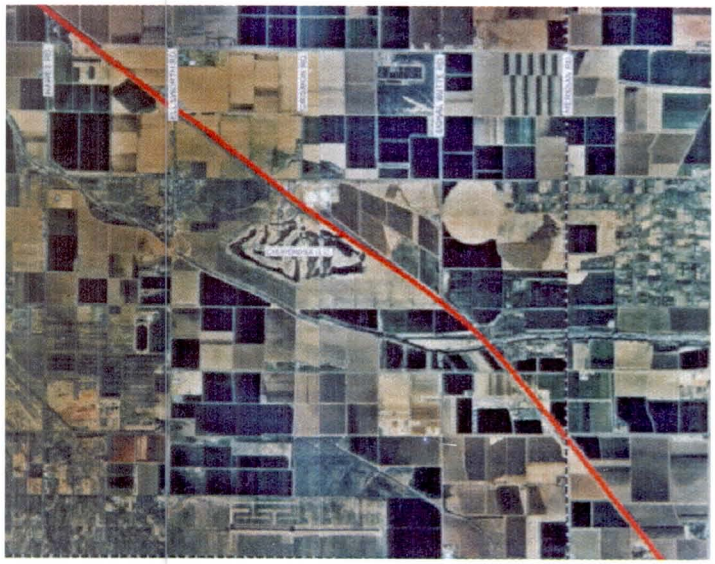

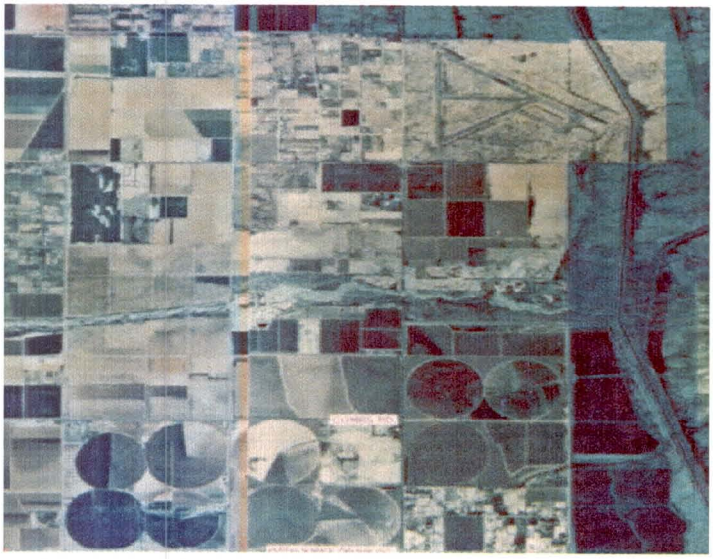

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EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY REPORT

(FCD 98-26)

FLOOD CONTROL DISTRICT of MARICOPA COUNTY 1959

Registered Professional Engineer (Civil)
CERTIFICATE NO. 12250
FRED K. DUREN, JR.
Date Signed 2/11/00
ARIZONA, U.S.A.

Presented to Flood Control District of Maricopa County

February 11, 2000

HUITT-ZOLLARS

in association with

Aquatic Consulting & Testing
Archaeological Consultant Services
Hoque & Associates, Inc.
Kenney Aerial Mapping
WEST Consultants

HUITT-ZOLLARS

Huitt-Zollars, Inc. / 4742 N. 24th Street / Suite 100 / Phoenix, Arizona 85016 / 602-952-9123 / Fax 602-952-9124

February 11, 2000

Mr. Tim Phillips, P.E.
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

Reference: Queen Creek/Sanokai Wash HMP and East Maricopa Floodway Capacity Mitigation Study – Contract FCD 98-25

Subject: East Maricopa Floodway Capacity Mitigation Report

Dear Mr. Phillips:

The East Maricopa Floodway (EMF) Capacity Mitigation Report is hereby submitted. This report, which includes revisions to the draft report based on District comments, contains the work completed under Change Order No. 1 to the prime contract. This change order covered preparation of a formal report documenting the findings, conclusions, and recommendations evolving from the study of capacity mitigation alternatives for the EMF.

The report consists of an Executive Summary, followed by the detailed engineering report. The Executive Summary contains a condensation of the essential elements of the work completed under the EMF study, while the following engineering report provides a more complete discussion.

Very truly yours,

Fred K. Duren, Jr., P.E., P.G.
Project Manager

ACKNOWLEDGMENTS

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Fred K. Duren

Registered Professional Engineer (Civil)
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ARIZONA, U.S.A.

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EXECUTIVE SUMMARY

This Executive Summary presents an overview of the East Maricopa Floodway (EMF) Capacity Mitigation Study report. It provides the principal findings of the study, while more detailed information is found in the following report. The reader is referred to the report to obtain details not covered in the Executive Summary.

INTRODUCTION

The EMF Capacity Mitigation Study was prepared under contract FCD 98-26 between the Flood Control District of Maricopa County (District) and Huitt-Zollars, Inc. Also included in this project is the Queen Creek/Sanokai Wash Hydraulic Master Plan (HMP) which is covered in a separate report.

PURPOSE OF STUDY

It has been found that the capacity of the EMF has been reduced to below the 100-year, 24-hour flood event due to changes in the tributary watershed. As a result, the District funded this study to develop concept-level planning information to mitigate the EMF's capacity deficiencies for the 100-yr, 24-hr flooding event.

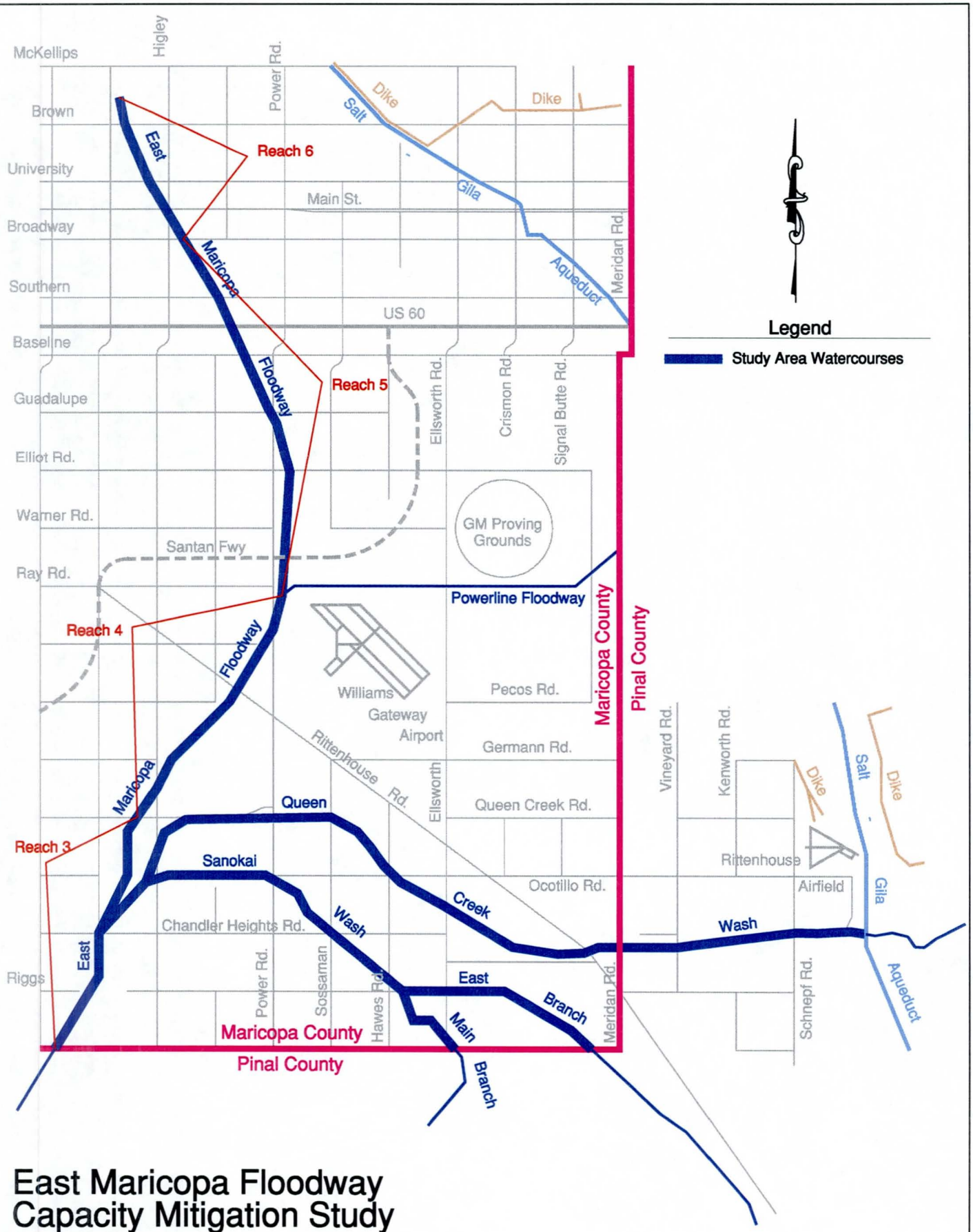
STUDY AREA

The EMF is a major drainage feature, conveying runoff from a large tributary area in eastern Maricopa County, as well as in western and northern Pinal County. The channel was completed in 1989 and was designed and constructed by the Soil Conservation Service (SCS). The floodway is approximately 27 miles long, extending from north Mesa to the Gila River. It is subdivided into six reaches, starting with Reach 1 at the confluence with the Gila River and extending northward to Reach 6 in Mesa. This study encompasses Reaches 3 through 6, which lie within Maricopa County (Figure ES1). Reaches 1 and 2 lie south of the study area within the Gila River Indian Community in Pinal County.

HYDROLOGY

In developing solutions to the EMF's capacity deficiency, preparation of new hydrology was required. Several prior studies provided EMF tributary hydrology; however, it was necessary to update and revise this hydrology to be internally consistent and to meet all current District hydrologic standards.

The study hydrology was developed using the U.S. Army Corps of Engineers (Corps) HEC-1 computer program in accordance with methods specified in the Districts' Drainage Design Manual, Volume I, Hydrology. Modifications made to the prior hydrology included: (1) utilizing the District's current loss-rate parameter estimation methodology; (2) adjusting certain subbasin boundaries and related hydrologic parameters; and (3) accounting for flow under existing development conditions, which was selected by the District as the condition upon which the hydrology should be based. Upon completion of these modifications, the hydrologic models were organized in a manner that would be useful for future watershed studies and local studies within the watershed areas.



East Maricopa Floodway Capacity Mitigation Study

Figure ES1: Study Limits

EMF Reaches 3, 4, 5, and 6.

EMFfig2.dwg

HYDRAULICS

A prior study provided a HEC-RAS computer model that was used as the basis for performing hydraulics analyses of the EMF. This model was utilized in conjunction with peak flows developed during the hydrologic analysis for the existing-conditions, 100-yr, 24-hr event to evaluate mitigation alternatives for the EMF.

The principal criteria used in evaluating the hydraulic capacity of the EMF was to contain peak discharges and maintain freeboard and clearance in accordance with SCS design requirements. The SCS criteria establishes minimum freeboard under both subcritical and supercritical flow regimes and clearance requirements at bridges and culverts.

DEVELOPMENT OF PROJECT ALTERNATIVES

The facilities that were evaluated to offset EMF capacity deficiencies included: (1) channel improvements, (2) detention basins adjacent to the EMF, and (3) detention basins within the watersheds tributary to the EMF. A constraint in developing various alternatives was the need to dramatically reduce peak discharges prior to Reach 2 (i.e., at Hunt Highway) to improve downstream conditions and provide freeboard in the downstream portion of Reach 3. As a result, the primary focus of the development of alternatives was on providing detention storage since channel improvements would not attain the flow attenuation necessary to meet this constraint.

PROCESS OF ALTERNATIVES DEVELOPMENT

The process of developing alternatives consisted of evaluating a number of potential project alternatives, comprised of combinations of the facilities described above, and eliminating those alternatives that were clearly infeasible or less attractive than others. Detention basin sites were located based on available land, prior studies, and presumed effectiveness. The opportunities for channel improvements were limited based on the hydraulic criterion described above. All potential alternatives developed during the study were presented in a meeting between the District, the City of Mesa, and Huitt-Zollars; and the most feasible alternatives selected for further refinement. An evaluation matrix was also presented as a method for selecting between the most feasible alternatives.

CHANNEL IMPROVEMENTS

As a result of an adverse channel slope through golf courses in the upper Reaches 5 and 6 located in Mesa, portions of the EMF did not meet minimum freeboard requirements; and a culvert at Higley Road and Main Street did not provide the minimum clearance requirements. Due to the lack of available land for detention sites in this developed area of the watershed, the deficiencies could only be resolved with channel improvements and is a common component of all the analyzed alternatives. While the 100-yr, 24-hr peak discharge upstream of the golf courses is contained within the channel, it is proposed that the channel be lined with soil cement and a 1.5-foot raised soil-cement embankment be constructed on both sides of the EMF to provide the required freeboard and lower the water surface elevation sufficiently to provide adequate clearance under the HigleyRoad/Main Street culvert. The District relaxed freeboard

requirements through the golf course areas; and, therefore, no changes were proposed through the golf courses.

DETENTION BASINS

Lower reaches of the EMF are located in less-developed areas than the upper reaches, which lie within the developed area of Mesa. As a result, there were opportunities for locating detention basins in the lower reaches, both adjacent to the EMF and within the outlying watershed areas. A number of different basin sites were included and evaluated in the various alternatives for capacity mitigation. Figure ES2 shows the locations of the various basins considered in the project alternatives.

EVALUATION MATRIX

An evaluation matrix consisting of eight criteria was developed to evaluate the alternatives. The eight criteria included: (1) Aesthetics/Landscaping/Recreation; (2) Biology; (3) Cost; (4) Culture; (5) Environment; (6) Implementability/Feasibility; (7) Land Planning; and (8) Public Acceptability. A range of point values was assigned to each criterion, with criteria deemed to have greater impact on alternative selection having a higher maximum point value.

PROJECT ALTERNATIVES

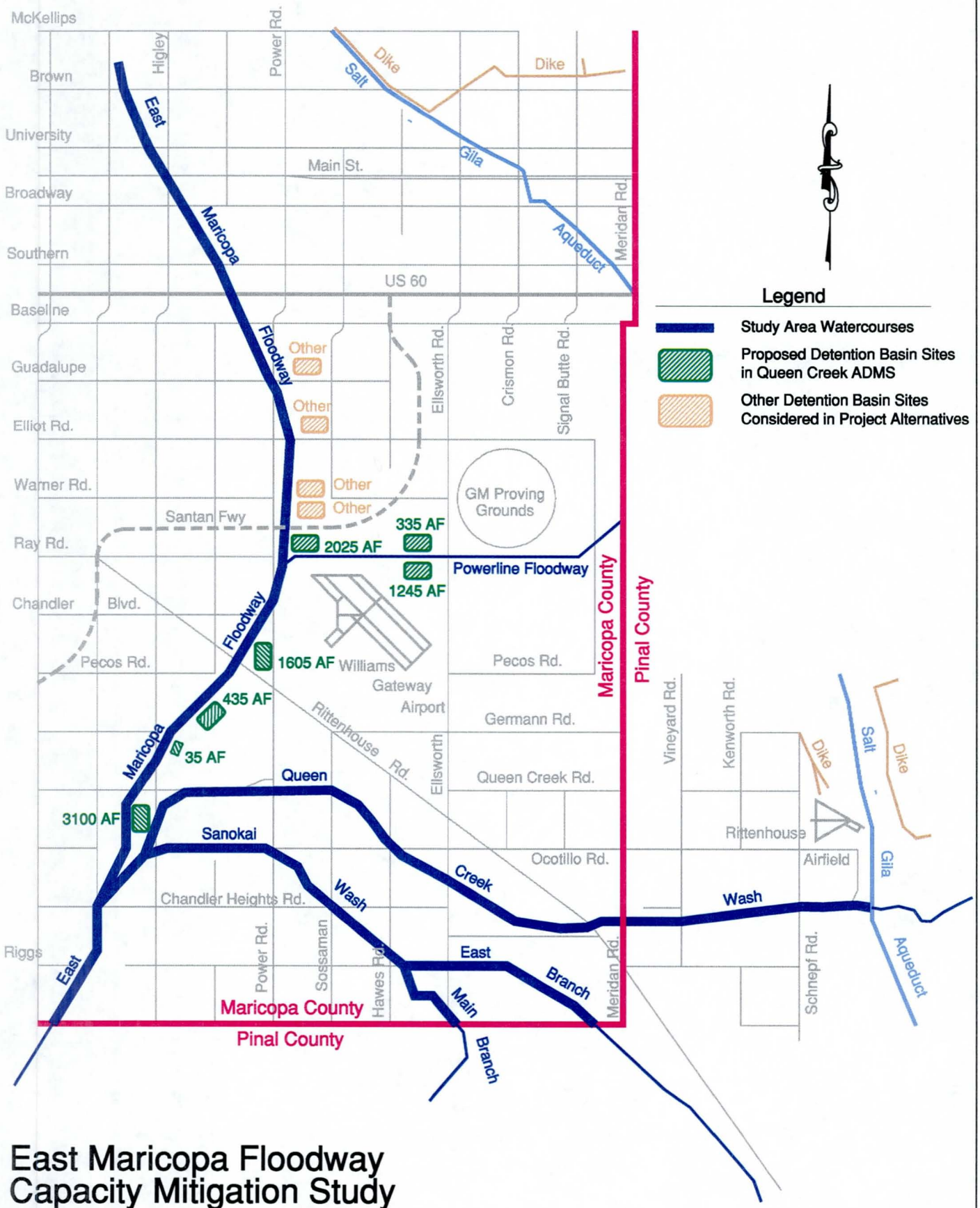
Five project alternatives were developed during the evaluation process of EMF capacity mitigation options. All of the alternatives included channel improvements between Broadway Road and Main Street, while each contained different configurations of detention basins.

PREFERRED ALTERNATIVE

Utilizing the evaluation matrix, Alternative 1C and 3 were selected as the most preferred. These alternatives are described as follows:

Alternative 1C

- Channel improvements between Broadway Road and Main Street
- 3330 acre-ft EMF basin at Chandler Heights Road (offline to the EMF and Queen Creek/Sanokai Wash)
- 1250 acre-ft EMF basin at Rittenhouse Road (offline to the EMF and the Rittenhouse Road Channel)
- 1060 acre-ft watershed basin at Ray Road (offline to the Powerline Floodway)
- 1090 acre-ft EMF basin at Knox Road
- 245 acre-ft watershed basin at Guadalupe Road (offline to the Guadalupe Channel)
- 6975 acre-ft of total detention storage by all detention basins



East Maricopa Floodway Capacity Mitigation Study

Figure ES-2: Detention Basin Sites Considered in Project Alternatives

Regional detention basins proposed in the Queen Creek Area Drainage Master Study and other detention basin sites considered in the EMF analyses

Alternative 3

- Channel improvements between Broadway Road and Main Street
- 3330 acre-ft EMF basin at Chandler Heights Road (offline to the EMF and Queen Creek/Sanokai Wash)
- 1250 acre-ft EMF basin at Rittenhouse Road (offline to the EMF and the Rittenhouse Road channel)
- 1060 acre-ft watershed basin at Ray Road (offline to the Powerline Floodway)
- 1315 acre-ft EMF basin at Knox Road
- 6955 acre-ft of total detention storage by all detention basins

Alternatives 1C and 3 are very similar, with the only significant difference being that Alternative 1C includes a detention basin at the Guadalupe location, which reduces the size of a downstream basin at Knox. Alternative 3 has a larger Knox Basin since the Guadalupe Basin is not included. Although both of these two alternatives were considered equivalent in overall benefit, Alternative 1C, which includes a basin at the Guadalupe site located partially on District-owned land, was considered to be slightly preferable to Alternative 3. Figure ES3 presents the components and basin volumes of Alternative 1C, while Table ES1 provides a more detailed summary of the principal components.

A capital cost estimate was prepared for Alternative 1C, as provided in Table ES2. A cost estimate was also prepared for Alternative 3, and it was found that the capital cost of Alternative 3 fell within the level of accuracy of that for Alternative 1C. Thus, without further refinement in the concept-level analysis performed in this study, there is no apparent differentiation between the costs of these two alternatives.

TABLE ES2

SUMMARY OF ESTIMATED CAPITAL COSTS

Total Project Capital Cost (by Basin or Improvement)	
Broadway-Main Street Channel Improvements	$1,668,670
Guadalupe Basin	$3,050,215
Knox Basin	$15,551,310
Ray Basin	$12,130,605
Rittenhouse Basin	$11,456,500
Chandler Heights Basin	$25,346,400
Total Estimated Project Capital Cost	**$69,203,700**

Total Project Capital Cost (by Type of Cost)	
Construction, Engineering & Contingency Costs	$55,068,700
Land Acquisition Costs	$14,135,000
Total Estimated Project Capital Cost	**$69,203,700**

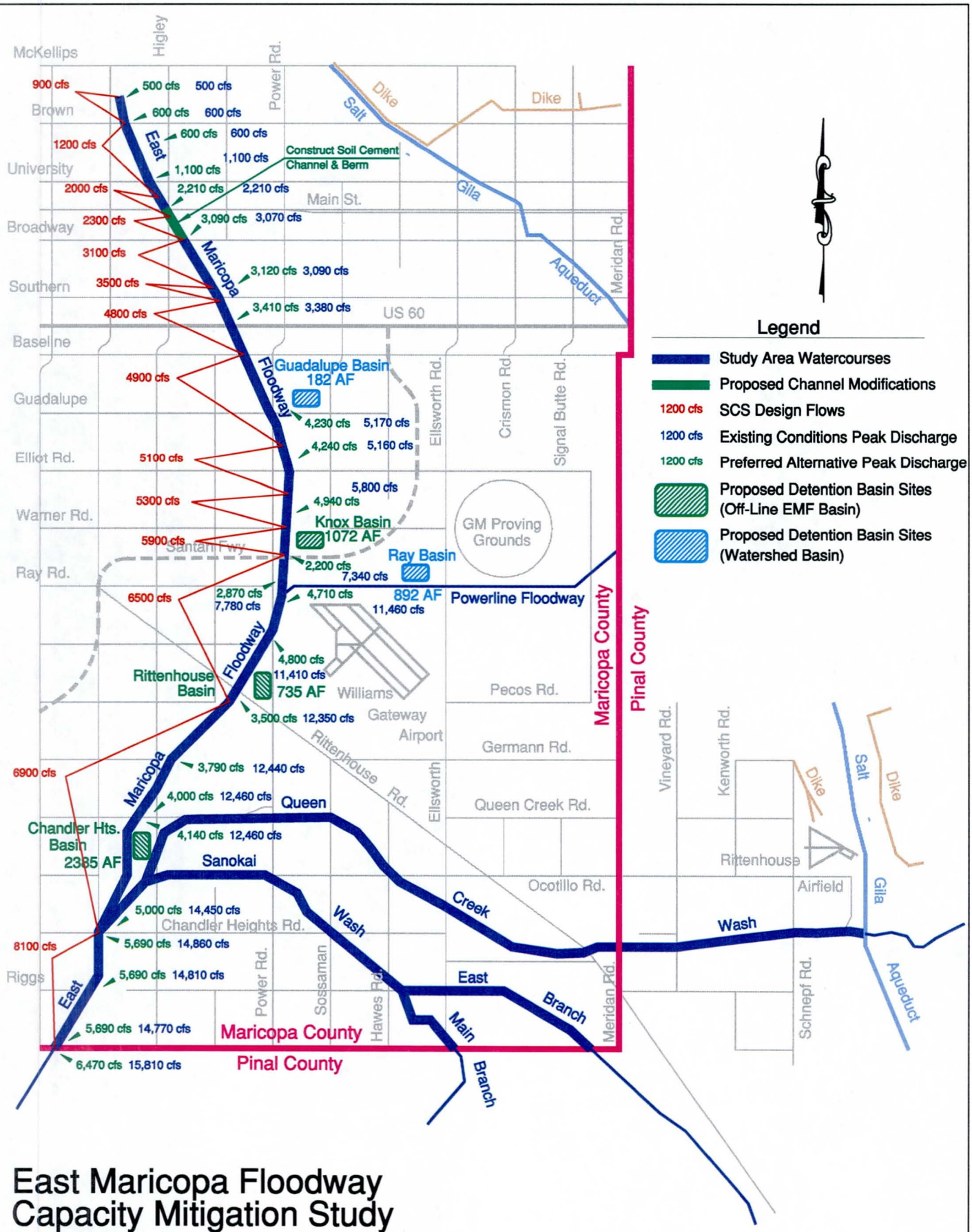
TABLE ES1

SUMMARY OF ALTERNATIVE 1C COMPONENTS

Component	Berm Length (ft)	Max. Levee Height (ft)	Length of Channel Improvement (ft)	Type Of Material	Basin Surface Area (acres)	Effective Storage Volume[1] (acre-ft)	Max. Basin Depth[2] (ft)	Max. Water Depth[2] (ft)	Estimated Side-Weir Lengths[3] (ft)	Detention Basin Outlet
EMF Channel Improvements between Broadway Road and Main Street	1290	1.5	2820	Soil Cement						
Guadalupe Basin (off Guadalupe Channel)					24	182	16.0	9.0	215	1-36" RCP
Knox Basin (north of San Tan Fwy.)					159	1072	10.8	7.0	1175	5-48" RCP
Ray Basin (off Powerline Floodway)					114	892	13.7	8.5	150	4-48" RCP
Rittenhouse Basin (off EMF and Rittenhouse Channel)					111	735	11.3	7.2	1435 (EMF) and 140 (R Road)	4-48" RCP
Chandler Heights Basin (off EMF and Queen Creek/ Sanokai Wash channel)					300	2385	14.3	8.5	575 (EMF) and 325 (QC)	5-60" RCP

1. Effective Storage Volume equals the estimated basin volume below the weir elevation (see Appendix C: Estimates – Basin Volumes Table).
2. Based upon estimated average elevations along the weir length and channel (see Appendix C: Estimates – Quantity Estimates for Side-Weirs Table).
3. See Appendix B: Hydraulics – Estimate of Side-Weir Lengths Based on Engels Side-Weir Equation Table.

As indicated previously in this Executive Summary, concept-level analyses were the basis for the evaluation of EMF capacity mitigation alternatives. As a result, several assumptions were made in developing and evaluating these alternatives. It is the intention of the District to prepare a follow-up, more-detailed analysis by performing a pre-design study, which will be based on the results of this concept-level study. In the preparation of the pre-design study, several of the assumptions and/or recommendations developed in the concept-level study will be refined. Although these refinements are not expected to alter the overall conclusions developed in the concept-level study, these refinements will allow for a more precise determination of key facility component sizes. Additionally, since as described above there is little differentiation between the benefits of Alternatives 1C and 3, it is recommended that Alternative 3 also be evaluated in more detail as part of the pre-design study.



East Maricopa Floodway Capacity Mitigation Study

ES-3: Preferred Alternative (Alternative 1C)

Alternative 1C - Channel modifications north of Broadway.
EMF basins at Knox, Rittenhouse, and Chandler Heights.
Watershed basins at Guadalupe and Ray (Powerline Floodway).

EMFfig5.dwg

SECTION 1 - INTRODUCTION

In October 1998, the Flood Control District of Maricopa County (District) contracted Huitt-Zollars, Inc., under Contract No. FCD 98-26, to study capacity mitigation measures for the portion of the East Maricopa Floodway (EMF) located within Maricopa County. The study was to be done as part of the Queen Creek/Sanokai Wash Hydraulic Master Plan (HMP) and EMF Capacity Mitigation Study. This report presents the results of the EMF Capacity Mitigation Study. The results of the Queen Creek/Sanokai Wash HMP are to be presented at a later date and in a separate report.

The EMF is one of the major regional outfalls for Eastern Maricopa County. Recent studies indicate that the floodway at some locations lacks the capacity to convey the existing conditions and future conditions 100-yr flood discharges. To insure the EMF provides the desired level of flood protection, measures need to be taken to increase its conveyance capacity or decrease peak discharges.

PURPOSE OF STUDY

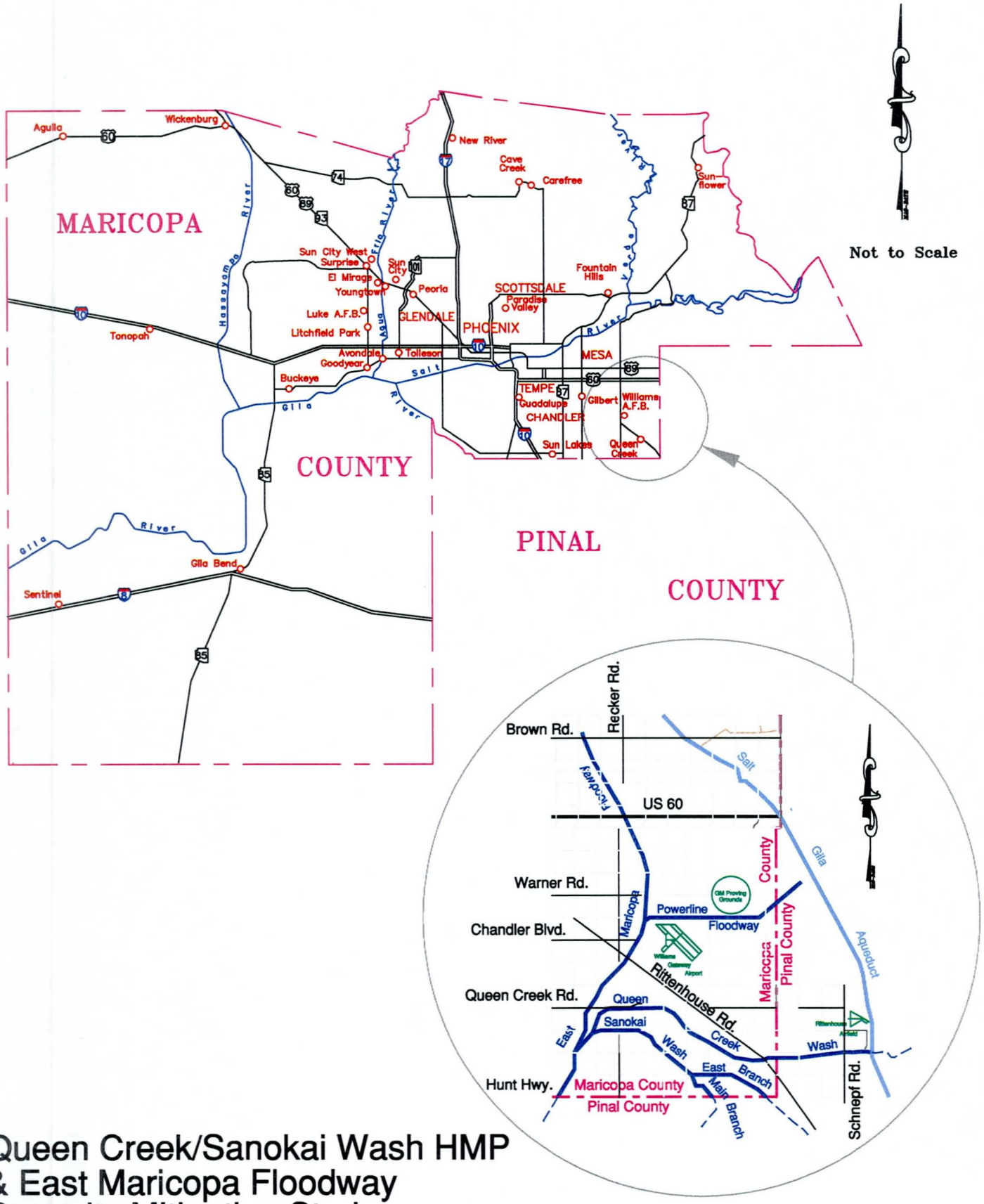
This is a concept study to develop and evaluate alternatives to resolve conveyance capacity inadequacies along the EMF within the study area and develop concept plans and a preliminary cost estimate for a preferred alternative. This report presents the preferred alternative and provides background information on the development and evaluation of the project alternatives. The results of this study are to serve as a basis for more detailed analysis and further development of potential EMF capacity mitigation measures.

STUDY AREA

The EMF was designed and constructed by the Soil Conservation Service to provide flood protection in the East Valley (Figure 1). Completed in 1989, it is now owned, operated, and maintained by the District. The floodway is approximately 27 miles long and runs parallel to the Roosevelt Water Conservation District (RWCD) irrigation canal. It extends from Princess Basin (above Brown Road) in north Mesa to the Gila River in Pinal County. It is primarily a compacted earthen trapezoidal channel, approximately 200 feet wide and ranging from eight to twelve feet in depth. There is an approximately one-mile concrete-lined reach in the vicinity of Williams Gateway Airport.

The EMF intercepts runoff from three major watersheds: Buckhorn-Mesa, Apache Junction-Gilbert, and the Williams-Chandler watersheds. These watersheds include portions of the City of Mesa, City of Chandler, Town of Gilbert, Town of Queen Creek, Maricopa County, Pinal County, and the Gila River Indian Community.

Several major drainage channels are tributary to the EMF. The Broadway Channel flows westerly and discharges into the EMF just south of Broadway Road. The Superstition Freeway Channel flows westerly and discharges into the EMF just north of the Superstition Freeway (US 60). The Guadalupe Channel flows westerly and discharges into the EMF just south of Guadalupe Road. The Powerline Floodway flows westerly and discharges into the EMF near Ray Road. The Rittenhouse Road Channel flows northwesterly and discharges into the EMF just



Queen Creek/Sanokai Wash HMP & East Maricopa Floodway Capacity Mitigation Study

Figure 1: Location and Vicinity Map

north of Rittenhouse Road. Queen Creek and Sanokai Wash flow westerly and discharge into the EMF just north of Chandler Heights Road.

The EMF is spanned by bridges and culverts at all major crossings. The proposed San Tan Freeway is planned to cross the EMF at Knox Road (between Ray Road and Warner Road) and continue east before turning north between Hawes Road and Ellsworth Road. New detention and drainage facilities associated with the proposed freeway will likely impact area hydrology; however, only conceptual drainage plans for have been developed to date.

STUDY LIMITS

The EMF was constructed in six reaches. Reach 1 is located at the tailwater, southern end of the EMF and discharges into the Gila River. Reach 6 is located at the headwater, northern end of the EMF and begins at the Princess Basin. This study encompasses Reaches 3, 4, 5, and 6, extending from the County Line at Hunt Highway to the Princess Basin, located just north of Brown Road, in Mesa (Figure 2). Reaches 1 and 2, located south of the Hunt Highway and in Pinal County, are not included in this study. However, consideration is given to ensure alternatives do not adversely impact these reaches.

PREVIOUS STUDIES

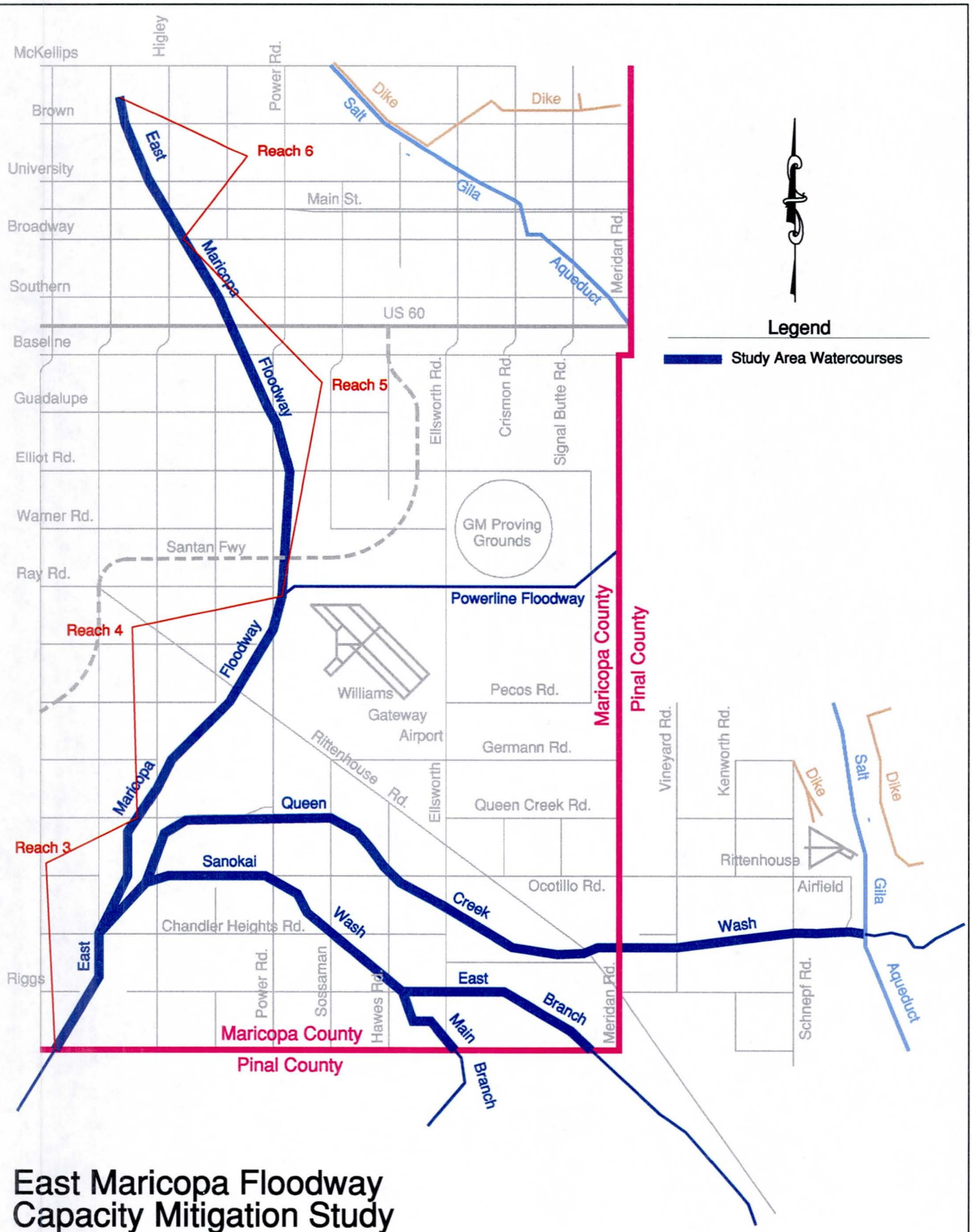
Several previous studies have been conducted in the area are identified below. For the studies used to development the design hydrology, a summary identifying the hydrologic methods and assumptions of each study is presented in the Hydrology Section of this report.

East Maricopa Floodway Capacity Assessment Study (HNTB, 1999)
This study assessed the conveyance capacity of the entire EMF for the existing conditions 100-yr discharge, the future conditions 100-yr discharge, and the SCS design discharge. The study also determined the conveyance capacity of the EMF under bank-full conditions.

East Mesa Area Drainage Master Plan (ADMP) (District/Dibble & Assoc., 1998)
This study determined the existing and future condition hydrology for the East Mesa area for planning purposes. It also identified drainage problems and proposed drainage facilities to provide flood protection in the East Mesa Area. Generally, the study area is bounded by the Central Arizona Project (CAP) canal to the north, District structures to the east (Powerline Flood Retarding Structure (FRS), Vineyard FRS, and Rittenhouse FRS), Queen Creek Road to the south and the EMF to the west

Queen Creek Area Drainage Master Study (ADMS) (Wood & Associates, 1991).
This study identified stormwater problems in the Queen Creek area and provides a master drainage plan to mitigate these problems. Generally, the study area is bound by the Goldmine and San Tan Mountains to the south, the EMF to the west, the CAP to the east, and the Powerline Floodway to the north.

Queen Creek/Sanokai Wash Hydraulic Master Plan (HMP) (Huitt-Zollars, under study).
The purpose of this study is to recommend drainage improvements that may be used by local agencies as a planning tool to guide future development in the area. The study



East Maricopa Floodway Capacity Mitigation Study

Figure 2: Study Limits

EMF Reaches 3, 4, 5, and 6.

EMFfig2.dwg

includes an update of the existing conditions hydrology for the Queen Creek watershed and the development of future conditions hydrology for the Queen Creek/Sanokai Wash watersheds. The study area includes the Queen Creek/Sanokai Wash watersheds located in southeast Maricopa County and includes part of northern Pinal County.

Sanokai Wash Floodplain Delineation Study (FDS) (Entellus, 1999)
This study developed the existing conditions hydrology for the Sanokai Wash watershed and delineated the Sanokai Wash floodplain between Higley Road and Riggs Road. The study area includes the Sanokai Wash watershed located in the southeast corner of Maricopa County and includes part of northern Pinal County.

STUDY CRITERIA

Being a conceptual study, the developed alternatives for EMF capacity mitigation and the preferred alternative are based upon preliminary analyses and will require more detailed study prior to actual implementation. However, the District established several initial design criteria in the scope of work. Additional criteria were established during the course of the study in subsequent meetings and discussions. These criteria are presented in Table 1.

TABLE 1

EMF DESIGN CRITERIA

Criteria	Description
Basin Drainage	All proposed detention basins must drain within 36 hours of flow cessation.
Design Hydrology	100-yr, 24-hr event, existing development conditions
Downstream Impact	Peak discharges in the EMF at Hunt Highway will be reduced at least to the SCS design discharge to ensure Reaches 1 & 2 will not be adversely impacted by any preferred improvements.
Freeboard	SCS required freeboard criteria: • Subcritical conditions, at least 20% of the energy head • Supercritical conditions, at least 25% of the flow depth • A minimum of 12 inches of clearance from the calculated water surface elevation and the low chord or top of culvert
Golf Course Modification	Channel improvements will not made through golf courses

During the course of the study, a number of important assumptions were also made which affected the project alternatives and results. These assumptions are described is subsequent sections of this report and should be considered upon further development of any project alternative

EMF UNDER EXISTING CONDITIONS

According to the EMF Capacity Assessment Study, there are a number of locations where the EMF has insufficient conveyance capacity to contain the existing conditions runoff. The study

assessed conveyance capacity based upon the top of bank elevations, but did not consider any freeboard requirements. To provide freeboard, the capacity of the EMF is significantly reduced and the extent of EMF inadequacies greatly increased. The existing conditions peak discharges and the SCS Design Capacity flows along the EMF are shown in Figure 3.

SECTION 2 – HYDROLOGY

This section describes the development of peak discharges used to prepare recommendations for mitigating EMF capacity deficiencies. It presents discussions of the hydrology developed in prior studies and the revisions made to make it suitable for this study.

INTRODUCTION

The scope of this study does not include a detailed hydrologic study nor an extensive review and revision of hydrology developed in other studies. Based on direction from the District, it was assumed that previously developed hydrology was acceptable for the purposes of this study and that modifications would generally be limited to changes in land-use conditions and updating rainfall loss parameters in the Queen Creek ADMS hydrology.

The District established the 100-yr, 24-hr existing conditions as the design hydrology for this study. This condition was specified by the District because it represents a conservative hydrologic condition. Any subsequent development of EMF capacity mitigating measures based upon future conditions hydrology are expected to be smaller in magnitude due to detention and drainage improvements required as part of future development within the watersheds.

The 100-yr, 24-hr existing conditions EMF hydrology was derived from several previous studies and updated for changes in hydrologic parameters and methodology as required by the District. The initial hydrology was prepared by the District as part of the East Mesa ADMP. It was then modified to include the Sanokai Wash FDS existing conditions hydrology and the updated Queen Creek ADMS existing conditions hydrology. The new existing conditions EMF hydrology is used as a basis to model and evaluate conceptual project alternatives.
Development of the Existing Conditions Hydrology

The 100-yr, 24-hr existing conditions hydrology for the EMF provides the most currently available hydrology from approximately the EMF to the CAP and from McKellips Road to the Goldmine/San Tan Mountains. Because the hydrology is a combination of several different studies operating under different assumptions and methodologies, some changes were necessary to combine the models into a coherent model of the study area. These changes, in some cases, produced results that differ from the separate study hydrology. The differences, however, are unavoidable.

PREVIOUS STUDY METHODOLOGIES

A summary of the hydrologic methods in each study used to develop the existing conditions hydrology is presented chronologically below. While some studies may include the development of various hydrologic conditions and rainfall events, all studies included the development of a 100-yr, 24-hr existing conditions hydrology.

Queen Creek Area Drainage Master Study (Wood & Associates, 1991)
Methods and assumptions are not all currently acceptable to the District. The hydrology was, therefore, updated as part of the Queen Creek/Sanokai Wash HMP.

Precipitation:	NOAA Precipitation-Frequency Atlas for Arizona (NOAA,1973)
	NOAA, NWS HYDRO-40 Depth-Area Reduction Factors
Rainfall Losses:	SCS Curve Numbers Loss Rate
Hydrograph:	SCS Dimensionless Unit Hydrograph
Routing:	Muskingum

East Mesa Area Drainage Master Plan (FCDMC, 1998)
This study includes some unmodified hydrology from the QC ADMS.

Precipitation:	NOAA Precipitation-Frequency Atlas for Arizona (NOAA,1973)
	Depth-Area Reduction Factors (FCDMC, 1996)
Rainfall Losses:	Green and Ampt Infiltration Equation
Hydrograph:	S-Graph Unit Hydrograph Method
Routing:	Normal Depth/Modified Puls

Sanokai Wash Floodplain Delineation Study (Entellus, 1997).

Precipitation:	NOAA Precipitation-Frequency Atlas for Arizona (NOAA,1973)
	Depth-Area Reduction Factors (FCDMC, 1996)
Rainfall Losses:	Green and Ampt Infiltration Equation
Hydrograph:	Clark Unit Hydrograph Method
Routing:	Normal Depth/Modified Puls

Queen Creek/Sanokai Wash Hydraulic Master Plan (Huitt-Zollars, under study).
This study is to include updates to the separate hydrology developed in different studies. For the Queen Creek watershed, this study updates the 100-yr, 24-hr hydrology developed in the Queen Creek ADMS for both existing and future land-use conditions. For the Sanokai Wash watershed, this study utilizes the Sanokai Wash FDS 100-yr, 24-hr existing conditions hydrology with some minor updates and then revises the hydrology for future land-use conditions.

Queen Creek Watershed (updated from QC ADMS)

Precipitation:	NOAA Precipitation-Frequency Atlas for Arizona (NOAA,1973)
	Depth-Area Reduction Factors (FCDMC, 1996)
Rainfall Losses:	Green and Ampt Infiltration Equation
Hydrograph:	S-Graph Unit Hydrograph Method
Routing:	Muskingum

Sanokai Wash Watershed (updated from Sanokai Wash FDS).

Precipitation:	NOAA Precipitation-Frequency Atlas for Arizona (NOAA,1973)
	Depth-Area Reduction Factors
Rainfall Losses:	Green and Ampt Infiltration Equation
Hydrograph:	Clark Unit Hydrograph Method
Routing:	Normal Depth/Modified Puls

STUDY METHODOLOGY

The study hydrology is modeled using the U.S. Army Corps of Engineers HEC-1 computer program (Version 4.1, dated June 1998). Hydrology was updated or developed using methods as described in the Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology (hereon referred to as DDM-V1). The Drainage Design Menu System (DDMS), developed by the District, was used to update or develop new hydrologic parameters as necessary.

EXISTING CONDITIONS HYDROLOGY PARAMETER ESTIMATION

Introduction. To update and revise the hydrology from previous studies, the estimation of new hydrology parameters was necessary. The estimation of hydrologic parameters was limited to the Queen Creek ADMS areas where it was necessary to develop new existing conditions hydrology as part of the Queen Creek/Sanokai Wash HMP or where it is necessary to update previous study methods as required by the District. Previous studies should be reviewed for discussion of the estimation of existing conditions hydrologic parameters in other watersheds. Summary tables of hydrologic parameters prepared as part of the Queen Creek/Sanokai Wash HMP are presented in Appendix A.

Subbasin Boundaries. Generally, the subbasin boundaries used for developing hydrology in the EMF Capacity Mitigation Study are those defined in the previous studies; however, some boundaries have been changed to resolve differences between studies. In addition, some subbasins have been split to better reflect existing conditions or for modeling purposes. The subbasin boundaries are shown in the HEC-1 Hydrology Maps provided along with this report. Smaller, 11 x 17-inch copies of the HEC-1 Hydrology Maps are provided in Appendix A.

FCDMC DDMS Computer Program. The District developed DDMS to assist in calculating hydrologic parameters and developing hydrology models. The DDMS contains several programs that calculate the subbasin parameters and compile HEC-1 subbasin data. The DDMS was used to update the subbasin parameters in the existing conditions hydrology for this study. The DDMS files used to update or develop new hydrologic parameters for both the existing and future land use conditions are provided in the project CD. A summary of some hydrologic parameters is provided in Appendix A.

Rainfall Parameters. The 100-yr, 24-hr point rainfall depths are selected from the NOAA Precipitation-Frequency Atlas for Arizona Isopluvials (NOAA, 1973) as provided in the DDM-V1. The point rainfall is converted to an equivalent uniform depth of rainfall over the watershed area using the 24-hour duration, depth-area reduction factors as defined in the DDM-V1.

Subbasin Parameters. Several different subbasin parameters are required for input to the DDMS. Development of this input is described below:

Soils. The soil type or map unit is critical in determining the amount of infiltration and runoff resulting from a rainfall event. The Soil Survey of Eastern Maricopa County and

Northern Pinal Counties Areas, Arizona [USDA, 1974] identifies the soil map units for most of the watershed area and was used to estimate soil distributions in the subbasins.

The District, which has digitized much of the soil survey mapping in Eastern Maricopa County, provided soil information for most of the subbasins in Maricopa County. For the remaining subbasins, soil distributions were estimated from hard copies of the soil survey.

The soil survey, however, did not completely cover the watershed and, in some areas, no soil information was available. If the soil survey did not completely cover a subbasin, it was assumed that the distribution of soil for the known portion of the subbasin applied for the entire subbasin. If the subbasin was outside of the survey area and no soil information was available, an estimate of the soil distribution was made based upon surrounding subbasins and aerial photos.

Land Uses. Land use is another important factor affecting the amount of infiltration and runoff resulting from a rainfall event. In addition, land use can greatly effect the timing of flow through a subbasin. Land uses are classified by type of development, each with different hydrologic parameters. A list of land use types and the associated hydrologic parameters was developed based upon previous studies and guidelines in the DDM-V1 (Table 2). Most of the existing land use information for the subbasins was provided by the District. When information was not provided, existing land use was estimated from aerial photographs or from field observation.

Lag Times. The S-Graph Method is used to develop unit hydrographs for the subbasins according to the procedures described in the DDM-V1. This method requires an estimation of subbasin runoff lag times based upon the length of the longest water course, the length along watercourse to subbasin centroid, the watercourse slope, and the mean roughness for all channels in the basin. Lengths and slopes were estimated using USGS quadrangle maps. The DDMS program estimates the mean roughness value based upon land use and the associated roughness values. The subbasin S-Graph Type (Phoenix Valley, Phoenix Mountain, Desert/Rangeland, and Agricultural) is based upon the topographic and vegetative characteristics of the subbasin as described in the DDM-V1.

Loss Parameters. The Green and Ampt method is used, as described in the DDM-V1, to update rainfall loss estimates in the Queen Creek ADMS . This method uses the soil characteristics and land use information (impervious area) to estimate the amount of infiltration and runoff resulting from a rainfall event based upon the soil moisture conditions and the hydraulic conductivity.

Routing Parameters. Muskingum Routing is the routing method used in the Queen Creek ADMS. These routing parameters were retained unless it was necessary to account for changes in subbasin boundaries or known routing changes. For consistency, when adjustments were necessary, the assumptions and parameters used in the Queen Creek ADMS were used unless considered unreasonable.

TABLE 2

LAND-USE HYDROLOGIC PARAMETERS

Land Use	DTHETA	Vegetative Cover	RTIMP %	IA (in)	Kn	Kb Roughness
Desert	Dry	25	0	0.35	0.03	Low
Open	Dry	10	0	0.10	0.02	Min
Vacant	Dry	10	0	0.35	0.09	Hi
Rural	Normal	30	5	0.30	0.05	Low
Very Low Density Residential (VLDR)	Normal	30	5	0.30	0.05	Low
Low Density Residential (LDR)	Normal	50	15	0.30	0.05	Low
Medium Density Residential (MDR)	Normal	50	30	0.25	0.05	Low
High Density Residential (HDR)	Normal	50	45	0.25	0.05	Low
Industrial (Ind)	Normal	60	55	0.15	0.03	Min
Water	Wet	0	0	0.00	1.00	Hi
Neighborhood Retail (NbrhdRet)	Normal	75	80	0.10	0.02	Min
Park	Normal	90	0	0.20	0.10	Hi
Public	Normal	75	80	0.10	0.02	Min
Institutional (Institut)	Normal	75	80	0.10	0.02	Min
School	Normal	80	45	0.29	0.05	Hi
Office	Normal	75	80	0.10	0.02	Min
Agricultural – Orchards (Ag-Orch)	Wet	85	0	0.50	0.10	Hi
Agricultural - Row Crops (Ag-Row)	Wet	85	0	0.50	0.10	Hi
Transportation	Normal	75	80	0.10	0.02	Min

EXISTING CONDITIONS HYDROLOGY MODELS

The 100-yr, 24-hr existing conditions hydrology for Reaches 3 through 6 of the EMF is comprised of five HEC-1 models. Four "watershed" models evaluate the EMF hydrology for the specific watershed areas. A fifth "routing" model uses the results of the four "watershed" models and routes the peak discharges along EMF Reaches 3 through 6. The 100-yr 24-hr existing conditions models are identified in Table 3 and are provided in the project CD.

TABLE 3

100-YR, 24-HR EXISTING CONDITIONS EMF HYDROLOGIC MODELS

Filename	Description	Model Dependent Upon*
X-NWMESA.DAT	NW Mesa watershed area	-
X-NEMESA.DAT	NE Mesa watershed area	-
X-SEMESA.DAT	SE Mesa watershed area	X-NWMESA and X-NEMESA
X-QCSW.DAT	Queen Creek/Sanokai Wash watershed area	-
X-ROUTE.DAT	Routes discharges along EMF Reaches 3-6	All models

* Indicates the models that the particular model depends upon for information. These models must be run prior to running that particular model.

It is important to note that the "watershed" models do not correctly route flow, nor do they import all the hydrographs necessary to evaluate flows in the EMF. To correctly evaluate flow in the EMF, the four "watershed" models should be run and then the "routing" model run to evaluate the peak discharges in the EMF. The EMF "routing" model imports all the necessary hydrographs through a TAPE21 file and correctly routes flow in the EMF.

The following steps should be taken to correctly run the existing conditions models for analysis of the EMF:

1. Delete any previously existing TAPE21 file prior to running any models;
2. Run models (order does not matter): X-NWMESA.DAT; X-NEMESA.DAT; X-QCSW.DAT
3. Run model X-SEMESA.DAT specifying X-NEMESA.DSS as the DSS file (default would be XSEMESA.DSS);
4. Run model X-ROUTE.DAT

Existing Conditions EMF Hydrology Results. The 100-yr, 24-hr existing conditions peak discharges along the EMF are presented in Figure 3 along with the SCS Design Discharges. The HEC-1 models are provided in the project CD. A summary of the existing conditions results are provided in Appendix A.

Assumptions. A number of assumptions were necessary in order to combine hydrologic models from a number of different studies. The most significant assumptions include:

- Previous hydrologic models reasonably described the drainage characteristics for their corresponding areas without need for modification (with the exception of the Queen Creek ADMS hydrology).
- Input hydrographs used in previous studies for upstream flood retarding structures are reasonable.
- The use of Depth-Area reduction factors in watersheds with numerous flow splits or diversions requires careful attention to insure the appropriate reduction factors for the point rainfall are used at downstream concentration points. It was decided by the District to hard code contributing areas at only two concentration points in the existing conditions hydrology

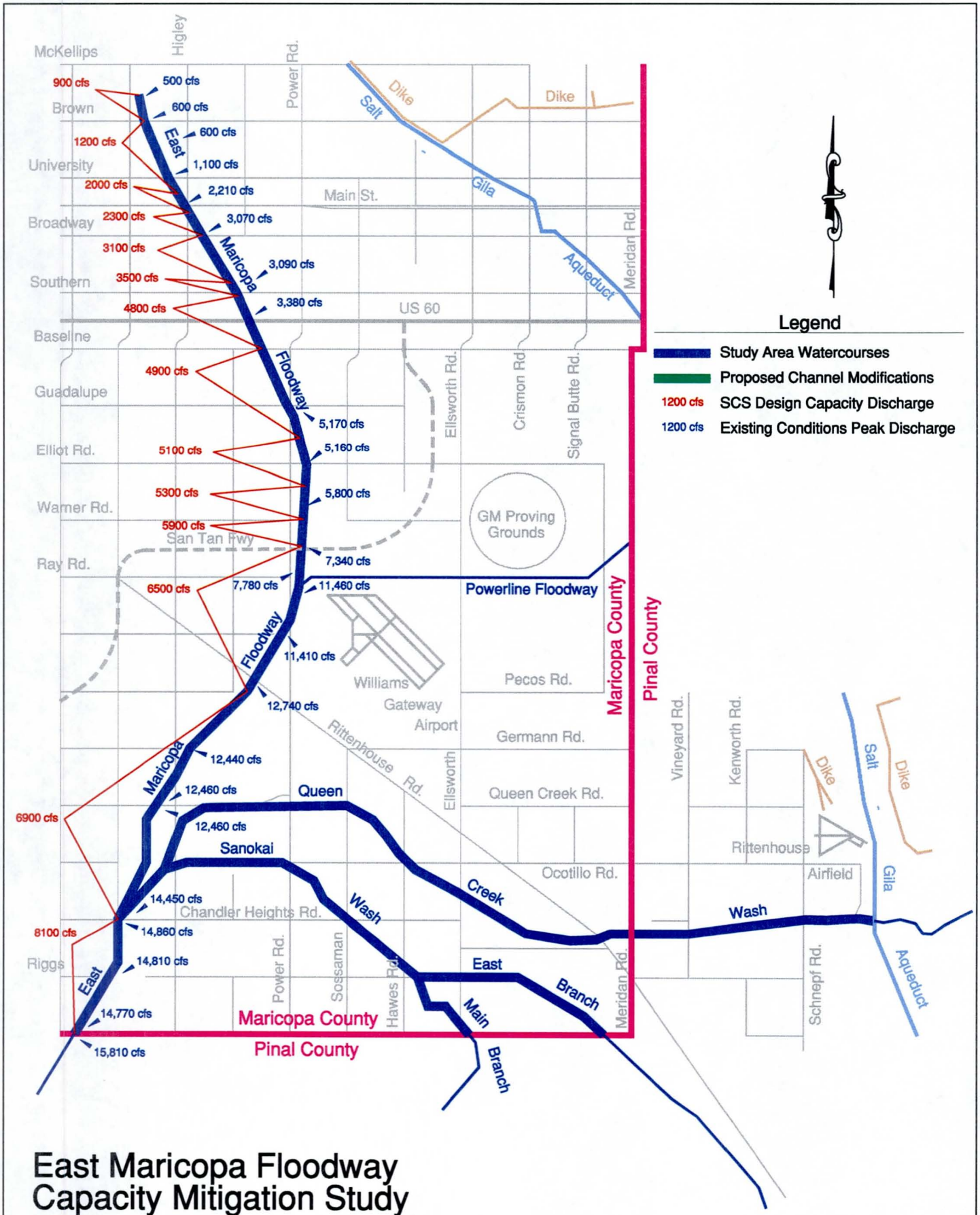


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Figure 3: SCS Design Flows and Existing Conditions Peak Discharges

The SCS Design Discharge and Existing Conditions Peak Discharges for EMF Reaches 3 through 6.

EMFfig3.dwg

due to diversions in the Sanokai Wash hydrology model (included in X-QCSW.DAT). The two concentration points are located at the EMF/Queen Creek confluence (CO510 in X-QCSW.DAT) and the EMF/Hunt Highway (south) confluence (CO612 in X-QCSW.DAT).

Considerations for Model Updates. In using these models for other hydrologic studies, several issues should be considered for further investigation. These include:

- Input hydrographs for upstream flood retarding structures should be reviewed in detail.
- Flow diversions occur not only in the Sanokai Wash hydrology but also in the East Mesa hydrology. Any concentration points with upstream flow diversions should be reviewed to ensure the appropriate depth-area reduction factors are used for the point rainfall. This may require hard-coding drainage areas at all affected concentration points.

Future Conditions Hydrology. The EMF was not analyzed under future conditions; however, as stipulated in Change Order No. 1, new future conditions hydrology for the Queen Creek and Sanokai Wash watersheds, developed as part of the Queen Creek/Sanokai Wash Hydraulic Master Plan, was incorporated into the EMF future conditions hydrology. The updated EMF future conditions hydrology was submitted to the District separate from this report. The future conditions DDMS files along with a Future Land Use Map for the Queen Creek and Sanokai Wash watersheds are provided in this report. Summary tables of the hydrologic parameters and a Future Land Use/General Plan Map are provided in Appendix A. The future conditions DDMS files are provided in the project CD.

SECTION 3 - HYDRAULIC ANALYSIS

INTRODUCTION

Subsequent to development of the updated, revised peak discharges for the EMF, hydraulic analyses were conducted to evaluate alternative improvements. The criteria used in preparing the hydraulic model are discussed in this section of the report.

The existing conditions hydraulic analyses for this study are based upon six hydraulic models developed as part of the EMF Capacity Assessment Study. Each model covers one of the six EMF reaches. This study only includes Reaches 3 through 6; however, the models for Reaches 1 and 2 are required in order to estimate the starting water surface elevation for Reach 3.

METHODOLOGY

The study hydraulics are modeled using the U.S. Army Corps of Engineers, HEC-RAS computer program (Version 2.1, dated Oct. 1997). The hydraulic model was originally developed as part of the EMF Capacity Assessment Study by HNTB. For details on the development of the hydraulic parameters and HEC-RAS model, the HNTB Capacity Mitigation Study Report should be reviewed.

HYDRAULIC MODELING

The principal design criterion for the hydraulic analyses is the need to contain peak discharges and provide sufficient freeboard to meet SCS requirements. SCS freeboard criteria requires freeboard of at least 20 percent of the energy head in subcritical flow conditions or 25 percent of

the calculated flow depth in supercritical flow conditions. At bridges or culvert structures, a minimum clearance of 12 inches is required between the calculated water surface elevation and the low chord of a bridge or the top invert of a culvert.

Because of the mild grade and low channel velocities throughout the majority of the study reaches, measures to prevent excessive erosion are not considered necessary, nor are there any indications of existing erosion control problems along the EMF.

RESULTS OF THE EMF CAPACITY ASSESSMENT STUDY

Because of the lack of freeboard requirements and the changes in the existing conditions EMF hydrology, the results of the EMF Capacity Assessment Study were of limited use in this study. However, the study did indicate that, under the existing conditions, the EMF could not provide the level of flood protection desired by the District. A summary table of the existing conditions hydraulic results showing the peak discharges, calculated water surface elevations and the available freeboard is provided in Appendix B.

GENERAL ASSUMPTIONS

The EMF flows through the Leisure World and Superstition Golf Courses that are between Broadway Road and Guadalupe Road. According to the EMF Capacity Mitigation Study, an n-value of 0.045 was used through the golf courses because they are not maintained by the District. However, the study also acknowledges that a more appropriate n-value for a well-maintained golf course is 0.035. For purposes of this study, it was felt that an n-value of 0.045 is overly conservative and a value of 0.035 is more appropriate given that the golf courses are well maintained.

SECTION 4 - DEVELOPMENT OF PROJECT ALTERNATIVES

After development of hydrologic models for the EMF, analyses were conducted of alternatives for mitigating capacity deficiencies that had been identified. This section describes the process of developing the project alternatives and the subsequent evaluations of those alternatives.

INTRODUCTION

Project alternatives considered both channel improvements and flow attenuation through detention. Alternatives to increase channel capacity through channel improvements considered changes in the cross section, slope, and material. Alternatives to reduce peak discharges in the channel considered detention of runoff from the watershed and the detention of flow from the EMF.

Based upon the preliminary analyses of various combinations of channel improvements and flow attenuation, the most effective elements were considered in the development of subsequent project alternatives. The most attractive project alternatives were evaluated in further detail and one was selected as the preferred alternative. The preferred alternative was developed further through conceptual plans and preliminary cost estimates.

PROCESS OF ALTERNATIVES DEVELOPMENT

The initial step in developing project alternatives was to consider the alternative constraints. Early in the development of the project alternatives, the District agreed that it was not appropriate to ignore downstream Reaches 1 and 2 and that channel improvements (if proposed) should not be simply made to Hunt Highway and then stopped as this could adversely affect the downstream reaches. Therefore, flow attenuation was necessary and the SCS Design Capacity flows were considered an appropriate goal for initial attenuation. It was apparent that flow attenuation of the necessary magnitude (i.e., found to be in excess of 7000 cfs) could not be accomplished solely through channel improvements. In fact, upon further analysis, it was revealed that it is necessary to reduce flows below the SCS Design Capacity flows in order to provide the required SCS freeboard at the beginning of Reach 3. Therefore, an alternative consisting solely of channel improvements was not feasible and, therefore, not considered.

Preliminary analyses were run to evaluate detention basin sites located throughout the EMF watershed. The basin sites were limited to undeveloped areas and areas considered hydrologically significant. The location of potential basins included sites proposed in previous studies. The most effective and practical sites were offline basins to the EMF or offline basins to major tributary channels, in particular the Powerline Floodway, the Guadalupe Channel, the Rittenhouse Road Channel, and Queen Creek/Sanokai Wash.

Analyses also indicated that backwater resulting from major tributary inflows spaced along the EMF significantly reduced its conveyance capacity. The backwater effect meant wider channel cross sections or other channel improvements would be much less effective in reducing water surface elevations and providing freeboard and that even with channel improvements, flow attenuation would still be necessary along the lower EMF reaches. It became apparent that sufficient flow attenuation could only be accomplished through several large regional detention basins spaced along the EMF. The need for detention and the resulting decrease in backwater made channel improvements though Reaches 3, 4, and 5 unnecessary.

Reach 6, located north of Broadway Road, is the only reach entirely located in a well-developed urban area, making large detention basins impractical and channel improvements necessary for mitigating measures. While the EMF through this reach was shown to contain the existing conditions peak discharges, backwater, resulting from an adverse channel slope in a golf course located downstream of Reach 6, increased water surface elevations to the extent that freeboard and clearance requirements were not met.

Based upon these results and observations, a number of alternatives were developed and evaluated. The most promising alternatives were then presented at meetings between the District, the City of Mesa, and Huitt-Zollars. The alternatives were further evaluated and subsequently eliminated or refined based upon meeting comments. At the final meeting, the alternatives were compared using a matrix consisting of eight evaluation criteria. Ultimately, a preferred alternative was selected for subsequent development of conceptual plans and preliminary cost estimates.

CHANNEL IMPROVEMENTS

As indicated previously in this report, a separate alternative to include only channel improvements was not feasible. In the upstream reaches, however, channel improvements were found appropriate to solve specific local capacity deficiencies.

Although the EMF between Broadway Road and Main Street was shown to contain the existing conditions peak discharges, preliminary analyses indicated that backwater, resulting from an adverse channel slope in a golf course located downstream, increased water surface elevations to the extent that freeboard along this reach and clearance requirements at the Higley Road/Main Street culvert were not met. Due to the lack of effective undeveloped local detention basin sites in the area, channel improvements were the only option for a short length of the EMF between Broadway and Main Street. These channel improvements are a common component of all the proposed alternatives.

It was found that by lining the channel to decrease channel roughness and lower water surface elevations, sufficient clearance could be obtained through the Higley Road/Main Street culvert. However, the water surface elevations could not be reduced sufficiently to provide all the required freeboard downstream of the culvert. Widening the channel proved to be ineffective due to backwater. Since the EMF can contain the existing conditions peak discharges, it was determined that a small erosion-resistant embankment, approximately 1.5 feet high, would be required to provide freeboard.

While channel improvements is a common component of all the proposed alternatives, the conceptual design of the improvements was deferred until the selection of the preferred alternative, as described in the Preferred Alternative Section.

DETENTION BASINS

In recognition of the need to provide peak flow reduction to mitigate most EMF deficiencies, the focus of EMF capacity mitigation was primarily on the selection of detention basins (channel improvements were proposed only where feasible and detention was not possible). The following section describes the methodology used in evaluating detention basins for alternatives development.

Introduction. A number of project alternatives were evaluated to determine the potential of different detention basin locations, sizes, types, and methods. Basin locations and sizes were limited by the availability of undeveloped property. Different detention basin types and methods were identified as either watershed or EMF basins and either inline or offline basins. Basins are modeled by diverting flow into a basin with no outflow. All basins are sized to store the entire diverted volume and basin outlets are considered closed until the peak discharges have passed.

Watershed Basins. Watershed basins refer to basins that do not detain inflow directly from the EMF and detain inflow solely from major channels tributary to the EMF. Other basins located within the watershed away from the major tributaries were considered; however, they were determined to be ineffective in reducing peak discharges in the EMF.

EMF Basins. EMF basins refer to basins that detain inflow directly from the EMF and, in some cases, may also detain inflow from tributary channels. These basins are located immediately adjacent to the EMF.

Inline Basins. Inline refers to basins in which the entire channel flows directly into the basin. These basins generally do not require elaborate inflow structures and are commonly used for small flows and localized detention. They may also be used as large flood retarding structures to collect and concentrate drainage over a large area (i.e. Sanokai Wash Flood Retarding Structure).

Offline Basins. Offline refers to basins in which flow is diverted from the channel and into a basin once the channel flow exceeds a specific water surface elevation. These basins require more elaborate inflow structures, but tend to be significantly smaller than inline basins because flow bypasses the basin during periods of low flow and flow is diverted into the basin only during periods of higher flow. The inflow structures for the proposed basins are side-weirs cut into the side of the channel. A discussion of side weirs is presented in the Preferred Alternatives section.

EVALUATION MATRIX

To assist in evaluating and comparing project alternatives, an evaluation matrix was developed consisting of eight criteria with a range of point values. The higher the point values, the better the alternative. The matrix was developed in cooperation with the District in an attempt to objectively evaluate alternatives for a wide range of flood control and non-flood control criteria while still emphasizing that the purpose of the alternative is flood control. The evaluation matrix is presented in Table 4.

TABLE 4

EVALUATION MATRIX

Evaluation Criterion	Range Of Point Value		
Aesthetics/Landscaping/Recreation	1	to	8
Biology	1	to	5
Cost	1	to	10
Culture	1	to	5
Environment	1	to	8
Implementability/Feasibility	1	to	10
Land Planning	1	to	10
Public Acceptability	1	to	10

SECTION 5 -PROJECT ALTERNATIVES

INTRODUCTION

This section describes the development of alternatives for EMF capacity mitigations. Combinations of various detention basins were the basis for alternatives development.

