FINAL

HYDROLOGY REPORT

OUTER LOOP HIGHWAY

CAMELBACK WALK CHANNEL TO

THE ARIZONA CANAL

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FINAL

HYDROLOGY REPORT

OUTER LOOP HIGHWAY

CAMELBACK WALK CHANNEL TO

THE ARIZONA CANAL

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I. INTRODUCTION

The purpose of this report is to document the assumptions and methodologies used to develop the offsite hydrology for the Concept Drainage Plan for an approximate 2.9 mile reach of the Outer Loop Highway located between the Camelback Walk Channel and the Arizona Canal.

The following sections of this report present a discussion of drainage area characteristics, meteorological conditions, and the results of the hydrologic modeling process that was undertaken to develop the rainfall/runoff data required for the design of a cross-drainage system for this reach of the highway.

This report supercedes a "Preliminary Hydrology Report" published in December 1986 for this segment of the Outer Loop. The 1986 study was based on a highway alignment along Pima Road. This revised 1989 study is based on a new highway alignment that follows a curvilinear path ranging from approximately 400 feet to 3700 feet east of Pima Road. The 1989 study also includes some additional drainage area, intercepted by the Arizona Canal, that should be considered in the design of the Outer Loop bridge over the Arizona Canal.

II. DRAINAGE BASIN CHARACTERISTICS

2.1 Drainage Area

Figure 2.1 presents a vicinity map showing the preliminary highway alignment and the perimeter of the drainage area that contributes runoff to this segment of the highway.

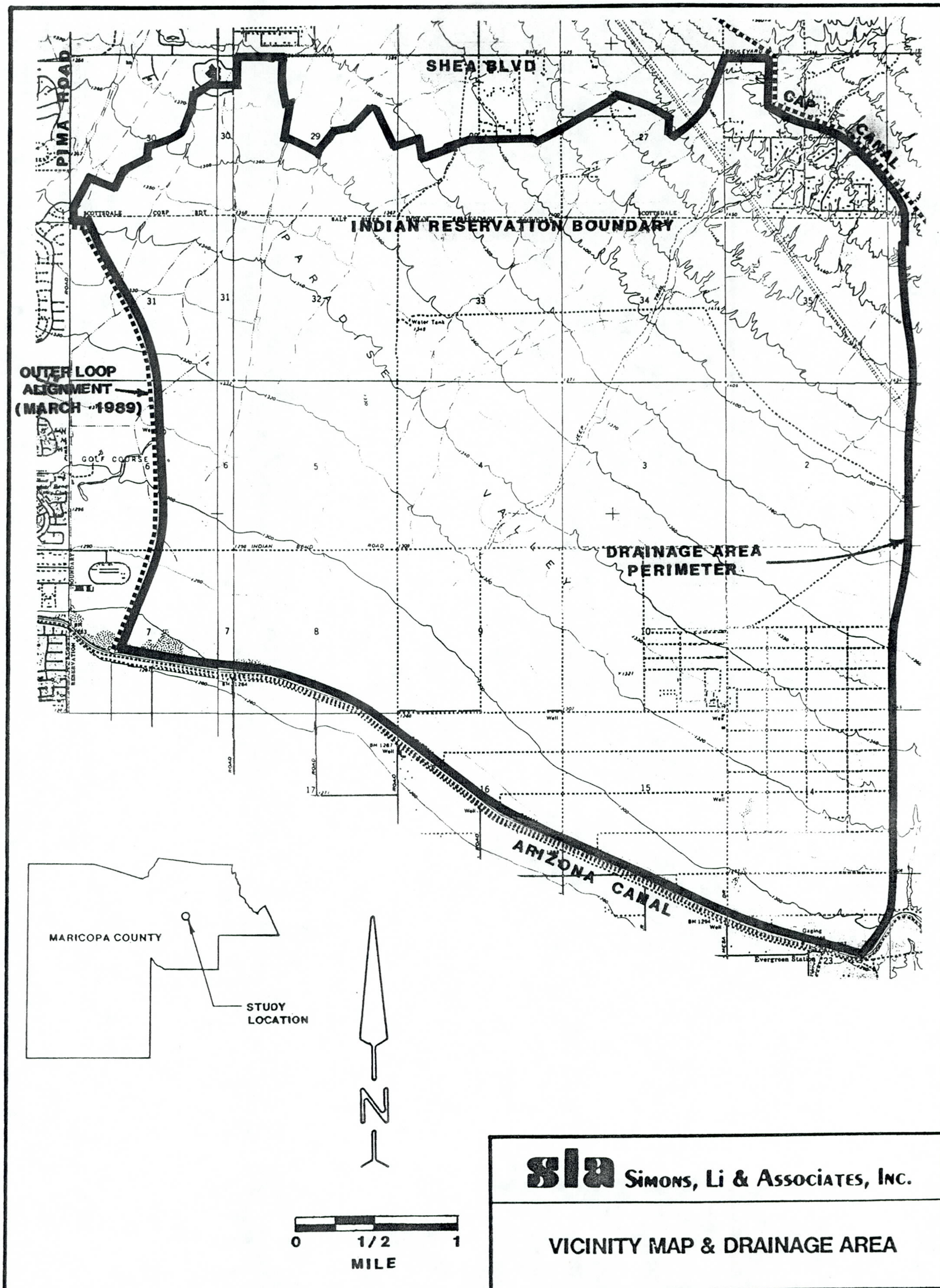
Several manmade alterations to the drainage area have created a unique set of conditions that have a significant impact on the runoff characteristics of the watershed, as related to the determination of a peak discharge for use in designing an offsite drainage system for the Outer Loop. These alterations include: 1) construction of the Central Arizona Project (CAP) Aqueduct; 2) development of a Master Drainage and Flood Control Plan for Scottsdale Ranch; 3) inclusion of onsite detention/retention basins for private development surrounding the ranch; and, 4) construction of the Arizona Canal. The importance of these alterations are discussed in the following paragraphs.

2.1.1 CAP Aqueduct

The large flood control dikes constructed along the upstream side of the CAP intercept runoff from the McDowell Mountains that would, under natural conditions, ultimately reach the proposed highway alignment along Pima Road. This intercepted drainage area is approximately 8.8 square miles. However, for the drainage area under investigation, there are four cross-drainage structures that allow some runoff to cross the CAP aqueduct. The first of these structures is a lined, 48-inch CMP culvert located at the intersection of the CAP with 112th Street. The runoff that passes through this structure is further controlled by a downstream lake system on Scottsdale Ranch.

The second cross-drainage structure consists of three 72-inch RCP culverts located approximately 750 feet south of Shea Boulevard (CAP Station 234+10). The discharge from this structure (Qp = 834 cfs) will be intercepted by the Arizona Canal and diverted west, where it will influence the design of the Outer Loop bridge over the Arizona Canal.

The third CAP structure is a 36-inch RCP located about 1700 feet south of Shea Boulevard (CAP Station 243+00). The peak discharge from this structure is 37 cfs. The outflow hydrograph from this site will also be intercepted by the



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VICINITY MAP & DRAINAGE AREA

FIGURE 2.1

Arizona Canal and diverted west where it will influence the design of the Outer Loop bridge over the canal.

The fourth cross-drainage structure is located approximately 6300 feet south of Shea Boulevard (CAP Station 332+75). This site consists of two 66-inch lined CMP culverts with a maximum outflow of 437 cfs. These two culverts are at the eastern edge of the drainage area boundary for this reach of the Outer Loop. The braided channel pattern that exists downstream of the culvert outlets creates difficulty in accurately identifying the specific amount of culvert outflow that will actually enter the Outer Loop drainage system; i.e., substantial portions of these culvert flows will probably be discharged to the Salt River through the Evergreen Wasteway gates on the Arizona Canal.

Based on a review of aerial photographs, it is evident that the outflow from these two culverts will be captured by a system of washs that will carry the outflow to a location along the Arizona Canal that is approximately two miles east of the Evergreen Wasteway. As a result, the intercepted flows would be discharged through the wasteway gates and not have any impact on the Outer Loop.

However, as the culvert outflow travels from the CAP to the Arizona Canal, the braided channel pattern makes a slight contact with the east edge of the watershed boundary for the Outer Loop. It is conceivable that some of this shallow, braided flow might break into the Outer Loop drainage area.

To acknowledge this possibility, an outflow hydrograph for this CAP cross-drainage structure was included in the Outer Loop HEC-1 model. A divert routine was also included in the model to control the amount of CAP cross-drainage flow that is allowed to enter the Outer Loop model. Based on the existence of the very prominent channel pattern that should prevent this water from entering the Outer Loop watershed, only 15 percent of the cross-drainage flow from CAP Station 332+75 was diverted into the Outer Loop.

2.1.2 Scottsdale Ranch

The Master Drainage and Flood Control Plan for Scottsdale Ranch includes a large manmade lake, which is designed to provide approximately 344.5 acre-feet of flood control storage, as well as provisions for several onsite retention basins on various parcels of land within the ranch. Discussions with representatives from Collar, Williams, and White Engineering, Inc. (consulting engineers for the Scottsdale Ranch development) and with representatives from the City of Scottsdale, indicate this lake system was designed on the basis of a 100-year, 24-hour storm. Accordingly, this lake, along with the onsite retention basins, have the capacity to substantially attenuate runoff hydrographs that emanate from Scottsdale Ranch or upstream drainage areas. This attenuation is an important factor to consider when conducting the hydrology analysis for the off-site drainage design for this reach of the Outer Loop.

2.1.3 Urban Retention/Detention Basins

The third manmade alteration that impacts this hydrology study is the construction of onsite detention/retention basins for those portions of the contributing drainage area west of 96th Street. Field inspections of this area indicated substantial onsite detention storage is present. Depending on site-specific design criteria, these basins may be able to capture all or part of the runoff from their contributing drainage area.

2.1.4 Arizona Canal

The Arizona Canal is the fourth manmade alteration that effectively forms a southern boundary for the watershed. This irrigation canal has a raised embankment (of variable height) along its northern side, as well as several inlet locations to allow ponded runoff to enter the canal. Southerly flowing storm runoff will pond along this embankment and, depending on location along the canal, will either flow towards the east or west and/or be allowed to spill into the canal.

Specific modeling techniques used to account for the influence of these four manmade alterations will be discussed in detail in subsequent sections of this report.

Considering the hydrologic control exerted on the watershed by the CAP, the Scottsdale Ranch lake system, and the Arizona Canal, the drainage area can be sub-divided into two very distinct categories: 1) the commercial/industrial/-urbanized area within the City of Scottsdale (approximately 2.9 square miles);

and 2) the undeveloped and agricultural property on the Salt River Indian Reservation (approximately 16.6 square miles).

The following subsections discuss the specific characteristics of each of these two major drainage area components.

2.2 Land Use

Plate 1 is an aerial photograph of the project area showing the degree of development existing as of October 1986. As can be seen from this photo, the majority of the drainage area north of the Salt River Indian Reservation is already developed.

The lower portion of the watershed lies within the Salt River Indian Reservation. This area is composed of approximately 30% irrigated agricultural fields and about 70% undeveloped desert land.

2.3 Soil Data

Soils information is needed in order to model the infiltration characteristics of the watershed. Such information is generally available from Soil Survey Reports published by the Soil Conservation Service (SCS). The watershed for this project was included in the Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona, U.S. Department of Agriculture, April 1986.

Using the standard SCS hydrologic soil group classification system, an estimate can be made of the runoff potential of the soils within any given subbasin of the project watershed. The SCS system is based on four hydrologic soil groups, A through D. Soils in group A have very low runoff potential (i.e., high infiltration rate), those in group B have moderately low runoff potential, those in group C have moderately high runoff potential, and those in group D have high runoff potential (i.e., very slow infiltration rate).

Plate 2 illustrates the composition of the project watershed in terms of hydrologic soil groups. The information in this figure is based on the previously referenced soil survey. As can be seen from Plate 2, the watershed is composed of two hydrologic soil groups (B and C).

From the SCS soil survey, the following descriptions are provided for some of the major soil classifications comprising the drainage area.

1. Soil Group B - Mohall Clay Loam

This deep and well drained soil is on fan terraces. It formed in alluvium derived dominantly from acid and basic igneous rock. Slope is 0 to 3 percent.

Typically, the surface layer is light brown clay loam about two inches thick. The upper 19 inches of the subsoil is light brown clay loam, and the lower 21 inches is light reddish brown and light brown, calcareous clay loam. The substratum to a depth of 60 inches or more is light reddish brown, calcareous extremely cobbly loamy sand.

Permeability of this Mohall soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

2. Soil Group C - Contine Clay Loam

This deep and well drained soil is on fan terraces. It formed in alluvium derived dominantly from acid and basic igneous rock. Slope is 0 to 3 percent.

Typically, the surface layer is brown, calcareous clay loam about two inches thick. The subsoil is reddish brown, calcareous clay loam and clay 28 inches thick. The substratum to a depth of 60 inches or more is light reddish brown, calcareous sandy loam.

Permeability of this Contine soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The soils data discussed in this section was used to select Soil Conservation Service (SCS) curve numbers. These curve numbers, which model the hydrologic abstractions and infiltration characteristics of the watershed, are discussed in more detail in Section 4.2 of this report.

2.4 Existing Drainage Facilities

As previously discussed in Section 2.1, the portion of the drainage area lying within the City of Scottsdale incorporates major drainage improvements which may have a significant influence on the runoff response of the watershed. These improvements are in the form of onsite detention/retention basins and a master drainage/flood control plan for Scottsdale Ranch.

Other than some small earth berms alongside certain dirt roads/trails, there are no significant drainage facilities on the Reservation.

III. RAINFALL CHARACTERISTICS

The hydrologic response of a watershed is dependent upon rainfall characteristics such as depth, duration, and the spatial and temporal distribution of the rainfall event. The rainfall depth is a function of the probability of occurrence and the duration of the event. This probability is expressed as a recurrence interval (50-year, 100-year, etc.), which is defined as the average interval of time within which the magnitude of an event will be equaled or exceeded once. Mathematically, recurrence interval is defined as the reciprocal of the probability of occurrence.

Evaluating storms with different recurrence intervals is required when considering the risk and economic factors associated with the design of a drainage system for a specific meteorological event. In order to incorporate a risk analysis into the freeway design process, ADOT has requested that both the 50- and 100-year storms be evaluated as part of the hydrologic analysis of the Outer Loop.

Rainfall depths for the project drainage area were developed using isopluvial maps and regression equations presented in the Precipitation-Frequency Atlas of the Western United States, Volume VIII - Arizona. Table 3.1 Summarizes point precipitation values for the 50- and 100-year storms for durations of 5 minutes, 15 minutes, and 1-, 2-, 3-, 6-, 12-, and 24-hours.

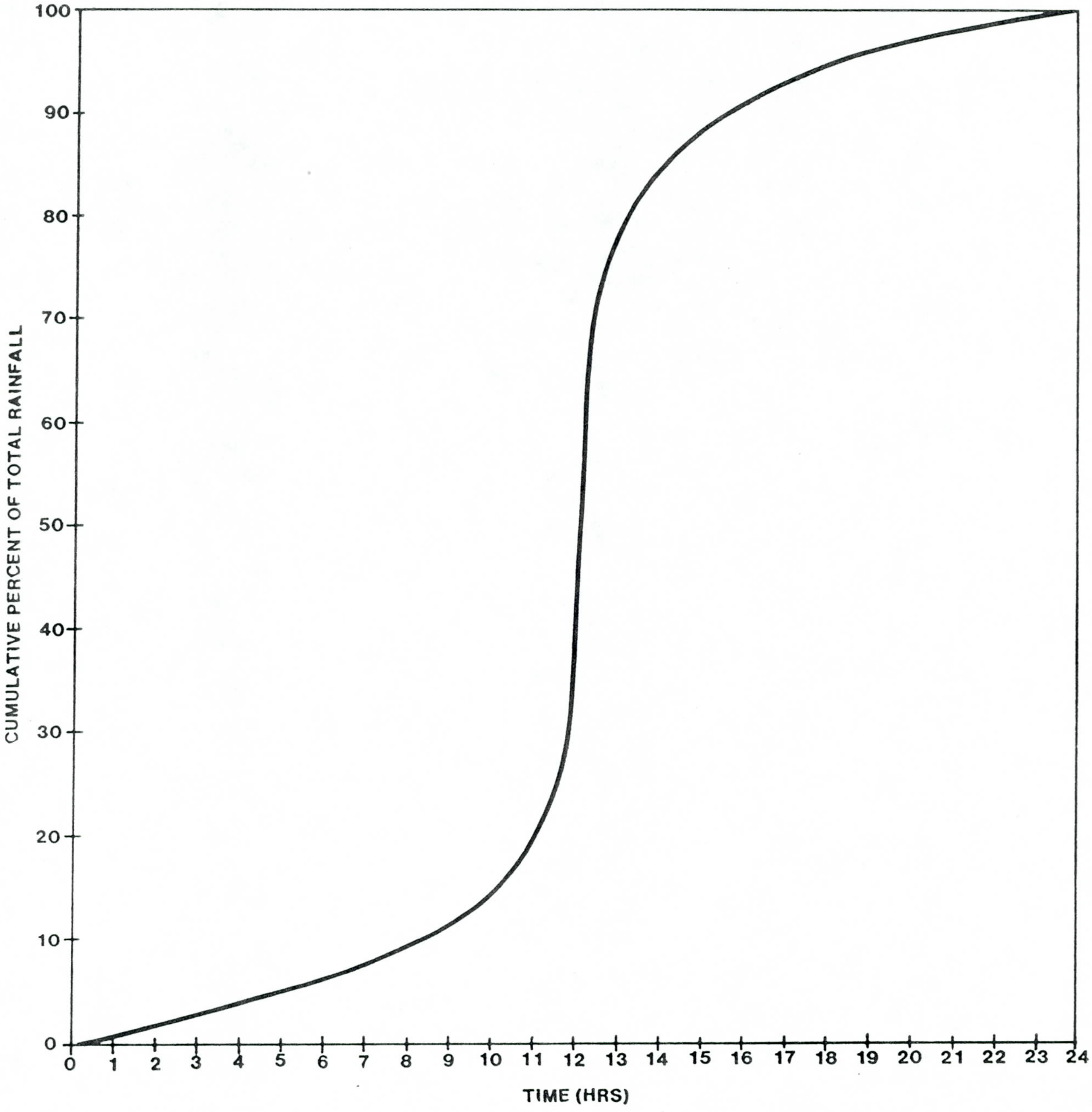
When using the hypothetical storm distribution in HEC-1, point rainfall values are automatically reduced (by the computer program) in accordance with procedures outlined in Weather Bureau Technical Paper No. 40, May 1961, to account for areal reduction of rainfall depths over large drainage areas. Due to the small size of the watershed under investigation, and the use of a 24-hour storm duration, no appreciable aerial reduction in point precipitation values was used. This was simulated by inserting a drainage area size of 0.1 square mile on the PH card in the HEC-1 model.

Since De Leuw, Cather & Company and ADOT have previously selected the 24-hour, HEC-1 hypothetical storm distribution for use in designing the offsite drainage improvements for the reach of the Outer Loop immediately north of this segment, no attempt was made during this study to evaluate different storm distributions, i.e., the analysis was confined to the 100- and 50-year, 24-hour events. Figure 3.1 presents a graphical illustration of the selected rainfall distribution. The reader is referred to the Hydrology Report, Outer Loop Highway, CAP Aqueduct to the Salt River Indian Reservation, August 19, 1986 by Simons, Li & Associates, Inc. for an overview of HEC-1 model sensitivity to several different rainfall distributions.

TABLE 3.1

Rainfall Depths as a Function of Recurrence Interval and Duration

Recurrence Interval (Years)	Point Precipitation Values (inches)							
	Duration							
	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
50	0.63	1.25	2.19	2.43	2.59	2.90	3.26	3.62
100	0.72	1.42	2.50	2.77	2.95	3.29	3.68	4.08



24—HR HEC—1 HYPOTHETICAL RAINFALL DISTRIBUTION

sla Simons, Li & Associates, Inc.

RAINFALL DISTRIBUTION

FIGURE 3.1

IV. HYDROLOGIC MODEL (HEC-1)

A computerized rainfall/runoff model was developed for the watershed using the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). HEC-1 uses numerical parameters to describe the amount and temporal distribution of rainfall, the runoff characteristics of the watershed, and the hydraulic properties of channels that collect and convey the direct runoff to concentration points. The computer output provides a runoff hydrograph at user selected locations. These hydrographs can be used to design drainage channels, detention/retention basins, or to evaluate the capacity of existing drainage facilities.

This section of the report presents a detailed discussion of specific components of the computer model that were created to simulate the rainfall/-runoff response of the watershed. The results of the modeling process are also presented (Section 4.4) along with a brief discussion of model verification (Section 4.5).

4.1 Delineation of Drainage Sub-Basins

As discussed previously, there are several manmade features which effectively control the delineation of drainage area boundaries for this watershed. The proposed alignment of the Outer Loop (east of Pima Road) sets the western boundary of the watershed, while the Arizona Canal and the Camelback Walk Channel/Scottsdale Ranch development establish south and north boundaries, respectively.

The northeast and eastern boundaries of the watershed are a function of the CAP Aqueduct and the land slope along the northern side of the Arizona Canal. The northeastern boundary formed by the CAP is easily delineated. However, because of the very flat east-west slope along the north side of the Arizona Canal, the eastern boundary of the drainage area is less discernable. As part of the hydrology analysis for the Indian Bend Wash Interceptor Channel, the Corps of Engineers selected the Evergreen Wasteway gates, on the Arizona Canal, as a physical location for establishing an eastern watershed boundary for the Interceptor Channel design. The logic for this selection is based on Salt River Project policy to open the wasteway gates and empty the Arizona Canal at the earliest time that it can be determined that significant runoff will reach the canal. Under this scenario, it can be reasonably assumed that any floodwaters entering the canal east of the Evergreen Wasteway would be discharged through the wasteway gates to the Salt River, therefore, being prevented from flowing further west where they might impact the design of the Outer Loop bridge over the Arizona Canal.

SLA concurs in the Corps' logic used to establish the Evergreen Wasteway as the eastern watershed boundary. Accordingly, this wasteway was also used to define the eastern boundary of the HEC-1 model used to analyze this reach of the Outer Loop Highway. A detailed discussion of the Corps' hydrology assumptions is presented in "Design Memorandum No. 4 - Feature Design for Interceptor Channel, Project Design for Indian Bend Wash", U.S. Army Corps of Engineers, January 1980.

Application of HEC-1 to an area with such diverse land uses, requires that the drainage area be further subdivided into smaller, homogeneous sub-basins with similar hydrologic properties. Accordingly, the watershed was divided into 179 sub-basins as shown on Plates 1, 2, and 3.

It should be noted that there were no current topographic maps available for this watershed other than 7.5 minute U.S.G.S. quadrangle maps. As a result, several sources of data were used to delineate drainage basin boundaries. These sources included the U.S.G.S. quadrangle maps, 1"=400' aerial photographs (June 6, 1986) obtained from Cooper Aerial Survey Co., 1"=1000' aerial photography (October 1986) provided by Landis Aerial surveys, subdivision plats obtained from the City of Scottsdale, and extensive field inspections. Representatives of the Salt River Indian Reservation provided the drainage pattern data for the agricultural fields located along the north side of the Arizona Canal, east of Alma School Road.

As a result of these numerous data sources, there may not be perfect "scale" correlation when the same sub-basin area or channel routing length is measured on two different maps. However, these type of scaling errors should have an insignificant impact on the hydrologic modeling results.

4.2 Interception/Infiltration

Precipitation losses due to interception and infiltration were modeled using the SCS curve number option in HEC-1. Selection of curve numbers was based on information gathered relative to type of soil cover, vegetation density, land use, and soil moisture conditions. An Antecedent Moisture Condition 2 (AMC 2) was assumed for all curve number selections.

Three primary land-use categories were used for the development of curve numbers for this watershed: 1) agricultural; 2) undeveloped desert; and, 3) commercial/residential areas.

Agricultural areas were modeled with curve number recommendations taken from Table 2-2b, Urban Hydrology for Small Watersheds, Technical Release 55 (TR55), SCS, June 1986. The fields were considered to be representative of "straight row crops" and curve numbers were selected at one point below those listed for "Poor" hydrologic condition. The possibility of a fully saturated field (as a result of recent irrigation) was used to weight the curve numbers toward a "Poor" condition rather than a "Good" condition. Table 4.1 lists the agricultural field curve numbers as a function of hydrologic soil group.

The percentage of each soil group in each field was estimated on the basis of a soil map overlay onto the HEC-1 sub-basin delineation map. An area-weighting procedure was then used to determine a composite curve number that would be representative of each field.

Curve numbers for undeveloped desert areas were based on recommendations from Table 2-2d of TR55. A "Poor" hydrologic condition was assumed to represent the sparse ground cover that is typical of this area. Table 4.2 lists the baseline desert curve numbers as a function of hydrologic soil group. As with the agricultural fields, an area-weighted curve number was developed for each desert parcel to reflect the existence of multiple soil groups within a specific sub-basin boundary.

Areas of the watershed that contain commercial and residential development were modeled using a pre-development baseline curve number and a percent of impervious cover. Since these areas were part of the undeveloped desert category prior to becoming urbanized, a baseline curve number was selected for each parcel using the values in Table 4.2 Based on a review of the 1986 aerial photo (Plate 1) and the Scottsdale Ranch Master Drainage Plan, a land-use classification was selected for each sub-basin. This land-use classification was then converted to a percent of impervious cover to reflect the additional runoff that is generated as a result of urbanization. This conversion to percent of impervious

TABLE 4.1 Baseline Curve Numbers for Agricultural Fields (Straight row crops)				
	Hydrologic Soil Group			
	A	B	C	D
Curve Number	71	80	87	90

TABLE 4.2 Baseline Curve Numbers for Undeveloped Desert ("Poor" hydrologic condition)				
	Hydrologic Soil Group			
	A	B	C	D
Curve Number	63	77	85	88

cover was based on a graphical relationship developed for the General Drainage Plan for North Scottsdale, Arizona, Water Resources Associates, Inc. 1989. This relationship, which is reproduced herein as Figure 4.1, relates residential dwelling units per acre to percent of impervious surface cover. Commercial areas and apartment complexes were, with two exceptions, assigned values of 85 percent impervious cover. Figure 4.1 was developed, in part, from percents of impervious cover taken from Table 2-2a, TR55.

In conclusion, it should be noted that the curve numbers selected as a result of the previously described procedures are considered representative of a 24-hour duration storm. Any attempt to model shorter storm durations should include revisions to the curve numbers, as recommended by Woodward in Runoff Curve Numbers for Semiarid Range and Forest Conditions, 1973.

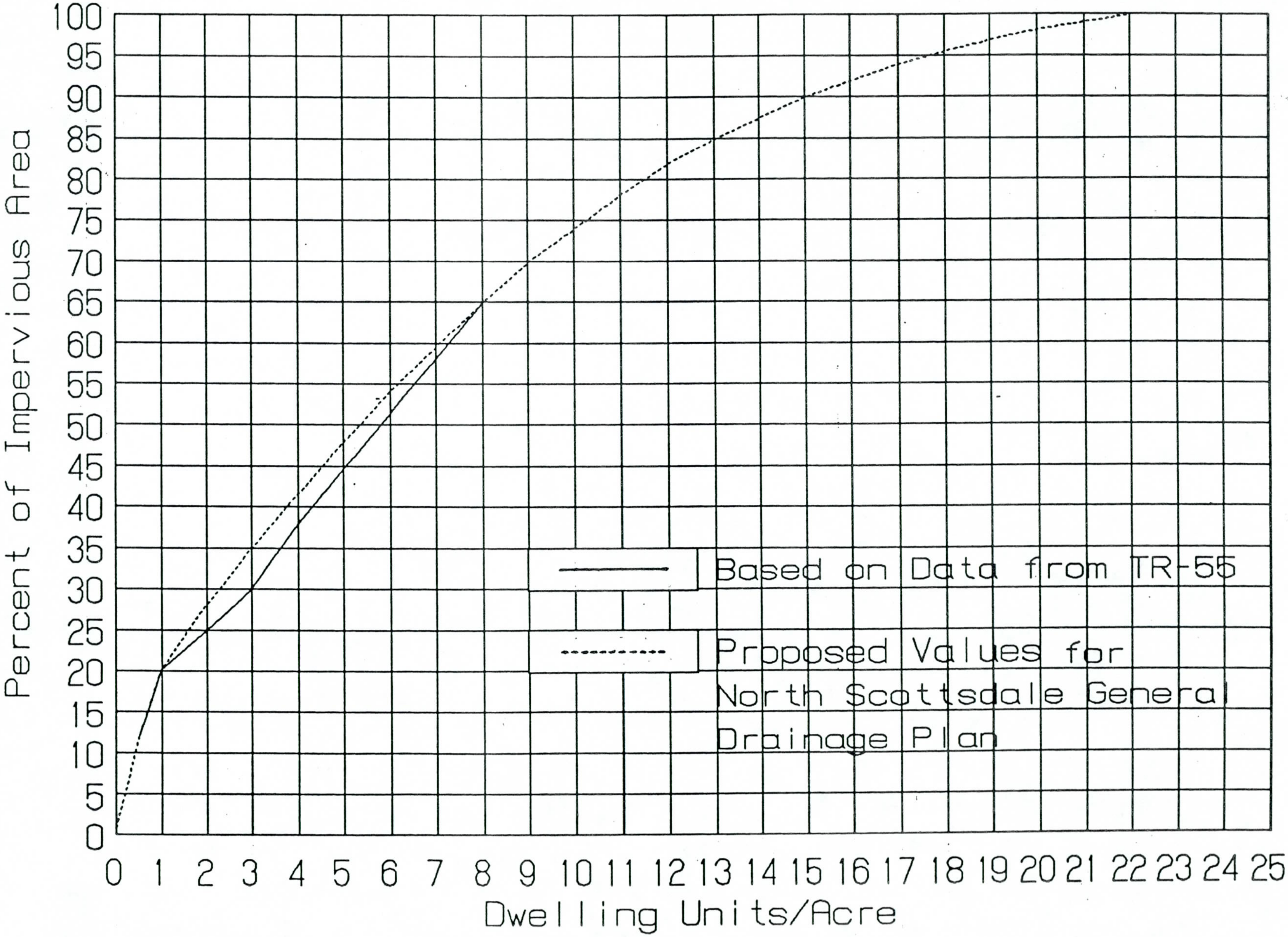
4.3 Configuration of the Hydrologic Model

The HEC-1 model developed by the Corps of Engineers Hydrologic Engineering Center, was used to simulate runoff conditions in the study area. The kinematic wave option was used to determine the hydrologic response of the sub-basin areas and for routing the resulting hydrographs through the tributary channels of the basin. This option was selected because runoff processes can be simulated using measurable geographic features such as overland flow elements and the shape, boundary roughness, length, and slope of channel elements. Unlike unit hydrograph techniques, the kinematic wave approach also provides for a non-linear response of runoff characteristics, i.e., peak discharge does not necessarily increase linearly with direct runoff when using the kinematic wave methodology.

A network of sub-basins and connecting channels was configured that simulates the natural drainage pattern in the basin. Plate 3 presents an illustration of the drainage patterns, sub-basin boundaries, and concentration points used in the model.

The following subsections describe the parameters that were used to model the physical characteristics of the watershed. Appendix A contains a complete listing of all HEC-1 input and output data for the 100-year event. Appendix B contains the output data for the 50-year event.

Figure 4.1
Percent of Impervious Area vs.
Dwelling Units/Acre



4.3.1 Kinematic Wave Parameters

The kinematic wave calculations used in HEC-1 are based on the hydraulic properties of simple geometric elements such as overland flow planes and prismatic channel cross-sections. These elements are selected and dimensioned so as to simulate the physical drainage characteristics of a specific watershed sub-basin.

For this project, overland flow planes were used to model the wide, flat shallow flow areas across the desert and urbanized areas of the watershed. These planes are described in terms of an average overland flow length, slope, and roughness coefficient. Lengths and slopes were measured from aerial photographs, 7.5-minute quadrangle maps, and the Master Drainage and Flood Control Plan for Scottsdale Ranch, while roughness values were based on recommendations presented in the HEC-1 Users Manual. Typical roughness values for desert areas were 0.1, those used in urban sub-basins were 0.09, while those used for agricultural fields were 0.15.

As one travels northeasterly through the watershed, a much more defined drainage pattern is encountered. This is in contrast to the very flat, smooth, relatively unincised land surface that is encountered west of Alma School Road. This change in drainage pattern justifies the selection of much shorted overland flow lengths for the more defined tributary pattern that exists east of Alma School Road. The selection of overland flow lengths for undeveloped desert areas was made with the use of the October 1986 aerial photograph.

For the long overland flow lengths west of Alma School Road, overland flow slopes were based on U.S.G.S. 7.5 minute quadrangle maps. Slopes for the short overland flow lengths east of Alma School Road were based on surveyed desert cross-sections taken north of the CAP. These cross-sections were previously used by SLA for the Outer Loop Hydrology Study north of the CAP (April 1987).

To establish consistency and uniformity to the overland flow slopes, the following assumptions were used:

1. Overland flow slopes for well-incised sub-basins were based on surveyed cross-sections taken on wide strips of desert north of the CAP. The average slope was found to be 0.0213 ft/ft. This slope was applied to all desert sub-basins with overland flow lengths of 145 feet.

2. Overland flow slopes for all other desert sub-basins were based on the average land slope taken from 7.5 minute quadrangle maps. The following two values were used:
   a. East of Alma School Road - 20/2500 = 0.0080 ft/ft.
   b. West of Alma School Road - 20/3500 = 0.0057 ft/ft.

The above criteria was applied to all Indian Reservation lands.

Agricultural fields were treated the same as those encountered below the Arizona Canal (see Final Hydrology Report, Outer Loop Highway, Arizona Canal to the Salt River, SLA, April 1989).

The streets and washes that collect runoff from the overland flow planes were modeled as either triangular or trapezoidal cross-sections. Data requirements for kinematic wave channel routing include reach length, channel slope, channel shape, and roughness coefficient. The dimensions and roughness values for those collector channels that were simulating subdivision streets, were determined from a comparison of the hydraulic conveyance of measured cross-sections to the conveyance of an equivalent prismatic section. This was accomplished by developing a rating curve of Depth versus Conveyance for a wide range of depths in the existing street cross-section.

Once the baseline conveyance curve was established, a trial and error procedure was employed whereby different prismatic sections were evaluated over the same range of flow depths used for the street section. The geometry and "n" value of the prismatic sections were adjusted until a cross-section was found that exhibited a similar conveyance curve to that generated for the natural baseline section. The prismatic section that most nearly duplicated the conveyance characteristics of the street section was used for the kinematic routing of flow through the subdivision.

As noted previously, the undeveloped desert areas exhibit a wide variation in channel pattern. Kinematic channel routing parameters for these areas was based largely on engineering judgement. However, this judgement was guided by hydraulic calculations to compute approximate flow velocities across the desert. An initial set of channel geometry was assigned to each desert sub-basin. The HEC-1 model was then executed and the resulting peak discharge values were combined with the assigned channel geometry and Manning's Equation to compute the flow velocity associated with these assigned conditions. These computed velocities were then reviewed in context with the channel pattern serving each sub-basin. The flat, relatively unincised land surface west of Alma School Road would be expected to have low velocities as a result of shallow sheetflow conditions. In contrast, the more incised channel pattern east of Alma School Road would present more concentrated flow conditions with higher flow velocities. Accordingly, channel geometry west of Alma School Road was selected to produce flow velocities in the 2 to 4 fps range, while the channels east of Alma School Road were configured to produce velocities in the range of 4 to 7 fps.

4.3.2 Channel Routing Along Arizona Canal

As previously discussed in Section 2.1, the Arizona Canal will intercept floodwaters and divert such flows to the west, where they will ultimately influence the hydraulic design of the Outer Loop Highway bridge over the Arizona Canal. For the purpose of this study, any flows intercepted by the canal east of the Evergreen Wasteway are assumed to be non-contributory to the Outer Loop intersection with the Arizona Canal (see Section 4.1 of this report).

Due to the existence of inlet locations along the north side of the canal embankment, some of the intercepted floodwaters will enter the canal and flow to the west through the canal cross-section. Some portion of the floodwaters will travel westerly along the north side of the canal embankment. The end result will be a combination of water flowing through the canal cross-section and along the roughly vegetated north canal bank.

