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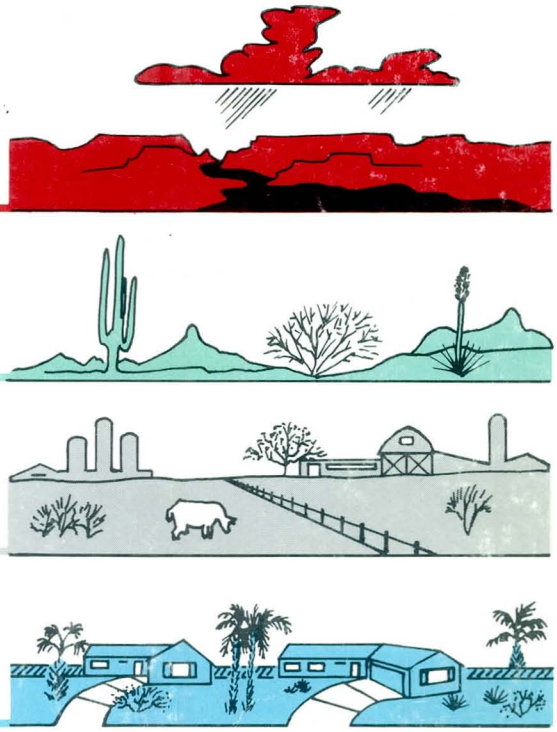

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A HYDROLOGIC ANALYSIS OF THE MCMICKEN DAM WATERSHED

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Report on

A HYDROLOGIC ANALYSIS OF THE MCMICKEN DAM WATERSHED

Prepared for

Maricopa County Flood Control District

by

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Timothy E. Sutko, Hydrologist

March 1987

A HYDROLOGIC ANALYSIS
OF THE
MCMICKEN DAM WATERSHED

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INTRODUCTION

This report presents the results of a hydrologic analysis of the McMicken Dam watershed. McMicken Dam is an earthen flood control structure designed and built by the U.S. Army Corps of Engineers (COE) in 1955, and currently operated and maintained by the Maricopa County Flood Control District (MCFCD). The contributing watershed is located in south-central Arizona and has an areal extent of 247 square miles. The watershed is generally bounded by the White Tank Mountains on the south, the Wickenburg Mountains on the north, and the Hieroglyphic Mountains on the east (Figure 1). The main contributing washes are Trilby Wash, Iona Wash, and Me Wash.

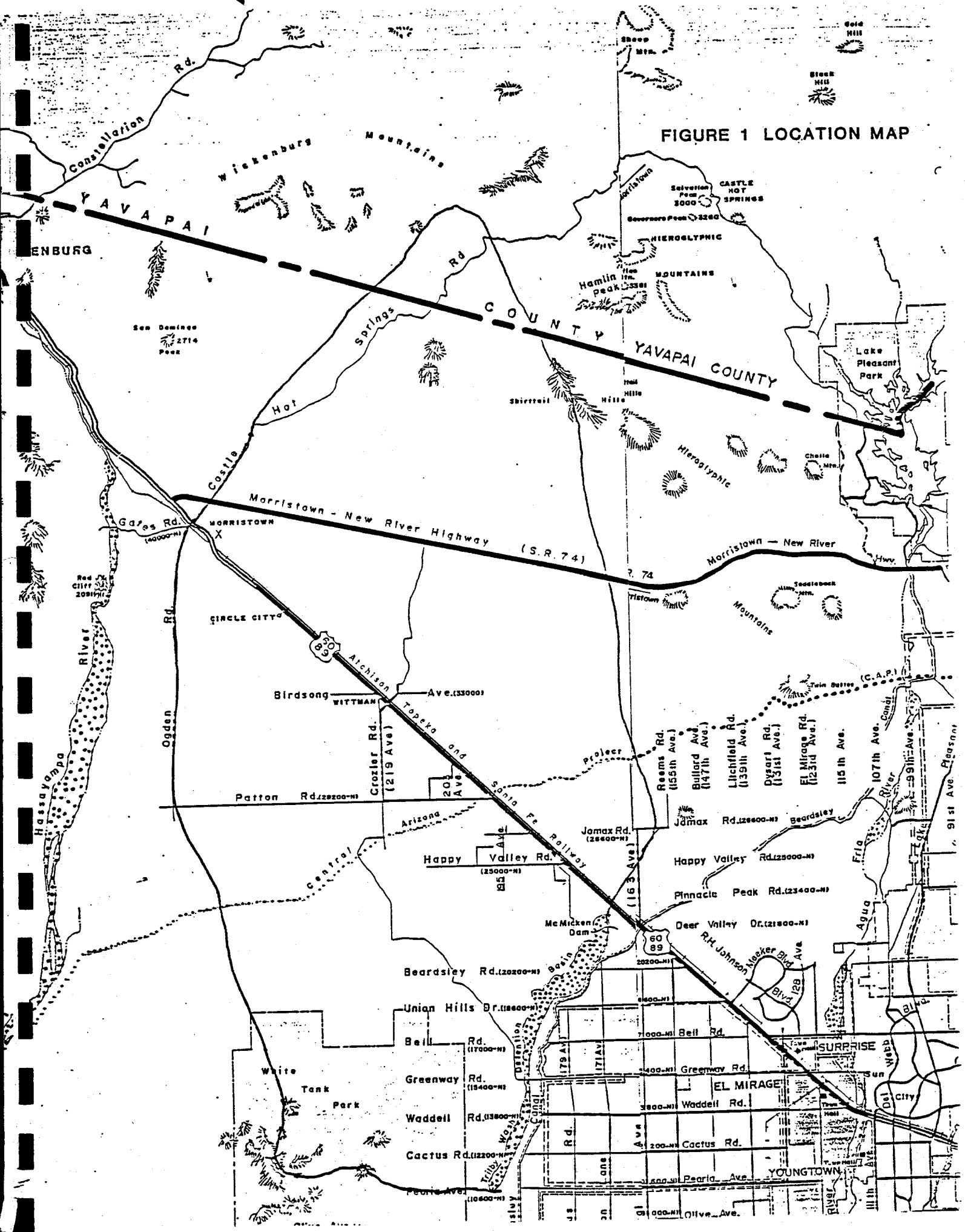


FIGURE 1 LOCATION MAP

Thursday

TL

PURPOSE

The purpose of this study was to evaluate the response of McMicken Dam to the Probable Maximum Flood and thus determine the adequacy of the dam and its appurtenances.

A hydrologic analysis of the McMicken Dam watershed was conducted by Sergent, Hauskins & Beckwith, Consulting Geotechnical Engineers (SH&B) in 1983. The results of this analysis were submitted to the Arizona Department of Water Resources (ADWR) at that time in order to obtain an Operational Certificate for the dam. Although the results of the study indicated that the dam and spillway were adequately sized, certification is pending since questions have been raised by ADWR concerning the methodologies of that study. A copy of ADWR's concerns and MCFCD's brief response are included in this report (Appendix 1).

The modeling performed for this report has incorporated portions of and expanded upon the SH&B study. For example, where the 1983 study modeled 8 subbasins within the watershed, this report modeled 44 subbasins. While this higher level of detail does not in itself insure better results, it does provide for better control at particular points in order to verify that the results are reasonable.

HYDROLOGY

The McMicken Dam watershed has an areal extent of 247 square miles with elevations ranging from 1340 to 4100 feet above mean sea level. The soils, vegetation and vegetative cover vary widely in the area. Based on Soil Conservation Service (SCS) hydrologic soil groupings, the mountainous areas consist primarily of D soils, the valleys and alluvial fans are largely C soils, and the washes are B soils. The vegetation is predominantly desert brush and cactus, with cover densities ranging from 10 to 40 percent.

One of the most significant natural features within the McMicken Dam watershed is the network of braided channels. Braided channels make it difficult to predict the exact flow paths of the runoff. Another important aspect of the watershed is the overall length of the watercourses. Runoff from the furthest contributing subbasin has to travel approximately 33 miles to the dam site. Channel slopes range from 1350 feet per mile at the headwaters to about 30 feet per mile immediately upstream of McMicken Dam.

Probably the most significant manmade feature within the study area is the Central Arizona Project (CAP) aqueduct which cuts across the basin on a southwest to northeast alignment. The aqueduct is constructed with large dikes, collection channels, and overchutes to protect it from flood damage. While these drainage facilities are designed to protect the CAP aqueduct from the 100 year flooding event, they have an impact on other flooding events as well. Other manmade features which affect the watershed hydrology are State Route 74, Highway 60-89, and the Atchison Topeka & Santa Fe (ATSF) Railroad.

However, these structures have less of an impact on the watershed than does the CAP because they are designed to pass the runoff rather than divert it.

Data on the basin characteristics and sub-basin delineations were based upon United States Geological Survey (USGS) 7.5 minute quadrangles (Plates 1 - 9) as well as numerous field observations of this area by Flood Control District personnel. Data on the storage on the upstream side of and flow across the CAP aqueduct were taken from U. S. Bureau of Reclamation as-built drawings.

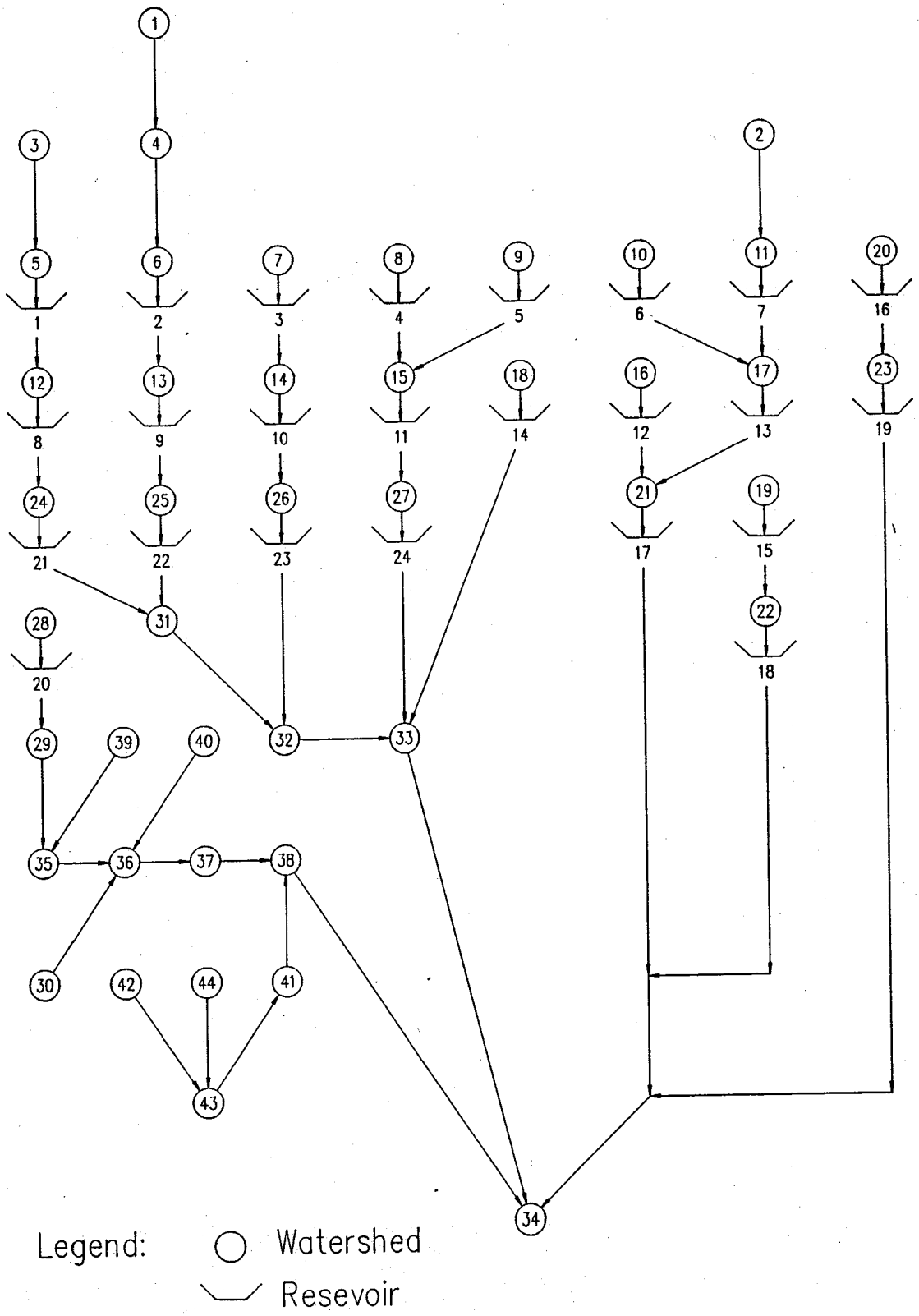
MODELING

The Hydrologic Engineering Center (HEC-1) flood hydrograph package (COE, 1981) was used for this analysis. The HEC-1 model simulates the surface runoff response of a basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. The McMicken Dam watershed was divided into 44 subbasins ranging in size from 0.87 to 17.92 square miles. The schematic on Figure 2 illustrates how the McMicken Dam watershed system was modeled (See Appendix 1, Plates 1-9 also).

In order to evaluate the adequacy of the McMicken Dam spillway, the proper design rainfall depth and its temporal and spatial distribution have to be determined for input to the model. It is also necessary to verify in some manner that the input parameters used to describe the physical and hydrologic characteristics of the watershed are reasonable.

The COE used their Standard Project Storm (SPS), which was based upon the August 26-29, 1951 storm in the Queen Creek area, to generate a design hydrograph for McMicken Dam. The SPS, uniformly distributed over the watershed, was used as an input to the model in this study. Inasmuch as there is insufficient rainfall and runoff data available to calibrate the model, a comparison of the COE design hydrograph and the model output was made to determine if the model output was reasonable. The model parameters describing rainfall losses and routings were adjusted so that reasonable agreement was obtained. A more in depth description of this adjustment process is described in a later section.

Figure 2: Schematic Diagram of McMicken Dam Watershed



In order to create a spillway design hydrograph, the COE applied this same design storm to the watershed, but used a more conservative estimate of the loss rate function parameters. The COE did not judge the use of a Probable Maximum Flood estimate to be appropriate in the design of this structure, and so did not evaluate its potential impact on the dam or its appurtenances.

In order to comply with ADWR regulations, the Probable Maximum Precipitation was determined as per HMR 49. The SH&B analysis determined that the 72 hour general storm event would produce more severe flooding than the 6 hour general storm. However, a miscalculation in the computation of this storm produced an erroneous total rainfall depth. The actual rainfall amounts modeled for the SPS and the PMP in this study are 8.6 and 15.7 inches, respectively.

Parameter Value Selection

The COE uniform loss rate methodology was used to model the rainfall losses. An initial loss of 0.95 inches, and subsequent loss rate of 0.15 inches per hour were used as basin average values. These values are consistent with the results of COE studies in this area (COE, 1974).

Two routing methods were used in this study, the kinematic wave and Muskingum Routing. Muskingum routing was used whenever possible as it more accurately reflects flow attenuation due to channel storage. As used in HEC-1, the constant K in the Muskingum routing method is equal to the travel time through a reach. Due to a lack of better information, K was determined by conservatively assuming channel velocities of 4 feet per second. The constant x is the Muskingum weighting factor and expresses the relative importance of

inflow and outflow in determining storage. The COE has determined that a Muskingum x value of 0.2 is appropriate for mildly sloped channels with a large portion of the flow in the overbanks (COE, 1974), and so that value was used in this study.

Two different methods were used to generate hydrographs in this study, the COE S-graph hydrograph, and kinematic wave. The COE hydrograph method was used on the mountainous subbasins since it was developed from measured data on similar watersheds. The lag time in hours used for the COE hydrograph is calculated using

$$LAG = 1.2\ (L*L_{ca}/S^{1/2})^{0.38}$$

where L equals the length of the watercourse in miles, L_{ca} equals the length along the watercourse to a point opposite the centroid of the subbasin in miles, and S equals the slope in feet per mile (COE, 1982). Kinematic wave is a physically based method and was used to generate hydrographs from subbasins where overland flow was judged to be the dominant flow regime. As stated in the SH&B report, the Hydrologic Engineering Center has verified that this is an appropriate methodology for such areas.

State Route 74, Highway 60-89, and the CAP were modeled as reservoirs. The data to model State Route 74 and Highway 60-89 as reservoirs were averaged values that represent the drainage structures for a particular section of road. The only place where modeling these structures as reservoirs becomes critical though is along the CAP. Therefore, design and as-built criteria for

the CAP was used for input (USBR, 1975). Table 1 lists the structures as they were modeled.

Outflow from the McMicken Dam structure was modeled using a single rating curve which represents the combined outflows of the principle and emergency outlets. The use of a single discharge rating curve to describe the outlet of McMicken Dam is more accurate than using orifice and weir coefficients because actual design data is used.

TABLE 1. General location of reservoirs modeled.

RESERVOIR NUMBER	LOCATION
1	State Route 74, Iona Wash
2	State Route 74, Trilby Wash
3	State Route 74
4	State Route 74
5	State Route 74
6	State Route 74
7	State Route 74, Me Wash
8	Railroad/Grand Ave., Iona Wash
9	Railroad/Grand Ave., Trilby Wash
10	Railroad/Grand Ave.
11	Railroad/Grand Ave.
12	C.A.P.
13	C.A.P., Me Wash
14	Railroad/Grand Ave.
15	C.A.P., East of Grand Ave.
16	C.A.P., East of Grand Ave.
17	Railroad/Grand Ave., South of C.A.P.
18	Railroad/Grand Ave., South of C.A.P.
19	Railroad/Grand Ave., South of C.A.P.
20	C.A.P., Sta. 466+0, West end of watershed
21	C.A.P., Sta. 572+5, Iona Wash
22	Central Arizona Project, Sta. 609+0, Trilby Wash
23	C.A.P., Sta. 688+0
24	C.A.P., Sta. 804+5, Just west of Grand Ave.

RESULTS

The peak runoff generated from the McMicken Dam watershed as a result of the Standard Project Precipitation is 42000 cfs. The time to peak for this event is 31.5 hours and the maximum water surface elevation is 1355.82 feet above sea level. The original COE design analysis of the Standard Project Storm indicated a peak runoff of 35000 cfs at hour 30.5 after the beginning of the storm, and a maximum water surface elevation of 1354.0 feet (COE, 1953). This indicates that the model created for this study provides a reasonable and conservative estimate of the response of this watershed to an extreme rainfall event.

The results from the Probable Maximum Precipitation event indicate that the peak runoff is 114850 cfs and the maximum water surface elevation is 1360.43 feet above sea level. The time to peak for this event is 18 hours and 15 minutes. The top of McMicken Dam itself is 1361.0 feet above sea level.