Numerous alternatives were developed and a number of potential basin sites evaluated with those found to be less favorable eliminated from consideration. (See Figure 4)

Five project alternatives were developed and presented at a meeting between the District, the City of Mesa, and Huitt-Zollars for consideration as the preferred alternative. Each alternative mitigates the EMF capacity deficiency based on the SCS freeboard criteria and reduces peak discharges at Hunt Highway (downstream end of study area) to below the SCS design capacity flows (see Study Criteria). The alternatives consist of different combinations of the most effective detention basin sites, but all alternatives include channel improvements between Broadway Road and Main Street. The key components of the project alternatives are summarized in Table 5 and discussed briefly in the paragraphs that follow. The stated volume for a basin represents the minimum volume of flow it is necessary to detain within the basin as obtained from the HEC-1 analyses.

TABLE 5

EMF PROJECT ALTERNATIVES

Alternative	Components
1C	Channel improvements between Broadway Road and Main Street EMF off-line detention basins at Knox, Rittenhouse and Chandler Heights Watershed detention basins at Guadalupe and Ray.
3	Channel improvements between Broadway Road and Main Street EMF off-line detention basins at Knox, Rittenhouse and Chandler Heights Watershed off-line detention basin at Ray.
3C	Channel improvements between Broadway Road and Main Street EMF off-line detention basins at Elliot, Knox, Rittenhouse and Chandler Heights Watershed detention basin at Ray.
6C	Channel improvements between Broadway Road and Main Street EMF off-line detention basins at Elliot, Rittenhouse and Chandler Heights Watershed detention basin at Knox and Ray.
6E	Channel improvements between Broadway Road and Main Street EMF off-line detention basins at Rittenhouse and Chandler Heights Watershed detention basins at Guadalupe Warner, Knox and Ray.

ALTERNATIVE 1C

- Channel improvements between Broadway Road and Main Street
- 3330 acre-ft EMF basin at Chandler Heights Road (offline to the EMF and Queen Creek/Sanokai Wash)
- 1250 acre-ft EMF basin at Rittenhouse Road (offline to the EMF and the Rittenhouse Road channel)
- 1060 acre-ft watershed basin at Ray Road (offline to the Powerline Floodway)
- 1090 acre-ft EMF basin at Knox Road
- 245 acre-ft watershed basin at Guadalupe Road (offline to the Guadalupe Channel)
- 6975 acre-ft of total detention storage by all detention basins

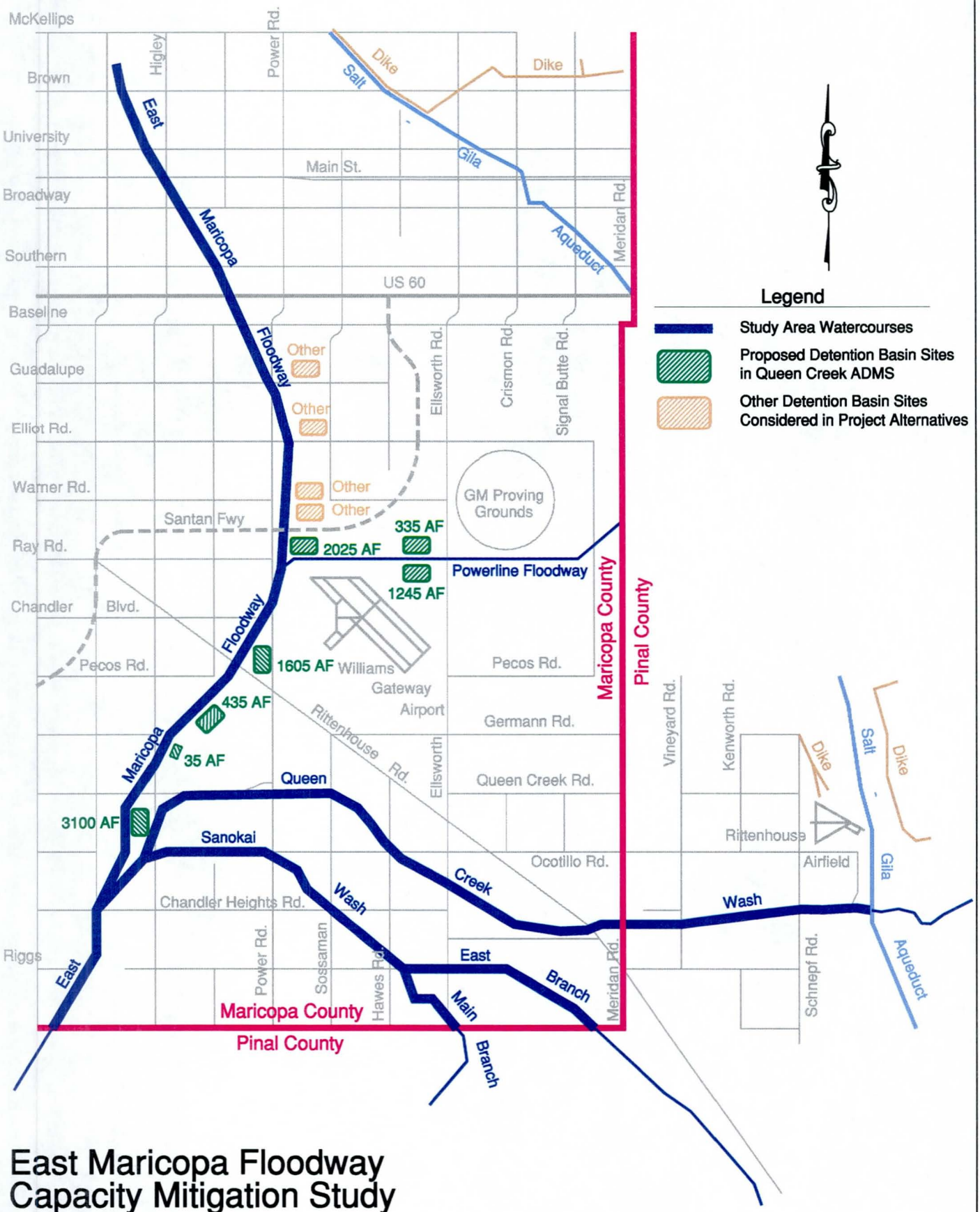

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Figure 4: Detention Basin Sites Considered in Project Alternatives

Regional detention basins proposed in the Queen Creek Area Drainage Master Study and other detention basin sites considered in the EMF analyses

Alternative 1C reduces peak discharges from Hunt Highway to the Guadalupe Road. This alternative utilizes available District property in the vicinity of the Guadalupe Basin, and as with all project alternatives, the available District property in the vicinity of the Chandler Heights Basin is used.

ALTERNATIVE 3

- Channel improvements between Broadway and Main Street
- 3330 acre-ft EMF basin at Chandler Heights Road (offline to the EMF and Queen Creek/Sanokai Wash)
- 1250 acre-ft EMF basin at Rittenhouse Road (offline to the EMF and the Rittenhouse Road channel)
- 1060 acre-ft watershed basin at Ray Road (offline to the Powerline Floodway)
- 1315 acre-ft EMF basin at Knox Road
- 6955 acre-ft of total detention storage by all detention basins
- Alternative 3 is similar to Alternative 1C except the Guadalupe Basin has been removed and the Knox Basin has been enlarged to provide additional storage. Peak discharges are reduced from Hunt Highway to the proposed San Tan Freeway (approximately Knox Road). This alternative has the least number of detention basin facilities of all the proposed alternatives. As with all proposed alternatives, the available District property in the vicinity of the Chandler Heights Basin is used.

ALTERNATIVE 3C

- Channel improvements between Broadway and Main Street
- 3330 acre-ft EMF basin at Chandler Heights Road (offline to EMF and Queen Creek/Sanokai Wash)
- 1250 acre-ft EMF basin at Rittenhouse Road (offline to EMF and Rittenhouse Road channel)
- 1060 acre-ft offline watershed basin at Ray Road (offline to Powerline Floodway)
- 860 acre-ft EMF basin at Knox Road (offline to EMF)
- 500 acre-ft EMF basin at Elliot Road (offline to EMF)
- 7000 acre-ft of total detention storage by all detention basins

Alternative 3C is similar to Alternative 3 except a basin has been added north of Elliot. The result is that the basins at Knox and Elliot now provide the detention storage that used to be provided in a larger single basin at Knox. Peak discharges are reduced from Hunt Highway to Elliot Road. This alternative has the largest total required storage volume of all the proposed alternatives. As with all project alternatives, the available District property in the vicinity of the Chandler Heights Basin is used.

ALTERNATIVE 6C

- Channel improvements between Broadway and Main Street
- 2705 acre-ft EMF basin at Chandler Heights Road (offline to EMF and Queen Creek/Sanokai Wash)
- 1335 acre-ft EMF basin at Rittenhouse Road (offline to EMF and Rittenhouse Road channel)
- 1060 acre-ft watershed basin at Ray Road (offline to Powerline Floodway)
- 1315 acre-ft watershed at Knox Road (inline to overland flow)
- 500 acre-ft EMF basin at Elliot Road (offline to EMF)
- 6915 acre-ft of total detention storage by all detention basins

Alternative 6C is similar to Alternative 3C except the Knox Basin has been changed to an inline watershed basin, capturing flow prior to entering the EMF. Therefore, the integrity of the EMF at Knox remains intact and elaborate inflow structures to divert flow from the EMF are not required. Peak discharges are reduced from Hunt Highway to Elliot Road. This alternative and Alternative 6E have the least total required storage volume of all the proposed alternatives. In addition, providing additional storage upstream has significantly reduced the size of the Chandler Heights basin. As with all project alternatives, the available District property in the vicinity of the Chandler Heights Basin is used.

ALTERNATIVE 6E

- Channel improvements between Broadway and Main Street
- 1970 acre-ft EMF basin at Chandler Heights Road (offline to EMF and Queen Creek/Sanokai Wash)
- 1030 acre-ft EMF basin at Rittenhouse Road (offline to EMF and Rittenhouse Road channel)
- 1060 acre-ft watershed basin at Ray Road (offline to Powerline Floodway)
- 1295 acre-ft watershed basin at Warner Road (inline to overland flow)
- 1315 acre-ft watershed basin at Knox Road (inline to overland flow)
- 245 acre-ft watershed basin at Guadalupe Road (offline to Guadalupe Channel)
- 6915 acre-ft of total detention storage by all detention basins

Alternative 6C has the most detention basin sites but the least number of offline basins thereby reducing the costs for inflow structures and maintaining the integrity of the EMF as much as possible. Peak discharges are reduced from Hunt Highway to Elliot Road. This alternative and Alternative 6C have the least total required storage volumes of all the proposed alternatives. In addition, the proposed Chandler Heights basin is the smallest of any of the other proposed alternatives. This alternative utilizes available District property in the vicinity of the Guadalupe Basin, and as with all project alternatives, the available District property in the vicinity of the Chandler Heights Basin is used.

SECTION 6 - PREFERRED ALTERNATIVE

SELECTION OF PREFERRED ALTERNATIVE

The proposed alternatives were presented, discussed and evaluated at a meeting between the District, the City of Mesa, and Huitt-Zollars. A consensus was developed that Alternatives 1C and Alternative 3 were the best alternatives based upon the results of the initial evaluation matrix and the desire to minimize the number of basins, the impacted area, and perceived project costs. Alternatives 1C and 3 are similar alternatives with the differences arising from the presence/absence of a basin at Guadalupe Road. Alternative 1C was ultimately selected as the preferred alternative primarily to further evaluate the relative benefits of the Guadalupe Basin in a more detailed analysis of the alternative. In addition, Alternative 1C utilizes District-owned property at the Guadalupe location, possibly reducing the amount of land needed to be purchased for subsequently larger detention basins downstream.

DESCRIPTION

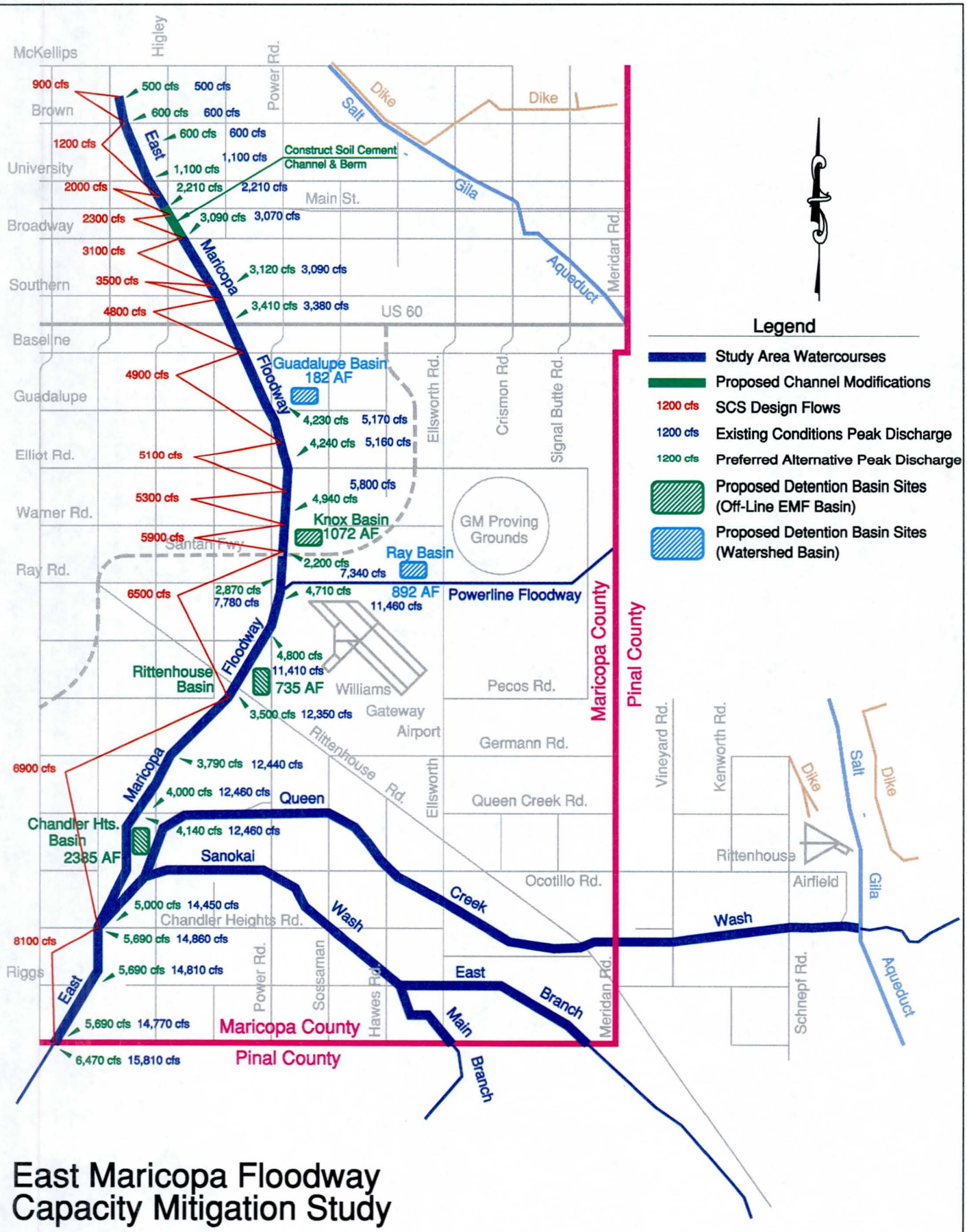
While the components of Alternative 1C are the same as in the preliminary analysis, a more detailed analysis of this alternative reduced the sizes of the detention basins; and, therefore, results of the preferred Alternative 1C differ from the preliminary Alternative 1C. In the preliminary analyses, alternatives were not optimized to minimize excess freeboard and thus minimize detention volumes. In the detailed analyses, excess freeboard at critical cross sections along the reaches were minimized thereby maximizing the conveyance capacity of the channel (given freeboard requirements) and minimizing detention volumes. In addition, modifications to the project hydrology between the preliminary analyses and the detailed analyses also contributed to differences between the preliminary results and the final results. Modifications to the project hydrology included changes to the number of hydrograph ordinates in some hydrologic models, hard-coding contributory areas at selected concentration points (to better estimate contributory drainage areas and areal reduction factors in the Sanokai Wash area where there are numerous flow diversions), and corrections to hydrologic parameters. Figure 5 shows the components of the preferred alternative. The components of Alternative 1C are summarized in Table 6, followed by more detailed descriptions. Conceptual Plans for Alternative 1C are provided in Appendix B.

Channel Improvements. Reach 6 between Broadway Road and Main Street is the only location along the EMF where channel improvements are recommended. While the EMF through this reach was originally shown to contain the existing conditions peak discharges, backwater, resulting from an adverse channel slope in a golf course located downstream of Reach 6, increased water surface elevations to the extent that freeboard and clearance requirements were not met. The effect of backwater combined with the inability to implement improvements downstream of Broadway Rd (due to existing golf courses) and the inability to provide detention upstream (due to lack of undeveloped, effective detention sites) makes it difficult to provide freeboard and clearance under the Higley Road/Main Street culvert.

In the hydraulic analyses, changes in the channel cross section, slope, and/or channel lining were able to reduce water surface elevations sufficiently to provide clearance under the Higley Road/Main Street culvert. However, reasonable channel modifications alone were not able to provide all the required freeboard through the reach. Therefore, it is recommended that the channel be lined with soil cement to provide clearance under the Higley Road/Main Street culvert and that a low soil cement berm be constructed along the EMF to provide sufficient freeboard (see Concept Plans and Appendix B).

Soil-Cement Channel Lining. It is proposed that approximately 2820 ft of the EMF between Broadway Road and Main Street be lined with soil cement to reduce channel roughness and lower water surface elevations to provide 12 inches of clearance through the Higley Road/Main Street culvert.

Soil-Cement Berm. To provide additional freeboard to meet SCS requirements, approximately 1300 ft. of soil cement berms, approximately 18 inches high are proposed between Broadway Road and Main Street.



East Maricopa Floodway Capacity Mitigation Study

Figure 5: Preferred Alternative (Alternative 1C)

Alternative 1C - Channel modifications north of Broadway.
EMF basins at Knox, Rittenhouse, and Chandler Heights.
Watershed basins at Guadalupe and Ray (Powerline Floodway).

EMFfig5.dwg

TABLE 6

SUMMARY OF ALTERNATIVE 1C COMPONENTS

Component	Berm Length (ft)	Max. Levee Height (ft)	Length of Channel Improvement (ft)	Type Of Material	Basin Surface Area (acres)	Effective Storage Volume[1] (acre-ft)	Max. Basin Depth[2] (ft)	Max. Water Depth[2] (ft)	Estimated Side-Weir Lengths[3] (ft)	Detention Basin Outlet
EMF Channel Improvements between Broadway Road and Main Street	1290	1.5	2820	Soil Cement						
Guadalupe Basin (off Guadalupe Channel)					24	182	16.0	9.0	215	1-36" RCP
Knox Basin (north of San Tan Fwy.)					159	1072	10.8	7.0	1175	5-48" RCP
Ray Basin (off Powerline Floodway)					114	892	13.7	8.5	150	4-48" RCP
Rittenhouse Basin (off EMF and Rittenhouse Channel)					111	735	11.3	7.2	1435 (EMF) and 140 (R Road)	4-48" RCP
Chandler Heights Basin (off EMF and Queen Creek/ Sanokai Wash channel)					300	2385	14.3	8.5	575 (EMF) and 325 (QC)	5-60" RCP

1. Effective Storage Volume equals the estimated basin volume below the weir elevation (see Appendix C: Estimates – Basin Volumes Table).
2. Based upon estimated average elevations along the weir length and channel (see Appendix C: Estimates – Quantity Estimates for Side-Weirs Table).
3. See Appendix B: Hydraulics – Estimate of Side-Weir Lengths Based on Engels Side-Weir Equation Table.

Detention Basins. The size and configuration of the detention basins are dependent upon the required storage volume, the available area and the flow characteristics of the channels. The basins are designed with 4H:1V side slopes and no consideration given for aesthetics. Table 6 summarizes the major detention basin components for Alternative 1C.

Guadalupe Basin. The Guadalupe Basin is a 24-acre, 182 acre-ft (effective storage) offline watershed basin located at the northeast corner of Guadalupe Road and Power Road. Approximately five acres are owned by the District. The remaining 19 acres would need to be purchased for the detention basin site. A 215-ft concrete side-weir is provided to divert a peak flow of approximately 1420 cfs from the Guadalupe Channel. The Guadalupe Channel is a concrete rectangular channel flowing under supercritical conditions at the weir inlet. For the purposes of this study, it is assumed that the channel is brought to subcritical conditions prior to the inlet weir to provide a more stable hydraulic condition. Changes in channel slope, configuration, material, impact structures and/or other hydraulic structures could be used to change flow conditions in the Guadalupe Channel prior to the basin inlet weir; however, methods of changing flow conditions in the Guadalupe Channel were not thoroughly investigated during this study. This design detail should be evaluated in subsequent more detailed analyses.

Knox Basin. The Knox Basin is a 159-acre, 1072 acre-ft (effective storage) offline EMF basin located adjacent to the EMF, just north of the proposed San Tan Freeway alignment (Knox Road). The entire 159 acres would need to be purchased for the detention basin site. A 1175-ft. concrete side-weir is provided to divert a peak flow of approximately 4400 cfs from the EMF.

Ray Basin. The Ray Basin is a 114-acre, 892 acre-ft (effective storage) offline basin located north of the Powerline Floodway, just west of the Hawes Road alignment. The entire 114 acres would need to be purchased for the detention basin site. A 185-ft. concrete side-weir is estimated to divert a peak flow of approximately 3160 cfs from the Powerline Floodway.

Rittenhouse Basin. The Rittenhouse Basin is a 111-acre, 735 acre-ft (effective storage) offline basin located northeast of the EMF and the Rittenhouse Road Channel. The entire 111 acres would need to be purchased for the detention basin site. A 1435-ft. concrete side-weir is estimated to divert a peak flow of approximately 1760 cfs from the EMF. Another 140-ft. concrete side-weir is provided to divert a peak flow of approximately 1890 cfs from the Rittenhouse Road Channel.

Chandler Heights Basin. The Chandler Heights Basin is a 300-acre, 2385 acre-ft (effective storage) offline basin located northeast of the EMF and Chandler Heights Road. Approximately 235 acres are owned by the District. The remaining 65 acres would need to be purchased for the detention basin site. A 575-ft. concrete side-weir is estimated to divert a peak flow of approximately 1840 cfs from the EMF. Another 345-ft. concrete side-weir is provided to divert a peak flow of approximately 2630 cfs from Queen Creek/Sanokai Wash.

Detention Basin Effective Storage. The detention basins are sized to provide the required storage volume below the weir elevation. The basin volume above the weir elevation is not used

for storage but greatly increases the excavated volume of the detention basin and the depth of the basin. Thus, for the Guadalupe Basin, the effective storage is 182-acre-ft while the excavated volume is 340-acre-ft. The total basin depth is 16 feet while the maximum water depth is 9 feet (see Table 6 and Appendix B).

The weir elevation is set at the calculated flow depth in the EMF for the allowable downstream flow rate.

The head on the weir is determined by difference between the weir elevation and the water surface elevations corresponding to the flow rate in the channel prior to diverting flow.

For example, if 7000 cfs is the total flow prior to the weir and flow in excess of 5000 cfs is to be diverted from the EMF (or tributary channel), the allowable downstream flow rate is 5000 cfs. The weir elevation is set at the 5000 cfs flow depth as determined by the HEC-RAS analysis (or by normal depth in the tributary channels). The head on the weir is the difference between the downstream flow depth at 5000 cfs and the upstream flow depth at 7000cfs. The length of the weir would then be based upon passing 2000 cfs at the calculated water depth above the weir (Appendix B).

Detention Basin Inlet Side-Weirs. The detention basin inlets along major channels are assumed to be concrete weirs cut into the side of the channel which divert flows exceeding a specific water surface elevation.

The normal weir equation was considered inappropriate to estimate the size of the proposed side-weirs because it is based upon the weir being perpendicular to the channel flow. In the case of the proposed offline basins, the weir is to be located parallel to the channel flow and, thus, parallel to the flow momentum.

For the purposes of this study, the side-weir equation selected to estimate side-weir length is was the Engel's Side-Weir Equation:

$$Q = 3.32 \times L^{0.83} \times H^{1.67}$$

where Q = weir flow rate
L = weir length
H = flow depth above weir

Calculations estimating the detention basin inlet side-weir lengths are presented in Appendix B.

Detention Basin Outlets. The offline detention basin outlets are assumed to be closed until the peak discharges have passed and would be manually opened to drain the detention basins. The number and size of pipes for the basin outlets have been sized to drain the detention basins within 36 hours of opening the outlets (Appendix B). The calculations are based upon the estimated average discharge of the pipes. The estimated average discharge of the pipes is the average discharge for the pipe(s) over the expected range of headwater for the basin. The estimated average discharge for the outlets must exceed the average rate necessary to drain the volume over 36 hours.

At Knox and Chandler Heights, the outlets will not gravity-drain the basins completely due to the basin bottom elevations being slightly lower than the bottom of the EMF at the basin outlets. However, given a percolation rate of 2 ft/day, both basins should completely drain within 36 hours using a combination of drainage through the basin outlets and a surface percolation. A percolation rate of 2 ft/day is considered conservative based upon average percolation rates in other areas of Maricopa County.

COST ESTIMATE

A summary of the reconnaissance-level cost estimate for the major items of the preferred alternative is presented in Table 7. A more detailed breakdown of the cost estimate is provided in Appendix C. Reconnaissance-level costs are defined by the American Association of Cost Engineers as being within the range of + 30 percent to - 20 percent of the true cost. Capital costs include construction and related project costs, such as engineering and contingencies.

TABLE 7

SUMMARY OF ESTIMATED CAPITAL COSTS

Total Project Capital Cost (by Basin or Improvement)	
Broadway-Main Street Channel Improvements	$1,668,670
Guadalupe Basin	$3,050,215
Knox Basin	$15,551,310
Ray Basin	$12,130,605
Rittenhouse Basin	$11,456,500
Chandler Heights Basin	$25,322,430
Total Estimated Project Capital Cost	**$69,203,700**

Total Project Capital Cost (by Type of Cost)	
Construction, Engineering and Contingency Costs	$55,068,700
Land Acquisition Costs	$14,135,000
Total Estimated Project Capital Cost	**$69,203,700**

As mentioned earlier in this section, Alternative 1C and Alternative 3 are similar alternatives; however, Alternative 1C was selected as preferred, primarily because it included the Guadalupe Basin for further study. An analysis was also conducted to compare the cost of Alternative 1C to the estimated cost of Alternative 3 (essentially Alternative 1C with no Guadalupe Basin and a larger Knox Basin). The total estimated project capital costs for Alternative 3 is $68,733,700. (See Appendix C.) It was determined that the difference in costs were not significant for a reconnaissance-level cost analysis. Further refinement of the cost and design will be necessary in order to determine the lower cost alternative.

CONCEPT PLANS

Full size concept plans are provided along with this report. Smaller 11 x 17-inch copies are provided in Appendix D. All information provided in the drawings is conceptual in nature.

Final determination of the basin areas, facility sizes and capacities, utility corridors, property boundaries, and costs will be developed as part of more detailed investigations.

The drawings show the proposed detention basin facilities along with land ownership boundaries, major utilities, and other pertinent information in plan view, superimposed on an aerial photograph. Property owners affected by the proposed facilities are noted on the plans. Plan and profile sheets show the proposed channel improvements between Broadway Road and Main Street. All proposed channel improvements should be located within the right-of-way limits of the EMF. Therefore, land ownership for channel improvements should not be an issue and is not identified on the plan and profile sheets. Detail sheets provide additional information on the channel improvements and the proposed detention basin facilities.

ASSUMPTIONS

Both general and specific assumptions were made during the course of this concept-level study. These are listed below.

General. General assumptions made during the course of the development of the preferred alternative include:

- The effective basin storage volume is equal to the basin storage at the weir elevation.
- Weir elevations are set at the calculated water surface elevation for the maximum allowable downstream flows (using HEC-RAS or normal depth).
- Calculations for water surface elevations for the tributary channels are based upon normal depth.
- Weir lengths are based upon the Engel's formula.
- As-Builts and other documents were used to estimate channel elevations and flow depth for major tributary channels (Guadalupe Channel, Powerline Floodway, Rittenhouse Road Channel, and Queen Creek/Sanokai Wash).
- Basin infiltration rates are approximately 2 feet/day.
- Outlets remain closed until peak discharges have passed.
- Detention basin volumes do not accommodate the accumulated volume of runoff from the basin area itself. The volume of runoff from the basin area is considered insignificant considering the size of the basins. In addition, excess storage provided by the basins should provide storage for most of the basin area runoff.

Specific. Specific assumptions made during the development of a particular component of the preferred alternative are presented below.

Guadalupe Basin. Along the length of the proposed Guadalupe Basin, the Guadalupe Channel flows under supercritical conditions. To estimate the weir length to divert flow into the basin it was necessary to assume the flow in the channel would be brought to subcritical flow prior to the weir. The flow depth at subcritical flow was determined using normal depth and was used to calculate the weir length for the basin. Upon further development of a basin at this location, a more detailed analysis of the Guadalupe Channel and the side-weir should be performed to better determine the design and feasibility of a side-weir along the channel.

Knox Basin. The Knox Basin is located approximately at a hydrologic concentration point that contributes significant flow to the EMF. To size the weir and to size the basin, it is

assumed that runoff concentrating at this location is discharged into the EMF prior to diverting flow into the basin. This means local runoff cannot be directly discharged into the basin and must be conveyed first to the EMF. To a lesser extent, this is the case with all of the basins. The basins are not modeled nor designed to have runoff from the immediate area flow directly into the basin unless it is through a major tributary (Guadalupe Channel, Powerline Floodway, Rittenhouse Road Channel or Queen Creek/Sanokai Wash). This assumption should be taken into consideration upon further development of EMF flood mitigation measures.

Ray Basin. The Ray Basin weir is to be located downstream of a major tributary to the Powerline Floodway. The tributary runs northwesterly along the east side of Williams Gateway Airport.

Chandler Heights Basin. The side-weir diverting flow into the Chandler Heights Basin from the Queen Creek/Sanokai Wash channel is located downstream of the confluence of Queen Creek and Sanokai Wash. In addition, the Queen Creek/Sanokai Wash HMP is currently under study and will likely recommend improvements to the Queen Creek and Sanokai Wash channels and/or watersheds. Improvements will likely change the detention requirement at the Chandler Heights Basin This study does not consider any proposed improvements along Queen Creek or Sanokai Wash. Upon further study of EMF capacity mitigation measures improvements proposed as part of the Queen Creek/Sanokai Wash HMP should be considered.

RESULTS

Hydrologic. For the preferred alternative, peak discharges along the EMF from Guadalupe Road to Hunt Highway are significantly reduced from the existing conditions. In most instances peak discharges have been reduced well below the original SCS design capacity flows due to the need to provide freeboard A summary of the peak discharges for Alternative 1C is shown in Figure 3. The summary results of the HEC-1 analyses are presented in Appendix A. The HEC-1 models are provided in the project CD.

Hydraulic. The HEC-RAS analysis of Reaches 3, 4, 5 and 6 indicate that the preferred alternative provides sufficient freeboard at all locations with the exception of the Leisure World and Superstition Springs Golf Courses. Providing adequate freeboard through the golf courses was not considered a requirement. Generally, the necessary reduction in flow in a reach was due to critical cross sections where freeboard was not being met. In providing the necessary flow reduction or improvements, much of the EMF has significantly more freeboard than is required. A summary of the HEC-RAS results is provided in Appendix B. The HEC-RAS models are provided in the project CD.

RECOMMENDATIONS FOR FURTHER CONSIDERATION

Alternative 3. Alternative 3 should be seriously considered prior to development of the preferred alternative (Alternative 1C). The difficulty and cost of designing, constructing and maintaining the Guadalupe Basin (primarily because of supercritical flow in the Guadalupe Channel) and the benefits of consolidating detention at the Knox Basin should be taken into consideration under more detailed study.

Sizing Weirs. The sizing and design of the detention basin side-weirs should be investigated in further detail. It is important that these structures are properly designed to divert the necessary flow.

Preferred Alternative. Preliminary Inline Basin Analysis After developing the hydrology and hydraulics for Alternative 1C, an initial optimization analysis was performed to evaluate the potential benefit of converting all or some of the proposed off-line basins to in-line basins with continuous flow outlets. The results of this analysis indicated that there were advantages and disadvantages for in-line basins and that a conceptual-level comparison between off-line and in-line basins was not conclusive as to which type of basin would be preferred. In addition, more detailed studies of capacity mitigating measures may use different, less extreme watershed conditions (i.e. future conditions) which may make inline basins more feasible. As a result, further analysis of the offline vs. inline basins should be performed during the pre-design study to select which basin types are preferable at each basin location.

Changes to Hydrology. Due to Development and Capital Improvement Projects. Rapid development, drainage improvement projects and other projects (such as the San Tan Freeway) will likely change area hydrology and impact the preferred alternative. Refinement of the preferred alternative should consider the impact of these changes on the proposed improvements. Hydrologic conditions should be considered to include facilities provided by new developments and projects.

Freeboard Criteria. Upon further development and consideration of EMF capacity mitigating measures, freeboard and clearance requirements should be reevaluated. Meeting freeboard criteria typically required significant reductions in the peak flows to lower water surface elevations at only a few inadequate cross sections. The result was a dramatic decrease in the allowable channel flows throughout the entire reach, excess freeboard in many locations and significantly larger detention basins. In addition, the SCS requirement of providing 12" of clearance through bridges and culverts is the primary reason extensive channel relining is required in Reach 6. In contrast, the Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics (DDM-V2) specifies 2' of clearance at bridges but does not specify any clearance requirement for culverts. Without the need to provide clearance through the Higley Road/Main Street culvert, channel improvements would be reduced to slightly higher and longer berms to provide freeboard

Multi-Use Facilities. The size, type and locations of the proposed detention facilities make them well-suited for purposes other than flood control. More detailed studies should consider recreational, recharge, and other non-flood control uses in the basin designs.

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APPENDIX A:
HYDROLOGY

- 100-yr, 24-hr Hydrology Parameters
  - Existing Conditions
  - Future Conditions with
    11"x17" Future Land-Use Map
- Existing Conditions Routing Model HEC-1 Output
- Preferred Alternative Routing Model HEC-1 Output
- Preferred Alternative HEC-1 Maps (11"x17")

HYDROLOGY

100-yr, 24-hr Hydrology Parameters
Existing Conditions

Summary of MCUHP2 Subbasin Input Parameters

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG mins.
258	3.650	0.340	0.170	4.70	0.420	18	122.0
272	0.533	0.490	0.010	4.70	0.470	1	82.7
274	1.503	0.390	0.140	4.80	0.410	9	103.0
278	1.395	0.460	0.040	4.80	0.440	4	105.0
260	0.984	0.500	0.000	4.80	0.460	0	60.7
264	0.998	0.500	0.000	4.70	0.480	0	65.8
268	0.970	0.450	0.040	4.65	0.480	6	107.0
306	1.208	0.330	0.270	4.55	0.350	6	76.2
310	0.972	0.450	0.050	4.80	0.440	9	106.0
314	1.052	0.450	0.100	4.55	0.470	3	131.0
318	1.323	0.450	0.090	4.40	0.520	3	119.0
322	1.134	0.480	0.030	4.65	0.480	1	115.0
328	0.997	0.500	0.000	4.45	0.570	0	83.6
330	0.966	0.490	0.020	4.50	0.530	0	103.0
506N	0.387	0.370	0.310	4.70	0.280	0	64.3
506S	0.325	0.370	0.310	4.70	0.280	0	97.0
338	1.103	0.350	0.350	4.80	0.290	0	20.6
342	0.459	0.350	0.350	4.80	0.290	0	20.6
346	3.150	0.460	0.090	4.30	0.570	0	166.0
354	1.505	0.470	0.070	6.80	0.190	0	138.0
356	4.244	0.480	0.040	5.30	0.350	0	246.0
360	4.791	0.460	0.090	6.60	0.200	0	183.0
364C	1.275	0.430	0.150	4.50	0.460	0	111.0
364B	2.207	0.430	0.150	4.60	0.430	0	113.0
364A	1.993	0.430	0.150	4.50	0.460	0	131.0
368	3.130	0.470	0.040	4.65	0.480	2	193.0
372	3.716	0.490	0.010	4.80	0.450	0	184.0
378	2.250	0.460	0.090	4.50	0.500	0	124.0
304	0.644	0.460	0.080	4.65	0.450	2	85.7
306S	0.673	0.500	0.000	4.80	0.460	0	86.2
310S	0.864	0.430	0.120	4.30	0.530	3	77.4
474	1.067	0.480	0.030	4.70	0.460	1	124.0
478	0.666	0.500	0.000	4.80	0.460	0	86.8
482	0.977	0.380	0.150	4.60	0.450	9	97.0
482S	0.155	0.410	0.210	4.55	0.380	0	43.3
556	0.628	0.430	0.160	4.80	0.360	0	100.0
W13	0.625	0.400	0.190	3.95	0.580	1	41.3
W14	0.370	0.380	0.250	3.95	0.530	0	30.0
W15	0.250	0.480	0.030	3.95	0.720	2	39.4
574	1.042	0.460	0.100	4.45	0.490	0	61.0
580	0.527	0.410	0.210	3.95	0.540	0	72.2
584	0.973	0.440	0.110	4.00	0.610	0	106.0
S16	4.347	0.200	0.350	4.40	0.370	33	77.0
S17	0.766	0.270	0.350	4.40	0.370	33	35.8
598	0.352	0.250	0.350	4.40	0.370	33	25.3
602	0.727	0.270	0.350	4.40	0.370	33	26.4
606	0.586	0.240	0.350	4.40	0.370	33	37.4
610	0.837	0.330	0.350	4.40	0.370	33	32.9

Summary of MCUHP2 Subbasin Input Parameters

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG mins.
258	3.650	0.340	0.170	4.70	0.420	18	122.0
272	0.533	0.490	0.010	4.70	0.470	1	82.7
274	1.503	0.390	0.140	4.80	0.410	9	103.0
278	1.395	0.460	0.040	4.80	0.440	4	105.0
260	0.984	0.500	0.000	4.80	0.460	0	60.7
264	0.998	0.500	0.000	4.70	0.480	0	65.8
268	0.970	0.450	0.040	4.65	0.480	6	107.0
306	1.208	0.330	0.270	4.55	0.350	6	76.2
310	0.972	0.450	0.050	4.80	0.440	9	106.0
314	1.052	0.450	0.100	4.55	0.470	3	131.0
318	1.323	0.450	0.090	4.40	0.520	3	119.0
322	1.134	0.480	0.030	4.65	0.480	1	115.0
328	0.997	0.500	0.000	4.45	0.570	0	83.6
330	0.966	0.490	0.020	4.50	0.530	0	103.0
506N	0.387	0.370	0.310	4.70	0.280	0	64.3
506S	0.325	0.370	0.310	4.70	0.280	0	97.0
338	1.103	0.350	0.350	4.80	0.290	0	20.6
342	0.459	0.350	0.350	4.80	0.290	0	20.6
346	3.150	0.460	0.090	4.30	0.570	0	166.0
354	1.505	0.470	0.070	6.80	0.190	0	138.0
356	4.244	0.480	0.040	5.30	0.350	0	246.0
360	4.791	0.460	0.090	6.60	0.200	0	183.0
364C	1.275	0.430	0.150	4.50	0.460	0	111.0
364B	2.207	0.430	0.150	4.60	0.430	0	113.0
364A	1.993	0.430	0.150	4.50	0.460	0	131.0
368	3.130	0.470	0.040	4.65	0.480	2	193.0
372	3.716	0.490	0.010	4.80	0.450	0	184.0
378	2.250	0.460	0.090	4.50	0.500	0	124.0
304	0.644	0.460	0.080	4.65	0.450	2	85.7
306S	0.673	0.500	0.000	4.80	0.460	0	86.2
310S	0.864	0.430	0.120	4.30	0.530	3	77.4
474	1.067	0.480	0.030	4.70	0.460	1	124.0
478	0.666	0.500	0.000	4.80	0.460	0	86.8
482	0.977	0.380	0.150	4.60	0.450	9	97.0
482S	0.155	0.410	0.210	4.55	0.380	0	43.3
556	0.628	0.430	0.160	4.80	0.360	0	100.0
W13	0.625	0.400	0.190	3.95	0.580	1	41.3
W14	0.370	0.380	0.250	3.95	0.530	0	30.0
W15	0.250	0.480	0.030	3.95	0.720	2	39.4
574	1.042	0.460	0.100	4.45	0.490	0	61.0
580	0.527	0.410	0.210	3.95	0.540	0	72.2
584	0.973	0.440	0.110	4.00	0.610	0	106.0
S16	4.347	0.200	0.350	4.40	0.370	33	77.0
S17	0.766	0.270	0.350	4.40	0.370	33	35.8
598	0.352	0.250	0.350	4.40	0.370	33	25.3
602	0.727	0.270	0.350	4.40	0.370	33	26.4
606	0.586	0.240	0.350	4.40	0.370	33	37.4
610	0.837	0.330	0.350	4.40	0.370	33	32.9

Summary of MCUHP1 Input Parameters

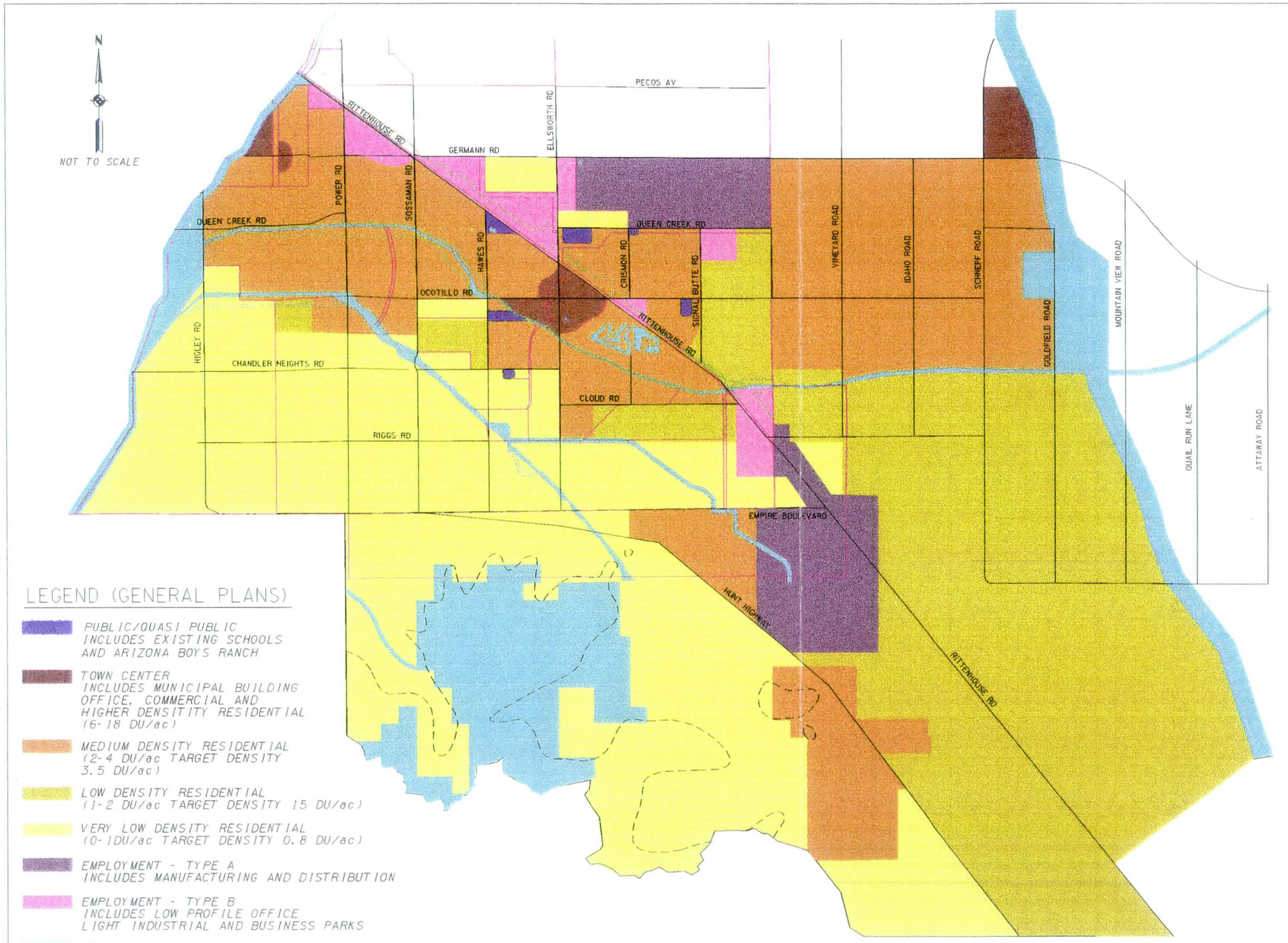
Input File: SNQ-EX.M1I
Output File: SNQ-EX.M1O

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Tc	R
S1	1.760	0.330	0.350	4.25	0.410	15.0	0.57	0.21
S2	3.074	0.320	0.350	4.60	0.330	6.0	1.15	0.54
E1	7.909	0.500	0.000	6.60	0.220	0.0	1.00	0.50
S3B	1.725	0.230	0.350	4.65	0.310	54.0	0.43	0.15
S3A	1.703	0.340	0.350	4.50	0.350	1.0	1.50	1.14
S4B	1.277	0.270	0.350	4.35	0.380	23.0	0.70	0.47
S4A	1.600	0.340	0.350	4.25	0.410	7.0	0.79	0.31
S5	0.338	0.250	0.350	4.50	0.350	25.0	0.31	0.17
S6	0.819	0.310	0.360	5.00	0.270	5.0	0.72	0.56
S7B	0.773	0.180	0.350	4.50	0.350	29.0	0.35	0.13
S7A	1.191	0.340	0.350	4.40	0.370	0.0	0.77	0.34
E2	7.328	0.480	0.010	4.90	0.440	2.0	1.00	0.50
E11	0.338	0.500	0.000	4.80	0.460	0.0	1.50	1.19
E3	0.430	0.500	0.000	4.80	0.460	0.0	1.50	1.12
E4	0.371	0.450	0.040	4.65	0.480	9.0	1.50	1.21
E7	0.356	0.420	0.100	4.80	0.400	2.0	1.34	0.94
S8B	1.696	0.240	0.350	4.50	0.350	40.0	0.50	0.23
S8A	1.740	0.350	0.350	4.10	0.440	0.0	0.98	0.51
S9	3.403	0.240	0.350	4.45	0.360	27.0	1.02	0.63
S10	0.711	0.230	0.350	3.95	0.470	27.0	0.45	0.25
E8	0.389	0.500	0.000	4.30	0.620	0.0	1.18	0.88
E5	0.571	0.500	0.000	3.95	0.730	0.0	0.80	0.36
E6	1.167	0.480	0.020	4.60	0.500	0.0	1.50	0.83
E9	0.954	0.570	0.000	4.20	0.660	0.0	1.45	0.94
E10	0.509	0.660	0.000	4.65	0.500	0.0	0.66	0.35
S11	0.993	0.190	0.350	4.55	0.340	38.0	0.59	0.38
C1	0.355	0.350	0.350	3.95	0.470	0.0	1.57	0.83
S12	0.408	0.240	0.350	4.45	0.360	31.0	0.35	0.20
C4	0.311	0.350	0.350	4.20	0.420	0.0	0.89	0.72
C2	0.322	0.470	0.070	4.30	0.580	0.0	1.50	1.29
C3	0.112	0.560	0.000	4.80	0.460	0.0	0.85	0.50
N2	0.540	0.660	0.030	4.80	0.440	0.0	0.71	0.40
N1	0.391	0.440	0.070	4.80	0.420	1.0	1.50	1.18
N3	0.654	0.400	0.110	4.65	0.440	9.0	1.45	0.76
C16	0.027	0.350	0.350	4.80	0.290	0.0	0.39	0.40
C7	0.484	0.370	0.200	4.65	0.380	5.0	1.35	0.88
S13	2.109	0.250	0.350	4.00	0.450	23.0	0.68	0.34
W1	0.280	0.350	0.350	4.00	0.450	0.0	0.62	0.47
C5	0.646	0.350	0.350	4.20	0.420	0.0	0.54	0.26
W2	0.253	0.350	0.350	4.10	0.440	0.0	0.70	0.59
W3	0.061	0.350	0.350	4.80	0.290	0.0	0.59	0.61
C6	0.301	0.350	0.350	4.70	0.300	0.0	1.45	1.25
C8	0.152	0.300	0.250	4.40	0.390	5.0	0.88	0.84
W4	0.490	0.700	0.000	4.45	0.570	0.0	0.47	0.33
S14	1.608	0.350	0.350	4.15	0.430	1.0	1.56	0.81
W5	0.489	0.430	0.140	4.35	0.500	3.0	0.88	0.61
W6	0.517	0.350	0.350	4.65	0.310	0.0	1.16	0.82
W7	0.228	0.300	0.250	4.80	0.310	5.0	1.23	1.23

W8	0.256	0.300	0.250	4.70	0.320	5.0	1.10	1.00
C9	0.206	0.250	0.250	4.70	0.380	30.0	0.89	0.71
C10	0.501	0.380	0.120	4.60	0.470	15.0	1.50	1.13
N4	0.277	0.490	0.020	3.38	1.060	0.0	1.50	1.32
C13	0.509	0.560	0.050	4.70	0.460	3.0	1.00	0.60
N5	0.426	0.430	0.170	4.70	0.390	0.0	1.44	0.94
C11	0.269	0.300	0.250	4.80	0.360	15.0	0.92	0.58
C12	0.264	0.460	0.050	4.80	0.440	3.0	1.50	1.11
C14	0.512	0.550	0.060	4.80	0.440	4.0	1.44	1.05
C15	0.511	0.440	0.080	4.80	0.430	5.0	1.50	1.02
N6	0.431	0.550	0.000	4.70	0.480	0.0	1.50	1.13
S15	1.950	0.220	0.350	4.55	0.340	44.0	0.77	0.44
W9	0.516	0.580	0.050	3.95	0.680	1.0	0.74	0.53
W10	0.513	0.430	0.090	3.95	0.650	2.0	0.86	0.51
W11	0.510	0.600	0.000	3.95	0.730	0.0	1.12	0.73
W12	0.527	0.700	0.000	4.50	0.550	0.0	0.72	0.51
W16	0.245	0.700	0.000	3.95	0.730	0.0	0.38	0.22
W17	0.256	0.700	0.000	4.55	0.530	0.0	0.36	0.20
W18	0.254	0.700	0.000	4.50	0.550	0.0	0.53	0.31
C7A	0.219	0.370	0.130	4.80	0.410	16.0	1.40	1.47

HYDROLOGY

100-yr, 24-hr Hydrology Parameters
Future Conditions



LEGEND (GENERAL PLANS)

- PUBLIC/QUASI PUBLIC
  INCLUDES EXISTING SCHOOLS
  AND ARIZONA BOYS RANCH
- TOWN CENTER
  INCLUDES MUNICIPAL BUILDING
  OFFICE, COMMERCIAL AND
  HIGHER DENSITITY RESIDENTIAL
  (6-18 DU/ac)
- MEDIUM DENSITY RESIDENTIAL
  (2-4 DU/ac TARGET DENSITY
  3.5 DU/ac)
- LOW DENSITY RESIDENTIAL
  (1-2 DU/ac TARGET DENSITY 1.5 DU/ac)
- VERY LOW DENSITY RESIDENTIAL
  (0-1DU/ac TARGET DENSITY 0.8 DU/ac)
- EMPLOYMENT - TYPE A
  INCLUDES MANUFACTURING AND DISTRIBUTION
- EMPLOYMENT - TYPE B
  INCLUDES LOW PROFILE OFFICE
  LIGHT INDUSTRIAL AND BUSINESS PARKS
- OPEN SPACE
  INCLUDES MAJOR WASHES
- COUNTY LINE
- MOUNTAINOUS AREAS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC
MASTER PLAN & EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY - FCD 98-26

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	RON WIETZEMA	09/01/99
CHECKED	FRED DUREN	12/11/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

HUITT-ZOLLARS
Huitt-Zollars, Inc. Engineers
4742 N. 24TH Street, Suite 100, Phoenix, AZ 85016
Phone (602) 957-1811 Fax (602) 957-1904

FUTURE LAND USE

SHEET 1 OF 1

Summary of MCUHP2 Subbasin Input Parameters

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG mins.
258	3.650	0.220	0.250	4.70	0.380	36	88.8
272	0.533	0.250	0.250	4.70	0.380	29	42.6
274	1.503	0.250	0.250	4.80	0.360	30	70.9
278	1.395	0.270	0.250	4.80	0.360	23	54.6
260	0.984	0.270	0.250	4.80	0.360	24	27.3
264	0.998	0.250	0.250	4.70	0.380	31	32.9
268	0.970	0.230	0.250	4.65	0.390	34	55.1
306	1.208	0.210	0.260	4.55	0.400	33	41.6
310	0.972	0.210	0.250	4.80	0.370	42	51.0
314	1.052	0.250	0.250	4.55	0.420	30	69.9
318	1.323	0.220	0.250	4.40	0.470	37	55.3
322	1.134	0.230	0.250	4.65	0.390	36	54.3
328	0.997	0.250	0.250	4.45	0.450	31	41.8
330	0.966	0.230	0.260	4.50	0.410	27	48.1
506N	0.387	0.100	0.350	4.70	0.260	0	14.1
506S	0.325	0.100	0.350	4.70	0.260	0	21.3
338	1.103	0.100	0.350	4.80	0.250	0	13.7
342	0.459	0.120	0.340	4.80	0.260	3	15.8
346	3.150	0.220	0.280	4.30	0.440	18	84.3
354	1.505	0.300	0.170	6.80	0.160	15	80.6
356	4.244	0.300	0.250	5.30	0.290	15	132.0
360	4.791	0.300	0.190	6.60	0.170	15	110.0
364C	1.275	0.300	0.250	4.50	0.430	15	79.6
364B	2.207	0.290	0.250	4.60	0.400	17	79.2
364A	1.993	0.270	0.250	4.50	0.440	24	86.6
368	3.130	0.290	0.250	4.65	0.390	19	99.8
372	3.716	0.230	0.280	4.80	0.320	13	76.2
378	2.250	0.270	0.250	4.50	0.390	13	69.2
304	0.644	0.240	0.260	4.65	0.380	27	42.0
306S	0.673	0.250	0.250	4.80	0.360	30	43.1
310S	0.864	0.190	0.250	4.30	0.490	48	30.8
474	1.067	0.250	0.250	4.70	0.360	25	64.0
478	0.666	0.230	0.260	4.80	0.340	27	40.8
482	0.977	0.240	0.260	4.60	0.390	27	65.1
482S	0.155	0.250	0.250	4.55	0.420	30	23.0
556	0.628	0.300	0.250	4.80	0.360	15	53.1
W13	0.625	0.300	0.250	3.95	0.560	13	33.3
W14	0.370	0.300	0.250	3.95	0.570	14	30.6
W15	0.250	0.300	0.250	3.95	0.580	15	20.9
574	1.042	0.300	0.250	4.45	0.450	15	31.5
580	0.527	0.300	0.250	3.95	0.580	15	38.4
584	0.973	0.300	0.250	4.00	0.550	14	56.6
S16	4.347	0.190	0.320	4.40	0.380	34	82.7
S17	0.766	0.240	0.290	4.40	0.380	36	44.5
598	0.352	0.230	0.300	4.40	0.380	36	29.9
602	0.727	0.240	0.290	4.40	0.380	36	32.8
606	0.586	0.220	0.310	4.40	0.380	35	43.2
610	0.837	0.280	0.260	4.40	0.390	38	49.9

Summary of MCUHP1 Input Parameters

Input File: SNQ-FUT.M1I
Output File: SNQ-FUT.M1O

SUBBASIN	AREA sq.miles	IA ins.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Tc	R
S1	1.760	0.300	0.270	3.33	0.750	20.0	0.48	0.17
S2	3.074	0.270	0.270	4.60	0.350	16.0	0.93	0.42
E1	7.909	0.250	0.190	6.60	0.170	30.0	1.50	0.79
S3B	1.725	0.210	0.310	4.65	0.320	56.0	0.38	0.14
S3A	1.703	0.270	0.250	4.50	0.400	20.0	1.25	0.93
S4B	1.277	0.240	0.290	4.35	0.400	26.0	0.61	0.40
S4A	1.600	0.260	0.250	4.25	0.470	28.0	0.62	0.23
S5	0.338	0.200	0.300	4.50	0.390	41.0	0.27	0.14
S6	0.819	0.270	0.270	5.00	0.280	9.0	0.60	0.45
S7B	0.773	0.170	0.340	4.50	0.350	30.0	0.32	0.12
S7A	1.191	0.290	0.260	4.40	0.390	5.0	0.61	0.26
E2	7.328	0.210	0.250	4.90	0.350	43.0	1.50	0.78
E11	0.338	0.190	0.250	4.80	0.380	51.0	0.70	0.51
E3	0.430	0.220	0.250	4.80	0.340	31.0	0.72	0.50
E4	0.371	0.250	0.250	4.65	0.350	23.0	0.92	0.70
E7	0.356	0.300	0.250	4.80	0.360	15.0	0.82	0.55
S8B	1.696	0.210	0.310	4.50	0.360	42.0	0.45	0.20
S8A	1.740	0.260	0.270	4.10	0.450	4.0	0.73	0.36
S9	3.403	0.180	0.320	4.45	0.350	28.0	0.84	0.51
S10	0.711	0.210	0.310	3.95	0.480	29.0	0.40	0.22
E8	0.389	0.280	0.260	4.30	0.460	12.0	0.62	0.43
E5	0.571	0.300	0.250	3.95	0.490	5.0	0.45	0.19
E6	1.167	0.280	0.260	4.60	0.350	6.0	1.02	0.54
E9	0.954	0.290	0.260	4.20	0.510	14.0	0.96	0.60
E10	0.509	0.260	0.260	4.65	0.380	21.0	0.74	0.39
S11	0.993	0.180	0.330	4.55	0.340	39.0	0.52	0.34
C1	0.355	0.280	0.260	3.95	0.480	5.0	0.40	0.18
S12	0.408	0.220	0.310	4.45	0.370	33.0	0.32	0.18
C4	0.311	0.300	0.250	4.20	0.440	5.0	0.70	0.55
C2	0.322	0.250	0.270	4.30	0.400	4.0	0.74	0.59
C3	0.112	0.270	0.260	4.80	0.300	4.0	0.53	0.29
N2	0.540	0.300	0.250	4.80	0.310	7.0	1.00	0.59
N1	0.391	0.260	0.250	4.80	0.360	27.0	0.99	0.74
N3	0.654	0.290	0.250	4.65	0.390	19.0	0.90	0.45
C16	0.027	0.300	0.250	4.80	0.310	5.0	0.34	0.34
C7	0.475	0.290	0.250	4.65	0.350	12.0	0.93	0.58
S13	2.109	0.230	0.300	4.00	0.470	26.0	0.58	0.29
W1	0.280	0.300	0.250	4.00	0.480	5.0	0.50	0.36
C5	0.646	0.300	0.250	4.20	0.440	5.0	0.44	0.21
W2	0.253	0.300	0.250	4.10	0.460	5.0	0.55	0.45
W3	0.061	0.300	0.250	4.80	0.310	5.0	0.48	0.49
C6	0.301	0.300	0.250	4.70	0.320	5.0	1.17	0.98
C8	0.152	0.300	0.250	4.40	0.390	5.0	0.75	0.71
W4	0.490	0.300	0.250	4.45	0.380	5.0	0.75	0.56
S14	1.608	0.300	0.250	4.15	0.450	6.0	0.62	0.29
W5	0.489	0.300	0.250	4.35	0.400	5.0	0.66	0.44
W6	0.517	0.300	0.250	4.65	0.330	5.0	0.93	0.65
W7	0.228	0.300	0.250	4.80	0.310	5.0	1.07	1.05

W8	0.256	0.300	0.250	4.70	0.320	5.0	0.96	0.85
C9	0.206	0.300	0.250	4.70	0.320	5.0	0.82	0.65
C10	0.501	0.230	0.280	4.60	0.340	12.0	1.02	0.73
N4	0.277	0.230	0.280	3.38	0.810	26.0	0.92	0.77
C13	0.509	0.270	0.250	4.70	0.370	21.0	0.79	0.47
N5	0.426	0.230	0.270	4.70	0.350	25.0	0.78	0.48
C11	0.269	0.300	0.250	4.80	0.310	6.0	0.80	0.50
C12	0.264	0.300	0.250	4.80	0.310	5.0	0.93	0.65
C14	0.512	0.300	0.250	4.80	0.360	15.0	1.28	0.93
C15	0.511	0.300	0.250	4.80	0.360	15.0	1.10	0.73
N6	0.431	0.230	0.270	4.70	0.350	25.0	0.99	0.71
S15	1.950	0.200	0.320	4.55	0.340	46.0	0.68	0.39
W9	0.516	0.300	0.250	3.95	0.490	5.0	0.74	0.53
W10	0.513	0.300	0.250	3.95	0.490	5.0	0.51	0.28
W11	0.510	0.300	0.250	3.95	0.490	5.0	0.88	0.56
W12	0.527	0.300	0.250	4.50	0.370	5.0	1.15	0.85
W16	0.245	0.300	0.250	3.95	0.490	5.0	0.56	0.34
W17	0.256	0.300	0.250	4.55	0.350	5.0	0.54	0.32
W18	0.254	0.300	0.250	4.50	0.370	5.0	0.55	0.33
C7A	0.219	0.280	0.250	4.80	0.320	15.0	0.93	0.94
LF	0.194	0.100	0.350	4.80	0.250	0.0	0.37	0.23

HYDROLOGY

Existing Conditions HEC-1 Summary Output

```
1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998           *
*            VERSION 4.1            *
*                                   *
*  RUN DATE   01DEC99  TIME  12:38:33  *
*                                   *
*************************************
```

```
*************************************
*                                   *
*   U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET         *
*      DAVIS, CALIFORNIA 95616      *
*          (916) 756-1104           *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


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

   1          ID    ********************************************************************
   2          ID         PROJECT:  Queen Creek/Sanokai Wash Hydraulic Master Plan &
   3          ID                   East Maricopa Floodway Capacity Mitigation Study
   4          ID    PREPARED FOR:  Flood Control District of Maricopa County
   5          ID     PREPARED BY:  Huitt-Zollars, Inc
   6          ID        FILENAME:  X-EMF-RT.DAT
   7          ID            DATE:  Dec 1999
   8          ID
   9          ID    This model is for the 100-year, 24 hr existing conditions EMF
  10          ID    routing model for Reaches 3, 4, 5 and 6 which extend from the
  11          ID    Princess Basin (located north of Brown Rd. in Mesa) to the
  12          ID    Maricopa/Pinal County Line at Hunt Highway.
  13          ID
  14          ID    This model was constructed from a previous model developed as part
  15          ID    of the East Mesa ADMP.
  16          ID
  17          ID    This model, X-EMF-RT.DAT, is the "routing" model used to evaluate
  18          ID    flows in the EMF for the existing conditions.  It imports
  19          ID    hydrographs via TAPE21 files from the supporting hydrologic
  20          ID    models and then routes them along the EMF from approximately
  21          ID    Brown Rd. and south to Hunt Hwy (the County Line).
  22          ID
  23          ID    This model requires the previous running of four supporting hydrologic
  24          ID    models.  Each model evaluates the hydrology for a specific area that
  25          ID    is ultimately tributary to the EMF. The four supporting models are:
  26          ID
  27          ID       *  X-NWMESA.DAT - Existing conditions hydrology for NE Mesa
  28          ID                         (-east of the EMF to the CAP(at Hawes Rd.)
  29          ID                         & -south of McKellips Rd. to US60)
  30          ID
  31          ID       *  X-NEMESA.DAT - Existing conditions hydrology for NW Mesa
  32          ID                         (-area northeast of Hawes Rd./US60)
  33          ID
  34          ID       *  X-SEMESA.DAT - Existing conditions hydrology for SE Mesa
  35          ID                         (-area east of the EMF from US60 south to
  36          ID                          Rittenhouse Rd. {excluding areas
  37          ID                          tributary to Queen Creek})
  38          ID                          X-SEMESA.DAT imports hydrographs from
  39          ID                          X-NEMESA.DAT via DSS files.  Therefore,
  40          ID                          X-NEMESA.DAT must be run first and then
  41          ID                          when running X-SEMESA.DAT, X-NEMESA.DSS
  42          ID                          must be specified as the DSS file
  43          ID                          (the default would be X-SEMESA.DSS)
  44          ID
  45          ID       *  X-QCSW.DAT   - Existing conditions hydrology for Queen
  46          ID                         Creek/Sanokai Wash area (all areas
  47          ID                         tributary to Queen Creek & Sanokai Wash
  48          ID                         and areas tributary to the EMF south of
  49          ID                         Rittenhouse Rd.)
  50          ID
  51          ID    IT IS IMPORTANT TO NOTE THAT THE SUPPORTING MODELS DO NOT
  52          ID    CORRECTLY ROUTE FLOWS ALONG THE EMF NOR DO THEY IMPORT ALL
  53          ID    THE NECESSARY FLOWS TO CORRECTLY EVALUATE FLOWS WITHIN THE
  54          ID    EMF.  TO EVALUATE FLOWS WITHIN THE EMF, ALL THE SUPPORTING
  55          ID    MODELS SHOULD BE RUN (TO DEVELOP THE TAPE21 FILE) AND THEN
```

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

  56          ID    THE EMF ROUTING MODEL (X-EMF-RT.DAT).  ONLY THE EMF ROUTING
  57          ID    MODEL SHOULD BE USED TO DETERMINE FLOWS WITHIN THE EMF.
  58          ID
  59          ID    ***********************************************************************
  60          ID              RECOMMENDED RUN ORDER FOR EMF HYDROLOGY MODELS
  61          ID    ***********************************************************************
  62          ID
  63          ID         1. Erase any existing TAPE21 file in run directory.
  64          ID         2. Run X-NEMESA.DAT, X-NWMESA.DAT & X-QCSW.DAT (any order)
  65          ID         3. Run X-SEMESA.DAT (specifying X-NEMESA.DSS as DSS file)
  66          ID         4. Run X-EMF-RT.DAT
  67          ID
  68          ID    ***********************************************************************
  69          ID
  70          ID   EMF MODEL EXISTING CONDITIONS, EXCEPT SUBBASIN 60
  71          ID   HYDROGRAPHS ARE STORED IN A TAPE 21 FILE.
  72          ID
  73          ID   FILE: EMF-E.DAT
  74          ID
  75          ID   HYDROGRAPHS WERE GENERATED FROM RUNNING THE FOLLOWING FILES
  76          ID       PH2.DAT,  MESANW.DAT, AND SMQC.DAT (USING THE MESANW.DSS FILE)
  77          ID
  78          ID   VELOCITIES FOR THE EMF WERE ESTIMATED FROM A MANNINGS EQUATION USING ACTUAL
  79          ID       SLOPES AND FLOWS.
  80          ID
  81          ID   THE CROSS-SECTIONS WERE EXTENDED VERTICALLY, IF THE CROSS-SECTIONS DID NOT
  82          ID       HAVE ENOUGH CAPACITY.
  83          ID
              *
              *DIAGRAM
  84          IT       5  1APR97    0000    2000
  85          IO       5
  86          IN      15
  87          JD    3.60     .01
  88          JD    3.58     1.0
  89          JD    3.49     5.0
  90          JD    3.38    10.0
  91          JD    3.24    30.0
  92          JD    3.10    60.0
  93          JD    3.05    90.0
  94          JD    3.00   120.0
  95          JD    2.97   150.0
              *

  96          KK  HOBART
  97          KM   INFLOW INTO EMF AT HOBART ROAD AND GREENFIELD.
  98          KM   HYDROGRAPH NAMED EMFHOB FROM PHASE 2 HYDROLOGY.
  99          BI  EMFHOB      21
              *
1                                        HEC-1 INPUT                                        PAGE  3

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

 100          KK    RHOB
 101          KM   ROUTE FLOW FROM HOBART ROAD TO BROWN ROAD
 102          RS       4    FLOW      -1
 103          RC    .025    .025    .025    2000  .00010
 104          RX       0      10      20      50      90     120     130     140
 105          RY      10      10      10       0       0      10      10      10
              *

 106          KK   BROWN
 107          KM   INFLOW INTO THE EMF AT BROWN ROAD
 108          KM   HYDROGRAPH NAMED C15A FROM PHASE 2 HYDROLOGY.
 109          BI    C15A      21
              *

 110          KK  EMFBRN
 111          KM    COMBINE FLOWS FROM HOBART ROAD AND BROWN ROAD
 112          HC       2
              *

 113          KK    RBRN
 114          KM   ROUTE FLOWS FROM BROWN ROAD TO COLBY ROAD
 115          RS       8    FLOW      -1
 116          RC    .025    .025    .025    4500   .0001
 117          RX       0      10      20      50     130     160     170     180
 118          RY      10      10      10       0       0      10      10      10
              *

 119          KK   COLBY
 120          KM   INFLOW INTO THE EMF AT COLBY ROAD ALIGNMENT
 121          KM   HYDROGRAPH NAMED 15B FROM PHASE 2 HYDROLOGY.
 122          BI     15B      21
              *

 123          KK  EMFCLB
 124          KM   COMBINE FLOWS FROM COLBY ROAD AND BROWN ROAD
 125          HC       2
              *

 126          KK  RCOLBY
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127          KM    ROUTE FLOWS FROM COLBY ROAD TO UNIVERSITY DRIVE
128          RS       2    FLOW      -1
129          RC    .025    .025    .025    1200   .0001
130          RX       0      10      20      50     130     160     170     180
131          RY      10      10      10       0       0      10      10      10
             *

132          KK    UNIV
133          KM   INFLOW INTO EMF AT UNIVERSITY DRIVE
134          KM   HYDROGRAPH NAMED C16 FROM PHASE 2 HYDROLOGY.
135          BI     C16      21
             *
1                                          HEC-1 INPUT                                                    PAGE  4

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

136          KK  EMFUNI
137          KM    COMBINE FLOWS FROM UNIVESITY DRIVE AND COLBY ROAD IN THE EMF
138          HC       2
             *

139          KK   RUNIV
140          KM    ROUTE FLOWS FROM UNIVERSITY DRIVE TO APACHE TRAIL IN THE EMF
141          RS       8    FLOW      -1
142          RC    .025    .025    .025    3400  .00004
143          RX       0      10      20      50     160     180     190     200
144          RY      12      12      12       0       0      25      25      25
             *

145          KK  APACHE
146          KM    FLOWS INTO THE EMF AT APACHE TRAIL
147          KM   HYDROGRAPH NAMED C21 FROM PHASE 2 HYDROLOGY.
148          BI     C21      21
             *

149          KK  EMFAPC
150          KM    COMBINE FLOWS FROM APACHE TRAIL AND UNIVERSITY DRIVE
151          HC       2
             *

