027
 88          LG     .25     .36    5.00     .23   19.00
 89          UC    .167    .233
             *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  90          KK  CP1819
  91          KM     COMBINES RUNOFF FROM SUBBASINS UC18, UC19 AND RCP89
  92          HC       3
              *

  93          KK   R1819
  94          KM    ROUTING REACH FROM CP1819 TO CP2223 THROUGH SUBBASIN 23
  95          KM    ENDPOINTS WERE EXTENDED
  96          KM    SLOPE = (2540-2511)/1790
  97          RS       2    FLOW      -1
  98          RC   0.045   0.030   0.045    1790  0.0162
  99          RX       0      92      99     100     112     113     120     200
 100          RY     108     104     102     100     100     102     104     108
 101          RL                    0.25     100
              *

 102          KK    UC22
 103          KM   SUBBASIN 22, UNNAMED WASH CENTRAL
 104          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 105          KM    L= .76   Kb= .034   S=111.0
 106          BA    .032
 107          LG     .25     .36    5.00     .23   16.00
 108          UC    .213    .379
              *

 109          KK    UC23
 110          KM   SUBBASIN 23, UNNAMED WASH CENTRAL
 111          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 112          KM    L= .40   Kb= 0.034   S=121.0
 113          BA    .013
 114          LG     .25     .36    5.00     .23   20.00
 115          UC    .154    .070
              *

 116          KK  CP2223
 117          KM    COMBINE ROUTED FLOW FROM CP1819 WITH RUNOFF FROM SUBBASINS 22 AND 23
 118          HC       3
              *

 119          KK   R2223
 120          KM    ROUTING REACH FROM CP2223 TO CP2930 THROUGH SUBBASIN 29
 121          KM    ENDPOINTS WERE EXTENDED
 122          KM    SLOPE = (2511-2482)/1862
 123          RS       2    FLOW      -1
 124          RC   0.045    0.03   0.045    1862  0.0156
 125          RX       0      95      99     100     112     113     117     200
 126          RY     110     104     102     100     100     102     104     110
 127          RL                    0.25     100
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 128          KK    UC28
 129          KM   SUBBASIN 28, UNNAMED WASH CENTRAL, COMBINED 24 THROUGH 28
 130          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 131          KM    L= .57   Kb= 0.029   S=109.0
 132          BA    .055
 133          LG     .25     .36    4.90     .25   17.00
 134          UC    .183    .142
              *

 135          KK     R28
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136          KM    ROUTING REACH FROM CP1028 TO CP2930 THROUGH SUBBASIN 30
137          KM    ENDPOINTS WERE EXTENDED
138          KM    SLOPE = (2502-2482)/1296
139          RS       2    FLOW      -1
140          RC   0.045   0.035   0.045    1296  0.0154
141          RX       0      86      99     100     108     109     122     200
142          RY     110     104     102     100     100     102     104     110
143          RL                    0.15     100
             *

144          KK    UC29
145          KM   SUBBASIN 29, UNNAMED WASH CENTRAL
146          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
147          KM    L= .47   Kb= 0.033   S=109.0
148          BA    .035
149          LG     .25     .36    5.00     .23   19.00
150          UC    .167    .185
             *

151          KK   UC30
152          KM   SUBBASIN 30, UNNAMED WASH CENTRAL
153          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
154          KM    L= .28   Kb= 0.034   S=134.0
155          BA    .012
156          LG     .25     .36    5.00     .23   18.00
157          UC    .125    .165
             *

158          KK  CP2930
159          KM    COMBINE SUBBASIN RUNOFF FROM 28, 29, 30 WITH ROUTED FLOWS FROM
160          KM    CP2223
161          HC       4
             *

162          KK   R2930
163          KM   Routing flow from CP2930 to CP34 through subbasin 34
164          KM    SLOPE = (2482-2469)/925
165          KM    ENDPOINTS WERE EXTENDED
166          RS       1    FLOW      -1
167          RC   0.045   0.030   0.045     925  0.0141
168          RX       0      89      99     100     110     111     122     200
169          RY     110     104     102     100     100     102     104     110
170          RL                    0.15     100
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

171          KK    UC34
172          KM   SUBBASIN 34, UNNAMED WASH CENTRAL, COMBINED 33 AND 34
173          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
174          KM    L= .31   Kb = 0.033   S= 117.0
175          BA    .037
176          LG     .25     .36    4.90     .22   21.00
177          UC    .129    .097
178          UA       0       5      16      30      65      77      84      90      94      97
179          UA     100
             *

180          KK    CP34
181          KM    COMBINE SUBBASIN RUNOFF FROM 34 WITH ROUTED FLOWS FROM
182          KM   R2930
183          HC       2
             *

184          KK     R34
185          KM   Routing flow from CP34 to CP3537 through subbasin 37
186          KM    ENDPOINTS WERE EXTENDED
187          KM    SLOPE = (2469-2318)/6475
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```
188          RS      11    FLOW      -1
189          RC   0.045   0.035   0.045    6475   .0233
190          RX       0      90      99     100     105     106     115     200
191          RY     110     104     102     100     100     102     104     110
192          RL                    0.15     100
             *

193          KK    UC37
194          KM   SUBBASIN 37, UNNAMED WASH CENTRAL, COMBINED 32 AND 37
195          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
196          KM    L= 2.03   Kb= 0.030   S= 98.0
197          BA    .207
198          LG     .25     .39    3.70     .16   24.00
199          UC    .346    .491
             *

200          KK    UC35
201          KM   SUBBASIN 35, UNNAMED WASH CENTRAL
202          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
203          KM    L= 1.27   Kb= 0.034   S=138.0
204          BA    .261
205          LG     .25     .38    3.90     .20   24.00
206          UC    .246    .202
             *

207          KK  CP3537
208          KM    COMBINE SUBBASIN RUNOFF FROM 35, 37 WITH ROUTED FLOWS FROM
209          KM    R34
210          HC       3
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

211          KK   R3537
212          KM   Routing flow from CP3537 to CP3149 through subbasin 49
213          KM    ENDPOINTS WERE EXTENDED
214          KM    SLOPE = (2318-2280)/1829
215          RS       3    FLOW      -1
216          RC   0.045   0.035   0.045    1829  0.0208
217          RX       0      90      99     100     105     106     115     200
218          RY     110     104     102     100     100     102     104     110
219          RL                    0.15     100
             *

220          KK    UC49
221          KM   SUBBASIN 49, UNNAMED WASH CENTRAL
222          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
223          KM    L= .47   Kb= 0.032   S=148.0
224          BA    .048
225          LG     .25     .39    3.60     .15   30.00
226          UC    .146    .135
             *

227          KK    UC31
228          KM   SUBBASIN 31, UNNAMED WASH CENTRAL
229          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
230          KM    L= 2.04   Kb= 0.028   S= 128.0
231          BA    .405
232          LG     .25     .38    4.10     .18   31.00
233          UC    .300    .288
234          UA       0       5      16      30      65      77      84      90      94      97
235          UA     100
             *

236          KK  CP3149
237          KM     COMBINE RUNOFF FROM SUBBASINS 31,49 WITH ROUTED FLOWS FROM
238          KM     R3537
239          HC       3
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                 *

 240             KK   R3149
 241             KM    ROUTING REACH FROM CP3149 TO CP4850 THROUGH SUBBASIN 50
 242             KM    ENDPOINTS WERE EXTENDED
 243             KM    SLOPE = (2280-2256)/1219
 244             RS       2    FLOW      -1
 245             RC   0.045   0.030   0.045    1219  0.0197
 246             RX       0      95      99     100     110     111     118     250
 247             RY     112     104     102     100     100     102     104     112
 248             RL                    0.15     100
                 *

 249             KK    UC46
 250             KM   SUBBASIN 46, UNNAMED WASH CENTRAL
 251             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 252             KM    L= .30  Kb= 0.061   Adj. Slope= 324.0
 253             BA    .034
 254             LG     .25     .39    3.60     .15   24.00
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LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 255             UC    .129    .100
 256             UA       0       5      16      30      65      77      84      90      94      97
 257             UA     100
                 *

 258             KK     R46
 259             KM   ROUTING FLOW FROM SUBBASIN 46 TO CP4547 THROUGH SUBBASIN 45
 260             KM    ENDPOINTS WERE EXTENDED
 261             KM    SLOPE = (2346-2315)/1783
 262             RS       3    FLOW      -1
 263             RC   0.045   0.035   0.045    1783  0.0174
 264             RX       0      92      99     100     105     106     113     200
 265             RY     110     104     102     100     100     102     104     110
 266             RL                    0.15     100
                 *

 267             KK    UC45
 268             KM   SUBBASIN 45, UNNAMED WASH CENTRAL
 269             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 270             KM    L= .48   Kb= 0.030   S= 135.0
 271             BA    .086
 272             LG     .25     .39    3.60     .15   24.00
 273             UC    .150    .102
 274             UA       0       5      16      30      65      77      84      90      94      97
 275             UA     100
                 *

 276             KK    UC47
 277             KM   SUBBASIN 47, UNNAMED WASH CENTRAL
 278             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 279             KM    L= .39   Kb= 0.056   Adj. Slope= 324.0
 280             BA    .031
 281             LG     .25     .39    3.60     .15   24.00
 282             UC    .142    .143
 283             UA       0       5      16      30      65      77      84      90      94      97
 284             UA     100
                 *

 285             KK  CP4547
 286             KM    COMBINE SUBBASIN RUNOFF FROM 45, 47 WITH ROUTED FLOWS FROM
 287             KM    R46
 288             HC       3
                 *

 289             KK   R4547
 290             KM   ROUTING FLOW FROM CP4547 TO CP4850 THROUGH SUBBASIN 48
 291             KM   ENDPOINTS WERE EXTENDED
```

```
 292          KM    SLOPE = (2315-2256)/2170
 293          RS       4    FLOW      -1
 294          RC   0.045   0.035   0.045    2170   .0272
 295          RX       0      90      99     100     105     106     115     200
 296          RY     110     104     102     100     100     102     104     110
 297          RL                    0.15     100
              *
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      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 298          KK    UC48
 299          KM   SUBBASIN 48, UNNAMED WASH CENTRAL, COMBINED 48 AND 56
 300          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 301          KM    L= .92   Kb= 0.048   S= 117.0
 302          BA    .197
 303          LG     .25     .39    3.70     .16   30.00
 304          UC    .275    .209
              *

 305          KK    UC50
 306          KM   SUBBASIN 50, UNNAMED WASH CENTRAL, COMBINED 50 AND 98
 307          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 308          KM    L= .27   Kb= 0.037   S= 93.0
 309          BA    .019
 310          LG     .25     .38    3.80     .24   24.00
 311          UC    .138    .136
              *

 312          KK  CP4850
 313          KM    COMBINE SUBBASIN RUNOFF FROM 48, 50 WITH ROUTED FLOWS FROM
 314          KM    R3149 AND R4547
 315          HC       4
              *

 316          KK   R4850
 317          KM   Routing flow from CP4850 to CP5157 through subbasin 57
 318          KM    ENDPOINTS WERE EXTENDED
 319          KM    SLOPE = (2256-2235)/1509
 320          RS       2    FLOW      -1
 321          RC   0.045   0.030   0.045    1509  0.0139
 322          RX       0      95      99     100     115     116     120     200
 323          RY     110     104     102     100     100     102     104     110
 324          RL                    0.25     100
              *

 325          KK    UC51
 326          KM   SUBBASIN 51, UNNAMED WASH CENTRAL
 327          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 328          KM    L= .42   Kb= 0.042   Adj. Slope= 317.0
 329          BA    .060
 330          LG     .25     .36    5.00     .21   29.00
 331          UC    .129    .092
 332          UA       0       5      16      30      65      77      84      90      94      97
 333          UA     100
              *

 334          KK    UC57
 335          KM   SUBBASIN 57, UNNAMED WASH CENTRAL
 336          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 337          KM    L= .47   Kb= 0.061   S= 200.0
 338          BA    .037
 339          LG     .25     .37    4.20     .28   20.00
 340          UC    .196    .219
              *
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      LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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341          KK  CP5157
342          KM     COMBINE RUNOFF FROM SUBBASINS 51,57 WITH ROUTED FLOWS FROM
343          KM     R4850
344          HC       3
             *

345          KK   R5157
346          KM    ROUTING REACH FROM CP5157 TO CP5859 THROUGH SUBBASIN 59
347          KM    ENDPOINTS WERE EXTENDED
348          KM    SLOPE = (2235-2208)/1796
349          RS       2    FLOW      -1
350          RC   0.045   0.030   0.045    1796  0.0150
351          RX       0      60      99     100     100     121     160     220
352          RY     112     104     102     100     100     102     104     112
353          RL                    0.35     100
             *

354          KK    UC58
355          KM   SUBBASIN 58, UNNAMED WASH CENTRAL
356          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
357          KM    L= .69   Kb= 0.054  Adj. Slope= 317.0
358          BA    .110
359          LG     .25     .37    4.80     .13   20.00
360          UC    .183    .147
             *

361          KK    UC59
362          KM   SUBBASIN 59, UNNAMED WASH CENTRAL
363          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
364          KM    L= .49   Kb= 0.033   S= 112.0
365          BA    .034
366          LG     .25     .32    5.80     .33   16.00
367          UC    .171    .202
             *

368          KK  CP5859
369          KM     COMBINE RUNOFF FROM SUBBASINS 58,59 WITH ROUTED FLOWS FROM
370          KM     R5157
371          HC       3
             *

372          KK  D5859N
373          KM    DIVERSION OF FLOWS AT FLOW SPLIT
374          DT  D5859S
375          DI       0      50     100     500   10000
376          DQ       0    24.9    49.5   248.5    4970
             *

377          KK  R5859N
378          KM   ROUTE DIVERTED FLOW FROM CP5859 TO CP63 THROUGH 63
379          KM   ENDPOINTS WERE EXTENDED
380          KM    SLOPE = (2208-2195)/699
381          RS       1    FLOW      -1
382          RC   0.045   0.030   0.045     699  0.0186
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

383          RX       0      50      99     100     110     111     160     210
384          RY     108     103     102     100     100     102     103     108
385          RL                    0.15     100
             *

386          KK    UC63
387          KM   SUBBASIN 63, UNNAMED WASH CENTRAL, COMBINED BASINS 63, 65
388          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
389          KM    L= .81   Kb= 0.054   Adj. Slope= 322.0
390          BA    .117
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391          LG     .25     .36    5.00     .19   19.00
392          UC    .204    .181
             *

393          KK    CP63
394          KM   COMBINE RUNOFF FROM SUBBASIN 63 WITH ROUTED FLOWS
395          KM   FROM RD5859N
396          HC       2
             *

397          KK     R63
398          KM   ROUTE FLOWS FROM CP63 TO CP6266 THROUGH SUBBASIN 66
399          KM    SLOPE = (2195-2170)/1394
400          KM    ENDPOINTS WERE EXTENDED
401          RS       2    FLOW      -1
402          RC   0.045   0.030   0.045    1394  0.0179
403          RX       0      80      99     100     125     126     145     200
404          RY     108     104     102     100     100     102     104     108
405          RL                    0.35     100
             *

406          KK    UC66
407          KM   SUBBASIN 66, UNNAMED WASH CENTRAL
408          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
409          KM    L= .54   Kb= 0.056   Adj. Slope= 324.0
410          BA    .037
411          LG     .25     .36    5.00     .25   15.00
412          UC    .167    .202
             *

413          KK    UC62
414          KM   SUBBASIN 62, UNNAMED WASH CENTRAL
415          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
416          KM    L= 1.33   Kb= 0.047   Adj. Slope= 321.0
417          BA    .361
418          LG     .25     .35    6.10     .13   14.00
419          UC    .242    .172
             *

420          KK  CP6266
421          KM   COMBINE RUNOFF FROM SUBBASINS 62, 66 WITH ROUTED FLOWS
422          KM   FROM R63
423          HC       3
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

424          KK   R6266
425          KM   ROUTE FLOWS FROM CP6266 TO CP82 THROUGH SUBBASIN 82
426          KM    SLOPE = (2170-2150)/990
427          KM    ENDPOINTS WERE EXTENDED
428          RS       2    FLOW      -1
429          RC   0.045   0.030   0.045     990  0.0202
430          RX       0      85      99     100     100     121     135     250
431          RY     108     104     102     100     100     102     104     108
432          RL                    0.35     100
             *

433          KK  D5859S
434          KM   RECALL DIVERTED FLOW FROM D5859N
435          DR  D5859S
             *

436          KK  R5859S
437          KM   ROUTING DIVERTED FLOW FROM D5859S TO CP64 THROUGH SUBBASIN 64
438          KM    SLOPE = (2208-2194)/803
439          RS       1    FLOW      -1
440          RC   0.045   0.030   0.045     803  0.0174
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441          RX       0      50      99     100     125     126     175     225
442          RY     108     103     102     100     100     102     103     108
443          RL                    0.15     100
             *

444          KK    UC64
445          KM   SUBBASIN 64, UNNAMED WASH CENTRAL
446          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
447          KM    L= .15   Kb= 0.078   S= 166.0
448          BA    .005
449          LG     .25     .31    6.90     .20   17.00
450          UC    .129    .180
             *

451          KK    CP64
452          KM    COMBINE SUBBASIN RUNOFF FROM 64 WITH ROUTED FLOWS FROM
453          KM    DIVERSION RD5859N
454          HC       2    1.88
             *

455          KK    D64N
456          KM   DIVERSION OF FLOWS AT FLOW SPLIT
457          KM   SOUTHERN PART OF DIVERSION GOES OFF SITE
458          DT    D64S
459          DI       0      50     100     500   10000
460          DQ       0    22.5      45     225    4500
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

461          KK   RD64N
462          KM   ROUTING FLOW FROM D64N TO CP87 THROUGH SUBBASIN 87
463          KM   ENDPOINTS WERE EXTENDED
464          KM    SLOPE = (2194-2161)/1721
465          RS       2    FLOW      -1
466          RC   0.045   0.030   0.045    1721  0.0192
467          RX       0      60      99     100     112     113     152     200
468          RY     108     104     102     100     100     102     104     108
469          RL                    0.25     100
             *

470          KK    UC87
471          KM   SUBBASIN 87, UNNAMED WASH CENTRAL
472          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
473          KM    L= .33   Kb= 0.033   S= 101.0
474          BA    .025
475          LG     .25     .35    3.40     .62    9.00
476          UC    .150    .153
             *

477          KK    CP87
478          KM    COMBINE SUBBASIN RUNOFF FROM 87 WITH ROUTED FLOWS FROM
479          KM    DIVERSION RD64N
480          HC       2
             *

481          KK   RD87N
482          KM   ROUTING FLOW FROM D87N TO CP82 THROUGH SUBBASIN 82
483          KM    SLOPE = (2161-2150)/557
484          RS       1    FLOW      -1
485          RC   0.045   0.030   0.045     557  0.0197
486          RX      25      85      99     100     120     121     135     195
487          RY     108     104     102     100     100     102     104     108
488          RL                    0.35     100
             *

489          KK    UC82
490          KM    SUB-BASIN 82, UNNAMED WASH CENTRAL, COMBINED 81, 82, 83
```

```
 491          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 492          KM    L= .22   Kb= 0.047   Adj. Slope= 220.0
 493          BA    .022
 494          LG     .25     .36    4.30    .400   15.00
 495          UC    .112    .087
              *

 496          KK    CP82
 497          KM   COMBINE DIVERTED FLOWS FROM D87N, ROUTED FLOWS FROM R6266,
 498          KM   SUBBASIN 82
 499          HC       3    2.45
              *
1                                          HEC-1 INPUT
PAGE 13

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 500          KK     R82
 501          KM   ROUTING FLOW FROM CP82 TO CP84 THROUGH SUBBASIN 84
 502          KM    SLOPE = (2150-2138)/579
 503          RS       1    FLOW      -1
 504          RC   0.045   0.030   0.045     579  0.0207
 505          RX       0      75      99     100     125     126     150     275
 506          RY     108     104     102     100     100     102     104     108
 507          RL                    0.35     100
              *

 508          KK    D84N
 509          KM   DIVERSION OF FLOWS AT FLOW SPLIT 84
 510          KM   PART OF TRIPLE DIVERSION JUST UPSTREAM OF TERRAVITA WAY
 511          DT    D84S
 512          DI       0     500    1275    1550    1964    2475    3223    4000
 513          DQ       0       0       0    79.7     255     490     888    1250
              *

 514          KK    UC84
 515          KM   SUBBASIN 84, UNNAMED WASH CENTRAL,
 516          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 517          KM    L= .30   Kb= 0.054   Adj. Slope= 246.0
 518          BA    .013
 519          LG     .25     .36    4.50     .35   15.00
 520          UC    .133    .156
              *

 521          KK    CP84
 522          KM    COMBINE SUBBASIN RUNOFF FROM 84 WITH REMAINDER OF DIVERTED FLOWS
 523          KM    FROM D84N
 524          HC       2
              *

 525          KK     R84
 526          KM   ROUTING FLOW FROM CP84 TO CP7879 THROUGH SUBBASIN 79
 527          KM   ENDPOINTS WERE EXTENDED
 528          KM    SLOPE = (2138-2054)/3463
 529          RS       5    FLOW      -1
 530          RC   0.045   0.030   0.045    3463  0.0243
 531          RX       0      94      99     100     110     111     116     225
 532          RY     108     104     102     100     100     102     104     108
 533          RL                    0.15     100
              *

 534          KK    UC79
 535          KM   SUBBASIN 79, UNNAMED WASH CENTRAL, COMBINED 79 AND 92
 536          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 537          KM    L= .88   Kb= 0.035   Adj. Slope= 233.0
 538          BA    .078
 539          LG     .25     .35    4.30     .45   19.00
 540          UC    .188    .222
 541          UA       0       5      16      30      65      77      84      90      94      97
 542          UA     100
```

```
                    *
                                                HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 543          KK    UC78
 544          KM   SUBBASIN 78, UNNAMED WASH CENTRAL
 545          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 546          KM    L= .86   Kb= 0.036   Adj. Slope= 319.0
 547          BA    .177
 548          LG     .25     .35    6.00     .17   17.00
 549          UC    .167    .120
 550          UA       0       5      16      30      65      77      84      90      94      97
 551          UA     100
              *

 552          KK  CP7879
 553          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 78, 79 WITH ROUTED FLOWS
 554          KM    FROM R84
 555          HC       3
              *

 556          KK   R7879
 557          KM   ROUTING FLOW FROM CP7879 TO CP77 THROUGH SUBBASIN 77
 558          KM   ENDPOINTS WERE EXTENDED
 559          KM    SLOPE = (2054-2048)/256
 560          RS       1    FLOW      -1
 561          RC   0.045   0.030   0.045     256   .0234
 562          RX       0      90      99     100     120     121     130     200
 563          RY     108     104     102     100     100     102     104     108
 564          RL                    0.35     100
              *

 565          KK    UC77
 566          KM   SUBBASIN 77, UNNAMED WASH CENTRAL
 567          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 568          KM    L= .93   Kb= 0.043  Adj. Slope= 324.0
 569          BA    .096
 570          LG     .25     .34    6.70     .13   16.00
 571          UC    .188    .206
 572          UA       0       5      16      30      65      77      84      90      94      97
 573          UA     100
              *

 574          KK    CP77
 575          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 77 WITH ROUTED FLOWS
 576          KM    FROM R7879
 577          HC       2
              *

 578          KK     R77
 579          KM   ROUTING FLOW FROM CP77 TO CP89 THROUGH SUBBASIN 89
 580          KM   ENDPOINTS WERE EXTENDED
 581          KM    SLOPE = (2048-2037)/593
 582          RS       1    FLOW      -1
 583          RC   0.045   0.030   0.045     593  0.0185
 584          RX       0      80      99     100     115     116     120     200
 585          RY     108     104     102     100     100     102     104     108
 586          RL                    0.25     100
              *
```



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                                                HEC-1 INPUT

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 587          KK    UC89
 588          KM   SUBBASIN 89, UNNAMED WASH CENTRAL
 589          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
```

```
590          KM    L= .77   Kb= 0.031   S= 126.0
591          BA    .073
592          LG     .25     .33    6.40     .20   21.00
593          UC    .196    .218
594          UA       0       5      16      30      65      77      84      90      94      97
595          UA     100
             *

596          KK    CP89
597          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 89 WITH ROUTED FLOWS
598          KM    FROM R77
599          HC       2
             *

600          KK     R89
601          KM   ROUTING FLOW FROM CP89 TO CP90EN THROUGH SUBBASIN 90
602          KM   CHANNEL ENDS WERE EXTENDED
603          KM    SLOPE = (2037-2008)/1912
604          RS       2    FLOW      -1
605          RC   0.045   0.030   0.045    1912  0.0152
606          RX       0      80      99     100     115     116     135     250
607          RY     108     104     102     100     100     102     104     108
608          RL                    0.25     100
             *

609          KK    UC74
610          KM   SUBBASIN 74, UNNAMED WASH CENTRAL
611          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
612          KM    L= 1.13   Kb= 0.041   Adj. Slope= 328.0
613          BA    .151
614          LG     .25     .34    6.60     .13   16.00
615          UC    .200    .201
             *

616          KK    UC76
617          KM   SUBBASIN 76, UNNAMED WASH CENTRAL
618          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
619          KM    L= .64   Kb= 0.033   Adj. Slope= 302.0
620          BA    .041
621          LG     .25     .35    6.10     .16   15.00
622          UC    .142    .183
             *

623          KK  CP7476
624          KM    COMBINE SUBBASIN RUNOFF FROM BASINS 74 AND 76
625          HC       2
             *
```


HEC-1 INPUT

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

626          KK   R7476
627          KM   ROUTING FLOW FROM CP7476 TO CP75 THROUGH SUBBASIN 75
628          KM   END POINTS WERE EXTENDED
629          KM    SLOPE = (2031-2017)/524
630          RS       1    FLOW      -1
631          RC   0.045   0.030   0.045     524  0.0267
632          RX       0      80      99     100     112     113     132     200
633          RY     108     104     102     100     100     102     104     108
634          RL                    0.25     100
             *

635          KK    UC75
636          KM   SUBBASIN 75, UNNAMED WASH CENTRAL
637          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
638          KM    L= 1.38   Kb= 0.031   Adj. Slope= 322.0
639          BA    .192
640          LG     .25     .34    6.50     .15   16.00
641          UC    .192    .196
```

```
642          UA       0       5      16      30      65      77      84      90      94      97
643          UA     100
             *

644          KK    CP75
645          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 75 AND ROUTED FLOWS
646          KM    FROM R7476
647          HC       2
             *

648          KK     R75
649          KM   ROUTING FLOW FROM CP75 TO CP90EN THROUGH SUBBASIN 90
650          KM   END POINTS WERE EXTENDED
651          KM    SLOPE = (2017-2008)/723
652          RS       1    FLOW      -1
653          RC   0.045   0.030   0.045     723  0.0124
654          RX       0      80      99     100     115     116     135     200
655          RY     108     104     102     100     100     102     104     108
656          RL                    0.25     100
             *

657          KK    UC90
658          KM   SUBBASIN 90, UNNAMED WASH CENTRAL
659          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
660          KM    L= .48   Kb= 0.035   S= 151.0
661          BA    .038
662          LG     .25     .35    3.70     .55   20.00
663          UC    .158    .170
             *

664          KK    UC91
665          KM   SUBBASIN 91, UNNAMED WASH CENTRAL
666          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
667          KM    L= .75   Kb= 0.033   S= 109.0
668          BA    .073
669          LG     .25     .31    7.40     .14   23.00
```



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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

670          UC    .204    .225
             *
             *

671          KK  CP90EN
672          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 90 AND 91 WITH ROUTED FLOWS
673          KM    FROM R89 AND R75
674          HC       4
             *

675          KK    D84S
676          KM   RETREVIAL OF DIVERTED FLOW FROM D84S
677          DR    D84S
             *

678          KK   RD84S
679          KM   ROUTING FLOW FROM CP84 (D84S) TO D84ii
680          KM    SLOPE = (2144-2140)/303
681          RS       6    FLOW      -1
682          RC   0.045   0.030   0.045     303  0.0132
683          RX       0      50      99     100     125     126     175     225
684          RY     106     104     102     100     100     102     104     106
685          RL                    0.35     100
             *

686          KK  D84IIS
687          KM   SOUTHERN PART OF TRIPLE DIVERSION AT TERRAVITA WAY
688          KM   D84S FLOWS THROUGH DIP CROSSING AT TERRAVITA WAY
689          DT  D84IIN
690          DI       0    79.7     255     490     880    1250
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```
691          DQ       0    78.3     229     419     732    1000
             *

692          KK  RD84IS
693          KM   ROUTING FLOWS FROM D84IIS TO CP94DS
694          KM   SLOPE = (2140-2078)/3225
695          RS       1    FLOW      -1
696          RC   0.045   0.030   0.045    3225  0.0192
697          RX       0      50      99     100     125     126     175     225
698          RY     106     104     102     100     100     102     104     106
699          RL                    0.25     100
             *

700          KK    UC94
701          KM   SUBBASIN 94, UNNAMED WASH CENTRAL
702          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
703          KM    L= .53   Kb= 0.119   S= 108.0
704          BA    .028
705          LG     .25     .36    5.00     .23   13.00
706          UC    .671   1.082
             *
1                                          HEC-1 INPUT
PAGE 18

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

707          KK  CP94DS
708          KM   COMBINE SUBBASIN RUNOFF FROM UC94 WITH ROUTED FLOW
709          KM   FROM RD84IS
710          HC       2
             *

711          KK   R94DS
712          KM   ROUTING FLOW FROM CP94DS TO CP88EN
713          KM   SLOPE = (2078-2041)/1950
714          RS       1    FLOW      -1
715          RC   0.045   0.030   0.045    1950  0.0189
716          RX      60      85      99     100     108     109     123     148
717          RY     106     104     102     100     100     102     104     106
718          RL                    0.25     100
             *

719          KK  D84IIN
720          KM   RECALL DIVERTED FLOW FROM D84II
721          DR  D84IIN
             *

722          KK  RD84IN
723          KM   ROUTING FLOW FROM D84II TO CP88EN
724          KM   SLOPE = (2140-2041)/5175
725          RS       1    FLOW      -1
726          RC   0.045   0.030   0.045    5175  0.0191
727          RX      60      78      90     100     125     132     135     150
728          RY     106     104     102     100     100     102     104     106
729          RL                    0.25     100
             *

730          KK    UC88
731          KM   SUBBASIN 88, UNNAMED WASH CENTRAL, COMBINED SUBBASIN 86, 88, 97
732          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
733          KM    L= 1.08   Kb= 0.104   S=111.0
734          BA    .108
735          LG     .25     .33    6.10     .20   14.00
736          UC    .962   1.337
             *

737          KK  CP88EN
738          KM    COMBINE SUBBASIN RUNOFF FROM BASIN 88 WITH ROUTED FLOWS
739          KM    FROM R94DS AND RD84IN
740          HC       3
```

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                    *
 741                KK    UC95
 742                KM   SUBBASIN 95, UNNAMED WASH CENTRAL
 743                KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 744                KM    L= 0.22   Kb= 0.034   Adj.Slope= 220
 745                BA    .024
 746                LG     .25     .39    3.70     .15   19.00
 747                UC    .092    .065
                    *
1                                                HEC-1 INPUT
PAGE 19

LINE                ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 748                KK    UC93
 749                KM   SUBBASIN 93, UNNAMED WASH CENTRAL
 750                KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 751                KM    L= .64   Kb= 0.033   S= 135.0
 752                BA    .038
 753                LG     .25     .30    8.00     .07   20.00
 754                UC    .179    .249
                    *

 755                KK    UC96
 756                KM   SUBBASIN 96, UNNAMED WASH CENTRAL
 757                KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 758                KM    L= .73   Kb= 0.031  S= 113.0
 759                BA    .061
 760                LG     .25     .32    7.00     .12   18.00
 761                UC    .196    .230
                    *
                    *
 762                ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
IPUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 42         UC8
            .
            .
 51         .         UC9
            .           .
            .           .
 60       CPC8............
             V
             V
 64      RCP89
            .
            .
 74         .        UC18
            .           .
            .           .
 83         .           .        UC19
            .           .           .
            .           .           .
 90    CP1819........................
             V
             V
 93      R1819
            .
            .
102         .        UC22
            .           .
            .           .
109         .           .        UC23
            .           .           .
            .           .           .
116    CP2223........................
             V
             V
119      R2223
            .
            .
128         .        UC28
            .           V
            .           V
135         .         R28
            .           .
            .           .
144         .           .        UC29
            .           .           .
            .           .           .
151         .           .           .       UC30
            .           .           .           .
            .           .           .           .
158    CP2930.....................................
             V
             V
162      R2930
            .
            .
171         .        UC34
            .           .
            .           .
180      CP34............
             V
             V
184       R34
            .
            .
193         .        UC37
```

```
                .           .
                .           .
200             .           .        UC35
                .           .           .
                .           .           .
207       CP3537.......................
              V
              V
211        R3537
                .
                .
220             .        UC49
                .           .
                .           .
227             .           .        UC31
                .           .           .
                .           .           .
236       CP3149.......................
              V
              V
240        R3149
                .
                .
249             .        UC46
                .           V
                .           V
258             .         R46
                .           .
                .           .
267             .           .        UC45
                .           .           .
                .           .           .
276             .           .           .        UC47
                .           .           .           .
                .           .           .           .
285             .      CP4547.......................
                .           V
                .           V
289             .       R4547
                .           .
                .           .
298             .           .        UC48
                .           .           .
                .           .           .
305             .           .           .        UC50
                .           .           .           .
                .           .           .           .
312       CP4850.....................................
              V
              V
316        R4850
                .
                .
325             .        UC51
                .           .
                .           .
334             .           .        UC57
                .           .           .
                .           .           .
341       CP5157.......................
              V
              V
345        R5157
                .
                .
354             .        UC58
                .           .
                .           .
361             .           .        UC59
                .           .           .
                .           .           .
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368      CP5859.......................
              .
              .
374           .-------> D5859S
372      D5859N
              V
              V
377      R5859N
              .
              .
386           .        UC63
              .           .
              .           .
393        CP63............
              V
              V
397         R63
              .
              .
406           .        UC66
              .           .
              .           .
413           .           .        UC62
              .           .           .
              .           .           .
420      CP6266.......................
              V
              V
424       R6266
              .
              .
435           .           .<-------  D5859S
433           .      D5859S
              .           V
              .           V
436           .      R5859S
              .           .
              .           .
444           .           .        UC64
              .           .           .
              .           .           .
451           .        CP64............
              .           .
              .           .
458           .           .------->    D64S
455           .        D64N
              .           V
              .           V
461           .       RD64N
              .           .
              .           .
470           .           .        UC87
              .           .           .
              .           .           .
477           .        CP87............
              .           V
              .           V
481           .       RD87N
              .           .
              .           .
489           .           .        UC82
              .           .           .
              .           .           .
496        CP82........................
              V
              V
500         R82
              .
              .
511           .------->    D84S
508       D84N
```

```
                .
                .
514             .        UC84
                .           .
                .           .
521         CP84............
                V
                V
525          R84
                .
                .
534             .        UC79
                .           .
                .           .
543             .           .        UC78
                .           .           .
                .           .           .
552       CP7879........................
                V
                V
556        R7879
                .
                .
565             .        UC77
                .           .
                .           .
574         CP77............
                V
                V
578          R77
                .
                .
587             .        UC89
                .           .
                .           .
596         CP89............
                V
                V
600          R89
                .
                .
609             .        UC74
                .           .
                .           .
616             .           .        UC76
                .           .           .
                .           .           .
623             .      CP7476............
                .           V
                .           V
626             .       R7476
                .           .
                .           .
635             .           .        UC75
                .           .           .
                .           .           .
644             .        CP75............
                .           V
                .           V
648             .         R75
                .           .
                .           .
657             .           .        UC90
                .           .           .
                .           .           .
664             .           .           .        UC91
                .           .           .           .
                .           .           .           .
671       CP90EN.................................
                .
                .
```

```
677          .          .<-------    D84S
675          .       D84S
             .          V
             .          V
678          .      RD84S
             .          .
             .          .
689          .          .-------> D84IIN
686          .     D84IIS
             .          V
             .          V
692          .     RD84IS
             .          .
             .          .
700          .          .        UC94
             .          .           .
             .          .           .
707          .     CP94DS............
             .          V
             .          V
711          .      R94DS
             .          .
             .          .
721          .          .           .<-------  D84IIN
719          .          .     D84IIN
             .          .          V
             .          .          V
722          .          .     RD84IN
             .          .           .
             .          .           .
730          .          .           .        UC88
             .          .           .           .
             .          .           .           .
737          .     CP88EN......................
             .          .
             .          .
741          .          .        UC95
             .          .           .
             .          .           .
748          .          .           .        UC93
             .          .           .           .
             .          .           .           .
755          .          .           .           .        UC96
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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
+	HYDROGRAPH AT	UC8	83.	12.10	12.	4.	1.	.05
+	HYDROGRAPH AT	UC9	82.	12.07	11.	3.	1.	.05
+	2 COMBINED AT	CPC8	164.	12.07	22.	7.	2.	.10
+	ROUTED TO	RCP89	160.	12.17	22.	7.	2.	.10
+	HYDROGRAPH AT	UC18	82.	12.07	8.	2.	1.	.04
+	HYDROGRAPH AT	UC19	53.	12.07	5.	2.	1.	.03
+	3 COMBINED AT	CP1819	277.	12.10	36.	11.	4.	.17
+	ROUTED TO	R1819	274.	12.13	36.	11.	4.	.17
+	HYDROGRAPH AT	UC22	48.	12.10	6.	2.	1.	.03
+	HYDROGRAPH AT	UC23	36.	12.03	3.	1.	0.	.01
+	3 COMBINED AT	CP2223	340.	12.13	44.	13.	5.	.21
+	ROUTED TO	R2223	337.	12.17	44.	13.	5.	.21
+	HYDROGRAPH AT	UC28	126.	12.07	10.	3.	1.	.05
+	ROUTED TO	R28	124.	12.10	10.	3.	1.	.05
+	HYDROGRAPH AT	UC29	76.	12.07	7.	2.	1.	.04
+	HYDROGRAPH AT	UC30	28.	12.03	2.	1.	0.	.01
+	4 COMBINED AT	CP2930	534.	12.13	63.	18.	7.	.31
+	ROUTED TO	R2930	530.	12.13	63.	18.	7.	.31
+	HYDROGRAPH AT	UC34	99.	12.00	7.	2.	1.	.04
+	2 COMBINED AT	CP34	580.	12.13	70.	20.	7.	.35
+	ROUTED TO	R34	551.	12.33	70.	20.	7.	.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC37	267.	12.20	46.	13.	5.	.21
+	HYDROGRAPH AT	UC35	528.	12.10	55.	16.	6.	.26
+	3 COMBINED AT	CP3537	1158.	12.20	168.	48.	17.	.82
+	ROUTED TO	R3537	1147.	12.27	168.	48.	17.	.82
+	HYDROGRAPH AT	UC49	123.	12.03	11.	3.	1.	.05
+	HYDROGRAPH AT	UC31	716.	12.10	91.	27.	10.	.41
+	3 COMBINED AT	CP3149	1802.	12.17	267.	78.	28.	1.27
+	ROUTED TO	R3149	1797.	12.20	267.	78.	28.	1.27
+	HYDROGRAPH AT	UC46	94.	12.00	8.	2.	1.	.03
+	ROUTED TO	R46	92.	12.07	8.	2.	1.	.03
+	HYDROGRAPH AT	UC45	235.	12.03	19.	6.	2.	.09
	HYDROGRAPH AT	UC47	79.	12.03	7.	2.	1.	.03
+	3 COMBINED AT	CP4547	402.	12.03	34.	10.	4.	.15
+	ROUTED TO	R4547	390.	12.07	34.	10.	3.	.15
+	HYDROGRAPH AT	UC48	397.	12.10	45.	13.	5.	.20
+	HYDROGRAPH AT	UC50	47.	12.03	4.	1.	0.	.02
+	4 COMBINED AT	CP4850	2467.	12.13	347.	101.	37.	1.64
+	ROUTED TO	R4850	2449.	12.20	347.	101.	36.	1.64
+	HYDROGRAPH AT	UC51	164.	12.00	13.	4.	1.	.06
+	HYDROGRAPH AT	UC57	72.	12.07	7.	2.	1.	.04
+	3 COMBINED AT	CP5157	2551.	12.17	366.	107.	38.	1.74
+	ROUTED TO	R5157	2532.	12.23	366.	107.	38.	1.74
	HYDROGRAPH AT	UC58	264.	12.07	24.	7.	2.	.11

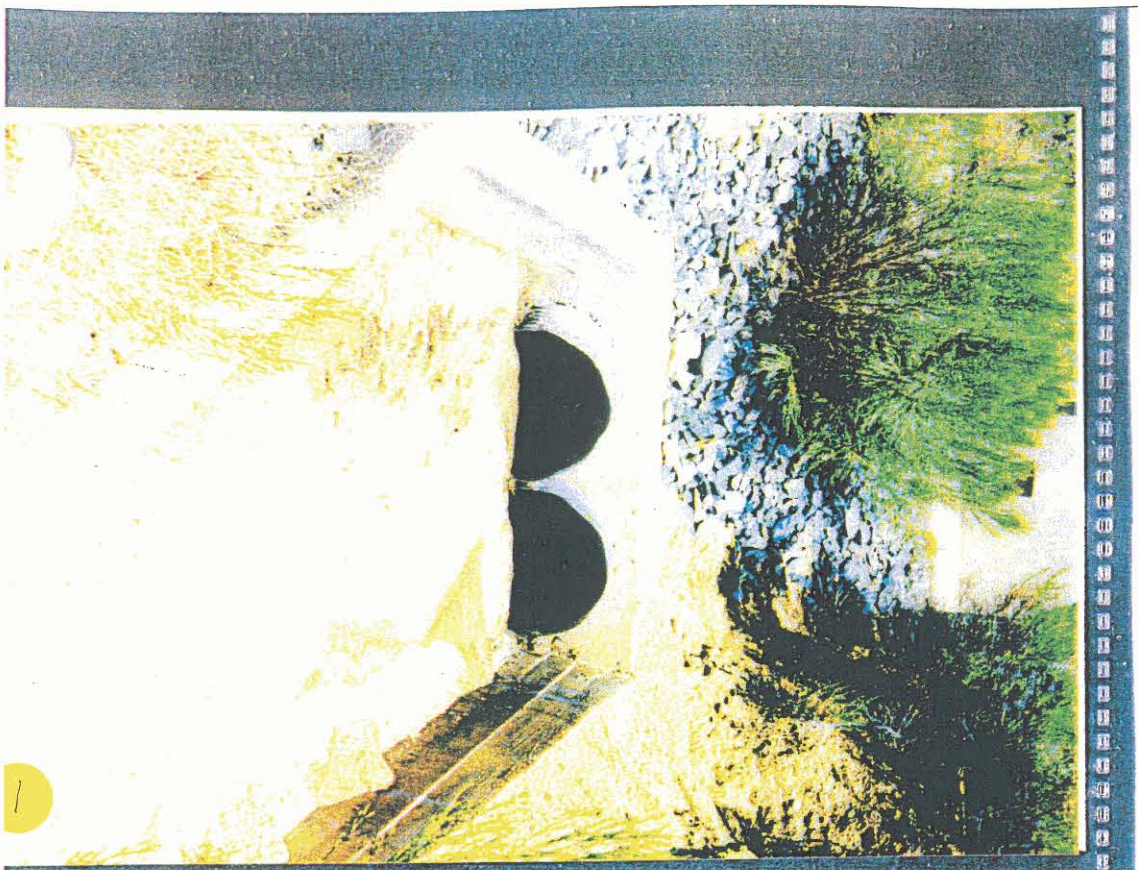
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	UC59	67.	12.07	6.	2.	1.	.03
+	3 COMBINED AT	CP5859	2719.	12.20	395.	115.	41.	1.88
+	DIVERSION TO	D5859S	1351.	12.20	196.	57.	21.	1.88
+	HYDROGRAPH AT	D5859N	1368.	12.20	199.	58.	21.	1.88
+	ROUTED TO	R5859N	1362.	12.23	199.	58.	21.	1.88
+	HYDROGRAPH AT	UC63	251.	12.07	24.	7.	2.	.12
+	2 COMBINED AT	CP63	1528.	12.20	221.	64.	23.	2.00
+	ROUTED TO	R63	1522.	12.23	221.	64.	23.	2.00
+	HYDROGRAPH AT	UC66	76.	12.07	7.	2.	1.	.04
+	HYDROGRAPH AT	UC62	775.	12.10	73.	20.	7.	.36
+	3 COMBINED AT	CP6266	2199.	12.17	298.	85.	31.	2.40
+	ROUTED TO	R6266	2187.	12.20	298.	85.	31.	2.40
+	HYDROGRAPH AT	D5859S	1351.	12.20	196.	57.	21.	1.88
+	ROUTED TO	R5859S	1342.	12.23	196.	57.	21.	1.88
+	HYDROGRAPH AT	UC64	11.	12.03	1.	0.	0.	.00
+	2 COMBINED AT	CP64	1348.	12.23	197.	57.	21.	1.88
+	DIVERSION TO	D64S	606.	12.23	89.	26.	9.	1.88
+	HYDROGRAPH AT	D64N	741.	12.23	108.	31.	11.	1.88
+	ROUTED TO	RD64N	730.	12.30	108.	31.	11.	1.88
+	HYDROGRAPH AT	UC87	49.	12.03	4.	1.	0.	.03
+	2 COMBINED AT	CP87	743.	12.30	112.	32.	12.	1.90
+	ROUTED TO	RD87N	743.	12.30	111.	32.	12.	1.90
+	HYDROGRAPH AT	UC82	56.	12.00	4.	1.	0.	.02
+	3 COMBINED AT	CP82	2882.	12.20	413.	118.	43.	2.45

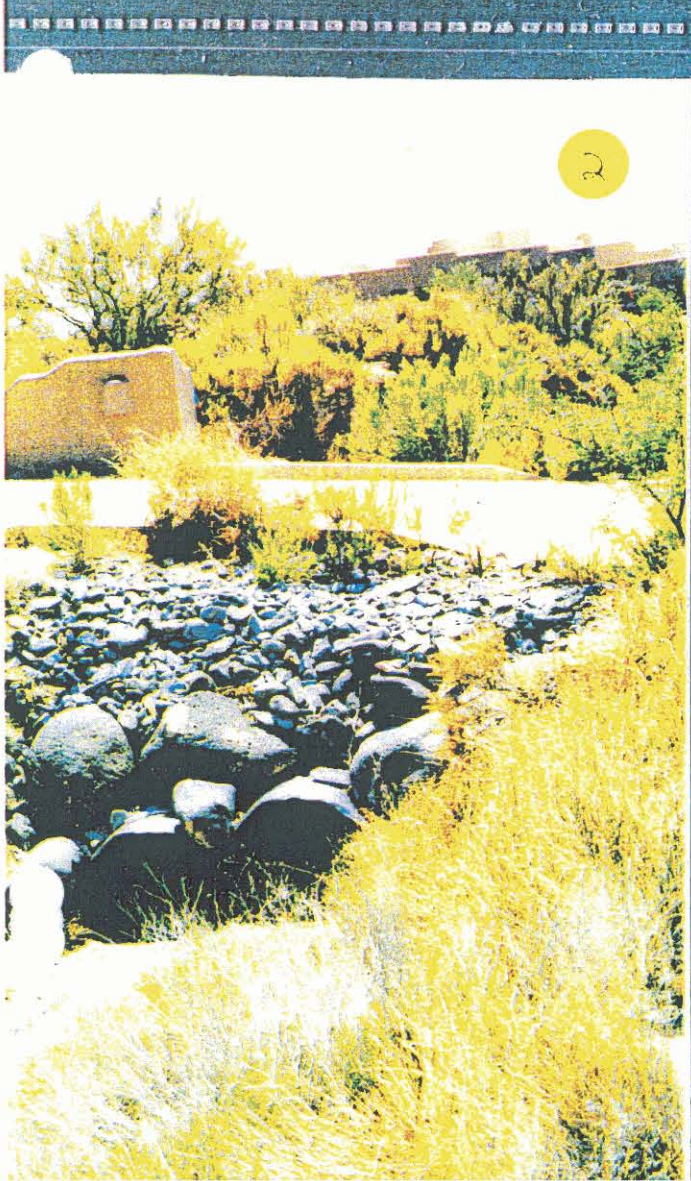
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO	R82	2875.	12.23	412.	118.	42.	2.45
+	DIVERSION TO	D84S	703.	12.23	46.	12.	4.	2.45
+	HYDROGRAPH AT	D84N	2172.	12.23	366.	106.	38.	2.45
+	HYDROGRAPH AT	UC84	29.	12.03	2.	1.	0.	.01
+	2 COMBINED AT	CP84	2183.	12.20	369.	107.	39.	2.46
+	ROUTED TO	R84	2163.	12.30	368.	107.	38.	2.46
+	HYDROGRAPH AT	UC79	142.	12.07	13.	4.	1.	.08
+	HYDROGRAPH AT	UC78	449.	12.03	35.	10.	4.	.18
+	3 COMBINED AT	CP7879	2331.	12.27	415.	120.	43.	2.72
+	ROUTED TO	R7879	2329.	12.27	415.	120.	43.	2.72
+	HYDROGRAPH AT	UC77	205.	12.07	20.	6.	2.	.10
	2 COMBINED AT	CP77	2432.	12.27	433.	125.	45.	2.81
+	ROUTED TO	R77	2429.	12.27	433.	125.	45.	2.81
+	HYDROGRAPH AT	UC89	148.	12.07	15.	4.	2.	.07
+	2 COMBINED AT	CP89	2505.	12.27	447.	129.	46.	2.89
+	ROUTED TO	R89	2493.	12.30	447.	129.	46.	2.89
+	HYDROGRAPH AT	UC74	317.	12.07	31.	9.	3.	.15
+	HYDROGRAPH AT	UC76	91.	12.03	8.	2.	1.	.04
+	2 COMBINED AT	CP7476	406.	12.07	39.	11.	4.	.19
+	ROUTED TO	R7476	404.	12.07	39.	11.	4.	.19
+	HYDROGRAPH AT	UC75	410.	12.07	38.	11.	4.	.19
+	2 COMBINED AT	CP75	808.	12.07	77.	21.	8.	.38
+	ROUTED TO	R75	795.	12.07	77.	21.	8.	.38
	HYDROGRAPH AT							

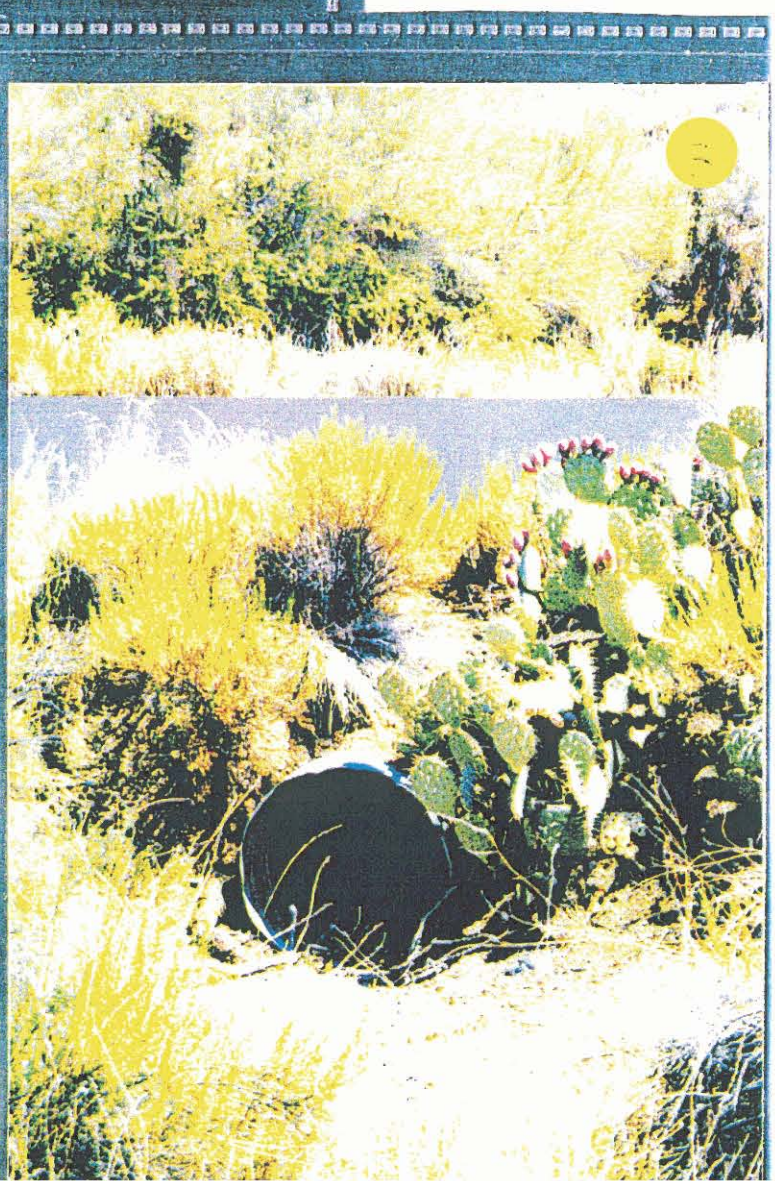
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		UC90	76.	12.07	6.	2.	1.	.04
+	HYDROGRAPH AT	UC91	147.	12.07	16.	5.	2.	.07
+	4 COMBINED AT	CP90EN	3188.	12.17	542.	155.	56.	3.38
+	HYDROGRAPH AT	D84S	703.	12.23	46.	12.	4.	2.45
+	ROUTED TO	RD84S	706.	12.23	46.	12.	4.	2.45
+	DIVERSION TO	D84IIN	592.	12.23	40.	10.	4.	2.45
+	HYDROGRAPH AT	D84IIS	114.	12.23	6.	2.	1.	2.45
+	ROUTED TO	RD84IS	85.	12.33	6.	2.	1.	2.45
+	HYDROGRAPH AT	UC94	18.	12.50	5.	1.	1.	.03
+	2 COMBINED AT	CP94DS	101.	12.37	11.	3.	1.	2.48
+	ROUTED TO	R94DS	96.	12.40	11.	3.	1.	2.48
+	HYDROGRAPH AT	D84IIN	592.	12.23	40.	10.	4.	2.45
+	ROUTED TO	RD84IN	471.	12.37	39.	10.	4.	2.45
+	HYDROGRAPH AT	UC88	58.	12.77	20.	6.	2.	.11
+	3 COMBINED AT	CP88EN	603.	12.37	69.	18.	6.	2.59
+	HYDROGRAPH AT	UC95	71.	12.00	5.	1.	1.	.02
+	HYDROGRAPH AT	UC93	78.	12.07	9.	3.	1.	.04
+	HYDROGRAPH AT	UC96	124.	12.07	13.	4.	1.	.06

*** NORMAL END OF HEC-1 ***

Appendix G – Photo Log





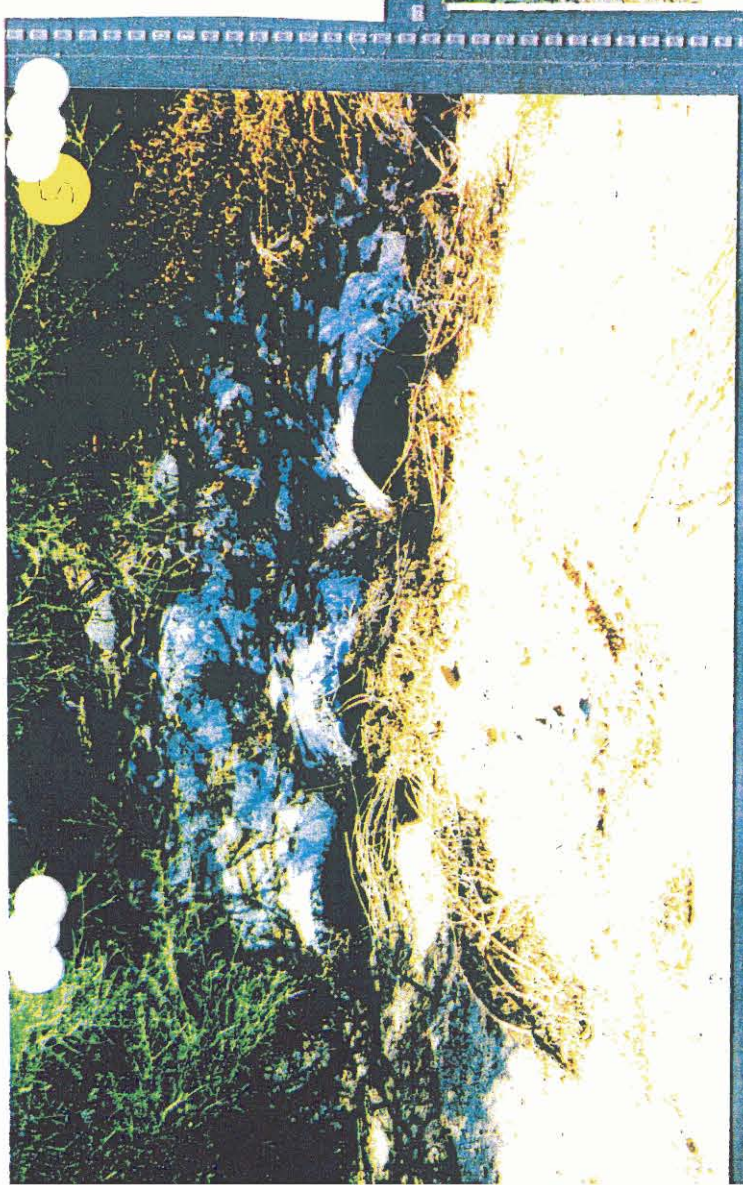


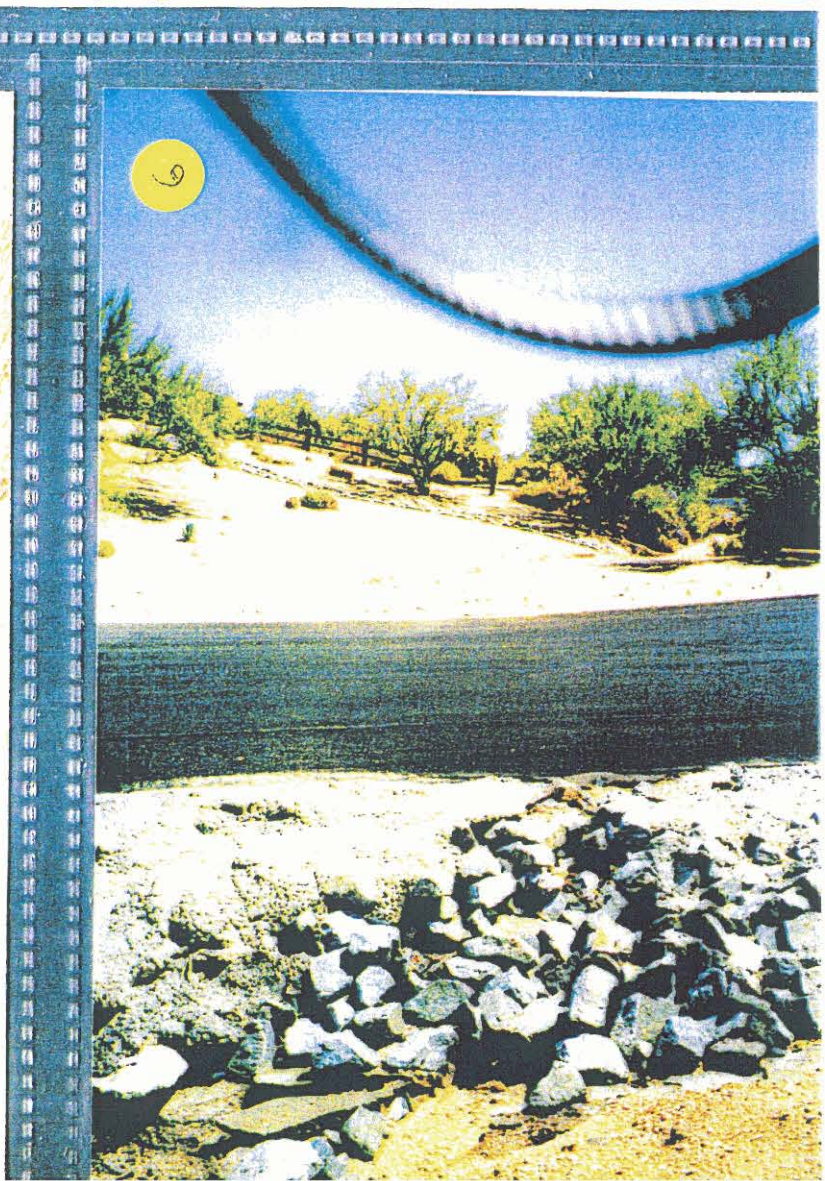
1. Site #146 – Wildflower North of Tree Lined Trail Outlet
2. Site #146 – Inlet
3. Site #145 – Wildflower @ Tree Lined Trail, Inlet

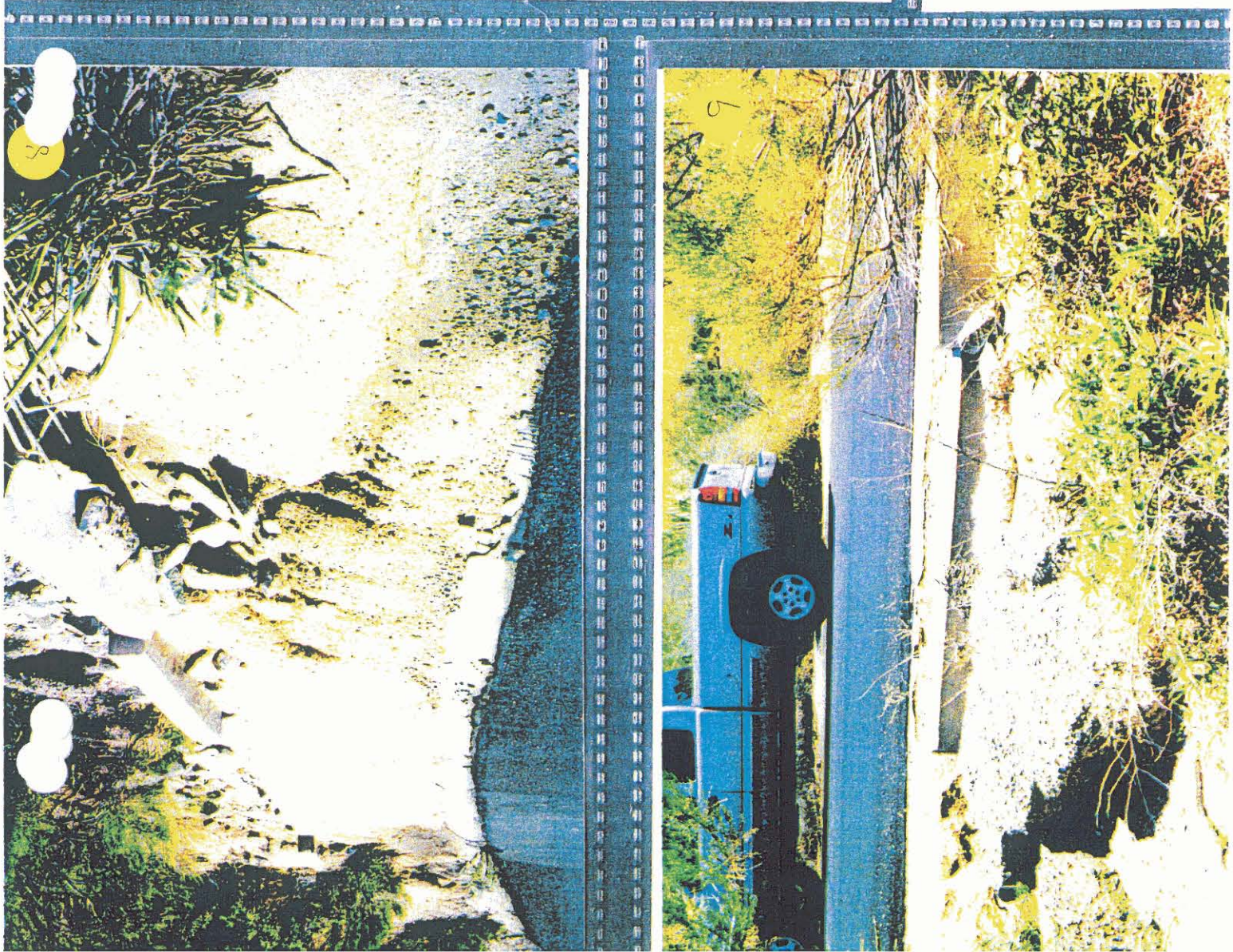
Site #153 – Wildflower Driveways (upstream)

5. Site #153 – Wildflower Driveways (downstream)

6. Site #138 – Quail at Romping (upstream)







7. Site #139 – Wildflower @ Stagecoach Pass (upstream)

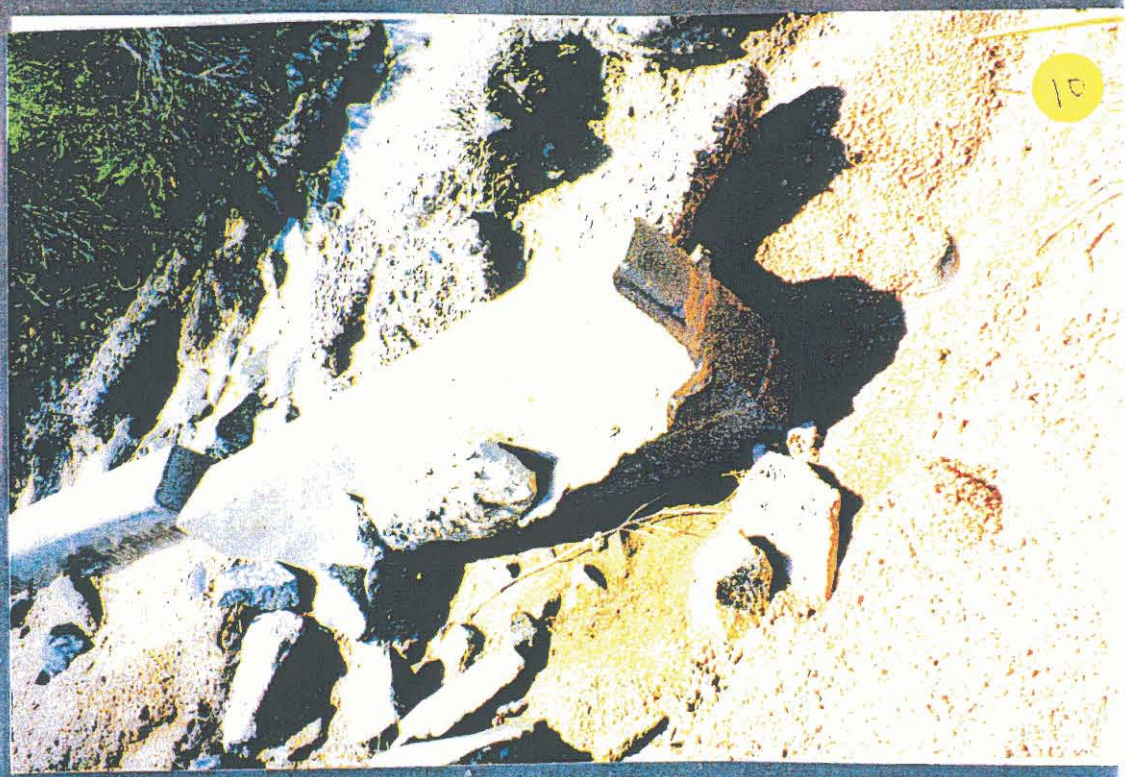
8. Site #140 – Wildflower @ Romping (downstream)

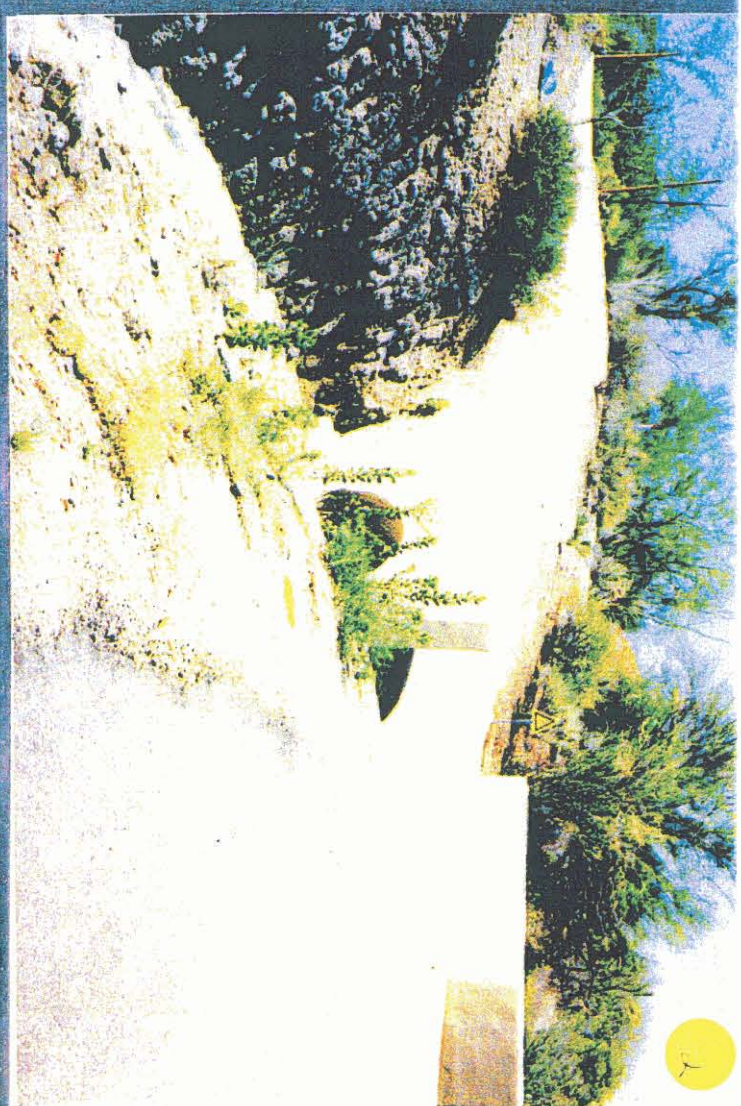
9. Site #140 – Wildflower @ Romping (upstream)

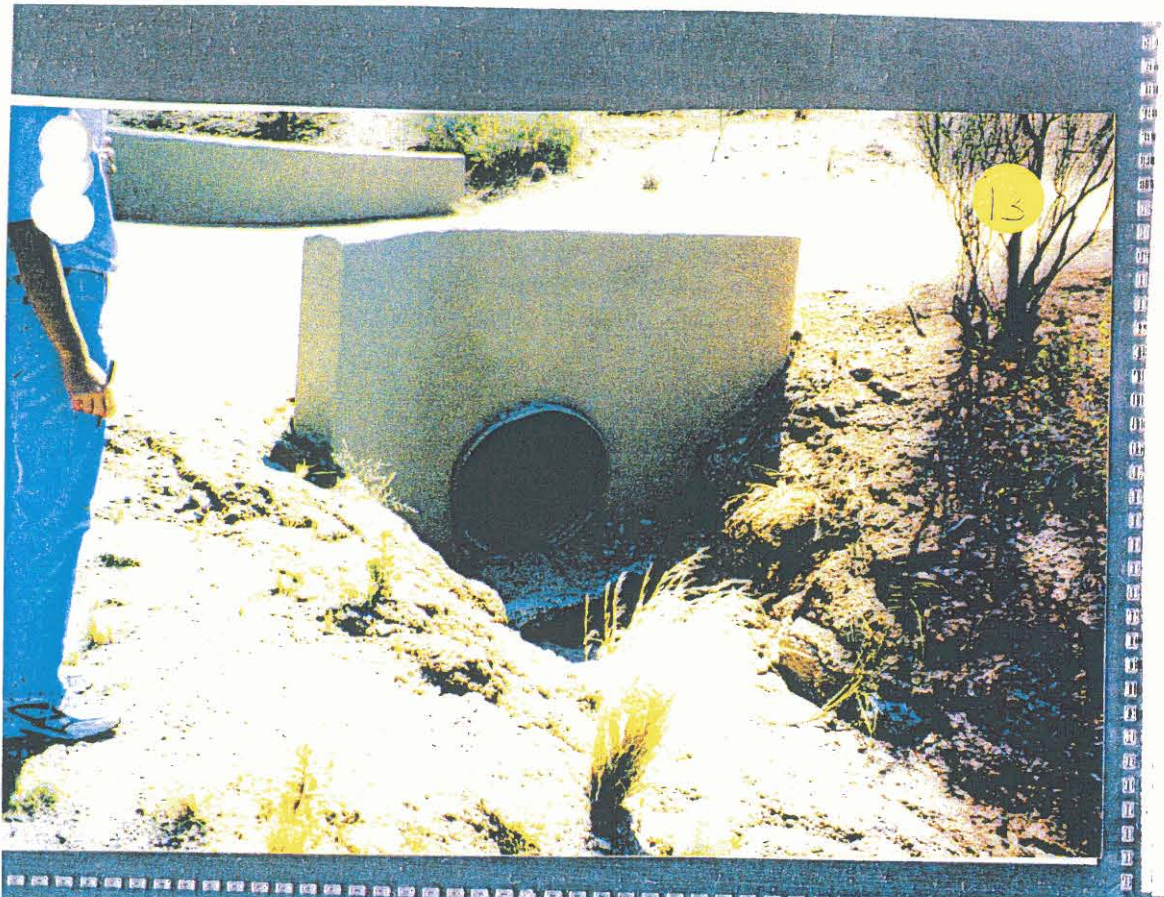
1 te #140 – Wildflower @ Romping (downstream)

11. Site #142 – Wildflower North of Quail (downstream)

12. Site #136 – Driveway @ 8131 Northview Lane (upstream)







13. Site #136 – Driveway @ 8131 Northview Lane (downstream)

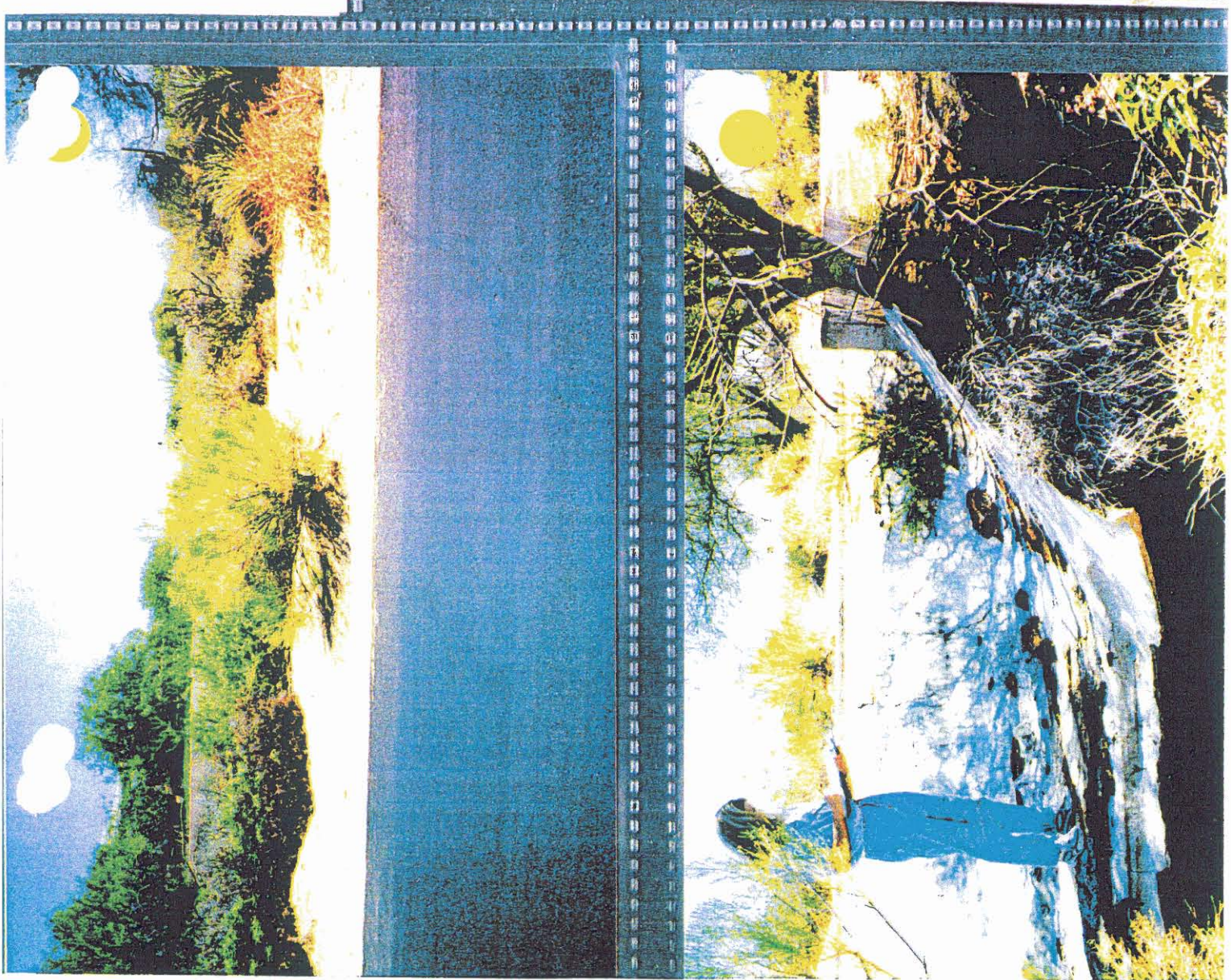
14. Site #137 – Church @ Cave Creek Road (downstream)

15. Site #137 – Church @ Cave Creek Road (upstream)

16. Site #3. Quail Trail @ Romping Road – Downstream

17. Site #5. Wildflower @ Romping – Upstream

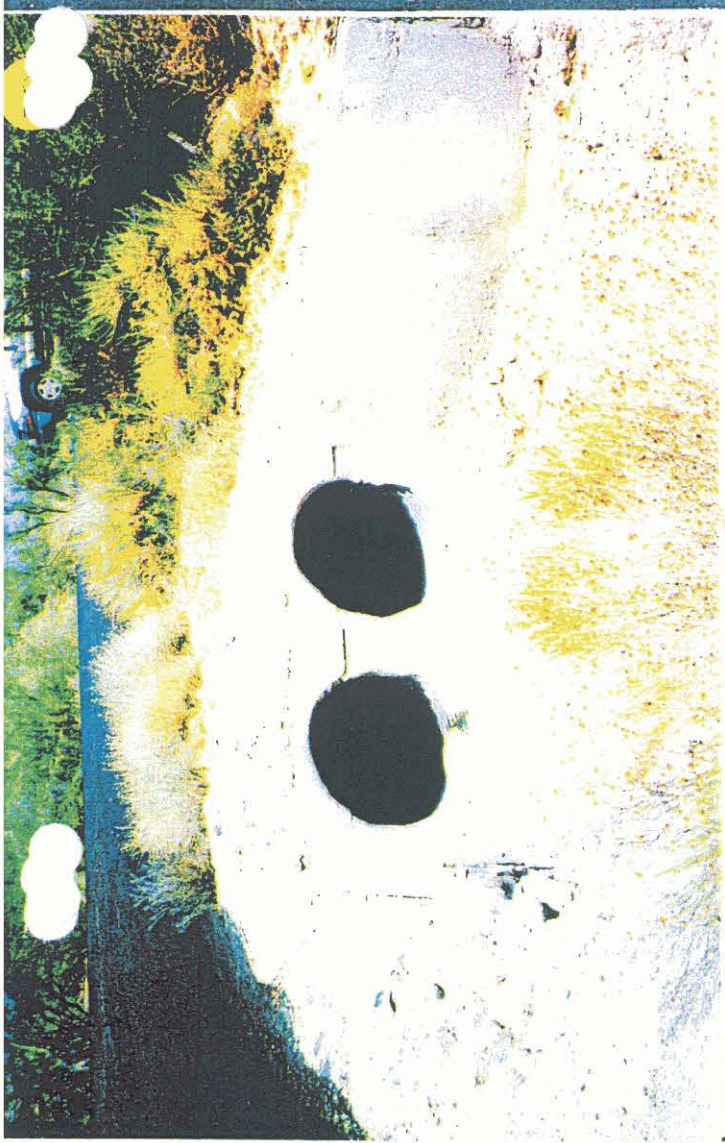
18. Site #7. Wildflower North of Quail - Upstream



19. Site #142. Wildflower North of Quail

20. Site #140. Romping @ Wildflower – Downstream

21. Site #148. –Wildflower Driveways



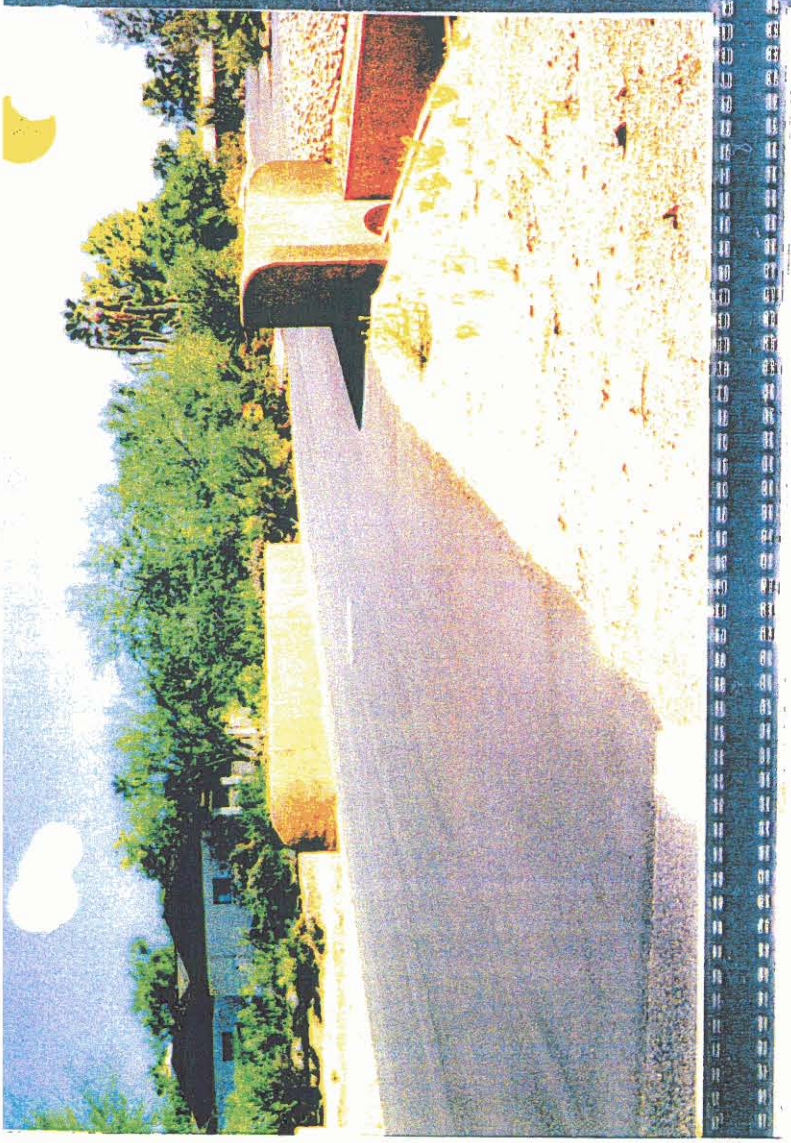
22 Site #33 (JEF).-Dream Street Wash crossing @ Carefree Drive

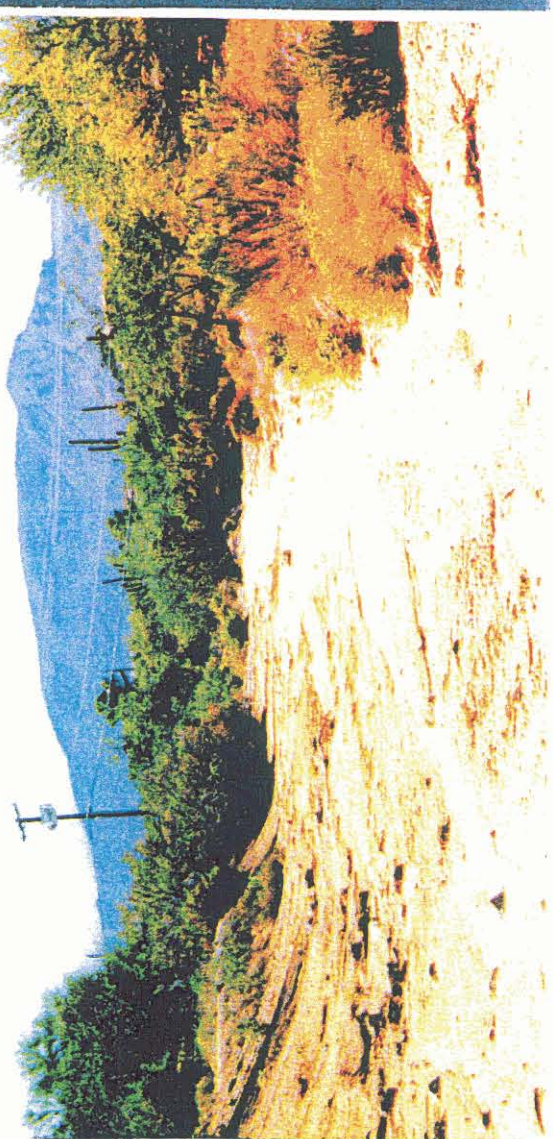
23. Site #33 (JEF). Dream Street Wash – Upstream @ Carefree Drive.