CONCLUSIONS

To evaluate the adequacy of McMicken Dam and its appurtenances, a conservative approach was used. The contributing watershed was subdivided into 44 subbasins based upon hydrologic characteristics. Model parameters were adjusted so that reasonable agreement between the design inflow hydrograph at the dam site and model output at the same point was obtained, given the Standard Project Storm as the driving input force.

The model was then run using the Probable Maximum Precipation event as the driving input force. Model output indicates that although not designed using the PMP for spillway sizing, the spillway will in fact pass the flood resulting from this storm without the dam being overtopped.

REFERENCES

Corps of Engineers, 1953, "Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel", Design Memorandum No. 1, Los Angeles, CA.

Corps of Engineers, 1974, "Gila River Basin, New River, and Phoenix City Streams, Arizona": Design Memorandum No. 2, Hydrology Part 1.

Corps of Engineers, 1981, "HEC-1 Flood Hydrograph Package, Users Manual", Water Resources Support Center, Computer Program 723-X6-L2010.

Corps of Engineers, 1982, "Gila River Basin, New River, and Phoenix City Streams, Arizona": Design Memorandum No. 2, Hydrology Part 2.

DeVries, J.J., MacArthur, R.C., 1979, "Introduction and Application of Kinematic Wave Routing Techniques Using HEC-1": Training Document No. 10, Davis, CA., Corps of Engineers.

Hansen, E.M., Schwarz, F.K., and Riedel, J.T., 1977, "Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages": Hydrometerological Report No. 49, Corps of Engineers, Silver Spring, Maryland.

National Oceanic and Atmospheric Administration (NOAA), 1973, "Precipitation-Frequency Atlas of the Western United States", NOAA Atlas No. 2, U.S. Department of Commerce.

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Sergent, Hauskins & Beckwith, 1983, "Surface Water Hydrology Report, McMicken Dam Restoration Study Maricopa County, Arizona".

U.S. Bureau of Reclamation, 1975, "Hydrologic Design Data Reaches 8 & 9 Granite Reef Aqueduct", Arizona Projects Office.

APPENDIX

PMP

COMPUTATIONS

PMP Computation for Trilby Wash

Local-storm PMP computation, Colorado River and Great Basin, and California drainages. (Giving areal distribution of PMP).

Steps correspond to those in sec. 6.3B.

1. Place idealized isohyetal pattern [fig. 4.10] over drainage adjusted to 1:500,000 scale to obtain most critical placement.

2. Note the isohyets within drainage.

3. Average 1-hr 1-mi^2 (2.6-km^2) PMP for drainage [fig. 4.5]. 11.6 in.

4. a. Reduction for elevation. [No adjustment for elevations up to 5,000 feet (1,524 m), 5% decrease per 1,000 feet (305 m) above 5,000 feet (1,524 m)]. 100 %

   b. Multiply step 3 by step 4a. 11.6 in.

5. Average 6/1-hr ratio for drainage [fig. 4.7]. 1.24

6. Obtain isohetal labels for 15-min incremental and the highest PMP from table 4.5 corresponding 6/1-hr ratio of step 5.

PMP Increment	Isohyet A	B	C	D	E	F	G	H	I	J	
Highest 1-hr	100	82	58	44	32	23	16	13	12	11	
Highest 15-min.	74	56	32	21	14	8	7	6	5	4	
2nd "	15	15	15	12	9	6	4	3	3	3	
3rd "	6	6	6	6	5	5	3	2	2	2	in %
4th "	5	5	5	5	4	4	2	2	2	2	

7. Obtain isohyetal labels in % of 1-hr PMP for 2nd to 6th highest hourly incremental PMP values from table 4.6 using 6/1-hr ratio of step 5.

2nd Highest 1-hr PMP	12	12	12	11	10	8	7	5	5	5	
3rd "	5	5	5	5	5	5	4	4	4	4	
4th "	4	4	4	4	4	4	4	3	3	3	in %
5th "	2	2	2	2	2	2	2	2	2	2	
6th "	1	1	1	1	1	1	1	1	1	1	

8. Multiply steps 6 and 7 by step 4b to get incremental isohyetal labels of PMP.

Highest 15-min.	8.6	6.5	3.7	2.4	1.6	0.9	0.8	0.7	0.6	0.5	
2nd "	1.7	1.7	1.7	1.4	1.0	0.7	0.5	0.3	0.3	0.3	
3rd "	0.7	0.7	0.7	0.7	0.6	0.6	0.3	0.2	0.2	0.2	
4th "	0.6	0.6	0.6	0.6	0.5	0.5	0.2	0.2	0.2	0.2	
Highest 1-hr	11.6	9.5	6.7	5.1	3.7	2.7	1.9	1.5	1.4	1.3	in in.
2nd "	1.4	1.4	1.4	1.3	1.2	0.9	0.8	0.6	0.6	0.6	
3rd "	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	
4th "	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	
5th "	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
6th "	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	

9. Arrange values of step 8 in time sequence [tables 4.7 and 4.8].

PMP Computation for Trilby Wash

General-storm PMP computations for the Colorado River and Great basin

Drainage Trilby Wash Area 247 mi^2

Latitude 33.8, Longitude 112.6 of basin center

Month September

Step	Duration (hrs) 6	12	18	24	48	72
A. Convergence PMP						
1. Drainage average value from one of figures 2.5 to 2.16	13.6 in.					
2. Reduction for barrier-elevation [fig. 2.18]	82%					
3. Barrier-elevation reduced PMP [step 1 X step 2]	11.2 in.					
4. Durational variation [figs. 2.25 to 2.27 and table 2.7].	74	89	95	100	112	117%
5. Convergence PMP for indicated durations [steps 3 X 4]	8.3	10.0	10.6	11.2	12.5	13.1 in.
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5]	8.3	1.7	0.6	0.6	1.3	0.6 in.
7. Areal reduction [select from figs. 2.28 and 2.29]	73	90	94	98	100	100%
8. Areally reduced PMP [step 6 X step 7]	6.1	1.5	0.6	0.6	1.3	0.6 in.
9. Drainage average PMP [accumulated values of step 8]	6.1	7.6	8.2	8.8	10.1	10.7 in.
B. Orographic PMP						
1. Drainage average orographic index from figure 3.11a to d.	3.4 in.					
2. Areal reduction [figure 3.20]	90%					
3. Adjustment for month [one of figs. 3.12 to 3.17]	100%					
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3]	3.1 in.					
5. Durational variation [table 3.9]	35	62	83	100	142	161%
6. Orographic PMP for given durations [steps 4 X 5]	1.1	1.9	2.6	3.1	4.4	5.0 in.
C. Total PMP						
1. Add steps A9 and B6	7.2	9.5	10.8	11.9	14.5	15.7 in.

2. PMP for other durations from smooth curve fitted to plot of computed data.

3. Comparison with local-storm PMP (see sec. 6.3).

APPENDIX

MCFCD

MEMORANDUM

ADWR has offered a number of comments regarding the Surface Water Hydrology Report, McMicken Dam Restoration Study prepared for FCD by Sergent, Hauskins & Beckwith (SHB). This memorandum addresses those comments in the order submitted to us.

1. The reduction of the watershed from 247 mi^2 to 236 mi^2 is unsupported and will reduce the runoff rate and volume, thereby reducing the maximum water surface elevation.

The difference in watershed areas is less than 5% and is probably due to planimeter error. In any case, each sub-area has been increased by 5% so that the watershed area now totals 247 mi^2.

2. The watershed area delineation is not supported for the the changes from the USCE boundary and that are traceable on 7 1/2 min. quadrangle topography. The drainage area is not defined by drainage course hydrologic units, but by two highways and the CAP Granite Reef Aqueduct which are structures designed on the basis of 50 and 100 year flood flows rather than the PMF which is the criteria for dam safety.

The structures may define the hydrologic units if they alter the natural drainageways of the watershed. However, inspection of the computer model output reveals that neither the peak, volume nor the timing of the hydrograph has been altered by the inclusion of these structures. In other words, the outflow hydrograph at these structures is essentially the same as the inflow hydrographs.

3. The spillway, outlet works, and dam data input on the SS, SL, and ST cards (lines 113, 114, and 115 respectively) are not in agreement with the AS-BUILT data and drawings submitted by the USCE upon original completion. No justification is given to support the changes.

a. Spillway is over-rated by SHB by a variable amount ranging from 78% to 28% of the USCE Design rating, primarily due to SHB using a uniform crest coefficient instead of the variable crest coefficient used by USCE. See attached figure for comparison of the two.

HEC-1 does not support the use of variable crest coefficients. In order to more correctly model outlet structures, a single rating curve representing the combined outflows of the principle and emergency outlets has been implemented.

b. Outlet works has a different orifice area, orifice center elevation, and 'C' value than the As-built and design data. SHB also did not treat the OW as a free flow channel at critical depth before the 11 x 20 orifice became submerged. The 1335.0 initial elevation on the SL card is supposed to be the free flow grade sill and not the center of the elevation at 1339.61.

See the comment above.

c. The dam crest length as a weir is different from the As-built data.

The length has been altered to reflect the as-built data.

4. If the SHB spillway crest elevation is based on the same bench system used for the dam embankment, the embankment and reservoir storage may have subsided equally. These elevations should be definitively resolved by a level circuit from bedrock benches. The text statement does not appear to be conclusive.

NO COMMENT

5. The HEC-1 kinematic wave routing may be inappropriate for the watershed subareas which are greater than the recommended 2 mi^2 considering the initial methodology was particularly created for small urban watersheds, or to a maximum of 4 to 5 mi^2.

The kinematic wave methodology was not 'created', but rather was derived from the St. Venant equations describing unsteady flow, and is appropriate where the bed slope and the water surface slope are equal and the acceleration components are negligible. The appropriateness of the methodology in this modeling effort was ascertained via communication with the Hydrologic Engineering Center (see page 15 of the SHB report).

6. The computer model watershed configuration of subareas and channel network is questionsble as appropriately descriptive of the lengths, widths, and areas, particularly in the White Tank Mountains.

This is a very broad criticism which requires elaboration before a response can be offered.

7. The precipitation amount and distribution needs to be reviewed under HMR-49 and HMR-36 criteria.

The 72-hour general storm was re-calculated according to HMR-49.

8. The use of HMR-49 isohyetal computation and the derivation of mean subarea precipitation amounts needs to be re-examined.

The 72-hour general storm was used for this study. The use of isohyetals in conjunction with the general storm is inappropriate.

9. The default instruction error at input data card 61 RK results in a erroneous schematic flow diagram and a computational error. This error drops a channel length of 37,600 ft from the routing of 64,651 cfs from a drainage area of 97.1 mi^2 and translates this Q directly to the spillway structure a flow path distance of over 54,000 ft away from the drop point. The error also routes the 41,406 cfs from the 61.2 mi^2 Subarea 4 through the default main channel length of 8000 ft, in a 30 ft bottom width channel with 2:1 sideslopes, and a channel slope of 0.2.

A correction in the input deck has been made to reflect the comment. It should be noted that channel routing using the kinematic wave methodology is insensitive to channel geometry. The hydrograph is translated through time with only negligible attenuation.

10. The Design Storm emphasis on "100 year rainfall" and "calibration" based on the USGS equation diverts attention from the fact that there are no gaged runoff records upon which to base a calibration.....

This comment is a criticism of the report text and not of the modeling effort. The section of the text to which this comment pertains is a justification of the choice of values for Initial Loss and Uniform Loss Rate for determining rainfall losses. The use of .95" and .15 in/hr for these parameters compares well with the values used by the COE in their modeling efforts in the Gila River Basin in that both result in appoximately 45% of the precipitation being lost to infiltration and channel losses.

11. The Manning's 'n' used in the draft report was 0.05, and in the final report the 'n' used was 0.075. No supporting information is provided to support such a significant increase, neither is there any discussion in deriving the draft 'n'....

A more commonly accepted (though perhaps no more correct) value of 0.035 has been used for 'n' for channel routings.

12. The starting of the PMF routing with an empty reservoir is not within the generally accepted policy and criteria of DWR...

Prior to the initial submittal of this report, extensive discussions on DWR policy were conducted by FCD and DWR personnel. At that time it was apparent that DWR had (has) no accepted policy. Common hydrologic procedure entails starting reservoir routing with the reservoir at normal operating level. In this instance, normal operating level is empty.

APPENDIX

HEC-1

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

                    *DIAGRAM
* FREE ***
      1             ID   MCMICKEN DAM WATERSHED
      2             ID   STANDARD PROJECT FLOOD
      3             ID   FCMCD JAN 87 J.RUMANN
      4             ID   SUB BASINS 1-44
      5             IT       5       0       0     900
      6             IO       5

      7             KK       1
      8             BA    9.60
      9             IN      60
     10             PB   8.600
     11             PI     0.0     .01     .01     .01     .01     .01     .01     .01     .08     .00
     12             PI     .02     .01     .02     .00     .00     .02     .04     .00     .02     .05
     13             PI     .10     .06     .05     .37     .39     .53     .72     .71     .55     .46
     14             PI     .53     .08     .02     .00     .02     .13     .16     .11     .09     .09
     15             PI     .14     .09     .20     .10     .08     .16     .08     .00     .00     .16
     16             PI     .14     .00     .00     .05     .41     .40     .03     .02     .13     .18
     17             PI     .10     .09     .00     .38     .00     .02     .01     .00     .13     0.0
     18             PI     .00     .00     .00
     19             LU     .95     .15
     20             UI       0     241     489     761    1196    1767    2405    3022    3742    3889
     21             UI    4131    4350    4350    4350    3744    3157    2953    2702    2265    2142
     22             UI    2032    1842    1467    1402    1343    1086    1005     967     932     920
     23             UI     900     869     580     562     545     529     514     319     274     267
     24             UI     260     254     295     171     150     146     143     140     137     134
     25             UI     131     129     126      67      66      65      64      62      61      60
     26             UI      59      58      57      19       0

     27             KK   ROUTE1 TO 4
     28             RM       1     0.7     0.2

     29             KK       4
     30             BA    3.42
     31             PB     8.6
     32             LU     .95     .15
     33             UK     300    0.09    0.15     100
     34             RK    7500    0.05    0.05     0.5    TRAP      25       3
     35             RK   19500    0.05   0.035            TRAP      50       3      NO

     36             KK COMBINE1 & 4
     37             HC       2

     38             KK       6
     39             BA    5.79
     40             PB     8.6
     41             LU     .95     .15
     42             UK     300    0.03    0.15     100
     43             RK   10000    0.02    0.04     1.0    TRAP      25       3
     44             RK   19500    0.02   0.035            TRAP      75       3     YES
```



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

     45             KK     DAM2
     46             KM   TRILBY WASH @ S.R. 74
     47             RS       1    STOR      -1
```

```
 48          SA        0      0.9
 49          SE     2050     2061
 50          SQ        0    17600
 51          ST     2061     3500        3     1.5

 52          KK    ROUTEDAM2 TO 13
 53          RM        1      1.1     0.2

 54          KK       13
 55          BA     6.05
 56          PB      8.6
 57          LU      .95      .15
 58          UK      300     0.03    0.15     100
 59          RK    21000     0.02   0.040     1.0    TRAP      25       3
 60          RK    27000     0.02   0.035            TRAP      50       3      NO

 61          KK COMBINEDAM 2 &13
 62          HC        2

 63          KK     DAM9
 64          KM    TRILBY WASH @ GRAND AVE.
 65          RS        1     STOR      -1
 66          SA        0       50
 67          SE     1850     1857
 68          SQ        0    30300
 69          ST     1857     9000        3     1.5

 70          KK    ROUTEDAM9 TO 25
 71          RM        1      2.6     0.2

 72          KK       25
 73          BA     9.36
 74          PB      8.6
 75          LU      .95      .15
 76          UK      300     0.01    0.15     100
 77          RK    20000    0.009   0.040     3.0    TRAP      50       3
 78          RK    40750    0.008   0.035            TRAP     150       3      NO

 79          KK COMBINEDAM9 TO 25
 80          HC        2

 81          KK    DAM22
 82          KM    TRILBY WASH @ C.A.P., STA. 609+0
 83          RS        1     STOR      -1
 84          SQ        0     6903
 85          SE     1540   1548.5
 86          SV        0     3436
 87          ST     1554     2000        3     1.5
```



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

 88          KK    ROUTEDAM22 TO 31
 89          RM        1      2.7     0.2

 90          KK        3
 91          BA     4.43
 92          PB      8.6
 93          LU      .95      .15
 94          UK      300     0.05    0.15     100
 95          RK     6200     0.05   0.040     1.0    TRAP      50       3
```

```
 97          KK       5
 98          BA    2.98
 99          PB     8.6
100          LU     .95      .15
101          UK     300     0.03     0.15      100
102          RK    4500     0.03    0.040      1.0    TRAP      50       3
103          RK   13000     0.01    0.035             TRAP     100       3      YES

104          KK    DAM1
105          KM   IONA WASH @ S.R. 74
106          RS       1     STOR       -1
107          SA       0      1.1
108          SE    2040     2048
109          SQ       0     7300
110          ST    2048     6000        3      1.5

111          KK   ROUTEDAM1 TO 12
112          RM       1      0.9      0.2

113          KK      12
114          BA    4.42
115          PB     8.6
116          LU     .95      .15
117          UK     300     0.02     0.15      100
118          RK    9300    0.015    0.040      1.0    TRAP      50       3
119          RK   13500    0.010    0.035             TRAP     100       3       NO

120          KK COMBINEDAM1 TO 12
121          HC       2

122          KK    DAM8
123          KM   IONA WASH @ GRAND AVE.
124          RS       1     STOR       -1
125          SA       0     50.0
126          SE    1920     1930
127          SQ       0    10500
128          ST    1930     7000        3      1.5
                                        HEC-1 INPUT                                                          PAGE  4

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

129          KK   ROUTEDAM8 TO 24
130          RM       1      3.3      0.2

131          KK      24
132          BA   17.92
133          PB    8.60
134          LU     .95      .15
135          UK     300    0.010     0.15      100
136          RK   16000    0.008    0.040      5.0    TRAP      75       3
137          RK   60250    0.007    0.035             TRAP     150       3       NO