152          KK  RAPCHE
153          KM    ROUTE FLOWS FROM APACHE TRAIL TO BROADWAY ROAD
154          RS       2    FLOW      -1
155          RC    .025    .025    .025    3300   .0013
156          RX       0     110     120     150     240     270     280     290
157          RY      12      11      10       0       0      10      11      12
             *

158          KK   BRDWY
159          KM   FLOWS INTO THE EMF AT BROADWAY ROAD
160          KM   HYDROGRAPH NAMED C28 FROM PHASE 2 HYDROLOGY.
161          BI     C28      21
             *

162          KK  EMFBRD
163          KM    COMBINE FLOWS IN EMF FROM BROADWAY ROAD AND APACHE TRAIL
164          HC       2
             *

165          KK  RBRDWY
166          KM   ROUTE FLOWS FROM BROADWAY ROAD TO SOUTHERN AVENUE
167          RS       4    FLOW      -1
168          RC    .025    .025    .025    5900   .0009
169          RX       0     110     120     150     240     270     280     390
170          RY      14      12      11       0       0      10      11      14
             *
1                                          HEC-1 INPUT                                                    PAGE  5

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

171          KK   STHRN
172          KM   FLOWS INTO EMF AT SOUTHERN ROAD
173          KM   HYDROGRAPH NAMED C35 FROM PHASE 2 HYDROLOGY.
174          BI     C35      21
             *

175          KK  EMFSTH
176          KM   COMBINE FLOWS FROM SOUTHERN AVENUE AND BROADWAY ROAD
177          HC       2
             *

178          KK  RSTHRN
179          KM   ROUTE FLOWS FROM SOUTHERN AVENUE TO SUPERSTITION FREEWAY
180          RS       2    FLOW      -1
181          RC    .035    .035    .035    3000   .0009
182          RX       0     115     130     145     220     250     280     395
183          RY      14      12      11       0       0      10      11      14
             *

184          KK   SUPER
185          KM   FLOWS INTO EMF FROM NORTH OF SUPERSTITION FREEWAY
186          KM   HYDROGRAPH NAMED C41 FROM PHASE 2 HYDROLOGY.
187          BI     C41      21
```

```
                 *
188              KK  EMFSPR
189              KM   COMBINE FLOWS IN EMF FROM NORTH OF SUPERSTITION FREEWAY AND SOUTHERN AVE.
190              HC       2
                 *

191              KK  RSUPER
192              KM   ROUTE FLOWS FROM SUPERSTITION FREEWAY TO GUADALUPE ROAD.
193              RS       6    FLOW      -1
194              RC    .025    .025    .025    9000    .0009
195              RX       0     115     130     145     220     250     280     395
196              RY      14      12      11       0       0      10      11      14
                 *

197              KK    GUAD
198              KM    FLOWS INTO EMF AT GUADALUPE ROAD
199              KM    HYDROGRAPH NAMED EMFGUA IN THE SMQC HYDROLOGY.
200              KM    THIS IS NOT WHAT COMES INTO THE EMF FROM THE GUADALUPE CHANNEL. THE ROUTED
201              KM    FLOW 59BT60 IS THE ACTUAL CHANNEL FLOW. ITS Q IS 2200 CFS. VERY LITTLE FLOW
202              KM    FROM SUBBASIN 60 GETS INTO THE GUADALUPE CHANNEL. THE CONCENTRATION POINT
203              KM    EMFGUA IS MERELY A CONVIENENT CONCENTRATION POINT FOR COMBINING THE
204              KM    SUBBASIN FLOWS WITH FLOWS IN THE CHANNEL SO THEY CAN BE SENT AS HYDROGRAPHS
205              KM    TO THE TAPE 21 FILE
206              BI  EMFGUA      21
                 *
1                                                HEC-1 INPUT                                                PAGE  6

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

207              KK  EMFGUA
208              KM   COMBINE FLOWS IN THE EMF AT GUADALUPE ROAD
209              HC       2
                 *

210              KK   RGUAD
211              KM   ROUTE FLOWS FROM GUADALUPE ROAD TO ELLIOTT ROAD.
212              KM   CHANNEL BOTTOM = 140 FT; CHANNEL TOP WIDTH = 206; CHANNEL DEPTH = 12 FT
213              KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
214              KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
215              RS       5    FLOW      -1
216              RC    .025    .025    .025    5700    .0003
217              RX       0       1     101     134     274     307     407     408
218              RY      16      13      12       0       0      12      13      16
                 *

219              KK  ELLIOT
220              KM   FLOWS AT THE EMF FROM ELLIOTT ROAD
221              KM    HYDROGRAPH NAME 64 IN THE SMQC HYDROLOGY.
222              BI      64      21
                 *

223              KK  EMFELT
224              KM   COMBINE FLOWS IN THE EMF AT ELLIOTT ROAD
225              HC       2
                 *

226              KK  RELIOT
227              KM   ROUTE FLOWS IN THE EMF FROM ELLIOT ROAD TO WARNER ROAD.
228              RS       5    FLOW      -1
229              RC    .025    .025    .025    5300    .0003
230              RX       0     100     110     143     283     316     326     426
231              RY      14      12      12       0       0      12      12      14
                 *

232              KK  WARNER
233              KM   FLOWS AT THE EMF FROM WARNER ROAD
234              KM   HYDROGRAPH NAME 71T72 FROM SMQC HYDROLOGY.
235              BI   71T72      21
                 *

236              KK  EMFWRN
237              KM   COMBINE FLOWS IN THE EMF AT WARNER ROAD.
238              HC       2
                 *

239              KK   RWRNR
240              KM   ROUTE FLOWS IN THE EMF FROM WARNER ROAD TO KNOX ROAD.
241              KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 212; CHANNEL DEPTH = 12 FT
242              KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
243              KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
244              RS       2    FLOW      -1
245              RC    .025    .025    .025    2500    .0001
246              RX       0       1     101     132     282     315     415     416
1                                                HEC-1 INPUT                                                PAGE  7

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

247              RY      16      13      12       0       0      12      13      16
                 *

248              KK    KNOX
249              KM   FLOWS AT THE EMF FROM KNOX ROAD
250              KM   HYDROGRAPH NAME KNOX FROM SMQC HYDROLOGY
```

```
 251          BI    KNOX      21
              *

 252          KK  EMFKNX
 253          KM   COMBINE FLOWS IN THE EMF AT KNOX ROAD
 254          HC       2
              *

 255          KK   RKNOX
 256          KM   ROUTE FLOWS IN THE EMF FROM KNOX ROAD TO RAY ROAD
 257          KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 222; CHANNEL DEPTH = 12 FT
 258          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 259          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 260          RS       2    FLOW      -1
 261          RC    .025    .025    .025    3000   .0003
 262          RX       0       1     101     137     287     323     423     424
 263          RY      16      13      12       0       0      12      13      16
              *

 264          KK     RAY
 265          KM   FLOWS AT RAY ROAD
 266          KM   HYDROGRAPH NAME 76A FROM SMQC HYDROLOGY
 267          BI     76A      21
              *

 268          KK  EMFRAY
 269          KM   COMBINE FLOWS IN THE EMF AT RAY ROAD
 270          HC       2
              *

 271          KK    RRAY
 272          KM   ROUTE FLOWS IN THE EMF FROM RAY ROAD TO POWERLINE FLOODWAY.
 273          KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 194; CHANNEL DEPTH = 11 FT
 274          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 275          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 276          RS       1    FLOW      -1
 277          RC    .035    .035    .035     500   .0009
 278          RX       0       1     201     223     373     395     595     596
 279          RY      21      12      11       0       0      11      12      21
              *

 280          KK   POWER
 281          KM   FLOWS AT POWERLINE FLOODWAY
 282          KM   HYDROGRAPH NAME CPOWER FROM SMQC HYDROLOGY
 283          BI  CPOWER      21
              *
1                                        HEC-1 INPUT                                          PAGE  8

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

 284          KK  EMFPWR
 285          KM   COMBINE FLOWS IN THE EMF AT POWERLINE FLOODWAY
 286          HC       2
              *

 287          KK  RPOWER
 288          KM   ROUTE FLOWS FROM POWERLINE FLOODWAY TO WILLIAMS FIELD ROAD
 289          RS       1    FLOW      -1
 290          RC    .015    .015    .015    5000   .0009
 291          RX       0     200     210     232     282     304     314     414
 292          RY      13      11      11       0       0      11      11      12
              *

 293          KK  WLMFLD
 294          KM   FLOWS AT WILLIAMS FIELD ROAD
 295          KM   HYDROGRAPH NAME 80B FROM SMQC HYDROLOGY
 296          BI     80B      21
              *

 297          KK  EMFWFD
 298          KM   COMBINE FLOWS IN THE EMF AT WILLIAMS FIELD ROAD
 299          HC       2
              *

 300          KK  RWFLD1
 301          KM    ROUTE FLOWS FROM WILLIAMS FIELD ROAD THROUGH A SHORT TRANSITION
 302          KM   CHANNEL BOTTOM =  50 FT; CHANNEL TOP WIDTH =  94; CHANNEL DEPTH = 11 FT
 303          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 304          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 305          RS       1    FLOW      -1
 306          RC    .015    .015    .015    1200 .000381
 307          RX       0       1     201     223     273     295     495     496
 308          RY      16      12      11       0       0      11      12      16
              *

 309          KK  RWFLD2
 310          KM   ROUTE FLOWS FROM 1200 FT SOUTH OF WILLIAMS FIELD ROAD TO RITTENHOUSE RD.
 311          KM   CHANNEL BOTTOM = 175 FT; CHANNEL TOP WIDTH = 239; CHANNEL DEPTH = 10.5 FT
 312          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 313          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 314          RS       3    FLOW      -1
 315          RC    .025    .025    .025    4200  .00025
 316          RX       0       1     101     133     283     315     415     416
 317          RY      16      11    10.5       0       0    10.5      11      16
```

```
                 *
 318             KK  RITTEN
 319             KM   FLOWS AT RITTENHOUSE ROAD
 320             KM   HYDROGRAPH NAME RITTEN FROM SMQC HYDROLOGY
 321             BI  RITTEN      21
                 *
1                                          HEC-1 INPUT                                                PAGE  9

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


 322             KK  EMFRIT
 323             KM   COMBINE FLOWS IN THE EMF AT RITTENHOUSE ROAD.
 324             HC       2
                 *

 325             KK  RRITN1
 326             KM   ROUTE FLOWS FROM RITTENHOUSE ROAD TO 1/4 MILE SOUTH OF PECOS ROAD
 327             KM   CHANNEL BOTTOM = 175 FT; CHANNEL TOP WIDTH = 239; CHANNEL DEPTH = 10.5 FT
 328             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 329             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 330             RS       2    FLOW      -1
 331             RC    .025    .025    .025    2300   .0003
 332             RX       0       1     101     133     308     340     440     441
 333             RY      16      11    10.5       0       0    10.5      11      16
                 *

 334             KK  RRITN2
 335             KM    ROUTE FLOWS FROM 1/4 MILE SOUTH OF PECOS ROAD TO GERMANN ROAD
 336             KM    CHANNEL BOTTOM WIDTH CHANGES FROM 175 FT TO 150 FT,
 337             KM      AND SLOPE CHANGES FROM .0005 TO .00035 FT/FT.
 338             KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
 339             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 340             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 341             RS       4    FLOW      -1
 342             RC    .025    .025    .025    6000  .00035
 343             RX       0       1     101     133     283     315     415     416
 344             RY      16      11    10.5       0       0    10.5      11      16
                 *

 345             KK  GERMAN
 346             KM   FLOWS AT GERMANN ROAD (FROM CO324 IN SMQC.OUT MODEL)
 347             BI   CO324      21
                 *

 348             KK  EMFGRM
 349             KM   COMBINE FLOWS IN THE EMF AT GERMANN ROAD
 350             HC       2
                 *

 351             KK   RGRMN
 352             KM    ROUTE FLOWS FROM GERMANN ROAD TO 1/2 MILE NORTH OF QUEEN CREEK ROAD
 353             KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
 354             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 355             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 356             RS       2    FLOW      -1
 357             RC    .025    .025    .025    3700   .0005
 358             RX       0       1     101     133     283     315     415     416
 359             RY      18      11    10.5       0       0    10.5      11      18
                 *
1                                          HEC-1 INPUT                                                PAGE 10

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


 360             KK     QCN
 361             KM     FLOWS AT 1/2 MILE NORTH OF QUEEN CREEK ROAD
 362             KM     FLOWS KNOWN AS RO329 FROM SMQC.OUT MODEL
 363             BI   RO329      21
                 *

 364             KK  EMFQCN
 365             KM    COMBINATION OF FLOWS IN THE EMF AT 1/2 MILE NORTH OF QUEEN CREEK ROAD
 366             HC       2
                 *

 367             KK    RQCN
 368             KM    ROUTE FLOWS FROM 1/2 MILE NORTH OF QUEEN CREEK TO JUST NORTH OF
 369             KM      QUEEN CREEK ROAD
 370             KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
 371             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 372             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 373             RS       2    FLOW      -1
 374             RC    .025    .025    .025    3500   .0006
 375             RX       0       1     101     133     283     315     415     416
 376             RY      18      11    10.5       0       0    10.5      11      18
                 *

 377             KK     QCS
 378             KM    FLOWS AT QUEEN CREEK ROAD
 379             KM    KNOWN AS SUB330 FROM SMQC.OUT MODEL
 380             BI  SUB330      21
                 *
```

```
 381          KK  EMFQCS
 382          KM    COMBINE FLOWS IN THE EMF AT QUEEN CREEK ROAD
 383          HC       2
              *

 384          KK    RQCS
 385          KM   ROUTE FLOWS FROM QUEEN CREEK ROAD TO CHANDLER HEIGHTS ROAD
 386          KM   CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
 387          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 388          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 389          RS       7    FLOW      -1
 390          RC    .025    .025    .025   11600   .0006
 391          RX       0       1     101     133     333     365     465     466
 392          RY      18      11    10.5       0       0    10.5      11      18
              *

 393          KK     CHN
 394          KM    FLOWS FROM QUEEN CREEK ENTERING IN THE THE EMF AT CHANDLER HEIGHTS ROAD
 395          KM    KNOWN AS CO510 IN THE SMQC.OUT MODEL
 396          BI   CO510      21
              *
1                                          HEC-1 INPUT                                          PAGE 11

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

 397          KK  EMFCHN
 398          KM    COMBINE FLOWS FROM QUEEN CREEK AND EMF AT CHANDLER HEIGHTS ROAD
 399          HC       2
              *

 400          KK     CHS
 401          KM        FLOWS JUST SOUTH OF CHANDLER HEIGHTS RD AND QUEEN CREEK CONFLUENCE
 402          KM        KNOW AS CO558 IN SMQC.OUT MODEL
 403          KM        ROUTING WAS NOT COMPUTED BECAUSE OF THE VERY SHORT DISTANCE
 404          KM        "ACTUALLY THE FLOWS MAY BE ENTERING RIGHT AT CHANDLER HEIGHTS ROAD"
 405          BI   CO558      21
              *

 406          KK  EMFCHS
 407          KM    COMBINE FLOW FROM JUST SOUTH OF CHANDLER HEIGHTS ROAD
 408          KM    "COMBINE FLOWS IN THE EMF AT CHANDLER HEIGHTS ROAD"
 409          HC       2
              *
              * ***********************************************************************
              *
              *    This section has been modified by the District.  Modifications to
              *    the model include the removal of RIGGSN, RRIGN, RIGGS and EMFRG,
              *    and the revision of RCH,
              *
              * ***********************************************************************
              *

 410          KK     RCH
 411          KM     ROUTE FLOWS FROM CHANDLER HEIGHTS ROAD TO 1/4 MILE NORTH OF RIGGS ROAD
 412          KM     CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
 413          KM     THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 414          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 415          KM     FLOWS ROUTED FROM CHANDLER HEIGHTS ROAD TO RIGGS ROAD,
 416          RS       3    FLOW      -1
              * RC  .025    .025    .025    3500   .0003
 417          RC    .025    .025    .025    5280   .0003
 418          RX       0       1     101     133     333     365     465     466
 419          RY      18      11    10.5       0       0    10.5      11      18
              *

 420          KK   RIGGS
 421          KM    BRING FLOWS INTO THE EMF AT RIGGS ROAD
 422          BI   CO580      21
              *

 423          KK   EMFRG
 424          KM    COMBINE FLOWS IN THE EMF AT RIGGS ROAD, NOT 1/4 MILE NORTH
              * KM COMBINE FLOWS FROM CO578A AND EMF 1/4 MILE NORTH OF RIGGS ROAD
 425          HC       2
              *
1                                          HEC-1 INPUT                                          PAGE 12

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

 426          KK  RRIGGS
 427          KM    ROUTE FLOWS FROM RIGGS ROAD TO HUNT HIGHWAY
 428          KM   CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
 429          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 430          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 431          RS       5    FLOW      -1
 432          RC    .025    .025    .025    7000   .0003
 433          RX       0       1     101     133     333     365     465     466
 434          RY      18      11    10.5       0       0    10.5      11      18
              *

 435          KK   HUNTN
 436          KM   FLOWS NORTH OF HUNT HIGHWAY
 437          KM    KNOWN AS SUB584 IN SMQC.OUT MODEL
```

```
438          BI     584      21
             *

439          KK  EMFHTN
440          KM   COMBINE FLOWS IN THE EMF NORTH OF HUNT HIGHWAY
441          HC       2
             *

442          KK   HUNTS
443          KM    FLOWS SOUTH OF HUNT HIGHWAY, FLOWS COMING OFF THE SANTAN MOUNTAINS
444          KM   KNOWN AS CO612 IN SMQC.OUT MODEL
445          BI   CO612      21
             *

446          KK  EMFHTS
447          KM    FLOWS IN THE EMF SOUTH OF HUNT HIGHWAY
448          HC       2
             *
449          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   96      HOBART
                V
                V
  100        RHOB
                .
                .
  106           .       BROWN
                .           .
                .           .
  110      EMFBRN............
                V
                V
  113        RBRN
                .
                .
  119           .       COLBY
                .           .
                .           .
  123      EMFCLB............
                V
                V
  126      RCOLBY
                .
                .
  132           .        UNIV
                .           .
                .           .
  136      EMFUNI............
                V
                V
  139       RUNIV
                .
                .
  145           .      APACHE
                .           .
                .           .
  149      EMFAPC............
                V
                V
  152      RAPCHE
                .
                .
  158           .       BRDWY
                .           .
                .           .
  162      EMFBRD............
                V
                V
  165      RBRDWY
                .
                .
  171           .       STHRN
                .           .
                .           .
  175      EMFSTH............
                V
                V
  178      RSTHRN
                .
                .
  184           .       SUPER
                .           .
                .           .
  188      EMFSPR............
                V
                V
  191      RSUPER
                .
                .
```

```
197          .        GUAD
             .           .
             .           .
207     EMFGUA............
             V
             V
210      RGUAD
             .
             .
219          .      ELLIOT
             .           .
             .           .
223     EMFELT............
             V
             V
226     RELIOT
             .
             .
232          .      WARNER
             .           .
             .           .
236     EMFWRN............
             V
             V
239      RWRNR
             .
             .
248          .        KNOX
             .           .
             .           .
252     EMFKNX............
             V
             V
255      RKNOX
             .
             .
264          .         RAY
             .           .
             .           .
268     EMFRAY............
             V
             V
271       RRAY
             .
             .
280          .       POWER
             .           .
             .           .
284     EMFPWR............
             V
             V
287     RPOWER
             .
             .
293          .      WLMFLD
             .           .
             .           .
297     EMFWFD............
             V
             V
300     RWFLD1
             V
             V
309     RWFLD2
             .
             .
318          .      RITTEN
             .           .
             .           .
322     EMFRIT............
             V
             V
325     RRITN1
             V
             V
334     RRITN2
             .
             .
345          .      GERMAN
             .           .
             .           .
348     EMFGRM............
             V
             V
351      RGRMN
             .
             .
360          .         QCN
             .           .
             .           .
364     EMFQCN............
             V
             V
367       RQCN
             .
```

```
                .
377             .          QCS
                .            .
                .            .
381       EMFQCS............
                V
                V
384         RQCS
                .
                .
393             .          CHN
                .            .
                .            .
397       EMFCHN............
                .
                .
400             .          CHS
                .            .
                .            .
406       EMFCHS............
                V
                V
410          RCH
                .
                .
420             .        RIGGS
                .            .
                .            .
423        EMFRG............
                V
                V
426       RRIGGS
                .
                .
435             .        HUNTN
                .            .
                .            .
439       EMFHTN............
                .
                .
442             .        HUNTS
                .            .
                .            .
446       EMFHTS............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   01DEC99  TIME  12:38:33  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
*********************************************************************
     PROJECT:  Queen Creek/Sanokai Wash Hydraulic Master Plan &
               East Maricopa Floodway Capacity Mitigation Study
PREPARED FOR:  Flood Control District of Maricopa County
 PREPARED BY:  Huitt-Zollars, Inc
    FILENAME:  X-EMF-RT.DAT
        DATE:  Dec 1999

This model is for the 100-year, 24 hr existing conditions EMF
routing model for Reaches 3, 4, 5 and 6 which extend from the
Princess Basin (located north of Brown Rd. in Mesa) to the
Maricopa/Pinal County Line at Hunt Highway.

This model was constructed from a previous model developed as part
of the East Mesa ADMP.

This model, X-EMF-RT.DAT, is the "routing" model used to evaluate
flows in the EMF for the existing conditions.  It imports
hydrographs via TAPE21 files from the supporting hydrologic
models and then routes them along the EMF from approximately
Brown Rd. and south to Hunt Hwy (the County Line).

This model requires the previous running of four supporting hydrologic
models.  Each model evaluates the hydrology for a specific area that
is ultimately tributary to the EMF. The four supporting models are:

   *  X-NWMESA.DAT - Existing conditions hydrology for NE Mesa
                     (-east of the EMF to the CAP(at Hawes Rd.)
                     & -south of McKellips Rd. to US60)

   *  X-NEMESA.DAT - Existing conditions hydrology for NW Mesa
                     (-area northeast of Hawes Rd./US60)

   *  X-SEMESA.DAT - Existing conditions hydrology for SE Mesa
                     (-area east of the EMF from US60 south to
```

```
                                        Rittenhouse Rd. {excluding areas
                                        tributary to Queen Creek})
                                        X-SEMESA.DAT imports hydrographs from
                                        X-NEMESA.DAT via DSS files.  Therefore,
                                        X-NEMESA.DAT must be run first and then
                                        when running X-SEMESA.DAT, X-NEMESA.DSS
                                        must be specified as the DSS file
                                        (the default would be X-SEMESA.DSS)

                                 *  X-QCSW.DAT   - Existing conditions hydrology for Queen
                                                   Creek/Sanokai Wash area (all areas
                                                   tributary to Queen Creek & Sanokai Wash
                                                   and areas tributary to the EMF south of
                                                   Rittenhouse Rd.)

                              IT IS IMPORTANT TO NOTE THAT THE SUPPORTING MODELS DO NOT
                              CORRECTLY ROUTE FLOWS ALONG THE EMF NOR DO THEY IMPORT ALL
                              THE NECESSARY FLOWS TO CORRECTLY EVALUATE FLOWS WITHIN THE
                              EMF.  TO EVALUATE FLOWS WITHIN THE EMF, ALL THE SUPPORTING
                              MODELS SHOULD BE RUN (TO DEVELOP THE TAPE21 FILE) AND THEN
                              THE EMF ROUTING MODEL (X-EMF-RT.DAT).  ONLY THE EMF ROUTING
                              MODEL SHOULD BE USED TO DETERMINE FLOWS WITHIN THE EMF.

                              ***********************************************************************
                                       RECOMMENDED RUN ORDER FOR EMF HYDROLOGY MODELS
                              ***********************************************************************

                                   1. Erase any existing TAPE21 file in run directory.
                                   2. Run X-NEMESA.DAT, X-NWMESA.DAT & X-QCSW.DAT (any order)
                                   3. Run X-SEMESA.DAT (specifying X-NEMESA.DSS as DSS file)
                                   4. Run X-EMF-RT.DAT

                              ***********************************************************************

                             EMF MODEL EXISTING CONDITIONS, EXCEPT SUBBASIN 60
                             HYDROGRAPHS ARE STORED IN A TAPE 21 FILE.

                             FILE: EMF-E.DAT

                             HYDROGRAPHS WERE GENERATED FROM RUNNING THE FOLLOWING FILES
                                 PH2.DAT,  MESANW.DAT, AND SMQC.DAT (USING THE MESANW.DSS FILE)

                             VELOCITIES FOR THE EMF WERE ESTIMATED FROM A MANNINGS EQUATION USING ACTUAL
                                 SLOPES AND FLOWS.

                             THE CROSS-SECTIONS WERE EXTENDED VERTICALLY, IF THE CROSS-SECTIONS DID NOT
                                 HAVE ENOUGH CAPACITY.

 85 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      1APR97  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      7APR97  ENDING DATE
                     NDTIME        2235  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

 87 JD          INDEX STORM NO. 1
                       STRM       3.60  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN

 88 JD          INDEX STORM NO. 2
                       STRM       3.58  PRECIPITATION DEPTH
                       TRDA       1.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN

 89 JD          INDEX STORM NO. 3
                       STRM       3.49  PRECIPITATION DEPTH
                       TRDA       5.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN
```

```
 90 JD          INDEX STORM NO. 4
                      STRM        3.38  PRECIPITATION DEPTH
                      TRDA       10.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 91 JD          INDEX STORM NO. 5
                      STRM        3.24  PRECIPITATION DEPTH
                      TRDA       30.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 92 JD          INDEX STORM NO. 6
                      STRM        3.10  PRECIPITATION DEPTH
                      TRDA       60.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 93 JD          INDEX STORM NO. 7
                      STRM        3.05  PRECIPITATION DEPTH
                      TRDA       90.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 94 JD          INDEX STORM NO. 8
                      STRM        3.00  PRECIPITATION DEPTH
                      TRDA      120.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 95 JD          INDEX STORM NO. 9
                      STRM        2.97  PRECIPITATION DEPTH
                      TRDA      150.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


 99 BI          READ STATION   EMFHOB HYDROGRAPH FROM UNIT 21

109 BI          READ STATION     C15A HYDROGRAPH FROM UNIT 21

122 BI          READ STATION      15B HYDROGRAPH FROM UNIT 21

135 BI          READ STATION      C16 HYDROGRAPH FROM UNIT 21

148 BI          READ STATION      C21 HYDROGRAPH FROM UNIT 21

161 BI          READ STATION      C28 HYDROGRAPH FROM UNIT 21

174 BI          READ STATION      C35 HYDROGRAPH FROM UNIT 21

187 BI          READ STATION      C41 HYDROGRAPH FROM UNIT 21

206 BI          READ STATION   EMFGUA HYDROGRAPH FROM UNIT 21

222 BI          READ STATION       64 HYDROGRAPH FROM UNIT 21

235 BI          READ STATION    71T72 HYDROGRAPH FROM UNIT 21

251 BI          READ STATION     KNOX HYDROGRAPH FROM UNIT 21

267 BI          READ STATION      76A HYDROGRAPH FROM UNIT 21

283 BI          READ STATION   CPOWER HYDROGRAPH FROM UNIT 21

296 BI          READ STATION      80B HYDROGRAPH FROM UNIT 21

321 BI          READ STATION   RITTEN HYDROGRAPH FROM UNIT 21

347 BI          READ STATION    CO324 HYDROGRAPH FROM UNIT 21

363 BI          READ STATION    RO329 HYDROGRAPH FROM UNIT 21

380 BI          READ STATION   SUB330 HYDROGRAPH FROM UNIT 21

396 BI          READ STATION    CO510 HYDROGRAPH FROM UNIT 21

405 BI          READ STATION    CO558 HYDROGRAPH FROM UNIT 21

422 BI          READ STATION    CO580 HYDROGRAPH FROM UNIT 21

438 BI          READ STATION      584 HYDROGRAPH FROM UNIT 21

445 BI          READ STATION    CO612 HYDROGRAPH FROM UNIT 21
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	HOBART	497.	13.58	145.	42.	14.	1.94		
+	ROUTED TO	RHOB	469.	13.83	144.	42.	14.	1.94		
+	HYDROGRAPH AT	BROWN	530.	12.50	112.	34.	12.	2.47		
+	2 COMBINED AT	EMFBRN	599.	12.50	247.	74.	25.	4.41		
+	ROUTED TO	RBRN	552.	13.50	243.	74.	25.	4.41		
+	HYDROGRAPH AT	COLBY	491.	12.50	79.	24.	8.	.51		
+	2 COMBINED AT	EMFCLB	604.	13.25	309.	96.	33.	4.92		
+	ROUTED TO	RCOLBY	596.	13.50	309.	96.	33.	4.92		
+	HYDROGRAPH AT	UNIV	640.	12.25	347.	113.	38.	.64		
+	2 COMBINED AT	EMFUNI	1098.	13.67	639.	203.	69.	5.56		
+	ROUTED TO	RUNIV	1090.	14.25	637.	203.	69.	5.56		
+	HYDROGRAPH AT	APACHE	1336.	13.67	376.	99.	33.	6.23		
+	2 COMBINED AT	EMFAPC	2209.	13.75	945.	284.	96.	11.79		
+	ROUTED TO	RAPCHE	2196.	13.92	944.	284.	96.	11.79		
+	HYDROGRAPH AT	BRDWY	1715.	12.67	593.	188.	63.	3.65		
+	2 COMBINED AT	EMFBRD	3065.	13.00	1469.	454.	154.	15.44		
+	ROUTED TO	RBRDWY	3008.	13.17	1466.	453.	154.	15.44		
+	HYDROGRAPH AT	STHRN	252.	14.42	98.	32.	11.	2.61		
+	2 COMBINED AT	EMFSTH	3091.	13.25	1516.	472.	160.	18.05		
+	ROUTED TO	RSTHRN	3060.	13.42	1514.	472.	160.	18.05		
+	HYDROGRAPH AT	SUPER	498.	12.83	239.	80.	27.	2.74		
+	2 COMBINED AT	EMFSPR	3376.	13.33	1690.	534.	182.	20.79		
+	ROUTED TO	RSUPER	3332.	13.67	1687.	533.	182.	20.79		
+	HYDROGRAPH AT	GUAD	2414.	12.92	1011.	316.	120.	16.00		
+	2 COMBINED AT	EMFGUA	5166.	13.58	2571.	814.	291.	36.79		
+	ROUTED TO	RGUAD	5095.	13.92	2562.	814.	290.	36.79		
+	HYDROGRAPH AT	ELLIOT	435.	13.00	86.	22.	7.	.81		
+	2 COMBINED AT	EMFELT	5158.	13.92	2614.	830.	296.	37.60		
+	ROUTED TO	RELIOT	5105.	14.17	2608.	829.	296.	37.60		
+	HYDROGRAPH AT	WARNER	1746.	16.17	1184.	558.	191.	8.82		
	2 COMBINED AT									

+		EMFWRN	5803.	14.17	3616.	1341.	472.	46.42
	ROUTED TO							
+		RWRNR	5735.	14.33	3603.	1341.	472.	46.42
	HYDROGRAPH AT							
+		KNOX	2071.	15.25	1303.	661.	510.	8.50
	2 COMBINED AT							
+		EMFKNX	7336.	14.42	4652.	1949.	960.	54.92
	ROUTED TO							
+		RKNOX	7303.	14.58	4647.	1949.	959.	54.92
	HYDROGRAPH AT							
+		RAY	807.	14.00	303.	77.	26.	1.91
	2 COMBINED AT							
+		EMFRAY	7780.	14.50	4836.	2007.	979.	56.83
	ROUTED TO							
+		RRAY	7778.	14.50	4836.	2007.	979.	56.83
	HYDROGRAPH AT							
+		POWER	5383.	13.33	3114.	894.	341.	35.97
	2 COMBINED AT							
+		EMFPWR	11456.	14.50	7453.	2787.	1282.	92.80
	ROUTED TO							
+		RPOWER	11381.	14.67	7447.	2787.	1282.	92.80
	HYDROGRAPH AT							
+		WLMFLD	1139.	12.58	212.	66.	22.	1.12
	2 COMBINED AT							
+		EMFWFD	11407.	14.67	7512.	2832.	1297.	93.92
	ROUTED TO							
+		RWFLD1	11398.	14.75	7511.	2832.	1297.	93.92
	ROUTED TO							
+		RWFLD2	11354.	15.00	7504.	2831.	1297.	93.92
	HYDROGRAPH AT							
+		RITTEN	2386.	13.33	1135.	492.	168.	18.91
	2 COMBINED AT							
+		EMFRIT	12347.	14.92	8286.	3217.	1427.	112.83
	ROUTED TO							
+		RRITN1	12324.	15.08	8282.	3217.	1427.	112.83
	ROUTED TO							
+		RRITN2	12268.	15.33	8268.	3217.	1426.	112.83
	HYDROGRAPH AT							
+		GERMAN	409.	18.83	349.	130.	44.	4.47
	2 COMBINED AT							
+		EMFGRM	12438.	15.33	8503.	3310.	1458.	117.30
	ROUTED TO							
+		RGRMN	12399.	15.50	8494.	3309.	1457.	117.30
	HYDROGRAPH AT							
+		QCN	352.	14.00	116.	29.	10.	1.00
	2 COMBINED AT							
+		EMFQCN	12462.	15.50	8569.	3330.	1464.	118.30
	ROUTED TO							
+		RQCN	12434.	15.67	8561.	3330.	1464.	118.30
	HYDROGRAPH AT							
+		QCS	311.	13.17	110.	28.	9.	.97
	2 COMBINED AT							
+		EMFQCS	12455.	15.67	8599.	3347.	1471.	119.27
	ROUTED TO							
+		RQCS	12405.	16.00	8567.	3344.	1470.	119.27
	HYDROGRAPH AT							
+		CHN	5324.	18.92	4329.	3387.	2210.	103.23
	2 COMBINED AT							
+		EMFCHN	14449.	16.17	11596.	6441.	3596.	222.50
	HYDROGRAPH AT							
+		CHS	1020.	13.17	760.	410.	138.	1.92
	2 COMBINED AT							
+		EMFCHS	14856.	16.17	12160.	6678.	3679.	224.42

```
          ROUTED TO
+                          RCH     14799.   16.50       12143.       6674.       3678.     224.42
          HYDROGRAPH AT
+                        RIGGS       721.   12.67         133.         33.         11.       1.53
          2 COMBINED AT
+                        EMFRG     14806.   16.50       12149.       6677.       3679.     225.95
          ROUTED TO
+                       RRIGGS     14755.   16.92       12120.       6669.       3677.     225.95
          HYDROGRAPH AT
+                        HUNTN       252.   13.25          91.         23.          8.        .97
          2 COMBINED AT
+                       EMFHTN     14769.   16.92       12138.       6676.       3680.     226.92
          HYDROGRAPH AT
+                        HUNTS      1657.   16.17        1110.        396.        134.      11.19
          2 COMBINED AT
+                       EMFHTS     15808.   16.83       12839.       6892.       3755.     238.11

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

HYDROLOGY

Preferred Alternative HEC-1 Summary Output

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1               *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   08FEB00  TIME  15:57:36  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

                                        X     X  XXXXXXX   XXXXX          X
                                        X     X  X        X     X        XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X        XXXXX  X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX        XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                HEC-1 INPUT                                                    PAGE  1

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

             1          ID    ********************************************************************
             2          ID         PROJECT:  Queen Creek/Sanokai Wash Hydraulic Master Plan &
             3          ID                   East Maricopa Floodway Capacity Mitigation Study
             4          ID    PREPARED FOR:  Flood Control District of Maricopa County
             5          ID     PREPARED BY:  Huitt-Zollars, Inc
             6          ID        FILENAME:  1C-EMFRT.DAT
             7          ID            DATE:  Dec 1999
             8          ID
             9          ID    This model is the routing model for the preferred alternative
            10          ID    (Alternative  1C) of the East Maricopa Floodway Capacity Mitigation
            11          ID    Study.  It is based upon the 100-year, 24 hr existing conditions EMF
            12          ID    routing model for Reaches 3, 4, 5 and 6 which extend from the
            13          ID    Princess Basin (located north of Brown Rd. in Mesa) to the
            14          ID    Maricopa/Pinal County Line at Hunt Highway.
            15          ID
            16          ID    Alternative 1C includes offline EMF detention basins at Chandler
            17          ID    Heights Rd., Rittenhouse Rd., and north of the proposed Santan
            18          ID    Freeway alignment (north of Knox. Rd).  In addition, this alternative
            19          ID    includes two watershed detention basins.  One off the Guadalupe
            20          ID    Channel located approximately northeast of the intersection of Power
            21          ID    Rd. and Guadalupe Rd.  The other off the Powerline Floodway
            22          ID    located approximately northwest of the intersection of the Powerline
            23          ID    Floodway and Ellsworth Rd (Ray Basin).  All basins for this alternative
            24          ID    are modeled in 1C-EMFRT.DAT with the exception of the Ray Basin.  The
            25          ID    Ray Basin is modeled in 1C-SEMESA.DAT.
            26          ID
            27          ID    In addition, in 1C-EMFRT.DAT the n-value for routing between Broadway
            28          ID    Rd. and Apache Trail (Main St.) has been changed from 0.025 to 0.018
            29          ID    to account for the proposed soil cement lining of the EMF as
            30          ID    part of the recommended alternative.
            31          ID
            32          ID    ************************************************************************
            33          ID                        RUNNING EMF HYDROLOGY MODELS
            34          ID    ************************************************************************
            35          ID    This model, 1C-EMFRT.DAT, is the "routing" model used to evaluate
            36          ID    flows in the EMF for the preferred alternative for the 100-yr, 24-hr
            37          ID    existing conditions.  The model imports hydrographs via TAPE21 files
            38          ID    from the supporting hydrologic models and then routes them along the
            39          ID    EMF from approximately Brown Rd. and south to Hunt Hwy (the County
            40          ID    Line).
            41          ID
            42          ID    This model requires the previous running of four supporting hydrologic
            43          ID    models.  Each model evaluates the hydrology for a specific area that is
            44          ID    ultimately tributary to the EMF. The four supporting models are:
            45          ID
            46          ID       *  1CNWMESA.DAT - Preferred Alternative 1C hydrology base on
            47          ID                          existing conditions hydrology for NE Mesa
            48          ID                          (~east of the EMF to the CAP(at Hawes Rd.)
            49          ID                          & ~south of McKellips Rd. to US60)
            50          ID
            51          ID       *  1CNEMESA.DAT - Preferred Alternative 1C hydrology based on
            52          ID                          existing conditions hydrology for NW Mesa
            53          ID                          (~area northeast of Hawes Rd./US60)
            54          ID
            55          ID       *  1CSEMESA.DAT - Preferred Alternative 1C hydrology based on
1                                                HEC-1 INPUT                                                    PAGE  2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  56          ID                        existing conditions hydrology for SE Mesa
  57          ID                        (~area east of the EMF from US60 south to
  58          ID                         Rittenhouse Rd. {excluding areas
  59          ID                         tributary to Queen Creek})
  60          ID                         1CSEMESA.DAT imports hydrographs from
  61          ID                         1CNEMESA.DAT via DSS files.  Therefore,
  62          ID                         1CNEMESA.DAT must be run first and then
  63          ID                         when running 1CSEMESA.DAT, 1CNEMESA.DSS
  64          ID                         must be specified as the DSS file
  65          ID                         (the default would be 1CSEMESA.DSS)
  66          ID
  67          ID       *  1CQCSW.DAT   - Preferred Alternative 1C hydrology based on
  68          ID                        existing conditions hydrology for Queen
  69          ID                        Creek/Sanokai Wash area (all areas
  70          ID                        tributary to Queen Creek & Sanokai Wash
  71          ID                        and areas tributary to the EMF south of
  72          ID                        Rittenhouse Rd.)
  73          ID
  74          ID    ********************************************************************
  75          ID      IT IS IMPORTANT TO NOTE THAT THE SUPPORTING MODELS DO NOT
  76          ID      CORRECTLY ROUTE FLOWS ALONG THE EMF NOR DO THEY IMPORT ALL
  77          ID      THE NECESSARY FLOWS TO CORRECTLY EVALUATE FLOWS WITHIN THE
  78          ID      EMF.  TO EVALUATE FLOWS WITHIN THE EMF, ALL THE SUPPORTING
  79          ID      MODELS SHOULD BE RUN (TO DEVELOP THE TAPE21 FILE) AND THEN
  80          ID      THE EMF ROUTING MODEL (1C-EMFRT.DAT).  ONLY THE EMF ROUTING
  81          ID      MODEL SHOULD BE USED TO DETERMINE FLOWS WITHIN THE EMF.
  82          ID    ********************************************************************
  83          ID
  84          ID    *********************************************************************
  85          ID              RECOMMENDED RUN ORDER FOR EMF HYDROLOGY MODELS
  86          ID    *********************************************************************
  87          ID
  88          ID         1. Erase any existing TAPE21 file in run directory.
  89          ID         2. Run 1CNEMESA.DAT, 1CNWMESA.DAT & 1CQCSW.DAT (any order)
  90          ID         3. Run 1CSEMESA.DAT (specifying 1CNEMESA.DSS as DSS file)
  91          ID         4. Run 1C-EMFRT.DAT
  92          ID
  93          ID    ********************************************************************
  94          ID              BEGIN ID COMMENTS FROM ORIGINAL HYDROLOGY MODELS
  95          ID    ********************************************************************
  96          ID
  97          ID   EMF MODEL EXISTING CONDITIONS, EXCEPT SUBBASIN 60
  98          ID   HYDROGRAPHS ARE STORED IN A TAPE 21 FILE.
  99          ID
 100          ID   HYDROGRAPHS WERE GENERATED FROM RUNNING THE FOLLOWING FILES
 101          ID       PH2.DAT,  MESANW.DAT, AND SMQC.DAT (USING THE MESANW.DSS FILE)
 102          ID
 103          ID   VELOCITIES FOR THE EMF WERE ESTIMATED FROM A MANNINGS EQUATION USING ACTUAL
 104          ID       SLOPES AND FLOWS.
 105          ID
 106          ID   THE CROSS-SECTIONS WERE EXTENDED VERTICALLY, IF THE CROSS-SECTIONS DID NOT
 107          ID       HAVE ENOUGH CAPACITY.
 108          ID
 109          ID    ********************************************************************
 110          ID              END ID COMMENTS FROM ORIGINAL HYDROLOGY MODELS
1                                        HEC-1 INPUT                                        PAGE  3

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

 111          ID    ********************************************************************
              *
              *DIAGRAM
 112          IT       5  1APR97    0000    2000
 113          IO       5
 114          IN      15
 115          JD    3.60     .01
 116          JD    3.58     1.0
 117          JD    3.49     5.0
 118          JD    3.38    10.0
 119          JD    3.24    30.0
 120          JD    3.10    60.0
 121          JD    3.05    90.0
 122          JD    3.00   120.0
 123          JD    2.97   150.0
              *

 124          KK  HOBART
 125          KM   INFLOW INTO EMF AT HOBART ROAD AND GREENFIELD.
 126          KM   HYDROGRAPH NAMED EMFHOB FROM PHASE 2 HYDROLOGY.
 127          BI  EMFHOB      21
              *

 128          KK    RHOB
 129          KM   ROUTE FLOW FROM HOBART ROAD TO BROWN ROAD
 130          RS       4    FLOW      -1
 131          RC    .025    .025    .025    2000  .00010
 132          RX       0      10      20      50      90     120     130     140
 133          RY      10      10      10       0       0      10      10      10
              *

 134          KK   BROWN
 135          KM   INFLOW INTO THE EMF AT BROWN ROAD
 136          KM   HYDROGRAPH NAMED C15A FROM PHASE 2 HYDROLOGY.
```

```
 137          BI    C15A      21
              *

 138          KK  EMFBRN
 139          KM    COMBINE FLOWS FROM HOBART ROAD AND BROWN ROAD
 140          HC       2
              *

 141          KK    RBRN
 142          KM   ROUTE FLOWS FROM BROWN ROAD TO COLBY ROAD
 143          RS       8    FLOW      -1
 144          RC    .025    .025    .025    4500   .0001
 145          RX       0      10      20      50     130     160     170     180
 146          RY      10      10      10       0       0      10      10      10
              *
1                                          HEC-1 INPUT                                                PAGE  4

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

 147          KK   COLBY
 148          KM   INFLOW INTO THE EMF AT COLBY ROAD ALIGNMENT
 149          KM   HYDROGRAPH NAMED 15B FROM PHASE 2 HYDROLOGY.
 150          BI     15B      21
              *

 151          KK  EMFCLB
 152          KM   COMBINE FLOWS FROM COLBY ROAD AND BROWN ROAD
 153          HC       2
              *

 154          KK  RCOLBY
 155          KM    ROUTE FLOWS FROM COLBY ROAD TO UNIVERSITY DRIVE
 156          RS       2    FLOW      -1
 157          RC    .025    .025    .025    1200   .0001
 158          RX       0      10      20      50     130     160     170     180
 159          RY      10      10      10       0       0      10      10      10
              *

 160          KK    UNIV
 161          KM   INFLOW INTO EMF AT UNIVERSITY DRIVE
 162          KM   HYDROGRAPH NAMED C16 FROM PHASE 2 HYDROLOGY.
 163          BI     C16      21
              *

 164          KK  EMFUNI
 165          KM    COMBINE FLOWS FROM UNIVESITY DRIVE AND COLBY ROAD IN THE EMF
 166          HC       2
              *

 167          KK   RUNIV
 168          KM    ROUTE FLOWS FROM UNIVERSITY DRIVE TO APACHE TRAIL IN THE EMF
 169          RS       8    FLOW      -1
 170          RC    .025    .025    .025    3400  .00004
 171          RX       0      10      20      50     160     180     190     200
 172          RY      12      12      12       0       0      25      25      25
              *

 173          KK  APACHE
 174          KM    FLOWS INTO THE EMF AT APACHE TRAIL
 175          KM   HYDROGRAPH NAMED C21 FROM PHASE 2 HYDROLOGY.
 176          BI     C21      21
              *

 177          KK  EMFAPC
 178          KM    COMBINE FLOWS FROM APACHE TRAIL AND UNIVERSITY DRIVE
 179          HC       2
              *
              * ************************************************************************
              *     The n-value from Apache to Broadway has been reduced from the
              *     original model to 0.018 to account for the proposed soil cement
              *     lining of the EMF between Apache and Broadway.
              * ************************************************************************
              *
1                                          HEC-1 INPUT                                                PAGE  5

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

 180          KK  RAPCHE
 181          KM    ROUTE FLOWS FROM APACHE TRAIL TO BROADWAY ROAD
 182          RS       2    FLOW      -1
 183          RC    .018    .018    .018    3300   .0013
 184          RX       0     110     120     150     240     270     280     290
 185          RY      12      11      10       0       0      10      11      12
              *

 186          KK   BRDWY
 187          KM   FLOWS INTO THE EMF AT BROADWAY ROAD
 188          KM   HYDROGRAPH NAMED C28 FROM PHASE 2 HYDROLOGY.
 189          BI     C28      21
              *

 190          KK  EMFBRD
 191          KM    COMBINE FLOWS IN EMF FROM BROADWAY ROAD AND APACHE TRAIL
```

```
192          HC       2
             *

193          KK  RBRDWY
194          KM   ROUTE FLOWS FROM BROADWAY ROAD TO SOUTHERN AVENUE
195          RS       4    FLOW      -1
196          RC    .025    .025    .025    5900   .0009
197          RX       0     110     120     150     240     270     280     390
198          RY      14      12      11       0       0      10      11      14
             *

199          KK   STHRN
200          KM   FLOWS INTO EMF AT SOUTHERN ROAD
201          KM   HYDROGRAPH NAMED C35 FROM PHASE 2 HYDROLOGY.
202          BI     C35      21
             *

203          KK  EMFSTH
204          KM   COMBINE FLOWS FROM SOUTHERN AVENUE AND BROADWAY ROAD
205          HC       2
             *

206          KK  RSTHRN
207          KM   ROUTE FLOWS FROM SOUTHERN AVENUE TO SUPERSTITION FREEWAY
208          RS       2    FLOW      -1
209          RC    .035    .035    .035    3000   .0009
210          RX       0     115     130     145     220     250     280     395
211          RY      14      12      11       0       0      10      11      14
             *

212          KK   SUPER
213          KM   FLOWS INTO EMF FROM NORTH OF SUPERSTITION FREEWAY
214          KM   HYDROGRAPH NAMED C41 FROM PHASE 2 HYDROLOGY.
215          BI     C41      21
             *
1                                        HEC-1 INPUT                                                    PAGE  6

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

216          KK  EMFSPR
217          KM   COMBINE FLOWS IN EMF FROM NORTH OF SUPERSTITION FREEWAY AND SOUTHERN AVE.
218          HC       2
             *

219          KK  RSUPER
220          KM   ROUTE FLOWS FROM SUPERSTITION FREEWAY TO GUADALUPE ROAD.
221          RS       6    FLOW      -1
222          RC    .025    .025    .025    9000   .0009
223          RX       0     115     130     145     220     250     280     395
224          RY      14      12      11       0       0      10      11      14
             *

225          KK    GUAD
226          KM    FLOWS INTO EMF AT GUADALUPE ROAD
227          KM    HYDROGRAPH NAMED EMFGUA IN THE SMQC HYDROLOGY.
228          KM    THIS IS NOT WHAT COMES INTO THE EMF FROM THE GUADALUPE CHANNEL. THE ROUTED
229          KM    FLOW 59BT60 IS THE ACTUAL CHANNEL FLOW. ITS Q IS 2200 CFS. VERY LITTLE FLOW
230          KM    FROM SUBBASIN 60 GETS INTO THE GUADALUPE CHANNEL. THE CONCENTRATION POINT
231          KM    EMFGUA IS MERELY A CONVIENENT CONCENTRATION POINT FOR COMBINING THE
232          KM    SUBBASIN FLOWS WITH FLOWS IN THE CHANNEL SO THEY CAN BE SENT AS HYDROGRAPHS
233          KM    TO THE TAPE 21 FILE
234          BI  EMFGUA      21
             *
             * ************************************************************************
             *     EMF Watershed Basin off the Guadalupe Channel:
             *
             *     This watershed basin is to be located off the Guadalupe
             *     Channel detaining runoff from the watershed prior to entering the
             *     EMF.  The basin is located northeast of the intersection of
             *     Power Rd. and Guadalupe Rd.  The basin is modeled below to detain all
             *     flow in the Guadalupe Channel in excess of 1000 cfs.
             * ************************************************************************
             *

235          KK  *DBNGU
236          KM        EMF WATERSHED BASIN NORTH OF GUADALUPE
237          KO       3
238          DT  NGUADB
239          DI       0    1000    1001   16000
240          DQ       0       0       1   15000
             *

241          KK  EMFGUA
242          KM   COMBINE FLOWS IN THE EMF AT GUADALUPE ROAD
243          HC       2
             *

244          KK   RGUAD
245          KM   ROUTE FLOWS FROM GUADALUPE ROAD TO ELLIOTT ROAD.
246          KM   CHANNEL BOTTOM = 140 FT; CHANNEL TOP WIDTH = 206; CHANNEL DEPTH = 12 FT
247          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
248          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
249          RS       5    FLOW      -1
1                                        HEC-1 INPUT                                                    PAGE  7
```

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

 250          RC    .025    .025    .025    5700   .0003
 251          RX       0       1     101     134     274     307     407     408
 252          RY      16      13      12       0       0      12      13      16
              *

 253          KK  ELLIOT
 254          KM   FLOWS AT THE EMF FROM ELLIOTT ROAD
 255          KM    HYDROGRAPH NAME 64 IN THE SMQC HYDROLOGY.
 256          BI      64      21
              *

 257          KK  EMFELT
 258          KM   COMBINE FLOWS IN THE EMF AT ELLIOTT ROAD
 259          HC       2
              *

 260          KK  RELIOT
 261          KM   ROUTE FLOWS IN THE EMF FROM ELLIOT ROAD TO WARNER ROAD.
 262          RS       5    FLOW      -1
 263          RC    .025    .025    .025    5300   .0003
 264          RX       0     100     110     143     283     316     326     426
 265          RY      14      12      12       0       0      12      12      14
              *

 266          KK  WARNER
 267          KM   FLOWS AT THE EMF FROM WARNER ROAD
 268          KM   HYDROGRAPH NAME 71T72 FROM SMQC HYDROLOGY.
 269          BI   71T72      21
              *

 270          KK  EMFWRN
 271          KM   COMBINE FLOWS IN THE EMF AT WARNER ROAD.
 272          HC       2
              *

 273          KK   RWRNR
 274          KM   ROUTE FLOWS IN THE EMF FROM WARNER ROAD TO KNOX ROAD.
 275          KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 212; CHANNEL DEPTH = 12 FT
 276          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 277          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 278          RS       2    FLOW      -1
 279          RC    .025    .025    .025    2500   .0001
 280          RX       0       1     101     132     282     315     415     416
 281          RY      16      13      12       0       0      12      13      16
              *

 282          KK    KNOX
 283          KM   FLOWS AT THE EMF FROM KNOX ROAD
 284          KM   HYDROGRAPH NAME KNOX FROM SMQC HYDROLOGY
 285          BI    KNOX      21
              *
```



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

 286          KK  EMFKNX
 287          KM   COMBINE FLOWS IN THE EMF AT KNOX ROAD
 288          HC       2
              *
              * ************************************************************************
              *     EMF Offline Basin located north Knox Rd.:
              *
              *     This offline basin is to be located north of the proposed
              *     Santan Freeway alignment (approximately northeast of
              *     of the intersection of Knox Rd. and the EMF).  The basin is
              *     modeled below to detain all flow in the EMF in excess of 2200 cfs.
              * ************************************************************************
              *

 289          KK  *DBNKX
 290          KM        OFFLINE EMF BASIN NORTH OF KNOX (NORTH OF THE PROPOSED SANTAN FWY)
 291          KO       3
 292          DT  NKNXDB
 293          DI       0    2200    2201   17200
 294          DQ       0       0       1   15000
              *

 295          KK   RKNOX
 296          KM   ROUTE FLOWS IN THE EMF FROM KNOX ROAD TO RAY ROAD
 297          KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 222; CHANNEL DEPTH = 12 FT
 298          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 299          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 300          RS       2    FLOW      -1
 301          RC    .025    .025    .025    3000   .0003
 302          RX       0       1     101     137     287     323     423     424
 303          RY      16      13      12       0       0      12      13      16
              *

 304          KK     RAY
 305          KM   FLOWS AT RAY ROAD
 306          KM   HYDROGRAPH NAME 76A FROM SMQC HYDROLOGY
```

```
307          BI     76A      21
             *

308          KK  EMFRAY
309          KM   COMBINE FLOWS IN THE EMF AT RAY ROAD
310          HC       2
             *

311          KK    RRAY
312          KM   ROUTE FLOWS IN THE EMF FROM RAY ROAD TO POWERLINE FLOODWAY.
313          KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 194; CHANNEL DEPTH = 11 FT
314          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
315          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
316          RS       1    FLOW      -1
317          RC    .035    .035    .035     500   .0009
318          RX       0       1     201     223     373     395     595     596
319          RY      21      12      11       0       0      11      12      21
             *
             * ************************************************************************
             *     EMF Watershed Basin off the Powerline Floodway (Ray Basin):
             *
             *     This watershed basin is to be located off the Powerline
             *     Floodway detaining runoff from the watershed prior to entering
             *     the EMF.  The basin is located northwest of the intersection of
             *     Powerline Floodway (Ray Rd.) and Ellsworth Rd.  The basin is modeled
             *     to detain all flow in the Powerline Floodway in excess of 1000 cfs.
             *
             *     The Ray Basin is not model in this model but in 1CSEMESA.DAT.  The
             *     impact of the basin is realized in this model through the importation
             *     of CPOWER in the following records.
             * ************************************************************************
             *
1                                          HEC-1 INPUT                                          PAGE  9

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

320          KK   POWER
321          KM   FLOWS AT POWERLINE FLOODWAY
322          KM   HYDROGRAPH NAME CPOWER FROM SEMESA HYDROLOGY
323          BI  CPOWER      21
             *

324          KK  EMFPWR
325          KM   COMBINE FLOWS IN THE EMF AT POWERLINE FLOODWAY
326          HC       2
             *

327          KK  RPOWER
328          KM   ROUTE FLOWS FROM POWERLINE FLOODWAY TO WILLIAMS FIELD ROAD
329          RS       1    FLOW      -1
330          RC    .015    .015    .015    5000   .0009
331          RX       0     200     210     232     282     304     314     414
332          RY      13      11      11       0       0      11      11      12
             *

333          KK  WLMFLD
334          KM   FLOWS AT WILLIAMS FIELD ROAD
335          KM   HYDROGRAPH NAME 80B FROM SEMESA HYDROLOGY
336          BI     80B      21
             *

337          KK  EMFWFD
338          KM   COMBINE FLOWS IN THE EMF AT WILLIAMS FIELD ROAD
339          HC       2
             *

340          KK  RWFLD1
341          KM    ROUTE FLOWS FROM WILLIAMS FIELD ROAD THROUGH A SHORT TRANSITION
342          KM   CHANNEL BOTTOM =  50 FT; CHANNEL TOP WIDTH =  94; CHANNEL DEPTH = 11 FT
343          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
344          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
345          RS       1    FLOW      -1
346          RC    .015    .015    .015    1200 .000381
347          RX       0       1     201     223     273     295     495     496
348          RY      16      12      11       0       0      11      12      16
             *

349          KK  RWFLD2
350          KM   ROUTE FLOWS FROM 1200 FT SOUTH OF WILLIAMS FIELD ROAD TO RITTENHOUSE RD.
351          KM   CHANNEL BOTTOM = 175 FT; CHANNEL TOP WIDTH = 239; CHANNEL DEPTH = 10.5 FT
352          KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
353          KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
354          RS       3    FLOW      -1
355          RC    .025    .025    .025    4200  .00025
356          RX       0       1     101     133     283     315     415     416
357          RY      16      11    10.5       0       0    10.5      11      16
             *
             * ************************************************************************
             *     EMF Offline Basin located north Rittenhouse Rd.:
             *
             *     This offline basin is to be located north of Rittenhouse Rd.
             *     between the EMF and Power Rd.  The basin is modeled to detain
             *     flow in excess of 3000 cfs from the EMF and flows in excess
             *     of 500 cfs from the Rittenhouse Rd. channel.  The next few
```

```
                    *     records model the diversion from the EMF.
                    * ************************************************************************
                    *
1                                                HEC-1 INPUT                                                    PAGE 10

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

           358      KK  *DBRIT
           359      KM        BASIN TO WITHDRAW FLOW FROM EMF & RITTENHOUSE CHANNEL
           360      KM        THIS DIVERTS FLOW FROM THE EMF INTO THE RITTENHOUSE BASIN
           361      KO       3
           362      DT  RITTDB
           363      DI       0    3000    3001   16500
           364      DQ       0       0       1   13500
                    *

           365      KK  RITTEN
           366      KM   FLOWS AT RITTENHOUSE ROAD
           367      KM   HYDROGRAPH NAME RITTEN FROM SMQC HYDROLOGY
           368      BI  RITTEN      21
                    *
                    * ************************************************************************
                    *     EMF Offline Basin located north Rittenhouse Rd.:
                    *
                    *     This offline basin is to be located north of Rittenhouse Rd.
                    *     between the EMF and Power Rd.  The basin is modeled to detain
                    *     flow in excess of 3000 cfs from the EMF and flows in excess
                    *     of 500 cfs from the Rittenhouse Rd. Channel.  The next few
                    *     records model the diversion from the Rittenhouse Rd. Channel.
                    * ************************************************************************
                    *

           369      KK  *DBRRD
           370      KM        BASIN TO WITHDRAW FLOW FROM EMF & RITTENHOUSE CHANNEL
           371      KM        THIS DIVERTS FLOW FROM THE RITTENHOUSE RD. CHANNEL
           372      KM        INTO THE RITTENHOUSE BASIN
           373      KO       3
           374      DT   RRDDB
           375      DI       0     500     501   10500
           376      DQ       0       0       1   10000
                    *

           377      KK  EMFRIT
           378      KM   COMBINE FLOWS IN THE EMF AT RITTENHOUSE ROAD.
           379      HC       2
                    *

           380      KK  RRITN1
           381      KM   ROUTE FLOWS FROM RITTENHOUSE ROAD TO 1/4 MILE SOUTH OF PECOS ROAD
           382      KM   CHANNEL BOTTOM = 175 FT; CHANNEL TOP WIDTH = 239; CHANNEL DEPTH = 10.5 FT
           383      KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
           384      KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
           385      RS       2    FLOW      -1
           386      RC    .025    .025    .025    2300   .0003
           387      RX       0       1     101     133     308     340     440     441
           388      RY      16      11    10.5       0       0    10.5      11      16
                    *
1                                                HEC-1 INPUT                                                    PAGE 11

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

           389      KK  RRITN2
           390      KM    ROUTE FLOWS FROM 1/4 MILE SOUTH OF PECOS ROAD TO GERMANN ROAD
           391      KM    CHANNEL BOTTOM WIDTH CHANGES FROM 175 FT TO 150 FT,
           392      KM      AND SLOPE CHANGES FROM .0005 TO .00035 FT/FT.
           393      KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
           394      KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
           395      KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
           396      RS       4    FLOW      -1
           397      RC    .025    .025    .025    6000  .00035
           398      RX       0       1     101     133     283     315     415     416
           399      RY      16      11    10.5       0       0    10.5      11      16
                    *

           400      KK  GERMAN
           401      KM   FLOWS AT GERMANN ROAD (FROM CO324 IN QCSW MODEL)
           402      BI   CO324      21
                    *

           403      KK  EMFGRM
           404      KM   COMBINE FLOWS IN THE EMF AT GERMANN ROAD
           405      HC       2
                    *

           406      KK   RGRMN
           407      KM    ROUTE FLOWS FROM GERMANN ROAD TO 1/2 MILE NORTH OF QUEEN CREEK ROAD
           408      KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
           409      KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
           410      KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
           411      RS       2    FLOW      -1
           412      RC    .025    .025    .025    3700   .0005
           413      RX       0       1     101     133     283     315     415     416
           414      RY      18      11    10.5       0       0    10.5      11      18
```

```
                 *

 415             KK     QCN
 416             KM     FLOWS AT 1/2 MILE NORTH OF QUEEN CREEK ROAD
 417             KM     FLOWS KNOWN AS RO329 FROM QCSW MODEL
 418             BI   RO329      21
                 *

 419             KK  EMFQCN
 420             KM    COMBINATION OF FLOWS IN THE EMF AT 1/2 MILE NORTH OF QUEEN CREEK ROAD
 421             HC       2
                 *

 422             KK    RQCN
 423             KM    ROUTE FLOWS FROM 1/2 MILE NORTH OF QUEEN CREEK TO JUST NORTH OF
 424             KM      QUEEN CREEK ROAD
 425             KM   CHANNEL BOTTOM = 150 FT; CHANNEL TOP WIDTH = 214; CHANNEL DEPTH = 10.5 FT
 426             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 427             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 428             RS       2    FLOW      -1
 429             RC    .025    .025    .025    3500   .0006
 430             RX       0       1     101     133     283     315     415     416
1                                             HEC-1 INPUT                                                    PAGE 12

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

 431             RY      18      11    10.5       0       0    10.5      11      18
                 *

 432             KK     QCS
 433             KM    FLOWS AT QUEEN CREEK ROAD
 434             KM    KNOWN AS SUB330 FROM QCSW MODEL
 435             BI  SUB330      21
                 *

 436             KK  EMFQCS
 437             KM    COMBINE FLOWS IN THE EMF AT QUEEN CREEK ROAD
 438             HC       2
                 *

 439             KK    RQCS
 440             KM   ROUTE FLOWS FROM QUEEN CREEK ROAD TO CHANDLER HEIGHTS ROAD
 441             KM   CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
 442             KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
 443             KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
 444             RS       7    FLOW      -1
 445             RC    .025    .025    .025   11600   .0006
 446             RX       0       1     101     133     333     365     465     466
 447             RY      18      11    10.5       0       0    10.5      11      18
                 *
                 * ************************************************************************
                 *     EMF Offline Basin located north Chandler Heights Rd.:
                 *
                 *     This offline basin is to be located north of Chandler Heights Rd.
                 *     between the EMF and Queen Creek.  The basin is modeled to detain
                 *     flow in excess of 2300 cfs from the EMF and flows in excess
                 *     of 2700 cfs from Queen Creek.  The next few records model the
                 *     diversion from the EMF.
                 * ************************************************************************
                 *
 448             KM       OFFLINE BASIN AT EMF/QC&SW CONFLUENCE
 449             KM       THIS DIVERTS FLOW FROM THE EMF INTO THE CHANDLER HEIGHTS BASIN
 450             KO       3
 451             DT   NCHDB
 452             DI       0    2300    2301   15800
 453             DQ       0       0       1   13500
                 *

 454             KK     CHN
 455             KM    FLOWS FROM QUEEN CREEK ENTERING IN THE THE EMF AT CHANDLER HEIGHTS ROAD
 456             KM    KNOWN AS CO510 IN THE QCSW MODEL
 457             BI   CO510      21
                 *
                 * ************************************************************************
                 *     EMF Offline Basin located north Chandler Heights Rd.:
                 *
                 *     This offline basin is to be located north of Chandler Heights Rd.
                 *     between the EMF and Queen Creek.  The basin is modeled to detain
                 *     flow in excess of 2300 cfs from the EMF and flows in excess
                 *     of 2700 cfs from Queen Creek.  The next few records model the
                 *     diversion from Queen Creek.
                 * ************************************************************************
                 *
1                                             HEC-1 INPUT                                                    PAGE 13

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

 458             KK  *DCHQC
 459             KM       OFFLINE BASIN AT EMF/QC&SW CONFLUENCE
 460             KM       THIS DIVERTS FLOW FROM QUEEN CREEK INTO THE CHANDLER HTS. BASIN
 461             KO       3
 462             DT  CHQCDB
 463             DI       0    2700    2701   12700
 464             DQ       0       0       1   10000
```

```
                    *
465                 KK  EMFCHN
466                 KM    COMBINE FLOWS FROM QUEEN CREEK AND EMF AT CHANDLER HEIGHTS ROAD
467                 HC       2
                    *

468                 KK     CHS
469                 KM        FLOWS JUST SOUTH OF CHANDLER HEIGHTS RD AND QUEEN CREEK CONFLUENCE
470                 KM        KNOW AS CO558 IN QCSW MODEL
471                 KM        ROUTING WAS NOT COMPUTED BECAUSE OF THE VERY SHORT DISTANCE
472                 KM        "ACTUALLY THE FLOWS MAY BE ENTERING RIGHT AT CHANDLER HEIGHTS ROAD"
473                 BI   CO558      21
                    *

474                 KK  EMFCHS
475                 KM    COMBINE FLOW FROM JUST SOUTH OF CHANDLER HEIGHTS ROAD
476                 KM    "COMBINE FLOWS IN THE EMF AT CHANDLER HEIGHTS ROAD"
477                 HC       2
                    *
                    * ************************************************************************
                    *
                    *    This section has been modified by the District.  Modifications to
                    *    the model include the removal of RIGGSN, RRIGN, RIGGS and EMFRG,
                    *    and the revision of RCH,
                    *
                    * ************************************************************************
                    *

478                 KK     RCH
479                 KM     ROUTE FLOWS FROM CHANDLER HEIGHTS ROAD TO 1/4 MILE NORTH OF RIGGS ROAD
480                 KM     CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
481                 KM     THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
482                 KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
483                 KM     FLOWS ROUTED FROM CHANDLER HEIGHTS ROAD TO RIGGS ROAD,
484                 RS       3    FLOW      -1
                    * RC  .025    .025    .025    3500   .0003
485                 RC    .025    .025    .025    5280   .0003
486                 RX       0       1     101     133     333     365     465     466
487                 RY      18      11    10.5       0       0    10.5      11      18
                    *
1                                                HEC-1 INPUT                                                PAGE 14

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

488                 KK   RIGGS
489                 KM    BRING FLOWS INTO THE EMF AT RIGGS ROAD
490                 BI   CO580      21
                    *

491                 KK   EMFRG
492                 KM    COMBINE FLOWS IN THE EMF AT RIGGS ROAD, NOT 1/4 MILE NORTH
                    * KM COMBINE FLOWS FROM CO578A AND EMF 1/4 MILE NORTH OF RIGGS ROAD
493                 HC       2
                    *

494                 KK  RRIGGS
495                 KM    ROUTE FLOWS FROM RIGGS ROAD TO HUNT HIGHWAY
496                 KM   CHANNEL BOTTOM = 200 FT; CHANNEL TOP WIDTH = 264; CHANNEL DEPTH = 10.5 FT
497                 KM   THE END OF THE CHANNEL CROSS-SECTION WAS INCREASED TO ELIMINATE THE
498                 KM     WARNING OF MAXIMUM ROUTED OUTFLOW IS EXCEEDED.
499                 RS       5    FLOW      -1
500                 RC    .025    .025    .025    7000   .0003
501                 RX       0       1     101     133     333     365     465     466
502                 RY      18      11    10.5       0       0    10.5      11      18
                    *

503                 KK   HUNTN
504                 KM   FLOWS NORTH OF HUNT HIGHWAY
505                 KM    KNOWN AS SUB584 IN QCSW MODEL
506                 BI     584      21
                    *

507                 KK  EMFHTN
508                 KM   COMBINE FLOWS IN THE EMF NORTH OF HUNT HIGHWAY
509                 HC       2
                    *

510                 KK   HUNTS
511                 KM    FLOWS SOUTH OF HUNT HIGHWAY, FLOWS COMING OFF THE SANTAN MOUNTAINS
512                 KM   KNOWN AS CO612 IN QCSW MODEL
513                 BI   CO612      21
                    *

514                 KK  EMFHTS
515                 KM    FLOWS IN THE EMF SOUTH OF HUNT HIGHWAY
516                 HC       2
                    *
517                 ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW
```

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

124     HOBART
             V
             V
128       RHOB
             .
             .
134          .        BROWN
             .            .
             .            .
138     EMFBRN............
             V
             V
141       RBRN
             .
             .
147          .        COLBY
             .            .
             .            .
151     EMFCLB............
             V
             V
154     RCOLBY
             .
             .
160          .         UNIV
             .            .
             .            .
164     EMFUNI............
             V
             V
167      RUNIV
             .
             .
173          .       APACHE
             .            .
             .            .
177     EMFAPC............
             V
             V
180     RAPCHE
             .
             .
186          .        BRDWY
             .            .
             .            .
190     EMFBRD............
             V
             V
193     RBRDWY
             .
             .
199          .        STHRN
             .            .
             .            .
203     EMFSTH............
             V
             V
206     RSTHRN
             .
             .
212          .        SUPER
             .            .
             .            .
216     EMFSPR............
             V
             V
219     RSUPER
             .
             .
225          .         GUAD
             .            .
             .            .
238          .            .-------->  NGUADB
235          .       *DBNGU
             .            .
             .            .
241     EMFGUA............
             V
             V
244      RGUAD
             .
             .
253          .       ELLIOT
             .            .
             .            .
257     EMFELT............
             V
             V
260     RELIOT
             .
             .
266          .       WARNER
             .            .
```

```
                .                .
270       EMFWRN............
               V
               V
273        RWRNR
                .
                .
282             .        KNOX
                .           .
                .           .
286       EMFKNX............
                .
                .
292             .-------> NKNXDB
289       *DBNKX
               V
               V
295        RKNOX
                .
                .
304             .         RAY
                .           .
                .           .
308       EMFRAY............
               V
               V
311         RRAY
                .
                .
320             .       POWER
                .           .
                .           .
324       EMFPWR............
               V
               V
327       RPOWER
                .
                .
333             .      WLMFLD
                .           .
                .           .
337       EMFWFD............
               V
               V
340       RWFLD1
               V
               V
349       RWFLD2
                .
                .
362             .-------> RITTDB
358       *DBRIT
                .
                .
365             .      RITTEN
                .           .
                .           .
374             .           .------->   RRDDB
369             .      *DBRRD
                .           .
                .           .
377       EMFRIT............
               V
               V
380       RRITN1
               V
               V
389       RRITN2
                .
                .
400             .      GERMAN
                .           .
                .           .
403       EMFGRM............
               V
               V
406        RGRMN
                .
                .
415             .         QCN
                .           .
                .           .
419       EMFQCN............
               V
               V
422         RQCN
                .
                .
432             .         QCS
                .           .
                .           .
436       EMFQCS............
               V
               V
439         RQCS
```

```
                .
                .
454             .         CHN
                .           .
                .           .
462             .           .-------> CHQCDB
458             .      *DCHQC
                .           .
                .           .
465       EMFCHN............
                .
                .
468             .         CHS
                .           .
                .           .
474       EMFCHS............
                V
                V
478          RCH
                .
                .
488             .       RIGGS
                .           .
                .           .
491        EMFRG............
                V
                V
494       RRIGGS
                .
                .
503             .       HUNTN
                .           .
                .           .
507       EMFHTN............
                .
                .
510             .       HUNTS
                .           .
                .           .
514       EMFHTS............
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   08FEB00  TIME  15:57:36  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
*********************************************************************
     PROJECT:  Queen Creek/Sanokai Wash Hydraulic Master Plan &
               East Maricopa Floodway Capacity Mitigation Study
PREPARED FOR:  Flood Control District of Maricopa County
 PREPARED BY:  Huitt-Zollars, Inc
    FILENAME:  1C-EMFRT.DAT
        DATE:  Dec 1999

This model is the routing model for the preferred alternative
(Alternative  1C) of the East Maricopa Floodway Capacity Mitigation
Study.  It is based upon the 100-year, 24 hr existing conditions EMF
routing model for Reaches 3, 4, 5 and 6 which extend from the
Princess Basin (located north of Brown Rd. in Mesa) to the
Maricopa/Pinal County Line at Hunt Highway.