The total length of flow diversion along the canal, from the Evergreen Wasteway to the proposed Outer Loop alignment, is approximately 4.6 miles. This length, combined with the referenced cross-section of flow, provides the potential for significant hydrograph attenuation. Accordingly, for the purpose of routing intercepted floodwaters along and through the Arizona Canal, the kinematic wave option was abandoned in favor of the "Normal Depth Storage Routing" option (Modified Puls) in HEC-1. This relatively simple option uses an 8-point cross-section (with variable "n" values) to conduct channel routing operations. Figure 4.2 illustrates the 8-point cross-section that was used for this analysis. This geometry is based on a typical cross-section described in the previously referenced Corps' report on the Indian Bend Wash Interceptor Channel analysis. As stated previously, this entire cross-section was used to

TYPICAL CROSS–SECTION USED FOR MODIFIED PULS ROUTING ALONG ARIZONA CANAL

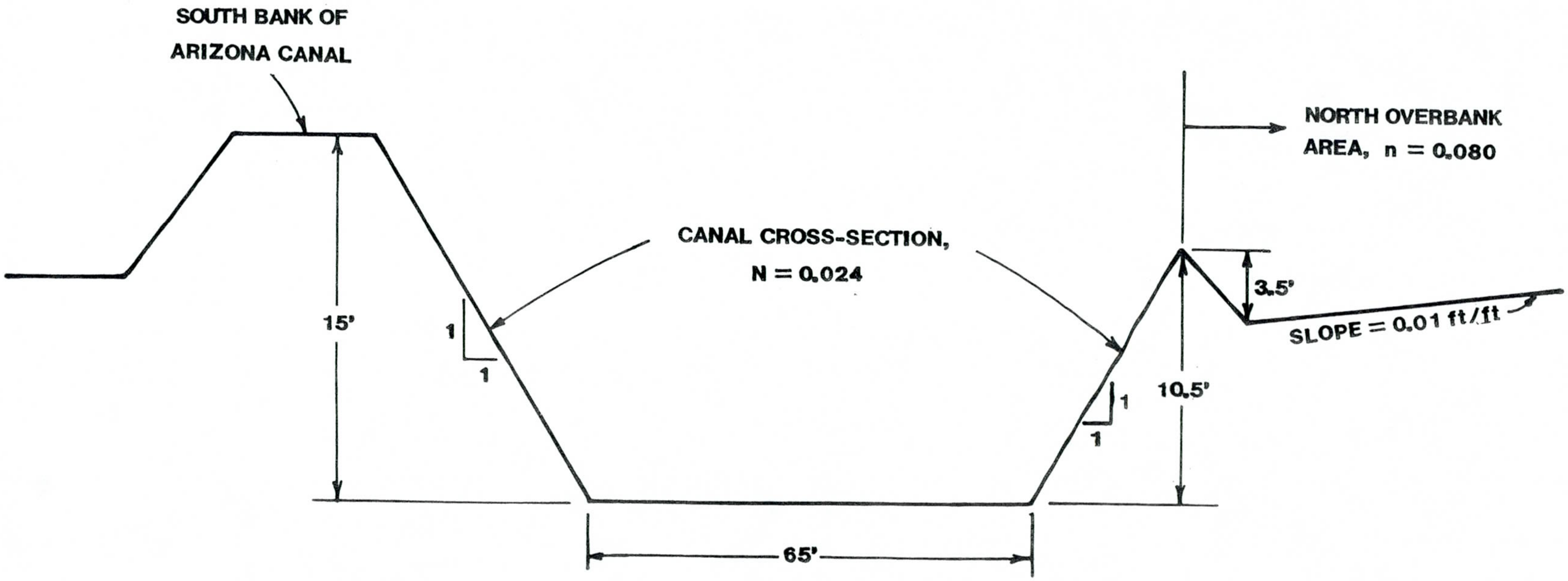


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FIGURE 4.2

route the intercepted floodwaters to the west, i.e., the canal is assumed to be drained of irrigation water (see Section 4.1).

For comparison purposes, a kinematic wave routing operation was also performed for those flows being diverted west along and through the canal. Based on similarity with the conveyance curve for the 8-point cross-section, a kinematic wave cross-section was chosen with a bottomwidth of 35 feet, 20:1 side-slopes, and a roughness value of 0.080. In order to provide a reasonable velocity match with previous Corps calculations, a bed-slope of 0.0045 feet/feet was used (i.e., this geometry and slope provide flow velocities in the 2 to 4 fps range for the majority of flows through the cross-section).

At the intersection with the Outer Loop alignment, the Modified Puls routing produced a peak 100-year discharge of 8120 cfs, while the kinemative wave option produced a peak discharge of 9803 cfs.

As a matter of technical interest, it should be noted that Modified Puls routing option produced a HEC-1 output message that the routed flows may be numerically unstable for discharges lying between 721 cfs and 2785 cfs. Such instability can be eliminated by decreasing the computation interval in the model or by increasing the routing reach length. Due to the limited number of hydrograph ordinates (300) that HEC-1 is capable of computing, it is not possible to decrease the computation interval to less than 5 minutes and still maintain the 24-hour hypothetical rainfall distribution. It is also infeasible to increase the routing reach lengths because of fixed concentration points used to combine flows in the model.

The routed hydrograph at Concentration Point 1986 was examined for oscillations and none were found. Accordingly, it is not believed that numerical instability is a major contributor to errors in the model.

4.3.3 Model Assumptions for Scottsdale Ranch Lake System

As discussed previously, the lake on Scottsdale Ranch is capable of providing a significant amount of flood control storage. In order to model the impact that this storage will have on downstream hydrographs, it was necessary to include the outflow hydrograph from the lake in the HEC-1 model. This outflow hydrograph is assumed to represent the total runoff contribution from all the contributing drainage area upstream of the lake system (including cross-drainage at the CAP).

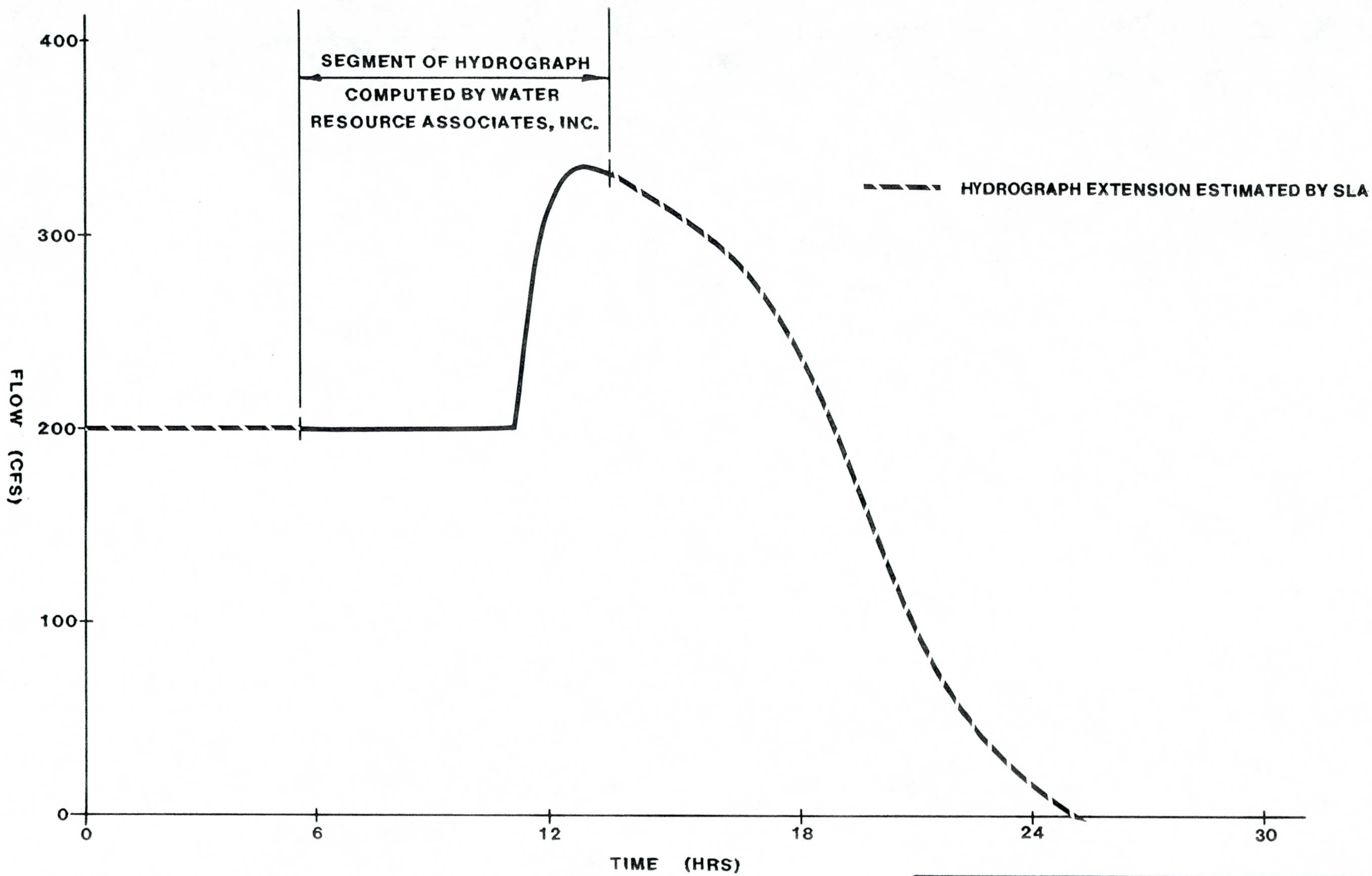
The outflow hydrograph that was used for this analysis was taken from Table 4 - Scottsdale Ranch, Detention Basin Operation Schedule for the 100-Year Frequency Flood, USCE, by Water Resources Associates, Inc., September 1979. This table was part of a report entitled Scottsdale Ranch, Offsite and Onsite Hydrology, prepared by Collar, Williams & White Engineering, Inc. This table only lists discharge ordinates for 32-15 minute time periods (total time base of 8-hours). Discussions with a former employee of Water Resources Associates were conducted in order to determine where the remainder of the hydrograph might be. The consensus of this discussion indicated the complete hydrograph was probably never computed since the peak outflow was all that was required. There was also no absolute confirmation as to what storm duration, or where within the storm duration, the hydrograph should be referenced.

For the purpose of this hydrology study, it was assumed that the outflow hydrograph was based on a 100-year, 24-hour storm and that the outflow hydrograph would be positioned within this storm so that its peak outflow would coincide with the peak rainfall intensity from the HEC-1 hypothetical 24-hour storm. Figure 4.3 is a graphical plot of this hydrograph as it was input into the HEC-1 model used for this study. This figure indicates the portion of the hydrograph that was taken from the Water Resources Associates study and the portion that was, judgementally, added by SLA. This hydrograph was input so that its outflow would be combined with the runoff from Sub-basin 300.

4.3.4 Model Assumptions for Onsite Detention/Retention

As was discussed in Section 2.1 of this report, there is a considerable amount of onsite retention/detention storage in the urbanized portions of the watershed. The attenuation impact of this storage on runoff hydrographs was simulated by inserting reservoir routing operations into the HEC-1 model. The storage volume assumptions used for these reservoir simulations are listed as follows:

1. Parcels on Scottsdale Ranch (east of 96th Street) - The Master Drainage and Flood Control Plan, August 1983, Collar, Williams, &



Simons, Li & Associates, Inc.

OUTFLOW HYDROGRAPH FROM
SCOTTSDALE RANCH LAKE

FIGURE 4.3

White Engineering, Inc. lists specific detention basin sites and basin volumes for eight locations. These locations are identified as DAM 1 through DAM 8 on Plate 3 and in the HEC-1 model. This information was used to develop the required storage relationship for a reservoir routing operation at each of these eight sites. An emergency spillway elevation and top of dam elevation was assigned to the dam elevation at which the allotted storage was obtained. Additional inflows to the reservoir (after the available storage was exceeded) were then routed over the top of the dam as weir flow.

2. Parcels west of 96th Street - Numerous discussions with representatives from the City of Scottsdale and many searches through available records failed to produce the drainage data needed for this area. Substantial onsite detention has been verified through field inspections conducted by SLA staff. Discussions with City staff indicated those parcels developed prior to 1984 should have onsite storage equivalent to the runoff from a 50-year, 24-hour storm. Parcels developed after 1984 were required to store the difference in runoff between pre- and post-development conditions, based on a 100-year, 1-hour storm. In the absence of having documented hydrology reports for these parcels, it was assumed that all parcels west of 96th Street were developed on the basis of providing detention storage for the increase in runoff between pre- and post-project conditions using the 100-year, 1-hour rainfall.

   To provide a safety factor for the uncertainty that the required storage was actually provided as part of the development, only 50 percent of the incremental runoff from the 100-year, 1-hour rainfall was used to develop the storage/volume relationship used in the reservoir routing operation for the Outer Loop HEC-1 model. All runoff volume calculations were based on the existing or forecast land-uses shown on Plate 1 and the Scottsdale Ranch Master Plan.

   The runoff volume calculations resulting from this procedure were used to develop a storage relationship for the reservoir routing operation used to simulate the detention basin performance. As with the Scottsdale Ranch parcels, the spillway and top of dam elevations were set to coincide with the dam elevation at which the allotted detention storage was exhausted. Any inflows beyond this point were allowed to spill over the dam and continue to downstream areas of the watershed.

When reviewing the HEC-1 output data, these detention basins are identified by a "DAM" prefix in front of the sub-basin number.

4.4 Hydrologic Modeling Results

Table 4.3 presents the results of the HEC-1 modeling that was accomplished to predict peak discharge values for the design of an interceptor channel along the proposed Outer Loop Highway alignment.

To avoid confusion when reviewing Table 4.3, a clarification is warranted relative to Concentration Points 545, 546, and 547. Concentration Point 545 represents the peak discharge that would be expected at the Arizona Canal in response to water flowing south through an interceptor channel located along the east side of the proposed Outer Loop Highway. Concentration Point 546 represents the peak discharge that would occur at the highway in response to water flowing west, through and along the north side of the Arizona Canal, while CP 547 represents the peak discharge that would occur at the Arizona Canal and Outer Loop intersection through the combining of flows from the north/south interceptor channel (CP 545) with westerly flowing water through and along the north bank of the Arizona Canal (CP 546).

When reviewing the data in Table 4.3, it should be noted that certain limitations are associated with the peak discharge values for the 50-year event. These limitations result from the following factors:

1. No outflow hydrograph from the Scottsdale Ranch lake system was available for any event other than the 100-year storm. Accordingly, the 100-year outflow hydrograph was used for both the 50- and 100-year HEC-1 models for the Outer Loop.

2. The peak outflows from the CAP cross-drainage structures were obtained from the Bureau of Reclamation. The Bureau had no data on how these discharges might fluctuate with lesser storm events. As

a result, the same peak discharge was used for both 50- and 100-year events.

These limitations will provide some additional conservatism in the peak discharge values used for the 50-year event, i.e., the 50-year peaks along the Outer Loop may be slightly higher than normal since they reflect some 100-year inflows along the perimeter of the watershed.

4.5 Verification of Model Results

In order to establish confidence in the results from the HEC-1 model, it is important to utilize an independent procedure to calculate peak discharge values that can be compared to the computerized modeling results. Due to the extreme differences in land-use throughout the study area, several different techniques were used for model verification.

As will be shown in the following subsections of this report, the HEC-1 model is considered to be producing reasonable results from the various sub-basins comprising the watershed. The overall model results are also considered reasonable as a result of comparing peak discharge values at the intersection of the Outer Loop and Arizona Canal with those developed by the Corps of Engineers for the intersection of Pima Road and the Arizona Canal. The peak 100-year Corps' discharge at Pima Road was 7824 cfs (rounded to 8000 cfs for design purposes), while the peak 100-year discharge at the Outer Loop/Arizona Canal intersection generated from this study is 9326 cfs.

It should be noted that the Corps used a considerably different approach in developing their hydrology, i.e., they used a 7-hour storm distribution with direct runoff values computed as 45 percent of the Standard Project Flood values. The Corps also used the exponential loss rate function, rather than the SCS curve number, to simulate soil infiltration losses.

TABLE 4.3

Peak Discharge Summary Along Outer Loop Alignment

Concentration Point	Q100 1/ (cfs)	Q50 2/ (cfs)
(North-south Interceptor Channel)		
103	514	428
360	507	433
410	549	457
422	755	618
402	997	788
501	996	782
503	1314	971
560	1378	1023
552	3234	2453
545	3239	2485
(Arizona Canal Bridge)		
546 3/	8120	6417
547 4/	9326	7449

1/ Model 2FD6.24I

2/ Model 2FD6.5I

3/ Peak discharge due to flows being routed west through the Arizona Canal.

4/ Combined peak discharge from flows routed through the north-south interceptor channel and flows routed west through the Arizona Canal, i.e., this combines the hydrograph from SUB 545 with that from CP 546.

4.5.1 Agricultural Fields

Model verification calculations were previously performed for this land-use category as part of the Final Outer Loop Hydrology Report for that study reach extending from the Arizona Canal to the Salt River (SLA, April 1989). Since the field dimensions and irrigation layout is the same for those fields north of the canal as for those south of the canal, identical kinematic wave modeling parameters were used in both cases. As a result, no additional verification calculations are required.

4.5.2 Undeveloped Desert

Due to the large size of the project study area, it is not practical to perform verification calculations for every concentration point in the HEC-1 model. Instead, a small number of "typical" sub-basins were selected from each land-use category to use in the verification procedure.

Sub-basins 440 and 1165 were selected as being typical of the undeveloped desert areas. Sub-basin 440 is representative of the smooth, relatively unincised desert region that lies west of Alma School Road, while Sub-basin 1165 is typical of the more incised, braided channel pattern that lies east of Alma School Road.

The following three procedures were used to verify the model results from those desert regions:

1. Peak discharge regression equations presented in Estimation of Magnitude and Frequency of Floods in Pima County, Arizona, With Comparisons of Alternative Methods, U.S.G.S. Water Resources Investigations report 84-4142, Table 2, J.H. Eychaner, August 1984.
2. Graphical peak discharge method presented in Urban Hydrology for Small Watersheds, Technical Release 55, Soil Conservation Service, USDA, June 1986.
3. Peak discharge methodology presented in Hydrology Manual for Engineering Design and Floodplain Management Within Pima County, Arizona, Pima County Department of Transportation and Flood Control District, September 1979.

Although the regression equations developed under Procedure 1 were based primarily on stream gage data in and around Pima County, their use in the Scottsdale area is justified on the basis of similar watershed characteristics in both areas.

Procedure 2 (TR55) is based on an SCS Type II rainfall distribution and uses a time of concentration that considers sheet flow, shallow concentrated flow, and open channel flow. Where applicable, the same overland flow and channel routing parameters that were used in the HEC-1 model were used in this procedure. The same SCS curve numbers were also used in the TR55 procedure as were used in the HEC-1 model.

Procedure 3 is a semi-empirical, peak discharge equation that acknowledges such watershed characteristics as watercourse length, mean slope, basin roughness, length to center of gravity, drainage area size, and infiltration rate (SCS curve number). Although this procedure was developed in Pima County, it is based on physical watershed characteristics that allow it to be used in any semi-arid environment. It should be noted, however, that the procedure is limited to individual sub-basins whose times of concentration are less that three hours. Since this procedure is based on short duration storms, all SCS curve numbers used for this method were taken from the Curve Number chart on page 107 of the Pima County Hydrology Manual.

Table 4.4 presents a summary of the independent peak discharge calculations that were performed for each of the two desert sub-basins. For comparison purposes, the peak discharge values from the HEC-1 model (using the 24-hour, hypothetical rainfall distribution) are also listed in this table.

Although Table 4.4 indicates considerable variation in the discharge values generated by the various methods, it is concluded that HEC-1 is providing results that are generally reasonable. The high value produced by the Eychaner regression equations for Sub-basin 440 is attributed to the fact that these

TABLE 4.4

Summary of Verification Calculations for HEC-1 Model

Undeveloped Desert Parcels

Sub-Basin	D.A. (sq.mi.)	Q100 (cfs) USGS Regression (Eychaner)	TR55	Pima County Peak	HEC-1
440	0.1004	236	50	135	92
1165	0.3942	645	404	583	787

riverine based equations are not accurately simulating the shallow sheetflow conditions that exist in this sub-basin.

4.5.3 Urbanized Land

Sub-basins 255 and 270 were selected as typical basins to use for the verification of peak discharge from the urbanized parcels lying north of the Salt River Indian Reservation Boundary. Urban runoff based regression equations were used as the primary verification method for these basins. These equations, which include a "Basin Development Factor" to account for urbanization effects, are presented in U.S.G.S. Water Supply Paper 2207, Flood Characteristics of Urban Watersheds in the United States, Sauer 1983.

Due to the small size of these two typical sub-basins, the Rational Equation was also employed to provide a second estimate of peak discharge from urbanized basins. As a result of the sensitivity of this procedure to time of concentration (Tc), this parameter was computed using procedures in TR55, as well as with the Kirpich equation. Peak discharge values using both Tc procedures are presented in Table 4.5.

A baseline runoff coefficient of 0.68 was used for both sub-basins. This value was increased by a factor of 1.25 to reflect the more severe runoff characteristics associated with a 100-year event. This adjustment produced a final runoff coefficient of 0.85.

A review of Table 4.5 indicates reasonable correlation between the HEC-1 results and those from the independent calculations. Accordingly, the HEC-1 modeling parameters used for the urban sub-basins are considered to be giving satisfactory results. It should be emphasized that the results listed in Table 4.5 do not reflect any impacts due to onsite detention storage.

TABLE 4.5

Summary of Verification Calculations for HEC-1 Model

Urbanized Parcels

Sub-Basin	D.A. (sq. mi.)	Q100 (cfs)			
		USGS WSP 2207 (Sauer)	Rational Method (variable Tc)		HEC-1
255	0.0290	112	54 1/	77 2/	78
270	0.0576	198	124 3/	160 4/	173

1/ Tc = 36 minutes
2/ Tc = 20.2 minutes
3/ Tc = 29.4 minutes
4/ Tc = 18.9 minutes

V. CONCLUSIONS AND RECOMMENDATIONS

This report presents a technical overview of the engineering parameters that were used to create a computerized rainfall/runoff model of the offsite drainage intercepted by that reach of the Outer Loop Highway extending from the Camelback Walk Channel to the Arizona Canal. The model simulates the runoff response that would be associated with both the 100- and 50-year, 24-hour precipitation applied to the 24-hour hypothetical rainfall distribution generated by HEC-1. When compared to peak discharge estimates generated from independent calculation methods, as well as previous Corps of Engineers studies, the model results were judged to be realistic.

Should future development occur in this watershed that would alter the existing drainage pattern used to create the routing structure of the model, the inflow points to the proposed highway interceptor channel could be significantly altered. Depending on how such alterations might occur, the proposed channel capacity might be subjected to either an under- or over-design.

It is also important to emphasize that any future land-use changes that might alter this watershed towards a more urbanized condition will undoubtedly generate a potential for increased runoff, as farmland and undeveloped desert areas are covered with more impervious surfaces such as asphalt streets, parking lots, rooftops, etc. If such changes are ever allowed to occur, it is important that effective drainage ordinances be enforced to insure that peak discharges are not increased along the Outer Loop Highway alignment.

In summary, SLA recommends that the HEC-1 model presented in this report be adopted for use in the concept design of offsite drainage structures for this reach of the Outer Loop Highway. The model was constructed in such a way that hydrology data is available for both the design of a north-south interceptor channel along the east side of the highway, and for the hydraulic design of a bridge structure to cross the Arizona Canal. Both 100- and 50-year storm frequencies should be considered for engineering and economic comparisons.

APPENDIX A

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

   1          ID       ******************************************************************
   2          ID       *                                                                *
   3          ID       *                SIMONS, LI AND ASSOCIATES, INC.                 *
   4          ID       *                                                                *
   5          ID       *                      OUTER LOOP FREEWAY                        *
   6          ID       *                 (NORTH OF THE ARIZONA CANAL)                   *
   7          ID       *                           PHASE 2                              *
   8          ID       *                                                                *
   9          ID       *            HYDROLOGY ANALYSIS FOR OFFSITE DRAINAGE             *
  10          ID       *                       100 YEAR EVENT                           *
  11          ID       *            24 HOUR HYPOTHETICAL STORM DISTRIBUTION             *
  12          ID       *                                                                *
  13          ID       *        USES % IMPERVIOUS COVER TO SIMULATE DEVELOPMENT         *
  14          ID       *            INCLUDES RETENTION/DETENTION BASINS FOR             *
  15          ID       *                 RESIDENTIAL & COMMERCIAL AREAS                 *
  16          ID       *                                                                *
  17          ID       *                                                                *
  18          ID       *              THIS MODEL INCLUDES THE ADDITIONAL AREA           *
  19          ID       *            PREVIOUSLY MODELED BY THE CORP OF ENGINEERS         *
  20          ID       *             N=.012 FOR THE HIGHWAY INTERCEPTOR CHANNEL         *
  21          ID       *          ALL CURVE NUMBERS ARE FOR 24-HOUR STORM DURATION      *
  22          ID       *          NORMAL DEPTH STORAGE ROUTING ALONG ARIZONA CANAL      *
  23          ID       *            INCLUDES CAP CROSS-DRAINAGE AT EAST BOUNDARY        *
  24          ID       *          USES APRIL 1989 HYDROLOGIC REVISIONS BY R. WARD       *
  25          ID       *                  MARCH 1989 HIGHWAY ALIGNMENT                  *
  26          ID       *                                                                *
  27          ID       *                         MODEL 2FD6.24I                         *
  28          ID       ******************************************************************
              *DIAGRAM
  29          IT       5 20APR89       0     289
  30          IO       5

  31          KK    1270     SUB
  32          KM         RUNOFF FROM SUB 1270
  33          BA   .0308
  34          PH              .1     .72    1.42    2.50    2.77    2.95    3.29    3.68    4.08
  35          LS              80
  36          UK    1300   .0028     .15     100
  37          RK     660   .0029    .045            TRAP      10     100

  38          KK    1280     SUB
  39          KM         RUNOFF FROM SUB 1280 AND ROUTE SUB 1270
  40          BA   .0308
  41          LS              80
  42          UK    1300   .0028     .15     100
  43          RK     660   .0029    .045            TRAP      10     100     YES

  44          KK    1350     SUB
  45          KM         RUNOFF FROM SUB 1350 AND ROUTE SUB 1280
  46          BA   .0308
  47          LS              80
  48          UK    1300   .0028     .15     100
  49          RK     660   .0029    .045            TRAP      10     100     YES
```

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

KK    1360     SUB
KM          RUNOFF FROM SUB 1360 AND ROUTE SUB 1350
BA   .0308
LS               80
UK    1300   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100      YES

KK    1440     SUB
KM          RUNOFF FROM SUB 1440 AND ROUTE SUB 1360
BA   .0308
LS               80
UK    1300   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100      YES

KK    1450     SUB
KM          RUNOFF FROM SUB 1450 AND ROUTE SUB 1440
BA   .0308
LS               80
UK    1300   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100      YES

KK    1520     SUB
KM          RUNOFF FROM SUB 1520 AND ROUTE SUB 1440
BA   .0308
LS               80
UK    1300   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100      YES

KK    1530     SUB
KM          RUNOFF FROM SUB 1530 AND ROUTE SUB 1520
BA   .0308
LS               80
UK    1300   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100      YES

KK    1600     SUB
KM          RUNOFF FROM SUB 1600 AND ROUTE SUB 1530
BA   .0616
LS               80
UK    1300   .0028     .15     100
RK    1320   .0029    .045             TRAP      10      100      YES

KK    1591      CP
KM          ROUTE SUB 1600 TO CP 1591
RK    1360   .0028    .045             TRAP      10      100

KK    1260     SUB
KM          RUNOFF FROM SUB 1260
BA   .0320
LS               80
UK    1350   .0028     .15     100
RK     660   .0029    .045             TRAP      10      100
```

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

  95        KK    1290     SUB
  96        KM         RUNOFF FROM SUB 1290 AND ROUTE SUB 1260
  97        BA   .0320
  98        LS               80
  99        UK    1350   .0028     .15     100
 100        RK     660   .0029    .045             TRAP      10     100     YES

 101        KK    1340     SUB
 102        KM         RUNOFF FROM SUB 1340 AND ROUTE SUB 1290
 103        BA   .0320
 104        LS               80
 105        UK    1350   .0028     .15     100
 106        RK     660   .0029    .045             TRAP      10     100     YES

 107        KK    1370     SUB
 108        KM         RUNOFF FROM SUB 1370 AND ROUTE SUB 1340
 109        BA   .0320
 110        LS               80
 111        UK    1350   .0028     .15     100
 112        RK     660   .0029    .045             TRAP      10     100     YES

 113        KK    1430     SUB
 114        KM         RUNOFF FROM SUB 1430 AND ROUTE SUB 1370
 115        BA   .0320
 116        LS               80
 117        UK    1350   .0028     .15     100
 118        RK     660   .0029    .045             TRAP      10     100     YES

 119        KK    1460     SUB
 120        KM         RUNOFF FROM SUB 1460 AND ROUTE SUB 1430
 121        BA   .0320
 122        LS               80
 123        UK    1350   .0028     .15     100
 124        RK     660   .0029    .045             TRAP      10     100     YES

 125        KK    1510     SUB
 126        KM         RUNOFF FROM SUB 1510 AND ROUTE SUB 1460
 127        BA   .0320
 128        LS               80
 129        UK    1350   .0028     .15     100
 130        RK     660   .0029    .045             TRAP      10     100     YES

 131        KK    1540     SUB
 132        KM         RUNOFF FROM SUB 1540 AND ROUTE SUB 1510
 133        BA   .0320
 134        LS               80
 135        UK    1350   .0028     .15     100
 136        RK     660   .0029    .045             TRAP      10     100     YES
```

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

 137          KK    1590     SUB
 138          KM        RUNOFF FROM SUB 1590 AND ROUTE SUB 1540
 139          BA   .0639
 140          LS              80
 141          UK    1350   .0028     .15     100
 142          RK    1320   .0029    .045             TRAP      10     100     YES

 143          KK    1592      CP
 144          KM        COMBINE SUB 1590 WITH CP 1591
 145          HC       2

 146          KK    1581      CP
 147          KM        ROUTE CP 1592 TO CP 1581
 148          RK    1280  0.0028    .045             TRAP      10     100

 149          KK    1250     SUB
 150          KM        RUNOFF FROM SUB 1250
 151          BA   .0303
 152          LS              80
 153          UK    1280   .0028     .15     100
 154          RK     660   .0029    .045             TRAP      10     100

 155          KK    1300     SUB
 156          KM        RUNOFF FROM SUB 1300 AND ROUTE SUB 1250
 157          BA   .0303
 158          LS              80
 159          UK    1280   .0028     .15     100
 160          RK     660   .0029    .045             TRAP      10     100     YES

 161          KK    1330     SUB
 162          KM        RUNOFF FROM SUB 1330 AND ROUTE SUB 1300
 163          BA   .0303
 164          LS              80
 165          UK    1280   .0028     .15     100
 166          RK     660   .0029    .045             TRAP      10     100     YES

 167          KK    1380     SUB
 168          KM        RUNOFF FROM SUB 1380 AND ROUTE SUB 1330
 169          BA   .0303
 170          LS              80
 171          UK    1280   .0028     .15     100
 172          RK     660   .0029    .045             TRAP      10     100     YES

 173          KK    1420     SUB
 174          KM        RUNOFF FROM SUB 1420 AND ROUTE SUB 1380
 175          BA   .0303
 176          LS              80
 177          UK    1280   .0028     .15     100
 178          RK     660   .0029    .045             TRAP      10     100     YES
```

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

 179          KK    1470     SUB
 180          KM         RUNOFF FROM SUB 1470 AND ROUTE SUB 1420
 181          BA   .0303
 182          LS              80
 183          UK    1280   .0028     .15     100
 184          RK     660   .0029    .045             TRAP      10     100     YES

 185          KK    1500     SUB
 186          KM         RUNOFF FROM SUB 1500 AND ROUTE SUB 1470
 187          BA   .0303
 188          LS              80
 189          UK    1280   .0028     .15     100
 190          RK     660   .0029    .045             TRAP      10     100     YES

 191          KK    1550     SUB
 192          KM         RUNOFF FROM SUB 1550 AND ROUTE SUB 1500
 193          BA   .0303
 194          LS              80
 195          UK    1280   .0028     .15     100
 196          RK     660   .0029    .045             TRAP      10     100     YES

 197          KK    1580     SUB
 198          KM         RUNOFF FROM SUB 1580 AND ROUTE SUB 1550
 199          BA   .0606
 200          LS              80
 201          UK    1280   .0028     .15     100
 202          RK     660   .0029    .045             TRAP      10     100     YES

 203          KK    1582      CP
 204          KM         COMBINE SUB 1580 WITH CP 1581
 205          HC       2

 206          KK    1571      CP
 207          KM         ROUTE CP 1582 TO CP 1571
 208          RK    1330  0.0028    .045             TRAP      10     100

 209          KK    1240     SUB
 210          KM         RUNOFF FROM SUB 1240
 211          BA   .0315
 212          LS              80
 213          UK    1330   .0028     .15     100
 214          RK     660   .0029    .024             TRAP       5      10

 215          KK    1310     SUB
 216          KM         RUNOFF FROM SUB 1310 AND ROUTE SUB 1240
 217          BA   .0315
 218          LS              80
 219          UK    1330   .0028     .15     100
 220          RK     660   .0029    .024             TRAP       5      10     YES
```

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

 221          KK    1320     SUB
 222          KM        RUNOFF FROM SUB 1320 AND ROUTE SUB 1310
 223          BA   .0306
 224          LS               81
 225          UK    1330   .0028     .15     100
 226          RK     660   .0029    .024             TRAP       5      10     YES

 227          KK    1400     SUB
 228          KM        RUNOFF FROM SUB 1400 AND ROUTE SUB 1320
 229          BA   .0080
 230          LS               84
 231          UK     300   .0028     .15     100
 232          RK     700   .0029    .024             TRAP       5      10     YES

 233          KK    1390     SUB
 234          KM        RUNOFF FROM SUB 1390
 235          BA   .0239
 236          LS               80
 237          UK    1020   .0028     .15     100
 238          RK     660   .0029    .045             TRAP      10     100

 239          KK    1391      CP
 240          KM        ROUTE SUB 1390 TO CP 1391
 241          RK     300  0.0028    .045             TRAP      10     100

 242          KK    1392      CP
 243          KM        COMBINE SUB 1400 AND CP 1391
 244          HC       2

 245          KK    1410     SUB
 246          KM        RUNOFF FROM SUB 1410 AND ROUTE CP 1392
 247          BA   .0315
 248          LS               80
 249          UK    1330   .0028     .15     100
 250          RK     660   .0029    .024             TRAP       5      10     YES

 251          KK    1480     SUB
 252          KM        RUNOFF FROM SUB 1480 AND ROUTE SUB 1410
 253          BA   .0315
 254          LS               80
 255          UK    1330   .0028     .15     100
 256          RK     660   .0029    .024             TRAP       5      10     YES

 257          KK    1490     SUB
 258          KM        RUNOFF FROM SUB 1490 AND ROUTE SUB 1480
 259          BA   .0315
 260          LS               80
 261          UK    1330   .0028     .15     100
 262          RK     660   .0029    .024             TRAP       5      10     YES
```

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

 263          KK    1560     SUB
 264          KM        RUNOFF FROM SUB 1560 AND ROUTE SUB 1490
 265          BA   .0315
 266          LS              80
 267          UK    1330   .0028     .15     100
 268          RK     660   .0029    .024             TRAP       5      10     YES

 269          KK    1570     SUB
 270          KM        RUNOFF FROM SUB 1570 AND ROUTE SUB 1560
 271          BA   .0630
 272          LS              80
 273          UK    1330   .0028     .15     100
 274          RK    1320   .0029    .024             TRAP       5      10     YES

 275          KK    1572      CP
 276          KM        COMBINE CP 1572 WITH CP 1571
 277          HC       2

 278          KK    1611      CP
 279          KM        ROUTE CP 1572 TO CP 1611
 280          RK    1330  0.0029    .024             TRAP       5      10

 281          KK    1610     SUB
 282          KM        RUNOFF FROM SUB 1610
 283          BA   .2505
 284          LS              80
 285          UK    1330   .0029     .15     100
 286          RK    5250   .0028    .045             TRAP      10     100