138          KK COMBINEDAM8 TO 24
139          HC       2

140          KK   DAM21
141          KM   IONA WASH @ C.A.P., STA. 572+5
142          RS       1     STOR       -1
143          SV       0        7       31       69     288     518
144          SE  1545.2     1546     1548     1550    1552    1554
145          SQ       0       72      505     1135    1914    2817
```

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146          ST    1553    2000       3     1.5

147          KK   ROUTEDAM 21 TO 31
148          RM       1     2.8     0.2

149          KK      31
150          BA    9.34
151          PB    8.60
152          LU     .95     .15
153          UK     300   0.007    0.15     100
154          RK   10000   0.006   0.040     2.0    TRAP     100       3
155          RK   39750   0.005   0.035            TRAP     175       3      NO

156          KK COMBINEDAMS 21 &22 TO 31
157          HC       3

158          KK   ROUTEDAMS 21 & 22/31 TO 32
159          RM       1     0.2     0.2

160          KK       7
161          BA    7.05
162          PB     8.6
163          LU     .95     .15
164          UK     300    0.03    0.15     100
165          RK   12400    0.02   0.040     1.0    TRAP      25       3
166          RK   24750    0.03   0.035            TRAP      50       3      NO

167          KK    DAM3
168          KM   S.R. 74
169          RS       1    STOR      -1
170          SA       0     1.1
171          SE    2000    2008
172          SQ       0   10300
173          ST    2008    6000       3     1.5
                                        HEC-1 INPUT                                                          PAGE  5

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

174          KK   ROUTEDAM3 TO14
175          RM       1     2.1     0.2

176          KK      14
177          BA    7.21
178          PB     8.6
179          LU     .95     .15
180          UK     300   0.020    0.15     100
181          RK   19000   0.015   0.040     2.0    TRAP      50       3
182          RK   32250   0.012   0.035            TRAP     100       3      NO

183          KK COMBINEDAM3 TO 14
184          HC       2

185          KK   DAM10
186          KM   GRAND AVE
187          RS       1    STOR      -1
188          SA       0      50
189          SE    1670    1675
190          SQ       0    8740
191          ST    1681    4000       3     1.5

192          KK   ROUTEDAM10 TO 26
193          RM       1     1.2     0.2
```

```
194          KK      26
195          BA    8.42
196          PB     8.6
197          LU     .95      .15
198          UK     300    0.010    0.15     100
199          RK   20000    0.008   0.040     2.0    TRAP     75       3
200          RK   27750    0.008   0.035            TRAP    150       3      NO

201          KK COMBINEDAM 10 TO 26
202          HC       2

203          KK   DAM23
204          KM   C.A.P., STA. 688+0
205          RS       1    STOR      -1
206          SQ       0     116     440     881    1414    2025    2705    3447
207          SE  1544.3    1545    1546    1547    1548    1549    1550    1551
208          SV       0       3      10      19      31     139     292     498
209          ST    1550    2000       3     1.5

210          KK   ROUTEDAM23 TO 32
211          RM       1     2.7     0.2

212          KK      32
213          BA    8.42
214          PB     8.6
215          LU     .95      .15
216          UK     300    0.007    0.15     100
217          RK   10000    0.006   0.040     3.0    TRAP    100       3
218          RK   38250    0.006   0.035            TRAP    175       3      NO
                                          HEC-1 INPUT                                                    PAGE  6

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

219          KK COMBINEDAMS 21,22,23 TO 32
220          HC       3

221          KK   ROUTEDAMS 21,22,23/31,32 TO 33
222          RM       1     0.6     0.2

223          KK       8
224          BA    3.38
225          PB     8.6
226          LU     .95      .15
227          UK     300     0.04    0.15     100
228          RK    6500     0.04   0.040     1.0    TRAP     25       3
229          RK   24500     0.03   0.035            TRAP     50       3      NO

230          KK    DAM4
231          KM   S.R. 74
232          RS       1    STOR      -1
233          SA       0    50.0
234          SE    1990    2000
235          SQ       0    1525
236          ST    2001    1500       3     1.5

237          KK   ROUTEDAM4 TO 15
238          RM       1     2.6     0.2

239          KK       9
240          BA    5.44
241          PB     8.6
```

PB 8.6

```
242          LU      .95      .15
243          UK      300     0.05     0.15      100
244          RK    12000     0.05     0.04      1.0    TRAP      25       3
245          RK    27500     0.04    0.035             TRAP      75       3      NO

246          KK     DAM5
247          KM    S.R. 74
248          RS        1     STOR       -1
249          SA        0      5.0
250          SE     1980     1988
251          SQ        0    12000
252          ST     1988     2500        3      1.5

253          KK    ROUTEDAM 5 TO 15
254          RM        1      2.6      0.2

255          KK       15
256          BA     6.65
257          PB      8.6
258          LU      .95      .15
259          UK      300     0.02     0.15      100
260          RK    11400     0.02     0.04      2.0    TRAP      50       3
261          RK    38000    0.011    0.035             TRAP     100       3      NO
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

262          KK COMBINEDAMS 4,5 TO 15
263          HC      - 3

264          KK    DAM11
265          KM    GRAND AVE
266          RS        1     STOR       -1
267          SA        0     50.0
268          SE     1560     1567
269          SQ        0     5000
270          ST     1568     5000        3      1.5

271          KK    ROUTEDAM 11 TO 27
272          RM        1     0.07      0.2

273          KK       27
274          BA     1.04
275          PB      8.6
276          LU      .95      .15
277          UK      300    0.009     0.15      100
278          RK    13500    0.008     0.04             TRAP      25       3      NO

279          KK COMBINEDAM11 TO 27
280          HC        2

281          KK    DAM24
282          KM    C.A.P., STA. 804+5
283          RS        1     STOR       -1
284          SQ        0       54      233      608     1007     1469     1985     2550     3161     3814
285          SQ     4506     5236
286          SE   1543.5     1544     1545     1546     1547     1548     1549     1550     1551     1552
287          SE     1553     1554
288          SV        0        0        0        0        1        3        4       18       44      114
289          SV      204      413
290          ST   1552.8     2000        3      1.5
```

```
291          KK   ROUTEDAM24 TO 33
292          RM       1      2.4      0.2

293          KK      18
294          BA    0.87
295          PB     8.6
296          LU     .95      .15
297          UK     300     0.01     0.15      100
298          RK   17500    0.009     0.04             TRAP      50       3      NO

299          KK   DAM14
300          KM   GRAND AVE.
301          RS       1     STOR       -1
302          SA       0     0.30
303          SE    1520     1527
304          SQ       0     1500
305          ST    1527     1500        3      1.5
                                      HEC-1 INPUT                                                          PAGE  8

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

306          KK   ROUTEDAM14 TO 33
307          RM       1      2.4      0.2

308          KK      33
309          BA    7.48
310          PB     8.6
311          LU     .95      .15
312          UK     300    0.005     0.15      100
313          RK   13000    0.005     0.04      2.0    TRAP      75       3
314          RK   34750    0.006    0.035             TRAP     100       3      NO

315          KK COMBINEDAMS 21,22,23/31,32 TO DAMS 14,24/33
316          HC       4

317          KK   ROUTEALL TO 34
318          RM       1      0.3      0.2

319          KK       2
320          BA   17.02
321          PB     8.6
322          LU     .95      .15
323          UK     300     0.09     0.15      100
324          RK    6800    0.071    0.040      2.0    TRAP      50       3
325          RK   48000    0.043    0.035             TRAP     100       3      NO

326          KK      11
327          BA    1.40
328          PB     8.6
329          LU     .95      .15
330          UK     300    0.030     0.15      100
331          RK    9000    0.022     0.04      0.5    TRAP      50       3
332          RK   11750    0.022    0.035             TRAP     100       3     YES

333          KK    DAM7
334          KM   ME WASH @ S.R. 74
335          RS       1     STOR       -1
336          SA       0       50
337          SE    1980     1988
338          SQ       0    15000
339          ST    1988     2500        3      1.5
```

```
340          KK   ROUTEDAM7 TO 17
341          RM       1      2.4      0.2

342          KK      10
343          BA    1.43
344          PB     8.6
345          LU     .95      .15
346          UK     300     0.03     0.15      100
347          RK    8500     0.28     0.04      0.5    TRAP      25       3
348          RK   17500    0.023    0.035             TRAP      50       3      NO
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

349          KK    DAM6
350          KM   S.R. 74
351          RS       1     STOR       -1
352          SA       0     0.20
353          SE    1980     1988
354          SQ       0     1325
355          ST    1988     1000        3      1.5

356          KK   ROUTEDAM6 TO 17
357          RM       1      2.4      0.2

358          KK      17
359          BA    6.70
360          PB     8.6
361          LU     .95      .15
362          UK     300    0.015     0.15      100
363          RK   18000    0.014     0.04      2.0    TRAP      50       3
364          RK   34250    0.013    0.035             TRAP     100       3      NO

365          KK COMBINEDAMS6 & 7 TO 17
366          HC       3

367          KK   DAM13
368          KM   ME WASH @ C.A.P.
369          RS       1     STOR       -1
370          SQ       0       51      778     3740     5531     6875     7646     7773
371          SE    1540     1542     1548  1549.03  1551.26  1552.82  1553.68  1553.82
372          SV       0        0        0       44      357      747     1024     1072
373          ST    1557     2000        3      1.5

374          KK   ROUTEDAM13 TO 21
375          RM       1      0.6      0.2

376          KK      16
377          BA    3.46
378          PB     8.6
379          LU     .95      .15
380          UK     300    0.015     0.15      100
381          RK    8500    0.014     0.04      1.0    TRAP      25       3
382          RK   35750    0.011    0.035             TRAP      75       3      NO

383          KK   DAM12
384          KM   C.A.P.
385          RS       1     STOR       -1
386          SQ       0       51      778     3740     5531     6875     7646     7773
387          SE    1540     1542     1548  1549.03  1551.26  1552.82  1553.68  1553.82
388          SV       0        0        0       44      357      747     1024     1072
389          ST    1557     2000        3      1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 390          KK   ROUTEDAM12 TO 21
 391          RM       1      0.6      0.2

 392          KK      21
 393          BA    1.04
 394          PB     8.6
 395          LU     .95      .15
 396          UK     300    0.009     0.15      100
 397          RK    8500    0.008     0.04              TRAP      25       3      NO

 398          KK COMBINEDAMS 12,13 TO 21
 399          HC       3

 400          KK   DAM17
 401          KM   GRAND AVE
 402          RS       1     STOR      -1
 403          SA       0       50
 404          SE    1480     1487
 405          SQ       0    12000
 406          ST    1488     3000       3      1.5

 407          KK   ROUTEDAM 17 TO 34
 408          RM       1      1.3      0.2

 409          KK      19
 410          BA    2.57
 411          PB     8.6
 412          LU     .95      .15
 413          UK     300    0.013     0.15      100
 414          RK   10000    0.012     0.04      1.0     TRAP      25       3
 415          RK   19000    0.012    0.035              TRAP      50       3      NO

 416          KK   DAM15
 417          KM   C.A.P. EAST OF GRAND AVE.
 418          RS       1     STOR      -1
 419          SQ       0       51      778     3740     5531     6875     7646     7773
 420          SE    1540     1542     1548  1549.03  1551.26  1552.82  1553.68  1553.82
 421          SV       0        0        0       44      357      747     1024     1072
 422          ST    1557     2000        3      1.5

 423          KK   ROUTEDAM15 TO 22
 424          RM       0        1      0.2

 425          KK      22
 426          BA    2.31
 427          PB     8.6
 428          LU     .95      .15
 429          UK     300    0.009     0.15      100
 430          RK   14750    0.008     0.04              TRAP      50       3      NO
```



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

 431          KK COMBINEDAM15 TO 22
 432          HC       2

 433          KK   DAM18
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```
434          KM   GRAND AVE
435          RS       1    STOR      -1
436          SA       0   0.600
437          SE    1420    1427
438          SQ       0   10000
439          ST    1427    3500       3     1.5

440          KK   ROUTEDAM18 TO 34
441          RM       1     0.8     0.2

442          KK COMBINEDAM 17 TO DAM 18
443          HC       2

444          KK      20
445          BA    1.08
446          PB     8.6
447          LU     .95     .15
448          UK     300    0.01    0.15     100
449          RK    6500    0.01    0.04     0.5    TRAP      25       3
450          RK   12250   0.011   0.035            TRAP      50       3      NO

451          KK   DAM16
452          KM   C.A.P.
453          RS       1    STOR      -1
454          SQ       0      51     778    3740    5531    6875    7646    7773
455          SE    1540    1542    1548 1549.03 1551.26 1552.82 1553.68 1553.82
456          SV       0       0       0      44     357     747    1024    1072
457          ST    1557    2000       3     1.5

458          KK   ROUTEDAM16 TO 23
459          RM       1     1.6     0.2

460          KK      23
461          BA    3.71
462          PB     8.6
463          LU     .95     .15
464          UK     300   0.008    0.15     100
465          RK   12000   0.008    0.04     1.0    TRAP      50       3
466          RK   23500   0.007   0.035            TRAP      75       3      NO