Alternative 1C includes offline EMF detention basins at Chandler
Heights Rd., Rittenhouse Rd., and north of the proposed Santan
Freeway alignment (north of Knox. Rd).  In addition, this alternative
includes two watershed detention basins.  One off the Guadalupe
Channel located approximately northeast of the intersection of Power
Rd. and Guadalupe Rd.  The other off the Powerline Floodway
located approximately northwest of the intersection of the Powerline
Floodway and Ellsworth Rd (Ray Basin).  All basins for this alternative
are modeled in 1C-EMFRT.DAT with the exception of the Ray Basin.  The
Ray Basin is modeled in 1C-SEMESA.DAT.

In addition, in 1C-EMFRT.DAT the n-value for routing between Broadway
Rd. and Apache Trail (Main St.) has been changed from 0.025 to 0.018
to account for the proposed soil cement lining of the EMF as
part of the recommended alternative.

*********************************************************************
                    RUNNING EMF HYDROLOGY MODELS
*********************************************************************
This model, 1C-EMFRT.DAT, is the "routing" model used to evaluate
flows in the EMF for the preferred alternative for the 100-yr, 24-hr
existing conditions.  The model imports hydrographs via TAPE21 files
from the supporting hydrologic models and then routes them along the
EMF from approximately Brown Rd. and south to Hunt Hwy (the County
```

```
                    Line).

                    This model requires the previous running of four supporting hydrologic
                    models.  Each model evaluates the hydrology for a specific area that is
                    ultimately tributary to the EMF. The four supporting models are:

                       *  1CNWMESA.DAT - Preferred Alternative 1C hydrology base on
                                         existing conditions hydrology for NE Mesa
                                         (~east of the EMF to the CAP(at Hawes Rd.)
                                         & ~south of McKellips Rd. to US60)

                       *  1CNEMESA.DAT - Preferred Alternative 1C hydrology based on
                                         existing conditions hydrology for NW Mesa
                                         (~area northeast of Hawes Rd./US60)

                       *  1CSEMESA.DAT - Preferred Alternative 1C hydrology based on
                                         existing conditions hydrology for SE Mesa
                                         (~area east of the EMF from US60 south to
                                          Rittenhouse Rd. {excluding areas
                                          tributary to Queen Creek})
                                          1CSEMESA.DAT imports hydrographs from
                                          1CNEMESA.DAT via DSS files.  Therefore,
                                          1CNEMESA.DAT must be run first and then
                                          when running 1CSEMESA.DAT, 1CNEMESA.DSS
                                          must be specified as the DSS file
                                          (the default would be 1CSEMESA.DSS)

                       *  1CQCSW.DAT   - Preferred Alternative 1C hydrology based on
                                         existing conditions hydrology for Queen
                                         Creek/Sanokai Wash area (all areas
                                         tributary to Queen Creek & Sanokai Wash
                                         and areas tributary to the EMF south of
                                         Rittenhouse Rd.)

                    ***********************************************************************
                      IT IS IMPORTANT TO NOTE THAT THE SUPPORTING MODELS DO NOT
                      CORRECTLY ROUTE FLOWS ALONG THE EMF NOR DO THEY IMPORT ALL
                      THE NECESSARY FLOWS TO CORRECTLY EVALUATE FLOWS WITHIN THE
                      EMF.  TO EVALUATE FLOWS WITHIN THE EMF, ALL THE SUPPORTING
                      MODELS SHOULD BE RUN (TO DEVELOP THE TAPE21 FILE) AND THEN
                      THE EMF ROUTING MODEL (1C-EMFRT.DAT).  ONLY THE EMF ROUTING
                      MODEL SHOULD BE USED TO DETERMINE FLOWS WITHIN THE EMF.
                    ***********************************************************************

                    ************************************************************************
                              RECOMMENDED RUN ORDER FOR EMF HYDROLOGY MODELS
                    ************************************************************************

                         1. Erase any existing TAPE21 file in run directory.
                         2. Run 1CNEMESA.DAT, 1CNWMESA.DAT & 1CQCSW.DAT (any order)
                         3. Run 1CSEMESA.DAT (specifying 1CNEMESA.DSS as DSS file)
                         4. Run 1C-EMFRT.DAT

                    ***********************************************************************
                              BEGIN ID COMMENTS FROM ORIGINAL HYDROLOGY MODELS
                    ***********************************************************************

                   EMF MODEL EXISTING CONDITIONS, EXCEPT SUBBASIN 60
                   HYDROGRAPHS ARE STORED IN A TAPE 21 FILE.

                   HYDROGRAPHS WERE GENERATED FROM RUNNING THE FOLLOWING FILES
                       PH2.DAT,  MESANW.DAT, AND SMQC.DAT (USING THE MESANW.DSS FILE)

                   VELOCITIES FOR THE EMF WERE ESTIMATED FROM A MANNINGS EQUATION USING ACTUAL
                       SLOPES AND FLOWS.

                   THE CROSS-SECTIONS WERE EXTENDED VERTICALLY, IF THE CROSS-SECTIONS DID NOT
                       HAVE ENOUGH CAPACITY.

                    ***********************************************************************
                              END ID COMMENTS FROM ORIGINAL HYDROLOGY MODELS
                    ***********************************************************************

113 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     1APR97  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     7APR97  ENDING DATE
                     NDTIME       2235  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
```

```
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT

115 JD          INDEX STORM NO. 1
                      STRM        3.60  PRECIPITATION DEPTH
                      TRDA         .01  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


116 JD          INDEX STORM NO. 2
                      STRM        3.58  PRECIPITATION DEPTH
                      TRDA        1.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


117 JD          INDEX STORM NO. 3
                      STRM        3.49  PRECIPITATION DEPTH
                      TRDA        5.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


118 JD          INDEX STORM NO. 4
                      STRM        3.38  PRECIPITATION DEPTH
                      TRDA       10.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


119 JD          INDEX STORM NO. 5
                      STRM        3.24  PRECIPITATION DEPTH
                      TRDA       30.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


120 JD          INDEX STORM NO. 6
                      STRM        3.10  PRECIPITATION DEPTH
                      TRDA       60.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


121 JD          INDEX STORM NO. 7
                      STRM        3.05  PRECIPITATION DEPTH
                      TRDA       90.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


122 JD          INDEX STORM NO. 8
                      STRM        3.00  PRECIPITATION DEPTH
                      TRDA      120.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN


123 JD          INDEX STORM NO. 9
                      STRM        2.97  PRECIPITATION DEPTH
                      TRDA      150.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN

127 BI          READ STATION   EMFHOB HYDROGRAPH FROM UNIT 21

137 BI          READ STATION     C15A HYDROGRAPH FROM UNIT 21

150 BI          READ STATION      15B HYDROGRAPH FROM UNIT 21

163 BI          READ STATION      C16 HYDROGRAPH FROM UNIT 21

176 BI          READ STATION      C21 HYDROGRAPH FROM UNIT 21

189 BI          READ STATION      C28 HYDROGRAPH FROM UNIT 21

202 BI          READ STATION      C35 HYDROGRAPH FROM UNIT 21

215 BI          READ STATION      C41 HYDROGRAPH FROM UNIT 21

234 BI          READ STATION   EMFGUA HYDROGRAPH FROM UNIT 21

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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            *            *
235 KK      *    *DBNGU  *
            *            *
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237 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     DT         DIVERSION
                      ISTAD      NGUADB  DIVERSION HYDROGRAPH IDENTIFICATION

     DI            INFLOW         .00   1000.00   1001.00  16000.00

     DQ      DIVERTED FLOW        .00       .00      1.00  15000.00

                                                                  ***

      ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH   NGUADB
                       TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1491.     12.92                395.         99.         33.          14.
                       (INCHES)     .229        .229        .229         .229
                        (AC-FT)     196.        196.        196.         196.

                       CUMULATIVE AREA =   16.00 SQ MI

      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   *DBNGU
                       TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                671.        232.         92.          52.
                       (INCHES)     .390        .539        .642         .836
                        (AC-FT)     333.        460.        548.         714.

                       CUMULATIVE AREA =   16.00 SQ MI

      ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH   NGUADB
                       TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1486.     12.92                392.         98.         33.          14.
                       (INCHES)     .228        .228        .228         .228
                        (AC-FT)     194.        194.        194.         194.

                       CUMULATIVE AREA =   16.00 SQ MI

      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   *DBNGU
                       TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                671.        232.         92.          52.
                       (INCHES)     .390        .538        .642         .836
                        (AC-FT)     333.        459.        548.         713.

                       CUMULATIVE AREA =   16.00 SQ MI

      ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH   NGUADB
                       TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1461.     12.92                376.         94.         31.          14.
                       (INCHES)     .219        .219        .219         .219
                        (AC-FT)     187.        187.        187.         187.

                       CUMULATIVE AREA =   16.00 SQ MI
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     ***            ***            ***            ***            ***

                HYDROGRAPH AT STATION   *DBNGU
              TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                668.        231.         92.          52.
                        (INCHES)    .388        .536        .640         .834
                         (AC-FT)    331.        458.        546.         711.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                DIVERSION HYDROGRAPH   NGUADB
              TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1431.     12.92                358.         90.         30.          13.
                        (INCHES)    .208        .208        .208         .208
                         (AC-FT)    178.        178.        178.         178.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                HYDROGRAPH AT STATION   *DBNGU
              TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                665.        230.         91.          51.
                        (INCHES)    .387        .534        .637         .831
                         (AC-FT)    330.        455.        544.         709.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                DIVERSION HYDROGRAPH   NGUADB
              TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1392.     12.92                334.         84.         28.          12.
                        (INCHES)    .194        .194        .194         .194
                         (AC-FT)    166.        166.        166.         166.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                HYDROGRAPH AT STATION   *DBNGU
              TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                661.        228.         91.          51.
                        (INCHES)    .384        .530        .633         .827
                         (AC-FT)    328.        452.        541.         706.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                DIVERSION HYDROGRAPH   NGUADB
              TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1352.     12.92                311.         78.         26.          11.
                        (INCHES)    .181        .181        .181         .181
                         (AC-FT)    154.        154.        154.         154.

                       CUMULATIVE AREA =   16.00 SQ MI
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     ***            ***            ***            ***            ***

                  HYDROGRAPH AT STATION   *DBNGU
                TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                657.        226.         90.          51.
                        (INCHES)    .382        .526        .630         .824
                         (AC-FT)    326.        449.        538.         703.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                  DIVERSION HYDROGRAPH   NGUADB
                TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1337.     12.92                302.         76.         25.          11.
                        (INCHES)    .176        .176        .176         .176
                         (AC-FT)    150.        150.        150.         150.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                  HYDROGRAPH AT STATION   *DBNGU
                TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                656.        226.         90.          51.
                        (INCHES)    .381        .525        .629         .822
                         (AC-FT)    325.        448.        536.         702.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                  DIVERSION HYDROGRAPH   NGUADB
                TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1322.     12.92                294.         73.         24.          11.
                        (INCHES)    .171        .171        .171         .171
                         (AC-FT)    146.        146.        146.         146.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                  HYDROGRAPH AT STATION   *DBNGU
                TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1000.     12.42                654.        225.         90.          51.
                        (INCHES)    .380        .524        .627         .821
                         (AC-FT)    324.        447.        535.         701.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***

                  DIVERSION HYDROGRAPH   NGUADB
                TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1313.     12.92                289.         72.         24.          10.
                        (INCHES)    .168        .168        .168         .168
                         (AC-FT)    143.        143.        143.         143.

                       CUMULATIVE AREA =   16.00 SQ MI
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     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNGU
                  TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1000.     12.42                653.        225.         90.          51.
                        (INCHES)    .380        .523        .627         .820
                         (AC-FT)    324.        446.        535.         700.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***


                INTERPOLATED DIVERSION HYDROGRAPH AT   NGUADB

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1414.     12.92                348.         87.         29.          13.
                        (INCHES)    .202        .202        .202         .202
                         (AC-FT)    173.        173.        173.         173.

                       CUMULATIVE AREA =   16.00 SQ MI

     ***            ***            ***            ***            ***


                       INTERPOLATED HYDROGRAPH AT   *DBNGU

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1000.     12.42                663.        229.         91.          51.
                        (INCHES)    .386        .532        .635         .829
                         (AC-FT)    329.        454.        542.         708.

                       CUMULATIVE AREA =   16.00 SQ MI

  256 BI          READ STATION       64 HYDROGRAPH FROM UNIT 21

  269 BI          READ STATION    71T72 HYDROGRAPH FROM UNIT 21

  285 BI          READ STATION     KNOX HYDROGRAPH FROM UNIT 21


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            *            *
  289 KK    *    *DBNKX  *
            *            *
            **************

  291 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           3  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

     DT           DIVERSION
                        ISTAD      NKNXDB  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW         .00   2200.00   2201.00  17200.00

     DQ       DIVERTED FLOW         .00       .00      1.00  15000.00

                                                                  ***

     ***            ***            ***            ***            ***

                     DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    6178.     15.33               3075.        769.        256.         111.
                        (INCHES)    .521        .521        .521         .521
                         (AC-FT)   1525.       1525.       1525.        1525.

                       CUMULATIVE AREA =   54.92 SQ MI
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***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   *DBNKX
               TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.08                2200.       1369.        767.        568.
                        (INCHES)     .372        .927       1.558       2.669
                         (AC-FT)    1091.       2716.       4564.       7818.

                        CUMULATIVE AREA =   54.92 SQ MI

***          ***          ***          ***          ***

                DIVERSION HYDROGRAPH   NKNXDB
               TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    6096.     15.33                3034.        759.        253.        109.
                        (INCHES)     .514        .514        .514        .514
                         (AC-FT)    1504.       1505.       1505.       1505.

                        CUMULATIVE AREA =   54.92 SQ MI

***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   *DBNKX
               TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.08                2200.       1368.        767.        568.
                        (INCHES)     .372        .926       1.557       2.668
                         (AC-FT)    1091.       2713.       4561.       7815.

                        CUMULATIVE AREA =   54.92 SQ MI

***          ***          ***          ***          ***

                DIVERSION HYDROGRAPH   NKNXDB
               TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    5748.     15.33                2851.        713.        238.        103.
                        (INCHES)     .483        .483        .483        .483
                         (AC-FT)    1413.       1414.       1414.       1414.

                        CUMULATIVE AREA =   54.92 SQ MI

***          ***          ***          ***          ***

                HYDROGRAPH AT STATION   *DBNKX
               TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.08                2200.       1363.        765.        567.
                        (INCHES)     .372        .923       1.553       2.664
                         (AC-FT)    1091.       2703.       4549.       7802.

                        CUMULATIVE AREA =   54.92 SQ MI

***          ***          ***          ***          ***

                DIVERSION HYDROGRAPH   NKNXDB
               TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    5330.     15.33                2630.        657.        219.         95.
                        (INCHES)     .445        .445        .445        .445
                         (AC-FT)    1304.       1304.       1304.       1304.
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                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.17                2200.       1357.        762.         566.
                        (INCHES)     .372        .919       1.548        2.659
                         (AC-FT)    1091.       2691.       4536.        7788.

                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4818.     15.25                2363.        591.        197.          85.
                        (INCHES)     .400        .400        .400         .400
                         (AC-FT)    1172.       1172.       1172.        1172.

                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.17                2198.       1345.        758.         564.
                        (INCHES)     .372        .911       1.540        2.650
                         (AC-FT)    1090.       2668.       4512.        7763.

                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4340.     14.83                2115.        529.        176.          76.
                        (INCHES)     .358        .358        .358         .358
                         (AC-FT)    1049.       1049.       1049.        1049.

                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.25                2195.       1333.        754.         562.
                        (INCHES)     .372        .903       1.532        2.641
                         (AC-FT)    1088.       2644.       4486.        7736.

                    CUMULATIVE AREA =   54.92 SQ MI

     ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4224.     14.75                2029.        507.        169.          73.
                        (INCHES)     .344        .344        .344         .344
                         (AC-FT)    1006.       1006.       1006.        1006.
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                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.25               2194.       1328.        752.         561.
                        (INCHES)    .371        .900       1.529        2.638
                         (AC-FT)   1088.       2635.       4477.        7727.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4116.     14.75               1946.        486.        162.          70.
                        (INCHES)    .329        .329        .329         .329
                         (AC-FT)    965.        965.        965.         965.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.25               2192.       1324.        751.         561.
                        (INCHES)    .371        .897       1.525        2.635
                         (AC-FT)   1087.       2627.       4468.        7717.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***

                    DIVERSION HYDROGRAPH   NKNXDB
                  TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4053.     14.75               1897.        474.        158.          68.
                        (INCHES)    .321        .321        .321         .321
                         (AC-FT)    941.        941.        941.         941.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION   *DBNKX
                  TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.33               2191.       1322.        750.         560.
                        (INCHES)    .371        .895       1.524        2.633
                         (AC-FT)   1086.       2622.       4462.        7711.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***            ***            ***            ***            ***


              INTERPOLATED DIVERSION HYDROGRAPH AT   NKNXDB

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    4395.     15.17               2146.        537.        179.          77.
                        (INCHES)    .363        .363        .363         .363
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                    (AC-FT)      1064.       1064.       1064.        1064.

                    CUMULATIVE AREA =   54.92 SQ MI

      ***           ***           ***           ***           ***


                    INTERPOLATED HYDROGRAPH AT   *DBNKX

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2200.     13.25                2195.       1334.        754.         562.
                        (INCHES)     .372        .904       1.533        2.642
                         (AC-FT)    1089.       2647.       4490.        7740.

                    CUMULATIVE AREA =   54.92 SQ MI


  307 BI          READ STATION      76A HYDROGRAPH FROM UNIT 21

  323 BI          READ STATION   CPOWER HYDROGRAPH FROM UNIT 21

  336 BI          READ STATION      80B HYDROGRAPH FROM UNIT 21


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            *            *
  358 KK    *    *DBRIT  *
            *            *
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  361 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           3  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

     DT           DIVERSION
                        ISTAD      RITTDB  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW         .00   3000.00   3001.00  16500.00

     DQ       DIVERTED FLOW         .00       .00      1.00  13500.00

                                                                  ***

      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH   RITTDB
                    TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2428.     13.58                 940.        235.         78.          34.
                        (INCHES)     .093        .093        .093         .093
                         (AC-FT)     466.        467.        467.         467.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DBRIT
                    TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    3000.     12.83                3000.       1754.        939.         673.
                        (INCHES)     .297        .695       1.116        1.850
                         (AC-FT)    1488.       3479.       5589.        9269.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH   RITTDB
                    TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2403.     13.58                 931.        233.         78.          34.
                        (INCHES)     .092        .092        .092         .092
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                    (AC-FT)      462.        462.        462.        462.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRIT
                  TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    3000.     12.83               3000.       1752.        939.        673.
                        (INCHES)     .297        .694       1.115       1.850
                         (AC-FT)    1488.       3476.       5585.       9265.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH   RITTDB
                  TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2290.     13.58                890.        223.         74.         32.
                        (INCHES)     .088        .088        .088        .088
                         (AC-FT)     441.        442.        442.        442.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRIT
                  TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    3000.     12.83               3000.       1745.        936.        672.
                        (INCHES)     .297        .691       1.112       1.846
                         (AC-FT)    1488.       3462.       5568.       9246.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH   RITTDB
                  TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2161.     13.67                840.        210.         70.         30.
                        (INCHES)     .083        .083        .083        .083
                         (AC-FT)     416.        416.        416.        416.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRIT
                  TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    3000.     12.83               3000.       1737.        933.        670.
                        (INCHES)     .297        .688       1.108       1.842
                         (AC-FT)    1487.       3445.       5550.       9225.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH   RITTDB
                  TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1993.     13.75                777.        194.         65.         28.
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                    (INCHES)      .077        .077        .077        .077
                     (AC-FT)      385.        385.        385.        385.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DBRIT
                    TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    3000.     12.92               2998.       1722.        927.        668.
                    (INCHES)      .297        .682       1.102       1.835
                     (AC-FT)     1486.       3415.       5519.       9192.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH   RITTDB
                    TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    1826.     13.75               712.        178.         59.         26.
                    (INCHES)      .071        .071        .071        .071
                     (AC-FT)      353.        353.        353.        353.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DBRIT
                    TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    3000.     13.00               2995.       1706.        922.        665.
                    (INCHES)      .296        .675       1.095       1.828
                     (AC-FT)     1485.       3383.       5485.       9156.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH   RITTDB
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    1771.     13.83               690.        172.         57.         25.
                    (INCHES)      .068        .068        .068        .068
                     (AC-FT)      342.        342.        342.        342.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DBRIT
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    3000.     13.00               2993.       1700.        920.        664.
                    (INCHES)      .296        .673       1.093       1.825
                     (AC-FT)     1484.       3372.       5473.       9142.

                    CUMULATIVE AREA =   93.92 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH   RITTDB
                    TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
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+    1717.     13.83                    667.        167.         56.          24.
                          (INCHES)      .066        .066        .066         .066
                           (AC-FT)      331.        331.        331.         331.

                          CUMULATIVE AREA =   93.92 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   *DBRIT
                         TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    3000.     13.00                   2991.       1694.        918.         663.
                          (INCHES)      .296        .671       1.090        1.822
                           (AC-FT)     1483.       3361.       5461.        9129.

                          CUMULATIVE AREA =   93.92 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH   RITTDB
                         TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1680.     13.83                    653.        163.         54.          24.
                          (INCHES)      .065        .065        .065         .065
                           (AC-FT)      324.        324.        324.         324.

                          CUMULATIVE AREA =   93.92 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   *DBRIT
                         TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    3000.     13.00                   2990.       1691.        917.         663.
                          (INCHES)      .296        .670       1.089        1.821
                           (AC-FT)     1483.       3354.       5454.        9121.

                          CUMULATIVE AREA =   93.92 SQ MI

      ***             ***             ***             ***             ***


                     INTERPOLATED DIVERSION HYDROGRAPH AT   RITTDB

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1763.     13.83                    686.        172.         57.          25.
                          (INCHES)      .068        .068        .068         .068
                           (AC-FT)      340.        340.        340.         340.

                          CUMULATIVE AREA =   93.92 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   *DBRIT

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    3000.     13.00                   2993.       1699.        920.         664.
                          (INCHES)      .296        .673       1.092        1.825
                           (AC-FT)     1484.       3370.       5471.        9140.

                          CUMULATIVE AREA =   93.92 SQ MI

  368 BI          READ STATION   RITTEN HYDROGRAPH FROM UNIT 21

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                *            *
369 KK          *    *DBRRD  *
                *            *
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373 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    DT          DIVERSION
                      ISTAD      RRDDB  DIVERSION HYDROGRAPH IDENTIFICATION

    DI             INFLOW        .00    500.00    501.00  10500.00

    DQ       DIVERTED FLOW       .00       .00      1.00  10000.00

                                                                 ***

     ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH    RRDDB
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2289.     13.25                 835.        249.         83.          36.
                         (INCHES)   .410        .490        .490         .490
                          (AC-FT)   414.        494.        494.         494.

                        CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   *DBRRD
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     500.     12.17                 500.        315.        109.          47.
                         (INCHES)   .246        .619        .644         .644
                          (AC-FT)   248.        624.        649.         649.

                        CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH    RRDDB
                      TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2261.     13.25                 823.        245.         82.          35.
                         (INCHES)   .405        .482        .482         .482
                          (AC-FT)   408.        486.        486.         486.

                        CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   *DBRRD
                      TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     500.     12.25                 500.        314.        109.          47.
                         (INCHES)   .246        .618        .642         .642
                          (AC-FT)   248.        623.        648.         648.

                        CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***

                        DIVERSION HYDROGRAPH    RRDDB
                      TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2140.     13.33                 769.        226.         75.          33.
                         (INCHES)   .378        .445        .445         .445
                          (AC-FT)   381.        449.        449.         449.
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                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION   *DBRRD
                   TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     500.     12.25                499.        311.        108.         47.
                   (INCHES)       .245        .612        .636        .636
                    (AC-FT)       247.        617.        641.        641.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH    RRDDB
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+    1997.     13.33                706.        204.         68.         29.
                   (INCHES)       .347        .401        .401        .401
                    (AC-FT)       350.        405.        405.        405.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION   *DBRRD
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     500.     12.25                497.        307.        106.         46.
                   (INCHES)       .245        .604        .628        .628
                    (AC-FT)       247.        609.        633.        633.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH    RRDDB
                   TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+    1817.     13.42                628.        177.         59.         25.
                   (INCHES)       .309        .348        .348        .348
                    (AC-FT)       311.        351.        351.        351.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION   *DBRRD
                   TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     500.     12.25                493.        302.        104.         45.
                   (INCHES)       .242        .593        .616        .616
                    (AC-FT)       245.        599.        621.        621.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***           ***           ***           ***           ***

                     DIVERSION HYDROGRAPH    RRDDB
                   TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                      (CFS)
+    1646.     13.42                554.        152.         51.         22.
                   (INCHES)       .272        .299        .299        .299
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                    (AC-FT)      275.        301.        301.        301.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRRD
                  TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     500.      12.33          485.        295.        102.         44.
                  (INCHES)      .238        .580        .602        .602
                   (AC-FT)      240.        585.        607.        607.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    RRDDB
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1582.      13.42          528.        143.         48.         21.
                  (INCHES)      .260        .282        .282        .282
                   (AC-FT)      262.        284.        284.        284.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRRD
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     500.      12.33          480.        292.        101.         44.
                  (INCHES)      .236        .574        .596        .596
                   (AC-FT)      238.        579.        601.        601.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    RRDDB
                  TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1520.      13.50          503.        135.         45.         19.
                  (INCHES)      .247        .266        .266        .266
                   (AC-FT)      249.        268.        268.        268.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   *DBRRD
                  TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     500.      12.33          475.        289.        100.         43.
                  (INCHES)      .234        .569        .589        .589
                   (AC-FT)      236.        573.        594.        594.

                    CUMULATIVE AREA =   18.91 SQ MI

      ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    RRDDB
                  TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1484.      13.50          488.        130.         43.         19.
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                    (INCHES)      .240        .256        .256        .256
                     (AC-FT)      242.        259.        259.        259.

                    CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION   *DBRRD
                   TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    500.     12.33                472.        287.         99.          43.
                    (INCHES)      .232        .565        .585        .585
                     (AC-FT)      234.        570.        590.        590.

                    CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***


                INTERPOLATED DIVERSION HYDROGRAPH AT    RRDDB

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+   1886.     13.33                660.        188.         63.          27.
                    (INCHES)      .325        .370        .370        .370
                     (AC-FT)      327.        373.        373.        373.

                    CUMULATIVE AREA =   18.91 SQ MI

     ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT   *DBRRD

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    500.     12.25                495.        304.        105.          45.
                    (INCHES)      .243        .598        .621        .621
                     (AC-FT)      245.        603.        626.        626.

                    CUMULATIVE AREA =   18.91 SQ MI

  402 BI          READ STATION    CO324 HYDROGRAPH FROM UNIT 21

  418 BI          READ STATION    RO329 HYDROGRAPH FROM UNIT 21

  435 BI          READ STATION   SUB330 HYDROGRAPH FROM UNIT 21


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            *            *
  439 KK    *      RQCS  *
            *            *
            **************

  450 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     DT           DIVERSION
                       ISTAD      NCHDB  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW        .00   2300.00   2301.00  15800.00

     DQ       DIVERTED FLOW        .00       .00      1.00  13500.00

                                                                 ***

     ***            ***            ***            ***            ***

                     DIVERSION HYDROGRAPH    NCHDB
                   TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+   2080.     14.00                1675.        541.        180.          78.
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                    (INCHES)      .131        .169        .169        .169
                     (AC-FT)      830.       1074.       1074.       1074.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     RQCS
                   TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    2300.     13.17                2300.       1710.        926.         663.
                    (INCHES)      .179        .533        .867       1.435
                     (AC-FT)     1140.       3391.       5512.       9126.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    NCHDB
                   TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    2071.     14.00                1669.        539.        180.          78.
                    (INCHES)      .130        .168        .168        .168
                     (AC-FT)      828.       1069.       1069.       1069.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     RQCS
                   TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    2300.     13.17                2300.       1708.        926.         663.
                    (INCHES)      .179        .533        .866       1.434
                     (AC-FT)     1140.       3389.       5509.       9122.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    NCHDB
                   TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    2031.     14.00                1644.        527.        176.          76.
                    (INCHES)      .128        .164        .164        .164
                     (AC-FT)      815.       1046.       1046.       1046.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     RQCS
                   TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    2300.     13.25                2300.       1703.        924.         661.
                    (INCHES)      .179        .531        .864       1.432
                     (AC-FT)     1140.       3378.       5495.       9106.

                    CUMULATIVE AREA =  119.27 SQ MI

     ***          ***          ***          ***          ***

                    DIVERSION HYDROGRAPH    NCHDB
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
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+    1985.     14.00                1613.        512.        171.          74.
                          (INCHES)      .126        .160        .160         .160
                           (AC-FT)      800.       1016.       1016.        1016.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION     RQCS
                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2300.     13.25                2300.       1697.        921.         660.
                          (INCHES)      .179        .529        .862        1.429
                           (AC-FT)     1140.       3365.       5481.        9090.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH    NCHDB
                        TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1923.     14.17                1572.        491.        164.          71.
                          (INCHES)      .123        .153        .153         .153
                           (AC-FT)      780.        974.        974.         974.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION     RQCS
                        TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2300.     13.25                2300.       1686.        917.         658.
                          (INCHES)      .179        .526        .858        1.425
                           (AC-FT)     1140.       3344.       5459.        9064.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH    NCHDB
                        TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1873.     14.17                1531.        470.        157.          68.
                          (INCHES)      .119        .147        .147         .147
                           (AC-FT)      759.        932.        932.         932.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION     RQCS
                        TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2300.     13.33                2300.       1674.        913.         656.
                          (INCHES)      .179        .522        .854        1.420
                           (AC-FT)     1140.       3320.       5433.        9034.

                          CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH    NCHDB
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
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                                (CFS)
+    1855.      14.17                  1515.        462.        154.          67.
                            (INCHES)     .118        .144        .144         .144
                             (AC-FT)     751.        916.        916.         916.

                            CUMULATIVE AREA =  119.27 SQ MI


      ***              ***              ***              ***              ***

                             HYDROGRAPH AT STATION     RQCS
                           TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    2300.      13.33                  2300.       1670.        912.         655.
                            (INCHES)     .179        .521        .853        1.419
                             (AC-FT)    1140.       3312.       5424.        9024.

                            CUMULATIVE AREA =  119.27 SQ MI


      ***              ***              ***              ***              ***

                            DIVERSION HYDROGRAPH    NCHDB
                           TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1836.      14.17                  1500.        454.        151.          65.
                            (INCHES)     .117        .141        .141         .141
                             (AC-FT)     744.        900.        900.         900.

                            CUMULATIVE AREA =  119.27 SQ MI


      ***              ***              ***              ***              ***

                             HYDROGRAPH AT STATION     RQCS
                           TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    2300.      13.33                  2300.       1665.        910.         655.
                            (INCHES)     .179        .519        .851        1.417
                             (AC-FT)    1140.       3303.       5414.        9013.

                            CUMULATIVE AREA =  119.27 SQ MI


      ***              ***              ***              ***              ***

                            DIVERSION HYDROGRAPH    NCHDB
                           TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1825.      14.25                  1490.        449.        150.          65.
                            (INCHES)     .116        .140        .140         .140
                             (AC-FT)     739.        890.        890.         890.

                            CUMULATIVE AREA =  119.27 SQ MI


      ***              ***              ***              ***              ***

                             HYDROGRAPH AT STATION     RQCS
                           TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    2300.      13.33                  2300.       1663.        909.         654.
                            (INCHES)     .179        .519        .850        1.416
                             (AC-FT)    1140.       3299.       5409.        9007.

                            CUMULATIVE AREA =  119.27 SQ MI

      ***              ***              ***              ***              ***


                     INTERPOLATED DIVERSION HYDROGRAPH AT    NCHDB

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
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+   (CFS)        (HR)
                              (CFS)
+    1837.      14.17                  1500.        454.        151.          65.
                            (INCHES)     .117        .142        .142         .142
                             (AC-FT)     744.        900.        900.         900.

                            CUMULATIVE AREA =  119.27 SQ MI

      ***             ***             ***             ***             ***


                            INTERPOLATED HYDROGRAPH AT     RQCS

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    2300.      13.33                  2300.       1666.        910.         655.
                            (INCHES)     .179        .519        .851        1.417
                             (AC-FT)    1140.       3304.       5415.        9013.

                            CUMULATIVE AREA =  119.27 SQ MI

  457 BI          READ STATION    CO510 HYDROGRAPH FROM UNIT 21


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            *            *
  458 KK    *    *DCHQC  *
            *            *
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  461 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           3  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

     DT           DIVERSION
                        ISTAD      CHQCDB  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW         .00   2700.00   2701.00  12700.00

     DQ       DIVERTED FLOW         .00       .00      1.00  10000.00

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      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH   CHQCDB
                        TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    3927.      18.33                  2767.       1322.        441.         191.
                            (INCHES)     .249        .476        .476         .476
                             (AC-FT)    1372.       2623.       2623.        2623.

                            CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   *DCHQC
                        TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    2700.      15.58                  2700.       2671.       1985.        1598.
                            (INCHES)     .243        .962       2.145        3.997
                             (AC-FT)    1339.       5298.      11810.       22006.

                            CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH   CHQCDB
                        TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    3879.      18.33                  2727.       1301.        434.         188.
                            (INCHES)     .246        .469        .469         .469
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                    (AC-FT)     1352.       2581.       2581.       2581.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    HYDROGRAPH AT STATION   *DCHQC
                  TRANSPOSITION AREA      1.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    2700.      15.58          2700.       2670.       1984.       1598.
                  (INCHES)      .243        .962       2.144       3.996
                  (AC-FT)     1339.       5297.      11806.      22002.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    DIVERSION HYDROGRAPH   CHQCDB
                  TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    3666.      18.42          2545.       1208.        403.        174.
                  (INCHES)      .229        .435        .435        .435
                  (AC-FT)     1262.       2395.       2395.       2395.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    HYDROGRAPH AT STATION   *DCHQC
                  TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    2700.      15.67          2700.       2667.       1981.       1597.
                  (INCHES)      .243        .961       2.141       3.992
                  (AC-FT)     1339.       5291.      11788.      21980.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    DIVERSION HYDROGRAPH   CHQCDB
                  TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    3410.      18.50          2323.       1095.        365.        158.
                  (INCHES)      .209        .394        .394        .394
                  (AC-FT)     1152.       2171.       2171.       2171.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    HYDROGRAPH AT STATION   *DCHQC
                  TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    2700.      15.75          2700.       2663.       1977.       1594.
                  (INCHES)      .243        .959       2.137       3.987
                  (AC-FT)     1339.       5283.      11765.      21951.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***         ***         ***         ***

                    DIVERSION HYDROGRAPH   CHQCDB
                  TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    3091.      18.67          2043.        953.        318.        137.
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                    (INCHES)      .184        .343        .343        .343
                     (AC-FT)     1013.       1891.       1891.       1891.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DCHQC
                    TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2700.     15.83              2700.       2657.       1972.       1592.
                    (INCHES)      .243        .957       2.131       3.980
                     (AC-FT)     1339.       5271.      11734.      21913.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH   CHQCDB
                    TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2781.     18.83              1770.        814.        271.        117.
                    (INCHES)      .159        .293        .293        .293
                     (AC-FT)      877.       1614.       1614.       1614.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DCHQC
                    TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2700.     16.08              2700.       2650.       1966.       1589.
                    (INCHES)      .243        .955       2.125       3.973
                     (AC-FT)     1339.       5257.      11701.      21871.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH   CHQCDB
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2674.     18.92              1673.        765.        255.        110.
                    (INCHES)      .151        .275        .275        .275
                     (AC-FT)      830.       1517.       1517.       1517.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   *DCHQC
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2700.     16.08              2700.       2647.       1964.       1588.
                    (INCHES)      .243        .954       2.123       3.970
                     (AC-FT)     1339.       5251.      11688.      21856.

                    CUMULATIVE AREA =  103.23 SQ MI

      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH   CHQCDB
                    TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
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+    2569.     18.92                  1580.        716.        239.         103.
                          (INCHES)     .142        .258        .258         .258
                           (AC-FT)     783.       1419.       1419.        1419.

                          CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   *DCHQC
                        TRANSPOSITION AREA    120.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    2700.     16.17                  2700.       2644.       1962.        1586.
                          (INCHES)     .243        .953       2.121        3.967
                           (AC-FT)    1339.       5245.      11675.       21839.

                          CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH   CHQCDB
                        TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    2507.     18.92                  1526.        686.        229.          99.
                          (INCHES)     .137        .247        .247         .247
                           (AC-FT)     757.       1361.       1361.        1361.

                          CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   *DCHQC
                        TRANSPOSITION AREA    150.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    2700.     16.25                  2700.       2642.       1961.        1586.
                          (INCHES)     .243        .952       2.119        3.965
                           (AC-FT)    1339.       5241.      11667.       21829.

                          CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***


                     INTERPOLATED DIVERSION HYDROGRAPH AT   CHQCDB

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    2624.     18.92                  1629.        741.        247.         107.
                          (INCHES)     .147        .267        .267         .267
                           (AC-FT)     808.       1470.       1470.        1470.

                          CUMULATIVE AREA =  103.23 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   *DCHQC

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    2700.     16.17                  2700.       2646.       1963.        1587.
                          (INCHES)     .243        .953       2.122        3.968
                           (AC-FT)    1339.       5248.      11682.       21848.

                          CUMULATIVE AREA =  103.23 SQ MI

  473 BI          READ STATION    CO558 HYDROGRAPH FROM UNIT 21

  490 BI          READ STATION    CO580 HYDROGRAPH FROM UNIT 21

  506 BI          READ STATION      584 HYDROGRAPH FROM UNIT 21

  513 BI          READ STATION    CO612 HYDROGRAPH FROM UNIT 21
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	HOBART	497.	13.58	145.	42.	14.	1.94		
+	ROUTED TO	RHOB	469.	13.83	144.	42.	14.	1.94		
+	HYDROGRAPH AT	BROWN	530.	12.50	112.	34.	12.	2.47		
+	2 COMBINED AT	EMFBRN	599.	12.50	247.	74.	25.	4.41		
+	ROUTED TO	RBRN	552.	13.50	243.	74.	25.	4.41		
+	HYDROGRAPH AT	COLBY	491.	12.50	79.	24.	8.	.51		
+	2 COMBINED AT	EMFCLB	604.	13.25	309.	96.	33.	4.92		
+	ROUTED TO	RCOLBY	596.	13.50	309.	96.	33.	4.92		
+	HYDROGRAPH AT	UNIV	640.	12.25	347.	113.	38.	.64		
+	2 COMBINED AT	EMFUNI	1098.	13.67	639.	203.	69.	5.56		
+	ROUTED TO	RUNIV	1090.	14.25	637.	203.	69.	5.56		
+	HYDROGRAPH AT	APACHE	1336.	13.67	376.	99.	33.	6.23		
+	2 COMBINED AT	EMFAPC	2209.	13.75	945.	284.	96.	11.79		
+	ROUTED TO	RAPCHE	2200.	13.83	944.	284.	96.	11.79		
+	HYDROGRAPH AT	BRDWY	1715.	12.67	593.	188.	63.	3.65		
+	2 COMBINED AT	EMFBRD	3094.	12.92	1469.	454.	154.	15.44		
+	ROUTED TO	RBRDWY	3041.	13.17	1467.	454.	154.	15.44		
+	HYDROGRAPH AT	STHRN	252.	14.42	98.	32.	11.	2.61		
+	2 COMBINED AT	EMFSTH	3117.	13.17	1517.	472.	160.	18.05		
+	ROUTED TO	RSTHRN	3089.	13.33	1515.	472.	160.	18.05		
+	HYDROGRAPH AT	SUPER	498.	12.83	239.	80.	27.	2.74		
+	2 COMBINED AT	EMFSPR	3407.	13.33	1691.	534.	182.	20.79		
+	ROUTED TO	RSUPER	3364.	13.67	1689.	534.	182.	20.79		
+	HYDROGRAPH AT	GUAD	2414.	12.92	1011.	316.	120.	16.00		
+	DIVERSION TO	NGUADB	1414.	12.92	348.	87.	29.	16.00		
+	HYDROGRAPH AT	*DBNGU	1000.	12.42	663.	229.	91.	16.00		
+	2 COMBINED AT	EMFGUA	4227.	13.75	2246.	733.	263.	36.79		
+	ROUTED TO	RGUAD	4196.	14.08	2237.	732.	263.	36.79		
+	HYDROGRAPH AT	ELLIOT	435.	13.00	86.	22.	7.	.81		

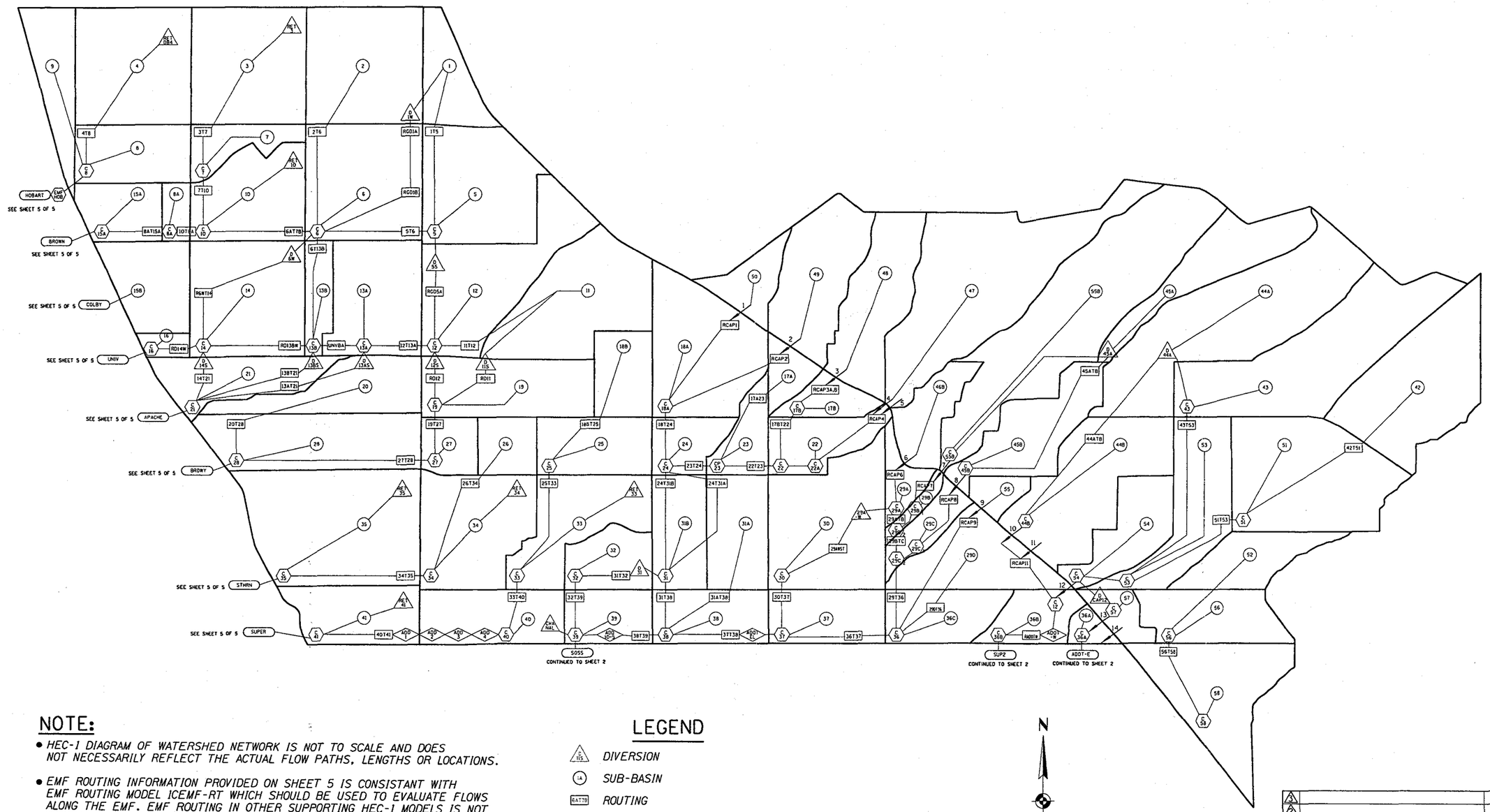
	2 COMBINED AT						
+		EMFELT	4240.	14.08	2290.	748.	269.	37.60
	ROUTED TO						
+		RELIOT	4216.	14.33	2284.	748.	269.	37.60
	HYDROGRAPH AT						
+		WARNER	1746.	16.17	1184.	558.	191.	8.82
	2 COMBINED AT						
+		EMFWRN	4934.	14.42	3305.	1262.	445.	46.42
	ROUTED TO						
+		RWRNR	4910.	14.67	3295.	1261.	445.	46.42
	HYDROGRAPH AT						
+		KNOX	2071.	15.25	1303.	661.	510.	8.50
	2 COMBINED AT						
+		EMFKNX	6595.	15.17	4342.	1871.	933.	54.92
	DIVERSION TO						
+		NKNXDB	4395.	15.17	2146.	537.	179.	54.92
	HYDROGRAPH AT						
+		*DBNKX	2200.	13.25	2195.	1334.	754.	54.92
	ROUTED TO						
+		RKNOX	2200.	14.75	2192.	1334.	754.	54.92
	HYDROGRAPH AT						
+		RAY	807.	14.00	303.	77.	26.	1.91
	2 COMBINED AT						
+		EMFRAY	2868.	14.00	2393.	1396.	775.	56.83
	ROUTED TO						
+		RRAY	2869.	14.00	2393.	1396.	775.	56.83
	HYDROGRAPH AT						
+		POWER	2741.	13.08	1349.	453.	194.	35.97
	2 COMBINED AT						
+		EMFPWR	4710.	13.50	3611.	1825.	961.	92.80
	ROUTED TO						
+		RPOWER	4682.	13.58	3607.	1825.	961.	92.80
	HYDROGRAPH AT						
+		WLMFLD	1139.	12.58	212.	66.	22.	1.12
	2 COMBINED AT						
+		EMFWFD	4795.	13.58	3686.	1871.	977.	93.92
	ROUTED TO						
+		RWFLD1	4795.	13.58	3686.	1871.	977.	93.92
	ROUTED TO						
+		RWFLD2	4763.	13.83	3679.	1871.	977.	93.92
	DIVERSION TO						
+		RITTDB	1763.	13.83	686.	172.	57.	93.92
	HYDROGRAPH AT						
+		*DBRIT	3000.	13.00	2993.	1699.	920.	93.92
	HYDROGRAPH AT						
+		RITTEN	2386.	13.33	1135.	492.	168.	18.91
	DIVERSION TO						
+		RRDDB	1886.	13.33	660.	188.	63.	18.91
	HYDROGRAPH AT						
+		*DBRRD	500.	12.25	495.	304.	105.	18.91
	2 COMBINED AT						
+		EMFRIT	3500.	13.00	3438.	1979.	1014.	112.83
	ROUTED TO						
+		RRITN1	3500.	14.00	3436.	1978.	1014.	112.83
	ROUTED TO						
+		RRITN2	3500.	14.75	3430.	1978.	1013.	112.83
	HYDROGRAPH AT						
+		GERMAN	409.	18.83	349.	130.	44.	4.47
	2 COMBINED AT						
+		EMFGRM	3788.	16.50	3696.	2078.	1047.	117.30
	ROUTED TO						
+		RGRMN	3787.	16.67	3693.	2078.	1047.	117.30
	HYDROGRAPH AT						
+		QCN	352.	14.00	116.	29.	10.	1.00

	2 COMBINED AT						
+		EMFQCN	3999.	14.08	3765.	2100.	1054.	118.30
	ROUTED TO						
+		RQCN	3992.	14.25	3762.	2100.	1054.	118.30
	HYDROGRAPH AT						
+		QCS	311.	13.17	110.	28.	9.	.97
	2 COMBINED AT						
+		EMFQCS	4137.	14.17	3800.	2119.	1061.	119.27
	DIVERSION TO						
+		NCHDB	1837.	14.17	1500.	454.	151.	119.27
	HYDROGRAPH AT						
+		RQCS	2300.	13.33	2300.	1666.	910.	119.27
	HYDROGRAPH AT						
+		CHN	5324.	18.92	4329.	3387.	2210.	103.23
	DIVERSION TO						
+		CHQCDB	2624.	18.92	1629.	741.	247.	103.23
	HYDROGRAPH AT						
+		*DCHQC	2700.	16.17	2700.	2646.	1963.	103.23
	2 COMBINED AT						
+		EMFCHN	5000.	16.25	5000.	4192.	2851.	222.50
	HYDROGRAPH AT						
+		CHS	1020.	13.17	760.	410.	138.	1.92
	2 COMBINED AT						
+		EMFCHS	5691.	17.75	5551.	4445.	2939.	224.42
	ROUTED TO						
+		RCH	5687.	18.00	5550.	4442.	2938.	224.42
	HYDROGRAPH AT						
+		RIGGS	721.	12.67	133.	33.	11.	1.53
	2 COMBINED AT						
+		EMFRG	5687.	18.00	5550.	4445.	2940.	225.95
	ROUTED TO						
+		RRIGGS	5684.	18.42	5549.	4443.	2940.	225.95
	HYDROGRAPH AT						
+		HUNTN	252.	13.25	91.	23.	8.	.97
	2 COMBINED AT						
+		EMFHTN	5686.	18.42	5550.	4449.	2942.	226.92
	HYDROGRAPH AT						
+		HUNTS	1657.	16.17	1110.	396.	134.	11.19
	2 COMBINED AT						
+		EMFHTS	6469.	16.83	6093.	4701.	3030.	238.11

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

HYDROLOGY

Preferred Alternative HEC-1 Maps (11"x17")
(full size maps provided in map holders)



NOTE:

- *HEC-1 DIAGRAM OF WATERSHED NETWORK IS NOT TO SCALE AND DOES NOT NECESSARILY REFLECT THE ACTUAL FLOW PATHS, LENGTHS OR LOCATIONS.*
- *EMF ROUTING INFORMATION PROVIDED ON SHEET 5 IS CONSISTANT WITH EMF ROUTING MODEL ICEMF-RT WHICH SHOULD BE USED TO EVALUATE FLOWS ALONG THE EMF. EMF ROUTING IN OTHER SUPPORTING HEC-1 MODELS IS NOT CONSISTANT WITH ICEMF-RT. SUPPORTING MODELS SHOULD NOT BE USED TO EVALUATE FLOW ALONG THE EMF.*
- *HEC-1 DIAGRAMS ARE DERIVED FROM SEVERAL DIFFERENT STUDIES. SYMBOLOGY AND FORMAT MAY THEREFORE DIFFER BETWEEN SHEETS.*

HEC-1 MODEL	DIAGRAM SHEET
ICNEMESA	1
ICNWMESA	1
ICSEMESA	2
ICQWSW	3-4
ICEMF-RT	5

LEGEND

- *DIVERSION*
- *SUB-BASIN*
- *ROUTING*
- *CONCENTRATION POINT*
- *FLOW CONTINUED TO/FROM ANOTHER SHEET*
- *DETENTION BASIN*
- *CAP OVERCHUTE*

N

NOT TO SCALE

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH
HMP AND EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	RON WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

Registered Professional Engineer (Civil) Certificate 12250 FRED K. DUREN, JR. Date Signed 02/11/00 ARIZONA, U.S.A.

HUITT-ZOLLARS
Huitt-Zollars, Inc. Engineering
4742 N. 24TH Street, Suite 100, Phoenix, AZ 85016
Phone (602) 952-0050 Fax (602) 952-0014

HEC-1 DIAGRAM FOR PREFERRED ALTERNATIVE (IC)

SHEET 1 OF 5

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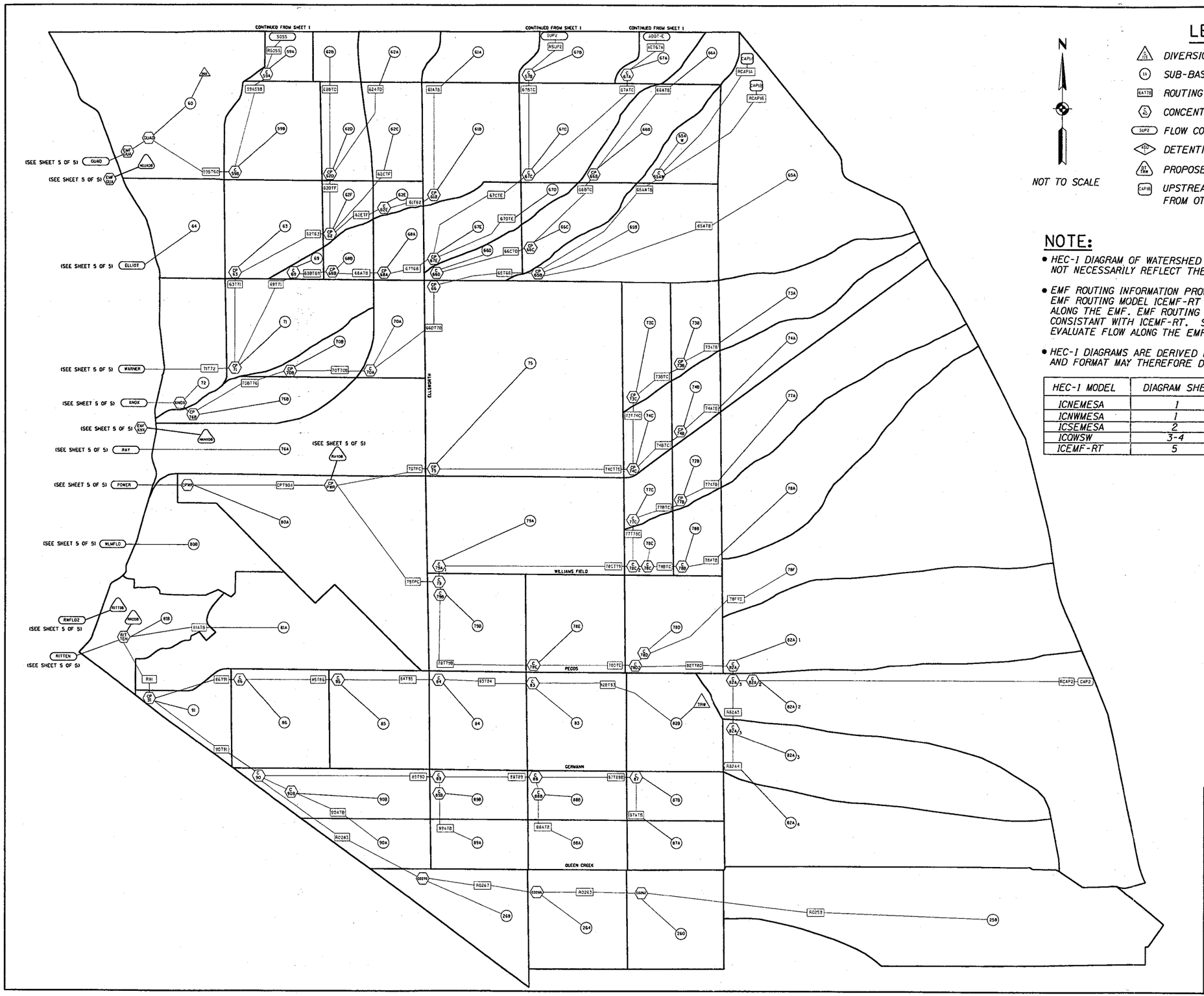

N

NOT TO SCALE

LEGEND

- DIVERSION
- SUB-BASIN
- ROUTING
- CONCENTRATION POINT
- FLOW CONTINUED TO/FROM ANOTHER SHEET
- DETENTION BASIN
- PROPOSED DETENTION BASIN
- UPSTREAM HYDROGRAPH OBTAINED FROM OTHER SOURCES

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HEC-1 MODEL	DIAGRAM SHEET
ICNEMESA	1
ICNWMESA	1
ICSEMESA	2
ICQWSW	3-4
ICEMF-RT	5

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH
HMP AND EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	RON WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

HUITT-ZOLLARS
Huitt-Zollars, Inc. Engineering
4742 N. 24TH Street, Suite 100, Phoenix, AZ 85016
Phone (602) 952-9933 Fax (602) 952-9934

HEC-1 DIAGRAM FOR PREFERRED ALTERNATIVE (IC)

SHEET 2 OF 5

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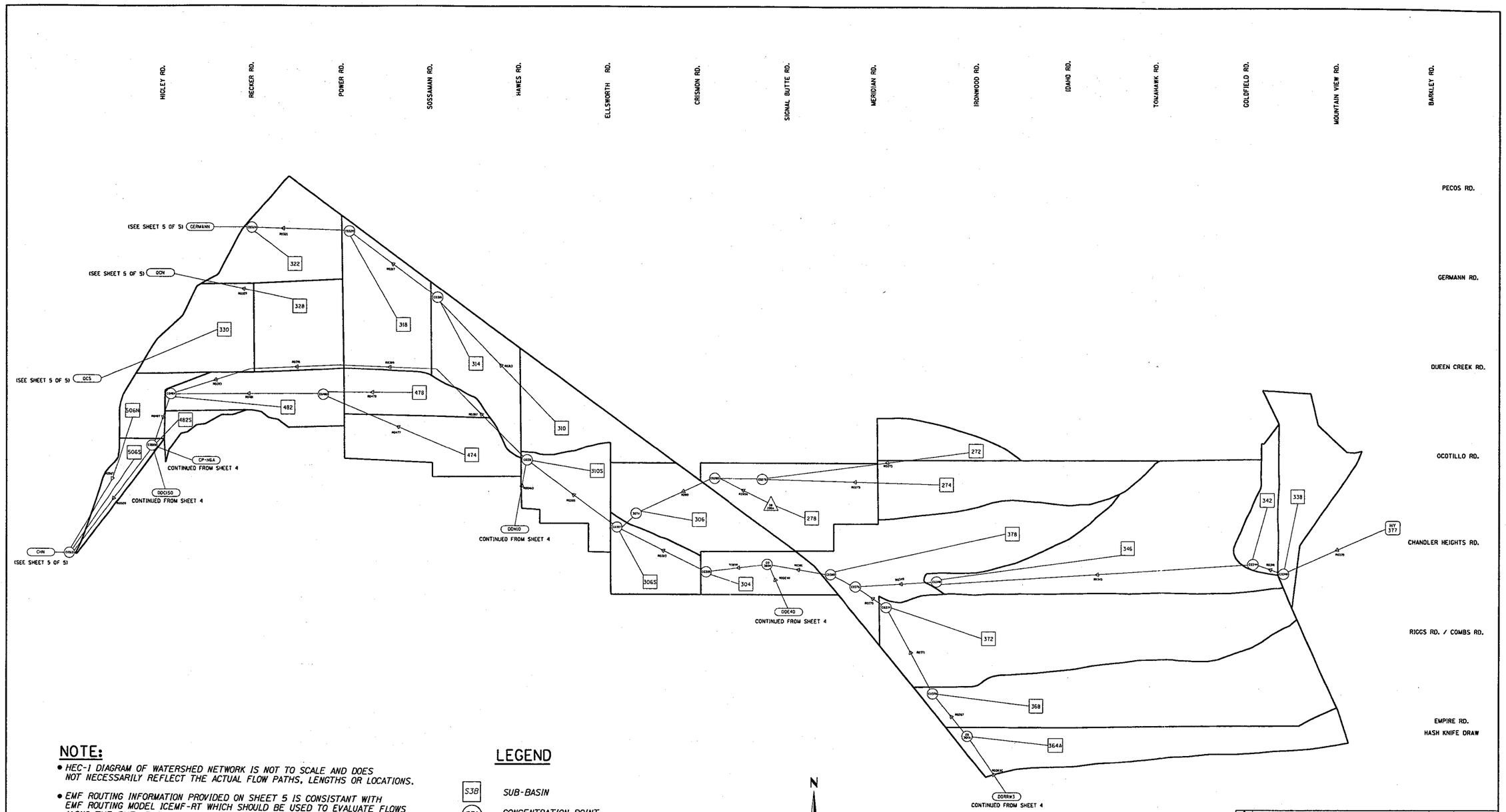

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HEC-1 MODEL	DIAGRAM SHEET
ICNEMESA	1
ICNWMESA	1
ICSEMESA	2
ICOWSW	3-4
ICEMF-RT	5

LEGEND

- S3B — SUB-BASIN
- S3A — CONCENTRATION POINT
- S12 — DIVERSION
- △RS14 — ROUTING DIRECTION & LABEL
- DDE40 — FLOW CONTINUED TO/FROM ANOTHER SHEET
- HY 377 — UPSTREAM HYDROGRAPH OBTAINED FROM OTHER SOURCES
- △ — DETENTION BASIN

N

NOT TO SCALE

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH
HMP AND EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY

Registered Professional Engineer (Civil) CERTIFICATE NO. 12258 FRED K. DUREN, JR. Date Signed 02/11/00 ARIZONA, U.S.A.

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	RON WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

HUITT-ZOLLARS
Huitt-Zollars, Inc.
Engineering
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Phone (602) 952-9933 Fax (602) 952-9934

HEC-1 DIAGRAM FOR PREFERRED ALTERNATIVE (IC)

SHEET 3 OF 5

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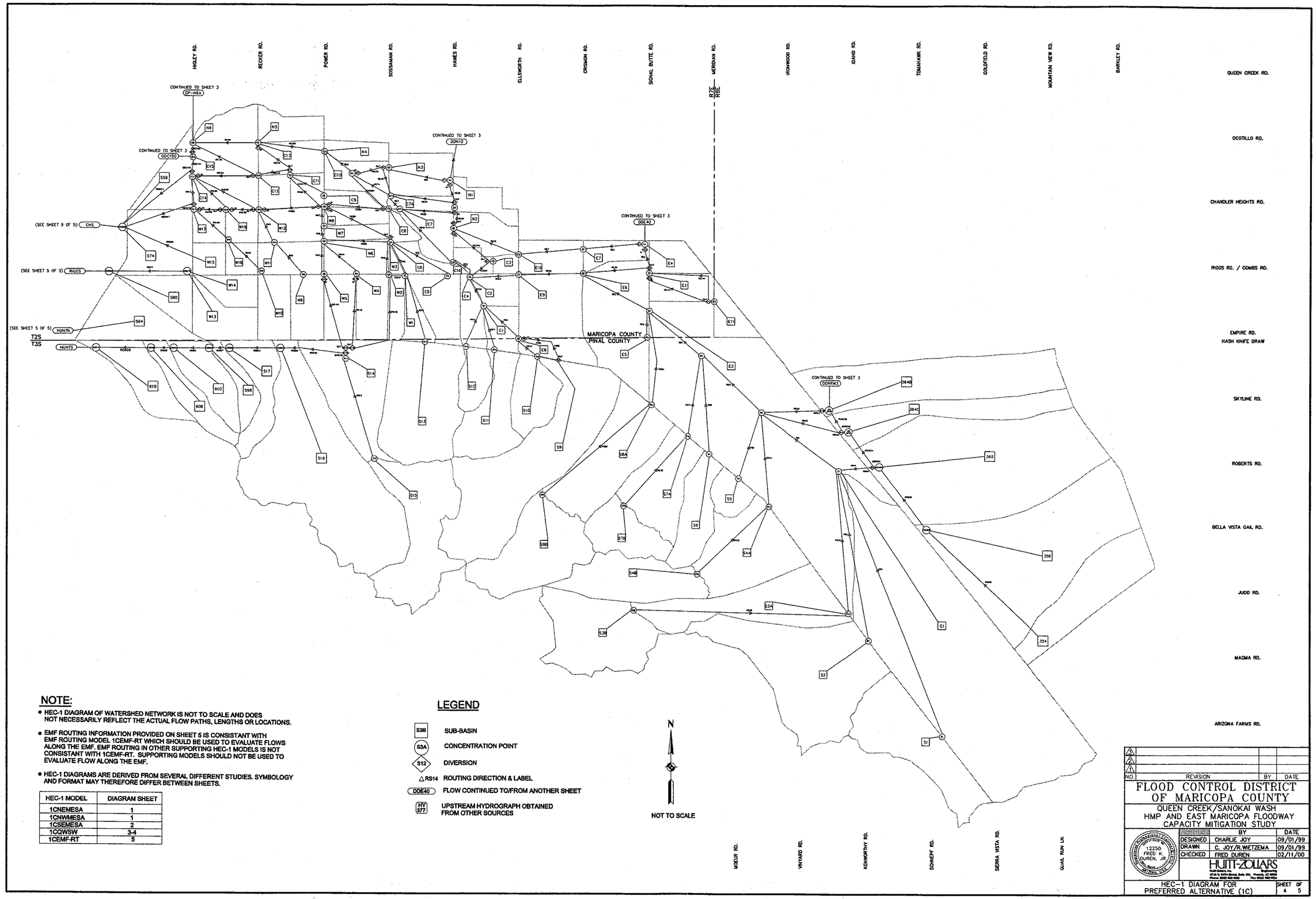

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- HEC-1 DIAGRAMS ARE DERIVED FROM SEVERAL DIFFERENT STUDIES. SYMBOLOGY AND FORMAT MAY THEREFORE DIFFER BETWEEN SHEETS.