 287          KK    1612      CP
 288          KM        COMBINE SUB 1610 AND CP 1611
 289          HC       2

 290          KK    1621      CP
 291          KM        ROUTE CP 1612 TO CP 1621
 292          RK    1350  0.0029    .024             TRAP       5      10

 293          KK    1620     SUB
 294          KM        RUNOFF FROM SUB 1620
 295          BA   .2542
 296          LS              82
 297          UK    1350   .0029     .15     100
 298          RK    5250   .0028    .045             TRAP      10     100

 299          KK    1630     SUB
 300          KM        RUNOFF FROM SUB 1630
 301          BA   .1107
 302          LS              84
 303          UK    1000   .0029     .15     100
 304          RK    2900   .0028    .045             TRAP      10     100
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 305           KK    1640     SUB
 306           KM         RUNOFF FROM SUB 1640 AND ROUTE SUB 1630
 307           BA   .0245
 308           LS               87
 309           UK     470   .0029     .15     100
 310           RK    2100   .0028    .045             TRAP      10     100     YES

 311           KK    1622       CP
 312           KM         COMBINE SUB 1640, CP 1621 AND SUB 1620
 313           HC       3

 314           KK    1887       CP
 315           KM         ROUTE CP 1622 TO CP 1887
 316           RS       1    FLOW      -1
 317           RC    .050    .024    .080   10500   .0007
 318           RX       0      50     100     115     180   190.5     194     544
 319           RY     400     400     400     385     385   395.5     392   395.5

 320           KK    1950     SUB
 321           KM         RUNOFF FROM SUB 1950
 322           BA   .0407
 323           LS               80
 324           UK     960   .0029     .15     100
 325           RK    1900   .0028    .045             TRAP      10     100

 326           KK    1945     SUB
 327           KM         RUNOFF FROM SUB 1945
 328           BA   .0822
 329           LS               82
 330           UK    1340   .0029     .15     100
 331           RK    1710   .0028    .045             TRAP      10     100

 332           KK    1951       CP
 333           KM         ROUTE SUB 1945 TO CP 1951
 334           RK     500  0.0029    .045             TRAP      10     100

 335           KK    1952       CP
 336           KM         COMBINE CP 1951 AND SUB 1950
 337           HC       2

 338           KK    1940     SUB
 339           KM         RUNOFF FROM SUB 1940 AND ROUTE CP 1952
 340           BA   .1143
 341           LS               87
 342           UK    1200   .0029     .15     100
 343           RK    2770   .0028    .045             TRAP      10     100     YES

 344           KK    1920     SUB
 345           KM         RUNOFF FROM SUB 1920
 346           BA   .1959
 347           LS               86
 348           UK    1300   .0029     .15     100
 349           RK    4200   .0028    .045             TRAP      10     100
```

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

 350          KK   1941     CP
 351          KM       ROUTE SUB 1920 TO CP 1941
 352          RK    650 0.0029    .045            TRAP      10     100

 353          KK   1942     CP
 354          KM       COMBINE SUB 1940 WITH CP 1941
 355          HC      2

 356          KK   1925     SUB
 357          KM       RUNOFF FROM SUB 1925 AND ROUTE CP 1942
 358          BA  .0655
 359          LS              87
 360          UK   1730  .0029     .15     100
 361          RK   1250  .0028    .045            TRAP      10     100     YES

 362          KK   1930     SUB
 363          KM       RUNOFF FROM SUB 1930 AND ROUTE SUB 1925
 364          BA  .0717
 365          LS              86
 366          UK   1090  .0029     .15     100
 367          RK   2200  .0028    .045            TRAP      10     100     YES

 368          KK   1910     SUB
 369          KM       RUNOFF FROM SUB 1910
 370          BA  .1445
 371          LS              85
 372          UK   1370  .0029     .15     100
 373          RK   2940  .0028    .045            TRAP      10     100

 374          KK   1900     SUB
 375          KM       RUNOFF FROM SUB 1900 AND ROUTE SUB 1910
 376          BA  .1214
 377          LS              87
 378          UK   1370  .0029     .15     100
 379          RK   2470  .0028    .045            TRAP      10     100     YES

 380          KK   1890     SUB
 381          KM       RUNOFF FROM SUB 1890 AND ROUTE SUB 1900
 382          BA  .0975
 383          LS              87
 384          UK   1370  .0029     .15     100
 385          RK   1980  .0028    .045            TRAP      10     100     YES

 386          KK   1931     CP
 387          KM       ROUTE SUB 1890 TO CP 1931
 388          RK    530 0.0029    .045            TRAP      10     100

 389          KK   1932     CP
 390          KM       COMBINE SUB 1930 WITH CP 1931
 391          HC      2
```

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


               KK    1885     SUB
               KM        RUNOFF FROM SUB 1885 AND ROUTE CP 1932
               BA   .0657
               LS              87
               UK    1100   .0029     .15     100
               RK    2400   .0028    .045             TRAP      10     100     YES

               KK    1850     SUB
               KM        RUNOFF FROM SUB 1850
               BA   .1392
               LS              86
               UK    1320   .0029     .15     100
               RK    2940   .0028    .045             TRAP      10     100

               KK    1860     SUB
               KM        RUNOFF FROM SUB 1860 AND ROUTE SUB 1850
               BA   .1170
               LS              87
               UK    1320   .0029     .15     100
               RK    2470   .0028    .045             TRAP      10     100     YES

               KK    1870     SUB
               KM        RUNOFF FROM SUB 1870 AND ROUTE SUB 1860
               BA   .1847
               LS              87
               UK    1320   .0029     .15     100
               RK    3900   .0028    .045             TRAP      10     100     YES

               KK    1886      CP
               KM        ROUTE SUB 1870 TO CP 1886
               RK     300  0.0029    .045             TRAP      10     100

               KK    1880     SUB
               KM        RUNOFF FROM SUB 1880
               BA   .0546
               LS              87
               UK    1200   .0029     .15     100
               RK    1700   .0028    .045             TRAP      10     100

               KK    1888      CP
               KM        COMBINE CP 1886, SUB 1880, AND SUB 1885 AND CP 1887
               HC       4

               KK    1984      CP
               KM        ROUTE CP 1888 TO CP 1984
               RS       1    FLOW      -1
               RC    .050    .024    .080    1850   .0007
               RX       0      50     100     115     180   190.5     194     544
               RY     400     400     400     385     385   395.5     392   395.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 434          KK    1840     SUB
 435          KM       RUNOFF FROM SUB 1840
 436          BA   .0315
 437          LS             86
 438          UK    1630   .0029     .15     100
 439          RK    2550   .0028    .024             TRAP       5       1

 440          KK    1670     SUB
 441          KM       RUNOFF FROM SUB 1670
 442          BA   .0759
 443          LS             80
 444          UK     830   .0029     .15     100
 445          RK    2550   .0028    .045             TRAP      10     100

 446          KK    1681      CP
 447          KM       ROUTE SUB 1670 TO CP 1681
 448          RK     830  0.0029    .045             TRAP      10     100

 449          KK    1680     SUB
 450          KM       RUNOFF FROM SUB 1680
 451          BA   .0759
 452          LS             80
 453          UK     830   .0029     .15     100
 454          RK    2550   .0028    .045             TRAP      10     100

 455          KK    1682      CP
 456          KM       COMBINE SUB 1680 AND CP 1681
 457          HC       2

 458          KK    1751      CP
 459          KM       ROUTE CP 1682 TO 1751
 460          RK     860  0.0029    .024             TRAP      10     100

 461          KK    1226      CP
 462          KM       DISCHARGE FROM 2-66" CMP OVER THE CAP AT STA 332+75
 463          IN      60 20APR89
 464          BA  .00001
 465          QI       0       0       0       0       0       0       0       0      40     100
 466          QI     200     300     437     437     437     300     250     200     150     100
 467          QI      70      40      27      13       0

 468          KK    1227     DIV
 469          KM       DIVERT CROSS-DRAINAGE FROM CP 1226 OUT OF OUTER LOOP MODEL
 470          DT    1228
 471          DI       0     100    1000
 472          DQ       0      85     850

 473          KK    1225     SUB
 474          KM       RUNOFF FROM SUB 1225 & ROUTE NON-DIVERTED FLOW FROM DIV 1227
 475          BA   .0778
 476          LS             77
 477          UK     145   .0213     .10     100
 478          RK    3200   .0119    .045             TRAP      10       5     YES
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 479           KK    1230     SUB
 480           KM       RUNOFF FROM SUB 1230 & ROUTE SUB 1225
 481           BA   .6421
 482           LS              77
 483           UK     445   .0080     .10     100
 484           RK    6800   .0091    .045             TRAP      10      20     YES

 485           KK    1221      CP
 486           KM       ROUTE SUB 1230 TO CP 1221
 487           RK    3450   .0043    .030             TRAP      20      10

 488           KK    1214     SUB
 489           KM       RUNOFF FROM SUB 1214
 490           BA   .0149
 491           LS              85      20
 492           UK     145   .0213     .10     100
 493           RK    1100   .0182    .045             TRAP      10       5

 494           KK    1217     SUB
 495           KM       RUNOFF FROM SUB 1217 & ROUTE SUB 1214
 496           BA   .7240
 497           LS              77
 498           UK     145   .0213     .10     100
 499           RK    6800   .0124    .045             TRAP      15       5     YES

 500           KK    1220     SUB
 501           KM       RUNOFF FROM SUB 1220 & ROUTE SUB 1217
 502           BA   .6675
 503           LS              77
 504           UK     445   .0080     .10     100
 505           RK    6440   .0087    .045             TRAP      10      20     YES

 506           KK    1222      CP
 507           KM       ROUTE SUB 1220 TO CP 1222
 508           RK    1900   .0074    .030             TRAP      20      10

 509           KK    1223      CP
 510           KM       COMBINE CP 1221 AND CP 1222
 511           HC       2

 512           KK    1750     SUB
 513           KM       RUNOFF FROM SUB 1750 AND ROUTE CP 1223
 514           BA   .0787
 515           LS              80
 516           UK     860   .0029     .15     100
 517           RK    2550   .0028    .045             TRAP      10     100     YES

 518           KK    1752      CP
 519           KM       COMBINE SUB 1750 AND CP 1751
 520           HC       2
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LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 521      KK    1761      CP
 522      KM        ROUTE CP 1752 TO CP 1761
 523      RK     550  0.0029    .024            TRAP      10     100

 524      KK    1760     SUB
 525      KM        RUNOFF FROM SUB 1760
 526      BA   .0493
 527      LS              80
 528      UK     550   .0029     .15     100
 529      RK    2550   .0028    .045            TRAP      10     100

 530      KK    1762      CP
 531      KM        COMBINE SUB 1760 AND CP 1761
 532      HC       2

 533      KK    1771      CP
 534      KM        ROUTE CP 1762 TO CP 1771
 535      RK     400  0.0029    .045            TRAP      10     100

 536      KK    1770     SUB
 537      KM        RUNOFF FROM SUB 1770
 538      BA   .0359
 539      LS              80
 540      UK     400   .0029     .15     100
 541      RK    2550   .0028    .045            TRAP      10     100

 542      KK    1772      CP
 543      KM        COMBINE SUB 1770 AND CP 1771
 544      HC       2

 545      KK    1841      CP
 546      KM        ROUTE CP 1772 TO CP 1841
 547      RK    1600  0.0029    .045            TRAP      10     100

 548      KK    1842      CP
 549      KM        COMBINE CP 1841 AND SUB 1840
 550      HC       2

 551      KK    1830     SUB
 552      KM        RUNOFF FROM SUB 1830 AND ROUTE CP 1842
 553      BA   .1134
 554      LS              87
 555      UK    1230   .0029     .15     100
 556      RK    2570   .0028    .024            TRAP       5       1     YES

 557      KK    1660     SUB
 558      KM        RUNOFF FROM SUB 1660
 559      BA   .0903
 560      LS              80
 561      UK     980   .0029     .15     100
 562      RK    2570   .0028    .045            TRAP      10     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 563          KK    1691       CP
 564          KM         ROUTE SUB 1660 TO CP 1691
 565          RK     980  0.0029    .045              TRAP      10      100

 566          KK    1690      SUB
 567          KM         RUNOFF FROM SUB 1690
 568          BA   .0922
 569          LS               80
 570          UK     980   .0029     .15     100
 571          RK    2570   .0028    .045              TRAP      10      100

 572          KK    1692       CP
 573          KM         COMBINE SUB 1690 AND CP 1691
 574          HC       2

 575          KK    1741       CP
 576          KM         ROUTE CP 1692 TO CP 1741
 577          RK     980  0.0029    .045              TRAP      10      100

 578          KK    1740      SUB
 579          KM         RUNOFF FROM SUB 1740
 580          BA   .0913
 581          LS               80
 582          UK     980   .0029     .15     100
 583          RK    2570   .0028    .045              TRAP      10      100

 584          KK    1742       CP
 585          KM         COMBINE SUB 1740 AND CP 1741
 586          HC       2

 587          KK    1781       CP
 588          KM         ROUTE CP 1742 TO CP 1781
 589          RK     980  0.0029    .045              TRAP      10      100

 590          KK    1780      SUB
 591          KM         RUNOFF FROM SUB 1780
 592          BA   .0903
 593          LS               83
 594          UK     980   .0029     .15     100
 595          RK    2570   .0028    .045              TRAP      10      100

 596          KK    1782       CP
 597          KM         COMBINE SUB 1780 AND CP 1781
 598          HC       2

 599          KK    1831       CP
 600          KM         ROUTE CP 1782 TO CP 1831
 601          RK    1230  0.0029    .045              TRAP      10      100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 602          KK    1832       CP
 603          KM        COMBINE CP 1831 AND SUB 1830
 604          HC       2

 605          KK    1820      SUB
 606          KM        RUNOFF FROM SUB 1820 AND ROUTE CP 1832
 607          BA   .1134
 608          LS              84
 609          UK    1230   .0029     .15     100
 610          RK    2570   .0028    .024              TRAP       5       1     YES

 611          KK    1650      SUB
 612          KM        RUNOFF FROM SUB 1650
 613          BA   .0903
 614          LS              80
 615          UK     980   .0029     .15     100
 616          RK    2570   .0028    .045              TRAP      10     100

 617          KK    1701       CP
 618          KM        ROUTE SUB 1650 TO CP 1701
 619          RK     980  0.0029    .045              TRAP      10     100

 620          KK    1700      SUB
 621          KM        RUNOFF FROM SUB 1700
 622          BA   .0922
 623          LS              80
 624          UK     980   .0029     .15     100
 625          RK    2570   .0028    .045              TRAP      10     100

 626          KK    1702       CP
 627          KM        COMBINE SUB 1700 AND CP 1701
 628          HC       2

 629          KK    1731       CP
 630          KM        ROUTE CP 1702 TO CP 1731
 631          RK     980  0.0029    .045              TRAP      10     100

 632          KK    1730      SUB
 633          KM        RUNOFF FROM SUB 1730
 634          BA   .0913
 635          LS              80
 636          UK     990   .0029     .15     100
 637          RK    2570   .0028    .045              TRAP      10     100

 638          KK    1732       CP
 639          KM        COMBINE SUB 1730 AND CP 1731
 640          HC       2

 641          KK    1791       CP
 642          KM        ROUTE CP 1732 TO CP 1791
 643          RK     980  0.0029    .045              TRAP      10     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 644          KK    1790     SUB
 645          KM         RUNOFF FROM SUB 1790
 646          BA   .0903
 647          LS              82
 648          UK     980   .0029     .15     100
 649          RK    2570   .0028    .045             TRAP      10     100

 650          KK    1792      CP
 651          KM         COMBINE SUB 1790 AND CP 1791
 652          HC       2

 653          KK    1822      CP
 654          KM         ROUTE CP 1792 TO CP 1822
 655          RK    1230  0.0029    .045             TRAP      10     100

 656          KK    1823      CP
 657          KM         COMBINE SUB 1820 AND CP 1822
 658          HC       2

 659          KK    1810     SUB
 660          KM         RUNOFF FROM SUB 1810 AND ROUTE CP 1823
 661          BA   .1156
 662          LS              87
 663          UK    1230   .0029     .15     100
 664          RK    2620   .0028    .024             TRAP       5       1     YES

 665          KK    1210     SUB
 666          KM         RUNOFF FROM SUB 1210
 667          BA   .9319
 668          LS              77
 669          UK     488   .0080     .10     100
 670          RK    9400   .0097    .045             TRAP      10      20

 671          KK    1201      CP
 672          KM         ROUTE SUB 1210 TO CP 1201
 673          RK    3650   .0044    .030             TRAP      20      10

 674          KK    1207     SUB
 675          KM         RUNOFF FROM SUB 1207
 676          BA   .1159
 677          LS              85      20
 678          UK     145   .0213     .10     100
 679          RK    2000   .0210    .045             TRAP      10       5

 680          KK    1204     SUB
 681          KM         RUNOFF FROM SUB 1204 & ROUTE SUB 1207
 682          BA   .6299
 683          LS              81
 684          UK     145   .0213     .10     100
 685          RK    7400   .0105    .045             TRAP      10      10     YES
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 686          KK    1200     SUB
 687          KM        RUNOFF FROM SUB 1200 & ROUTE SUB 1204
 688          BA   .5624
 689          LS               77
 690          UK     610   .0080     .10     100
 691          RK    8480   .0083    .045             TRAP      10      20     YES

 692          KK    1202      CP
 693          KM        COMBINE SUB 1200 & CP 1201
 694          HC       2

 695          KK    1191      CP
 696          KM        ROUTE CP 1202 TO CP 1191
 697          RK    2400   .0054    .035             TRAP      25      15

 698          KK    1186     SUB
 699          KM        RUNOFF FROM SUB 1186
 700          BA   .1189
 701          LS               81      20
 702          UK     145   .0213     .10     100
 703          RK    3800   .0111    .045             TRAP      10       3

 704          KK    1187     SUB
 705          KM        RUNOFF FROM SUB 1187 & ROUTE SUB 1186
 706          BA   .1871
 707          LS               78
 708          UK     145   .0213     .10     100
 709          RK    5800   .0100    .045             TRAP      10       5     YES

 710          KK    1190     SUB
 711          KM        RUNOFF FROM SUB 1190 & ROUTE SUB 1187
 712          BA   .7228
 713          LS               77
 714          UK     610   .0080     .10     100
 715          RK   10600   .0081    .045             TRAP      10      20     YES

 716          KK    1192      CP
 717          KM        COMBINE SUB 1190 & CP 1191
 718          HC       2

 719          KK    1181      CP
 720          KM        ROUTE CP 1192 TO CP 1181
 721          RK    1850   .0059    .035             TRAP      25      15

 722          KK    1173      CP
 723          KM        DISCHARGE FROM 36" RCP OVER CAP AT STA 243+00
 724          IN      60 20APR89
 725          BA  .00001
 726          QI       0       0       0       0       0       0       0       0       0       0
 727          QI      15      37      37      25      20      15      10       5       0       0
 728          QI       0       0       0       0       0
```

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

 729          KK    1174     SUB
 730          KM        RUNOFF FROM SUB 1174 & ROUTE CAP CROSS-DRAINAGE FROM CP 1173
 731          BA   .2122
 732          LS              78      20
 733          UK     145   .0213     .10     100
 734          RK    3400   .0103    .045             TRAP      10       4     YES

 735          KK    1177     SUB
 736          KM        RUNOFF FROM SUB 1177 & ROUTE SUB 1174
 737          BA   .2394
 738          LS              77
 739          UK     145   .0213     .10     100
 740          RK    5600   .0123    .045             TRAP      10       5     YES

 741          KK    1180     SUB
 742          KM        RUNOFF FROM SUB 1180 & ROUTE SUB 1177
 743          BA   .7011
 744          LS              77
 745          UK     575   .0080     .10     100
 746          RK   11000   .0078    .045             TRAP      10      20     YES

 747          KK    1000     SUB
 748          KM        RUNOFF FROM SUB 1000
 749          BA   .0166
 750          LS              77      60
 751          UK     725   .0063     .10     100
 752          RK     700   .0040    .024             TRAP      10      50

 753          KK    1042      CP
 754          KM        ROUTE SUB 1000 TO CP 1042
 755          RK     320   0.004    .024             TRAP      10      50

 756          KK    1060     SUB
 757          KM        RUNOFF FROM SUB 1060
 758          BA   .0399
 759          LS              77      60
 760          UK     210   .0014     .09     100
 761          RK    2400   .0001    .024             TRAP       5      25

 762          KK    1051      CP
 763          KM        ROUTE SUB 1060 TO CP 1051
 764          RK     800   .0040    .024             TRAP      10      50

 765          KK    1050     SUB
 766          KM        RUNOFF FROM SUB 1050
 767          BA   .0009
 768          LS              77      60
 769          UK     100   .0040     .09     100
 770          RK     450   .0040    .024   .0006     TRAP       5      25
 771          RK     200   .0040    .040             TRAP       5      10
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 772          KK    1052      CP
 773          KM       COMBINE SUB 1050 & CP 1051
 774          HC       2

 775          KK    1041      CP
 776          KM       ROUTE CP 1052 TO CP 1041
 777          RK    1820   .0040    .024            TRAP      10      50

 778          KK    1040     SUB
 779          KM       RUNOFF FROM SUB 1040
 780          BA   .0381
 781          LS              77      60
 782          UK     100   .0040     .09     100
 783          RK    2200   .0040    .025            TRAP       0      50

 784          KK    1043      CP
 785          KM       COMBINE SUB 1040 WITH CP 1041 AND CP 1442
 786          HC       3

 787          KK    DAM8
 788          KM       ROUTE CP 1043 THROUGH RETENTION BASIN 8
 789          RS       1    STOR
 790          SV       0   1.895    3.79
 791          SE     100     101     102
 792          SS  101.99     200     2.9     1.5
 793          ST     102     200     2.9     1.5

 794          KK    1011      CP
 795          KM       ROUTE OUTFLOW FROM DAM 8 TO CP 1011
 796          RK    1280  0.0040    .024            TRAP      10      50

 797          KK    1010     SUB
 798          KM       RUNOFF FROM SUB 1010
 799          BA   .0387
 800          LS              77      45
 801          UK     130   .0040     .09     100
 802          RK     680   .0040    .024   .0057    TRAP       5      25
 803          RK    1250   .0040    .024            TRAP       5      25

 804          KK    1012      CP
 805          KM       COMBINE SUB 1010 WITH CP 1011
 806          HC       2

 807          KK    1110     SUB
 808          KM       RUNOFF FROM SUB 1110 AND ROUTE CP 1012
 809          KM       ROUTING DOWN ALMA SCHOOL ROAD
 810          BA   .0109
 811          LS              77
 812          UK     450   .0080     .10     100
 813          RK     950   .0074    .030            TRAP      20       1    YES
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 814        KK    1020     SUB
 815        KM        RUNOFF FROM SUB 1020
 816        BA   .0345
 817        LS              77      45
 818        UK     110   .0063     .10     100
 819        RK    1300   .0054    .024            TRAP       5       1

 820        KK    1120     SUB
 821        KM        RUNOFF FROM SUB 1120 AND ROUTE SUB 1020
 822        BA   .0352
 823        LS              77
 824        UK     355   .0080     .10     100
 825        RK    1200   .0083    .045            TRAP       5       3     YES

 826        KK    1121      CP
 827        KM        COMBINE SUB 1110 AND SUB 1120
 828        HC       2

 829        KK    2222     DIV
 830        KM        DIVERT FLOW TO SUB 480
 831        DT    2223
 832        DI       0    1000   10000
 833        DQ       0     400    4000

 834        KK    1131      CP
 835        KM        ROUTE DIV 2222 TO CP 1131
 836        KM        ROUTING DOWN ALMA SCHOOL ROAD
 837        RK     750   .0027    .030            TRAP      20       1

 838        KK    1070     SUB
 839        KM        RUNOFF FROM SUB 1070
 840        BA   .0393
 841        LS              77      45
 842        UK     130   .0040     .10     100
 843        RK     300   .0040    .024   .0057    TRAP       0      50
 844        RK    1900    .004    .035            TRAP       5      10

 845        KK    1031      CP
 846        KM        ROUTE SUB 1070 TO CP 1031
 847        RK     400  0.0035    .035            TRAP       5      10

 848        KK    1030     SUB
 849        KM        RUNOFF FROM SUB 1030
 850        BA   .0308
 851        LS              77      45
 852        UK     160   .0040     .10     100
 853        RK     500   .0041    .025   .0045    TRAP       0      50
 854        RK    1800    .003    .035            TRAP      12       4
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 855           KK    1032     CP
 856           KM       COMBINE SUB 1030 WITH CP 1031
 857           HC       2

 858           KK    1130     SUB
 859           KM       RUNOFF FROM SUB 1130 AND ROUTE CP 1032
 860           BA   .0603
 861           LS               77
 862           UK     260   .0080     .10     100
 863           RK    2500   .0076    .045             TRAP       5      10      YES

 864           KK    1132     CP
 865           KM       COMBINE SUB 1130 WITH CP 1131
 866           HC       2

 867           KK    3333     DIV
 868           KM       DIVERT FLOW AT CP 1132
 869           DT    3334
 870           DI       0     100     500    1000    5000
 871           DQ       0      50     250     500    2500

 872           KK    1151     CP
 873           KM       ROUTE DIV 3333 TO CP 1151
 874           KM       ROUTING DOWN ALMA SCHOOL ROAD
 875           RK    2300   .0061    .030             TRAP      20       1

 876           KK    1080     SUB
 877           KM       RUNOFF FROM SUB 1080
 878           BA   .0824
 879           LS               77      38
 880           UK     110   .0040     .10     100
 881           RK    2100   .0057    .024             TRAP       5      25

 882           KK    1090     SUB
 883           KM       RUNOFF FROM SUB 1090 AND ROUTE SUB 1080
 884           BA   .0528
 885           LS               77      38
 886           UK     105   .0040     .10     100
 887           RK    1500   .0040    .024             TRAP       5      25      YES

 888           KK    1150     SUB
 889           KM       RUNOFF FROM SUB 1150 AND ROUTE SUB 1090
 890           BA   .2350
 891           LS               77
 892           UK     770   .0080     .10     100
 893           RK    5300   .0077    .045             TRAP       5      10      YES

 894           KK    1152     CP
 895           KM       COMBINE SUB 1150 AND CP 1151
 896           HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 897          KK    4444     DIV
 898          KM        DIVERT CP 1152
 899          DT    4445
 900          DI       0     100     500    1000    5000
 901          DQ       0      50     250     500    2500

 902          KK    1161      CP
 903          KM        ROUTE DIV 4444 TO CP 1161
 904          KM        ROUTING DOWN ALMA SCHOOL ROAD
 905          RK    3350   .0048    .030            TRAP      20       5

 906          KK    1159      CP
              *  ********************************************************************************
              *      DISCHARGE IN CFS RELEASED FROM 3-72" CMP ACROSS CAP AT STA 234+10
              *  ********************************************************************************
 907          KM        OUTFLOW FROM PIPES
 908          IN      10 20APR89       0
 909          BA   .0001
 910          QI       0       2       5       7      10      14      17      21      25      29
 911          QI      33      37      41      46      51      57      63      69      75      82
 912          QI      89      96     104     112     120     130     140     150     162     173
 913          QI     185     198     212     225     239     252     266     283     300     317
 914          QI     333     350     366     384     402     420     440     460     480     500
 915          QI     520     540     557     573     590     607     623     640     655     670
 916          QI     695     712     728     745     757     770     782     790     798     806
 917          QI     811     817     822     825     827     830     831     833     834     834
 918          QI     833     832     832     831     830     828     825     823     822     820
 919          QI     819     817     814     812     810     809     807     804     802     799
 920          QI     796     793     790     787     783     780     776     773     770     766
 921          QI     763     760     756     752     748     743     738     733     728     724
 922          QI     719     713     706     700     694     687     681     674     667     660
 923          QI     653     645     638     628     618     608     597     589     580     570
 924          QI     559     549     539     528     518
              *  ********************************************************************************

 925          KK    1154     SUB
 926          KM        RUNOFF FROM SUB 1154 & ROUTE CP 1159
 927          BA   .1600
 928          LS              85      20
 929          UK     145   .0213     .10     100
 930          RK    4600   .0120    .045            TRAP      10       5     YES

 931          KK    1155     SUB
 932          KM        RUNOFF FROM SUB 1155 & ROUTE SUB 1154
 933          BA   .4584
 934          LS              77
 935          UK     305   .0213     .10     100
 936          RK    6280   .0105    .045            TRAP      12       5     YES
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 937          KK    1153     SUB
 938          KM        RUNOFF FROM SUB 1153
 939          BA   .0773
 940          LS              77      20
 941          UK     145   .0213     .10     100
 942          RK    1600   .0100    .035             TRAP      10       5

 943          KK    1101      CP
 944          KM        ROUTE SUB 1153 TO CP 1101
 945          RK    2500   .0104    .045             TRAP      12       5

 946          KK    1100     SUB
 947          KM        RUNOFF FROM SUB 1100
 948          BA   .0043
 949          LS              77      38
 950          UK     150   .0040     .10     100
 951          RK     450   .0030    .024             TRAP       5      25

 952          KK    1102      CP
 953          KM        COMBINE SUB 1100 & CP 1101
 954          HC       2

 955          KK    1156      CP
 956          KM        ROUTE CP 1102 TO CP 1156
 957          RK    2800   .0089    .045             TRAP      12       5

 958          KK    1157      CP
 959          KM        COMBINE SUB 1155 & CP 1156
 960          HC       2

 961          KK    1160     SUB
 962          KM        RUNOFF FROM SUB 1160 & ROUTE CP 1157
 963          BA   .3033
 964          LS              77
 965          UK     640   .0080     .10     100
 966          RK    7200   .0071    .045             TRAP      10      20     YES

 967          KK    1166     SUB
 968          KM        RUNOFF FROM SUB 1166
 969          BA   .1080
 970          LS              85      20
 971          UK     145   .0213     .10     100
 972          RK    2800   .0143    .045             TRAP       6       3

 973          KK    1165     SUB
 974          KM        RUNOFF FROM SUB 1165 & ROUTE SUB 1166
 975          BA   .3942
 976          LS              79
 977          UK     145   .0213     .10     100
 978          RK    5800   .0121    .045             TRAP      10       5     YES
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 979          KK    1170     SUB
 980          KM         RUNOFF FROM SUB 1170 & ROUTE SUB 1165
 981          BA   .2588
 982          LS               77
 983          UK     480   .0080     .10     100
 984          RK    6800   .0078    .045             TRAP      10      20     YES

 985          KK    1162       CP
 986          KM         ROUTE SUB 1170 TO CP 1162
 987          RK    1850   .0070    .045             TRAP      10      20

 988          KK    1163       CP
 989          KM         COMBINE SUB 1160, CP 1161, & CP 1162
 990          HC       3

 991          KK    5555      DIV
 992          KM         DIVERT FLOW TO SUB 1970
 993          DT    5556
 994          DI       0    1000    4000
 995          DQ       0     500    2000

 996          KK    1182       CP
 997          KM         ROUTE NON-DIVERTED FLOW FROM CP 1163 (DIV 5555) TO CP 1182
 998          KM         ROUTE DOWN ALMA SCHOOL ROAD
 999          RK    1500   .0053    .030             TRAP      20       5

1000          KK    1183       CP
1001          KM         COMBINE CP 1182 & SUB 1180
1002          HC       2

1003          KK    1184       CP
1004          KM         ROUTE CP 1183 TO CP 1184
1005          KM         ROUTE DOWN ALMA SCHOOL ROAD
1006          RK    1850   .0059    .030             TRAP      20      10

1007          KK    1185       CP
1008          KM         COMBINE CP 1181 & CP 1184
1009          HC       2

1010          KK    1646       CP
1011          KM         ROUTE CP 1185 TO CP 1646
1012          KM         ROUTE DOWN ALMA SCHOOL ROAD
1013          RK     980   .0054    .030             TRAP      20      10

1014          KK    1645      SUB
1015          KM         RUNOFF FROM SUB 1645
1016          BA   .0921
1017          LS               84
1018          UK     980   .0054     .15     100
1019          RK    2620   .0035    .045             TRAP      10     100
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1020            KK    1647       CP
1021            KM        COMBINE CP 1646 WITH SUB 1645
1022            HC       2

1023            KK    1711       CP
1024            KM        ROUTE SUB 1647 TO CP 1711
1025            RK     980   .0029    .030            TRAP      20       10

1026            KK    1710      SUB
1027            KM        RUNOFF FROM SUB 1710
1028            BA   .0940
1029            LS               83
1030            UK     980   .0029     .15     100
1031            RK    2620   .0028    .045            TRAP      10      100

1032            KK    1712       CP
1033            KM        COMBINE SUB 1710 AND CP 1711
1034            HC       2

1035            KK    1721       CP
1036            KM        ROUTE CP 1712 TO CP 1721
1037            RK     980   .0029    .030            TRAP      20       10

1038            KK    1720      SUB
1039            KM        RUNOFF FROM SUB 1720
1040            BA   .0930
1041            LS               85
1042            UK     980   .0029     .15     100
1043            RK    2620   .0028    .045            TRAP      10      100

1044            KK    1722       CP
1045            KM        COMBINE SUB 1720 AND CP 1721
1046            HC       2

1047            KK    1801       CP
1048            KM        ROUTE CP 1722 TO CP 1801
1049            RK     980   .0029    .030            TRAP      20       10

1050            KK    1800      SUB
1051            KM        RUNOFF FROM SUB 1800
1052            BA   .0921
1053            LS               87
1054            UK     980   .0029     .15     100
1055            RK    2620   .0028    .045            TRAP      10      100

1056            KK    1802       CP
1057            KM        COMBINE SUB 1800 AND CP 1801
1058            HC       2
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1059        KK    1811      CP
1060        KM        ROUTE CP 1802 TO CP 1811
1061        RK    1230   .0029    .030             TRAP      20       10

1062        KK    1812      CP
1063        KM        COMBINE CP 1811 AND SUB 1810
1064        HC       2

1065        KK    1813      CP
1066        KM        ROUTE CP 1812 TO CP 1813
1067        RK     700   .0029    .030             TRAP      20       10

1068        KK    1985      CP
1069        KM        COMBINE CP 1813 AND CP 1984
1070        HC       2

1071        KK    1986      CP
1072        KM        ROUTE CP 1985 TO CP 1986
1073        RS       1    FLOW      -1
1074        RC    .050    .024    .080    2900   .0007
1075        RX       0      50     100     115     180   190.5     194     544
1076        RY     400     400     400     385     385   395.5     392   395.5

1077        KK    3334     RET
1078        KM        RETRIEVE DIVERT FROM CP 1132
1079        DR    3334

1080        KK    1135     SUB
1081        KM        RUNOFF FROM SUB 1135 AND ROUTE RET 3334
1082        BA   .1096
1083        LS              80
1084        UK     260   .0057     .10     100
1085        RK    4400   .0070    .045             TRAP       5       10     YES

1086        KK    1136      CP
1087        KM        ROUTE SUB 1135 TO CP 1136 (ROUTE ALONG DIRT ROAD)
1088        RK    1700   .0047    .030             TRAP      10        5

1089        KK    4445     RET
1090        KM        RETRIEVE DIVERT FROM CP 1152
1091        DR    4445

1092        KK    1140     SUB
1093        KM        RUNOFF FROM SUB 1140 AND ROUTE RET 4445
1094        BA   .1387
1095        LS              80
1096        UK     770   .0057     .10     100
1097        RK    4000   .0063    .045             TRAP       5       10     YES
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1098            KK    1141      CP
1099            KM        COMBINE CP 1136 AND SUB 1140
1100            HC       2

1101            KK    1971      CP
1102            KM        ROUTE CP 1141 TO CP 1971 (ROUTE ALONG DIRT ROAD)
1103            RK    4000   .0045    .030            TRAP      10       5

1104            KK    5556      RET
1105            KM        RETRIEVE DIVERT FROM  CP 1163
1106            DR    5556

1107            KK    1972      CP
1108            KM        ROUTE RET 5556 TO CP 1972
1109            RK    5200   .0052    .045            TRAP       5      10

1110            KK    1970      SUB
1111            KM        RUNOFF FROM SUB 1970
1112            BA   .5112
1113            LS              81
1114            UK    1200   .0057     .10     100
1115            RK    6400   .0061    .045            TRAP       5      10

1116            KK    1973      CP
1117            KM        COMBINE SUB 1970, CP 1171, AND CP 1172
1118            HC       3

1119            KK    1980      SUB
1120            KM        RUNOFF FROM SUB 1980 AND ROUTE CP 1973 (ROUTE ALONG DIRT ROAD)
1121            BA   .4734
1122            LS              85
1123            UK    1200   .0057     .10     100
1124            RK    4500   .0038    .045            TRAP      15      25     YES

1125            KK    1987      CP
1126            KM        COMBINE SUB 1980 WITH CP 1986
1127            HC       2

1128            KK    1991      CP
1129            KM        ROUTE CP 1987 TO CP 1991
1130            RS       1    FLOW      -1
1131            RC    .050    .024    .080    2660   .0007
1132            RX       0      50     100     115     180   190.5     194     544
1133            RY     400     400     400     385     385   395.5     392   395.5

1134            KK    1960      SUB
1135            KM        RUNOFF FROM SUB 1960
1136            BA   .3809
1137            LS              85
1138            UK    1200   .0057     .10     100
1139            RK    6100   .0051    .045            TRAP       5      15
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LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1140       KK    1990     SUB
1141       KM        RUNOFF FROM SUB 1990 AND ROUTE SUB 1960
1142       BA   .3793
1143       LS              85
1144       UK    1200   .0057     .10     100
1145       RK    4200   .0038    .045             TRAP      10      20     YES

1146       KK    1993      CP
1147       KM        COMBINE CP 1991 AND SUB 1990
1148       HC       2

1149       KK    2001      CP
1150       KM        ROUTE CP 1993 TO CP 2001
1151       RS       1    FLOW      -1
1152       RC    .050    .024    .080    1550   .0007
1153       RX       0      50     100     115     180   190.5     194     544
1154       RY     400     400     400     385     385   395.5     392   395.5

1155       KK    2000     SUB
1156       KM        RUNOFF FROM SUB 2000
1157       BA   .1153
1158       LS              85
1159       UK    1200   .0057     .10     100
1160       RK    2500   .0048    .045             TRAP       5      15

1161       KK    2002      CP
1162       KM        COMBINE CP 2001, SUB 2000
1163       HC       2

1164       KK     541      CP
1165       KM        ROUTE CP 2002 TO CP 541
1166       RS       1    FLOW      -1
1167       RC    .050    .024    .080    1100   .0007
1168       RX       0      50     100     115     180   190.5     194     544
1169       RY     400     400     400     385     385   395.5     392   395.5

1170       KK     540     SUB
1171       KM        RUNOFF FROM SUB 540
1172       BA   .2064
1173       LS              77
1174       UK    1200   .0057     .10     100
1175       RK    4400   .0045    .045             TRAP       5      15

1176       KK     542      CP
1177       KM        COMBINE CP 2001 & SUB 540
1178       HC       2

1179       KK     546      CP
1180       KM       ROUTE CP 542 TO CP 546
1181       RS       1    FLOW      -1
1182       RC    .050    .024    .080     850   .0007
1183       RX       0      50     100     115     180   190.5     194     544
1184       RY     400     400     400     385     385   395.5     392   395.5
           *       ***********************************************************************
           *       BEGIN DRAINAGE AREA CONTRIBUTING DIRECTLY TO HIGHWAY DRAINAGE CHANNEL
           *       ***********************************************************************
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1185          KK     165     SUB
1186          KM         RUNOFF FROM SUB 165
1187          BA   .0133
1188          LS              77      85
1189          UK     230    .005     .09     100
1190          RK     320    .004    .024            TRAP      10      25

1191          KK  DAM165
1192          KM         ROUTE SUB 165 THROUGH RETENTION BASIN
1193          RS       1    STOR
1194          SV       0    .265     .53
1195          SE     100     101     102
1196          SS  101.99     200     2.9     1.5
1197          ST     102     200     2.9     1.5

1198          KK     156      CP
1199          KM         ROUTE DAM 165 TO CP 156
1200          RK     840    .004    .024            TRAP      10      25

1201          KK     160     SUB
1202          KM         RUNOFF FROM SUB 160
1203          BA   .0234
1204          LS              77      85
1205          UK     230    .005     .09     100
1206          RK     880    .004    .024            TRAP      10      25

1207          KK  DAM160
1208          KM         ROUTE SUB 160 THROUGH RETENTION BASIN
1209          RS       1    STOR
1210          SV       0    .465     .93
1211          SE     100     101     102
1212          SS  101.99     200     2.9     1.5
1213          ST     102     200     2.9     1.5

1214          KK     161      CP
1215          KM         ROUTE DAM 160 TO CP 161
1216          RK     740    .004    .025            TRAP      50       2

1217          KK     155     SUB
1218          KM         RUNOFF FROM SUB 155
1219          BA   .0256
1220          LS              77      85
1221          UK     230    .005     .09     100
1222          RK    1120    .004    .024            TRAP      10      25

1223          KK  DAM155
1224          KM         ROUTE SUB 155 THROUGH RETENTION BASIN
1225          RS       1    STOR
1226          SV       0     .51    1.02
1227          SE     100     101     102
1228          SS  101.99     200     2.9     1.5
1229          ST     102     200     2.9     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1230          KK     157      CP
1231          KM         COMBINE DAM 155 WITH CP 156 AND CP 161
1232          HC       3

1233          KK     151      CP
1234          KM         ROUTE CP 157 TO CP 151
1235          RK    1140    .004    .024              TRAP      10      25

1236          KK     150     SUB
1237          KM         RUNOFF FROM SUB 150
1238          BA   .0427
1239          LS              77      85
1240          UK     230    .005     .09     100
1241          RK    1200    .004    .024              TRAP      10      25

1242          KK  DAM150
1243          KM         ROUTE SUB 150 THROUGH RETENTION BASIN
1244          RS       1    STOR
1245          SV       0     .85    1.70
1246          SE     100     101     102
1247          SS  101.99     200     2.9     1.5
1248          ST     102     200     2.9     1.5

1249          KK     152      CP
1250          KM         COMBINE DAM 150 WITH CP 151
1251          HC       2

1252          KK     121      CP
1253          KM         ROUTE CP 152 TO CP 121
1254          RK     720    .004    .024              TRAP      10      25

1255          KK      70     SUB
1256          KM         RUNOFF FROM SUB 70
1257          BA   .0108
1258          LS              77
1259          UK     270  .00625      .1     100
1260          RK     760    .004    .024              TRAP      10      50

1261          KK     122      CP
1262          KM         ROUTE CP SUB 70 TO CP 122
1263          RK     520    .004    .024              TRAP      10      25

1264          KK     120     SUB
1265          KM         RUNOFF FROM SUB 120
1266          BA   .0149
1267          LS              77      85
1268          UK     270    .005     .09     100
1269          RK     800    .004    .024              TRAP       0      25
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1270          KK  DAM120
1271          KM        ROUTE SUB 120 THROUGH RETENTION BASIN
1272          RS       1    STOR
1273          SV       0    .295     .59
1274          SE     100     101     102
1275          SS  101.99     200     2.9     1.5
1276          ST     102     200     2.9     1.5

1277          KK     123      CP
1278          KM        COMBINE DAM 120 WITH CP 121 AND CP 122
1279          HC       3

1280          KK      75     SUB
1281          KM        RUNOFF FROM SUB 75 AND ROUTE CP 123
1282          BA   .0025
1283          LS              77      85
1284          UK     100    .005     .09     100
1285          RK     200    .004    .024            TRAP      10      50     YES

1286          KK   DAM75
1287          KM        ROUTE SUB 75 THROUGH RETENTION BASIN
1288          RS       1    STOR
1289          SV       0     .05     .10
1290          SE     100     101     102
1291          SS  101.99     200     2.9     1.5
1292          ST     102     200     2.9     1.5

1293          KK      85     SUB
1294          KM        RUNOFF FROM SUB 85 AND ROUTE DAM 75
1295          BA   .0027
1296          LS              77      85
1297          UK      70    .005     .09     100
1298          RK     285    .004    .024            TRAP      10      25     YES

1299          KK   DAM85
1300          KM        ROUTE SUB 85 THROUGH RETENTION BASIN
1301          RS       1    STOR
1302          SV       0    .055     .11
1303          SE     100     101     102
1304          SS  101.99     200     2.9     1.5
1305          ST     102     200     2.9     1.5

1306          KK      80     SUB
1307          KM        RUNOFF FROM SUB 80
1308          BA   .0066
1309          LS              77      85
1310          UK     105    .005     .09     100
1311          RK     240    .004    .024            TRAP       0      25
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1312          KK   DAM80
1313          KM         ROUTE SUB 80 THROUGH RETENTION BASIN
1314          RS       1     STOR
1315          SV       0      .13      .26
1316          SE     100      101      102
1317          SS  101.99      200      2.9      1.5
1318          ST     102      200      2.9      1.5

1319          KK      87       CP
1320          KM         ROUTE DAM 80 TO CP 87
1321          RK     240     .004     .024              TRAP       10       50

1322          KK      88       CP
1323          KM         COMBINE CP 87 AND DAM 85
1324          HC       2

1325          KK      96       CP
1326          KM         ROUTE CP 88 TO CP 96
1327          RK     600     .004     .024              TRAP       10       25

1328          KK      95      SUB
1329          KM         RUNOFF FROM SUB 95
1330          BA   .0124
1331          LS                77       95
1332          UK     315     .005      .09      100
1333          RK    1020     .004     .035              TRAP        6      3.6

1334          KK   DAM95
1335          KM         ROUTE SUB 95 THROUGH RETENTION BASIN
1336          RS       1     STOR
1337          SV       0     .275      .55
1338          SE     100      101      102
1339          SS  101.99      200      2.9      1.5
1340          ST     102      200      2.9      1.5

1341          KK      97       CP
1342          KM         COMBINE DAM 95 WITH CP 96
1343          HC       2

1344          KK      91       CP
1345          KM         ROUTE CP 97 TO CP 91
1346          RK     520     .004     .024              TRAP       10       25

1347          KK      90      SUB
1348          KM         RUNOFF FROM SUB 90
1349          BA   .0151
1350          LS                77       60
1351          UK     150     .005      .09      100
1352          RK    1000     .004     .035              TRAP       30        3
```