467          KK COMBINEDAM16 TO 23
468          HC       2

469          KK   DAM19
470          KM   GRAND AVE
471          RS       1    STOR      -1
472          SA       0   0.650
473          SE    1375    1382
474          SQ       0   10000
475          ST    1382    4000       3     1.5
```



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

476          KK   ROUTEDAM19 TO 34
477          RM       1     0.2     0.2

478          KK COMBINEDAMS 17,18 TO DAM 19
479          HC       2

480          KK      34
481          BA    3.32
```

```
482          PB      8.6
483          LU      .95      .15
484          UK      300    0.008     0.15      100
485          RK    12000    0.008     0.04      1.0    TRAP      75       3
486          RK    24000    0.007    0.035             TRAP     100       3      NO

487          KK       44
488          BA     8.70
489          IN       60
490          PB     8.60
491          LU      .95      .15
492          UI        0      144      292      398      593      826     1097     1476     1794     2129
493          UI     2582     2587     2710     3037     3037     3037     3037     3037     2621     2242
494          UI     2127     2024     1883     1597     1529     1466     1409     1345     1040     1003
495          UI      969      938      802      715      694      674      655      637      620      604
496          UI      588      523      399      389      380      372      364      351      196      192
497          UI      188      184      184      181      177      174      110      104      102      100
498          UI       99       97       95       94       92       91       89       88       87       47
499          UI       46       45       45       44       44       43       42       42       41       41
500          UI       40       38        0        0

501          KK    ROUTE44
502          KM    ROUTE 44 TO 43
503          RK    12500    0.001     0.03             TRAP     100       3

504          KK       42
505          BA     5.46
506          PB      8.6
507          UI        0      144      292      466      723     1096     1469     1846     2256     2225
508          UI     2550     2550     2550     2549     1928     1795     1679     1431     1288     1218
509          UI     1189      875      834      797      684      595      572      550      530      511
510          UI      494      396      330      319      310      313      164      160      156      152
511          UI      148      157       87       85       83       81       80       78       76       75
512          UI       73       81       39       38       38       37       36       36       35       34
513          UI       34       16        0        0

514          KK    ROUTE42
515          KM    ROUTE 42 TO 43
516          RK    21000    0.013    0.035             TRAP     100       3

517          KK       43
518          BA     5.11
519          PB      8.6
520          LU      .95      .15
521          UK      300     0.02     0.15      100
522          RK     6500     0.02     0.04        1    TRAP      20       3
                                              HEC-1 INPUT                                                          PAGE 13

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

523          RK    25500    0.017    0.035             TRAP      50       3

524          KK COMBINE
525          HC        3

526          KK    ROUTE
527          KM    ROUTE COMBINED HYDROGRAPHS
528          KM    42 43 44 TO 41
529          RK     5000    0.001     0.03             TRAP     100       3

530          KK       41
531          BA     3.05
532          PB      8.6
```

```
533          LU     .95     .15
534          UK     300    0.02    0.15     100
535          RK    6200    0.09    0.04       1    TRAP     20      3
536          RK   24750    0.09   0.035            TRAP     50      3

537          KK COMBINE
538          HC       2

539          KK   ROUTE41 TO 38
540          RK    7000   0.001    0.03            TRAP    100      3

541          KK      38
542          BA    7.18
543          PB     8.6
544          LU     .95     .15
545          UK     300    0.02    0.15     100
546          RK    8500    0.09    0.04       2    TRAP     20      3
547          RK   33750    0.06   0.035            TRAP     50      3

548          KK COMBINE
549          HC       2

550          KK      39
551          BA    2.77
552          PB     8.6
553          UI       0     137     308     595    1015    1468    1736    1776    1915    1829
554          UI    1393    1266     997     917     787     629     574     449     424     401
555          UI     380     318     246     235     201     121     116     112     105      65
556          UI      62      60      58      57      55      47      29      28      27      27
557          UI      26      24       0       0

558          KK   ROUTE39 TO 35
559          RK   24000    0.01   0.035            TRAP     50      3

560          KK      35
561          BA    2.57
562          PB     8.6
563          LU     .95     .15
564          UK     300    0.02    0.15     100
565          RK    6000    0.02    0.04       1    TRAP     20      3
566          RK   24000    0.01   0.035            TRAP     50      3
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                                     HEC-1 INPUT

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

567          KK      28
568          BA   17.59
569          PB     8.6
570          LU     .95     .15
571          UK     300   0.007    0.15     100
572          RK   19000   0.007    0.04       6    TRAP     25      3
573          RK   44500   0.006   0.035            TRAP     50      3      NO

574          KK   DAM20
575          KM   C.A.P., STA. 466+0
576          RS       1    STOR      -1
577          SV       0       9      33      97     436     912
578          SE    1536    1538    1540    1542    1544    1546
579          SQ       0     432    1222    2245    3457    4830
580          ST    1546    2000       3     1.5

581          KK   ROUTE28 TO 29
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RK   14000   0.005    0.03            TRAP      75       3

KK      29
BA   10.32
PB     8.6
LU     .95      .15
UK     300    0.04    0.15     100
RK   16000    0.06    0.04       3   TRAP      25       3
RK   44000    0.04   0.035           TRAP      75       3      NO

KK COMBINE28 TO 29
HC       2

KK COMBINE28,29,39 &35
HC       3

KK   ROUTE
RK    6500   0.004   0.035           TRAP     100       3

KK      40
BA    2.15
PB     8.6
UI       0     168     397     786    1319    1870    2068    2259    2259    1805
UI    1532    1254    1095     949     743     665     526     494     466     462
UI     298     283     270     161     139     133     129      76      74      71
UI      69      66      74      35      33      33      32      31      30       4
UI       0

KK   ROUTE40 TO 36
RK   18000    0.01   0.035           TRAP      50       3

KK      36
BA    4.37
PB     8.6
LU     .95      .15
UK     300    0.02    0.15     100
RK    6600    0.02    0.04       2   TRAP      20       3
                              HEC-1 INPUT
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LINE  ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

RK   26500    0.01   0.035           TRAP      50       3

KK      30
BA    1.50
PB     8.6
LU     .95      .15
UK     300   0.007    0.15     100
RK   19000   0.005   0.035           TRAP      25       3

KK COMBINE30, 35, 36, 39 & 40
HC       4

KK   ROUTETO 37
RK    5000    0.01   0.035           TRAP     100       3

KK      37
BA    2.94
PB     8.6
LU     .95      .15
UK     300    0.02    0.15     100
RK    6700    0.09    0.04       1   TRAP      50       3
RK   26750    0.07   0.035           TRAP     100       3
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 72             .          25
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                .           .
 79     COMBINE.............
                V
                V
 81       DAM22
                V
                V
 88       ROUTE
                .
                .
 90             .           3
                .           V
                .           V
 97             .           5 ***
                .           V
                .           V
104             .         DAM1
                .           V
                .           V
111             .       ROUTE
                .           .
                .           .
113             .           .          12
                .           .           .
                .           .           .
120             .     COMBINE.............
                .           V
                .           V
122             .        DAM8
                .           V
                .           V
129             .       ROUTE
                .           .
                .           .
131             .           .          24
                .           .           .
                .           .           .
138             .     COMBINE.............
                .           V
                .           V
140             .       DAM21
                .           V
                .           V
147             .       ROUTE
                .           .
                .           .
149             .           .          31
                .           .           .
                .           .           .
156     COMBINE.......................
                V
                V
158       ROUTE
                .
                .
160             .           7
                .           V
                .           V
167             .        DAM3
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                 .          V
                 .          V
174              .       ROUTE
                 .          .
                 .          .
176              .          .          14
                 .          .          .
                 .          .          .
183              .     COMBINE...........
                 .          V
                 .          V
185              .      DAM10
                 .          V
                 .          V
192              .      ROUTE
                 .          .
                 .          .
194              .          .          26
                 .          .          .
                 .          .          .
201              .     COMBINE...........
                 .          V
                 .          V
203              .      DAM23
                 .          V
                 .          V
210              .      ROUTE
                 .          .
                 .          .
212              .          .          32
                 .          .          .
                 .          .          .
219        COMBINE.......................
                V
                V
221         ROUTE
                 .
                 .
223              .          8
                 .          V
                 .          V
230              .       DAM4
                 .          V
                 .          V
237              .      ROUTE
                 .          .
                 .          .
239              .          .          9
                 .          .          V
                 .          .          V
246              .          .       DAM5
                 .          .          V
                 .          .          V
253              .          .      ROUTE
                 .          .          .
                 .          .          .
255              .          .          .          15
                 .          .          .          .
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262              .     COMBINE.......................
                 .          V
                 .          V
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                 .          V
                 .          V
 271             .       ROUTE
                 .          .
                 .          .
 273             .          .          27
                 .          .           .
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 279             .     COMBINE............
                 .          V
                 .          V
 281             .      DAM24
                 .          V
                 .          V
 291             .      ROUTE
                 .          .
                 .          .
 293             .          .          18
                 .          .           V
                 .          .           V
 299             .          .       DAM14
                 .          .           V
                 .          .           V
 306             .          .       ROUTE
                 .          .           .
                 .          .           .
 308             .          .           .          33
                 .          .           .           .
                 .          .           .           .
 315     COMBINE..................................
                 V
                 V
 317       ROUTE
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                 .
 319             .          2
                 .          V
                 .          V
 326             .         11 ***
                 .          V
                 .          V
 333             .       DAM7
                 .          V
                 .          V
 340             .      ROUTE
                 .          .
                 .          .
 342             .          .          10
                 .          .           V
                 .          .           V
 349             .          .       DAM6
                 .          .           V
                 .          .           V
 356             .          .       ROUTE
                 .          .           .
                 .          .           .
 358             .          .           .          17
                 .          .           .           .
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 365             .     COMBINE.......................
                 .          V
                 .          V
 367             .      DAM13
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                 V
                 V
374            ROUTE
                 .
                 .
376              .          16
                 .           V
                 .           V
383              .       DAM12
                 .           V
                 .           V
390              .       ROUTE
                 .           .
                 .           .
392              .           .          21
                 .           .           .
                 .           .           .
398          COMBINE.........................
                 V
                 V
400            DAM17
                 V
                 V
407            ROUTE
                 .
                 .
409              .          19
                 .           V
                 .           V
416              .       DAM15
                 .           V
                 .           V
423              .       ROUTE
                 .           .
                 .           .
425              .           .          22
                 .           .           .
                 .           .           .
431              .     COMBINE.............
                 .           V
                 .           V
433              .       DAM18
                 .           V
                 .           V
440              .       ROUTE
                 .           .
                 .           .
442          COMBINE.............
                 .
                 .
444              .          20
                 .           V
                 .           V
451              .       DAM16
                 .           V
                 .           V
458              .       ROUTE
                 .           .
                 .           .
460              .           .          23
                 .           .           .
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467              .     COMBINE.............
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                                V
                                V
469                          DAM19
                                V
                                V
476                          ROUTE
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478                   COMBINE...........
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480                             34
                                .
                                .
487                                        44
                                           V
                                           V
501                                     ROUTE
                                           .
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504                                           .          42
                                           .           V
                                           .           V
514                                           .       ROUTE
                                           .           .
                                           .           .          43
517                                        .           .           .
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524                                     COMBINE.......................
                                           V
                                           V
526                                     ROUTE
                                           .
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530                                           .          41
                                           .           .
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537                                     COMBINE...........
                                           V
                                           V
539                                     ROUTE
                                           .
                                           .
541                                           .          38
                                           .           .
                                           .           .
548                                     COMBINE...........
                                           .
                                           .
550                                           .          39
                                           .           V
                                           .           V
558                                           .       ROUTE
                                           .           .
                                           .           .
560                                           .           .          35
                                           .           .           .
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567                                           .           .           .          28
                                           .           .           .           V
                                           .           .           .           V
574                                           .           .           .       DAM20
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  581             .           .           .           .           .           .       ROUTE
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  583             .           .           .           .           .           .           .          29
                  .           .           .           .           .           .           .           .
  590             .           .           .           .           .           .     COMBINE............
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  592             .           .           .           .     COMBINE........................
                  .           .           .           .           V
                  .           .           .           .           V
  594             .           .           .           .       ROUTE
                  .           .           .           .           .
  596             .           .           .           .           .          40
                  .           .           .           .           .           V
                  .           .           .           .           .           V
  604             .           .           .           .           .       ROUTE
                  .           .           .           .           .           .
  606             .           .           .           .           .           .          36
                  .           .           .           .           .           .           .
  613             .           .           .           .           .           .           .          30
                  .           .           .           .           .           .           .           .
  619             .           .           .           .     COMBINE....................................
                  .           .           .           .           V
                  .           .           .           .           V
  621             .           .           .           .       ROUTE
                  .           .           .           .           .
  623             .           .           .           .           .          37
                  .           .           .           .           .           .
  630             .           .           .           .     COMBINE............
                  .           .           .           .           V
                  .           .           .           .           V
  632             .           .           .           .       ROUTE
                  .           .           .           .           .
  634             .           .           .     COMBINE............
                  .           .           .           V
                  .           .           .           V
  636             .           .           .       ROUTE
                  .           .           .           .
  638       COMBINE....................................
                  V
                  V
  641      MCMICKEN
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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	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE

				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	1	3197.	28.42	2477.	730.	309.	9.60		
ROUTED TO	ROUTE	3079.	29.00	2428.	730.	309.	9.60		
HYDROGRAPH AT	4	1162.	27.17	867.	245.	104.	3.42		
2 COMBINED AT	COMBINE	3952.	28.33	3219.	974.	413.	13.02		
HYDROGRAPH AT	6	5835.	28.25	4637.	1399.	595.	18.81		
ROUTED TO	DAM2	5835.	28.25	4637.	1399.	595.	18.81	2053.65	28.25
ROUTED TO	ROUTE	5297.	29.50	4441.	1398.	595.	18.81		
HYDROGRAPH AT	13	2018.	28.17	1473.	431.	184.	6.05		
2 COMBINED AT	COMBINE	6931.	28.75	5821.	1828.	779.	24.86		
ROUTED TO	DAM9	6931.	28.83	5821.	1829.	779.	24.86	1851.60	28.83
ROUTED TO	ROUTE	5762.	32.17	4997.	1826.	776.	24.86		
HYDROGRAPH AT	25	2955.	28.58	2176.	670.	287.	9.36		
2 COMBINED AT	COMBINE	7593.	31.42	6722.	2490.	1063.	34.22		
ROUTED TO	DAM22	4475.	34.58	4181.	2354.	1018.	34.22	1545.51	34.58
ROUTED TO	ROUTE	4084.	37.25	3870.	2322.	993.	34.22		
HYDROGRAPH AT	3	1546.	27.33	1131.	321.	137.	4.43		
HYDROGRAPH AT	5	2610.	27.58	1909.	545.	232.	7.41		
ROUTED TO	DAM1	2610.	27.58	1909.	545.	232.	7.41	2042.86	27.58
ROUTED TO	ROUTE	2466.	28.58	1840.	545.	232.	7.41		

HYDROGRAPH AT	12	1500.	27.67	1108.	317.	135.	4.42		
2 COMBINED AT	COMBINE	3880.	28.33	2913.	862.	367.	11.83		
ROUTED TO	DAM8	3873.	28.42	2915.	862.	367.	11.83	1923.69	28.42
ROUTED TO	ROUTE	2661.	32.08	2338.	862.	365.	11.83		
HYDROGRAPH AT	24	5488.	28.58	4104.	1282.	548.	17.92		
2 COMBINED AT	COMBINE	7303.	29.17	6165.	2139.	913.	29.75		
ROUTED TO	DAM21	7272.	29.42	5800.	2137.	912.	29.75	1553.83	29.42
ROUTED TO	ROUTE	5643.	32.92	4884.	2128.	900.	29.75		
HYDROGRAPH AT	31	2859.	28.67	2136.	669.	286.	9.34		
3 COMBINED AT	COMBINE	9250.	33.17	8652.	5020.	2179.	73.31		
ROUTED TO	ROUTE	9245.	33.33	8648.	5019.	2176.	73.31		
HYDROGRAPH AT	7	2383.	27.58	1767.	505.	215.	7.05		
ROUTED TO	DAM3	2383.	27.58	1767.	505.	215.	7.05	2001.85	27.58
ROUTED TO	ROUTE	1842.	29.50	1553.	505.	215.	7.05		
HYDROGRAPH AT	14	2368.	28.25	1720.	514.	220.	7.21		
2 COMBINED AT	COMBINE	4018.	28.58	3218.	1017.	434.	14.26		
ROUTED TO	DAM10	4011.	28.67	3220.	1018.	435.	14.26	1672.29	28.67
ROUTED TO	ROUTE	3621.	30.00	3063.	1017.	434.	14.26		
HYDROGRAPH AT	26	2721.	28.42	1985.	605.	259.	8.42		
2 COMBINED AT	COMBINE	5879.	29.33	4925.	1620.	693.	22.68		

ROUTED TO	DAM23	5710.	30.00	4540.	1620.	692.	22.68	1550.57	30.00
ROUTED TO	ROUTE	4548.	33.08	3971.	1616.	686.	22.68		
HYDROGRAPH AT	32	2640.	28.50	1953.	604.	258.	8.42		
3 COMBINED AT	COMBINE	14712.	32.58	13452.	7214.	3121.	104.41		
ROUTED TO	ROUTE	14599.	33.25	13379.	7207.	3109.	104.41		
HYDROGRAPH AT	8	1178.	27.42	863.	245.	104.	3.38		
ROUTED TO	DAM4	1028.	28.50	846.	245.	104.	3.38	1996.74	28.50
ROUTED TO	ROUTE	824.	30.67	716.	245.	104.	3.38		
HYDROGRAPH AT	9	1841.	27.50	1368.	390.	166.	5.44		
ROUTED TO	DAM5	1841.	27.42	1368.	390.	166.	5.44	1981.23	27.42
ROUTED TO	ROUTE	1332.	29.75	1151.	390.	166.	5.44		
HYDROGRAPH AT	15	2165.	28.25	1581.	474.	203.	6.65		
3 COMBINED AT	COMBINE	3873.	28.75	3325.	1107.	472.	15.47		
ROUTED TO	DAM11	3798.	29.42	3321.	1108.	473.	15.47	1565.32	29.42
ROUTED TO	ROUTE	3798.	29.50	3320.	1108.	473.	15.47		
HYDROGRAPH AT	27	362.	28.08	267.	77.	33.	1.04		
2 COMBINED AT	COMBINE	4055.	29.33	3547.	1184.	505.	16.51		
ROUTED TO	DAM24	3823.	30.58	3500.	1183.	505.	16.51	1552.01	30.58
ROUTED TO	ROUTE	3547.	33.42	3080.	1181.	503.	16.51		

HYDROGRAPH AT	18	304.	28.08	221.	65.	28.	.87		
ROUTED TO	DAM14	304.	28.08	221.	65.	28.	.87	1521.42	28.08
ROUTED TO	ROUTE	222.	29.92	191.	65.	28.	.87		
HYDROGRAPH AT	33	2401.	28.50	1755.	537.	230.	7.48		
4 COMBINED AT	COMBINE	19074.	32.83	17219.	8969.	3869.	129.27		
ROUTED TO	ROUTE	19039.	33.08	17195.	8966.	3862.	129.27		
HYDROGRAPH AT	2	5893.	27.50	4385.	1250.	531.	17.02		
HYDROGRAPH AT	11	6380.	27.67	4752.	1353.	575.	18.42		
ROUTED TO	DAM7	6379.	27.75	4753.	1353.	575.	18.42	1983.40	27.75
ROUTED TO	ROUTE	4784.	29.83	4063.	1354.	574.	18.42		
HYDROGRAPH AT	10	497.	27.50	370.	105.	45.	1.43		
ROUTED TO	DAM6	497.	27.50	370.	105.	45.	1.43	1983.00	27.50
ROUTED TO	ROUTE	371.	29.58	317.	105.	44.	1.43		
HYDROGRAPH AT	17	2183.	28.33	1588.	477.	204.	6.70		
3 COMBINED AT	COMBINE	6960.	29.08	5867.	1934.	822.	26.55		
ROUTED TO	DAM13	5861.	31.92	5429.	1933.	823.	26.55	1551.64	31.92
ROUTED TO	ROUTE	5840.	32.33	5393.	1932.	823.	26.55		
HYDROGRAPH AT	16	1142.	28.25	831.	249.	106.	3.46		
ROUTED TO	DAM12	1133.	28.42	831.	249.	106.	3.46	1548.12	28.42
ROUTED TO									

	ROUTE	1086.	28.92	818.	249.	106.	3.46		
HYDROGRAPH AT	21	365.	27.33	272.	77.	33.	1.04		
3 COMBINED AT	COMBINE	6728.	31.25	6187.	2253.	962.	31.05		
ROUTED TO	DAM17	6719.	31.33	6187.	2252.	962.	31.05	1483.92	31.33
ROUTED TO	ROUTE	6510.	32.67	5987.	2250.	959.	31.05		
HYDROGRAPH AT	19	868.	28.08	636.	184.	79.	2.57		
ROUTED TO	DAM15	866.	28.17	636.	184.	79.	2.57	1548.03	28.17
ROUTED TO	ROUTE	814.	28.92	610.	184.	79.	2.57		
HYDROGRAPH AT	22	805.	27.83	595.	171.	73.	2.31		
2 COMBINED AT	COMBINE	1519.	28.25	1170.	355.	151.	4.88		
ROUTED TO	DAM18	1519.	28.25	1170.	355.	151.	4.88	1421.06	28.25
ROUTED TO	ROUTE	1432.	29.17	1142.	354.	151.	4.88		
2 COMBINED AT	COMBINE	7445.	32.00	6768.	2602.	1111.	35.93		
HYDROGRAPH AT	20	365.	27.92	269.	77.	33.	1.08		
ROUTED TO	DAM16	365.	27.92	269.	77.	33.	1.08	1544.59	27.92
ROUTED TO	ROUTE	303.	29.17	246.	77.	33.	1.08		
HYDROGRAPH AT	23	1241.	28.25	898.	267.	114.	3.71		
2 COMBINED AT	COMBINE	1511.	28.42	1137.	345.	147.	4.79		
ROUTED TO	DAM19	1511.	28.42	1137.	345.	147.	4.79	1376.06	28.42
ROUTED TO	ROUTE	1507.	28.58	[illegible]	[illegible]	[illegible]	[illegible]		

2 COMBINED AT	COMBINE	8437.	31.67	7578.	2947.	1258.	40.72	
HYDROGRAPH AT	34	1076.	28.33	779.	235.	100.	3.23	
HYDROGRAPH AT	44	2756.	28.67	2186.	661.	280.	8.70	
ROUTED TO	ROUTE	2722.	29.08	2157.	658.	280.	8.70	
HYDROGRAPH AT	42	1827.	28.42	1412.	415.	176.	5.46	
ROUTED TO	ROUTE	1807.	28.75	1391.	413.	176.	5.46	
HYDROGRAPH AT	43	1726.	27.67	1280.	366.	156.	5.11	
3 COMBINED AT	COMBINE	5952.	28.42	4731.	1436.	612.	19.27	
ROUTED TO	ROUTE	5948.	28.58	4726.	1434.	611.	19.27	
HYDROGRAPH AT	41	1073.	27.25	800.	226.	96.	3.05	
2 COMBINED AT	COMBINE	6877.	28.33	5444.	1658.	707.	22.32	
ROUTED TO	ROUTE	6872.	28.50	5437.	1655.	706.	22.32	
HYDROGRAPH AT	38	2519.	27.33	1876.	531.	225.	7.18	
2 COMBINED AT	COMBINE	9197.	28.25	7150.	2183.	931.	29.50	
HYDROGRAPH AT	39	971.	28.08	735.	211.	89.	2.77	
ROUTED TO	ROUTE	961.	28.58	721.	210.	89.	2.77	
HYDROGRAPH AT	35	861.	28.08	630.	184.	78.	2.57	
HYDROGRAPH AT	28	5768.	28.25	4202.	1255.	537.	17.59	
ROUTED TO	DAM20	3814.	30.42	3543.	1255.	536.	17.59	1544.52 30.42
ROUTED TO	ROUTE	3813.	30.58	3540.	1251.	535.	17.59	
HYDROGRAPH AT								

29	3474.	28.08	2567.	738.	315.	10.32
2 COMBINED AT						
COMBINE	6363.	28.25	5648.	1986.	850.	27.91
3 COMBINED AT						
COMBINE	8160.	28.25	6961.	2380.	1018.	33.25
ROUTED TO						
ROUTE	8152.	28.33	6957.	2377.	1016.	33.25
HYDROGRAPH AT						
40	1071.	28.08	810.	232.	98.	2.15
ROUTED TO						
ROUTE	1063.	28.42	798.	231.	98.	2.15
HYDROGRAPH AT						
36	1515.	28.08	1095.	317.	135.	4.37
HYDROGRAPH AT						
30	526.	28.08	385.	112.	48.	1.50
4 COMBINED AT						
COMBINE	11201.	28.25	9140.	3035.	1297.	41.27
ROUTED TO						
ROUTE	11198.	28.33	9139.	3036.	1297.	41.27
HYDROGRAPH AT						
37	1026.	27.58	753.	215.	91.	2.94
2 COMBINED AT						
COMBINE	12176.	28.25	9841.	3249.	1388.	44.21
ROUTED TO						
ROUTE	12130.	28.42	9818.	3242.	1385.	44.21
2 COMBINED AT						
COMBINE	21274.	28.33	16915.	5419.	2316.	73.71
ROUTED TO						
ROUTE	21268.	28.42	16913.	5419.	2315.	73.71
4 COMBINED AT						
COMBINE	41972.	31.50	37484.	17494.	7536.	246.93
ROUTED TO						
MCMICKEN	18413.	36.83	16803.	9528.	4776.	246.93

1355.82 36.83

HEC-1 INPUT


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
              *DIAGRAM
FREE ***
    1         ID   MCMICKEN DAM WATERSHED
    2         ID   PROBABLE MAXIMUM FLOOD
    3         ID   FCMCD JAN 87 J.RUMANN
    4         ID   SUB BASINS 1-44
    5         IT       5       0       0     900
    6         IO       5
```

```
 7          KK       1
 8          BA    9.60
 9          IN     360
10          PB   15.70
11          PI     1.1      2.3      7.2      1.3      .65      .65      .65      .65      .30      .30
12          PI     .30      .30
13          LU     .95      .15
14          UI       0      241      489      761     1196     1767     2405     3022     3742     3889
15          UI    4131     4350     4350     4350     3744     3157     2953     2702     2265     2142
16          UI    2032     1842     1467     1402     1343     1086     1005      967      932      920
17          UI     900      869      580      562      545      529      514      319      295      274
18          UI     267      260      254      171      150      146      143      140      137      134
19          UI     131      129      126       67       66       65       64       62       61       60
20          UI      59       58       57       19        0

21          KK   ROUTE1 TO 4
22          RM       1      0.7      0.2

23          KK       4
24          BA    3.42
25          PB   15.70
26          LU     .95      .15
27          UK     300     0.09     0.15      100
28          RK    7500     0.05     0.05      0.5     TRAP       25        3
29          RK   19500     0.05    0.035              TRAP       50        3       NO

30          KK COMBINE1 & 4
31          HC       2

32          KK       6
33          BA    5.79
34          PB    15.7
35          LU     .95      .15
36          UK     300     0.03     0.15      100
37          RK   10000     0.02     0.04      1.0     TRAP       25        3
38          RK   19500     0.02    0.035              TRAP       75        3      YES

39          KK    DAM2
40          KM   TRILBY WASH @ S.R. 74
41          RS       1     STOR       -1
42          SA       0      0.9
43          SE    2050     2061
44          SQ       0    17600
45          ST    2061     3500        3     1.5
                                          HEC-1 INPUT                                                    PAGE  2

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

46          KK   ROUTEDAM2 TO 13
47          RM       1      1.1      0.2

48          KK      13
49          BA    6.05
50          PB    15.7
51          LU     .95      .15
52          UK     300     0.03     0.15      100
53          RK   21000     0.02    0.040      1.0     TRAP       25        3
54          RK   27000     0.02    0.035              TRAP       50        3       NO

55          KK COMBINEDAM 2 &13
56          HC       2
```

```
 57          KK    DAM9
 58          KM   TRILBY WASH @ GRAND AVE.
 59          RS       1    STOR      -1
 60          SA       0      50
 61          SE    1850    1857
 62          SQ       0   30300
 63          ST    1857    9000       3     1.5

 64          KK   ROUTEDAM9 TO 25
 65          RM       1     2.6     0.2

 66          KK      25
 67          BA    9.36
 68          PB    15.7
 69          LU     .95     .15
 70          UK     300    0.01    0.15     100
 71          RK   20000   0.009   0.040     3.0    TRAP      50       3
 72          RK   40750   0.008   0.035            TRAP     150       3      NO

 73          KK COMBINEDAM9 TO 25
 74          HC       2

 75          KK   DAM22
 76          KM   TRILBY WASH @ C.A.P., STA. 609+0
 77          RS       1    STOR      -1
 78          SQ       0    6903
 79          SE    1540  1548.5
 80          SV       0    3436
 81          ST    1554    2000       3     1.5

 82          KK   ROUTEDAM22 TO 31
 83          RM       1     2.7     0.2

 84          KK       3
 85          BA    4.43
 86          PB    15.7
 87          LU     .95     .15
 88          UK     300    0.05    0.15     100
 89          RK    6200    0.05   0.040     1.0    TRAP      50       3
 90          RK   26500    0.04   0.035            TRAP      75       3      NO
```