24. Site #33 (JEF) Dream Street Wash Upstream @ Carefree Drive??

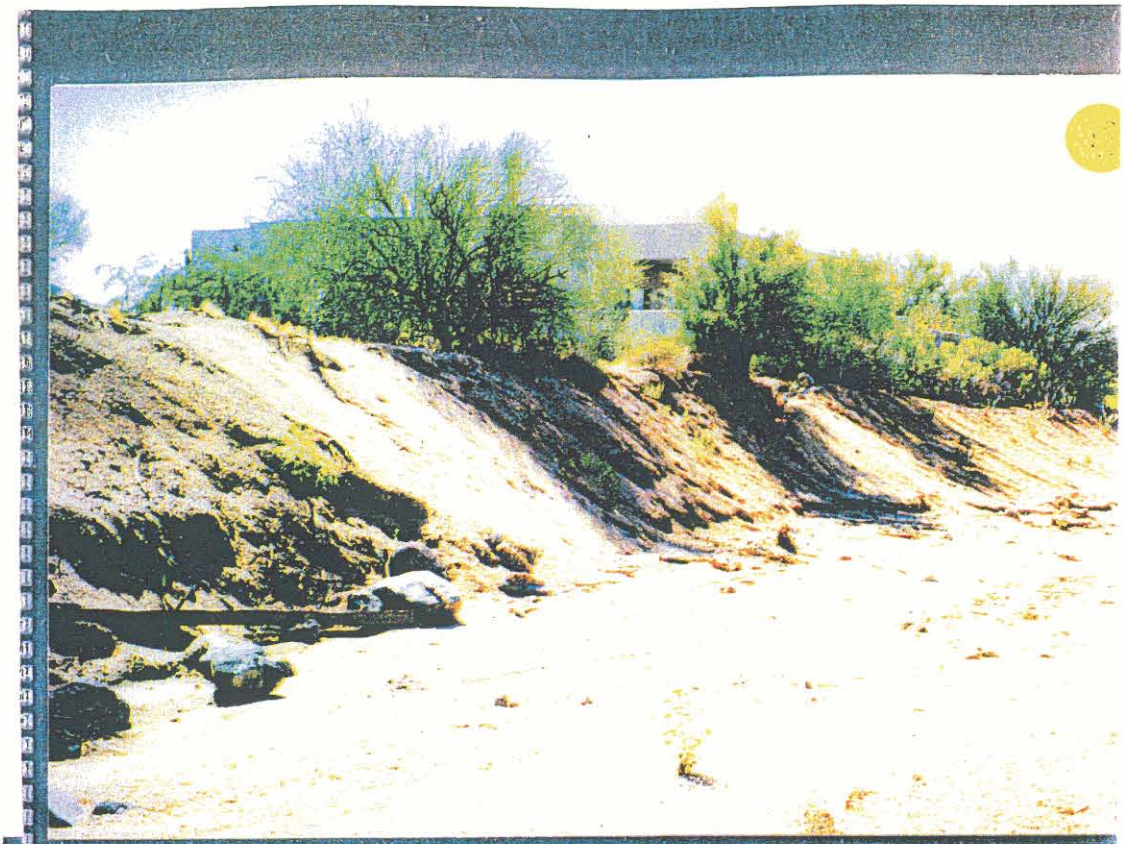
25. No title (Carefree Galloway Wash Preserve sign)

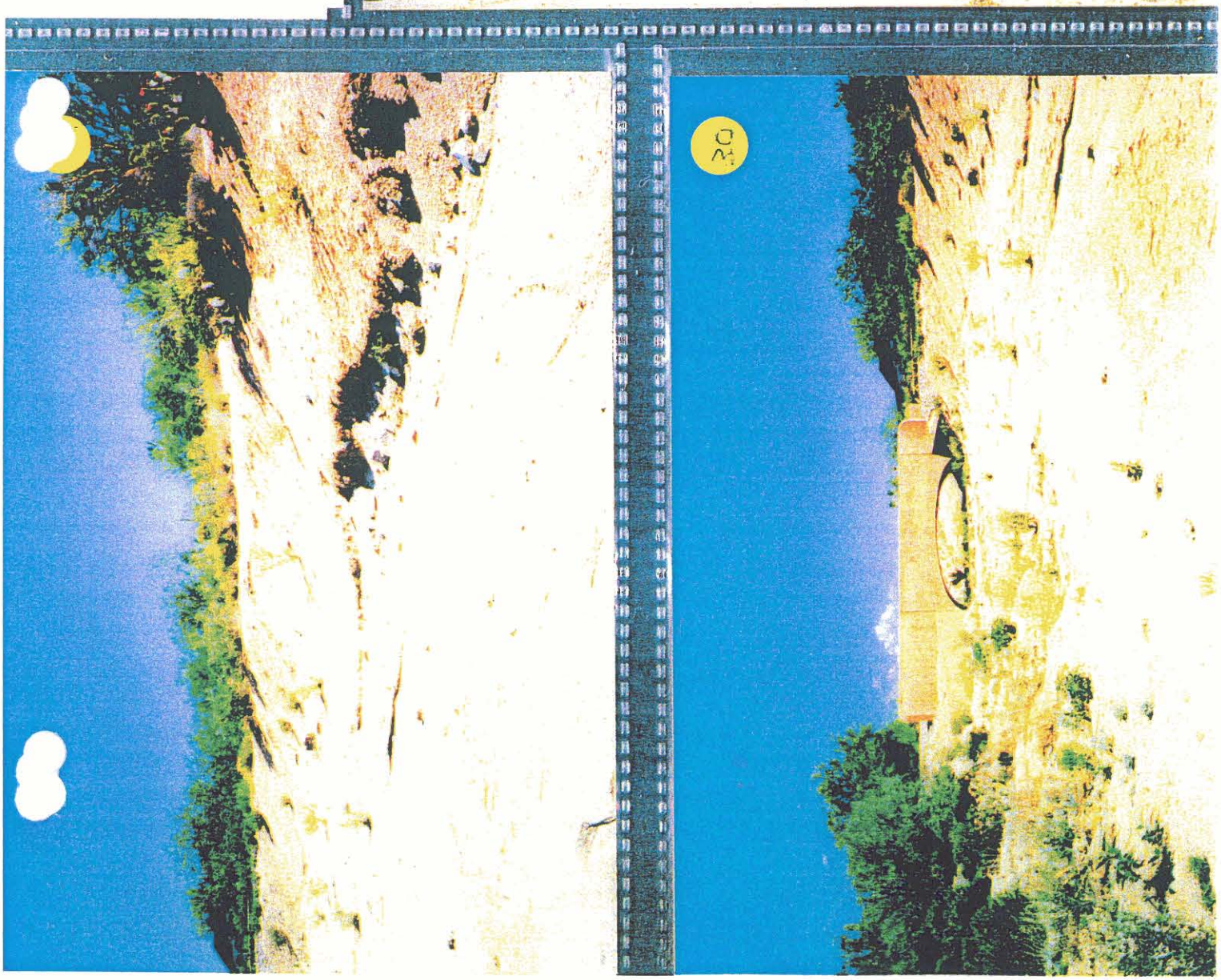
26. –44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

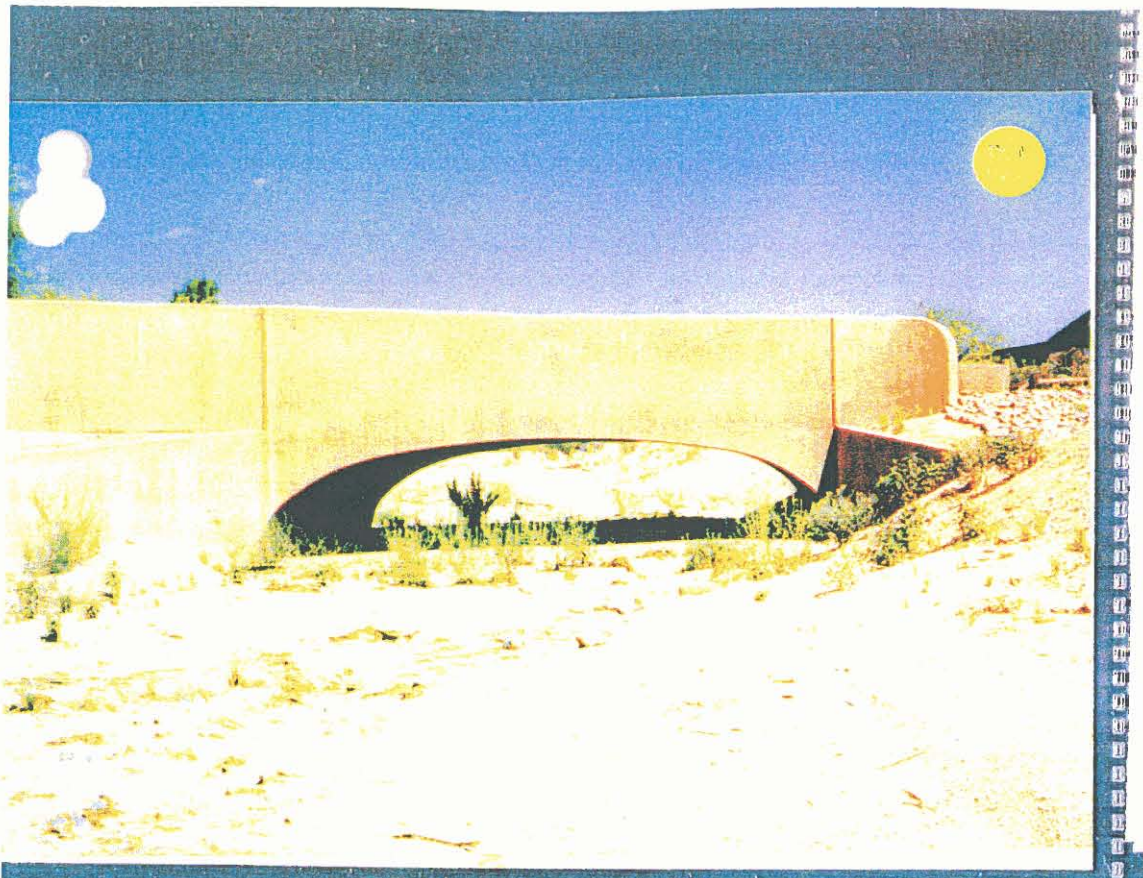




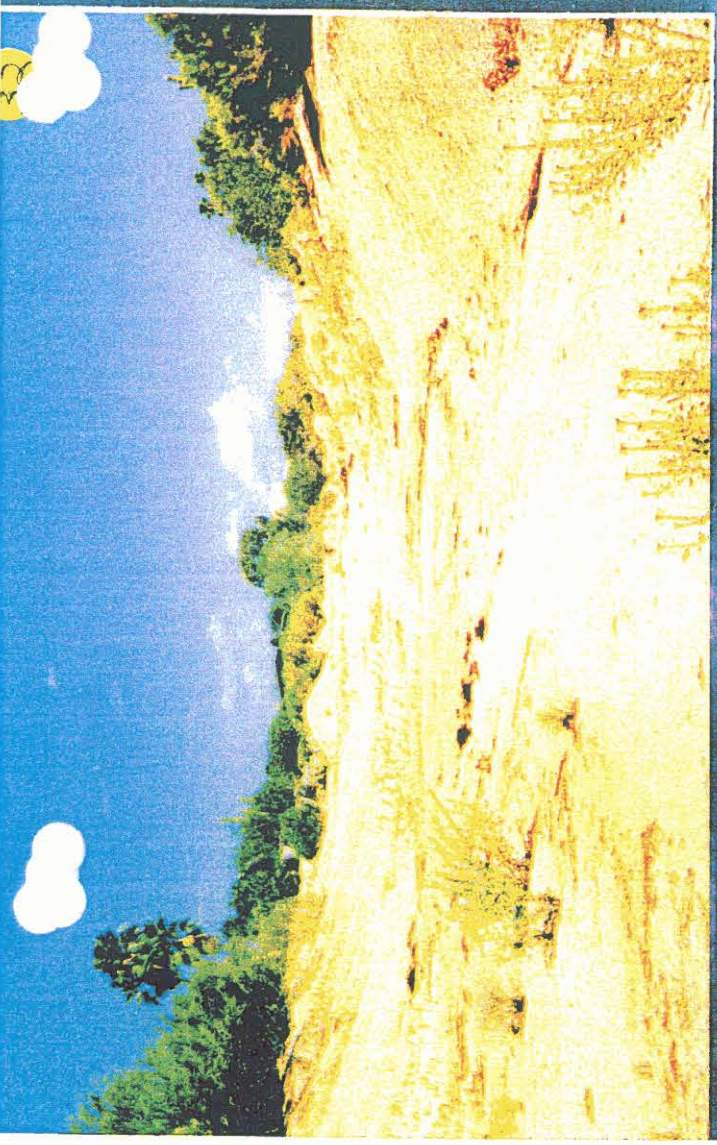
2. - 44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

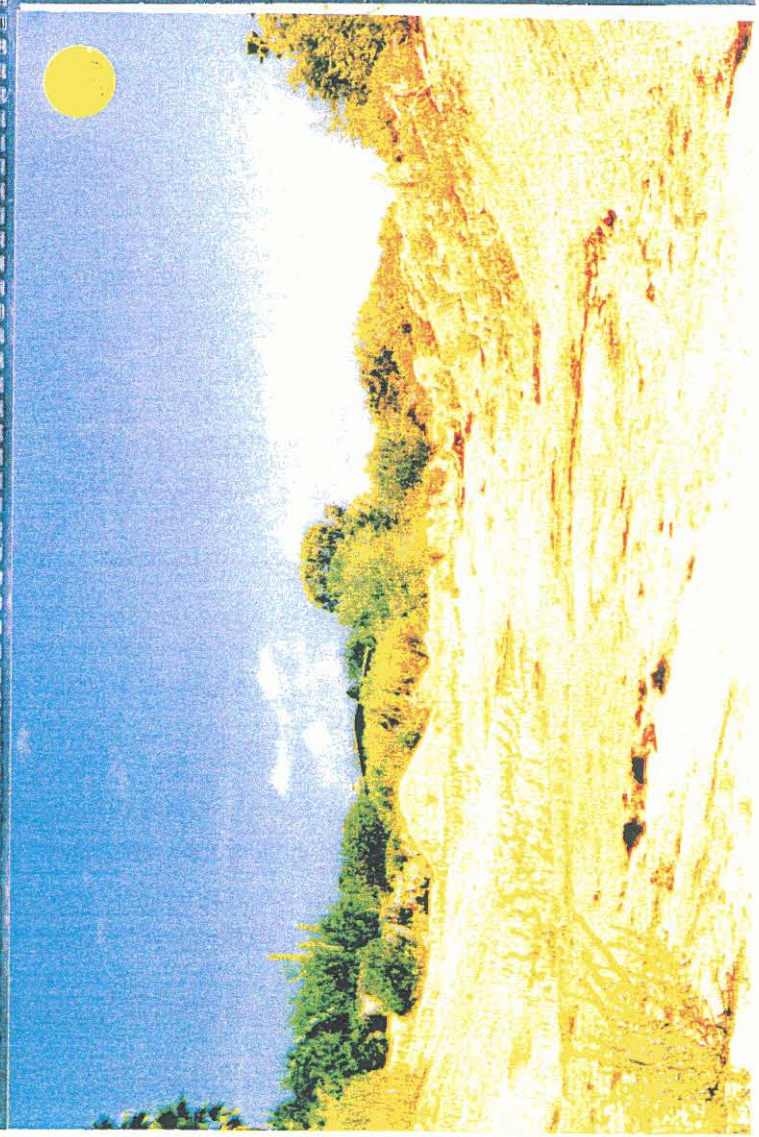




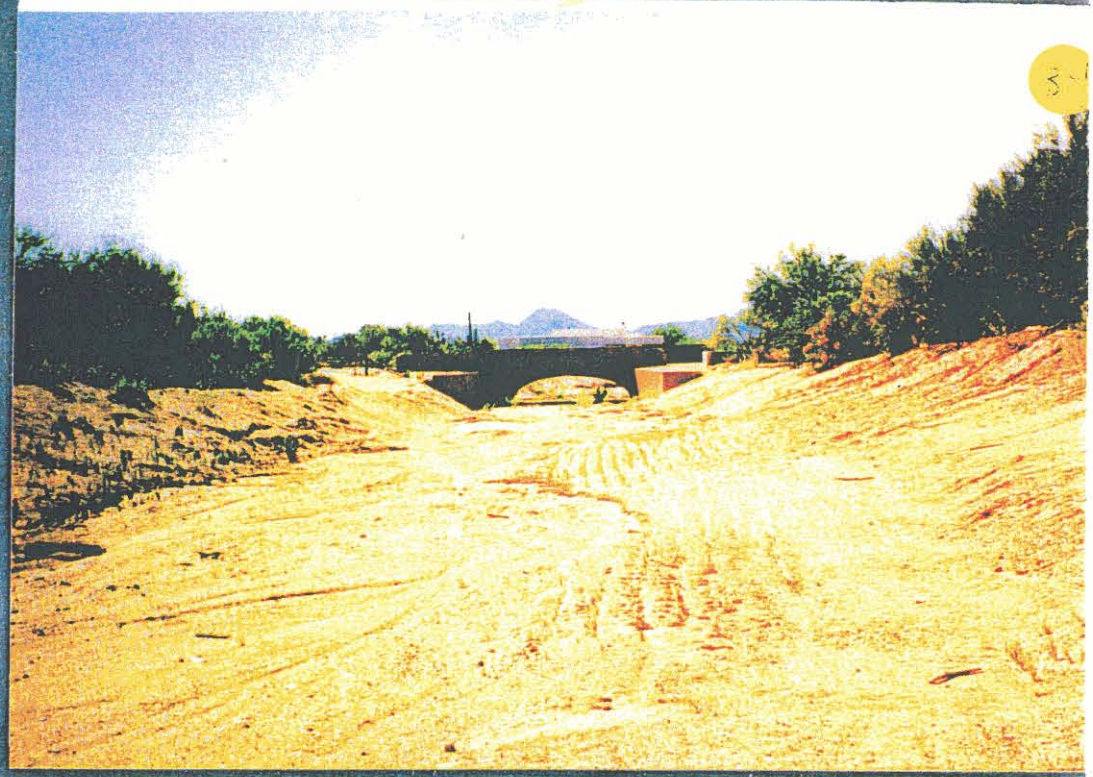


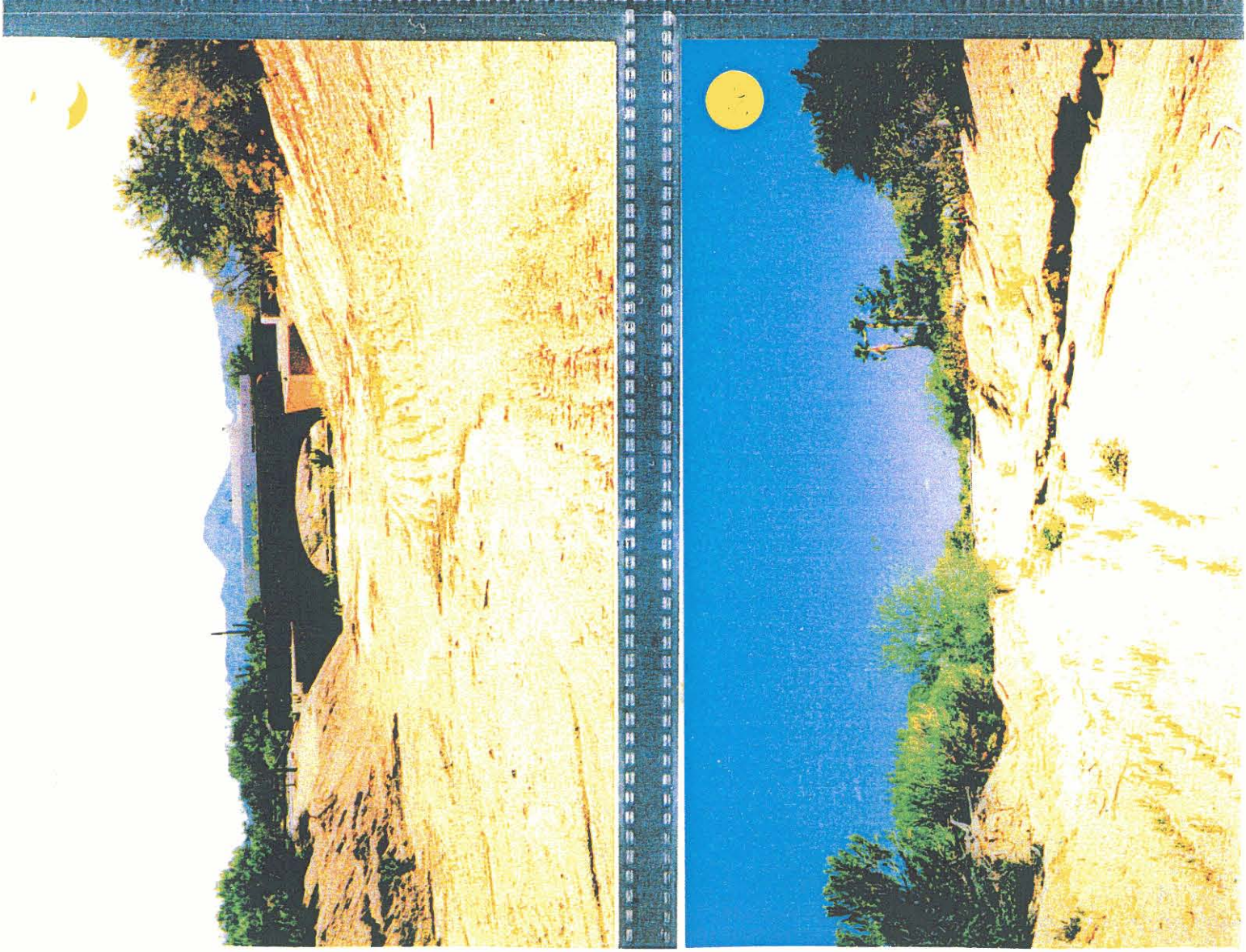
26. – 44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

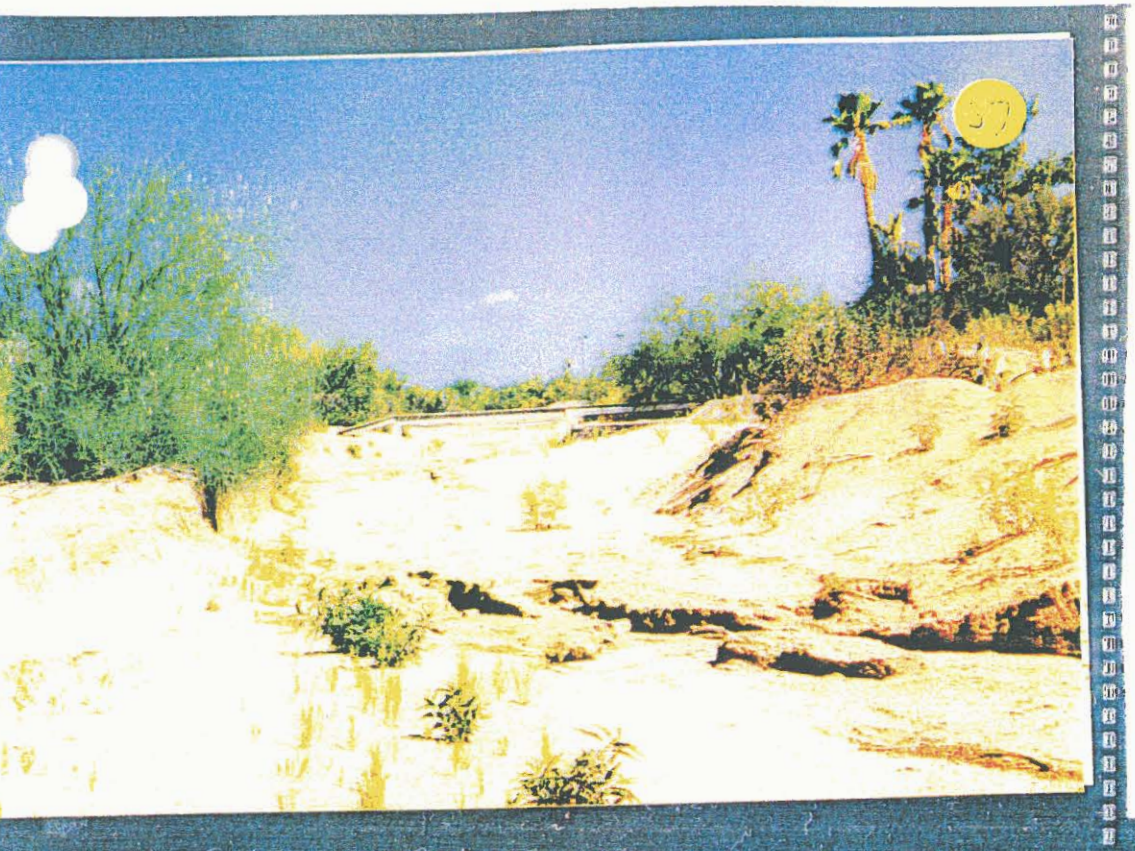




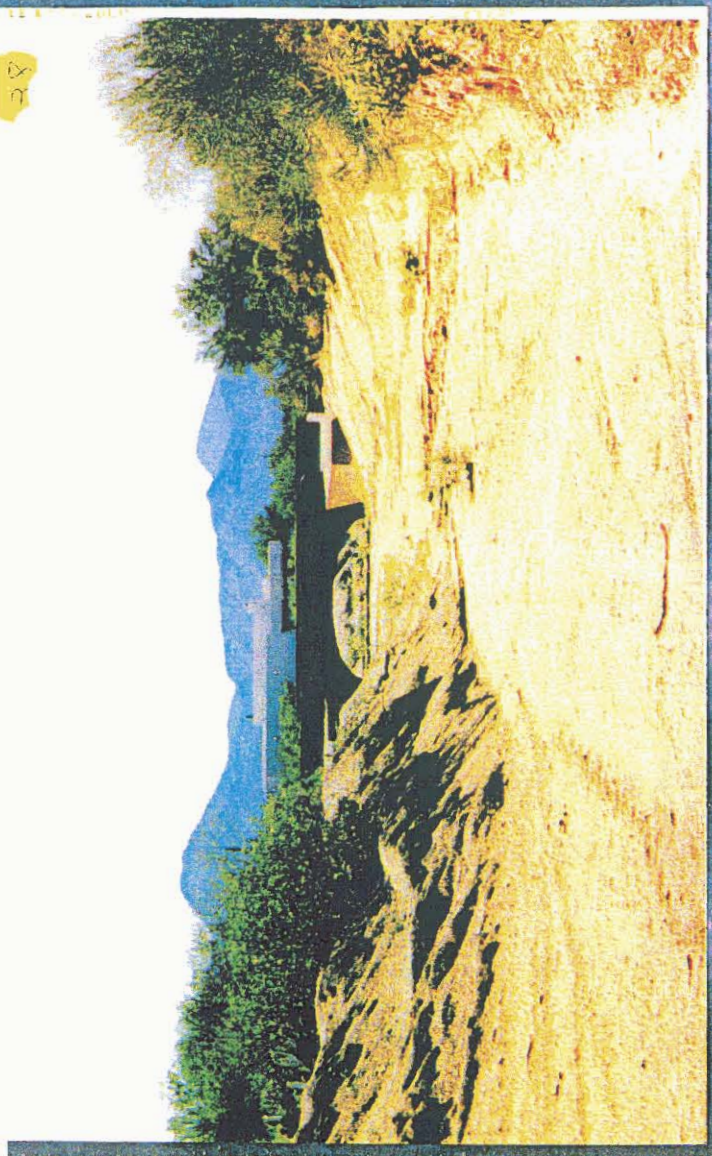
44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

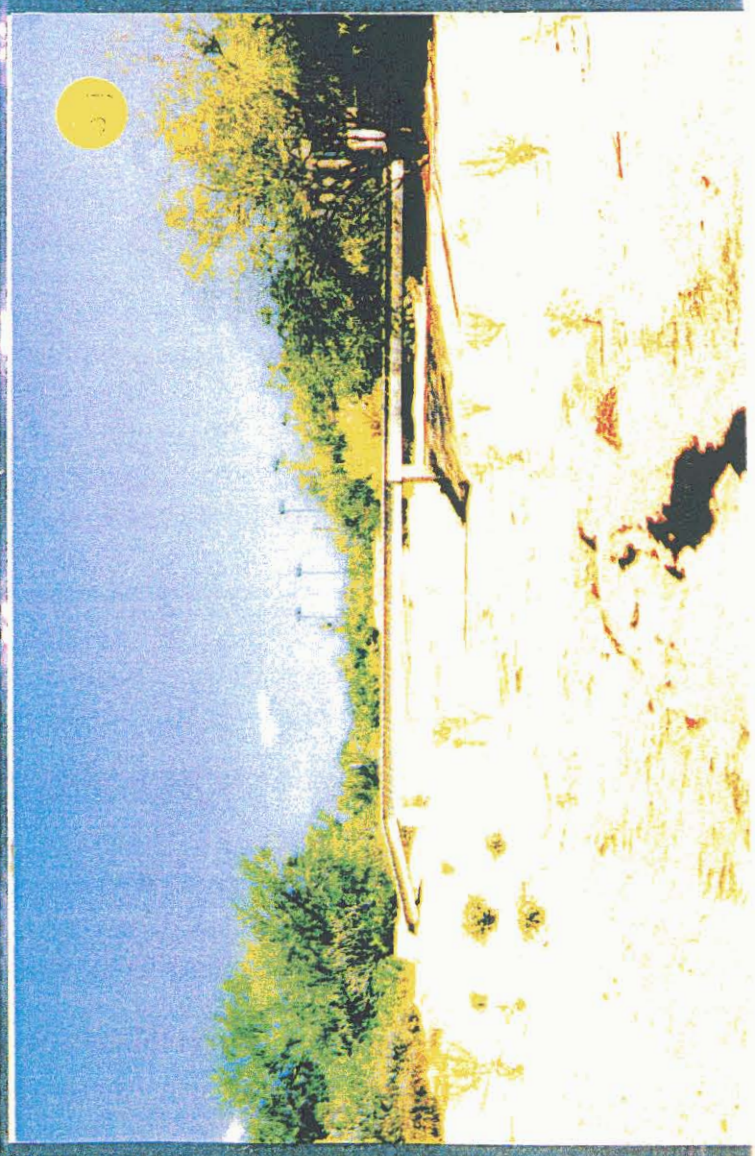




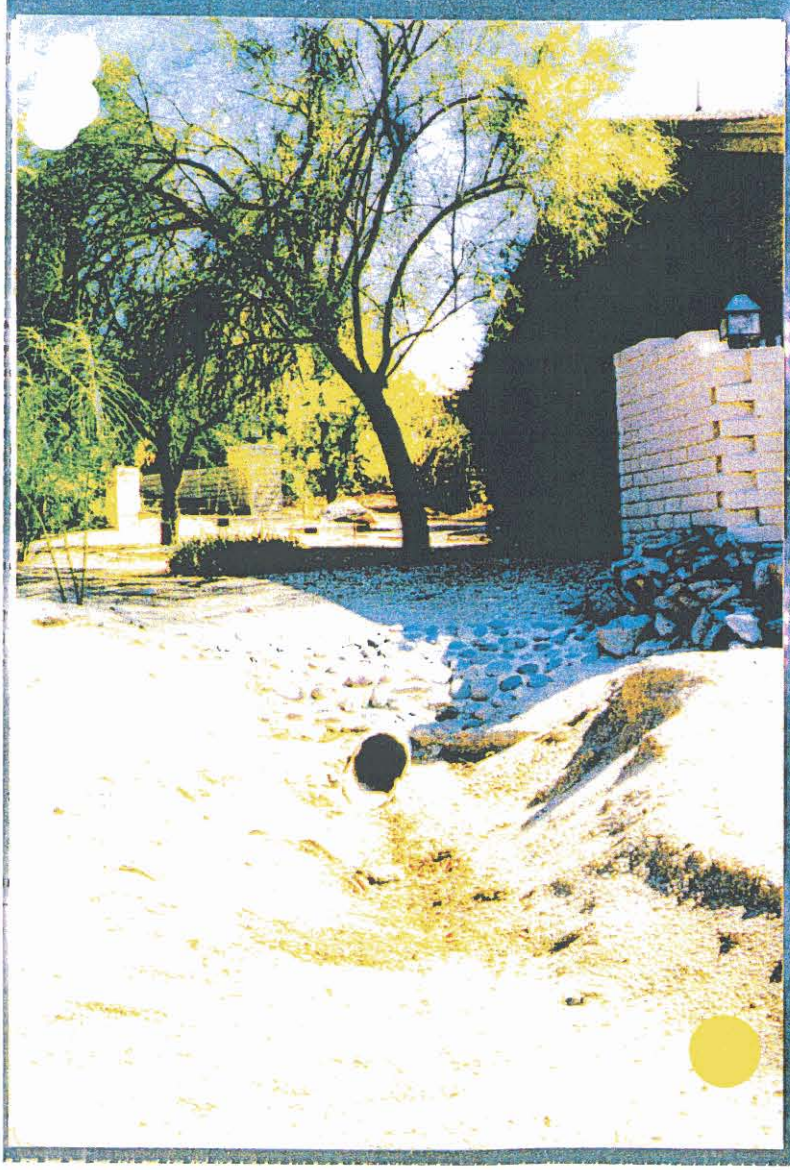


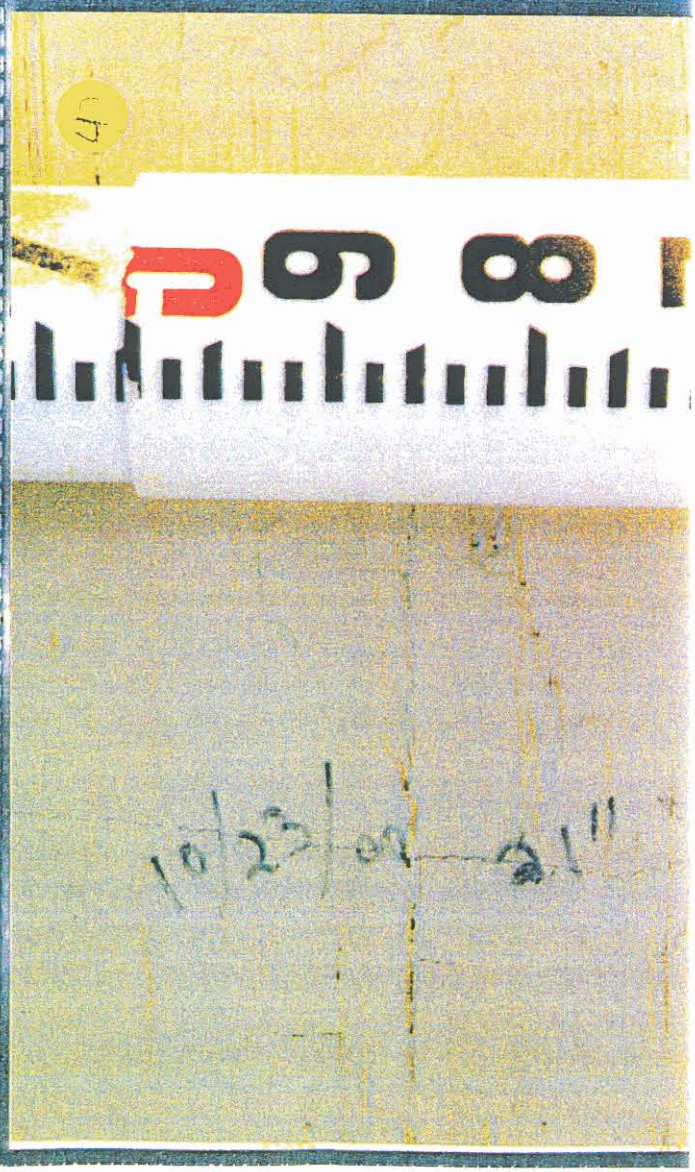
26. – 44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

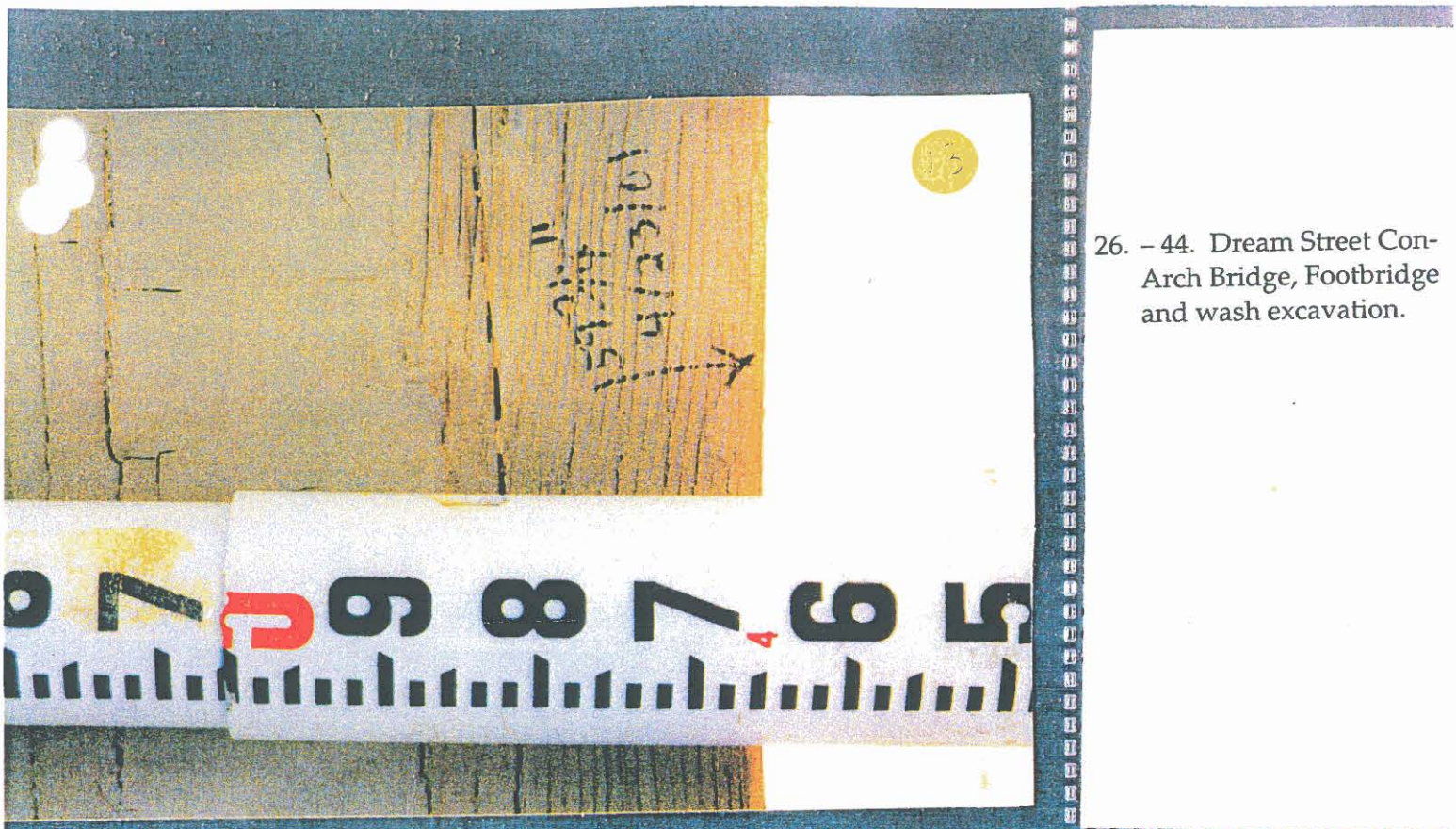


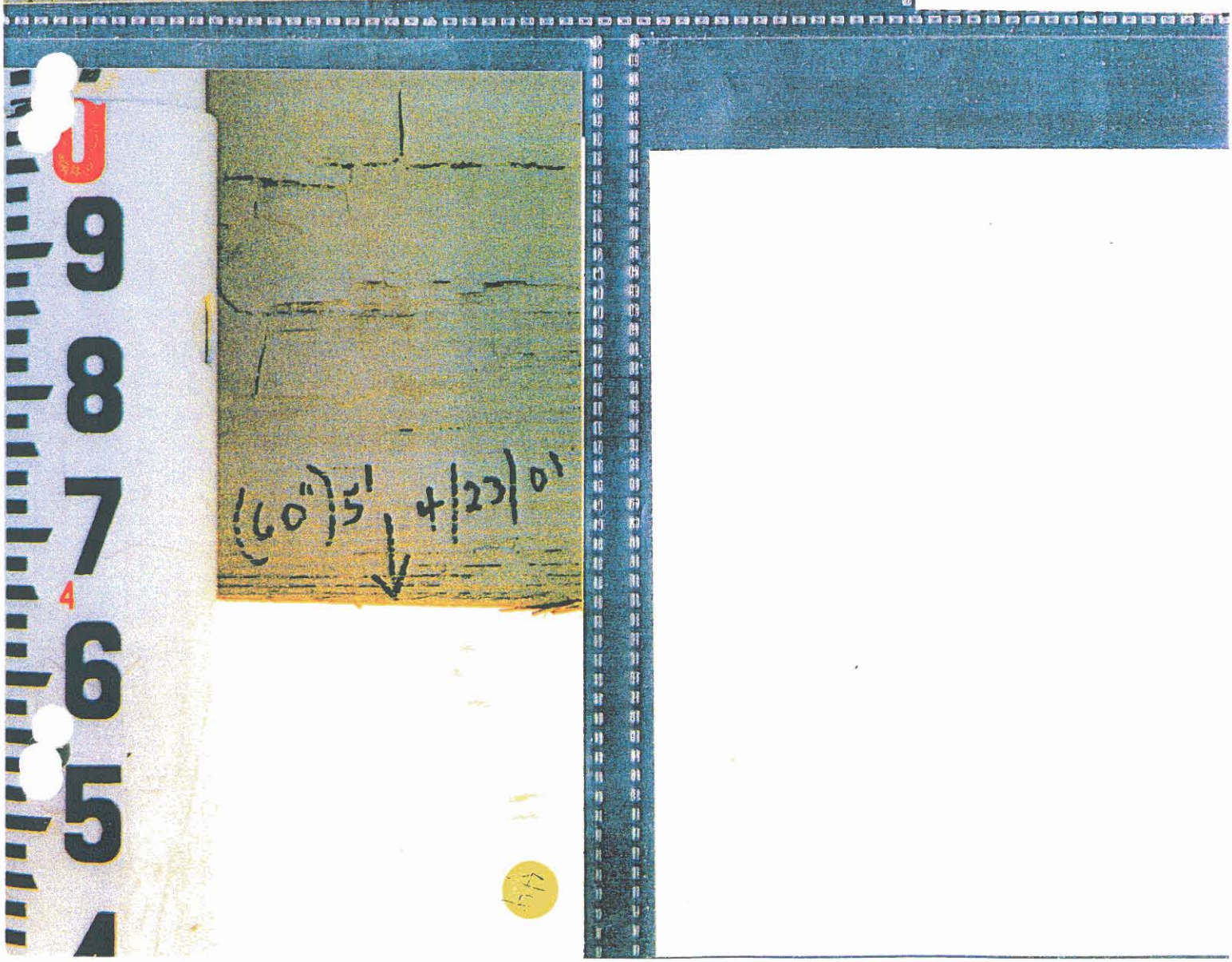


14. Dream Street Con-Arch Bridge, Footbridge and wash excavation.







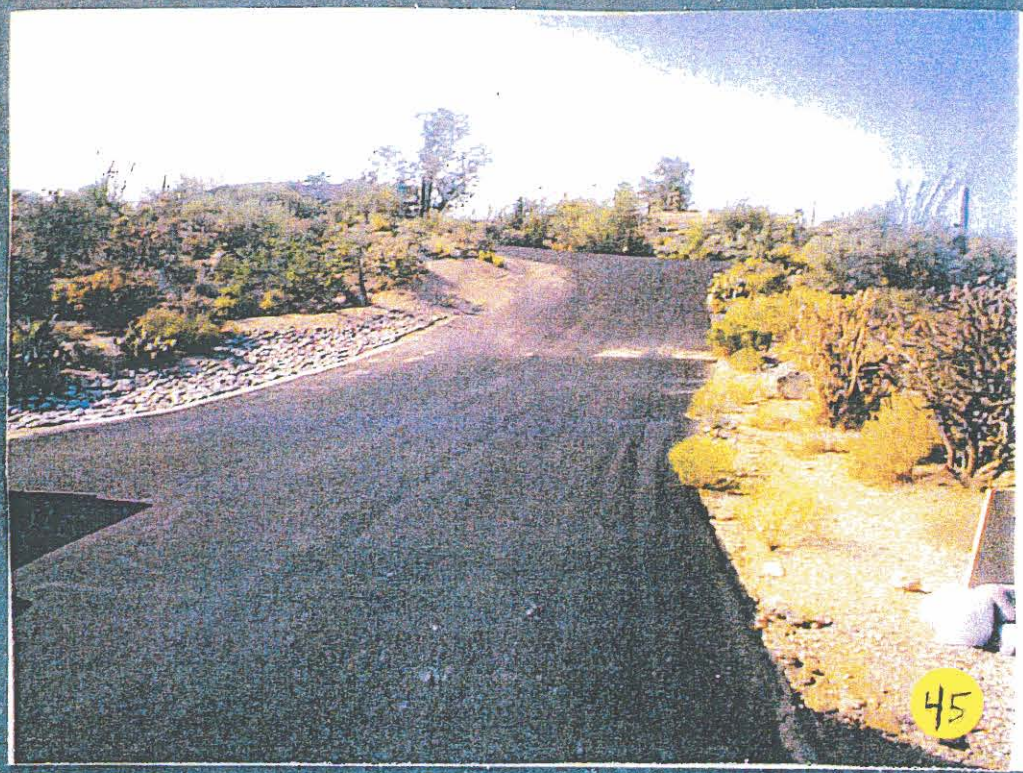


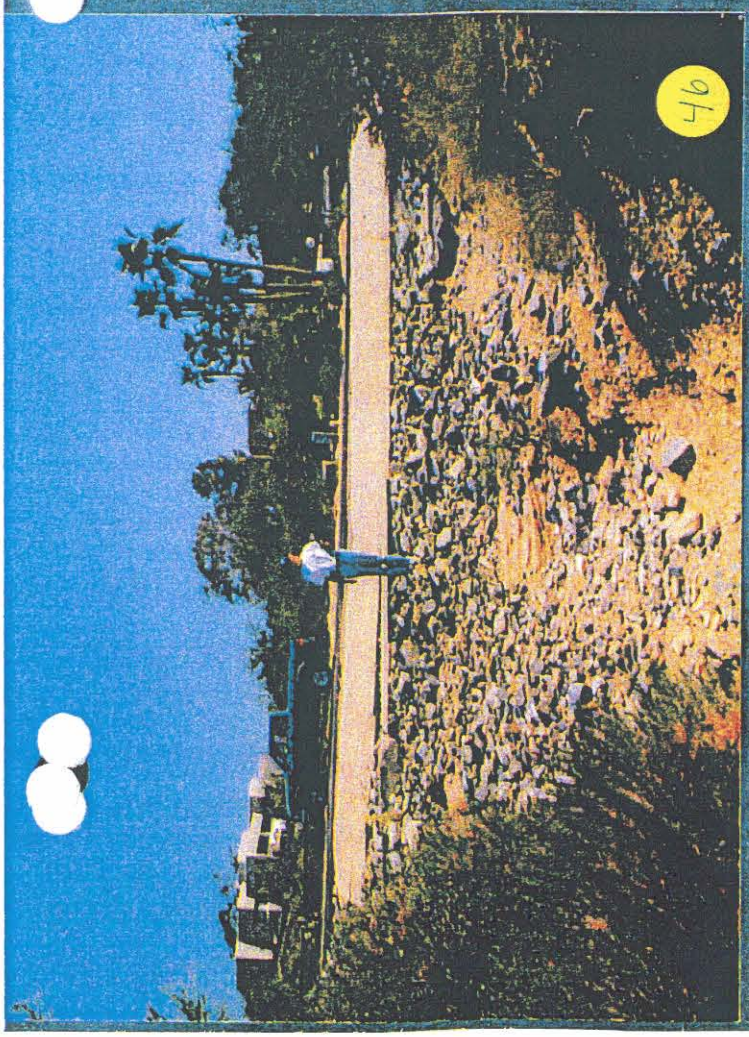
26. – 44. Dream Street Con-Arch Bridge, Footbridge and wash excavation.

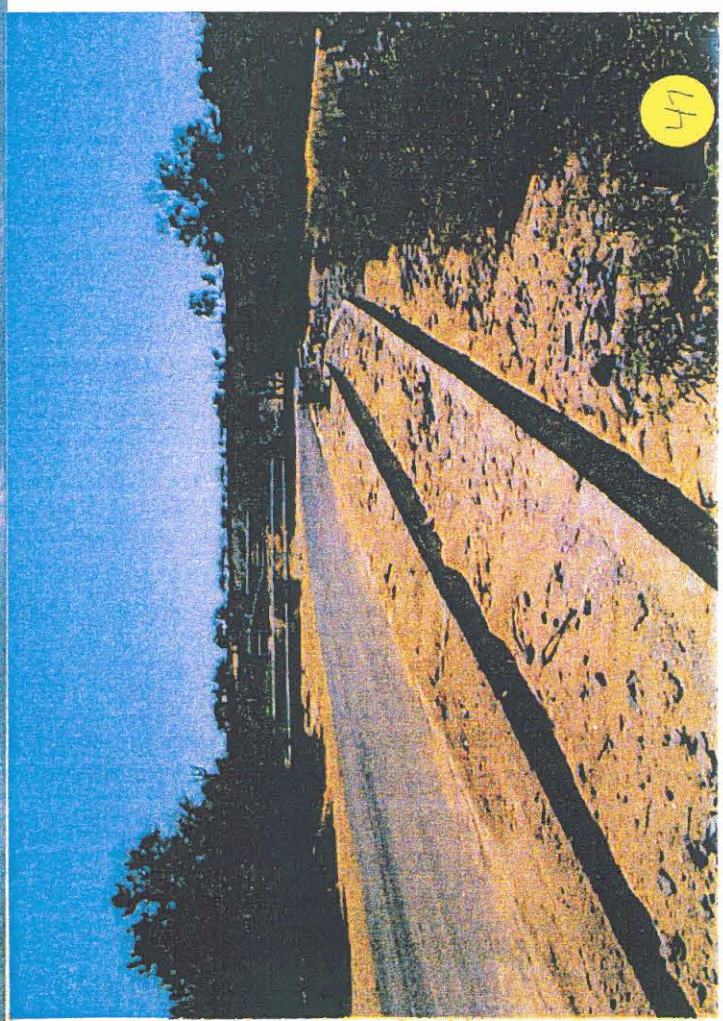
5. Site #169. Carefree Drive west of Foremore Cir.

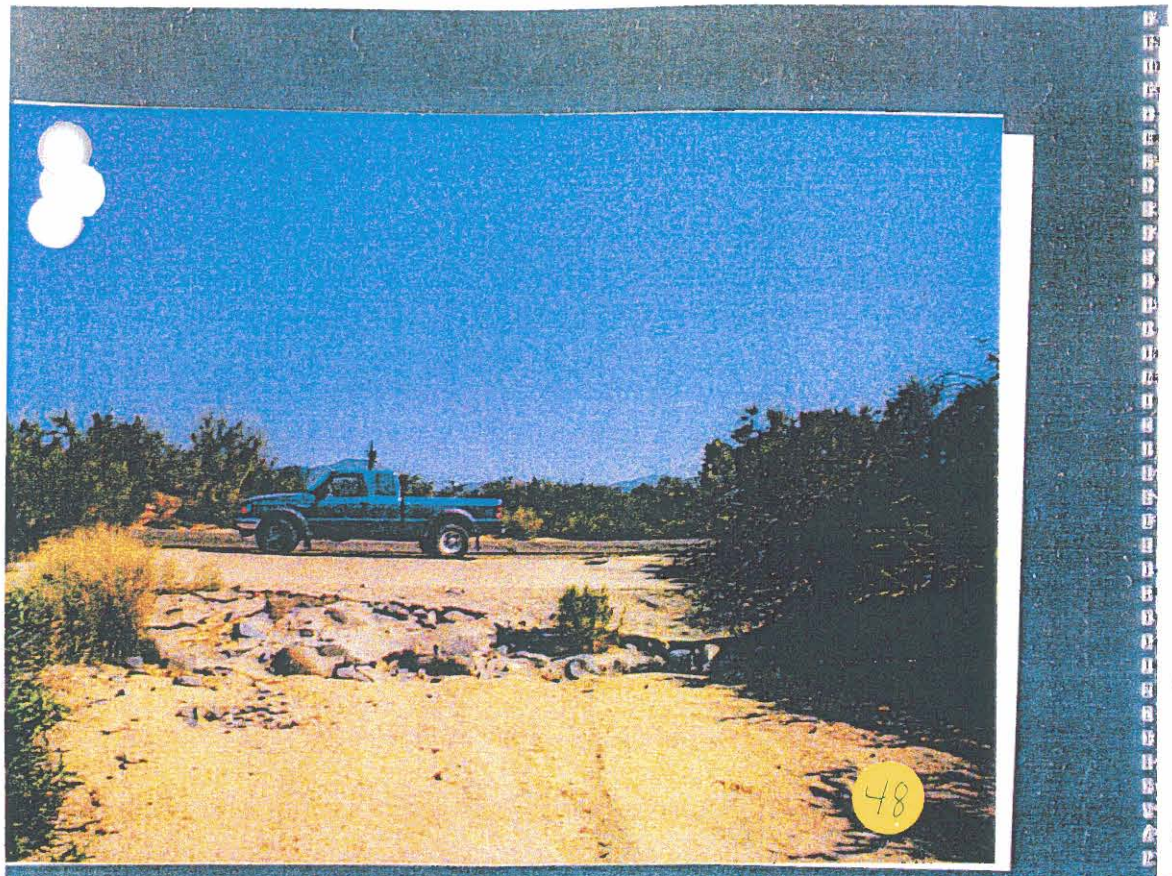
6. Site # 171. Carefree Drive west of Dog Leg

7. Site #43. (JEF). Cow Track at Scottsdale Border





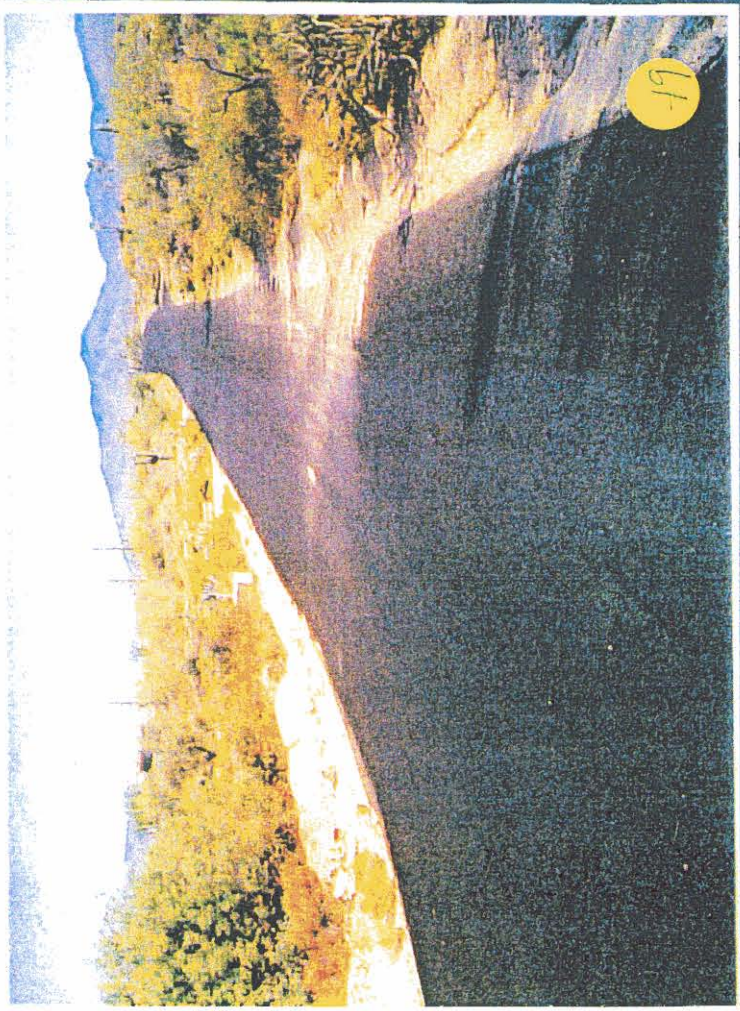


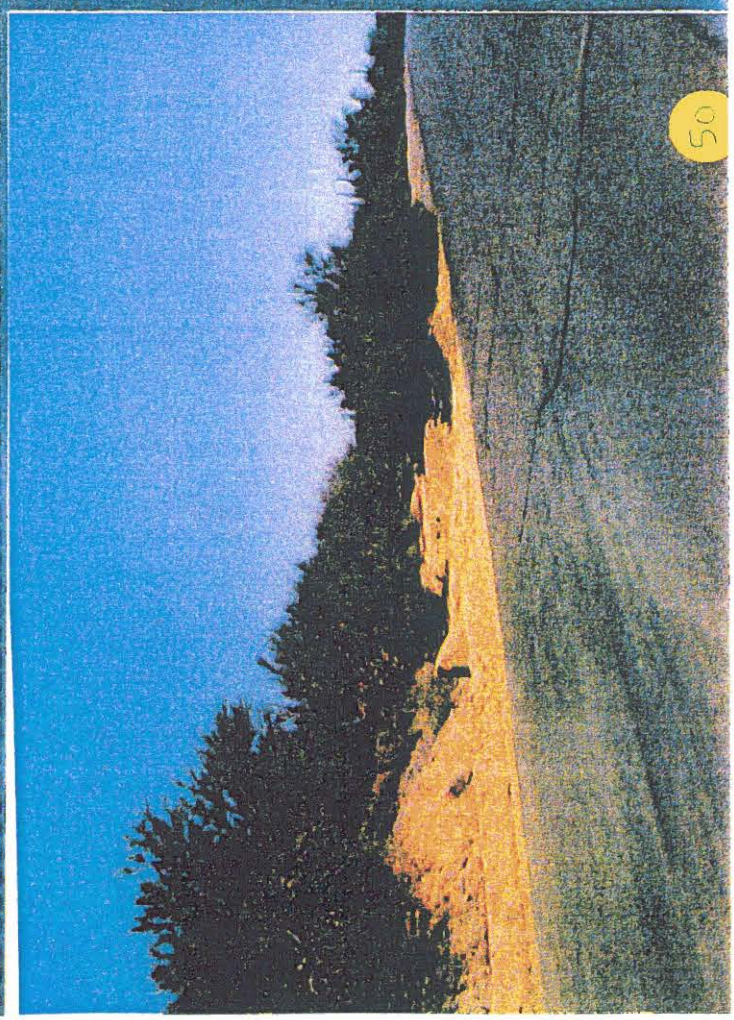


48. Site #37. (JEF) Doble Eagle west of Pima

49. Site #37. (JEF) Double Eagle west of Pima

50. DCP01903

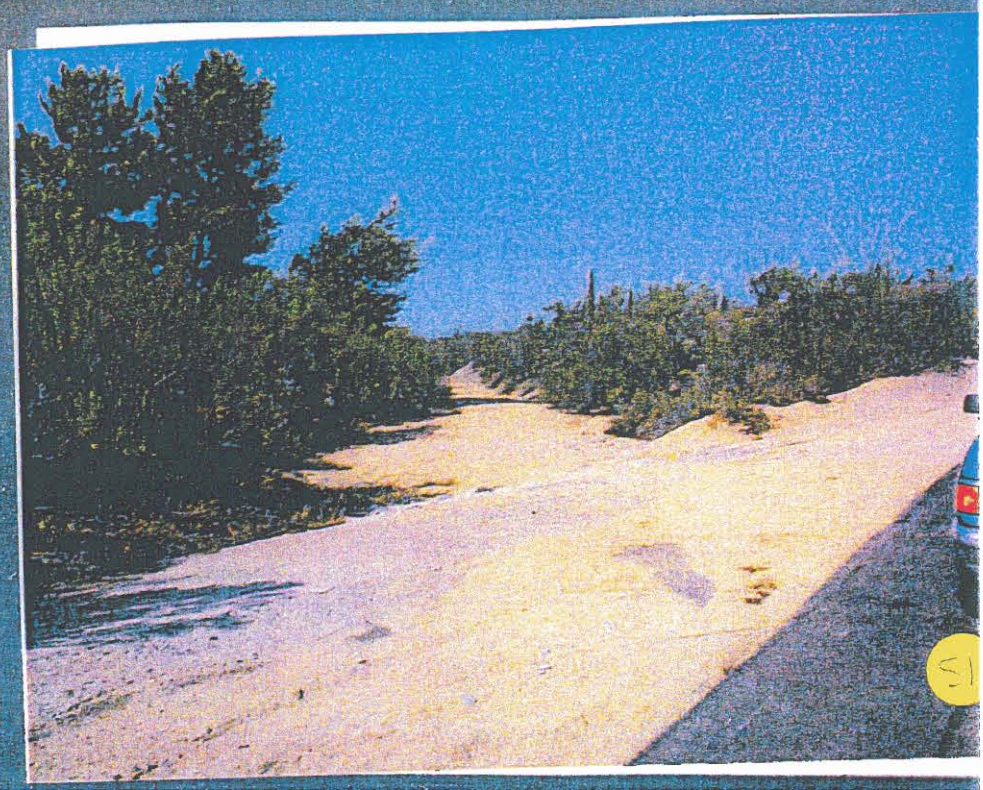


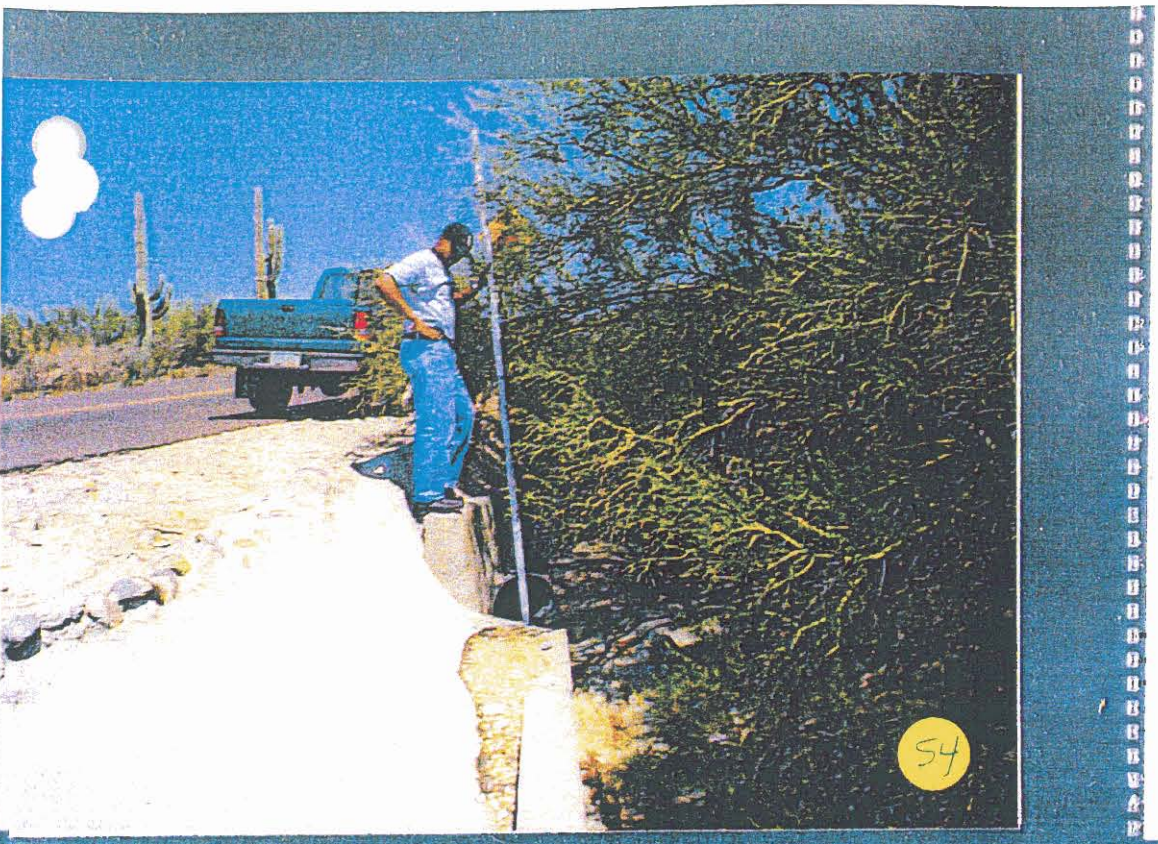


51. Site DCP01904

52. Site #190, 53 (JEF). Rising Sun Road.

53. Site # 190, 53 (JEF). Rising Sun Road

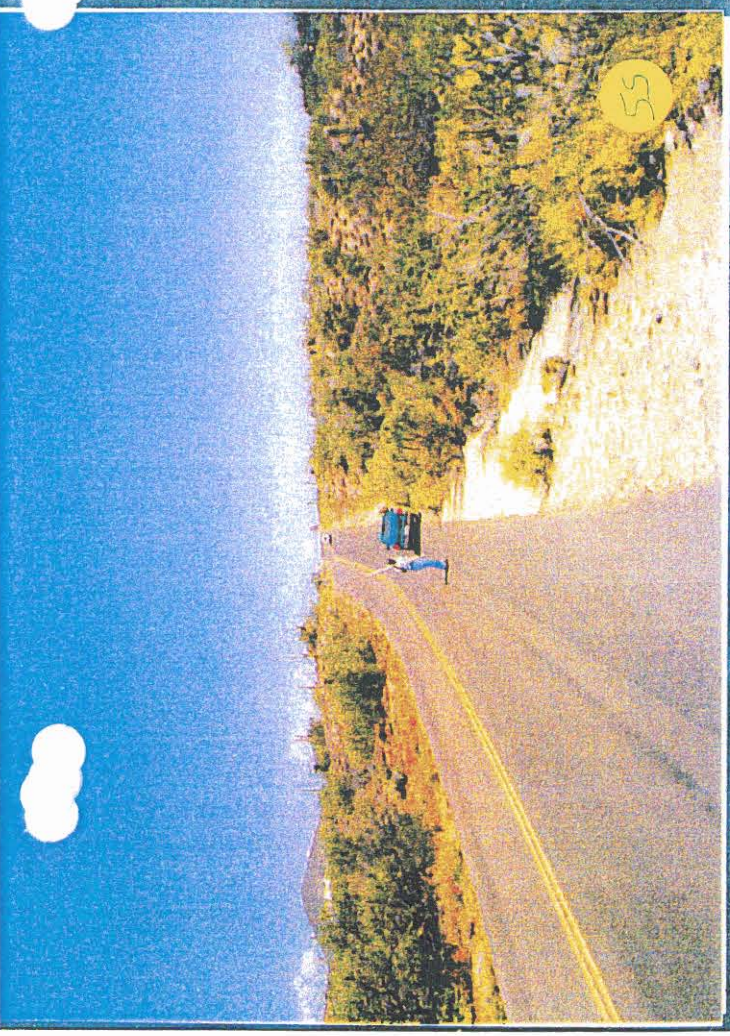


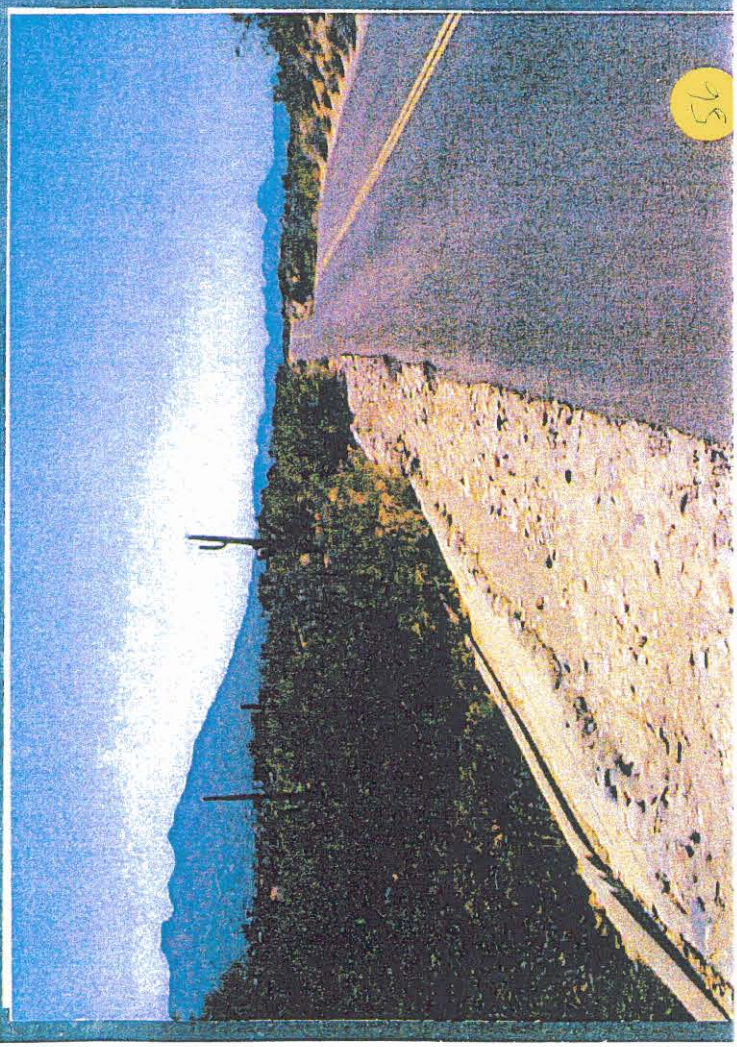


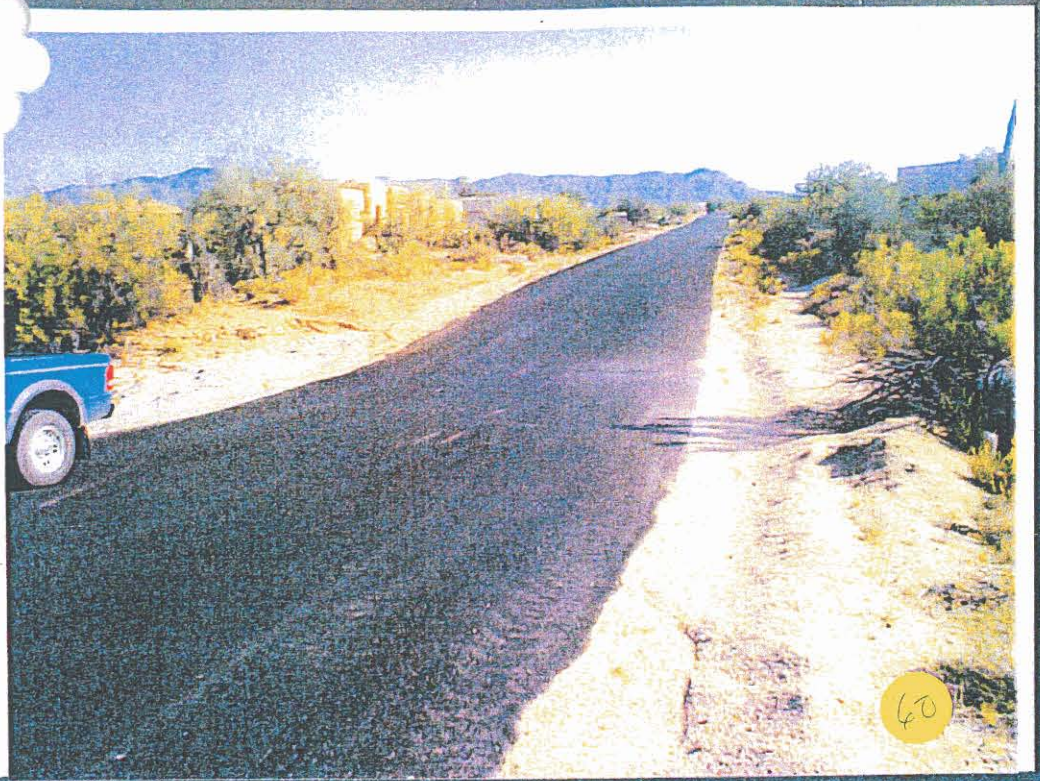
54. Site #191. Rising Sun Road

55. Site #191. Rising Sun Road

56.Site #191. Rising Sun Road



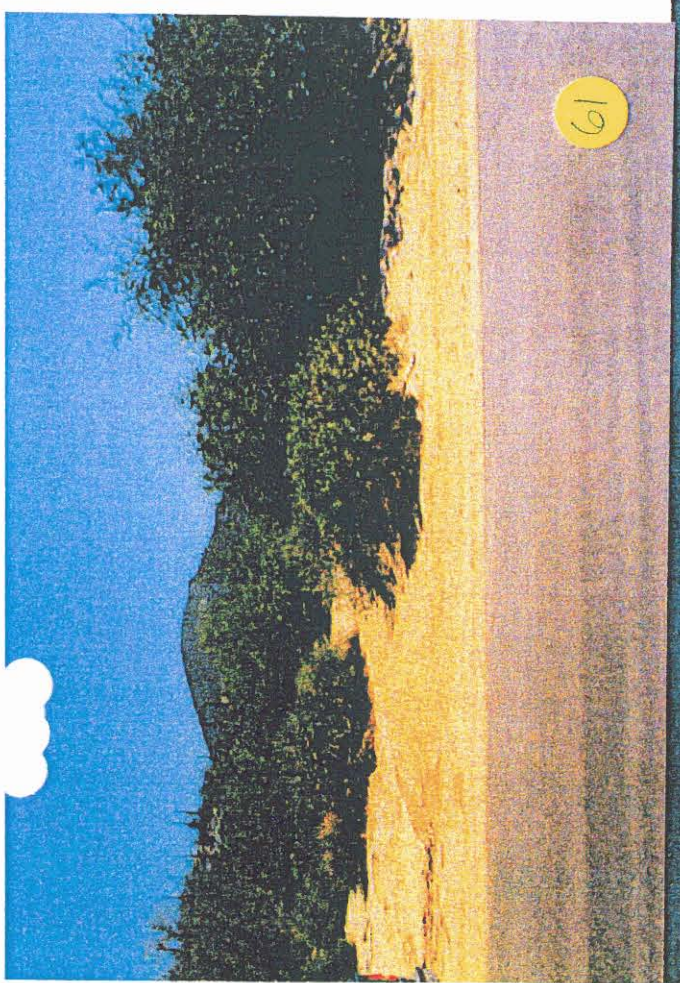


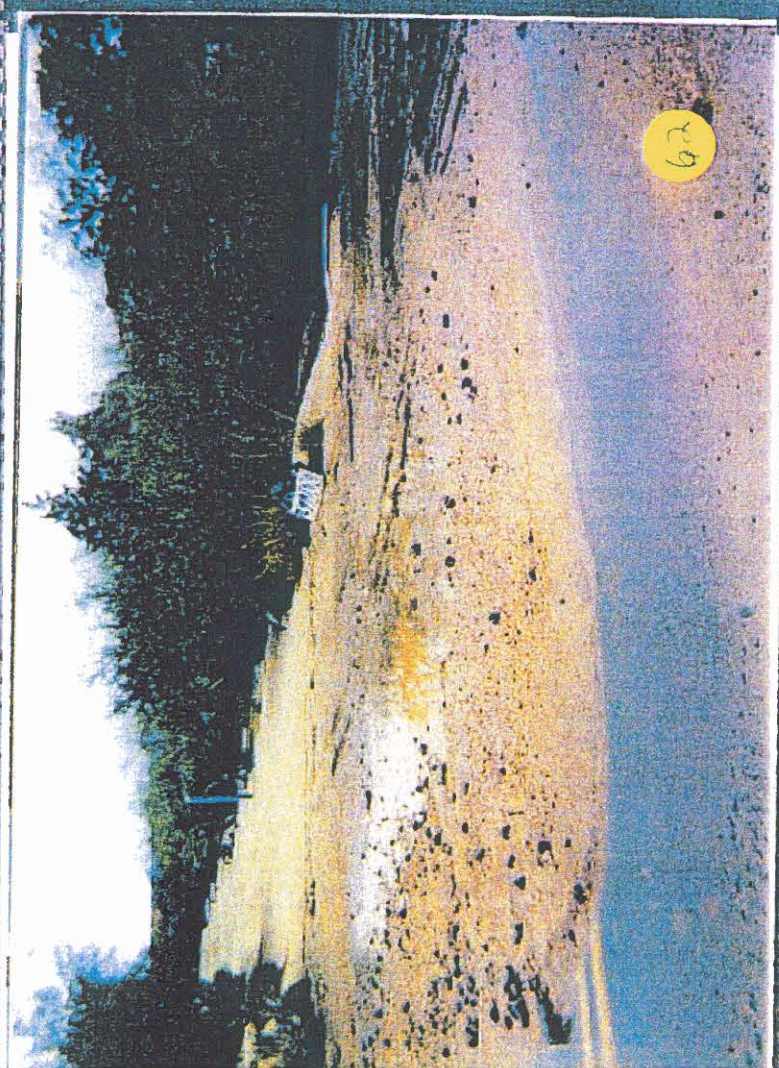


60. Site #159. Twillight south of Venus View

61.Site #43. (JEF) Upstream Cow Trackat Scottsdale Border

62. Site #32. (JEF). Pruett family photos during flood event





Site #32. (JEF). Pruett
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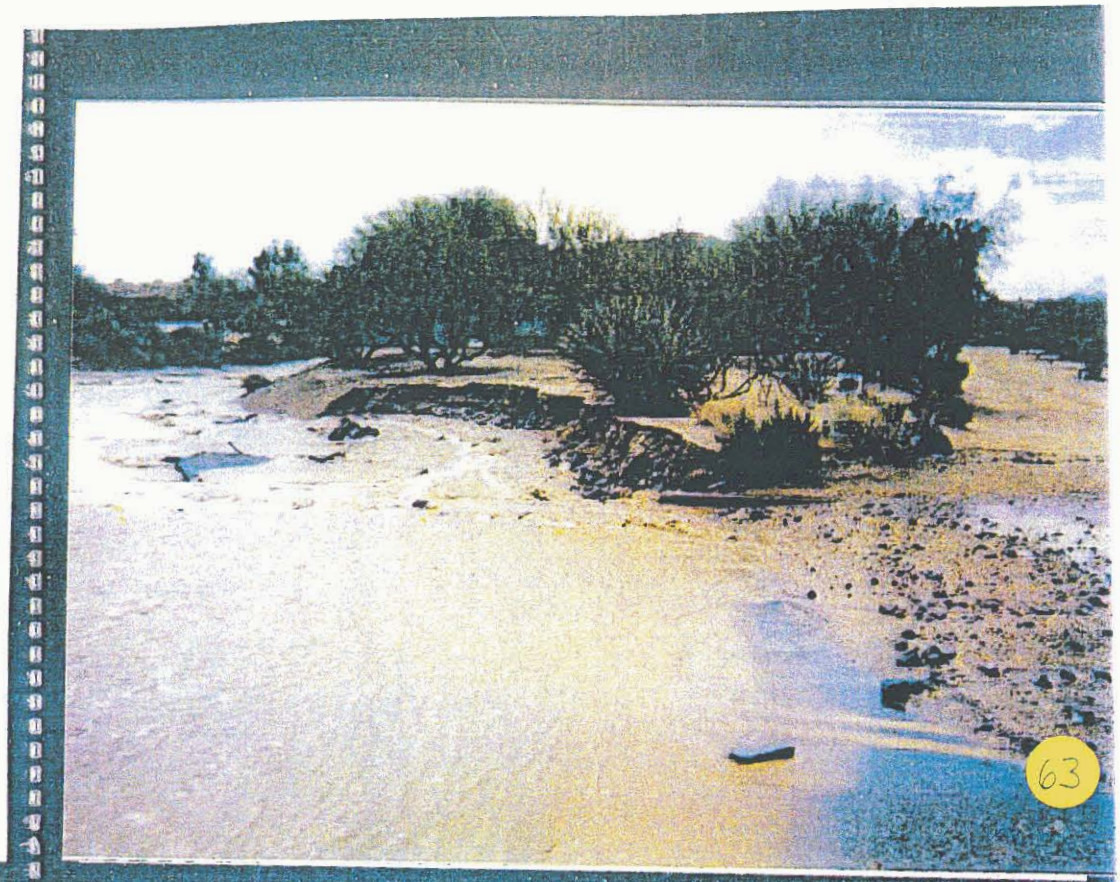
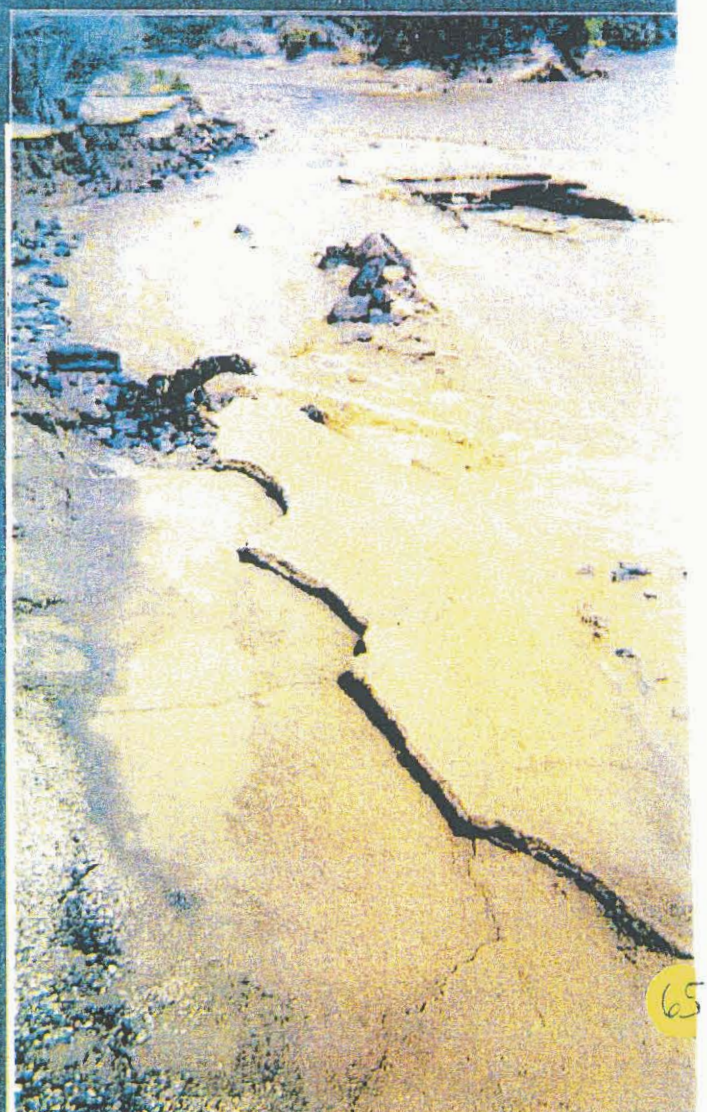
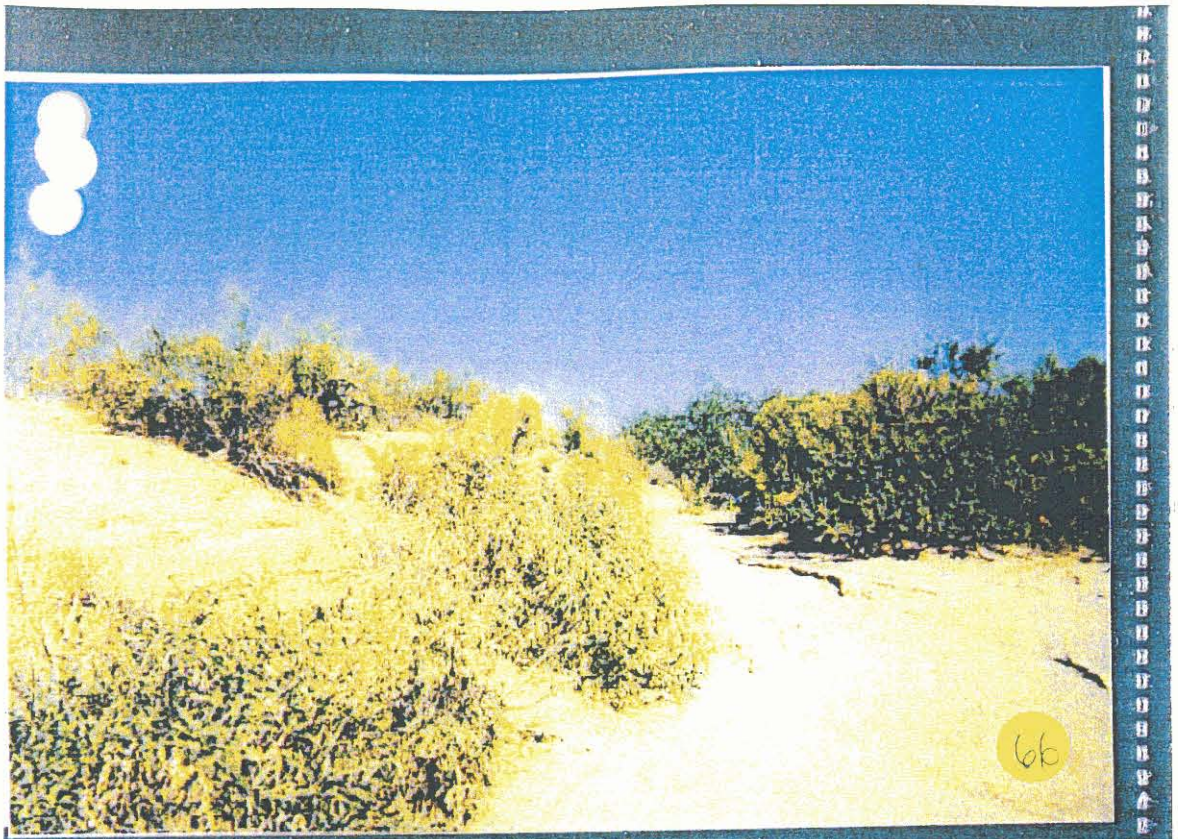
64. Site #32. (JEF). Pruett family photos during flood event