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

1353           KK   DAM90
1354           KM          ROUTE SUB 90 THROUGH RETENTION BASIN
1355           RS       1    STOR
1356           SV       0     .26     .52
1357           SE     100     101     102
1358           SS  101.99     200     2.9     1.5
1359           ST     102     200     2.9     1.5

1360           KK      92      CP
1361           KM          COMBINE DAM 90 WITH CP 91
1362           HC       2

1363           KK     110     SUB
1364           KM          RUNOFF FROM SUB 110
1365           BA   .0158
1366           LS              77      85
1367           UK     120    .005     .09     100
1368           RK    1280    .004    .024             TRAP      10      25

1369           KK  DAM110
1370           KM          ROUTE SUB 110 THROUGH RETENTION BASIN
1371           RS       1    STOR
1372           SV       0    .315     .63
1373           SE     100     101     102
1374           SS  101.99     200     2.9     1.5
1375           ST     102     200     2.9     1.5

1376           KK     101      CP
1377           KM          ROUTE DAM 110 TO CP 101
1378           RK     680    .004    .024             TRAP      10      25

1379           KK     100     SUB
1380           KM          RUNOFF FROM SUB 100
1381           BA   .0032
1382           LS              77      85
1383           UK     200    .005     .09     100
1384           RK     640    .004    .024             TRAP      10      25

1385           KK  DAM100
1386           KM          ROUTE SUB 100 THROUGH RETENTION BASIN
1387           RS       1    STOR
1388           SV       0     .11     .22
1389           SE     100     101     102
1390           SS  101.99     200     2.9     1.5
1391           ST     102     200     2.9     1.5

1392           KK     102      CP
1393           KM          COMBINE CP 101 WITH DAM 100 AND CP 92
1394           HC       3
```

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

1395        KK     103      CP
1396        KM          ROUTE CP 102 TO CP 103
1397        RK     250    .004    .018            TRAP      10       1

1398        KK     360     SUB
1399        KM          RUNOFF FROM SUB 360 AND ROUTE CP 103
1400        BA   .0253
1401        LS              77
1402        UK    1000   .0057     .10     100
1403        RK    1200   .0042    .012            TRAP      15       1     YES

1404        KK     410     SUB
1405        KM          RUNOFF FROM SUB 410 & ROUTE SUB 360
1406        BA   .0330
1407        LS              77
1408        UK     400   .0057     .10     100
1409        RK    1500   .0067    .045   .0330    TRAP       5       5
1410        RK    1000   .0060    .012            TRAP      15       1     YES

1411        KK     421      CP
1412        KM          ROUTE SUB 410 TO CP 421
1413        RK     200    .010    .012            TRAP      15       1

1414        KK     140     SUB
1415        KM          RUNOFF FROM SUB 140
1416        BA   .0263
1417        LS              77      85
1418        UK     230    .005     .09     100
1419        RK    2000    .004    .024            TRAP      10      50

1420        KK  DAM140
1421        KM          ROUTE SUB 140 THROUGH RETENTION BASIN
1422        RS       1    STOR
1423        SV       0    .525    1.05
1424        SE     100     101     102
1425        SS  101.99     200     2.9     1.5
1426        ST     102     200     2.9     1.5

1427        KK     130     SUB
1428        KM          RUNOFF FROM SUB 130 AND ROUTE DAM 140
1429        BA   .0317
1430        LS              77      85
1431        UK     510    .005     .09     100
1432        RK     200    .004    .025            TRAP       5       2     YES

1433        KK  DAM130
1434        KM          ROUTE SUB 130 THROUGH RETENTION BASIN
1435        RS       1    STOR
1436        SV       0    .505    1.01
1437        SE     100     101     102
1438        SS  101.99     200     2.9     1.5
1439        ST     102     200     2.9     1.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1440          KK     420     SUB
1441          KM         RUNOFF FROM SUB 420 AND ROUTE DAM 130
1442          BA   .0940
1443          LS              77
1444          UK    1200  .0057      .10     100
1445          RK    2400  .0058     .045             TRAP       5       5     YES

1446          KK     422      CP
1447          KM         COMBINE SUB 420 WITH CP 421
1448          HC       2

1449          KK     401      CP
1450          KM         ROUTE CP 422 TO CP 401
1451          RK     800  .0013     .012             TRAP      15       1

1452          KK     240     SUB
1453          KM         RUNOFF FROM SUB 240
1454          BA   .0739
1455          LS              77      33
1456          UK     140    .004     .09     100
1457          RK    1720    .004    .024    .034     TRAP      10      25

1458          KK     246      CP
1459          KM         ROUTE SUB 240 TO CP 246
1460          RK     960  .0077     .035             TRAP     3.5     2.6

1461          KK     245     SUB
1462          KM         RUNOFF FROM SUB 245
1463          BA   .0235
1464          LS              77      36
1465          UK     130    .004     .09     100
1466          RK    1320    .004    .024             TRAP      10      25

1467          KK     247      CP
1468          KM         COMBINE CP 246 WITH SUB 245
1469          HC       2

1470          KK     248      CP
1471          KM         ROUTE CP 247 TO CP 248
1472          RK     580    .004    .035             TRAP     3.5     2.6

1473          KK     180     SUB
1474          KM         RUNOFF FROM SUB 180
1475          BA   .0659
1476          LS              77
1477          UK     400  .0082       .1     100
1478          RK    1600    .004    .035             TRAP       5       2

1479          KK     255     SUB
1480          KM         RUNOFF FROM SUB 255
1481          BA   .0290
1482          LS              77      36
1483          UK     135    .004     .09     100
1484          RK     780    .004    .024   .0079     TRAP      10      25
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1485          RK     800    .004    .024            TRAP      10      50

1486          KK     236      CP
1487          KM        ROUTE SUB 255 TO CP 236
1488          RK     680    .004    .024            TRAP      10      50

1489          KK     235     SUB
1490          KM        RUNOFF FROM SUB 235
1491          BA   .0136
1492          LS              77      36
1493          UK     140    .004     .09     100
1494          RK     800    .004    .024            TRAP      10      25

1495          KK     237      CP
1496          KM        COMBINE CP 236 WITH SUB 235
1497          HC       2

1498          KK     181      CP
1499          KM        ROUTE CP 237 TO CP 181
1500          RK    1160    .004    .024            TRAP      10      25

1501          KK     182      CP
1502          KM        COMBINE CP 248 WITH CP 181 AND SUB 180
1503          HC       3

1504          KK     191      CP
1505          KM        ROUTE CP 182 TO CP 191
1506          RK    1320    .004    .024            TRAP       4     2.6

1507          KK     195     SUB
1508          KM        RUNOFF FROM SUB 195
1509          BA   .0393
1510          LS              77      85
1511          UK      80   .0082     .09     100
1512          RK    1000    .004    .024            TRAP      10      25

1513          KK     186      CP
1514          KM        ROUTE SUB 195 TO CP 186
1515          RK    1040    .004    .024            TRAP      10      25

1516          KK     185     SUB
1517          KM        RUNOFF FROM SUB 185
1518          BA   .0241
1519          LS              77      85
1520          UK      80   .0082     .09     100
1521          RK    1040    .004    .024            TRAP      10      25

1522          KK     187      CP
1523          KM        COMBINE SUB 185 WITH CP 186
1524          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1525          KK     188       CP
1526          KM         ROUTE CP 187 TO CP 188
1527          RK     680    .004    .024             TRAP      10      50

1528          KK     189       CP
1529          KM         COMBINE CP 188 & CP 191
1530          HC       2

1531          KK    DAM1
1532          KM         ROUTE CP 189 THROUGH RETENTION BASIN 1
1533          RS       1    STOR
1534          SV       0     5.6    11.2
1535          SE     100     101     102
1536          SS  101.99     200     2.9     1.5
1537          ST     102     200     2.9     1.5

1538          KK     190     SUB
1539          KM         RUNOFF FROM SUB 190
1540          BA   .0321
1541          LS              77
1542          UK    1230  .00625      .1     100
1543          RK     600    .004    .035             TRAP      10     100

1544          KK     192      CP
1545          KM         COMBINE OUTFLOW FROM DAM 1 WITH SUB 190
1546          HC       2

1547          KK     211      CP
1548          KM         ROUTE CP 192 TO CP 211
1549          RK    1320    .004    .035             TRAP      10       2

1550          KK     210     SUB
1551          KM         RUNOFF FROM SUB 210
1552          BA   .0224
1553          LS              77      45
1554          UK     153    .004     .09     100
1555          RK    1200    .004    .024             TRAP      10      25

1556          KK     212      CP
1557          KM         COMBINE SUB 210 WITH CP 211
1558          HC       2

1559          KK     213     DIV
1560          KM         DIVERT CP 212 TO SUB 430
1561          DT     429
1562          DI       2      50     500    1000
1563          DQ       1      25     250     500

1564          KK     405     SUB
1565          KM         RUNOFF FROM SUB 405 AND ROUTE DIV 213
1566          BA   .0133
1567          LS              77
1568          UK     200   .0057     .10     100
1569          RK    1200   .0050    .045             TRAP       5      10     YES
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1570          KK     200     SUB
1571          KM         RUNOFF FROM SUB 200
1572          BA   .0416
1573          LS              77      13
1574          UK     260    .005     .10     100
1575          RK    1640    .004    .024            TRAP      10      50

1576          KK  DAM200
1577          KM         ROUTE SUB 200 THROUGH RETENTION BASIN
1578          RS       1    STOR
1579          SV       0    .125     .25
1580          SE     100     101     102
1581          SS  101.99     200     2.9     1.5
1582          ST     102     200     2.9     1.5

1583          KK     415     SUB
1584          KM         RUNOFF FROM SUB 415 AND ROUTE DAM 200
1585          BA   .0072
1586          LS              77
1587          UK     200   .0057     .10     100
1588          RK     600   .0100    .045            TRAP       5       1     YES

1589          KK     135     SUB
1590          KM         RUNOFF FROM SUB 135
1591          BA   .0253
1592          LS              77      85
1593          UK     390    .005     .09     100
1594          RK    1160    .004    .024            TRAP      10      50

1595          KK  DAM135
1596          KM         ROUTE SUB 135 THROUGH RETENTION BASIN
1597          RS       1    STOR
1598          SV       0    .505    1.01
1599          SE     100     101     102
1600          SS  101.99     200     2.9     1.5
1601          ST     102     200     2.9     1.5

1602          KK     425     SUB
1603          KM         RUNOFF FROM SUB 425 AND ROUTE DAM 135
1604          BA   .0108
1605          LS              77
1606          UK     200   .0057     .10     100
1607          RK     600   .0083    .045            TRAP       5       1     YES

1608          KK     426      CP
1609          KM         COMBINE SUB 405, SUB 415 AND SUB 425
1610          HC       3

1611          KK     400     SUB
1612          KM         RUNOFF FROM SUB 400 AND ROUTE CP 426
1613          BA   .1483
1614          LS              81
1615          UK    1000   .0057     .10     100
1616          RK    3250   .0046    .045            TRAP       5      10     YES
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1617          KK     402      CP
1618          KM        COMBINE SUB 400 WITH CP 401
1619          HC       2

1620          KK     501      CP
1621          KM        ROUTE CP 402 TO CP 501
1622          RK     790   .0038    .012             TRAP      20       1

1623          KK     500     SUB
1624          KM        RUNOFF FROM SUB 500 AND ROUTE CP 501
1625          BA   .1205
1626          LS              84
1627          UK    1000   .0057     .10     100
1628          RK    3160   .0038    .012             TRAP      25       1     YES

1629          KK     429     RET
1630          KM        RETRIEVE DIVERT FROM CP 212
1631          DR     429

1632          KK     430     SUB
1633          KM        RUNOFF FROM SUB 430 AND ROUTE RET 429
1634          BA   .1849
1635          LS              82
1636          UK    1025   .0057     .10     100
1637          RK    5500   .0053    .045             TRAP       5       7     YES

1638          KK     440     SUB
1639          KM        RUNOFF FROM SUB 440
1640          BA   .1004
1641          LS              83
1642          UK    1200   .0057     .10     100
1643          RK    3100   .0055    .045             TRAP       5       5

1644          KK     441      CP
1645          KM        COMBINE SUB 430 WITH SUB 440
1646          HC       2

1647          KK     502      CP
1648          KM        ROUTE CP 441 TO CP 502
1649          RK    1550   .0045    .045             TRAP       5      10

1650          KK     503      CP
1651          KM        COMBINE SUB 500 WITH CP 502
1652          HC       2

1653          KK     560     SUB
1654          KM        RUNOFF FROM SUB 560 & ROUTE CP 503
1655          BA   .0890
1656          LS              78
1657          UK     500   .0057     .10     100
1658          RK    1700   .0047    .045   .0890     TRAP       5       5
1659          RK    2000   .0045    .012             TRAP      25       1     YES
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LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1660      KK     551      CP
1661      KM         ROUTE SUB 560 TO CP 551
1662      RK    2120   .0047    .012             TRAP      25       1

1663      KK     304      CP
          *  ***********************************************************************************
          *                    DISCHARGE IN CFS RELEASED FROM THE LAKES
          *  ***********************************************************************************
1664      KM         FLOW RELEASED FROM THE LAKES
1665      IN      10 20APR89       0
1666      BA   .0001
1667      QI     200     200     200     200     200     200     200     200     200     200
1668      QI     200     200     200     200     200     200     200     200     200     200
1669      QI     200     200     200     200     200     200     200     200     200     200
1670      QI     200     200     200     200     200     200     200     200     200     200
1671      QI     200     200     200     200     200     200     200     200     200     200
1672      QI     200     200     200     200     200     200     200     200     200     200
1673      QI     200     200     200     200     200     200     200     207     230     260
1674      QI     288     305     317     324     330     333     336     336     335     334
1675      QI     333     332     330     328     327     326     324     322     319     317
1676      QI     313     311     308     306     303     301     298     295     291     287
1677      QI     282     278     272     268     263     258     250     244     240     234
1678      QI     227     219     211     203     194     186     179     170     161     152
1679      QI     140     132     124     116     109     102      96      88      79      72
1680      QI      67      62      58      54      49      44      39      35      31      28
1681      QI      24      20      18      15      12
          *  ***********************************************************************************

1682      KK     300     SUB
1683      KM         RUNOFF FROM SUB 300 & ROUTE CP 304
1684      BA   .0319
1685      LS              77      31
1686      UK     270   .0033     .10     100
1687      RK    1360   .0059    .035             TRAP      20       2     YES

1688      KK    DAM7
1689      KM         ROUTE SUB 300 THROUGH RETENTION BASIN 7
1690      RS       1    STOR
1691      SV       0    .325     .65
1692      SE     100     101     102
1693      SS  101.99     200     2.9     1.5
1694      ST     102     200     2.9     1.5

1695      KK     291      CP
1696      KM         ROUTE OUTFLOW FROM DAM 7 TO CP 291
1697      RK     650    .004    .035             TRAP      12       2

1698      KK     290     SUB
1699      KM         RUNOFF FROM SUB 290
1700      BA   .0154
1701      LS              77      92
1702      UK     100    .004     .09     100
1703      RK     640    .004    .035             TRAP      12       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1704          KK    DAM6
1705          KM        ROUTE SUB 290 THROUGH RETENTION BASIN 6
1706          RS       1    STOR
1707          SV       0      .8     1.6
1708          SE     100     101     102
1709          SS  101.99     200     2.9     1.5
1710          ST     102     200     2.9     1.5

1711          KK     292      CP
1712          KM        COMBINE OUTFLOW FROM DAM 6 WITH CP 291
1713          HC       2

1714          KK     331      CP
1715          KM        ROUTE CP 292 TO CP 331
1716          RK     680    .004    .035            TRAP      12       2

1717          KK     330     SUB
1718          KM        RUNOFF FROM SUB 330
1719          BA   .0179
1720          LS              77      92
1721          UK     100    .004     .09     100
1722          RK    1080    .004    .035            TRAP      12       2

1723          KK    DAM2
1724          KM        ROUTE SUB 330 THROUGH RETENTION BASIN 2
1725          RS       1    STOR
1726          SV       0      .8     1.6
1727          SE     100     101     102
1728          SS  101.99     200     2.9     1.5
1729          ST     102     200     2.9     1.5

1730          KK     332      CP
1731          KM        COMBINE OUTFLOW FROM DAM 2 WITH CP 331
1732          HC       2

1733          KK     231      CP
1734          KM        ROUTE CP 332 TO CP 231
1735          RK     480    .004    .035            TRAP      12       2

1736          KK     230     SUB
1737          KM        RUNOFF FROM SUB 230
1738          BA   .0419
1739          LS              77      60
1740          UK     110    .004     .09     100
1741          RK    1840    .004    .035            TRAP      12       2

1742          KK     232      CP
1743          KM        COMBINE SUB 230 WITH CP 231
1744          HC       2
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1745           KK     233      CP
1746           KM        ROUTE CP 232 TO CP 233
1747           RK     380    .004    .035             TRAP      12       2

1748           KK     220     SUB
1749           KM        RUNOFF FROM SUB 220 AND ROUTE CP 233
1750           BA   .0810
1751           LS              77      45
1752           UK     135    .004     .09     100
1753           RK     600    .004    .024   .0091     TRAP      10      25
1754           RK    1440   .0044    .035             TRAP      25       4     YES

1755           KK     445     SUB
1756           KM        RUNOFF FROM SUB 445 AND ROUTE SUB 220
1757           BA   .0237
1758           LS              77
1759           UK     460   .0057     .10     100
1760           RK     950   .0063    .045             TRAP       5       5     YES

1761           KK     310     SUB
1762           KM        RUNOFF FROM SUB 310
1763           BA   .0286
1764           LS              77      41
1765           UK     680    .004     .10     100
1766           RK     680    .004    .024             TRAP       0      75

1767           KK    DAM4
1768           KM        ROUTE SUB 310 THROUGH RETENTION BASIN 4
1769           RS       1    STOR
1770           SV       0     1.8     3.6
1771           SE     100     101     102
1772           SS  101.99     200     2.9     1.5
1773           ST     102     200     2.9     1.5

1774           KK     312      CP
1775           KM        ROUTE OUTFLOW FROM DAM 4 TO CP 312
1776           RK     720    .004    .024             TRAP      10      25

1777           KK     320     SUB
1778           KM        RUNOFF FROM SUB 320
1779           BA   .0166
1780           LS              77      92
1781           UK      80    .004     .09     100
1782           RK     960    .004    .024    .009     TRAP      10      25

1783           KK     322      CP
1784           KM        COMBINE SUB 320 WITH CP 312
1785           HC       2
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1786            KK    DAM3
1787            KM         ROUTE CP 322 THROUGH RETENTION BASIN 3
1788            RS       1    STOR
1789            SV       0      .8     1.6
1790            SE     100     101     102
1791            SS  101.99     200     2.9     1.5
1792            ST     102     200     2.9     1.5

1793            KK     260     SUB
1794            KM         RUNOFF FROM SUB 260 AND ROUTE OUTFLOW FROM DAM 3
1795            BA   .0448
1796            LS              77      36
1797            UK     120    .004     .09     100
1798            RK    1000    .004    .024   .0256    TRAP      10      25
1799            RK     800    .004    .035            TRAP       8       2     YES

1800            KK     451      CP
1801            KM         ROUTE SUB 260 TO CP 451
1802            RK     760    .004    .035            TRAP       8       2

1803            KK     450     SUB
1804            KM         RUNOFF FROM SUB 450 AND ROUTE CP 451
1805            BA   .0255
1806            LS              77
1807            UK     350   .0057     .10     100
1808            RK    1400   .0057    .045            TRAP       5       2     YES

1809            KK     452      CP
1810            KM         COMBINE SUB 450 WITH SUB 445
1811            HC       2

1812            KK     455     SUB
1813            KM         RUNOFF FROM SUB 455 AND ROUTE CP 452
1814            BA   .0643
1815            LS              81
1816            UK     520   .0057     .10     100
1817            RK    2450   .0057    .045            TRAP       5      10     YES

1818            KK     280     SUB
1819            KM         RUNOFF FROM SUB 280
1820            BA   .0599
1821            LS              77      85
1822            UK     165    .004     .09     100
1823            RK    1600    .004    .024            TRAP      10      50

1824            KK    DAM5
1825            KM         ROUTE SUB 280 THROUGH RETENTION BASIN 5
1826            RS       1    STOR
1827            SV       0     2.9     5.8
1828            SE     100     101     102
1829            SS  101.99     200     2.9     1.5
1830            ST     102     200     2.9     1.5
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1831            KK     250     SUB
1832            KM         RUNOFF FROM SUB 250 AND ROUTE OUTFLOW FROM DAM 5
1833            BA   .0488
1834            LS              77      36
1835            UK     150    .004     .09     100
1836            RK    1840    .004    .024             TRAP      10      50     YES

1837            KK     460     SUB
1838            KM         RUNOFF FROM SUB 460 AND ROUTE SUB 250
1839            BA   .1292
1840            LS              79
1841            UK     700   .0057     .10     100
1842            RK    4000   .0058    .045             TRAP       5       7     YES

1843            KK     461      CP
1844            KM         COMBINE SUB 455 WITH SUB 460
1845            HC       2

1846            KK     495     SUB
1847            KM         RUNOFF FROM SUB 495 AND ROUTE CP 461
1848            BA   .1559
1849            LS              85
1850            UK     800   .0057     .10     100
1851            RK    4000   .0043    .045             TRAP       5      15     YES

1852            KK     270     SUB
1853            KM         RUNOFF FROM SUB 270
1854            BA   .0576
1855            LS              77      45
1856            UK     130    .004     .09     100
1857            RK    1440    .004    .024             TRAP      10      25

1858            KK     470     SUB
1859            KM         RUNOFF FROM SUB 470 AND ROUTE SUB 270
1860            BA   .0770
1861            LS              77
1862            UK     425   .0057     .10     100
1863            RK    3400   .0062    .045             TRAP       5       5     YES

1864            KK    2223     RET
1865            KM         RETRIEVE DIVERTED FLOW FROM CP 1121
1866            DR    2223

1867            KK     480     SUB
1868            KM         RUNOFF FROM SUB 480 & ROUTE RET 2223
1869            BA   .0753
1870            LS              77
1871            UK     560   .0057     .10     100
1872            RK    3200   .0069    .045             TRAP       5       5     YES
```

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


1873        KK     481      CP
1874        KM        COMBINE SUB 480 WITH SUB 470
1875        HC       2

1876        KK     490     SUB
1877        KM        RUNOFF FROM SUB 490 AND ROUTE CP 481
1878        BA   .2027
1879        LS              85
1880        UK     950   .0057     .10     100
1881        RK    5400   .0048    .045             TRAP      5      10     YES

1882        KK     491      CP
1883        KM        COMBINE SUB 490 WITH SUB 495
1884        HC       2

1885        KK     550     SUB
1886        KM        RUNOFF FROM SUB 550 AND ROUTE CP 491
1887        BA   .2120
1888        LS              84
1889        UK    1200   .0057     .10     100
1890        RK    3900   .0049    .045             TRAP     10      20     YES

1891        KK     552      CP
1892        KM        COMBINE SUB 550 WITH CP 551
1893        HC       2

1894        KK     545     SUB
1895        KM        RUNOFF FROM SUB 545 AND ROUTE CP 552
1896        BA   .0888
1897        LS              77
1898        UK    1000   .0057     .10     100
1899        RK    3600   .0047    .012             TRAP     30       1     YES
            *       *******************************************************
            *       THIS CONCLUDES THE AREA CONTRIBUTING TO THE NORTH/SOUTH
            *       HIGHWAY DRAINAGE CHANNEL
            *       *******************************************************

1900        KK     547      CP
1901        KM        COMBINE CP 546 AND SUB 545
1902        KM        THIS WILL BE THE DESIGN DISCHARGE FOR THE OUTER LOOP BRIDGE
1903        KM        OVER THE  ARIZONA CANAL
1904        KM        THIS OPERATION BRINGS IN THE WATER FLOWING ALONG THE NORTH BANK OF
1905        KM        THE ARIZONA CANAL FROM AS FAR EAST AS THE EVERGREEN WASTEWAY
1906        HC       2
1907        ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  31        1270
               V
               V
  38        1280 ***
               V
               V
  44        1350 ***
               V
               V
  50        1360 ***
               V
               V
  56        1440 ***
               V
               V
  62        1450 ***
               V
               V
  68        1520 ***
               V
               V
  74        1530 ***
               V
               V
  80        1600 ***
               V
               V
  86        1591
               .
               .
  89           .          1260
               .             V
               .             V
  95           .          1290 ***
               .             V
               .             V
 101           .          1340 ***
               .             V
               .             V
 107           .          1370 ***
               .             V
               .             V
 113           .          1430 ***
               .             V
               .             V
 119           .          1460 ***
               .             V
               .             V
 125           .          1510 ***
               .             V
               .             V
 131           .          1540 ***
               .             V
               .             V
 137           .          1590 ***
               .             .
```

```
             V
             V
146       1581
             .
             .
149          .      1250
             .         V
             .         V
155          .      1300 ***
             .         V
             .         V
161          .      1330 ***
             .         V
             .         V
167          .      1380 ***
             .         V
             .         V
173          .      1420 ***
             .         V
             .         V
179          .      1470 ***
             .         V
             .         V
185          .      1500 ***
             .         V
             .         V
191          .      1550 ***
             .         V
             .         V
197          .      1580 ***
             .         .
             .         .
203       1582..........
             V
             V
206       1571
             .
             .
209          .      1240
             .         V
             .         V
215          .      1310 ***
             .         V
             .         V
221          .      1320 ***
             .         V
             .         V
227          .      1400 ***
             .         .
             .         .
233          .         .      1390
             .         .         V
             .         .         V
239          .         .      1391
             .         .         .
             .         .         .
242          .      1392..........
             .         V
             .         V
245          .      1410 ***
             .         V
             .         V
251          .      1480 ***
             .         V
```