HEC-1 MODEL	DIAGRAM SHEET
1CNEMESA	1
1CNWMESA	1
1CSEMESA	2
1CQWSW	3-4
1CEMF-RT	5

LEGEND

- S3B — SUB-BASIN
- S3A — CONCENTRATION POINT
- S12 — DIVERSION
- △RS14 — ROUTING DIRECTION & LABEL
- DOE40 — FLOW CONTINUED TO/FROM ANOTHER SHEET
- HY 377 — UPSTREAM HYDROGRAPH OBTAINED FROM OTHER SOURCES

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH
HMP AND EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY

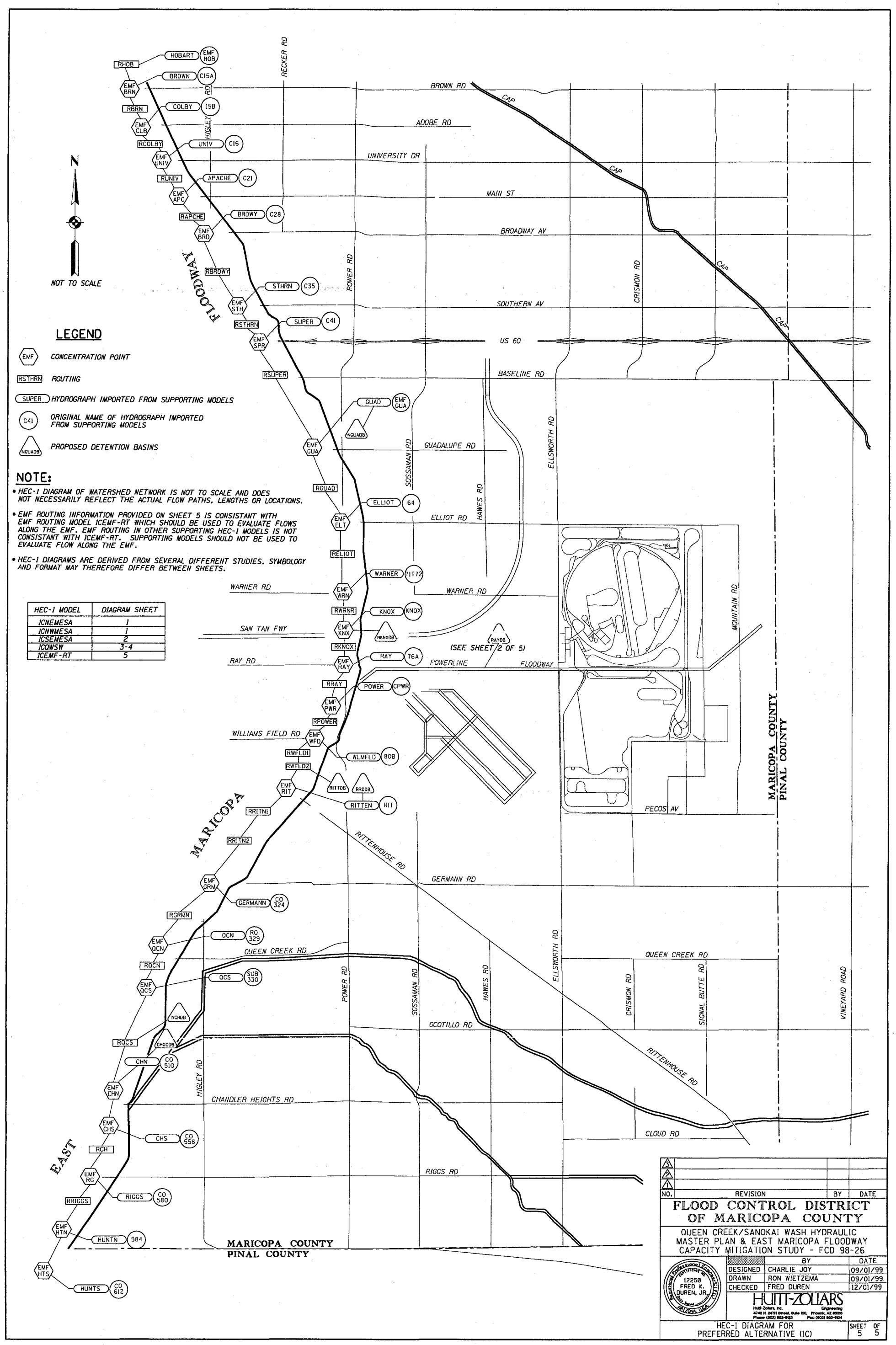
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	C. JOY/R.WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

HUITT-ZOLLARS
Huitt-Zollars, Inc. Engineering
4745 N. 7th Street, Suite 100, Phoenix, AZ 85014
Phone: (602) 955-1500 Fax: (602) 955-1944

HEC-1 DIAGRAM FOR PREFERRED ALTERNATIVE (1C)

SHEET 4 OF 5



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APPENDIX B:
HYDRAULICS

- **Existing Conditions HEC-RAS Summary Output**
- **Preferred Alternative HEC-RAS Summary Output**
- **Weir Calculations**
- **Basin Outlet Calculations**

HYDRAULICS

Existing Conditions HEC-RAS Summary Output

HEC-RAS Plan: Existing River: EMF Reach: Reach 1

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 1	0.000	15810.00	1194.70	0.27	2.89	1201.30	1203.92	1201.03	12.88	6.33	1203.61	0.0300
Reach 1	0.004	15810.00	1195.36	2.46	2.28	1203.98	1203.80	1201.52	13.18	6.25	1204.22	0.0300
Reach 1	0.019	15810.00	1194.97	0.01	-0.08	1203.69	1203.60	1203.68	9.09	8.71	1204.96	0.0300
Reach 1	0.077	15810.00	1195.67	-0.58	-0.48	1203.90	1204.00	1204.48	8.91	8.81	1205.72	0.0300
Reach 1	0.084	15810.00	1195.57	-0.48	-0.66	1204.07	1203.89	1204.55	9.07	8.98	1205.83	0.0350
Reach 1	0.125	15810.00	1195.04	-0.90	-0.94	1204.18	1204.14	1205.08	9.07	10.04	1206.35	0.0250
Reach 1	0.22	15810.00	1195.36	-0.98	-0.60	1205.10	1205.48	1206.08	8.17	10.72	1207.12	0.0250
Reach 1	0.315	15810.00	1196.75	-0.70	-1.24	1206.05	1205.51	1206.75	8.07	10.00	1207.76	0.0250
Reach 1	0.41	15810.00	1197.40	-0.18	-0.98	1207.20	1206.40	1207.38	8.01	9.98	1208.37	0.0250
Reach 1	0.445	15810.00	1197.94	-0.77	-0.46	1206.89	1207.20	1207.66	7.78	9.72	1208.60	0.0250
Reach 1	0.449	15810.00	1198.66	-1.87	-1.51	1206.44	1206.80	1208.31	5.41	9.65	1208.76	0.0300
Reach 1	0.454	15810.00	1198.77	-1.87	-1.77	1206.50	1206.60	1208.37	5.17	9.60	1208.79	0.0150
Reach 1	0.459	15810.00	1198.30	-0.57	-0.78	1207.56	1207.36	1208.14	7.64	9.83	1209.04	0.0250
Reach 1	0.504	15810.00	1197.98	-0.50	-0.71	1207.89	1207.68	1208.39	7.81	10.41	1209.34	0.0250
Reach 1	0.56	15810.00	1197.53	-0.35	-0.45	1208.36	1208.26	1208.71	7.79	11.18	1209.66	0.0250
Reach 1	0.655	15810.00	1197.70	0.07	-0.55	1209.34	1208.72	1209.27	7.88	11.57	1210.23	0.0250
Reach 1	0.75	15810.00	1199.88	0.10	0.07	1209.98	1209.95	1209.88	7.61	10.00	1210.78	0.0250
Reach 1	0.752	15810.00	1199.88	0.22	0.08	1210.10	1209.96	1209.88	7.73	10.00	1210.80	0.0300
Reach 1	0.766	15810.00	1200.98	0.24	0.19	1210.10	1210.05	1209.86	8.52	8.88	1210.99	0.0300
Reach 1	0.839	15810.00	1202.26	0.22	0.18	1210.87	1210.83	1210.65	8.79	8.39	1211.85	0.0300
Reach 1	0.917	15810.00	1202.50	-0.75	-0.68	1210.92	1210.99	1211.67	8.10	9.17	1212.69	0.0300
Reach 1	1.01	15810.00	1202.94	-0.87	-1.13	1211.70	1211.44	1212.57	7.95	9.63	1213.55	0.0300
Reach 1	1.074	15810.00	1202.89	-0.89	-0.46	1212.20	1212.63	1213.09	7.90	10.20	1214.06	0.0250
Reach 1	1.142	15810.00	1204.55	-0.28	-0.50	1213.30	1213.08	1213.58	8.14	9.03	1214.61	0.0300
Reach 1	1.186	15810.00	1204.90	-0.81	-0.55	1213.19	1213.45	1214.00	8.07	9.10	1215.02	0.0300
Reach 1	1.246	15810.00	1205.35	-0.74	-0.39	1213.84	1214.19	1214.58	7.96	9.23	1215.56	0.0300
Reach 1	1.306	15810.00	1205.97	-0.51	-0.68	1214.58	1214.41	1215.09	8.19	9.12	1216.13	0.0300
Reach 1	1.389	15810.00	1206.31	-1.51	-1.42	1214.71	1214.80	1216.22	6.47	9.91	1216.77	0.0300
Reach 1	1.476	15810.00	1206.65	-0.86	-1.15	1215.70	1215.41	1216.56	7.56	9.91	1217.36	0.0250
Reach 1	1.545	15810.00	1206.63	-0.39	-1.08	1216.56	1215.87	1216.95	7.47	10.32	1217.78	0.0250
Reach 1	1.64	15810.00	1208.16	-0.73	-0.14	1216.77	1217.36	1217.50	8.16	9.34	1218.53	0.0300
Reach 1	1.644	Bridge										
Reach 1	1.649	15810.00	1208.44	-2.40	-2.02	1216.98	1217.36	1219.38	6.81	10.94	1220.10	0.0300
Reach 1	1.693	15810.00	1208.40	-2.97	-3.30	1217.03	1216.70	1220.00	5.21	11.60	1220.34	0.0250
Reach 1	1.734	15810.00	1208.14	-2.87	-2.55	1217.17	1217.49	1220.04	5.57	11.90	1220.45	0.0250
Reach 1	1.829	15810.00	1207.54	-2.21	-1.99	1217.88	1218.10	1220.09	6.85	12.55	1220.82	0.0250
Reach 1	1.924	15810.00	1208.00	-1.82	-1.54	1218.62	1218.90	1220.44	6.90	12.44	1221.18	0.0250
Reach 1	2.018	15810.00	1208.98	-1.41	-1.47	1219.40	1219.34	1220.81	6.96	11.83	1221.56	0.0250
Reach 1	2.113	15810.00	1208.81	-0.80	-1.31	1220.41	1219.90	1221.21	6.94	12.40	1221.95	0.0250
Reach 1	2.208	15810.00	1208.46	-0.48	-0.77	1221.10	1220.81	1221.58	6.98	13.12	1222.34	0.0250
Reach 1	2.303	15810.00	1212.24	-0.42	-0.56	1221.47	1221.33	1221.89	7.89	9.65	1222.86	0.0250
Reach 1	2.305	15810.00	1211.60	-0.38	-0.62	1221.60	1221.36	1221.98	7.59	10.38	1222.88	0.0250
Reach 1	2.381	15810.00	1211.04	0.07	-0.28	1222.49	1222.14	1222.42	7.48	11.38	1223.29	0.0250
Reach 1	2.476	15810.00	1210.67	0.37	-0.42	1223.29	1222.50	1222.92	7.46	12.25	1223.79	0.0250
Reach 1	2.571	15810.00	1210.91	0.28	0.67	1223.69	1224.08	1223.41	7.31	12.50	1224.24	0.0250
Reach 1	2.636	15810.00	1215.15	0.65	0.92	1224.21	1224.48	1223.56	8.74	8.41	1224.74	0.0250
Reach 1	2.641	15810.00	1216.27	-0.66	1.03	1223.59	1225.28	1224.25	6.63	7.98	1224.94	0.0300
Reach 1	2.646	15810.00	1215.90	-0.84	1.32	1223.49	1225.65	1224.33	6.41	8.43	1224.97	0.0150
Reach 1	2.65	15810.00	1215.80	0.47	1.01	1224.44	1224.98	1223.97	9.47	8.17	1225.37	0.0250
Reach 1	2.757	15810.00	1215.65	0.06	0.93	1225.30	1226.17	1225.24	8.71	9.59	1226.41	0.0250
Reach 1	2.814	15810.00	1216.19	0.20	0.72	1225.97	1226.49	1225.77	8.46	9.58	1226.89	0.0250
Reach 1	2.909	15810.00	1216.67	0.08	0.29	1226.64	1226.85	1226.56	8.09	9.89	1227.57	0.0250
Reach 1	2.912	15810.00	1216.46	0.13	0.33	1226.70	1226.90	1226.57	8.09	10.11	1227.59	0.0250
Reach 1	2.985	15810.00	1216.10	0.42	0.42	1227.50	1227.50	1227.08	7.94	10.98	1228.06	0.0250
Reach 1	3.079	15810.00	1216.12	0.66	0.51	1228.30	1228.15	1227.64	7.98	11.52	1228.63	0.0250
Reach 1	3.174	15810.00	1218.74	0.62	0.70	1228.79	1228.87	1228.17	8.59	9.43	1229.32	0.0250
Reach 1	3.176	15810.00	1218.73	0.58	0.42	1228.76	1228.60	1228.18	8.64	9.45	1229.34	0.0250
Reach 1	3.334	15810.00	1218.24	0.35	0.35	1229.80	1229.80	1229.45	7.91	11.21	1230.42	0.0250
Reach 1	3.429	15810.00	1218.34	0.33	0.67	1230.37	1230.71	1230.04	7.69	11.70	1230.96	0.0250
Reach 1	3.524	15810.00	1221.16	0.62	0.83	1231.10	1231.31	1230.48	8.61	9.32	1231.63	0.0250
Reach 1	3.527	15810.00	1220.53	0.46	0.65	1231.10	1231.29	1230.64	8.13	10.11	1231.66	0.0250
Reach 1	3.593	15810.00	1220.19	0.53	0.69	1231.62	1231.78	1231.09	7.97	10.90	1232.08	0.0250
Reach 1	3.688	15810.00	1220.40	0.65	1.15	1232.30	1232.80	1231.65	8.11	11.25	1232.67	0.0250
Reach 1	3.782	15810.00	1220.72	0.76	0.87	1233.04	1233.15	1232.28	7.80	11.56	1233.23	0.0250
Reach 1	3.877	15810.00	1224.04	1.74	1.84	1234.35	1234.45	1232.61	9.84	8.57	1234.11	0.0250
Reach 1	3.88	15810.00	1224.04	1.62	1.66	1234.46	1234.50	1232.84	9.22	8.80	1234.16	0.0250
Reach 1	3.899	15810.00	1224.23	1.88	1.75	1234.60	1234.47	1232.72	11.03	8.49	1234.61	0.0300
Reach 1	3.964	15810.00	1226.11	0.89	0.91	1235.10	1235.12	1234.21	9.79	8.10	1235.70	0.0250
Reach 1	4.047	15810.00	1226.59	0.38	0.64	1235.60	1235.86	1235.22	9.63	8.63	1236.66	0.0250
Reach 1	4.08	15810.00	1226.40	-0.13	0.19	1235.73	1236.05	1235.86	8.61	9.46	1237.00	0.0250
Reach 1	4.142	15810.00	1226.74	0.08	0.58	1236.40	1236.90	1236.32	9.01	9.58	1237.58	0.0250
Reach 1	4.148	15810.00	1228.12	0.95	0.97	1237.26	1237.28	1236.31	9.65	8.19	1237.75	0.0300
Reach 1	4.152	Bridge										
Reach 1	4.156	15810.00	1228.04	-0.60	-0.67	1237.35	1237.28	1237.95	7.92	9.91	1238.93	0.0300
Reach 1	4.161	15810.00	1227.99	-1.66	-1.75	1236.39	1236.30	1238.05	7.82	10.06	1238.98	0.0300
Reach 1	4.203	15810.00	1228.65	-1.03	-1.03	1237.75	1237.75	1238.78	5.88	10.13	1239.29	0.0250
Reach 1	4.298	15810.00	1228.91	-0.94	-0.82	1238.21	1238.33	1239.15	6.76	10.24	1239.84	0.0250
Reach 1	4.393	15810.00	1229.55	-1.23	-1.19	1238.37	1238.41	1239.60	7.40	10.05	1240.42	0.0250

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 1	4.487	15810.00	1230.05	-1.81	-0.18	1238.44	1240.07	1240.25	7.01	10.20	1240.99	0.0250

HEC-RAS Plan: Existing River: EMF Reach: Reach 2

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 2	4.487	15810.00	1230.05	-1.81	-0.18	1238.44	1240.07	1240.25	7.01	10.20	1240.99	0.0250
Reach 2	4.506	15810.00	1230.31	-1.38	-1.72	1238.89	1238.55	1240.27	7.69	9.96	1241.16	0.0250
Reach 2	4.578	15810.00	1232.72	2.84	1.94	1243.50	1242.60	1240.66	9.91	7.94	1242.18	0.0300
Reach 2	4.584	Bridge										
Reach 2	4.590	15810.00	1231.84	0.19	-0.20	1243.11	1242.72	1242.92	6.93	11.08	1243.67	0.0300
Reach 2	4.610	15810.00	1232.14	-0.27	0.18	1242.75	1243.20	1243.02	7.08	10.88	1243.80	0.0300
Reach 2	4.613	Bridge										
Reach 2	4.615	15810.00	1232.22	-1.49	-1.65	1243.55	1243.39	1245.04	5.64	12.82	1245.53	0.0300
Reach 2	4.669	15810.00	1232.79	-3.37	-3.76	1242.00	1241.61	1245.37	4.91	12.58	1245.68	0.0300
Reach 2	4.715	15810.00	1233.16	-2.88	-2.98	1242.40	1242.30	1245.28	6.21	12.12	1245.88	0.0250
Reach 2	4.727	15810.00	1232.99	-2.60	-2.41	1242.75	1242.94	1245.35	6.01	12.36	1245.91	0.0250
Reach 2	4.746	15810.00	1233.09	-2.52	-2.46	1242.86	1242.92	1245.38	6.18	12.29	1245.97	0.0250
Reach 2	4.82	15810.00	1233.57	-2.41	-2.56	1243.16	1243.01	1245.57	6.25	12.00	1246.17	0.0250
Reach 2	4.914	15810.00	1233.70	-2.26	-2.47	1243.56	1243.35	1245.82	6.36	12.12	1246.45	0.0250
Reach 2	5.009	15810.00	1233.90	-1.48	-1.72	1244.60	1244.36	1246.08	6.64	12.18	1246.76	0.0250
Reach 2	5.104	15810.00	1234.18	-1.18	-0.98	1245.20	1245.40	1246.38	6.88	12.20	1247.12	0.0250
Reach 2	5.198	15810.00	1234.80	-0.89	-1.03	1245.85	1245.71	1246.74	6.94	11.94	1247.49	0.0250
Reach 2	5.293	15810.00	1235.10	0.07	0.18	1247.15	1247.26	1247.08	7.41	11.98	1247.94	0.0250
Reach 2	5.388	15810.00	1236.07	0.30	0.16	1247.83	1247.69	1247.53	7.69	11.46	1248.45	0.0250
Reach 2	5.483	15810.00	1236.40	0.76	0.69	1248.80	1248.73	1248.04	7.87	11.64	1249.00	0.0250
Reach 2	5.578	15810.00	1237.47	0.89	0.81	1249.50	1249.42	1248.61	8.26	11.14	1249.67	0.0300
Reach 2	5.58	15810.00	1237.20	0.90	1.38	1249.46	1249.94	1248.56	8.62	11.36	1249.72	0.0300
Reach 2	5.581	15810.00	1237.21	1.18	1.50	1249.67	1249.99	1248.49	9.02	11.28	1249.75	0.0130
Reach 2	5.582	15810.00	1238.32	1.77	1.50	1249.80	1249.53	1248.03	11.13	9.71	1249.95	0.0130
Reach 2	5.586	15810.00	1243.67	-1.70	-0.94	1249.22	1249.98	1250.92	14.13	7.25	1253.93	0.0130
Reach 2	5.658	15810.00	1247.61	-6.70	-6.68	1252.92	1252.94	1259.62	18.00	12.01	1264.11	0.0130
Reach 2	5.722	15810.00	1250.89	-6.58	-6.66	1255.98	1255.90	1262.56	17.50	11.67	1266.85	0.0130
Reach 2	5.817	15810.00	1255.90	-3.81	-6.70	1264.00	1261.11	1267.81	17.76	11.91	1272.30	0.0130
Reach 2	5.912	15810.00	1260.84	-6.21	-6.27	1266.10	1266.04	1272.31	17.89	11.47	1276.71	0.0130
Reach 2	6.007	15810.00	1265.41	-5.50	-5.31	1271.87	1272.06	1277.37	17.84	11.96	1281.86	0.0130
Reach 2	6.101	15810.00	1270.39	-6.38	-5.91	1276.63	1277.10	1283.01	8.85	12.62	1283.61	0.0130
Reach 2	6.196	15810.00	1275.54	-4.76	-5.24	1283.19	1282.71	1287.95	18.03	12.41	1292.58	0.0130
Reach 2	6.23	15810.00	1284.98	-2.92	-1.42	1290.80	1292.30	1293.72	5.07	10.34	1293.96	0.0130
Reach 2	6.252	15810.00	1282.70	0.24	0.20	1293.49	1293.45	1293.25	7.91	10.55	1294.22	0.0300
Reach 2	6.3	15810.00	1282.63	-0.41	0.48	1293.28	1294.17	1293.69	7.41	11.06	1294.55	0.0300
Reach 2	6.388	15810.00	1282.50	1.27	0.21	1295.53	1294.47	1294.26	7.09	11.76	1295.04	0.0300
Reach 2	6.486	15810.00	1282.91	6.02	1.97	1300.80	1296.75	1294.78	6.89	11.87	1295.52	0.0300
Reach 2	6.510	15810.00	1283.13	6.40	1.87	1301.78	1297.25	1295.38	4.57	12.25	1295.71	0.0300
Reach 2	6.576	15810.00	1283.27	9.75	3.17	1305.22	1298.64	1295.47	4.77	12.20	1295.83	0.0250
Reach 2	6.671	15810.00	1283.41	10.04	3.53	1305.66	1298.95	1295.62	4.71	12.21	1295.97	0.0250
Reach 2	6.766	15810.00	1283.50	9.21	2.82	1304.96	1298.57	1295.75	4.73	12.25	1296.10	0.0250
Reach 2	6.86	15810.00	1283.49	4.01	-0.80	1299.92	1295.11	1295.91	4.60	12.42	1296.24	0.0250
Reach 2	6.894	15810.00	1283.50	-1.79	-1.36	1294.20	1294.63	1295.99	4.36	12.49	1296.29	0.0250
Reach 2	6.898	15810.00	1283.50	-1.52	-2.43	1294.65	1293.74	1296.17	3.24	12.67	1296.33	0.0300
Reach 2	6.902	15810.00	1283.66	-1.57	-2.17	1294.60	1294.00	1296.17	3.25	12.51	1296.33	0.0150
Reach 2	6.907	15810.00	1283.60	-2.71	-1.53	1293.38	1294.56	1296.09	4.54	12.49	1296.41	0.0250
Reach 2	6.999	15810.00	1283.70	-1.23	-1.76	1294.97	1294.44	1296.20	4.68	12.50	1296.54	0.0250
Reach 2	7.026	15810.00	1283.73	-0.33	-1.16	1295.83	1295.00	1296.16	5.73	12.43	1296.67	0.0250
Reach 2	7.05	15810.00	1283.73	-1.71	-1.12	1294.52	1295.11	1296.23	5.65	12.50	1296.72	0.0250
Reach 2	7.144	15810.00	1283.80	-4.91	-1.21	1291.55	1295.25	1296.46	5.40	12.66	1296.92	0.0250
Reach 2	7.239	15810.00	1283.70	-1.09	-1.07	1295.55	1295.57	1296.64	5.41	12.94	1297.09	0.0250
Reach 2	7.334	15810.00	1284.00	-1.01	-1.20	1295.80	1295.61	1296.81	5.43	12.81	1297.27	0.0250
Reach 2	7.429	15810.00	1284.00	0.39	-1.27	1297.38	1295.72	1296.99	5.45	12.99	1297.45	0.0250
Reach 2	7.523	15810.00	1284.40	0.04	-0.86	1297.20	1296.30	1297.16	5.54	12.76	1297.64	0.0250
Reach 2	7.618	15810.00	1284.38	0.61	-1.17	1297.96	1296.18	1297.35	5.59	12.97	1297.84	0.0250
Reach 2	7.719	15810.00	1284.58	0.29	-1.25	1297.86	1296.32	1297.57	5.50	12.99	1298.04	0.0250
Reach 2	7.792	15810.00	1284.60	0.43	-1.52	1298.15	1296.20	1297.72	5.43	13.12	1298.18	0.0250
Reach 2	7.823	15810.00	1284.72	0.41	-1.55	1298.20	1296.24	1297.79	5.36	13.07	1298.24	0.0250
Reach 2	7.91	15810.00	1284.98	-0.34	-1.34	1297.60	1296.60	1297.94	5.46	12.96	1298.41	0.0250
Reach 2	8	15810.00	1284.88	0.54	-1.76	1298.67	1296.37	1298.13	5.32	13.25	1298.57	0.0250
Reach 2	8.057	15810.00	1285.09	0.73	-1.23	1298.97	1297.01	1298.24	5.32	13.15	1298.68	0.0250
Reach 2	8.104	15810.00	1285.37	0.62	-1.74	1298.95	1296.59	1298.33	5.41	12.96	1298.79	0.0300
Reach 2	8.15	15810.00	1285.62	0.73	-1.78	1299.16	1296.65	1298.43	5.43	12.81	1298.89	0.0250
Reach 2	8.245	15810.00	1285.80	0.22	-2.08	1298.83	1296.53	1298.61	5.45	12.81	1299.07	0.0250
Reach 2	8.34	15810.00	1285.77	0.19	-1.41	1298.99	1297.39	1298.80	5.36	13.03	1299.25	0.0250
Reach 2	8.382	15810.00	1286.16	-0.05	-1.48	1298.84	1297.41	1298.89	5.37	12.73	1299.34	0.0300
Reach 2	8.403	15810.00	1285.89	-0.08	-1.92	1298.87	1297.03	1298.95	5.39	13.06	1299.40	0.0300
Reach 2	8.514	15810.00	1286.10	-0.32	-1.71	1298.87	1297.48	1299.19	5.44	13.09	1299.65	0.0250
Reach 2	8.594	15810.00	1285.96	-0.45	-1.99	1298.93	1297.39	1299.38	5.22	13.42	1299.80	0.0250
Reach 2	8.668	15810.00	1285.99	-0.44	-1.68	1299.10	1297.86	1299.54	5.11	13.55	1299.94	0.0300
Reach 2	8.775	15810.00	1286.50	-0.13	-1.63	1299.60	1298.10	1299.73	5.18	13.23	1300.15	0.0250
Reach 2	8.87	15810.00	1286.45	-0.40	-1.46	1299.50	1298.44	1299.90	5.08	13.45	1300.30	0.0250
Reach 2	8.948	15810.00	1286.38	-0.44	-1.34	1299.58	1298.68	1300.02	5.13	13.64	1300.43	0.0250
Reach 2	9.001	15810.00	1286.69	-0.10	-1.13	1300.00	1298.97	1300.10	5.16	13.41	1300.52	0.0250

HEC-RAS Plan: Existing River: EMF Reach: Reach 3

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 3	9.001	15810.00	1286.69	-0.10	-1.13	1300.00	1298.97	1300.10	5.16	13.41	1300.51	0.0250
Reach 3	9.018	15810.00	1287.10	-0.82	-0.83	1299.31	1299.30	1300.13	5.14	13.03	1300.54	0.0250
Reach 3	9.036	14770.00	1287.51	-0.79	-1.18	1299.40	1299.01	1300.19	4.95	12.68	1300.57	0.0250
Reach 3	9.053	14810.00	1287.57	-1.54	-1.51	1298.67	1298.70	1300.21	5.05	12.64	1300.60	0.0250
Reach 3	9.145	14810.00	1288.14	-1.18	-0.86	1299.17	1299.49	1300.35	5.19	12.21	1300.77	0.0250
Reach 3	9.24	14810.00	1288.06	-1.53	-1.03	1299.00	1299.50	1300.53	5.16	12.47	1300.94	0.0250
Reach 3	9.334	14810.00	1288.00	-1.13	-1.76	1299.57	1298.94	1300.70	5.05	12.70	1301.10	0.0250
Reach 3	9.424	14810.00	1287.94	-1.78	-0.91	1299.07	1299.94	1300.85	5.04	12.91	1301.24	0.0250
Reach 3	9.518	14810.00	1287.94	-1.74	-1.30	1299.27	1299.71	1301.01	4.96	13.07	1301.39	0.0250
Reach 3	9.613	14810.00	1287.19	-3.17	-1.07	1298.01	1300.11	1301.18	4.75	13.99	1301.53	0.0250
Reach 3	9.708	14810.00	1287.70	-1.60	-1.00	1299.70	1300.30	1301.30	4.91	13.60	1301.67	0.0250
Reach 3	9.802	14810.00	1288.71	-1.93	-0.86	1299.50	1300.57	1301.43	5.11	12.72	1301.83	0.0250
Reach 3	9.844	14810.00	1288.56	-1.29	-1.83	1300.23	1299.69	1301.52	4.93	12.96	1301.90	0.0250
Reach 3	9.849	14810.00	1288.45	1.52	-1.11	1302.97	1300.34	1301.45	5.96	13.00	1302.00	0.0250
Reach 3	9.854	14810.00	1288.40	-1.49	-1.39	1300.20	1300.30	1301.69	4.88	13.29	1302.06	0.0250
Reach 3	9.897	14810.00	1288.50	-2.13	-1.61	1299.63	1300.15	1301.76	4.84	13.26	1302.12	0.0250
Reach 3	9.944	14810.00	1288.55	-1.99	-1.26	1299.83	1300.56	1301.82	4.92	13.27	1302.19	0.0250
Reach 3	10.039	14810.00	1288.96	-1.71	-1.78	1300.30	1300.23	1302.01	4.63	13.05	1302.33	0.0250
Reach 3	10.134	14810.00	1289.47	-1.23	-1.21	1300.90	1300.92	1302.13	4.72	12.66	1302.46	0.0250
Reach 3	10.171	14810.00	1288.86	-2.06	3.16	1300.11	1305.33	1302.17	4.79	13.31	1302.52	0.0250
Reach 3	10.195	14810.00	1288.91	4.78	4.26	1306.99	1306.47	1302.21	4.85	13.30	1302.57	0.0300
Reach 3	10.207	Bridge										
Reach 3	10.218	14810.00	1288.64	3.92	3.93	1306.38	1306.39	1302.46	4.57	13.82	1302.78	0.0300
Reach 3	10.252	14810.00	1288.80	-1.10	-1.42	1301.40	1301.08	1302.50	4.67	13.70	1302.84	0.0250
Reach 3	10.346	14810.00	1288.88	-2.12	-1.42	1300.52	1301.22	1302.64	4.50	13.76	1302.95	0.0250
Reach 3	10.441	14810.00	1289.06	-2.52	-1.62	1300.22	1301.12	1302.74	4.64	13.68	1303.07	0.0250
Reach 3	10.518	14860.00	1289.62	-1.34	-1.27	1301.48	1301.55	1302.82	4.88	13.20	1303.19	0.0250
Reach 3	10.566	14860.00	1289.50	-1.36	-0.75	1301.52	1302.13	1302.88	4.90	13.38	1303.25	0.0250
Reach 3	10.654	14860.00	1290.00	-1.27	-0.64	1301.74	1302.37	1303.01	4.92	13.01	1303.39	0.0250
Reach 3	10.749	14860.00	1289.80	-1.36	-1.15	1301.82	1302.03	1303.18	4.75	13.38	1303.52	0.0250
Reach 3	10.843	14860.00	1289.90	-1.70	-0.99	1301.62	1302.33	1303.32	4.61	13.42	1303.65	0.0250
Reach 3	10.938	14860.00	1290.11	-2.16	-0.91	1301.30	1302.55	1303.46	4.65	13.35	1303.79	0.0300
Reach 3	11.033	14860.00	1290.41	-1.61	-0.73	1302.02	1302.90	1303.63	4.74	13.22	1303.97	0.0300
Reach 3	11.127	14860.00	1290.70	-1.88	-1.30	1301.95	1302.53	1303.83	4.64	13.13	1304.15	0.0300
Reach 3	11.189	14860.00	1290.70	-1.84	-1.10	1302.10	1302.84	1303.94	4.65	13.24	1304.27	0.0300
Reach 3	11.231	14860.00	1290.62	-1.90	7.59	1302.13	1311.62	1304.03	4.59	13.41	1304.35	0.0300
Reach 3	11.249	14450.00	1290.69	6.63	5.44	1310.69	1309.50	1304.06	4.61	13.37	1304.39	0.0300
Reach 3	11.254	Bridge										
Reach 3	11.26	14450.00	1290.40	5.43	5.93	1309.56	1310.06	1304.13	4.49	13.73	1304.44	0.0300
Reach 3	11.297	12460.00	1290.78	1.88	3.46	1306.10	1307.68	1304.22	4.36	13.44	1304.51	0.0300
Reach 3	11.308	12460.00	1290.71	3.02	3.15	1307.14	1307.27	1304.12	5.78	13.41	1304.64	0.0130
Reach 3	11.321	12460.00	1296.29	4.32	4.14	1307.56	1307.38	1303.24	12.22	6.95	1305.56	0.0130
Reach 3	11.328	12460.00	1294.88	1.37	1.86	1306.96	1307.45	1305.59	5.88	10.71	1306.12	0.0250
Reach 3	11.391	12460.00	1295.69	0.95	1.31	1306.75	1307.11	1305.80	5.79	10.11	1306.32	0.0250
Reach 3	11.486	12460.00	1296.57	0.92	1.33	1307.00	1307.41	1306.08	5.87	9.51	1306.62	0.0250
Reach 3	11.531	12460.00	1296.26	0.83	1.77	1307.06	1308.00	1306.23	5.79	9.97	1306.76	0.0250
Reach 3	11.572	12460.00	1296.51	2.75	2.04	1309.11	1308.40	1306.36	5.79	9.85	1306.88	0.0250
Reach 3	11.609	12460.00	1296.39	1.95	1.90	1308.45	1308.40	1306.50	5.61	10.11	1306.99	0.0250
Reach 3	11.703	12460.00	1296.68	0.53	1.37	1307.29	1308.13	1306.76	5.59	10.08	1307.25	0.0250
Reach 3	11.798	12460.00	1296.67	0.36	1.16	1307.40	1308.20	1307.04	5.42	10.37	1307.49	0.0250
Reach 3	11.893	12460.00	1296.71	0.50	1.15	1307.77	1308.42	1307.27	5.36	10.56	1307.72	0.0250
Reach 3	11.988	12460.00	1296.90	-0.09	1.59	1307.42	1309.10	1307.51	5.28	10.61	1307.94	0.0250
Reach 3	12.082	12460.00	1297.29	-0.27	1.57	1307.44	1309.28	1307.71	5.40	10.42	1308.17	0.0250
Reach 3	12.177	12460.00	1297.28	0.20	1.99	1308.15	1309.94	1307.95	5.28	10.67	1308.39	0.0250
Reach 3	12.245	12460.00	1297.40	0.34	1.76	1308.43	1309.85	1308.09	5.42	10.69	1308.55	0.0250
Reach 3	12.302	12460.00	1297.60	0.42	1.33	1308.66	1309.57	1308.24	5.39	10.64	1308.69	0.0250
Reach 3	12.349	12460.00	1297.66	0.44	1.44	1308.80	1309.80	1308.36	5.33	10.70	1308.80	0.0250
Reach 3	12.441	12460.00	1297.71	-0.12	0.92	1308.46	1309.50	1308.58	5.24	10.87	1309.01	0.0250
Reach 3	12.488	12460.00	1297.80	-0.15	0.50	1308.55	1309.20	1308.70	5.17	10.90	1309.11	0.0250
Reach 3	12.552	12460.00	1297.54	-0.36	0.47	1308.48	1309.31	1308.84	5.10	11.30	1309.25	0.0250
Reach 3	12.6	12460.00	1297.79	-0.21	0.36	1308.72	1309.29	1308.93	5.18	11.14	1309.35	0.0250
Reach 3	12.694	12460.00	1298.04	-0.72	0.60	1308.43	1309.75	1309.15	5.08	11.11	1309.55	0.0250
Reach 3	12.789	12460.00	1298.10	-0.78	0.36	1308.56	1309.70	1309.34	5.06	11.24	1309.74	0.0250
Reach 3	12.884	12460.00	1298.30	-0.47	-0.26	1309.06	1309.27	1309.53	5.01	11.23	1309.92	0.0250
Reach 3	12.905	12460.00	1298.40	-0.58	-0.49	1308.99	1309.08	1309.57	5.05	11.17	1309.97	0.0250
Reach 3	12.981	12460.00	1298.62	-0.41	0.74	1309.31	1310.46	1309.72	5.05	11.10	1310.11	0.0250
Reach 3	13.037	12460.00	1298.52	-0.44	0.36	1309.40	1310.20	1309.84	4.94	11.32	1310.22	0.0250
Reach 3	13.084	12460.00	1298.67	-0.22	0.28	1309.70	1310.20	1309.92	5.03	11.25	1310.32	0.0250
Reach 3	13.179	12460.00	1299.00	-0.15	0.40	1309.95	1310.50	1310.10	5.14	11.10	1310.51	0.0250
Reach 3	13.232	12460.00	1299.09	-0.11	0.07	1310.10	1310.28	1310.21	5.17	11.12	1310.63	0.0250
Reach 3	13.28	12460.00	1299.23	0.07	0.01	1310.40	1310.34	1310.33	5.04	11.10	1310.73	0.0250
Reach 3	13.374	12460.00	1299.45	-0.03	0.07	1310.50	1310.60	1310.53	4.97	11.08	1310.91	0.0250
Reach 3	13.426	12460.00	1299.62	3.59	3.40	1314.24	1314.05	1310.65	4.99	11.03	1311.03	0.0300
Reach 3	13.431	Bridge										
Reach 3	13.439	12460.00	1299.34	3.40	3.39	1314.18	1314.17	1310.78	4.75	11.44	1311.13	0.0300
Reach 3	13.471	12460.00	1299.43	3.30	-1.31	1314.11	1309.50	1310.81	5.37	11.38	1311.25	0.0250

HEC-RAS Plan: Existing River: EMF Reach: Reach 4

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 4	13.471	12460.00	1299.43	3.30	-1.31	1314.11	1309.50	1310.81	5.37	11.38	1311.26	0.0250
Reach 4	13.566	12440.00	1299.46	3.23	-0.89	1314.17	1310.05	1310.94	6.25	11.48	1311.54	0.0250
Reach 4	13.661	12440.00	1299.76	2.84	-0.95	1314.09	1310.30	1311.25	6.09	11.49	1311.83	0.0250
Reach 4	13.755	12440.00	1300.50	2.66	-1.01	1314.18	1310.51	1311.52	6.22	11.02	1312.11	0.0250
Reach 4	13.842	12440.00	1300.89	2.96	-0.67	1314.73	1311.10	1311.77	6.40	10.88	1312.40	0.0250
Reach 4	13.911	12440.00	1300.88	3.01	-0.85	1315.06	1311.20	1312.05	6.15	11.17	1312.63	0.0250
Reach 4	13.946	12440.00	1299.65	2.69	2.90	1314.97	1315.18	1312.28	5.70	12.63	1312.78	0.0300
Reach 4	13.954	Bridge										
Reach 4	13.961	12440.00	1299.55	2.81	2.67	1315.26	1315.12	1312.45	5.54	12.90	1312.93	0.0300
Reach 4	14	12440.00	1300.90	-1.15	-0.77	1311.40	1311.78	1312.55	5.90	11.65	1313.08	0.0250
Reach 4	14.191	12440.00	1301.20	-1.14	-0.87	1311.93	1312.20	1313.07	5.66	11.87	1313.55	0.0250
Reach 4	14.3	12440.00	1301.54	-1.11	-1.15	1312.20	1312.16	1313.31	5.76	11.77	1313.81	0.0250
Reach 4	14.412	12440.00	1301.60	-1.08	-1.08	1312.50	1312.50	1313.58	5.74	11.98	1314.08	0.0250
Reach 4	14.637	12440.00	1302.17	-1.46	-1.19	1312.70	1312.97	1314.16	5.22	11.99	1314.56	0.0250
Reach 4	14.738	12350.00	1302.42	2.55	2.55	1316.69	1316.69	1314.14	7.15	11.72	1314.94	0.0250
Reach 4	14.754	12350.00	1306.32	1.51	1.76	1316.67	1316.92	1315.16	14.89	8.84	1318.61	0.0250
Reach 4	14.764	12350.00	1306.30	-2.02	-1.22	1316.80	1317.60	1318.82	3.66	12.52	1318.96	0.0250
Reach 4	14.823	12350.00	1306.39	-1.35	-1.33	1317.50	1317.52	1318.85	3.98	12.46	1319.03	0.0250
Reach 4	14.926	12350.00	1306.28	-2.20	-1.26	1316.71	1317.65	1318.91	4.69	12.63	1319.21	0.0250
Reach 4	15.035	12350.00	1306.87	-1.56	-1.65	1317.50	1317.41	1319.06	4.83	12.19	1319.38	0.0250
Reach 4	15.225	12350.00	1307.00	-1.31	-1.09	1318.08	1318.30	1319.39	4.71	12.39	1319.68	0.0250
Reach 4	15.414	12350.00	1308.11	-0.71	-0.87	1318.96	1318.80	1319.67	5.16	11.56	1320.03	0.0250
Reach 4	15.483	12350.00	1307.90	-0.83	-0.85	1319.00	1318.98	1319.83	4.95	11.93	1320.16	0.0250
Reach 4	15.606	12350.00	1308.20	-0.88	-0.79	1319.16	1319.25	1320.04	5.07	11.84	1320.39	0.0250
Reach 4	15.811	12350.00	1308.82	-0.82	-1.10	1319.61	1319.33	1320.43	4.76	11.61	1320.75	0.0250
Reach 4	16	12350.00	1308.91	-1.57	-0.83	1319.14	1319.88	1320.71	5.03	11.80	1321.09	0.0250
Reach 4	16.19	12350.00	1309.35	-0.68	-0.71	1320.36	1320.33	1321.04	5.25	11.69	1321.47	0.0250
Reach 4	16.205	12350.00	1309.37	2.26	2.44	1323.33	1323.51	1321.07	5.34	11.70	1321.51	0.0300
Reach 4	16.213	Bridge										
Reach 4	16.221	12350.00	1309.43	1.95	2.24	1323.20	1323.49	1321.25	5.30	11.82	1321.69	0.0300
Reach 4	16.238	12350.00	1309.56	0.62	0.31	1322.00	1321.69	1321.38	4.90	11.82	1321.75	0.0300
Reach 4	16.240	Bridge										
Reach 4	16.242	12350.00	1309.67	-0.58	-1.67	1320.92	1319.83	1321.50	4.96	11.83	1321.88	0.0300
Reach 4	16.251	12350.00	1309.50	-0.60	-0.61	1320.91	1320.90	1321.51	5.06	12.01	1321.91	0.0250
Reach 4	16.321	11410.00	1309.10	-0.64	-1.14	1321.10	1320.60	1321.74	4.41	12.64	1322.03	0.0250
Reach 4	16.389	11410.00	1309.76	-0.74	-1.20	1321.10	1320.64	1321.84	4.38	12.08	1322.12	0.0250
Reach 4	16.468	11410.00	1309.49	-1.18	-1.34	1320.76	1320.60	1321.94	4.39	12.45	1322.23	0.0250
Reach 4	16.63	11410.00	1309.48	-1.15	-1.19	1321.02	1320.98	1322.17	4.18	12.69	1322.43	0.0250
Reach 4	16.819	11410.00	1309.76	-1.08	-1.39	1321.29	1320.98	1322.37	4.41	12.61	1322.67	0.0250
Reach 4	16.94	11410.00	1309.91	-1.52	-0.52	1321.01	1322.01	1322.53	4.37	12.62	1322.82	0.0250
Reach 4	17.039	11410.00	1310.37	-0.10	0.03	1322.54	1322.67	1322.64	4.98	12.27	1323.03	0.0300
Reach 4	17.071	11410.00	1310.83	6.29	5.02	1327.67	1326.40	1321.38	14.57	10.55	1324.68	0.0300
Reach 4	17.082	11410.00	1310.51	6.69	6.99	1328.21	1328.51	1321.52	14.65	11.01	1324.85	0.0150
Reach 4	17.086	Bridge										
Reach 4	17.101	11410.00	1310.54	-0.74	-0.76	1324.29	1324.27	1325.03	9.88	14.49	1326.55	0.0150
Reach 4	17.17	11410.00	1311.12	-1.63	-0.51	1324.08	1325.20	1325.71	8.64	14.59	1326.75	0.0150
Reach 4	17.213	11460.00	1311.10	-2.00	-0.07	1323.56	1325.49	1325.56	9.58	14.46	1326.94	0.0150
Reach 4	17.25	11460.00	1311.10	-0.68	0.31	1324.91	1325.90	1325.59	9.73	14.49	1327.06	0.0150
Reach 4	17.254	11460.00	1310.98	0.39	0.86	1325.97	1326.44	1325.58	9.85	14.60	1327.09	0.0150
Reach 4	17.261	Bridge										
Reach 4	17.269	11460.00	1311.04	-1.60	-1.13	1325.71	1326.18	1327.31	8.30	16.27	1328.38	0.0150
Reach 4	17.288	11460.00	1311.13	-3.79	-3.07	1323.68	1324.40	1327.47	7.98	16.34	1328.42	0.0150
Reach 4	17.339	11460.00	1311.41	-4.35	-2.36	1323.58	1325.57	1327.93	6.73	16.52	1328.51	0.0150
Reach 4	17.48	11460.00	1311.88	-4.98	-2.88	1323.30	1325.40	1328.28	5.78	16.40	1328.63	0.0150
Reach 4	17.571	11460.00	1312.05	-5.16	-5.45	1323.25	1322.96	1328.41	5.40	16.36	1328.69	0.0150
Reach 4	17.672	11460.00	1312.57	-4.66	-5.19	1323.78	1323.25	1328.44	5.74	15.87	1328.77	0.0150
Reach 4	17.803	11460.00	1313.58	-3.77	-3.69	1324.63	1324.71	1328.40	6.95	14.82	1328.93	0.0150
Reach 4	17.898	11460.00	1314.10	-3.31	-3.00	1325.00	1325.31	1328.31	8.18	14.21	1329.14	0.0150
Reach 4	18.087	11460.00	1315.14	-1.90	-2.08	1326.55	1326.37	1328.45	9.35	13.31	1329.65	0.0150
Reach 4	18.193	11460.00	1315.38	-1.59	-2.11	1326.92	1326.40	1328.51	10.11	13.13	1330.01	0.0150
Reach 4	18.237	11460.00	1317.30	-1.70	-1.10	1328.40	1329.00	1330.10	4.65	12.80	1330.41	0.0150
Reach 4	18.345	7780.00	1317.07	-2.05	-1.85	1328.30	1328.50	1330.35	3.10	13.28	1330.49	0.0300

HEC-RAS Plan: existing River: EMF Reach: Reach 5

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 5	18.345	7780.00	1317.07	-2.05	-1.85	1328.30	1328.50	1330.35	3.09	13.28	1330.49	0.0300
Reach 5	18.535	7340.00	1317.85	-1.40	-1.73	1329.14	1328.81	1330.54	2.29	12.69	1330.60	0.0250
Reach 5	18.782	7340.00	1318.05	-1.25	-2.26	1329.36	1328.35	1330.61	2.72	12.56	1330.71	0.0250
Reach 5	18.97	7340.00	1318.41	-0.69	-2.15	1330.00	1328.54	1330.69	3.09	12.28	1330.83	0.0250
Reach 5	19.109	5800.00	1318.80	-0.82	-2.14	1329.99	1328.67	1330.81	2.57	12.01	1330.91	0.0250
Reach 5	19.298	5800.00	1319.02	-0.63	-1.85	1330.27	1329.05	1330.90	2.62	11.88	1331.00	0.0250
Reach 5	19.408	5160.00	1319.19	-0.17	-1.63	1330.80	1329.34	1330.97	2.43	11.78	1331.05	0.0250
Reach 5	19.458	5160.00	1319.39	-0.41	-1.14	1330.57	1329.84	1330.98	2.55	11.59	1331.08	0.0250
Reach 5	19.489	5160.00	1319.60	-0.40	-0.95	1330.60	1330.05	1331.00	2.54	11.40	1331.10	0.0250
Reach 5	19.541	5160.00	1319.56	-0.29	-1.11	1330.73	1329.91	1331.02	2.55	11.46	1331.12	0.0250
Reach 5	19.592	5160.00	1319.50	0.05	-1.27	1331.10	1329.78	1331.05	2.55	12.35	1331.15	0.0250
Reach 5	19.745	5160.00	1319.61	0.16	-0.63	1331.29	1330.50	1331.13	2.54	11.52	1331.22	0.0250
Reach 5	19.863	5160.00	1319.74	0.35	-0.61	1331.53	1330.57	1331.18	2.59	11.44	1331.29	0.0250
Reach 5	20.058	5160.00	1320.10	0.50	-0.32	1331.79	1330.97	1331.29	2.64	11.19	1331.39	0.0250
Reach 5	20.247	5160.00	1320.62	0.91	-0.19	1332.30	1331.20	1331.39	2.80	10.77	1331.51	0.0250
Reach 5	20.306	5160.00	1320.70	0.79	0.82	1332.22	1332.25	1331.43	2.89	10.73	1331.56	0.0250
Reach 5	20.316	5160.00	1320.83	3.61	4.68	1335.04	1336.11	1331.43	2.93	10.60	1331.57	0.0250
Reach 5	20.323	Bridge										
Reach 5	20.328	5160.00	1320.85	3.75	4.81	1335.22	1336.28	1331.47	2.90	10.62	1331.61	0.0250
Reach 5	20.334	5160.00	1320.59	0.89	2.67	1332.37	1334.15	1331.48	2.95	10.89	1331.61	0.0250
Reach 5	20.353	5160.00	1320.90	0.71	0.17	1332.20	1331.66	1331.49	2.93	10.59	1331.63	0.0250
Reach 5	20.428	5170.00	1321.04	0.45	0.45	1332.00	1332.00	1331.55	2.90	10.51	1331.68	0.0250
Reach 5	20.517	5170.00	1320.90	0.38	0.45	1331.99	1332.06	1331.61	2.93	10.71	1331.75	0.0250
Reach 5	20.61	5170.00	1321.01	0.58	0.52	1332.26	1332.20	1331.68	2.95	10.67	1331.82	0.0250
Reach 5	20.704	5170.00	1321.02	0.95	0.71	1332.70	1332.46	1331.75	2.97	10.73	1331.89	0.0250
Reach 5	20.799	5170.00	1321.43	1.30	0.78	1333.12	1332.60	1331.82	3.06	10.39	1331.96	0.0250
Reach 5	20.894	5170.00	1321.60	0.67	0.36	1332.57	1332.26	1331.90	3.10	10.30	1332.05	0.0250
Reach 5	21	5170.00	1321.41	0.66	0.53	1332.65	1332.52	1331.99	3.06	10.58	1332.14	0.0250
Reach 5	21.093	5170.00	1321.82	0.86	0.66	1332.93	1332.73	1332.07	3.18	10.25	1332.23	0.0250
Reach 5	21.188	5170.00	1322.28	0.89	0.64	1333.05	1332.80	1332.16	3.34	9.88	1332.33	0.0250
Reach 5	21.282	5170.00	1322.47	1.80	2.46	1334.04	1334.70	1332.24	3.69	9.77	1332.46	0.0250
Reach 5	21.326	3380.00	1322.60	4.38	6.45	1336.70	1338.77	1332.32	3.62	9.72	1332.52	0.0300
Reach 5	21.339	Bridge										
Reach 5	21.355	3380.00	1322.56	3.61	5.35	1336.16	1337.90	1332.55	3.44	9.99	1332.73	0.0300
Reach 5	21.391	3380.00	1322.68	1.94	0.51	1334.53	1333.10	1332.59	3.70	9.91	1332.81	0.0300
Reach 5	21.402	3380.00	1322.54	3.01	3.26	1335.63	1335.88	1332.62	3.63	10.08	1332.83	0.0300
Reach 5	21.407	Bridge										
Reach 5	21.413	3380.00	1322.28	3.00	3.21	1335.69	1335.90	1332.69	3.53	10.41	1332.88	0.0300
Reach 5	21.418	3380.00	1324.17	0.84	2.52	1333.47	1335.15	1332.63	4.32	8.46	1332.92	0.0300
Reach 5	21.439	3380.00	1315.40	0.97	1.87	1333.90	1334.80	1332.93	1.36	17.53	1332.96	0.0350
Reach 5	21.485	3380.00	1315.40	2.35	2.15	1335.30	1335.10	1332.95	1.03	17.55	1332.97	0.0350
Reach 5	21.531	3380.00	1315.45	3.40	2.44	1336.37	1335.41	1332.97	0.63	17.52	1332.97	0.0350
Reach 5	21.591	3380.00	1315.45	7.56	2.73	1340.53	1335.70	1332.97	0.83	17.52	1332.98	0.0350
Reach 5	21.633	3380.00	1315.40	7.70	2.69	1340.67	1335.66	1332.97	0.79	17.57	1332.98	0.0350
Reach 5	21.656	3380.00	1314.40	8.58	1.92	1341.55	1334.89	1332.97	0.81	18.57	1332.98	0.0350
Reach 5	21.713	3380.00	1324.20	7.74	6.54	1340.64	1339.44	1332.90	2.85	8.70	1333.03	0.0350
Reach 5	21.745	3380.00	1324.22	5.47	1.61	1338.50	1334.64	1333.03	1.48	8.81	1333.07	0.0350
Reach 5	21.839	3380.00	1324.20	7.32	2.23	1340.40	1335.31	1333.08	1.17	8.88	1333.10	0.0350
Reach 5	21.947	3380.00	1325.42	7.91	5.58	1340.94	1338.61	1333.03	3.72	7.61	1333.24	0.0350
Reach 5	22.022	3380.00	1325.91	8.40	2.67	1341.95	1336.22	1333.55	3.16	7.64	1333.71	0.0350
Reach 5	22.107	3380.00	1326.00	6.90	2.90	1340.77	1336.77	1333.87	2.30	7.87	1333.95	0.0350
Reach 5	22.189	3380.00	1324.50	7.08	4.45	1341.09	1338.46	1334.01	3.22	9.51	1334.17	0.0350
Reach 5	22.263	3380.00	1325.29	6.24	3.40	1340.53	1337.69	1334.29	2.54	9.00	1334.39	0.0350
Reach 5	22.348	3380.00	1326.63	5.69	2.72	1340.17	1337.20	1334.48	1.61	7.85	1334.52	0.0350
Reach 5	22.436	3380.00	1325.51	1.99	5.19	1336.53	1339.73	1334.54	1.14	9.03	1334.56	0.0350
Reach 5	22.475	3380.00	1325.50	1.34	3.69	1335.89	1338.24	1334.55	1.15	9.05	1334.57	0.0350
Reach 5	22.557	3380.00	1325.50	2.53	2.40	1337.10	1336.97	1334.57	1.41	9.07	1334.60	0.0350
Reach 5	22.599	3380.00	1326.67	3.19	4.89	1337.75	1339.45	1334.56	2.82	7.89	1334.68	0.0350
Reach 5	22.608	Bridge										
Reach 5	22.615	3380.00	1326.91	3.87	4.95	1338.50	1339.58	1334.63	2.77	7.72	1334.75	0.0350
Reach 5	22.68	3380.00	1326.34	20.38	6.56	1355.16	1341.34	1334.78	2.53	8.44	1334.88	0.0350
Reach 5	22.74	3380.00	1326.29	17.78	4.58	1352.70	1339.50	1334.92	2.64	8.63	1335.02	0.0350
Reach 5	22.797	3380.00	1326.57	16.32	4.39	1351.39	1339.46	1335.07	2.54	8.50	1335.17	0.0350
Reach 5	22.866	3380.00	1326.20	2.85	1.97	1338.08	1337.20	1335.23	3.19	9.03	1335.39	0.0350
Reach 5	22.944	3380.00	1327.70	9.28	1.99	1344.80	1337.51	1335.52	4.09	7.82	1335.78	0.0350
Reach 5	23.009	3380.00	1327.11	2.81	3.13	1338.70	1339.02	1335.89	1.61	8.78	1335.93	0.0350
Reach 5	23.087	3380.00	1324.80	2.34	2.58	1338.30	1338.54	1335.96	2.55	11.16	1336.06	0.0350
Reach 5	23.135	3380.00	1324.83	13.93	3.63	1350.00	1339.70	1336.07	2.04	11.24	1336.13	0.0350
Reach 5	23.166	3380.00	1327.40	16.46	4.12	1352.54	1340.20	1336.08	2.55	8.68	1336.18	0.0350
Reach 5	23.193	3380.00	1326.10	21.76	21.77	1357.91	1357.92	1336.15	2.10	10.05	1336.22	0.0350
Reach 5	23.206	Bridge										
Reach 5	23.219	3380.00	1326.60	21.07	20.67	1357.86	1357.46	1336.79	2.10	10.19	1336.86	0.0350
Reach 5	23.274	3090.00	1328.46	2.56	3.55	1339.40	1340.39	1336.84	2.26	8.38	1336.92	0.0350
Reach 5	23.315	3090.00	1327.54	4.80	3.51	1341.69	1340.40	1336.89	2.66	9.35	1337.00	0.0350
Reach 5	23.45	3090.00	1328.56	9.18	4.20	1346.30	1341.32	1337.12	1.34	8.56	1337.15	0.0350
Reach 5	23.604	3090.00	1328.94	7.27	4.27	1344.50	1341.50	1337.23	2.49	8.29	1337.32	0.0350
Reach 5	23.712	3090.00	1328.32	5.50	4.56	1343.00	1342.06	1337.50	3.09	9.18	1337.64	0.0350
Reach 5	23.758	3090.00	1328.32	2.73	3.87	1340.40	1341.54	1337.67	1.56	9.35	1337.70	0.0350

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 5	23.803	3090.00	1328.80	3.41	2.89	1341.01	1340.49	1337.60	3.75	8.80	1337.82	0.0150
Reach 5	23.804	3090.00	1328.24	4.29	4.08	1341.91	1341.70	1337.62	3.64	9.38	1337.82	0.0150
Reach 5	23.815	Bridge										
Reach 5	23.825	3090.00	1328.39	4.35	3.50	1342.02	1341.17	1337.67	3.63	9.28	1337.88	0.0150
Reach 5	23.827	3090.00	1328.70	3.52	3.63	1341.19	1341.30	1337.67	3.69	8.97	1337.88	0.0150
Reach 5	23.911	3070.00	1330.30	4.24	5.99	1342.00	1343.75	1337.76	3.91	7.46	1338.00	0.0350
Reach 5	23.962	3070.00	1331.20	7.05	5.53	1345.20	1343.68	1338.15	3.44	6.95	1338.34	0.0350
Reach 5	24.06	3070.00	1332.60	5.17	4.79	1344.00	1343.62	1338.83	3.20	6.23	1338.99	0.0350
Reach 5	24.1	3070.00	1332.95	4.91	4.07	1344.00	1343.16	1339.09	3.22	6.14	1339.25	0.0350
Reach 5	24.13	3070.00	1330.19	4.71	4.07	1344.00	1343.36	1339.29	2.00	9.10	1339.36	0.0350
Reach 5	24.247	3070.00	1329.56	4.54	2.55	1344.00	1342.01	1339.46	1.57	9.90	1339.50	0.0350
Reach 5	24.32	3070.00	1330.52	10.77	4.85	1350.30	1344.38	1339.53	2.06	9.01	1339.59	0.0350
Reach 5	24.454	3070.00	1332.11	11.75	4.26	1351.50	1344.01	1339.75	2.16	7.64	1339.83	0.0350
Reach 5	24.535	3070.00	1329.50	6.53	3.89	1346.40	1343.76	1339.87	1.71	10.37	1339.92	0.0350
Reach 5	24.621	3070.00	1329.41	4.08	3.34	1344.00	1343.26	1339.92	2.40	10.51	1340.01	0.0350
Reach 5	24.723	3070.00	1328.84	4.17	3.30	1344.20	1343.33	1340.03	2.75	11.19	1340.15	0.0300

HEC-RAS Plan: Existing River: EMF Reach: Reach 6

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 6	24.723	3110.00	1328.84	4.17	3.30	1344.20	1343.33	1340.03	2.78	11.19	1340.15	0.0300
Reach 6	24.862	2210.00	1331.09	1.00	1.22	1341.22	1341.44	1340.22	2.16	9.13	1340.29	0.0300
Reach 6	24.9	2210.00	1330.99	1.00	1.46	1341.22	1341.68	1340.22	2.82	9.23	1340.34	0.0300
Reach 6	24.926	2210.00	1331.58	4.29	5.06	1344.26	1345.03	1339.97	7.06	8.39	1340.74	0.0300
Reach 6	24.936	Bridge										
Reach 6	24.946	2210.00	1331.70	3.68	3.88	1344.52	1344.72	1340.84	6.42	9.14	1341.48	0.0300
Reach 6	24.957	2210.00	1332.02	1.50	1.18	1342.90	1342.58	1341.40	3.99	9.38	1341.65	0.0300
Reach 6	24.987	2210.00	1332.02	0.87	1.12	1342.50	1342.75	1341.63	2.23	9.61	1341.70	0.0300
Reach 6	25.028	2210.00	1332.55	0.44	0.84	1342.10	1342.50	1341.66	2.25	9.11	1341.74	0.0300
Reach 6	25.1	2210.00	1332.84	1.38	1.49	1343.09	1343.20	1341.71	2.42	8.87	1341.80	0.0300
Reach 6	25.2	2210.00	1333.22	1.31	1.00	1343.12	1342.81	1341.81	2.41	8.59	1341.90	0.0300
Reach 6	25.3	2210.00	1334.14	2.23	1.62	1344.15	1343.54	1341.92	2.57	7.78	1342.02	0.0300
Reach 6	25.4	2210.00	1335.39	2.51	2.25	1344.56	1344.30	1342.05	2.96	6.66	1342.18	0.0300
Reach 6	25.463	2210.00	1334.94	1.74	1.96	1343.88	1344.10	1342.14	3.79	7.20	1342.36	0.0300
Reach 6	25.49	2210.00	1335.32	1.21	1.38	1343.33	1343.50	1342.12	5.11	6.80	1342.53	0.0300
Reach 6	25.508	2210.00	1335.30	1.61	1.60	1343.69	1343.68	1342.08	6.09	6.78	1342.66	0.0130
Reach 6	25.565	Culvert										
Reach 6	25.578	2210.00	1335.86	2.99	3.13	1345.60	1345.74	1342.61	6.19	6.75	1343.20	0.0130
Reach 6	25.597	2210.00	1335.97	2.86	2.48	1345.90	1345.52	1343.04	4.22	7.07	1343.31	0.0130
Reach 6	25.598	2210.00	1335.97	2.55	2.61	1345.69	1345.75	1343.14	3.45	7.17	1343.32	0.0300
Reach 6	25.647	1100.00	1336.60	2.94	3.02	1346.31	1346.39	1343.37	1.37	6.77	1343.40	0.0300
Reach 6	25.749	1100.00	1336.53	2.90	2.29	1346.31	1345.70	1343.41	1.28	6.88	1343.43	0.0300
Reach 6	25.844	1100.00	1336.30	2.46	1.71	1345.90	1345.15	1343.44	1.24	7.14	1343.47	0.0300
Reach 6	25.939	1100.00	1336.46	2.55	1.46	1346.02	1344.93	1343.47	1.23	7.01	1343.50	0.0300
Reach 6	26.047	1100.00	1336.61	2.66	2.69	1346.17	1346.20	1343.51	1.30	6.90	1343.53	0.0300
Reach 6	26.133	1100.00	1336.51	2.42	3.04	1345.96	1346.58	1343.54	1.27	7.03	1343.56	0.0300
Reach 6	26.154	1100.00	1336.58	3.60	3.53	1347.15	1347.08	1343.55	1.32	6.97	1343.57	0.0350
Reach 6	26.163	Bridge										
Reach 6	26.171	1100.00	1336.67	3.33	3.08	1347.07	1346.82	1343.74	1.32	7.07	1343.77	0.0350
Reach 6	26.187	1100.00	1336.77	1.49	2.13	1345.24	1345.88	1343.75	1.38	6.98	1343.78	0.0300
Reach 6	26.228	610.00	1336.68	2.46	2.34	1346.24	1346.12	1343.78	0.90	7.10	1343.79	0.0300
Reach 6	26.311	610.00	1336.19	2.28	1.74	1346.07	1345.53	1343.79	0.85	7.60	1343.81	0.0300
Reach 6	26.385	610.00	1336.58	2.28	2.19	1346.09	1346.00	1343.81	0.88	7.23	1343.82	0.0300
Reach 6	26.5	600.00	1336.94	1.94	2.17	1345.76	1345.99	1343.82	0.88	6.88	1343.84	0.0300
Reach 6	26.595	600.00	1337.10	2.53	2.66	1346.37	1346.50	1343.84	0.90	6.74	1343.85	0.0300
Reach 6	26.678	600.00	1337.17	2.67	2.24	1346.53	1346.10	1343.86	1.04	6.69	1343.87	0.0300
Reach 6	26.697	600.00	1337.18	2.03	2.34	1345.89	1346.20	1343.86	1.27	6.68	1343.88	0.0300
Reach 6	26.702	600.00	1337.17	1.77	1.02	1345.61	1344.86	1343.84	2.03	6.67	1343.90	0.0130
Reach 6	26.712	Culvert										
Reach 6	26.722	600.00	1337.21	2.16	1.94	1346.04	1345.82	1343.88	2.02	6.67	1343.94	0.0130
Reach 6	26.727	600.00	1337.30	2.07	1.77	1346.00	1345.70	1343.93	1.35	6.63	1343.96	0.0130
Reach 6	26.762	600.00	1337.15	2.24	2.37	1346.19	1346.32	1343.95	0.92	6.80	1343.96	0.0300
Reach 6	26.811	600.00	1337.40	2.09	2.66	1346.05	1346.62	1343.96	0.92	6.56	1343.97	0.0300
Reach 6	26.905	600.00	1337.56	2.58	2.83	1346.56	1346.81	1343.98	0.95	6.42	1343.99	0.0300
Reach 6	27	600.00	1337.52	2.72	3.04	1346.72	1347.04	1344.00	0.95	6.48	1344.01	0.0300
Reach 6	27.095	600.00	1337.86	2.28	2.93	1346.30	1346.95	1344.02	1.00	6.16	1344.04	0.0300
Reach 6	27.189	600.00	1337.78	2.74	2.47	1346.78	1346.51	1344.04	1.02	6.26	1344.06	0.0300
Reach 6	27.244	600.00	1337.80	3.09	2.32	1347.10	1346.33	1344.01	2.70	6.21	1344.12	0.0300
Reach 6	27.248	600.00	1337.39	2.56	2.56	1346.40	1346.40	1343.84	5.44	6.45	1344.30	0.0130
Reach 6	27.261	Culvert										
Reach 6	27.274	600.00	1337.30	2.01	1.83	1346.12	1345.94	1344.11	5.49	6.81	1344.58	0.0130
Reach 6	27.278	600.00	1337.39	2.85	2.76	1347.48	1347.39	1344.63	2.09	7.24	1344.70	0.0130
Reach 6	27.295	500.00	1337.80	2.71	2.58	1347.40	1347.27	1344.69	1.10	6.89	1344.71	0.0300
Reach 6	27.371	500.00	1338.02	3.09	3.54	1347.80	1348.25	1344.71	1.23	6.69	1344.74	0.0300
Reach 6	27.39	500.00	1338.00	2.32	3.88	1347.04	1348.60	1344.72	1.31	6.72	1344.75	0.0300