65. Site #32> (JEF). Pruett family photos during flood event



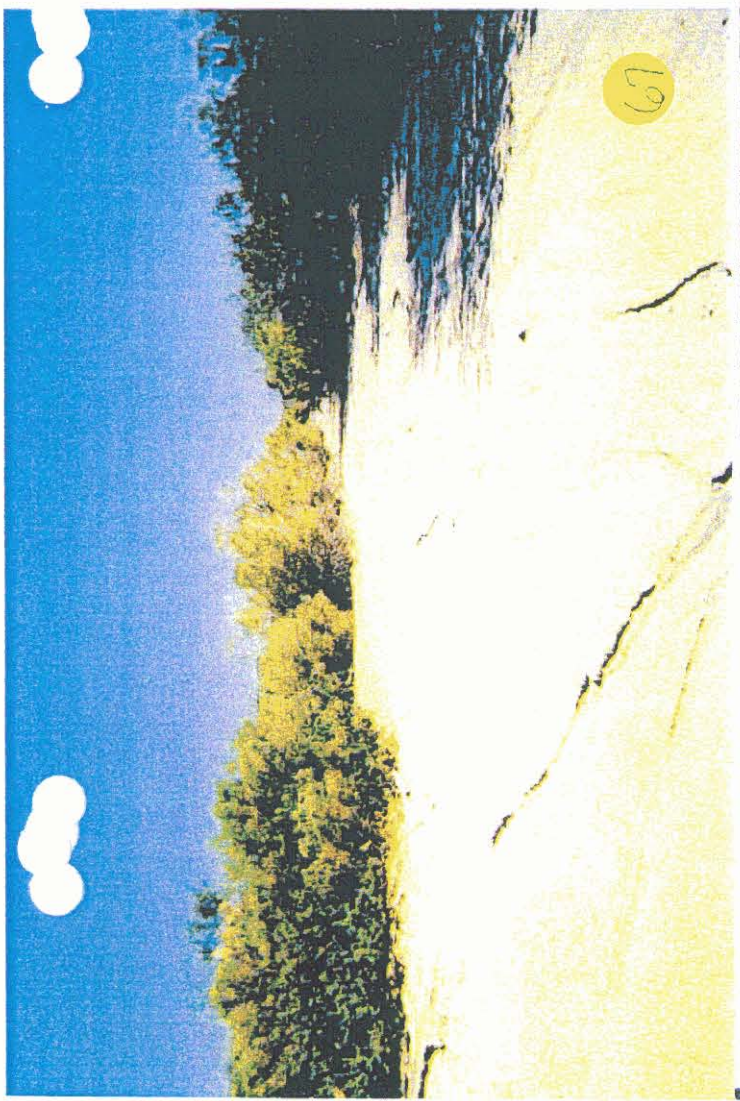


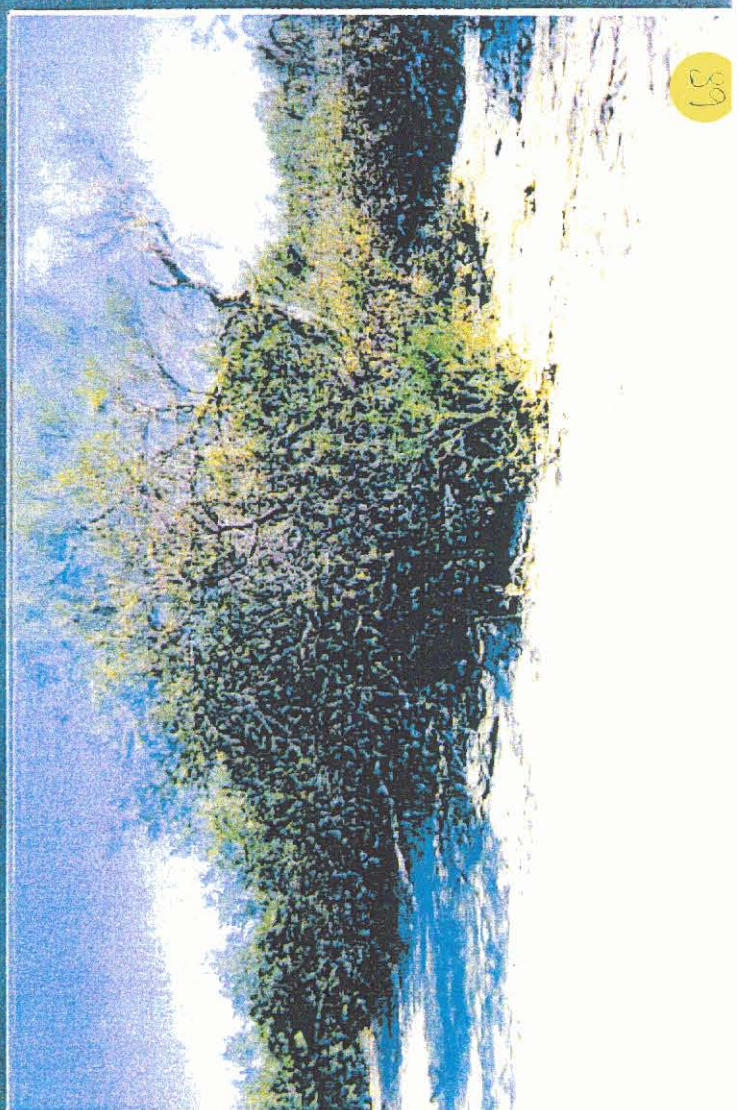


66. Site #32. (JEF) Pruett family photos during flood event

67. Site #32. (JEF). Pruett family photos during flood event

68. Site #32. (JEF). Pruett family photos during flood event





Site #32. (JEF) Pruett
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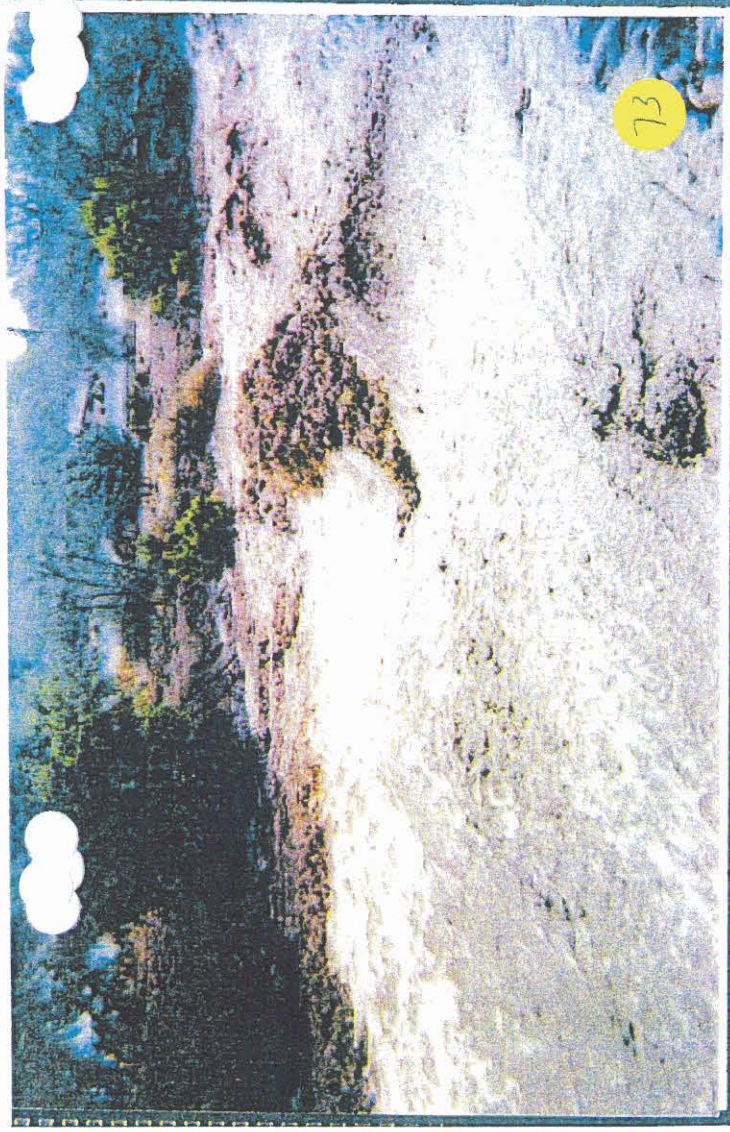
70. Site #32. (JEF). Pruett family photos during flood event

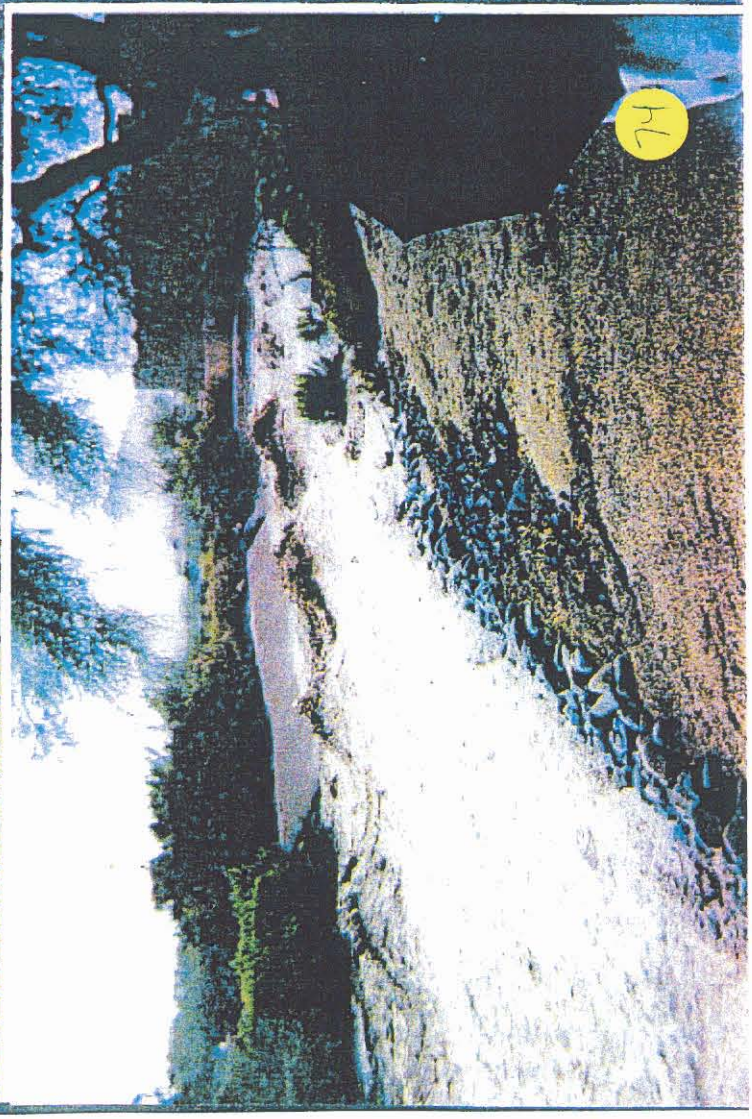
71. Site #32. (JEF) Pruett family photos during flood event

72. Site #32. (JEF). Pruett family photos during flood event

73. Site #32. (JEF) Pruett family photos during flood event

74. Site #32. (JEF) Pruett family photos during flood event

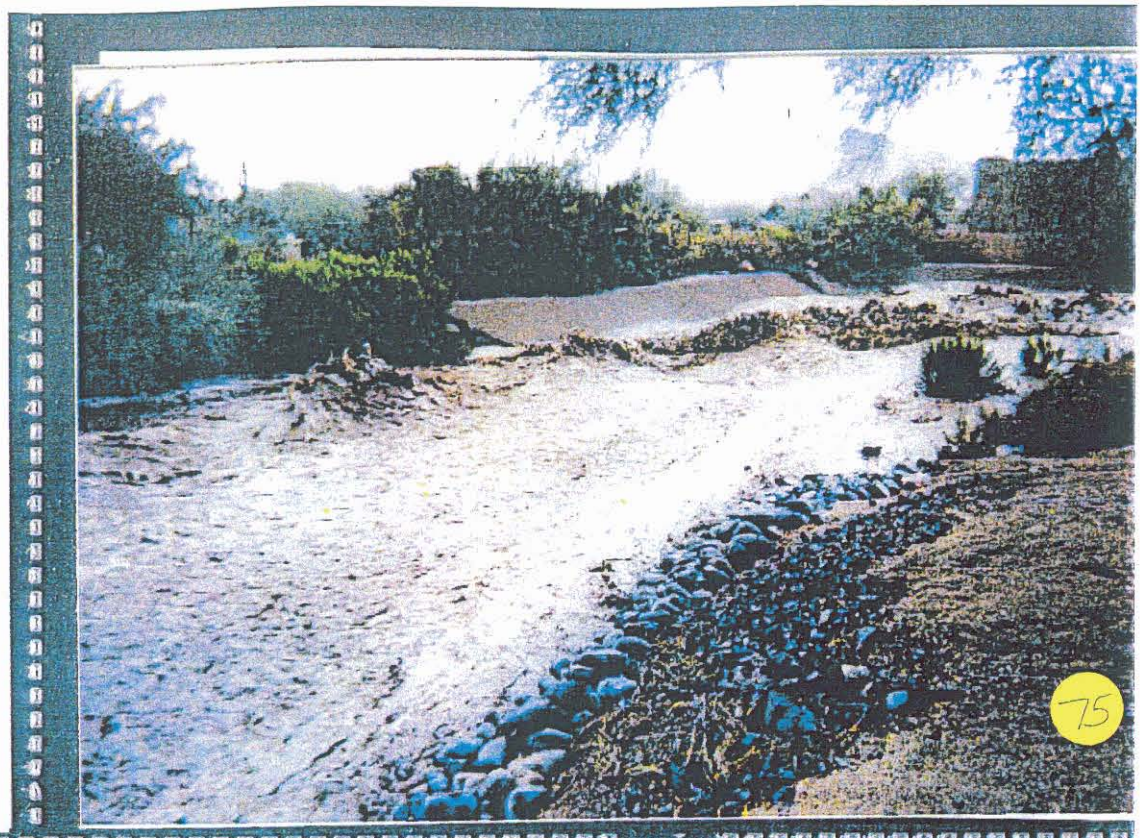


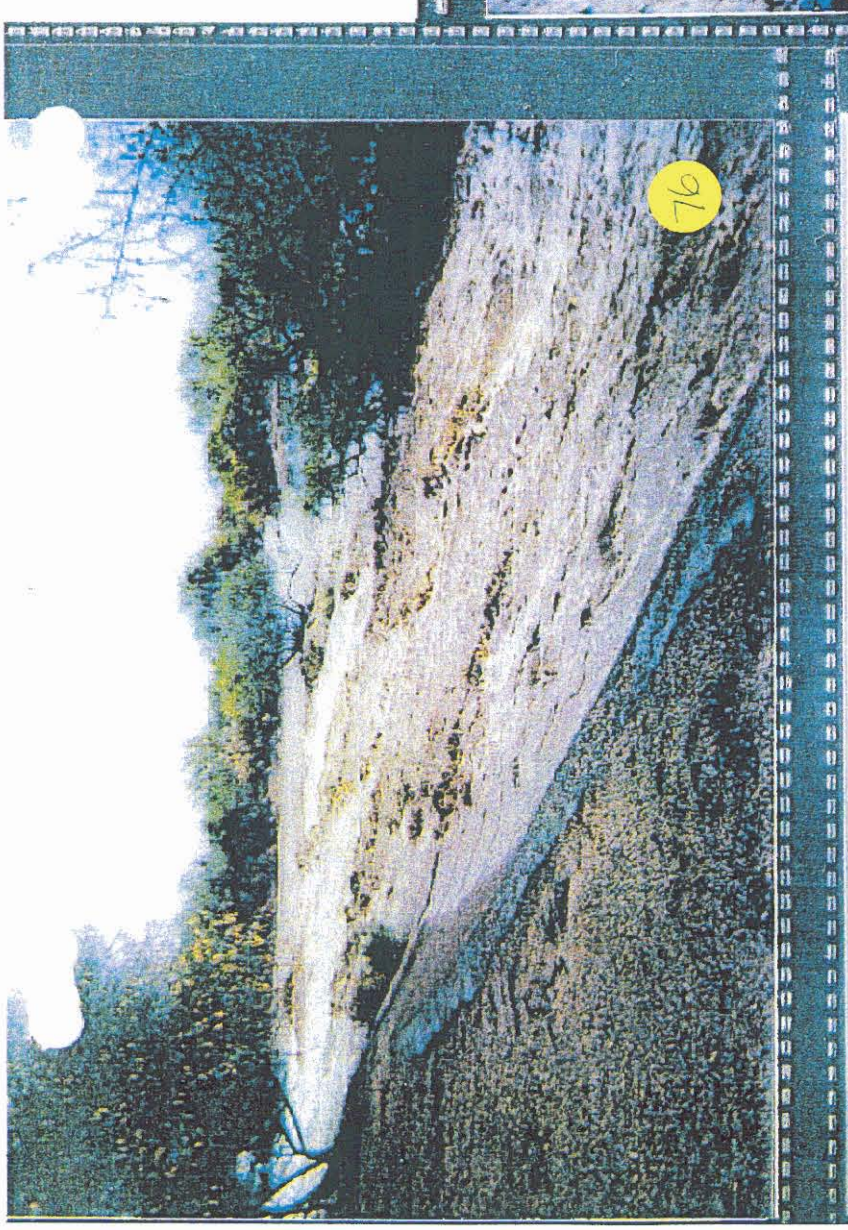


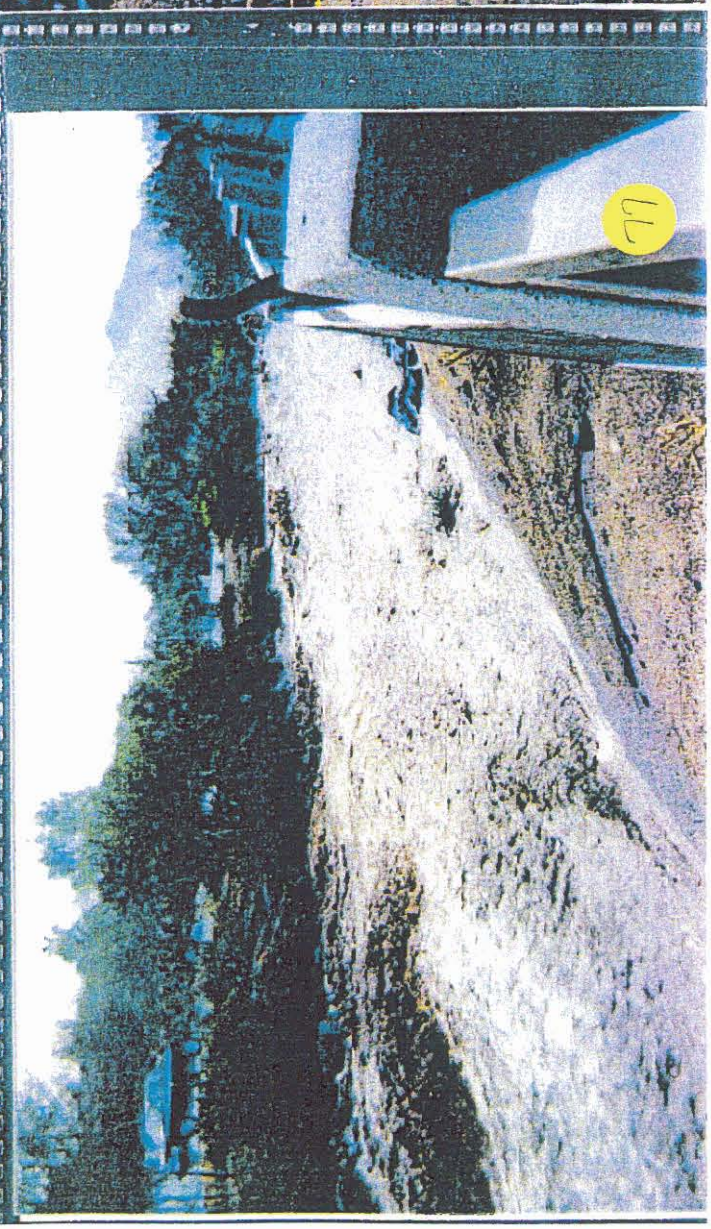
7. : #32. (JEF) Pruett f. ıy photos during flood event

76. Site #32. (JEF) Pruett family photos during flood event

77. Site #32. (JEF). Pruett family photos during flood event



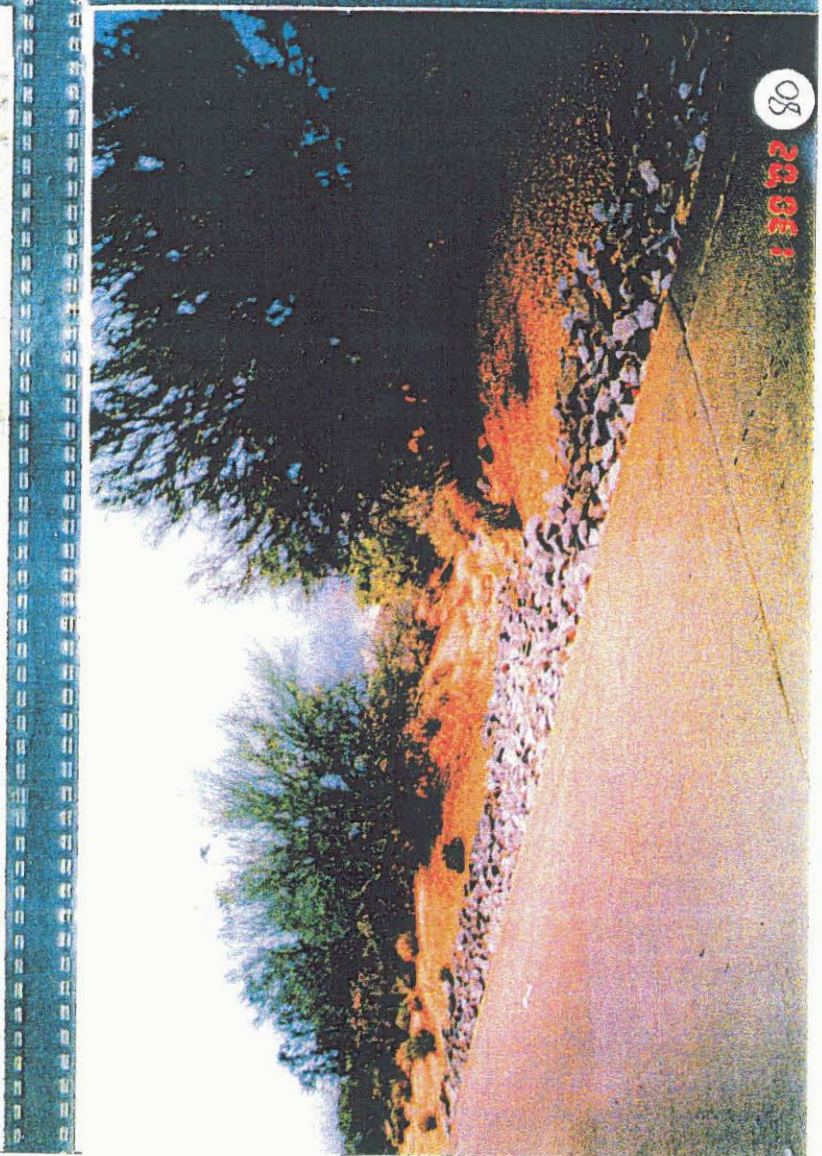




78. Site #32. (JEF) Pruett family photos during flood event

79. Site #32. (JEF). Pruett family photos during flood event

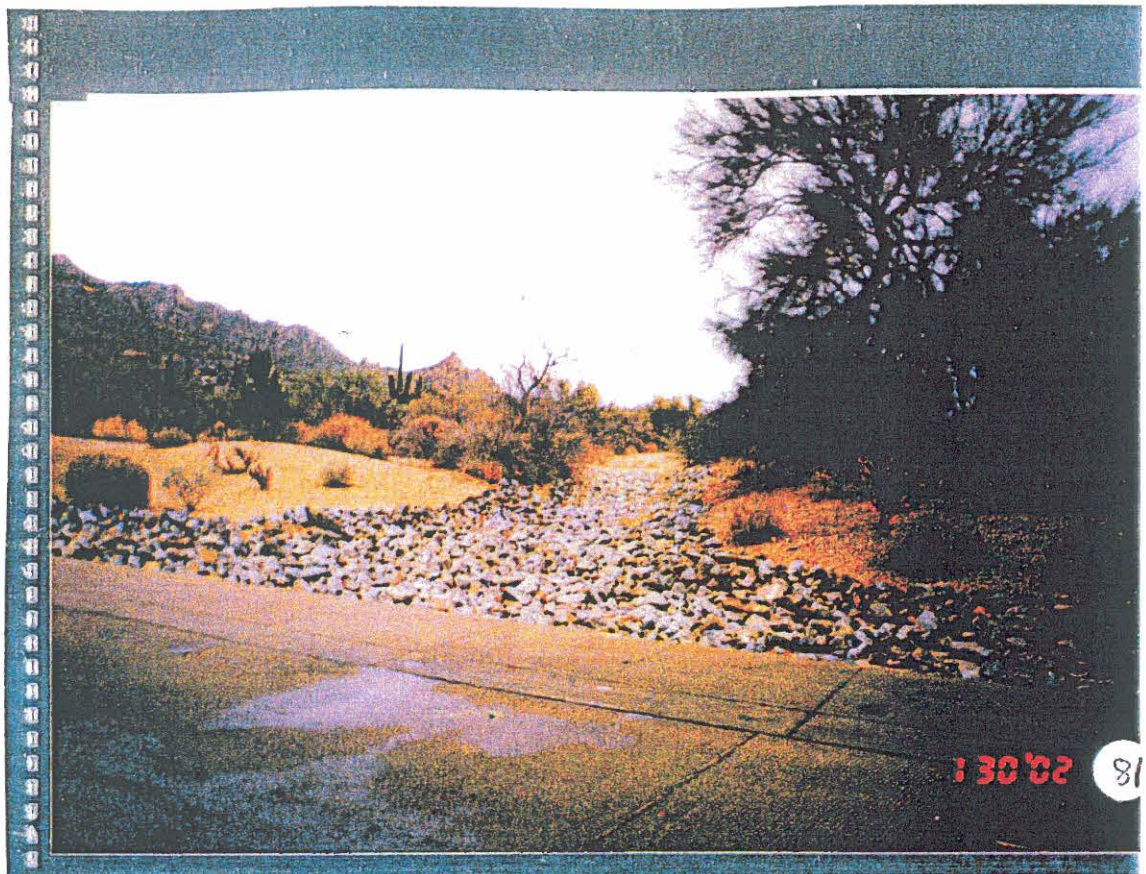
80.Terravita Way Dip Crossing Downstream Exit View looking West

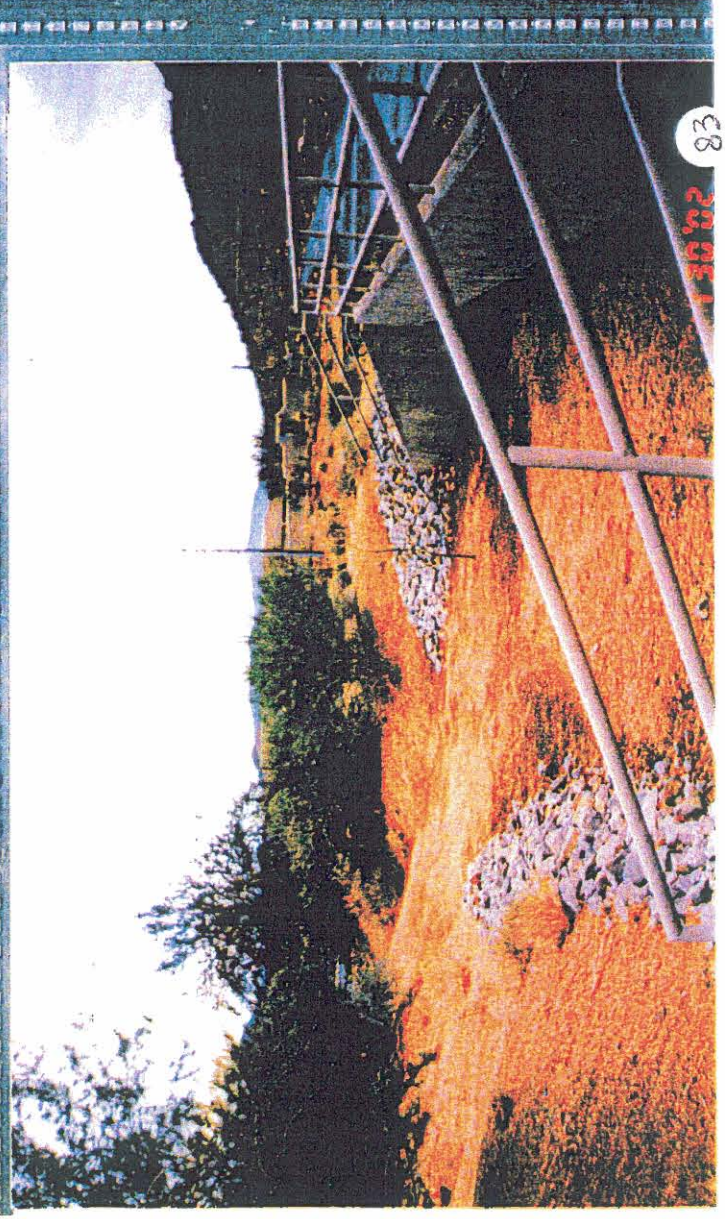


1. 7 avita Way Dip
(sing View Looking
ream

2. Terravita Way Center Median in Dip Crossing

3. Terravita Way Culverts Downstream End

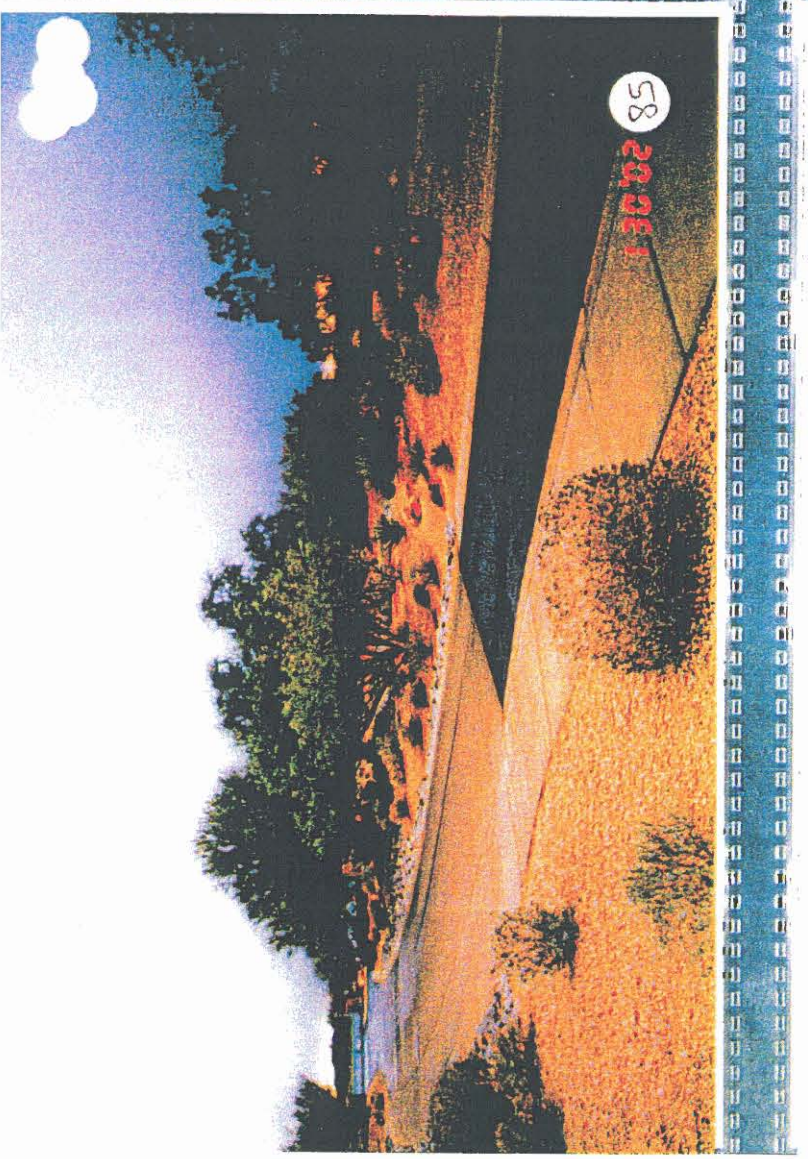


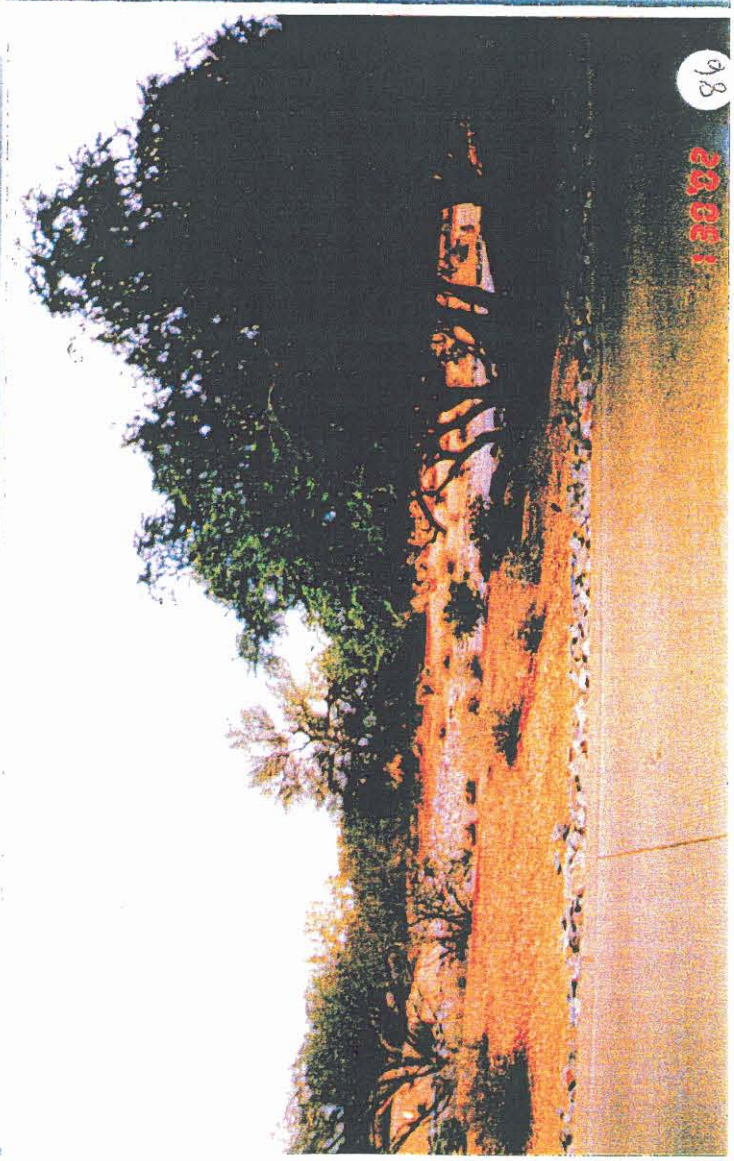


84. Terravita Way View Looking South @ Dip Crossing, Downstream Section

85. Terravita Way Dip Crossing View Looking South Upstream Portion

86. Terravita Way Dip Crossing View Looking Upstream (oblique). Note landscaping mounds

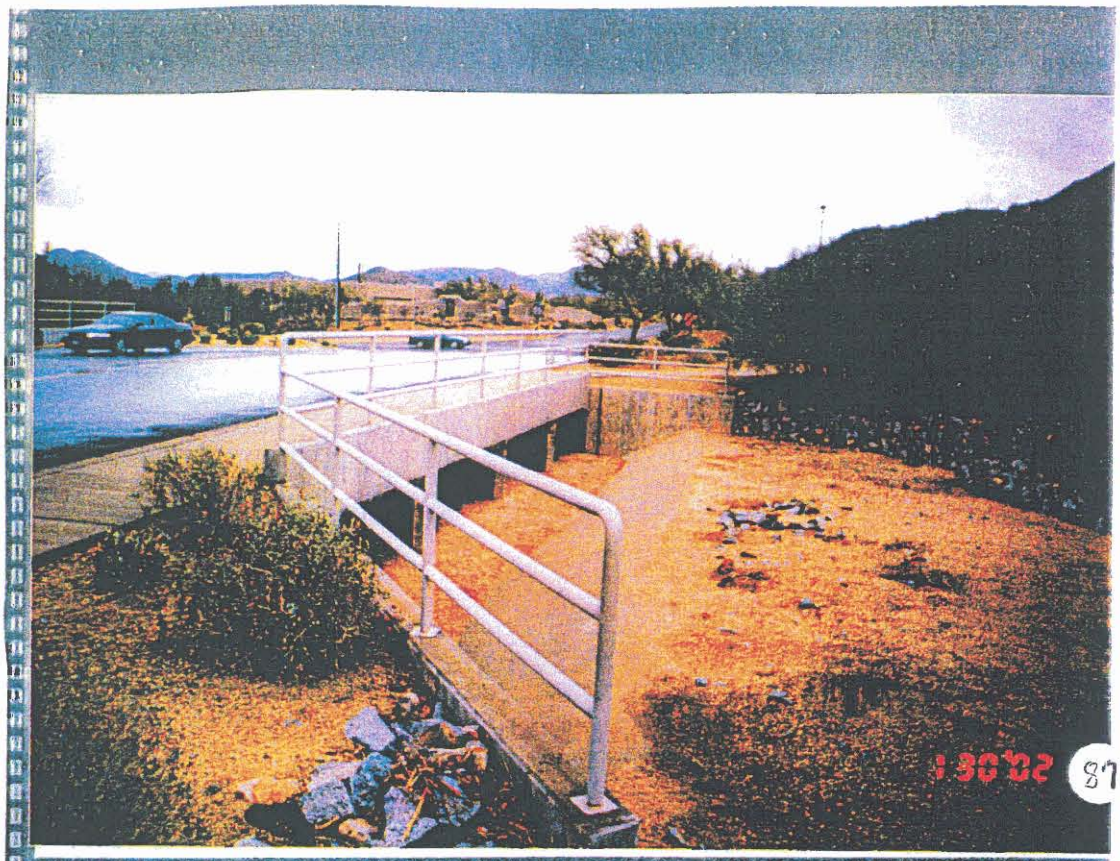


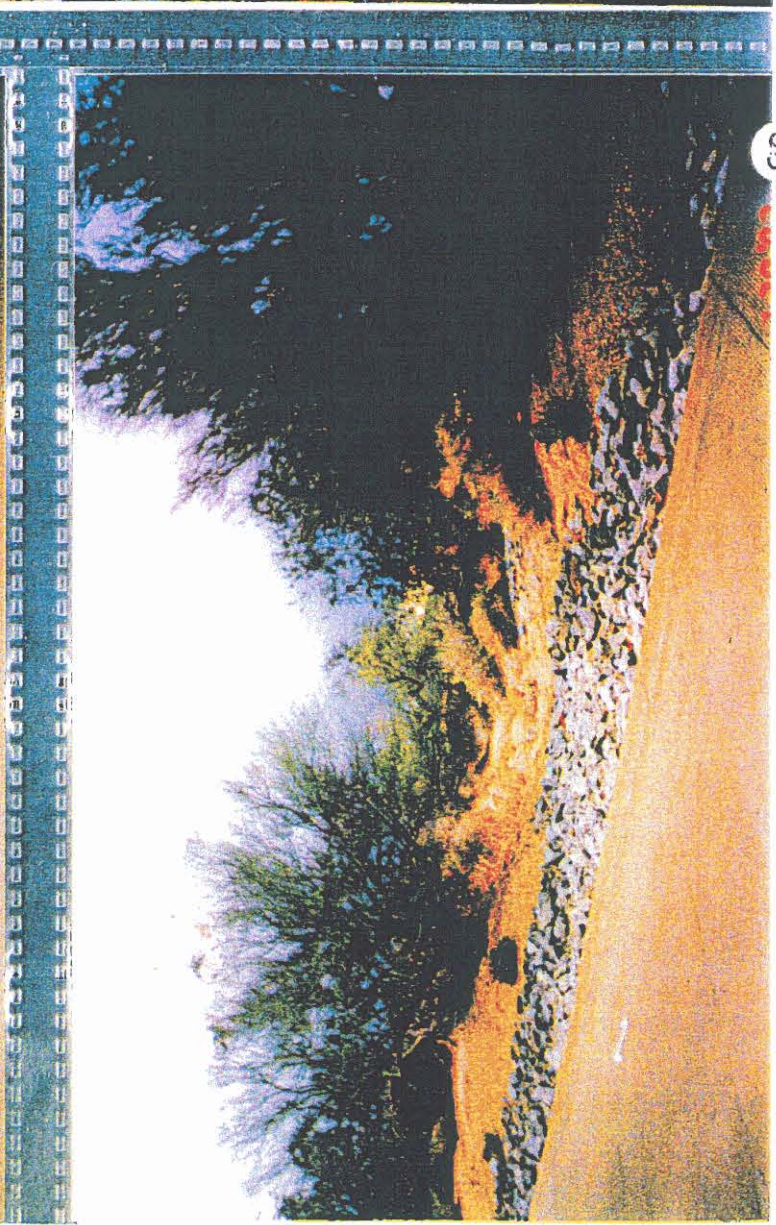


37 ravita Way Upstream
Culvert Entrance

38. Terravita Way Dip
Crossing Center

89. Terravita Way Dip
Crossing Downstream
Exit View Looking West

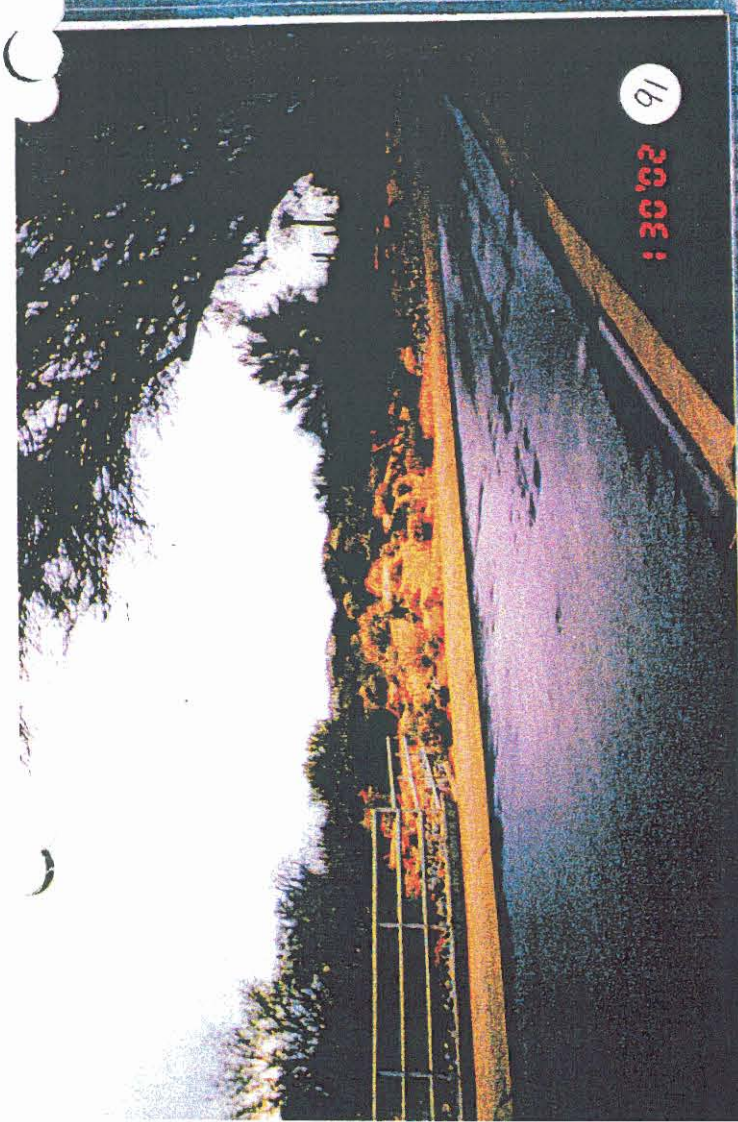




90. Terrivita Way Dip Crossing Central portion View Looking Upstream Note Landscape Mounds

91. Terravita Way Looking Upstream at Both Culvert & Dip Crossing.

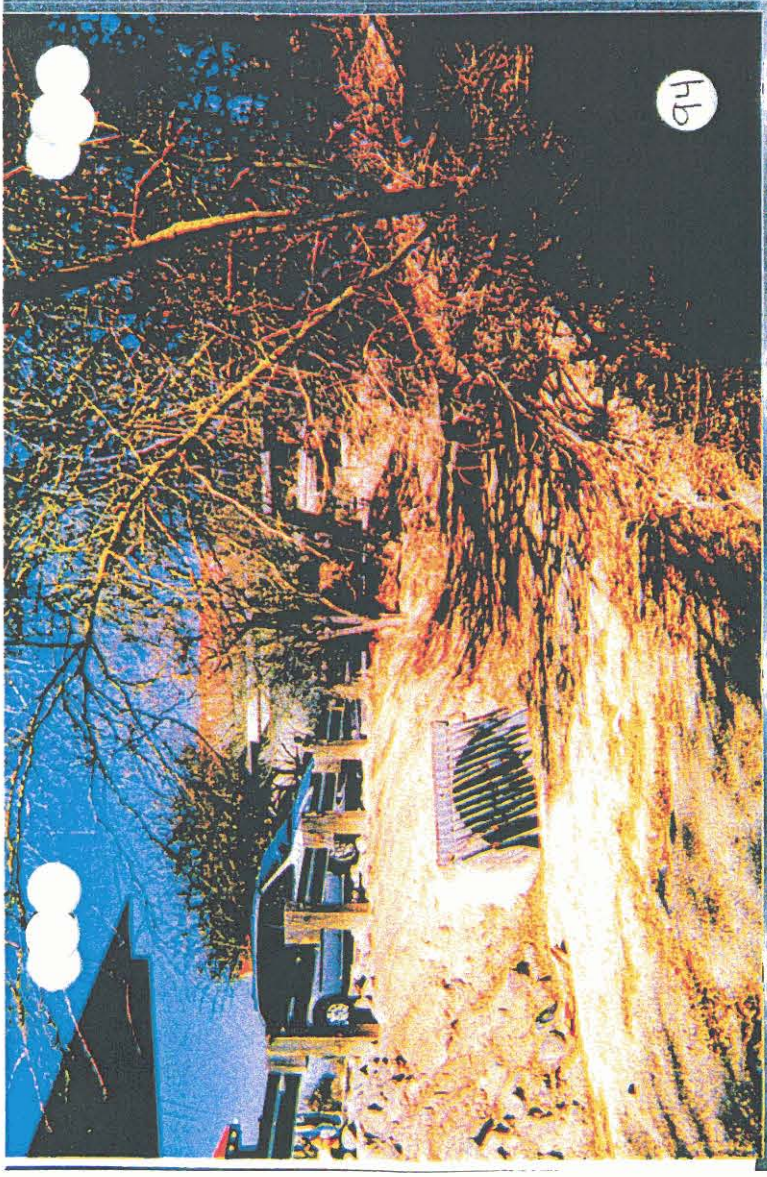
92.Site #71, 27 (JEF) Carefree Terrace Apts.

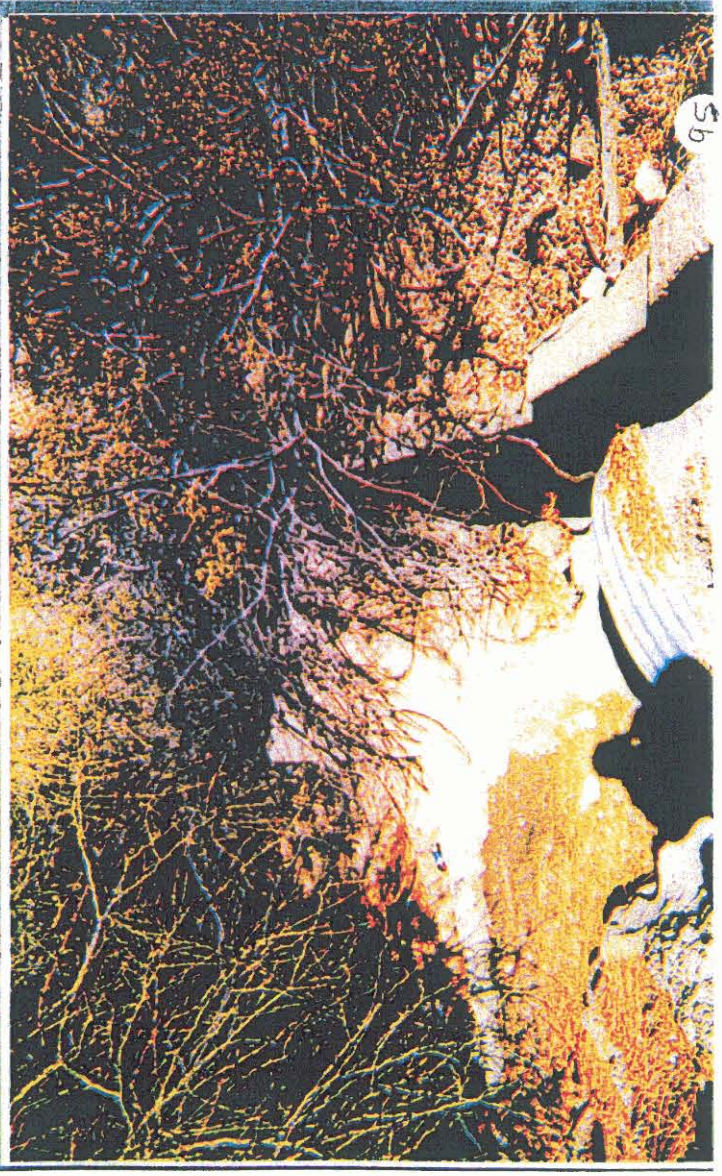


93 #71, 27 (JEF). Carefree Te :e Apts.

94. Site #71, 27 (JEF). Carefree Terrace Apts.

95. Downstream Exit from Culvert-Carefree Terrace Apts.





96. Downstream of Carefree Terrace Apts.

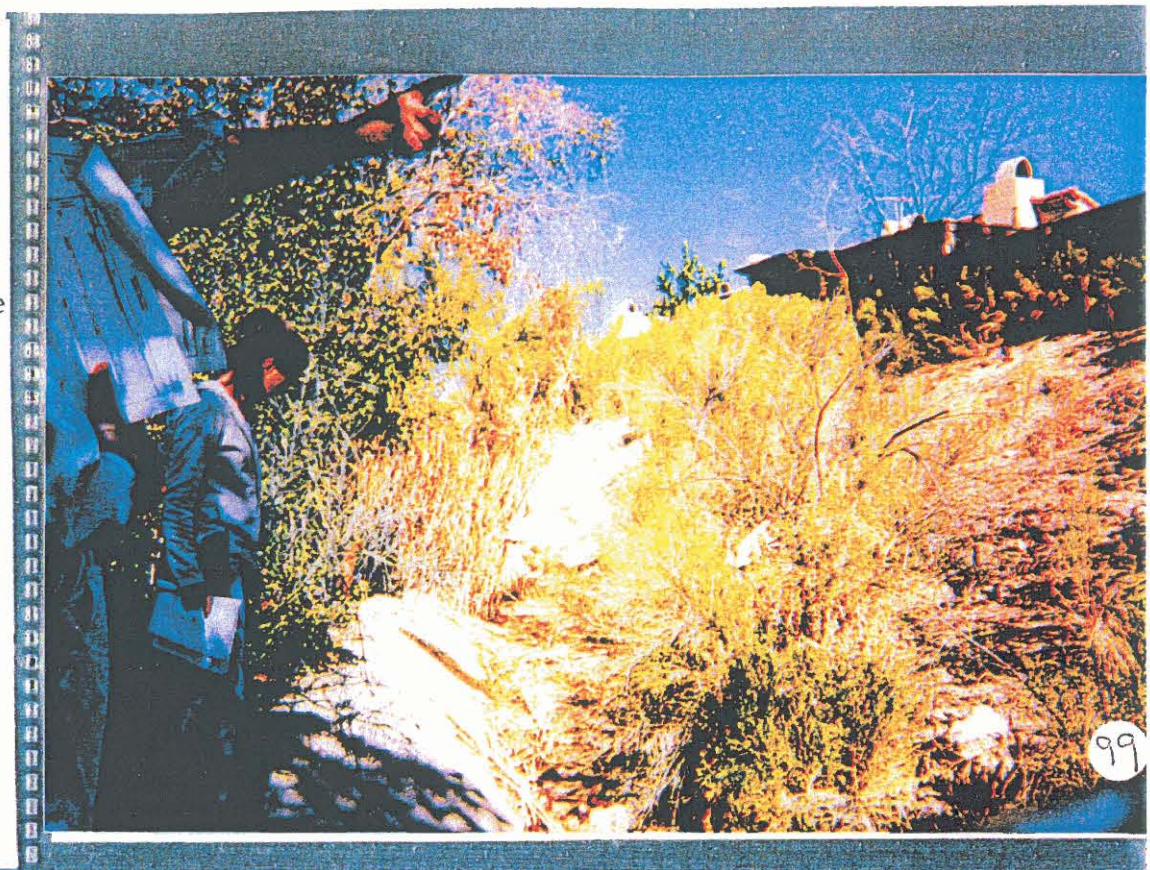
97. Downstream of Carefree Terrace Apts.

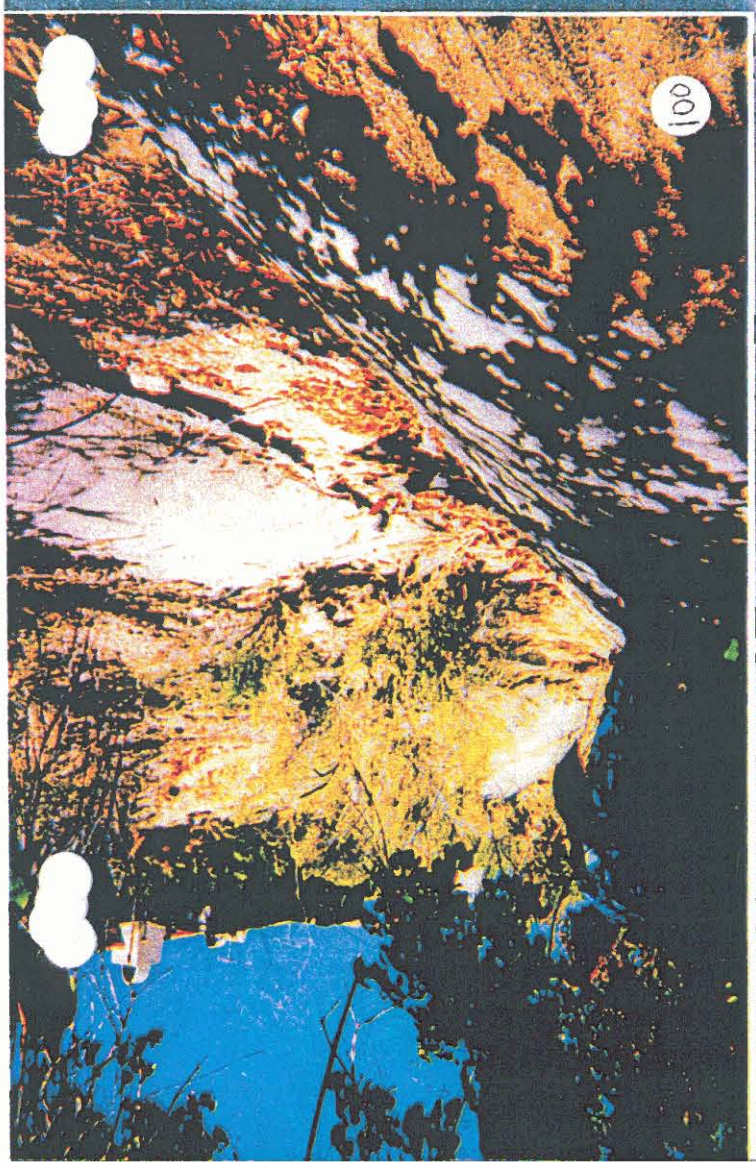
98. Debris in Ditch Behind Sundial Apts.

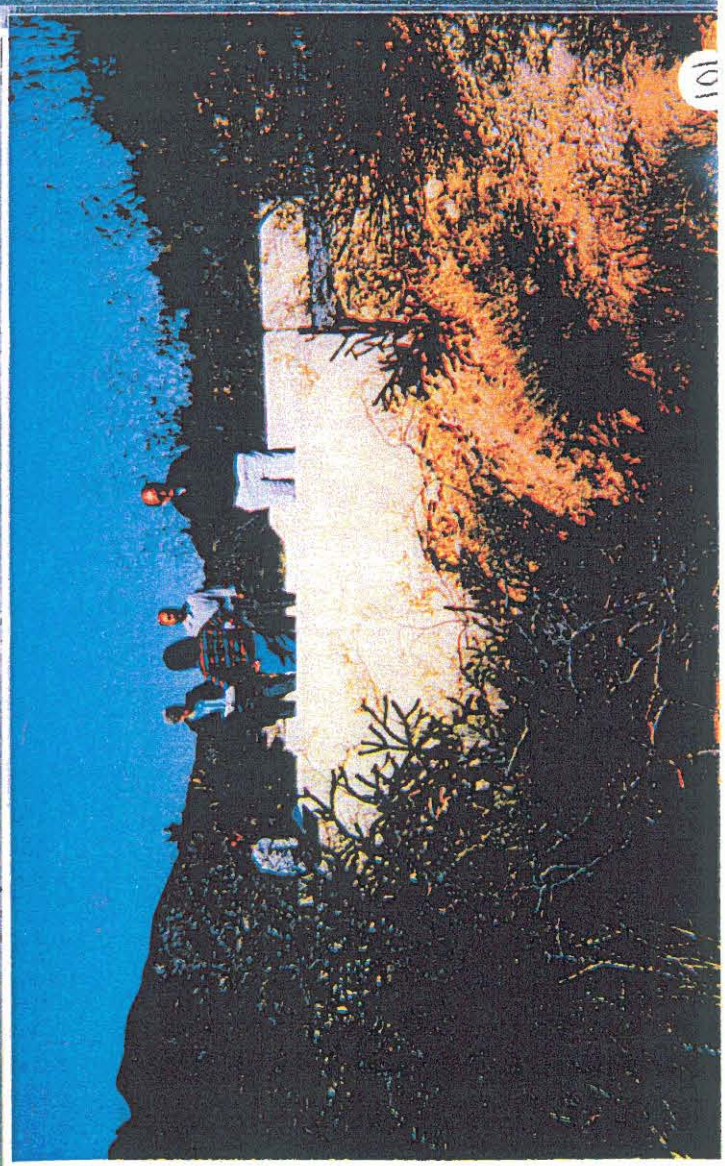
99 ıdial Apts. Off of Cave Cr...k Road

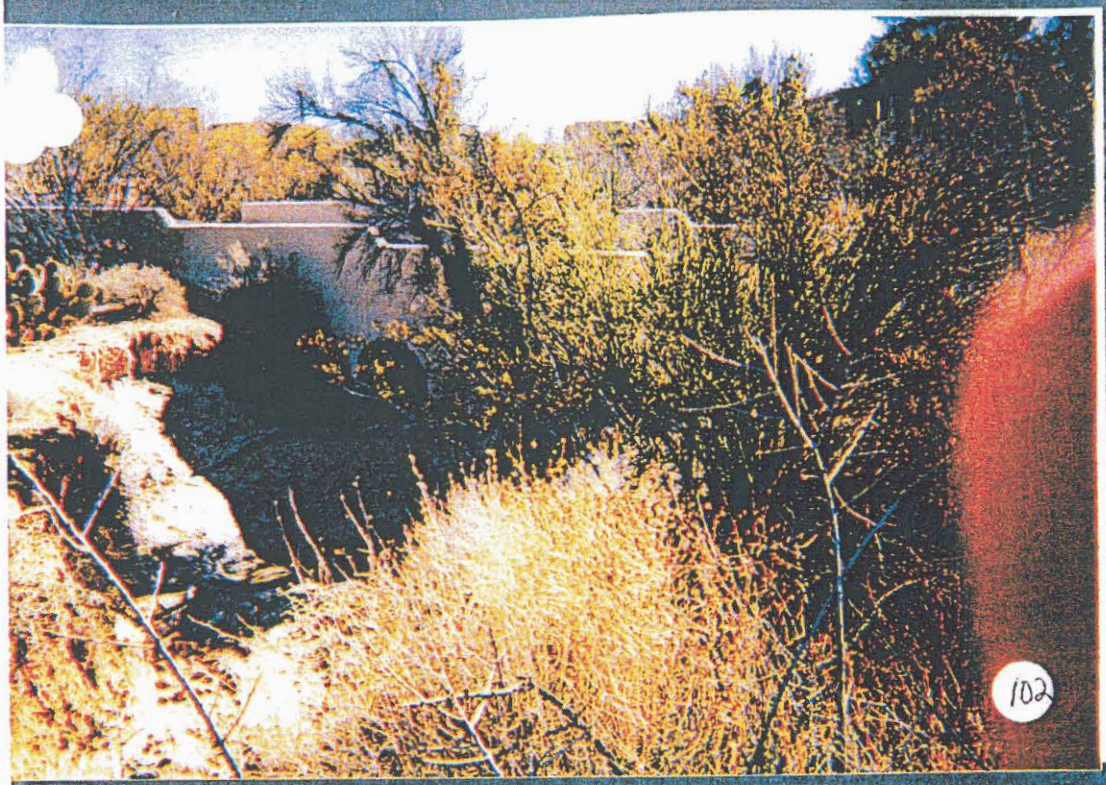
100. Sundial Apts. off of Cave Creek Road

101. Driveway Cave Creek Road Near Mule Train





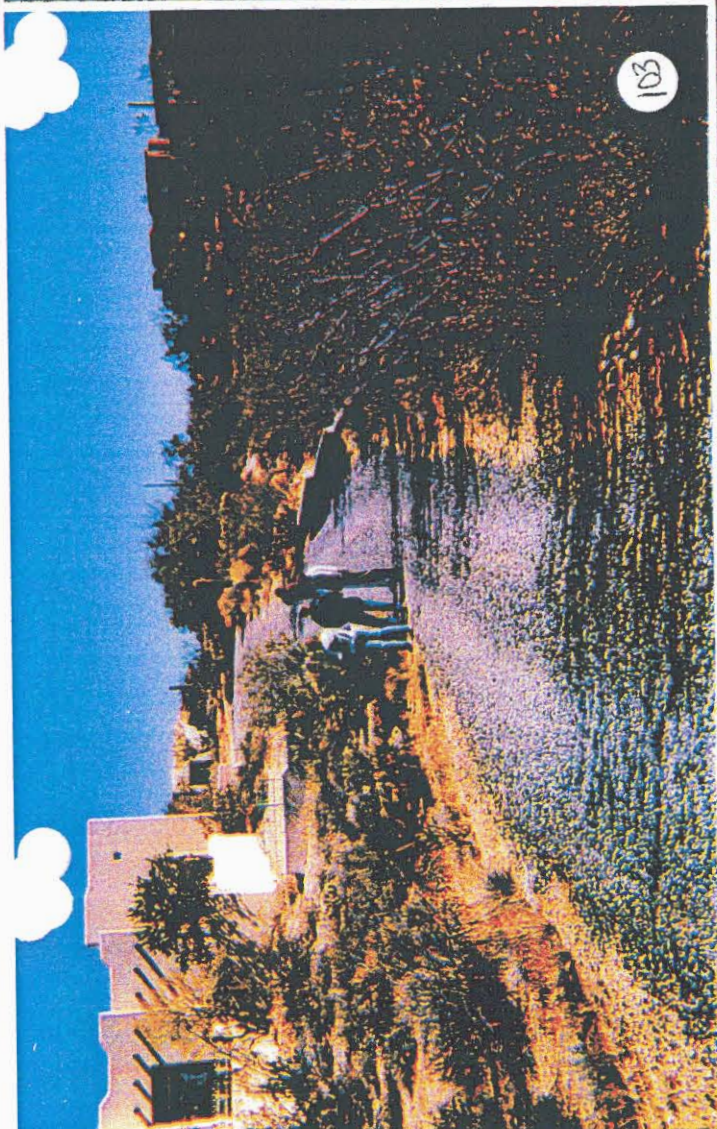


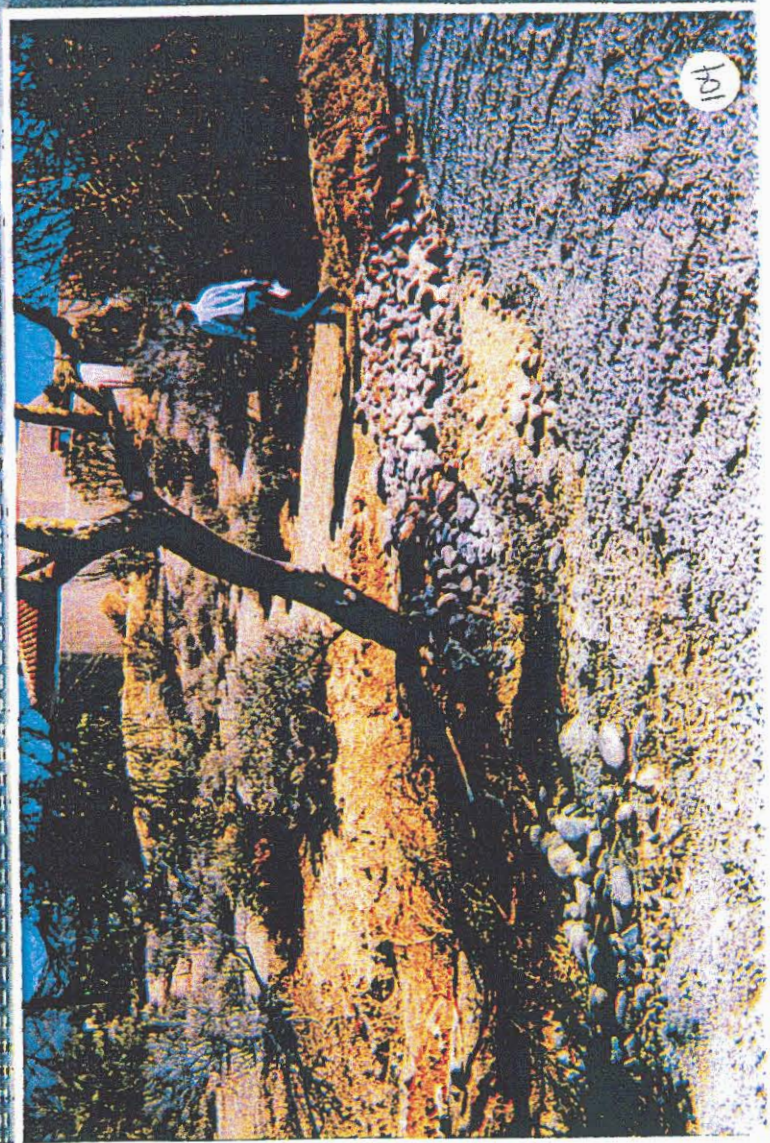


102. Driveway Cave Creek Road Near Mule Train

103. Driveway Cave Creek Road Near Mule Train

104. Site #70, 30 (JEF). Sundance Road New Overland Crossing Downstream

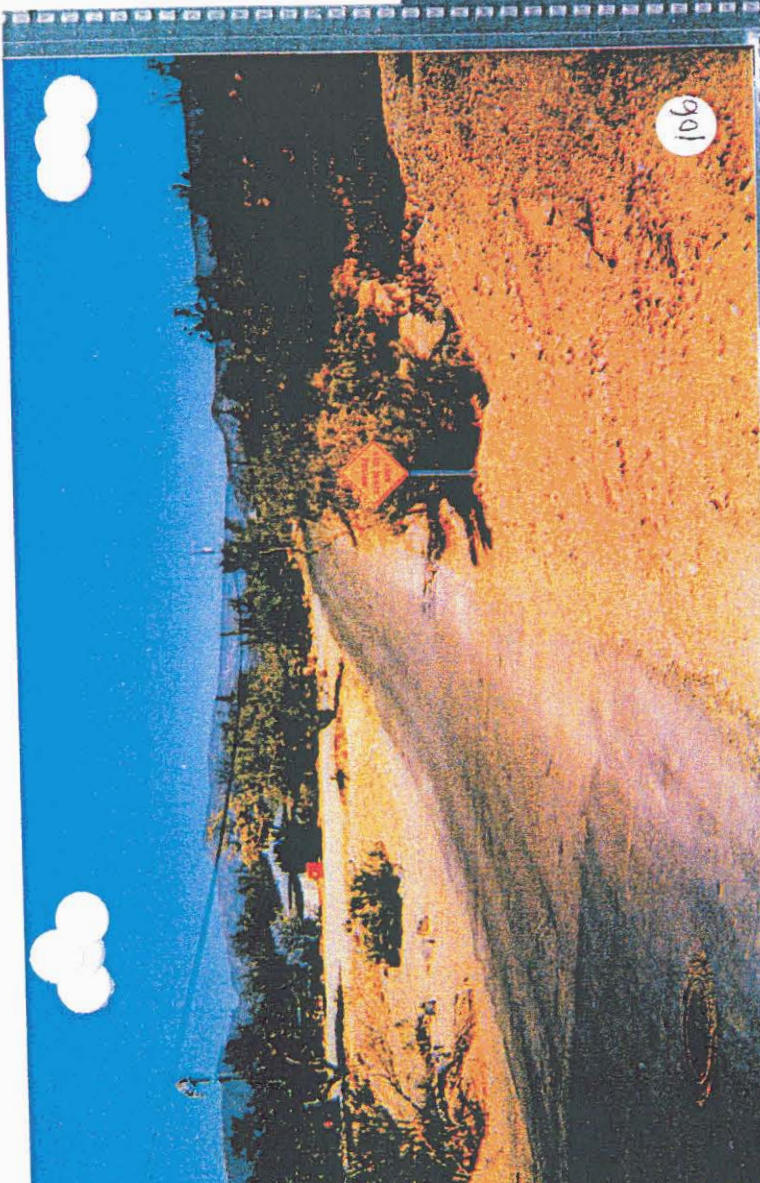


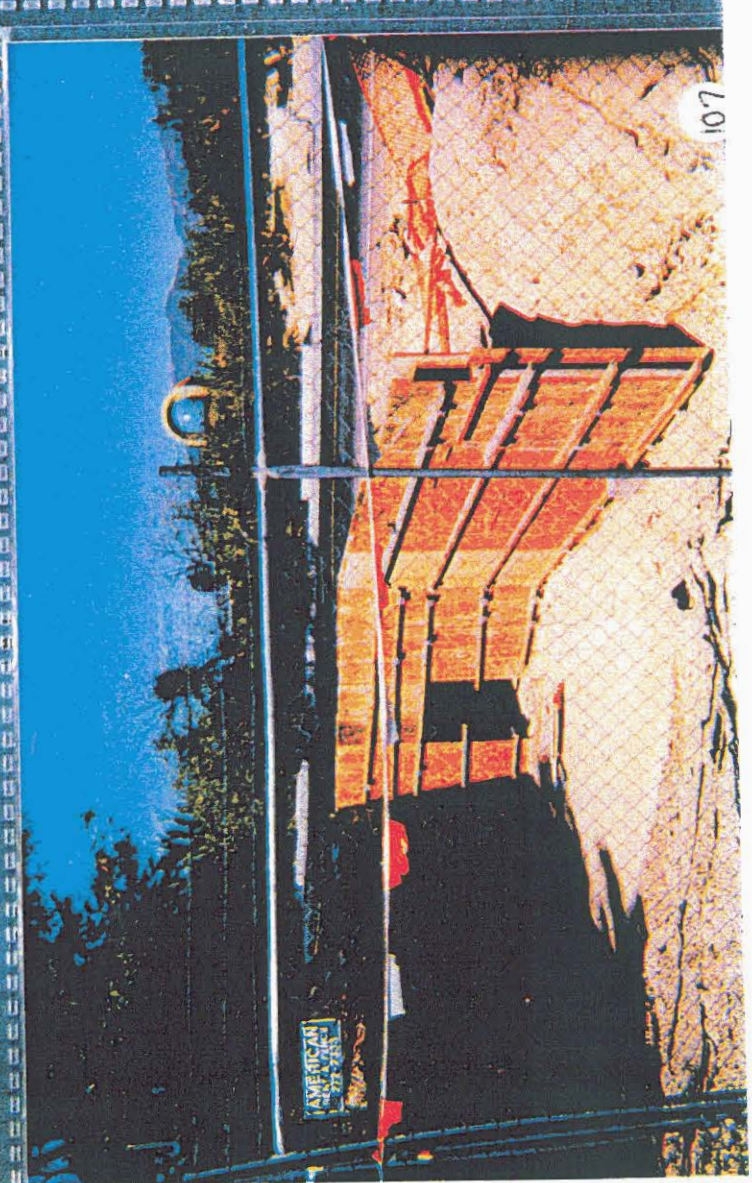


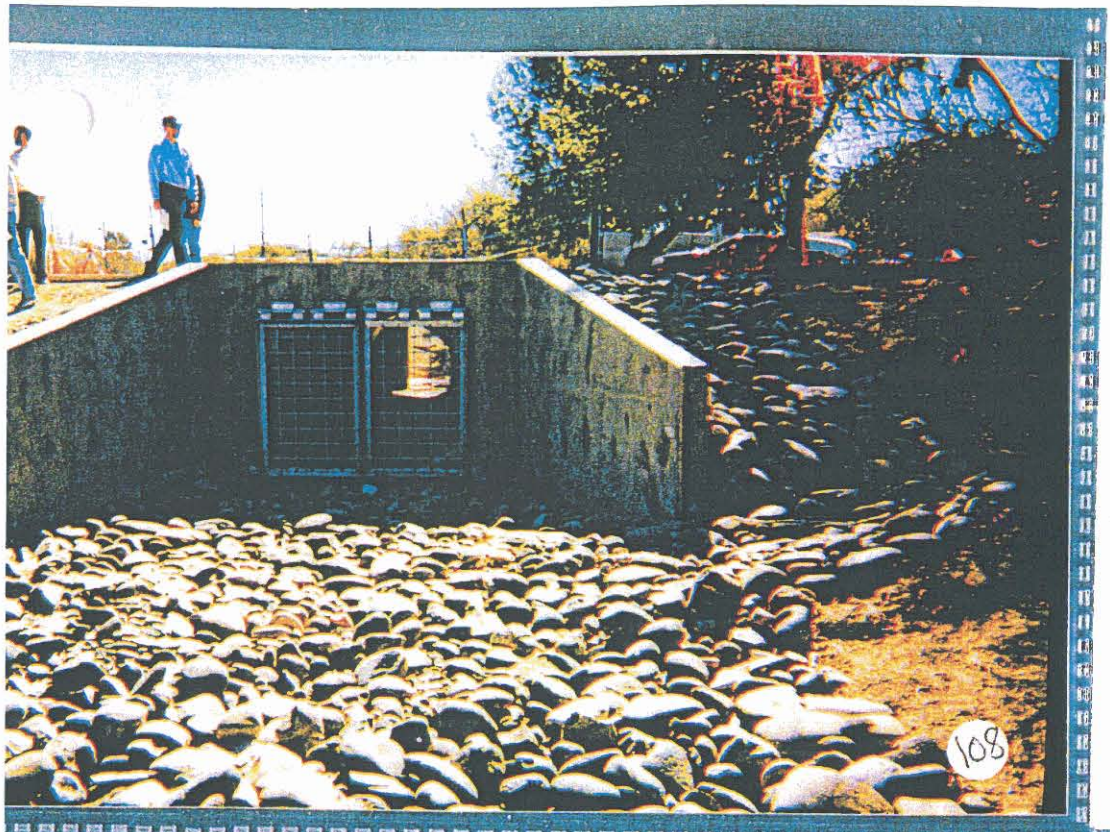
.05 te #70, 30 (JEF).
Su ace Road New
O and Crossing