```
            .         V
            .         V
263         .      1560 ***
            .         V
            .         V
269         .      1570 ***
            .         .
            .         .
275      1572..........
            V
            V
278      1611
            .
            .
281         .      1610
            .         .
            .         .
287      1612..........
            V
            V
290      1621
            .
            .
293         .      1620
            .         .
            .         .
299         .         .      1630
            .         .         V
            .         .         V
305         .         .      1640 ***
            .         .         .
            .         .         .
311      1622....................
            V
            V
314      1887
            .
            .
320         .      1950
            .         .
            .         .
326         .         .      1945
            .         .         V
            .         .         V
332         .         .      1951
            .         .         .
            .         .         .
335         .      1952..........
            .         V
            .         V
338         .      1940 ***
            .         .
            .         .
344         .         .      1920
            .         .         V
            .         .         V
350         .         .      1941
            .         .         .
            .         .         .
353         .      1942..........
            .         V
            .         V
356         .      1925 ***
            .         V
```

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             .           .
             .           .
368          .           .        1910
             .           .           V
             .           .           V
374          .           .        1900 ***
             .           .           V
             .           .           V
380          .           .        1890 ***
             .           .           V
             .           .           V
386          .           .        1931
             .           .           .
             .           .           .
389          .        1932............
             .           V
             .           V
392          .        1885 ***
             .           .
             .           .
398          .           .        1850
             .           .           V
             .           .           V
404          .           .        1860 ***
             .           .           V
             .           .           V
410          .           .        1870 ***
             .           .           V
             .           .           V
416          .           .        1886
             .           .           .
             .           .           .
419          .           .           .        1880
             .           .           .           .
             .           .           .           .
425       1888....................................
             V
             V
428       1984
             .
             .
434          .        1840
             .           .
             .           .
440          .           .        1670
             .           .           V
             .           .           V
446          .           .        1681
             .           .           .
             .           .           .
449          .           .           .        1680
             .           .           .           .
             .           .           .           .
455          .           .        1682............
             .           .           V
             .           .           V
458          .           .        1751
             .           .           .
             .           .           .
461          .           .           .        1226
             .           .           .           .
             .           .           .           .
470          .           .           .           .-------)     1228
468          .           .           .        1227
```

```
473            .           .           .        1225 ***
               .           .           .           V
               .           .           .           V
479            .           .           .        1230 ***
               .           .           .           V
               .           .           .           V
485            .           .           .        1221
               .           .           .           .
               .           .           .           .
488            .           .           .           .        1214
               .           .           .           .           V
               .           .           .           .           V
494            .           .           .           .        1217 ***
               .           .           .           .           V
               .           .           .           .           V
500            .           .           .           .        1220 ***
               .           .           .           .           V
               .           .           .           .           V
506            .           .           .           .        1222
               .           .           .           .           .
               .           .           .           .           .
509            .           .           .        1223............
               .           .           .           V
               .           .           .           V
512            .           .           .        1750 ***
               .           .           .           .
               .           .           .           .
518            .           .        1752............
               .           .           V
               .           .           V
521            .           .        1761
               .           .           .
               .           .           .
524            .           .           .        1760
               .           .           .           .
               .           .           .           .
530            .           .        1762............
               .           .           V
               .           .           V
533            .           .        1771
               .           .           .
               .           .           .
536            .           .           .        1770
               .           .           .           .
               .           .           .           .
542            .           .        1772............
               .           .           V
               .           .           V
545            .           .        1841
               .           .           .
               .           .           .
548            .        1842............
               .           V
               .           V
551            .        1830 ***
               .           .
               .           .
557            .           .        1660
               .           .           V
               .           .           V
563            .           .        1691
               .           .           .
               .           .           .
566            .           .           .        1690
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572           .           .       1692............
              .           .          V
              .           .          V
575           .           .       1741
              .           .          .
              .           .          .
578           .           .          .       1740
              .           .          .           .
              .           .          .           .
584           .           .       1742............
              .           .          V
              .           .          V
587           .           .       1781
              .           .          .
              .           .          .
590           .           .          .       1780
              .           .          .           .
              .           .          .           .
596           .           .       1782............
              .           .          V
              .           .          V
599           .           .       1831
              .           .          .
              .           .          .
602           .        1832............
              .           V
              .           V
605           .        1820 ***
              .           .
              .           .
611           .           .       1650
              .           .          V
              .           .          V
617           .           .       1701
              .           .          .
              .           .          .
620           .           .          .       1700
              .           .          .           .
              .           .          .           .
626           .           .       1702............
              .           .          V
              .           .          V
629           .           .       1731
              .           .          .
              .           .          .
632           .           .          .       1730
              .           .          .           .
              .           .          .           .
638           .           .       1732............
              .           .          V
              .           .          V
641           .           .       1791
              .           .          .
              .           .          .
644           .           .          .       1790
              .           .          .           .
              .           .          .           .
650           .           .       1792............
              .           .          V
              .           .          V
653           .           .       1822
              .           .          .
              .           .          .
656           .        1823............
                          V
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659         .      1810 ***
            .         .
            .         .
665         .         .      1210
            .         .         V
            .         .         V
671         .         .      1201
            .         .         .
            .         .         .
674         .         .         .      1207
            .         .         .         V
            .         .         .         V
680         .         .         .      1204 ***
            .         .         .         V
            .         .         .         V
686         .         .         .      1200 ***
            .         .         .         .
            .         .         .         .
692         .         .      1202..........
            .         .         V
            .         .         V
695         .         .      1191
            .         .         .
            .         .         .
698         .         .         .      1186
            .         .         .         V
            .         .         .         V
704         .         .         .      1187 ***
            .         .         .         V
            .         .         .         V
710         .         .         .      1190 ***
            .         .         .         .
            .         .         .         .
716         .         .      1192..........
            .         .         V
            .         .         V
719         .         .      1181
            .         .         .
            .         .         .
722         .         .         .      1173
            .         .         .         V
            .         .         .         V
729         .         .         .      1174 ***
            .         .         .         V
            .         .         .         V
735         .         .         .      1177 ***
            .         .         .         V
            .         .         .         V
741         .         .         .      1180 ***
            .         .         .         .
            .         .         .         .
747         .         .         .         .      1000
            .         .         .         .         V
            .         .         .         .         V
753         .         .         .         .      1042
            .         .         .         .         .
            .         .         .         .         .
756         .         .         .         .         .      1060
            .         .         .         .         .         V
            .         .         .         .         .         V
762         .         .         .         .         .      1051
            .         .         .         .         .         .
            .         .         .         .         .         .
765         .         .         .         .         .         .      1050
```

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772           .           .           .           .           .        1052............
              .           .           .           .           .           V
              .           .           .           .           .           V
775           .           .           .           .           .        1041
              .           .           .           .           .           .
              .           .           .           .           .           .
778           .           .           .           .           .           .        1040
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
784           .           .           .           .        1043........................
              .           .           .           .           V
              .           .           .           .           V
787           .           .           .           .        DAM8
              .           .           .           .           V
              .           .           .           .           V
794           .           .           .           .        1011
              .           .           .           .           .
              .           .           .           .           .
797           .           .           .           .           .        1010
              .           .           .           .           .           .
              .           .           .           .           .           .
804           .           .           .           .        1012............
              .           .           .           .           V
              .           .           .           .           V
807           .           .           .           .        1110 ***
              .           .           .           .           .
              .           .           .           .           .
814           .           .           .           .           .        1020
              .           .           .           .           .           V
              .           .           .           .           .           V
820           .           .           .           .           .        1120 ***
              .           .           .           .           .           .
              .           .           .           .           .           .
826           .           .           .           .        1121............
              .           .           .           .           .
              .           .           .           .           .
831           .           .           .           .           .-------)    2223
829           .           .           .           .        2222
              .           .           .           .           V
              .           .           .           .           V
834           .           .           .           .        1131
              .           .           .           .           .
              .           .           .           .           .
838           .           .           .           .           .        1070
              .           .           .           .           .           V
              .           .           .           .           .           V
845           .           .           .           .           .        1031
              .           .           .           .           .           .
              .           .           .           .           .           .
848           .           .           .           .           .           .        1030
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
855           .           .           .           .           .        1032............
              .           .           .           .           .           V
              .           .           .           .           .           V
858           .           .           .           .           .        1130 ***
              .           .           .           .           .           .
              .           .           .           .           .           .
864           .           .           .           .        1132............
              .           .           .           .           .
              .           .           .           .           .
869           .           .           .           .           .-------)    3334
867           .           .           .           .        3333
              .           .           .           .           V
```

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            .         .         .         .         .
            .         .         .         .         .
876         .         .         .         .         .      1080
            .         .         .         .         .         V
            .         .         .         .         .         V
882         .         .         .         .         .      1090 ***
            .         .         .         .         .         V
            .         .         .         .         .         V
888         .         .         .         .         .      1150 ***
            .         .         .         .         .         .
            .         .         .         .         .         .
894         .         .         .         .     1152...........
            .         .         .         .         .
            .         .         .         .         .
899         .         .         .         .         .-------)   4445
897         .         .         .         .      4444
            .         .         .         .         V
            .         .         .         .         V
902         .         .         .         .      1161
            .         .         .         .         .
            .         .         .         .         .
906         .         .         .         .         .      1159
            .         .         .         .         .         V
            .         .         .         .         .         V
925         .         .         .         .         .      1154 ***
            .         .         .         .         .         V
            .         .         .         .         .         V
931         .         .         .         .         .      1155 ***
            .         .         .         .         .         .
            .         .         .         .         .         .
937         .         .         .         .         .         .      1153
            .         .         .         .         .         .         V
            .         .         .         .         .         .         V
943         .         .         .         .         .         .      1101
            .         .         .         .         .         .         .
            .         .         .         .         .         .         .
946         .         .         .         .         .         .         .      1100
            .         .         .         .         .         .         .         .
            .         .         .         .         .         .         .         .
952         .         .         .         .         .         .      1102..........
            .         .         .         .         .         .         V
            .         .         .         .         .         .         V
955         .         .         .         .         .         .      1156
            .         .         .         .         .         .         .
            .         .         .         .         .         .         .
958         .         .         .         .         .      1157..........
            .         .         .         .         .         V
            .         .         .         .         .         V
961         .         .         .         .         .      1160 ***
            .         .         .         .         .         .
            .         .         .         .         .         .
967         .         .         .         .         .         .      1166
            .         .         .         .         .         .         V
            .         .         .         .         .         .         V
973         .         .         .         .         .         .      1165 ***
            .         .         .         .         .         .         V
            .         .         .         .         .         .         V
979         .         .         .         .         .         .      1170 ***
            .         .         .         .         .         .         V
            .         .         .         .         .         .         V
985         .         .         .         .         .         .      1162
            .         .         .         .         .         .         .
            .         .         .         .         .         .         .
988         .         .         .         .      1163....................
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993         .         .         .         .         .-------)    5556
991         .         .         .         .      5555
            .         .         .         .         V
            .         .         .         .         V
996         .         .         .         .      1182
            .         .         .         .         .
            .         .         .         .         .
1000        .         .         .      1183..........
            .         .         .         V
            .         .         .         V
1003        .         .         .      1184
            .         .         .         .
            .         .         .         .
1007        .         .      1185..........
            .         .         V
            .         .         V
1010        .         .      1646
            .         .         .
            .         .         .
1014        .         .         .      1645
            .         .         .         .
            .         .         .         .
1020        .         .      1647..........
            .         .         V
            .         .         V
1023        .         .      1711
            .         .         .
            .         .         .
1026        .         .         .      1710
            .         .         .         .
            .         .         .         .
1032        .         .      1712..........
            .         .         V
            .         .         V
1035        .         .      1721
            .         .         .
            .         .         .
1038        .         .         .      1720
            .         .         .         .
            .         .         .         .
1044        .         .      1722..........
            .         .         V
            .         .         V
1047        .         .      1801
            .         .         .
            .         .         .
1050        .         .         .      1800
            .         .         .         .
            .         .         .         .
1056        .         .      1802..........
            .         .         V
            .         .         V
1059        .         .      1811
            .         .         .
            .         .         .
1062        .      1812..........
            .         V
            .         V
1065        .      1813
            .         .
            .         .
1068     1985..........
            V
            V
```