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

 91          KK       5
 92          BA    2.98
 93          PB    15.7
 94          LU     .95     .15
 95          UK     300    0.03    0.15     100
 96          RK    4500    0.03   0.040     1.0    TRAP      50       3
 97          RK   13000    0.01   0.035            TRAP     100       3     YES

 98          KK    DAM1
 99          KM   IONA WASH @ S.R. 74
100          RS       1    STOR      -1
101          SA       0     1.1
102          SE    2040    2048
103          SQ       0    7300
104          ST    2048    6000       3     1.5

105          KK   ROUTEDAM1 TO 12
106          RM       1     0.9     0.2
```

```
107          KK      12
108          BA    4.42
109          PB    15.7
110          LU     .95     .15
111          UK     300    0.02    0.15     100
112          RK    9300   0.015   0.040     1.0    TRAP     50      3
113          RK   13500   0.010   0.035            TRAP    100      3      NO

114          KK COMBINEDAM1 TO 12
115          HC       2

116          KK    DAM8
117          KM   IONA WASH @ GRAND AVE.
118          RS       1    STOR      -1
119          SA       0    50.0
120          SE    1920    1930
121          SQ       0   10500
122          ST    1930    7000       3     1.5

123          KK   ROUTEDAM8 TO 24
124          RM       1     3.3     0.2

125          KK      24
126          BA   17.92
127          PB    15.7
128          LU     .95     .15
129          UK     300   0.010    0.15     100
130          RK   16000   0.008   0.040     5.0    TRAP     75      3
131          RK   60250   0.007   0.035            TRAP    150      3      NO
                                          HEC-1 INPUT                                                    PAGE  4

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

132          KK COMBINEDAM8 TO 24
133          HC       2

134          KK   DAM21
135          KM   IONA WASH @ C.A.P., STA. 572+5
136          RS       1    STOR      -1
137          SQ       0      72     505    1135    1914    2817
138          SE  1545.2    1546    1548    1550    1552    1554
139          SV       0       7      31      69     288     518
140          ST    1553    2000       3     1.5

141          KK   ROUTEDAM 21 TO 31
142          RM       1     2.8     0.2

143          KK      31
144          BA    9.34
145          PB    15.7
146          LU     .95     .15
147          UK     300   0.007    0.15     100
148          RK   10000   0.006   0.040     2.0    TRAP    100      3
149          RK   39750   0.005   0.035            TRAP    175      3      NO

150          KK COMBINEDAMS 21 &22 TO 31
151          HC       3

152          KK   ROUTEDAMS 21 & 22/31 TO 32
153          RM       1     0.2     0.2
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154          KK       7
155          BA    7.05
156          PB    15.7
157          LU     .95      .15
158          UK     300     0.03    0.15      100
159          RK   12400     0.02   0.040      1.0    TRAP      25        3
160          RK   24750     0.03   0.035             TRAP      50        3      NO

161          KK    DAM3
162          KM   S.R. 74
163          RS       1     STOR      -1
164          SA       0      1.1
165          SE    2000     2008
166          SQ       0    10300
167          ST    2008     6000       3      1.5

168          KK   ROUTEDAM3 TO14
169          RM       1      2.1     0.2

170          KK      14
171          BA    7.21
172          PB    15.7
173          LU     .95      .15
174          UK     300    0.020    0.15      100
175          RK   19000    0.015   0.040      2.0    TRAP      50        3
176          RK   32250    0.012   0.035             TRAP     100        3      NO
                                              HEC-1 INPUT                                                          PAGE  5

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

177          KK COMBINEDAM3 TO 14
178          HC       2

179          KK   DAM10
180          KM   GRAND AVE.
181          RS       1     STOR      -1
182          SA       0       50
183          SE    1670     1675
184          SQ       0     8740
185          ST    1681     4000       3      1.5

186          KK   ROUTEDAM10 TO 26
187          RM       1      1.2     0.2

188          KK      26
189          BA    8.42
190          PB    15.7
191          LU     .95      .15
192          UK     300    0.010    0.15      100
193          RK   20000    0.008   0.040      2.0    TRAP      75        3
194          RK   27750    0.008   0.035             TRAP     150        3      NO

195          KK COMBINEDAM 10 TO 26
196          HC       2

197          KK   DAM23
198          KM   C.A.P., STA. 688+0
199          RS       1     STOR      -1
200          SQ       0      116     440      881    1414    2025    2705    3447
201          SE  1544.3     1545    1546     1547    1548    1549    1550    1551
202          SV       0        3      10       19      31     139     292     498
203          ST  1550.2     2000       3      1.5
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```
 252          LU      .95      .15
 253          UK      300     0.02     0.15      100
 254          RK    11400     0.02     0.04      2.0    TRAP      50       3
 255          RK    38000    0.011    0.035             TRAP     100       3      NO

 256          KK COMBINEDAMS 4,5 TO 15
 257          HC        3
```



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

 258          KK    DAM11
 259          KM    GRAND AVE.
 260          RS        1     STOR      -1
 261          SA        0     50.0
 262          SE     1560     1567
 263          SQ        0     5000
 264          ST     1568     5000       3      1.5

 265          KK    ROUTEDAM 11 TO 27
 266          RM        1     0.07      0.2

 267          KK       27
 268          BA     1.04
 269          PB     15.7
 270          LU      .95      .15
 271          UK      300    0.009     0.15      100
 272          RK    13500    0.008     0.04             TRAP      25       3      NO

 273          KK COMBINEDAM11 TO 27
 274          HC        2

 275          KK    DAM24
 276          KM    C.A.P. STA. 804+5
 277          RS        1     STOR      -1
 278          SQ        0       54      233      608     1007     1469     1985     2550     3161     3814
 279          SQ     4506     5236
 280          SE   1543.5     1544     1545     1546     1547     1548     1549     1550     1551     1552
 281          SE     1553     1554
 282          SV        0        0        0        0        1        3        9       18       44      114
 283          SV      204      413
 284          ST   1552.8     2000        3      1.5

 285          KK    ROUTEDAM24 TO 33
 286          RM        1      2.4      0.2

 287          KK       18
 288          BA     0.87
 289          PB     15.7
 290          LU      .95      .15
 291          UK      300     0.01     0.15      100
 292          RK    17500    0.009     0.04             TRAP      50       3      NO

 293          KK    DAM14
 294          KM    GRAND AVE.
 295          RS        1     STOR      -1
 296          SA        0     0.30
 297          SE     1520     1527
 298          SQ        0     1500
 299          ST     1527     1500       3      1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 300          KK   ROUTEDAM14 TO 33
 301          RM       1      2.4      0.2

 302          KK      33
 303          BA    7.48
 304          PB    15.7
 305          LU     .95      .15
 306          UK     300    0.005     0.15      100
 307          RK   13000    0.005     0.04      2.0    TRAP      75       3
 308          RK   34750    0.006    0.035             TRAP     100       3      NO

 309          KK COMBINEDAMS 21,22,23/31,32 TO DAMS 14,24/33
 310          HC       4

 311          KK   ROUTEALL TO 34
 312          RM       1      0.3      0.2

 313          KK       2
 314          BA   17.02
 315          PB    15.7
 316          LU     .95      .15
 317          UK     300     0.09     0.15      100
 318          RK    6800    0.071    0.040      2.0    TRAP      50       3
 319          RK   48000    0.043    0.035             TRAP     100       3      NO

 320          KK      11
 321          BA    1.40
 322          PB    15.7
 323          LU     .95      .15
 324          UK     300    0.030     0.15      100
 325          RK    9000    0.022     0.04      0.5    TRAP      50       3
 326          RK   11750    0.022    0.035             TRAP     100       3     YES

 327          KK    DAM7
 328          KM   ME WASH @ S.R. 74
 329          RS       1     STOR       -1
 330          SA       0       50
 331          SE    1980     1988
 332          SQ       0    15000
 333          ST    1988     2500        3      1.5

 334          KK   ROUTEDAM7 TO 17
 335          RM       1      2.4      0.2

 336          KK      10
 337          BA    1.43
 338          PB    15.7
 339          LU     .95      .15
 340          UK     300    0.03     0.15      100
 341          RK    8500    0.28     0.04      0.5    TRAP      25       3
 342          RK   17500    0.023    0.035             TRAP      50       3      NO
```



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

 343          KK    DAM6
 344          KM   S.R. 74
 345          RS       1     STOR       -1
 346          SA       0     0.20
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347          SE    1980    1988
348          SQ       0    1325
349          ST    1988    1000       3     1.5

350          KK   ROUTEDAM6 TO 17
351          RM       1     2.4     0.2

352          KK      17
353          BA    6.70
354          PB    15.7
355          LU     .95     .15
356          UK     300   0.015    0.15     100
357          RK   18000   0.014    0.04     2.0    TRAP      50       3
358          RK   34250   0.013   0.035            TRAP     100       3      NO

359          KK COMBINEDAMS6 & 7 TO 17
360          HC       3

361          KK   DAM13
362          KM   ME WASH @ C.A.P.
363          RS       1    STOR      -1
364          SQ       0      51     778    3740    5531    6875    7646    7773
365          SE    1540    1542    1548 1549.03 1551.26 1552.32 1553.68 1553.82
366          SV       0       0       0      44     357     747    1024    1072
367          ST    1557    2000       3     1.5

368          KK   ROUTEDAM13 TO 21
369          RM       1     0.6     0.2

370          KK      16
371          BA    3.46
372          PB    15.7
373          LU     .95     .15
374          UK     300   0.015    0.15     100
375          RK    8500   0.014    0.04     1.0    TRAP      25       3
376          RK   35750   0.011   0.035            TRAP      75       3      NO

377          KK   DAM12
378          KM   C.A.P.
379          RS       1    STOR      -1
380          SQ       0      51     778    3740    5531    6875    7646    7773
381          SE    1540    1542    1548 1549.03 1551.26 1552.82 1553.68 1553.82
382          SV       0       0       0      44     357     747    1024    1072
383          ST    1557     200       3     1.5
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

384          KK   ROUTEDAM12 TO 21
385          RM       1     0.6     0.2

386          KK      21
387          BA    1.04
388          PB    15.7
389          LU     .95     .15
390          UK     300   0.009    0.15     100
391          RK    8500   0.008    0.04            TRAP      25       3      NO

392          KK COMBINEDAMS 12,13 TO 21
393          HC       3

394          KK   DAM17
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```
395          KM   GRAND AVE.
396          RS       1    STOR      -1
397          SA       0      50
398          SE    1480    1487
399          SQ       0   12000
400          ST    1488    3000       3     1.5

401          KK   ROUTEDAM 17 TO 34
402          RM       1     1.3     0.2

403          KK      19
404          BA    2.57
405          PB    15.7
406          LU     .95     .15
407          UK     300   0.013    0.15     100
408          RK   10000   0.012    0.04     1.0    TRAP      25       3
409          RK   19000   0.012   0.035            TRAP      50       3      NO

410          KK   DAM15
411          KM   C.A.P.
412          RS       1    STOR      -1
413          SQ       0      51     778    3740    5531    6875    7646    7773
414          SE    1540    1542    1548 1549.03 1551.26 1552.82 1553.68 1553.82
415          SV       0       0       0      44     357     747    1024    1072
416          ST    1557    2000       3     1.5

417          KK   ROUTEDAM15 TO 22
418          RM       0       1     0.2

419          KK      22
420          BA    2.31
421          PB    15.7
422          LU     .95     .15
423          UK     300   0.009    0.15     100
424          RK   14750   0.008    0.04            TRAP      50       3      NO
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

425          KK COMBINEDAM15 TO 22
426          HC       2

427          KK   DAM18
428          KM   GRAND AVE.
429          RS       1    STOR      -1
430          SA       0   0.600
431          SE    1420    1427
432          SQ       0   10000
433          ST    1427    3500       3     1.5

434          KK   ROUTEDAM18 TO 34
435          RM       1     0.8     0.2

436          KK COMBINEDAM 17 TO DAM 18
437          HC       2

438          KK      20
439          BA    1.08
440          PB    15.7
441          LU     .95     .15
442          UK     300    0.01    0.15     100
443          RK    6500    0.01    0.04     0.5    TRAP      25       3
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444          RK   12250   0.011   0.035            TRAP      50       3      NO

445          KK   DAM16
446          KM   C.A.P.
447          RS       1    STOR      -1
448          SQ       0      51     778    3740    5531    6875    7646    7773
449          SE    1540    1542    1548 1549.03 1551.26 1552.82 1553.68 1553.82
450          SV       0       0       0      44     357     747    1024    1072
451          ST    1557    2000       3     1.5

452          KK   ROUTEDAM16 TO 23
453          RM       1     1.6     0.2

454          KK      23
455          BA    3.71
456          PB    15.7
457          LU     .95     .15
458          UK     300   0.008    0.15     100
459          RK   12000   0.008    0.04     1.0    TRAP      50       3
460          RK   23500   0.007   0.035            TRAP      75       3      NO

461          KK COMBINEDAM16 TO 23
462          HC       2

463          KK   DAM19
464          KM   GRAND AVE.
465          RS       1    STOR      -1
466          SA       0   0.650
467          SE    1375    1382
468          SQ       0   10000
469          ST    1382    4000       3     1.5
                                        HEC-1 INPUT                                                          PAGE 12

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

470          KK   ROUTEDAM19 TO 34
471          RM       1     0.2     0.2

472          KK COMBINEDAMS 17,18 TO DAM 19
473          HC       2

474          KK      34
475          BA    3.23
476          PB    15.7
477          LU     .95     .15
478          UK     300   0.008    0.15     100
479          RK   12000   0.008    0.04     1.0    TRAP      75       3
480          RK   24000   0.007   0.035            TRAP     100       3      NO