.06. Site #36 (JEF). Galloway
Wash at Scopa Trail

.07.Site #96. Nonchalant @
Elbow Bend Culvert Outside
of Easement



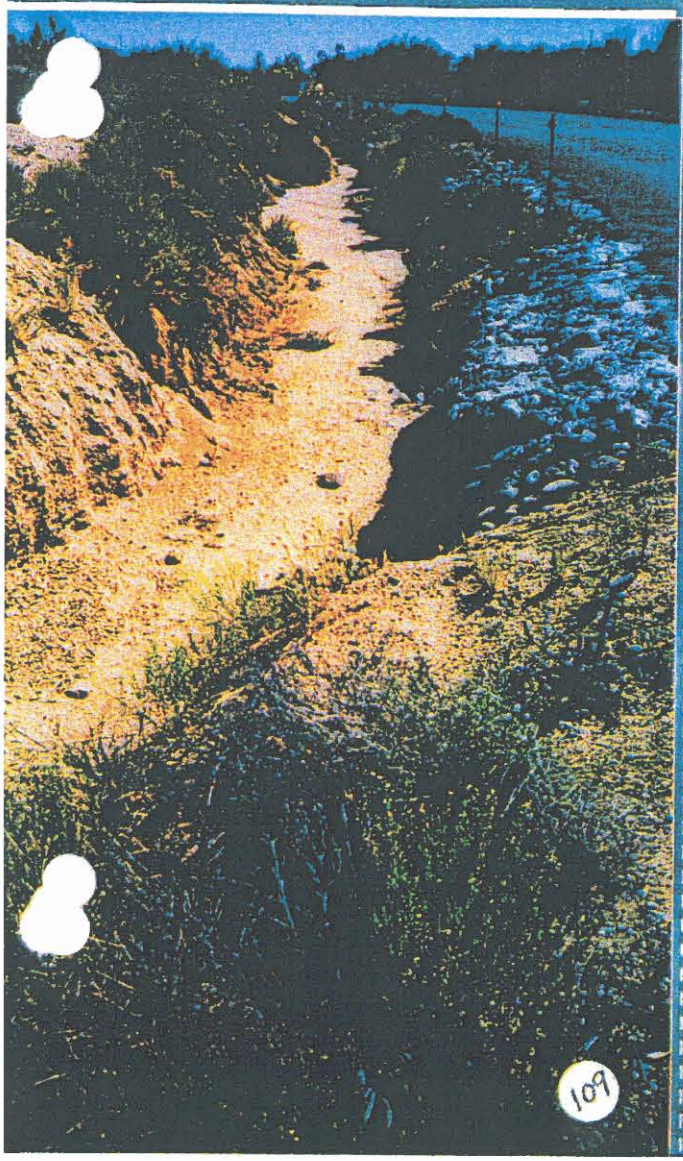


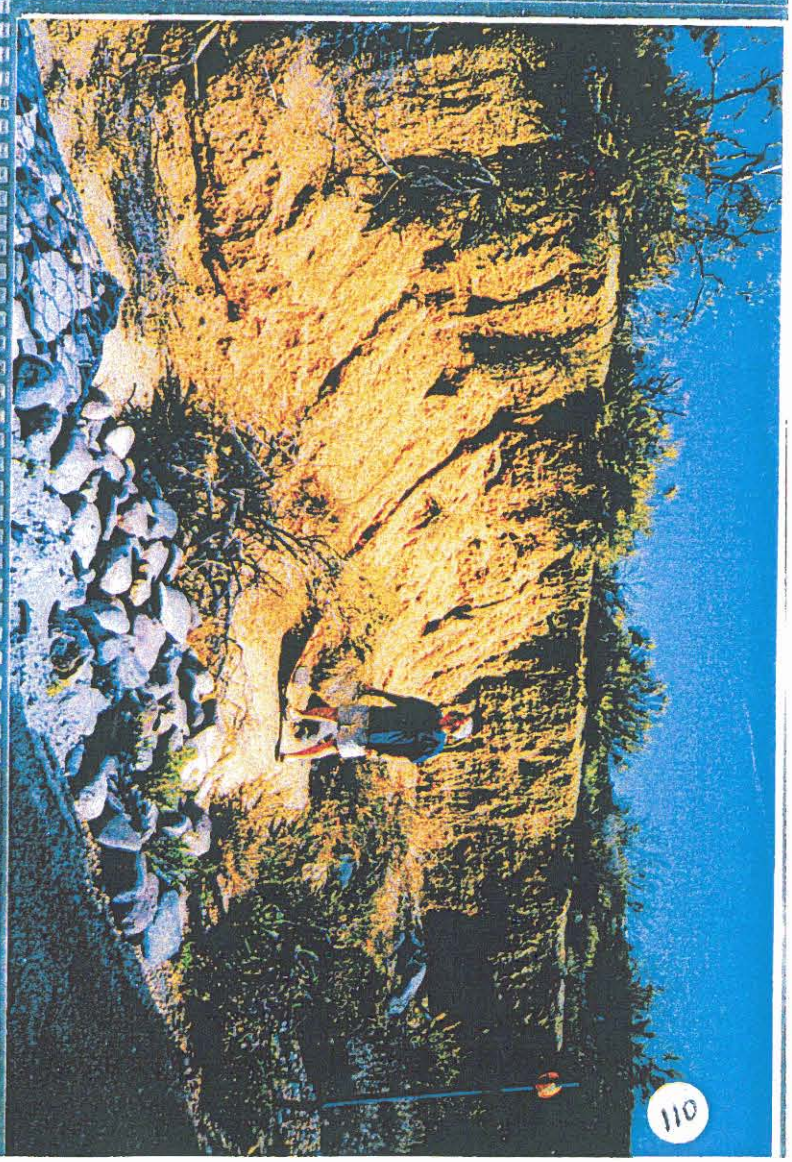


108. Site #96. Nonchalant @ Elbow Bend Downstream End of Culvert

109. Bowyer Photos- Romping Road Wash

110. Bowyer Photos- Romping Road Wash

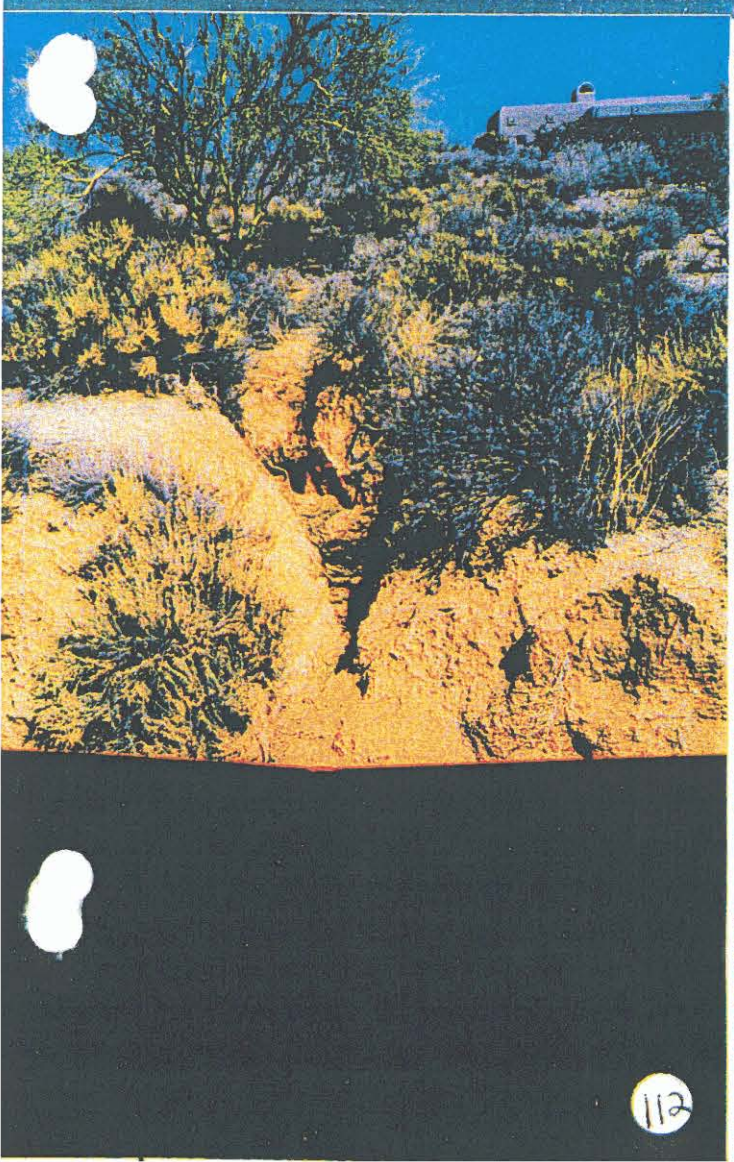


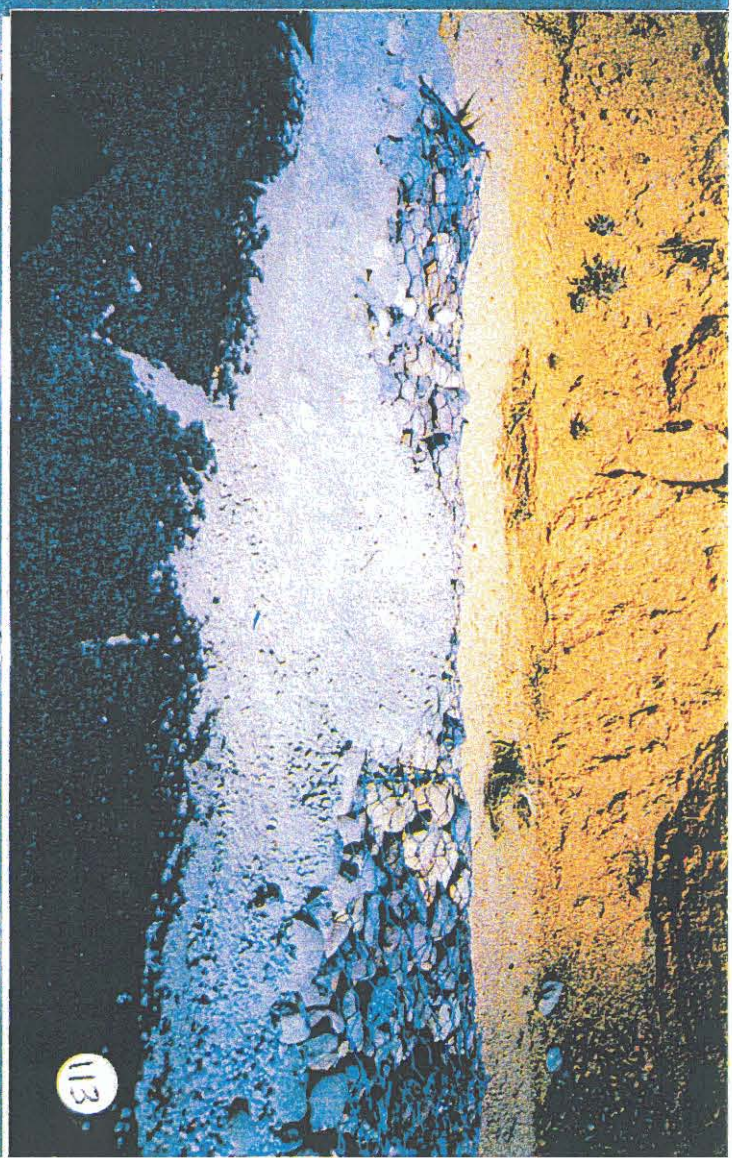


111. Bowyer Photos-
Romping Road Wash

112. Bowyer Photos-
Romping Road Wash

113. Bowyer Photos-
Romping Road Wash





Appendix H – JE Fuller Sedimentation and Geomorphic Evaluation Memorandum

CAREFREE DMP

Sedimentation Engineering & Geomorphic Evaluation Technical Memorandum

Prepared For:
Flood Control District Of Maricopa County

Prepared By:
JE Fuller Hydrology & Geomorphology, Inc.

February 12, 2002

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

6101 S. Rural Rd., Suite 110, Tempe, Az 85283
Phone: (480) 752-2124 Fax: (480) 839-2193

Registered Professional Engineer (Civil)
CERTIFICATE NO. 26945
JONATHAN E. FULLER
Date Signed 2-12-02
ARIZONA, U.S.A.

DATE: February 12, 2002

TO: Geza Kmetty/FCDMC
Doug Williams/FCDMC
Tony Bokich/CH2M Hill

FROM: Jon Fuller, P.E.
Tamara Norton, E.I.T.

RE: Carefree Drainage Master Plan
Sedimentation Engineering & Geomorphic Evaluation

Introduction

The Carefree Drainage Master Plan (DMP) is a flood control planning study of major watersheds draining to the Town of Carefree. The objectives of the DMP are to quantify the extent of existing and potential flooding problems within the Town of Carefree, to develop alternative solutions to reduce flooding, and to evaluate and recommend emergency access routes. A sedimentation engineering and geomorphic evaluation was included in the DMP to evaluate the erosion and sedimentation patterns and characteristics within the Town of Carefree. The evaluation will serve as a tool for estimating the long-term effects of flood control alternatives.

This analysis was performed by JE Fuller/ Hydrology & Geomorphology, Inc. (JEF) on behalf of CH2M Hill Inc. under Task 2.1.10, of contract FCD 2000C037 with the Flood Control District of Maricopa County (District).

Study Area

The Carefree DMP study area encompasses approximately 20 square miles bounded by the Tonto National Forest on the north, the City of Scottsdale on the east, the City of Phoenix on the south, and the Town of Cave Creek on the west. Five major washes were evaluated as part of the sedimentation engineering portion of the study; Galloway Wash, Galloway Wash North Branch, Grapevine Wash, Rowe Wash, and Andora Hills Wash.

Scope of Services

The scope of services for the sedimentation engineering and geomorphic evaluation included the following tasks:

- Sedimentation Engineering (Task 2.1.10)
    - Data Collection (Task 2.1.10.1)
    - Field Investigation (Task 2.1.10.1.1)
    - Geomorphic Analysis (Task 2.1.10.1.2)
    - Report (Task 2.1.10.1.3)

Detailed descriptions of each of the specific tasks are provided in the District's scope of services included in TDN Attachment 1 (CH2M Hill, 2002).

Report Format

As required by the scope of services, this report consists of a series of technical memorandums prepared for each of the tasks listed above. The report is organized as follows:

- Chapter 1 – Introduction
- Chapter 2 – Data Collection
- Chapter 3 – Geomorphic Analysis
- Chapter 4 – Assessment of Road Crossing Erosion
- Chapter 5 – Conclusions and Recommendations

DATE: February 12, 2002

TO: Geza Kmetty/FCDMC
Doug Williams/FCDMC
Tony Bokich, P.E./CH2M Hill

FROM: Jon Fuller, P.E.
Tamara Norton, E.I.T.

RE: Carefree Drainage Master Plan
Sedimentation Engineering & Geomorphic Evaluation
Task 2.1.10 Data Collection

Introduction

Historic and existing condition data for the Carefree DMP study area were collected to evaluate the geomorphic nature of the watershed and to determine the impact of development and future improvements on the five major watercourses in the study area. The following types of data were collected:

- Historical aerial photographs
- Historical topographic maps
- Surficial geology
- Soils classification
- Rainfall records
- Flood records
- Information from local residents
- Field observations

The data itemized above were used to develop a chronology of watershed and channel change to identify potential causes of sedimentation and erosion problems observed in the watershed.

Description of Data Sources

Historical Aerial Photography. Historic aerial photographs of the Carefree DMP study area for the years 1953, 1962, 1977, 1988 and 1992 were obtained from the USGS EROS Data Center. Aerial photographs for 1998 and 2001 were obtained from the District. Side by side plots of the aerial photographs of the study area are shown in Figure 2-1. Information about channel migration, encroachment, and modifications to the channels and floodplain due to development was collected by comparison of the aerial photos as discussed in the Chronology of Channel and Watershed Change section provided later in this Chapter.

Historical Topography. Historical topographic data were utilized to estimate bed elevation changes over time. Topographic data were obtained from USGS 7.5-minute

quadrangles (USGS, 1965), the Cave Creek Flood Insurance Study (Harris-Toups & Associates, 1978), the Flood Insurance Re-Study for Various Streams in Maricopa County, Arizona (Cella Barr & Associates, 1988), the Cave Creek and Tributaries, Cave Creek, AZ Flood Insurance Study (CH2M Hill, 1990), and the Andora/Galloway Floodplain Delineation Study (JEF, 1998). Bed elevation changes identified by comparing various years of topographic coverage are discussed in Chapter 3 of this report.

Surficial Geology. Mapping of the surficial geology in the study area was derived from the Geologic Map of the Cave Creek Quadrangle, Maricopa County (Leighty et. al., 1997) as shown in Figure 2-2. The surficial geology map was used to identify the geologic units located within and along each wash corridor. Individual map units are described in Chapter 3 of this report.

Soils Clasification. Mapping of soils units in the study area was derived from the Soils Survey of Augila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona (Camp, 1986), as shown in Figure 2-3. The soils map was used to identify the soils units located within and along each wash corridor. Individual soil units are described in Chapter 3 of this report.

Rainfall Records. Long-term precipitation data were obtained for the Phoenix metropolitan region and for the Carefree DMP watershed from the Western Regional Climate Center web site operated by the Desert Research Institute in Nevada.[1] Supplemental rainfall records were collected from the District ALERT network records posted on the District's web site.

Flood Records. There are no systematic stream gage records for any of the major washes within the study area. The nearest USGS gages are located on Cave Creek, and include the following two stations: Cave Creek below Cottonwood Creek and Cave Creek near Cave Creek. Other sources of flood records were investigated, including the District's photographic and publications library and Internet database, local newspaper archives, and the recollections of local residents met at public meetings and during field work.

Field Observations

Field visits were conducted in the study area during the summer and fall of 2001. A team of hydrologists and geomorphologists walked each of the five major watercourses, and visited all of the significant road crossings in the study area. The objectives of the field visits were to describe existing channel and floodplain conditions, and to document the type and location of sedimentation and erosion problems. The types of field observations and data collected included the following:

- Evidence of recent and historic channel erosion

[1] Western Regional Climate Center internet address: http://www.wrcc.dri.edu/index.html. A link describing the WRCC mission and personnel is found at http://www.wrcc.dri.edu/wrccmssn.html.

- Location and extent of cut banks
- Location and extent of caliche or bedrock outcrops
- Location, height and boundaries of stream terraces
- Location of human impacts on the channel and floodplain
- Channel conditions at bridge, culvert, and road crossings
- Photographs of typical channel sections, erosion features and structures

Field data were marked and collated on aerial photographic base maps, and were later digitized in AutoCAD on the semi-rectified aerial photographs shown in Figure 2-4. Figure 2-4 shows the location of cut banks, bedrock outcrops, caliche outcrops, field photographs, human modifications to the washes, and other observed features. Brief descriptions of each of the major washes are provided in the following paragraphs. General characteristics of each wash are listed below in Table 2-1.

Table 2-1. Carefree DMP Major Wash Characteristics

Wash Name	Channel Slope (ft/ft)	Average Channel Width (ft)	Q_{100} Floodplain Width
Galloway Wash	0.024	85	182
Galloway Wash North Branch	0.024	87	208
Grapevine Wash	0.025	288	333
Rowe Wash	0.048	114	229
Andora Hills Wash	0.020	38	119

Galloway Wash. Galloway Wash consists of a well-defined, braided single channel with some reaches of divided and avulsive flow. The channel bed, banks and floodplain consist of granitic sand and gravel with few isolated cobbles. Bank vegetation is sparse, consisting mostly of desert brush, with some small trees and a few large trees. Much of the natural historical floodplain has been developed. Development encroaches on the main channel at several locations. Approximately 23% of the channel banks are cut banks with evidence of recent lateral erosion. Several small head cuts have developed in a number of places on Galloway Wash, including the reach upstream of the new Dream Street Bridge. Headcutting near the Dream Street Bridge may be due to channel excavation and narrowing in the reach around the bridge crossing. Other headcuts observed in the field are small (less than 1 foot) and are located near areas of recent of historical channel and floodplain disturbance. Bedrock crops out at several locations within the channel and banks, covering approximately 13% of the total channel length. Most of the bedrock outcrops along Galloway Wash within the study area consist of weakly to moderately consolidated conglomerates. Comparison of recent 100-year floodplain delineations with field evidence of the natural floodplain width suggests that approximately four to six feet of long-term degradation has occurred within the past several hundred years, but not within the past several decades. Long-term degradation has significantly narrowed the floodplain of Galloway Wash. Local scour was observed at a number of road crossings, as discussed in Chapter 4 of this report.

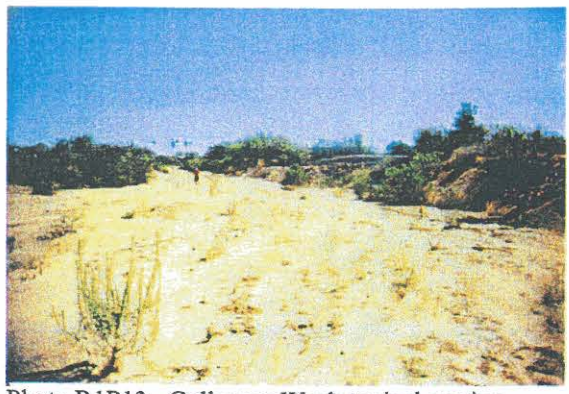


Photo R1P13. Galloway Wash typical section.

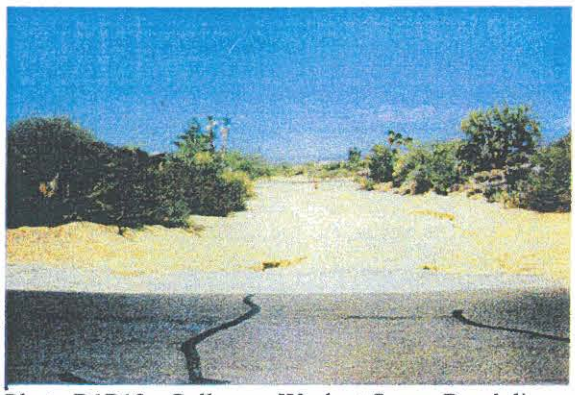


Photo R1P19. Galloway Wash at Scopa Road dip crossing with slight downstream scour.

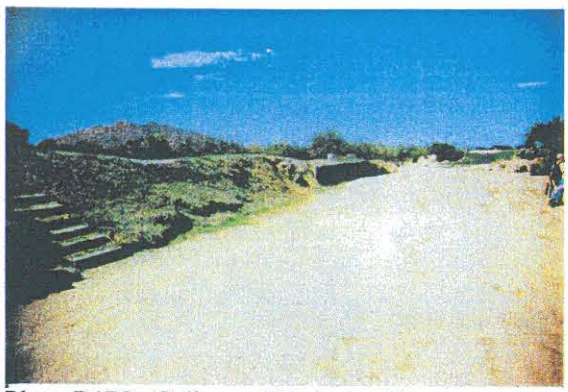


Photo R1P9. Galloway Wash at golf course encroachment of floodplain.

Photo R1P21. Galloway Wash with cut banks and headcut upstream of Dream Street.

Galloway Wash North Branch. The morphology of Galloway Wash North Branch is similar to that of Galloway Wash near their confluence. Galloway Wash has a single braided channel, with granitic bed and bank material, but the channel is wider and the banks have more bedrock outcrops than Galloway Wash. However, the channel morphology changes radically upstream of the Cow Track Road dip crossing. Upstream of Cow Track Road, the shallow canyon walls consist of slatey bedrock material and the channel becomes strongly braided or anastomosing, with multiple defined flow channels. Approximately 40% of the left bank consists of recently eroded cut banks. The floodplain elevation is only about 1 to 2 feet above the channel bed, with numerous small avulsive channels cutting across its surface. The floodplain vegetation is relatively old and includes large saguaro cacti, mesquite, palo verde, and yucca. Upstream of the Cow Tracks Road dip crossing there are several headcuts and 1 to 3 foot deep scour holes on the downstream side of dip crossings. No scour and headcuts were observed downstream of Cow Tracks Road. Other than the scour observed at the dip crossings, there is no evidence of recent long-term degradation on the Galloway Wash North Branch.

Photo R2P23. Galloway Wash North Branch – cut banks, bank erosion, gabion erosion control, and slope failures adjacent to new home construction.

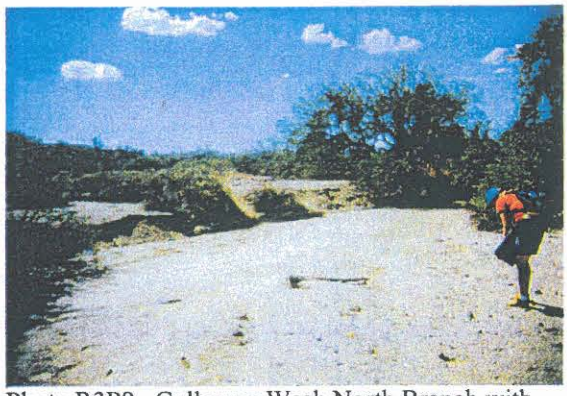


Photo R3P9. Galloway Wash North Branch with braided and perched overbank channel in left floodplain.

Photo R2P5. Galloway Wash North Branch – typical section.

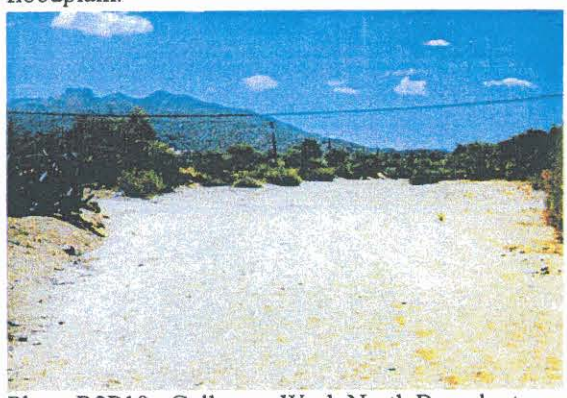


Photo R2P10. Galloway Wash North Branch at unnamed dip crossing with no downstream scour.

Grapevine Wash. Grapevine Wash has braided wide channels with sand and gravel-sized granitic bed material and bars of cobble-sized slatey material. The banks range to 15 feet high with some areas of cut banks, although cut banks were observed on less than 5% if the total wash length. The floodplain is wide and is frequently dissected by avulsive channels that connect split flow paths. Vegetation is fairly dense within the floodplain and consists of large mesquite, palo verde and saguaros. There is little to no evidence of long-term scour, with only minor localized scour at some crossings.

Photo R1P9. Grapevine Wash typical section.

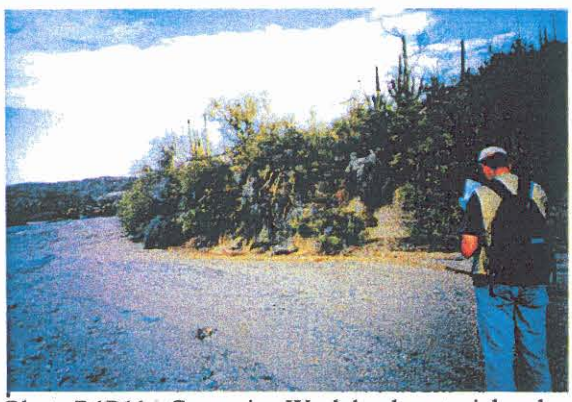


Photo R1P11. Grapevine Wash bank material and vegetation.

Photo R2P9. Grapevine Wash at unnamed road crossing with no downstream scour.

Photo R2P7. Grapevine Wash large cut bank.

Rowe Wash. Rowe Wash is a highly braided stream with relatively wide channels composed of large, slatey cobbles and boulders. The banks are steep and consist of loosely consolidated, highly erodible material. The banks contain some large cobbles that, despite their size, do not prevent bank erosion. The floodplain is relatively wide and is covered by dense vegetation that includes large mesquite, palo verde and saguaro. There are few cut banks, less than 5% of the total wash length was observed to have cut banks. No evidence of head cutting was observed along the wash. Overall, no evidence of long-term scour or deposition was observed.

Photo R1P16. Rowe Wash braided reach at flow split.

Photo R1P19. Rowe Wash at cut bank in straight reach.

Photo R1P13. Rowe Wash typical section.

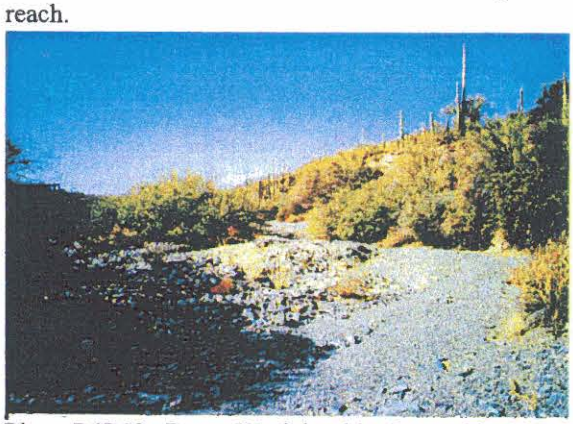


Photo R1P18. Rowe Wash boulder bar and braid.

Andora Hills Wash. Andora Hills Wash consists of a defined, incised, single channel stream with cobble and boulder bed and bank material. Channel banks range from 1 to 3 feet high in the upper reaches where the watershed area is smallest to 5 to 10 feet high in the lower reaches of the study area. The floodplain is fairly narrow and is covered by dense shrubs, mesquite and palo verde. Bedrock is exposed within the channel and banks for approximately 14% of the wash with few observed cut banks. Local scour was observed at several dip crossings. Overall, no significant long-term degradation was observed.

Photo R1P19. Andora Hills Wash bedrock outcrop.

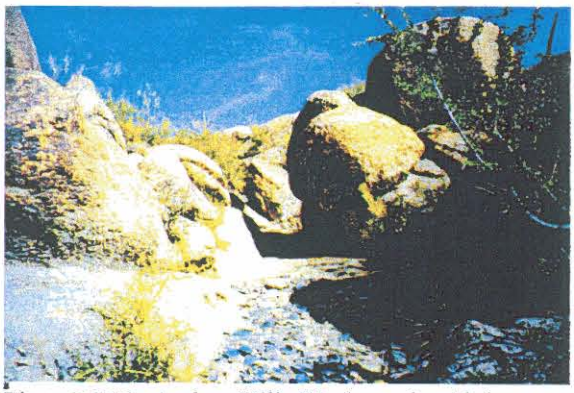


Photo R3P7. Andora Hills Wash reach with large boulders and bedrock.

Photo R2P5. Andora Hills Wash typical section.

Photo R1P29. Andora Hills Wash bedrock outcrops on channel bed.

Watershed Description

Stream stability is directly impacted by watershed characteristics such as drainage area, type of development, vegetative cover, elevation, and other physiographic information. Watershed characteristics for the streams in the Carefree DMP study area are described below. Key watershed characteristics are summarized in Table 2-2.

Table 2-2. Carefree DMP Watershed Characteristics				
Wash Name	**Drainage Area (mi2)**	**100-Year Discharge (cfs)**	**Channel Slope (ft/ft)**	**Type of Urbanization**
Galloway Wash	20.95	13,668	0.024	Commercial and low density residential devolvement to natural desert. Some floodplain encroachment.
Galloway Wash North Branch	3.26	3,096	0.024	Low density residential development to natural desert.
Grapevine Wash	7.06	9,393	0.025	Very low density residential development to natural desert.
Rowe Wash	5.87	6,687	0.048	Low density residential development to natural desert.
Andora Hills Wash	2.77	3,635	0.020	Low density residential development.
Note: Drainage areas reported are for entire watershed at downstream confluence.				

Drainage Area. The Carefree DMP study area encompasses approximately 20 square miles that heads in the New River Mountains north of the Town of Carefree and flows into Cave Creek to the southwest. The drainage area is bounded by the Tonto National Forest on the north, the City of Scottsdale on the east, the City of Phoenix on the south, and the Town of Cave Creek on the west. The five major washes evaluated as part of the sedimentation engineering study included Galloway Wash, Galloway Wash North Branch, Grapevine Wash, Rowe Wash, and Andora Hills Wash. All five streams are tributary to Cave Creek. Galloway Wash North Branch, Grapevine Wash, and Rowe Wash all join Galloway Wash before it reaches Cave Creek. Andora Hills Wash flows directly to Cave Creek.

All of the streams within the study limits are ephemeral. Some perennial springs and stream reaches occur near the headwaters of Cave Creek, but the only permanent water in the upper watersheds of the DMP drainage area occurs in isolated stock ponds. The average annual rainfall for the watershed above the Cave Creek near Cave Creek USGS gage that is located about one mile downstream of Carefree Highway is reported as 15.7 inches per year (Pope et. al., 1998). About three percent (3%) of the annual rainfall over the Cave Creek watershed becomes runoff, as measured at the Cave Creek near Cave Creek USGS gage. It is likely that a slightly smaller percentage of rainfall becomes runoff in the Carefree DMP watersheds.

Channel stability tends to decrease with watershed size. Larger watersheds generate larger floods capable of greater destruction or channel change. In addition, streams draining large watersheds typically have finer grained sediments, with less bedrock control, and are therefore more subject to lateral erosion and scour. For the Carefree

DMP study area, the most evidence of instability was observed along Galloway Wash, which is the largest watershed with the finest bed material.

Physiographic Setting. The Carefree DMP watershed is located at the margin of the Transition Zone and Basin and Range Physiographic Provinces of central Arizona. The Transition Zone is characterized by rugged bedrock mountains that are drained by small intermittent streams that flow in narrow bedrock canyons. The Basin and Range is characterized by parallel mountain ranges with intervening deep alluvial basins. The watersheds of the five major streams in the study area are formed in dissected basin fill alluvium of the Carefree Basin, that was once part of an alluvial fan connected to Transition Zone mountains located to the north and west. Elevations in the watershed range from about 5,340 feet at Blackjack Point in the Tonto National Forest to about 2,020 feet near the Galloway Wash/Cave Creek Wash confluence.

Elevations along the major washes range from 2,800 to 2,020, well within the Upper Sonoran Desert range. The steepest of the five washes studied is Rowe Wash, which is the wash that is closest to its headwaters. Andora Hills Wash has the flattest average channel slope, though it is the wash with the greatest degree of bedrock control. Bedrock also crops out along the canyon margins of Grapevine Wash.

Geologic Setting. Understanding the overall geology of the study area is fundamental to understanding and predicting the types and magnitude of channel processes such as lateral migration. The Basin and Range and Transition Zone Physiographic Provinces have a long, complex history of geologic activity. The most recent major geologic activity involved crustal extension and normal faulting during the late Tertiary Period that helped to form the modern Basin and Range - Transition Zone boundary. The alluvial deposits associated with the major washes within the Carefree DMP study area provide evidence of the evolution of this fluvial system in response to geologic activity over the past several million years. The geology of the study area, as it relates to stream stability and sedimentation is discussed in Chapter 3 of this report.

Urbanization. The Carefree Drainage Master Plan (DMP) study area consists of commercial and residential development and undeveloped desert. The residential development is primarily low density, consisting of one-acre plus lots with grading limited to the building pad and accessory features. Portions of the Galloway Wash and Andora Hills Wash include commercial areas associated with the Carefree town center. Outside the Town limits, the watersheds are mostly undeveloped natural desert, with the exception of the headwaters of Galloway Wash, which is located in the City of Scottsdale. Despite the low density of most development in the watershed, development has encroached within the historical natural floodplain. The timing of urbanization in the study area is discussed in the following section of this chapter.

Chronology of Channel and Watershed Change

Channel positions and other features observed on historical aerial photographs were compared to develop a chronology of channel and watershed change for the Carefree

DMP study area. A chronology of channel and watershed change can be used to identify when sedimentation problems occurred and thus identify and eliminate potential causes of sedimentation problems. The chronology of channel and watershed change was then compared to records of historical rainfall and flooding to evaluate the role of flooding in sedimentation problems.

Comparison of Historical Aerial Photographs. Side-by-side aerial photographs for the study area dating from 1953 to 2000 and printed at similar scales were provided in Figure 2-1. Plots of channel bank position from the years of coverage are shown in Exhibits 2-1 and 2-2. In 1953, the study area was mostly uninhabited with only a few dirt roads and almost no homes, except for a ranch located in the floodplain of Grapevine Wash. Between 1953 and 1962 most of the infrastructure for the Town of Carefree and surrounding area was constructed, and consisted mostly of unpaved roads. A golf course, which straightened and narrowed the main channel and encroached into the floodplain of Galloway Wash north of the airport, was also constructed between 1953 and 1962. A large flood probably occurred during this time period that caused the breakout channel on Galloway Wash near Scopa Trail (Figure 2-5) to be widened, providing a more defined connection to the southern flow path. Finally, a large amount of surface grading occurred near the ranch located along Grapevine Wash (Figure 2-6).

Between 1962 and 1977 many of the roads were paved and the few existing crossings with culverts were constructed. Many of the homes in the Galloway Wash and Andora Hills Wash watersheds within the town limits were also built between 1962 and 1977, including several homes that were built in the area of the Galloway Wash breakout near Scopa Trail. The floodplain appears to have recovered from the grading at the ranch on Grapevine Wash. Homes were also built in the area near Rowe Wash (Figure 2-7), and a few dirt roads were graded in the upper reaches of Grapevine Wash. A small sand and gravel excavation was started upstream of Scopa Trail on the island between two braids.

Between 1977 and 1985, a large residential development was constructed in the upper watershed of Galloway Wash, east of Pima Road within the City of Scottsdale (outside the photograph limits in Figure 2-1). More homes were constructed throughout the study area during this period, though for the most part, little appears to have changed between 1977 and 1985 along the stream corridors themselves. Also during this period, the Galloway Wash breakout channel near Scopa Trail became less prominent, a trend that continued up to the time of this study.

Between 1985 and 1992, the golf course was constructed downstream of the Andora Hills Wash study limit, significantly narrowing the main channel through the fairways (Figure 2-8). The active braided and flow split area located on Galloway Wash downstream of Piedra Grande Drive began to be modified during this time period (Figure 2-9). The southern (left) braids became more active and the northern (right) braids were abandoned except during high flows, forming a small island in the floodplain. A similar phenomenon occurred just downstream of the Galloway Wash study limit between School House Road and Spur Cross Road, except that homes were constructed on the island by 1977.

Between 1992 and 2000, the areas within the watershed continued to develop, including the upstream areas in the City of Scottsdale. Except for the City of Scottsdale development and a few commercial ranches, the most recent development has been limited to large lot residential units with limited building envelopes and natural desert landscaping. Of the five streams considered, Grapevine Wash remains the least disturbed by development.

Rainfall Records. Runoff in ephemeral streams, like those in the study area, is directly related to precipitation. Precipitation records can be used to identify wet/dry cycles, climatic variation, and other trends that may affect stream stability or explain historical channel change. For streams that lack any systematic stream gauge record, precipitation data can be used to identify likely flood years or periods of frequent sustained flow. Also, since regional precipitation records are available dating back to the late 1800's, they provide a longer record than streamflow records, which typically do not exist prior to the 1970's on most small streams in Arizona.

Regional precipitation measurement station names and their periods of record are listed in Table 2-3. Station locations and long-term average and seasonal precipitation data are shown in Figures 2-10, 2-11 and 2-12, respectively. Average annual runoff computed as a percent of the long-term regional average precipitation is shown in Figure 2-11.

Table 2-3. Carefree Area DrainageMaster Plan Regional Long-Term Precipitation Stations

Station Name	Period of Record	Average Annual Precipitation (in)
Mesa	1896-1999	8.33
Buckeye	1893-1999	7.74
Alhambra	1948-1976	7.77
Bartlett	1939-1999	13.66
Carefree	1962-1999	13.37
Deer Valley	1950-1985	8.64
Litchfield Park	1917-1999	8.13
Marinette	1913-1964	7.90
Paradise Valley	1955-1970	8.46
Phoenix City	1948-1998	7.89
Youngtown	1964-1999	9.17

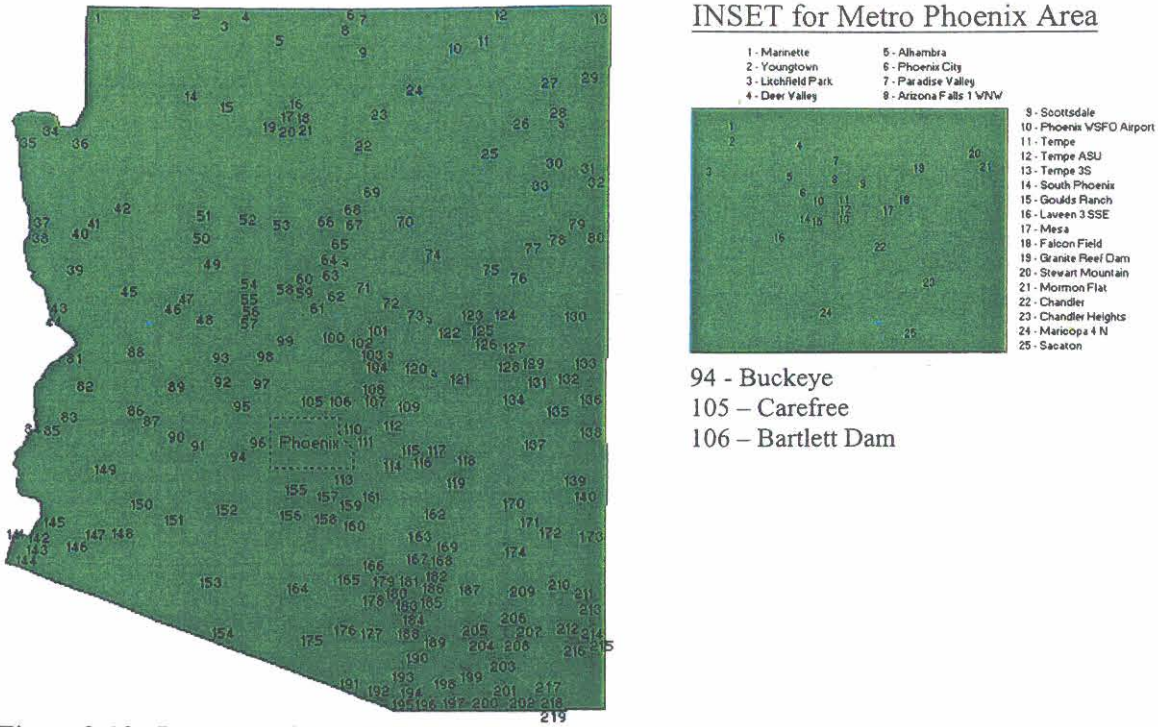


Figure 2-10. Location of long-term precipitation stations in Arizona and the Phoenix metro area.

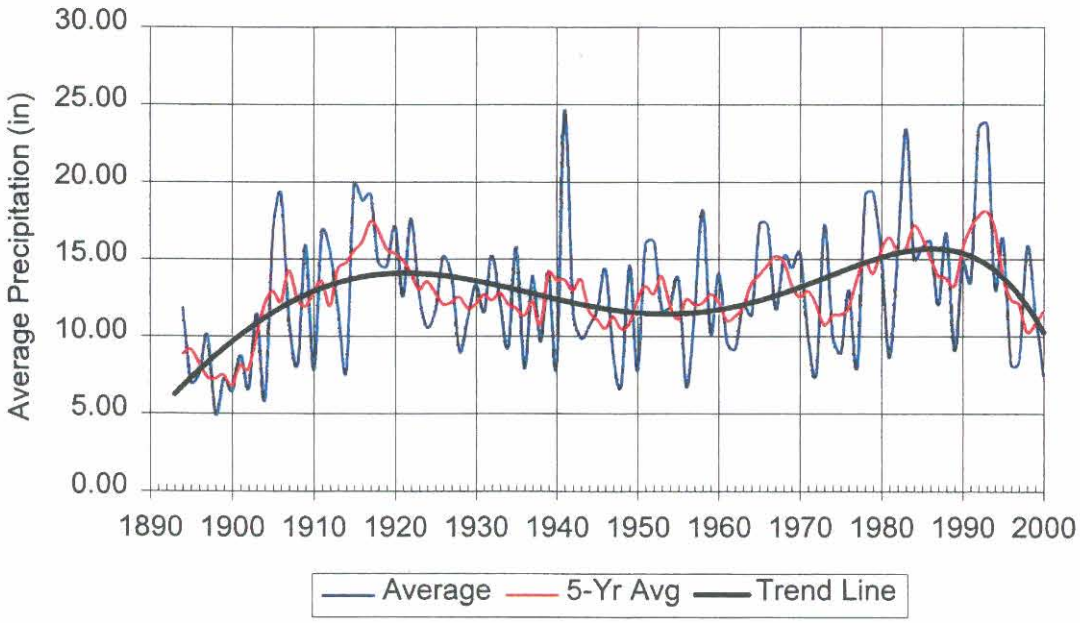


Figure 2-11. Precipitation Measurement Stations & Annual Precipitation Trends for Station Located near Phoenix, Arizona. (See Table 2-3 for the listed of stations used to estimate long-term trends.)

Figure 2-12. Long-Term Average Monthly Precipitation

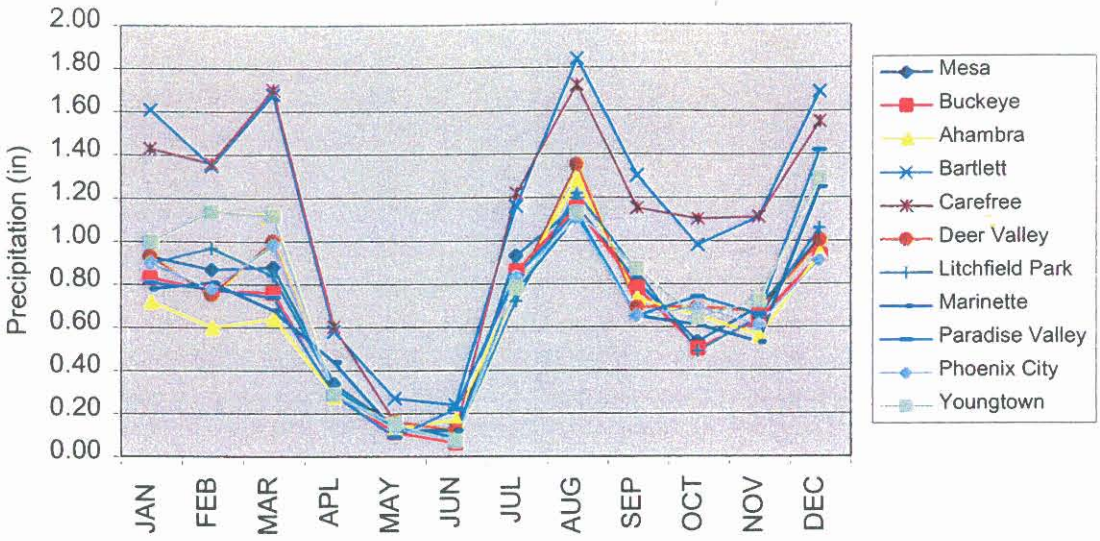
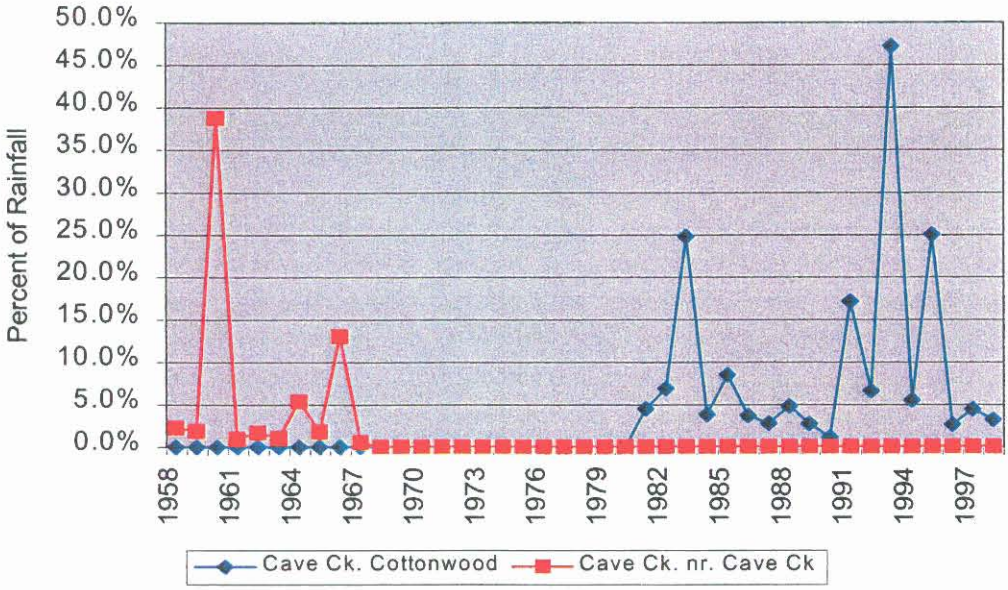


Figure 2-13. Runoff as Percent of Regional Average Precipitation



Local precipitation records are also available from the District's ALERT network. The ALERT station closest to the Carefree DMP study area is the Carefree Ranch weather station (#4930), which was installed in July 1985. Precipitation data from the Carefree Ranch are summarized in Table 2-4. Interestingly, since 1985 only one of the eight recorded rainfall events over one inch occurred during a summer monsoon. Only one rainfall exceeded the 10-year, 6-hour rainfall depth (2.37 inch), and only two events

exceeded the 2-year, 24-hour rainfall depth (2.20 inch). These rainfall data also indicate that few current residents have seen any significant flooding in the study area.

Table 2-4. Carefree DMP
Rainfall Events at the Carefree Ranch ALERT Station (#4930)

Date	Depth (inch)
March 1, 1991	2.17
December 4, 1992	1.77
January 7, 1993	2.28
January 8, 1993	1.81
August 20, 1995	2.40
February 4, 1998	1.73
March 6, 2000	1.85
October 22, 2000	1.93

From the data presented in Tables 2-3 and 2-4, and in Figures 2-11 to 2-13, the following conclusions can be drawn:

- Long-Term Trends. Figure 2-11 shows the regional average annual precipitation,[1] as well as a 5-year moving average and the trend line of the annual values. The trend line indicates that annual precipitation volume increased significantly since the Town of Carefree was founded until the late 1980's, but has decreased markedly over the past 10 years, the period during which most of the current residents have lived there. Therefore, if precipitation is directly related to flooding, most residents may be unfamiliar with the true potential flood magnitude or frequency.

- Wet/Dry Cycles. Sustained periods of above average precipitation, or wet cycles, occurred from about 1904 to 1922 and from 1978 to 1993. Sustained periods of below average precipitation, or dry cycles, occurred from 1896 to 1904 and from 1943 to 1963. The greatest degree of channel change should be expected during periods of higher precipitation and runoff, particularly when these wetter periods immediately follow periods of sustained drought. Based on rainfall records alone, if natural processes were responsible for channel changes, the most channel change in the study area should have occurred during the late 1970's and early 1980's.

- Wet Years. Years of unusually high annual precipitation occurred in 1905, 1915, 1917, 1941, 1965, 1978, and 1993. The percent of rainfall that became runoff typically spiked in these years as well, according the Cave Creek gage records, as shown in Figure 2-13.

- Floods. A comparison of Figures 2-11 and 2-12 indicates that years of high annual precipitation correlates moderately well to years of high annual runoff volume, with one notable exception in 1960.

[1] Average of the annual precipitation totals for all of the stations shown in Table 2-3.

- Seasonal Variation. Precipitation records support the conclusion of a winter and late summer period of seasonal high flow indicated in Figure 2-12. These seasonal variations in precipitation are expressed more strongly in the precipitation records of the stations closest to the Carefree watershed (Carefree & Bartlett) than in stations located elsewhere in the Phoenix area.

Flood Records. There are no systematic stream gage records or flood histories for the streams in the Carefree DMP study area. Therefore, flood data were obtained from gage records of Cave Creek, from accounts of flooding from local residents, and from newspaper accounts. Photos from 1985 were found in the FCDMC library under the title Floodplain Inspection Photos – Major Washes In and Around Cave Creek (Cave Creek Wash, Galloway Wash, Rowe Wash, Ocotillo Wash, Willow Springs Wash, Andora Hills Wash). Theses photos include several locations along all the major washes within the study area. However, there is no indication that the photographs were taken as a result of a flooding event, and no flood damages were observed in the photographs. No other records pertaining to flooding in the study area were found in the FCDMC library.

Local newspaper archives were researched for articles on historic flooding in the study area. No articles were found that adequately described flooding. We conclude from the lack of newspaper accounts that floods on the small streams in the study area, while troublesome to some local residents, are not newsworthy events.

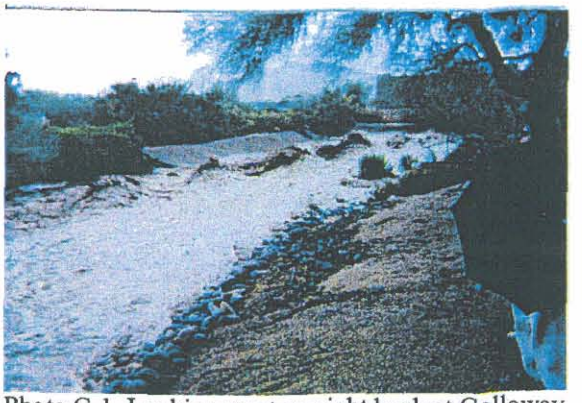


Photo C-1. Looking west on right bank at Galloway Wash and Pima Road during flood of August 2000.

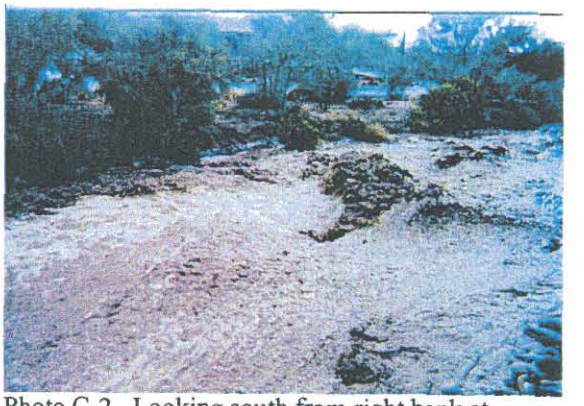


Photo C-2. Looking south from right bank at Galloway Wash downstream of Pima Road during flood of August 2000.

Photo C-3. Looking west at erosion at Pima Road crossing of Galloway Wash.

Photo C-5. Looking east at Pima Road crossing on the west bank of Galloway Wash.

Photo C-4. View of local scour at downstream side of Galloway Wash at Pima Road.

Several local residents brought photos of their properties during and after recent flooding to the public meeting held at the Carefree Town Hall on November 13, 20001. Photos of flooding on Galloway Wash at the Pima Crossing during the August 2000 flood are shown above. The flood photographs provided by local residents show high velocity flow with standing waves, active sediment transport, and local bank and bed erosion. However, the flood photographs indicate that these were relatively small floods that filled the main channel, but did not inundate the floodplain. The occurrence of only small floods during the past several years is consistent with the rainfall records that indicate below average annual precipitation since the mid-1990's. The District's ALERT station at Carefree Ranch recorded only 0.71 inches on any day in August 2000, the date of the Galloway Wash flood photographs shown above.

Comparison of Flood and Rainfall Records. The rainfall records and sparse flood data available for the Carefree DMP study area are consistent, though there is little overlap between the available records. These data sources both indicate that there have been few significant floods or rainfall events during the past 10 years, a conclusion that is also supported by field observations.

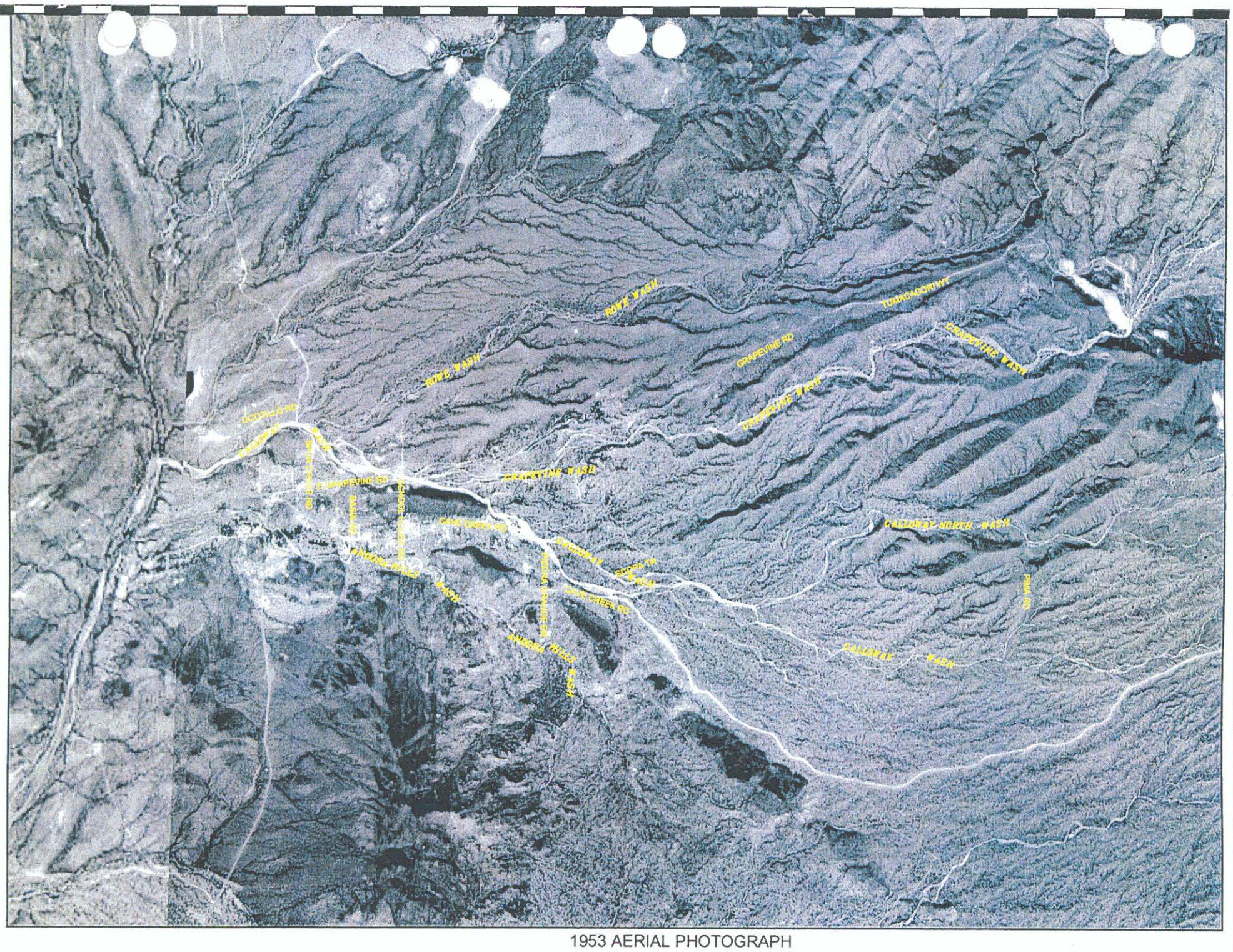
Summary

Comparison of aerial photographs does not support the conclusion that channel changes were concentrated during periods of above-average rainfall. The greatest degree of channel change was observed along Galloway Wash, which is the largest stream system and which also experienced the greatest degree of urbanization impacts. Comparison of floodplain widths indicates that, despite being the largest and flattest watershed, Galloway Wash has a much narrower floodplain than its tributaries, indicating that it experienced long-term degradation that increased the main channel capacity and abandoned its natural floodplain. The Grapevine Wash watershed and floodplain are the least impacted by urbanization of the five streams evaluated, and show the least amount of degradation and lateral instability. Historical and field data suggest that sedimentation and erosion problems are localized, rather than regional, pointing to local perturbations as the most likely cause.

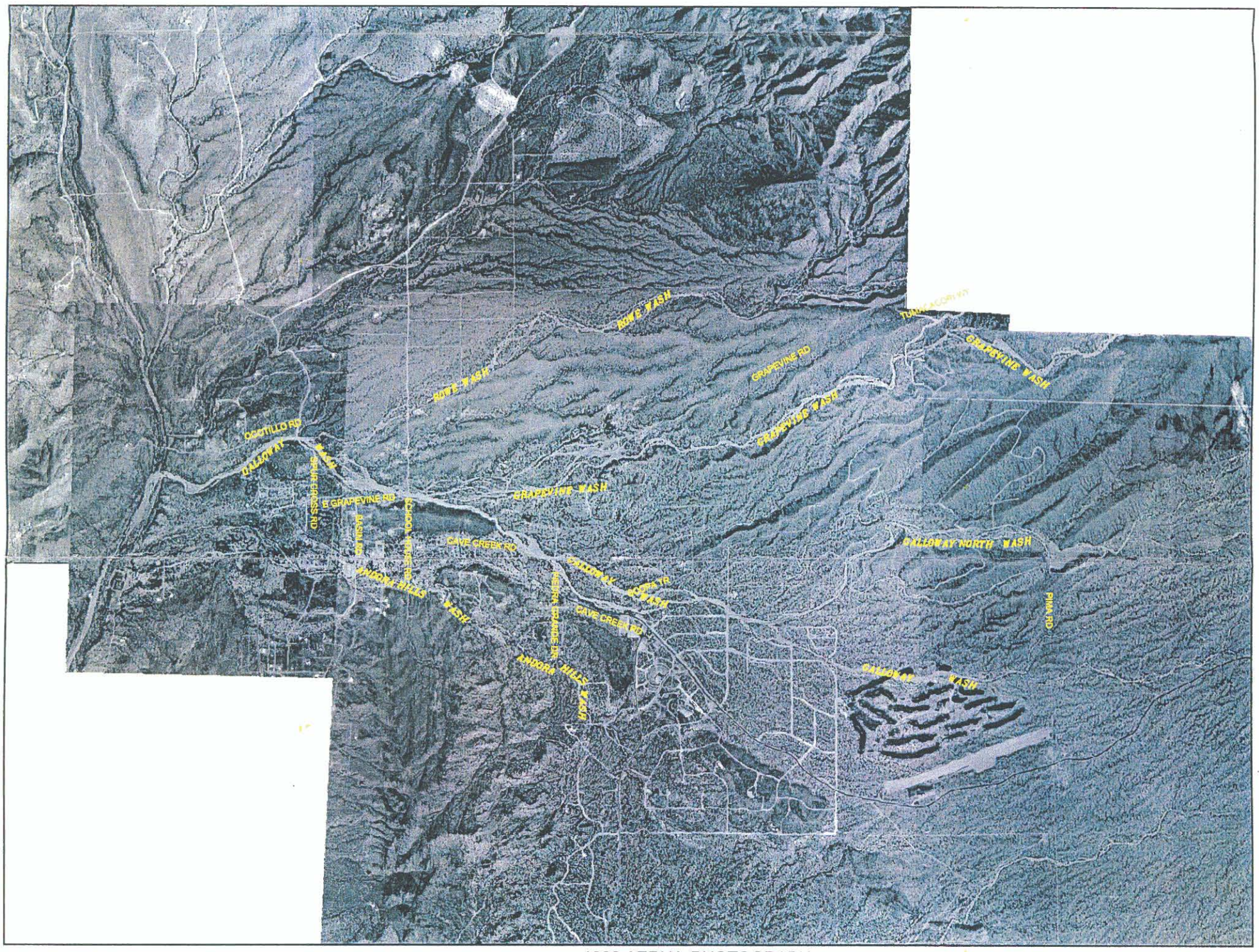
References

Geologic Map of the Cave Creek Quadrangle, Maricopa County, Robert Leighty, Steven Skotnicki, and Philip Pearthree; Arizona Geologic Survey, 1997.

Survey of Augila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona, U.S. Department of Agriculture, Soil Conservation Service; 1977.



1953 AERIAL PHOTOGRAPH



1962 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-1
HISTORICAL AERIAL PHOTOGRAPHS

N
1"=3000'

CH2MHILL

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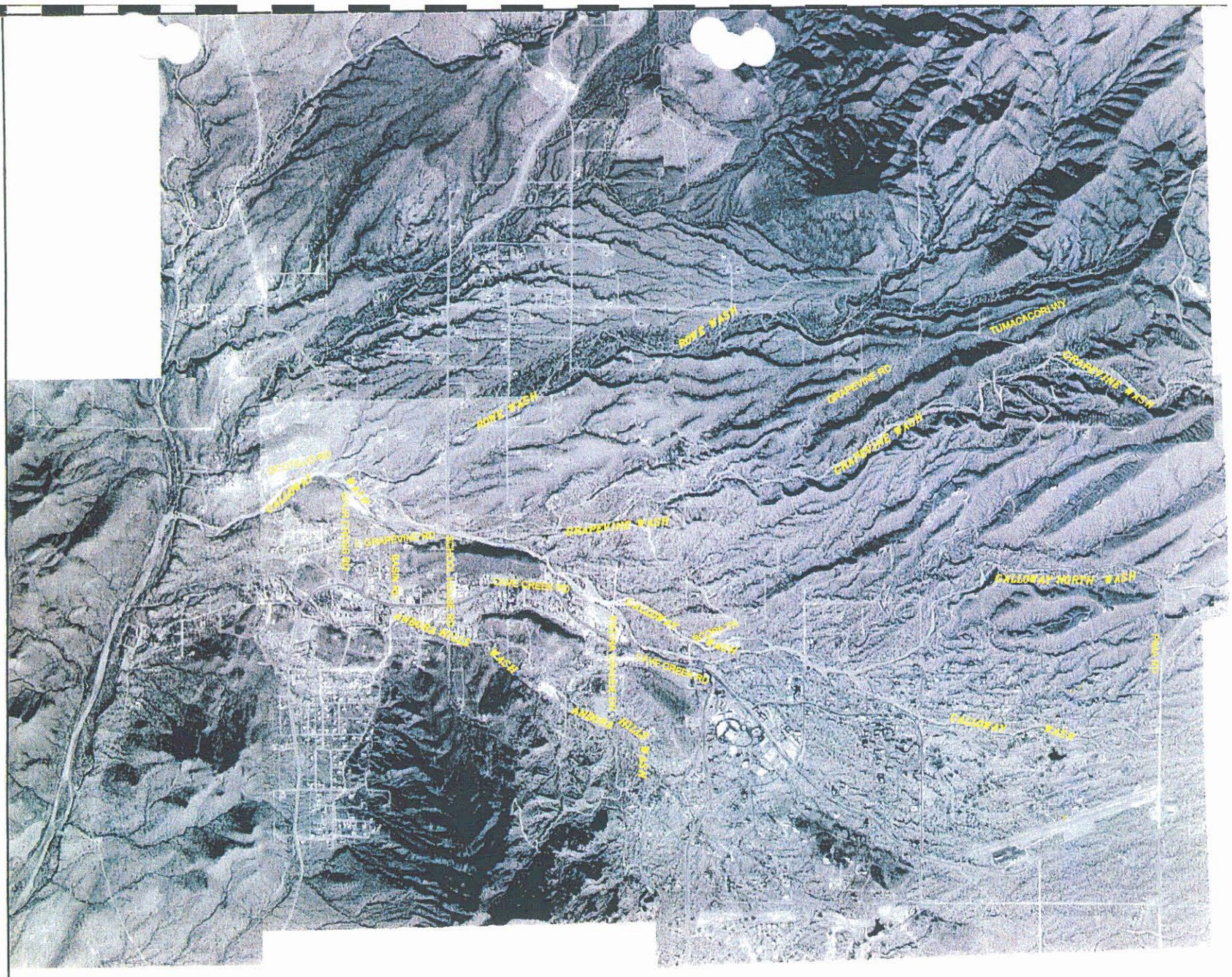
SHEET 1 OF 4



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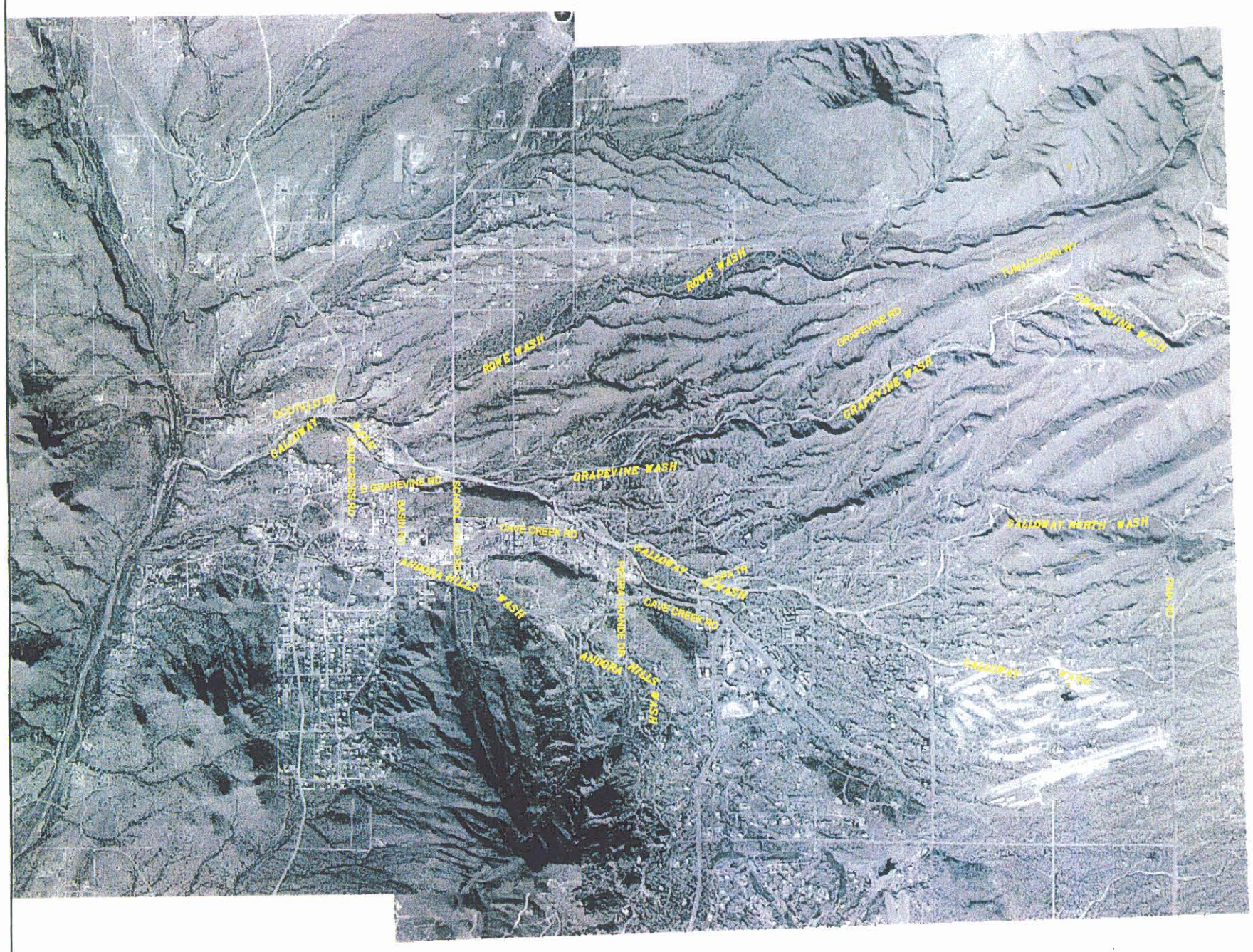

1985 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-1
HISTORICAL AERIAL PHOTOGRAPHS

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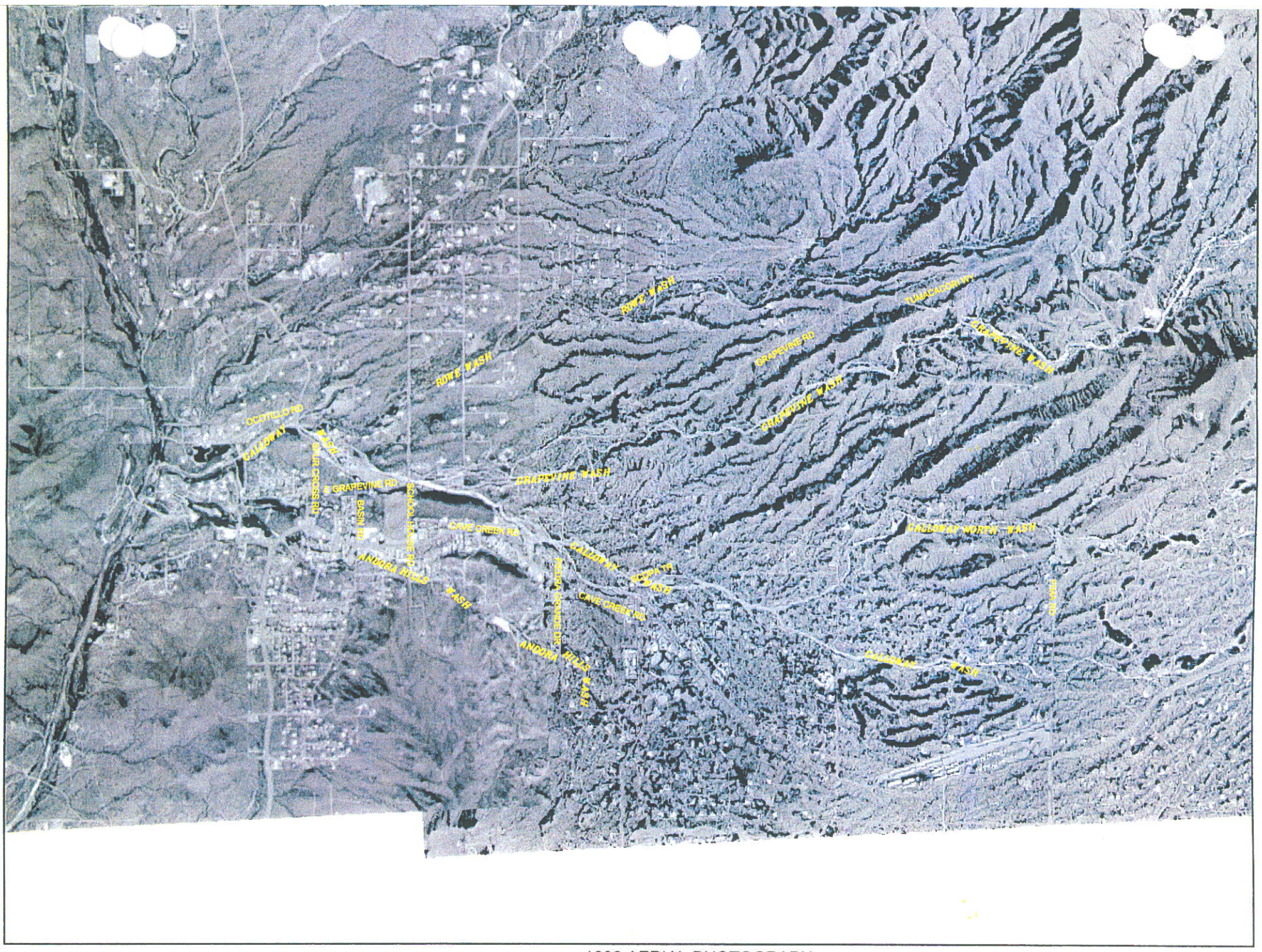

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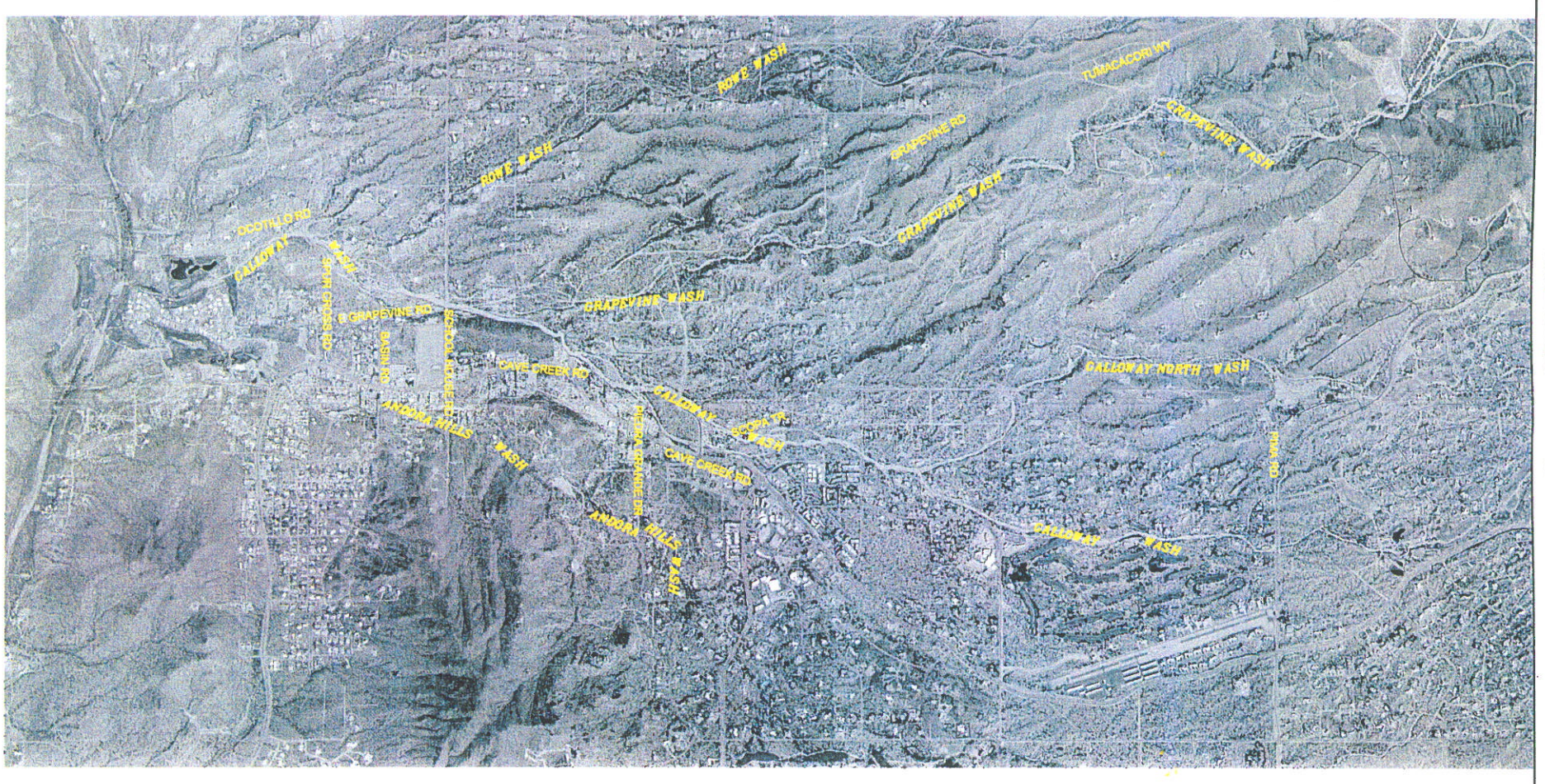

1999 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-1
HISTORICAL AERIAL PHOTOGRAPHS

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CH2MHILL

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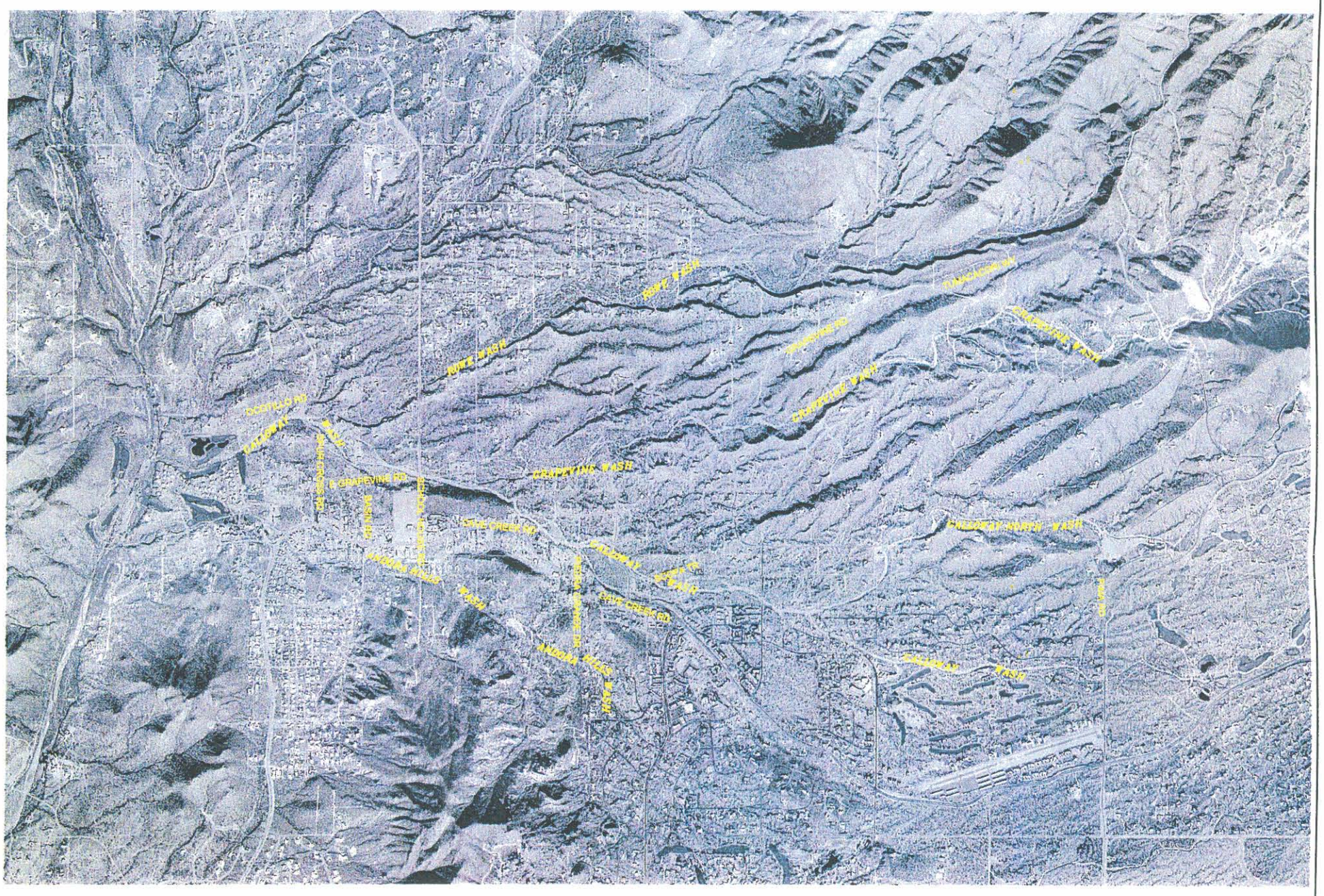
SHEET 3 OF 4



2000 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-1
HISTORICAL AERIAL PHOTOGRAPHS

N
1"=3000'

SHEET 4 OF 4

CH2MHILL

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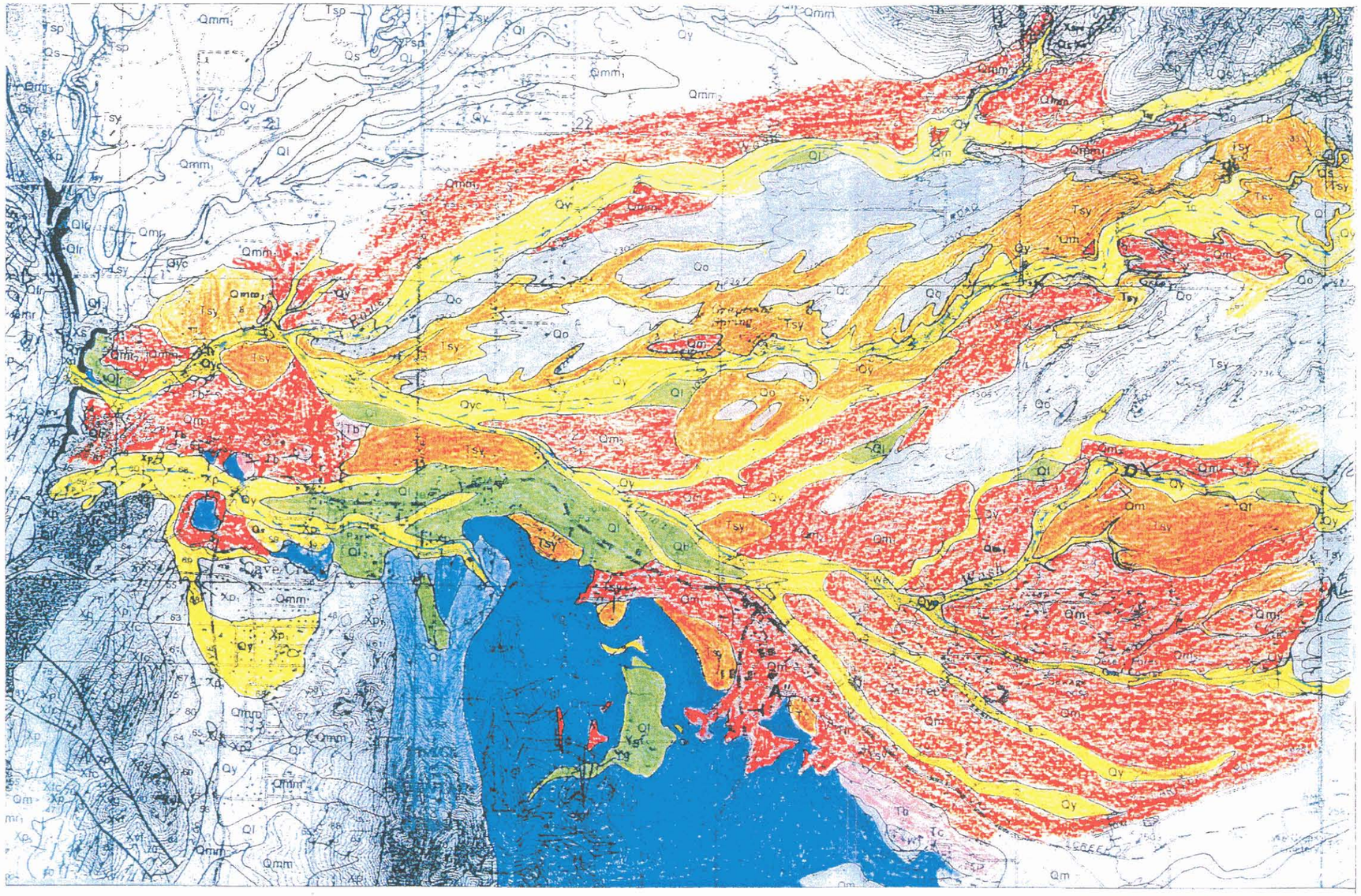


UNIT DESCRIPTIONS

Quaternary piedmont deposits

- ☐ Q_y Holocene alluvium (< 10 Ka)
- ☐ Q_l Late Pleistocene alluvium (10 to 250 Ka)
- ☐ Q_m Middle Pleistocene alluvium (250 to 750 Ka)
- ☐ Q_o Early Pleistocene alluvium fan deposits (750 Ka to 1.6 Ma)
- ☐ Q_c Colluvium, undivided (< 750Ka)

Quaternary river deposits

- ☐ Q_{yc} Active channel deposits

Miocene to Pliocene sedimentary rocks

- ☐ T_{sy} Sandstones and Conglomerates
- ☐ T_c Conglomerate

Late Oligocene to Miocene volcanic rocks

- ☐ T_b Miocene basalt

Middle Proterozoic intrusive rocks

- ☐ Y_g Coarse-grained granite

Early Proterozoic metasedimentary rocks

- ☐ X_{ma} Meta-argillite

Early Proterozoic metamorphic rocks

- ☐ X_p Phyllite

GRAPHIC SCALE

2000' 0 1000' 2000' 4000' 8000'

(IN FEET)
1 inch = 2000'ft.