HYDRAULICS

Preferred Alternative HEC-RAS Summary Output

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 1

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 1	0.000	6470.00	1194.70	2.93	5.55	1201.30	1203.92	1198.37	10.02	3.67	1199.93	0.0300
Reach 1	0.004	6470.00	1195.36	5.07	4.89	1203.98	1203.80	1198.91	10.04	3.64	1200.48	0.0300
Reach 1	0.019	6470.00	1194.97	3.30	3.21	1203.69	1203.60	1200.39	6.68	5.42	1201.09	0.0300
Reach 1	0.077	6470.00	1195.67	2.68	2.78	1203.90	1204.00	1201.22	6.59	5.55	1201.89	0.0300
Reach 1	0.084	6470.00	1195.57	2.77	2.59	1204.07	1203.89	1201.30	6.74	5.73	1202.01	0.0350
Reach 1	0.125	6470.00	1195.04	2.31	2.27	1204.18	1204.14	1201.87	6.55	6.83	1202.54	0.0250
Reach 1	0.22	6470.00	1195.36	2.37	2.75	1205.10	1205.48	1202.73	5.82	7.37	1203.25	0.0250
Reach 1	0.315	6470.00	1196.75	2.73	2.19	1206.05	1205.51	1203.32	5.79	6.57	1203.84	0.0250
Reach 1	0.41	6470.00	1197.40	3.31	2.51	1207.20	1206.40	1203.89	5.69	6.49	1204.39	0.0250
Reach 1	0.445	6470.00	1197.94	2.78	3.09	1206.89	1207.20	1204.11	5.60	6.17	1204.59	0.0250
Reach 1	0.449	6470.00	1198.66	2.09	2.45	1206.44	1206.80	1204.35	4.54	5.69	1204.67	0.0300
Reach 1	0.454	6470.00	1198.77	2.11	2.21	1206.50	1206.60	1204.39	4.40	5.62	1204.69	0.0150
Reach 1	0.459	6470.00	1198.30	3.29	3.09	1207.56	1207.36	1204.27	6.00	5.97	1204.83	0.0250
Reach 1	0.504	6470.00	1197.98	3.29	3.08	1207.89	1207.68	1204.60	5.75	6.62	1205.11	0.0250
Reach 1	0.56	6470.00	1197.53	3.44	3.34	1208.36	1208.26	1204.92	5.74	7.39	1205.43	0.0250
Reach 1	0.655	6470.00	1197.70	3.88	3.26	1209.34	1208.72	1205.46	5.88	7.76	1206.00	0.0250
Reach 1	0.75	6470.00	1199.88	3.92	3.89	1209.98	1209.95	1206.06	5.51	6.18	1206.53	0.0250
Reach 1	0.752	6470.00	1199.88	4.05	3.91	1210.10	1209.96	1206.05	5.66	6.17	1206.55	0.0300
Reach 1	0.766	6470.00	1200.98	4.06	4.01	1210.10	1210.05	1206.04	6.82	5.06	1206.76	0.0300
Reach 1	0.839	6470.00	1202.26	3.73	3.69	1210.87	1210.83	1207.14	6.73	4.88	1207.84	0.0300
Reach 1	0.917	6470.00	1202.50	2.70	2.77	1210.92	1210.99	1208.22	5.82	5.72	1208.74	0.0300
Reach 1	1.01	6470.00	1202.94	2.64	2.38	1211.70	1211.44	1209.06	5.82	6.12	1209.59	0.0300
Reach 1	1.074	6470.00	1202.89	2.64	3.07	1212.20	1212.63	1209.56	5.90	6.67	1210.10	0.0250
Reach 1	1.142	6470.00	1204.55	3.19	2.97	1213.30	1213.08	1210.11	5.89	5.56	1210.65	0.0300
Reach 1	1.186	6470.00	1204.90	2.66	2.92	1213.19	1213.45	1210.53	5.83	5.63	1211.06	0.0300
Reach 1	1.246	6470.00	1205.35	2.74	3.09	1213.84	1214.19	1211.10	5.68	5.75	1211.60	0.0300
Reach 1	1.306	6470.00	1205.97	2.98	2.81	1214.58	1214.41	1211.60	5.94	5.63	1212.15	0.0300
Reach 1	1.389	6470.00	1206.31	2.30	2.39	1214.71	1214.80	1212.41	5.98	6.10	1212.96	0.0300
Reach 1	1.476	6470.00	1206.65	2.58	2.29	1215.70	1215.41	1213.12	6.24	6.47	1213.73	0.0250
Reach 1	1.545	6470.00	1206.63	2.81	2.12	1216.56	1215.87	1213.75	5.22	7.12	1214.17	0.0250
Reach 1	1.64	6470.00	1208.16	2.51	3.10	1216.77	1217.36	1214.26	5.51	6.10	1214.73	0.0300
Reach 1	1.644	Bridge										
Reach 1	1.649	6470.00	1208.44	2.27	2.65	1216.98	1217.36	1214.71	5.32	6.27	1215.15	0.0300
Reach 1	1.693	6470.00	1208.40	2.08	1.75	1217.03	1216.70	1214.95	5.40	6.55	1215.41	0.0250
Reach 1	1.734	6470.00	1208.14	2.02	2.34	1217.17	1217.49	1215.15	5.45	7.01	1215.61	0.0250
Reach 1	1.829	6470.00	1207.54	2.25	2.47	1217.88	1218.10	1215.63	5.33	8.09	1216.07	0.0250
Reach 1	1.924	6470.00	1208.00	2.56	2.84	1218.62	1218.90	1216.06	5.29	8.06	1216.49	0.0250
Reach 1	2.018	6470.00	1208.98	2.93	2.87	1219.40	1219.34	1216.47	5.33	7.49	1216.91	0.0250
Reach 1	2.113	6470.00	1208.81	3.52	3.01	1220.41	1219.90	1216.89	5.25	8.08	1217.32	0.0250
Reach 1	2.208	6470.00	1208.46	3.82	3.53	1221.10	1220.81	1217.28	5.17	8.82	1217.70	0.0250
Reach 1	2.303	6470.00	1212.24	3.83	3.69	1221.47	1221.33	1217.64	6.46	5.40	1218.29	0.0250
Reach 1	2.305	6470.00	1211.60	3.85	3.61	1221.60	1221.36	1217.75	6.01	6.15	1218.31	0.0250
Reach 1	2.381	6470.00	1211.04	4.22	3.87	1222.49	1222.14	1218.27	5.70	7.23	1218.77	0.0250
Reach 1	2.476	6470.00	1210.67	4.51	3.72	1223.29	1222.50	1218.78	5.56	8.11	1219.26	0.0250
Reach 1	2.571	6470.00	1210.91	4.44	4.83	1223.69	1224.08	1219.25	5.36	8.34	1219.70	0.0250
Reach 1	2.636	6470.00	1215.15	4.81	5.08	1224.21	1224.48	1219.40	7.79	4.25	1220.34	0.0250
Reach 1	2.641	6470.00	1216.27	4.22	5.91	1223.59	1225.28	1219.37	8.89	3.10	1220.60	0.0300
Reach 1	2.646	6470.00	1215.90	3.28	5.44	1223.49	1225.65	1220.21	6.30	4.31	1220.82	0.0150
Reach 1	2.65	6470.00	1215.80	4.47	5.01	1224.44	1224.98	1219.97	8.67	4.17	1221.14	0.0250
Reach 1	2.757	6470.00	1215.65	3.42	4.29	1225.30	1226.17	1221.88	6.32	6.23	1222.50	0.0250
Reach 1	2.814	6470.00	1216.19	3.62	4.14	1225.97	1226.49	1222.35	6.13	6.16	1222.93	0.0250
Reach 1	2.909	6470.00	1216.67	3.60	3.81	1226.64	1226.85	1223.04	5.80	6.37	1223.56	0.0250
Reach 1	2.912	6470.00	1216.46	3.65	3.85	1226.70	1226.90	1223.05	5.80	6.59	1223.58	0.0250
Reach 1	2.985	6470.00	1216.10	4.01	4.01	1227.50	1227.50	1223.49	5.64	7.39	1223.98	0.0250
Reach 1	3.079	6470.00	1216.12	4.31	4.16	1228.30	1228.15	1223.99	5.72	7.87	1224.50	0.0250
Reach 1	3.174	6470.00	1218.74	4.27	4.35	1228.79	1228.87	1224.52	6.49	5.78	1225.17	0.0250
Reach 1	3.176	6470.00	1218.73	4.24	4.08	1228.76	1228.60	1224.52	6.56	5.79	1225.19	0.0250
Reach 1	3.334	6470.00	1218.24	4.04	4.04	1229.80	1229.80	1225.76	5.66	7.52	1226.26	0.0250
Reach 1	3.429	6470.00	1218.34	4.11	4.45	1230.37	1230.71	1226.26	5.44	7.92	1226.72	0.0250
Reach 1	3.524	6470.00	1221.16	4.42	4.63	1231.10	1231.31	1226.68	6.74	5.52	1227.38	0.0250
Reach 1	3.527	6470.00	1220.53	4.26	4.45	1231.10	1231.29	1226.84	6.08	6.31	1227.42	0.0250
Reach 1	3.593	6470.00	1220.19	4.32	4.48	1231.62	1231.78	1227.30	5.83	7.11	1227.83	0.0250
Reach 1	3.688	6470.00	1220.40	4.45	4.95	1232.30	1232.80	1227.85	5.98	7.45	1228.40	0.0250
Reach 1	3.782	6470.00	1220.72	4.60	4.71	1233.04	1233.15	1228.44	5.61	7.72	1228.93	0.0250
Reach 1	3.877	6470.00	1224.04	5.51	5.61	1234.35	1234.45	1228.84	8.47	4.80	1229.95	0.0250
Reach 1	3.88	6470.00	1224.04	5.30	5.34	1234.46	1234.50	1229.16	7.48	5.12	1230.02	0.0250
Reach 1	3.899	6470.00	1224.23	5.35	5.22	1234.60	1234.47	1229.25	9.91	5.02	1230.77	0.0300
Reach 1	3.964	6470.00	1226.11	3.72	3.74	1235.10	1235.12	1231.38	6.83	5.27	1232.10	0.0250
Reach 1	4.047	6470.00	1226.59	3.35	3.61	1235.60	1235.86	1232.25	6.90	5.66	1232.99	0.0250
Reach 1	4.08	6470.00	1226.40	3.00	3.32	1235.73	1236.05	1232.73	6.05	6.33	1233.30	0.0250
Reach 1	4.142	6470.00	1226.74	3.23	3.73	1236.40	1236.90	1233.17	6.40	6.43	1233.80	0.0250
Reach 1	4.148	6470.00	1228.12	4.08	4.10	1237.26	1237.28	1233.18	6.99	5.06	1233.93	0.0300
Reach 1	4.152	Bridge										
Reach 1	4.156	6470.00	1228.04	3.66	3.59	1237.35	1237.28	1233.69	6.52	5.65	1234.35	0.0300
Reach 1	4.161	6470.00	1227.99	2.64	2.55	1236.39	1236.30	1233.75	6.60	5.76	1234.43	0.0300
Reach 1	4.203	6470.00	1228.65	3.48	3.48	1237.75	1237.75	1234.27	6.28	5.62	1234.89	0.0250
Reach 1	4.298	6470.00	1228.91	3.12	3.24	1238.21	1238.33	1235.09	6.04	6.18	1235.65	0.0250
Reach 1	4.393	6470.00	1229.55	2.60	2.64	1238.37	1238.41	1235.77	6.03	6.22	1236.34	0.0250

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 1	4.487	6470.00	1230.05	1.98	3.61	1238.44	1240.07	1236.46	6.22	6.41	1237.06	0.0250

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 2

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 2	4.487	6470.00	1230.05	1.98	3.61	1238.44	1240.07	1236.46	6.22	6.41	1237.06	0.0250
Reach 2	4.506	6470.00	1230.31	2.30	1.96	1238.89	1238.55	1236.59	6.49	6.28	1237.24	0.0250
Reach 2	4.578	6470.00	1232.72	6.12	5.22	1243.50	1242.60	1237.38	7.44	4.66	1238.23	0.0300
Reach 2	4.584	Bridge										
Reach 2	4.590	6470.00	1231.84	4.93	4.54	1243.11	1242.72	1238.18	5.48	6.34	1238.65	0.0300
Reach 2	4.610	6470.00	1232.14	4.44	4.89	1242.75	1243.20	1238.31	5.85	6.17	1238.84	0.0300
Reach 2	4.613	Bridge										
Reach 2	4.615	6470.00	1232.22	4.87	4.71	1243.55	1243.39	1238.68	5.21	6.46	1239.10	0.0300
Reach 2	4.669	6470.00	1232.79	3.01	2.62	1242.00	1241.61	1238.99	5.76	6.20	1239.50	0.0300
Reach 2	4.715	6470.00	1233.16	3.10	3.00	1242.40	1242.30	1239.30	6.06	6.14	1239.87	0.0250
Reach 2	4.727	6470.00	1232.99	3.28	3.47	1242.75	1242.94	1239.47	5.55	6.48	1239.95	0.0250
Reach 2	4.746	6470.00	1233.09	3.30	3.36	1242.86	1242.92	1239.56	5.72	6.47	1240.06	0.0250
Reach 2	4.82	6470.00	1233.57	3.17	3.02	1243.16	1243.01	1239.99	5.60	6.42	1240.48	0.0250
Reach 2	4.914	6470.00	1233.70	3.05	2.84	1243.56	1243.35	1240.51	5.48	6.81	1240.97	0.0250
Reach 2	5.009	6470.00	1233.90	3.62	3.38	1244.60	1244.36	1240.98	5.68	7.08	1241.48	0.0250
Reach 2	5.104	6470.00	1234.18	3.69	3.89	1245.20	1245.40	1241.51	5.80	7.33	1242.04	0.0250
Reach 2	5.198	6470.00	1234.80	3.77	3.63	1245.85	1245.71	1242.08	5.59	7.28	1242.57	0.0250
Reach 2	5.293	6470.00	1235.10	4.57	4.68	1247.15	1247.26	1242.58	6.04	7.48	1243.15	0.0250
Reach 2	5.388	6470.00	1236.07	4.62	4.48	1247.83	1247.69	1243.21	6.20	7.14	1243.81	0.0250
Reach 2	5.483	6470.00	1236.40	4.90	4.83	1248.80	1248.73	1243.90	6.19	7.50	1244.49	0.0250
Reach 2	5.578	6470.00	1237.47	4.85	4.77	1249.50	1249.42	1244.65	5.76	7.18	1245.17	0.0300
Reach 2	5.58	6470.00	1237.20	4.80	5.28	1249.46	1249.94	1244.66	5.78	7.46	1245.18	0.0300
Reach 2	5.581	6470.00	1237.21	5.00	5.32	1249.67	1249.99	1244.67	5.77	7.46	1245.18	0.0130
Reach 2	5.582	6470.00	1238.32	5.36	5.09	1249.80	1249.53	1244.44	7.35	6.12	1245.28	0.0130
Reach 2	5.586	6470.00	1243.67	1.66	2.42	1249.22	1249.98	1247.56	11.14	3.89	1249.49	0.0130
Reach 2	5.658	6470.00	1247.61	-1.68	-1.66	1252.92	1252.94	1254.60	13.84	6.99	1257.47	0.0130
Reach 2	5.722	6470.00	1250.89	-1.84	-1.92	1255.98	1255.90	1257.82	13.51	6.93	1260.56	0.0130
Reach 2	5.817	6470.00	1255.90	1.10	-1.79	1264.00	1261.11	1262.90	13.92	7.00	1265.86	0.0130
Reach 2	5.912	6470.00	1260.84	-1.63	-1.69	1266.10	1266.04	1267.73	13.71	6.89	1270.56	0.0130
Reach 2	6.007	6470.00	1265.41	-0.75	-0.56	1271.87	1272.06	1272.62	13.64	7.21	1275.46	0.0130
Reach 2	6.101	6470.00	1270.39	-0.93	-0.46	1276.63	1277.10	1277.56	13.76	7.17	1280.47	0.0130
Reach 2	6.196	6470.00	1275.54	0.73	0.25	1283.19	1282.71	1282.46	14.63	6.92	1285.78	0.0130
Reach 2	6.23	6470.00	1284.98	1.40	2.90	1290.80	1292.30	1289.40	9.95	6.02	1290.94	0.0130
Reach 2	6.252	6470.00	1282.70	2.61	2.57	1293.49	1293.45	1290.88	4.31	8.18	1291.16	0.0300
Reach 2	6.3	6470.00	1282.63	2.25	3.14	1293.28	1294.17	1291.03	4.13	8.40	1291.30	0.0300
Reach 2	6.388	6470.00	1282.50	4.27	3.21	1295.53	1294.47	1291.26	4.06	8.76	1291.51	0.0300
Reach 2	6.486	6470.00	1282.91	9.31	5.26	1300.80	1296.75	1291.49	4.07	8.58	1291.75	0.0300
Reach 2	6.510	6470.00	1283.13	10.07	5.54	1301.78	1297.25	1291.71	2.78	8.58	1291.83	0.0300
Reach 2	6.576	6470.00	1283.27	13.46	6.88	1305.22	1298.64	1291.76	2.95	8.49	1291.90	0.0250
Reach 2	6.671	6470.00	1283.41	13.81	7.10	1305.66	1298.95	1291.85	2.91	8.44	1291.98	0.0250
Reach 2	6.766	6470.00	1283.50	13.03	6.64	1304.96	1298.57	1291.93	2.95	8.43	1292.06	0.0250
Reach 2	6.86	6470.00	1283.49	7.91	3.10	1299.92	1295.11	1292.01	2.90	8.52	1292.15	0.0250
Reach 2	6.894	6470.00	1283.50	2.15	2.58	1294.20	1294.63	1292.05	2.83	8.55	1292.17	0.0250
Reach 2	6.898	6470.00	1283.50	2.53	1.62	1294.65	1293.74	1292.12	2.17	8.62	1292.19	0.0300
Reach 2	6.902	6470.00	1283.66	2.48	1.88	1294.60	1294.00	1292.12	2.21	8.46	1292.20	0.0150
Reach 2	6.907	6470.00	1283.60	1.29	2.47	1293.38	1294.56	1292.09	2.89	8.49	1292.22	0.0250
Reach 2	6.999	6470.00	1283.70	2.80	2.27	1294.97	1294.44	1292.17	3.02	8.47	1292.31	0.0250
Reach 2	7.026	6470.00	1283.73	3.66	2.83	1295.83	1295.00	1292.17	3.75	8.44	1292.38	0.0250
Reach 2	7.05	6470.00	1283.73	2.31	2.90	1294.52	1295.11	1292.21	3.69	8.48	1292.42	0.0250
Reach 2	7.144	6470.00	1283.80	-0.82	2.88	1291.55	1295.25	1292.37	3.57	8.57	1292.57	0.0250
Reach 2	7.239	6470.00	1283.70	3.04	3.06	1295.55	1295.57	1292.51	3.52	8.81	1292.70	0.0250
Reach 2	7.334	6470.00	1284.00	3.17	2.98	1295.80	1295.61	1292.63	3.56	8.63	1292.83	0.0250
Reach 2	7.429	6470.00	1284.00	4.62	2.96	1297.38	1295.72	1292.76	3.60	8.76	1292.96	0.0250
Reach 2	7.523	6470.00	1284.40	4.31	3.41	1297.20	1296.30	1292.89	3.71	8.49	1293.10	0.0250
Reach 2	7.618	6470.00	1284.38	4.93	3.15	1297.96	1296.18	1293.03	3.79	8.65	1293.25	0.0250
Reach 2	7.719	6470.00	1284.58	4.66	3.12	1297.86	1296.32	1293.20	3.70	8.62	1293.41	0.0250
Reach 2	7.792	6470.00	1284.60	4.84	2.89	1298.15	1296.20	1293.31	3.67	8.71	1293.52	0.0250
Reach 2	7.823	6470.00	1284.72	4.84	2.88	1298.20	1296.24	1293.36	3.60	8.64	1293.56	0.0250
Reach 2	7.91	6470.00	1284.98	4.12	3.12	1297.60	1296.60	1293.48	3.73	8.50	1293.70	0.0250
Reach 2	8	6470.00	1284.88	5.04	2.74	1298.67	1296.37	1293.63	3.61	8.75	1293.83	0.0250
Reach 2	8.057	6470.00	1285.09	5.26	3.30	1298.97	1297.01	1293.71	3.64	8.62	1293.91	0.0250
Reach 2	8.104	6470.00	1285.37	5.16	2.80	1298.95	1296.59	1293.79	3.71	8.42	1294.00	0.0300
Reach 2	8.15	6470.00	1285.62	5.29	2.78	1299.16	1296.65	1293.87	3.77	8.25	1294.09	0.0250
Reach 2	8.245	6470.00	1285.80	4.81	2.51	1298.83	1296.53	1294.02	3.80	8.22	1294.25	0.0250
Reach 2	8.34	6470.00	1285.77	4.81	3.21	1298.99	1297.39	1294.18	3.71	8.41	1294.40	0.0250
Reach 2	8.382	6470.00	1286.16	4.58	3.15	1298.84	1297.41	1294.26	3.74	8.10	1294.48	0.0300
Reach 2	8.403	6470.00	1285.89	4.56	2.72	1298.87	1297.03	1294.31	3.77	8.42	1294.53	0.0300
Reach 2	8.514	6470.00	1286.10	4.35	2.96	1298.87	1297.48	1294.52	3.84	8.42	1294.75	0.0250
Reach 2	8.594	6470.00	1285.96	4.25	2.71	1298.93	1297.39	1294.68	3.60	8.72	1294.88	0.0250
Reach 2	8.668	6470.00	1285.99	4.29	3.05	1299.10	1297.86	1294.81	3.49	8.82	1295.00	0.0300
Reach 2	8.775	6470.00	1286.50	4.63	3.13	1299.60	1298.10	1294.97	3.60	8.47	1295.17	0.0250
Reach 2	8.87	6470.00	1286.45	4.39	3.33	1299.50	1298.44	1295.11	3.52	8.66	1295.30	0.0250
Reach 2	8.948	6470.00	1286.38	4.37	3.47	1299.58	1298.68	1295.21	3.55	8.83	1295.41	0.0250
Reach 2	9.001	6470.00	1286.69	4.72	3.69	1300.00	1298.97	1295.28	3.61	8.59	1295.48	0.0250

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 3

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 3	9.001	6470.00	1286.69	4.72	3.69	1300.00	1298.97	1295.28	3.61	8.59	1295.48	0.0250
Reach 3	9.018	6470.00	1287.10	4.01	4.00	1299.31	1299.30	1295.30	3.62	8.20	1295.51	0.0250
Reach 3	9.036	5690.00	1287.51	4.04	3.65	1299.40	1299.01	1295.36	3.34	7.85	1295.54	0.0250
Reach 3	9.053	5690.00	1287.57	3.29	3.32	1298.67	1298.70	1295.38	3.39	7.81	1295.56	0.0250
Reach 3	9.145	5690.00	1288.14	3.67	3.99	1299.17	1299.49	1295.50	3.61	7.36	1295.70	0.0250
Reach 3	9.24	5690.00	1288.06	3.34	3.84	1299.00	1299.50	1295.66	3.56	7.60	1295.86	0.0250
Reach 3	9.334	5690.00	1288.00	3.76	3.13	1299.57	1298.94	1295.81	3.45	7.81	1296.00	0.0250
Reach 3	9.424	5690.00	1287.94	3.13	4.00	1299.07	1299.94	1295.94	3.44	8.00	1296.13	0.0250
Reach 3	9.518	5690.00	1287.94	3.19	3.63	1299.27	1299.71	1296.08	3.36	8.14	1296.25	0.0250
Reach 3	9.613	5690.00	1287.19	1.80	3.90	1298.01	1300.11	1296.21	3.23	9.02	1296.37	0.0250
Reach 3	9.708	5690.00	1287.70	3.38	3.98	1299.70	1300.30	1296.32	3.31	8.62	1296.49	0.0250
Reach 3	9.802	5690.00	1288.71	3.07	4.14	1299.50	1300.57	1296.43	3.58	7.72	1296.63	0.0250
Reach 3	9.844	5690.00	1288.56	3.72	3.18	1300.23	1299.69	1296.51	3.39	7.95	1296.69	0.0250
Reach 3	9.849	5690.00	1288.45	6.48	3.85	1302.97	1300.34	1296.49	3.97	8.04	1296.73	0.0250
Reach 3	9.854	5690.00	1288.40	3.61	3.71	1300.20	1300.30	1296.59	3.36	8.19	1296.76	0.0250
Reach 3	9.897	5690.00	1288.50	2.98	3.50	1299.63	1300.15	1296.65	3.33	8.15	1296.82	0.0250
Reach 3	9.944	5690.00	1288.55	3.13	3.86	1299.83	1300.56	1296.70	3.40	8.15	1296.88	0.0250
Reach 3	10.039	5690.00	1288.96	3.47	3.40	1300.30	1300.23	1296.83	3.43	7.87	1297.01	0.0250
Reach 3	10.134	5690.00	1289.47	3.94	3.96	1300.90	1300.92	1296.96	3.46	7.49	1297.15	0.0250
Reach 3	10.171	5690.00	1288.86	3.08	8.30	1300.11	1305.33	1297.03	3.35	8.17	1297.20	0.0250
Reach 3	10.195	5690.00	1288.91	9.92	9.40	1306.99	1306.47	1297.07	3.34	8.16	1297.24	0.0300
Reach 3	10.207	Bridge										
Reach 3	10.218	5690.00	1288.64	9.22	9.23	1306.38	1306.39	1297.16	3.11	8.52	1297.31	0.0300
Reach 3	10.252	5690.00	1288.80	4.21	3.89	1301.40	1301.08	1297.19	3.29	8.39	1297.36	0.0250
Reach 3	10.346	5690.00	1288.88	3.20	3.90	1300.52	1301.22	1297.32	3.07	8.44	1297.47	0.0250
Reach 3	10.441	5690.00	1289.06	2.81	3.71	1300.22	1301.12	1297.41	3.20	8.35	1297.57	0.0250
Reach 3	10.518	5690.00	1289.62	3.99	4.06	1301.48	1301.55	1297.49	3.45	7.87	1297.68	0.0250
Reach 3	10.566	5690.00	1289.50	3.96	4.57	1301.52	1302.13	1297.56	3.45	8.06	1297.74	0.0250
Reach 3	10.654	5690.00	1290.00	4.06	4.69	1301.74	1302.37	1297.68	3.49	7.68	1297.87	0.0250
Reach 3	10.749	5690.00	1289.80	3.99	4.20	1301.82	1302.03	1297.83	3.36	8.03	1298.01	0.0250
Reach 3	10.843	5690.00	1289.90	3.66	4.37	1301.62	1302.33	1297.96	3.25	8.06	1298.12	0.0250
Reach 3	10.938	5690.00	1290.11	3.21	4.46	1301.30	1302.55	1298.09	3.36	7.98	1298.27	0.0300
Reach 3	11.033	5690.00	1290.41	3.75	4.63	1302.02	1302.90	1298.27	3.42	7.86	1298.45	0.0300
Reach 3	11.127	5690.00	1290.70	3.48	4.06	1301.95	1302.53	1298.47	3.36	7.77	1298.64	0.0300
Reach 3	11.189	5690.00	1290.70	3.52	4.26	1302.10	1302.84	1298.58	3.37	7.88	1298.76	0.0300
Reach 3	11.231	5690.00	1290.62	3.45	12.94	1302.13	1311.62	1298.68	3.25	8.06	1298.84	0.0300
Reach 3	11.249	5000.00	1290.69	11.95	10.76	1310.69	1309.50	1298.74	2.96	8.05	1298.88	0.0300
Reach 3	11.254	Bridge										
Reach 3	11.26	5000.00	1290.40	10.78	11.28	1309.56	1310.06	1298.78	2.84	8.38	1298.91	0.0300
Reach 3	11.297	4140.00	1290.78	7.25	8.83	1306.10	1307.68	1298.85	2.71	8.07	1298.96	0.0300
Reach 3	11.308	4140.00	1290.71	8.33	8.46	1307.14	1307.27	1298.81	3.70	8.10	1299.02	0.0130
Reach 3	11.321	4140.00	1296.29	8.04	7.86	1307.56	1307.38	1299.52	9.96	3.23	1301.06	0.0130
Reach 3	11.328	4140.00	1294.88	5.70	6.19	1306.96	1307.45	1301.26	3.81	6.38	1301.48	0.0250
Reach 3	11.391	4140.00	1295.69	5.32	5.68	1306.75	1307.11	1301.43	3.83	5.74	1301.66	0.0250
Reach 3	11.486	4140.00	1296.57	5.30	5.71	1307.00	1307.41	1301.70	3.95	5.13	1301.94	0.0250
Reach 3	11.531	4140.00	1296.26	5.21	6.15	1307.06	1308.00	1301.85	3.83	5.59	1302.08	0.0250
Reach 3	11.572	4140.00	1296.51	7.14	6.43	1309.11	1308.40	1301.97	3.78	5.46	1302.19	0.0250
Reach 3	11.609	4140.00	1296.39	6.37	6.32	1308.45	1308.40	1302.08	3.67	5.69	1302.29	0.0250
Reach 3	11.703	4140.00	1296.68	4.98	5.82	1307.29	1308.13	1302.31	3.63	5.63	1302.51	0.0250
Reach 3	11.798	4140.00	1296.67	4.87	5.67	1307.40	1308.20	1302.53	3.46	5.86	1302.72	0.0250
Reach 3	11.893	4140.00	1296.71	5.05	5.70	1307.77	1308.42	1302.72	3.43	6.01	1302.91	0.0250
Reach 3	11.988	4140.00	1296.90	4.51	6.19	1307.42	1309.10	1302.91	3.37	6.01	1303.09	0.0250
Reach 3	12.082	4140.00	1297.29	4.36	6.20	1307.44	1309.28	1303.08	3.52	5.79	1303.28	0.0250
Reach 3	12.177	4140.00	1297.28	4.86	6.65	1308.15	1309.94	1303.29	3.39	6.01	1303.46	0.0250
Reach 3	12.245	4140.00	1297.40	5.02	6.44	1308.43	1309.85	1303.41	3.53	6.01	1303.60	0.0250
Reach 3	12.302	4140.00	1297.60	5.14	6.05	1308.66	1309.57	1303.52	3.53	5.92	1303.72	0.0250
Reach 3	12.349	4140.00	1297.66	5.17	6.17	1308.80	1309.80	1303.63	3.48	5.97	1303.81	0.0250
Reach 3	12.441	4140.00	1297.71	4.65	5.69	1308.46	1309.50	1303.81	3.46	6.10	1304.00	0.0250
Reach 3	12.488	4140.00	1297.80	4.64	5.29	1308.55	1309.20	1303.91	3.40	6.11	1304.09	0.0250
Reach 3	12.552	4140.00	1297.54	4.44	5.27	1308.48	1309.31	1304.04	3.32	6.50	1304.21	0.0250
Reach 3	12.6	4140.00	1297.79	4.60	5.17	1308.72	1309.29	1304.12	3.43	6.33	1304.30	0.0250
Reach 3	12.694	4140.00	1298.04	4.12	5.44	1308.43	1309.75	1304.31	3.33	6.27	1304.48	0.0250
Reach 3	12.789	4140.00	1298.10	4.09	5.23	1308.56	1309.70	1304.47	3.30	6.37	1304.64	0.0250
Reach 3	12.884	4140.00	1298.30	4.42	4.63	1309.06	1309.27	1304.64	3.29	6.34	1304.81	0.0250
Reach 3	12.905	4140.00	1298.40	4.32	4.41	1308.99	1309.08	1304.67	3.30	6.27	1304.84	0.0250
Reach 3	12.981	4140.00	1298.62	4.50	5.65	1309.31	1310.46	1304.81	3.31	6.19	1304.98	0.0250
Reach 3	13.037	4140.00	1298.52	4.49	5.29	1309.40	1310.20	1304.91	3.23	6.39	1305.07	0.0250
Reach 3	13.084	4140.00	1298.67	4.72	5.22	1309.70	1310.20	1304.98	3.33	6.31	1305.15	0.0250
Reach 3	13.179	4140.00	1299.00	4.80	5.35	1309.95	1310.50	1305.15	3.45	6.15	1305.33	0.0250
Reach 3	13.232	4140.00	1299.09	4.84	5.03	1310.10	1310.28	1305.26	3.50	6.17	1305.45	0.0250
Reach 3	13.28	4140.00	1299.23	5.04	4.98	1310.40	1310.34	1305.36	3.36	6.13	1305.54	0.0250
Reach 3	13.374	4140.00	1299.45	4.96	5.06	1310.50	1310.60	1305.54	3.34	6.09	1305.71	0.0250
Reach 3	13.426	4000.00	1299.62	8.57	8.38	1314.24	1314.05	1305.67	3.20	6.05	1305.83	0.0300
Reach 3	13.431	Bridge										
Reach 3	13.439	4000.00	1299.34	8.43	8.42	1314.18	1314.17	1305.75	2.98	6.41	1305.88	0.0300
Reach 3	13.471	4000.00	1299.43	8.33	3.72	1314.11	1309.50	1305.78	3.45	6.35	1305.97	0.0250

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 4

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 4	13.471	4000.00	1299.43	8.33	3.72	1314.11	1309.50	1305.78	3.45	6.35	1305.97	0.0250
Reach 4	13.566	3790.00	1299.46	8.22	4.10	1314.17	1310.05	1305.95	3.84	6.49	1306.18	0.0250
Reach 4	13.661	3790.00	1299.76	7.92	4.13	1314.09	1310.30	1306.17	3.80	6.41	1306.40	0.0250
Reach 4	13.755	3790.00	1300.50	7.79	4.12	1314.18	1310.51	1306.39	3.98	5.89	1306.64	0.0250
Reach 4	13.842	3790.00	1300.89	8.10	4.47	1314.73	1311.10	1306.63	4.18	5.74	1306.90	0.0250
Reach 4	13.911	3790.00	1300.88	8.19	4.33	1315.06	1311.20	1306.87	3.94	5.99	1307.11	0.0250
Reach 4	13.946	3790.00	1299.65	7.98	8.19	1314.97	1315.18	1306.99	3.89	7.34	1307.22	0.0300
Reach 4	13.954	Bridge										
Reach 4	13.961	3790.00	1299.55	8.13	7.99	1315.26	1315.12	1307.13	3.82	7.58	1307.36	0.0300
Reach 4	14	3790.00	1300.90	4.15	4.53	1311.40	1311.78	1307.25	3.77	6.35	1307.47	0.0250
Reach 4	14.191	3790.00	1301.20	4.26	4.53	1311.93	1312.20	1307.67	3.63	6.47	1307.88	0.0250
Reach 4	14.3	3790.00	1301.54	4.31	4.27	1312.20	1312.16	1307.89	3.73	6.35	1308.11	0.0250
Reach 4	14.412	3790.00	1301.60	4.36	4.36	1312.50	1312.50	1308.14	3.74	6.54	1308.36	0.0250
Reach 4	14.637	3790.00	1302.17	4.08	4.35	1312.70	1312.97	1308.62	3.54	6.45	1308.82	0.0250
Reach 4	14.738	3500.00	1302.42	7.89	7.89	1316.69	1316.69	1308.80	4.21	6.38	1309.07	0.0250
Reach 4	14.754	3500.00	1306.32	6.15	6.40	1316.67	1316.92	1310.52	10.59	4.20	1312.26	0.0250
Reach 4	14.764	3500.00	1306.30	4.53	5.33	1316.80	1317.60	1312.27	3.65	5.97	1312.48	0.0250
Reach 4	14.823	3500.00	1306.39	5.10	5.12	1317.50	1317.52	1312.40	3.68	6.01	1312.61	0.0250
Reach 4	14.926	3500.00	1306.28	4.07	5.01	1316.71	1317.65	1312.64	3.56	6.36	1312.83	0.0250
Reach 4	15.035	3500.00	1306.87	4.64	4.55	1317.50	1317.41	1312.86	3.74	5.99	1313.08	0.0250
Reach 4	15.225	3500.00	1307.00	4.77	4.99	1318.08	1318.30	1313.31	3.72	6.31	1313.52	0.0250
Reach 4	15.414	3500.00	1308.11	5.18	5.02	1318.96	1318.80	1313.78	3.91	5.67	1314.01	0.0250
Reach 4	15.483	3500.00	1307.90	5.02	5.00	1319.00	1318.98	1313.98	3.75	6.08	1314.20	0.0250
Reach 4	15.606	3500.00	1308.20	4.89	4.98	1319.16	1319.25	1314.27	3.74	6.07	1314.49	0.0250
Reach 4	15.811	3500.00	1308.82	4.86	4.58	1319.61	1319.33	1314.75	3.25	5.93	1314.91	0.0250
Reach 4	16	3500.00	1308.91	4.06	4.80	1319.14	1319.88	1315.08	3.15	6.17	1315.24	0.0250
Reach 4	16.19	3500.00	1309.35	4.96	4.93	1320.36	1320.33	1315.40	3.27	6.05	1315.57	0.0250
Reach 4	16.205	3500.00	1309.37	7.90	8.08	1323.33	1323.51	1315.43	3.28	6.06	1315.60	0.0300
Reach 4	16.213	Bridge										
Reach 4	16.221	3500.00	1309.43	7.66	7.95	1323.20	1323.49	1315.54	3.28	6.11	1315.71	0.0300
Reach 4	16.238	3500.00	1309.56	6.39	6.08	1322.00	1321.69	1315.61	3.05	6.05	1315.76	0.0300
Reach 4	16.240	Bridge										
Reach 4	16.242	3500.00	1309.67	5.15	4.06	1320.92	1319.83	1315.77	3.03	6.10	1315.91	0.0300
Reach 4	16.251	3500.00	1309.50	5.13	5.12	1320.91	1320.90	1315.78	3.16	6.28	1315.94	0.0250
Reach 4	16.321	4800.00	1309.10	5.24	4.74	1321.10	1320.60	1315.86	4.15	6.76	1316.12	0.0250
Reach 4	16.389	4800.00	1309.76	5.06	4.60	1321.10	1320.64	1316.04	4.29	6.28	1316.32	0.0250
Reach 4	16.468	4800.00	1309.49	4.47	4.31	1320.76	1320.60	1316.29	4.01	6.80	1316.54	0.0250
Reach 4	16.63	4800.00	1309.48	4.35	4.31	1321.02	1320.98	1316.67	3.71	7.19	1316.88	0.0250
Reach 4	16.819	4800.00	1309.76	4.27	3.96	1321.29	1320.98	1317.02	3.59	7.26	1317.22	0.0250
Reach 4	16.94	4800.00	1309.91	3.78	4.78	1321.01	1322.01	1317.23	3.58	7.32	1317.43	0.0250
Reach 4	17.039	4800.00	1310.37	5.12	5.25	1322.54	1322.67	1317.42	4.11	7.05	1317.69	0.0300
Reach 4	17.071	4800.00	1310.83	10.66	9.39	1327.67	1326.40	1317.01	12.46	6.18	1319.42	0.0300
Reach 4	17.082	4800.00	1310.51	9.68	9.98	1328.21	1328.51	1318.53	9.25	8.02	1319.86	0.0150
Reach 4	17.086	Bridge										
Reach 4	17.101	4800.00	1310.54	4.95	4.93	1324.29	1324.27	1319.34	8.25	8.80	1320.40	0.0150
Reach 4	17.17	4800.00	1311.12	4.55	5.67	1324.08	1325.20	1319.53	8.43	8.41	1320.63	0.0150
Reach 4	17.213	4710.00	1311.10	3.80	5.73	1323.56	1325.49	1319.76	8.08	8.66	1320.77	0.0150
Reach 4	17.25	4710.00	1311.10	4.98	5.97	1324.91	1325.90	1319.93	7.82	8.83	1320.88	0.0150
Reach 4	17.254	4710.00	1310.98	6.03	6.50	1325.97	1326.44	1319.94	7.83	8.96	1320.89	0.0150
Reach 4	17.261	Bridge										
Reach 4	17.269	4710.00	1311.04	5.59	6.06	1325.71	1326.18	1320.12	7.56	9.08	1321.01	0.0150
Reach 4	17.288	4710.00	1311.13	3.53	4.25	1323.68	1324.40	1320.15	7.67	9.02	1321.06	0.0150
Reach 4	17.339	4710.00	1311.41	3.33	5.32	1323.58	1325.57	1320.25	7.90	8.84	1321.22	0.0150
Reach 4	17.48	4710.00	1311.88	2.70	4.80	1323.30	1325.40	1320.60	8.22	8.72	1321.65	0.0150
Reach 4	17.571	4710.00	1312.05	2.35	2.06	1323.25	1322.96	1320.90	8.16	8.85	1321.93	0.0150
Reach 4	17.672	4710.00	1312.57	2.61	2.08	1323.78	1323.25	1321.17	8.34	8.60	1322.25	0.0150
Reach 4	17.803	4710.00	1313.58	3.16	3.24	1324.63	1324.71	1321.47	9.31	7.89	1322.82	0.0150
Reach 4	17.898	4710.00	1314.10	3.15	3.46	1325.00	1325.31	1321.85	9.52	7.75	1323.26	0.0150
Reach 4	18.087	4710.00	1315.14	3.81	3.63	1326.55	1326.37	1322.74	9.50	7.60	1324.14	0.0150
Reach 4	18.193	4710.00	1315.38	3.33	2.81	1326.92	1326.40	1323.59	7.87	8.21	1324.55	0.0150
Reach 4	18.237	4710.00	1317.30	3.82	4.42	1328.40	1329.00	1324.58	3.98	7.28	1324.82	0.0150
Reach 4	18.345	2870.00	1317.07	3.46	3.66	1328.30	1328.50	1324.84	2.27	7.77	1324.92	0.0300

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 5

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 5	18.345	2870.00	1317.07	3.46	3.66	1328.30	1328.50	1324.84	2.27	7.77	1324.92	0.0300
Reach 5	18.535	2200.00	1317.85	4.14	3.81	1329.14	1328.81	1325.00	1.91	7.15	1325.06	0.0250
Reach 5	18.782	2200.00	1318.05	4.24	3.23	1329.36	1328.35	1325.12	1.87	7.07	1325.18	0.0250
Reach 5	18.97	2200.00	1318.41	4.78	3.32	1330.00	1328.54	1325.22	2.06	6.81	1325.29	0.0250
Reach 5	19.109	4930.00	1318.80	4.74	3.42	1329.99	1328.67	1325.25	4.93	6.45	1325.63	0.0250
Reach 5	19.298	4930.00	1319.02	4.33	3.11	1330.27	1329.05	1325.94	4.54	6.92	1326.26	0.0250
Reach 5	19.408	4240.00	1319.19	4.48	3.02	1330.80	1329.34	1326.32	3.77	7.13	1326.54	0.0250
Reach 5	19.458	4240.00	1319.39	4.16	3.43	1330.57	1329.84	1326.41	3.92	7.02	1326.64	0.0250
Reach 5	19.489	4240.00	1319.60	4.13	3.58	1330.60	1330.05	1326.47	3.94	6.87	1326.71	0.0250
Reach 5	19.541	4240.00	1319.56	4.14	3.32	1330.73	1329.91	1326.59	3.85	7.03	1326.82	0.0250
Reach 5	19.592	4240.00	1319.50	4.40	3.08	1331.10	1329.78	1326.70	3.84	8.00	1326.93	0.0250
Reach 5	19.745	4240.00	1319.61	4.28	3.49	1331.29	1330.50	1327.01	3.69	7.40	1327.22	0.0250
Reach 5	19.863	4240.00	1319.74	4.30	3.34	1331.53	1330.57	1327.23	3.63	7.49	1327.43	0.0250
Reach 5	20.058	4240.00	1320.10	4.23	3.41	1331.79	1330.97	1327.56	3.66	7.46	1327.77	0.0250
Reach 5	20.247	4240.00	1320.62	4.41	3.31	1332.30	1331.20	1327.89	3.74	7.27	1328.11	0.0250
Reach 5	20.306	4240.00	1320.70	4.22	4.25	1332.22	1332.25	1328.00	3.82	7.30	1328.23	0.0250
Reach 5	20.316	4240.00	1320.83	7.02	8.09	1335.04	1336.11	1328.02	3.83	7.19	1328.25	0.0250
Reach 5	20.323	Bridge										
Reach 5	20.328	4240.00	1320.85	7.10	8.16	1335.22	1336.28	1328.12	3.74	7.27	1328.33	0.0250
Reach 5	20.334	4240.00	1320.59	4.25	6.03	1332.37	1334.15	1328.12	3.83	7.53	1328.35	0.0250
Reach 5	20.353	4240.00	1320.90	4.03	3.49	1332.20	1331.66	1328.17	3.79	7.27	1328.39	0.0250
Reach 5	20.428	4230.00	1321.04	3.68	3.68	1332.00	1332.00	1328.32	3.67	7.28	1328.53	0.0250
Reach 5	20.517	4230.00	1320.90	3.51	3.58	1331.99	1332.06	1328.48	3.65	7.58	1328.68	0.0250
Reach 5	20.61	4230.00	1321.01	3.62	3.56	1332.26	1332.20	1328.64	3.63	7.63	1328.84	0.0250
Reach 5	20.704	4230.00	1321.02	3.90	3.66	1332.70	1332.46	1328.80	3.60	7.78	1329.00	0.0250
Reach 5	20.799	4230.00	1321.43	4.17	3.65	1333.12	1332.60	1328.95	3.70	7.52	1329.16	0.0250
Reach 5	20.894	4230.00	1321.60	3.45	3.14	1332.57	1332.26	1329.12	3.73	7.52	1329.34	0.0250
Reach 5	21	4230.00	1321.41	3.32	3.19	1332.65	1332.52	1329.33	3.60	7.92	1329.53	0.0250
Reach 5	21.093	4230.00	1321.82	3.45	3.25	1332.93	1332.73	1329.48	3.76	7.66	1329.70	0.0250
Reach 5	21.188	4230.00	1322.28	3.39	3.14	1333.05	1332.80	1329.66	3.97	7.38	1329.91	0.0250
Reach 5	21.282	4230.00	1322.47	4.18	4.84	1334.04	1334.70	1329.86	4.25	7.39	1330.14	0.0250
Reach 5	21.326	3410.00	1322.60	6.75	8.82	1336.70	1338.77	1329.95	5.09	7.35	1330.35	0.0300
Reach 5	21.339	Bridge										
Reach 5	21.355	3410.00	1322.56	5.65	7.39	1336.16	1337.90	1330.51	4.52	7.95	1330.83	0.0300
Reach 5	21.391	3410.00	1322.68	3.90	2.47	1334.53	1333.10	1330.63	4.89	7.95	1331.01	0.0300
Reach 5	21.402	3410.00	1322.54	4.92	5.17	1335.63	1335.88	1330.71	4.71	8.17	1331.06	0.0300
Reach 5	21.407	Bridge										
Reach 5	21.413	3410.00	1322.28	4.83	5.04	1335.69	1335.90	1330.86	4.49	8.58	1331.17	0.0300
Reach 5	21.418	3410.00	1324.17	2.75	4.43	1333.47	1335.15	1330.72	5.97	6.55	1331.27	0.0300
Reach 5	21.439	3410.00	1315.40	2.60	3.50	1333.90	1334.80	1331.30	1.59	15.90	1331.34	0.0350
Reach 5	21.485	3410.00	1315.40	3.97	3.77	1335.30	1335.10	1331.33	1.22	15.93	1331.35	0.0350
Reach 5	21.531	3410.00	1315.45	5.02	4.06	1336.37	1335.41	1331.35	0.71	15.90	1331.36	0.0350
Reach 5	21.591	3410.00	1315.45	9.18	4.35	1340.53	1335.70	1331.35	0.97	15.90	1331.36	0.0350
Reach 5	21.633	3410.00	1315.40	9.31	4.30	1340.67	1335.66	1331.36	0.91	15.96	1331.37	0.0350
Reach 5	21.656	3410.00	1314.40	10.19	3.53	1341.55	1334.89	1331.36	0.93	16.96	1331.37	0.0350
Reach 5	21.713	3410.00	1324.20	9.42	8.22	1340.64	1339.44	1331.22	3.87	7.02	1331.45	0.0350
Reach 5	21.745	3410.00	1324.22	7.03	3.17	1338.50	1334.64	1331.47	1.87	7.25	1331.53	0.0350
Reach 5	21.839	3410.00	1324.20	8.83	3.74	1340.40	1335.31	1331.57	1.49	7.37	1331.60	0.0350
Reach 5	21.947	3410.00	1325.42	9.53	7.20	1340.94	1338.61	1331.41	5.88	5.99	1331.95	0.0350
Reach 5	22.022	3410.00	1325.91	9.18	3.45	1341.95	1336.22	1332.77	3.99	6.86	1333.02	0.0350
Reach 5	22.107	3410.00	1326.00	7.48	3.48	1340.77	1336.77	1333.29	2.61	7.29	1333.40	0.0350
Reach 5	22.189	3410.00	1324.50	7.61	4.98	1341.09	1338.46	1333.48	3.58	8.98	1333.68	0.0350
Reach 5	22.263	3410.00	1325.29	6.69	3.85	1340.53	1337.69	1333.84	2.85	8.55	1333.97	0.0350
Reach 5	22.348	3410.00	1326.63	6.08	3.11	1340.17	1337.20	1334.09	1.76	7.46	1334.13	0.0350
Reach 5	22.436	3410.00	1325.51	2.37	5.57	1336.53	1339.73	1334.16	1.21	8.65	1334.19	0.0350
Reach 5	22.475	3410.00	1325.50	1.71	4.06	1335.89	1338.24	1334.18	1.23	8.68	1334.20	0.0350
Reach 5	22.557	3410.00	1325.50	2.90	2.77	1337.10	1336.97	1334.20	1.49	8.70	1334.24	0.0350
Reach 5	22.599	3410.00	1326.67	3.56	5.26	1337.75	1339.45	1334.19	3.01	7.52	1334.33	0.0350
Reach 5	22.608	Bridge										
Reach 5	22.615	3410.00	1326.91	4.23	5.31	1338.50	1339.58	1334.27	2.95	7.36	1334.41	0.0350
Reach 5	22.68	3410.00	1326.34	20.71	6.89	1355.16	1341.34	1334.45	2.73	8.11	1334.57	0.0350
Reach 5	22.74	3410.00	1326.29	18.08	4.88	1352.70	1339.50	1334.62	2.83	8.33	1334.74	0.0350
Reach 5	22.797	3410.00	1326.57	16.59	4.66	1351.39	1339.46	1334.80	2.72	8.23	1334.91	0.0350
Reach 5	22.866	3410.00	1326.20	3.08	2.20	1338.08	1337.20	1335.00	3.38	8.80	1335.18	0.0350
Reach 5	22.944	3410.00	1327.70	9.46	2.17	1344.80	1337.51	1335.34	4.29	7.64	1335.63	0.0350
Reach 5	23.009	3410.00	1327.11	2.95	3.27	1338.70	1339.02	1335.75	1.67	8.64	1335.79	0.0350
Reach 5	23.087	3410.00	1324.80	2.48	2.72	1338.30	1338.54	1335.82	2.65	11.02	1335.93	0.0350
Reach 5	23.135	3410.00	1324.83	14.06	3.76	1350.00	1339.70	1335.94	2.10	11.11	1336.01	0.0350
Reach 5	23.166	3410.00	1327.40	16.59	4.25	1352.54	1340.20	1335.95	2.62	8.55	1336.06	0.0350
Reach 5	23.193	3410.00	1326.10	21.88	21.89	1357.91	1357.92	1336.03	2.16	9.93	1336.10	0.0350
Reach 5	23.206	Bridge										
Reach 5	23.219	3410.00	1326.60	21.19	20.79	1357.86	1357.46	1336.67	2.15	10.07	1336.74	0.0350
Reach 5	23.274	3120.00	1328.46	2.68	3.67	1339.40	1340.39	1336.72	2.33	8.26	1336.81	0.0350
Reach 5	23.315	3120.00	1327.54	4.92	3.63	1341.69	1340.40	1336.77	2.75	9.23	1336.89	0.0350
Reach 5	23.45	3120.00	1328.56	9.28	4.30	1346.30	1341.32	1337.02	1.38	8.46	1337.05	0.0350
Reach 5	23.604	3120.00	1328.94	7.36	4.36	1344.50	1341.50	1337.14	2.57	8.20	1337.24	0.0350
Reach 5	23.712	3120.00	1328.32	5.57	4.63	1343.00	1342.06	1337.43	3.16	9.11	1337.58	0.0350

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 5 (Continued)

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 5	23.758	3120.00	1328.32	2.79	3.93	1340.40	1341.54	1337.61	1.59	9.29	1337.65	0.0350
Reach 5	23.803	3120.00	1328.80	3.47	2.95	1341.01	1340.49	1337.54	3.81	8.74	1337.76	0.0150
Reach 5	23.804	3120.00	1328.24	4.35	4.14	1341.91	1341.70	1337.56	3.71	9.32	1337.77	0.0150
Reach 5	23.815	Bridge										
Reach 5	23.825	3120.00	1328.39	4.40	3.55	1342.02	1341.17	1337.62	3.69	9.23	1337.83	0.0150
Reach 5	23.827	3120.00	1328.70	3.58	3.69	1341.19	1341.30	1337.61	3.75	8.91	1337.83	0.0150
Reach 5	23.911	3090.00	1330.30	4.29	6.04	1342.00	1343.75	1337.71	3.98	7.41	1337.95	0.0350
Reach 5	23.962	3090.00	1331.20	7.08	5.56	1345.20	1343.68	1338.12	3.50	6.92	1338.31	0.0350
Reach 5	24.06	3090.00	1332.60	5.18	4.80	1344.00	1343.62	1338.82	3.23	6.22	1338.98	0.0350
Reach 5	24.1	3090.00	1332.95	4.91	4.07	1344.00	1343.16	1339.09	3.24	6.14	1339.25	0.0350
Reach 5	24.13	3090.00	1330.19	4.71	4.07	1344.00	1343.36	1339.29	2.02	9.10	1339.36	0.0350
Reach 5	24.247	3090.00	1329.56	4.54	2.55	1344.00	1342.01	1339.46	1.58	9.90	1339.50	0.0350
Reach 5	24.32	3090.00	1330.52	10.77	4.85	1350.30	1344.38	1339.53	2.07	9.01	1339.60	0.0350
Reach 5	24.454	3090.00	1332.11	11.74	4.25	1351.50	1344.01	1339.76	2.17	7.65	1339.83	0.0350
Reach 5	24.535	3090.00	1329.50	6.52	3.88	1346.40	1343.76	1339.88	1.72	10.38	1339.92	0.0350
Reach 5	24.621	3090.00	1329.41	4.07	3.33	1344.00	1343.26	1339.93	2.41	10.52	1340.02	0.0350
Reach 5	24.723	3090.00	1328.84	4.16	3.29	1344.20	1343.33	1340.04	2.76	11.20	1340.16	0.0300

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 6

Reach	River Sta	Q Total	Min Ch El	L. Freeboard	R. Freeboard	LOB Elev	ROB Elev	W.S. Elev	Vel Chnl	Max Chl Dpth	E.G. Elev	Mann Comp
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	
Reach 6	24.723	3090.00	1328.84	4.16	3.29	1344.20	1343.33	1340.04	2.76	11.20	1340.16	0.0300
Reach 6	24.862	2210.00	1331.09	1.00	1.22	1341.22	1341.44	1340.22	2.15	9.13	1340.29	0.0300
Reach 6	24.9	2210.00	1330.99	1.00	1.46	1341.22	1341.68	1340.22	2.81	9.23	1340.35	0.0300
Reach 6	24.926	2210.00	1331.58	4.29	5.06	1344.26	1345.03	1339.97	7.05	8.39	1340.74	0.0300
Reach 6	24.936	Bridge										
Reach 6	24.946	2210.00	1331.70	3.67	3.87	1344.52	1344.72	1340.85	6.42	9.15	1341.49	0.0300
Reach 6	24.957	2210.00	1332.02	1.52	1.20	1342.90	1342.58	1341.38	4.00	9.36	1341.63	0.0180
Reach 6	24.987	2210.00	1332.02	0.92	1.17	1342.50	1342.75	1341.58	2.24	9.56	1341.66	0.0180
Reach 6	25.028	2210.00	1332.55	0.51	0.91	1342.10	1342.50	1341.59	2.27	9.04	1341.67	0.0180
Reach 6	25.1	2210.00	1332.84	1.48	1.59	1343.09	1343.20	1341.61	2.45	8.77	1341.70	0.0180
Reach 6	25.2	2210.00	1333.22	1.48	1.17	1343.12	1342.81	1341.64	2.47	8.42	1341.74	0.0180
Reach 6	25.3	2210.00	1334.14	2.47	1.86	1344.15	1343.54	1341.68	2.67	7.54	1341.79	0.0180
Reach 6	25.4	2210.00	1335.39	2.85	2.59	1344.56	1344.30	1341.71	3.14	6.32	1341.86	0.0180
Reach 6	25.463	2210.00	1334.94	2.18	2.40	1343.88	1344.10	1341.70	4.09	6.76	1341.96	0.0180
Reach 6	25.49	2210.00	1335.32	1.75	1.92	1343.33	1343.50	1341.58	5.60	6.26	1342.07	0.0130
Reach 6	25.508	2210.00	1335.30	2.18	2.17	1343.69	1343.68	1341.51	6.66	6.21	1342.20	0.0130
Reach 6	25.565	Culvert										
Reach 6	25.578	2210.00	1335.86	3.42	3.56	1345.60	1345.74	1342.18	6.61	6.32	1342.86	0.0130
Reach 6	25.597	2210.00	1335.97	3.22	2.84	1345.90	1345.52	1342.68	4.45	6.71	1342.99	0.0130
Reach 6	25.598	2210.00	1335.97	2.90	2.96	1345.69	1345.75	1342.79	3.66	6.82	1343.00	0.0300
Reach 6	25.647	1100.00	1336.60	3.26	3.34	1346.31	1346.39	1343.05	1.45	6.45	1343.08	0.0300
Reach 6	25.749	1100.00	1336.53	3.21	2.60	1346.31	1345.70	1343.10	1.35	6.57	1343.13	0.0300
Reach 6	25.844	1100.00	1336.30	2.76	2.01	1345.90	1345.15	1343.14	1.31	6.84	1343.17	0.0300
Reach 6	25.939	1100.00	1336.46	2.84	1.75	1346.02	1344.93	1343.18	1.30	6.72	1343.20	0.0300
Reach 6	26.047	1100.00	1336.61	2.95	2.98	1346.17	1346.20	1343.22	1.37	6.61	1343.25	0.0300
Reach 6	26.133	1100.00	1336.51	2.71	3.33	1345.96	1346.58	1343.25	1.34	6.74	1343.28	0.0300
Reach 6	26.154	1100.00	1336.58	3.89	3.82	1347.15	1347.08	1343.26	1.38	6.68	1343.29	0.0350
Reach 6	26.163	Bridge										
Reach 6	26.171	1100.00	1336.67	3.61	3.36	1347.07	1346.82	1343.46	1.38	6.79	1343.49	0.0350
Reach 6	26.187	1100.00	1336.77	1.77	2.41	1345.24	1345.88	1343.47	1.45	6.70	1343.50	0.0300
Reach 6	26.228	600.00	1336.68	2.74	2.62	1346.24	1346.12	1343.50	0.93	6.82	1343.51	0.0300
Reach 6	26.311	600.00	1336.19	2.55	2.01	1346.07	1345.53	1343.52	0.88	7.33	1343.53	0.0300
Reach 6	26.385	600.00	1336.58	2.56	2.47	1346.09	1346.00	1343.53	0.91	6.95	1343.54	0.0300
Reach 6	26.5	600.00	1336.94	2.21	2.44	1345.76	1345.99	1343.55	0.92	6.61	1343.56	0.0300
Reach 6	26.595	600.00	1337.10	2.80	2.93	1346.37	1346.50	1343.57	0.94	6.47	1343.58	0.0300
Reach 6	26.678	600.00	1337.17	2.94	2.51	1346.53	1346.10	1343.59	1.10	6.42	1343.61	0.0300
Reach 6	26.697	600.00	1337.18	2.30	2.61	1345.89	1346.20	1343.59	1.34	6.41	1343.62	0.0300
Reach 6	26.702	600.00	1337.17	2.04	1.29	1345.61	1344.86	1343.57	2.12	6.40	1343.64	0.0130
Reach 6	26.712	Culvert										
Reach 6	26.722	600.00	1337.21	2.42	2.20	1346.04	1345.82	1343.62	2.10	6.41	1343.69	0.0130
Reach 6	26.727	600.00	1337.30	2.33	2.03	1346.00	1345.70	1343.67	1.42	6.37	1343.70	0.0130
Reach 6	26.762	600.00	1337.15	2.50	2.63	1346.19	1346.32	1343.69	0.97	6.54	1343.71	0.0300
Reach 6	26.811	600.00	1337.40	2.35	2.92	1346.05	1346.62	1343.70	0.96	6.30	1343.72	0.0300
Reach 6	26.905	600.00	1337.56	2.84	3.09	1346.56	1346.81	1343.72	1.00	6.16	1343.74	0.0300
Reach 6	27	600.00	1337.52	2.97	3.29	1346.72	1347.04	1343.75	1.00	6.23	1343.76	0.0300
Reach 6	27.095	600.00	1337.86	2.53	3.18	1346.30	1346.95	1343.77	1.05	5.91	1343.79	0.0300
Reach 6	27.189	600.00	1337.78	2.98	2.71	1346.78	1346.51	1343.80	1.07	6.02	1343.82	0.0300
Reach 6	27.244	600.00	1337.80	3.34	2.57	1347.10	1346.33	1343.76	2.83	5.96	1343.89	0.0300
Reach 6	27.248	600.00	1337.39	2.82	2.82	1346.40	1346.40	1343.58	5.67	6.19	1344.08	0.0130
Reach 6	27.261	Culvert										
Reach 6	27.274	600.00	1337.30	2.25	2.06	1346.12	1345.94	1343.88	5.70	6.58	1344.38	0.0130
Reach 6	27.278	600.00	1337.39	3.04	2.95	1347.48	1347.39	1344.44	2.18	7.05	1344.51	0.0130
Reach 6	27.295	500.00	1337.80	2.90	2.77	1347.40	1347.27	1344.50	1.14	6.70	1344.52	0.0300
Reach 6	27.371	500.00	1338.02	3.27	3.72	1347.80	1348.25	1344.53	1.28	6.51	1344.56	0.0300
Reach 6	27.39	500.00	1338.00	2.50	4.06	1347.04	1348.60	1344.54	1.36	6.54	1344.57	0.0300

HYDRAULICS

Weir Calculations

Estimate of Side-Weir Lengths
based on Engels side-weir equation

Detention Basin	Channel Elevations**													Channel Weir					Needed Weir Capacity (cfs)	Weir Based on Normal Weir Equation (C=2.63)	
	Upstream						Downstream						Estimated Outlet Elevation (ft)	Weir Coeff. C (ft)	Length of Weir L (ft)	Weir Elevation (ft)	Depth on Weir (ft)	Weir Capacity (Engels) (cfs)		Capacity at "Engels Length" (cfs)	Length Based on Needed Capacity (cfs)
	Cross Section	Channel Depth (ft)	Flow Rate (cfs)	Channel Invert** (ft)	Flow Depth (ft)	WSEL (ft)	Cross Section	Channel Depth (ft)	Flow Rate (cfs)	Channel Invert** (ft)	Flow Depth (ft)	WSEL (ft)									
Guadalupe Basin*	N/A	10.00	2420	1331.78	5.16	1336.94	N/A	12.00	1000	1331.39	2.92	1334.31	1324.50	3.32	215	1334.31	2.63	1437	1420	2408	127
Knox Basin	19.298	10.00	6600	1319.02	8.50	1327.52	19.109	10.00	2200	1318.80	6.51	1325.31	1318.41	3.32	1175	1325.31	2.21	4410	4400	10153	509
Ray Basin	N/A	7.50	4160	1353.00	6.82	1359.82	N/A	7.50	1000	1352.28	2.98	1355.26	1346.80	3.32	185	1355.26	4.56	3183	3160	4733	124
Rittenhouse (along EMF)	17.039	10.00	4800	1310.37	7.05	1317.42	16.630	10.00	3000	1309.48	6.78	1316.26	1309.10	3.32	1435	1316.26	1.16	1774	1770	4715	539
(along Ritt. Rd. Channel)	N/A	7.40	2390	1314.20	7.36	1321.56	N/A	7.40	500	1314.13	3.59	1317.72		3.32	140	1317.72	3.84	1898	1890	2771	96
Chandler Heights (along EMF)	13.374	10.00	4140	1299.45	6.09	1305.54	13.280	10.00	2300	1299.23	4.44	1303.67	1296.67	3.32	575	1303.67	1.87	1843	1840	3867	274
(along Queen Creek)	N/A	12.00	5320	1314.20	8.08	1322.28	N/A	12.00	2700	1313.51	5.78	1319.29		3.32	345	1319.29	2.99	2642	2630	4691	193

Notes:

* The existing Guadalupe Channel is under super critical flow. For the calculated weir length, it is assumed that prior to the weir, flow will be brought to subcritical conditions either by a milder slope or a hydraulic structure. For purposes of weir length calculations, a milder slope of .0018 ft/ft was used (ex = 0.003635 ft/ft)

** When possible, inverts and WSELs are based on HEC-RAS cross sections. Along the EMF, upstream water surface data is based on the main channel flow prior to the weir, downstream water surface data is based upon a HEC-RAS run with the flow reduced by the amount of flow passing through the weir. For channels other than the EMF or where a HEC-RAS analysis is not available, inverts and other elevations were estimated as best as possible using available As-Builts and other construction documents. For these locations, flow depths and water surface elevations were determined using general channel dimensions and Manning's Equation.

Reference:

Frederick S Merritt, Standard Handbook for Engineers

Equation:

Q = 3.32 x L^0.83 x H^1.67

The common application of this equation is to control of flow in a combined sewer when as the discharge goes through a water treatment plant.

QC/SW Channel (upstream calculation)
Worksheet for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Queen Creek (upstream)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.002000 ft/ft			
Elevation range: 1,314.20 ft to 1,326.50 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
9,910.00	1,326.50	9,910.00	10,090.00	0.035
9,950.00	1,316.00			
10,000.00	1,314.20			
10,050.00	1,316.00			
10,090.00	1,326.50			
Discharge	5,320.00 cfs			

Results		
Wtd. Mannings Coefficient	0.035	
Water Surface Elevation	1,322.28	ft
Flow Area	867.64	ft²
Wetted Perimeter	149.50	ft
Top Width	147.82	ft
Height	8.08	ft
Critical Depth	1,319.45	ft
Critical Slope	0.011548	ft/ft
Velocity	6.13	ft/s
Velocity Head	0.58	ft
Specific Energy	1,322.86	ft
Froude Number	0.45	
Flow is subcritical.		

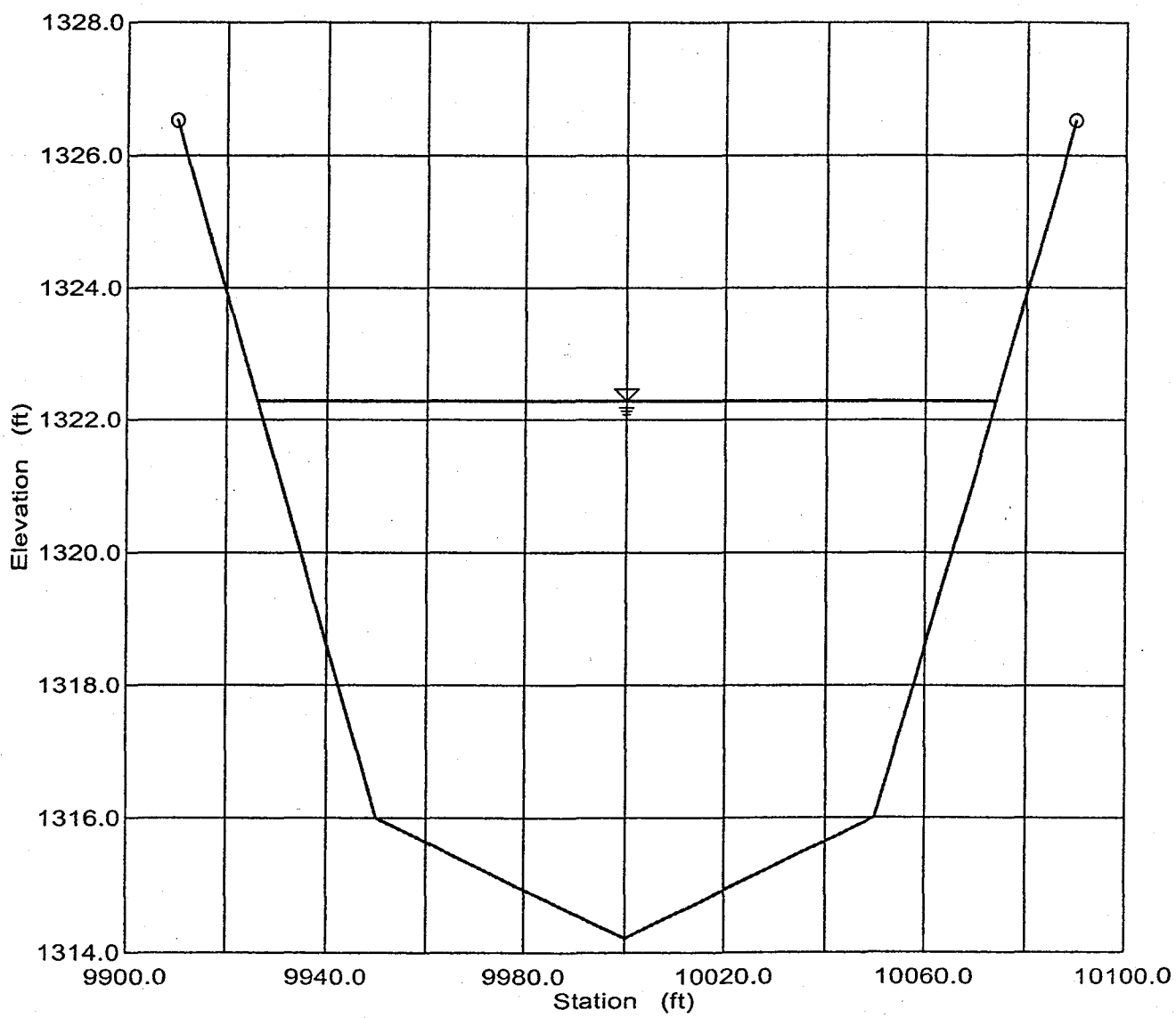
Notes:

This cross section is a generalized cross section of an HEC-2 model provided by the District. The cross section is representative of Queen Creek as it turns south from Queen Creek Road until it begine to turn southwesterly towrads the EMF. The cross section used and slightly modified was cross section 1.900. The slope was determined using the average slope across ~0.5 miles of Queen Creek south of the Higley Rd. Bridge.

QC/SW Channel (upstream calculation)
Cross Section for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Queen Creek (upstream)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.035	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	1,322.28	ft
Discharge	5,320.00	cfs



QC/SW Channel (downstream calculation)
Worksheet for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Queen Creek (downsteam)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.002000 ft/ft			
Elevation range: 1,314.20 ft to 1,326.50 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
9,910.00	1,326.50	9,910.00	10,090.00	0.035
9,950.00	1,316.00			
10,000.00	1,314.20			
10,050.00	1,316.00			
10,090.00	1,326.50			
Discharge	2,700.00	cfs		

Results		
Wtd. Mannings Coefficient	0.035	
Water Surface Elevation	1,319.98	ft
Flow Area	548.57	ft^2
Wetted Perimeter	131.43	ft
Top Width	130.34	ft
Height	5.78	ft
Critical Depth	1,317.92	ft
Critical Slope	0.013094	ft/ft
Velocity	4.92	ft/s
Velocity Head	0.38	ft
Specific Energy	1,320.36	ft
Froude Number	0.42	
Flow is subcritical.		

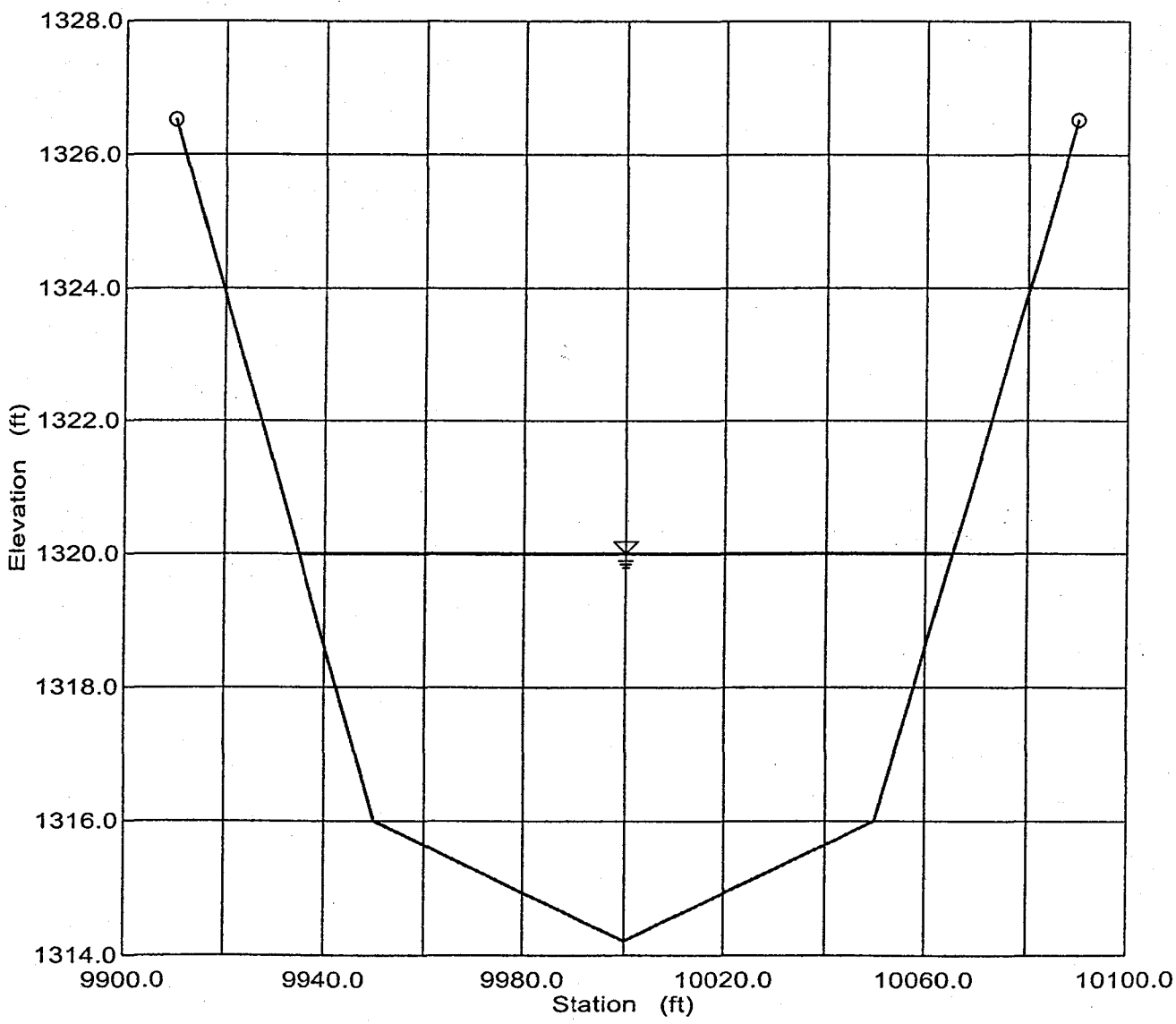
Notes:

This cross section is a generalized cross section of an HEC-2 model provided by the District. The cross section is representative of Queen Creek as it turns south from Queen Creek Road until it begine to turn southwesterly towrads the EMF. The cross section used and slightly modified was cross section 1.900. The slope was determined using the average slope across ~0.5 miles of Queen Creek south of the Higley Rd. Bridge.