481          KK      44
482          BA    8.70
483          IN      60
484          PB    15.7
485          LU     .95     .15
486          UI       0     144     292     398     593     826    1097    1476    1794    2129
487          UI    2582    2587    2710    3037    3037    3037    3037    3037    2621    2242
488          UI    2127    2024    1883    1597    1529    1466    1409    1345    1040    1003
489          UI     969     938     802     715     694     674     655     637     620     604
490          UI     588     523     399     389     380     372     364     351     196     192
491          UI     188     184     184     181     177     174     110     104     102     100
492          UI      99      97      95      94      92      91      89      88      87      47
493          UI      46      45      45      44      44      43      42      42      41      41
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494          UI      40      38       0       0

495          KK   ROUTE44
496          KM   ROUTE 44 TO 43
497          RK   12500   0.001    0.03            TRAP     100       3

498          KK      42
499          BA    5.46
500          PB    15.7
501          UI       0     144     292     466     723    1096    1469    1846    2256    2225
502          UI    2550    2550    2550    2549    1928    1795    1679    1431    1288    1218
503          UI    1189     875     834     797     684     595     572     550     530     511
504          UI     494     396     330     319     310     313     164     160     156     152
505          UI     148     157      87      85      83      81      80      78      76      75
506          UI      73      81      39      38      38      37      36      36      35      34
507          UI      34      16       0       0

508          KK   ROUTE42
509          KM   ROUTE 42 TO 43
510          RK   21000   0.013   0.035            TRAP     100       3

511          KK      43
512          BA    5.11
513          PB    15.7
514          LU     .95     .15
515          UK     300    0.02    0.15     100
516          RK    6500    0.02    0.04       1    TRAP      20       3
                                          HEC-1 INPUT                                                    PAGE 13

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

517          RK   25500   0.017   0.035            TRAP      50       3

518          KK COMBINE
519          HC       3

520          KK   ROUTE
521          KM   ROUTE COMBINED HYDROGRAPHS
522          KM   42 43 44 TO 41
523          RK    5000   0.001    0.03            TRAP     100       3

524          KK      41
525          BA    3.05
526          PB    15.7
527          LU     .95     .15
528          UK     300    0.02    0.15     100
529          RK    6200    0.09    0.04       1    TRAP      20       3
530          RK   24750    0.09   0.035            TRAP      50       3

531          KK COMBINE
532          HC       2

533          KK   ROUTE41 TO 38
534          RK    7000   0.001    0.03            TRAP     100       3

535          KK      38
536          BA    7.18
537          PB    15.7
538          LU     .95     .15
539          UK     300    0.02    0.15     100
540          RK    8500    0.09    0.04       2    TRAP      20       3
541          RK   33750    0.06   0.035            TRAP      50       3
```

```
 542          KK COMBINE
 543          HC       2

 544          KK      39
 545          BA    2.77
 546          PB    15.7
 547          UI       0     137     308     595    1015    1468    1786    1776    1915    1829
 548          UI    1393    1266     997     917     787     629     574     449     424     401
 549          UI     380     318     246     235     201     121     116     112     105      65
 550          UI      62      60      58      57      55      47      29      28      27      27
 551          UI      26      24       0       0

 552          KK   ROUTE39 TO 35
 553          RK   24000    0.01   0.035            TRAP      50       3

 554          KK      35
 555          BA    2.57
 556          PB    15.7
 557          LU     .95     .15
 558          UK     300    0.02    0.15     100
 559          RK    6000    0.02    0.04       1    TRAP      20       3
 560          RK   24000    0.01   0.035            TRAP      50       3
                                             HEC-1 INPUT                                          PAGE 14
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 561          KK      28
 562          BA   17.59
 563          PB    15.7
 564          LU     .95     .15
 565          UK     300   0.007    0.15     100
 566          RK   19000   0.007    0.04       6    TRAP      25       3
 567          RK   44500   0.006   0.035            TRAP      50       3      NO

 568          KK   DAM20
 569          KM   C.A.P., STA. 466+0
 570          RS       1    STOR      -1
 571          SV       0       9      33      97     436     912
 572          SE    1536    1538    1540    1542    1544    1546
 573          SQ       0     432    1222    2245    3457    4830
 574          ST    1546    2000       3     1.5

 575          KK   ROUTE28 TO 29
 576          RK   14000   0.005    0.03            TRAP      75       3

 577          KK      29
 578          BA   10.32
 579          PB    15.7
 580          LU     .95     .15
 581          UK     300    0.04    0.15     100
 582          RK   16000    0.06    0.04       3    TRAP      25       3
 583          RK   44000    0.04   0.035            TRAP      75       3      NO

 584          KK COMBINE28 TO 29
 585          HC       2

 586          KK COMBINE28,29,39 &35
 587          HC       3

 588          KK   ROUTE
 589          RK    6500   0.004   0.035            TRAP     100       3
```

```
590          KK      40
591          BA    2.15
592          PB    15.7
593          UI       0     168     397     786    1319    1870    2068    2259    2259    1805
594          UI    1532    1254    1095     949     743     665     526     494     466     462
595          UI     298     283     270     161     139     133     129      76      74      71
596          UI      69      66      74      35      33      33      32      31      30       4
597          UI       0

598          KK   ROUTE40 TO 36
599          RK   18000    0.01   0.035            TRAP      50       3

600          KK      36
601          BA    4.37
602          PB    15.7
603          LU     .95     .15
604          UK     300    0.02    0.15     100
605          RK    6600    0.02    0.04       2    TRAP      20       3
                                          HEC-1 INPUT                                                    PAGE 15

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

606          RK   26500    0.01   0.035            TRAP      50       3

607          KK      30
608          BA    1.50
609          PB    15.7
610          LU     .95     .15
611          UK     300   0.007    0.15     100
612          RK   19000   0.005   0.035            TRAP      25       3

613          KK COMBINE30, 35, 36, 39 & 40
614          HC       4

615          KK   ROUTETO 37
616          RK    5000    0.01   0.035            TRAP     100       3

617          KK      37
618          BA    2.94
619          PB    15.7
620          LU     .95     .15
621          UK     300    0.02    0.15     100
622          RK    6700    0.09    0.04       1    TRAP      50       3
623          RK   26750    0.07   0.035            TRAP     100       3

624          KK COMBINE
625          HC       2

626          KK   ROUTE
627          RK   14500   0.005   0.035            TRAP     100       3

628          KK COMBINE
629          HC       2

630          KK   ROUTEMCM. SUB. TO 34
631          RK    3000   0.001    0.03            TRAP     100       3

632          KK COMBINEALL TO 34
633          HC       4
634          KO       5       2

635          KKMCMICKEN DAM
636          RS       1    ELEV    1335
```

```
637        SV       0       0    2200    8800   19000   32400   35500   49800
638        SE    1335    1340    1345    1350    1355    1360    1361    1365
639        SQ     0.0  1750.0  4600.0  10500.  20100.  47000.  63600.  81150.102200.0
640        SE  1335.0  1345.0  1353.9  1355.0  1356.0  1358.0  1359.0  1360.0  1361.0
641        ST    1361   49500    3.05     1.5
642        ZZ
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	1	6376.	17.33	5840.	2056.	685.	9.60		
ROUTED TO	ROUTE	6375.	18.33	5708.	2056.	685.	9.60		
HYDROGRAPH AT	4	2130.	14.33	2077.	686.	229.	3.42		
2 COMBINED AT	COMBINE	8493.	18.08	7475.	2742.	914.	13.02		
HYDROGRAPH AT	6	12233.	18.08	10781.	3946.	1317.	18.81		
ROUTED TO	DAM2	12233.	18.08	10781.	3946.	1317.	18.81	2057.65	18.08
ROUTED TO	ROUTE	12290.	18.42	10399.	3945.	1317.	18.81		
HYDROGRAPH AT	13	3799.	17.92	3599.	1220.	408.	6.05		
2 COMBINED AT	COMBINE	15839.	18.17	13640.	5165.	1725.	24.86		
ROUTED TO	DAM9	15837.	18.17	13641.	5166.	1725.	24.86	1853.66	18.17
ROUTED TO	ROUTE	14310.	19.17	12104.	5149.	1725.	24.86		
HYDROGRAPH AT	25	5936.	18.08	5446.	1894.	638.	9.36		
2 COMBINED AT	COMBINE	19009.	18.33	16217.	7038.	2363.	34.22		
ROUTED TO	DAM22	12203.	21.08	11005.	6514.	2362.	34.22	1554.23	21.08
		12208							
ROUTED TO	ROUTE	10786.	23.83	10299.	6438.	2362.	34.22		
		11087							

HYDROGRAPH AT	3	2870.	14.75	2781.	917.	306.	4.43	
HYDROGRAPH AT	5	4855.	14.92	4688.	1551.	518.	7.41	
ROUTED TO	DAM1	4855.	14.33	4688.	1551.	518.	7.41	2045.32 14.33
ROUTED TO	ROUTE	4953.	18.33	4485.	1551.	518.	7.41	
HYDROGRAPH AT	12	2794.	14.67	2693.	899.	300.	4.42	
2 COMBINED AT	COMBINE	7646.	18.08	7077.	2449.	819.	11.83	
ROUTED TO	DAM8	7644.	18.08	7060.	2448.	818.	11.83	1927.28 18.08
ROUTED TO	ROUTE	7080.	19.25	5789.	2433.	818.	11.83	
HYDROGRAPH AT	24	11373.	18.08	10351.	3623.	1222.	17.92	
2 COMBINED AT	COMBINE	17639.	18.08	15168.	6050.	2040.	29.75	
ROUTED TO	DAM21	17607.	18.17	15153.	6044.	2040.	29.75	1554.80 18.17
ROUTED TO	ROUTE	15321.	19.50	13182.	5986.	2040.	29.75	
HYDROGRAPH AT	31	5932.	18.08	5395.	1889.	637.	9.34	
3 COMBINED AT	COMBINE	25218.	18.92	23423.	13963.	5039.	73.31	
ROUTED TO	ROUTE	25192.	19.17	23413.	13962.	5039.	73.31	
HYDROGRAPH AT	7	4427.	14.50	4272.	1425.	476.	7.05	
ROUTED TO	DAM3	4427.	14.08	4272.	1425.	476.	7.05	2003.44 14.08
ROUTED TO	ROUTE	4507.	18.50	3748.	1423.	476.	7.05	
HYDROGRAPH AT	14	4558.	16.92	4277.	1461.	490.	7.21	
2 COMBINED AT								

	COMBINE	8809.	18.08	7825.	2883.	966.	14.26	
ROUTED TO								
	DAM10	8772.	18.25	7805.	2881.	965.	14.26	1675.02 18.25
ROUTED TO								
	ROUTE	8645.	18.33	7456.	2879.	965.	14.26	
HYDROGRAPH AT								
	26	5344.	18.00	4941.	1707.	574.	8.42	
2 COMBINED AT								
	COMBINE	13762.	18.17	11959.	4585.	1539.	22.68	
ROUTED TO								
	DAM23	13716.	18.25	11896.	4585.	1539.	22.68	1551.59 18.25
ROUTED TO								
	ROUTE	12040.	19.75	10384.	4558.	1539.	22.68	
HYDROGRAPH AT								
	32	5348.	18.08	4895.	1705.	574.	8.42	
3 COMBINED AT								
	COMBINE	40419.	18.67	36462.	20031.	7153.	104.41	
ROUTED TO								
	ROUTE	39855.	19.33	36281.	20022.	7152.	104.41	
HYDROGRAPH AT								
	8	2188.	14.75	2118.	699.	233.	3.38	
ROUTED TO								
	DAM4	2187.	17.42	1788.	699.	233.	3.38	2001.22 17.42
ROUTED TO								
	ROUTE	1916.	18.58	1620.	697.	233.	3.38	
HYDROGRAPH AT								
	9	3419.	15.25	3307.	1100.	367.	5.44	
ROUTED TO								
	DAM5	3419.	14.42	3307.	1100.	367.	5.44	1982.28 14.42
ROUTED TO								
	ROUTE	3441.	18.58	2789.	1098.	367.	5.44	
HYDROGRAPH AT								
	15	4204.	17.67	3941.	1347.	452.	6.65	
3 COMBINED AT								
	COMBINE	9136.	18.17	7790.	3141.	1053.	15.47	
ROUTED TO								
	DAM11	9127.	18.17	7659.	3139.	1052.	15.47	1568.35 18.17
ROUTED TO								
	ROUTE	9123.	18.25	7659.	3139.	1052.	15.47	

HYDROGRAPH AT	27	677.	15.50	649.	218.	73.	1.04	
2 COMBINED AT	COMBINE	9757.	18.17	8186.	3356.	1125.	16.51	
ROUTED TO	DAM24	9688.	18.25	8099.	3356.	1125.	16.51	1553.65 18.25
ROUTED TO	ROUTE	8598.	19.50	7362.	3340.	1125.	16.51	
HYDROGRAPH AT	18	567.	17.67	534.	182.	61.	.87	
ROUTED TO	DAM14	567.	16.17	534.	182.	61.	.87	1522.65 16.17
ROUTED TO	ROUTE	560.	18.58	464.	182.	61.	.87	
HYDROGRAPH AT	33	4752.	18.08	4377.	1517.	510.	7.48	
4 COMBINED AT	COMBINE	51694.	19.00	46353.	24872.	8849.	129.27	
ROUTED TO	ROUTE	51519.	19.25	46295.	24868.	8849.	129.27	
HYDROGRAPH AT	2	10941.	15.00	10567.	3499.	1169.	17.02	
HYDROGRAPH AT	11	11847.	15.00	11438.	3796.	1268.	18.42	
ROUTED TO	DAM7	11847.	15.00	11423.	3795.	1268.	18.42	1986.32 15.00
ROUTED TO	ROUTE	12106.	18.75	9788.	3789.	1268.	18.42	
HYDROGRAPH AT	10	926.	14.92	894.	296.	99.	1.43	
ROUTED TO	DAM6	926.	14.50	894.	296.	99.	1.43	1985.59 14.50
ROUTED TO	ROUTE	940.	18.50	765.	296.	99.	1.43	
HYDROGRAPH AT	17	4235.	16.92	3964.	1357.	455.	6.70	
3 COMBINED AT	COMBINE	16213.	18.17	14113.	5440.	1822.	26.55	
ROUTED TO								

	DAM13	15143.	18.92	11325.	5439.	1822.	26.55	1557.74	18.92
ROUTED TO									
	ROUTE	14463.	19.50	11279.	5437.	1822.	26.55		
HYDROGRAPH AT									
	16	2183.	18.00	2034.	699.	235.	3.46		
ROUTED TO									
	DAM12	2183.	16.58	2027.	699.	235.	3.46	1548.49	16.58
ROUTED TO									
	ROUTE	2187.	18.33	1993.	699.	235.	3.46		
HYDROGRAPH AT									
	21	677.	14.17	656.	218.	73.	1.04		
3 COMBINED AT									
	COMBINE	16081.	19.33	12883.	6348.	2129.	31.05		
ROUTED TO									
	DAM17	16040.	19.42	12859.	6347.	2129.	31.05	1488.34	19.42
ROUTED TO									
	ROUTE	14712.	20.33	12600.	6340.	2129.	31.05		
HYDROGRAPH AT									
	19	1620.	15.75	1548.	521.	174.	2.57		
ROUTED TO									
	DAM15	1620.	14.67	1542.	521.	174.	2.57	1548.29	14.67
ROUTED TO									
	ROUTE	1634.	18.50	1475.	521.	174.	2.57		
HYDROGRAPH AT									
	22	1505.	15.50	1446.	484.	162.	2.31		
2 COMBINED AT									
	COMBINE	3122.	18.08	2823.	1004.	336.	4.88		
ROUTED TO									
	DAM18	3122.	18.08	2823.	1004.	336.	4.88	1422.19	18.08
ROUTED TO									
	ROUTE	3134.	18.25	2757.	1004.	336.	4.88		
2 COMBINED AT									
	COMBINE	16142.	20.17	14287.	7336.	2465.	35.93		
HYDROGRAPH AT									
	20	683.	15.08	655.	219.	73.	1.08		
ROUTED TO									
	DAM16	684.	15.25	655.	220.	73.	1.08	1547.22	15.25
ROUTED TO									

	ROUTE	696.	18.50	598.	219.	73.	1.08		
HYDROGRAPH AT	23	2350.	17.17	2198.	753.	252.	3.71		
2 COMBINED AT	COMBINE	3021.	18.08	2769.	972.	326.	4.79		
ROUTED TO	DAM19	3022.	18.08	2769.	972.	326.	4.79	1377.12	18.08
ROUTED TO	ROUTE	3021.	18.17	2762.	972.	326.	4.79		
2 COMBINED AT	COMBINE	17460.	18.50	16091.	8307.	2791.	40.72		
HYDROGRAPH AT	34	2049.	17.58	1898.	655.	220.	3.23		
HYDROGRAPH AT	44	5754.	18.08	5149.	1864.	621.	8.70		
ROUTED TO	ROUTE	5747.	18.25	5121.	1861.	621.	8.70		
HYDROGRAPH AT	42	3625.	17.42	3330.	1169.	390.	5.46		
ROUTED TO	ROUTE	3625.	18.17	3307.	1168.	390.	5.46		
HYDROGRAPH AT	43	3321.	15.17	3199.	1060.	354.	5.11		
3 COMBINED AT	COMBINE	12688.	18.08	11284.	4088.	1365.	19.27		
ROUTED TO	ROUTE	12684.	18.08	11281.	4086.	1365.	19.27		
HYDROGRAPH AT	41	1982.	14.42	1929.	637.	213.	3.05		
2 COMBINED AT	COMBINE	14666.	18.08	13005.	4722.	1578.	22.32		
ROUTED TO	ROUTE	14660.	18.08	12998.	4719.	1578.	22.32		
HYDROGRAPH AT	38	4666.	14.33	4530.	1499.	500.	7.18		
2 COMBINED AT	COMBINE	19326.	18.08	17188.	6215.	2078.	29.50		
HYDROGRAPH AT	39	1843.	15.50	1741.	594.	198.	2.77		
ROUTED TO	ROUTE	1843.	17.67	1712.	593.	198.	2.77		