N

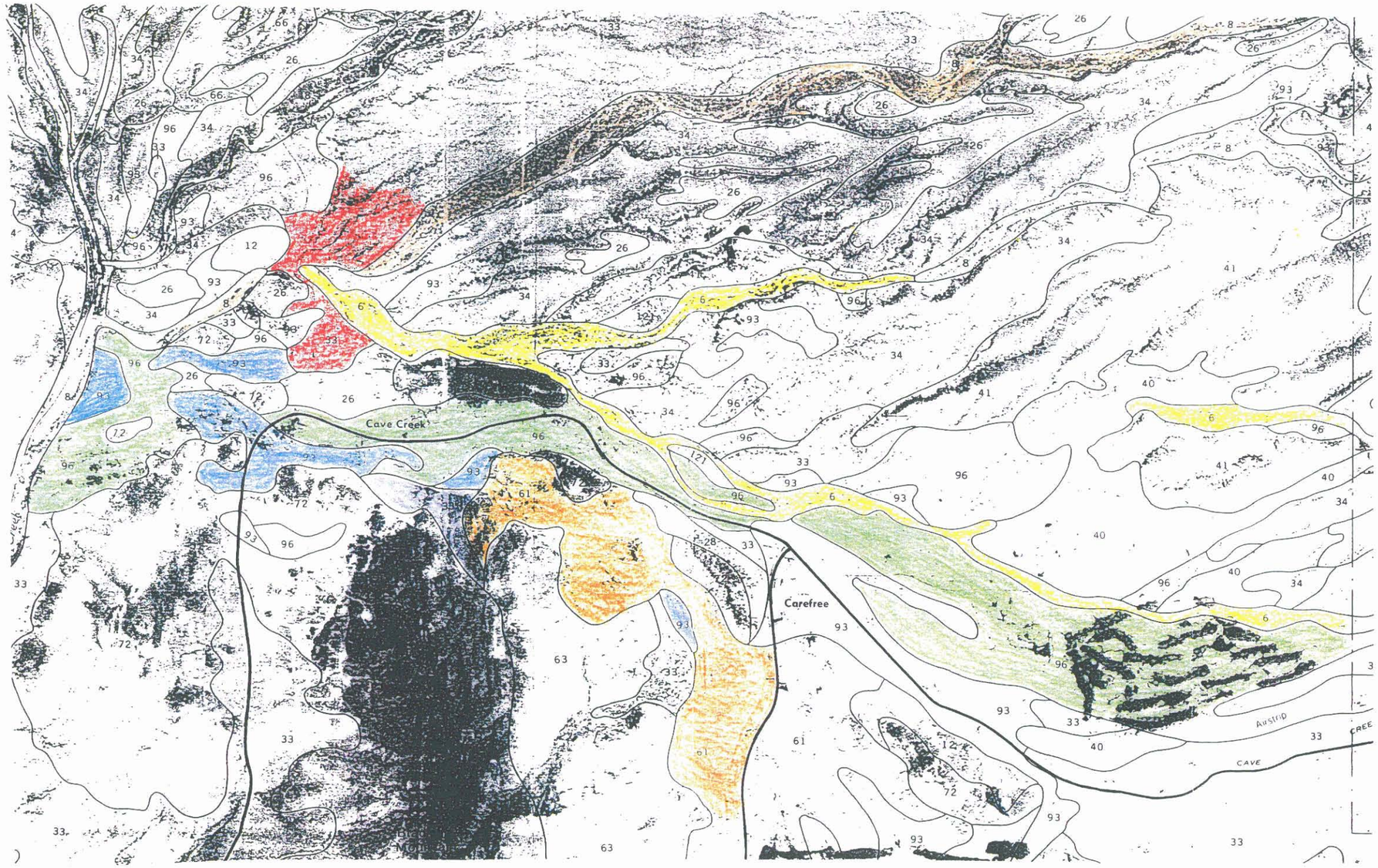
Geologic Map of the Cave Creek Quadrangle, Maricopa County, Arizona

by

Robert S. Leighty, Steven J. Skotnicki, and Philip Pearthree

1977

FIGURE 2-2

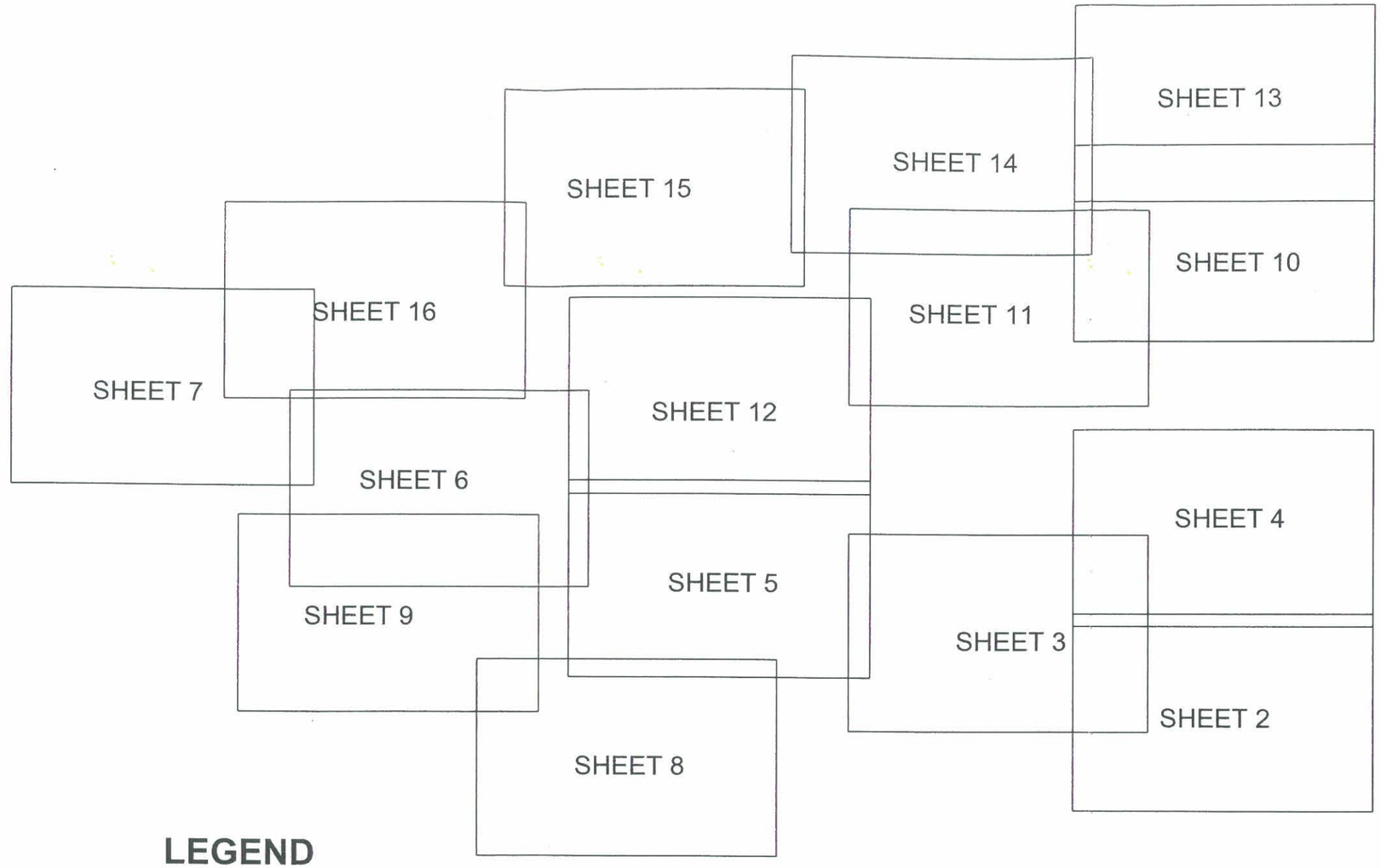


This soil survey was compiled in 1978 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

AGUILA — CAREFREE AREA, PARTS OF MARICOPA AND PINAL COUNTIES, ARIZONA NO. 24

SHEET NO. 23
AGUILA-CAREFREE AREA, PARTS OF
MARICOPA AND PINAL COUNTIES, ARIZONA

FIGURE 2-3



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N.T.S.

INDEX SHEET

LEGEND

R1P5	Photo Location - Galloway / Gallowy North Wash	BR	Bedrock	FILL	Fill
R2P5	Photo Location - Andora Hills Wash	CG	Conglomerate	BERM	Berm
R2P5	Photo Location - Grapevine Wash	-C-C-C-	Cut Bank	SB-SB-SB	Sandbags
R2P5	Photo Location - Rowe Wash	BO	Boulders		
	Riprap		Headcut		
	Wooden Poles		Brick Or Wooden Wall		
CB	Calcium Carbonate		Retaining Wall		

CH2MHILL

Flood Control District of Maricopa County

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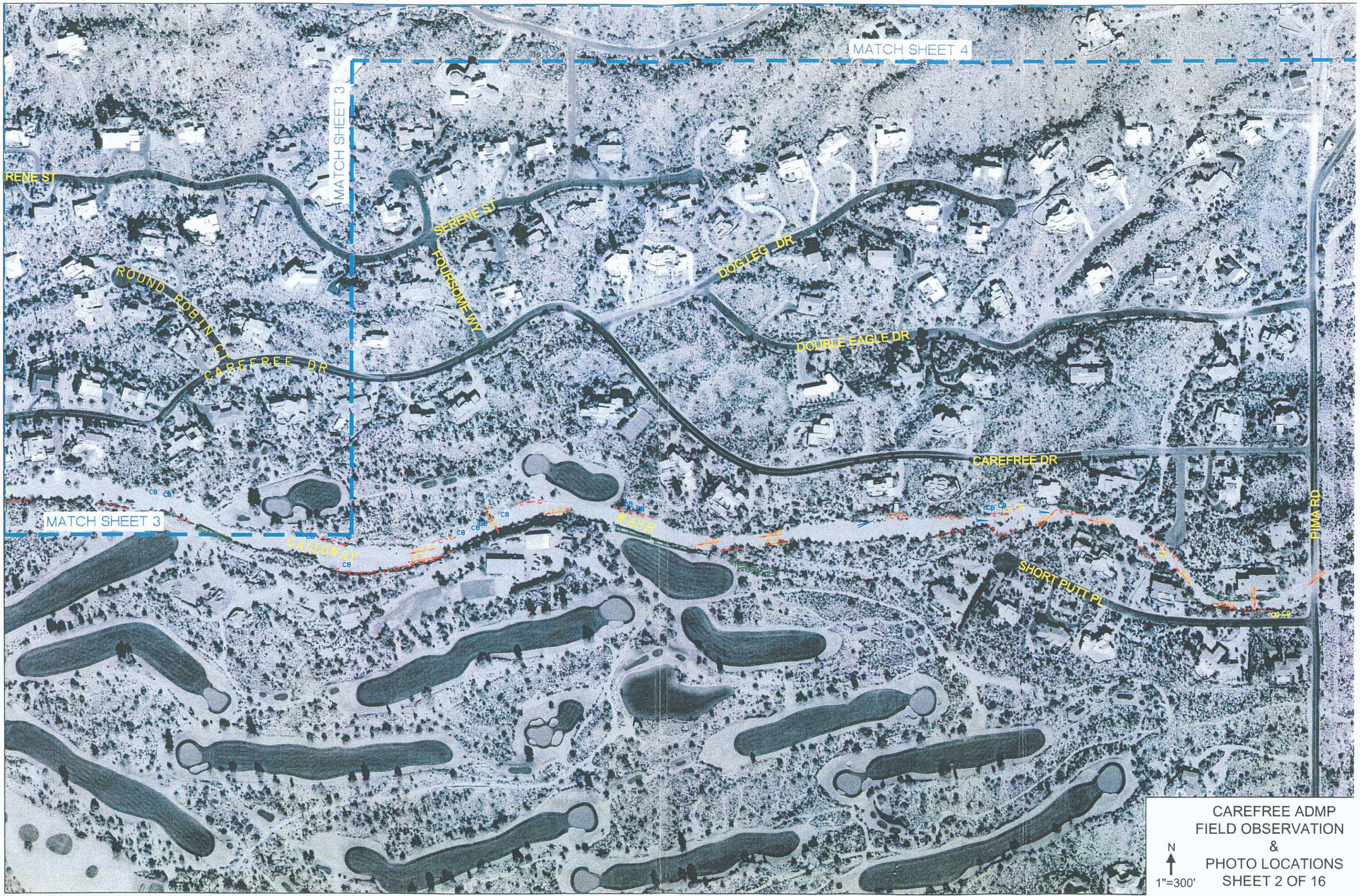
FIGURE 2-4

CAREFREE ADMP
FIELD OBSERVATIONS
&
PHOTO LOCATIONS
SHEET 1 OF 16

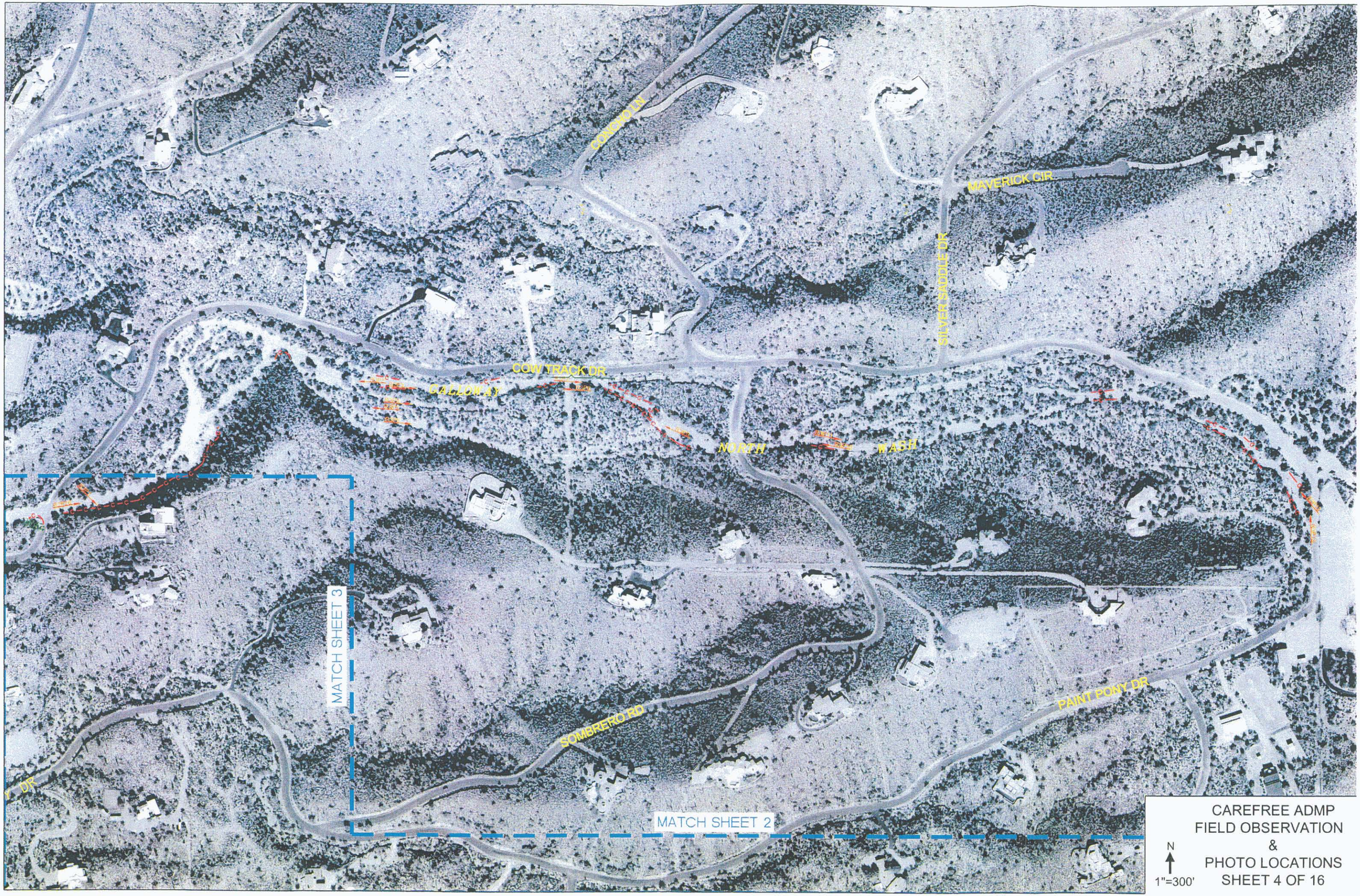


CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 2 OF 16

N
1"=300'

CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 3 OF 16

N
1"=300'



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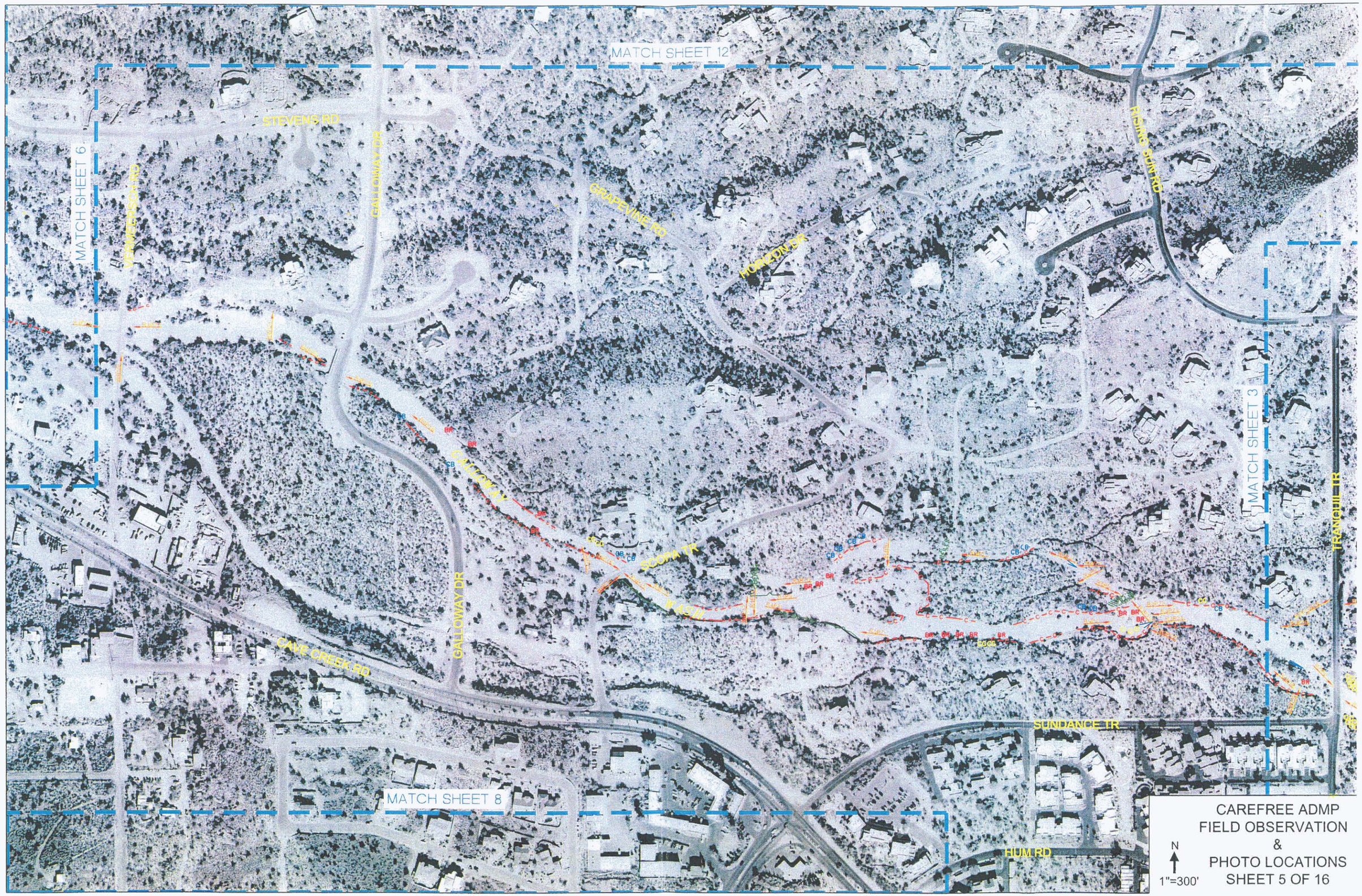
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 4 OF 16



CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 5 OF 16

N

1"=300'

CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 6 OF 16

CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 7 OF 16

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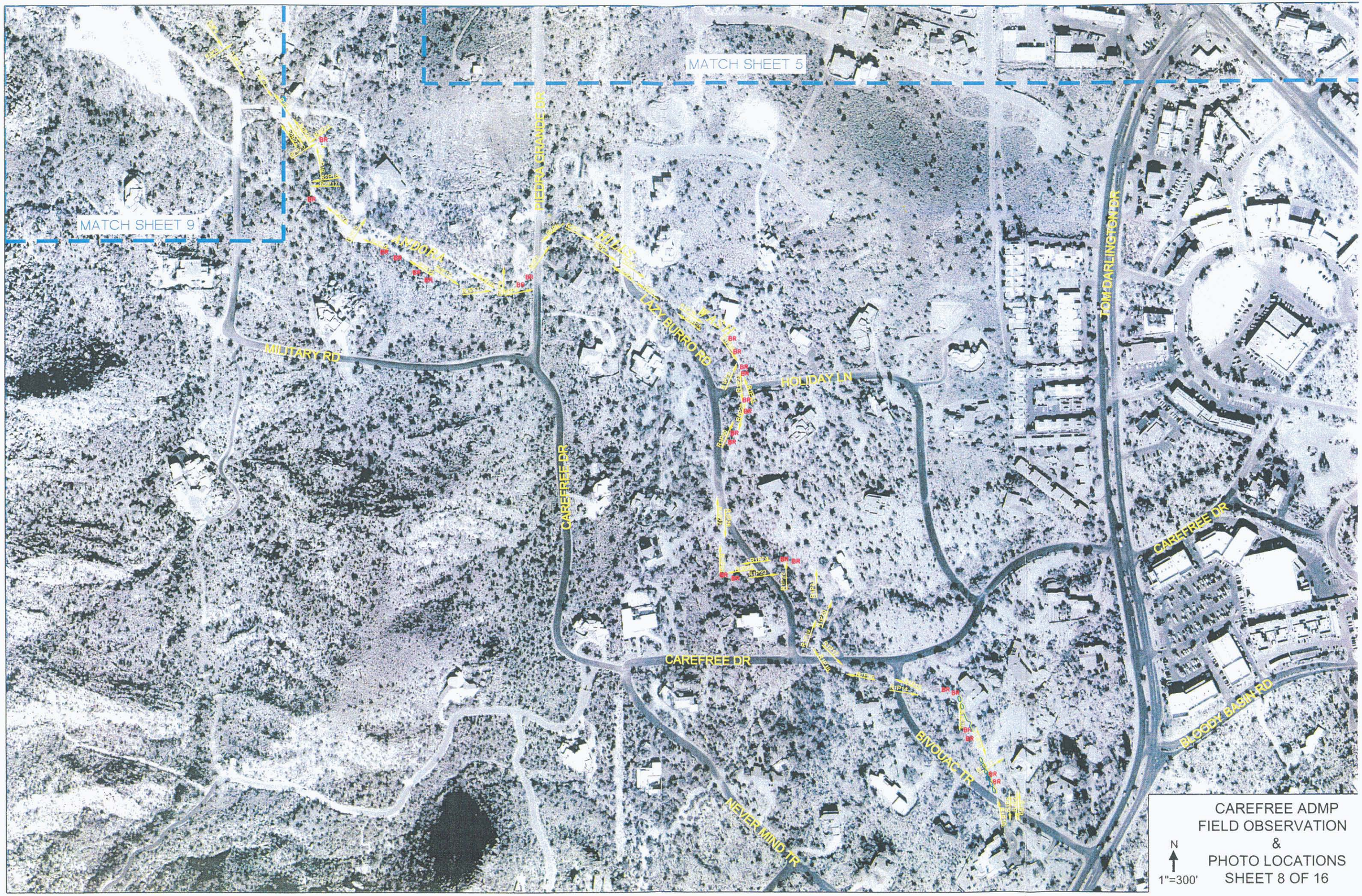

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FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 8 OF 16

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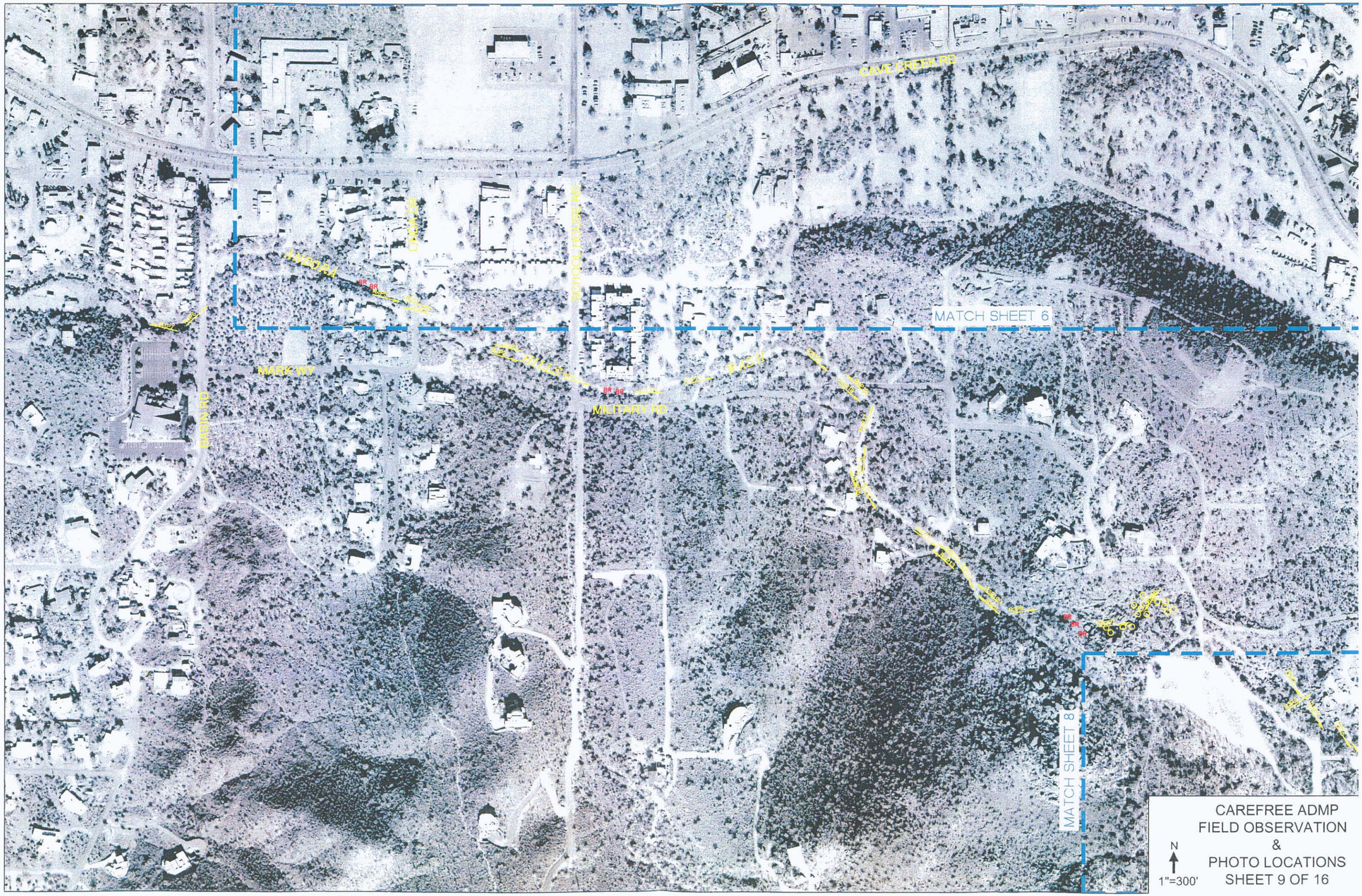

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FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 9 OF 16

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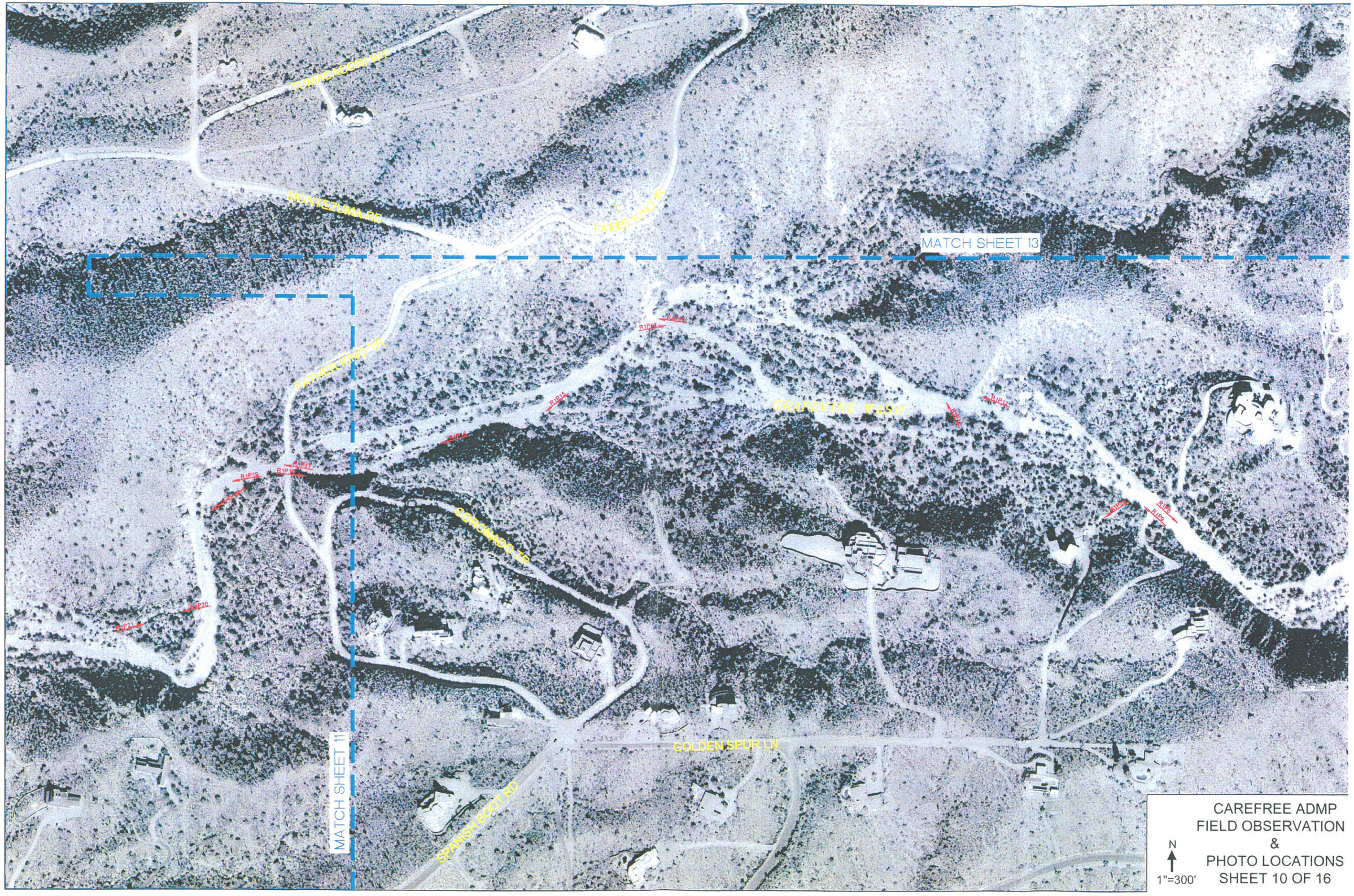

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FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 10 OF 16

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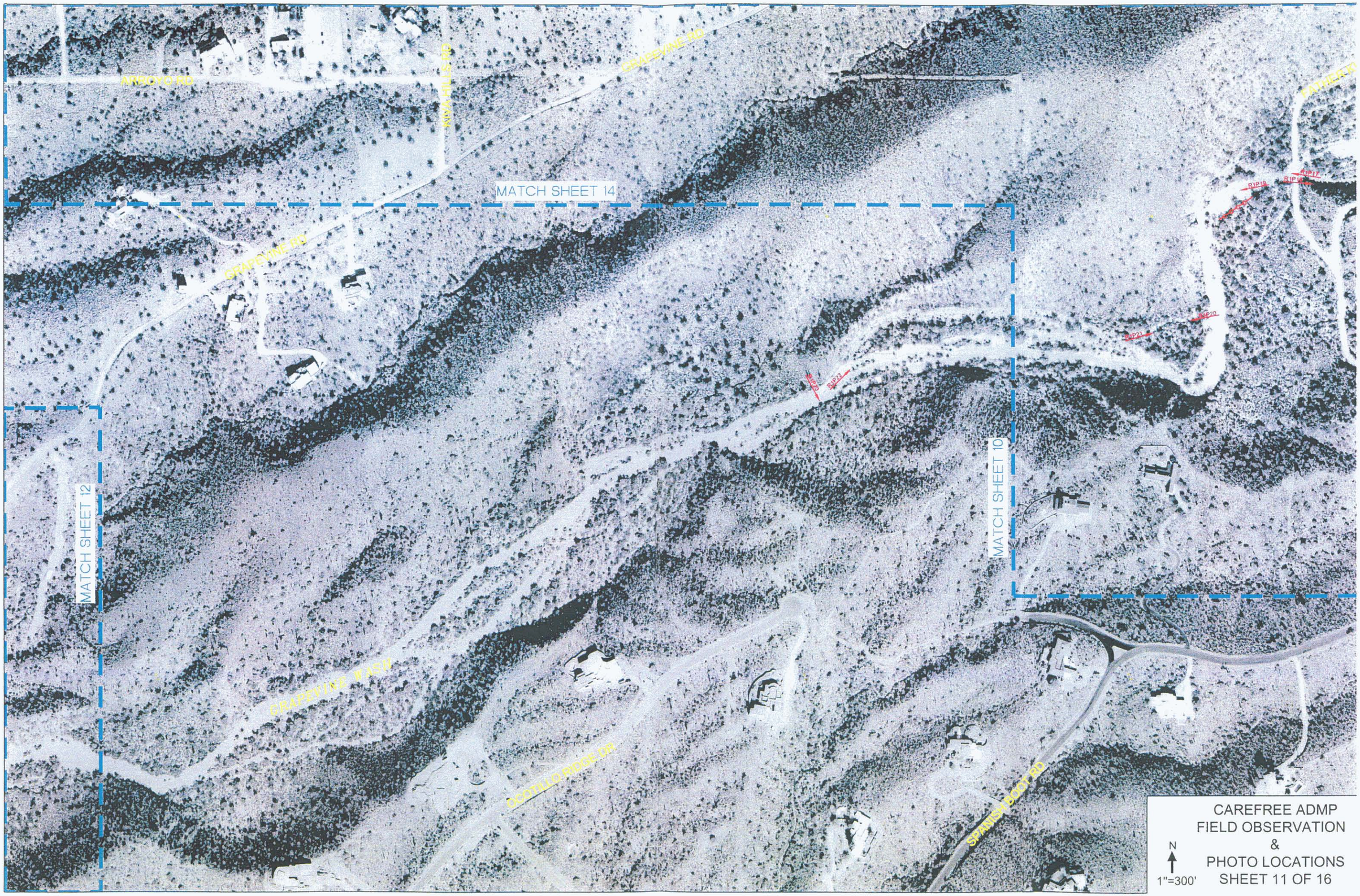

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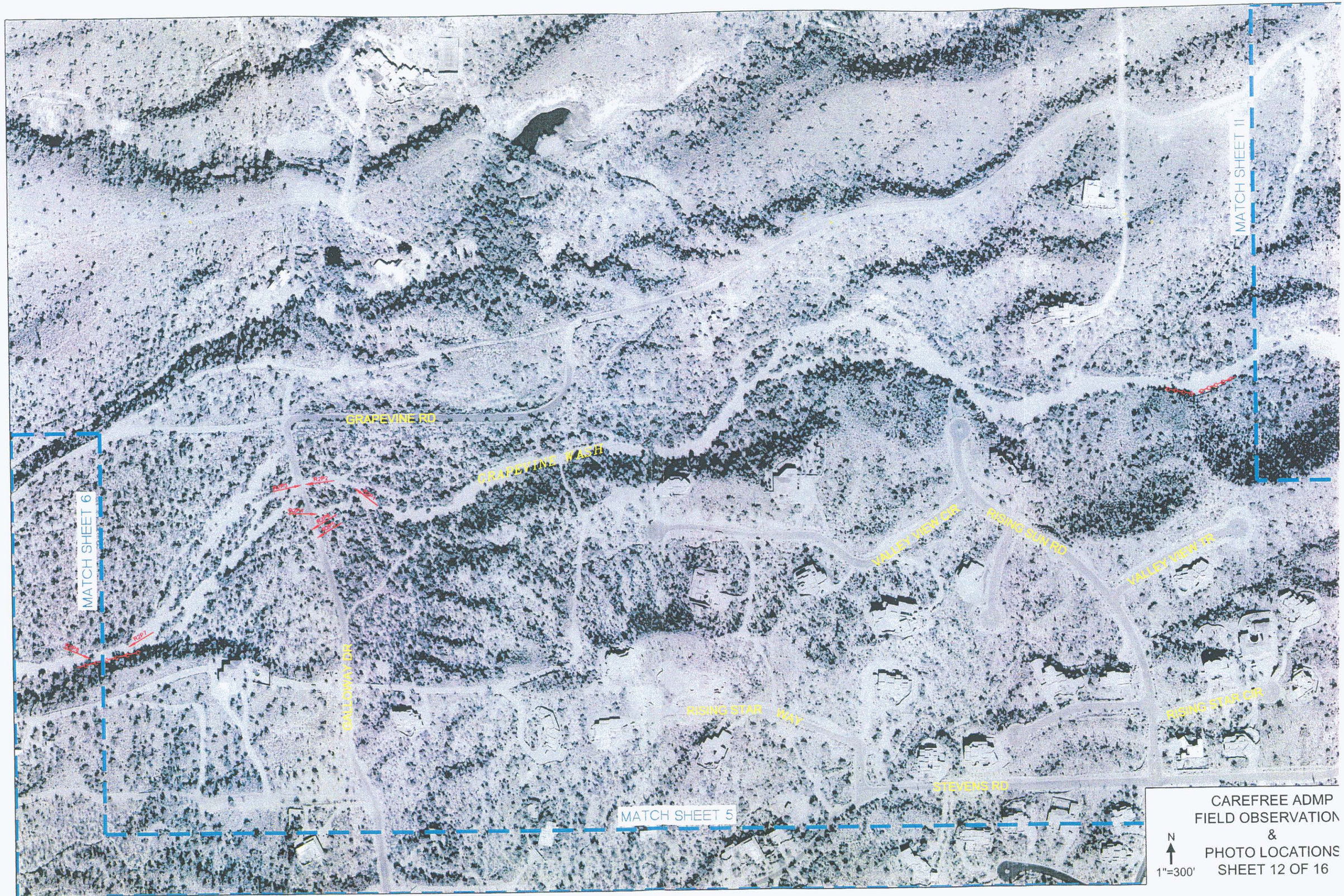
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 11 OF 16



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&
PHOTO LOCATIONS
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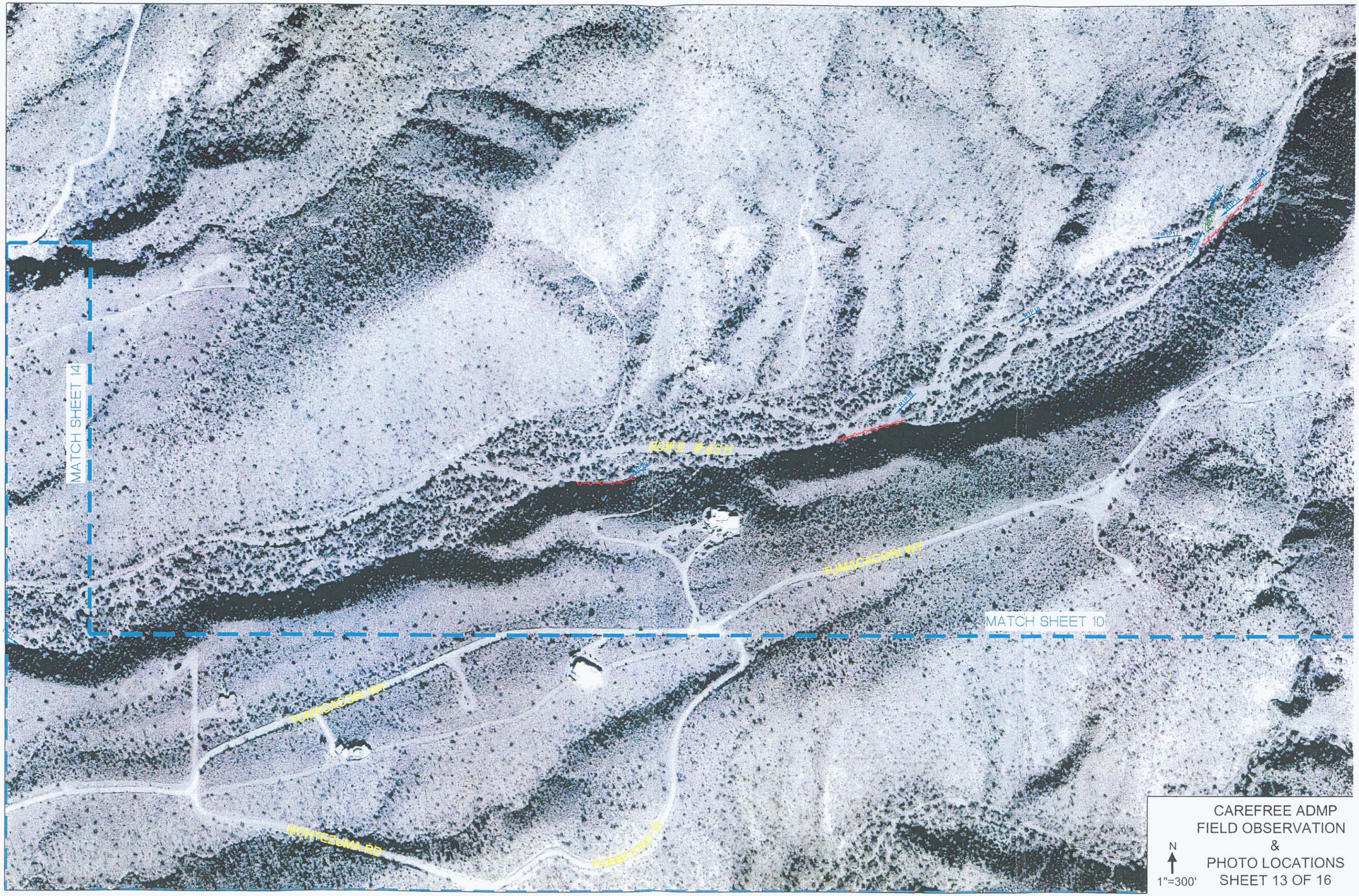

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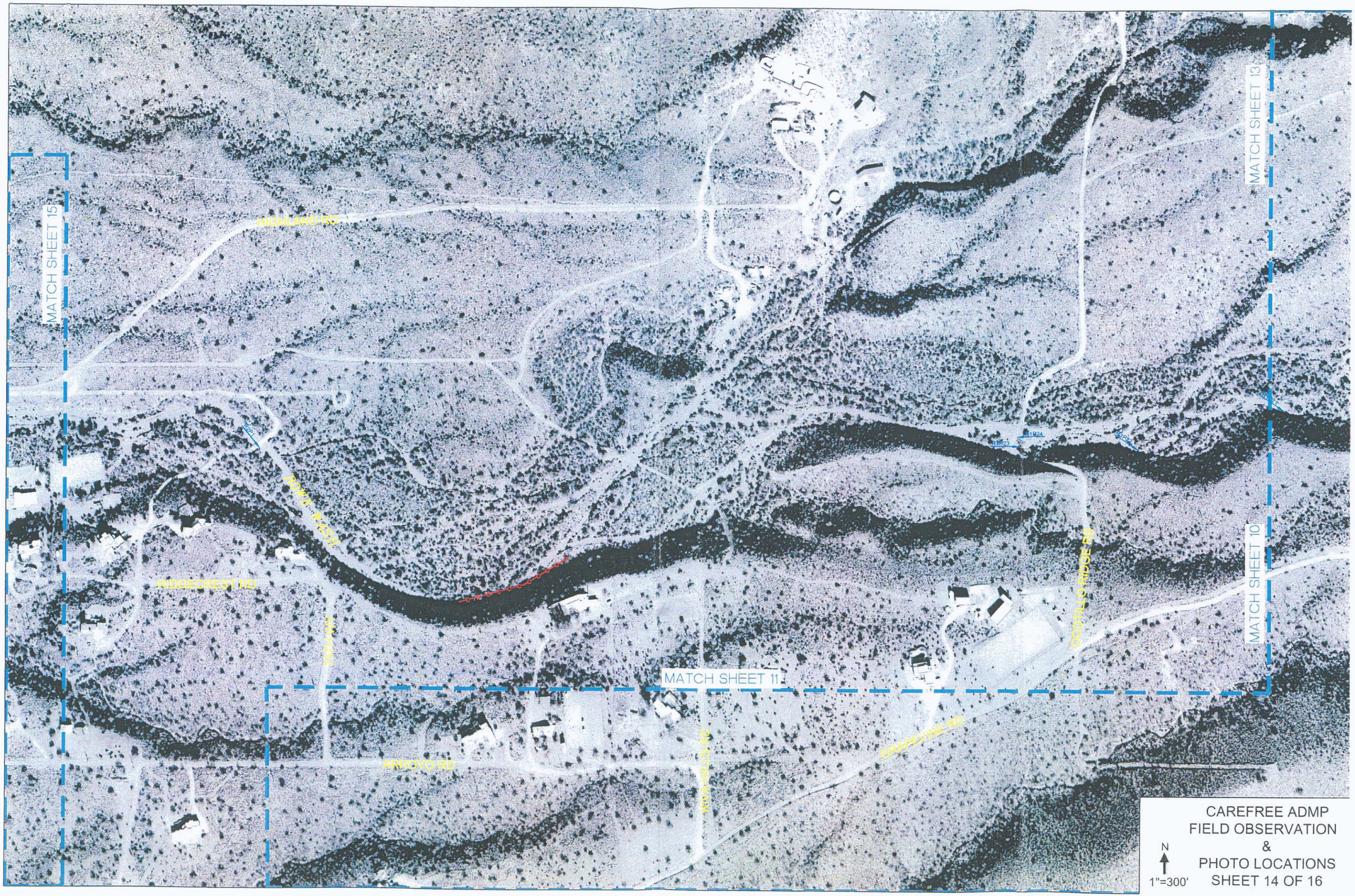
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 13 OF 16



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&
PHOTO LOCATIONS
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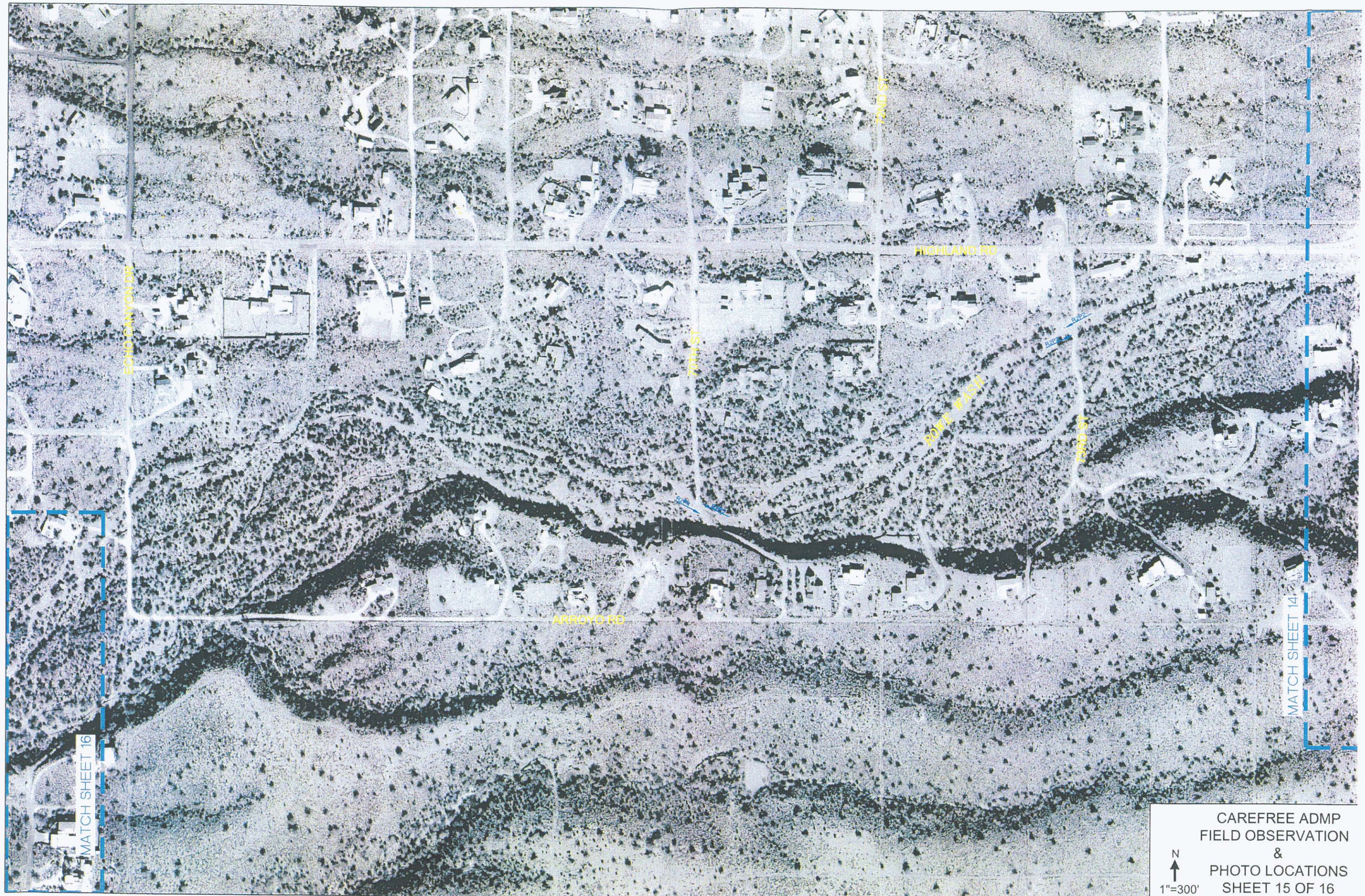

CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 15 OF 16

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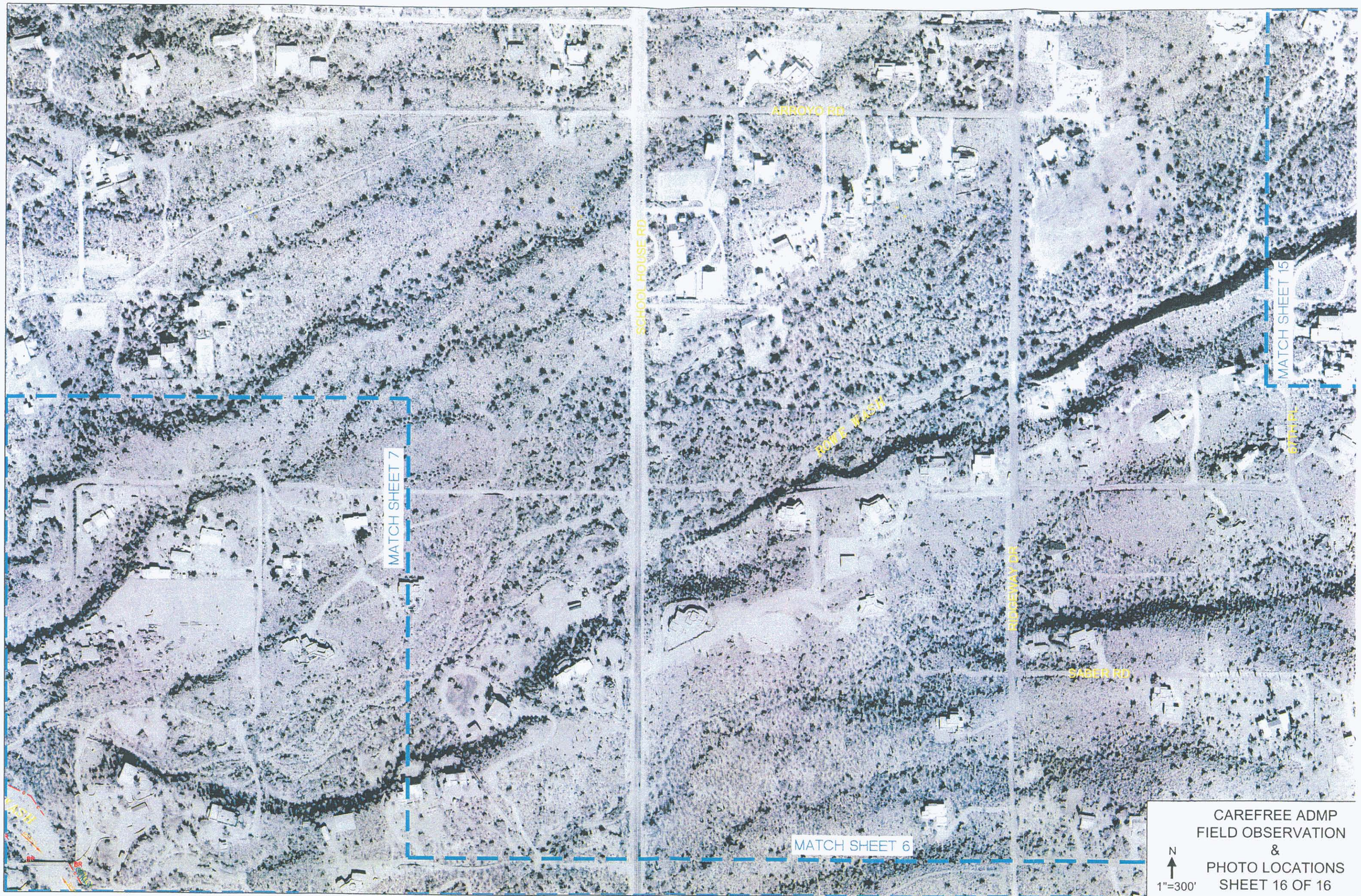
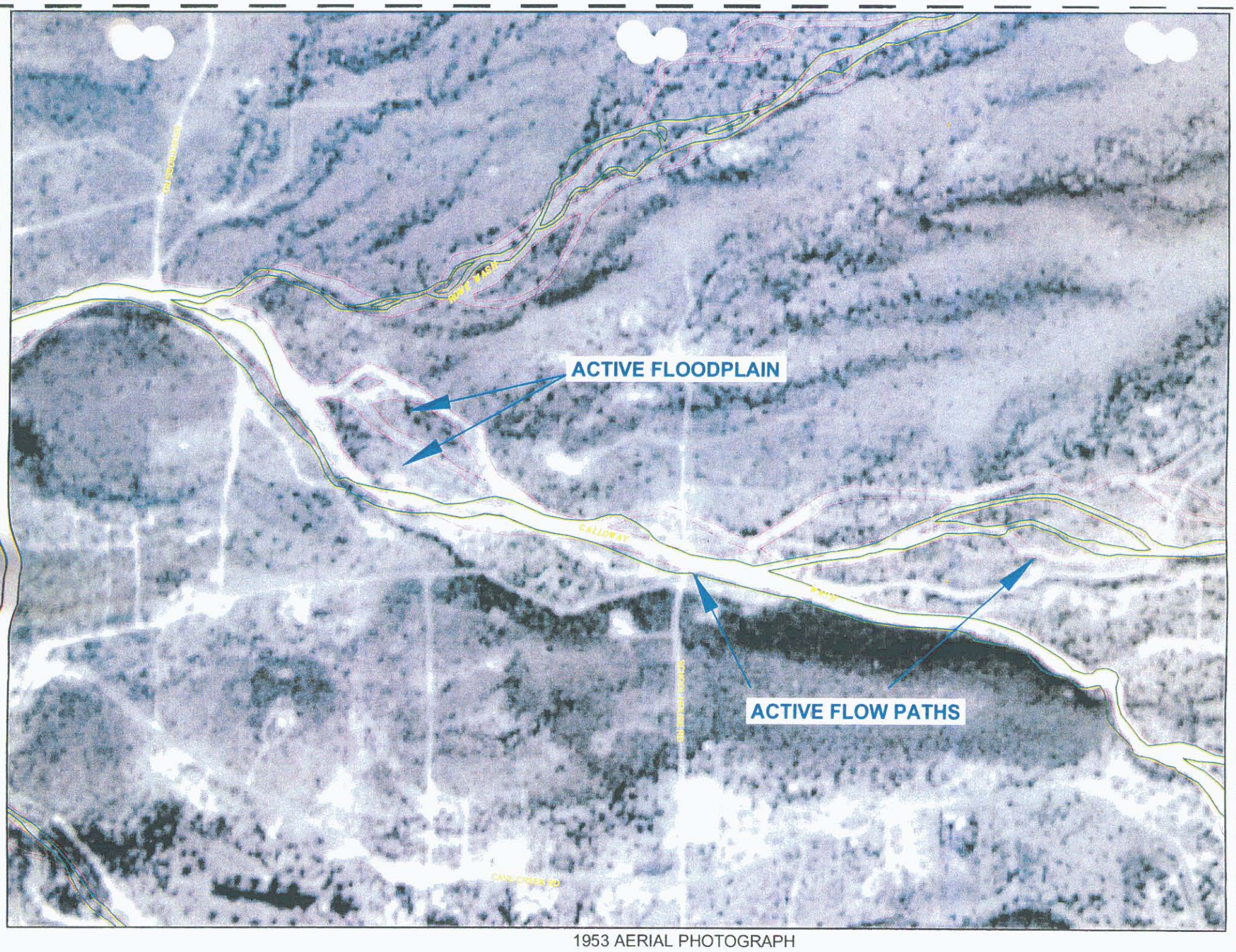


CAREFREE ADMP
FIELD OBSERVATION
&
PHOTO LOCATIONS
SHEET 16 OF 16



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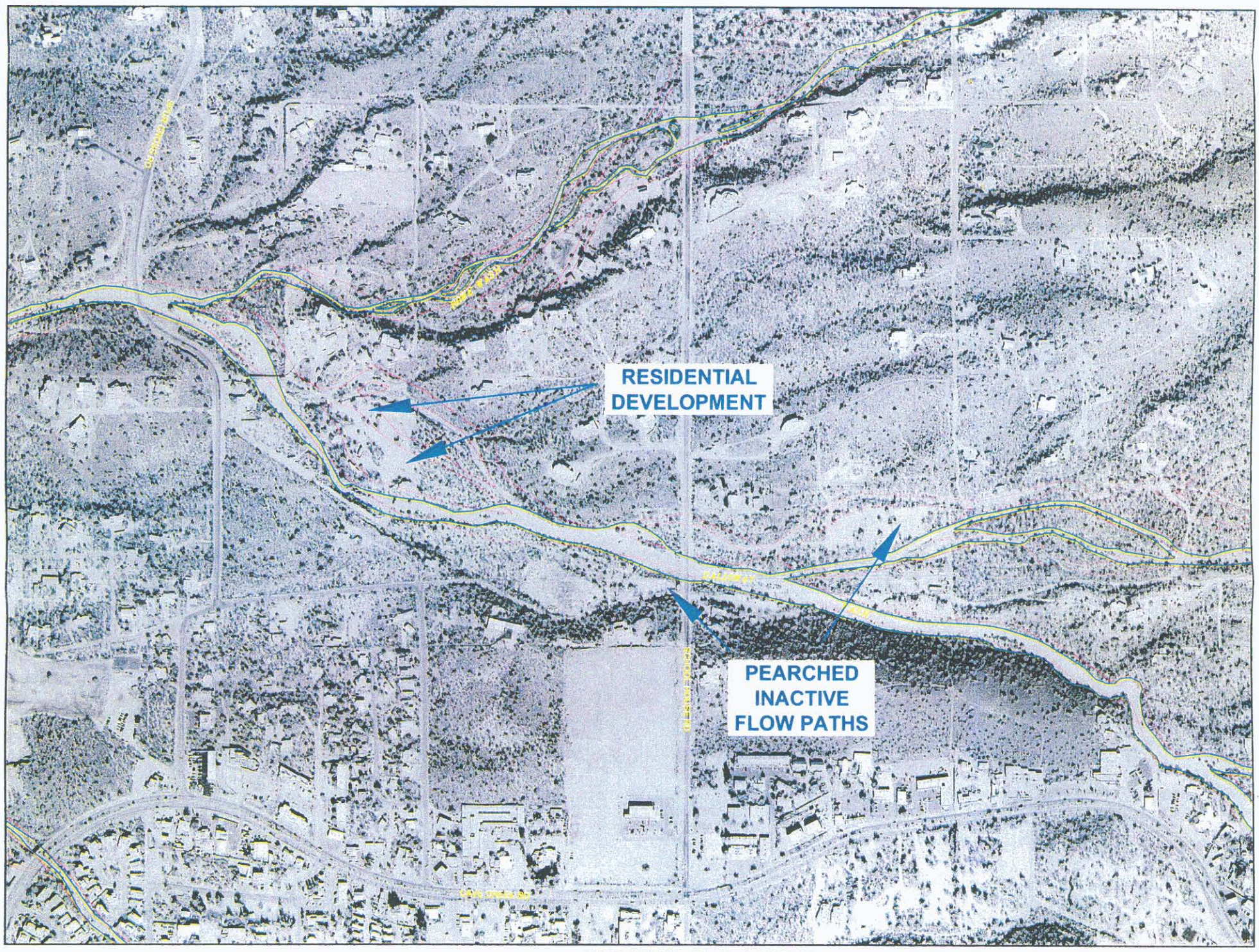

2000 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-6
GRAPEVINE WASH
GRADING

N
1"=600'

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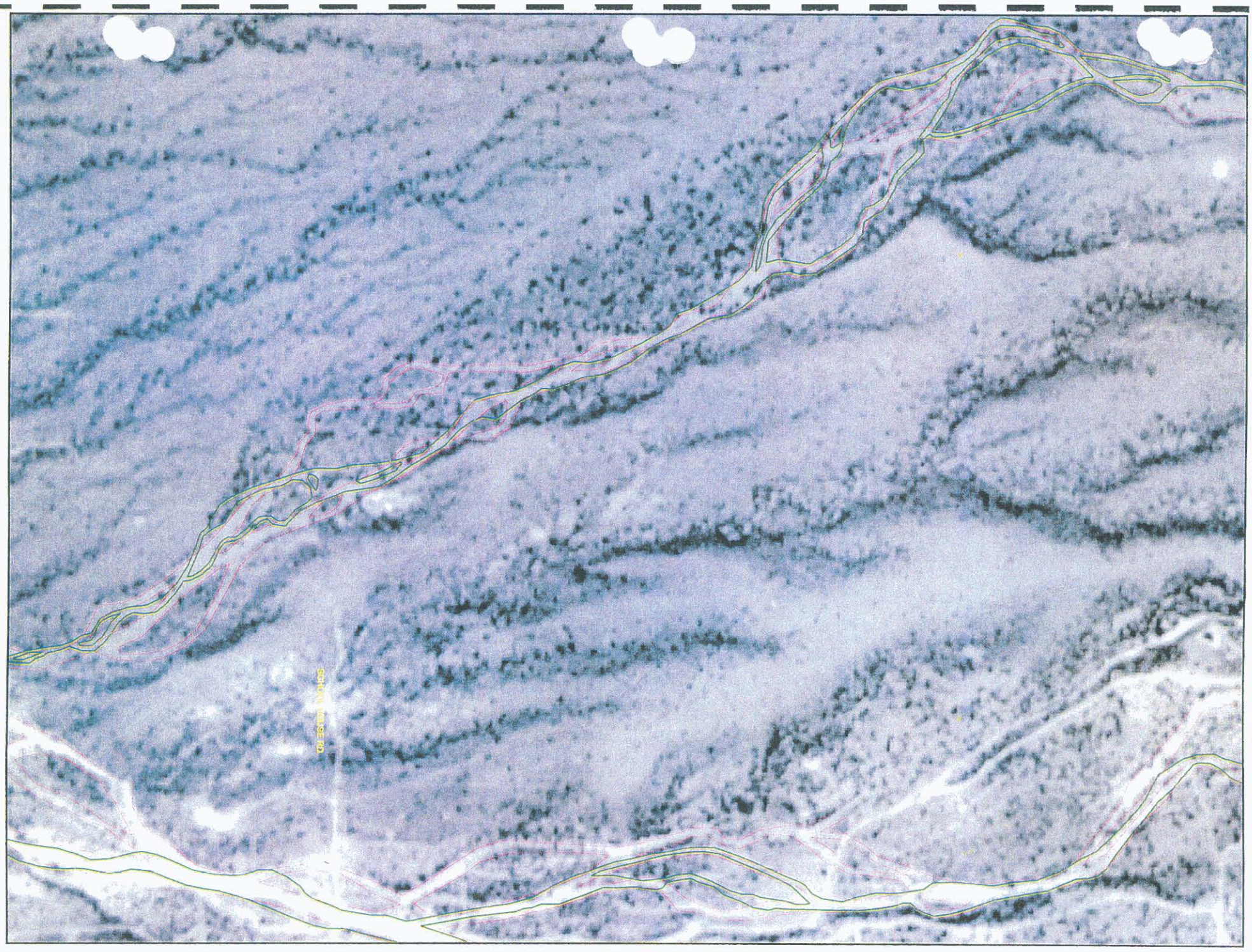

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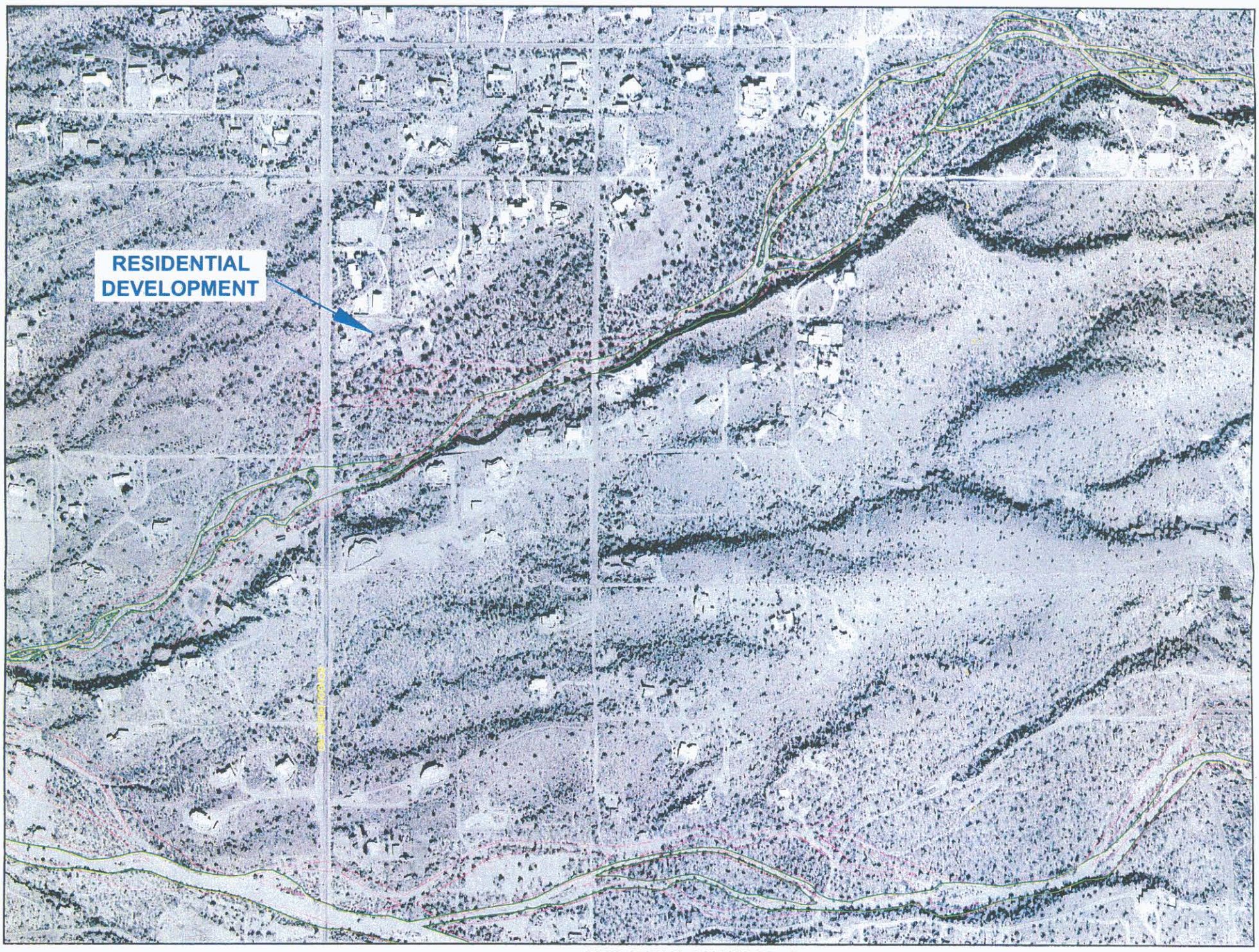

2000 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-7
ROWE WASH
FLOODPLAIN ENCROACHMENT

N
1"=600'

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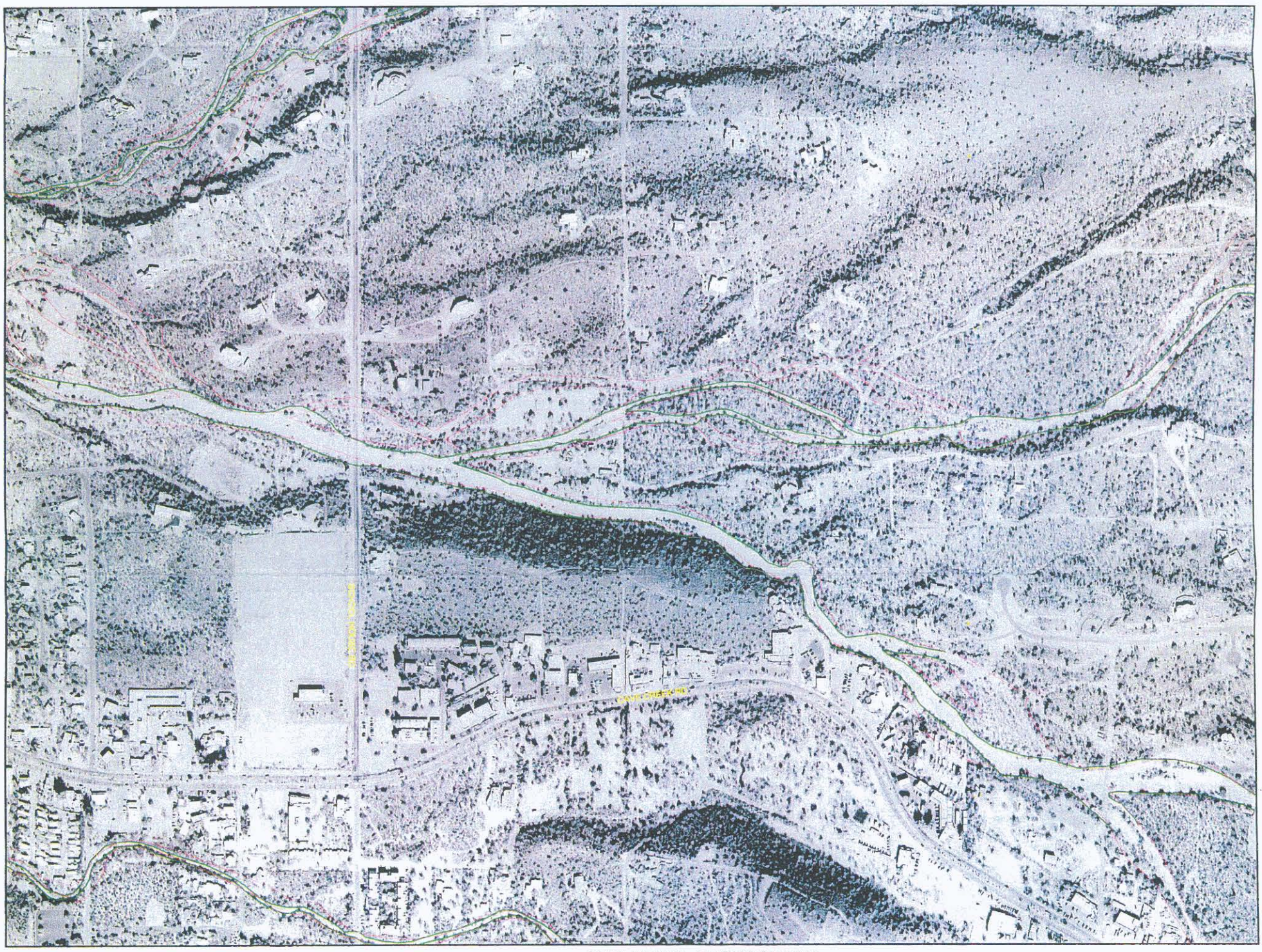
1953 AERIAL PHOTOGRAPH



2000 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-9
GRAPEVINE WASH
CONFLUENCE

N
1"=600'

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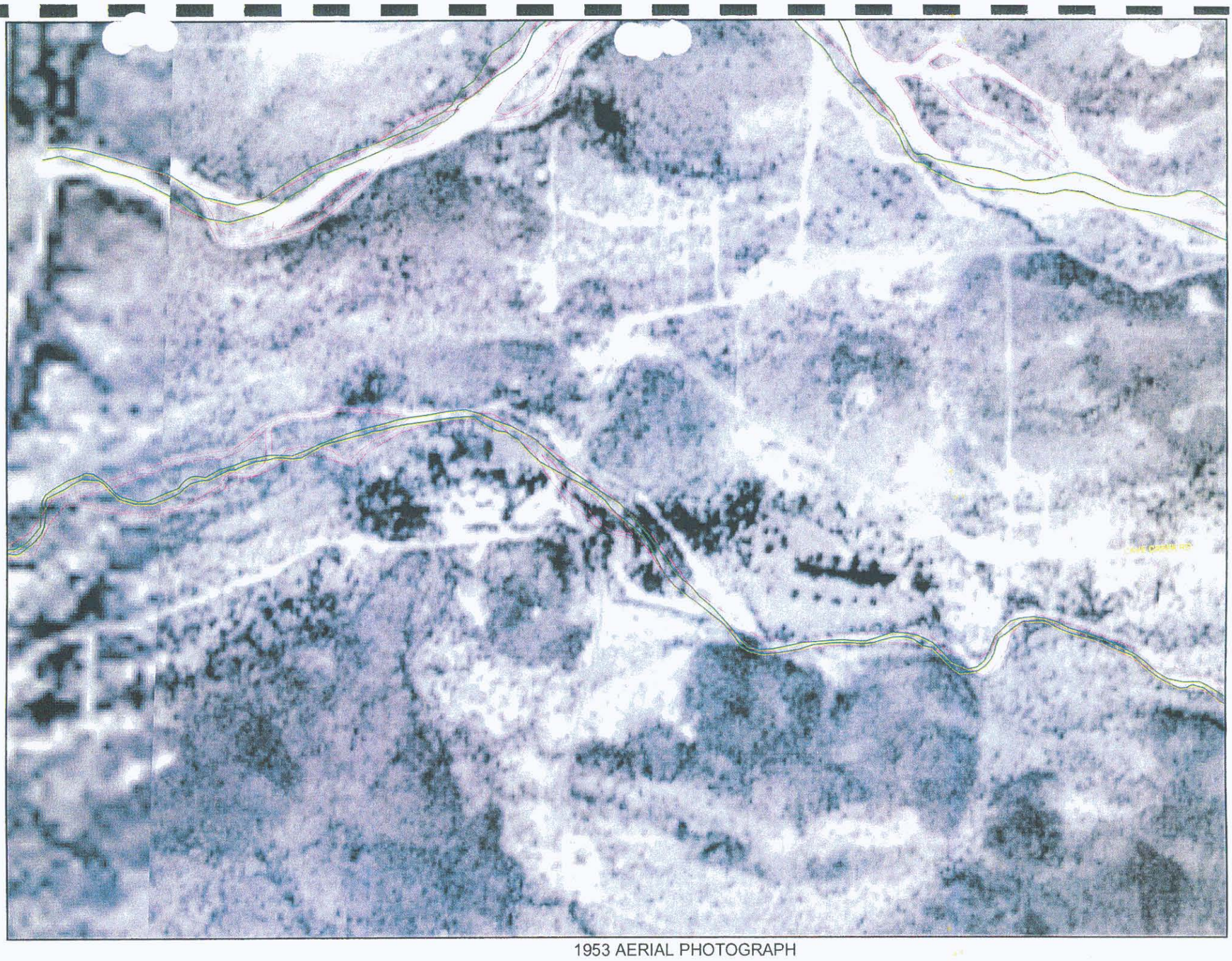

1953 AERIAL PHOTOGRAPH

2000 AERIAL PHOTOGRAPH

CAREFREE DMP
FIGURE 2-8
ANDORA HILLS WASH
CAVE CREEK RD CROSSING

N

1"=600'

CH2MHILL

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HYDROLOGY & GEOMORPHOLOGY, INC

DATE: February 12, 2002

TO: Geza Kmetty/FCDMC
Doug Williams/FCDMC
Tony Bokich, P.E./CH2M Hill

FROM: Jon Fuller, P.E.
Tamara Norton, E.I.T.