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               .
1079           .           .(-------    3334
1077           .        3334
               .           V
               .           V
1080           .        1135 ***
               .           V
               .           V
1086           .        1136
               .           .
               .           .
1091           .           .           .(-------    4445
1089           .           .        4445
               .           .           V
               .           .           V
1092           .           .        1140 ***
               .           .           .
               .           .           .
1098           .        1141............
               .           V
               .           V
1101           .        1971
               .           .
               .           .
1106           .           .           .(-------    5556
1104           .           .        5556
               .           .           V
               .           .           V
1107           .           .        1972
               .           .           .
               .           .           .
1110           .           .           .        1970
               .           .           .           .
               .           .           .           .
1116           .        1973........................
               .           V
               .           V
1119           .        1980 ***
               .           .
               .           .
1125        1987............
               V
               V
1128        1991
               .
               .
1134           .        1960
               .           V
               .           V
1140           .        1990 ***
               .           .
               .           .
1146        1993............
               V
               V
1149        2001
               .
               .
1155           .        2000
               .           .
               .           .
1161        2002............
               V
               V
```

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               .
1170           .         540
               .           .
               .           .
1176         542............
               V
               V
1179         546
               .
               .
1185           .         165
               .           V
               .           V
1191           .      DAM165
               .           V
               .           V
1198           .         156
               .           .
               .           .
1201           .           .         160
               .           .           V
               .           .           V
1207           .           .      DAM160
               .           .           V
               .           .           V
1214           .           .         161
               .           .           .
               .           .           .
1217           .           .           .         155
               .           .           .           V
               .           .           .           V
1223           .           .           .      DAM155
               .           .           .           .
               .           .           .           .
1230           .         157........................
               .           V
               .           V
1233           .         151
               .           .
               .           .
1236           .           .         150
               .           .           V
               .           .           V
1242           .           .      DAM150
               .           .           .
               .           .           .
1249           .         152............
               .           V
               .           V
1252           .         121
               .           .
               .           .
1255           .           .          70
               .           .           V
               .           .           V
1261           .           .         122
               .           .           .
               .           .           .
1264           .           .           .         120
               .           .           .           V
               .           .           .           V
1270           .           .           .      DAM120
               .           .           .           .
               .           .           .           .
1277           .         123
```

```
             .         V
1280         .        75 ***
             .         V
             .         V
1286         .     DAM75
             .         V
             .         V
1293         .        85 ***
             .         V
             .         V
1299         .     DAM85
             .         .
             .         .
1306         .         .        80
             .         .         V
             .         .         V
1312         .         .     DAM80
             .         .         V
             .         .         V
1319         .         .        87
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1322         .        88..........
             .         V
             .         V
1325         .        96
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1328         .         .        95
             .         .         V
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1334         .         .     DAM95
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             .         .         .
1341         .        97..........
             .         V
             .         V
1344         .        91
             .         .
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1347         .         .        90
             .         .         V
             .         .         V
1353         .         .     DAM90
             .         .         .
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1360         .        92..........
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1363         .         .       110
             .         .         V
             .         .         V
1369         .         .    DAM110
             .         .         V
             .         .         V
1376         .         .       101
             .         .         .
             .         .         .
1379         .         .         .       100
             .         .         .         V
             .         .         .         V
1385         .         .         .    DAM100
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              .          V
1395          .        103
              .          V
              .          V
1398          .        360 ***
              .          V
              .          V
1404          .        410 ***
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              .          V
1411          .        421
              .          .
              .          .
1414          .          .        140
              .          .          V
              .          .          V
1420          .          .     DAM140
              .          .          V
              .          .          V
1427          .          .        130 ***
              .          .          V
              .          .          V
1433          .          .     DAM130
              .          .          V
              .          .          V
1440          .          .        420 ***
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1446          .        422...........
              .          V
              .          V
1449          .        401
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              .          .
1452          .          .        240
              .          .          V
              .          .          V
1458          .          .        246
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1461          .          .          .        245
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1467          .          .        247...........
              .          .          V
              .          .          V
1470          .          .        248
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1473          .          .          .        180
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1479          .          .          .          .        255
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1486          .          .          .          .        236
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1489          .          .          .          .          .        235
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1495          .          .          .          .        237...........
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1501        .         .       182....................
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1504        .         .       191
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1507        .         .         .        195
            .         .         .          V
            .         .         .          V
1513        .         .         .        186
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1516        .         .         .          .        185
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1522        .         .         .        187..........
            .         .         .          V
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1525        .         .         .        188
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1528        .         .       189..........
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            .         .         V
1531        .         .      DAM1
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1538        .         .         .        190
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1544        .         .       192..........
            .         .         V
            .         .         V
1547        .         .       211
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1550        .         .         .        210
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1556        .         .       212..........
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1561        .         .         .-------)     429
1559        .         .       213
            .         .         V
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1564        .         .       405 ***
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1570        .         .         .        200
            .         .         .          V
            .         .         .          V
1576        .         .         .     DAM200
            .         .         .          V
            .         .         .          V
1583        .         .         .        415 ***
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1589        .         .         .          .        135
            .         .         .          .          V
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1595        .         .         .          .     DAM135
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1608           .           .         426........................
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1611           .           .         400 ***
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1617           .         402............
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1620           .         501
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1623           .         500 ***
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1631           .           .           .<-------    429
1629           .           .         429
               .           .           V
               .           .           V
1632           .           .         430 ***
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1638           .           .           .         440
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1644           .           .         441............
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1647           .           .         502
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1650           .         503............
               .           V
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1653           .         560 ***
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               .           V
1660           .         551
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1663           .           .         304
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1682           .           .         300 ***
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1688           .           .        DAM7
               .           .           V
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1695           .           .         291
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1698           .           .           .         290
               .           .           .           V
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1704           .           .           .        DAM6
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1711           .           .         292............
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               .           .           V
1714           .           .         331
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1717            .            .            .        330
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1723            .            .            .       DAM2
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1730            .            .         332............
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                .            .           V
1733            .            .         231
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1736            .            .            .        230
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1742            .            .         232............
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1745            .            .         233
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1748            .            .         220 ***
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                .            .           V
1755            .            .         445 ***
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1761            .            .            .        310
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1767            .            .            .       DAM4
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1774            .            .            .        312
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1777            .            .            .          .          320
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1783            .            .            .        322.............
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1786            .            .            .       DAM3
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1793            .            .            .        260 ***
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                .            .            .          V
1800            .            .            .        451
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1803            .            .            .        450 ***
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1809            .            .         452............
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1812            .            .         455 ***
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1818            .            .            .        280
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1824            .            .            .       DAM5
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1831         .         .         .       250 ***
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             .         .         .         V
1837         .         .         .       460 ***
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1843         .         .       461..........
             .         .         V
             .         .         V
1846         .         .       495 ***
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1852         .         .         .       270
             .         .         .         V
             .         .         .         V
1858         .         .         .       470 ***
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1866         .         .         .         .        .(-------  2223
1864         .         .         .         .      2223
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             .         .         .         .         V
1867         .         .         .         .       480 ***
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1873         .         .         .       481..........
             .         .         .         V
             .         .         .         V
1876         .         .         .       490 ***
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1882         .         .       491..........
             .         .         V
             .         .         V
1885         .         .       550 ***
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1891         .       552..........
             .         V
             .         V
1894         .       545 ***
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1900       547..........
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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	1270	12.	13.33	5.	2.	2.	.03		
HYDROGRAPH AT	1280	23.	13.42	11.	3.	3.	.06		
HYDROGRAPH AT	1350	35.	13.50	16.	5.	5.	.09		
HYDROGRAPH AT	1360	47.	13.50	21.	6.	6.	.12		
HYDROGRAPH AT	1440	58.	13.58	27.	8.	8.	.15		
HYDROGRAPH AT	1450	69.	13.58	32.	9.	9.	.18		
HYDROGRAPH AT	1520	80.	13.67	38.	11.	11.	.22		
HYDROGRAPH AT	1530	90.	13.67	43.	13.	13.	.25		
HYDROGRAPH AT	1600	110.	13.75	53.	16.	16.	.31		
ROUTED TO	1591	110.	13.92	53.	15.	15.	.31		
HYDROGRAPH AT	1260	12.	13.42	5.	2.	2.	.03		
HYDROGRAPH AT	1290	24.	13.42	11.	3.	3.	.06		
HYDROGRAPH AT	1340	35.	13.50	17.	5.	5.	.10		
HYDROGRAPH AT	1370	47.	13.58	22.	7.	7.	.13		
HYDROGRAPH AT	1430	58.	13.58	28.	8.	8.	.16		
HYDROGRAPH AT	1460	69.	13.58	33.	10.	10.	.19		
HYDROGRAPH AT	1510	80.	13.67	39.	11.	11.	.22		
HYDROGRAPH AT	1540	91.	13.75	44.	13.	13.	.26		
HYDROGRAPH AT	1590	112.	13.83	55.	16.	16.	.32		
2 COMBINED AT	1592	221.	13.92	107.	32.	32.	.63		
ROUTED TO	1581	220.	14.00	107.	31.	31.	.63		
HYDROGRAPH AT	1250	12.	13.33	5.	2.	2.	.03		
HYDROGRAPH AT	1300	23.	13.33	11.	3.	3.	.06		
HYDROGRAPH AT	1330	35.	13.42	16.	5.	5.	.09		
HYDROGRAPH AT	1380	46.	13.50	21.	6.	6.	.12		
HYDROGRAPH AT	1420	58.	13.42	26.	8.	8.	.15		
HYDROGRAPH AT	1470	69.	13.58	32.	9.	9.	.18		
HYDROGRAPH AT	1500	79.	13.58	37.	11.	11.	.21		

HYDROGRAPH AT	1580	110.	13.75	52.	15.	15.	.30		
2 COMBINED AT	1582	327.	13.92	158.	47.	47.	.93		
ROUTED TO	1571	326.	14.00	157.	46.	46.	.93		
HYDROGRAPH AT	1240	12.	13.33	6.	2.	2.	.03		
HYDROGRAPH AT	1310	24.	13.33	11.	3.	3.	.06		
HYDROGRAPH AT	1320	36.	13.33	17.	5.	5.	.09		
HYDROGRAPH AT	1400	38.	13.33	19.	5.	5.	.10		
HYDROGRAPH AT	1390	11.	13.08	4.	1.	1.	.02		
ROUTED TO	1391	11.	13.17	4.	1.	1.	.02		
2 COMBINED AT	1392	49.	13.25	23.	7.	7.	.13		
HYDROGRAPH AT	1410	61.	13.33	28.	8.	8.	.16		
HYDROGRAPH AT	1480	73.	13.33	34.	10.	10.	.19		
HYDROGRAPH AT	1490	85.	13.33	39.	11.	11.	.22		
HYDROGRAPH AT	1560	97.	13.42	45.	13.	13.	.25		
HYDROGRAPH AT	1570	120.	13.42	56.	16.	16.	.31		
2 COMBINED AT	1572	430.	13.92	211.	63.	63.	1.25		
ROUTED TO	1611	429.	14.00	211.	63.	63.	1.25		
HYDROGRAPH AT	1610	86.	13.83	42.	13.	13.	.25		
2 COMBINED AT	1612	515.	14.00	253.	75.	75.	1.50		
ROUTED TO	1621	515.	14.00	253.	75.	75.	1.50		
HYDROGRAPH AT	1620	99.	13.75	47.	14.	14.	.25		
HYDROGRAPH AT	1630	64.	13.17	23.	7.	7.	.11		
HYDROGRAPH AT	1640	67.	13.50	28.	8.	8.	.14		
3 COMBINED AT	1622	668.	13.92	327.	97.	97.	1.89		
ROUTED TO	1887	532.	14.75	303.	92.	92.	1.89	387.61	14.75
HYDROGRAPH AT	1950	20.	13.17	7.	2.	2.	.04		
HYDROGRAPH AT	1945	35.	13.33	15.	4.	4.	.08		
ROUTED TO	1951	35.	13.50	15.	4.	4.	.08		
2 COMBINED AT	1952	54.	13.33	23.	7.	7.	.12		
HYDROGRAPH AT	1940	106.	13.50	48.	14.	14.	.24		
HYDROGRAPH AT	1920	103.	13.50	43.	12.	12.	.20		
ROUTED TO	1941	103.	13.58	43.	12.	12.	.20		

HYDROGRAPH AT	1925	239.	13.67	105.	31.	31.	.50		
HYDROGRAPH AT	1930	257.	13.92	119.	35.	35.	.57		
HYDROGRAPH AT	1910	71.	13.42	30.	9.	9.	.14		
HYDROGRAPH AT	1900	127.	13.58	57.	17.	17.	.27		
HYDROGRAPH AT	1890	167.	13.75	79.	23.	23.	.36		
ROUTED TO	1931	167.	13.75	78.	23.	23.	.36		
2 COMBINED AT	1932	423.	13.83	197.	58.	58.	.93		
HYDROGRAPH AT	1885	434.	14.08	208.	62.	62.	1.00		
HYDROGRAPH AT	1850	75.	13.33	31.	9.	9.	.14		
HYDROGRAPH AT	1860	130.	13.58	57.	17.	17.	.26		
HYDROGRAPH AT	1870	190.	13.92	96.	28.	28.	.44		
ROUTED TO	1886	190.	14.00	96.	28.	28.	.44		
HYDROGRAPH AT	1880	34.	13.08	13.	4.	4.	.05		
4 COMBINED AT	1888	1106.	14.33	612.	186.	186.	3.38		
ROUTED TO	1984	1103.	14.42	611.	184.	184.	3.38	389.07	14.42
HYDROGRAPH AT	1840	15.	13.33	7.	2.	2.	.03		
HYDROGRAPH AT	1670	39.	13.17	14.	4.	4.	.08		
ROUTED TO	1681	39.	13.33	14.	4.	4.	.08		
HYDROGRAPH AT	1680	39.	13.17	14.	4.	4.	.08		
2 COMBINED AT	1682	78.	13.25	27.	8.	8.	.15		
ROUTED TO	1751	77.	13.33	27.	8.	8.	.15		
HYDROGRAPH AT	1226	437.	12.00	357.	129.	129.	.00		
DIVERSION TO	1228	371.	12.00	304.	110.	110.	.00		
HYDROGRAPH AT	1227	66.	12.00	54.	19.	19.	.00		
HYDROGRAPH AT	1225	244.	12.25	67.	23.	23.	.08		
HYDROGRAPH AT	1230	721.	12.50	175.	53.	53.	.72		
ROUTED TO	1221	717.	12.67	179.	54.	54.	.72		
HYDROGRAPH AT	1214	49.	12.17	4.	1.	1.	.01		
HYDROGRAPH AT	1217	1348.	12.25	129.	36.	36.	.74		
HYDROGRAPH AT	1220	1534.	12.50	241.	67.	67.	1.41		
ROUTED TO	1222	1492.	12.58	241.	67.	67.	1.41		
2 COMBINED AT	1223	2173.	12.58	420.	121.	121.	2.13		

2 COMBINED AT	1752	2064.	12.75	459.	132.	132.	2.36
ROUTED TO	1761	2040.	12.83	459.	132.	132.	2.36
HYDROGRAPH AT	1760	31.	13.00	9.	3.	3.	.05
2 COMBINED AT	1762	2067.	12.83	468.	135.	135.	2.41
ROUTED TO	1771	2046.	12.83	468.	135.	135.	2.41
HYDROGRAPH AT	1770	24.	13.00	7.	2.	2.	.04
2 COMBINED AT	1772	2069.	12.83	474.	137.	137.	2.44
ROUTED TO	1841	2057.	13.00	485.	139.	139.	2.44
2 COMBINED AT	1842	2071.	13.00	492.	141.	141.	2.47
HYDROGRAPH AT	1830	2102.	13.08	514.	148.	148.	2.59
HYDROGRAPH AT	1660	42.	13.25	16.	5.	5.	.09
ROUTED TO	1691	42.	13.50	16.	5.	5.	.09
HYDROGRAPH AT	1690	43.	13.25	16.	5.	5.	.09
2 COMBINED AT	1692	84.	13.42	32.	9.	9.	.18
ROUTED TO	1741	83.	13.50	32.	9.	9.	.18
HYDROGRAPH AT	1740	42.	13.25	16.	5.	5.	.09
2 COMBINED AT	1742	124.	13.42	48.	14.	14.	.27
ROUTED TO	1781	124.	13.58	48.	14.	14.	.27
HYDROGRAPH AT	1780	51.	13.17	18.	5.	5.	.09
2 COMBINED AT	1782	169.	13.42	66.	19.	19.	.36
ROUTED TO	1831	168.	13.58	65.	19.	19.	.36
2 COMBINED AT	1832	2189.	13.08	580.	167.	167.	2.95
HYDROGRAPH AT	1820	2222.	13.08	600.	174.	174.	3.06
HYDROGRAPH AT	1650	42.	13.25	16.	5.	5.	.09
ROUTED TO	1701	42.	13.50	16.	5.	5.	.09
HYDROGRAPH AT	1700	43.	13.25	16.	5.	5.	.09
2 COMBINED AT	1702	84.	13.42	32.	9.	9.	.18
ROUTED TO	1731	83.	13.50	32.	9.	9.	.18
HYDROGRAPH AT	1730	42.	13.25	16.	5.	5.	.09
2 COMBINED AT	1732	124.	13.42	48.	14.	14.	.27
ROUTED TO	1791	123.	13.58	48.	14.	14.	.27
HYDROGRAPH AT	1790	47.	13.17	17.	5.	5.	.09

ROUTED TO	1822	166.	13.58	65.	19.	19.	.36		
2 COMBINED AT	1823	2319.	13.17	665.	193.	193.	3.43		
HYDROGRAPH AT	1810	2373.	13.17	689.	200.	200.	3.54		
HYDROGRAPH AT	1210	725.	12.58	155.	44.	44.	.93		
ROUTED TO	1201	725.	12.75	157.	44.	44.	.93		
HYDROGRAPH AT	1207	387.	12.17	30.	9.	9.	.12		
HYDROGRAPH AT	1204	1332.	12.33	159.	44.	44.	.75		
HYDROGRAPH AT	1200	1247.	12.67	251.	70.	70.	1.31		
2 COMBINED AT	1202	1920.	12.67	408.	114.	114.	2.24		
ROUTED TO	1191	1917.	12.75	406.	114.	114.	2.24		
HYDROGRAPH AT	1186	352.	12.25	27.	8.	8.	.12		
HYDROGRAPH AT	1187	563.	12.33	62.	17.	17.	.31		
HYDROGRAPH AT	1190	673.	12.75	180.	51.	51.	1.03		
2 COMBINED AT	1192	2590.	12.75	585.	165.	165.	3.27		
ROUTED TO	1181	2574.	12.83	589.	165.	165.	3.27		
HYDROGRAPH AT	1173	37.	11.00	25.	7.	7.	.00		
HYDROGRAPH AT	1174	602.	12.25	70.	20.	20.	.21		
HYDROGRAPH AT	1177	986.	12.33	114.	32.	32.	.45		
HYDROGRAPH AT	1180	880.	12.75	229.	65.	65.	1.15		
HYDROGRAPH AT	1000	30.	12.33	5.	1.	1.	.02		
ROUTED TO	1042	30.	12.42	5.	1.	1.	.02		
HYDROGRAPH AT	1060	41.	12.92	11.	3.	3.	.04		
ROUTED TO	1051	41.	13.00	11.	3.	3.	.04		
HYDROGRAPH AT	1050	3.	12.25	0.	0.	0.	.00		
2 COMBINED AT	1052	41.	13.00	11.	3.	3.	.04		
ROUTED TO	1041	41.	13.08	11.	3.	3.	.04		
HYDROGRAPH AT	1040	104.	12.25	10.	3.	3.	.04		
3 COMBINED AT	1043	131.	12.25	26.	8.	8.	.10		
ROUTED TO	DAM8	120.	12.42	21.	6.	6.	.10	102.22	12.42
ROUTED TO	1011	125.	12.50	22.	6.	6.	.10		
HYDROGRAPH AT	1010	111.	12.25	10.	3.	3.	.04		
2 COMBINED AT	1012	162.	12.50	31.	9.	9.	.13		

HYDROGRAPH AT	1020	108.	12.17	9.	3.	3.	.03
HYDROGRAPH AT	1120	143.	12.25	15.	4.	4.	.07
2 COMBINED AT	1121	250.	12.33	47.	14.	14.	.21
DIVERSION TO	2223	100.	12.33	19.	5.	5.	.21
HYDROGRAPH AT	2222	150.	12.33	28.	8.	8.	.21
ROUTED TO	1131	150.	12.33	28.	8.	8.	.21
HYDROGRAPH AT	1070	105.	12.25	10.	3.	3.	.04
ROUTED TO	1031	100.	12.33	10.	3.	3.	.04
HYDROGRAPH AT	1030	77.	12.33	7.	2.	2.	.03
2 COMBINED AT	1032	177.	12.33	17.	5.	5.	.07
HYDROGRAPH AT	1130	254.	12.33	29.	8.	8.	.13
2 COMBINED AT	1132	404.	12.33	57.	16.	16.	.35
DIVERSION TO	3334	202.	12.33	29.	8.	8.	.35
HYDROGRAPH AT	3333	202.	12.33	29.	8.	8.	.35
ROUTED TO	1151	185.	12.50	29.	8.	8.	.35
HYDROGRAPH AT	1080	238.	12.25	19.	6.	6.	.08
HYDROGRAPH AT	1090	313.	12.25	32.	9.	9.	.14
HYDROGRAPH AT	1150	416.	12.50	72.	21.	21.	.37
2 COMBINED AT	1152	602.	12.50	101.	29.	29.	.72
DIVERSION TO	4445	301.	12.50	50.	14.	14.	.72
HYDROGRAPH AT	4444	301.	12.50	50.	14.	14.	.72
ROUTED TO	1161	298.	12.67	52.	15.	15.	.72
HYDROGRAPH AT	1159	834.	13.00	817.	538.	538.	.00
HYDROGRAPH AT	1154	1328.	12.25	859.	547.	547.	.16
HYDROGRAPH AT	1155	2170.	12.25	942.	565.	565.	.62
HYDROGRAPH AT	1153	199.	12.17	16.	5.	5.	.08
ROUTED TO	1101	220.	12.25	18.	5.	5.	.08
HYDROGRAPH AT	1100	13.	12.25	1.	0.	0.	.00
2 COMBINED AT	1102	233.	12.25	19.	5.	5.	.08
ROUTED TO	1156	239.	12.33	21.	6.	6.	.08
2 COMBINED AT	1157	2284.	12.33	963.	571.	571.	.70
HYDROGRAPH AT	1160	2153.	12.50	1014.	574.	574.	1.00

HYDROGRAPH AT	1165	1165.	12.25	103.	29.	29.	.50			
HYDROGRAPH AT	1170	845.	12.58	146.	41.	41.	.76			
ROUTED TO	1162	839.	12.67	147.	41.	41.	.76			
3 COMBINED AT	1163	3213.	12.58	1212.	629.	629.	2.48			
DIVERSION TO	5556	1607.	12.58	606.	315.	315.	2.48			
HYDROGRAPH AT	5555	1607.	12.58	606.	315.	315.	2.48			
ROUTED TO	1182	1585.	12.67	606.	314.	314.	2.48			
2 COMBINED AT	1183	2454.	12.67	835.	379.	379.	3.63			
ROUTED TO	1184	2425.	12.75	835.	378.	378.	3.63			