QC/SW Channel (downstream calculation)
Cross Section for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Queen Creek (downsteam)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.035	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	1,319.98	ft
Discharge	2,700.00	cfs



Rittenhouse Channel (w/low flow, u/s)
Worksheet for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Rittenhouse Channel (w/Low Flow) (u/s)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.000500	ft/ft

Elevation range: 92.60 ft to 100.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	97.20	0.019
29.60	92.60			
37.60	92.60			
41.60	93.60			
71.60	93.60			
97.20	100.00			
Discharge	2,390.00	cfs		

Results		
Wtd. Mannings Coefficient	0.018	
Water Surface Elevation	100.00	ft
Flow Area	470.72	ft^2
Wetted Perimeter	99.03	ft
Top Width	97.20	ft
Height	7.40	ft
Critical Depth	97.31	ft
Critical Slope	0.003475	ft/ft
Velocity	5.08	ft/s
Velocity Head	0.40	ft
Specific Energy	100.41	ft
Froude Number	0.41	

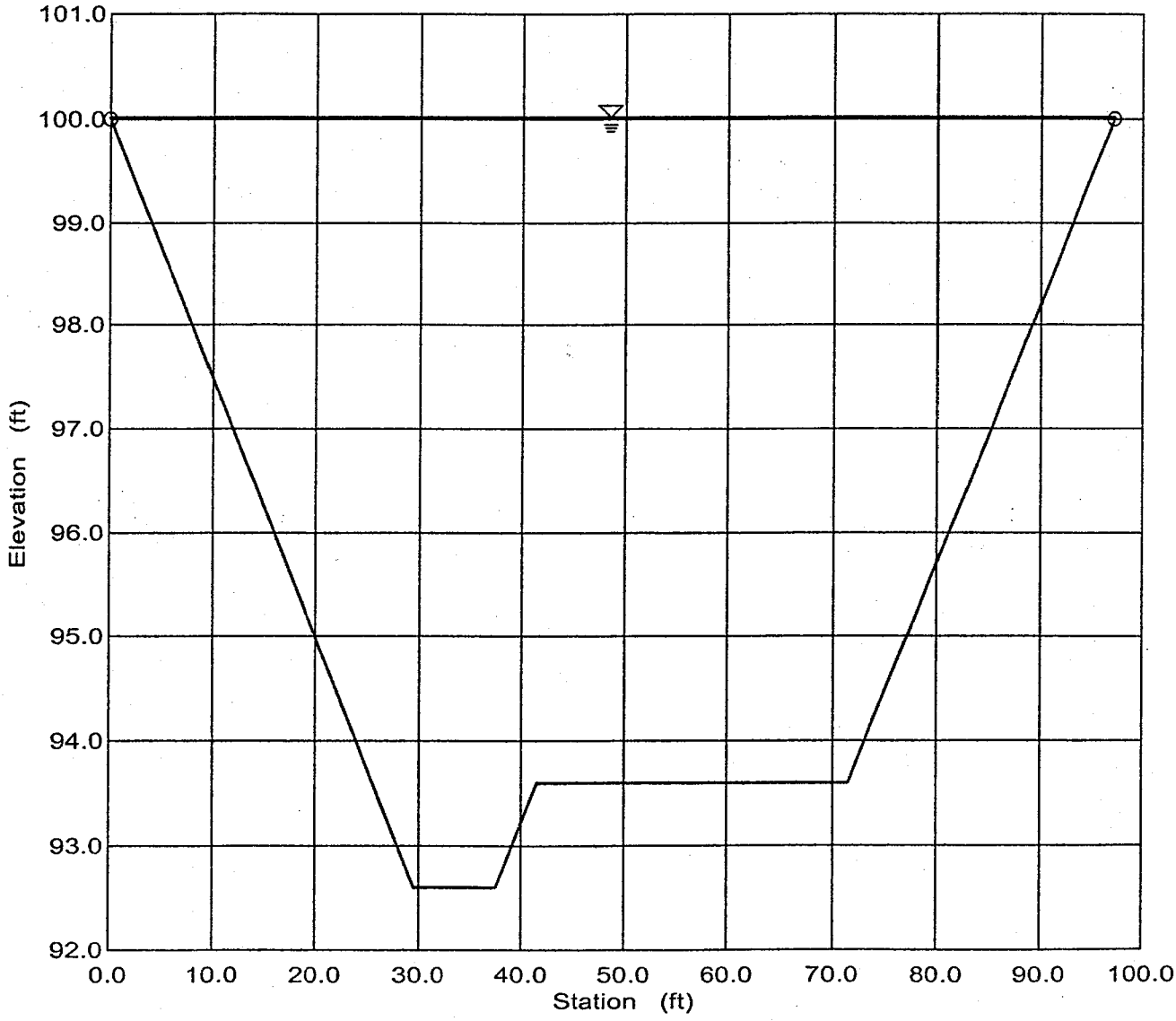
Flow is subcritical.

Water elevation exceeds lowest end station by 0.49e-2 ft.

Rittenhouse Rd. (w/Low Flow Channel, u/s)
Cross Section for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Rittenhouse Channel (w/Low Flow) (u/s)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.018	
Channel Slope	0.000500	ft/ft
Water Surface Elevation	100.00	ft
Discharge	2,390.00	cfs



Rittenhouse Channel (w/low flow, d/s)
Worksheet for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Rittenhouse Channel (with Low Flow)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

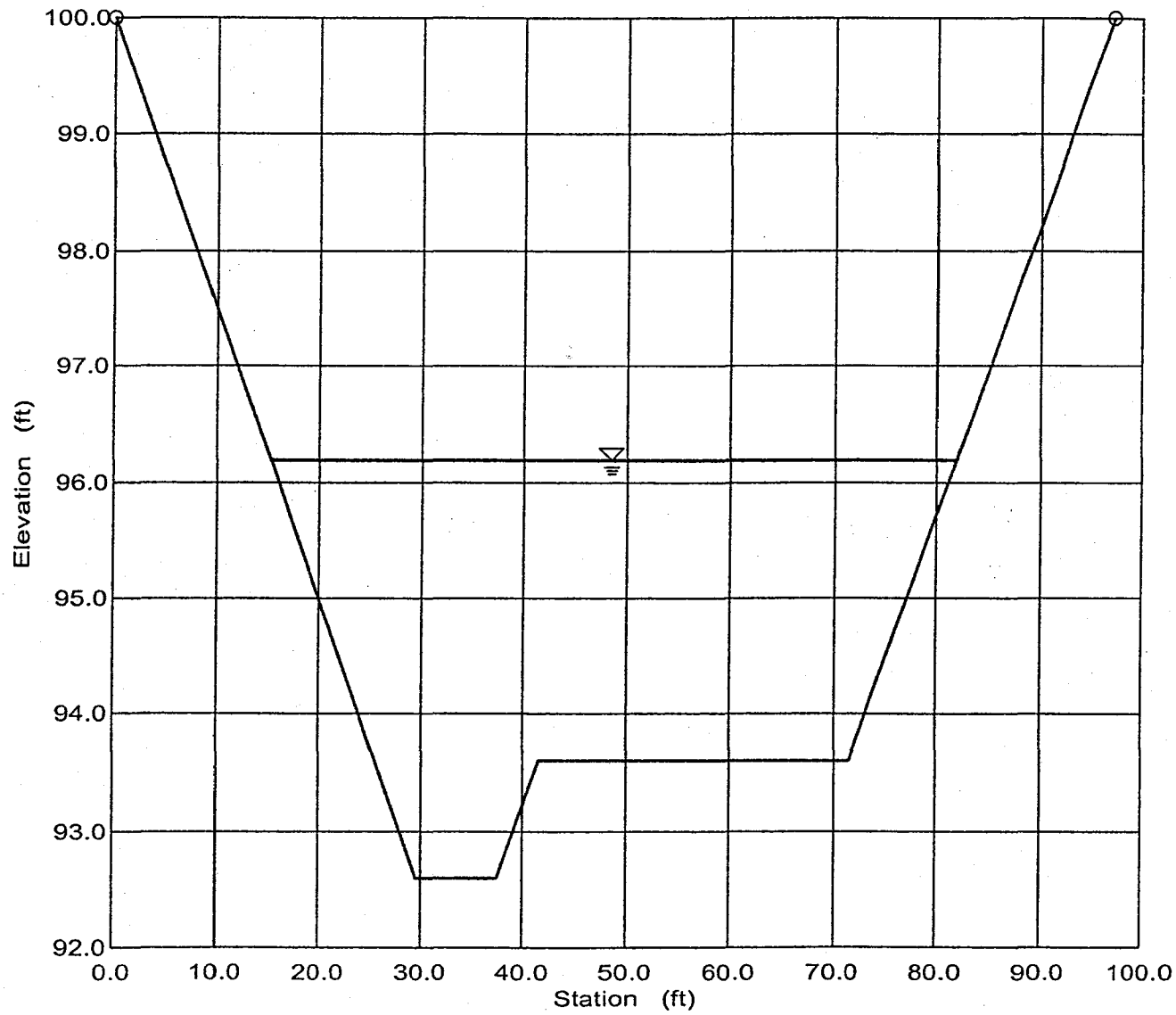
Input Data					
Channel Slope	0.000500 ft/ft				
Elevation range: 92.60 ft to 100.00 ft.					
Station (ft)	Elevation (ft)		Start Station	End Station	Roughness
0.00	100.00		0.00	97.20	0.019
29.60	92.60				
37.60	92.60				
41.60	93.60				
71.60	93.60				
97.20	100.00				
Discharge	500.00	cfs			

Results		
Wtd. Mannings Coefficient	0.019	
Water Surface Elevation	96.19	ft
Flow Area	158.06	ft^2
Wetted Perimeter	67.61	ft
Top Width	66.73	ft
Height	3.59	ft
Critical Depth	94.85	ft
Critical Slope	0.004569	ft/ft
Velocity	3.16	ft/s
Velocity Head	0.16	ft
Specific Energy	96.35	ft
Froude Number	0.36	
Flow is subcritical.		

Rittenhouse Rd. (w/Low Flow Channel, d/s)
Cross Section for Irregular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Rittenhouse Channel (with Low Flow)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.019	
Channel Slope	0.000500	ft/ft
Water Surface Elevation	96.19	ft
Discharge	500.00	cfs



Powerline Floodway-Ray Basin (upstream)
Worksheet for Trapezoidal Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Powerline Floodway Weir (upstream)
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

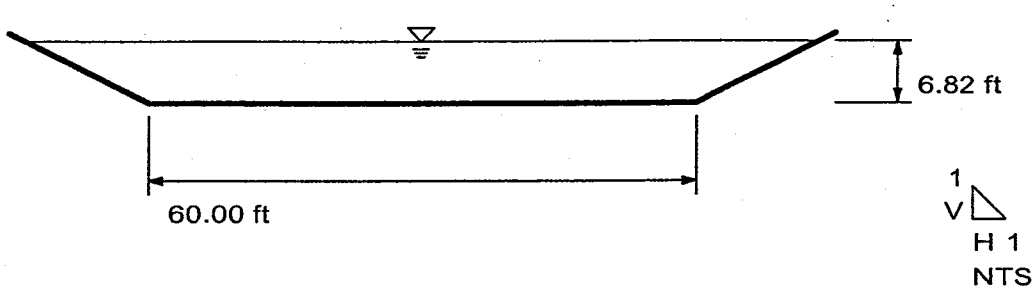
Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.003874	ft/ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	60.00	ft
Discharge	4,160.00	cfs

Results		
Depth	6.82	ft
Flow Area	502.24	ft²
Wetted Perimeter	90.50	ft
Top Width	87.28	ft
Critical Depth	5.01	ft
Critical Slope	0.011342	ft/ft
Velocity	8.28	ft/s
Velocity Head	1.07	ft
Specific Energy	7.89	ft
Froude Number	0.61	
Flow is subcritical.		

Powerline Floodway-Ray Basin (upstream)
Cross Section for Trapezoidal Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Powerline Floodway Weir (upstream)
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Channel Slope	0.003874	ft/ft
Depth	6.82	ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	60.00	ft
Discharge	4,160.00	cfs



Powerline Floodway-Ray Basin (d/s)
Worksheet for Trapezoidal Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Powerline Floodway Weir (downstream)
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

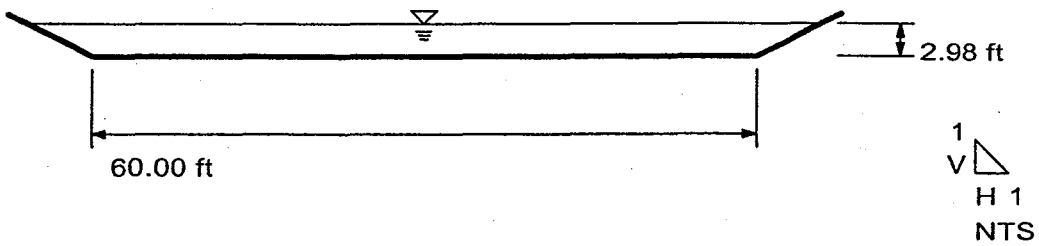
Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.003874	ft/ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	60.00	ft
Discharge	1,000.00	cfs

Results		
Depth	2.98	ft
Flow Area	196.27	ft²
Wetted Perimeter	73.31	ft
Top Width	71.90	ft
Critical Depth	2.01	ft
Critical Slope	0.014714	ft/ft
Velocity	5.09	ft/s
Velocity Head	0.40	ft
Specific Energy	3.38	ft
Froude Number	0.54	
Flow is subcritical.		

Powerline Floodway-Ray Basin (d/s)
Cross Section for Trapezoidal Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Powerline Floodway Weir (downstream)
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.035	
Channel Slope	0.003874	ft/ft
Depth	2.98	ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	60.00	ft
Discharge	1,000.00	cfs



Guadalupe Channel (Subcritical) (u/s)
Worksheet for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (subcritical) (u/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.001800	ft/ft
Bottom Width	38.00	ft
Discharge	2,420.00	cfs

Results		
Depth	5.16	ft
Flow Area	196.13	ft²
Wetted Perimeter	48.32	ft
Top Width	38.00	ft
Critical Depth	5.01	ft
Critical Slope	0.001966	ft/ft
Velocity	12.34	ft/s
Velocity Head	2.37	ft
Specific Energy	7.53	ft
Froude Number	0.96	
Flow is subcritical.		

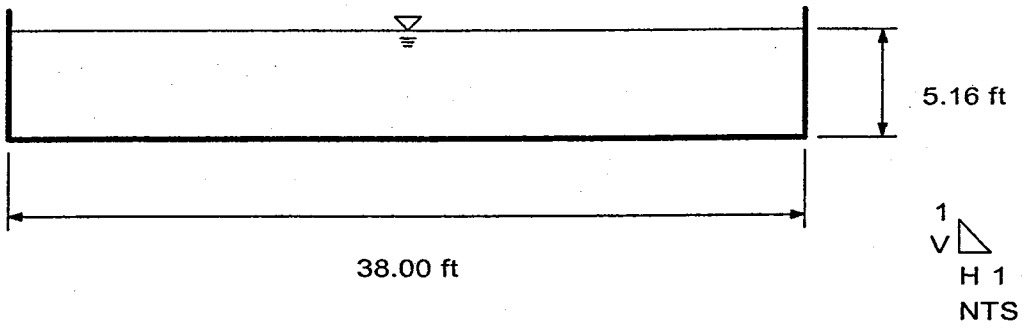
Notes:

It is assumed that subcritical flow can be attained by station 12+00 as stationed by the Guadalupe Channel As-Builts either by reducing the slope or by hydraulic structures. For purposes of determining weir elevations, etc.. the elevations of 12+00 is used for the upstream channel invert elevation. The downstrem channel invert elevation is assumed to be the elevation at 12+00 minus the subcritical slope used times the weir length.

Guadalupe Channel (subcritical) (u/s)
Cross Section for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (subcritical) (u/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.001800	ft/ft
Depth	5.16	ft
Bottom Width	38.00	ft
Discharge	2,420.00	cfs



Guadalupe Channel (Subcritical) (d/s)
Worksheet for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (subcritical) (d/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.001800	ft/ft
Bottom Width	38.00	ft
Discharge	1,000.00	cfs

Results		
Depth	2.92	ft
Flow Area	111.01	ft^2
Wetted Perimeter	43.84	ft
Top Width	38.00	ft
Critical Depth	2.78	ft
Critical Slope	0.002101	ft/ft
Velocity	9.01	ft/s
Velocity Head	1.26	ft
Specific Energy	4.18	ft
Froude Number	0.93	
Flow is subcritical.		

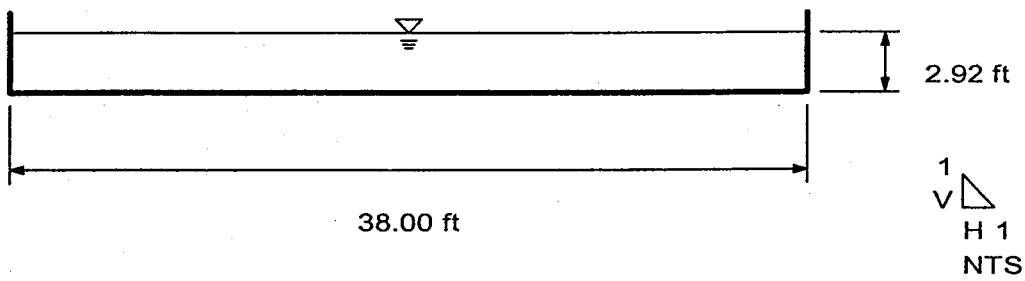
Notes:

It is assumed that subcritical flow can be attained by station 12+00 as stationed by the Guadalupe Channel As-Builts either by reducing the slope or by hydraulic structures. For purposes of determining weir elevations, etc.. the elevations of 12+00 is used for the upstream channel invert elevation. The downstrem channel invert elevation is assumed to be the elevation at 12+00 minus the subcritical slope used times the weir length.

Guadalupe Channel (subcritical) (d/s)
Cross Section for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (subcritical) (d/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.001800	ft/ft
Depth	2.92	ft
Bottom Width	38.00	ft
Discharge	1,000.00	cfs



Guadalupe Channel (supercritical) (u/s)
Worksheet for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (ex. supercrit.) (u/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

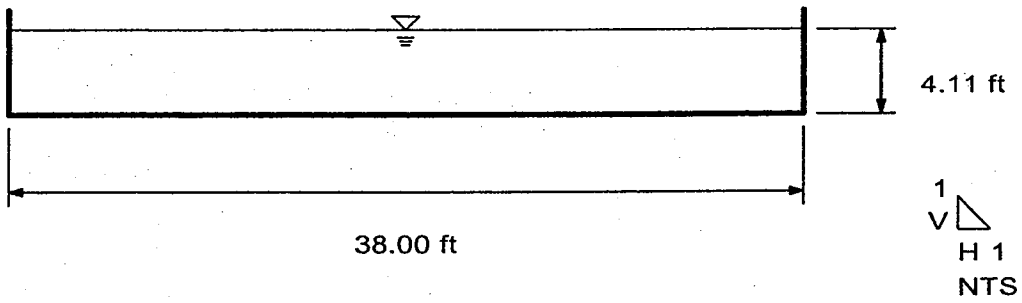
Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.003635	ft/ft
Bottom Width	38.00	ft
Discharge	2,420.00	cfs

Results		
Depth	4.11	ft
Flow Area	156.03	ft²
Wetted Perimeter	46.21	ft
Top Width	38.00	ft
Critical Depth	5.01	ft
Critical Slope	0.001966	ft/ft
Velocity	15.51	ft/s
Velocity Head	3.74	ft
Specific Energy	7.84	ft
Froude Number	1.35	
Flow is supercritical.		

Guadalupe Channel (supercritical) (u/s)
Cross Section for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (ex. supercrit.) (u/s)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.003635	ft/ft
Depth	4.11	ft
Bottom Width	38.00	ft
Discharge	2,420.00	cfs



Guadalupe Channel (supercritical) (d/s)
Worksheet for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (exist. supercritical)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

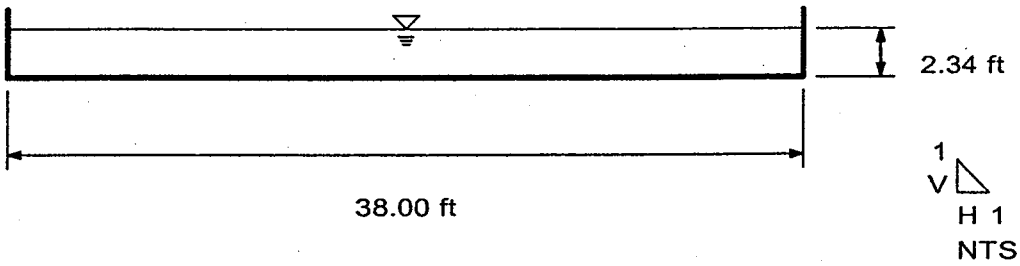
Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.003635	ft/ft
Bottom Width	38.00	ft
Discharge	1,000.00	cfs

Results		
Depth	2.34	ft
Flow Area	88.94	ft²
Wetted Perimeter	42.68	ft
Top Width	38.00	ft
Critical Depth	2.78	ft
Critical Slope	0.002101	ft/ft
Velocity	11.24	ft/s
Velocity Head	1.96	ft
Specific Energy	4.31	ft
Froude Number	1.30	
Flow is supercritical.		

Guadalupe Channel (supercritical) (d/s)
Cross Section for Rectangular Channel

Project Description	
Project File	g:\proj\05094901\hh\working\emf\hydraulics\weirs.fm2
Worksheet	Guadalupe Channel (exist. supercritical)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.003635	ft/ft
Depth	2.34	ft
Bottom Width	38.00	ft
Discharge	1,000.00	cfs



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HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 3

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 3	9.001	6470.00	1286.69	1295.28	1290.25	1295.48	0.000266	3.61	1791.60	246.68	0.24
Reach 3	9.018	6470.00	1287.10	1295.30	1290.53	1295.51	0.000276	3.62	1786.99	252.23	0.24
Reach 3	9.036	5690.00	1287.51	1295.36	1290.57	1295.54	0.000244	3.34	1705.98	248.40	0.22
Reach 3	9.053	5690.00	1287.57	1295.38	1290.69	1295.56	0.000256	3.39	1676.07	246.04	0.23
Reach 3	9.145	5690.00	1288.14	1295.50	1291.28	1295.70	0.000312	3.61	1574.15	244.61	0.25
Reach 3	9.24	5690.00	1288.06	1295.66	1291.31	1295.86	0.000297	3.56	1600.52	245.38	0.25
Reach 3	9.334	5690.00	1288.00	1295.81	1291.28	1296.00	0.000272	3.45	1648.81	247.35	0.24
Reach 3	9.424	5690.00	1287.94	1295.94	1291.26	1296.13	0.000264	3.44	1654.57	244.34	0.23
Reach 3	9.518	5690.00	1287.94	1296.08	1291.21	1296.25	0.000245	3.36	1693.66	245.05	0.23
Reach 3	9.613	5690.00	1287.19	1296.21	1291.19	1296.37	0.000222	3.23	1763.08	250.82	0.21
Reach 3	9.708	5690.00	1287.70	1296.32	1291.36	1296.49	0.000234	3.31	1716.59	244.44	0.22
Reach 3	9.802	5690.00	1288.71	1296.43	1292.07	1296.63	0.000303	3.58	1588.29	244.79	0.25
Reach 3	9.844	5690.00	1288.56	1296.51	1291.84	1296.69	0.000256	3.39	1679.31	247.81	0.23
Reach 3	9.849	5690.00	1288.45	1296.49	1292.05	1296.73	0.000348	3.97	1434.77	203.22	0.26
Reach 3	9.854	5690.00	1288.40	1296.59	1291.83	1296.76	0.000249	3.36	1691.90	246.97	0.23
Reach 3	9.897	5690.00	1288.50	1296.65	1291.78	1296.82	0.000241	3.33	1708.39	246.85	0.22
Reach 3	9.944	5690.00	1288.55	1296.70	1291.96	1296.88	0.000255	3.40	1674.10	244.68	0.23
Reach 3	10.039	5690.00	1288.96	1296.83	1292.18	1297.01	0.000264	3.43	1660.56	246.55	0.23
Reach 3	10.134	5690.00	1289.47	1296.96	1292.56	1297.15	0.000281	3.46	1642.38	251.29	0.24
Reach 3	10.171	5690.00	1288.86	1297.03	1292.15	1297.20	0.000241	3.35	1698.67	243.90	0.22
Reach 3	10.195	5690.00	1288.91	1297.07	1292.22	1297.24	0.000346	3.34	1705.23	245.14	0.22
Reach 3	10.207	Bridge									
Reach 3	10.218	5690.00	1288.64	1297.16	1291.86	1297.31	0.000279	3.11	1831.15	249.18	0.20
Reach 3	10.252	5690.00	1288.80	1297.19	1292.19	1297.36	0.000228	3.29	1727.96	243.79	0.22
Reach 3	10.346	5690.00	1288.88	1297.32	1292.01	1297.47	0.000191	3.07	1853.10	254.06	0.20
Reach 3	10.441	5690.00	1289.06	1297.41	1292.28	1297.57	0.000213	3.20	1775.91	248.32	0.21
Reach 3	10.518	5690.00	1289.62	1297.49	1292.93	1297.68	0.000269	3.45	1650.06	245.67	0.23
Reach 3	10.566	5690.00	1289.50	1297.56	1292.95	1297.74	0.000265	3.45	1649.91	243.37	0.23
Reach 3	10.654	5690.00	1290.00	1297.68	1293.20	1297.87	0.000278	3.49	1629.53	244.64	0.24
Reach 3	10.749	5690.00	1289.80	1297.83	1293.11	1298.01	0.000248	3.36	1693.44	246.94	0.23
Reach 3	10.843	5690.00	1289.90	1297.96	1293.02	1298.12	0.000224	3.25	1748.67	247.78	0.22
Reach 3	10.938	5690.00	1290.11	1298.09	1293.42	1298.27	0.000363	3.36	1690.97	248.93	0.23
Reach 3	11.033	5690.00	1290.41	1298.27	1293.68	1298.45	0.000378	3.42	1663.97	246.49	0.23
Reach 3	11.127	5690.00	1290.70	1298.47	1293.81	1298.64	0.000362	3.36	1695.04	249.72	0.23
Reach 3	11.189	5690.00	1290.70	1298.58	1293.95	1298.76	0.000368	3.37	1686.12	249.40	0.23
Reach 3	11.231	5690.00	1290.62	1298.68	1293.76	1298.84	0.000328	3.25	1749.32	251.38	0.22
Reach 3	11.249	5000.00	1290.69	1298.74	1293.85	1298.88	0.000281	2.96	1690.35	249.52	0.20
Reach 3	11.254	Bridge									
Reach 3	11.26	5000.00	1290.40	1298.78	1293.66	1298.91	0.000251	2.84	1757.88	252.92	0.19
Reach 3	11.297	4140.00	1290.78	1298.85	1293.86	1298.96	0.000241	2.71	1527.35	228.62	0.18
Reach 3	11.308	4140.00	1290.71	1298.81	1294.31	1299.02	0.000089	3.70	1118.61	174.08	0.26
Reach 3	11.321	4140.00	1296.29	1299.52	1299.52	1301.06	0.001819	9.96	415.75	137.89	1.01
Reach 3	11.328	4140.00	1294.88	1301.26	1298.36	1301.48	0.000502	3.81	1085.91	222.82	0.30
Reach 3	11.391	4140.00	1295.69	1301.43	1298.73	1301.66	0.000534	3.83	1081.70	231.17	0.31
Reach 3	11.486	4140.00	1296.57	1301.70	1299.17	1301.94	0.000595	3.95	1047.71	231.34	0.33
Reach 3	11.531	4140.00	1296.26	1301.85	1299.13	1302.08	0.000529	3.83	1082.25	229.64	0.31
Reach 3	11.572	4140.00	1296.51	1301.97	1299.18	1302.19	0.000504	3.78	1094.15	227.64	0.30
Reach 3	11.609	4140.00	1296.39	1302.08	1299.20	1302.29	0.000469	3.67	1129.49	233.57	0.29
Reach 3	11.703	4140.00	1296.68	1302.31	1299.26	1302.51	0.000440	3.63	1141.00	228.39	0.29
Reach 3	11.798	4140.00	1296.67	1302.53	1299.25	1302.72	0.000379	3.46	1196.49	229.73	0.27
Reach 3	11.893	4140.00	1296.71	1302.72	1299.38	1302.91	0.000369	3.43	1206.44	229.86	0.26
Reach 3	11.988	4140.00	1296.90	1302.91	1299.47	1303.09	0.000347	3.37	1228.86	230.17	0.26
Reach 3	12.082	4140.00	1297.29	1303.08	1299.84	1303.28	0.000395	3.52	1176.96	227.77	0.27
Reach 3	12.177	4140.00	1297.28	1303.29	1299.85	1303.46	0.000352	3.39	1220.54	228.58	0.26
Reach 3	12.245	4140.00	1297.40	1303.41	1300.05	1303.60	0.000386	3.53	1173.09	222.04	0.27
Reach 3	12.302	4140.00	1297.60	1303.52	1300.26	1303.72	0.000394	3.53	1172.73	225.21	0.27
Reach 3	12.349	4140.00	1297.66	1303.63	1300.26	1303.81	0.000375	3.48	1191.21	225.47	0.27
Reach 3	12.441	4140.00	1297.71	1303.81	1300.52	1304.00	0.000379	3.46	1197.51	230.46	0.27
Reach 3	12.488	4140.00	1297.80	1303.91	1300.58	1304.09	0.000363	3.40	1218.40	232.85	0.26
Reach 3	12.552	4140.00	1297.54	1304.04	1300.51	1304.21	0.000334	3.32	1246.03	231.31	0.25
Reach 3	12.6	4140.00	1297.79	1304.12	1300.78	1304.30	0.000370	3.43	1207.23	231.00	0.26
Reach 3	12.694	4140.00	1298.04	1304.31	1300.82	1304.48	0.000337	3.33	1244.99	232.42	0.25
Reach 3	12.789	4140.00	1298.10	1304.47	1300.92	1304.64	0.000327	3.30	1253.46	231.28	0.25
Reach 3	12.884	4140.00	1298.30	1304.64	1301.09	1304.81	0.000326	3.29	1258.15	232.53	0.25
Reach 3	12.905	4140.00	1298.40	1304.67	1301.08	1304.84	0.000323	3.30	1255.21	229.90	0.25
Reach 3	12.981	4140.00	1298.62	1304.81	1301.32	1304.98	0.000332	3.31	1249.89	232.09	0.25
Reach 3	13.037	4140.00	1298.52	1304.91	1301.27	1305.07	0.000307	3.23	1282.74	233.79	0.24
Reach 3	13.084	4140.00	1298.67	1304.98	1301.49	1305.15	0.000336	3.33	1244.80	231.96	0.25
Reach 3	13.179	4140.00	1299.00	1305.15	1301.83	1305.33	0.000374	3.45	1200.08	229.39	0.27

EC-RAS Plan: Alt 1C River: EMF Reach: Reach 3 (Continued)

4140

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 3	13.232	4140.00	1299.09	1305.26	1302.03	1305.45	0.000395	3.50	1182.05	230.01	0.27
each 3	13.28	4140.00	1299.23	1305.36	1301.92	1305.54	0.000346	3.36	1232.93	231.56	0.26
each 3	13.374	4140.00	1299.45	1305.54	1302.23	1305.71	0.000352	3.34	1240.55	237.97	0.26
each 3	13.426	4000.00	1299.62	1305.67	1302.23	1305.83	0.000453	3.20	1251.38	235.15	0.24
Reach 3	13.431	Bridge									
each 3	13.439	4000.00	1299.34	1305.75	1301.91	1305.88	0.000367	2.98	1340.93	239.04	0.22
each 3	13.471	4000.00	1299.43	1305.78	1302.22	1305.97	0.000353	3.45	1159.11	211.61	0.26

HEC-RAS Plan: Chandler Hei River: EMF Reach: Reach 3

2300

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 3	9.001	6470.00	1286.69	1295.28	1290.25	1295.48	0.000266	3.61	1791.60	246.68	0.24
Reach 3	9.018	6470.00	1287.10	1295.30	1290.53	1295.51	0.000276	3.62	1786.99	252.23	0.24
Reach 3	9.036	5690.00	1287.51	1295.36	1290.57	1295.54	0.000244	3.34	1705.98	248.40	0.22
Reach 3	9.053	5690.00	1287.57	1295.38	1290.69	1295.56	0.000256	3.39	1676.07	246.04	0.23
Reach 3	9.145	5690.00	1288.14	1295.50	1291.28	1295.70	0.000312	3.61	1574.15	244.61	0.25
Reach 3	9.24	5690.00	1288.06	1295.66	1291.31	1295.86	0.000297	3.56	1600.52	245.38	0.25
Reach 3	9.334	5690.00	1288.00	1295.81	1291.28	1296.00	0.000272	3.45	1648.81	247.35	0.24
Reach 3	9.424	5690.00	1287.94	1295.94	1291.26	1296.13	0.000264	3.44	1654.57	244.34	0.23
Reach 3	9.518	5690.00	1287.94	1296.08	1291.21	1296.25	0.000245	3.36	1693.66	245.05	0.23
Reach 3	9.613	5690.00	1287.19	1296.21	1291.19	1296.37	0.000222	3.23	1763.08	250.82	0.21
Reach 3	9.708	5690.00	1287.70	1296.32	1291.36	1296.49	0.000234	3.31	1716.59	244.44	0.22
Reach 3	9.802	5690.00	1288.71	1296.43	1292.07	1296.63	0.000303	3.58	1588.29	244.79	0.25
Reach 3	9.844	5690.00	1288.56	1296.51	1291.84	1296.69	0.000256	3.39	1679.31	247.81	0.23
Reach 3	9.849	5690.00	1288.45	1296.49	1292.05	1296.73	0.000348	3.97	1434.77	203.22	0.26
Reach 3	9.854	5690.00	1288.40	1296.59	1291.83	1296.76	0.000249	3.36	1691.90	246.97	0.23
Reach 3	9.897	5690.00	1288.50	1296.65	1291.78	1296.82	0.000241	3.33	1708.39	246.85	0.22
Reach 3	9.944	5690.00	1288.55	1296.70	1291.96	1296.88	0.000255	3.40	1674.10	244.68	0.23
Reach 3	10.039	5690.00	1288.96	1296.83	1292.18	1297.01	0.000264	3.43	1660.56	246.55	0.23
Reach 3	10.134	5690.00	1289.47	1296.96	1292.56	1297.15	0.000281	3.46	1642.38	251.29	0.24
Reach 3	10.171	5690.00	1288.86	1297.03	1292.15	1297.20	0.000241	3.35	1698.67	243.90	0.22
Reach 3	10.195	5690.00	1288.91	1297.07	1292.22	1297.24	0.000346	3.34	1705.23	245.14	0.22
Reach 3	10.207	Bridge									
Reach 3	10.218	5690.00	1288.64	1297.16	1291.86	1297.31	0.000279	3.11	1831.15	249.18	0.20
Reach 3	10.252	5690.00	1288.80	1297.19	1292.19	1297.36	0.000228	3.29	1727.96	243.79	0.22
Reach 3	10.346	5690.00	1288.88	1297.32	1292.01	1297.47	0.000191	3.07	1853.10	254.06	0.20
Reach 3	10.441	5690.00	1289.06	1297.41	1292.28	1297.57	0.000213	3.20	1775.91	248.32	0.21
Reach 3	10.518	5690.00	1289.62	1297.49	1292.93	1297.68	0.000269	3.45	1650.06	245.67	0.23
Reach 3	10.566	5690.00	1289.50	1297.56	1292.95	1297.74	0.000265	3.45	1649.91	243.37	0.23
Reach 3	10.654	5690.00	1290.00	1297.68	1293.20	1297.87	0.000278	3.49	1629.53	244.64	0.24
Reach 3	10.749	5690.00	1289.80	1297.83	1293.11	1298.01	0.000248	3.36	1693.44	246.94	0.23
Reach 3	10.843	5690.00	1289.90	1297.96	1293.02	1298.12	0.000224	3.25	1748.67	247.78	0.22
Reach 3	10.938	5690.00	1290.11	1298.09	1293.42	1298.27	0.000363	3.36	1690.97	248.93	0.23
Reach 3	11.033	5690.00	1290.41	1298.27	1293.68	1298.45	0.000378	3.42	1663.97	246.49	0.23
Reach 3	11.127	5690.00	1290.70	1298.47	1293.81	1298.64	0.000362	3.36	1695.04	249.72	0.23
Reach 3	11.189	5690.00	1290.70	1298.58	1293.95	1298.76	0.000368	3.37	1686.12	249.40	0.23
Reach 3	11.231	5690.00	1290.62	1298.68	1293.76	1298.84	0.000328	3.25	1749.32	251.38	0.22
Reach 3	11.249	5000.00	1290.69	1298.74	1293.85	1298.88	0.000281	2.96	1690.35	249.52	0.20
Reach 3	11.254	Bridge									
Reach 3	11.26	5000.00	1290.40	1298.78	1293.66	1298.91	0.000251	2.84	1757.88	252.92	0.19
Reach 3	11.297	2300.00	1290.78	1298.93	1293.05	1298.97	0.000071	1.49	1546.96	229.21	0.10
Reach 3	11.308	2300.00	1290.71	1298.92	1293.21	1298.98	0.000026	2.02	1138.68	174.98	0.14
Reach 3	11.321	2300.00	1296.29	1298.51	1298.51	1299.56	0.001940	8.21	280.26	131.85	0.99
Reach 3	11.328	2300.00	1294.88	1299.72	1297.59	1299.86	0.000493	3.06	751.03	211.43	0.29
Reach 3	11.391	2300.00	1295.69	1299.89	1297.98	1300.04	0.000568	3.14	732.82	221.11	0.30
Reach 3	11.486	2300.00	1296.57	1300.18	1298.42	1300.35	0.000651	3.27	703.79	221.44	0.32
Reach 3	11.531	2300.00	1296.26	1300.34	1298.37	1300.49	0.000539	3.10	742.86	219.95	0.30
Reach 3	11.572	2300.00	1296.51	1300.46	1298.40	1300.60	0.000500	3.04	757.78	218.42	0.29
Reach 3	11.609	2300.00	1296.39	1300.56	1298.45	1300.70	0.000465	2.94	782.64	224.58	0.28
Reach 3	11.703	2300.00	1296.68	1300.79	1298.49	1300.92	0.000412	2.87	801.95	217.69	0.26
Reach 3	11.798	2300.00	1296.67	1300.99	1298.48	1301.11	0.000342	2.70	850.34	219.38	0.24
Reach 3	11.893	2300.00	1296.71	1301.16	1298.61	1301.28	0.000334	2.69	856.15	219.01	0.24
Reach 3	11.988	2300.00	1296.90	1301.33	1298.69	1301.44	0.000313	2.63	873.71	219.24	0.23
Reach 3	12.082	2300.00	1297.29	1301.49	1299.06	1301.61	0.000374	2.79	823.25	216.21	0.25
Reach 3	12.177	2300.00	1297.28	1301.68	1299.08	1301.79	0.000325	2.67	861.39	217.80	0.24
Reach 3	12.245	2300.00	1297.40	1301.79	1299.24	1301.91	0.000358	2.79	824.24	209.78	0.25
Reach 3	12.302	2300.00	1297.60	1301.90	1299.48	1302.02	0.000380	2.82	816.07	214.09	0.25
Reach 3	12.349	2300.00	1297.66	1302.00	1299.47	1302.12	0.000353	2.76	833.47	213.70	0.25
Reach 3	12.441	2300.00	1297.71	1302.17	1299.74	1302.29	0.000371	2.77	829.14	218.94	0.25
Reach 3	12.488	2300.00	1297.80	1302.27	1299.81	1302.38	0.000354	2.72	844.98	221.64	0.25
Reach 3	12.552	2300.00	1297.54	1302.39	1299.74	1302.50	0.000312	2.63	874.60	219.25	0.23
Reach 3	12.6	2300.00	1297.79	1302.47	1300.01	1302.58	0.000362	2.75	835.56	218.98	0.25
Reach 3	12.694	2300.00	1298.04	1302.65	1300.05	1302.75	0.000322	2.65	868.70	220.83	0.24
Reach 3	12.789	2300.00	1298.10	1302.81	1300.15	1302.91	0.000308	2.62	877.42	219.35	0.23
Reach 3	12.884	2300.00	1298.30	1302.96	1300.31	1303.07	0.000310	2.62	877.84	220.43	0.23
Reach 3	12.905	2300.00	1298.40	1302.99	1300.30	1303.10	0.000304	2.62	879.00	217.90	0.23
Reach 3	12.981	2300.00	1298.62	1303.12	1300.55	1303.23	0.000324	2.65	867.61	221.18	0.24
Reach 3	13.037	2300.00	1298.52	1303.22	1300.49	1303.32	0.000290	2.56	897.28	221.73	0.22
Reach 3	13.084	2300.00	1298.67	1303.29	1300.72	1303.40	0.000329	2.67	861.82	220.05	0.24
Reach 3	13.179	2300.00	1299.00	1303.46	1301.05	1303.58	0.000379	2.80	821.63	217.40	0.25

EC-RAS Plan: Chandler Hei River: EMF Reach: Reach 3 (Continued)

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Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 3	13.232	2300.00	1299.09	1303.56	1301.25	1303.69	0.000410	2.86	803.27	217.91	0.26
Reach 3	13.28	2300.00	1299.23	1303.67	1301.15	1303.79	0.000342	2.70	851.21	219.64	0.24
Reach 3	13.374	2300.00	1299.45	1303.85	1301.47	1303.96	0.000365	2.72	846.37	227.53	0.25
Reach 3	13.426	4000.00	1299.62	1303.96	1302.23	1304.29	0.001524	4.67	855.73	226.59	0.42
Reach 3	13.431	Bridge									
Reach 3	13.439	4000.00	1299.34	1304.19	1301.91	1304.45	0.000996	4.09	977.24	229.49	0.35
Reach 3	13.471	4000.00	1299.43	1304.32	1302.22	1304.65	0.000904	4.67	856.12	201.27	0.40

HEC-RAS Plan: Alt 1C River: EMF Reach: Reach 4

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 4	13.471	4000.00	1299.43	1305.78	1302.22	1305.97	0.000353	3.45	1158.36	211.58	0.26
Reach 4	13.566	3790.00	1299.46	1305.95	1302.58	1306.18	0.000443	3.84	986.44	181.66	0.29
Reach 4	13.661	3790.00	1299.76	1306.17	1302.87	1306.40	0.000440	3.80	998.19	186.09	0.29
Reach 4	13.755	3790.00	1300.50	1306.39	1303.34	1306.64	0.000512	3.98	951.80	185.15	0.31
Reach 4	13.842	3790.00	1300.89	1306.63	1303.86	1306.90	0.000602	4.18	905.89	184.92	0.33
Reach 4	13.911	3790.00	1300.88	1306.87	1303.81	1307.11	0.000498	3.94	962.28	186.31	0.31
Reach 4	13.946	3790.00	1299.65	1306.99	1303.83	1307.22	0.000695	3.89	973.92	187.65	0.30
Reach 4	13.954	Bridge									
Reach 4	13.961	3790.00	1299.55	1307.13	1303.93	1307.36	0.000662	3.82	993.42	190.24	0.29
Reach 4	14	3790.00	1300.90	1307.25	1303.92	1307.47	0.000433	3.77	1004.61	186.87	0.29
Reach 4	14.191	3790.00	1301.20	1307.67	1304.11	1307.88	0.000380	3.63	1044.41	186.53	0.27
Reach 4	14.3	3790.00	1301.54	1307.89	1304.42	1308.11	0.000413	3.73	1014.80	184.91	0.28
Reach 4	14.412	3790.00	1301.60	1308.14	1304.70	1308.36	0.000417	3.74	1012.69	185.34	0.28
Reach 4	14.637	3790.00	1302.17	1308.62	1304.98	1308.82	0.000363	3.54	1069.73	191.81	0.26
Reach 4	14.738	3500.00	1302.42	1308.80	1305.54	1309.07	0.000530	4.21	831.00	151.98	0.32
Reach 4	14.754	3500.00	1306.32	1310.52	1310.52	1312.26	0.006169	10.59	330.49	95.48	1.00
Reach 4	14.764	3500.00	1306.30	1312.27	1309.11	1312.48	0.000430	3.65	959.08	186.79	0.28
Reach 4	14.823	3500.00	1306.39	1312.40	1309.15	1312.61	0.000430	3.68	952.03	183.34	0.28
Reach 4	14.926	3500.00	1306.28	1312.64	1309.18	1312.83	0.000387	3.56	983.00	183.25	0.27
Reach 4	15.035	3500.00	1306.87	1312.86	1309.68	1313.08	0.000450	3.74	937.08	182.32	0.29
Reach 4	15.225	3500.00	1307.00	1313.31	1310.08	1313.52	0.000441	3.72	941.16	181.39	0.29
Reach 4	15.414	3500.00	1308.11	1313.78	1310.92	1314.01	0.000530	3.91	894.89	183.60	0.31
Reach 4	15.483	3500.00	1307.90	1313.98	1310.81	1314.20	0.000454	3.75	934.20	182.04	0.29
Reach 4	15.606	3500.00	1308.20	1314.27	1311.09	1314.49	0.000451	3.74	936.58	182.26	0.29
Reach 4	15.811	3500.00	1308.82	1314.75	1311.39	1314.91	0.000339	3.25	1077.36	209.04	0.25
Reach 4	16	3500.00	1308.91	1315.08	1311.53	1315.24	0.000305	3.15	1110.66	208.50	0.24
Reach 4	16.19	3500.00	1309.35	1315.40	1312.00	1315.57	0.000340	3.27	1071.62	206.98	0.25
Reach 4	16.205	3500.00	1309.37	1315.43	1312.05	1315.60	0.000492	3.28	1067.98	205.67	0.25
Reach 4	16.213	Bridge									
Reach 4	16.221	3500.00	1309.43	1315.54	1312.08	1315.71	0.000484	3.28	1068.58	203.44	0.25
Reach 4	16.238	3500.00	1309.56	1315.61	1312.01	1315.76	0.000411	3.05	1149.27	215.86	0.23
Reach 4	16.240	Bridge									
Reach 4	16.242	3500.00	1309.67	1315.77	1312.12	1315.91	0.000400	3.03	1154.13	214.03	0.23
Reach 4	16.251	3500.00	1309.50	1315.78	1312.28	1315.94	0.000312	3.16	1109.29	211.34	0.24
Reach 4	16.321	4800.00	1309.10	1315.86	1312.68	1316.12	0.000512	4.15	1157.53	212.07	0.31
Reach 4	16.389	4800.00	1309.76	1316.04	1313.04	1316.32	0.000569	4.29	1119.29	211.26	0.33
Reach 4	16.468	4800.00	1309.49	1316.29	1312.88	1316.54	0.000455	4.01	1197.16	210.96	0.30
Reach 4	16.63	4800.00	1309.48	1316.67	1312.78	1316.88	0.000357	3.71	1294.58	213.73	0.27
Reach 4	16.819	4800.00	1309.76	1317.02	1312.92	1317.22	0.000323	3.59	1335.67	214.36	0.25
Reach 4	16.94	4800.00	1309.91	1317.23	1313.17	1317.43	0.000326	3.58	1342.02	218.70	0.25
Reach 4	17.039	4800.00	1310.37	1317.42	1314.00	1317.69	0.000674	4.11	1166.80	201.71	0.30
Reach 4	17.071	4800.00	1310.83	1317.01	1317.01	1319.42	0.008007	12.46	385.28	79.48	1.00
Reach 4	17.082	4800.00	1310.51	1318.53	1316.64	1319.86	0.000777	9.25	519.13	80.96	0.64
Reach 4	17.086	Bridge									
Reach 4	17.101	4800.00	1310.54	1319.34	1316.72	1320.40	0.000565	8.25	582.05	84.92	0.56
Reach 4	17.17	4800.00	1311.12	1319.53	1317.15	1320.63	0.000612	8.43	569.60	85.44	0.58
Reach 4	17.213	4710.00	1311.10	1319.76	1317.13	1320.77	0.000549	8.08	583.18	85.98	0.55
Reach 4	17.25	4710.00	1311.10	1319.93	1317.12	1320.88	0.000507	7.82	602.60	88.16	0.53
Reach 4	17.254	4710.00	1310.98	1319.94	1317.06	1320.89	0.000500	7.83	601.38	86.48	0.52
Reach 4	17.261	Bridge									
Reach 4	17.269	4710.00	1311.04	1320.12	1317.04	1321.01	0.000457	7.56	622.90	88.40	0.50
Reach 4	17.288	4710.00	1311.13	1320.15	1317.27	1321.06	0.000488	7.67	614.01	89.82	0.52
Reach 4	17.339	4710.00	1311.41	1320.25	1317.50	1321.22	0.000523	7.90	596.07	87.68	0.53
Reach 4	17.48	4710.00	1311.88	1320.60	1318.16	1321.65	0.000590	8.22	572.94	87.12	0.56
Reach 4	17.571	4710.00	1312.05	1320.90	1318.27	1321.93	0.000558	8.16	577.33	84.91	0.55
Reach 4	17.672	4710.00	1312.57	1321.17	1318.72	1322.25	0.000600	8.34	564.69	84.86	0.57
Reach 4	17.803	4710.00	1313.58	1321.47	1319.74	1322.82	0.000825	9.31	505.73	81.99	0.66
Reach 4	17.898	4710.00	1314.10	1321.85	1320.26	1323.26	0.000879	9.52	494.94	81.56	0.68
Reach 4	18.087	4710.00	1315.14	1322.74	1321.13	1324.14	0.000872	9.50	496.02	81.37	0.68
Reach 4	18.193	4710.00	1315.38	1323.59	1320.98	1324.55	0.000528	7.87	598.72	88.74	0.53
Reach 4	18.237	4710.00	1317.30	1324.58	1320.47	1324.82	0.000134	3.98	1184.38	180.49	0.27
Reach 4	18.345	2870.00	1317.07	1324.84	1319.67	1324.92	0.000175	2.27	1266.74	195.22	0.16

EC-RAS Plan: Weir River: EMF Reach: Reach 4

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 4	13.471	4000.00	1299.43	1305.78	1302.22	1305.97	0.000353	3.45	1158.36	211.58	0.26
Reach 4	13.566	3790.00	1299.46	1305.95	1302.58	1306.18	0.000443	3.84	986.44	181.66	0.29
Reach 4	13.661	3790.00	1299.76	1306.17	1302.87	1306.40	0.000440	3.80	998.19	186.09	0.29
Reach 4	13.755	3790.00	1300.50	1306.39	1303.34	1306.64	0.000512	3.98	951.80	185.15	0.31
Reach 4	13.842	3790.00	1300.89	1306.63	1303.86	1306.90	0.000602	4.18	905.89	184.92	0.33
Reach 4	13.911	3790.00	1300.88	1306.87	1303.81	1307.11	0.000498	3.94	962.28	186.31	0.31
Reach 4	13.946	3790.00	1299.65	1306.99	1303.83	1307.22	0.000695	3.89	973.92	187.65	0.30
Reach 4	13.954	Bridge									
Reach 4	13.961	3790.00	1299.55	1307.13	1303.93	1307.36	0.000662	3.82	993.42	190.24	0.29
Reach 4	14	3790.00	1300.90	1307.25	1303.92	1307.47	0.000433	3.77	1004.61	186.87	0.29
Reach 4	14.191	3790.00	1301.20	1307.67	1304.11	1307.88	0.000380	3.63	1044.41	186.53	0.27
Reach 4	14.3	3790.00	1301.54	1307.89	1304.42	1308.11	0.000413	3.73	1014.80	184.91	0.28
Reach 4	14.412	3790.00	1301.60	1308.14	1304.70	1308.36	0.000417	3.74	1012.69	185.34	0.28
Reach 4	14.637	3790.00	1302.17	1308.62	1304.98	1308.82	0.000363	3.54	1069.73	191.81	0.26
Reach 4	14.738	3500.00	1302.42	1308.80	1305.54	1309.07	0.000530	4.21	831.00	151.98	0.32
Reach 4	14.754	3500.00	1306.32	1310.52	1310.52	1312.26	0.006169	10.59	330.49	95.48	1.00
Reach 4	14.764	3500.00	1306.30	1312.27	1309.11	1312.48	0.000430	3.65	959.08	186.79	0.28
Reach 4	14.823	3500.00	1306.39	1312.40	1309.15	1312.61	0.000430	3.68	952.03	183.34	0.28
Reach 4	14.926	3500.00	1306.28	1312.64	1309.18	1312.83	0.000387	3.56	983.00	183.25	0.27
Reach 4	15.035	3500.00	1306.87	1312.86	1309.68	1313.08	0.000450	3.74	937.08	182.32	0.29
Reach 4	15.225	3500.00	1307.00	1313.31	1310.08	1313.52	0.000441	3.72	941.16	181.39	0.29
Reach 4	15.414	3500.00	1308.11	1313.78	1310.92	1314.01	0.000530	3.91	894.89	183.60	0.31
Reach 4	15.483	3500.00	1307.90	1313.98	1310.81	1314.20	0.000454	3.75	934.20	182.04	0.29
Reach 4	15.606	3500.00	1308.20	1314.27	1311.09	1314.49	0.000451	3.74	936.58	182.26	0.29
Reach 4	15.811	3500.00	1308.82	1314.75	1311.39	1314.91	0.000339	3.25	1077.36	209.04	0.25
Reach 4	16	3500.00	1308.91	1315.08	1311.53	1315.24	0.000305	3.15	1110.66	208.50	0.24
Reach 4	16.19	3500.00	1309.35	1315.40	1312.00	1315.57	0.000340	3.27	1071.62	206.98	0.25
Reach 4	16.205	3500.00	1309.37	1315.43	1312.05	1315.60	0.000492	3.28	1067.98	205.67	0.25
Reach 4	16.213	Bridge									
Reach 4	16.221	3500.00	1309.43	1315.54	1312.08	1315.71	0.000484	3.28	1068.58	203.44	0.25
Reach 4	16.238	3500.00	1309.56	1315.61	1312.01	1315.76	0.000411	3.05	1149.27	215.86	0.23
Reach 4	16.240	Bridge									
Reach 4	16.242	3500.00	1309.67	1315.77	1312.12	1315.91	0.000400	3.03	1154.13	214.03	0.23
Reach 4	16.251	3500.00	1309.50	1315.78	1312.28	1315.94	0.000312	3.16	1109.29	211.34	0.24
Reach 4	16.321	3000.00	1309.10	1315.93	1311.91	1316.03	0.000191	2.56	1173.70	212.56	0.19
Reach 4	16.389	3000.00	1309.76	1316.00	1312.29	1316.11	0.000227	2.70	1111.43	211.02	0.21
Reach 4	16.468	3000.00	1309.49	1316.10	1312.12	1316.20	0.000197	2.59	1157.23	209.80	0.19
Reach 4	16.63	3000.00	1309.48	1316.26	1312.03	1316.36	0.000172	2.48	1208.45	211.19	0.18
Reach 4	16.819	3000.00	1309.76	1316.43	1312.17	1316.53	0.000171	2.48	1210.98	210.63	0.18
Reach 4	16.94	3000.00	1309.91	1316.55	1312.43	1316.64	0.000182	2.51	1193.76	213.92	0.19
Reach 4	17.039	3000.00	1310.37	1316.66	1313.24	1316.79	0.000409	2.96	1013.57	197.73	0.23
Reach 4	17.071	3000.00	1310.83	1316.23	1315.49	1317.55	0.005135	9.24	324.75	75.37	0.78
Reach 4	17.082	3000.00	1310.51	1316.83	1315.11	1317.76	0.000715	7.75	386.87	74.25	0.60
Reach 4	17.086	Bridge									
Reach 4	17.101	3000.00	1310.54	1317.38	1315.18	1318.16	0.000551	7.08	423.71	76.66	0.53
Reach 4	17.17	3000.00	1311.12	1317.56	1315.65	1318.39	0.000624	7.33	409.46	77.42	0.56
Reach 4	17.213	4710.00	1311.10	1317.14	1317.14	1319.62	0.001997	12.62	373.13	74.82	1.00
Reach 4	17.25	4710.00	1311.10	1318.48	1317.13	1319.98	0.000978	9.82	479.46	81.79	0.72
Reach 4	17.254	4710.00	1310.98	1318.54	1317.06	1320.01	0.000927	9.72	484.76	80.52	0.70
Reach 4	17.261	Bridge									
Reach 4	17.269	4710.00	1311.04	1319.03	1317.04	1320.26	0.000730	8.91	528.90	83.64	0.62
Reach 4	17.288	4710.00	1311.13	1319.08	1317.27	1320.35	0.000784	9.06	520.14	84.93	0.64
Reach 4	17.339	4710.00	1311.41	1319.26	1317.50	1320.58	0.000808	9.20	511.77	83.30	0.65
Reach 4	17.48	4710.00	1311.88	1319.86	1318.16	1321.19	0.000825	9.25	509.44	83.72	0.66
Reach 4	17.571	4710.00	1312.05	1320.34	1318.27	1321.56	0.000709	8.87	530.93	82.55	0.62
Reach 4	17.672	4710.00	1312.57	1320.71	1318.72	1321.95	0.000735	8.95	525.97	82.85	0.63
Reach 4	17.803	4710.00	1313.58	1321.10	1319.74	1322.62	0.000982	9.89	476.01	80.40	0.72
Reach 4	17.898	4710.00	1314.10	1321.59	1320.26	1323.12	0.001000	9.95	473.32	80.39	0.72
Reach 4	18.087	4710.00	1315.14	1322.64	1321.13	1324.09	0.000912	9.64	488.35	80.98	0.69
Reach 4	18.193	4710.00	1315.38	1323.54	1320.98	1324.52	0.000539	7.92	594.36	88.56	0.54
Reach 4	18.237	4710.00	1317.30	1324.54	1320.47	1324.79	0.000136	4.00	1178.41	180.34	0.28
Reach 4	18.345	2870.00	1317.07	1324.81	1319.67	1324.89	0.000178	2.28	1260.90	195.02	0.16

EC-RAS Plan: Knox River: EMF Reach: Reach 5

2200

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 5	18.345	2870.00	1317.07	1324.84	1319.67	1324.92	0.000176	2.27	1265.88	195.19	0.16
Reach 5	18.535	2200.00	1317.85	1325.00	1320.05	1325.06	0.000097	1.91	1149.57	192.39	0.14
Reach 5	18.782	2200.00	1318.05	1325.12	1320.10	1325.18	0.000091	1.87	1177.41	194.56	0.13
Reach 5	18.97	2200.00	1318.41	1325.22	1320.72	1325.29	0.000122	2.06	1066.36	189.77	0.15
Reach 5	19.109	2200.00	1318.80	1325.31	1320.93	1325.38	0.000138	2.18	1009.52	181.69	0.16
Reach 5	19.298	2200.00	1319.02	1325.45	1321.09	1325.52	0.000143	2.21	994.83	179.76	0.17
Reach 5	19.408	4240.00	1319.19	1325.48	1322.29	1325.77	0.000561	4.35	974.90	177.69	0.33
Reach 5	19.458	4240.00	1319.39	1325.62	1322.64	1325.94	0.000630	4.51	940.43	177.28	0.34
Reach 5	19.489	4240.00	1319.60	1325.73	1322.75	1326.04	0.000630	4.50	942.13	178.16	0.34
Reach 5	19.541	4240.00	1319.56	1325.91	1322.74	1326.20	0.000565	4.34	975.93	179.16	0.33
Reach 5	19.592	4240.00	1319.50	1326.07	1322.79	1326.35	0.000538	4.28	989.72	178.90	0.32
Reach 5	19.745	4240.00	1319.61	1326.50	1322.83	1326.75	0.000438	4.02	1055.48	180.09	0.29
Reach 5	19.863	4240.00	1319.74	1326.78	1322.96	1327.01	0.000401	3.90	1087.09	181.36	0.28
Reach 5	20.058	4240.00	1320.10	1327.19	1323.32	1327.42	0.000396	3.89	1089.40	180.67	0.28
Reach 5	20.247	4240.00	1320.62	1327.59	1323.80	1327.83	0.000413	3.94	1076.91	181.24	0.28
Reach 5	20.306	4240.00	1320.70	1327.72	1324.06	1327.96	0.000442	4.01	1058.23	182.57	0.29
Reach 5	20.316	4240.00	1320.83	1327.74	1324.07	1327.99	0.000437	4.01	1056.09	180.04	0.29
Reach 5	20.323	Bridge									
Reach 5	20.328	4240.00	1320.85	1327.85	1324.06	1328.09	0.000403	3.91	1084.48	180.96	0.28
Reach 5	20.334	4240.00	1320.59	1327.85	1324.06	1328.10	0.000426	4.01	1057.94	177.40	0.29
Reach 5	20.353	4240.00	1320.90	1327.90	1324.10	1328.15	0.000416	3.96	1071.12	179.61	0.29
Reach 5	20.428	4230.00	1321.04	1328.08	1324.12	1328.30	0.000376	3.81	1109.12	182.15	0.27
Reach 5	20.517	4230.00	1320.90	1328.26	1324.17	1328.48	0.000362	3.78	1118.67	180.80	0.27
Reach 5	20.61	4230.00	1321.01	1328.43	1324.30	1328.65	0.000350	3.74	1129.69	180.88	0.26
Reach 5	20.704	4230.00	1321.02	1328.61	1324.39	1328.82	0.000338	3.70	1141.72	181.00	0.26
Reach 5	20.799	4230.00	1321.43	1328.78	1324.79	1329.01	0.000371	3.81	1110.92	181.04	0.27
Reach 5	20.894	4230.00	1321.60	1328.97	1324.99	1329.19	0.000381	3.83	1104.45	182.24	0.27
Reach 5	21	4230.00	1321.41	1329.19	1325.05	1329.40	0.000341	3.69	1147.72	184.60	0.26
Reach 5	21.093	4230.00	1321.82	1329.35	1325.53	1329.58	0.000393	3.84	1101.03	184.88	0.28
Reach 5	21.188	4230.00	1322.28	1329.55	1326.02	1329.80	0.000463	4.05	1044.76	183.64	0.30
Reach 5	21.282	4230.00	1322.47	1329.76	1326.04	1330.05	0.000486	4.32	979.53	161.67	0.31
Reach 5	21.326	3410.00	1322.60	1329.85	1326.47	1330.26	0.001001	5.17	659.09	106.63	0.37
Reach 5	21.339	Bridge									
Reach 5	21.355	3410.00	1322.56	1330.44	1326.39	1330.77	0.000708	4.57	745.90	111.76	0.31
Reach 5	21.391	3410.00	1322.68	1330.57	1326.82	1330.95	0.000862	4.95	689.50	106.40	0.34
Reach 5	21.402	3410.00	1322.54	1330.65	1326.64	1331.00	0.000769	4.76	716.46	107.68	0.33
Reach 5	21.407	Bridge									
Reach 5	21.413	3410.00	1322.28	1330.80	1326.44	1331.11	0.000659	4.53	752.78	107.85	0.30
Reach 5	21.418	3410.00	1324.17	1330.65	1328.24	1331.22	0.001641	6.04	564.39	105.56	0.46
Reach 5	21.439	3410.00	1315.40	1331.25	1319.27	1331.29	0.000062	1.59	2139.95	200.71	0.09
Reach 5	21.485	3410.00	1315.40	1331.28	1318.87	1331.30	0.000041	1.22	2789.26	290.47	0.07
Reach 5	21.531	3410.00	1315.45	1331.30	1317.35	1331.31	0.000010	0.72	4753.29	377.68	0.04
Reach 5	21.591	3410.00	1315.45	1331.30	1319.50	1331.31	0.000024	0.97	3514.81	340.73	0.05
Reach 5	21.633	3410.00	1315.40	1331.31	1318.01	1331.32	0.000018	0.92	3716.04	321.79	0.05
Reach 5	21.656	3410.00	1314.40	1331.31	1318.73	1331.32	0.000019	0.93	3647.28	315.57	0.05
Reach 5	21.713	3410.00	1324.20	1331.17	1327.31	1331.41	0.000994	3.91	872.28	169.38	0.30
Reach 5	21.745	3410.00	1324.22	1331.43	1326.14	1331.48	0.000170	1.89	1807.93	285.40	0.13
Reach 5	21.839	3410.00	1324.20	1331.52	1326.38	1331.56	0.000121	1.50	2275.91	394.92	0.11
Reach 5	21.947	3410.00	1325.42	1331.36	1330.33	1331.91	0.004333	5.97	570.81	181.65	0.59
Reach 5	22.022	3410.00	1325.91	1332.76	1330.91	1333.01	0.001826	4.00	852.60	257.41	0.39
Reach 5	22.107	3410.00	1326.00	1333.29	1329.81	1333.39	0.000469	2.61	1307.02	271.37	0.21
Reach 5	22.189	3410.00	1324.50	1333.48	1329.02	1333.68	0.000743	3.58	951.89	173.00	0.27
Reach 5	22.263	3410.00	1325.29	1333.83	1330.09	1333.96	0.000680	2.85	1196.09	287.36	0.25
Reach 5	22.348	3410.00	1326.63	1334.08	1330.14	1334.13	0.000224	1.76	1938.37	419.09	0.14
Reach 5	22.436	3410.00	1325.51	1334.16	1327.54	1334.18	0.000065	1.21	2814.51	421.75	0.08
Reach 5	22.475	3410.00	1325.50	1334.18	1327.63	1334.20	0.000073	1.23	2770.75	440.61	0.09
Reach 5	22.557	3410.00	1325.50	1334.20	1327.39	1334.23	0.000081	1.50	2280.29	485.96	0.09
Reach 5	22.599	3410.00	1326.67	1334.18	1329.69	1334.32	0.000431	3.01	1133.35	177.15	0.21
Reach 5	22.608	Bridge									
Reach 5	22.615	3410.00	1326.91	1334.27	1329.70	1334.41	0.000408	2.95	1154.37	177.54	0.20
Reach 5	22.68	3410.00	1326.34	1334.45	1329.89	1334.57	0.000529	2.73	1248.20	265.64	0.22
Reach 5	22.74	3410.00	1326.29	1334.62	1329.84	1334.74	0.000552	2.84	1202.26	249.15	0.23
Reach 5	22.797	3410.00	1326.57	1334.80	1331.36	1334.91	0.000572	2.72	1253.90	284.84	0.23
Reach 5	22.866	3410.00	1326.20	1335.00	1331.77	1335.18	0.000809	3.38	1008.01	213.30	0.27
Reach 5	22.944	3410.00	1327.70	1335.34	1332.46	1335.63	0.001321	4.29	795.43	170.35	0.35
Reach 5	23.009	3410.00	1327.11	1335.74	1330.08	1335.79	0.000190	1.67	2043.63	423.16	0.13
Reach 5	23.087	3410.00	1324.80	1335.82	1329.30	1335.93	0.000466	2.65	1288.58	260.49	0.21
Reach 5	23.135	3410.00	1324.83	1335.94	1328.82	1336.00	0.000205	2.10	1624.42	250.84	0.15
Reach 5	23.166	3410.00	1327.40	1335.95	1330.53	1336.06	0.000318	2.62	1301.20	200.18	0.18

HEC-RAS Plan: Knox River: EMF Reach: Reach 5 (Continued)

2200

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 5	23.193	3410.00	1326.10	1336.03	1329.61	1336.10	0.000173	2.16	1581.61	205.17	0.14
Reach 5	23.206	Bridge									
Reach 5	23.219	3410.00	1326.60	1336.67	1330.13	1336.74	0.000169	2.15	1585.73	203.47	0.14
Reach 5	23.274	3140.00	1328.46	1336.72	1331.18	1336.80	0.000248	2.34	1341.19	202.43	0.16
Reach 5	23.315	3140.00	1327.54	1336.77	1332.14	1336.89	0.000530	2.77	1132.66	235.77	0.22
Reach 5	23.45	3140.00	1328.56	1337.02	1331.82	1337.05	0.000112	1.39	2258.37	415.05	0.11
Reach 5	23.604	3140.00	1328.94	1337.14	1332.89	1337.24	0.000516	2.58	1216.59	276.86	0.22
Reach 5	23.712	3140.00	1328.32	1337.43	1332.76	1337.59	0.000665	3.18	988.81	198.77	0.25
Reach 5	23.758	3140.00	1328.32	1337.61	1330.59	1337.65	0.000105	1.59	1968.79	278.02	0.11
Reach 5	23.803	3140.00	1328.80	1337.55	1332.38	1337.77	0.000112	3.84	818.70	111.36	0.25
Reach 5	23.804	3140.00	1328.24	1337.56	1332.20	1337.78	0.000103	3.73	842.41	113.92	0.24
Reach 5	23.815	Bridge									
Reach 5	23.825	3140.00	1328.39	1337.62	1332.22	1337.84	0.000101	3.71	845.83	113.99	0.24
Reach 5	23.827	3140.00	1328.70	1337.62	1332.52	1337.84	0.000107	3.77	832.14	114.52	0.25
Reach 5	23.911	3120.00	1330.30	1337.72	1335.26	1337.97	0.001306	4.02	776.95	182.34	0.34
Reach 5	23.962	3120.00	1331.20	1338.13	1335.47	1338.33	0.001360	3.52	885.69	261.59	0.34
Reach 5	24.06	3120.00	1332.60	1338.84	1336.53	1339.00	0.001241	3.24	963.17	301.32	0.32
Reach 5	24.1	3120.00	1332.95	1339.11	1336.33	1339.27	0.001277	3.25	958.97	304.50	0.32
Reach 5	24.13	3120.00	1330.19	1339.31	1334.52	1339.38	0.000355	2.02	1540.99	381.97	0.18
Reach 5	24.247	3120.00	1329.56	1339.48	1334.39	1339.52	0.000166	1.59	1961.94	395.66	0.13
Reach 5	24.32	3120.00	1330.52	1339.55	1334.72	1339.62	0.000311	2.09	1496.15	321.52	0.17
Reach 5	24.454	3120.00	1332.11	1339.78	1336.09	1339.86	0.000358	2.18	1429.96	317.88	0.18
Reach 5	24.535	3120.00	1329.50	1339.90	1333.77	1339.95	0.000134	1.73	1807.34	273.10	0.12
Reach 5	24.621	3120.00	1329.41	1339.95	1334.19	1340.05	0.000279	2.43	1286.16	201.90	0.17
Reach 5	24.723	3120.00	1328.84	1340.06	1333.19	1340.18	0.000215	2.78	1122.93	147.23	0.18