RE: Carefree Drainage Master Plan
Sedimentation Engineering & Geomorphic Evaluation
Task 2.1.10.1.2 Geomorphic Analysis

Introduction

Sedimentation engineering and geomorphic analyses of the five major streams in the Carefree DMP study area were conducted to identify trends of channel behavior and to identify probable causes of sedimentation problems. The following methodologies were used:

- Equilibrium slope equations
- Longitudinal profile analysis
- Interpretation of geomorphic surfaces
- Sediment continuity modeling
- Lane's relation
- Stream classification techniques

The results of these analyses are summarized in this chapter. For the purposes of the geomorphic analysis, Galloway Wash was divided into five reaches defined by the confluences of its three tributaries with an additional reach defined in the narrow canyon upstream of the Grapevine Wash confluence. The remaining washes were considered as single reaches.

Equilibrium Slope

Equilibrium slope[1] is defined as the slope that causes the channel's sediment transport capacity to equal the incoming sediment supply (ADWR, 1985). If the slope is too steep, channel velocities will be high and net erosion will occur. If the slope is too flat, channel velocities will be low and net deposition will occur. The equilibrium slope is the slope that the undisturbed, natural channel will tend towards over the long term. While there are philosophical and practical problems with applying equilibrium slope concepts to small ephemeral streams with variable channel geometry and high flash flood potential, equilibrium slope equations provide a useful order-of-magnitude assessment of the likelihood of vertical channel adjustments.

[1] Equilibrium slope is also referred to as stable slope or limiting slope.

Methodology. Reach-averaged data required for application of equilibrium slope equations to the study area were derived from the following sources:

- Hydraulic data - HEC-RAS modeling
- Hydrologic data - HEC-1 modeling and precipitation records
- Topographic data – Floodplain delineation studies

Most equilibrium slope equations are based on the mean annual flood, the "channel-forming," or "bankfull" discharge. On many alluvial streams, the mean annual flood and the channel-forming and bankfull discharges are nearly equivalent. However, on ungauged ephemeral streams where flow events are rare, the average annual discharge is difficult to determine. Bankfull discharge, or the flow rate just prior to inundating the floodplain, ranges from a recurrence interval of 2- to 25-years on ephemeral streams in central Arizona. To account for the discrepancies in what flow rate is appropriate for equilibrium slope analyses, and to assess the trend of expected slope adjustments during floods, the 2-, 10-, and 100-year peaks were used in the equilibrium slope equations to assess the expected slope adjustment over a range of discharges. The 2-year event approximates the mean annual flood calculated on a weighted probability basis. The 10-year event better approximates bankfull conditions on the streams in the study area. The 100-year event represents possible channel responses during extreme flooding. The following equilibrium slope equations were applied to the study reach:

- Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) Equations
- BUREC Equation
- Bray Equation
- Henderson Equation
- Schoklitsch Equation
- Meyer-Peter Muller Equation
- Shield's Diagram Method
- Lane's Tractive Force Method

AMAFCA Equation. The AMAFCA (1994) equation for the maximum equilibrium slope is based on the sediment transport characteristics of the reach.

$$S_L = \left(\frac{a}{q_s}\right)^{\frac{10}{3(c-b)}} q^{\frac{2(2b+3c)}{3(c-b)}} \left(\frac{n}{1.49}\right)$$

Where S_L = channel slope (ft./ft.)
q_s = unit sediment transport (cfs/ft)
q = water discharge (cfs)
n = Manning's roughness
a, b, c = power function coefficients from sediment transport function

A simplified version of the AMAFCA Equation is written for wide, rectangular channels, similar to those in the study area, based on the assumptions that steep, wide, rectangular alluvial streams flow at or close to critical depth and that sediment supply is transport limited.[2]

$$S_s = 18.28\, n^2\, F^{0.133}\, F_r^{2.133}\, Q_{dd}^{-0.133}$$

Where S_s = Stable slope (ft/ft)
n = Manning's roughness value for the channel
F = Width/depth ratio of the channel
F_r = Froude number for the channel
Q_{dd} = Dominant discharge (cfs)

BUREC Equation. The BUREC published an equation for stable slope based on theoretical considerations of sediment transport (MacBroom, 1981).

$$S_L = (0.00021\, D_{50}\, W_{bf} / Q)^{0.75}$$

Where S_L = Stable slope (ft/ft)
D_{50} = Bed sediment diameter (ft)
W_{bf} = Channel width (ft)
Q = Discharge (cfs)

Bray Equation. Bray's (1979) equation for equilibrium slope is based on regime analysis of perennial gravel bed streams in Alberta, Canada.

$$S_L = 0.965\, Q_2^{-0.344}\, D_{50}^{0.58}$$

Where S_L = Equilibrium slope (ft/ft)
D_{50} = Mean bed sediment diameter (ft)
Q_2 = 2-year discharge (cfs)

Henderson Equation. To generate an equation for the slope of stable channels, Henderson (1961) modified the Lane (1952) equations using a threshold theory of shear stress concept.

$$S_L = 0.44\, D_{90}^{1.15}\, Q^{-0.46}$$

Where S_L = Stable slope (ft/ft)
D_{90} = Bed sediment diameter for which 90 percent is smaller (ft)
Q = Discharge (cfs)

The BUREC (Pemberton and Lara, 1984) published a manual for computing scour and channel degradation downstream of dams or other structures that interrupt the natural

---

[2] Transport limited means that the sediment inflow equals or exceeds the reach transport capacity.

sediment supply to the downstream channel. The BUREC manual describes the following four approaches for estimating equilibrium slope: (1) Schoklitsch Equation, (2) Meyer-Peter Muller Equation, (3) Shield's Diagram Method, and (4) Lane's Tractive Force Method. The approaches are based on the assumption of zero sediment transport. Therefore, these results represent a minimum probable slope for the streams in the study area, unless their watersheds become intensely urbanized and the sediment supply is drastically reduced.

Schoklitsch Equation. The Schoklitsch (Shulits, 1935) equation is based on the concept of zero bedload transport.

$$S_L = K_s (D\ W_{bf}/Q)^{3/4}$$

Where S_L = Stable slope (ft/ft)
K_s = 0.00174 (constant)
W_{bf} = Bankfull width (ft)
D = Mean bed sediment diameter (mm)
Q = Dominant discharge (cfs)

Meyer-Peter, Muller Equation. The Meyer-Peter, Muller (1948) equation is based on the incipient motion theory, or the point of initiation of sediment transport.

$$S_L = K_{mpm} (Q/Q_{bf}) (n_s/D_{90}^{1/6})^{3/2}\ D / d$$

Where S_L = Stable slope (ft/ft)
K_{mpm} = 0.19 (constant)
Q = Total discharge
Q_{bf} = Dominant (bankfull) discharge (cfs); flow over the channel
n_s = Manning's n for the stream bed
D_{90} = Bed sediment diameter for which 90 percent is smaller (mm)
D = Mean sediment diameter (mm)
d = Channel depth (ft)

Shields Diagram Method. The Shields diagram (1936) for determining the boundary condition for no sediment transport can be used to define an equation for stable slope.

$$R_* = U_* D / \upsilon$$
$$U_* = (S_L R\ g)^{1/2}$$
$$T_* = \tau_c / ((\gamma_s - \gamma_w) D)$$

Where S_L = Stable slope (ft/ft)
R_* = Boundary Reynold's number
U_* = Shear velocity = $(S_L R\ g)^{\wedge 0.5}$
D = Mean sediment diameter (mm)
υ = Kinematic velocity of water (ft/sec^2)
R = Hydraulic radius for wide channels (ft)

g = Gravitational constant = 32.2 ft/sec^2
T_* = Dimensionless shear stress
τ_c = Critical shear stress (lb/ft^2)
γ_s = Specific weight of sediment (lb/ft^3)
γ_w = Specific weight of water (lb/ft^3)

Lane's Tractive Force Method. Lane's equation (1952) for stable slope uses critical tractive force relationships.

$$S_L = (\tau_c/\gamma_w)\, d$$

Where S_L = Stable slope (ft/ft)
d = Mean flow depth (ft)
τ_c = Critical shear stress (lb/ft^2)
γ_w = Specific weight of water (lb/ft^3)

Results. As indicated from the results shown in Table 3-1, the equilibrium slopes of all the streams in the study area are significantly flatter than the existing channel slopes. Therefore, the natural tendency for the major streams in the study area is to flatten their slopes by degrading. Degradation should be expected over the long-term, particularly as the sediment supply is reduced by urbanization and floodplain encroachment. The disparity between existing and predicted equilibrium slopes indicates that the streams in the study area may be highly sensitive to changes in sediment supply. The extremely flat slopes predicted by the BUREC methodologies reflect the slopes that should be expected if the sediment supply were completely cut off, as would occur downstream of a major dam or retention basin.

Table 3-1. Carefree DMP Equilibrium Slope Results				
Stream Reach	**Existing Channel Slope (ft/ft)**	**Energy Slope from HEC-RAS (ft/ft)**	**BUREC Equilibrium Slope (ft/ft)**	**Regime Equilibrium Slope (ft/ft)**
	Q100			
Galloway Wash - Study Limit to North Branch	0.026	0.027	0.00012	0.008
North Branch to Narrows	0.024	0.023	0.00007	0.007
Narrows to Grapevine Wash	0.023	0.024	0.00004	0.008
Grapevine Wash to Rowe Wash	0.028	0.022	0.00004	0.007
Rowe Wash to Cave Creek	0.020	0.020	0.00004	0.006
Andora Hills Wash	0.020	0.021	0.00006	0.007
Rowe Wash	0.048	0.147	0.00005	0.032
North Branch Galloway Wash	0.024	0.034	0.00043	0.009
Grapevine Wash	0.025	0.029	0.00003	0.007
	Q10			
Galloway Wash - Study Limit to North Branch	0.028	0.027	0.00018	0.008
North Branch to Narrows	0.024	0.024	0.00010	0.007
Narrows to Grapevine Wash	0.023	0.025	0.00006	0.008
Grapevine Wash to Rowe Wash	0.028	0.026	0.00006	0.008
Rowe Wash to Cave Creek	0.020	0.021	0.00005	0.006
Andora Hills Wash	0.020	0.023	0.00007	0.007
Rowe Wash	0.048	0.183	0.00017	0.039
North Branch Galloway Wash	0.024	0.028	0.00781	0.008
Grapevine Wash	0.025	0.028	0.00005	0.007
	Q2			
Galloway Wash - Study Limit to North Branch	0.028	0.024	0.00046	0.008
North Branch to Narrows	0.024	0.032	0.00054	0.008
Narrows to Grapevine Wash	0.023	0.023	0.00040	0.008
Grapevine Wash to Rowe Wash	0.028	0.024	0.00040	0.007
Rowe Wash to Cave Creek	0.020	0.021	0.00024	0.007
Andora Hills Wash	0.020	0.023	0.00044	0.008
Rowe Wash	0.048	0.203	0.00038	0.046
North Branch Galloway Wash	0.024	0.025	0.00092	0.008
Grapevine Wash	0.025	0.026	0.00347	0.007

Longitudinal Profile

A longitudinal profile is a plot of the channel elevation versus distance along the streambed. Analysis of the longitudinal profile can be used to identify slope irregularities, over-steepened or over-flattened reaches, headcuts, and areas of natural grade control. Interpretation of the longitudinal profile also provides information on the expected lateral stability of the stream. Because of the influence of channel slope on sediment transport rates, reaches with lower slopes than upstream reaches will tend to experience net deposition (aggradation) and bank erosion associated with braiding and

avulsions. Similarly, reaches with steeper slopes than upstream reaches will tend to experience net degradation and bank erosion associated with undercutting and scour. Comparison of historical profiles with modern profiles can be used to indicate where degradation and aggradation have occurred in the recent past, and where future adjustments of channel geometry are most likely to occur.

Methodology. Longitudinal profiles for the five major washes within the watershed were constructed from topographic data from the most recent floodplain delineation studies. Historical longitudinal profiles were also constructed for each stream using older topographic data from previous floodplain studies and the 1965 USGS topographic mapping. Topographic data obtained from floodplain delineation studies printed maps have two main types of potential error. Measurement error is a function of the map scale and results from manually measuring distances on printed maps. Measurement error was estimated as half the smallest unit (0.02 inch) of measurement on the engineering scale used to determine distances on the paper copy of the map. Vertical error is a function of level of detail of the survey data used to generate the topographic map. Vertical accuracy of a topographic map is generally considered to be half the contour interval.

Results. Due to the relatively small change in elevation from each of data sets, any actual change in profile slope or elevation would be difficult to see at the scales required to include the entire stream profile. Therefore, Figures 3-1 to 3-10 were developed for each wash to show the change in profile elevation versus river station for each wash, with the 1965 USGS contour data used as the reference elevation. That is, profile elevation differences were measured from the 1965 elevations. Results for each wash are discussed below.

Galloway Wash. Galloway Wash has a relatively uniform slightly concave up longitudinal profile (Figure 3-1), although small headcuts create a few small discontinuities. Historical topographic data (Figure 3-2), however, indicate that there have been active fluctuations in bed elevation over the length of the study reach. Downstream of Station 15000 (approximately the Scopa Trail alignment), Galloway degraded up to 12 feet between 1965 and 1978, although the channel has recovered slightly since 1978. Upstream of Station 15000, the channel aggraded slightly from 1965 to 1988, although the elevation differences are within the error of measurement. Some of the degradation and aggradation that occurred prior to 1988 was removed by 1999.

Galloway Wash North Branch. The longitudinal profile of the Galloway Wash North Branch (Figure 3-3) is not concave up, and is slightly more irregular than the profile of the main stem of Galloway Wash. While some of the profile irregularities can be explained by scale of the plot, the main cause of the irregular shape is the chute and splay channel pattern which causes local zones of deposition (mounds) and scour (troughs). Comparison of the 1988 and 1965 topographic data (Figure 3-4) indicates that the North Branch of Galloway Wash experienced aggradation during the period of record, particularly in the reach immediately upstream of the Galloway Wash confluence, although the elevation differences are within the error of measurement for the

topographic data. Field observations do not support a theory of recent historical aggradation on Galloway Wash North Branch.

Grapevine Wash. Grapevine Wash has a relatively uniform slightly concave up longitudinal profile (Figure 3-5). Historical topographic data (Figure 3-6), however, indicate that there have been active fluctuations in bed elevation over the length of the study reach. Except at the Galloway Wash confluence, the historical data indicate that Grapevine Wash degraded up to 10 feet between 1965 and 1990, although the irregular elevation differences with distance indicate channel pattern has a strong influence on the mode of degradation. The partial data from 1978 indicate that some of the aggradation that occurred prior to 1988 was removed by 1999.

Rowe Wash. The Rowe Wash study reach is located closest to its headwaters and therefore has a strongly concave up shape (Figure 3-7). Historical topographic data (Figure 3-8) indicate that local aggradation occurred between 1965 and 1990, although most of the elevation difference is within the error of measurement.

Andora Hills Wash. Andora Hills Wash has a very irregular concave down longitudinal profile (Figure 3-9). Profile discontinuities are due to bedrock control and steep bouldery riffles. Historical topographic data (Figure 3-10) indicates that there have been active fluctuations in bed elevation over the length of the study reach, with increasing degradation in the upstream direction. Since the topographic data indicate that most of the degradation occurred near the more densely developed portion of the watershed, it is tempting to assume the cause of degradation is urbanization impacts on water and sediment supply. However, given the presence of bedrock and other field observations, it is likely that at least some of the apparent elevation difference is due to error of measurement.

Summary. The irregular non-linear trace of channel elevation changes over the length of the study reaches suggests that the cause of bed elevation changes is at least partially from within the study reach, rather than outside forces from upstream or downstream of the study area. An internal or local cause of degradation effectively eliminates base level fall (e.g., degradation in Cave Creek) or upstream development as the sole cause of historical or on-going channel changes in the study reaches. The sinusoidal pattern of elevation differences versus distance suggests that sediment movement occurs in waves, with alternating zones of deposition and aggradation typical of braided streams with a chutes and splay pattern. The historical data did not indicate the presence of significant headcut migration through the study reach, which also suggests that observed bed elevation changes are not the solely result of upstream or downstream influences.

Figure 3-1. Longitudinal Profile of Galloway Wash (1999 Data)

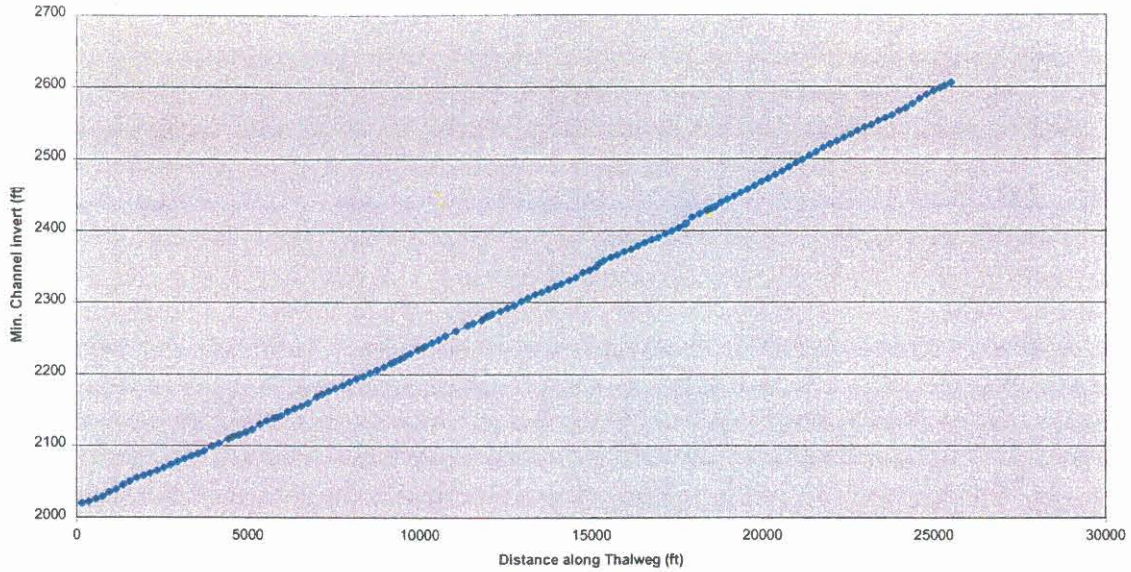


Figure 3-2. Galloway Wash Change in Elevation Over Time

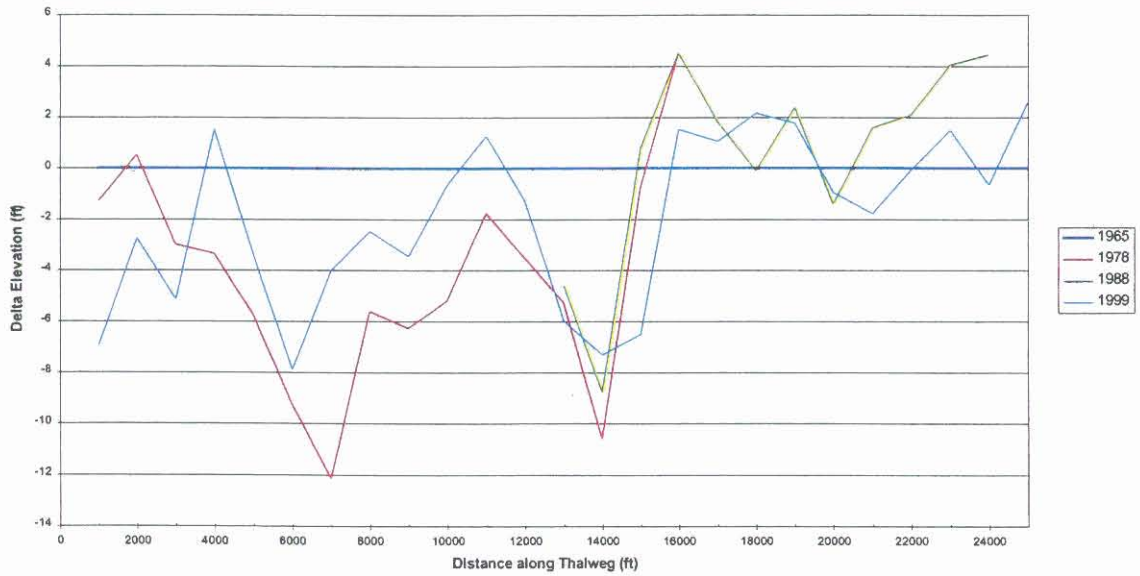


Figure 3-3. Longitudinal Profile of Galloway Wash North Branch (1988 Data)

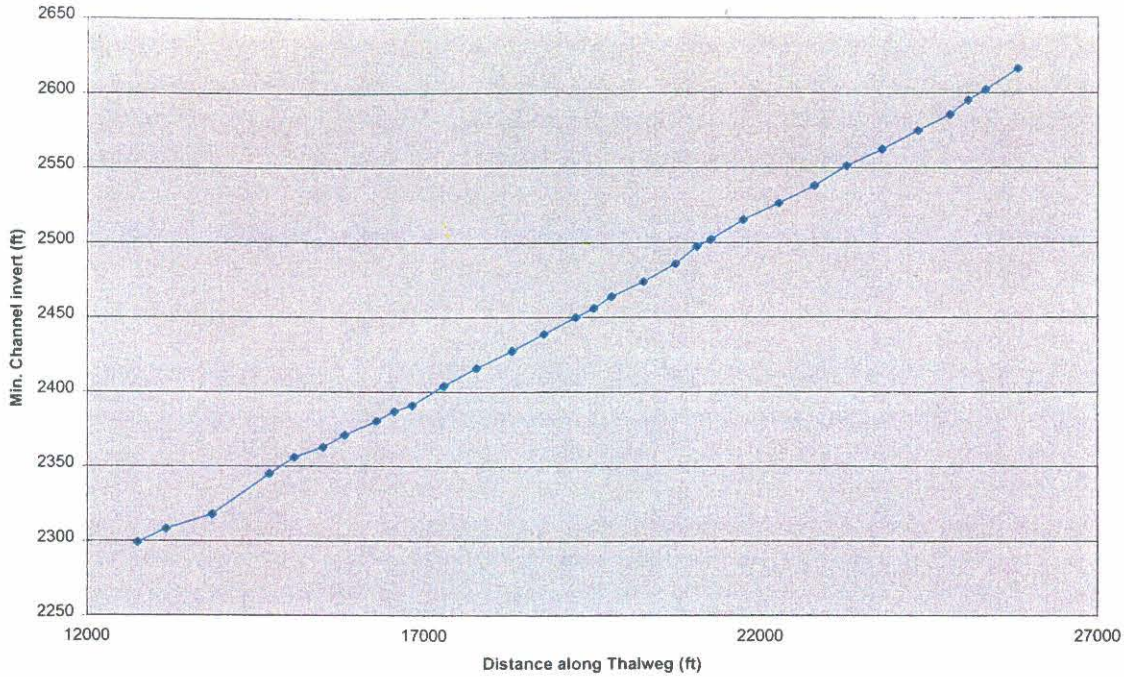


Figure 3-4. Galloway Wash North Branch Change in Elevation Over Time

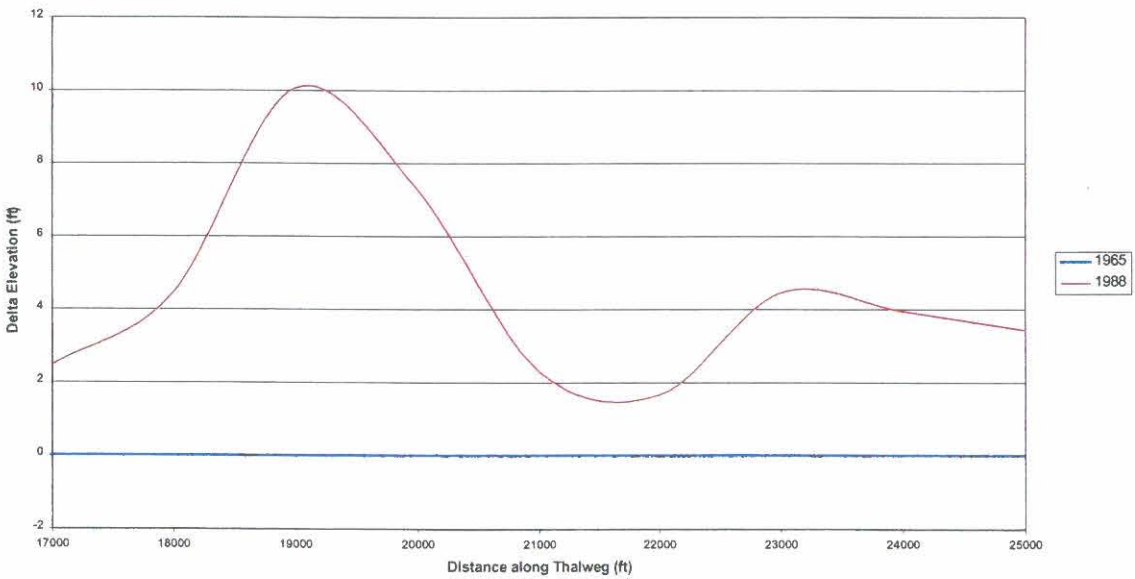


Figure 3-5. Longitudinal Profile of Grapevine Wash (1990 Data)

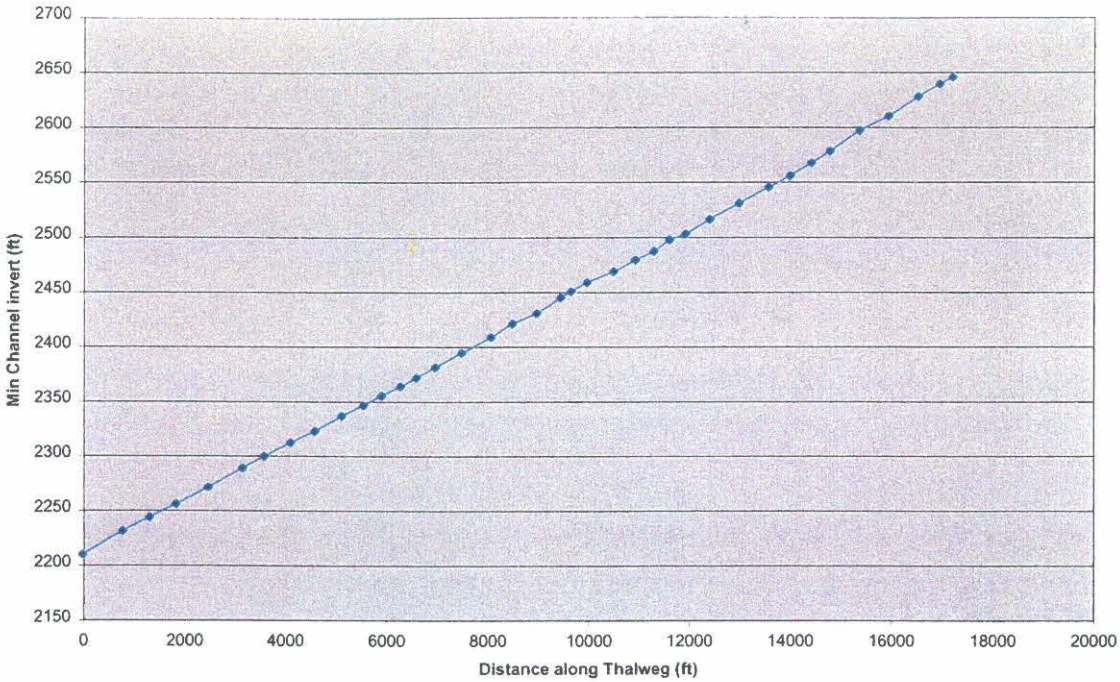


Figure 3-6. Grapevine Wash Change in Elevation Over Time

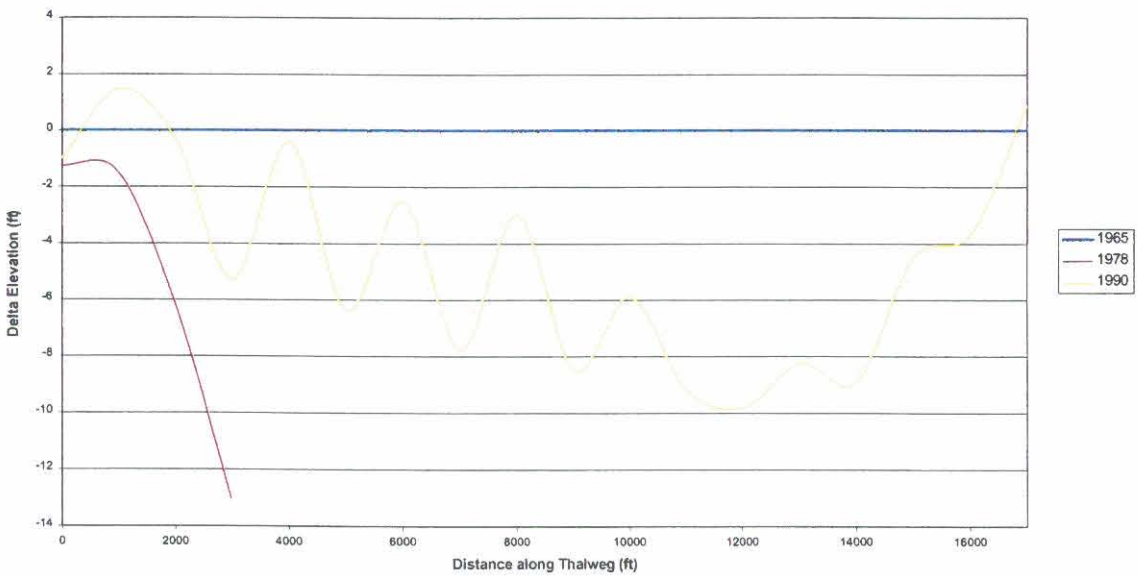


Figure 3-7. Longitudinal Profile of Rowe Wash (1990 Data)

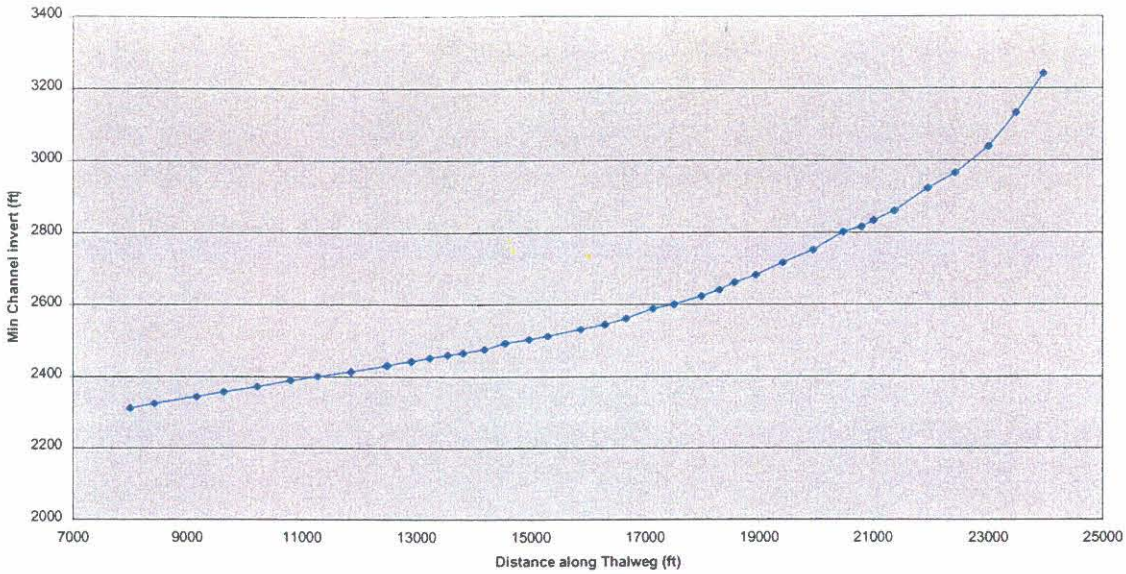


Figure 3-8. Rowe Wash Change in Elevation Over Time

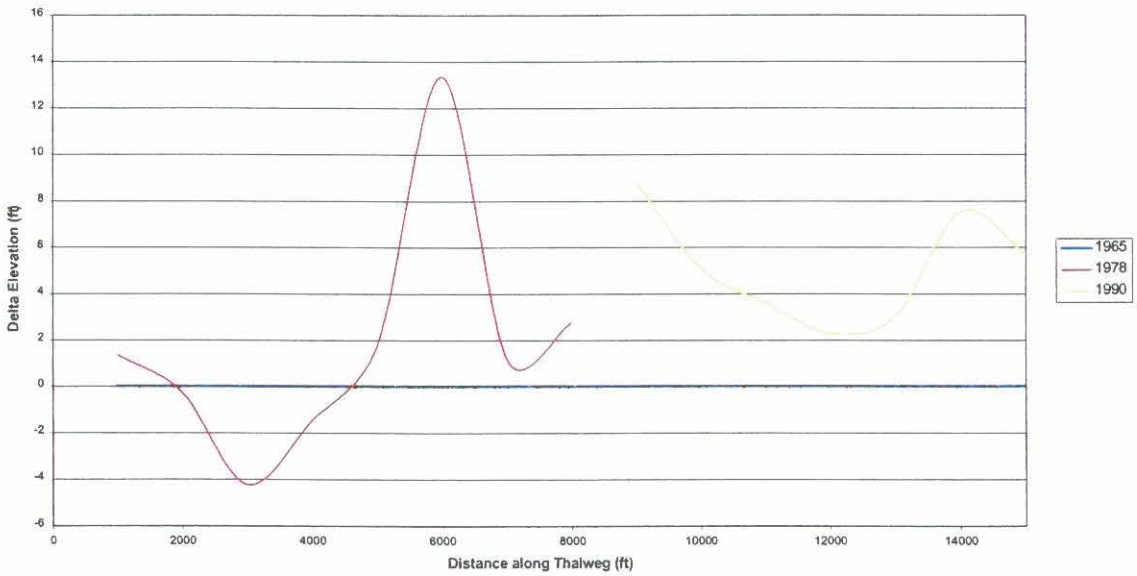


Figure 3-9. Longitudinal Profile of Andora Wash (1999 Data)

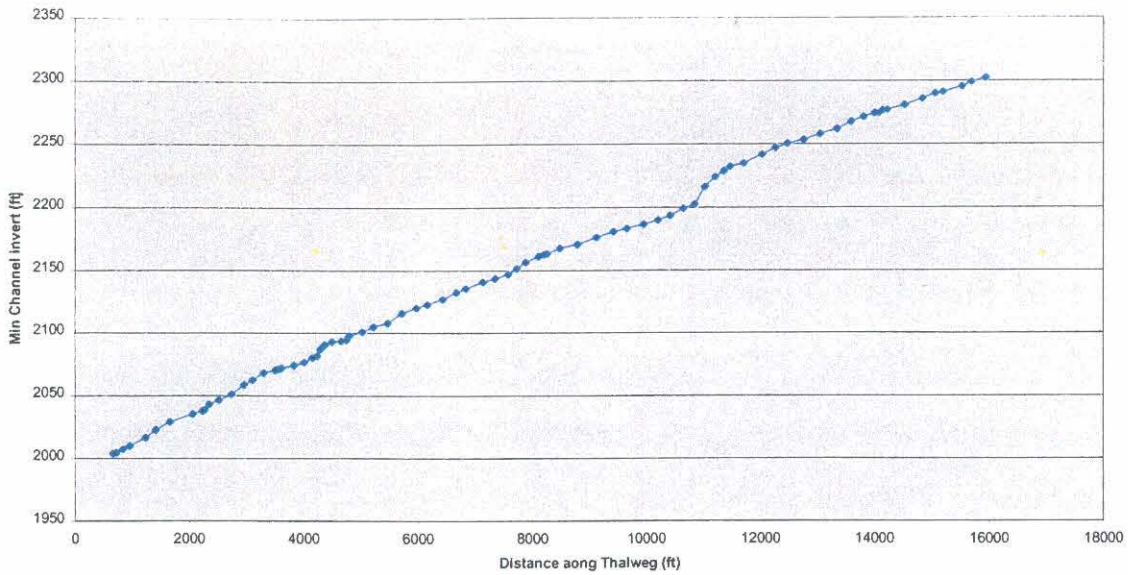


Figure 3-10. Andora Hills Wash Change in Elevation Over Time

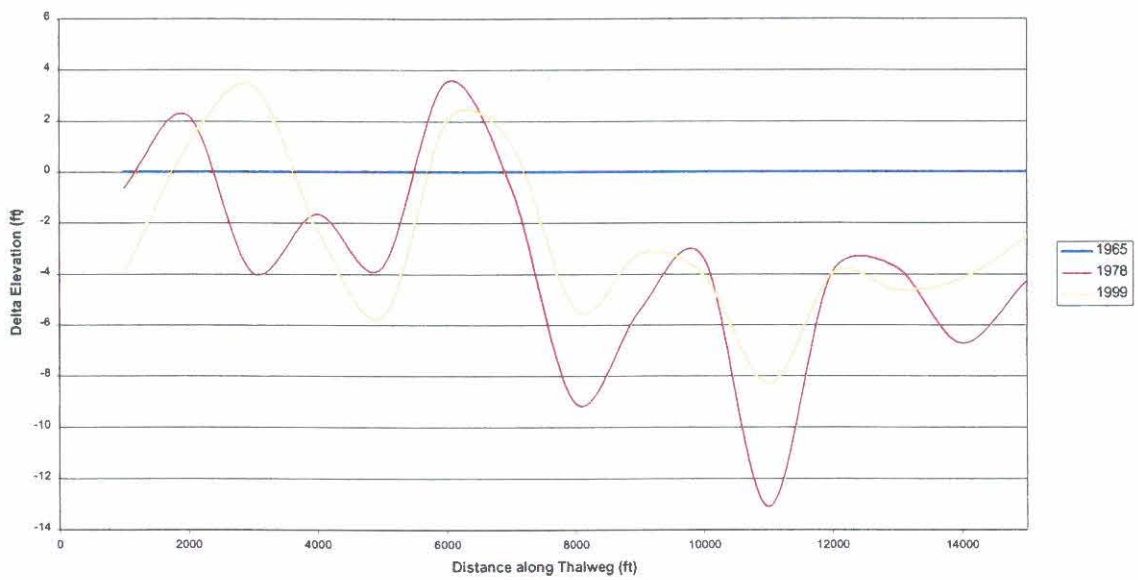


Figure 3-13 Sediment Continuity Modeling - Galloway Wash

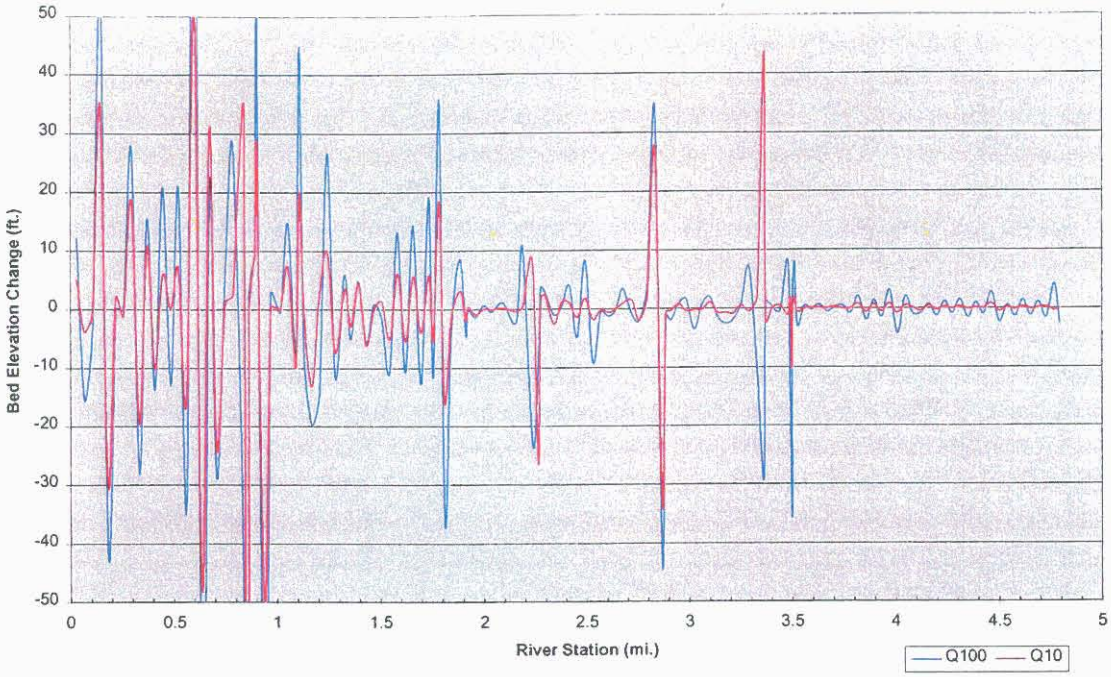


Figure 3-14. Sediment Continuity Modeling: Galloway Wash North Branch

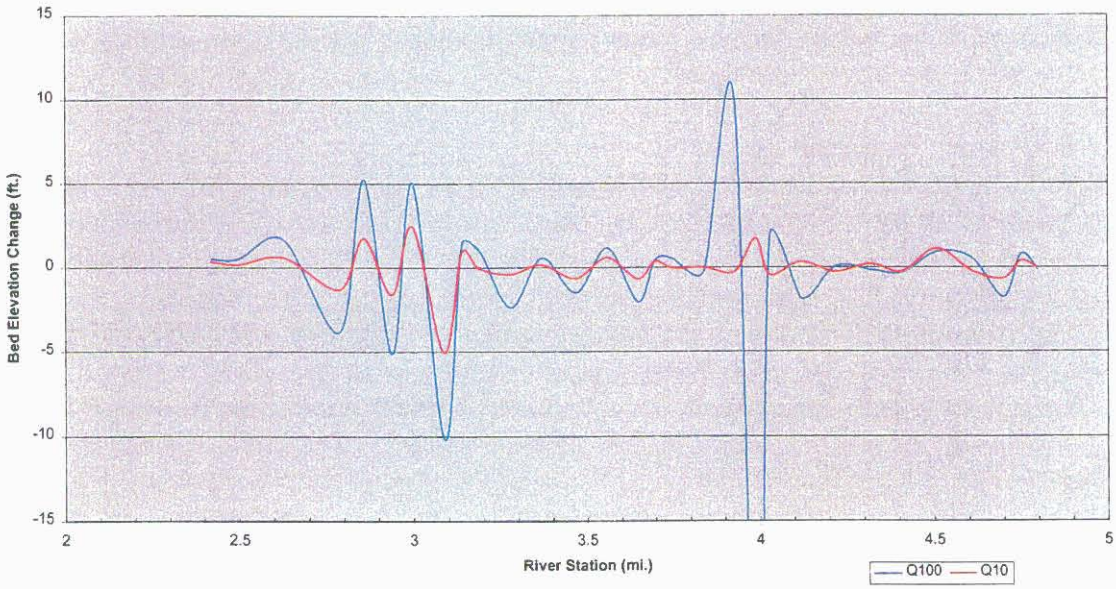


Figure 3-15. Sediment Continuity Modeling: Grapevine Wash

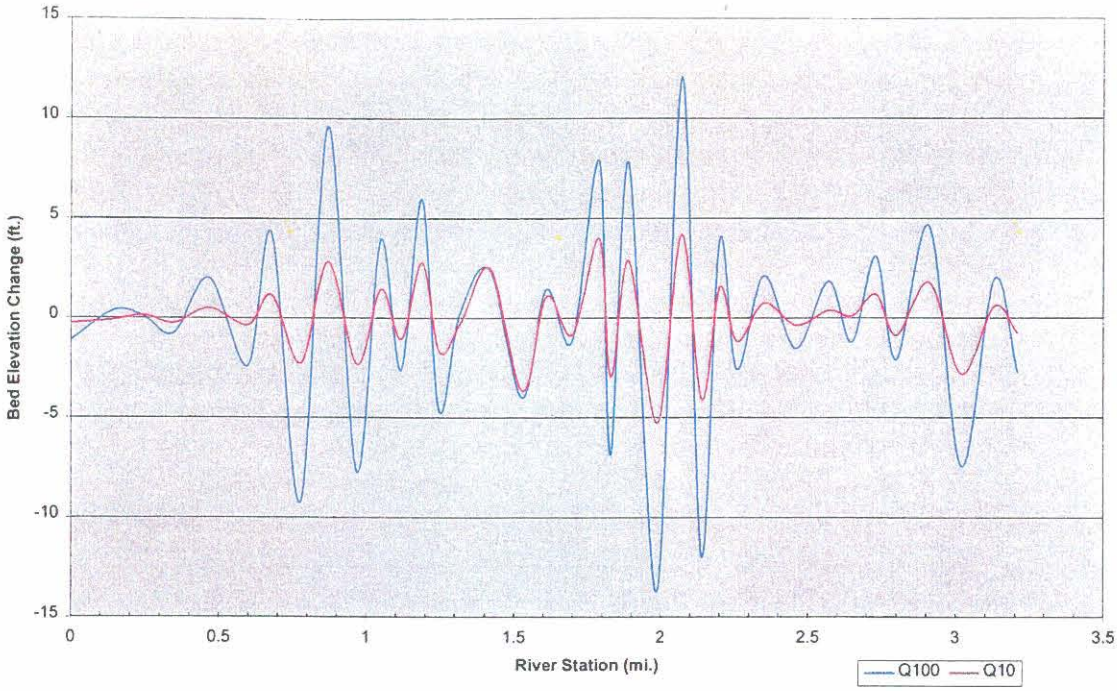


Figure 3-16. Sediment Continuity Modeling: Rowe Wash

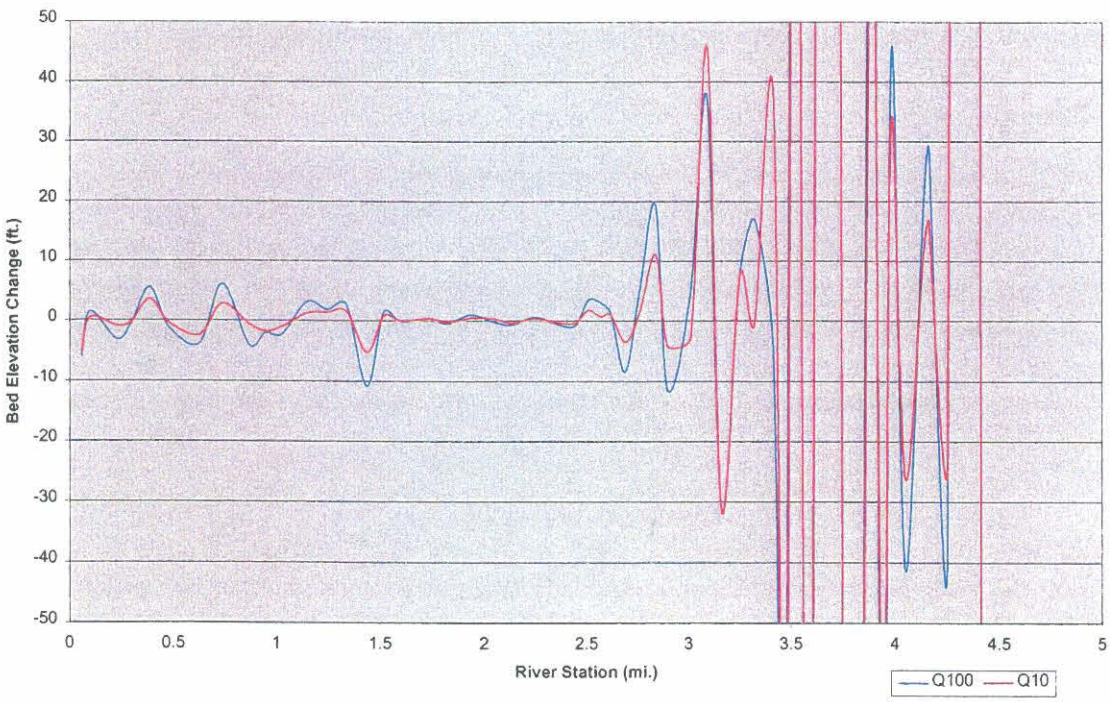
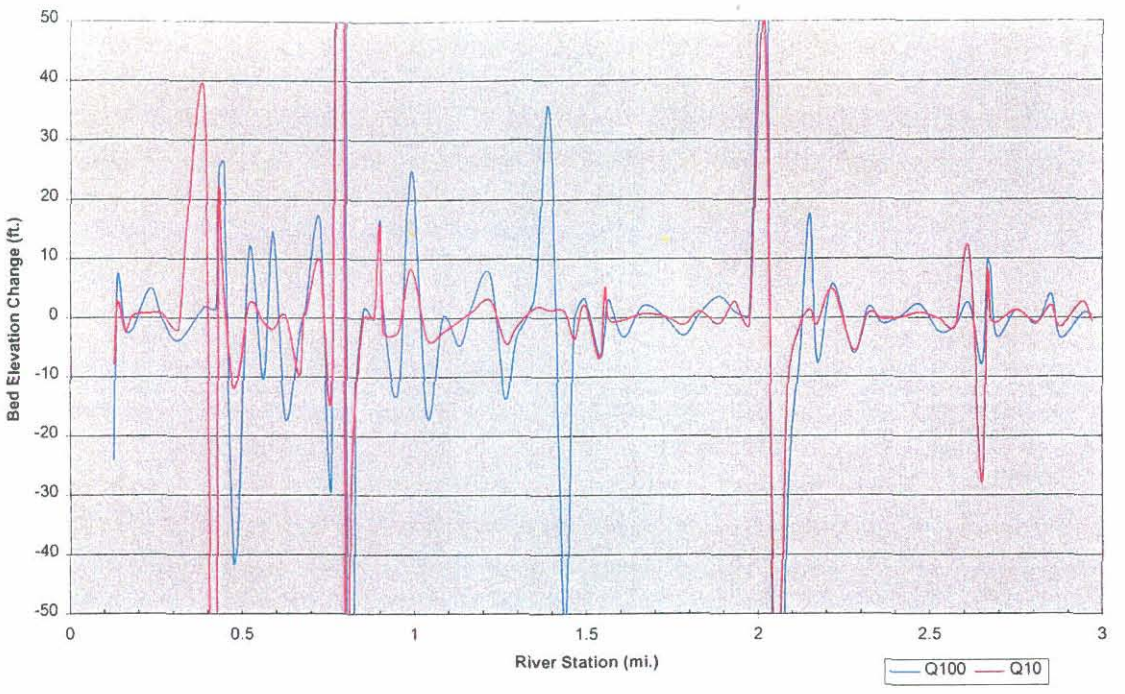


Figure 3-17. Sediment Continuity Modeling: Andora Hills Wash



Application of Lane's Relation

Lane (1955) developed the following equation that expresses the delicate balance and adjustment between several key geomorphic variables:

$$Q_s\, d \propto Q\, S;$$

Where Q_s = sediment discharge (cfs)
d = sediment size (mm)
Q = water discharge (cfs)
S = slope (ft./ft.)

Lane's relation implies that to maintain stability a change in one variable requires a change in one or more of the other variables. Lane's relation provides a means to evaluate the effects of historical changes in watershed and channel conditions, and to estimate future river responses to watershed changes.

For the study area, the primary watershed change has been light urbanization and local encroachment of the floodplain. Given regional historical accounts, it is likely that the watershed was over-grazed (e.g., Earl, 1983) in the late 1800's and early 1900's. By reducing vegetative cover and increasing the percent of rainfall that becomes runoff,

Geomorphic Surface Mapping

Surficial mapping of geomorphic surfaces provides information regarding long-term history of channel processes in the study area, and helps place recent observations of channel behavior in their proper geologic context. The age of stream terraces adjacent to the main channels provides information on past stream bed elevations and positions that can be used to forecast where the stream may be located in the future as well as how it behaved in the past. Field mapping of geomorphic surfaces and mapping prepared by the Arizona Geological Survey (Leighty et. al., 1997) and the USDA Soil Conservation Service (SCS) were used to identify surficial units along the major stream corridors in the study area. Geomorphic mapping was based on the following characteristics:

- Soil development
- Desert pavement
- Desert varnish
- Topographic relief
- Vegetative characteristics

Individually, these age-indicating characteristics may provide a relatively low degree of confidence in age estimates and unit distinctions. Considered together, the characteristics provide a higher degree of confidence. The physical characteristics of a landform or geomorphic surface give clues as to its depositional history, stability, and its flood potential. As a landform ceases to receive new deposits, its surface will begin to age. As it ages, the surface begins to develop distinctive physical and chemical characteristics indicative of its age. As the soil develops, its structure, color and content change. Clay and calcium carbonate accumulate in the soil, causing the soil to redden (clay) and become more cemented (carbonate) and resistant to erosion. Surfaces may also develop gravel lag coverings known as desert pavement as they age. The large clasts on the surface, if they contain sufficient ferromagnesian minerals, will develop a dark black patina called desert varnish on their tops and an orange coating underneath. Surfaces free from new deposition will also begin to erode and develop new tributary channel networks, creating a greater degree of relief between the channel bottoms and the ridges that separate them.

Because it takes thousands of years for many of these characteristics to develop, it can be concluded that surfaces that exhibit well developed soils, red color, significant carbonate development, desert pavements of strongly varnished gravels, and tributary drainage networks have been relatively free from flooding and erosion for thousands of years. Therefore, without external disturbance, it can be assumed that the flood and erosion hazard potential in the future will remain low.

The surficial geology of the Carefree DMP watershed was mapped previously by the Arizona Geological Survey (AZGS).[3] The AZGS mapping (Figure 2-2) distinguishes the following geomorphic surfaces along the wash corridors in the study area:

- Active channel deposits (Q_{yc}). The unit Q_{yc} consist of active channel deposits that are less than 10,000 years old. The unit is characterized by loose, unconsolidated, subrounded to well-rounded sand and gravel sized clasts, and is subject to frequent flooding and erosion.

- Holocene alluvium (Q_y). The Q_y unit consists of piedmont deposits younger than 10,000 years, and is generally found in small active channels and on low terraces. The unit is characterized by unconsolidated, stratified, poorly to moderately sorted sand and gravel deposits found along drainageways. Alluvial surfaces exhibit bar and swale topography, with the ridges typically being slightly more vegetated. Q_y surfaces typically lack desert varnish or pavement, and often have a sandy loam mantle. Surface colors are usually light brown to yellowish brown, with slight reddening due to clay illuviation. Q_y surfaces are considered subject to flooding and erosion.

- Late Pleistocene alluvium (Q_l). The Q_l unit consists of piedmont surfaces and terraces that are 10,000 to 250,000 years old. The unit may be moderately incised by stream channels, but has some constructional, relatively flat interfluvial surfaces with a subdued bar and swale topography. The surfaces have no to moderately developed desert pavement and varnish, with slightly more red color than Q_y surfaces. Soil profiles have weak to moderate argillic horizons and stage II carbonate development. Q_l surfaces are generally not flood prone, although since they are immediately adjacent to active washes they may be subject to erosion.

- Middle Pleistocene alluvium (Q_m, Q_{m1}, Q_{m2}). The Q_m unit consists of piedmont and river terraces greater than 250,000 years old. The unit is characterized by tan, sandy to loamy materials with sand- to boulder-sized clasts. Q_m surfaces have generally been eroded into shallow valleys and ridges due to development of an internal drainage pattern. The surfaces typically have moderate to strongly developed desert pavement and varnish, except where surface erosion has removed them, and are brown to reddish brown. The soils are strongly developed with reddened argillic horizons and stage II-IV calcic horizons. Q_m surfaces are generally not flood prone and are somewhat resistant to erosion.

- Early Pleistocene alluvial fan deposits (Q_o). The Q_o unit consists of piedmont and river terraces that are 750, 000 to 1,600,000 years old. The unit is characterized by brown, sandy to loamy conglomerates with metamorphic and volcanic gravel

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[3] Leighty, R.S., Skotnicki, S.J., and Pearthree, P.A., 1997, Geologic Map of the Cave Creek Quadrangle, Maricopa County, Arizona. AZGS Open-File Report 97-1.

sized clasts. Q_o surfaces are deeply dissected by larger drainages. The surfaces typically have moderate to well-developed reddish-brown argillic horizons, and relatively well-preserved alluvial surface remnants. Q_o surfaces are generally not flood prone and are typically resistant to erosion.

- Colluvium, undivided (Q_s). The Q_s unit consists of piedmont and river terraces that are less than 750,000 years old. The unit is characterized by fairly coarse to sub-angular, very poorly sorted, weakly bedded, unconsolidated to moderately consolidated colluvium deposits on steep hillslopes.

- Bedrock units. The following bedrock units occur along the stream corridors:
  - Younger basin-fill bedrock units (T_{sy}). The T_{sy} unit consists of late Miocene to Pliocene sedimentary rocks. The unit is characterized by interbedded moderately to poorly sorted sandstones and conglomerates with subrounded to angular clasts of metamorphic, volcanic and sedimentary rocks ranging in size from sand to boulders.
  - Conglomerate (T_c). The T_c unit consists of early Miocene conglomerate. The unit is characterized by angular to subangular, mostly pebble to cobble sized metasedimentary clasts. The matrix is rusty red and grussy and forms dark, rounded slopes and hills.
  - Basalt, undivided (T_b). The T_b unit consists of early to middle Miocene basaltic lavas. The unit is generally characterized by olivine phenocrysts in dark gray, fine-grained groundmass, columnar jointing and zones of vesicles, and is moderately vesicular with smaller vesicles typically filled with calcite.
  - Coarse-grained granite (Y_g). The Y_g unit consists of middle Proterozoic bedrock. The unit is characterized by unfoliated, coarse-grained granite with phenocrysts of subhedral potassium feldspar, light gray plagioclases, clear gray quartz and subhedral black biotite. This unit generally weathers into spheroidal boulders and easily erodes into a grussy deposit.
  - Meta-argillite (X_{sa}). The X_{sa} unit consists of early Proterozoic metasedimentary bedrock. The unit is characterized by massive, very fine-grained, medium to dark gray ridge forming a metasedimentary unit with relatively homogenous internal fabric. X_{sa} is locally conglomeratic, with interbedded conglomerate and sandstone and weathers to a dark brown. This unit commonly shows some degree of desert varnish.
  - Phyllite, undivided (X_p). The X_p unit consists of early Proterozoic metamorphic bedrock. The unit is characterized by moderately to highly foliated fine-grained metasedimentary and metavolvanic rocks. X_{sa} is typically fine grained with minor amounts of carbonate rocks present. This unit typically forms slopes and saddles.

Detailed soils mapping of the study area (Figure 2-3) is available from the Soil Conservation Service (Camp, 1986). Brief descriptions of the mapped soil units near the major stream corridors in the study area are provided in Tables 3-2 to 3-3. Engineering characteristics of the soils are listed in Table 3-4. SCS soils mapping indicates that the

floodplains and channels of the streams in the Carefree DMP study area are confined within relatively narrow corridors bounded by fan terraces. Fan terrace units were formed during Middle Pleistocene time when the study area consisted of a large alluvial fan receiving sediments from the mountains to the north. As the drainage system evolved during the Holocene and formed the streams in the study area, the resulting incision perched on the former alluvial fan surfaces that now form the canyon margins.

The SCS soil unit boundaries are generally similar to the AZGS surficial geology maps. Differences between the two maps are probably due to the scale of mapping used by each agency, rather than to different interpretation of the surfaces. The following types of information regarding stream stability and sedimentation can be gleaned from the maps:

- Lateral migration. The main channels of the streams in the study area have migrated over their floodplains during the past several thousand years. Therefore, the (geologic) floodplains should be considered erosion hazard areas.
- Avulsion. The soils mapping confirms observations made from historical photographs that the southern flow path of Galloway Wash located between Scopa Road and Vermeersch Road was cut off by development and floodplain encroachment. In addition, the AZGS mapping shows that a connection between Galloway Wash and Andora Hills Wash existed up until the early Holocene in the area near Viola Lane and Hidden Rock Road.
- Bedrock. The canyons of Andora Hills Wash and Grapevine Wash, as well as the upper reaches of the Galloway Wash North Branch, are bounded by bedrock.
- Expected channel behavior. Geologic evidence suggests that long-term degradation and lateral migration are natural processes, and should be expected to continue in the future.
- Sediment supply. Because bank erosion is a significant source of sediment, streams surrounded by bedrock (or floodplain development) will tend to be supply limited, and therefore, more likely to experience erosion problems in adjacent non-bedrock reaches than other non-supply limited streams. Where lateral erosion is prevented by bedrock or bank protection, scour should be expected.

Finally, the most recent geomorphic surfaces observed during fieldwork were mapped along each of the five major watercourses. The surfaces mapped in the field consisted of a series of inset stream terraces adjacent to the main channels. The field mapping is consistent with the AZGS and SCS mapping, but was done at a high resolution. Descriptions of the terrace units and the location of mapped terraces are shown on Figure 3-11.

Table 3-2. Carefree DMP
SCS Soils Information: Description, Classification, & Geomorphic Setting

SCS Map Unit	Component Soil Series	Position/Landform	Key Characteristics	Subgroup/Order
Anthony-Arizo complex (6)	Anthony - 40% Arizo – 40%	Adjacent to and on floodplains	Anthony: Light brown surface layer, light brown and brown calcarious gravelly sand loam Arizo: Pink gravelly sand loam surface layer and reddish yellow and pink subsurface layer	Typic Torrifluvents Typic Torriorthents
Arizo cobbly sandy loam (8)	Arizo - 80%	Floodplains	Pink gravelly sand loam surface layer and reddish yellow and pink subsurface layer	Typic Torriorthents
Eba very gravelly loam (33)	Eba – 80%	On fan and stream terraces	Pink very gravelly loam surface layers and reddish yellow extremely gravelly sandy loam subsurface layer	Typic Haplargids
Eba-Pinaleno complex (40)	Eba – 40% Pinaleno – 35%	On fan terrace	Eba: Pink very gravelly sandy loam and reddish yellow gravelly clay subsurface layer Pinaleno: Yellowish red, calcareous gravelly clay loam surface layer and light brown calcareous gravelly loam subsurface layer Main limitation for development of Eba is slope. Few limitations for Pinaleno	Typic Haplargids Typic Haplargids
Gran-Wickenburg complex (61)	Gran – 40% Wickenburg – 35%	Pediments and hillslopes	Gran: Reddish yellow very gravelly sandy loam and light red extremely gravelly sandy clay subsurface layer Wickenburg: Reddish brown gravelly sandy loam surface layer and reddish brown very gravelly sandy loam subsurface layer Main limitation for development of Gran is shrink swell potential. Few limitations for Wickenburg	Typic Haplargids Typic Camborthid
Nickel-Cave complex (93)	Nickel – 50% Cave – 35%	On fan terraces	Nickel: Pinkish gray, calcareous gravelly sandy loam surface layer and pinkish gray calcareous very gravelly sandy loam subsurface layer Cave: Light brown, calcareous gravelly loam surface layer and pinkish gray, calcareous loam subsurface layer Main limitation for development is cemented hard pan.	Typic Calciorthids Typic Paleorthids
Pinaleno-Tres Hermanos complex (96)	Pinaleno – 45% Tres Hermanos – 40%	On fan terraces	Pinaleno: Yellowish red very gravelly clay laom surface layer and yellowish red, calcareous gravelly clay loam subsurface Tres Hermanos: Reddish yellow gravelly loam surface layer and reddish yellow, calcareous clay loam subsurface layer Main limitation for development of Tres Hermanos is shrink swell potential. Few limitations for Pinaleno	Typic Haplargids Typic Haplargids

Table 3-3. Carefree DMP
General Soil Age & Relation of SCS and AZGS Map Units

SCS Map Unit	Subgroup/Order	Order	Minimum General Age Of Soil Order	AZGS Map Unit
Anthony-Arizo complex (6)	Typic Torrifluvents Typic Torriorthents	Aridisols	Early Holocene (7-11 ka)	Q_{yc} – Active channel deposits
Arizo cobbly sandy loam (8)	Typic Torriorthents	Aridisols	Early Holocene (7-11 ka)	Q_y – Holocene Alluvium (< 10ka)
Eba very gravelly loam (33)	Typic haplargids	Aridisols	Early Holocene (7-11 ka)	Q_m – Middle Pleistocene Alluvium (250-750ka)
Eba-Pinaleno complex (40)	Typic haplargids Typic haplargids	Aridisols	Early Holocene (7-11 ka)	Q_m – Middle Pleistocene Alluvium (250-750ka)
Gran-Wickenburg complex (61)	Typic haplargids Typic camborthid	Aridisols	Early Holocene (7-11 ka)	Y_g – Coarse-grained granite
Nickel-Cave complex (93)	Typic calciorthids Typic Paleorthids	Aridisols	Early Holocene (7-11 ka)	Q_m – Middle Pleistocene Alluvium (250-750ka)
Pinaleno-Tres Hermanos complex (96)	Typic haplargids Typic haplargids	Aridisols	Early Holocene (7-11 ka)	Q_m – Middle Pleistocene Alluvium (250-750ka)

Table 3-4. Carefree DMP
SCS Soil Unit Hazards

SCS Map Unit	Building Site Development Restrictions (SCS Report: Table 9)				Sanitary Facility Hazards (SCS Report: Table 10)	Flooding Hazard (SCS Rpt: Table 15)	Depth to Bedrock
	Shallow Excavation	Dwellings without basements	Local Roads	Lawns & Landscaping			
Anthony-Arizo complex (6)	Slight Severe – cutbanks cave	Severe - flooding	Moderate – flooding Severe - flooding	Slight Severe - droughty	Flooding, seepage, poor filter, small stones	Rare to occasional	> 60 in
Arizo cobbly sandy loam (8)	Severe – cutbanks cave	Moderate – large stones	Moderate – large stones	Severe – large stones, droughty	Flooding, poor filter, to sandy, large stones and small stones	Occasional	> 60 in
Eba very gravelly loam (33)	Moderate – too clayey	Moderate – Shrink swell	Moderate – Shrink swell	Severe – small stones	Percs slow, seepage, small stones	None	> 60 in
Eba-Pinaleno complex (40)	Moderate – too clayey, slope Moderate - slope	Moderate – shrink swell, slope Moderate - slope	Moderate – shrink swell, slope Moderate - slope	Severe – small stones	Percs slow, small stones, seepage, slope	None	> 60 in
Gran-Wickenburg complex (61)	Severe – depth to rock	Moderate – shrink swell, depth to rock; slope	Moderate – shrink swell, depth to rock; slope	Severe – small stones; droughty; thin soil layer	Depth to rock, area reclaim, small stones	None	20-40 in 3-20 in
Nickel-Cave complex (93)	Severe – cutbanks cave, slope; cemented pan	Severe – slope; cemented pan	Severe – slope; cemented pan	Severe – slope; thin soil layer	Slope, cemented pan, seepage, area reclaim, small stones	None	> 60 in
Pinaleno-Tres Hermanos complex (96)	Slight	Slight Moderate – shrink swell	Slight Moderate – low strength; shrink swell	Severe – small stones Moderate – small stones	Perc slow, seepage, slope, small stones	None	> 60 in

Descriptions of the soils and geomorphic mapping adjacent to each of the five major streams in the study area are provided below.

- Galloway Wash. The main channels and portions of the floodplain are mapped as geologic unit Q_{yc}, and SCS soils units 6 and 8, the Anthony-Arizo Complex and the Arizona cobbly sandy loam, all of which are designated by the SCS as floodplain and drainageway deposits. The floodplain margins are generally bounded by AZGS Q_m unit and a variety of SCS fan terrace soil units. Bedrock crops out along the left bank in the narrows upstream of the Grapevine Wash confluence, with a large area of Late Pleistocene alluvium (Q_l) upstream of the narrows.

- Galloway Wash North Branch. The main channels and portions of the floodplain are mapped as geologic unit Q_{yc}, and SCS soil units 6, the Anthony-Arizo Complex, both of which are designated as floodplain and drainageway deposits by the SCS. The floodplain margins are generally bounded by AZGS Q_m unit and a variety of SCS fan terrace soil units. Bedrock crops out along the left bank upstream of Paint Pony Drive.

- Grapevine Wash. The main channels and portions of the floodplain are mapped as geologic unit Q_{yc} and Q_y, and SCS soils units 6 and 8, the Anthony-Arizo Complex and the Arizona cobbly sandy loam, all of which are designated by the SCS as floodplain and drainageway deposits. The floodplain margins are generally bounded by Tertiary aged bedrock or AZGS Q_m unit and a variety of SCS fan terrace soil units. Bedrock crops out along both sides of the canyon bottom, with more bedrock in the right bank.

- Rowe Wash. The main channels and portions of the floodplain are mapped as geologic unit Q_y and SCS soil unit 8, the Arizona cobbly sandy loam, both of which are designated by the SCS as floodplain and drainageway deposits. The floodplain margins are generally bounded by AZGS Q_m unit and a variety of SCS fan terrace soil units.

- Andora Hills Wash. The main channels and floodplains of Andora Hills Wash are mapped as AZGS unit Q_y downstream of Basin Road. Upstream of Basin Road, the channels and floodplains of Andora Hills Wash are not distinguished from the surrounding bedrock units. The SCS soils mapping does not break out a separate unit for Andora Hills Wash or its floodplain.

Summary. Geomorphic mapping of the stream corridors in the Carefree DMP study area indicates that the main channels of the five major streams are located within very young, active floodplains subject to lateral erosion. The geologic floodplains not mapped as within in the 100-year floodplain appear to have been subject to more frequent flooding in the recent past, and are only outside the active floodplain due to recent channel incision. The geologic floodplains are bounded by very old, relatively stable surfaces that have not been significantly altered for tens of thousands of years. Field mapping of

recent stream terraces indicates that Galloway Wash and Galloway Wash North Branch experienced channel incision during the late Holocene that perched portions of their floodplains.

Sediment Continuity Modeling

An assessment of sediment continuity within the streams in the Carefree DMP study area was made to identify differences in sediment transport capacity between adjacent reaches, to identify likely areas of scour or deposition, and to evaluate the potential for future channel changes. Sediment routing of a design hydrograph using a detailed model such as HEC-6 is beyond the scope of this investigation.

Methodology. Sediment continuity modeling was performed using HEC-RAS hydraulic data,[4] sediment data obtained from the SCS Soils Survey soils descriptions for channel and floodplain soil units, and the Zeller-Fullerton sediment transport function (ADWR, 1985). The sediment transport capacity for the 10- and 100-year peak discharges was estimated at each HEC-RAS cross section using the Zeller-Fullerton equation. Sediment continuity was then estimated by comparing the sediment load supplied to a cross section from the cross section immediately upstream, to the sediment load transported out of the cross section using the continuity equation:

$$\text{Sediment}_{(in)} - \text{Sediment}_{(out)} = \text{Change in Sediment Storage}$$

The volume of the change in sediment storage at each cross section was then applied over the distance between the cross sections using the average channel width (i.e., channel area) to estimate the vertical change in bed elevation equivalent to the sediment storage volume. The procedure described above is similar to the HEC-6 modeling algorithm, except that only the peak discharges, rather the entire hydrograph, were evaluated for this analysis. The vertical bed elevation changes reported are not intended to depict actual changes in bed elevation. Instead, they are intended to illustrate the expected direction of channel change (scour or deposition) so that trends in expected channel behavior can be identified.

Results. Sediment continuity principles dictate that if less sediment is supplied to a reach than can be transported out of the reach, erosion will occur and the stream will degrade, widen, or meander. Conversely, if more sediment is supplied than can be transported, the excess will be deposited and the stream will aggrade and become braided or anastomosing. Sediment supply from a watershed can be disturbed by construction of on-line detention basins, construction of raised grade road crossings, excavation of in-stream sand and gravel mines, construction of bank protection, paving of natural surfaces, or conversion of desert landscape to irrigated turf. The time it takes for a channel to respond to such disturbances depends on the frequency of runoff, the magnitude and duration of floods, and the degree of disturbance.

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[4] HEC-RAS models were originally prepared for Floodplain Delineation Studies. Optimization of the HEC-RAS models for sediment continuity routing was not part of the project scope of services.