2 COMBINED AT	1185	4980.	12.75	1423.	543.	543.	6.90			
ROUTED TO	1646	4916.	12.83	1423.	542.	542.	6.90			
HYDROGRAPH AT	1645	67.	12.92	20.	6.	6.	.09			
2 COMBINED AT	1647	4981.	12.83	1442.	548.	548.	6.99			
ROUTED TO	1711	4978.	12.83	1442.	547.	547.	6.99			
HYDROGRAPH AT	1710	53.	13.17	19.	5.	5.	.09			
2 COMBINED AT	1712	5020.	12.83	1461.	552.	552.	7.09			
ROUTED TO	1721	4969.	12.83	1461.	551.	551.	7.09			
HYDROGRAPH AT	1720	59.	13.08	20.	6.	6.	.09			
2 COMBINED AT	1722	5019.	12.83	1481.	557.	557.	7.18			
ROUTED TO	1801	4999.	12.92	1481.	556.	556.	7.18			
HYDROGRAPH AT	1800	65.	13.08	22.	6.	6.	.09			
2 COMBINED AT	1802	5060.	12.92	1502.	562.	562.	7.27			
ROUTED TO	1811	5023.	12.92	1502.	561.	561.	7.27			
2 COMBINED AT	1812	7025.	13.08	2190.	761.	761.	10.82			
ROUTED TO	1813	7018.	13.08	2190.	760.	760.	10.82			
2 COMBINED AT	1985	7241.	13.08	2786.	944.	944.	14.20			
ROUTED TO	1986	6352.	13.33	2780.	938.	938.	14.20	395.88	13.33	
HYDROGRAPH AT	3334	202.	12.33	29.	8.	8.	.00			
HYDROGRAPH AT	1135	267.	12.58	50.	14.	14.	.11			
ROUTED TO	1136	266.	12.58	50.	14.	14.	.11			
HYDROGRAPH AT	4445	301.	12.50	50.	14.	14.	.00			
HYDROGRAPH AT	1140	400.	12.67	76.	22.	22.	.14			

ROUTED TO	1971	652.	12.83	129.	36.	36.	.25		
HYDROGRAPH AT	5556	1607.	12.58	606.	315.	315.	.00		
ROUTED TO	1972	1530.	12.75	606.	310.	310.	.00		
HYDROGRAPH AT	1970	375.	12.83	98.	28.	28.	.51		
3 COMBINED AT	1973	2544.	12.75	832.	374.	374.	.76		
HYDROGRAPH AT	1980	2781.	12.92	937.	398.	398.	1.23		
2 COMBINED AT	1987	8384.	13.25	3701.	1336.	1336.	15.43		
ROUTED TO	1991	7881.	13.50	3697.	1328.	1328.	15.43	396.89	13.50
HYDROGRAPH AT	1960	326.	12.83	85.	24.	24.	.38		
HYDROGRAPH AT	1990	591.	12.92	169.	48.	48.	.76		
2 COMBINED AT	1993	8248.	13.50	3859.	1376.	1376.	16.19		
ROUTED TO	2001	8123.	13.58	3857.	1372.	1372.	16.19	397.04	13.58
HYDROGRAPH AT	2000	112.	12.67	26.	7.	7.	.12		
2 COMBINED AT	2002	8160.	13.58	3879.	1379.	1379.	16.31		
ROUTED TO	541	8095.	13.67	3878.	1375.	1375.	16.31	397.02	13.67
HYDROGRAPH AT	540	116.	12.92	33.	10.	10.	.21		
2 COMBINED AT	542	8154.	13.67	3910.	1385.	1385.	16.51		
ROUTED TO	546	8120.	13.75	3910.	1382.	1382.	16.51	397.03	13.75
HYDROGRAPH AT	165	51.	12.25	4.	1.	1.	.01		
ROUTED TO	DAM165	53.	12.25	4.	1.	1.	.01	102.12	12.25
ROUTED TO	156	47.	12.33	4.	1.	1.	.01		
HYDROGRAPH AT	160	89.	12.25	7.	2.	2.	.02		
ROUTED TO	DAM160	86.	12.25	7.	2.	2.	.02	102.17	12.25
ROUTED TO	161	72.	12.33	7.	2.	2.	.02		
HYDROGRAPH AT	155	96.	12.25	8.	2.	2.	.03		
ROUTED TO	DAM155	91.	12.25	7.	2.	2.	.03	102.18	12.25
3 COMBINED AT	157	202.	12.25	18.	5.	5.	.06		
ROUTED TO	151	198.	12.25	18.	5.	5.	.06		
HYDROGRAPH AT	150	161.	12.25	14.	4.	4.	.04		
ROUTED TO	DAM150	155.	12.25	12.	3.	3.	.04	102.26	12.25
2 COMBINED AT	152	353.	12.25	30.	8.	8.	.10		
ROUTED TO	121	329.	12.33	30.	8.	8.	.10		

ROUTED TO	122	17.	12.42	2.	1.	1.	.01		
HYDROGRAPH AT	120	49.	12.25	5.	1.	1.	.01		
ROUTED TO	DAM120	47.	12.17	4.	1.	1.	.01	102.11	12.17
3 COMBINED AT	123	384.	12.33	36.	10.	10.	.13		
HYDROGRAPH AT	75	384.	12.33	37.	10.	10.	.13		
ROUTED TO	DAM75	384.	12.33	37.	10.	10.	.13	102.47	12.33
HYDROGRAPH AT	85	378.	12.33	38.	10.	10.	.14		
ROUTED TO	DAM85	377.	12.33	38.	10.	10.	.14	102.47	12.33
HYDROGRAPH AT	80	28.	12.17	2.	1.	1.	.01		
ROUTED TO	DAM80	29.	12.17	2.	1.	1.	.01	102.08	12.17
ROUTED TO	87	24.	12.25	2.	1.	1.	.01		
2 COMBINED AT	88	394.	12.33	40.	11.	11.	.14		
ROUTED TO	96	369.	12.33	40.	11.	11.	.14		
HYDROGRAPH AT	95	41.	12.25	4.	1.	1.	.01		
ROUTED TO	DAM95	41.	12.17	4.	1.	1.	.01	102.10	12.17
2 COMBINED AT	97	405.	12.33	44.	12.	12.	.15		
ROUTED TO	91	387.	12.42	44.	12.	12.	.15		
HYDROGRAPH AT	90	50.	12.25	4.	1.	1.	.02		
ROUTED TO	DAM90	52.	12.25	4.	1.	1.	.02	102.12	12.25
2 COMBINED AT	92	408.	12.42	48.	13.	13.	.17		
HYDROGRAPH AT	110	59.	12.25	5.	2.	2.	.02		
ROUTED TO	DAM110	63.	12.25	5.	1.	1.	.02	102.14	12.25
ROUTED TO	101	56.	12.33	5.	1.	1.	.02		
HYDROGRAPH AT	100	120.	12.25	10.	3.	3.	.00		
ROUTED TO	DAM100	120.	12.25	10.	3.	3.	.00	102.22	12.25
3 COMBINED AT	102	518.	12.33	62.	17.	17.	.19		
ROUTED TO	103	514.	12.33	62.	17.	17.	.19		
HYDROGRAPH AT	360	507.	12.33	66.	18.	18.	.21		
HYDROGRAPH AT	410	549.	12.42	72.	20.	20.	.25		
ROUTED TO	421	548.	12.42	72.	20.	20.	.25		
HYDROGRAPH AT	140	81.	12.25	8.	2.	2.	.03		
ROUTED TO	DAM140	88.	12.25	7.	2.	2.	.03	102.17	12.25

ROUTED TO	DAM130	163.	12.25	17.	5.	5.	.06	102.27	12.25
HYDROGRAPH AT	420	208.	12.33	34.	9.	9.	.15		
2 COMBINED AT	422	755.	12.42	106.	29.	29.	.40		
ROUTED TO	401	750.	12.42	106.	29.	29.	.40		
HYDROGRAPH AT	240	206.	12.25	17.	5.	5.	.07		
ROUTED TO	246	182.	12.25	17.	5.	5.	.07		
HYDROGRAPH AT	245	67.	12.25	5.	2.	2.	.02		
2 COMBINED AT	247	249.	12.25	22.	6.	6.	.10		
ROUTED TO	248	228.	12.33	22.	6.	6.	.10		
HYDROGRAPH AT	180	92.	12.33	11.	3.	3.	.07		
HYDROGRAPH AT	255	78.	12.25	7.	2.	2.	.03		
ROUTED TO	236	72.	12.33	7.	2.	2.	.03		
HYDROGRAPH AT	235	39.	12.25	3.	1.	1.	.01		
2 COMBINED AT	237	98.	12.33	10.	3.	3.	.04		
ROUTED TO	181	93.	12.42	10.	3.	3.	.04		
3 COMBINED AT	182	404.	12.33	43.	13.	13.	.21		
ROUTED TO	191	375.	12.33	43.	13.	13.	.21		
HYDROGRAPH AT	195	161.	12.17	13.	4.	4.	.04		
ROUTED TO	186	146.	12.25	13.	4.	4.	.04		
HYDROGRAPH AT	185	96.	12.17	8.	2.	2.	.02		
2 COMBINED AT	187	229.	12.25	20.	6.	6.	.06		
ROUTED TO	188	206.	12.33	21.	6.	6.	.06		
2 COMBINED AT	189	581.	12.33	63.	19.	19.	.27		
ROUTED TO	DAM1	449.	12.50	47.	13.	13.	.27	102.53	12.50
HYDROGRAPH AT	190	20.	12.67	5.	2.	2.	.03		
2 COMBINED AT	192	467.	12.50	52.	15.	15.	.30		
ROUTED TO	211	430.	12.58	54.	15.	15.	.30		
HYDROGRAPH AT	210	67.	12.25	5.	2.	2.	.02		
2 COMBINED AT	212	449.	12.50	59.	17.	17.	.32		
DIVERSION TO	429	224.	12.50	29.	8.	8.	.32		
HYDROGRAPH AT	213	224.	12.50	29.	8.	8.	.32		
HYDROGRAPH AT	405	221.	12.67	32.	9.	9.	.34		

ROUTED TO	DAM200	67.	12.33	8.	2.	2.	.04	102.14	12.33
HYDROGRAPH AT	415	75.	12.33	9.	2.	2.	.05		
HYDROGRAPH AT	135	77.	12.33	8.	2.	2.	.03		
ROUTED TO	DAM135	78.	12.25	7.	2.	2.	.03	102.16	12.25
HYDROGRAPH AT	425	87.	12.33	9.	2.	2.	.04		
3 COMBINED AT	426	287.	12.58	50.	14.	14.	.42		
HYDROGRAPH AT	400	401.	12.75	78.	22.	22.	.57		
2 COMBINED AT	402	997.	12.50	184.	51.	51.	.97		
ROUTED TO	501	996.	12.50	184.	51.	51.	.97		
HYDROGRAPH AT	500	1103.	12.50	211.	59.	59.	1.09		
HYDROGRAPH AT	429	224.	12.50	29.	8.	8.	.00		
HYDROGRAPH AT	430	305.	12.75	67.	19.	19.	.18		
HYDROGRAPH AT	440	89.	12.67	21.	6.	6.	.10		
2 COMBINED AT	441	392.	12.75	87.	25.	25.	.29		
ROUTED TO	502	387.	12.92	88.	25.	25.	.29		
2 COMBINED AT	503	1314.	12.58	298.	83.	83.	1.38		
HYDROGRAPH AT	560	1378.	12.58	313.	88.	88.	1.46		
ROUTED TO	551	1374.	12.67	313.	88.	88.	1.46		
HYDROGRAPH AT	304	336.	12.67	309.	206.	206.	.00		
HYDROGRAPH AT	300	389.	12.33	316.	208.	208.	.03		
ROUTED TO	DAM7	391.	12.33	316.	208.	208.	.03	102.48	12.33
ROUTED TO	291	388.	12.33	316.	208.	208.	.03		
HYDROGRAPH AT	290	65.	12.17	5.	2.	2.	.02		
ROUTED TO	DAM6	55.	12.33	3.	1.	1.	.02	102.13	12.33
2 COMBINED AT	292	443.	12.33	319.	209.	209.	.05		
ROUTED TO	331	426.	12.33	319.	209.	209.	.05		
HYDROGRAPH AT	330	71.	12.17	6.	2.	2.	.02		
ROUTED TO	DAM2	56.	12.33	4.	1.	1.	.02	102.13	12.33
2 COMBINED AT	332	482.	12.33	323.	210.	210.	.07		
ROUTED TO	231	470.	12.33	323.	210.	210.	.07		
HYDROGRAPH AT	230	138.	12.25	11.	3.	3.	.04		
2 COMBINED AT	232	561.	12.33	334.	214.	214.	.11		

HYDROGRAPH AT	220	713.	12.25	354.	220.	220.	.19		
HYDROGRAPH AT	445	727.	12.33	358.	221.	221.	.21		
HYDROGRAPH AT	310	40.	12.42	7.	2.	2.	.03		
ROUTED TO	DAM4	1.	20.25	0.	0.	0.	.03	102.00	20.33
ROUTED TO	312	1.	20.42	0.	0.	0.	.03		
HYDROGRAPH AT	320	67.	12.17	6.	2.	2.	.02		
2 COMBINED AT	322	67.	12.17	6.	2.	2.	.05		
ROUTED TO	DAM3	56.	12.33	3.	1.	1.	.05	102.13	12.33
HYDROGRAPH AT	260	133.	12.25	14.	4.	4.	.09		
ROUTED TO	451	130.	12.33	14.	4.	4.	.09		
HYDROGRAPH AT	450	151.	12.42	18.	5.	5.	.12		
2 COMBINED AT	452	869.	12.33	376.	227.	227.	.33		
HYDROGRAPH AT	455	927.	12.50	389.	230.	230.	.39		
HYDROGRAPH AT	280	224.	12.25	19.	6.	6.	.06		
ROUTED TO	DAM5	102.	12.42	10.	3.	3.	.06	102.19	12.42
HYDROGRAPH AT	250	143.	12.50	22.	6.	6.	.11		
HYDROGRAPH AT	460	241.	12.67	45.	13.	13.	.24		
2 COMBINED AT	461	1130.	12.50	434.	243.	243.	.63		
HYDROGRAPH AT	495	1256.	12.67	470.	252.	252.	.79		
HYDROGRAPH AT	270	173.	12.25	14.	4.	4.	.06		
HYDROGRAPH AT	470	227.	12.33	27.	8.	8.	.13		
HYDROGRAPH AT	2223	100.	12.33	19.	5.	5.	.00		
HYDROGRAPH AT	480	166.	12.42	32.	9.	9.	.08		
2 COMBINED AT	481	387.	12.42	59.	17.	17.	.21		
HYDROGRAPH AT	490	474.	12.67	105.	30.	30.	.41		
2 COMBINED AT	491	1729.	12.67	575.	282.	282.	1.20		
HYDROGRAPH AT	550	1878.	12.75	620.	294.	294.	1.41		
2 COMBINED AT	552	3234.	12.75	933.	381.	381.	2.87		
HYDROGRAPH AT	545	3239.	12.75	947.	385.	385.	2.96		
2 COMBINED AT	547	9326.	13.67	4838.	1768.	1768.	19.48		

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM8

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	4.	4.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.22	.22	4.	120.	11.75	12.42	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM165

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.12	.12	1.	53.	5.00	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM160

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.17	.17	1.	86.	8.08	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM155

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.18	.18	1.	91.	8.92	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM150

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.26	.26	2.	155.	12.00	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM120

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.11	.11	1.	47.	5.58	12.17	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM75

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.47	.47	0.	384.	12.08	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM85

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.47	.47	0.	377.	12.08	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM80

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	100.00	101.99	102.00
	STORAGE	0.	0.	0.
	OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.08	.08	0.	29.	2.42	12.17	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM95

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.10	.10	1.	41.	4.75	12.17	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM90

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.12	.12	1.	52.	5.08	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM110

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.14	.14	1.	63.	5.67	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM100

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.22	.22	0.	120.	15.25	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM140

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.17	.17	1.	88.	9.33	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM130

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.27	.27	1.	163.	12.08	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM1

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	11.	11.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.53	.53	14.	449.	11.75	12.50	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM200

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.14	.14	0.	67.	11.92	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM135

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.16	.16	1.	78.	9.08	12.25	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM7

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.48	.48	1.	391.	24.00	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM6

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	2.	55.	5.33	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM2

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	2.	56.	6.25	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM4

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	4.	4.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.00	.00	4.	1.	2.50	20.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM3

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	2.	56.	10.50	12.33	.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM5

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	6.	6.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.19	.19	6.	102.	11.75	12.42	.00

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

APPENDIX B

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                                 1                                                                        ****
                  FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
    U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                            ****




   THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


1                                         HEC-1 INPUT                                             PAGE  1

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

            1         ID       *****************************************************************
            2         ID       *                                                               *
            3         ID       *               SIMONS, LI AND ASSOCIATES, INC.                 *
            4         ID       *                                                               *
            5         ID       *                     OUTER LOOP FREEWAY                        *
            6         ID       *                 (NORTH OF THE ARIZONA CANAL)                  *
            7         ID       *                           PHASE 2                             *
            8         ID       *                                                               *
            9         ID       *            HYDROLOGY ANALYSIS FOR OFFSITE DRAINAGE            *
           10         ID       *                        50 YEAR EVENT                          *
           11         ID       *             24 HOUR HYPOTHETICAL STORM DISTRIBUTION           *
           12         ID       *                                                               *
           13         ID       *        USES % IMPERVIOUS COVER TO SIMULATE DEVELOPMENT        *
           14         ID       *            INCLUDES RETENTION/DETENTION BASINS FOR            *
           15         ID       *                 RESIDENTIAL & COMMERCIAL AREAS                *
           16         ID       *                                                               *
           17         ID       *                                                               *
           18         ID       *             THIS MODEL INCLUDES THE ADDITIONAL AREA           *
           19         ID       *           PREVIOUSLY MODELED BY THE CORP OF ENGINEERS         *
           20         ID       *            N=.012 FOR THE HIGHWAY INTERCEPTOR CHANNEL         *
           21         ID       *       ALL CURVE NUMBERS ARE FOR 24-HOUR STORM DURATION        *
           22         ID       *       NORMAL DEPTH STORAGE ROUTING ALONG ARIZONA CANAL        *
           23         ID       *         INCLUDES CAP CROSS-DRAINAGE AT EAST BOUNDARY          *
           24         ID       *        USES APRIL 1989 HYDROLOGIC REVISIONS BY R. WARD        *
           25         ID       *               MARCH 1989 HIGHWAY ALIGNMENT                    *
           26         ID       *                                                               *
           27         ID       *                      MODEL 2FD6.5I                            *
           28         ID       *****************************************************************
*** NOLIST ***
1                                           ****
                  FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
    U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                            ****



                     *****************************************************************
                     *                                                               *
                     *               SIMONS, LI AND ASSOCIATES, INC.                 *
                     *                                                               *
                     *                     OUTER LOOP FREEWAY                        *
                     *                 (NORTH OF THE ARIZONA CANAL)                  *
                     *                           PHASE 2                             *
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*            HYDROLOGY ANALYSIS FOR OFFSITE DRAINAGE              *
*                    50 YEAR EVENT                                *
*         24 HOUR HYPOTHETICAL STORM DISTRIBUTION                 *
*                                                                 *
*     USES % IMPERVIOUS COVER TO SIMULATE DEVELOPMENT             *
*         INCLUDES RETENTION/DETENTION BASINS FOR                 *
*              RESIDENTIAL & COMMERCIAL AREAS                     *
*                                                                 *
*                                                                 *
*         THIS MODEL INCLUDES THE ADDITIONAL AREA                 *
*       PREVIOUSLY MODELED BY THE CORP OF ENGINEERS               *
*        N=.012 FOR THE HIGHWAY INTERCEPTOR CHANNEL               *
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*     USES APRIL 1989 HYDROLOGIC REVISIONS BY R. WARD             *
*              MARCH 1989 HIGHWAY ALIGNMENT                       *
*                                                                 *
*                    MODEL 2FD6.5I                                *
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30 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE    20APR89  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        289  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE    21APR89  ENDING DATE
                    NDTIME       0000  ENDING TIME

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.00 HOURS
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1

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1270	8.	13.58	4.	1.	1.	.03		
+	HYDROGRAPH AT	1280	17.	13.58	9.	3.	3.	.06		
+	HYDROGRAPH AT	1350	25.	13.58	13.	4.	4.	.09		
+	HYDROGRAPH AT	1360	34.	13.67	17.	5.	5.	.12		
+	HYDROGRAPH AT	1440	42.	13.75	21.	6.	6.	.15		
+	HYDROGRAPH AT	1450	50.	13.75	26.	8.	8.	.18		

HYDROGRAPH AT

	HYDROGRAPH AT							
+		1530	66.	13.92	34.	10.	10.	.25
	HYDROGRAPH AT							
+		1600	81.	14.00	42.	13.	13.	.31
	ROUTED TO							
+		1591	80.	14.17	42.	12.	12.	.31
	HYDROGRAPH AT							
+		1260	8.	13.58	4.	1.	1.	.03
	HYDROGRAPH AT							
+		1290	17.	13.67	9.	3.	3.	.06
	HYDROGRAPH AT							
+		1340	26.	13.67	13.	4.	4.	.10
	HYDROGRAPH AT							
+		1370	34.	13.75	18.	5.	5.	.13
	HYDROGRAPH AT							
+		1430	42.	13.83	22.	7.	7.	.16
	HYDROGRAPH AT							
+		1460	50.	13.75	26.	8.	8.	.19
	HYDROGRAPH AT							
+		1510	58.	13.83	31.	9.	9.	.22
	HYDROGRAPH AT							
+		1540	66.	13.92	35.	11.	11.	.26
	HYDROGRAPH AT							
+		1590	81.	14.00	43.	13.	13.	.32
	2 COMBINED AT							
+		1592	161.	14.08	85.	26.	26.	.63
	ROUTED TO							
+		1581	161.	14.25	85.	25.	25.	.63
	HYDROGRAPH AT							
+		1250	8.	13.50	4.	1.	1.	.03
	HYDROGRAPH AT							
+		1300	17.	13.58	8.	3.	3.	.06
	HYDROGRAPH AT							
+		1330	25.	13.58	13.	4.	4.	.09
	HYDROGRAPH AT							
+		1380	34.	13.67	17.	5.	5.	.12
	HYDROGRAPH AT							
+		1420	42.	13.67	21.	6.	6.	.15
	HYDROGRAPH AT							
+		1470	50.	13.75	25.	8.	8.	.18
	HYDROGRAPH AT							
+		1500	58.	13.83	29.	9.	9.	.21
	HYDROGRAPH AT							

	HYDROGRAPH AT							
+		1580	80.	13.92	42.	13.	13.	.30
	2 COMBINED AT							
+		1582	239.	14.17	125.	38.	38.	.93
	ROUTED TO							
+		1571	239.	14.25	125.	38.	38.	.93
	HYDROGRAPH AT							
+		1240	9.	13.50	4.	1.	1.	.03
	HYDROGRAPH AT							
+		1310	17.	13.58	9.	3.	3.	.06
	HYDROGRAPH AT							
+		1320	26.	13.58	13.	4.	4.	.09
	HYDROGRAPH AT							
+		1400	27.	13.58	15.	4.	4.	.10
	HYDROGRAPH AT							
+		1390	8.	13.25	3.	1.	1.	.02
	ROUTED TO							
+		1391	8.	13.33	3.	1.	1.	.02
	2 COMBINED AT							
+		1392	35.	13.50	18.	5.	5.	.13
	HYDROGRAPH AT							
+		1410	44.	13.50	23.	7.	7.	.16
	HYDROGRAPH AT							
+		1480	52.	13.58	27.	8.	8.	.19
	HYDROGRAPH AT							
+		1490	61.	13.58	32.	9.	9.	.22
	HYDROGRAPH AT							
+		1560	69.	13.58	36.	11.	11.	.25
	HYDROGRAPH AT							
+		1570	86.	13.67	45.	13.	13.	.31
	2 COMBINED AT							
+		1572	315.	14.17	167.	51.	51.	1.25
	ROUTED TO							
+		1611	315.	14.17	167.	51.	51.	1.25
	HYDROGRAPH AT							
+		1610	63.	14.08	33.	10.	10.	.25
	2 COMBINED AT							
+		1612	377.	14.17	200.	61.	61.	1.50
	ROUTED TO							
+		1621	377.	14.25	200.	61.	61.	1.50
	HYDROGRAPH AT							
+		1620	72.	14.00	37.	11.	11.	.25
	HYDROGRAPH AT							
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	HYDROGRAPH AT									
+		1640	50.	13.67	23.	7.	7.	.14		
	3 COMBINED AT									
+		1622	491.	14.17	260.	79.	79.	1.89		
	ROUTED TO									
+		1887	390.	15.00	239.	74.	74.	1.89		
+									387.16	15.00
	HYDROGRAPH AT									
+		1950	14.	13.33	6.	2.	2.	.04		
	HYDROGRAPH AT									
+		1945	25.	13.58	12.	4.	4.	.08		
	ROUTED TO									
+		1951	25.	13.67	13.	4.	4.	.08		
	2 COMBINED AT									
+		1952	39.	13.50	18.	5.	5.	.12		
	HYDROGRAPH AT									
+		1940	80.	13.67	39.	12.	12.	.24		
	HYDROGRAPH AT									
+		1920	77.	13.58	35.	10.	10.	.20		
	ROUTED TO									
+		1941	77.	13.75	35.	10.	10.	.20		
	2 COMBINED AT									
+		1942	157.	13.75	75.	22.	22.	.43		
	HYDROGRAPH AT									
+		1925	179.	13.83	86.	25.	25.	.50		
	HYDROGRAPH AT									
+		1930	194.	14.08	97.	29.	29.	.57		
	HYDROGRAPH AT									
+		1910	54.	13.58	25.	7.	7.	.14		
	HYDROGRAPH AT									
+		1900	97.	13.75	47.	14.	14.	.27		
	HYDROGRAPH AT									
+		1890	128.	13.92	65.	19.	19.	.36		
	ROUTED TO									
+		1931	127.	13.92	65.	19.	19.	.36		
	2 COMBINED AT									
+		1932	321.	14.00	161.	48.	48.	.93		
	HYDROGRAPH AT									
+		1885	329.	14.25	171.	51.	51.	1.00		
	HYDROGRAPH AT									
+		1850	57.	13.50	25.	7.	7.	.14		
	HYDROGRAPH AT									
+		1860	99.	13.75	47.	14.	14.	.26		

	ROUTED TO									
+		1886	146.	14.17	79.	24.	24.	.44		
	HYDROGRAPH AT									
+		1880	26.	13.25	11.	3.	3.	.05		
	4 COMBINED AT									
+		1888	826.	14.58	491.	152.	152.	3.38		
	ROUTED TO									
+		1984	824.	14.67	490.	151.	151.	3.38		
+									388.41	14.67
	HYDROGRAPH AT									
+		1840	11.	13.50	6.	2.	2.	.03		
	HYDROGRAPH AT									
+		1670	28.	13.33	11.	3.	3.	.08		
	ROUTED TO									
+		1681	28.	13.58	11.	3.	3.	.08		
	HYDROGRAPH AT									
+		1680	28.	13.33	11.	3.	3.	.08		
	2 COMBINED AT									
+		1682	56.	13.42	22.	6.	6.	.15		
	ROUTED TO									
+		1751	56.	13.58	22.	6.	6.	.15		
	HYDROGRAPH AT									
+		1226	437.	12.00	357.	129.	129.	.00		
	DIVERSION TO									
+		1228	371.	12.00	304.	110.	110.	.00		
	HYDROGRAPH AT									
+		1227	66.	12.00	54.	19.	19.	.00		
	HYDROGRAPH AT									
+		1225	208.	12.25	64.	22.	22.	.08		
	HYDROGRAPH AT									
+		1230	566.	12.58	151.	47.	47.	.72		
	ROUTED TO									
+		1221	563.	12.75	154.	47.	47.	.72		
	HYDROGRAPH AT									
+		1214	41.	12.17	3.	1.	1.	.01		
	HYDROGRAPH AT									
+		1217	956.	12.25	104.	29.	29.	.74		
	HYDROGRAPH AT									
+		1220	1117.	12.50	194.	55.	55.	1.41		
	ROUTED TO									
+		1222	1115.	12.58	195.	55.	55.	1.41		
	2 COMBINED AT									
+		1223	1673.	12.58	348.	102.	102.	2.13		

+		1750	1536.	12.83	358.	105.	105.	2.21
	2 COMBINED AT							
+		1752	1556.	12.83	380.	111.	111.	2.36
	ROUTED TO							
+		1761	1533.	12.92	379.	111.	111.	2.36
	HYDROGRAPH AT							
+		1760	22.	13.17	7.	2.	2.	.05
	2 COMBINED AT							
+		1762	1553.	12.92	387.	113.	113.	2.41
	ROUTED TO							
+		1771	1545.	12.92	387.	113.	113.	2.41
	HYDROGRAPH AT							
+		1770	18.	13.08	5.	2.	2.	.04
	2 COMBINED AT							
+		1772	1562.	12.92	392.	115.	115.	2.44
	ROUTED TO							
+		1841	1557.	13.08	398.	116.	116.	2.44
	2 COMBINED AT							
+		1842	1568.	13.08	404.	117.	117.	2.47
	HYDROGRAPH AT							
+		1830	1597.	13.17	423.	123.	123.	2.59
	HYDROGRAPH AT							
+		1660	30.	13.42	13.	4.	4.	.09
	ROUTED TO							
+		1691	30.	13.58	13.	4.	4.	.09
	HYDROGRAPH AT							
+		1690	31.	13.42	13.	4.	4.	.09
	2 COMBINED AT							
+		1692	61.	13.50	26.	8.	8.	.18
	ROUTED TO							
+		1741	60.	13.67	26.	8.	8.	.18
	HYDROGRAPH AT							
+		1740	31.	13.42	13.	4.	4.	.09
	2 COMBINED AT							
+		1742	90.	13.58	38.	11.	11.	.27
	ROUTED TO							
+		1781	90.	13.75	38.	11.	11.	.27
	HYDROGRAPH AT							
+		1780	37.	13.33	15.	4.	4.	.09
	2 COMBINED AT							
+		1782	123.	13.67	53.	16.	16.	.36
	ROUTED TO							
+		1831	122.	13.75	52.	15.	15.	.36

+		1832	1654.	13.17	475.	139.	139.	2.95
	HYDROGRAPH AT							
+		1820	1677.	13.17	492.	144.	144.	3.06
	HYDROGRAPH AT							
+		1650	30.	13.42	13.	4.	4.	.09
	ROUTED TO							
+		1701	30.	13.58	13.	4.	4.	.09
	HYDROGRAPH AT							
+		1700	31.	13.42	13.	4.	4.	.09
	2 COMBINED AT							
+		1702	61.	13.50	26.	8.	8.	.18
	ROUTED TO							
+		1731	60.	13.67	26.	8.	8.	.18
	HYDROGRAPH AT							
+		1730	30.	13.42	13.	4.	4.	.09
	2 COMBINED AT							
+		1732	90.	13.58	38.	11.	11.	.27
	ROUTED TO							
+		1791	90.	13.75	38.	11.	11.	.27
	HYDROGRAPH AT							
+		1790	35.	13.33	14.	4.	4.	.09
	2 COMBINED AT							
+		1792	121.	13.67	52.	15.	15.	.36
	ROUTED TO							
+		1822	121.	13.83	52.	15.	15.	.36
	2 COMBINED AT							
+		1823	1744.	13.25	543.	159.	159.	3.43
	HYDROGRAPH AT							
+		1810	1784.	13.25	563.	166.	166.	3.54
	HYDROGRAPH AT							
+		1210	552.	12.67	124.	35.	35.	.93
	ROUTED TO							
+		1201	552.	12.75	125.	35.	35.	.93
	HYDROGRAPH AT							
+		1207	318.	12.17	25.	7.	7.	.12
	HYDROGRAPH AT							
+		1204	1039.	12.33	131.	37.	37.	.75
	HYDROGRAPH AT							
+		1200	916.	12.75	204.	58.	58.	1.31
	2 COMBINED AT							
+		1202	1469.	12.75	328.	93.	93.	2.24
	ROUTED TO							
+		1191	1449.	12.83	327.	92.	92.	2.24

+		1186	273.	12.25	23.	7.	7.	.12		
	HYDROGRAPH AT									
+		1187	414.	12.33	51.	14.	14.	.31		
	HYDROGRAPH AT									
+		1190	489.	12.83	144.	41.	41.	1.03		
	2 COMBINED AT									
+		1192	1938.	12.83	470.	134.	134.	3.27		
	ROUTED TO									
+		1181	1926.	12.92	473.	134.	134.	3.27		
	HYDROGRAPH AT									
+		1173	37.	11.00	25.	7.	7.	.00		
	HYDROGRAPH AT									
+		1174	509.	12.25	62.	18.	18.	.21		
	HYDROGRAPH AT									
+		1177	805.	12.33	95.	27.	27.	.45		
	HYDROGRAPH AT									
+		1180	637.	12.83	186.	53.	53.	1.15		
	HYDROGRAPH AT									
+		1000	25.	12.42	4.	1.	1.	.02		
	ROUTED TO									
+		1042	25.	12.42	4.	1.	1.	.02		
	HYDROGRAPH AT									
+		1060	33.	12.92	9.	3.	3.	.04		
	ROUTED TO									
+		1051	33.	13.00	9.	3.	3.	.04		
	HYDROGRAPH AT									
+		1050	2.	12.25	0.	0.	0.	.00		
	2 COMBINED AT									
+		1052	33.	13.00	10.	3.	3.	.04		
	ROUTED TO									
+		1041	33.	13.25	10.	3.	3.	.04		
	HYDROGRAPH AT									
+		1040	86.	12.25	9.	3.	3.	.04		
	3 COMBINED AT									
+		1043	107.	12.25	22.	7.	7.	.10		
	ROUTED TO									
+		DAM8	82.	12.50	17.	5.	5.	.10		
+									102.17	12.50
	ROUTED TO									
+		1011	92.	12.58	18.	5.	5.	.10		
	HYDROGRAPH AT									
+		1010	92.	12.25	8.	2.	2.	.04		
	2 COMBINED AT									

	HYDROGRAPH AT							
+		1110	106.	12.67	27.	8.	8.	.15
	HYDROGRAPH AT							