HEC-RAS Plan: Knox River: EMF Reach: Reach 5

6600

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 5	18.345	2870.00	1317.07	1324.84	1319.67	1324.92	0.000176	2.27	1265.88	195.19	0.16
Reach 5	18.535	6600.00	1317.85	1325.00	1322.04	1325.52	0.000869	5.74	1150.56	192.43	0.41
Reach 5	18.782	6600.00	1318.05	1326.03	1322.06	1326.40	0.000532	4.86	1357.18	200.90	0.33
Reach 5	18.97	6600.00	1318.41	1326.57	1322.70	1326.95	0.000565	4.97	1328.68	199.61	0.34
Reach 5	19.109	6600.00	1318.80	1326.97	1322.98	1327.36	0.000553	4.99	1321.64	193.46	0.34
Reach 5	19.298	6600.00	1319.02	1327.52	1323.16	1327.88	0.000479	4.77	1383.22	194.50	0.32
Reach 5	19.408	4240.00	1319.19	1327.94	1322.29	1328.08	0.000176	2.96	1432.90	194.55	0.19
Reach 5	19.458	4240.00	1319.39	1327.98	1322.64	1328.13	0.000199	3.08	1378.28	193.51	0.20
Reach 5	19.489	4240.00	1319.60	1328.01	1322.75	1328.16	0.000204	3.10	1368.15	194.14	0.21
Reach 5	19.541	4240.00	1319.56	1328.07	1322.74	1328.22	0.000199	3.07	1379.18	194.07	0.20
Reach 5	19.592	4240.00	1319.50	1328.12	1322.79	1328.27	0.000201	3.09	1372.57	193.47	0.20
Reach 5	19.745	4240.00	1319.61	1328.29	1322.83	1328.43	0.000192	3.05	1388.69	192.40	0.20
Reach 5	19.863	4240.00	1319.74	1328.41	1322.96	1328.55	0.000191	3.05	1391.86	192.04	0.20
Reach 5	20.058	4240.00	1320.10	1328.61	1323.32	1328.76	0.000207	3.13	1352.53	190.12	0.21
Reach 5	20.247	4240.00	1320.62	1328.82	1323.80	1328.98	0.000232	3.25	1305.02	189.86	0.22
Reach 5	20.306	4240.00	1320.70	1328.89	1324.06	1329.06	0.000252	3.32	1277.47	191.41	0.23
Reach 5	20.316	4240.00	1320.83	1328.90	1324.07	1329.07	0.000251	3.34	1269.74	187.89	0.23
Reach 5	20.323	Bridge									
Reach 5	20.328	4240.00	1320.85	1328.96	1324.06	1329.13	0.000238	3.29	1290.53	187.91	0.22
Reach 5	20.334	4240.00	1320.59	1328.97	1324.06	1329.14	0.000253	3.37	1260.03	185.25	0.23
Reach 5	20.353	4240.00	1320.90	1329.00	1324.10	1329.17	0.000248	3.33	1271.75	187.22	0.23
Reach 5	20.428	4230.00	1321.04	1329.10	1324.12	1329.27	0.000234	3.26	1298.81	189.02	0.22
Reach 5	20.517	4230.00	1320.90	1329.21	1324.17	1329.38	0.000234	3.27	1294.27	187.33	0.22
Reach 5	20.61	4230.00	1321.01	1329.32	1324.30	1329.49	0.000233	3.27	1293.16	186.86	0.22
Reach 5	20.704	4230.00	1321.02	1329.44	1324.39	1329.61	0.000232	3.27	1293.99	186.52	0.22
Reach 5	20.799	4230.00	1321.43	1329.55	1324.79	1329.73	0.000258	3.38	1253.15	186.18	0.23
Reach 5	20.894	4230.00	1321.60	1329.68	1324.99	1329.87	0.000271	3.42	1237.15	187.51	0.23
Reach 5	21	4230.00	1321.41	1329.84	1325.05	1330.01	0.000252	3.33	1269.84	188.97	0.23
Reach 5	21.093	4230.00	1321.82	1329.96	1325.53	1330.15	0.000291	3.48	1214.78	188.89	0.24
Reach 5	21.188	4230.00	1322.28	1330.11	1326.02	1330.32	0.000348	3.68	1148.15	187.68	0.26
Reach 5	21.282	4230.00	1322.47	1330.26	1326.04	1330.51	0.000383	3.99	1061.46	164.92	0.28
Reach 5	21.326	3410.00	1322.60	1330.33	1326.47	1330.68	0.000799	4.80	710.49	108.52	0.33
Reach 5	21.339	Bridge									
Reach 5	21.355	3410.00	1322.56	1330.81	1326.39	1331.10	0.000600	4.33	787.03	112.41	0.29
Reach 5	21.391	3410.00	1322.68	1330.91	1326.82	1331.26	0.000738	4.69	726.69	107.90	0.32
Reach 5	21.402	3410.00	1322.54	1330.98	1326.64	1331.30	0.000660	4.53	752.55	108.06	0.30
Reach 5	21.407	Bridge									
Reach 5	21.413	3410.00	1322.28	1331.11	1326.44	1331.40	0.000573	4.33	786.66	107.86	0.28
Reach 5	21.418	3410.00	1324.17	1330.99	1328.24	1331.49	0.001364	5.68	600.23	107.06	0.42
Reach 5	21.439	3410.00	1315.40	1331.51	1319.27	1331.55	0.000058	1.55	2193.56	203.37	0.08
Reach 5	21.485	3410.00	1315.40	1331.54	1318.87	1331.56	0.000038	1.19	2866.27	293.40	0.07
Reach 5	21.531	3410.00	1315.45	1331.56	1317.35	1331.57	0.000009	0.70	4852.75	380.27	0.03
Reach 5	21.591	3410.00	1315.45	1331.56	1319.50	1331.58	0.000022	0.95	3604.56	343.22	0.05
Reach 5	21.633	3410.00	1315.40	1331.57	1318.01	1331.58	0.000017	0.90	3800.67	324.33	0.05
Reach 5	21.656	3410.00	1314.40	1331.57	1318.73	1331.58	0.000018	0.91	3730.14	317.60	0.05
Reach 5	21.713	3410.00	1324.20	1331.45	1327.31	1331.66	0.000866	3.71	919.91	174.67	0.28
Reach 5	21.745	3410.00	1324.22	1331.68	1326.14	1331.73	0.000151	1.81	1879.17	288.15	0.13
Reach 5	21.839	3410.00	1324.20	1331.76	1326.38	1331.79	0.000106	1.44	2370.39	396.50	0.10
Reach 5	21.947	3410.00	1325.42	1331.63	1330.33	1332.10	0.003380	5.50	619.97	185.33	0.53
Reach 5	22.022	3410.00	1325.91	1332.82	1330.91	1333.06	0.001740	3.93	867.22	259.03	0.38
Reach 5	22.107	3410.00	1326.00	1333.33	1329.81	1333.43	0.000458	2.59	1317.27	271.88	0.21
Reach 5	22.189	3410.00	1324.50	1333.51	1329.02	1333.71	0.000731	3.56	957.62	173.45	0.27
Reach 5	22.263	3410.00	1325.29	1333.86	1330.09	1333.99	0.000667	2.83	1203.96	287.91	0.24
Reach 5	22.348	3410.00	1326.63	1334.11	1330.14	1334.15	0.000220	1.75	1948.14	419.40	0.14
Reach 5	22.436	3410.00	1325.51	1334.18	1327.54	1334.21	0.000064	1.21	2823.93	422.12	0.08
Reach 5	22.475	3410.00	1325.50	1334.20	1327.63	1334.22	0.000072	1.23	2780.49	440.88	0.09
Reach 5	22.557	3410.00	1325.50	1334.22	1327.39	1334.26	0.000080	1.49	2286.67	486.47	0.09
Reach 5	22.599	3410.00	1326.67	1334.20	1329.69	1334.34	0.000427	3.00	1137.24	177.24	0.21
Reach 5	22.608	Bridge									
Reach 5	22.615	3410.00	1326.91	1334.29	1329.70	1334.43	0.000404	2.94	1158.12	177.62	0.20
Reach 5	22.68	3410.00	1326.34	1334.47	1329.89	1334.58	0.000523	2.72	1253.39	265.95	0.22
Reach 5	22.74	3410.00	1326.29	1334.63	1329.84	1334.76	0.000556	2.83	1207.04	252.94	0.23
Reach 5	22.797	3410.00	1326.57	1334.82	1331.36	1334.93	0.000565	2.71	1259.15	285.34	0.23
Reach 5	22.866	3410.00	1326.20	1335.01	1331.77	1335.19	0.000800	3.37	1011.43	213.49	0.27
Reach 5	22.944	3410.00	1327.70	1335.35	1332.46	1335.64	0.001310	4.28	797.55	170.45	0.35
Reach 5	23.009	3410.00	1327.11	1335.75	1330.08	1335.80	0.000189	1.67	2047.87	423.38	0.13
Reach 5	23.087	3410.00	1324.80	1335.83	1329.30	1335.94	0.000473	2.64	1291.27	264.54	0.21
Reach 5	23.135	3410.00	1324.83	1335.95	1328.82	1336.01	0.000204	2.10	1627.00	251.10	0.15
Reach 5	23.166	3410.00	1327.40	1335.96	1330.53	1336.07	0.000317	2.62	1303.23	200.32	0.18

HEC-RAS Plan: Knox River: EMF Reach: Reach 5 (Continued)

6600

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 5	23.193	3410.00	1326.10	1336.04	1329.61	1336.11	0.000172	2.15	1583.64	205.23	0.14
Reach 5	23.206	Bridge									
Reach 5	23.219	3410.00	1326.60	1336.68	1330.13	1336.75	0.000169	2.15	1587.70	203.53	0.14
Reach 5	23.274	3140.00	1328.46	1336.73	1331.18	1336.81	0.000247	2.34	1343.09	202.55	0.16
Reach 5	23.315	3140.00	1327.54	1336.78	1332.14	1336.90	0.000528	2.77	1134.82	236.10	0.22
Reach 5	23.45	3140.00	1328.56	1337.03	1331.82	1337.06	0.000112	1.39	2261.71	415.22	0.10
Reach 5	23.604	3140.00	1328.94	1337.15	1332.89	1337.25	0.000514	2.58	1218.65	277.01	0.22
Reach 5	23.712	3140.00	1328.32	1337.44	1332.76	1337.60	0.000663	3.17	989.99	198.88	0.25
Reach 5	23.758	3140.00	1328.32	1337.62	1330.59	1337.66	0.000104	1.59	1970.35	278.10	0.11
Reach 5	23.803	3140.00	1328.80	1337.55	1332.38	1337.78	0.000112	3.83	819.33	111.39	0.25
Reach 5	23.804	3140.00	1328.24	1337.57	1332.20	1337.78	0.000102	3.72	843.05	113.95	0.24
Reach 5	23.815	Bridge									
Reach 5	23.825	3140.00	1328.39	1337.63	1332.22	1337.84	0.000101	3.71	846.47	114.02	0.24
Reach 5	23.827	3140.00	1328.70	1337.63	1332.52	1337.85	0.000107	3.77	832.77	114.55	0.25
Reach 5	23.911	3120.00	1330.30	1337.72	1335.26	1337.97	0.001301	4.01	777.95	182.40	0.34
Reach 5	23.962	3120.00	1331.20	1338.14	1335.47	1338.33	0.001356	3.52	886.75	261.71	0.34
Reach 5	24.06	3120.00	1332.60	1338.84	1336.53	1339.00	0.001239	3.24	963.79	301.39	0.32
Reach 5	24.1	3120.00	1332.95	1339.11	1336.33	1339.27	0.001276	3.25	959.46	304.54	0.32
Reach 5	24.13	3120.00	1330.19	1339.31	1334.52	1339.38	0.000355	2.02	1541.50	382.00	0.18
Reach 5	24.247	3120.00	1329.56	1339.49	1334.39	1339.53	0.000166	1.59	1962.37	395.68	0.13
Reach 5	24.32	3120.00	1330.52	1339.55	1334.72	1339.62	0.000311	2.08	1496.50	321.56	0.17
Reach 5	24.454	3120.00	1332.11	1339.78	1336.09	1339.86	0.000357	2.18	1430.23	317.90	0.18
Reach 5	24.535	3120.00	1329.50	1339.90	1333.77	1339.95	0.000134	1.73	1807.58	273.11	0.12
Reach 5	24.621	3120.00	1329.41	1339.95	1334.19	1340.05	0.000279	2.43	1286.34	201.91	0.17
Reach 5	24.723	3120.00	1328.84	1340.07	1333.19	1340.19	0.000215	2.78	1123.06	147.24	0.18

HYDRAULICS

Basin Outlet Calculations

Estimated Outfall Pipe Discharge for Off-Line Basins

Basin Location	Outlet Size (in)	Number of Pipes	Discharge for Flow Depth (per pipe) =													Range of Headwater	Est. Ave. Discharge (cfs)	Ave. Rate to Drain in 36 hrs* (cfs)
			0 ft (cfs)	1 ft (cfs)	2 ft (cfs)	3 ft (cfs)	4 ft (cfs)	5 ft (cfs)	6 ft (cfs)	7 ft (cfs)	8 ft (cfs)	9 ft (cfs)	10 ft (cfs)	11 ft (cfs)	12 ft (cfs)			
Guadalupe	36	1	0	6	19	37	50	63	75	83	92	100	110	120	130	0' ~ 10'	64	62
Knox	48	5	0	15	24	50	80	105	130	145	160	175	190	205	220	0' ~ 7'	392	354
Ray	48	4	0	15	24	50	80	105	130	145	160	175	190	205	220	0' ~ 8'	355	300
Rittenhouse	48	4	0	15	24	50	80	105	130	145	160	175	190	205	220	0' ~ 7'	314	248
Chandler Heights	60	5	0	15	30	58	92	135	170	200	230	260	290	320	350	0' ~ 12'	896	666

All discharges determined by nomograph, Chart 2 FHWA.

* Estimated to drain to outfall elevation. Basin volume below outfall elevation to drain within the required 36 hours given a percolation rate of 2 ft/day. No pumping is proposed.

APPENDIX C:
ESTIMATES

- Summary and Detailed Cost Estimates
    - Alternative 1C - Preferred Alternative
    - Alternative 3
- Quantity Estimates

ESTIMATES

Summary and Detailed Cost Estimate
Alternative 1C – Preferred Alternative

TABLE C-1
EMF CAPACITY MITIGATION
SUMMARY OF ESTIMATED CAPITAL COSTS
(ALTERNATIVE 1C)

TOTAL PROJECT CAPITAL COST BY BASIN OR IMPROVEMENT	
BROADWAY-MAIN ST. CHANNEL IMPROVEMENTS	$1,668,670
GUADALUPE BASIN	$3,050,215
KNOX BASIN	$15,551,310
RAY BASIN	$12,130,605
RITTENHOUSE BASIN	$11,456,500
CHANDLER HEIGHTS BASIN	$25,346,400
TOTAL ESTIMATED PROJECT CAPITAL COST	**$69,203,700**

TOTAL PROJECT CAPITAL COST BY TYPE	
CONSTRUCTION, ENGINEERING & CONTINGENCY COSTS	$55,068,700
LAND ACQUISITION COSTS	$14,135,000
TOTAL ESTIMATED PROJECT CAPITAL COST	**$69,203,700**

Note: Estimated project cpaital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers

TABLE C-2
ESTIMATED CAPITAL COSTS
CHANDLER HEIGHTS DETENTION BASIN
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	300	$500.00	$150,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	6,597,000	$2.50	$16,492,500
8	SEEDING	ACRES	300	$1,500.00	$450,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	8,960	$2.50	$22,400
10	CONCRETE SIDE WEIR	C.Y.	1,560	$350.00	$546,000
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	3,070	$35.00	$107,450
12	OUTLET PIPES (60" RGRCP)	L.F.	425	$200.00	$85,000
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	5	$1,300.00	$6,500
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$17,859,850
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (6%)**	L.SUM	1	$1,071,590.00	$1,071,590
19	**CONTINGENCY (25%)**	L.SUM	1	$4,464,960.00	$4,464,960
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$23,396,400**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	65	$30,000.00	$1,950,000
27	FCDMC PROPERTY	ACRES	235	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$1,950,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$25,346,400**

Note: Estimated project capital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

TABLE C-3
ESTIMATED CAPITAL COSTS
RITTENHOUSE DETENTION BASIN
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	111	$500.00	$55,500
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	1,905,400	$2.50	$4,763,500
8	SEEDING	ACRES	111	$1,500.00	$166,500
9	EXCAVATION FOR SIDE WEIR	C.Y.	8,480	$2.50	$21,200
10	CONCRETE SIDE WEIR	C.Y.	2,490	$350.00	$871,500
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	5,250	$35.00	$183,750
12	OUTLET PIPES (60" RGRCP)	L.F.	340	$130.00	$44,200
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	4	$1,000.00	$4,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$6,110,150
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$488,810.00	$488,810
19	**CONTINGENCY (25%)**	L.SUM	1	$1,527,540.00	$1,527,540
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$8,126,500**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	111	$30,000.00	$3,330,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$3,330,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$11,456,500**

Note: Estimated project captial costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

EMF COST ESTIMATE.XLS

TABLE C-4
ESTIMATED CAPITAL COSTS
RAY DETENTION BASIN
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	114	$2,000.00	$228,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	2,382,900	$2.50	$5,957,250
8	SEEDING	ACRES	114	$1,500.00	$171,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	1,310	$2.50	$3,275
10	CONCRETE SIDE WEIR	C.Y.	240	$350.00	$84,000
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	620	$35.00	$21,700
12	OUTLET PIPES (60" RGRCP)	L.F.	270	$130.00	$35,100
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	4	$1,000.00	$4,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	1	$45,000.00	$45,000
15	**SUBTOTAL (CONSTRUCTION)**				$6,549,325
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$523,950.00	$523,950
19	**CONTINGENCY (25%)**	L.SUM	1	$1,637,330.00	$1,637,330
20					$2,161,280
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$8,710,605**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	114	$30,000.00	$3,420,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$3,420,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$12,130,605**

Note: Estimated project captial costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

EMF COST ESTIMATE.XLS

TABLE C-5
ESTIMATED CAPITAL COSTS
KNOX DETENTION BASIN
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	159	$2,000.00	$318,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	2,670,100	$2.50	$6,675,250
8	SEEDING	ACRES	159	$1,500.00	$238,500
9	EXCAVATION FOR SIDE WEIR	C.Y.	6,220	$2.50	$15,550
10	CONCRETE SIDE WEIR	C.Y.	1,890	$350.00	$661,500
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	3,920	$35.00	$137,200
12	OUTLET PIPES (60" RGRCP)	L.F.	425	$130.00	$55,250
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	5	$1,000.00	$5,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$8,106,250
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$648,500.00	$648,500
19	**CONTINGENCY (25%)**	L.SUM	1	$2,026,560.00	$2,026,560
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$10,781,310**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	159	$30,000.00	$4,770,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$4,770,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$15,551,310**

Note: Estimated project capital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

EMF COST ESTIMATE.XLS

TABLE C-6
ESTIMATED CAPITAL COSTS
GUADALUPE DETENTION BASIN
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	24	$500.00	$12,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	548,600	$2.50	$1,371,500
8	SEEDING	ACRES	24	$1,500.00	$36,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	2,330	$2.50	$5,825
10	CONCRETE SIDE WEIR	C.Y.	250	$350.00	$87,500
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	720	$35.00	$25,200
12	OUTLET PIPES (60" RGRCP)	L.F.	60	$100.00	$6,000
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	1	$700.00	$700
14	MAJOR UTILITY RELOCATIONS	L.SUM	1	$159,000.00	$159,000
15	**SUBTOTAL (CONSTRUCTION)**				$1,703,725
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (15%)**	L.SUM	1	$255,560.00	$255,560
19	**CONTINGENCY (25%)**	L.SUM	1	$425,930.00	$425,930
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$2,385,215**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	19	$35,000.00	$665,000
27	FCDMC PROPERTY	ACRES	5	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$665,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$3,050,215**

Note: Estimated project capital costs are to a reconnaisance-level accuracy, as defined by the American Association of Cost Engineers.

EMF COST ESTIMATE.XLS

TABLE C-7
ESTIMATED CAPITAL COSTS
BROADWAY RD. TO MAIN ST. CHANNEL IMPROVEMENTS
(ALTERNATIVE 1C)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CHANNEL EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	24,440	$2.50	$61,100
7	SOIL CEMENT CHANNEL (INCLUDES ACCESS MAINTENANCE ROAD)	C.Y.	24,440	$40.00	$977,600
8	SOIL CEMENT LEVEES	C.Y.	1,080	$40.00	$43,200
9	MISC. REMOVALS & ADJUSTMENTS (SIDE INLETS & SPILLWAYS)	L.SUM	1	$10,000.00	$10,000
10	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
11	**SUBTOTAL (CONSTRUCTION)**				$1,191,900
12					
13					
14	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (15%)**	L.SUM	1	$178,790.00	$178,790
15	**CONTINGENCY (25%)**	L.SUM	1	$297,980.00	$297,980
16					
17					
18	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$1,668,670**
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$1,668,670**

Note: Estimated project capital costs are to a reconnaisance-level accuracy, as defined by the American Association of Cost Engineers.

ESTIMATES

Summary and Detailed Cost Estimate
Alternative 3

TABLE C-1a
EMF CAPACITY MITIGATION
SUMMARY OF ESTIMATED CAPITAL COSTS
(ALTERNATIVE 3)

TOTAL PROJECT CAPITAL COST BY BASIN OR IMPROVEMENT	
BROADWAY-MAIN ST. CHANNEL IMPROVEMENTS	$1,668,670
KNOX BASIN	$18,131,543
RAY BASIN	$12,130,605
RITTENHOUSE BASIN	$11,456,500
CHANDLER HEIGHTS BASIN	$25,346,400
TOTAL ESTIMATED PROJECT CAPITAL COST	**$68,733,718**

TOTAL PROJECT CAPITAL COST BY TYPE	
CONSTRUCTION, ENGINEERING & CONTINGENCY COSTS	$54,513,718
LAND ACQUISITION COSTS	$14,220,000
TOTAL ESTIMATED PROJECT CAPITAL COST	**$68,733,718**

Note: Estimated project cpaital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers

TABLE C-2a
ESTIMATED CAPITAL COSTS
CHANDLER HEIGHTS DETENTION BASIN
(ALTERNATIVE 3)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	300	$500.00	$150,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	6,597,000	$2.50	$16,492,500
8	SEEDING	ACRES	300	$1,500.00	$450,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	8,960	$2.50	$22,400
10	CONCRETE SIDE WEIR	C.Y.	1,560	$350.00	$546,000
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	3,070	$35.00	$107,450
12	OUTLET PIPES (60" RGRCP)	L.F.	425	$200.00	$85,000
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	5	$1,300.00	$6,500
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$17,859,850
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (6%)**	L.SUM	1	$1,071,590.00	$1,071,590
19	**CONTINGENCY (25%)**	L.SUM	1	$4,464,960.00	$4,464,960
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$23,396,400**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	65	$30,000.00	$1,950,000
27	FCDMC PROPERTY	ACRES	235	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$1,950,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$25,346,400**

Note: Estimated project capital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

TABLE C-3a
ESTIMATED CAPITAL COSTS
RITTENHOUSE DETENTION BASIN
(ALTERNATIVE 3)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	111	$500.00	$55,500
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	1,905,400	$2.50	$4,763,500
8	SEEDING	ACRES	111	$1,500.00	$166,500
9	EXCAVATION FOR SIDE WEIR	C.Y.	8,480	$2.50	$21,200
10	CONCRETE SIDE WEIR	C.Y.	2,490	$350.00	$871,500
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	5,250	$35.00	$183,750
12	OUTLET PIPES (60" RGRCP)	L.F.	340	$130.00	$44,200
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	4	$1,000.00	$4,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$6,110,150
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$488,810.00	$488,810
19	**CONTINGENCY (25%)**	L.SUM	1	$1,527,540.00	$1,527,540
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$8,126,500**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	111	$30,000.00	$3,330,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$3,330,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$11,456,500**

Note: Estimated project captial costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

TABLE C-4a
ESTIMATED CAPITAL COSTS
RAY DETENTION BASIN
(ALTERNATIVE 3)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	114	$2,000.00	$228,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	2,382,900	$2.50	$5,957,250
8	SEEDING	ACRES	114	$1,500.00	$171,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	1,310	$2.50	$3,275
10	CONCRETE SIDE WEIR	C.Y.	240	$350.00	$84,000
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	620	$35.00	$21,700
12	OUTLET PIPES (60" RGRCP)	L.F.	270	$130.00	$35,100
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	4	$1,000.00	$4,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	1	$45,000.00	$45,000
15	**SUBTOTAL (CONSTRUCTION)**				$6,549,325
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$523,950.00	$523,950
19	**CONTINGENCY (25%)**	L.SUM	1	$1,637,330.00	$1,637,330
20					$2,161,280
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$8,710,605**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	114	$30,000.00	$3,420,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$3,420,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$12,130,605**

Note: Estimated project captial costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

TABLE C-5a
ESTIMATED CAPITAL COSTS
KNOX DETENTION BASIN
(ALTERNATIVE 3)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CLEARING AND GRUBBING	ACRES	184	$2,000.00	$368,000
7	BASIN EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	3,099,300	$2.50	$7,748,250
8	SEEDING	ACRES	184	$1,500.00	$276,000
9	EXCAVATION FOR SIDE WEIR	C.Y.	7,775	$2.50	$19,438
10	CONCRETE SIDE WEIR	C.Y.	2,363	$350.00	$826,875
11	GROUTED RIPRAP FOR EROSION PROTECTION (WEIR)	S.Y.	4,900	$35.00	$171,500
12	OUTLET PIPES (60" RGRCP)	L.F.	510	$130.00	$66,300
13	TRASH RACK/ACCESS BARRIER (60" PIPE)	EACH	6	$1,000.00	$6,000
14	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
15	**SUBTOTAL (CONSTRUCTION)**				$9,482,363
16					
17					
18	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (8%)**	L.SUM	1	$758,590.00	$758,590
19	**CONTINGENCY (25%)**	L.SUM	1	$2,370,590.00	$2,370,590
20					
21					
22	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$12,611,543**
23					
24					
25	**LAND ACQUISITION**				
26	PRIVATELY HELD	ACRES	184	$30,000.00	$5,520,000
27	FCDMC PROPERTY	ACRES	-	$0.00	$0
28	**TOTAL (LAND ACQUISITION)**				**$5,520,000**
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$18,131,543**

Note: Estimated project capital costs are to a reconnaissance-level accuracy, as defined by the American Association of Cost Engineers.

EMF COST ESTIMATE.XLS

TABLE C-6a
ESTIMATED CAPITAL COSTS
BROADWAY RD. TO MAIN ST. CHANNEL IMPROVEMENTS
(ALTERNATIVE 3)

	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1					
2					
3					
4	**CONSTRUCTION**				
5	MOBILIZATION	L.SUM	1	$100,000.00	$100,000
6	CHANNEL EXCAVATION (INCLUDES REMOVAL & DISPOSAL OF WASTE)	C.Y.	24,440	$2.50	$61,100
7	SOIL CEMENT CHANNEL (INCLUDES ACCESS MAINTENANCE ROAD)	C.Y.	24,440	$40.00	$977,600
8	SOIL CEMENT LEVEES	C.Y.	1,080	$40.00	$43,200
9	MISC. REMOVALS & ADJUSTMENTS (SIDE INLETS & SPILLWAYS)	L.SUM	1	$10,000.00	$10,000
10	MAJOR UTILITY RELOCATIONS	L.SUM	-	$0.00	$0
11	**SUBTOTAL (CONSTRUCTION)**				$1,191,900
12					
13					
14	**ENGINEERING (DESIGN & CONSTRUCTION MANAGEMENT) (15%)**	L.SUM	1	$178,790.00	$178,790
15	**CONTINGENCY (25%)**	L.SUM	1	$297,980.00	$297,980
16					
17					
18	**TOTAL (CONSTRUCTION, ENGINEERING & CONTINGENCY)**				**$1,668,670**
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31	**TOTAL ESTIMATED CAPITAL COSTS**				**$1,668,670**

Note: Estimated project capital costs are to a reconnaisance-level accuracy, as defined by the American Association of Cost Engineers.

ESTIMATES

Quantity Estimates

Basin Volumes

Basin	Elevation		Basin	Elevation		Basin Storage Volume					Ave. Outfall Rate
	Est. Actual (ft)	Conceptual (ft)	Depth, D (ft)	Surface Area (sq ft)	(acres)	Incremental (acre-ft)	Total (acre-ft)	Bottom-Up (acre-ft)	Below Weir (acre-ft)	Required (acre-ft)	(using 36 hrs) (cfs)
Guadalupe Basin										**173**	
Top of Basin	1341.78	100.00		1,041,400	24	0	0	340			
Weir Elevation	1334.78	93.00		922,500	21	158	158	182	0		
Bottom of Basin (Required)	**1325.78**	**84.00**	**16.0**	**841,400**	**19**	**182**	**340**	**0**	**182**		**62**
Outfall Elevation	1324.50	82.72		778,900	18	24	364	0	206		
North of Knox Basin										**1064**	
Top of Basin	1329.02	100.00		6,919,200	159	0	0	1655			
Weir Elevation	1325.31	96.29		6,764,900	155	583	583	1072	0		
Outfall Elevation	1318.41	89.39		6,507,300	149	1051	1634	21	1051		**354**
Bottom of Basin (Required)	**1318.27**	**89.25**	**10.8**	**6,477,000**	**149**	**21**	**1655**	**0**	**1072**		
Ray Basin										**887**	
Top of Basin	1360.50	100.00		4,964,900	114	0	0	1477			
Weir Elevation	1355.26	94.76		4,757,000	109	585	585	892	0		
Outfall Elevation	1346.80	86.30		4,428,600	102	892	1477	0	892		**300**
Bottom of Basin (Required)	**1346.80**	**86.30**	**13.7**	**4,428,600**	**102**	**0**	**1477**	**0**	**892**		
Rittenhouse Basin										**713**	
Top of Basin	1320.37	100.00		4,818,400	111	0	0	1181			
Weir Elevation	1316.26	95.89		4,631,600	106	446	446	735	0		
Outfall Elevation	**1309.10**	**88.73**	**11.3**	**4,311,900**	**99**	**735**	**1181**	**0**	**735**		**248**
Bottom of Basin (Required)	1309.10	88.73		4,311,900	99	0	1181	0	735		
Chandler Heights Basin										**2370**	
Top of Basin	1309.45	100.00		13,075,500	300	0	0	4089			
Weir Elevation	1303.67	94.22		12,606,300	289	1704	1704	2385	0		
Outfall Elevation	1296.67	87.22		12,043,100	276	1981	3684	404	1981		**666**
Bottom of Basin (Required)	**1295.20**	**85.75**	**14.3**	**11,925,500**	**274**	**404**	**4089**	**0**	**2385**		

Quantity Estimates for Side-Weirs

Detention Basin	Weir Quantities														
	Average Elevations				Channel SideSlope (X : 1) (ft)	Basin SideSlope (X : 1) (ft)	Maintenance Road Width (ft)	Estimated Weir Width (ft)	Toe to Toe Width for Outlet Length (ft)	Total Length of Concrete (ft)	Depth of Concrete (ft)	Width of Erosion Protection (ft)	Volume of Concrete (cy)	Weir Excavation (cy)	Area of Erosion Protection (sy)
	Top of Channel (ft)	Invert of Channel (ft)	Height of Weir,H (ft)	Top of Channel to Weir Crest, Hw (ft)											
Guadalupe Basin*	1342.59	1331.59	2.73	8.27	0	4	15	48.09	59.00	62	0.5	30	**247**	**2,325**	**717**
Knox Basin	1328.91	1318.91	6.40	3.60	3	4	15	40.20	85.00	87	0.5	30	**1,893**	**6,217**	**3,917**
Ray Basin	1360.14	1352.64	2.62	4.88	3	4	15	49.15	67.50	68	0.5	30	**233**	**1,305**	**617**
Rittenhouse (along EMF)	1319.93	1309.93	6.34	3.66	3	4	15	40.65	85.00	87	0.5	30	2,312	7,732	4,783
(along Ritt. Rd. Channel)	1321.57	1314.17	3.56	3.85	3	4	15	41.92		68	0.5	30	176	743	467
												Total	**2,488**	**8,475**	**5,250**
Chandler Heights (along EMF)	1309.34	1299.34	4.33	5.67	3	4	15	54.69	85.00	86	0.5	30	916	5,124	1,917
(along Queen Creek)	1325.86	1313.86	5.43	6.57	3	4	15	60.96		101	0.5	30	645	3,831	1,150
												Total	**1,561**	**8,955**	**3,067**
												Total	**6,422**	**27,277**	**13,568**

Quantity Estimates for Levee and Channel Improvements

Improvement	Begin Station	End Station	Total Length (ft)	Channel/Berm Configuration			Excavation Depth		Total	
				Depth (ft)	Sideslope (X:1)	Bottom Width (ft)	Sides (ft)	Bottom (ft)	X Section Area (s.f.)	Excavation Volume (c.y.)
Soil Cement Channel	24.957	25.49	2820	9	3	90	8	1	234	**24,440**
Soil Cement Berm	24.957	25.2	1290	1.5	3	12	0	0	11.25	**1,080**
									Total	**25,520**

APPENDIX D:
CONCEPT PLANS

11"x17" Concept Plans (not to scale)
(full size plans provided in map holders)

APPENDIX D:
CONCEPT PLANS

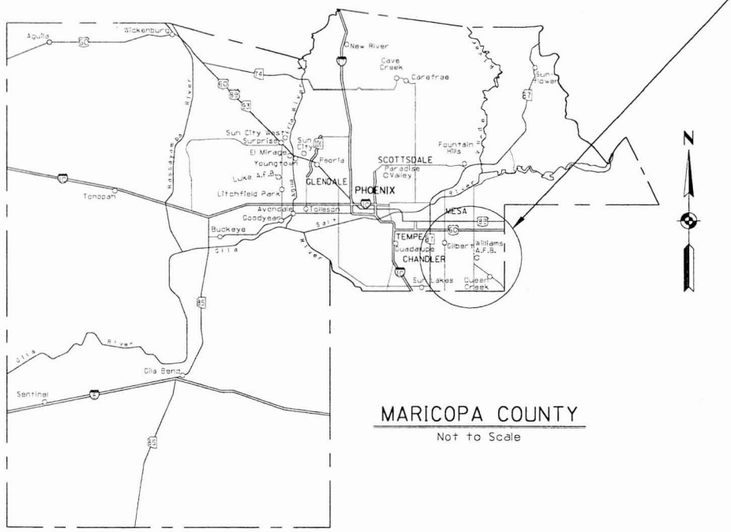
11"x17" Concept Plans (not to scale)
(full size plans provided in map holders)

THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

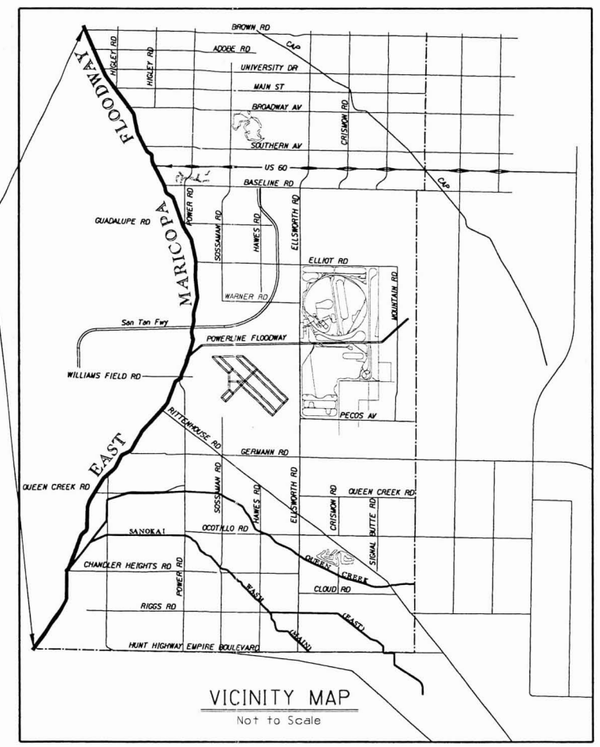
QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN
&
EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY
FCD 98-26

LEVEL III EMF CAPACITY MITIGATION STUDY
CONCEPTUAL PLANS

PROJECT NO. FCD 98-26
LEVEL III - EMF
CAPACITY MIT. STUDY



MARICOPA COUNTY
Not to Scale



VICINITY MAP
Not to Scale

SHEET INDEX

1.....COVER SHEET
2.....CONCEPTUAL PLAN - CHANDLER HEIGHTS DETENTION BASIN (DB)
3.....CONCEPTUAL PLAN - RITTENHOUSE DB
4.....CONCEPTUAL PLANS - KNOX & RAY DB
5.....CONCEPTUAL PLAN - GUADALUPE DB
6.....CONCEPTUAL DETAILS - INLET WEIRS & CROSS SECTIONS
7-8.....CONCEPTUAL PLAN & PROFILES - EMF IMPROVEMENTS (R.M. 24.957 TO R.M. 25.463)
9.....CONCEPTUAL EMF CHANNEL - TYPICAL SECTIONS

9.....TOTAL SHEETS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN & EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY - FCD 98-26

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	C. JOY/R. WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

HUITT-ZOLLARS
Engineering
Huitt-Zollars, Inc.
4742 N. 24TH Street, Suite 100, Phoenix, AZ 85016
Phone (602) 952-9923 Fax (602) 952-9924

COVER SHEET

SHEET 1 OF 9

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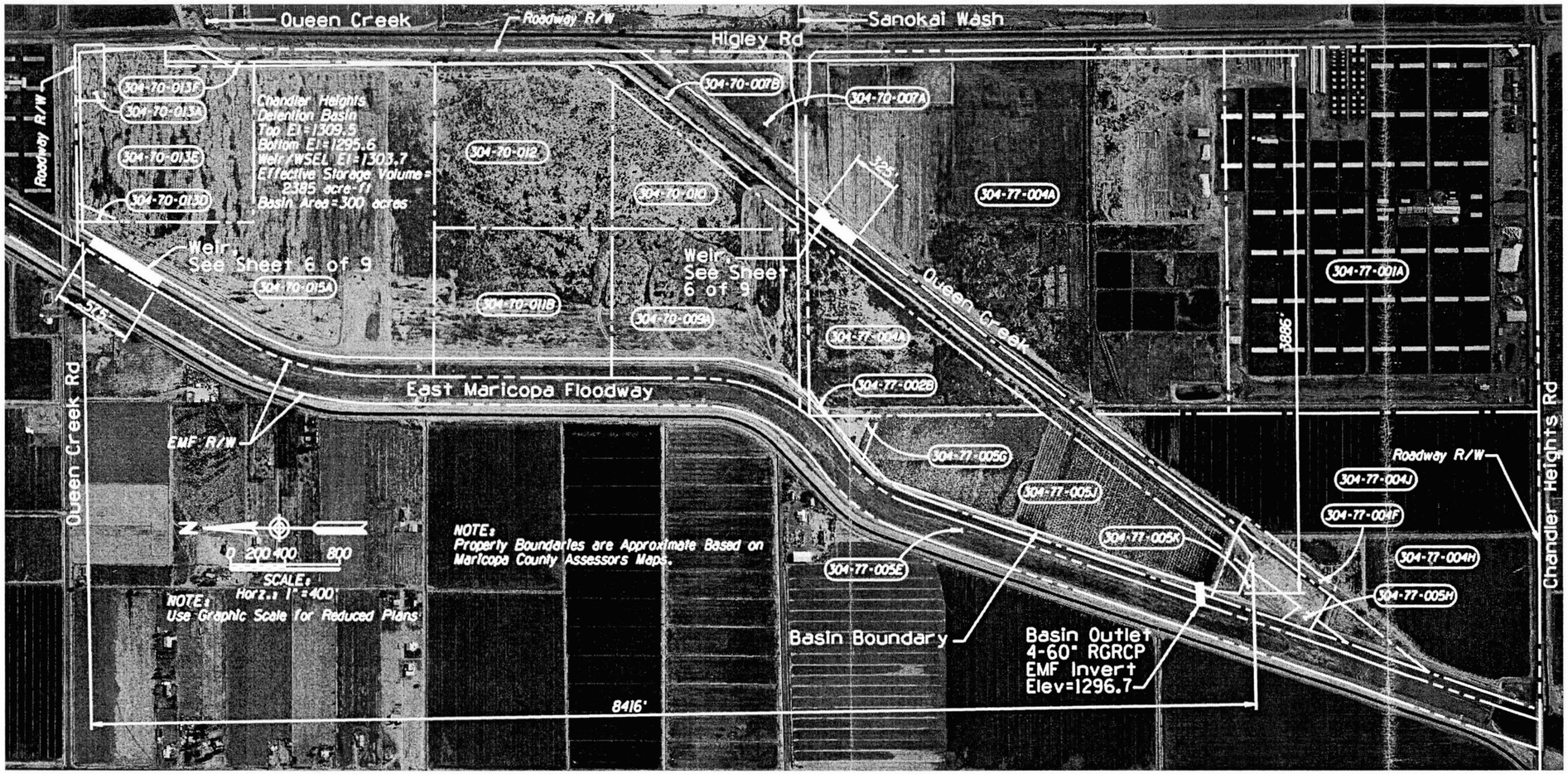

KNOWN FCDMC PROPERTIES

Parcel Numbers
304-70-009A
304-70-011B
304-70-012
304-70-013A
304-70-013D
304-70-013E
304-70-013F
304-70-015A
304-77-022B
304-77-004A
304-77-005G
304-77-005H
304-77-005K

IMPACTED PROPERTIES

Parcel Numbers	Parcel Numbers
304-70-009A	304-77-005H
304-70-010	304-77-005J
304-70-011B	304-77-005K
304-70-012	304-77-007B
304-70-013A	
304-70-013D	
304-70-013E	
304-70-013F	
304-70-015A	
304-77-002B	
304-77-004A	
304-77-004F	
304-77-005E	

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC
MASTER PLAN & EAST MARICOPA FLOODWAY
CAPACITY MITIGATION STUDY - FCD 98-26

	BY	DATE
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DRAWN	C. JOY/ R. WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/11/00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

HUITT-ZOLLARS
Huitt-Zollars, Inc. Engineering
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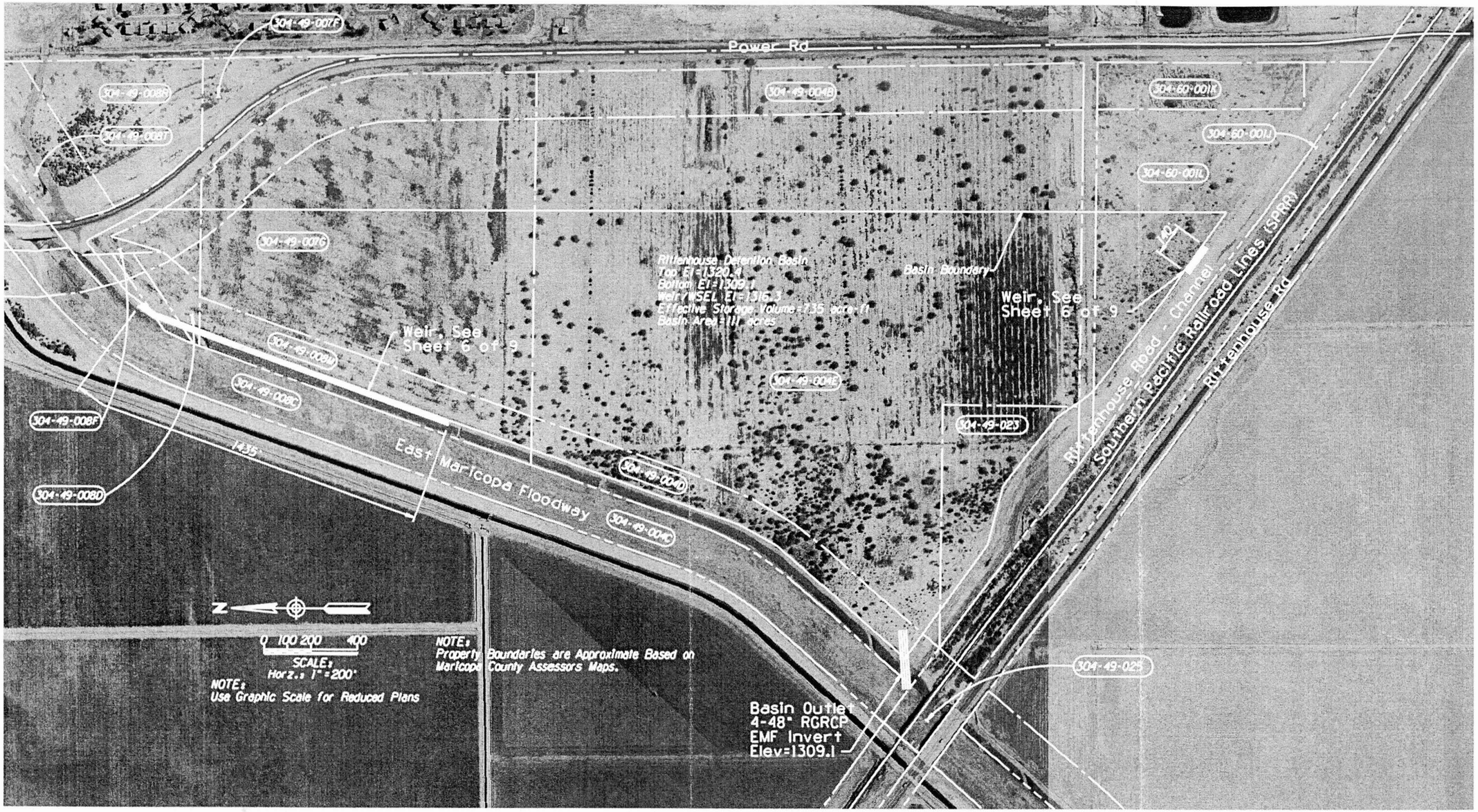
Phone: (602) 952-9933 Fax: (602) 952-9934

CONCEPTUAL PLAN - CHANDLER HEIGHTS
DETENTION BASIN

SHEET 2 OF 9



KNOWN FCDMC PROPERTIES

Parcel Numbers
304-49-004C
304-49-004D
304-49-008C
304-49-008D
304-49-025

IMPACTED PROPERTIES

Parcel Numbers
304-49-004C
304-49-004D
304-49-004E
304-49-007G
304-49-008C
304-49-008D
304-49-008F
304-49-008M
304-49-023
304-60-001L

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN & EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY - FCD 98-26

Registered Professional Engineer (Civil) CERTIFICATE 12250 FRED K. DUREN, JR. Date Signed 02/14/00 ARIZONA, U.S.A.

	BY	DATE
DESIGNED	CHARLIE JOY	09/01/99
DRAWN	C. JOY/R. WIETZEMA	09/01/99
CHECKED	FRED DUREN	02/14/00

HULITT-ZOLLARS
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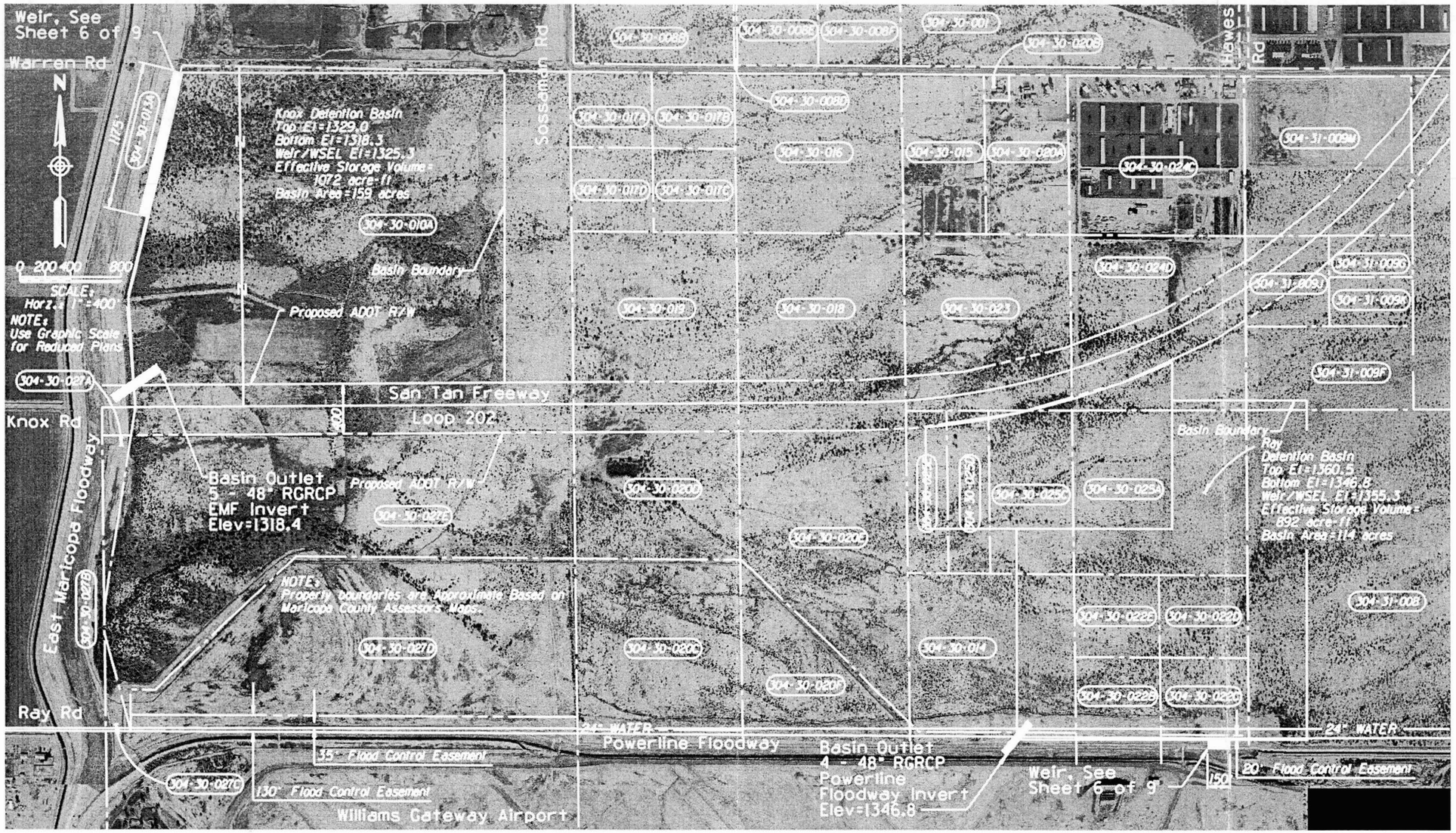
CONCEPTUAL PLAN - RITTENHOUSE DETENTION BASIN

SHEET 3 OF 9



KNOWN FCDMC PROPERTIES

Parcel Numbers
None

KNOX DETENTION BASIN IMPACTED PROPERTIES

Parcel Numbers
304-30-010A
304-30-013A

RAY DETENTION BASIN IMPACTED PROPERTIES

Parcel Numbers
304-30-014
304-30-022B
304-30-022C
304-30-022D
304-30-022E
304-30-024D
304-30-025A
304-30-025C
304-31-008
304-30-009F

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN & EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY - FCD 98-26

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CHECKED	FRED DUREN	02/11/00

REGISTERED PROFESSIONAL ENGINEER 12250 FRED K. DUREN, JR. ARIZONA, U.S.A.

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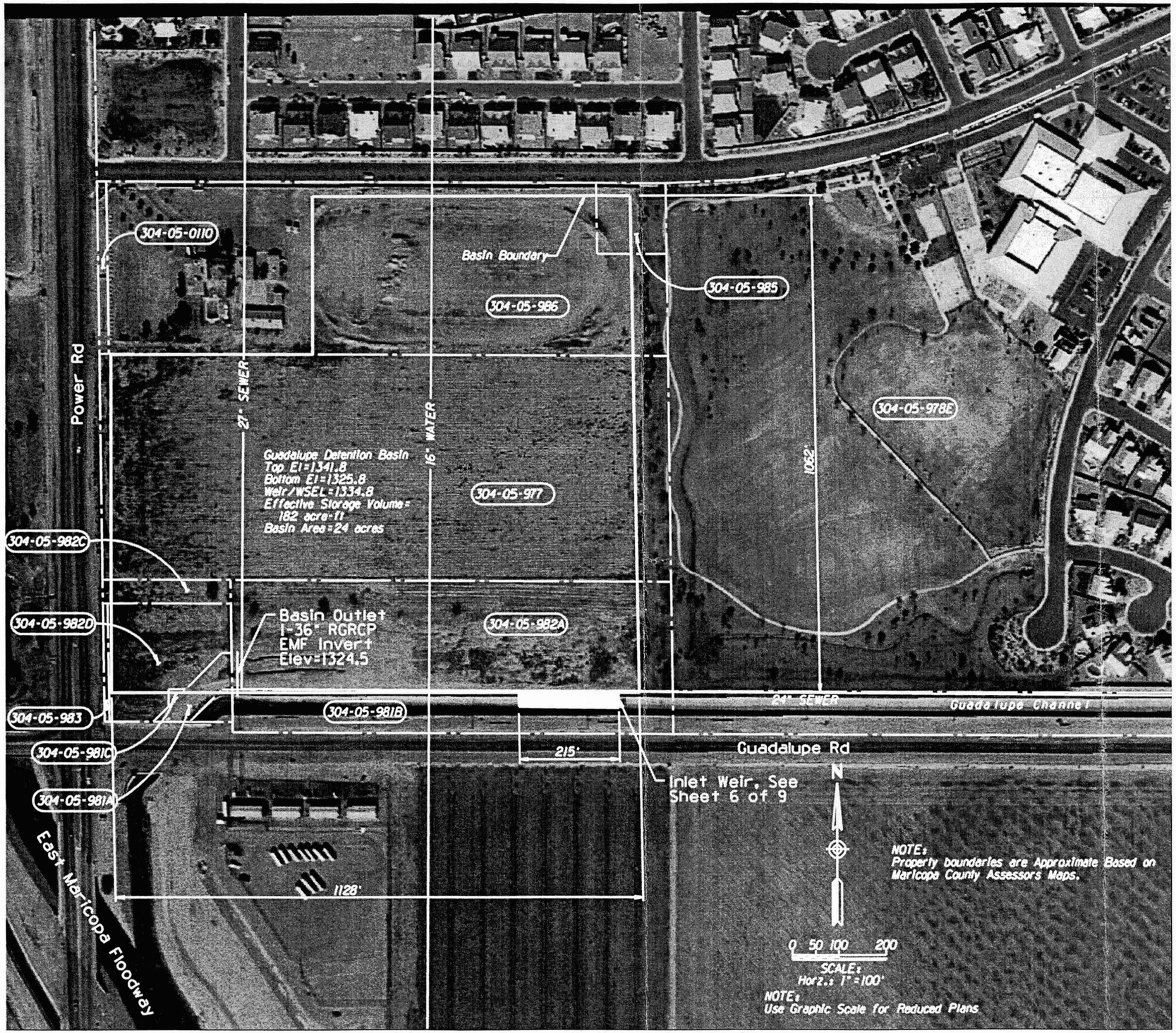
CONCEPTUAL PLANS - KNOX & RAY DETENTION BASIN

SHEET 4 OF 9



KNOWN FCDMC PROPERTIES

Parcel Numbers
304-05-981A
304-05-981B
304-05-982A
304-05-982C

IMPACTED PROPERTIES

Parcel Numbers
304-05-977
304-05-981A
304-05-981B
304-05-981C
304-05-982A
304-05-982C
304-05-982D
304-05-985
304-05-986

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN & EAST MARICOPA FLOODWAY CAPACITY MITIGATION STUDY - FCD 98-26

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4040 N. 44th Street, Suite 100, Phoenix, AZ 85018
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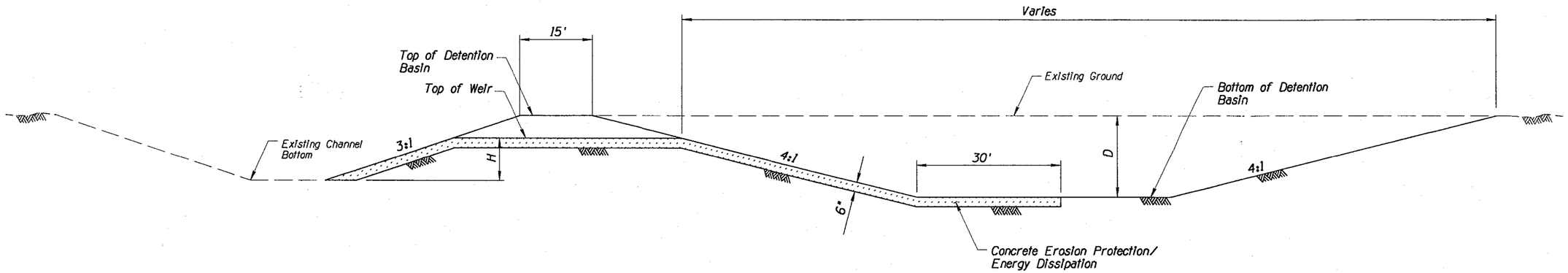
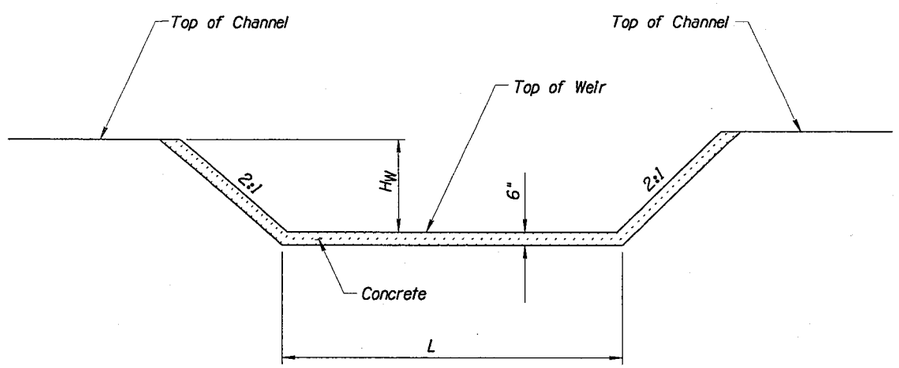
CONCEPTUAL PLAN - GUADALUPE DETENTION BASIN

SHEET 5 OF 9



DETENTION BASIN CROSS SECTION (TYPICAL)



WEIR DIMENSIONS (TYPICAL)

DETENTION BASIN	L^1	H^2	$H_W{}^2$	D^3
Guadalupe (Guadalupe Channel)	215'	2.7'	8.3'	16.0'
Knox (EMF)	1175'	6.4'	3.6'	10.8'
Ray (Powerline Floodway)	185'	2.6'	4.9'	13.7'
Rittenhouse (EMF)	1435'	6.3'	3.7'	11.3'
Rittenhouse (Rittenhouse Channel)	140'	2.6'	3.8'	-
Chandler Heights (EMF)	575'	4.3'	5.7'	14.3'
Chandler Heights (Queen Creek)	325'	5.4'	6.6'	-

1 - EMF Capacity Mitigation Study Report
Appendix B: Weir Calculations
"Estimate of Side-Weir Lengths Table"

2 - EMF Capacity Mitigation Study Report
Appendix C: Estimates
"Quantity Estimates for Side-Weir Table"

3 - EMF Capacity Mitigation Study Report
Appendix C: Estimates
"Basin Volumes Table"

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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CONCEPTUAL DETAILS - INLET WEIRS & CROSS SECTIONS

SHEET 6 OF 9

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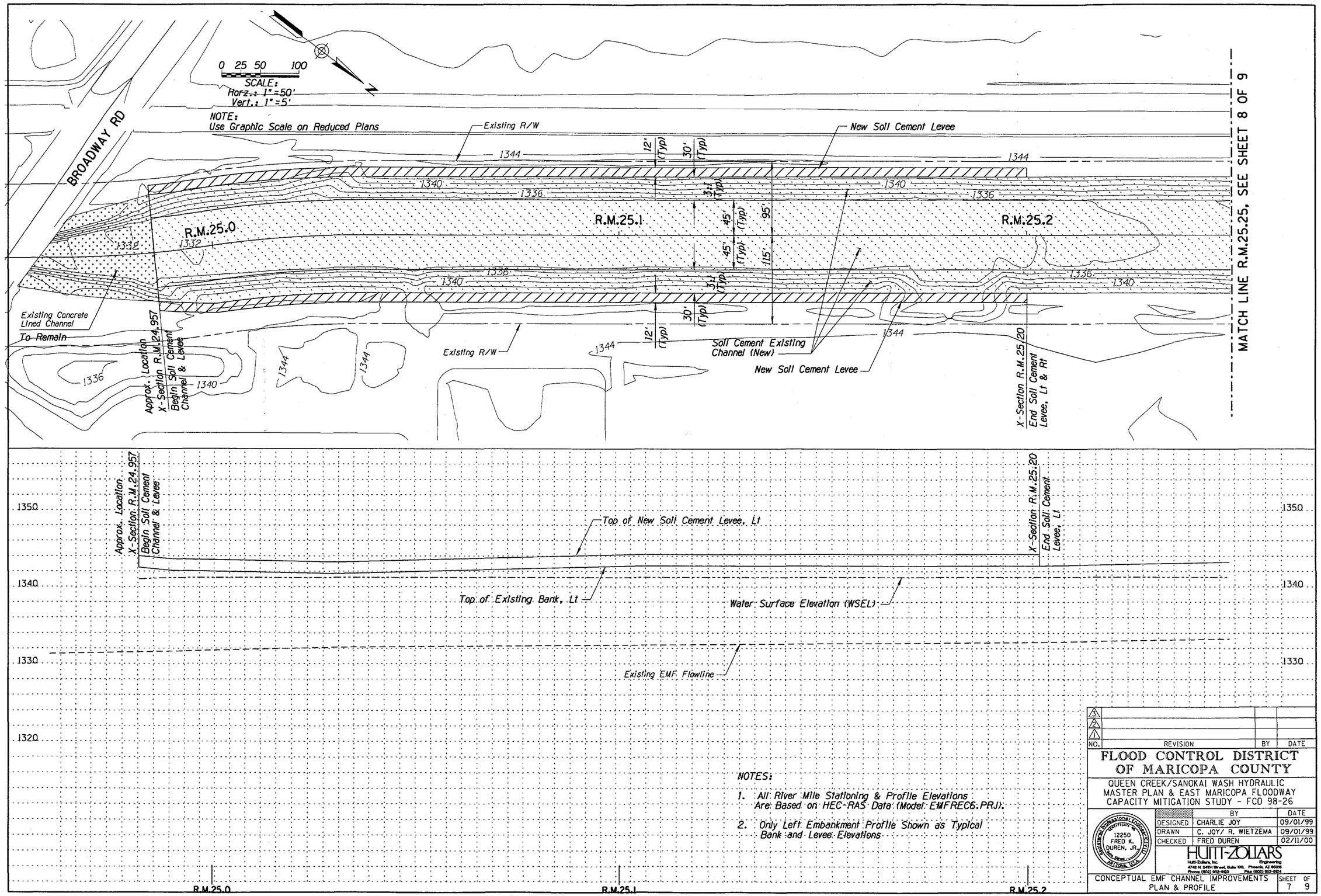

NOTES:

1. All River Mile Stationing & Profile Elevations Are Based on HEC-RAS Data (Model: EMFREC6.PRJ).
2. Only Left Embankment Profile Shown as Typical Bank and Levee Elevations

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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CONCEPTUAL EMF CHANNEL IMPROVEMENTS PLAN & PROFILE

SHEET 7 OF 9

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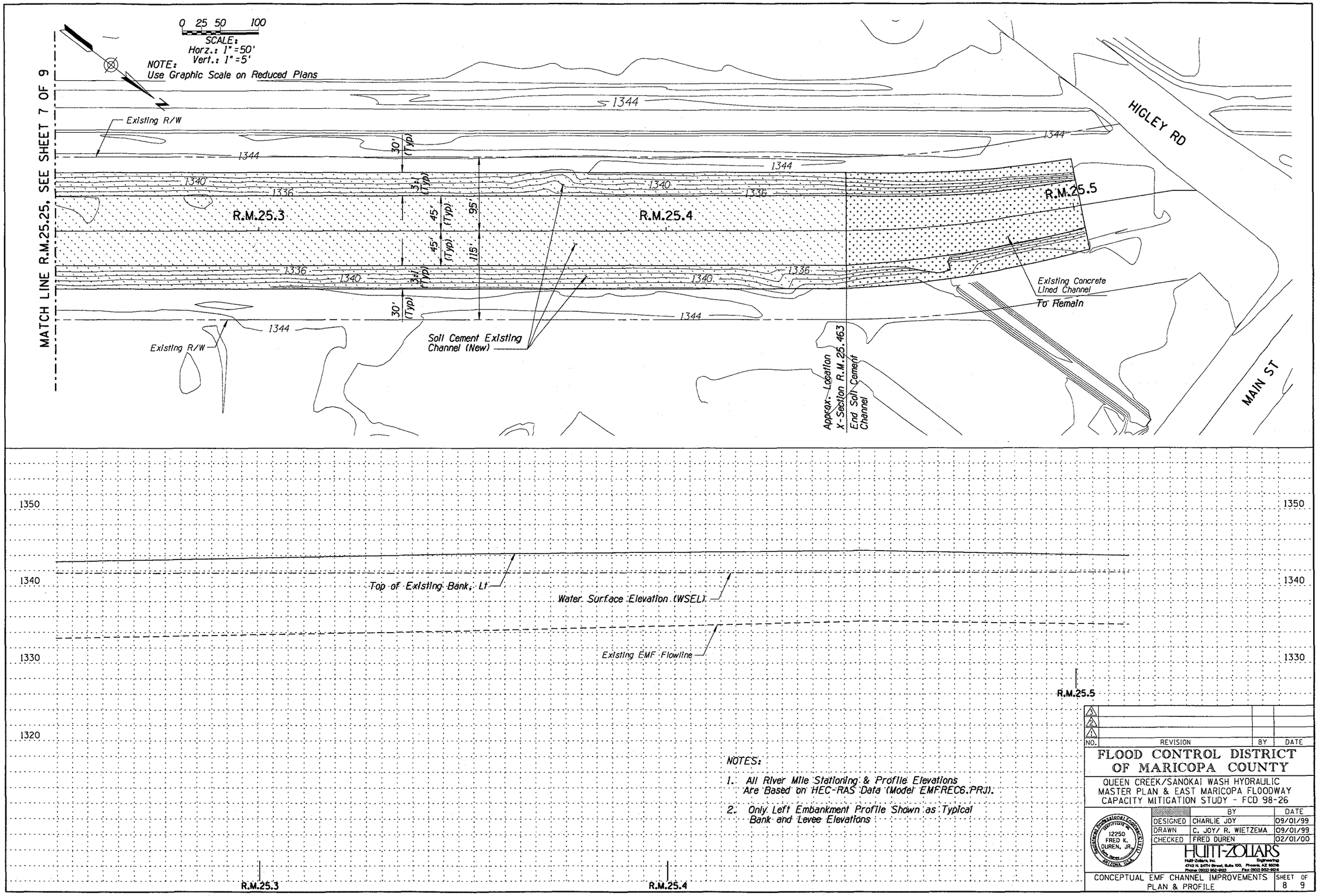

NOTES:

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2. Only Left Embankment Profile Shown as Typical Bank and Levee Elevations

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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CONCEPTUAL EMF CHANNEL IMPROVEMENTS PLAN & PROFILE

SHEET 8 OF 9

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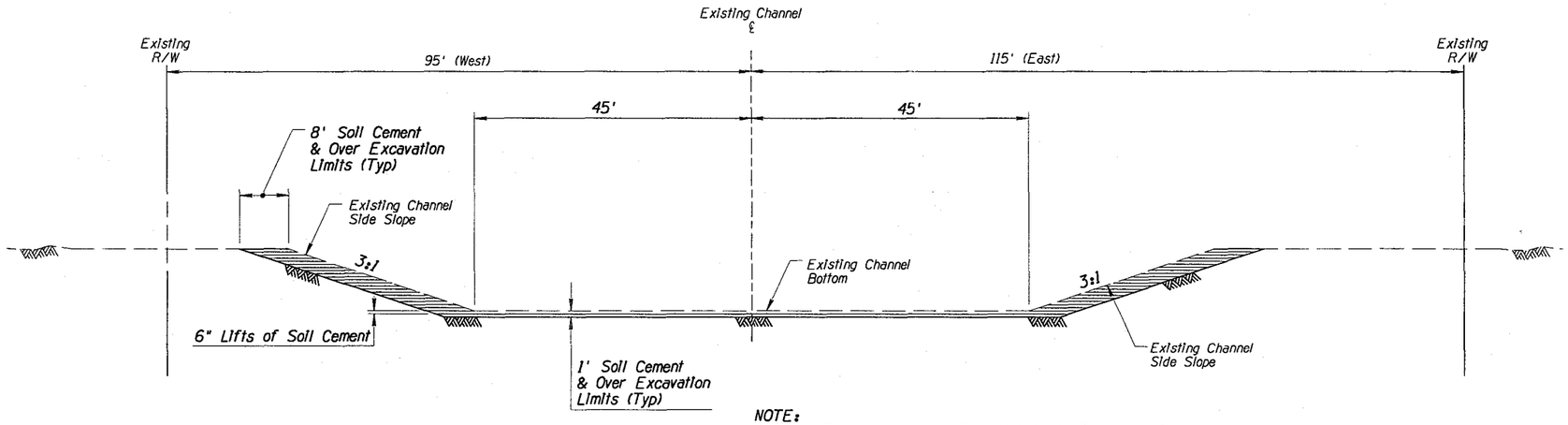
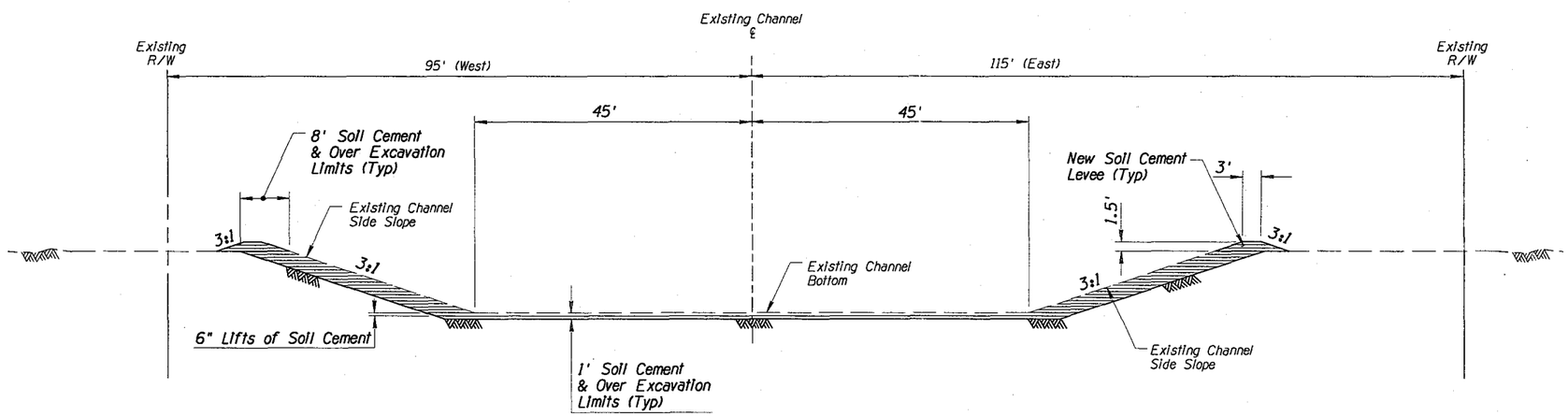


NOTE:
Existing Drainage Inlets & Pipe Outlets to Remain In Place.

TYPICAL SECTION
RIVER MILE 25.20 to 25.463



NOTE:
Existing Drainage Inlets & Pipe Outlets to Remain In Place.

TYPICAL SECTION
RIVER MILE 24.957 to 25.20

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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CONCEPTUAL EMF CHANNEL IMPROVEMENTS
TYPICAL SECTIONS

SHEET 9 OF 9

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