Because the sediment continuity modeling methodology used exaggerates the predicted bed elevation changes, the results shown in Figures 3-13 to 3-17 should be interpreted as relative trends, rather than specific indications of the actual magnitude of channel change. The following conclusions can be drawn from the results shown in Figures 3-13 to 3-17:

- Variable sediment transport capacity. The clearest result of the sediment continuity routing is that sediment transport capacity varies drastically between adjacent cross sections along the streams in the study area. Predicted aggradation and degradation alternates between almost every cross section. There are no extended reaches that are consistently degradational or aggradational. Alternating transport capacity should be expected on steep streams with a braided channel pattern.
- Instability. Reaches that show excessive predicted bed elevation changes are less stable than reaches with more muted predicted bed elevation changes, and are probably more sensitive to encroachment or other human impacts on the streams. Examples of reaches of significant instability include Galloway Wash downstream of River Station 2.0, and Rowe Wash upstream of River Station 3.0.
- Recurrence interval. At many cross sections, opposite trends are predicted for the 10- and 100-year discharges, indicating that channel hydraulics vary significantly between small floods and large floods. Therefore, since historical records indicate that recent floods have been small, the types of channel behavior observed during recent years may not be indicative of the channel response if the 100-year flood were to occur.

over-grazing and urbanization increases water supply (Q). To balance the Lane equation in response to increased runoff (Q^+), a stream would have to flatten its slope (S^-, degradation) and/or increase the sediment transport rate (Q_s^+, scour). Therefore, over-grazing could be a plausible explanation for historical degradation inferred from field observations, geomorphic mapping, and interpretation of the oldest aerial photographs described in Chapter 2.

Urbanization not only increases runoff volumes (Q^+), it also decreases sediment supply (Q_s^-). Therefore, as the watersheds become more urbanized, the streams in the study area will tend to decrease their slopes (S^-, degradation) and/or increase the bed material size (d^+, armoring) to achieve a new equilibrium form. The grain sizes observed in the streambeds in the study area are too small to form armor layers. Therefore, it is likely that continued urbanization will cause more channel degradation.

The effect of floodplain encroachment can also be evaluated using Lane's relation. Encroachment reduces the floodplain width and increases the percent of flooding conveyed in the channels relative to the floodplain, effectively increasing the discharge "seen" by the channel and mimicking the effects of an increase in water supply (Q^+). Where encroachment is accompanied by channelization and bank protection, the source of sediment normally supplied by bank erosion is depleted (Q_s^-). The natural channel response would be to flatten the slope through degradation (S^-). However, encroachment is often accompanied by channel straightening, which increases the slope (S^+), making the stream further out of balance, and resulting in degradation and local scour.

Summary. Lane's relation clearly predicts that the streams in the Carefree DMP study area will continue to degrade. The lack of more extensive degradation than expected from the Lane's relation results (or equilibrium slope analysis) is probably due to the infrequent flooding during the past several decades. Because few significant floods have occurred, the streams have lacked the energy to respond to watershed alterations.

Stream Classification Techniques

The primary objective of stream classification is to match measurable stream characteristics with expected river responses. The following two classification systems were applied to the stream segments within the Carefree DMP study area: (1) a descriptive classification system based on the Brice system, and (2) the morphologic and field-based Rosgen system. Data for the stream classification were obtained from field surveys of the project site, topographic mapping, aerial photographs, and published reports. Only the channel characteristics required to perform the stream classification are presented here. More detailed discussions of specific channel characteristics and specific reaches were provided in Chapter 2.

Brice Classification System. The Brice system was developed primarily for the evaluation of stream stability near roadways or bridge structures, but is not limited to highway design applications. The Brice System uses readily identified stream characteristics to make subjective predictions of lateral stability (FHWA, 1991; Brice and

Blogett, 1978). Use of the Brice Classification system is appropriate for the Carefree DMP, since one of the primary objectives is to assess stream stability. The Brice system assigns relative erosion potential classifications based on the 13 stream characteristics summarized below (Table 3-5). These classifications can be used to prepare a subjective, relative assessment of stream stability. Where high or moderate potential for lateral migration is identified, sedimentation problems should be expected to occur. The Brice classification system categories are discussed briefly below.

1. Stream Size. The potential for, and scale of, lateral erosion generally increase with stream size. All five streams in the Carefree DMP study area have small channel widths, although some reaches of Grapevine and Rowe Washes could be considered medium width if the total distance between the furthest braids is considered.
2. Flow Habit. Perennial streams tend to experience more frequent erosion than ephemeral streams in equivalent climates. However, in arid regions where flash floods and unstable bank materials can cause significant lateral erosion, ephemeral streams are often highly erosive. All five streams in the study area are ephemeral and experience flash floods, and thus are subject to rapid rates of lateral movement and long-term fluctuations in bed elevation.
3. Bed and Bank Material. Bed and bank materials generally consist of sand and gravel. Some boulder and cobble bars were observed on Rowe Wash and Andora Hills Wash. Stream banks, where not formed in bedrock, generally consisted of materials similar to the bed materials. The sand and gravel materials in the beds and banks are poorly consolidated and highly erosive. Bedrock crops in some places along Galloway Wash, Galloway Wash North Branch, and Andora Hills Wash, as shown in 2-4.
4. Valley Setting. Channel reaches with low valley relief (< 100 ft.) typically have more erosion-prone banks than streams in valleys with high relief. The streams in the study area have low relief. The streams in the study area flow within an entrenched middle Pleistocene-aged alluvial fan complex, a landform that does not fall into the Brice valley setting categories, but is most similar to a low relief valley.
5. Floodplains. Channels with wide floodplains (> 10 times channel width) typically experience more lateral channel movement than channels with little or no floodplain (< 2 times channel width). The streams in the study area have narrow floodplains relative to the channel width, primarily because the streams have large widths relative to the watershed area.
6. Natural Levees. Streams with natural levees tend to have low rates of lateral migration. The streams in the study area do not have natural levees.
7. Apparent Incision. Streams with vertical cut banks are generally unstable. Field and historical evidence suggests that Galloway Wash, portions of Galloway Wash North Branch, Grapevine Wash, and Andora Hills Wash have incised during the period of record, as well as during the prehistoric period prior to the founding of the Town of Carefree. Vertical cut banks and constructed erosion protection were observed throughout the study area.
8. Channel Boundaries and Bank Materials. Alluvial streams are more susceptible to lateral erosion than non-alluvial streams. Bedrock crops out in several places on the bed and banks of Galloway Wash, Galloway Wash North Branch, and Andora Hills

Wash. The banks of Grapevine Wash and Rowe Wash are generally alluvial, although their canyons are partially bounded by bedrock.

9. Vegetation. Streams that lack adequate vegetative cover along banks tend to be more susceptible to erosion. Dense, woody vegetation may also slow flood velocities against the banks, as well as redirect flow away from the banks. Roots can also stabilize the soils in the banks, by providing a structure that tends to hold bank materials together. Deeper and denser root networks provide greater stability than shallow, less dense roots, which tend to be undercut. In general, field evidence indicates that the banks of the streams in the study area are poorly to moderately well vegetated, mostly with perched or shallow-rooting species. Deep-rooting species were generally spaced well apart. Bank vegetation is not likely to stabilize the existing channel banks in the study area.
10. Sinuosity. The streams in the study area have sinuosity values of less than 1.2 and are not considered "meandering" streams. Therefore, their patterns cannot be accurately predicted by published meander geometry relationships.[5]
11. Degree of Braiding. Braided streams tend to be laterally unstable. All of the streams in the study area except Andora Hills Wash are braided, especially at low flow rates. At higher discharges, the channel beds are inundated and the braided pattern is obscured.
12. Degree of Anabranching. All of the streams in the study area except Andora Hills Wash are locally ananbranched. Anabranching is probably the result of avulsions that formed semi-permanent channels away from the main channel. Anabranching streams are subject to high rates of lateral erosion.
13. Variability of Width and Development of Bars. Streams with relatively uniform width and narrow, regular point bars tend to have slow lateral migration rates. The streams in the study area have irregular channel widths, irregular point bars, and are subject to rapid lateral migration except where bank resistance is increased by soil conditions or bank vegetation.

According to the Brice classification scheme, the streams in the study area exhibit many characteristics that indicate that they are subject to erosion and sedimentation problems. These broad stream characteristics indicate potential for frequent bank erosion and rapid lateral channel movement, high rates of sediment transport, and frequent adjustments in channel geometry.

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[5] By definition, meandering streams have sinuosity greater than 1.2. Therefore, meander relationships are not applicable to streams with sinuosity less than 1.2.

Table 3-5. Carefree DMP
Brice Classification System Data

Stream Characteristic	Galloway Wash	Galloway Wash North Branch	Andora Hills Wash	Grapevine Wash	Rowe Wash
Stream Size	Small (<100 ft) Avg. chl. width = 85 ft.	Small (<100 ft) Avg. chl. width = 97 ft.	Small (<100 ft) Avg. chl. width = 39 ft.	Small (<100 ft) Avg. chl. width = ft.	Small (<100 ft) Avg. chl. width = ft.
Flow Habit	Ephemeral Flashy	Ephemeral Flashy	Ephemeral Flashy	Ephemeral Flashy	Ephemeral Flashy
Bed Material	Gravel (coarse sand to med. gravel) D_{50}=0.50mm; D_{90} =11mm	Gravel (coarse sand to med. gravel) D_{50}=0.50mm; D_{90} =11mm	Sand (fine gravel to medium sand) D_{50}=0.35mm; D_{90} =8.2 mm	Sand (very fine gravel to very fine sand) D_{50}=0.11mm; D_{90} =3.1 mm	Sand (very fine gravel to very fine sand) D_{50}=0.11mm; D_{90} =3.1 mm
Valley Setting	Low relief valley (<100 ft.)	Low relief valley (<100 ft.)	Low relief valley (<100 ft.)	Low relief valley (<100 ft.)	Low relief valley (<100 ft.)
Floodplain	Narrow (2-10x chl width) Avg. floodplain width = 160 ft. (2x channel width)	Narrow (2-10x chl width) Avg. floodplain width = 208 ft. (2x channel width)	Narrow (2-10x chl width) Avg. floodplain width = 124 ft. (3x channel width)	Narrow (2-10x chl width) Avg. floodplain width = 333 ft. (1x channel width)	Narrow (2-10x chl width) Avg. floodplain width = 229 ft. (2x channel width)
Natural Levees	Little or none	Little or none	Little or none	Little or none	Little or none
Apparent Incision	Slight incision 3-10 ft banks	Slight incision 3-10 ft banks	Slight incision 3-10 ft banks	No incision	No incision
Channel Boundaries/ Bank Materials	Semi-alluvial Intermittent local bedrock in banks	Semi-alluvial Intermittent local bedrock in banks	Semi-alluvial Intermittent bedrock in banks and channel	Alluvial	Alluvial
Bank Vegetative Cover	<50 percent of bankline	<50 percent of bankline	<50 percent of bankline	<50 percent of bankline	<50 percent of bankline
Sinuosity (S)	Straight (S= 1.0-1.05)	Straight (S= 1.0-1.05)	Straight (S= 1.0-1.05)	Straight (S= 1.0-1.05)	Straight (S= 1.0-1.05)
Braiding	Locally braided low flows	Locally braided low flows	Not braided	Locally braided Low flows	Generally braided
Anabranching	Locally anabranched	Locally anabranched	Not anabranched	Locally anabranched	Locally anabranched
Width Variability Bar Development	Random variation Irregular point & lateral bars	Random variation Irregular point & lateral bars	Equiwidth	Random variation Irregular point & lateral bars	Random variation Irregular point & lateral bars

Rosgen Classification System.

The Rosgen classification system (Rosgen, 1996) is based on measurable channel characteristics observed on streams located primarily in the western mountain region of the United States, although the classification system is now used in many parts of North America. The Rosgen (1996) system was applied to the study area because it has many adherents among State and Federal agencies in the western United States, and because it provides a common language for discussions of stream stability. The field survey techniques used for the study reach incorporated procedures recommended by Rosgen (1996) for obtaining channel sections, pool and riffle spacing, bankfull elevations, entrenchment ratio, slope, meander geometry, bank characteristics, and bed sediment distribution.

With the exception of the bedrock and bouldery reaches of Andora Hills Wash, the stream segments in the study area appear to best match Rosgen's D4b (Table 3-6) category. The streams have gravel beds, with steep slopes between 0.02 and 0.05 ft./ft. and sinuosity of less than 1.2, all of which are criteria that fit within the range of expected stream type D characteristics. The width/depth ratio is generally close to, but less than 40, the cutoff for Rosgen's D4 category.[6] However, the streams are not truly braided during flows that impact their banks, except for a few local subreaches. But because the Rosgen classification system is strongly weighted to low flow conditions (less than the 2-year) and the channels are braided at very low flow rates, the D category was assumed to be the most applicable.

The Rosgen description of D4 stream types follows:

> *The D4 stream types are multiple channel systems, described as braided streams found within broad alluvial valleys and on alluvial fans consisting of coarse depositional materials formed into moderately steep terrain. Primarily, the braided system consists of interconnected distributary channels formed in depositional environments. The D4 stream type occurs in moderately steep, narrow, U-shaped glacial valleys; on alluvial fans; and in gentle gradient alluvial valleys. This stream type can also occur on low relief river deltas, as well as on the upper lobes of glacial outwash valleys. The D4 stream channel may be found in Valley Types III,V, VIII,IX, X, and XI[7]. Channel bed materials are predominantly gravel, with a strong bi-modal distribution of sands. Cobble may also be found in lesser amounts, often imbedded with sands. The braided channel system is characterized by high bank erosion rates, excessive deposition occurring as both longitudinal and transverse bars, and annual shifts of the bed locations. Bed features are developed from convergence/divergence processes. Bed morphology is characterized by a closely spaced series of rapids and scour*

[6] The Rosgen categories with lower width/depth ratios have much higher sinuosity and lower entrenchment ratios than those with higher width/depth ratios, and therefore, did not fit as well as the D4 category selected.

[7] These valley types encompass the range of valley types found in the study area.

pools formed by convergence/divergence processes that are very unstable. The channels generally are at the same gradient as their parent valley. A combination of adverse conditions are [sic] *responsible for channel braiding, including high sediment supply, high bank erodibility, moderately steep gradients, and very flashy runoff conditions which can vary rapidly from a base flow to an overbank high flow on a frequent basis. Characteristic width/depth ratios are very high, exceeding values of 40 to 50 with values of 400 or larger often noted. D4 channel gradients are generally less than 2%, however, D4 types can also develop within alluvial fans which have slopes of 2% to 4% (D4b). The D4 system is a very high sediment supply system and typically produces high bedload sediment yields. (Emphasis added.)*

Table 3-6. Carefree Drainage Master Plan Rosgen Classification Data

	Reach #				
Galloway Wash	1	2	3	4	5
Rosgen Classification	D4b	D4b	D4b	D4b	D4b
Entrenchment Ratio	1.6	1.1	1.0	1.0	1.0
Width/Depth Ratio	25	26	27	28	30
Sinuosity	1.05	1.05	1.0	1.0	1.05
Channel Slope	0.026	0.024	0.023	0.028	0.020
Channel Materials (D50)	Sand & gravel	Sand & gravel	Sand & gravel	Sand & gravel	Sand & gravel
Channel Pattern	S	SB	SB	SB	SB

	Andora Hills Wash	Rowe Wash	Grapevine Wash	Galloway North Branch
Rosgen Classification	D4b	D4b	D4b	D4b
Entrenchment Ratio	1	1	1	1
Width/Depth Ratio	23	26	20	26
Sinuosity	1.05	1.05	1.05	1.05
Channel Slope	0.02	0.048	0.024	0.025
Channel Materials (D50)	Sand & gravel	Sand & gravel	Sand & gravel	Sand & gravel
Channel Pattern	S	SB	SB	SB

Notes:
1. Sinuosity – measured on 2000 aerial photographs
2. Entrenchment ratio – Larger of channel or total flow topwidth ÷ Q_2 topwidth (data from HEC-RAS)
3. Width/Depth ratio – Q_2 flow width ÷ Q_2 flow depth (data from HEC-RAS)
4. Channel slope – reach average of HEC-RAS S_o values
5. Channel materials – best fit sediment distribution from sieve and boulder count data
6. Channel pattern codes: B = braided; MC = multiple channel; S = single channel; DIST = disturbed
7. Channel materials codes: F = fine; M = medium; C = coarse; G = gravel; V = very (SCS gradations)
8. Galloway Wash Reaches:
   1= Pima Rd. to North Branch 2=North Branch to Narrows 3=Narrows to Grapevine
   4=Grapevine to Rowe 5=Rowe to Cave Creek

Summary. Stream classification data presented above indicate that streams in the Carefree DMP study area have characteristics typical of braided, ephemeral streams. Therefore, the expected channel processes include high rates of sedimentation, susceptibility to bank erosion, and potential shifts in low flow channel characteristics.

Both the Brice and Rosgen classification systems indicate that lateral channel movement should be expected for the stream segments in the study area.

Summary

The sedimentation and geomorphic analysis indicates that long-term degradation and rapid rates of channel change are natural processes in the study area and should be expected to continue in the future. The major watercourses are confined by older, more stable geomorphic surfaces. Within these corridors, the streams will experience frequent lateral migration, avulsions, sedimentation and scour. Analysis of equilibrium slopes indicates that the streams will continue to degrade. Longitudinal profile analysis and surficial geomorphic mapping indicate that fluctuations in bed elevations have occurred in the recent past, and that such fluctuations are more related to channel pattern and local hydraulic conditions than to watershed or regional impacts. Sediment movement through the channels probably occurs in waves that create local fluctuations in bed elevation that vary with time and the flood series. Of the washes in the study area, Galloway Wash is the most disturbed by human impacts, and has evidence of the greatest degree of instability. Andora Hills Wash may be the most stable due to the abundance of bedrock control.

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Figure 3-11

Geomorphic Mapping of Stream Corridor Terraces

ial terraces associated with the drainage systems within the Town of Carefree were mapped during field reconnaissance on the basis of surficial characteristics, topographic relief, vegetation, and elevation of the active channel. A simplified three-category classification scheme was used to map the terrace surfaces, based on the relative elevation above the active channel:

1. 1-2 feet above active channel
2. 3-4 feet above active channel
3. 5-6 feet above active channel

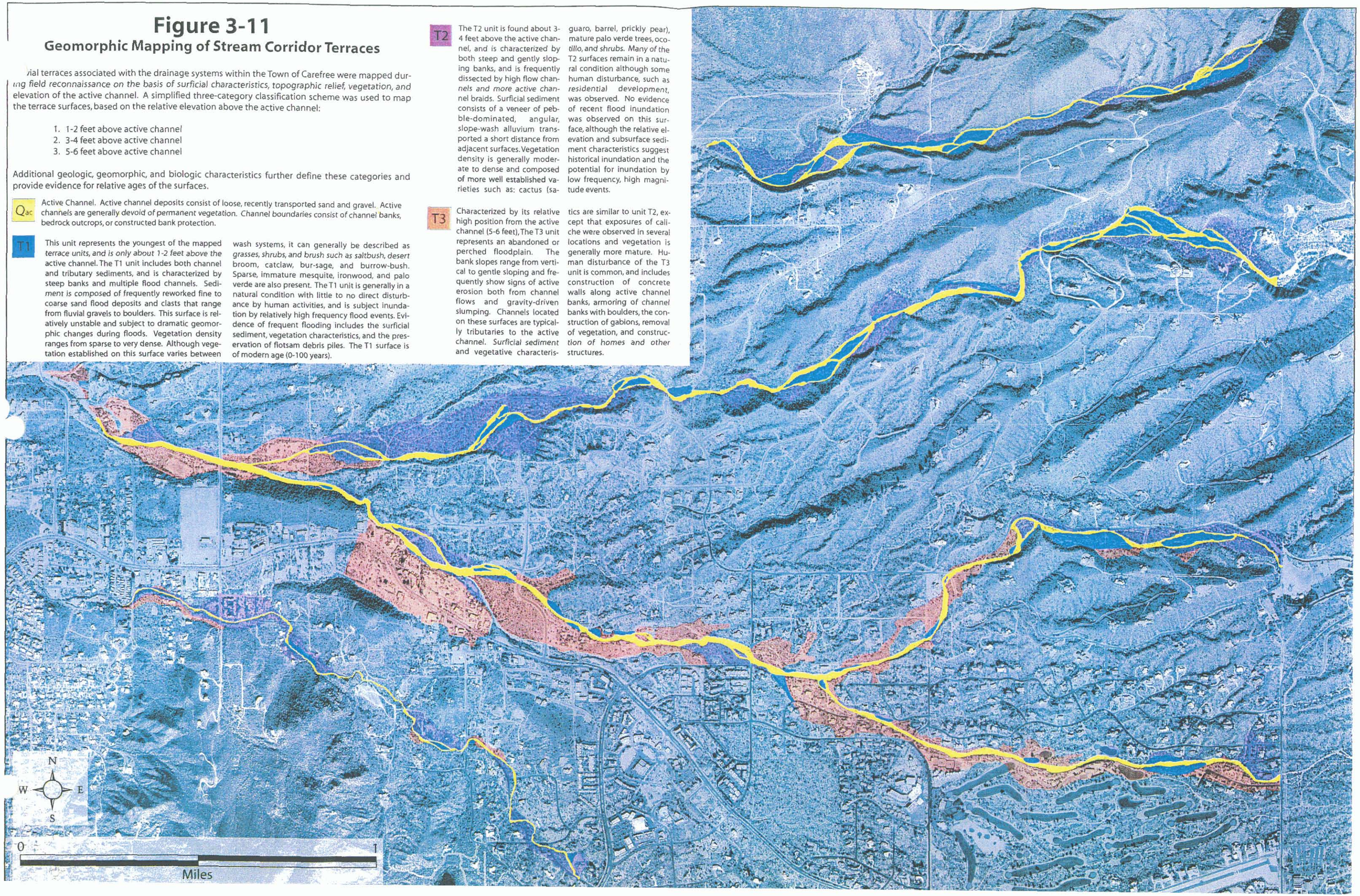
Additional geologic, geomorphic, and biologic characteristics further define these categories and provide evidence for relative ages of the surfaces.

Qac Active Channel. Active channel deposits consist of loose, recently transported sand and gravel. Active channels are generally devoid of permanent vegetation. Channel boundaries consist of channel banks, bedrock outcrops, or constructed bank protection.

T1 This unit represents the youngest of the mapped terrace units, and is only about 1-2 feet above the active channel. The T1 unit includes both channel and tributary sediments, and is characterized by steep banks and multiple flood channels. Sediment is composed of frequently reworked fine to coarse sand flood deposits and clasts that range from fluvial gravels to boulders. This surface is relatively unstable and subject to dramatic geomorphic changes during floods. Vegetation density ranges from sparse to very dense. Although vegetation established on this surface varies between wash systems, it can generally be described as grasses, shrubs, and brush such as saltbush, desert broom, catclaw, bur-sage, and burrow-bush. Sparse, immature mesquite, ironwood, and palo verde are also present. The T1 unit is generally in a natural condition with little to no direct disturbance by human activities, and is subject inundation by relatively high frequency flood events. Evidence of frequent flooding includes the surficial sediment, vegetation characteristics, and the preservation of flotsam debris piles. The T1 surface is of modern age (0-100 years).

T2 The T2 unit is found about 3-4 feet above the active channel, and is characterized by both steep and gently sloping banks, and is frequently dissected by high flow channels and more active channel braids. Surficial sediment consists of a veneer of pebble-dominated, angular, slope-wash alluvium transported a short distance from adjacent surfaces. Vegetation density is generally moderate to dense and composed of more well established varieties such as: cactus (saguaro, barrel, prickly pear), mature palo verde trees, ocotillo, and shrubs. Many of the T2 surfaces remain in a natural condition although some human disturbance, such as residential development, was observed. No evidence of recent flood inundation was observed on this surface, although the relative elevation and subsurface sediment characteristics suggest historical inundation and the potential for inundation by low frequency, high magnitude events.

T3 Characterized by its relative high position from the active channel (5-6 feet), The T3 unit represents an abandoned or perched floodplain. The bank slopes range from vertical to gentle sloping and frequently show signs of active erosion both from channel flows and gravity-driven slumping. Channels located on these surfaces are typically tributaries to the active channel. Surficial sediment and vegetative characteristics are similar to unit T2, except that exposures of caliche were observed in several locations and vegetation is generally more mature. Human disturbance of the T3 unit is common, and includes construction of concrete walls along active channel banks, armoring of channel banks with boulders, the construction of gabions, removal of vegetation, and construction of homes and other structures.



DATE: February 12, 2002

TO: Geza Kmetty/FCDMC
Doug Williams/FCDMC
Tony Bokich, P.E./CH2M Hill

FROM: Jon Fuller, P.E.
Tamara Norton, E.I.T.

RE: Carefree DMP
Sedimentation Engineering & Geomorphic Evaluation
Task 2.1.10 – Assessment of Erosion at Road Crossings

Introduction

The District identified sedimentation problems at road crossings of washes as one of the chief concerns for the Carefree DMP. Spatial, temporal and hydraulic analyses of road crossings in the study area were performed to evaluate potential causes of observed sedimentation problems so that effective design guidelines could be proposed.

Data Collection

Data describing existing road crossings were collected in the field and from historical aerial photographs of the study area. In addition to field photographs documenting existing conditions, the data collected for each crossing considered are summarized in Table 4-1. Exhibit 4-1 shows the crossing locations and presents a brief description of each crossing.

Spatial and Temporal Analysis

Spatial analysis is the manipulation of location-related data to determine whether problem areas or non-problem areas are distributed in some regular pattern relative to other spatial features of the study area. For the Carefree DMP, the locations of crossings with scour or sedimentation problems were compared with maps of surficial geology, SCS soils classifications, geomorphic features, channel pattern, distance from the headwaters, position along a given channel, degree of urbanization, and channel slope. As shown in Table 4-1 and Exhibit 4-1, no spatial pattern was detected. The occurrences of scour problems at road crossings were not clustered in any given surficial geology unit, SCS soil classifications, zoning category, stream, watershed, bedrock outcrop, drainage area, channel sloe, or general location.

Temporal analysis examines the development of, or changes to a given attribute over time. The attributes evaluated for the road crossings in the study area included changes in horizontal channel position (Chapter 2) and vertical channel change (Chapter 3). Horizontal channel change occurred within the study area, but was found to be unrelated to the occurrence of scour at road crossings. Longitudinal profile analyses described in Chapter 3 indicate that bed elevation

Table 4-1. Carefree DMP Road Crossing Inventory

Wash Name	#	Observed Scour?	Road Crossing Description	Road Surface	Flow Regime	Year Appear on Aerials	Year Paved	Channel Bed Material	Bed-rock	AZGS Map Unit	SCS Soils Unit	Drainage Area (mi2)	Q_{100}, 6-hr (cfs)	Channel Slope (ft/ft)	Historic Encroachment		
																Date	Description
Galloway	G3	no	@ grade - no change	dirt	supercritical	1953	N/A	CS	No	Qyc	6			0.02	No		
	G6	no	@ grade - no change	paved	supercritical	1962	1985	CS	No	Qyc	6	5.14	3380	0.02	Yes	1962	Channel graded
	G1	yes	shallow	paved	supercritical	1953	1977	CS	Yes	Qyc	33			0.02	No		
	G2	yes	shallow	paved	supercritical	1953	1977	CS	No	Qyc	6			0.02	No		
	G5	yes	shallow - narrow	paved	critical	1953	1992	CS	No	Qyc	6	6.07	3990	0.02	Yes	1992	Channel graded
	G8	yes	@ grade - narrow	paved	supercritical	1962	1977	CS	No	Qyc	6	1.72	1910	0.03	Yes	1962	Golf course built, graded new channel, straightened wash
	G9	yes	@ grade - narrow	paved	supercritical	1962	1985	CS	No	Qyc	6	1.04	1160	0.03	Yes	1992	Home built between braids, truncating north braid
	G4	yes	box - widen	N/A	subcritical	1962	1998	CS	No	Qyc	6			0.02	No		
	G7	yes	Conarch - narrow	N/A	critical	1962	1998	CS	No	Qyc	6	1.83	2040	0.05	Yes	1962	Channel graded
Galloway North	GN 3	no	@ grade - no change	paved	supercritical	1962	1977	CS	No	Qyc	40	3.58	2870	0.02	No		
	GN 1	no	@ grade - no change	concrete	supercritical	1985	1992	CS	No	Qyc	40			0.02	Yes	1962	Channel graded, possibly filled too
	GN 2	yes	shallow	paved	supercritical	1962	1977	CS	No	Qyc	40	3.6	2880	0.02	Yes	1962	Street intersection built in middle of wash
Andora Hills	A3	no	@ grade - no change	paved	subcritical	1953	1992	CS/G, Co	No	Qy	61			0.08	Yes	1977	Building built very close to wash
	A10	no	shallow	paved	subcritical	1962	1977	CS/G, Co	Yes	Ql	61	0.97	2150	0.01	No		
	A11	no	shallow	paved	subcritical	1962	1977	CS/G, Co	No	Yg	61	0.92	2050	0.01	No		
	A12	no	@ grade - no change	paved	subcritical	1962	1977	CS/G, Co	No	Yg	61	0.65	1630	0.01	No		
	A13	no	@ grade - no change	paved	subcritical	1962	1977	CS/G, Co	No	Yg	61	0.42	1260	0.01	No		
	A9	no	@ grade - no change	paved	subcritical	1962	1977	CS/G, Co bedrock	Yes	Ql	61	0.99	2210	0.01	No		
	A18	no	@ grade - no change	paved	subcritical	1962	1998	S/Co	No	Qy	93			0.02	No		
	A4	no	@ grade - no change	gravel	subcritical	1962	N/A	CS/G, Co	No	Qy	61			0.02	No		
	A16	no	4 barrel	N/A	subcritical	1977	1977	S/Co	No	Qy	93			0.08	Yes	1977	Culvert constructed, widened channel, grading
	A6	no	@ grade - no change	paved	subcritical	1985	1985	CS/G, Co	No	Ql	61	1.09	2240	0.04	Yes	1977	Some grading around wash
	A7	no	2 barrel, 12' x 13'	N/A	subcritical	1985	1985	CS/G, Co	No	Ql	61	1.06	2350	0.04	No		
	A14	no	2 barrel	N/A	subcritical	1998	1998	Co/B	Yes	Xp	96			0.06	Yes	1998	Golf course construction, wash regraded
	A8	yes	shallow	paved	subcritical	1962	1977	CS/G, Co, B	Yes	Yg	61	1.01	2240	0.01	No		

Table 4-1. Carefree DMP Road Crossing Inventory

Wash Name	#	Observed Scour?	Road Crossing Description	Road Surface	Flow Regime	Year Appear on Aerials	Year Paved	Channel Bed Material	Bed-rock	AZGS Map Unit	SCS Soils Unit	Drainage Area (mi2)	Q_{100}, 6-hr (cfs)	Channel Slope (ft/ft)	Historic Encroachment		
																Date	Description
	A1	yes	shallow	paved	subcritical	1962	1992	CS/G, Co	No	Qy	96			0.02	Yes	1962	Parking lot built adjacent to wash, some grading
	A2	yes	shallow	paved	subcritical	1962	1992	CS/G, Co	No	Qy	93			0.03	Yes	1992	Building built close to wash
	A5	yes	shallow	dirt	subcritical	1977	N/A	CS/G, Co	No	Yg	61	1.17	2400	0.02	Yes	2000	Grading/filling of channel in this area (see Photos)
	A15	yes	5 - 36 in CMPs	N/A	supercritical	1998	1998	S/Co	Yes	Qy	93			0.09	Yes	1992	Golf course construction, wash regraded
	A17	yes	@ grade - no change	paved	subcritical	1998	1998	S/Co	No	Qy	93			0.08	No		
Grapevine	GR4	no	@ grade - no change	dirt	supercritical	1953	N/A	CS/G, Co	No	Qyc	6			0.02	No		
	GR1	no	@ grade - no change	dirt	supercritical	1998	N/A	CS	No	Qy	8			0.03	No		
	GR3	yes	@ grade - narrow	oiled	supercritical	1953	N/A	CS/G, Co	No	Qyc	6			0.02	No		
	GR2	yes	@ grade - narrow	dirt	supercritical	1962	N/A	CS/G, Co	No	Qy	8	6.02	4690	0.03	No		
Rowe	R5	no	@ grade - narrow	paved	supercritical	1962	1977	G/Co	No	Qy	8			0.03	No		
	R1	no	@ grade - no change	dirt		1962	N/A	G/Co	No	Qy	8				No		
	R3	no	@ grade - no change	dirt	subcritical	1962	N/A	G/Co	No	Qy	8			0.03	No		
	R6	no	@ grade - no change	dirt	supercritical	1962	N/A	G/Co/B	No	Qy	8			0.03	No		
	R4	no	@ grade - no change	dirt	supercritical	1985	N/A	G/Co	No	Qy	8			0.03	No		
	R2	yes	@ grade - narrow	concrete	subcritical	1998	1998	G/Co	No	Qy	8			0.03	No		
Trib 2 Galloway Wash	48	yes	@ grade - shallow	paved		1962	1977	S/Co	No	Qy	40	0.28	340		No		
South Trib to Galloway Wash	31	yes	@ grade - shallow	paved		1953	1992	S	No	Qyc	6	0.94	1290		No		

changes during the period of record are cyclical and are not longitudinally consistent within any of the five wash systems evaluated. Therefore, the occurrence of scour holes at road crossings could not be causally related to temporal changes in bed elevation. The construction and paving dates were also found to be unrelated to the occurrence of scour problems.

Figures 4-1 through 4-6 were developed from the data in Table 4-1 to evaluated whether observed scour could be correlated to several temporal variables. The data presented in Table 4-1 only describe those crossings where scour or sedimentation problems were observed in the field or on aerial photographs. The temporal variables evaluated included *Year Crossing Appears on Aerial Photo*, *Year Crossing Appears Paved on Aerial Photo* and *Year Encroachment Appears on Aerial Photo*. Figures 4-1 through 4-5 are summaries for the five major streams. Figure 4-6 summarizes these data for all crossings with evidence of scour. The approximate time period crossings were built, the time period crossings were paved and the time period when encroachment occurred near or around a crossing were noted to evaluate whether the time the crossings were constructed was related to whether scour had occurred. That is, construction techniques for the time period or the flood series since the date of construction might have influenced whether scour occurred. However, no direct correlation was determined between the temporal variables and erosion at the crossings for either the individual washes or all the wash data analyzed together.

Figure 4-1 shows the results for Galloway Wash. All the crossings with scour evidence on Galloway Wash have changed the natural wash geometry. 57% of the crossings experience supercritical flow, with another 29% at critical. All crossings are paved.

Figure 4-2 shows the results for Galloway Wash North Branch. The data set for this wash is small, with only three crossings, only one of which has evidence of scour. The crossing with scour evidence is paved, with a constructed drop in elevation at the downstream side, and experiences supercritical flow.

Figure 4-3 shows the results for Andora Hills Wash. 67% of the crossings with scour evidence have a constructed drop in elevation at their downstream side. 83% of the crossings experience subcritical flow and are paved.

Figure 4-4 shows the results for Grapevine Wash. The data set for this wash is small with only four crossings, only two of which have scour evidence. Both crossings with scour evidence were narrowed during the crossing construction and experience supercritical flow, but neither crossing is paved.

Figure 4-5 shows the results for Rowe Wash. Only one crossing on Rowe Wash has evidence of scour. The crossing with scour evidence was narrowed and paved during construction of the dip section.

Summary. Of the 42 road crossings evaluated in the study area along the major watercourses, 19 (45%) were observed to have scour problems and 23 (55%) did not appear to have existing scour problems. Table 4-2 summarizes differences between the characteristics of crossings with

observed scour and crossings without observed scour. Of the variables shown in Table 4-2, the most diagnostic for predicting scour include the following:

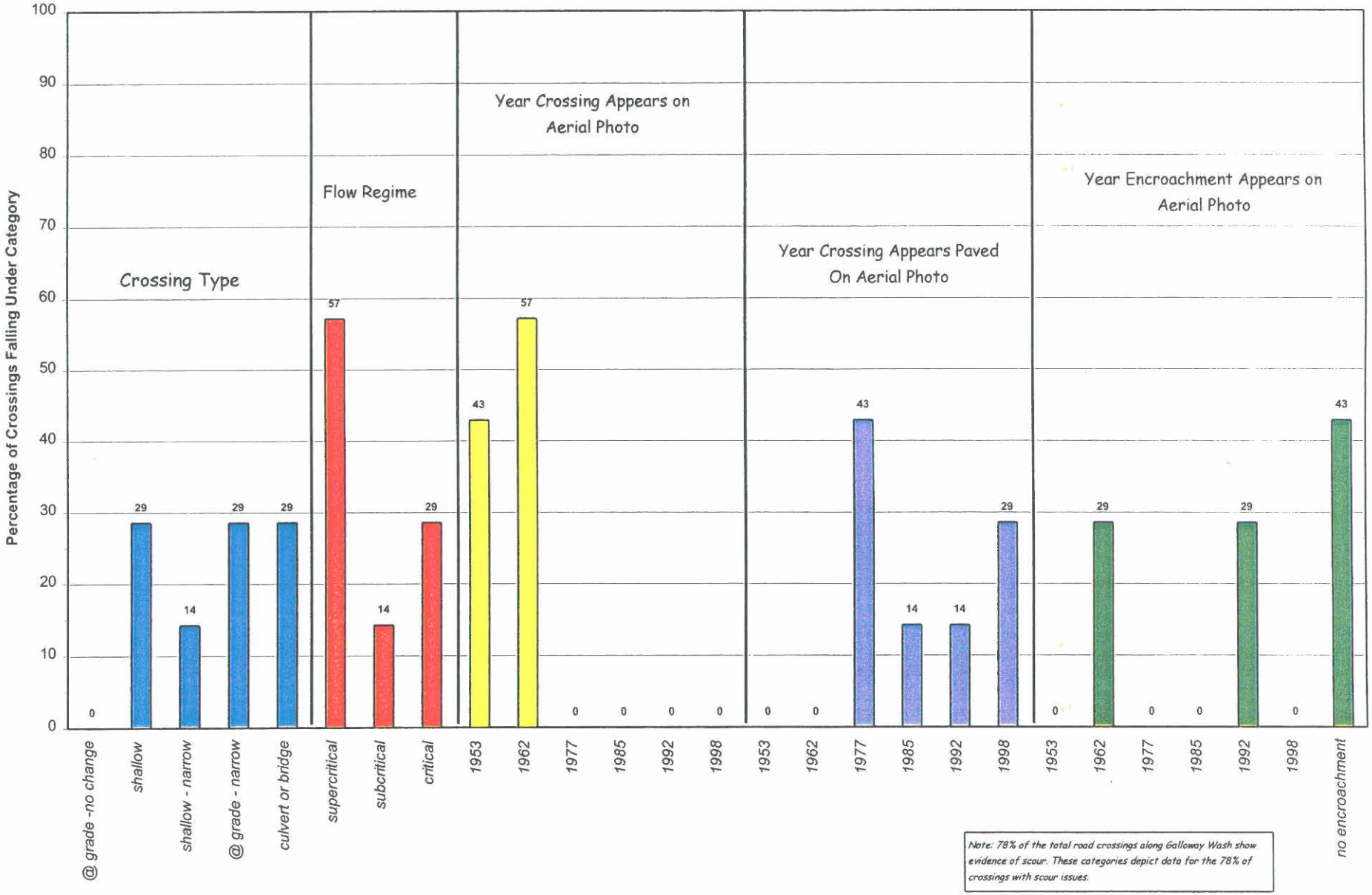
- Surface Type. 89% of the paved crossings had scour problems, whereas only 65% of the unpaved crossings had scour problems. The effect of paving on stream hydraulics is discussed in the next section of this chapter.
- Crossing Type. 74% of the crossings without scour problems were constructed to minimize changes in the natural channel geometry, compared to only 5% of the crossings with scour problems. That is, 95% of the crossings with scour problems altered the natural channel cross section.
- Flow Regime. 63% of the crossings with scour problems flow at supercritical conditions during the 100-year event, compared to only 43% of the crossings without scour problems. High velocities and less stable flow conditions associated with supercritical flow are correlated with scour and sedimentation problems.
- Bed Materials. All (100%) of the crossings with scour problems had channel bed materials composed primarily of sand and gravel. 26% of the crossings without scour problems had coarse bed materials such as cobbles or gravel. Large diameter rock, whether natural or dumped, is a moderately effective scour prevention measure.

The spatial and temporal analyses indicate that construction practices such as paving, altering the natural channel geometry, and use of rock scour protection are best correlated to incidence of scour at road crossings.

Table 4-2. Carefree DMP
Characteristics of Crossings With or Without Scour Problems

Characteristic	Crossings With Scour (19)		Crossings Without Scour (23)	
	#	Percent	#	Percent
Crossing Type				
At-grade (dip)	16	84	20	87
Culvert or Box Culvert	2	11	3	13
Bridge	1	5	0	0
Surface Type				
Paved	17	**89**	15	65
Unpaved	2	11	8	35
Crossing Type (See Fig. 4-7 to 4-17)				
At-Grade Narrow	7	37	1	4
At-Grade Shallow	9	47	2	9
At-Grade No Change	1	5	17	**74**
Box Widen	3	16	3	13
Flow Regime				
Subcritical	7	37	13	57
Supercritical/Critical	12	63	10	43
Date Constructed (Appear on Photo)				
1953	5	26	3	13
1962	10	53	13	57
1971	1	5	1	4
1985	0	0	4	17
1998	3	16	2	9
Date Paved				
1953	0	0	0	0
1962	0	0	0	0
1977	6	32	8	35
1985	1	5	3	13
1992	4	21	2	9
1998	5	26	2	9
Floodplain Encroachment				
Yes	9	47	6	26
No	10	53	17	**74**
Bedrock Exposed in Bed or Banks				
Yes	3	16	3	13
No	16	84	20	87
Bed Materials				
Mostly Sand	19	**100**	17	74
Mostly Cobbles	0	0	6	26
AZGS Map Unit				
Ql	0	0	4	17
Qy/Qyc	17	89	15	65
Bedrock	2	11	4	17
SCS Map Unit				
6,8	10	53	9	39
40	4	21	2	9
61	2	11	9	39
93,96	4	21	3	13
Average Channel Slope	0.028	N/A	0.028	N/A

Figure 4-1. Galloway Wash Data
For Crossings Showing Evidence of Scour



Note: 78% of the total road crossings along Galloway Wash show evidence of scour. These categories depict data for the 78% of crossings with scour issues.

Figure 4-2. Galloway North Wash Data
For Crossings Showing Evidence of Scour

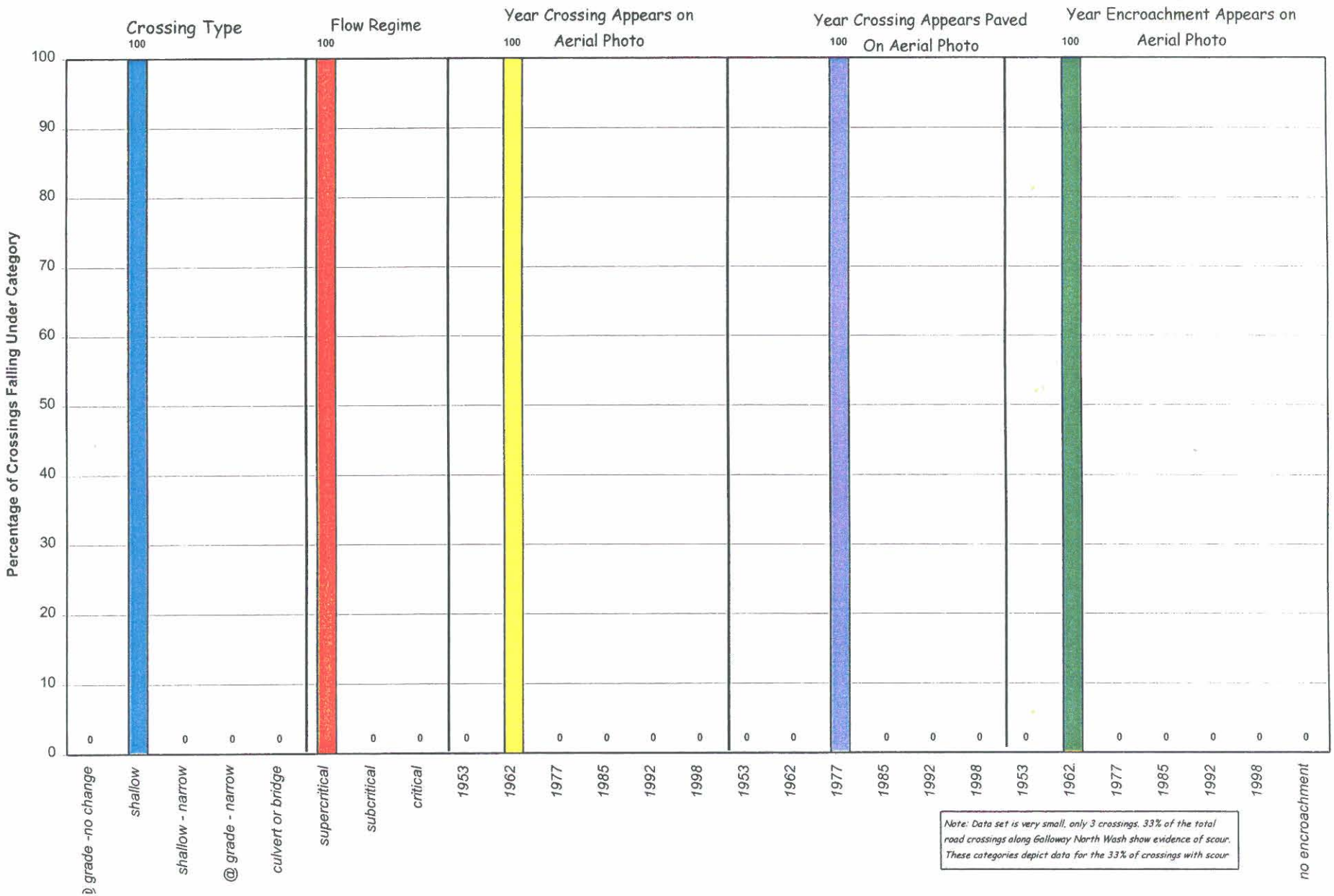


Figure 4-3. Andora Hills Wash Data
For Crossings Showing Evidence of Scour

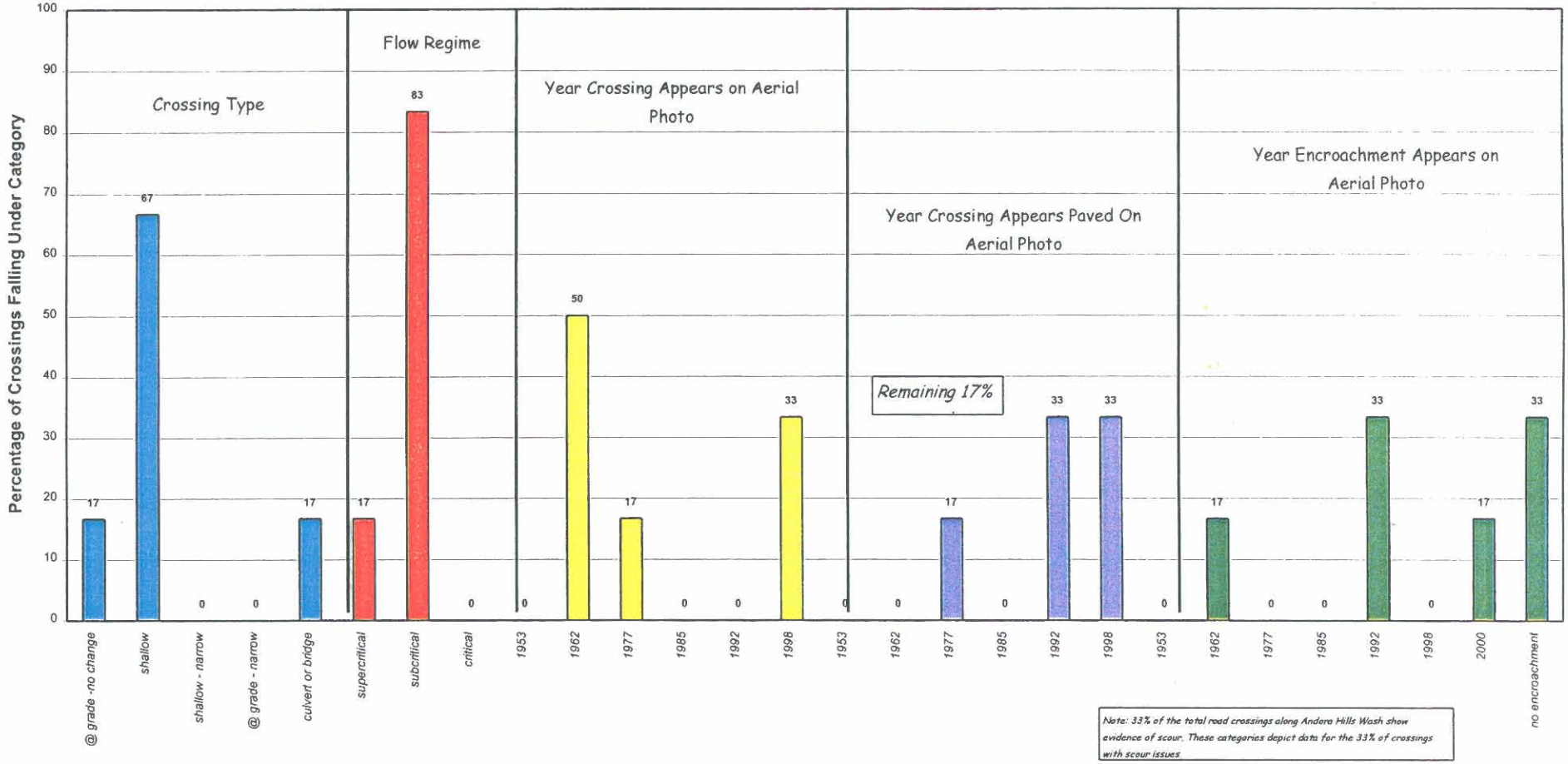
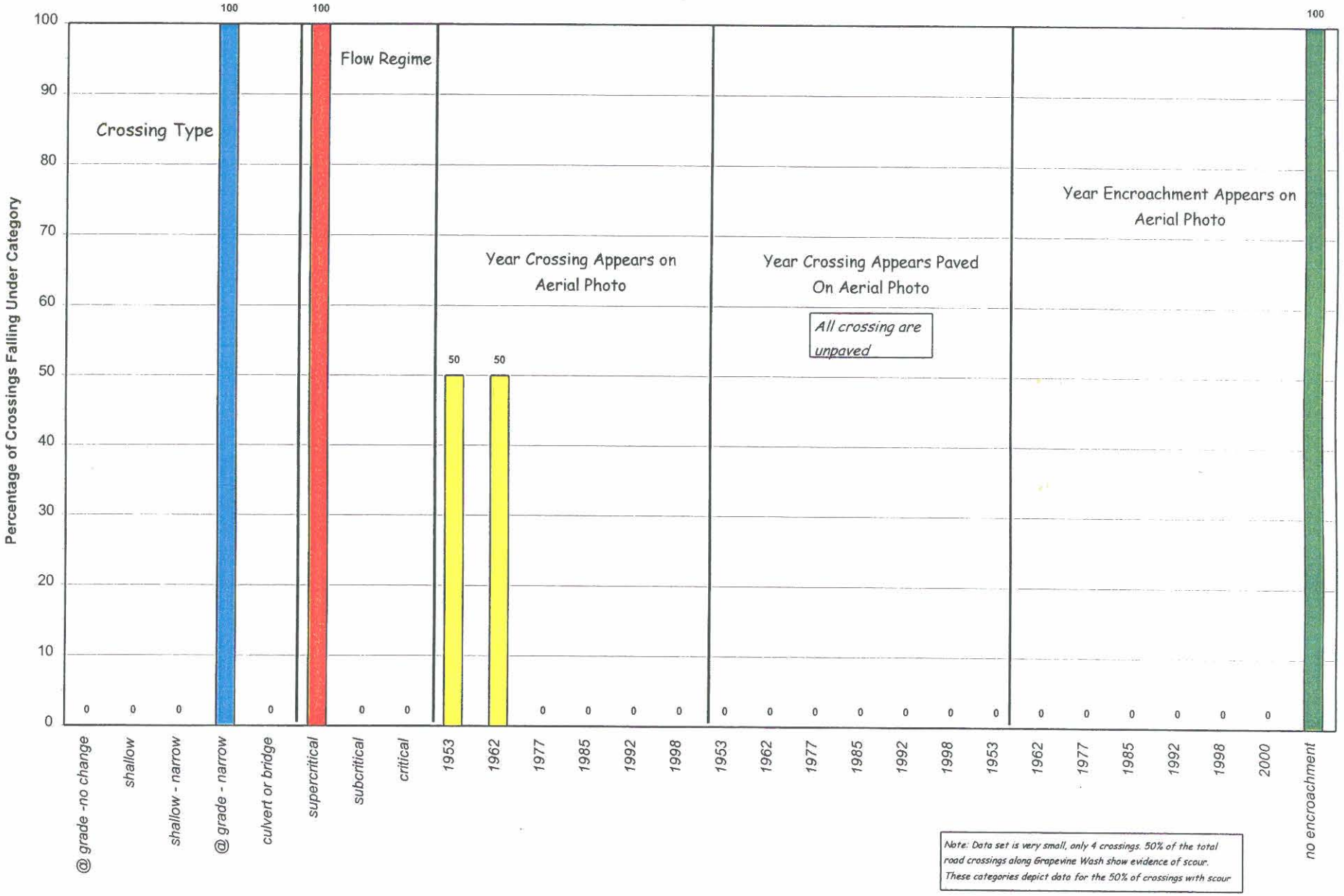
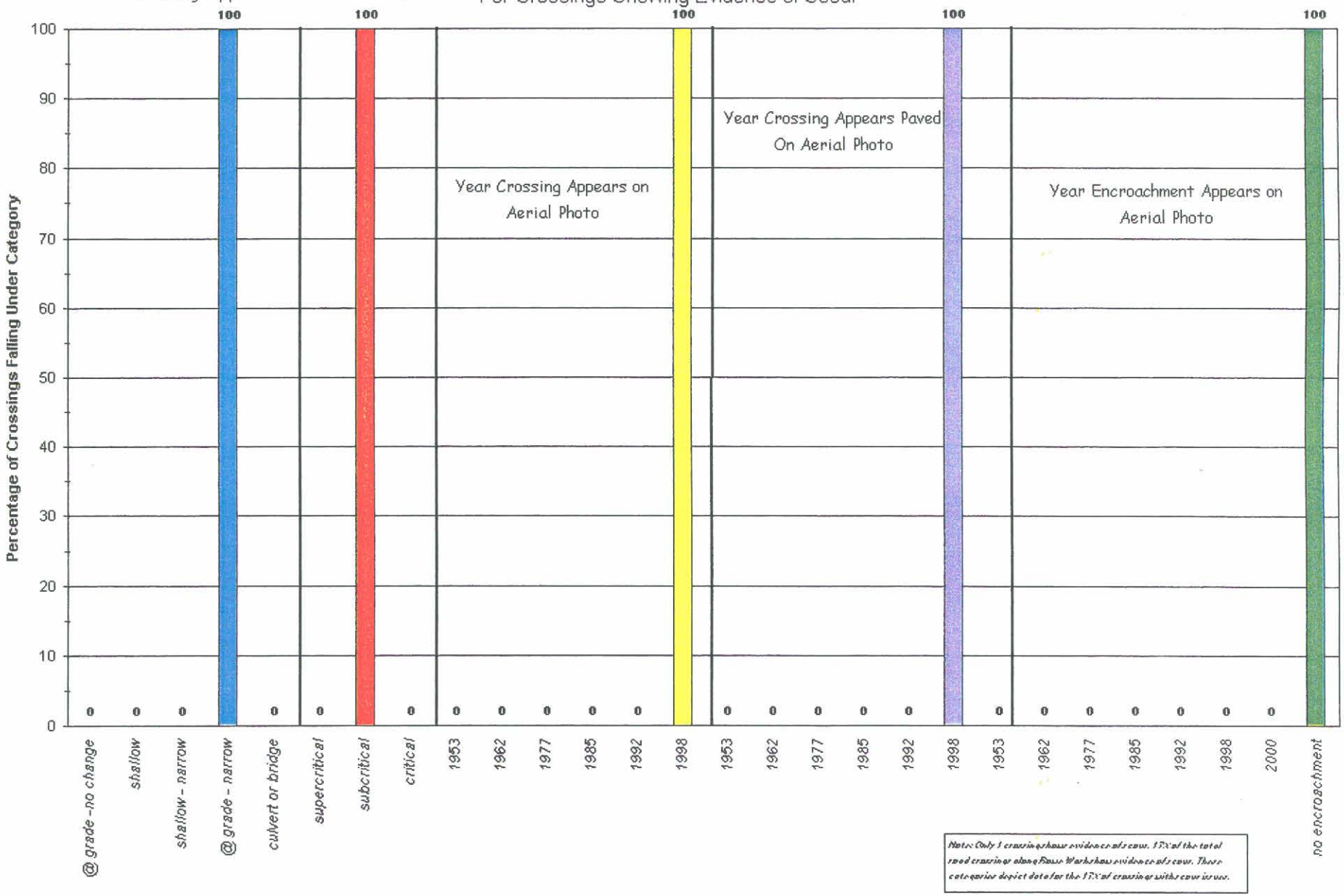


Figure 4-4. Grapevine Wash Data
For Crossings Showing Evidence of Scour



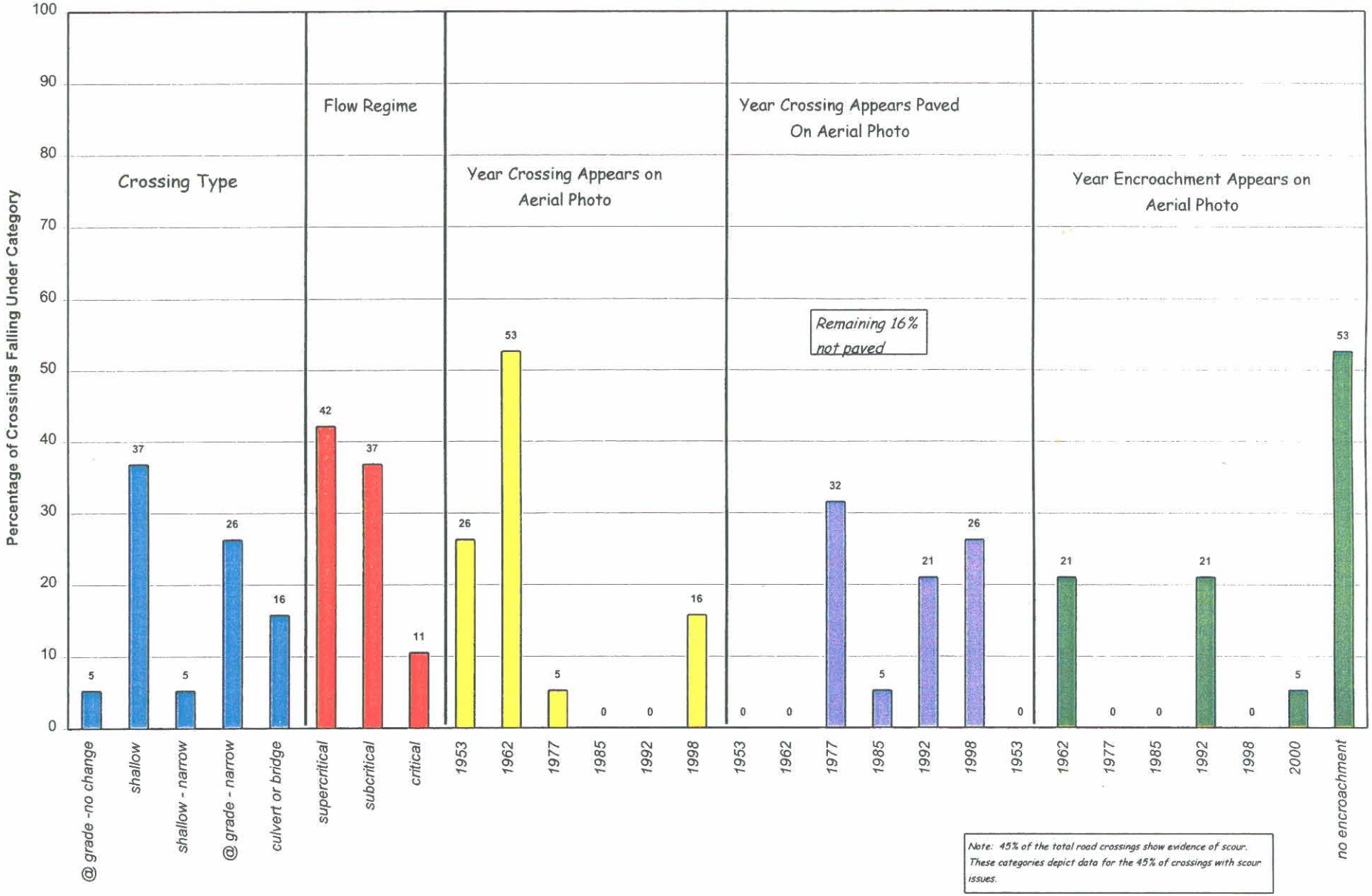
Note: Data set is very small, only 4 crossings. 50% of the total road crossings along Grapevine Wash show evidence of scour. These categories depict data for the 50% of crossings with scour

Figure 4-5. Rowe Wash Data
For Crossings Showing Evidence of Scour



Note: Only 1 crossing shows evidence of scour. 17% of the total road crossings along Rowe Wash show evidence of scour. These categories depict data for the 17% of crossings with scour issues.

Figure 4-6. All Wash Data
For Crossings Showing Evidence of Scour



Hydraulic Analysis

To determine the hydraulic impacts of roadway crossing construction practices, an idealized stream segment was modeled using HEC-RAS. Seven different types of crossings were modeled to evaluate relative impacts on channel hydraulics at the crossings. The crossing types modeled included the following:

- Crossing Type 1 (Dip – no change) consists of a paved dip section[1] with no change in the natural cross-section geometry.
- Crossing Type 2 (Paved dip – widened channel) consists of a paved dip section that maintains the natural channel bottom width, but increases the total cross section width and floodplain.
- Crossing Type 3 (Paved dip – narrowed channel) consists of a paved dip section that maintains the natural channel top width and floodplain, but reduces the natural channel bottom width.
- Crossing Type 4 (Dip – shallow slope) consists of a paved dip crossing in which the cross-slope of the road is less than the natural slope of the channel, causing a stepped drop in elevation on the downstream side of the crossing.
- Crossing Type 5 (Box – widened channel) consists of a box culvert crossing which widens the natural channel cross section, maintaining the natural water surface elevation upstream of the crossing.
- Crossing Type 6 (Conarch) consists of a Conspan Arch crossing that is essentially a bridge, minimizing the change in the natural cross section topwidth and bottom width.
- Crossing Type 7 (Bridge) consists of a bridge crossing with one pier, minimizing the change in the natural cross section topwidth and bottom width.

Figure 4-7 shows an example of Crossing Type 1 (Dip – no change). The channel geometry has not been changed, only the Manning's n-value for the pavement. Some sediment has been deposited on the pavement, but there is no evidence of significant deposition or scour.

[1] An unpaved dip section with no change in channel geometry would cause no changes in hydraulic parameters modeled by HEC-RAS, ,and was therefore not considered as an alternative to be evaluated using HEC-RAS.

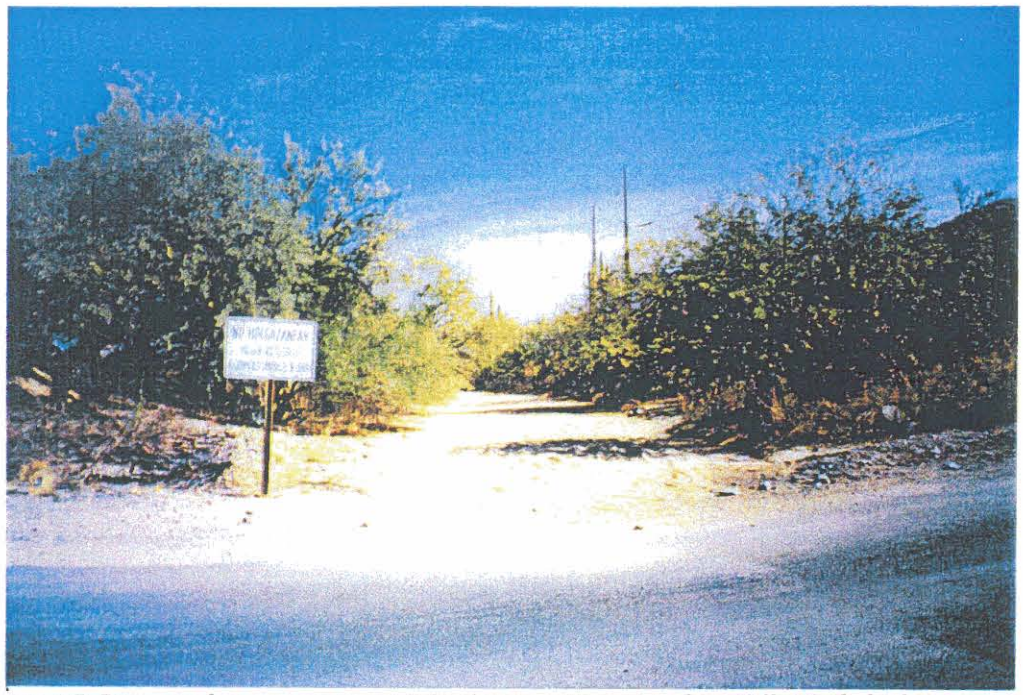


Figure 4-7. Dip - no change crossing at School House Rd. and Andora Hills Wash, looking upstream.

Figure 4-8 shows an example of Crossing Type 2 (Paved dip – widened channel). The bottom width of the wash is maintained, but the cross-section width is increased to accommodate traffic engineering concerns.

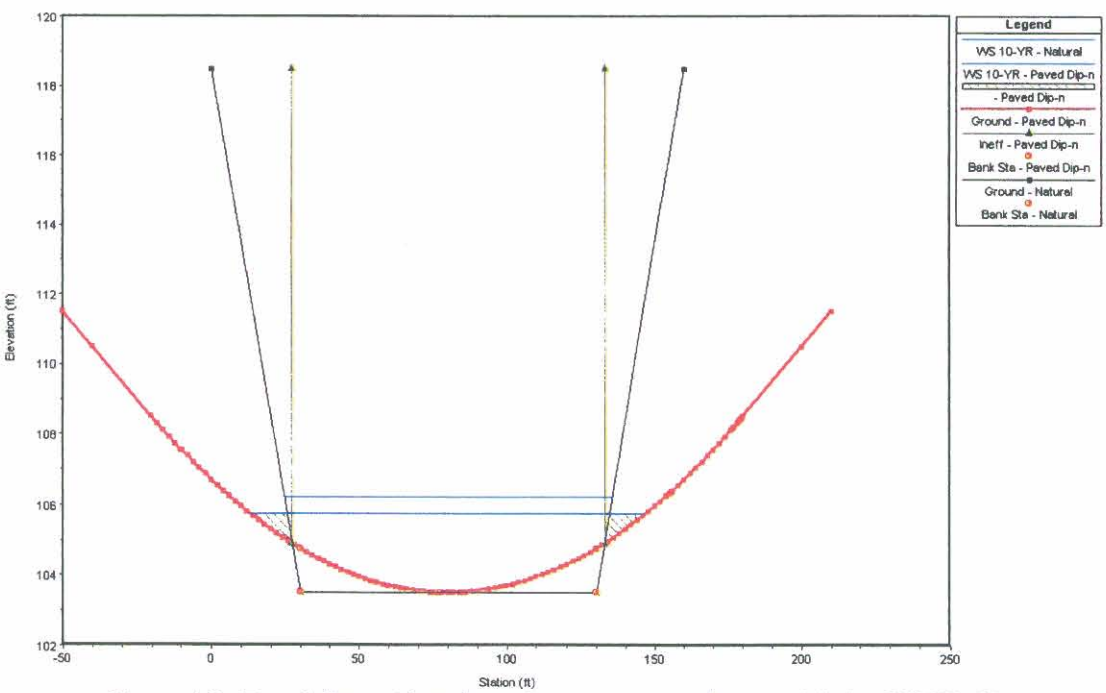


Figure 4-8. Paved dip – widen channel crossing example as modeled in HEC-RAS.

Figure 4-9. Paved dip – narrowed crossing at Scopa Trail and Galloway Wash, looking at downstream side.

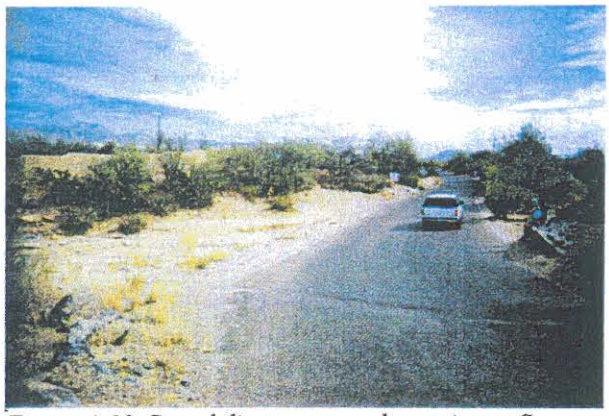


Figure 4-10. Paved dip – narrowed crossing at Scopa Trail and Galloway Wash looking north.

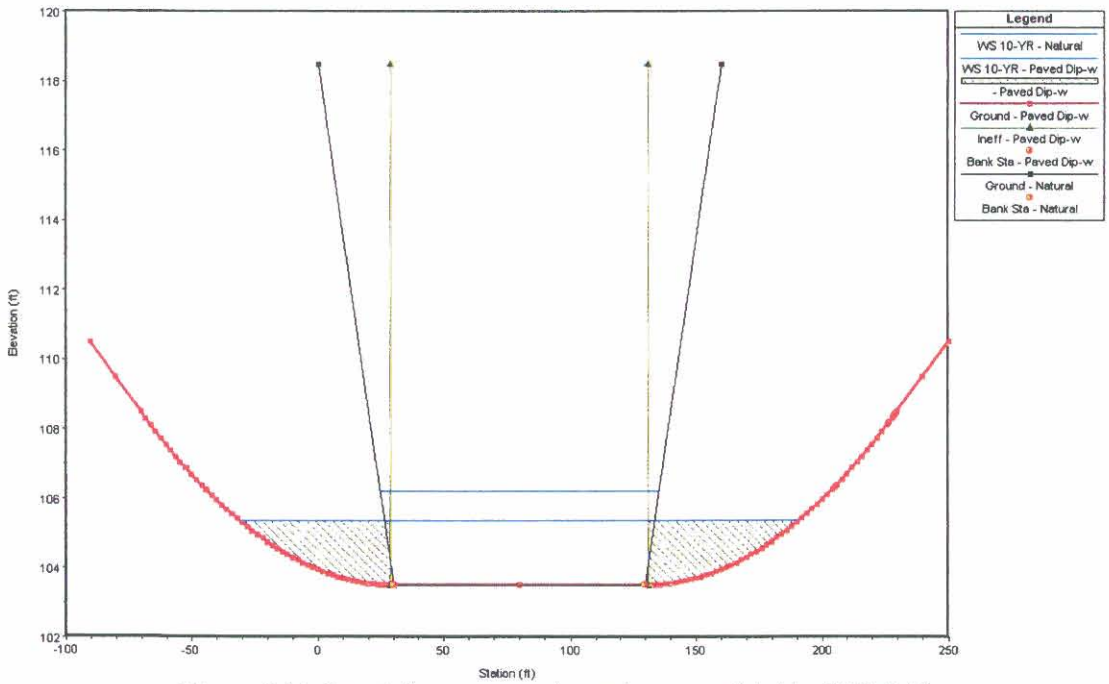


Figure 4-11. Paved dip – narrowed crossing as modeled in HEC-RAS.

Figures 4-9 to 4-11 show examples of Crossing Type 3 (Paved dip – narrowed). Note that the retaining wall in Figure 4-10 (with seated person) has encroached into the wash and that scour at the downstream end of the crossing has caused the roadway surface to be undercut.

Figures 4-12 and 4-13 show examples of Crossing Type 4 (Dip – shallow slope). There is about a 2.5 feet difference in wash bed elevation from the upstream side and the downstream side of the crossing. The wider the road crossing, the greater the drop in elevation on the downstream side. Note the undercutting and scour around the grade control and scour protection in Figure 4-12.

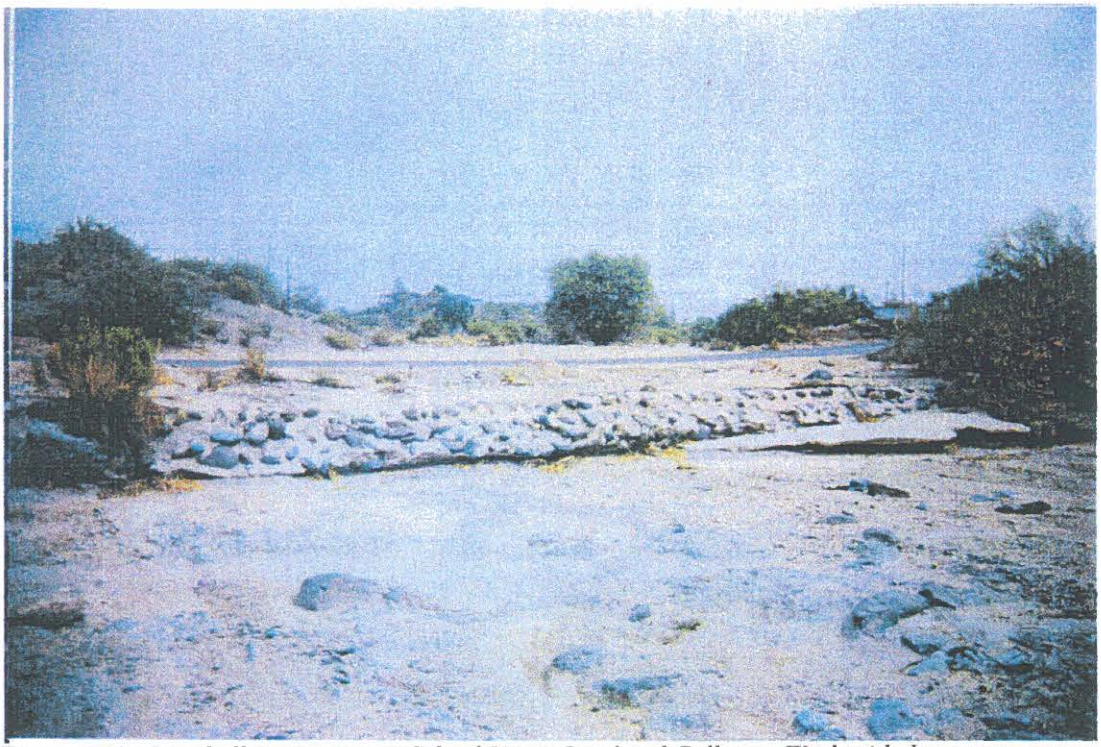


Figure 4-12. Dip shallow crossing at School House Road and Galloway Wash with downstream scour.

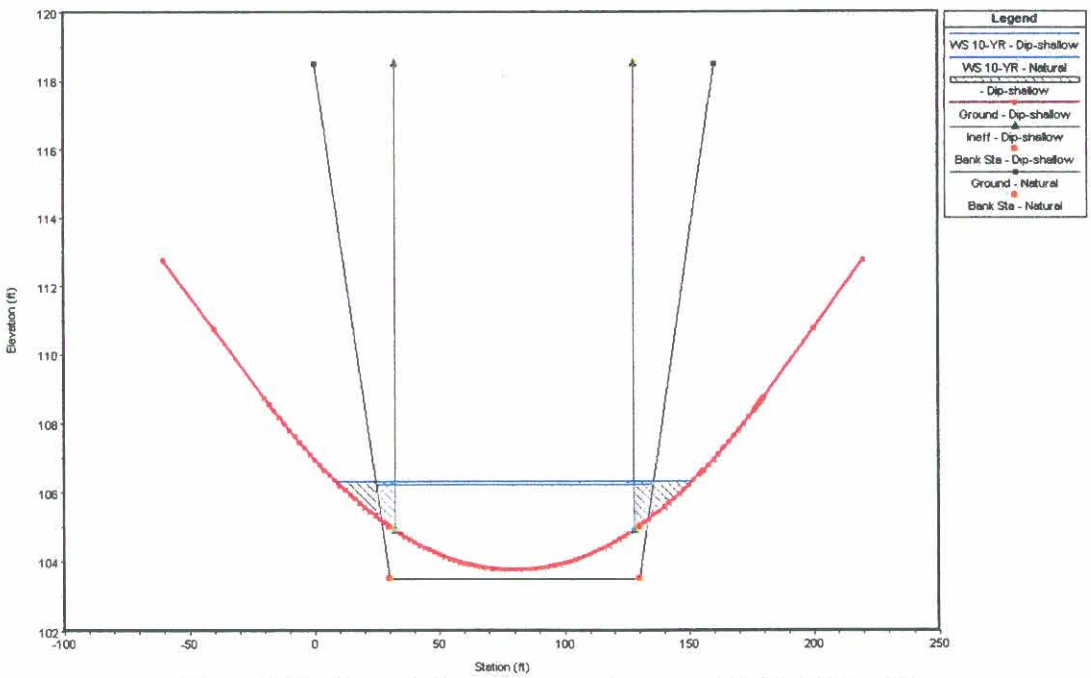


Figure 4-13. Dip – shallow slope crossing as modeled in HEC-RAS.

Figures 4-14 and 4-15 show examples of Crossing Type 5 (Box – widened). The crossing shown in Figure 4-14 consists of an 8-cell 9'x 6' concrete box culvert crossing at Galloway Road and Galloway Wash. Note that only six cells are visible in the photo. The upstream and downstream bottom widths of Galloway Wash are about 4 cells wide, indicating that the natural channel was significantly widened to accommodate the eight-cell structure and that the culvert represents an unnatural and rapid flow expansion. At the time of the field reconnaissance, there was about six inches of sediment deposition at the upstream end of the culverts, but the concrete bottom of the culverts is exposed at the downstream end. A downstream island blocks cells 7 and 8, rendering them hydraulically ineffective. Over time, cells 5, 6, 7 and 8 will tend to fill with sediment as the wash reestablishes a more natural cross-section geometry.

Figure 4-14. Box – widened crossing at Galloway Road and Galloway Wash looking upstream.

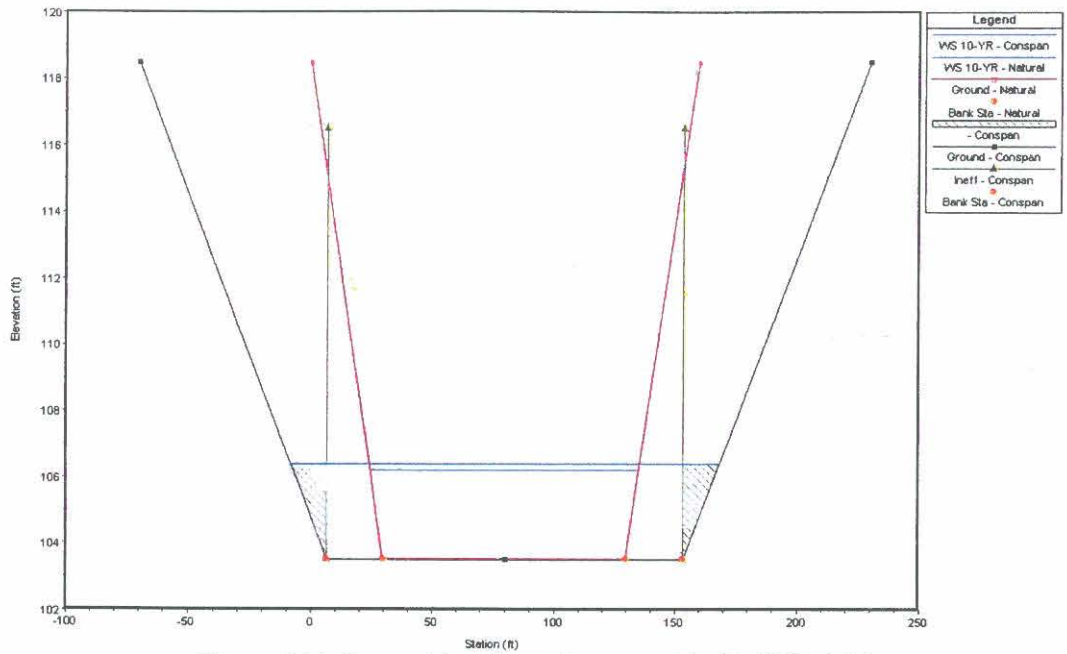


Figure 4-15. Box – widened crossing as modeled in HEC-RAS.

Figure 4-16 shows an example of Crossing Type 6 (Conarch). The Conarch design minimizes change in channel geometry and produces minimal change in the hydraulics. Currently, there are no Conarch structures in the Carefree DMP study area.