HYDROGRAPH AT	35	1670.	16.67	1590.	533.	178.	2.57	
HYDROGRAPH AT	28	11119.	17.33	10423.	3565.	1195.	17.59	
ROUTED TO	DAM20	11114.	16.83	9153.	3563.	1195.	17.59	1546.96 16.83
ROUTED TO	ROUTE	11114.	17.42	9149.	3560.	1195.	17.59	
HYDROGRAPH AT	29	6485.	15.33	6236.	2086.	697.	10.32	
2 COMBINED AT	COMBINE	17599.	17.42	14623.	5639.	1892.	27.91	
3 COMBINED AT	COMBINE	21113.	17.67	17867.	6766.	2268.	33.25	
ROUTED TO	ROUTE	21113.	17.42	17864.	6763.	2268.	33.25	
HYDROGRAPH AT	40	2026.	15.33	1922.	654.	218.	2.15	
ROUTED TO	ROUTE	2026.	16.67	1904.	653.	218.	2.15	
HYDROGRAPH AT	36	2840.	15.83	2715.	907.	303.	4.37	
HYDROGRAPH AT	30	976.	16.67	924.	314.	105.	1.50	
4 COMBINED AT	COMBINE	26955.	17.42	23289.	8634.	2894.	41.27	
ROUTED TO	ROUTE	26955.	17.50	23286.	8633.	2894.	41.27	
HYDROGRAPH AT	37	1913.	14.92	1846.	612.	204.	2.94	
2 COMBINED AT	COMBINE	28869.	17.50	25047.	9243.	3098.	44.21	
ROUTED TO	ROUTE	28869.	17.67	25023.	9235.	3098.	44.21	
2 COMBINED AT	COMBINE	48195.	18.08	42181.	15441.	5176.	73.71	
ROUTED TO	ROUTE	48192.	18.08	42176.	15440.	5176.	73.71	
4 COMBINED AT	COMBINE	114849.	18.25	95941.	48637.	17036.	246.93	
ROUTED TO	MCMICKEN	90108.	19.58	80219.	40677.	15784.	244.07	

1360.43 19.58

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

RED PICACHO QUADRANGLE
ARIZONA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

To place on the predicted North American Datum 1983, move the projection lines 1 meter south and 67 meters east as shown by dashed corner ticks

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Map photoinspected 1978
No major culture or drainage changes observed

ROAD CLASSIFICATION
Light-duty ——— Unimproved dirt - - - - -

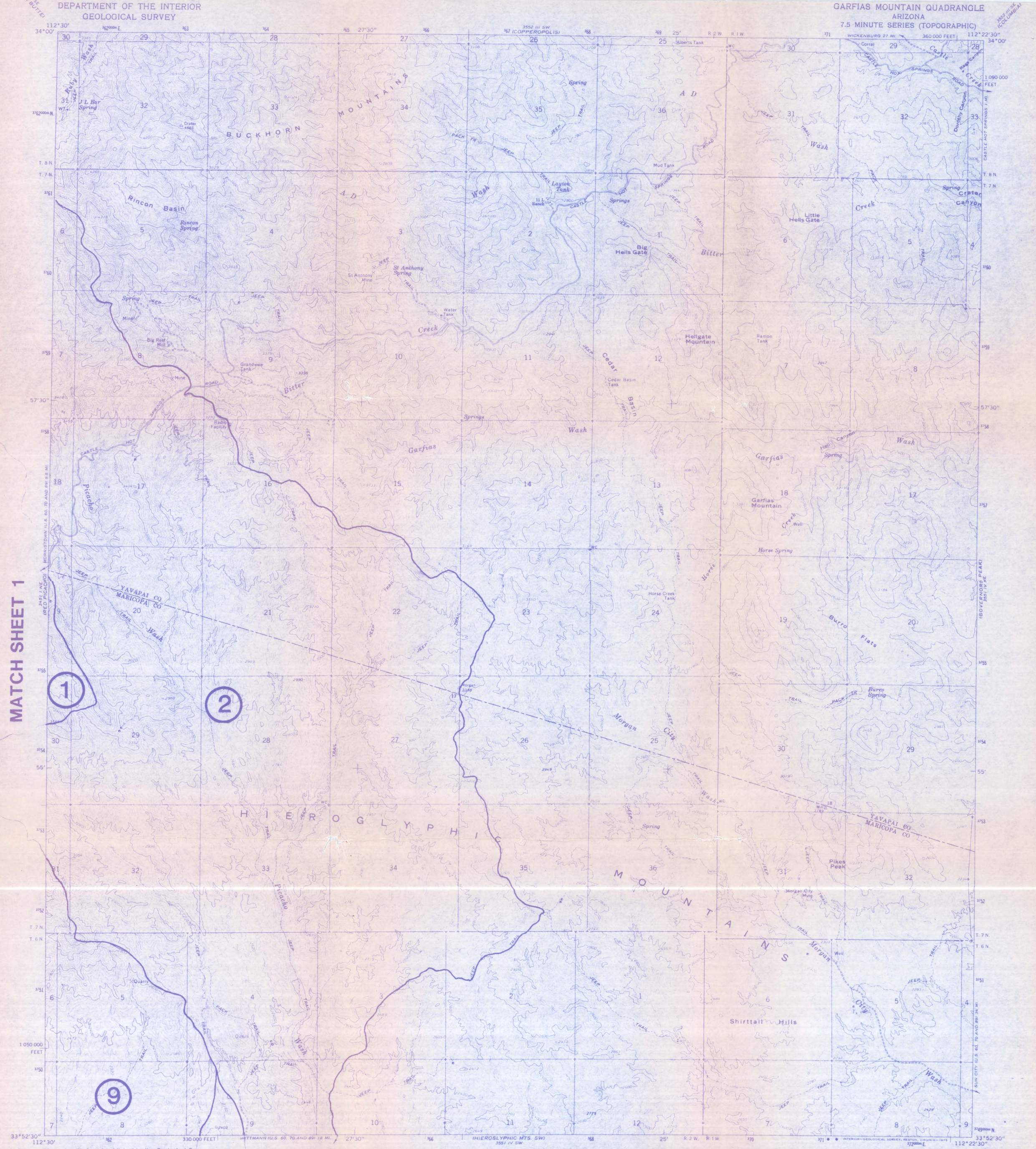
WHITE WORLD OF MAPS

RED PICACHO, ARIZ.
N3352.5—W11230/7.5

1964
PHOTOINSPECTED 1978
DMA 3451 I NE—SERIES V898

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GARFIAS MOUNTAIN QUADRANGLE
ARIZONA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-metre Universal Transverse Mercator grid ticks, zone 12, shown in blue

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

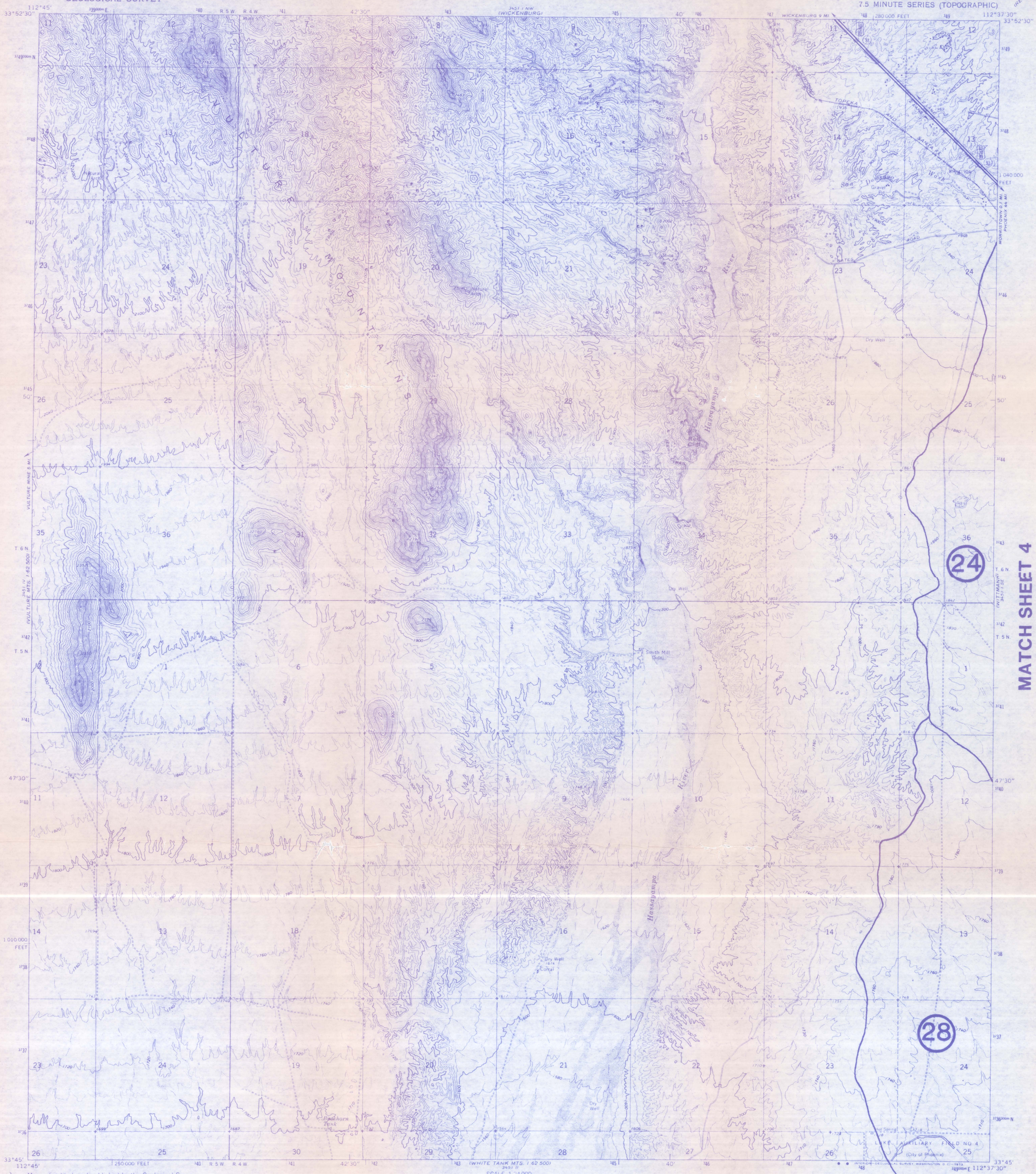
ROAD CLASSIFICATION
Light-duty — Unimproved dirt

WIDE WORLD OF MAPS
2626 W. INDIAN SCHOOL ROAD
PHOENIX, AZ 85017
602-0000

GARFIAS MOUNTAIN, ARIZ.
N3352.5—W11222.5/7.5
1964
AMS 3551 IV NW—SERIES V898

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WICKENBURG SW QUADRANGLE
ARIZONA – MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1965

Polyconic projection. 1927 North American datum
10 000 foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Unimproved dirt
U. S. Route — State Route

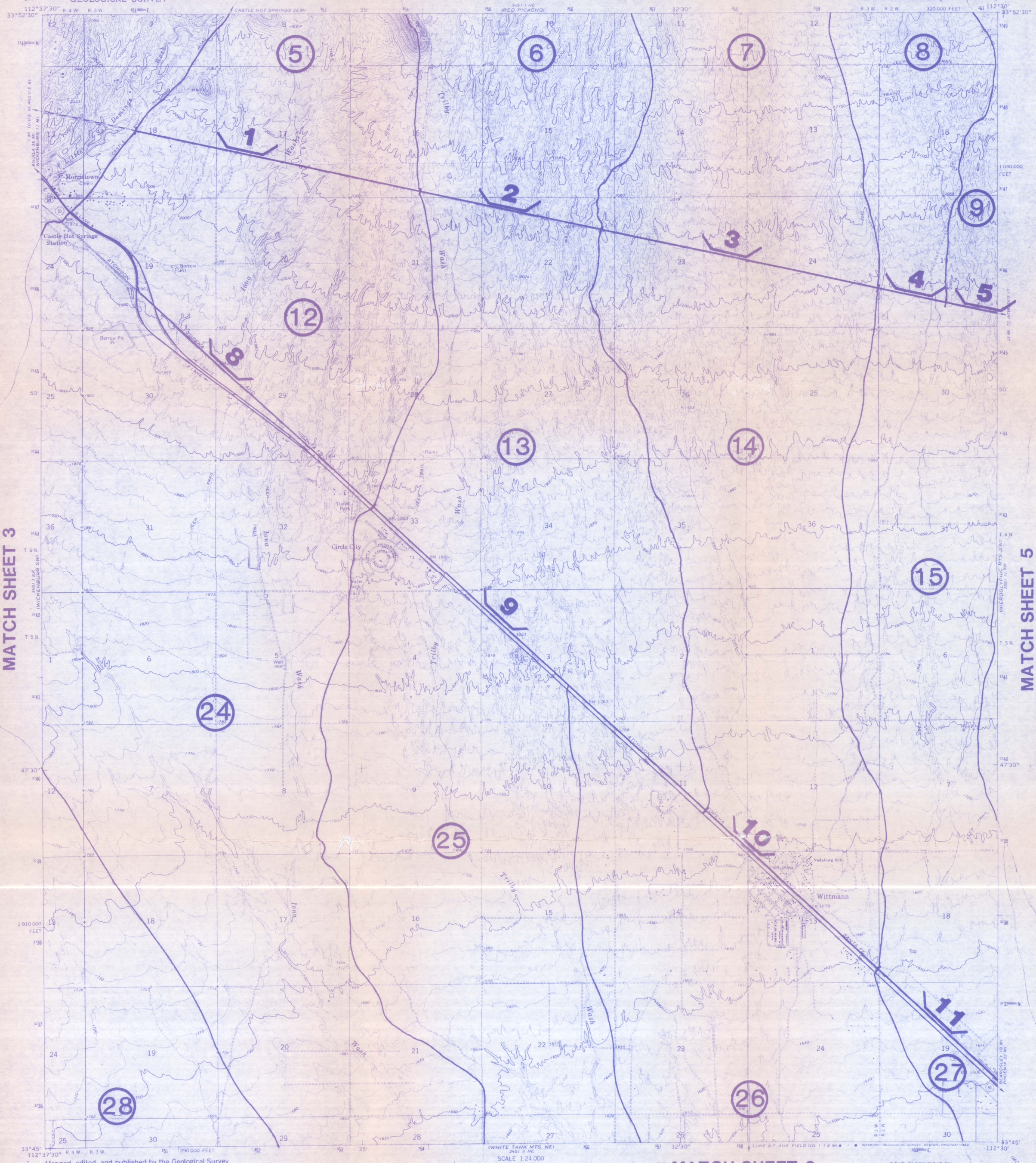
WICKENBURG SW, ARIZ.
N3345—W11237.5/7.5
1965
AMS 3451 I SW—SERIES V898

3

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 1

ARIZONA – MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1965

Polyconic projection. 10,000-foot grid ticks based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 1 meter south and 67 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

Revisions shown in purple and woodland compiled from aerial photographs taken 1978 and other sources. This information not field checked. Map edited 1981

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Unimproved dirt
U.S. Route — State Route

WIDE WORLD OF MAPS
2626 W. INDIAN SCHOOL ROAD
PHOENIX, AZ 85017
279-2323

WITTMANN, ARIZ.
N3345—W11230/7.5

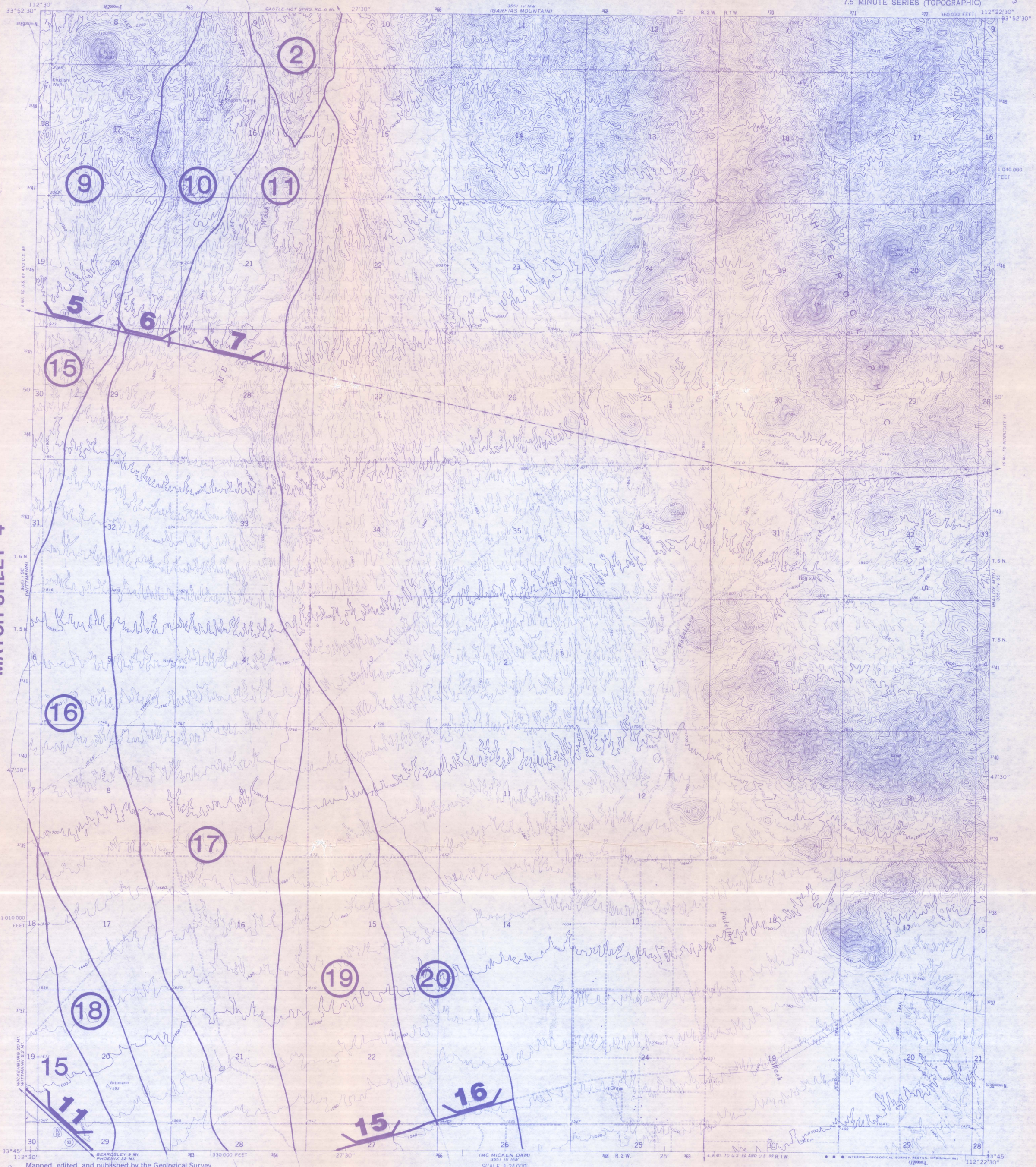
1965
PHOTOREVISED 1981
DMA 3451 I SE-SERIES V898

4

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 2

HIEROGLYPHIC MTS. SW QUADRANGLE
ARIZONA – MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1965

Polyconic projection. 10,000-foot grid ticks based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 1 meter south and 66 meters east as shown by dashed corner ticks

Revisions shown in purple compiled from aerial photographs taken 1978 and other sources. This information not field checked. Map edited 1981