+		1020	89.	12.17	7.	2.	2.	.03
	HYDROGRAPH AT							
+		1120	113.	12.33	12.	4.	4.	.07
	2 COMBINED AT							
+		1121	205.	12.33	39.	11.	11.	.21
	DIVERSION TO							
+		2223	82.	12.33	16.	5.	5.	.21
	HYDROGRAPH AT							
+		2222	123.	12.33	24.	7.	7.	.21
	ROUTED TO							
+		1131	119.	12.33	24.	7.	7.	.21
	HYDROGRAPH AT							
+		1070	84.	12.25	8.	2.	2.	.04
	ROUTED TO							
+		1031	80.	12.33	8.	2.	2.	.04
	HYDROGRAPH AT							
+		1030	58.	12.33	6.	2.	2.	.03
	2 COMBINED AT							
+		1032	138.	12.33	14.	4.	4.	.07
	HYDROGRAPH AT							
+		1130	195.	12.42	24.	7.	7.	.13
	2 COMBINED AT							
+		1132	305.	12.42	47.	14.	14.	.35
	DIVERSION TO							
+		3334	152.	12.42	24.	7.	7.	.35
	HYDROGRAPH AT							
+		3333	152.	12.42	24.	7.	7.	.35
	ROUTED TO							
+		1151	148.	12.50	24.	7.	7.	.35
	HYDROGRAPH AT							
+		1080	200.	12.25	16.	5.	5.	.08
	HYDROGRAPH AT							
+		1090	257.	12.33	27.	8.	8.	.14
	HYDROGRAPH AT							
+		1150	312.	12.58	59.	17.	17.	.37
	2 COMBINED AT							
+		1152	449.	12.58	83.	24.	24.	.72
	DIVERSION TO							
+		4445	224.	12.58	41.	12.	12.	.72
	HYDROGRAPH AT							

ROUTED TO							
+	1161	224.	12.75	42.	12.	12.	.72
HYDROGRAPH AT							
+	1159	834.	13.00	817.	538.	538.	.00
HYDROGRAPH AT							
+	1154	1253.	12.25	852.	545.	545.	.16
HYDROGRAPH AT							
+	1155	1812.	12.25	917.	558.	558.	.62
HYDROGRAPH AT							
+	1153	160.	12.25	13.	4.	4.	.08
ROUTED TO							
+	1101	169.	12.25	15.	4.	4.	.08
HYDROGRAPH AT							
+	1100	9.	12.25	1.	0.	0.	.00
2 COMBINED AT							
+	1102	179.	12.25	16.	5.	5.	.08
ROUTED TO							
+	1156	162.	12.42	17.	5.	5.	.08
2 COMBINED AT							
+	1157	1959.	12.33	934.	563.	563.	.70
HYDROGRAPH AT							
+	1160	1825.	12.58	976.	563.	563.	1.00
HYDROGRAPH AT							
+	1166	285.	12.25	24.	7.	7.	.11
HYDROGRAPH AT							
+	1165	858.	12.25	85.	24.	24.	.50
HYDROGRAPH AT							
+	1170	631.	12.58	119.	33.	33.	.76
ROUTED TO							
+	1162	615.	12.75	120.	34.	34.	.76
3 COMBINED AT							
+	1163	2580.	12.67	1137.	609.	609.	2.48
DIVERSION TO							
+	5556	1290.	12.67	568.	305.	305.	2.48
HYDROGRAPH AT							
+	5555	1290.	12.67	568.	305.	305.	2.48
ROUTED TO							
+	1182	1286.	12.67	568.	304.	304.	2.48
2 COMBINED AT							
+	1183	1898.	12.75	755.	357.	357.	3.63
ROUTED TO							
+	1184	1893.	12.75	755.	356.	356.	3.63
2 COMBINED AT							

+	ROUTED TO	1646	3745.	12.83	1227.	489.	489.	6.90		
+	HYDROGRAPH AT	1645	50.	13.08	16.	5.	5.	.09		
+	2 COMBINED AT	1647	3790.	12.83	1243.	494.	494.	6.99		
+	ROUTED TO	1711	3786.	12.92	1242.	493.	493.	6.99		
+	HYDROGRAPH AT	1710	39.	13.33	15.	4.	4.	.09		
+	2 COMBINED AT	1712	3816.	12.92	1258.	497.	497.	7.09		
+	ROUTED TO	1721	3785.	12.92	1258.	496.	496.	7.09		
+	HYDROGRAPH AT	1720	44.	13.25	17.	5.	5.	.09		
+	2 COMBINED AT	1722	3822.	12.92	1274.	501.	501.	7.18		
+	ROUTED TO	1801	3805.	13.00	1274.	500.	500.	7.18		
+	HYDROGRAPH AT	1800	50.	13.17	18.	5.	5.	.09		
+	2 COMBINED AT	1802	3853.	13.00	1292.	505.	505.	7.27		
+	ROUTED TO	1811	3829.	13.00	1292.	504.	504.	7.27		
+	2 COMBINED AT	1812	5358.	13.17	1854.	670.	670.	10.82		
+	ROUTED TO	1813	5349.	13.17	1854.	669.	669.	10.82		
+	2 COMBINED AT	1985	5515.	13.17	2327.	820.	820.	14.20		
+	ROUTED TO	1986	4958.	13.42	2322.	814.	814.	14.20		
+									394.73	13.42
+	HYDROGRAPH AT	3334	152.	12.42	24.	7.	7.	.00		
+	HYDROGRAPH AT	1135	209.	12.58	41.	12.	12.	.11		
+	ROUTED TO	1136	208.	12.67	41.	12.	12.	.11		
+	HYDROGRAPH AT	4445	224.	12.58	41.	12.	12.	.00		

2 COMBINED AT									
+	1141	500.	12.67	104.	30.	30.	.25		
ROUTED TO									
+	1971	498.	12.83	105.	30.	30.	.25		
HYDROGRAPH AT									
+	5556	1290.	12.67	568.	305.	305.	.00		
ROUTED TO									
+	1972	1235.	12.83	568.	300.	300.	.00		
HYDROGRAPH AT									
+	1970	269.	12.92	79.	23.	23.	.51		
3 COMBINED AT									
+	1973	1998.	12.83	752.	352.	352.	.76		
HYDROGRAPH AT									
+	1980	2181.	13.00	839.	372.	372.	1.23		
2 COMBINED AT									
+	1987	6622.	13.33	3146.	1185.	1185.	15.43		
ROUTED TO									
+	1991	6232.	13.58	3143.	1178.	1178.	15.43		
+								395.79	13.58
HYDROGRAPH AT									
+	1960	261.	12.83	71.	20.	20.	.38		
HYDROGRAPH AT									
+	1990	463.	13.00	141.	40.	40.	.76		
2 COMBINED AT									
+	1993	6533.	13.58	3277.	1218.	1218.	16.19		
ROUTED TO									
+	2001	6424.	13.67	3275.	1213.	1213.	16.19		
+								395.93	13.67
HYDROGRAPH AT									
+	2000	85.	12.75	21.	6.	6.	.12		
2 COMBINED AT									
+	2002	6455.	13.67	3294.	1219.	1219.	16.31		
ROUTED TO									
+	541	6402.	13.83	3293.	1216.	1216.	16.31		
+								395.92	13.83
HYDROGRAPH AT									
+	540	82.	13.00	26.	8.	8.	.21		
2 COMBINED AT									
+	542	6447.	13.83	3318.	1224.	1224.	16.51		
ROUTED TO									
+	546	6417.	13.92	3318.	1221.	1221.	16.51		
+								395.93	13.92
HYDROGRAPH AT									
+	165	39.	12.17	4.	1.	1.	.01		

+		DAM165	45.	12.17	3.	1.	1.	.01		
+									102.11	12.17
	ROUTED TO									
+		156	37.	12.25	3.	1.	1.	.01		
	HYDROGRAPH AT									
+		160	69.	12.25	6.	2.	2.	.02		
	ROUTED TO									
+		DAM160	65.	12.25	6.	2.	2.	.02		
+									102.14	12.25
	ROUTED TO									
+		161	99.	12.25	6.	2.	2.	.02		
	HYDROGRAPH AT									
+		155	75.	12.25	7.	2.	2.	.03		
	ROUTED TO									
+		DAM155	78.	12.25	6.	2.	2.	.03		
+									102.16	12.25
	3 COMBINED AT									
+		157	214.	12.25	16.	4.	4.	.06		
	ROUTED TO									
+		151	201.	12.25	16.	4.	4.	.06		
	HYDROGRAPH AT									
+		150	126.	12.25	12.	4.	4.	.04		
	ROUTED TO									
+		DAM150	131.	12.25	10.	3.	3.	.04		
+									102.23	12.25
	2 COMBINED AT									
+		152	331.	12.25	26.	7.	7.	.10		
	ROUTED TO									
+		121	290.	12.33	26.	7.	7.	.10		
	HYDROGRAPH AT									
+		70	13.	12.33	1.	0.	0.	.01		
	ROUTED TO									
+		122	12.	12.42	2.	0.	0.	.01		
	HYDROGRAPH AT									
+		120	41.	12.25	4.	1.	1.	.01		
	ROUTED TO									
+		DAM120	42.	12.25	4.	1.	1.	.01		
+									102.10	12.25
	3 COMBINED AT									
+		123	333.	12.33	32.	9.	9.	.13		
	HYDROGRAPH AT									
+		75	328.	12.33	32.	9.	9.	.13		
	ROUTED TO									
+		DAM75	324.	12.33	32.	9.	9.	.13		
+									102.42	12.33

+		85	315.	12.33	33.	9.	9.	.14		
+	ROUTED TO	DAM85	314.	12.33	33.	9.	9.	.14	102.41	12.33
+	HYDROGRAPH AT	80	24.	12.17	2.	1.	1.	.01		
+	ROUTED TO	DAM80	22.	12.25	2.	0.	0.	.01	102.07	12.25
+	ROUTED TO	87	22.	12.25	2.	0.	0.	.01		
+	2 COMBINED AT	88	329.	12.33	35.	9.	9.	.14		
+	ROUTED TO	96	307.	12.42	35.	9.	9.	.14		
+	HYDROGRAPH AT	95	35.	12.25	4.	1.	1.	.01		
+	ROUTED TO	DAM95	39.	12.25	3.	1.	1.	.01	102.10	12.25
+	2 COMBINED AT	97	332.	12.42	38.	10.	10.	.15		
+	ROUTED TO	91	331.	12.42	38.	10.	10.	.15		
+	HYDROGRAPH AT	90	42.	12.25	4.	1.	1.	.02		
+	ROUTED TO	DAM90	59.	12.25	3.	1.	1.	.02	102.13	12.25
+	2 COMBINED AT	92	357.	12.42	41.	11.	11.	.17		
+	HYDROGRAPH AT	110	52.	12.25	4.	1.	1.	.02		
+	ROUTED TO	DAM110	52.	12.17	4.	1.	1.	.02	102.12	12.17
+	ROUTED TO	101	51.	12.25	4.	1.	1.	.02		
+	HYDROGRAPH AT	100	105.	12.25	9.	3.	3.	.00		
+	ROUTED TO	DAM100	106.	12.25	9.	3.	3.	.00	102.20	12.25
+	3 COMBINED AT	102	429.	12.42	54.	15.	15.	.19		

+		103	428.	12.42	54.	15.	15.	.19		
+	HYDROGRAPH AT	360	433.	12.42	57.	16.	16.	.21		
+	HYDROGRAPH AT	410	457.	12.42	61.	17.	17.	.25		
+	ROUTED TO	421	456.	12.42	61.	17.	17.	.25		
+	HYDROGRAPH AT	140	63.	12.25	7.	2.	2.	.03		
+	ROUTED TO	DAM140	74.	12.25	6.	2.	2.	.03		
+									102.15	12.25
+	HYDROGRAPH AT	130	133.	12.25	15.	4.	4.	.06		
+	ROUTED TO	DAM130	130.	12.33	14.	4.	4.	.06		
+									102.23	12.33
+	HYDROGRAPH AT	420	164.	12.50	28.	8.	8.	.15		
+	2 COMBINED AT	422	618.	12.42	89.	25.	25.	.40		
+	ROUTED TO	401	602.	12.42	89.	25.	25.	.40		
+	HYDROGRAPH AT	240	171.	12.25	14.	4.	4.	.07		
+	ROUTED TO	246	146.	12.33	14.	4.	4.	.07		
+	HYDROGRAPH AT	245	56.	12.25	5.	1.	1.	.02		
+	2 COMBINED AT	247	199.	12.25	19.	6.	6.	.10		
+	ROUTED TO	248	190.	12.33	19.	5.	5.	.10		
+	HYDROGRAPH AT	180	64.	12.33	9.	3.	3.	.07		
+	HYDROGRAPH AT	255	64.	12.25	6.	2.	2.	.03		
+	ROUTED TO	236	59.	12.33	6.	2.	2.	.03		
+	HYDROGRAPH AT	235	33.	12.25	3.	1.	1.	.01		
+	2 COMBINED AT	237	80.	12.33	8.	2.	2.	.04		

3 COMBINED AT	182	318.	12.33	36.	11.	11.	.21		
ROUTED TO	191	300.	12.42	36.	11.	11.	.21		
HYDROGRAPH AT	195	138.	12.17	11.	3.	3.	.04		
ROUTED TO	186	126.	12.25	11.	3.	3.	.04		
HYDROGRAPH AT	185	83.	12.17	7.	2.	2.	.02		
2 COMBINED AT	187	199.	12.25	18.	5.	5.	.06		
ROUTED TO	188	182.	12.33	18.	5.	5.	.06		
2 COMBINED AT	189	465.	12.33	53.	16.	16.	.27		
ROUTED TO	DAM1	299.	12.50	37.	10.	10.	.27	102.40	12.50
HYDROGRAPH AT	190	14.	12.83	4.	1.	1.	.03		
2 COMBINED AT	192	311.	12.58	41.	12.	12.	.30		
ROUTED TO	211	311.	12.58	42.	12.	12.	.30		
HYDROGRAPH AT	210	57.	12.25	5.	1.	1.	.02		
2 COMBINED AT	212	325.	12.58	46.	13.	13.	.32		
DIVERSION TO	429	163.	12.58	23.	7.	7.	.32		
HYDROGRAPH AT	213	163.	12.58	23.	7.	7.	.32		
HYDROGRAPH AT	405	155.	12.75	25.	7.	7.	.34		
HYDROGRAPH AT	200	53.	12.33	6.	2.	2.	.04		
ROUTED TO	DAM200	55.	12.42	6.	2.	2.	.04	102.13	12.42
HYDROGRAPH AT	415	57.	12.42	7.	2.	2.	.05		
HYDROGRAPH AT									

	ROUTED TO									
+		DAM135	81.	12.25	6.	2.	2.	.03		
+									102.16	12.25
	HYDROGRAPH AT									
+		425	68.	12.33	8.	2.	2.	.04		
	3 COMBINED AT									
+		426	210.	12.67	40.	11.	11.	.42		
	HYDROGRAPH AT									
+		400	287.	12.83	63.	18.	18.	.57		
	2 COMBINED AT									
+		402	788.	12.50	152.	43.	43.	.97		
	ROUTED TO									
+		501	782.	12.50	152.	43.	43.	.97		
	HYDROGRAPH AT									
+		500	861.	12.58	174.	49.	49.	1.09		
	HYDROGRAPH AT									
+		429	163.	12.58	23.	7.	7.	.00		
	HYDROGRAPH AT									
+		430	219.	12.92	53.	15.	15.	.18		
	HYDROGRAPH AT									
+		440	64.	12.75	17.	5.	5.	.10		
	2 COMBINED AT									
+		441	280.	12.83	70.	20.	20.	.29		
	ROUTED TO									
+		502	278.	13.00	71.	20.	20.	.29		
	2 COMBINED AT									
+		503	971.	12.58	245.	69.	69.	1.38		
	HYDROGRAPH AT									
+		560	1023.	12.67	257.	73.	73.	1.46		
	ROUTED TO									
+		551	1023.	12.67	257.	73.	73.	1.46		
	HYDROGRAPH AT									
+		304	336.	12.67	309.	206.	206.	.00		
	HYDROGRAPH AT									
+		300	376.	12.33	315.	208.	208.	.03		
	ROUTED TO									
+		DAM7	377.	12.33	315.	208.	208.	.03		
+									102.47	12.33
	ROUTED TO									
+		291	375.	12.33	315.	208.	208.	.03		
	HYDROGRAPH AT									
+		290	55.	12.17	5.	1.	1.	.02		
	ROUTED TO									
+		DAM6	24.	12.42	2.	1.	1.	.02		

	2 COMBINED AT									
+		292	396.	12.42	317.	209.	209.	.05		
	ROUTED TO									
+		331	395.	12.42	317.	209.	209.	.05		
	HYDROGRAPH AT									
+		330	60.	12.17	5.	2.	2.	.02		
	ROUTED TO									
+		DAM2	60.	12.33	3.	1.	1.	.02		
+									102.13	12.33
	2 COMBINED AT									
+		332	443.	12.33	320.	210.	210.	.07		
	ROUTED TO									
+		231	425.	12.33	320.	210.	210.	.07		
	HYDROGRAPH AT									
+		230	119.	12.25	10.	3.	3.	.04		
	2 COMBINED AT									
+		232	506.	12.33	330.	213.	213.	.11		
	ROUTED TO									
+		233	501.	12.33	330.	213.	213.	.11		
	HYDROGRAPH AT									
+		220	635.	12.25	347.	218.	218.	.19		
	HYDROGRAPH AT									
+		445	633.	12.33	350.	219.	219.	.21		
	HYDROGRAPH AT									
+		310	31.	12.50	6.	2.	2.	.03		
	ROUTED TO									
+		DAM4	0.	.08	0.	0.	0.	.03		
+									101.81	24.00
	ROUTED TO									
+		312	0.	.08	0.	0.	0.	.03		
	HYDROGRAPH AT									
+		320	57.	12.17	5.	1.	1.	.02		
	2 COMBINED AT									
+		322	57.	12.17	5.	1.	1.	.05		
	ROUTED TO									
+		DAM3	42.	12.33	3.	1.	1.	.05		
+									102.10	12.33
	HYDROGRAPH AT									
+		260	104.	12.25	11.	3.	3.	.09		
	ROUTED TO									
+		451	98.	12.33	11.	3.	3.	.09		
	HYDROGRAPH AT									
+		450	116.	12.42	15.	4.	4.	.12		
	2 COMBINED AT									

HYDROGRAPH AT									
+	455	789.	12.50	375.	226.	226.	.39		
HYDROGRAPH AT									
+	280	195.	12.25	16.	5.	5.	.06		
ROUTED TO									
+	DAM5	51.	12.50	7.	2.	2.	.06		
+								102.12	12.50
HYDROGRAPH AT									
+	250	101.	12.25	17.	5.	5.	.11		
HYDROGRAPH AT									
+	460	149.	12.67	36.	10.	10.	.24		
2 COMBINED AT									
+	461	926.	12.50	411.	237.	237.	.63		
HYDROGRAPH AT									
+	495	1018.	12.67	440.	244.	244.	.79		
HYDROGRAPH AT									
+	270	147.	12.25	12.	4.	4.	.06		
HYDROGRAPH AT									
+	470	173.	12.42	23.	7.	7.	.13		
HYDROGRAPH AT									
+	2223	82.	12.33	16.	5.	5.	.00		
HYDROGRAPH AT									
+	480	122.	12.50	26.	7.	7.	.08		
2 COMBINED AT									
+	481	289.	12.42	49.	14.	14.	.21		
HYDROGRAPH AT									
+	490	358.	12.75	87.	25.	25.	.41		
2 COMBINED AT									
+	491	1362.	12.67	527.	269.	269.	1.20		
HYDROGRAPH AT									
+	550	1474.	12.83	564.	278.	278.	1.41		
2 COMBINED AT									
+	552	2453.	12.83	821.	351.	351.	2.87		
HYDROGRAPH AT									
+	545	2485.	12.83	832.	354.	354.	2.96		
2 COMBINED AT									
+	547	7449.	13.83	4131.	1575.	1575.	19.48		

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM8

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	4.	4.
OUTFLOW	0.	0.	1.

RATIO MAXIMUM MAXIMUM MAXIMUM MAXIMUM DURATION TIME OF TIME OF

1.00	102.17	.17	4.	82.	11.67	12.50	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM165

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.11	.11	1.	45.	4.58	12.17	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM160

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.14	.14	1.	65.	7.33	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM155

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.16	.16	1.	78.	8.00	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM150

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.23	.23	2.	131.	11.92	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM120

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.10	.10	1.	42.	5.00	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM75

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.42	.42	0.	324.	12.00	12.33	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM85

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.41	.41	0.	314.	12.08	12.33	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM80

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.07	.07	0.	22.	2.17	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM95

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.10	.10	1.	39.	4.33	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM90

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	1.	59.	4.67	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM110

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.12	.12	1.	52.	5.17	12.17	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM100

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.20	.20	0.	106.	13.75	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM140

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.15	.15	1.	74.	8.42	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM130

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM1

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	11.	11.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.40	.40	13.	299.	11.67	12.50	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM200

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	0.	55.	10.75	12.42	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM135

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.16	.16	1.	81.	8.33	12.25	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM7

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	1.	1.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.47	.47	1.	377.	24.00	12.33	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM6

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

OF PMF	RESERVOIR W.S.ELEV	DEPTH OVER DAM	STORAGE AC-FT	OUTFLOW CFS	OVER TOP HOURS	MAX OUTFLOW HOURS	FAILURE HOURS
1.00	102.07	.07	2.	24.	4.83	12.42	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM2

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.13	.13	2.	60.	5.75	12.33	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM4

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	4.	4.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	101.81	.00	3.	0.	.00	.00	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM3

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	2.	2.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.10	.10	2.	42.	5.25	12.33	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DAM5

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	101.99	102.00
STORAGE	0.	6.	6.
OUTFLOW	0.	0.	1.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	102.12	.12	6.	51.	11.67	12.50	.00

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

HYDROLOGIC MODEL DATA SHEET

Date:
By:

Area Modelled: Camelback Walk Channel to Az. Canal

~~FCD~~ File Code: ADOT

Report Title: Hydrology Report: Outer Loop Highway Camelback Walk Channel to Az. Canal

Author: Simons, Li, & Assoc

Date: May 1989, final copy

~~FCD~~ Staff Contact:

Hydrologic Model Summary

Computer Model Used: HEC-1

version/date:

Total Area: 2.9 mile reach of Outer loop highway affected.

No. of Subbasins:

Rainfall:

freq. & duration:

temporal dist.:

~~rainfall depth~~:

areal reduction:

Excess:

Hydrograph:

Routing:

Significant Structures and Drainage Features:

Comments:

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY

10240 N. 31st AVE., SUITE 213
PHOENIX, ARIZONA 85051-9565
PHONE: (602) 997-4050
TELECOPY: (602) 943-3072

LETTER OF TRANSMITTAL

DATE 3-12-90	PROJ. No. 3863
ATTENTION Mr. Dick Perreault	
RE: Contract No. 89-34	
Pima Freeway	
90th Street - Indian School Road	
101 L MA H2447 01D	

TO: Maricopa County Flood Control Dist.
3335 West Durango Street
Phoenix, AZ

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via Messenger the following items

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ See Below

COPIES	DATE	NO.	DESCRIPTION
3		1	Meeting Notes from 3-8-90 9:30 a.m. meeting re: Discharge for
			drainage water from Arizona Canal to MCFCD

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval

☐ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return ____ corrected prints

☒ For review and comment ☐ ____

☐ FOR BIDS DUE ____ 19 ____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS:

FLOOD CONTROL DISTRICT RECEIVED ~~MAR 02 1990~~ 8
CH ENG | P & PM
DEP | HYDRO
ADMIN | LMGT
FINANCE | FILE
C & O
EMGR
REMARKS

FLOOD CONTROL DISTRICT RECEIVED MAR 12 1990
CH ENG | P & PM
DEP | HYDRO
ADMIN | LMGT
FINANCE | FILE
C & O
EMGR
REMARKS

COPY TO:

SIGNED: Dawn M. Speight

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

PIMA FREEWAY
90th STREET TO INDIAN SCHOOL ROAD
MEETING NOTES

DATE: March 8, 1990
TIME: 0930 Hrs
LOCATION: MCFCD

ADOT PROJECT NO.: 89-34
TRACS NO.: 101 L MA H2447 01D
MKE PROJECT NO.: 3863
SERIAL NO.: G66.mtg

ATTENDEES:		
	Dick Perreault	MCFCD
	Dave Johnson	MCFCD
	Ed Raleigh	MCFCD
	Mike Karpuk	DCCO
	Stan Polasik	DCCO
	Ray Jordan	ADOT
	Frank Medina	ADOT
	Rich DeBoer	ADOT
	Norm Gutcher	MKE

This meeting was held specifically as a vehicle for DCCO and ADOT to present the current proposal for discharge of drainage water from the area North of the Arizona Canal to the Maricopa County Flood Control District (MCFCD).

Stan Polasik made the initial presentation. He explained that two concepts had been evaluated. One that used the existing flood plain east on Pima Road and north of the Arizona Canal as it currently functions and provided a bridge across the flood plain to avoid increasing the 100 year flood elevation. The other alternate, referred to as number 2, utilizes a lined channel parallel to the Az. Canal on the north side draining to the west under Pima Road through a new multi-barrel box culvert and into MCFCD facilities which ultimately empty into the Indian Bend Wash.

The concept presented in the Arizona Canal Crossing Study which took all of the flow south across the canal and to the Salt River was not mentioned.

The drainage channel north of the Arizona Canal along the freeway will be an unlined channel. Only that portion turning the corner at the Az. Canal and through the new box under Pima Road will be lined.

Conjecture was that the COE studies may not have accounted for the effect of the bar screen in the Arizona Canal which exists just upstream of Pima Road.

Downstream of Pima Road the Az. Canal capacity is thought to be

2500 cfs. There was considerable discussion on this point. The spillway provided by the COE west of Pima Road is a side weir spillway which is supposed to have a capacity of 5500 cfs. This is the same as the flow proposed to come from the project drainage channel. Flood flow above that would go to the Arizona Canal.

The statement was made by Ray Jordan that the entire analysis assumed "responsible" operation of the Evergreen Wasteway Gate by SRP. This means dumping the normal flow of the Canal to accept flood flow.

The statement was made by several of the participants that there was no flood plain definition by FEMA east of Pima Road because the area was Indian Land.

Ray Jordan, in response to a question from Dick Perreault, said that the drainage area north of the Arizona Canal was approximately 26 square miles.

It was stated that this alternate is now made feasible because the Indians have agreed to make ROW available. Ray Jordan said that it was not yet clear whether the ROW would be in "fee" of as an easement.

Dick Perreault asked who would maintain the drainage facility. Ray Jordan answered that ADOT would maintain the portion that they construct, which would include the portion from east of the freeway through the Pima Road box and box discharge area.

According to Mike Karpuk DCCO has estimated the capacity of the Arizona Canal at 3700 cfs without overtopping the south bank. (In previous conversations SRP staff has said 1900 cfs) There is a low section of the south bank near the bar screen just east on Pima Road which, according to Mike Karpuk, should be raised. This improvement, he says, should raise the capacity of the Arizona Canal to 5000 cfs.

Note: MKE should obtain a copy of the COE study for Indian Bend Wash.

There was discussion of the design Q. The COE studies use 8000 cfs while the SLI studies show 9326 cfs. Stan Polasik explained that the difference was explained in that SLI had used HEC-1 and the Kenimatic Wave formula to predict the 9326 and felt that their number was conservatively high. Both Stan and Ray said that the 8000 cfs flow would be used for design with the higher flow used only to check and be sure that the design would not create a hazard to private property.

Mike Karpuk gave some estimated flow velocities downstream of the Pima Road Box Culvert. At the end of the culvert V = 13.5 fps, at the end of the apron V = 11.3 fps and 200 downstream V = 6.7 fps.

There was discussion of the extent of improvements downstream of the box to be provided by ADOT. While there was no definite limit set all agreed that some work would be needed to allow the flow velocity to reduce to a point where erosion of the downstream drainage channel would not be a problem.

Over the last two years a developer has been attempting to build a golf course in the drainage way downstream of Pima Road. Apparently he has given up. His license from MCFCD has expired. Any subsequent such development will require a new approval process and will, according to MCFCD have to accommodate the drainage way.

Regarding permits, no one seemed sure if a COE section 404 permit would be required. The consensus was to apply for on at the earliest opportunity and let the COE either issue the permit or state in writing that one was not needed. Water Quality seemed to be of more concern that wetlands encroachment. Degradation of receiving waters was the concern here.

Per Ray Jordan, the next step in the process is to go to the City of Scottsdale. Ray made the statement that he assumed SRP would be no problem.

Through the design process, MCFCD agreed to be the point of contact with the COE.

DCCO will attempt to set up a meeting with the City of Scottsdale as soon as possible. Dick Perreault pointed out that with in the City of Scottsdale there are four individuals that will be part of the decision making process. 1) Bill Erickson, Drainage, 2) John Ferimelli (spelling unknown), Development, 3) Mike Millilo (spelling unknown), Development and 4) Bill ????, Parks Department.

Respectfully Submitted,

Norman K. Gutcher

Norman K. Gutcher, P. E.

cc: In house only
Ron Holmes
Bob Ferrese
Norm Gutcher

NOTE: Should any participant in the above conversation have any comments regarding these notes, notify the signer, in writing, within ten (10) days from the date above. Otherwise, these notes will remain as prepared.

DeLEUW
CATHER

De Leuw, Cather & Company
One Gateway Center 426 N. 44th Street Suite 252
Phoenix, Arizona 85008 (602) 244-9096

LETTER OF TRANSMITTAL

DATE 3/9/90	JOB NO. 03731

ATTENTION Richard G. Perreault 3/12/90

RE: Pima Freeway Crossing
Arizona Canal

DR-47A-6-24

TO Flood Control District
3335 West Durango
Phoenix, AZ

COPIES	DATE	NO.	DESCRIPTION
1			Final Hydrology Report-OLH-Camelback Walk Channel to the Arizona Canal

THESE ARE TRANSMITTED as checked below:

- ☐ For approval
- ☐ For your use
- ☒ As requested
- ☐ For review and comment
- ☐ For your information
- ☐ ________________

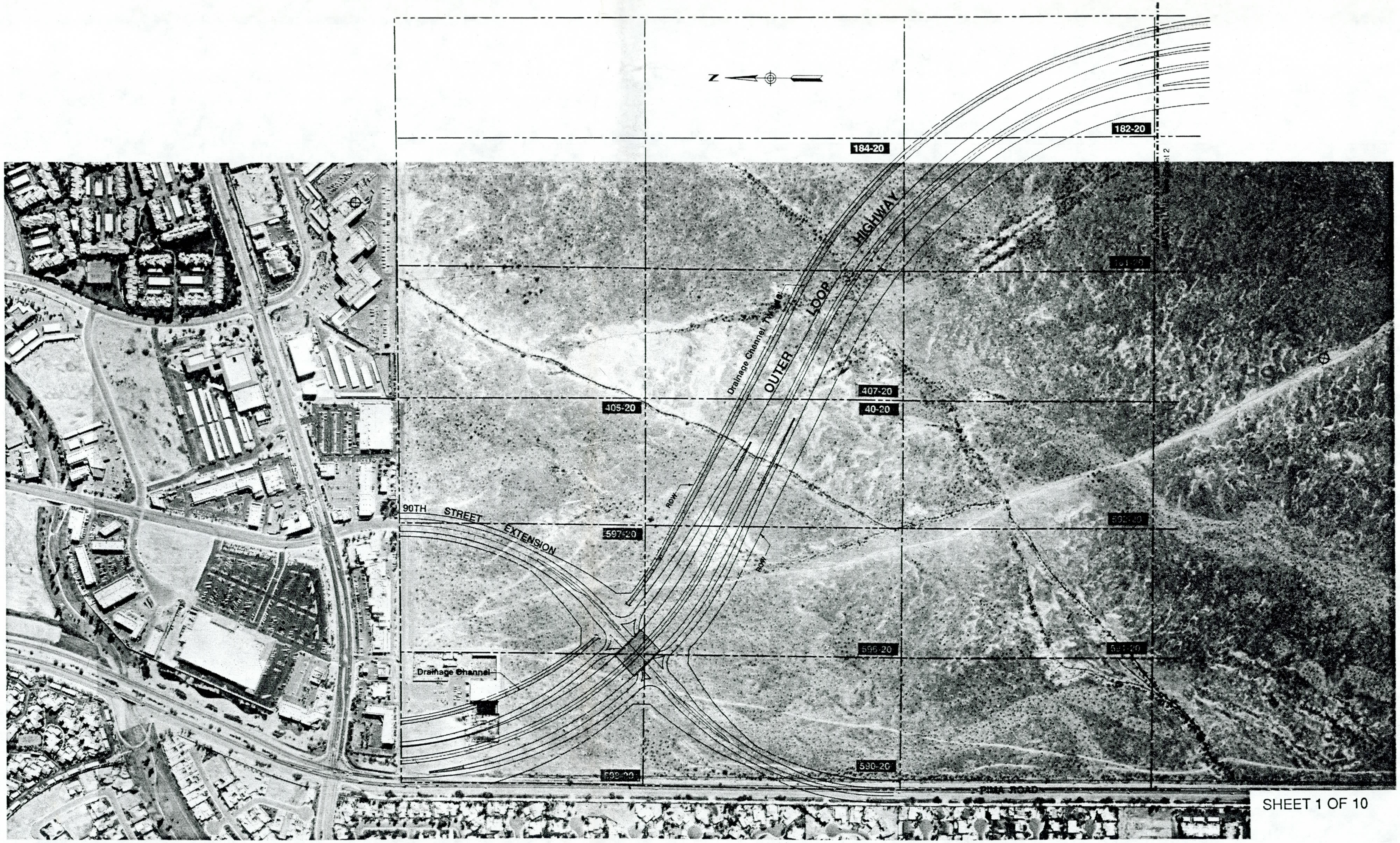
REMARKS:

cc: R. Simeon
R. Jordan

SIGNED: Stan Polasik

If Enclosures are not as noted, kindly notify us at once.

RGP
3/8/90



2/21/90

SHEET 1 OF 10

Outer Loop Highway

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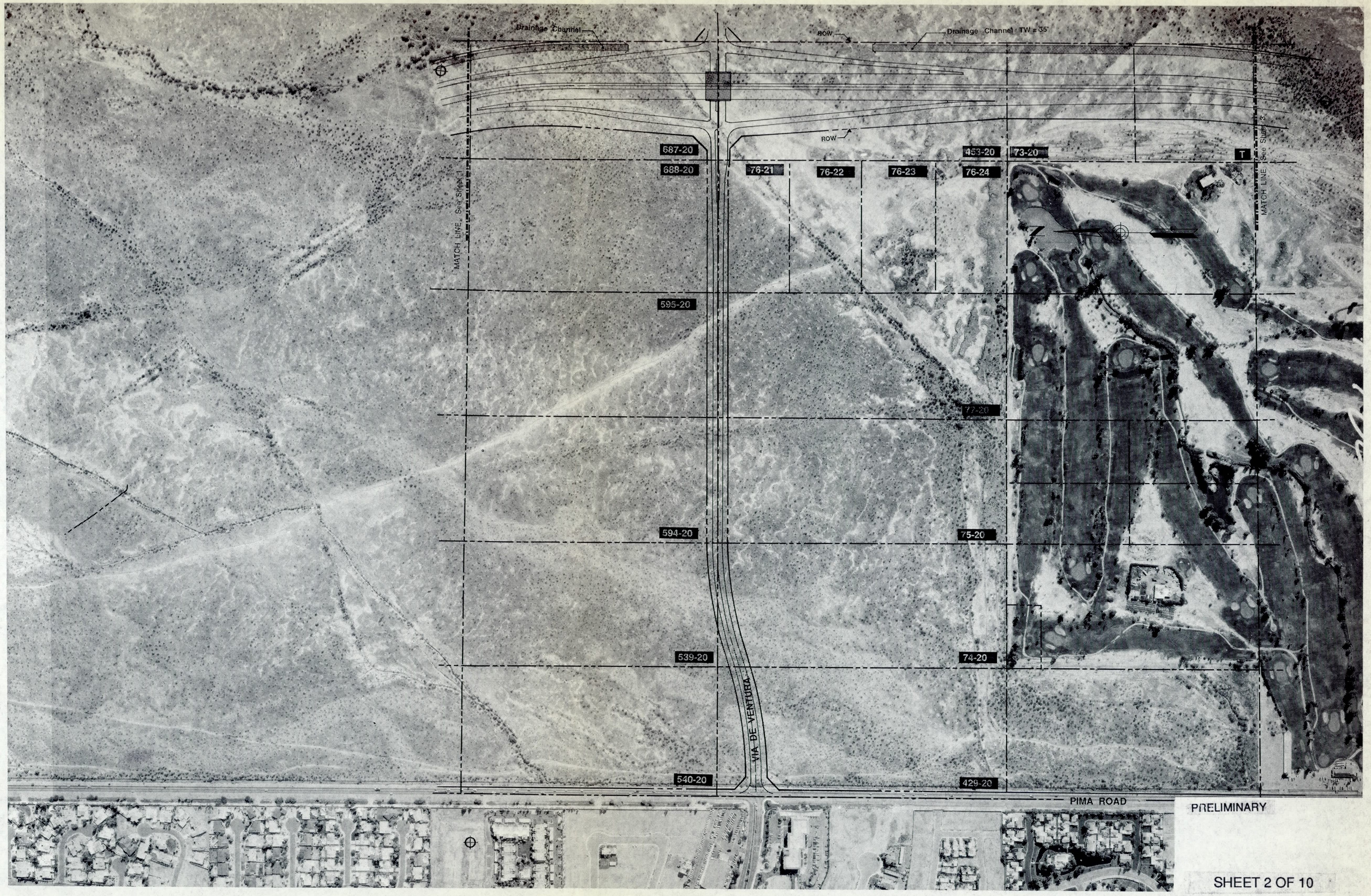

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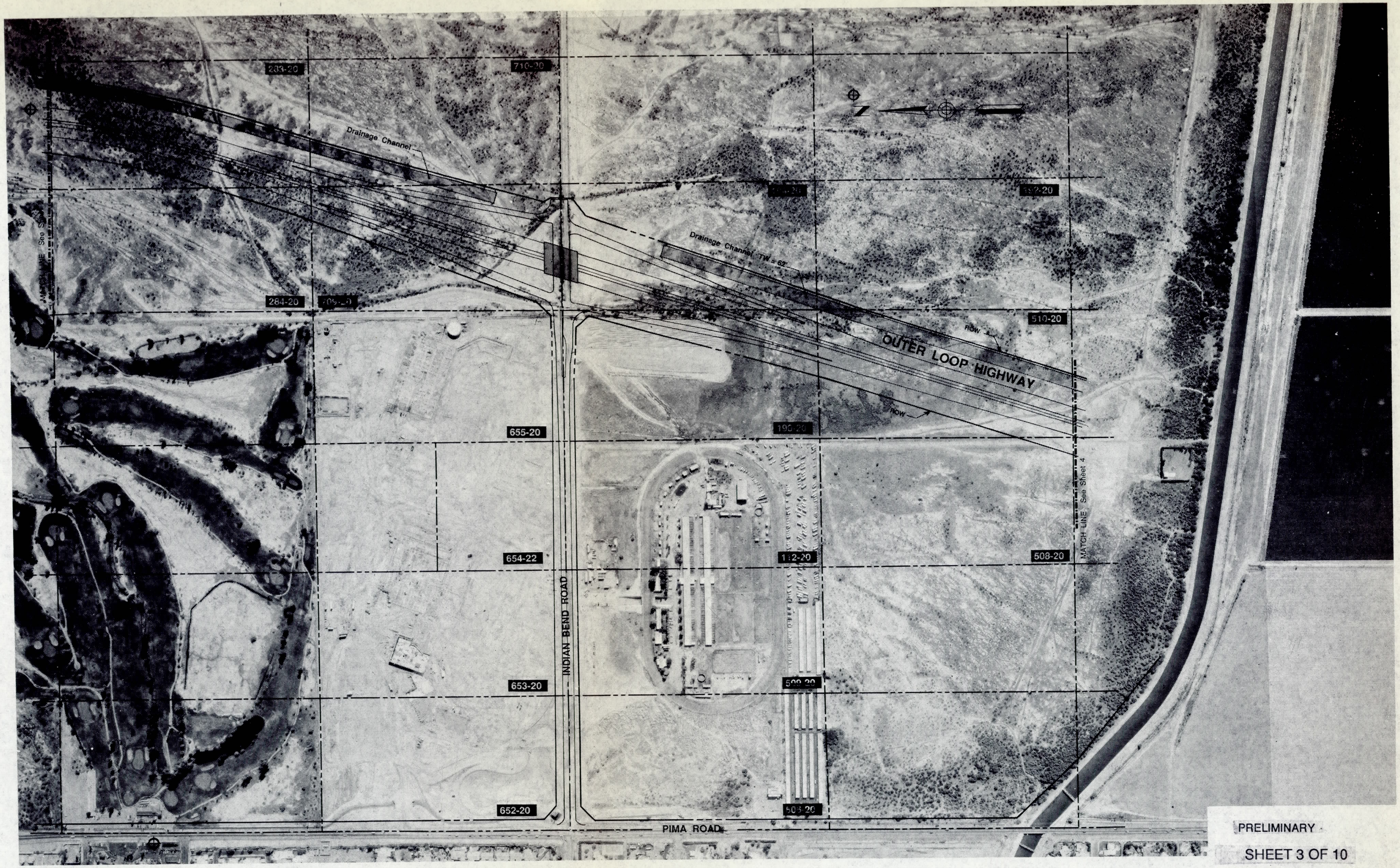

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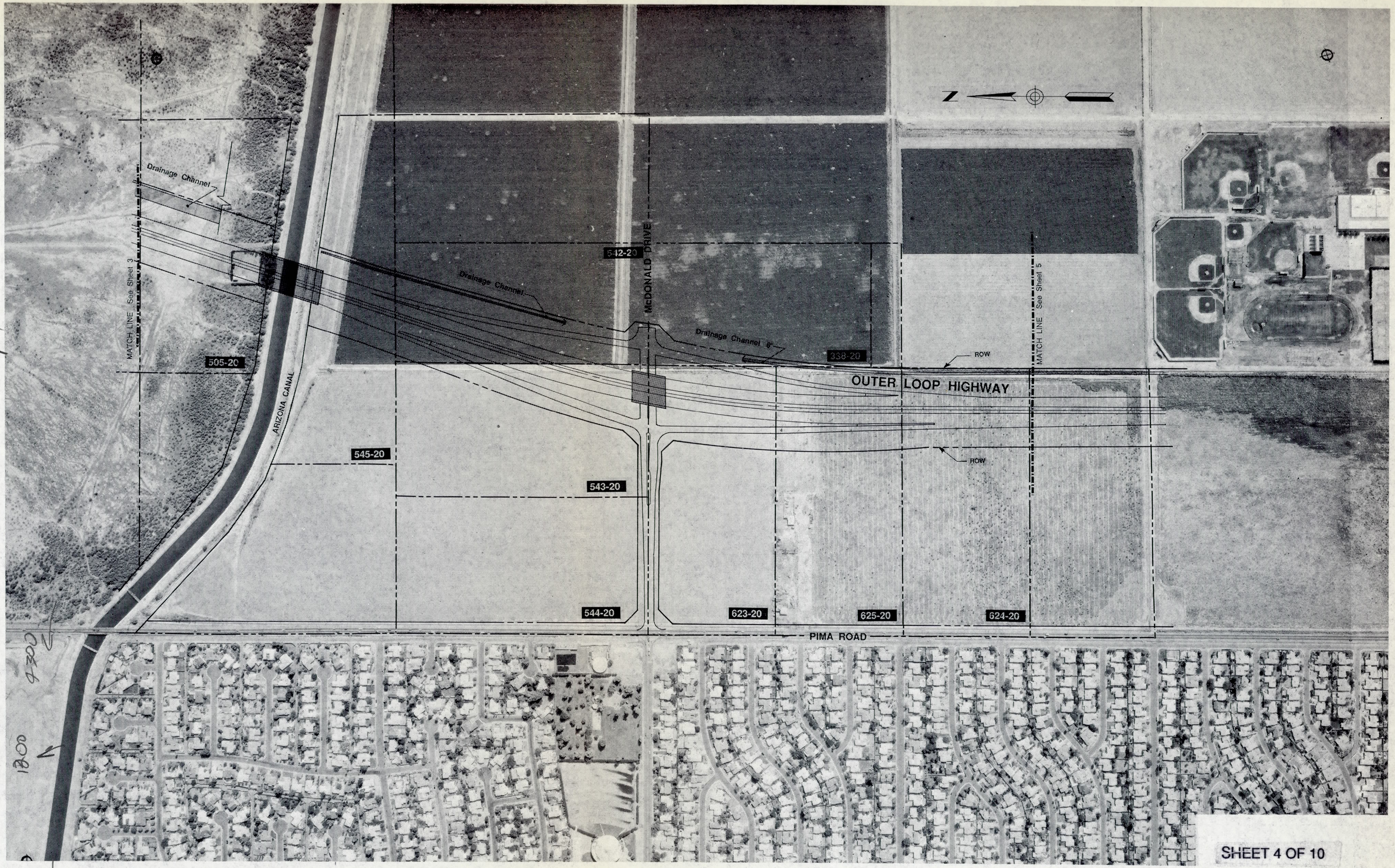

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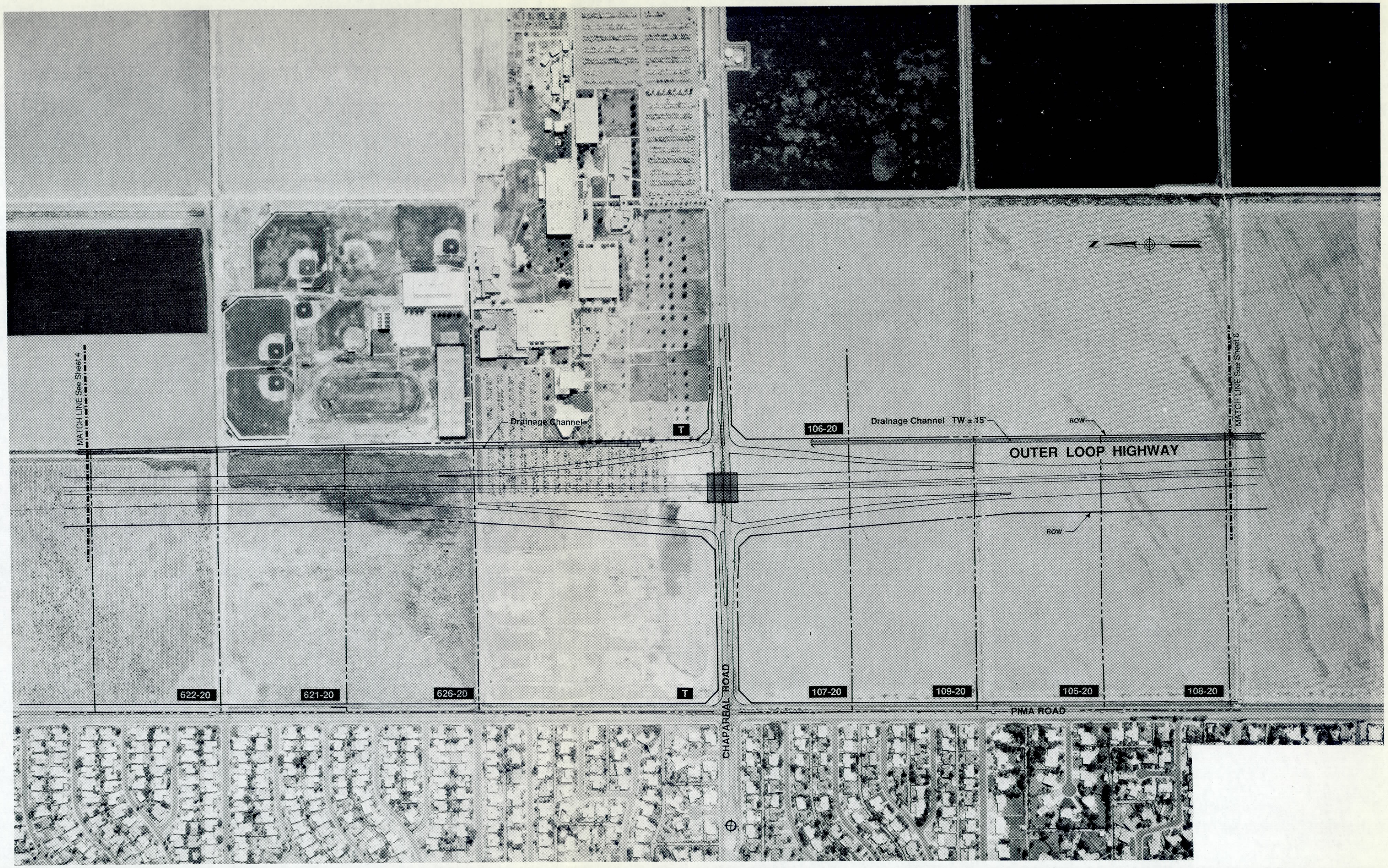

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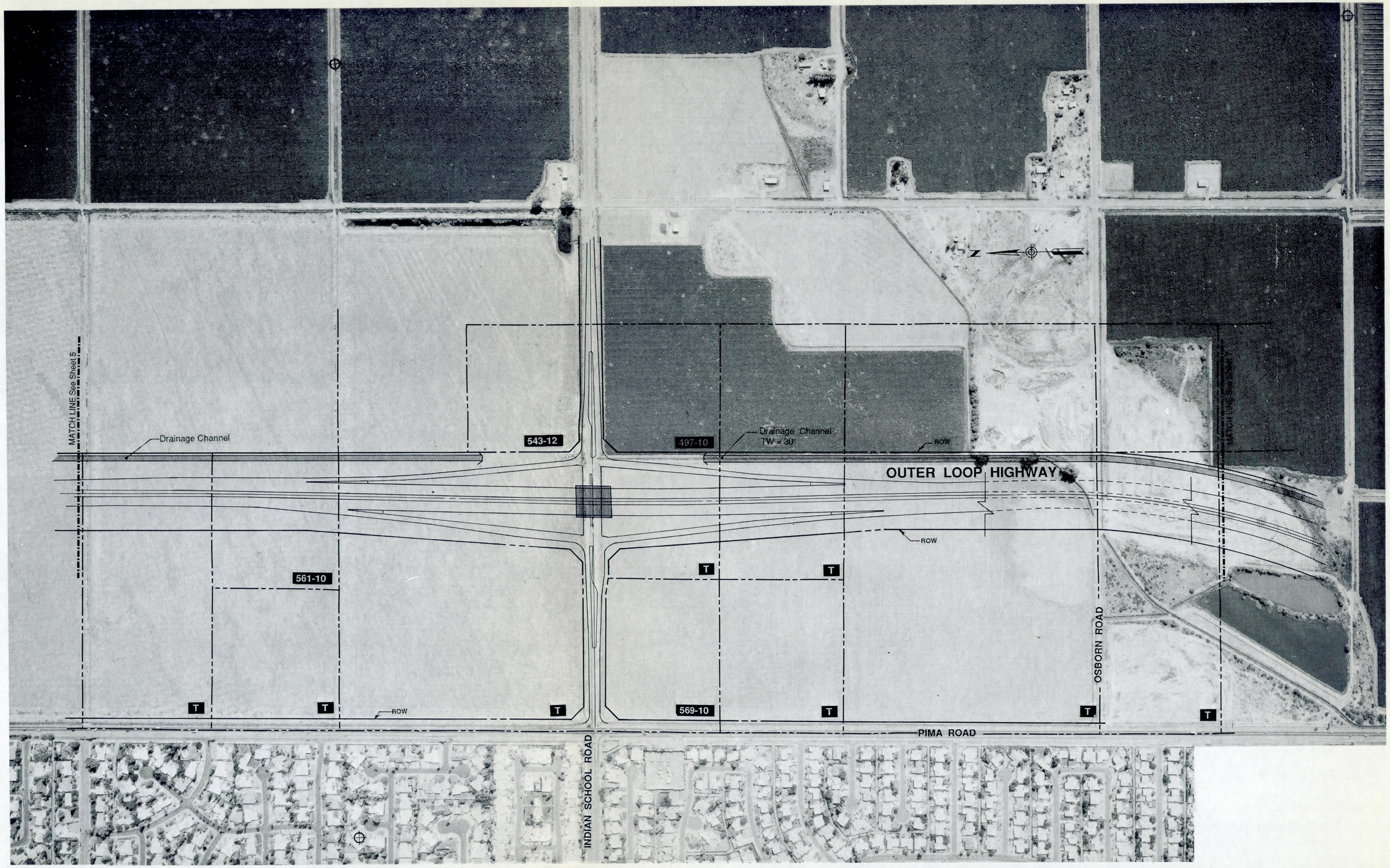

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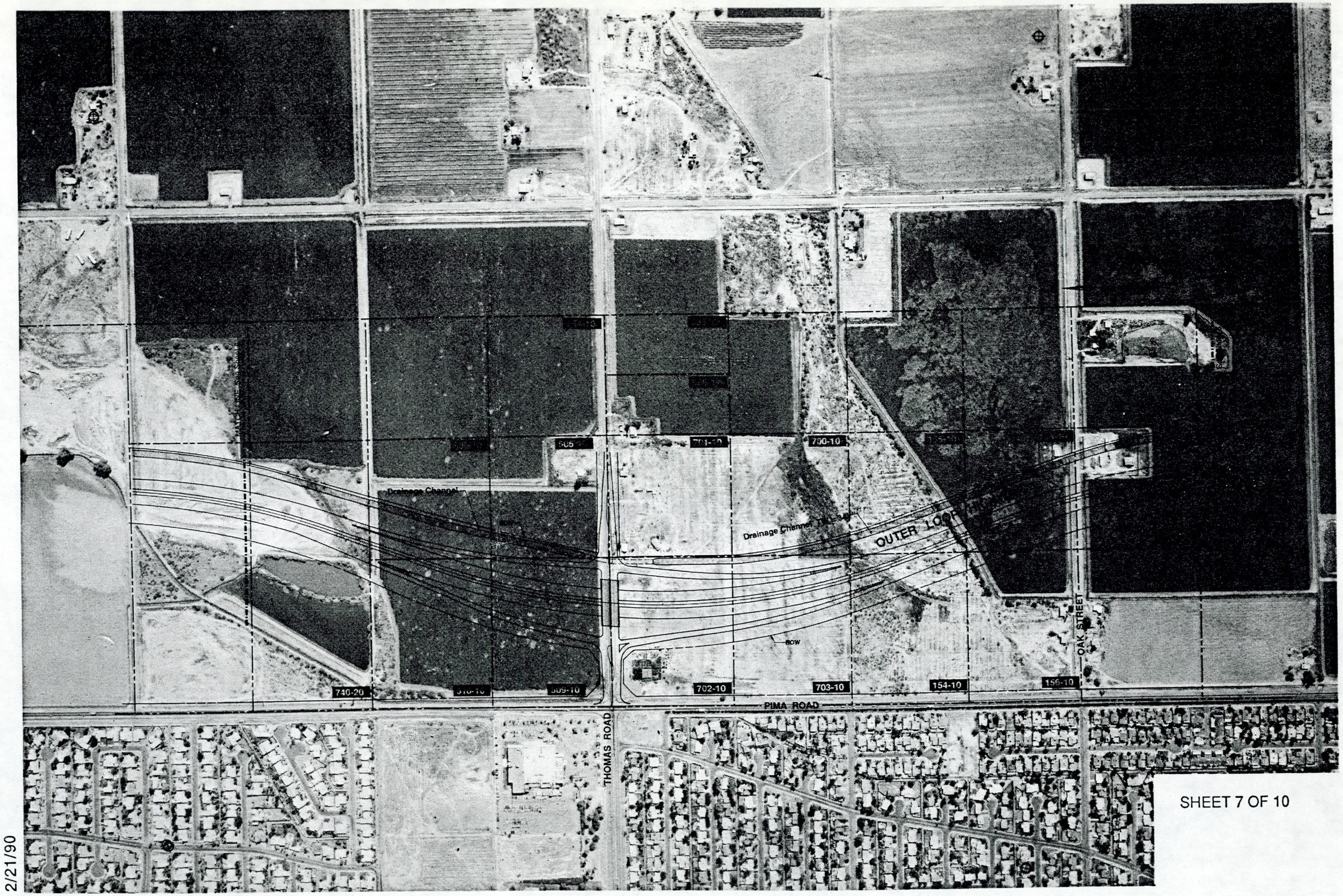

2/21/90

SHEET 7 OF 10

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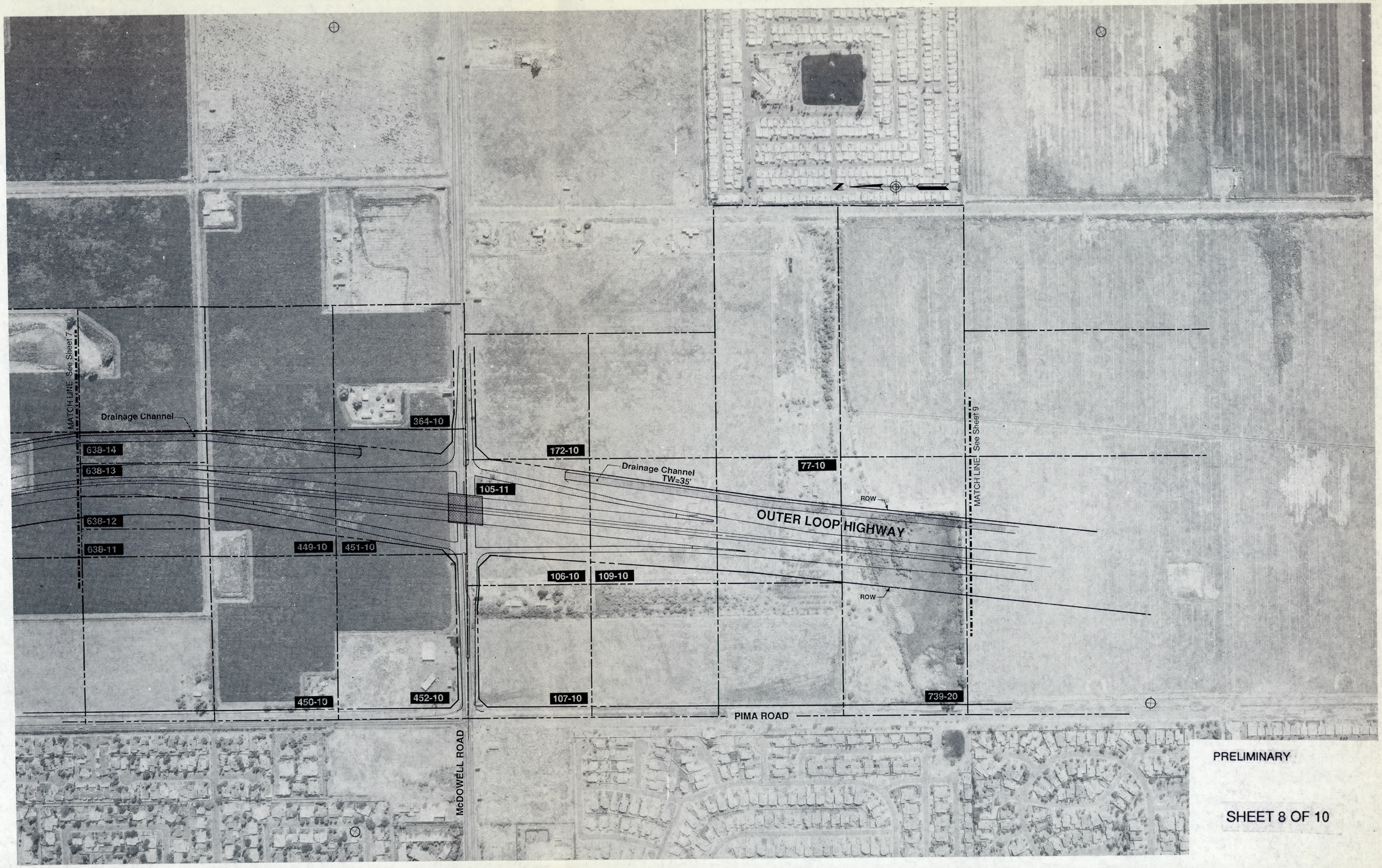

PRELIMINARY

SHEET 8 OF 10

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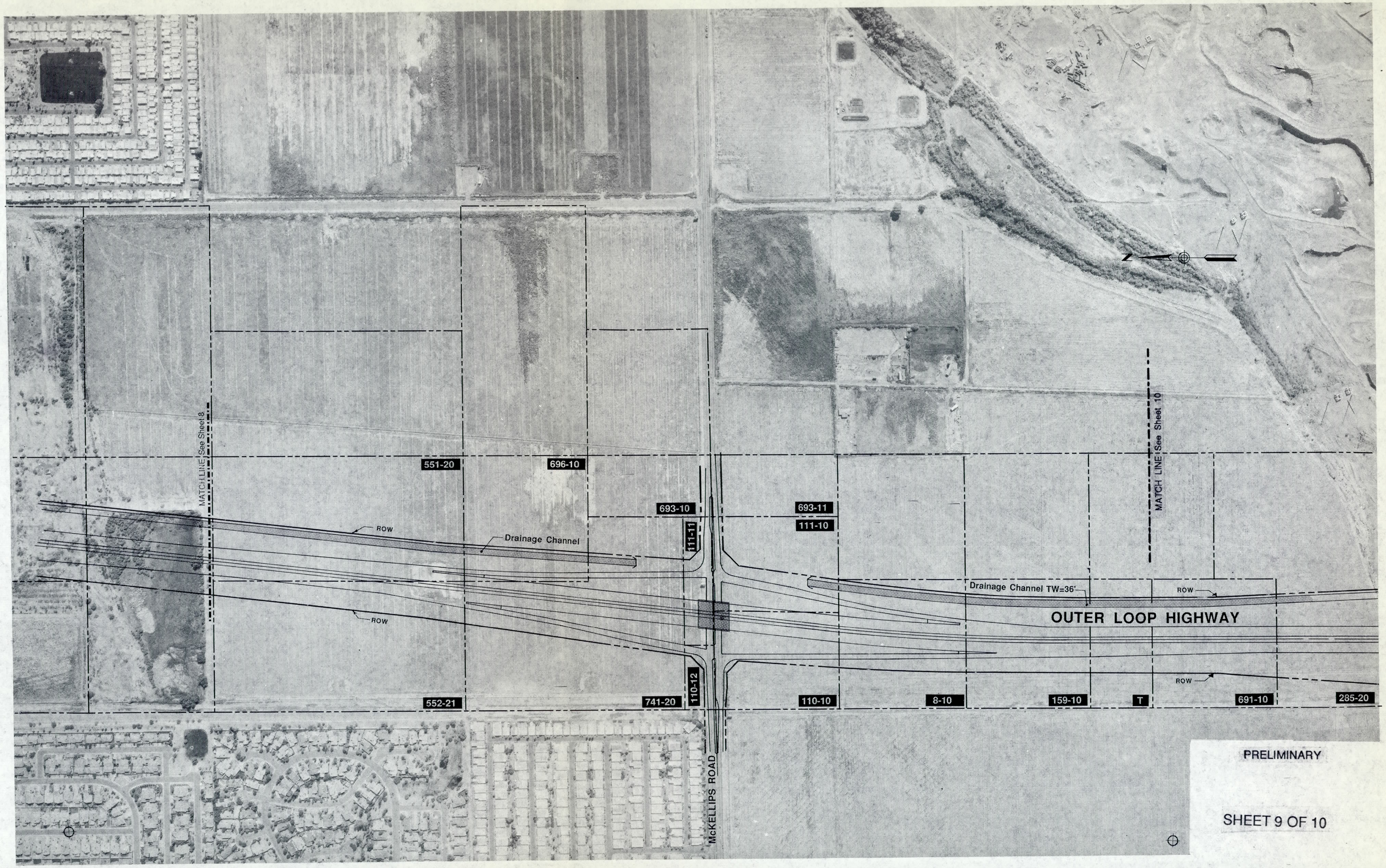

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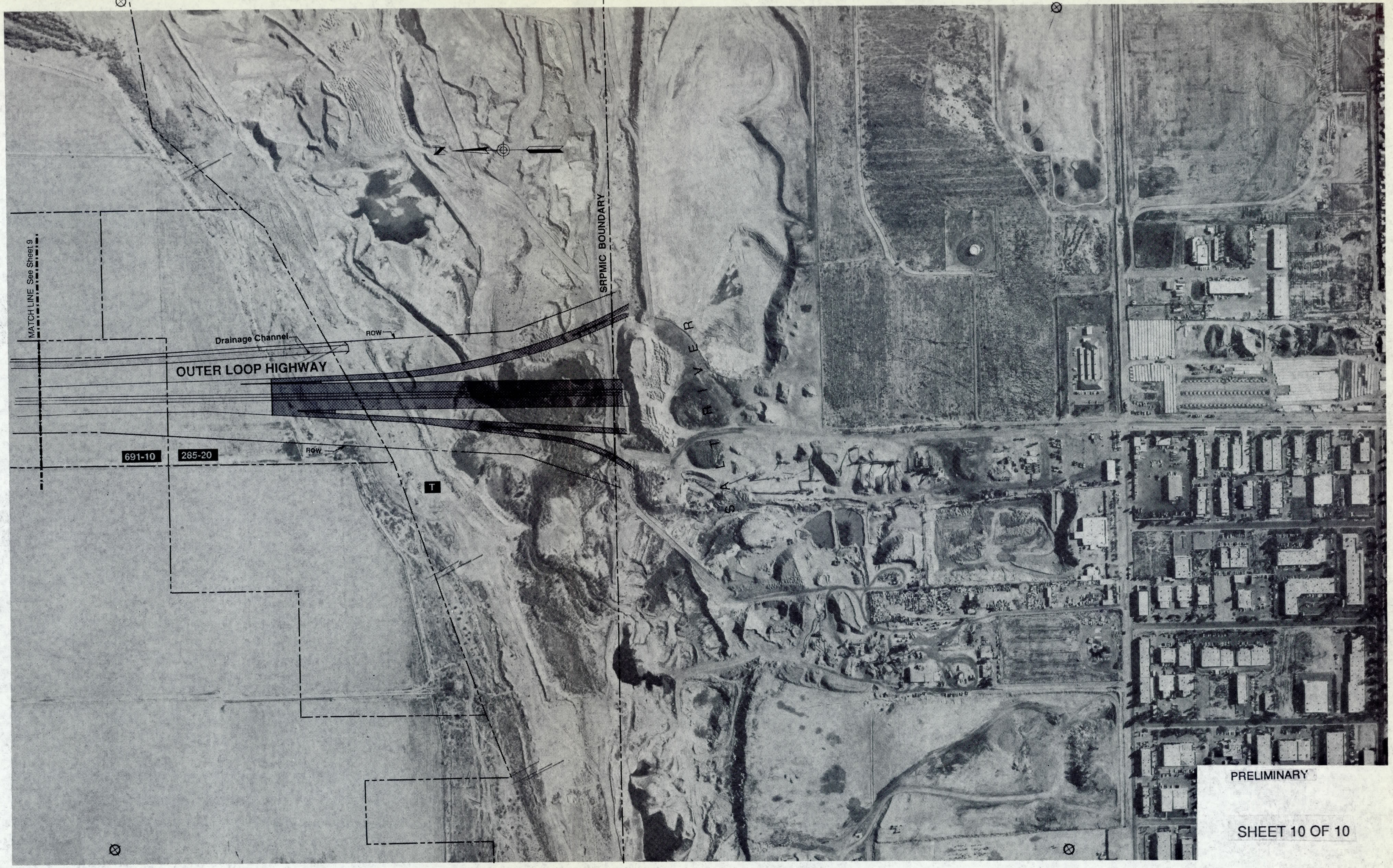

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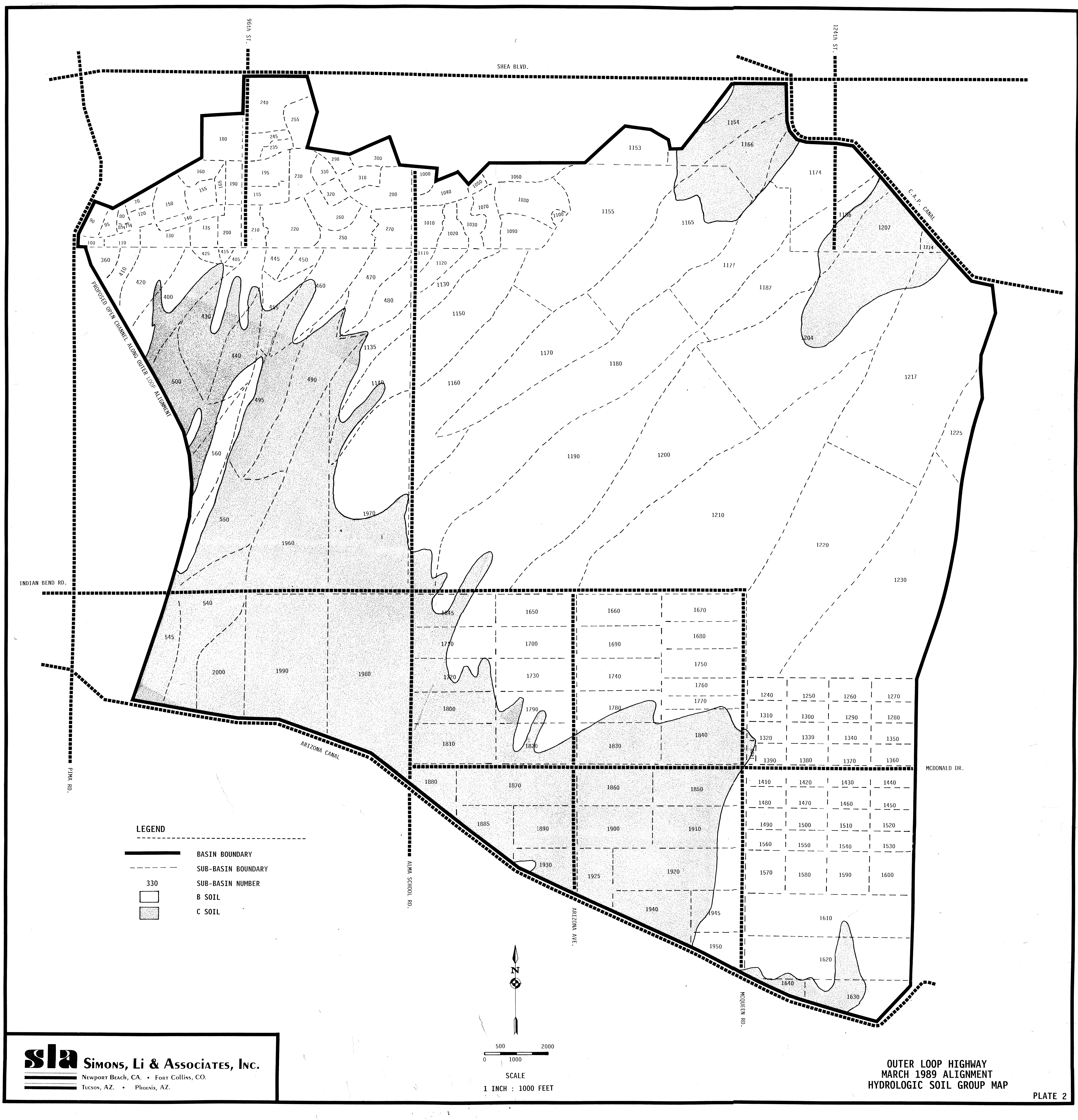
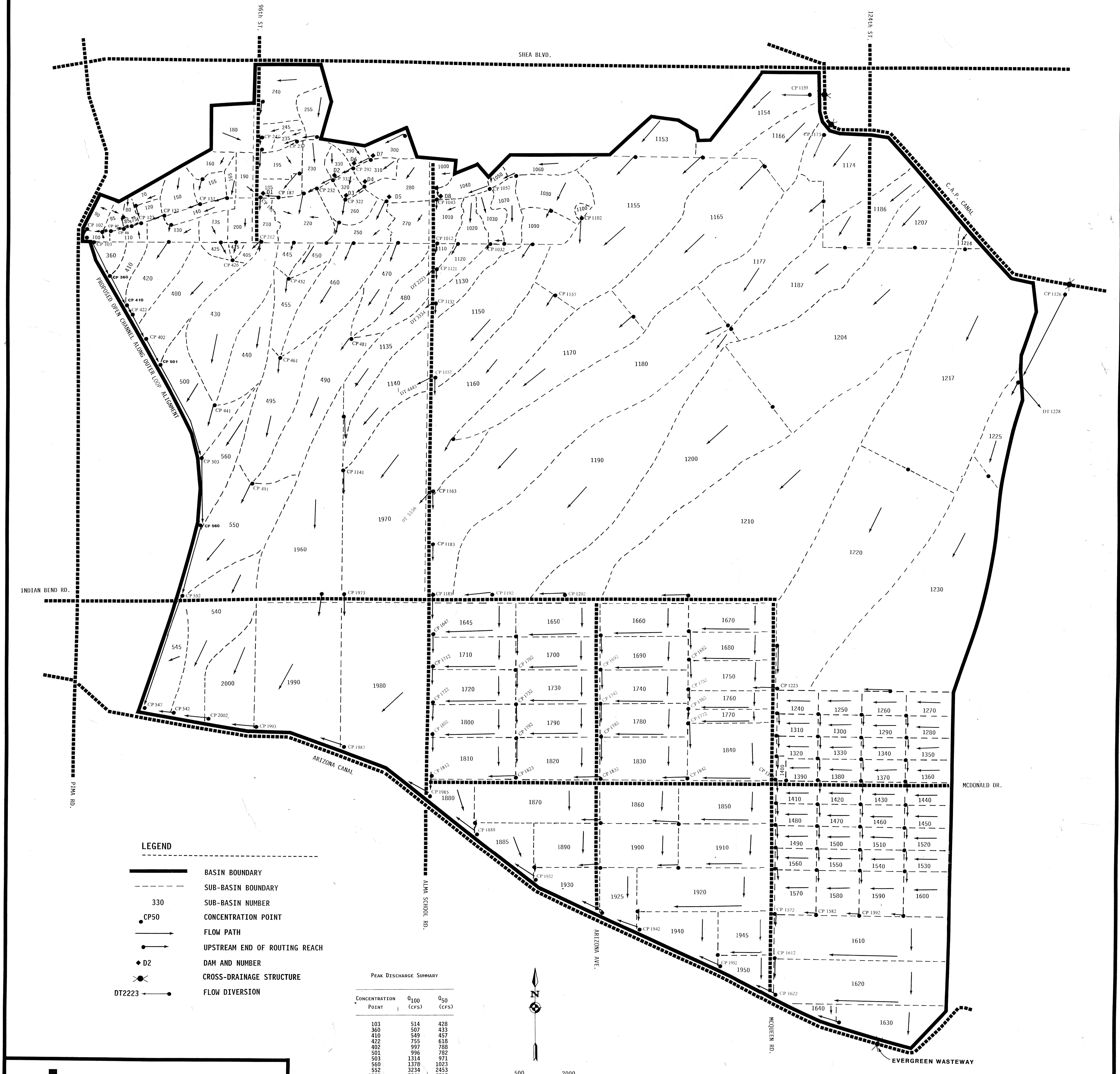

SHEA BLVD.
96th ST.
124th ST.
C.A.P. CANAL
PROPOSED OPEN CHANNEL ALONG OUTER LOOP ALIGNMENT
INDIAN BEND RD.
PIMA RD.
ARIZONA CANAL
ALMA SCHOOL RD.
ARIZONA AVE.
MCQUEEN RD.
MCDONALD DR.
LEGEND
BASIN BOUNDARY
SUB-BASIN BOUNDARY
330 SUB-BASIN NUMBER
B SOIL
C SOIL
N
SCALE
1 INCH : 1000 FEET
sla Simons, Li & Associates, Inc.
Newport Beach, CA. • Fort Collins, CO.
Tucson, AZ. • Phoenix, AZ.
OUTER LOOP HIGHWAY
MARCH 1989 ALIGNMENT
HYDROLOGIC SOIL GROUP MAP
PLATE 2



PEAK DISCHARGE SUMMARY

CONCENTRATION POINT	Q_{100} (CFS)	Q_{50} (CFS)
103	514	428
360	507	433
410	549	457
422	755	618
402	997	788
501	996	782
503	1314	971
560	1378	1023
552	3234	2453
1985	7241	5515
1987	8384	6622
1993	8248	6533
2002	8160	6455
542	8154	6447
547	9326	7449

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OUTER LOOP HIGHWAY
MARCH 1989 ALIGNMENT
HYDROLOGIC MODEL SCHEMATIC

PLATE 3