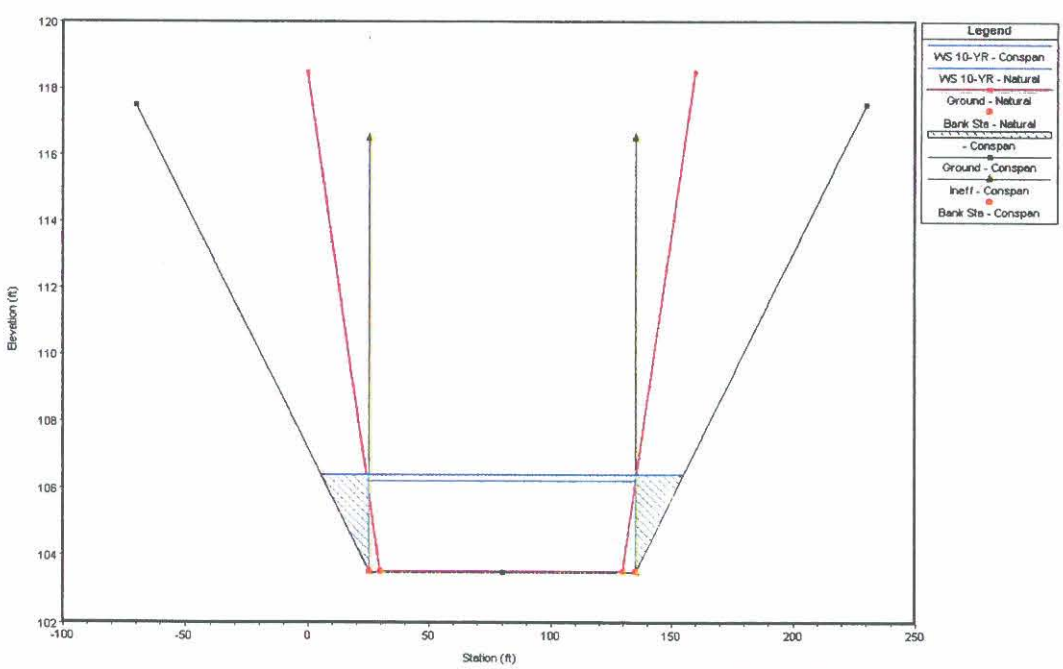


Figure 4-16. Conarch crossing as modeled in HEC-RAS.

Figures 4-17 shows an example of Crossing Type 7 (Bridge). There is minimal scour around the bottom of the pier of the bridge shown in Figure 4-17. Signs of weathering of the pier were observed during the field reconnaissance, but were attributed to construction practices rather than to bridge scour.

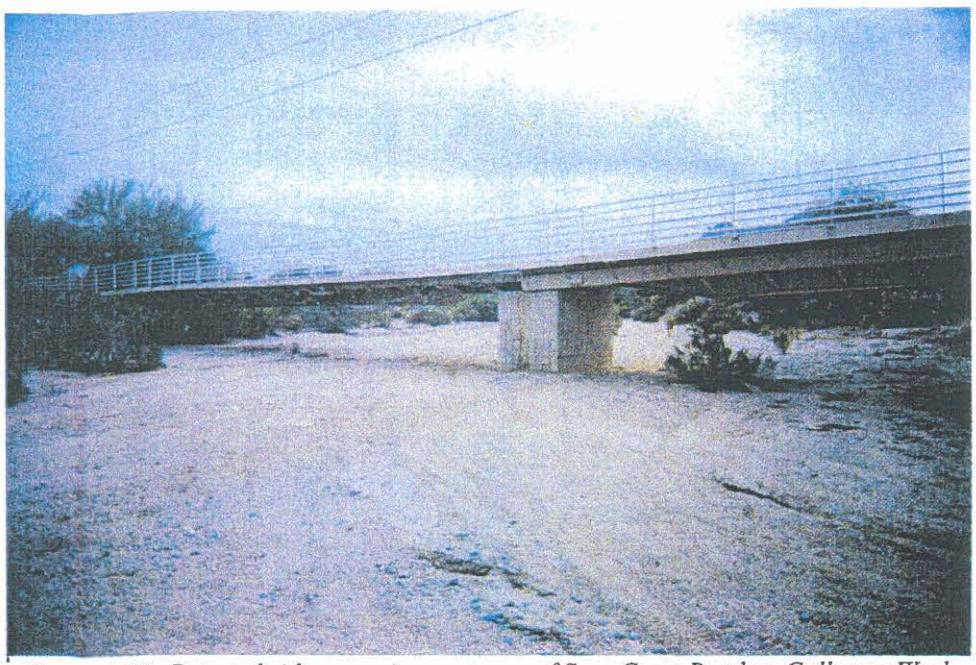


Figure 4-17. Private bridge crossing upstream of Spur Cross Road on Galloway Wash.

Results. The hydraulics of each crossing type were modeled using HEC-RAS, and was compared to the HEC-RAS natural condition hydraulics results. HEC-RAS input and output data are included in the Appendix. Profiles illustrating changes in water surface elevation are shown in Figures 4-18 to 4-22. All of the improved crossing HEC-RAS models produced similar results, with increased velocities over the paved section causing a small hydraulic jump at the downstream end of the crossing. The modeling results showing flow acceleration and a hydraulic jump are consistent with field observations of scour on the downstream side of the crossings. The box culvert (widened) alternative produced the least change in the upstream water surface elevation. However, this type of crossing resulted in a reduction in velocity upstream of the culvert due to the wider section. This reduction in velocity will cause sediment to be deposited upstream and within the culvert, causing the culvert to fill and requiring periodic maintenance, a condition that was observed in the field. The Conspan Arch model produced the least amount of change in the hydraulic variables. Given the size of the arch, it behaves more like a bridge than a culvert. The arch size selected was based available manufactured sizes and the best fit for the section, minimizing changes in geometry and conveyance area.

Figure 4-18. Profile comparing the natural condition versus Dip- no change crossing

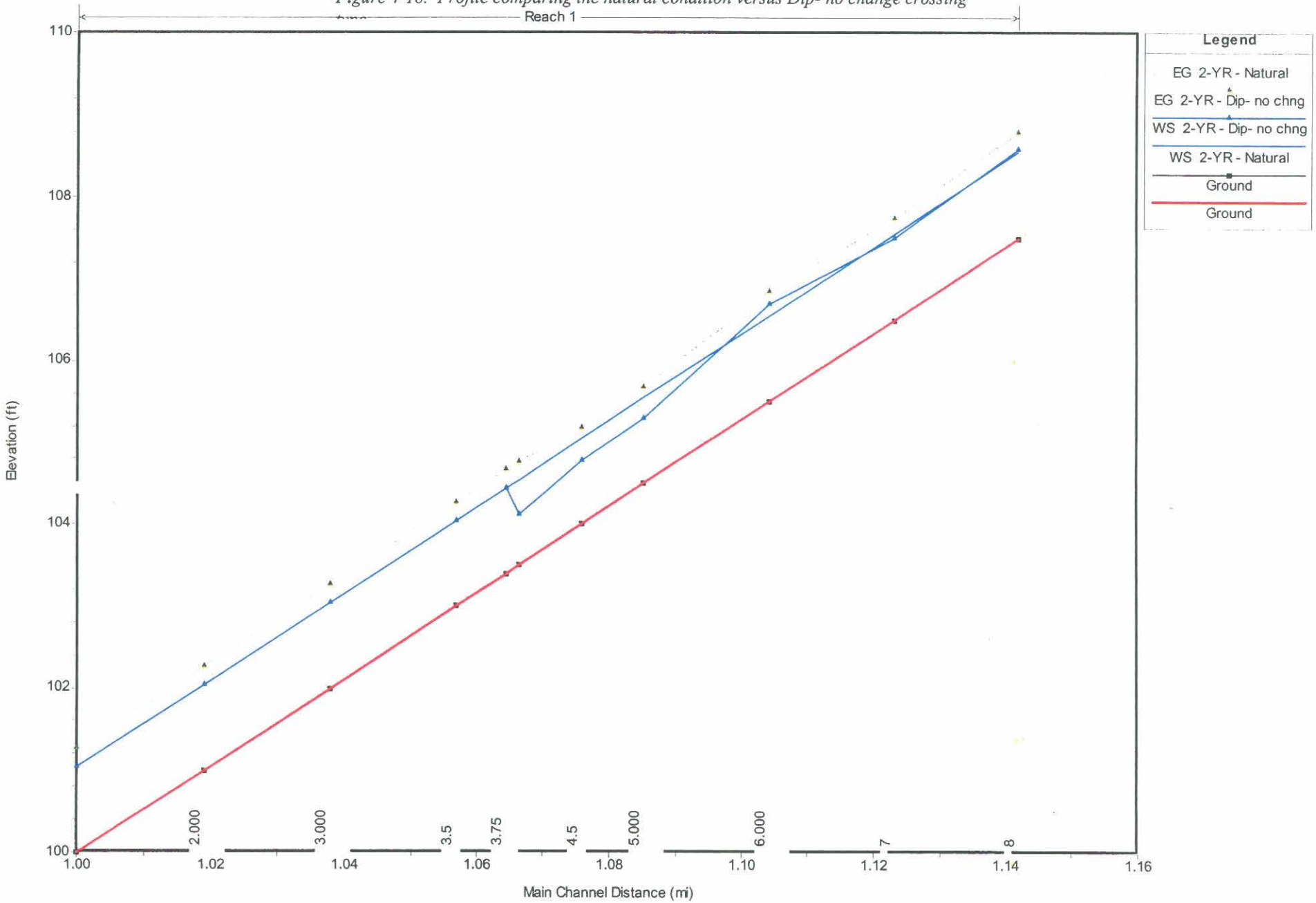
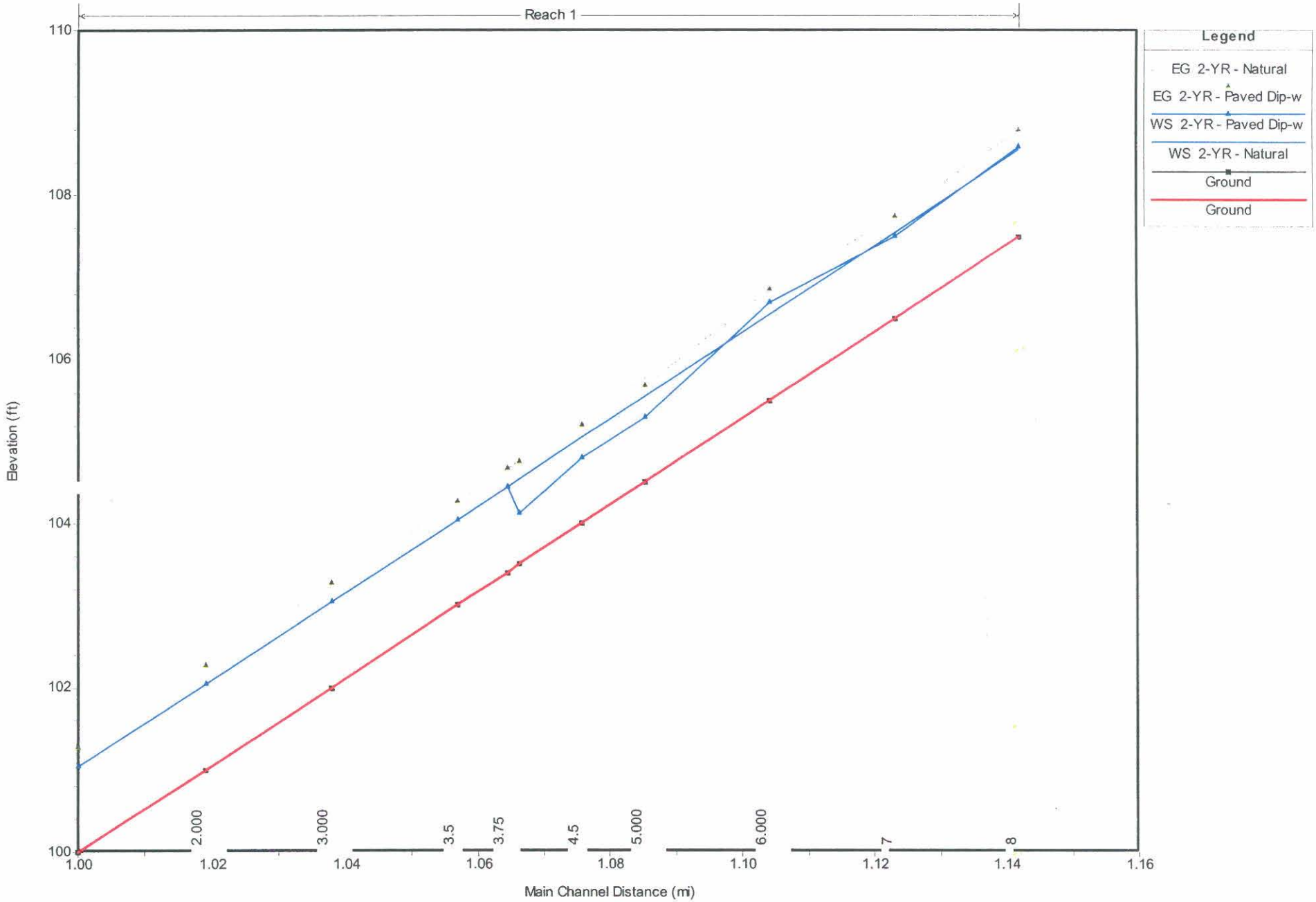


Figure 4-19. Profile comparing the natural condition versus Paved dip –widen channel crossing type.



M. Geza Kmetty/FCDMC
JEFuller, Inc.
2/12/02

Figure 4-20. Profile comparing the natural condition versus Dip-shallow channel crossing type.

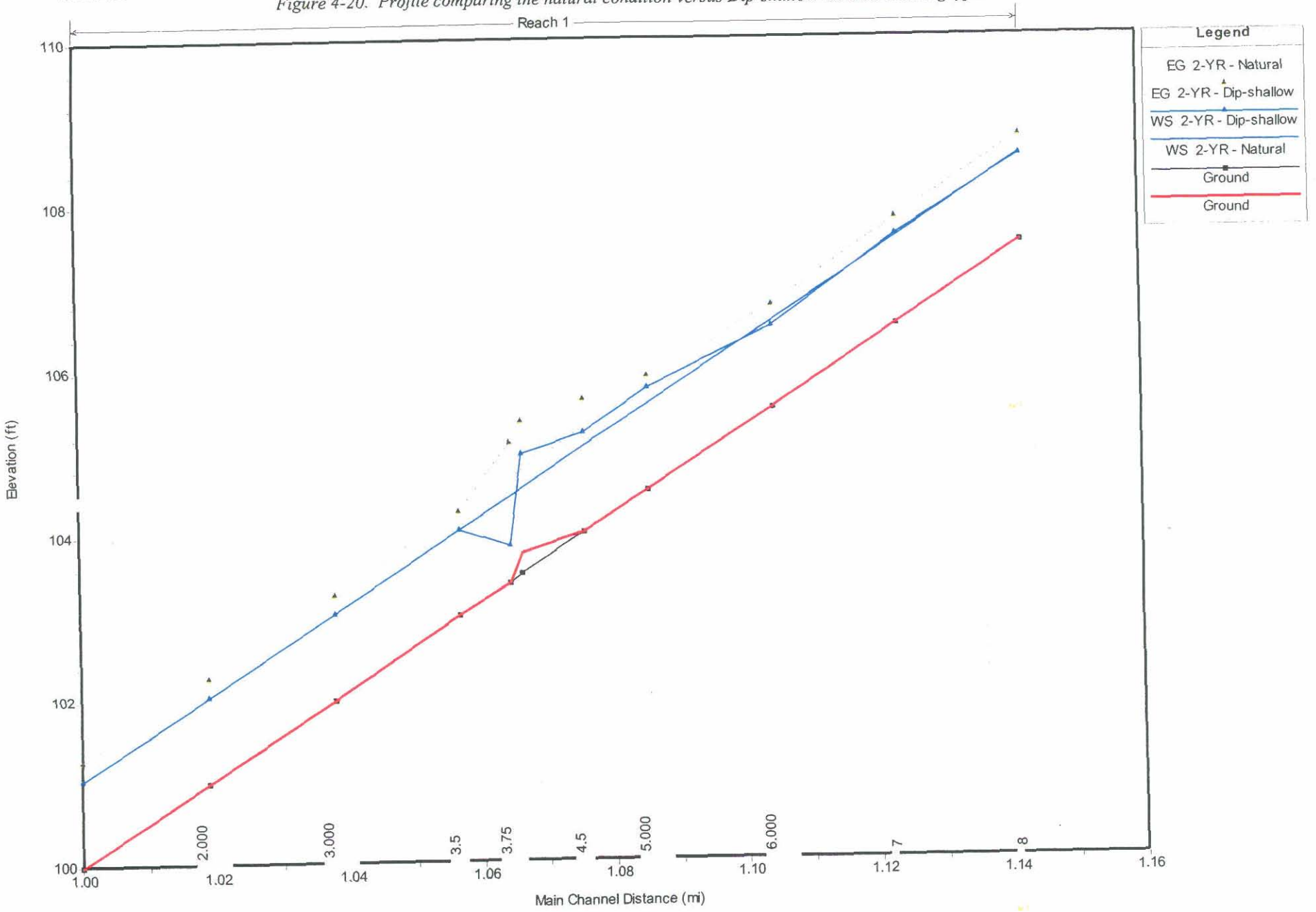


Figure 4-21. Profile comparing the natural condition versus Box-widen channel crossing type.

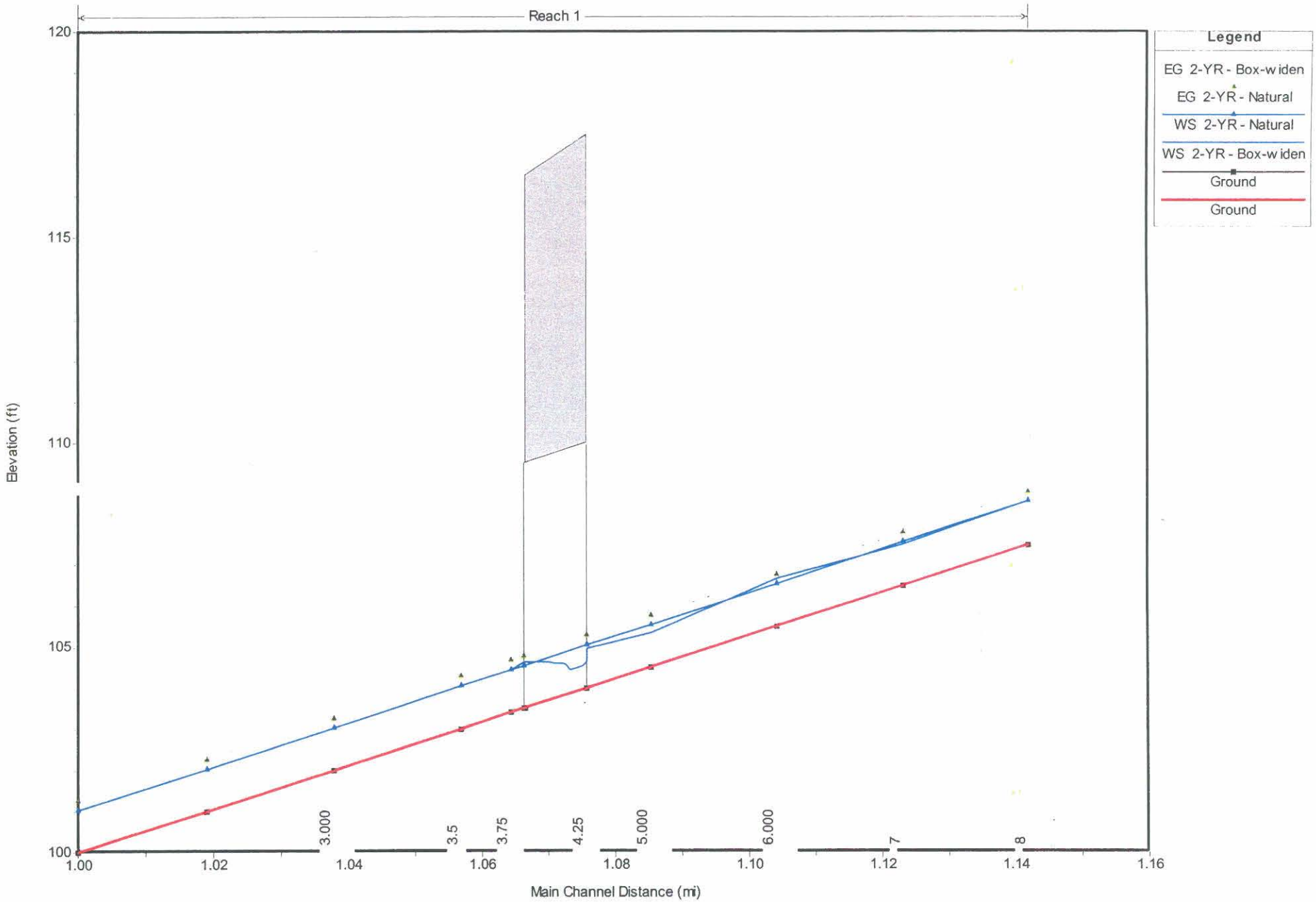
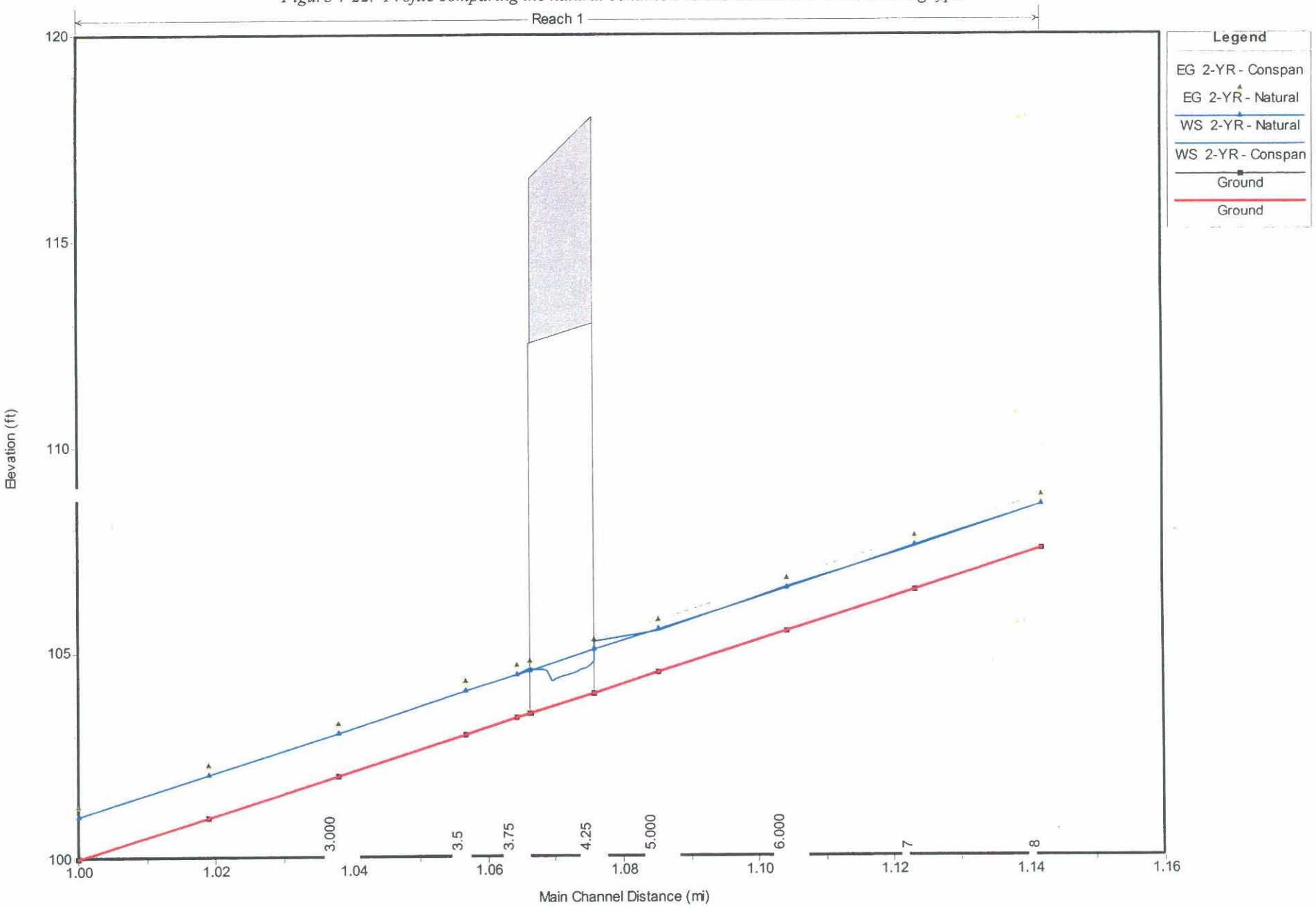


Figure 4-22. Profile comparing the natural condition versus Conarch channel crossing type.



Summary

The hydraulic and geomorphic analysis, as well as the spatial and temporal analyses, of the drainage crossings in the Carefreee DMP study area indicate that scour and sedimentation problems are most likely where the natural channel conditions are most disturbed. Crossings that narrow or widen the natural channel width tend to induce scour on the downstream side of the crossing, regardless of whether the crossing is at-grade, a bridge, or a culvert. Simply paving the crossing increases the incidence of downstream scour because changes in channel velocity over the paved section change the sediment transport capacity of the stream. The channels in the Carefree DMP study area may be especially susceptible to scour at road crossings due to their steep slope, sandy bed material, and frequent supercritical flow regime.

DATE: February 12, 2002

TO: Geza Kmetty/FCDMC
Doug Williams/FCDMC
Tony Bokich, P.E./CH2M Hill

FROM: Jon Fuller, P.E.
Tamara Norton, E.I.T.

RE: Carefree Drainage Master Plan
Sedimentation Engineering & Geomorphic Evaluation
Task 2.1.10

Introduction

A sedimentation engineering and geomorphic evaluation was completed for the Carefree Drainage Master Plan (DMP), a flood control planning study for the Town of Carefree. The objectives of the DMP are to quantify the extent of existing and potential flooding problems within the Town of Carefree, to develop alternative solutions to reduce flooding, and to evaluate and recommend emergency access routes. The sedimentation engineering and geomorphic evaluation assessed erosion and sedimentation patterns and characteristics within the Town of Carefree to provide a tool for estimating the long-term effects of flood control alternatives.

Conclusions

Cause of Channel Change. Channel change observed on the major watercourses in the study area during the period of record were well within expected natural fluctuation of channel position, bed elevation, and channel pattern. Flood flows have high velocities, sediment transport capacity, and erosive power. Therefore, it is concluded that the dominant causes of channel change are natural forces common to ephemeral streams in the Arid West. However, local scour and lateral erosion were accelerated in reaches with more intense floodplain encroachment and channel disturbance, particularly along Galloway Wash.

Cause of Sedimentation Problems at Road Crossings. Hydraulic analyses and geomorphic interpretation of landform and channel characteristics indicate that the primary cause of scour at road crossings is related to the design of the crossing. Paving an at-grade crossing or changing the geometry of the cross-section due to roadway construction causes increased velocities over and through the crossing, resulting in scour on the downstream end. Streams flowing at supercritical velocities with sand-sized bed material are more likely to experience scour problems at crossings than streams flowing at subcritical velocities with cobble or boulder beds.

Expected Channel Responses. Over the long-term, channels in the study area are expected to degrade and incise, especially where upstream development narrows the floodplain, increases rates of surface runoff, or decreases the sediment supply. The streams in the study area are highly unstable and sensitive to changes in the natural water and sediment supply, and especially to changes in channel pattern or width. Changing the geometry of the wash and floodplain anywhere along the reach, not only at road crossings, will induce a channel response of some sort.

Recommendations

Based on the conclusions of the sedimentation engineering and geomorphic analyses, the following recommendations are proposed for inclusion in the Drainage Master Plan for the Town of Carefree:

- Restrict Floodplain Encroachment. Future development in the Carefree DMP study area should minimize disturbances of the main channel and floodplain, and leave the natural floodplain area untouched.

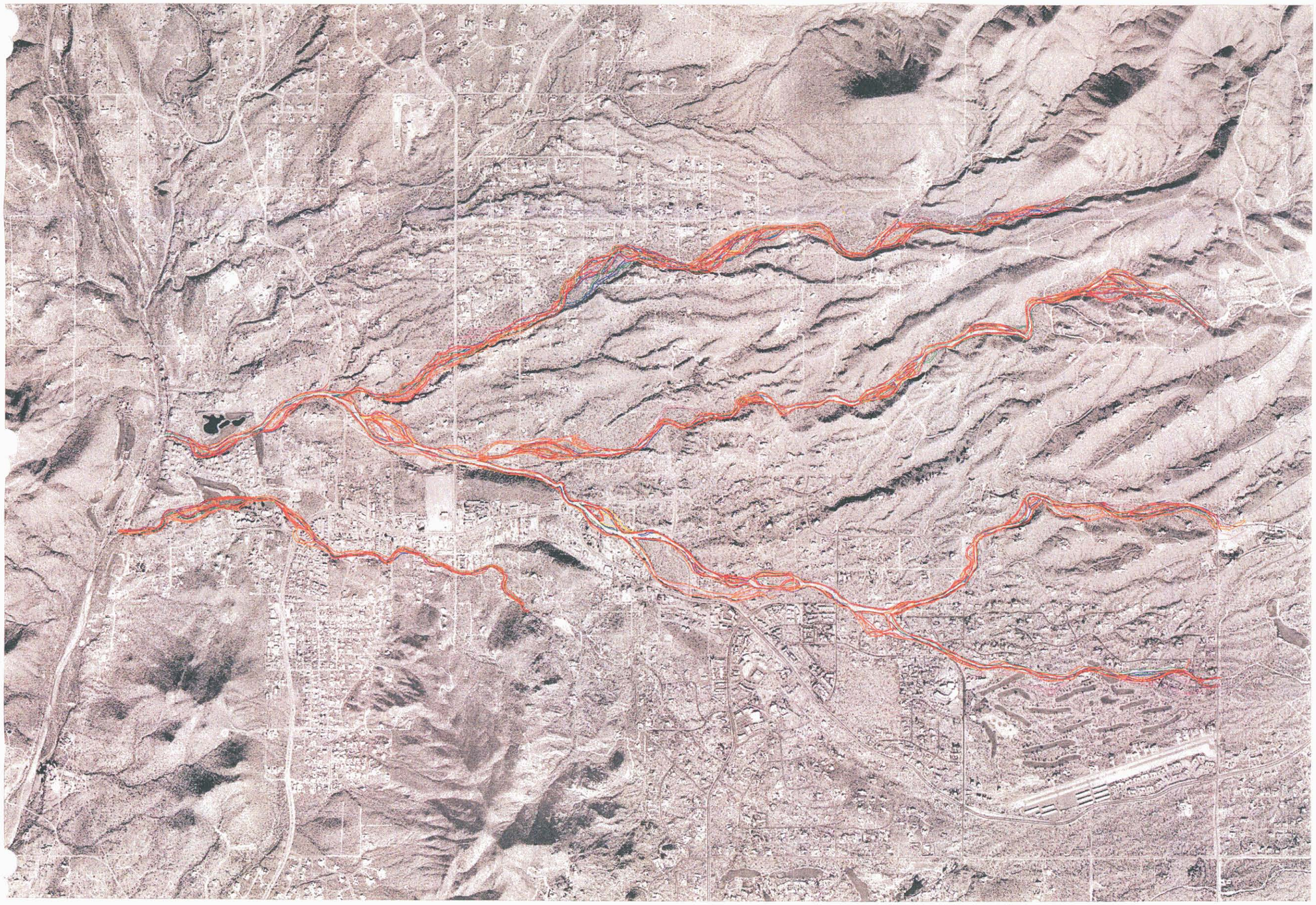
- At-Grade Road Crossings. At-grade road crossings should be designed to mimic the natural channel and floodplain cross section. Large diameter rock should be installed at the downstream sides of crossings to act as an energy dissipater over the expected length of the hydraulic jump.

- Culvert Crossings. Culverts should be designed to span the active channel, and not increase or decrease the natural channel width. Large diameter rock should be installed at the downstream sides of crossings to act as an energy dissipater over the expected length of the hydraulic jump. Where culvert crossings are necessary, they should maintain the bottom width and be designed to overtop.

- Bridges. Bridges that span the active channel and floodplain are the preferred mode of drainage crossing. Bridge crossings should be designed to minimize cross section geometry change. Bridges and Conspan arches are clearly the best choice, hydraulically speaking, but may not be economical. Where a dip crossing is necessary, appropriate scour protection at the downstream end is required. When possible, channel slope should be maintained through the crossing.

- Erosion Setbacks. Erosion hazard zones should be defined for major watercourses that consider the geology and geomorphology of the stream corridors, historical behavior of the streams in the study area, and expected future watershed changes.

- Regulatory Water Surface Elevation. Because of the historical fluctuations of channel bed elevations, additional freeboard should be applied to the 100-year water surface elevations used for floodplain management and for setting finished floor elevations to account for potential aggradation.



1999 Channel Bank location
1992 Channel Bank location
1985 Channel Bank location
1977 Channel Bank location
1962 Channel Bank location
1953 Channel Bank location

GRAPHIC SCALE
1000 0 500 1000 2000
(IN FEET)
1 inch = 1000 ft.

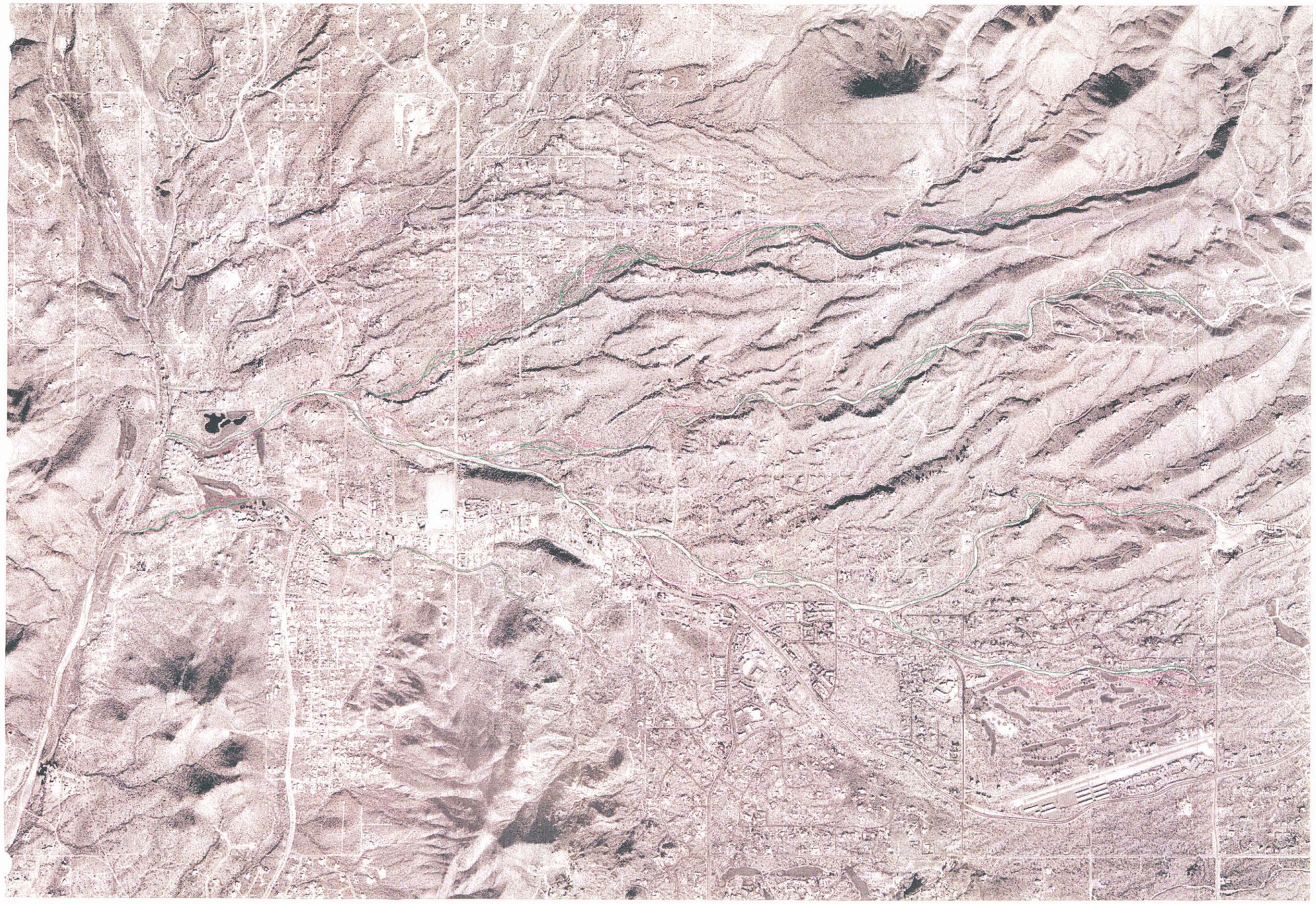
N

CAREFREE ADMP
EXHIBIT 2-1
HISTORICAL BANK LOCATIONS

CH2MHILL

Flood Control District of Maricopa County

JE FULLER
HYDROLOGY & GEOMORPHOLOGY INC



1999 Channel Bank location
1953 Channel Bank location

GRAPHIC SCALE
1000 0 500 1000 2000
(IN FEET)
1 inch = 1000 ft.

N

CAREFREE ADMP
EXHIBIT 2-2
HISTORICAL BANK LOCATIONS

CH2MHILL

Flood Control District of Maricopa County

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC

G1 Dip - Shallow, paved; Scour downstream, Deposition upstream.

G2 Dip - Shallow, paved; Head Cutting upstream, 4' drop downstream end.

G3 Dip - No Change, unpaved; No evidnece of scour or deposition.

G4 Box - Widen; Deposition upstream.

G5 Dip - Shallow, paved; Scour downstream, road being undercut.

G6 Dip - No Change, paved; No evidence of scour or deposition.

G7 Conarch; massive headcutting upstream, scour downstream.

G8 Dip - Narrow, paved; grading downstream, Deposition upstream.

G9 Dip - Narrow, paved; Scour downstream.

GN1 Dip - No Change, paved; Minor scour downstream.

GN2 Dip - Shallow, paved; headcutting upstream.

GN3 Dip - No change, paved; No evidence of scour or deposition.

A1 Dip - Shallow, paved; Wide angle, Scour downstream.

A2 Dip - Shallow, paved; Scour downstream, Sediment on roadway.

A3 Dip - No change, paved; No evidence of scour or deposition.

A4 Dip - No Change, gravel; No evidence of scour or depostion.

A5 Dip - Shallow, unpaved; Scour downstream, Ponding upstream.

A6 Dip - No change, paved; No evidence of scour or deposition.

A7 Box Culvert; No evidence of scour of deposition.

A8 Dip - Shallow, paved; Scour downstream, Deposition upstream.

A9 Dip - No change, paved; Minor scour downstream.

A10 Dip - Shallow, paved; Minor Scour downstream, Concrete protected.

A11 Dip - Shallow, paved; Minor pounding upstream, No evidence of scour.

A12 Dip - No change, paved; No evidence of scour or deposition.

A13 Dip - No change, paved; No evidence of scour or deposition.

A14 Box Culvert; No evidence of scour or deposition.

A15 Culvert, 5 - 36" CMPs; Pipes filled ½ with sediment.

A16 Box Culvert; No evidence of scour or deposition.

A17 Dip - No change, paved; Scour downstream.

A18 Dip - No change, recently paved; Unsure of stability.

GR1 Dip - No change, paved; No evidence of scour of deposition.

GR2 Dip - Narrow, unpaved; Grading on left braid due to deposition.

GR3 Dip - Narrow, oiled; Scour downstream, graded upstream.

GR4 Dip - No change, unpaved; No evidence of scour or deposition.

R1 Dip - No change, unpaved; No evidence of scour or deposition.

R2 Dip - Narrow, concrete; Scour downstream.

R3 Dip - No change, unpaved; No evidence of scour or deposition.

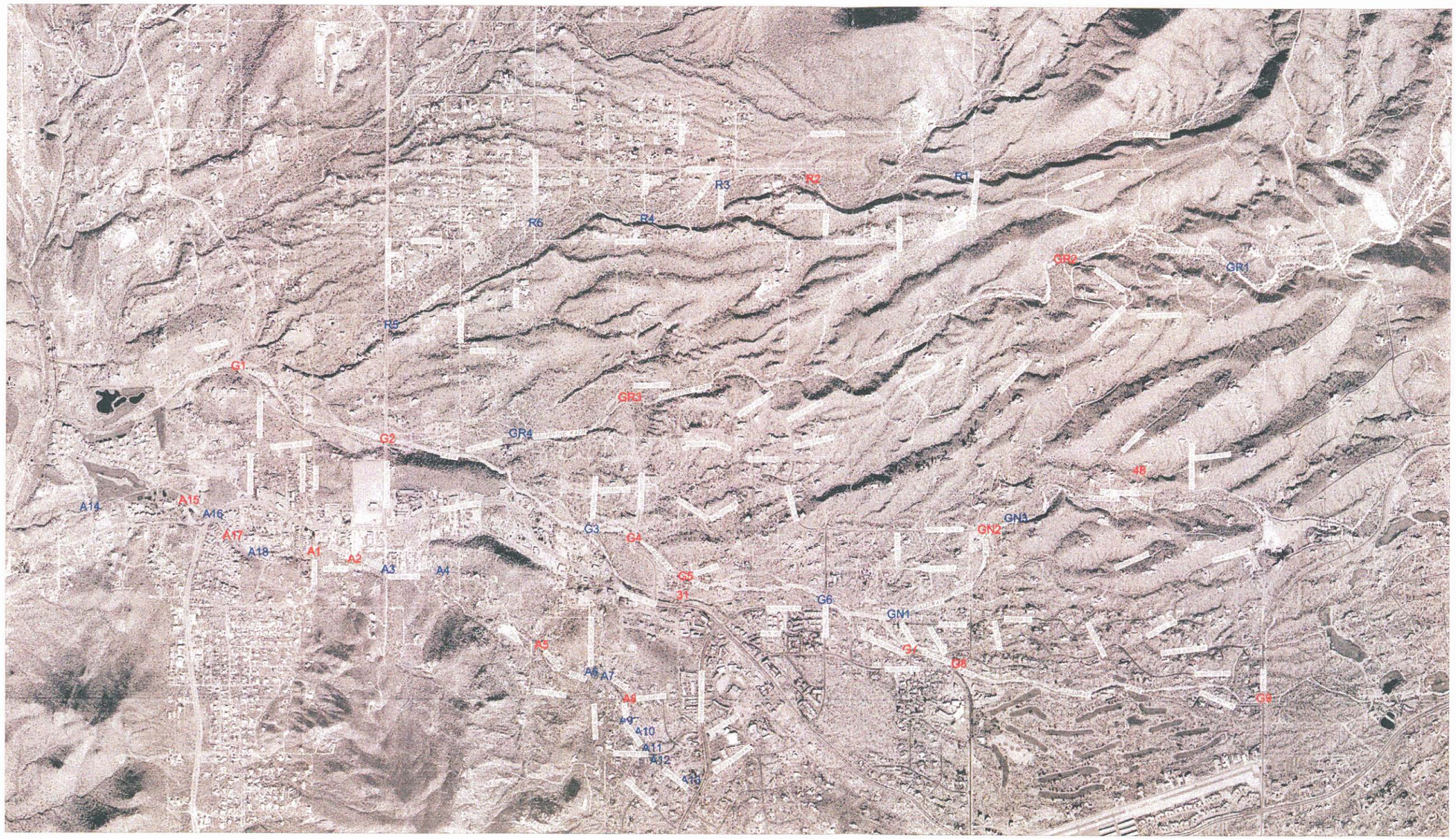
R4 Dip - No change, unpaved; No evidence of scour or deposition.

R5 Dip - Narrow, paved; No evidence of scour or deposition.

R6 Dip - No change, unpaved; No evidence of scour or deposition.

48 Dip - Shallow, paved; Scour downstream.

31 Dip - Shallow, paved; Scour downstream.



LEGEND

GN2 Crossing Label, Indicating Scour

GN3 Crossing Label, Indicating No Scour

GRAPHIC SCALE

1000 0 500 1000 2000

(IN FEET)
1 inch = 1000 ft.

N

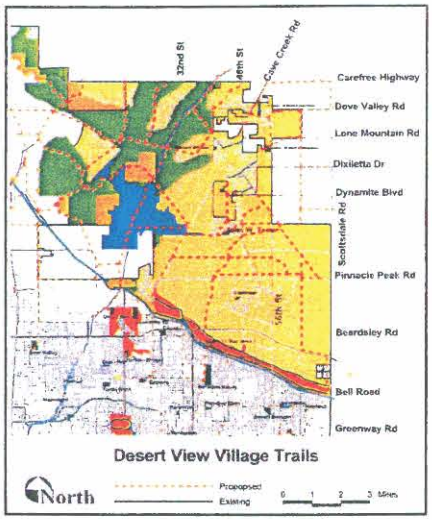
CAREFREE ADMP
EXHIBIT 4-1
ROAD CROSSING LOCATIONS

CH2MHILL

Flood Control District of Maricopa County

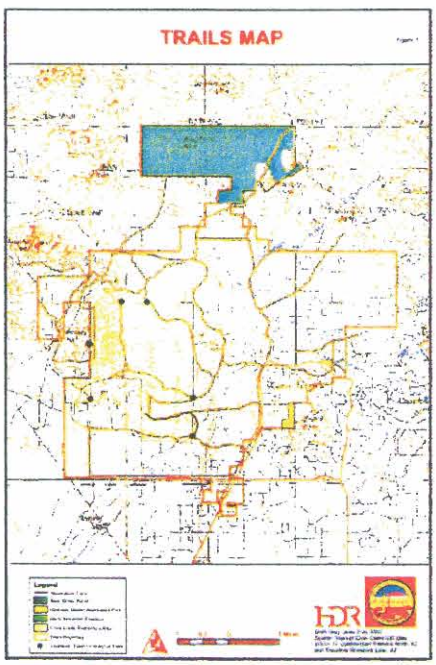
JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC

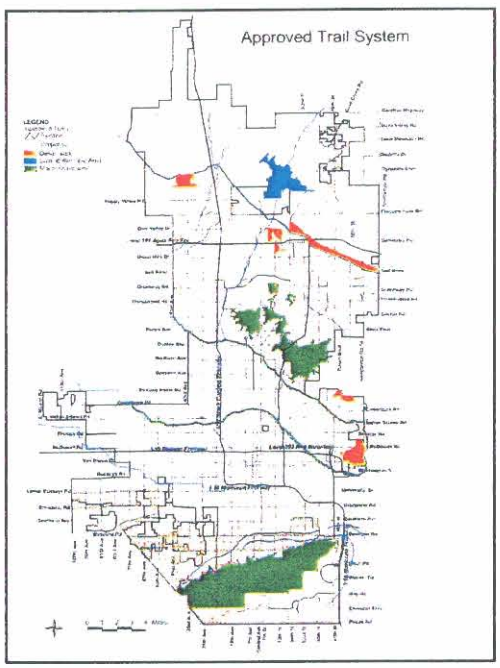
Appendix A – Tables

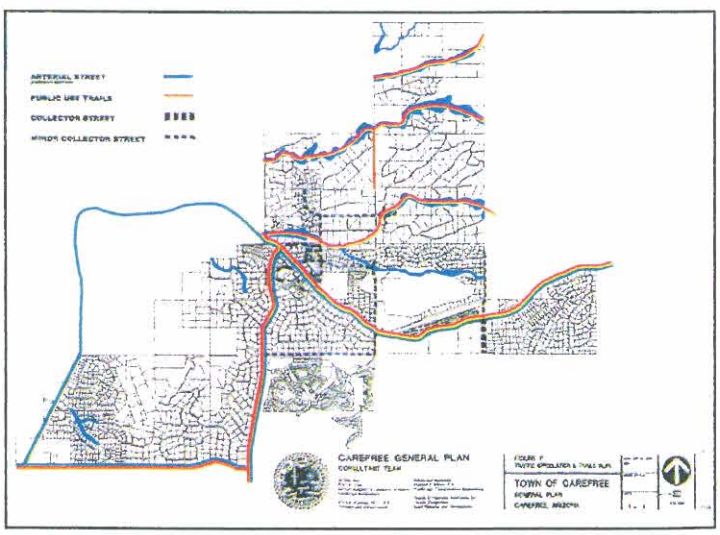


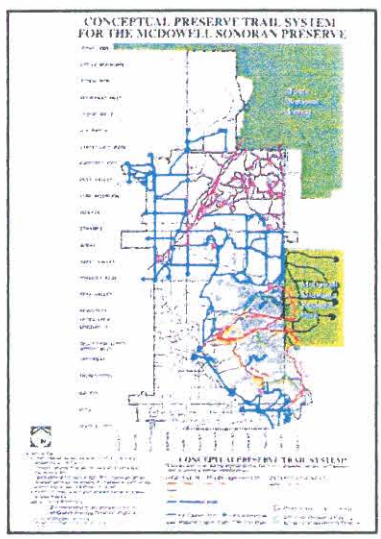
CAREFREE DRAINAGE MASTER PLAN
TRAILS COMPONENT

TASK 1: RECONNAISSANCE









HDR

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TOWN OF CAVE CREEK	9
OCTOBER 3, 2001 FOCUS GROUP MEETING	11

1. INTRODUCTION AND PURPOSE

This report provides an inventory of existing and planned trails and trail access areas. The purpose of this inventory is to identify opportunities for connections to trails that could be considered along and within floodplains and drainage ways within the Carefree Drainage Master Plan study area. Opportunities to use flood control facilities to enhance or complement this inventory will be addressed during the upcoming alternatives phase of the project. Draft and final opportunities for specific multiple use facilities will be provided in the recommended Drainage Master Plan.

Information contained in this report was obtained from published plans and documents, interviews with staff and elected officials representing the Cities of Scottsdale and Phoenix, the Towns of Cave Creek and Carefree, and Maricopa County.

2. TOWN OF CAREFREE

2.1 Town of Carefree General Plan

The Town of Carefree updated its' General Plan in December 2000. While non-motorized circulation opportunities are not identified in the Plan as an issue, the Plan includes the following policies regarding the development of trails within the Town:

Policy: The Town will work with neighboring communities in evaluating and implementing a connecting trail system that will provide access to valuable recreational opportunities. (Regional Development, page 33.)

Policy: The Town will continue to explore shared use of other publicly owned facilities, i.e., school recreational facilities. (Population, page 35.)

Objective: To preserve major open space/recreation areas available to all its residents. (Land Use, page 35.)

Objective: Provide alternative modes of transportation such as walking trails and bikeways to the Town's residents. (Traffic Circulation, page 37.)

Policy: The Town will evaluate the need for a system of walking, hiking, biking and horseback trails throughout the Town that may also connect with trail systems in adjacent communities. (Traffic Circulation, page 37)

In addition to the policies and objectives in the plan, the Traffic Circulation and Trails Plan Element includes a Trail System section. This section states "The proposed trail system includes a long range plan for the development of trails throughout the Town. The design for each trail segment will take place as public access is approved. Bikeways will be considered along major roadways including the portions of Cave Creek Road that are in Carefree, Carefree Highway between Cave Creek Road and Tom Darlington Drive, along Tom Darlington Drive, and along Mule Train and Carefree Drive. Bikeways should be developed after documentation of need and further design analysis."

The Plan additionally includes a Traffic Circulation and Trails Plan Map that identifies public use trails along Grapevine, Galloway and Fleming Springs washes. Figure 1 shows the Town of Carefree Circulation and Trails map.

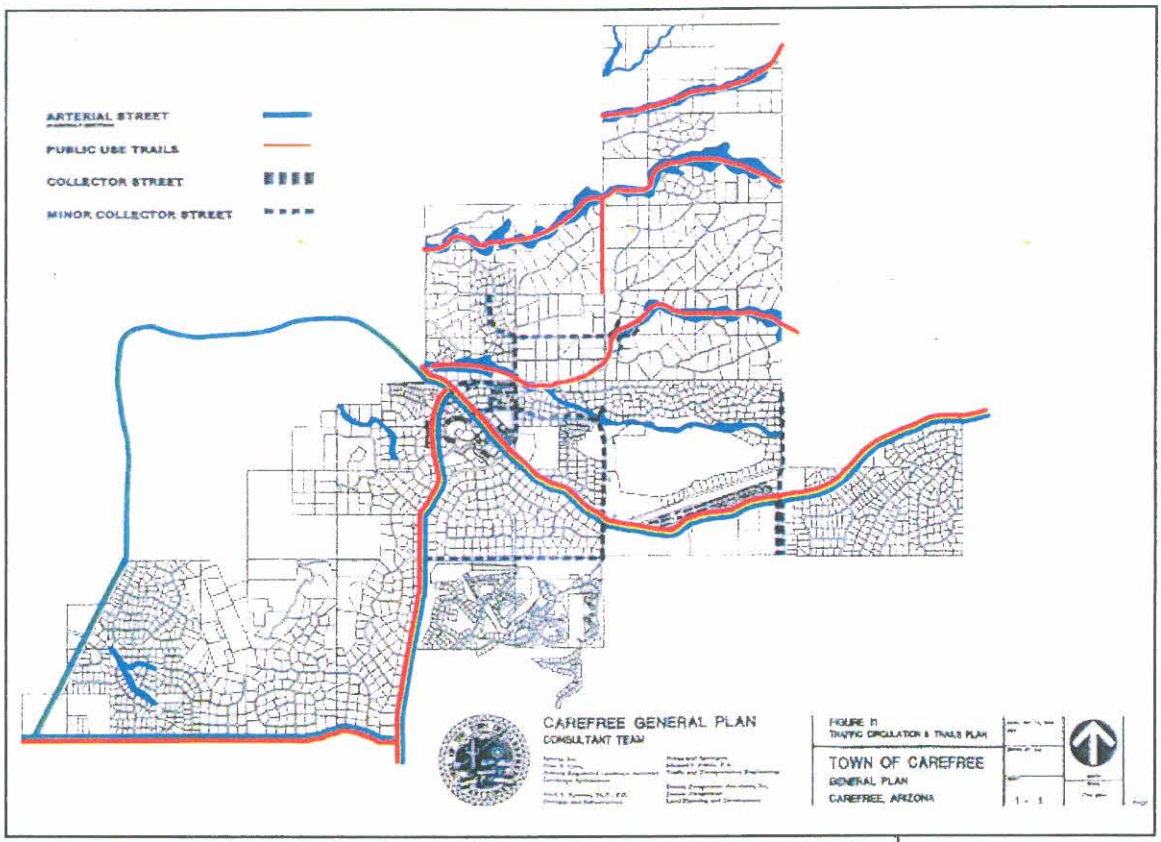

Figure 1: Town of Carefree Traffic Circulation and Trails Plan [1]

3. CITY OF PHOENIX

The City of Phoenix is located to the south east of Carefree. It has an adopted trails plan and trails standards and has adopted specific goals, policies and recommendations regarding the provision, construction and maintenance of trails in its General Plan.

3.a Trails Definitions:

The City permits three types of trails; a multi-use, shared use and private trail.

Multi-Use Trail:

- Barrier Free Trail
- Can occur in gentle topography or hilly locations where use in is anticipated to be relatively heavy.
- Grades are generally easy to negotiate.
- Maximum sustained longitudinal slope of 20:1 or 5%.
- Tread width minimum of ten (10) feet.
- Surface shall be compacted, stabilized, decomposed granite.
- Must meet all Americans with Disabilities Act (ADA) requirements.

Shared Use Trail:

- Non-equestrian Trail
- Occurs in areas with easy to moderate topography

[1] This map is available for reproduction only as a paper map.

- Slopes up to 5% (20:1 for short distances).
- Tread width minimum of ten (10) feet.
- Cross slope maximum of 3%.
- Must meet all ADA requirements.

Private Trail:

- Should follow the Shared Use Trail or Multi-Use Trail Guidelines.

3.b. Trails Specifications:

Trails specifications are included in Appendix A of this report. They address grade, tread, vegetation clearance and removal, vertical height, plants, surface treatment, and locations. Specifications additionally exist for switchbacks and underpass or bridge clearance. A copy of the specifications is located in Appendix A of this report.

3.c. Trails Plan

The adopted City of Phoenix Trail System Map and the adopted City of Phoenix Desert View Village Trails Plan shows a trail along Carefree Highway between Scottsdale Road and Cave Creek Road. This trail is planned to connect to a future trailhead at an unnamed park at 52nd Street and Dove Valley Road. The trail also provides connections to the Sonoran Preserve which extends as far east as 48th street along the Carefree Highway. The trail shown on the Desert View Village Trails Plan and on the adopted City of Phoenix Trail system map is not within the City of Phoenix incorporated area. Figure 2 shows the Desert View Village Trails Plan and Figure 3 shows the City of Phoenix Trail Plan.

3.d. City of Phoenix General Plan

The City of Phoenix ratified its General Plan in March 2002. The General Plan addresses pedestrians, bicycles and non motorized transportation in a variety of elements and has the following specific goals and objectives related to washes and trails in the Open Space and Recreation Elements:

Open Space Element

Goal 2	**Linear Open Space** – Linear systems of Open Space such as canals, washes, drainage corridors, and rivers should contribute to a continuous non-motorized trail system that serves as an alternative transportation system, provides a positive recreational experience, and forms a neighborhood amenity.
Policy 4	Consider applying canal design guidelines to other canal drainage systems.
Recommendation 1	Monitor developments adjacent to canal banks, washes, rivers, and drainage corridors, utilizing new standards and guidelines.
Goal 3	**Desert Parks and Preserve Trails** – A network of shared use trails and pathways that is safe, convenient, and connected within an open space system of desert parks and preserves should be created, managed and preserved.
Policy 2	**Integrate the trails system into the regional network.**
Recommendation 1	Update the City trails/pathways plan, including an inventory by location, types of surface, management responsibilities, etc.
Recommendation 2	Develop standards for planning design, and management of trails and pathways within parks, preserves, open space and rights of way.

Recommendation 3 Prepare and distribute maps, brochures, and other information on the trails and pathway system in order to inform the public of current and future opportunities. An interactive worldwide web Internet site should be the primary component of the system.

Recreation Element

Goal 3 **Trails** – Develop throughout the City a functional network of shared trails that are accessible, convenient, and that connect parks, major open spaces and Village Cores.

Policy 1: Encourage and where appropriate require private developers to provide public trails within their developments.

Policy 3: Connect public parks with pedestrian destinations and open space areas created in conjunction with urban development.

Policy 4: Plan, design and develop pedestrian linkages between parks, open spaces and the Village Cores.

Policy 5: Provide, preserve and manage trails in parks and open space.

Policy 6: Encourage the widest possible range of opportunities for non-motorized recreation and multi-modal transportation systems.

Policy 7: Prepare standards for planning, design and management of trails and pathways within parks, preserves, open space and rights of way.

Recommendation 1: Develop a trails and pathways system plan.

Recommendation 5: Create standard details, signage, locational criteria and other design guidelines to establish consistency within the trails and preserve system.

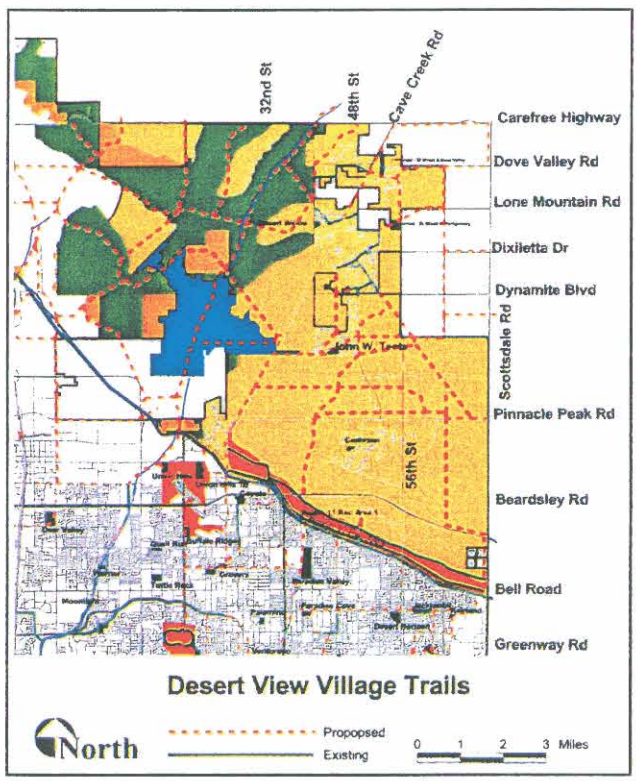

Figure 2 –City of Phoenix Desert View Village Trails Plan

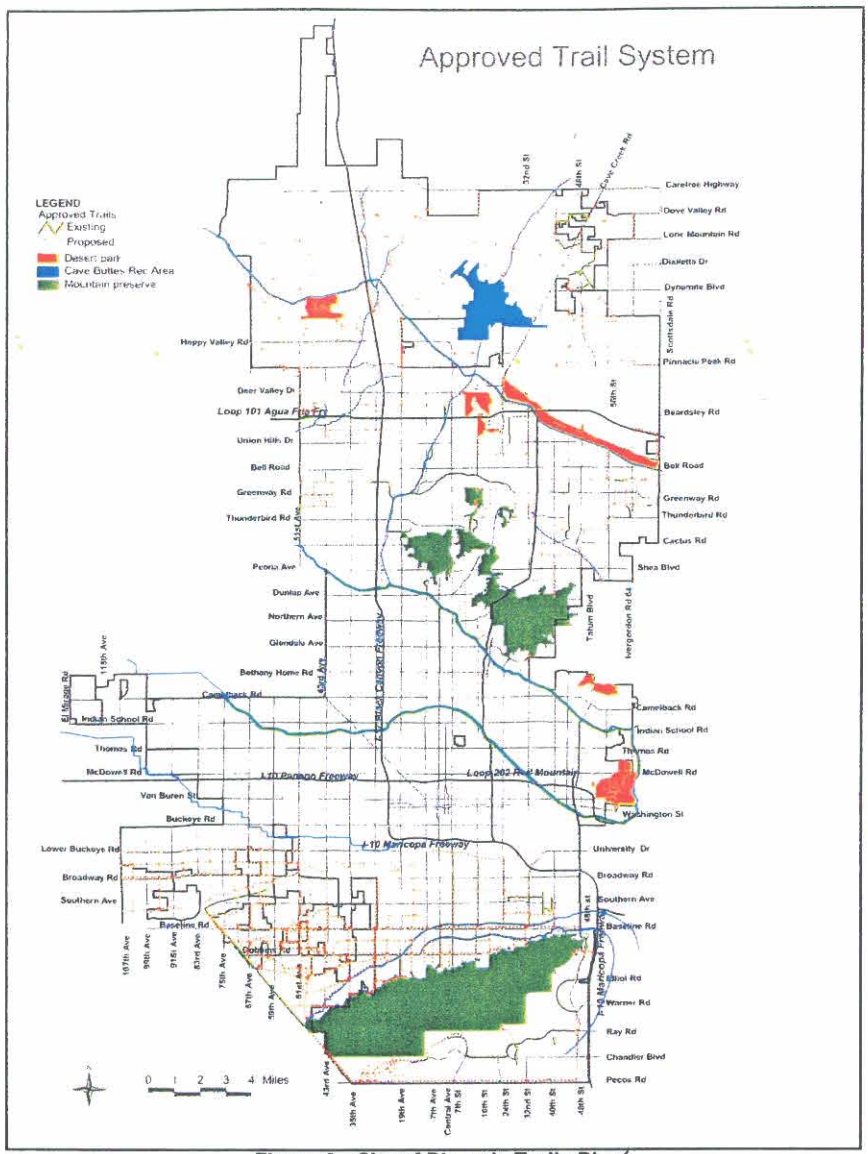

Figure 3 - City of Phoenix Trails Plan[2]

4. CITY OF SCOTTSDALE

The City of Scottsdale borders the Town of Cave Creek to the east and south. The City is presently developing a trails plan, and was able to provide information on trails that are planned or being constructed as a part of private development projects. It has adopted design standards and policies for Non-Paved Trails. These are included in Appendix B. The City has additionally adopted specific goals and approaches regarding the provision of trails within its General Plan.

4.a. Trails Definitions

The City defines five kinds of trails; Urban trail, Rural trail, Backcountry Primary Trail, Backcountry Secondary Trail, Interpretive Trail and Barrier Free Trail.

Urban Trail

- Maximum sustained grade not to exceed 8% (maximum 10% grade for crossings, dips and other situations not exceeding 50 linear feet).
- Minimum tread eight (8) feet.

[2] This map is only available for reproduction as a paper map.

- Surface should be composed of native soils in undisturbed desert areas, decomposed granite in areas that have been graded, landscaped or are unnatural.
- Trail should have a minimum impact on surrounding vegetation.
- Cross slope of 3% to 5%.
- Must be contained in a minimum 15' wide trail easement.

Rural Trail

- Maximum sustained grade not to exceed 10%. (Maximum 15% grade for wash crossings, grade dips and other areas not to exceed 100 linear feet).
- Minimum tread 6'.
- Surface should be native soils or decomposed granite in areas that have been graded, landscaped or are unnatural.
- Trail should have minimum impact on surrounding vegetation.
- Cross slope of 6% to 10%.
- Must be contained in a minimum 25' trail easement.

Backcountry Primary Trail

- Maximum sustained grade 10%. (Maximum grade of 15% allowed for wash crossings, grade dips and other areas not to exceed 100').
- Minimum tread 4'.
- Surface must be native soils.
- Trail should have a minimum impact on vegetation.
- Cross Slope of 6% to 10%.
- Typically located within large open space areas controlled by the City, or within a 50' trail easement.

Backcountry Secondary Trail

- Maximum sustained grade 15%. Maximum grade of 20% for wash crossings, grade dips and other areas for a distance not to exceed 25 linear feet.
- Tread 2'.
- Surface must be native soils.
- Trails should be designed to have a minimum impact on vegetation.
- Cross Slope of no less than 10%.
- Typically located within large open space areas controlled by the City, or within a 50' trail easement.

Interpretive

- Primary function to provide educational opportunities for all users.
- Maximum sustained grade not to exceed 10%. (Maximum grade of 15% allowed for wash crossings, grade dips and other areas not to exceed 100 linear feet.)
- Tread between 4' to 6'.
- Surface should be native soils or decomposed granite in areas that have been graded, landscaped or are unnatural.
- Minimum impact on vegetation
- Cross slope of 3% to 5%.

Barrier Free Trail

- Provide opportunities for persons with physical disabilities including mobility, visual, and hearing impairments, and shall meet the standards of the Americans with Disabilities Guidelines (ADA).
- Maximum sustained grade 5% or constructed to handicapped ramp standards.
- Total trail distance maximum 1.5 miles.
- Tread 7' for two directional travel, 5' for one direction travel.
- Minimum impact on native plants.
- Cross slope from 1% to 3%.
- Surface must be accessible.

4.b Trails Specifications

Trail construction and sign and marker guidelines and cross sections are located in appendix B.

4.c. Projects to the immediate east of Carefree:

Carefree Ranch Homesteads.

- Platted in the County. Very rugged terrain with no dedications for trails in either wash. Residents don't want trails and washes and don't need anything from the City, so it is unlikely that there will be trails or facilities in the near future.
- One wash has a lot of petroglyphs.
- Desert Hills probably won't plat north of carefree north boundary...Rockaway Hills.
- Desert Foothills Trail starts at gatehouse near Joy Ranch Road.

Scottsdale Road and Carefree Highway:

- Trail easements on the south side of Carefree Highway from Scottsdale Road west to about 58th St. – Good connection on anything that intersects with Carefree Highway north of 58th Street.
- Planned grade separated crossing at Pima and Stagecross. This will accommodate horses, etc. when Pima is rebuilt.

4.d. Trails Maps

The City has two trails maps that are currently in use. The City Conceptual Preserve Trail System for the McDowell Sonoran Preserve describes trails and connections to and within the Preserve. The City of Scottsdale Public Trails Map is under revision and shows trails outside the Preserve influence area.

The City Conceptual Preserve Trail System for the McDowell Sonoran Preserve.
This map identifies destination trails along Scottsdale and Pima Roads and Carefree Highway. The Carefree Highway trail is coincident with the Trail identified in the City of Phoenix Plans. A Grade separation is identified for the Trail at Stagecoach Pass and Pima Road. Additional trails are identified at Rockaway Hills Road, but this is unlikely due to the current development pattern and property owner resistance. Figure 4 describes the Scottsdale Conceptual Preserve Trail System.

City of Scottsdale Public Trails.
This map reflect the trails on the Conceptual Preserve Trail System Map and shows additional trails at Circle Mountain and Jenny Lynn Roads. Figure 5 describes the City of Scottsdale Public Trails Map.

4.e. City of Scottsdale General Plan

The City of Scottsdale General Plan includes several statements about connecting and integrating open space into development throughout the City. These areas are identified below:

Land Use Element:

Approach: Provide an interconnected open space system that is accessible to the public, including pedestrian and equestrian links, recreation areas and drainage ways.

Approach: Incorporate open space, mobility and drainage networks while protecting the area's character and natural systems.

Approach: Develop and reinforce links (i.e. trails, paths, open space, transit, and streets) within and between residential, retail, employment recreational and other public land uses.

Open Space and Recreation Element

Value: The developing potential of existing open space resources represented by school grounds, flood control areas and other open spaces.

Approach: Develop a non-paved public trail system for hiking, mountain biking, and horseback riding and link these trails with other City and Regional Trails.

Approach: Permanently secure an interconnected open space system to maintain visual and functional linkages between major city open spaces. This system should include significant Scottsdale landmarks, major drainage courses, regional linkages and utility corridors.

Approach: Support other agencies in the development of regional pedestrian/bicycle /multi-use trails.

Approach: Provide trailhead facilities that provide parking and trail access for users where needed and appropriate.

Approach: Develop parks, paths and trails with the participation of private development through required fees, dedication of land and construction of facilities.

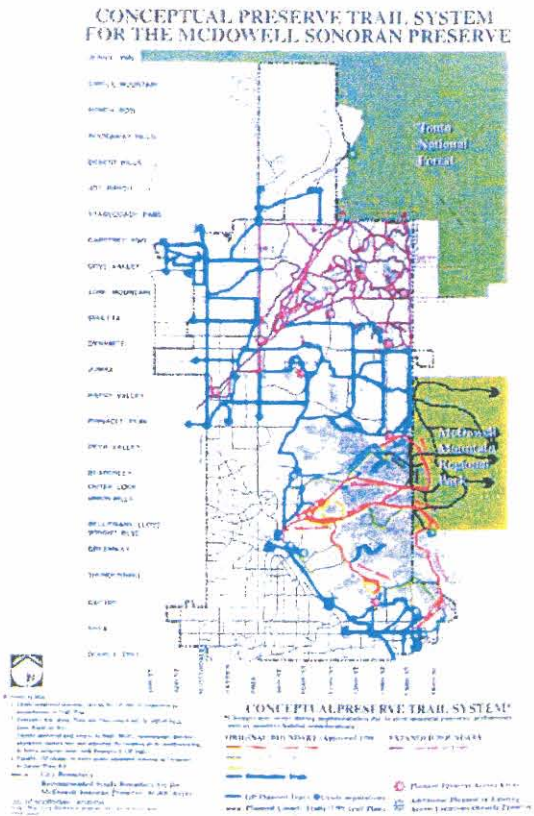

Figure 4 – City of Scottsdale Conceptual Preserve Trail System for the McDowell Sonoaran Preerve[3]

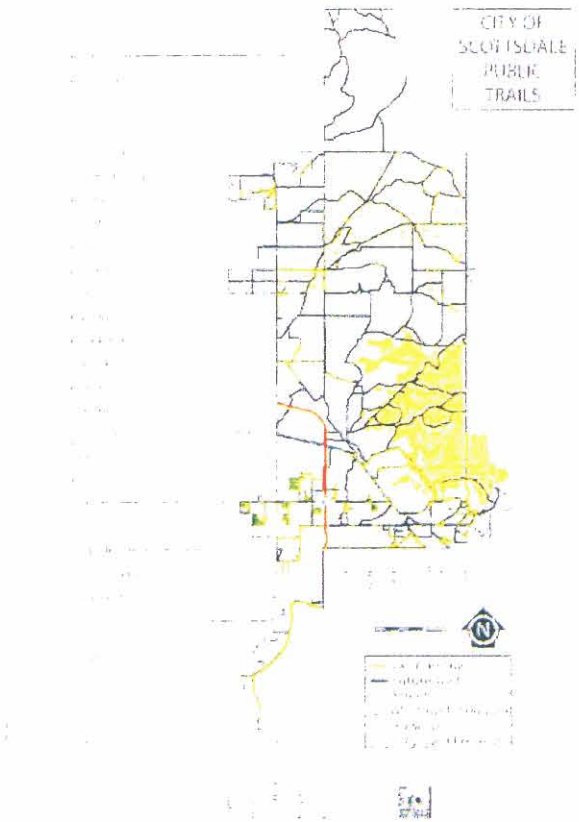

Figure 5 – City of Scottsdale Public Trails Map[4].

[3] This map in only available for reproduction in a paper format.

[4] This Map is only available for reproduction in a paper format.

5. TOWN OF CAVE CREEK

The Town of Cave Creek has trails standards in its subdivision ordinance. It is currently updating its General Plan. The General Plan contains a trails plan and Goals, objectives and policies that address the provision of trails throughout the Town.

5.a. Cave Creek Trails Standards.

- 15 foot easement
- Design standards for subdivisions include trails standards

5.b. Cave Creek Trails Plan.

The Town has trails planned for Andora, Galloway, Grapevine and Fleming Springs Washes. Figure 6 describes the proposed Town of Cave Creek Trails Map.

5.c. Town of Cave Creek General Plan

The Town is in the process of revising its General Plan. The proposed draft includes the following goals, objectives and policies related to trails and washes.

Environmental Element

Goal 5, Objective B, Policy 2	Encourage perpendicular wash crossings.
Goal 5, Objective C, Policy 3	Develop signs that indicate trail location and prohibit off-trail travel.
Goal 8, Objective B, Policy 3	Restrict development in or near stream courses or wetlands.
Goal 9, Objective B, Policy 4	Avoid placement of fill or development within floodplains or floodways.
Goal 12, Objective A	Connect open spaces within and adjacent to the Town with non-motorized, shared use trails.
Goal 12, Objective A, Policy 1	Develop and implement a Trails Master Plan.
Goal 12, Objective A, Policy 2	Work with the Flood Control District of Maricopa County and property owners to integrate washes into a public Town-wide recreational open space network.
Goal 12, Objective A, Policy 3	Continue to work with the cities of Phoenix and Scottsdale, the Town of Cave Creek, the Tonto National Forest and Maricopa County to identify and develop connections to countywide, regional, and other local trails.
Goal 12, Objective A, Policy 4	Provide connectivity between Cave Creek Recreational Area, the Tonto National Forest and the significant wash corridors and mountains and hillsides in the planning area.
Goal 12, Objective B	Design trails to minimize impacts to riparian habitats and wildlife habitat and movement corridors.
Goal 12, Objective B, Policy 1	Promote placement of trails primarily in uplands parallel to stream courses, with limited stream/wash crossings.
Goal 12, Objective B, Policy 2	Continue to use signs that indicate trail locations and prohibit off-trail travel.
Goal 12, Objective C	Design trails to complement and enhance understanding of cultural resources, vegetation and views.
Goal 12, Objective C, Policy 1	Develop interpretive signs that inform trail users about the ecology and cultural history of the area.
Goal 12, Objective D	Identify/develop funding sources and mechanisms for trail development and maintenance.
Goal 12, Objective D, Policy 1	Policy: Continue to apply for federal, county, state and other grants to acquire land for, design and construct trails.

Goal 12, Objective D, Policy 2	Continue to work with property owners, land trusts and other entities to obtain trail access.
Goal 12, Objective D, Policy 3	Require dedications for trails easements from development adjacent to washes, trail corridors identified in this plan or other plans incorporated by reference as a condition of plat or building permit approval.
Goal 12, Objective E	Provide adequate facilities for equestrians, pedestrians and bicyclists and to accommodate persons with disabilities.
Goal 12, Objective E, Policy 1	Encourage all trail to provide a separate, unpaved path for equestrian use.
Goal 12, Objective E, Policy 2	Encourage the dedication and development of trail heads, parking areas, hitching posts, and other facilities for bicycles, equestrians, and pedestrians when feasible and appropriate.

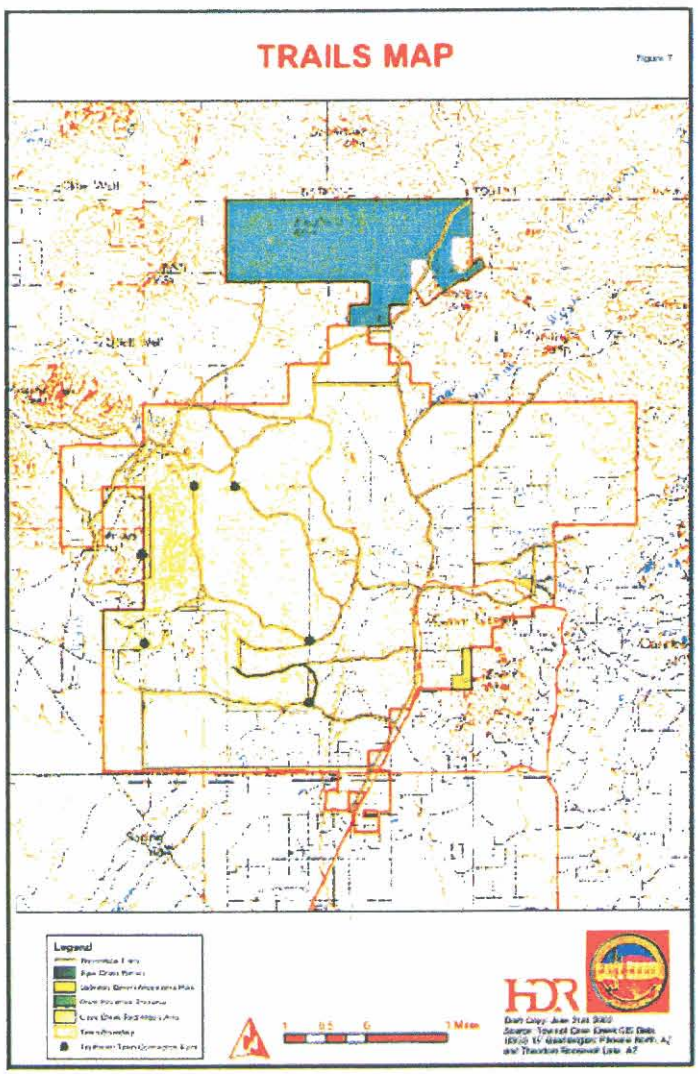

Figure 6 – Town of Cave Creek Proposed Trails Plan

Goal 12, Objective E, Policy 2 Require provision and maintenance adequate areas for safe bicycle, pedestrian and equestrian traffic on all new private and public roads along existing and planned trail alignments.

Goal 17, Objective A: Provide facilities for bicycles, horses and pedestrians.

Transportation Element

Goal 17, Objective A, Policy 5 Identify appropriate locations for trails throughout the Town to assure adequate circulation for bicycles, pedestrians and horses consistent with the General Plan areas.

5. OCTOBER 3, 2001 FOCUS GROUP MEETING

A focus group meeting including representatives of the Sonoran Foothills Land Trust, Town of Cave Creek representatives Vern Willardt, Ian Cordwell, Brian Miller, Wayne Anderson and Town of Carefree representatives Nancy Zeno, Carolyn Bohannan, Dennis Zwaggerman, Erich Korsten.

6.a. Issues and Concerns:

Town of Cave Creek:

- The Galloway Wash is important for non-motorized recreation use.
- The Grapevine Wash from Cave Creek's Gateway Park to Roe Wash is a major trail corridor into Carefree.

Town of Carefree:

- Roe Wash is a good trail. It dead-ends at Slot Canyon. People use it as a way to get to the "China Wall". This trail is accessible from many horse properties in Carefree.
- Ocotillo Ridge – there are trails planned and/that exist there…check on their status.
- Andora Wash from south of Cave Creek Road is a good trail opportunity directly into the Town of Carefree. This trail could go to Mule Train.
- 80th Street alignment provides access opportunities into Grapevine and Galloway Washes
- Keep trails informal…people are comfortable with access, but they probably won't want to dedicate right of way for trails.

Desert Foothills Land Trust:

- Consider part of Galloway Wash at Tranquil Trail and Sundance. People use the historic trail that is the old wash, next to Ocotillo Ridge.
- An extension to Ocotillo Ridge is dedicated for a trail but there is no direct access to Grapevine Wash. Father Kino Trail provides access at the present time. We need to check with the Land Trust regarding parking opportunities here.
- Horse properties adjacent to washes make their own entrances.
- Any flood control structures or right of way need to permit horse and trail access should be discussed with them for their properties.

Other comments:

- There is a planned public park at the south side of Cave Creek Road across from the airport. Access into this area is only by an on-street bike trail.
- The old Fort McDowell trail (Stone Mountain historic trail) crosses the park, it used to go to Cave Creek and through the McDowell Mountain Park to Verde River.
- There are no current, formal, connections to washes in Carefree.