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Unimproved dirt
U. S. Route — State Route

HIEROGLYPHIC MTS. SW, ARIZ.
N3345—W11222.5/7.5

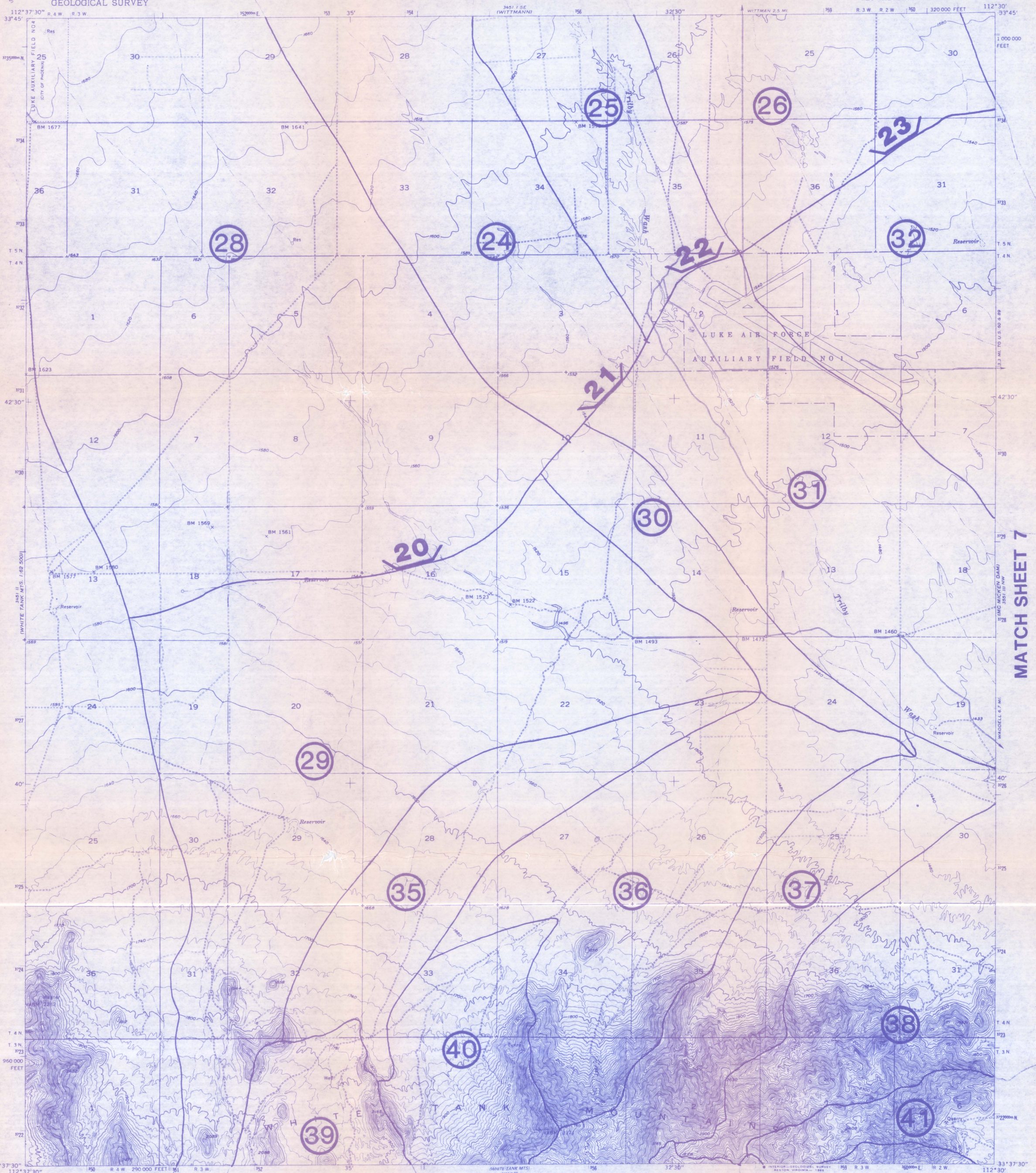
1965
PHOTOREVISED 1981
DMA 3551 IV SW—SERIES V898

From
WIDE WORLD OF MAPS, INC.
ARIZ. MAP SHOP & GALLERY
Phoenix, Arizona

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 4

ARIZONA—MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 WHITE TANK MTS. 15' QUADRANGLE



MATCH SHEET 7

MATCH SHEET 8

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USBR

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Field check 1957

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

To place on the predicted North American Datum 1983 move the projection lines 2 meters south and 67 meters east as shown by dashed corner ticks

Dashed lines indicate approximate locations

Where omitted land lines have not been established

There may be private inholdings within the boundaries of the National or State reservations shown on this map

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Revision shown in purple compiled from aerial photographs taken 1971. This information not field checked

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Map photoinspected 1978
No major culture or drainage changes observed

ROAD CLASSIFICATION
Light-duty ——— Unimproved dirt - - - -

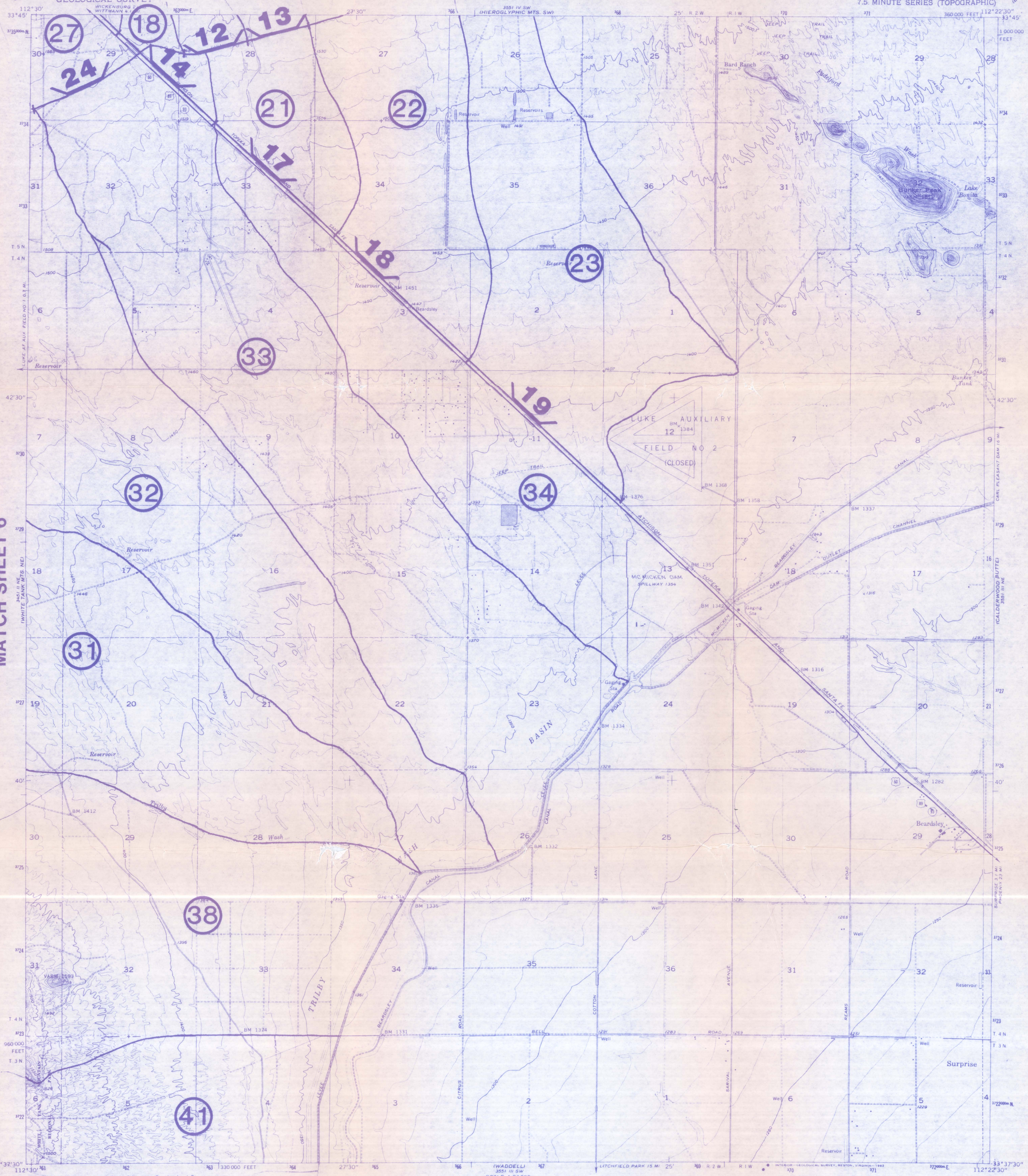
WHITE TANK MTS. NE, ARIZ.
NE/4 WHITE TANK MTS. 15' QUADRANGLE
33112-F5-TF-024
PHOTOINSPECTED 1978
1957
PHOTOREVISED 1971
DMA 3451 II NE—SERIES V898

6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 5

MC MICKEN DAM QUADRANGLE
ARIZONA—MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography from aerial photographs by Kelsh plotter and by planetable surveys 1957. Aerial photographs taken 1954

Polyconic projection. 10,000-foot grid ticks based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue. 1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 2 meters south and 66 meters east as shown by dashed corner ticks

Dashed land lines indicate approximate locations

There may be private inholdings within the boundaries of the National or State reservations shown on this map

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Revisions shown in purple and woodland compiled from aerial photographs taken 1978 and other sources. This information not field checked. Map edited 1981

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Unimproved dirt
U. S. Route — State Route

WIDE WORLD OF MAPS
2626 W. INDIAN SCHOOL ROAD
PHOENIX, AZ 85017
279-2323

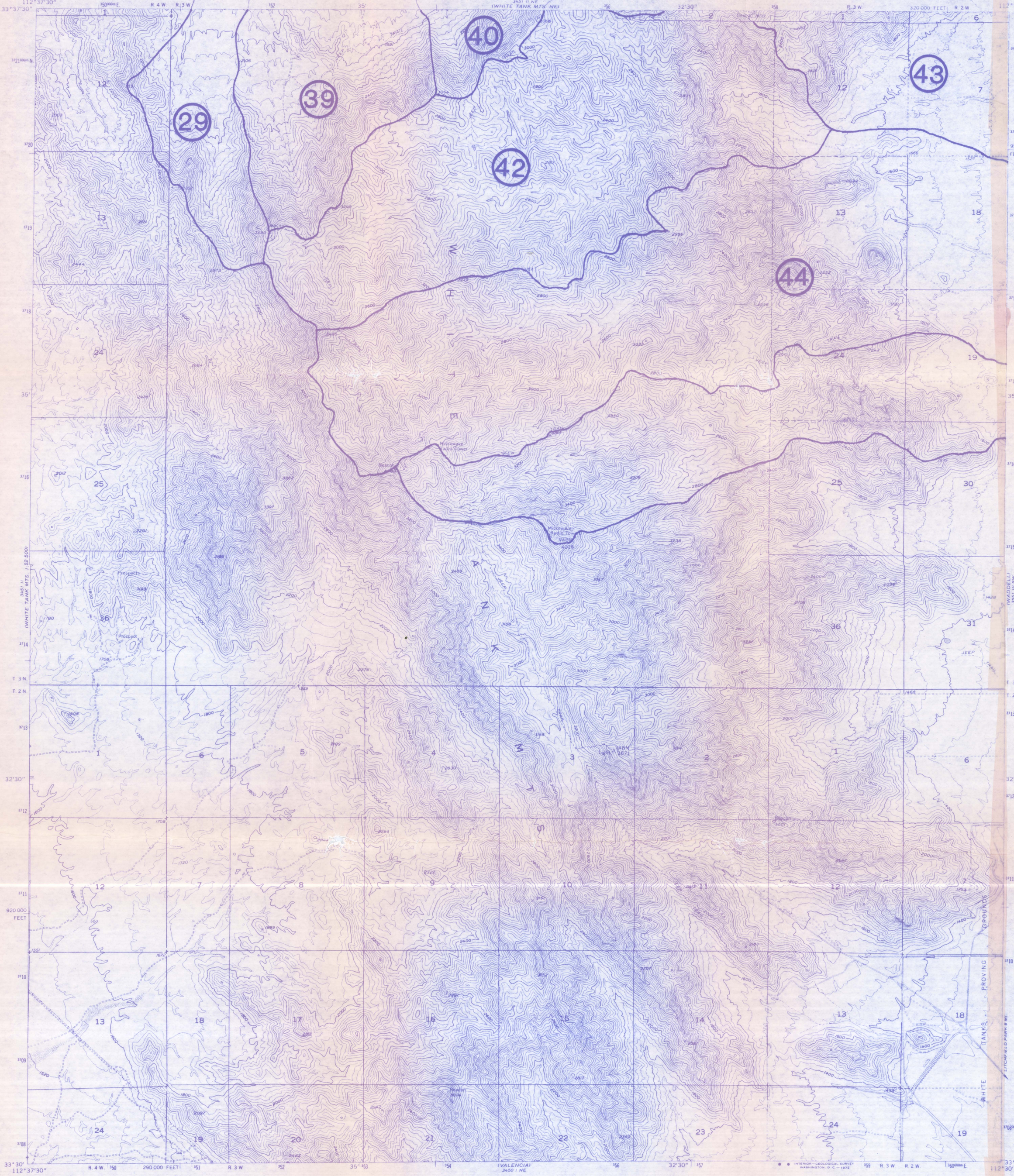
MC MICKEN DAM, ARIZ.
N3337.5—W11222.5/7.5

1957
PHOTOREVISED 1981
DMA 3551 III NW-SERIES V898

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 6

WHITE TANK MTS. SE QUADRANGLE
ARIZONA – MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 WHITE TANK MTS. 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Field check 1957

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Where omitted, land lines have not been established

Revisions shown in purple compiled from aerial photographs taken 1971. This information not field checked

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Light duty — Unimproved dirt

WHITE TANK MTS. SE, ARIZ.
SE/4 WHITE TANK MTS. 15' QUADRANGLE
N3330—W11230/7.5

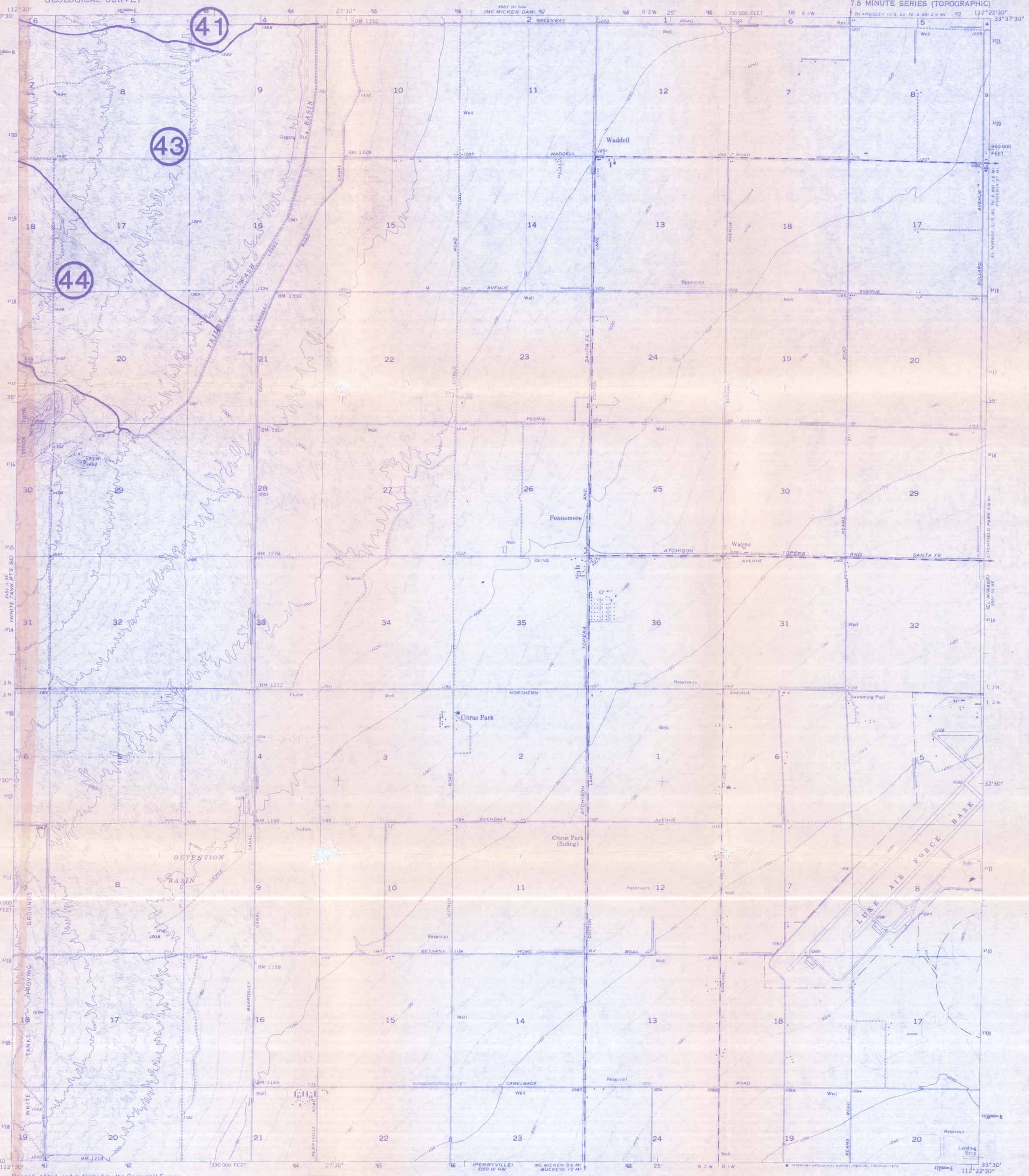
1957
PHOTOREVISED 1971
AMS 3451 II SE—SERIES V898

8

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MATCH SHEET 7

WADDELL QUADRANGLE
ARIZONA—MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods and by planetable surveys 1957. Aerial photographs taken 1954

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-metre Universal Transverse Mercator grid ticks, zone 12, shown in blue

Revisions shown in purple compiled from aerial photographs taken 1971. This information not field checked

Map photoinspected 1975
No major culture or drainage changes observed

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DASHED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

WIDE WORLD OF MAPS
2626 W. INDIAN SCHOOL RD.
PHOENIX, ARIZONA 85017
279-2323

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Medium-duty — Light-duty
Unimproved dirt

WADDELL, ARIZ.
N3330—W11222.5/7.5

1957
PHOTOREVISED 1971
AMS 3551 III SW—SERIES V898
PHOTOINSPECTED 1975