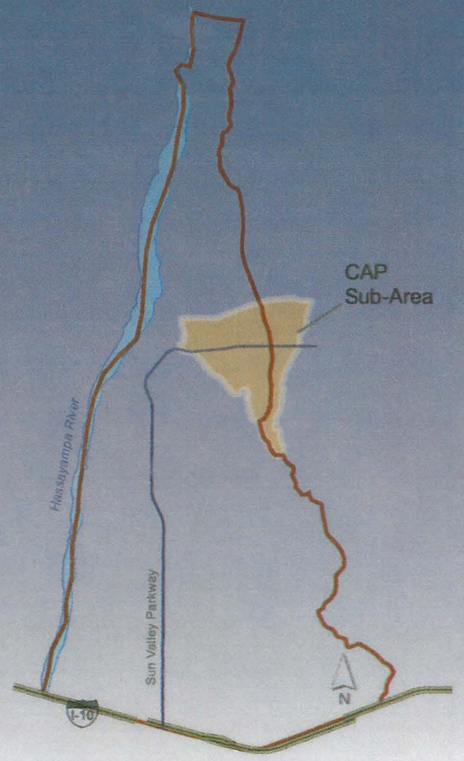
BOOK 13 OF 30

Sun Valley Area Drainage Master Plan



Step 3
Recommended Alternative Report

Volume 2
PART 3 OF 3

CAP
SUB-AREA

December 2006

Flood Control District of Maricopa County

A211.214

DATE: May 8, 2007

TO: Bing Zhao, PE, PhD/FCDMC

FROM: Jon Fuller, PE

RE: Sun Valley ADMP – Corridor Wall Concept Sketch

CC: Valerie Swick/FCDMC

The concept sketch shown in the Sun Valley ADMP final reports inaccurately depicts toe-down measured from the base of the flood wall. In fact, toe-down was measured from the channel invert as shown in the sketch below. A corrected sketch is provided below.

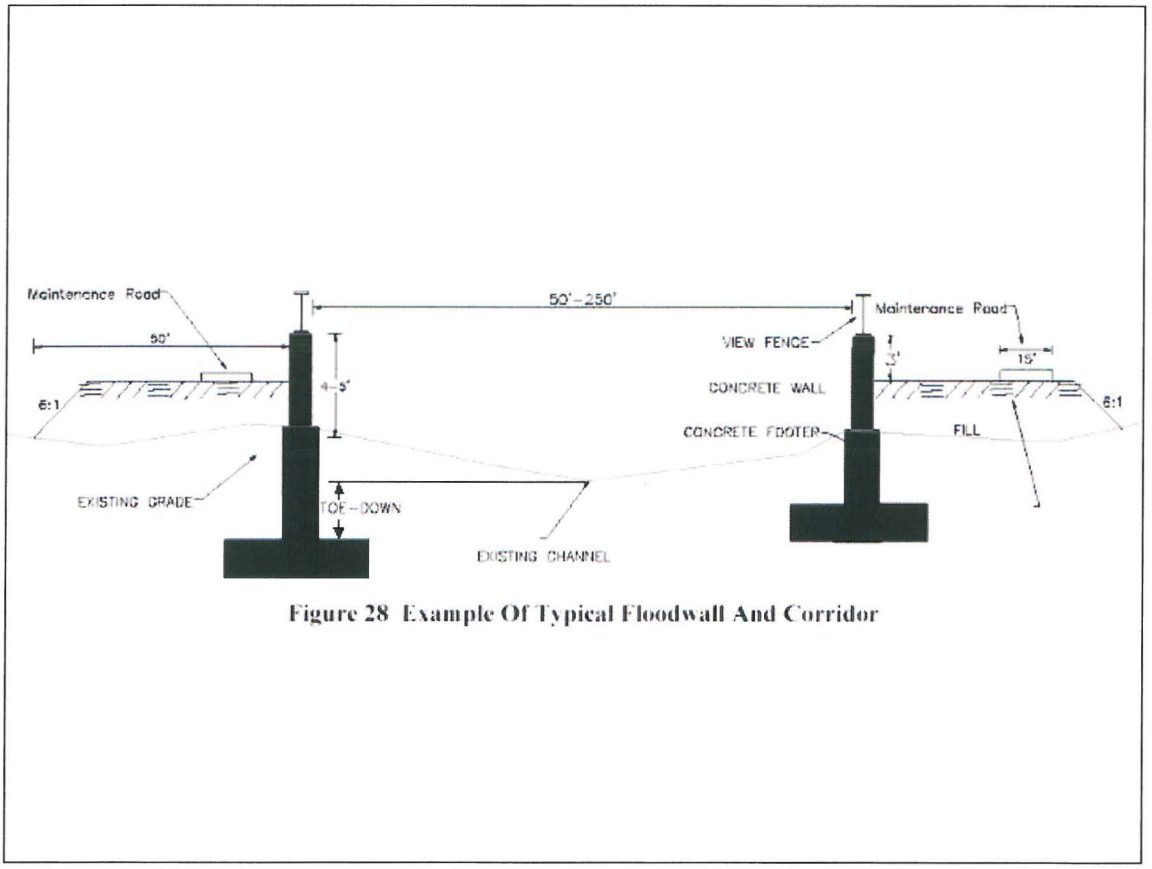


Figure 28 Example Of Typical Floodwall And Corridor

SUN VALLEY AREA DRAINAGE MASTER PLAN

STEP 3 RECOMMENDED ALTERNATIVE REPORT
CAP SUB-AREA
VOLUME 2

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

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December 2006

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Appendix A: Design Analyses – Fan System 1/2

Appendix B: Miscellaneous Additional Materials

ENCLOSED DATA DISC INCLUDES:

- Digital Copy of Report in PDF Format
- GIS Shapefiles of Project Elements
- Excel Files of Design Analyses
- HEC-1 Model Files
- MCDOT As-Builts for Sun Valley Parkway Culverts & Channel

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1 ABSTRACT / EXECUTIVE SUMMARY

The Sun Valley Area Drainage Master Plan (SVADMP) is a regional flood control master plan developed for a 180 square mile area in western Maricopa County. The area lies between the White Tank Mountains and the Hassayampa River mostly within the Town of Buckeye. The mountains drain on to a large sloping alluvial area of coalescing alluvial fans, or bajada (Figure 1). Alluvial fans are sloping, fan-shaped landforms created over long periods of time by the deposition of sediment. Alluvial fan landforms are commonly located at the base of mountain ranges in the arid and semi-arid American Southwest.

Figure 1 Example Of Sun Valley Piedmont In The Wagner Sub-Area

The highly dynamic nature of alluvial fan flooding presents significant challenges for the design of engineered flood control measures. The designed drainage infrastructure must effectively and efficiently convey 100-year discharges without creating unwanted sediment deposition or erosion. Further complexity is added as flood hazards change in type and severity with geographic position on the fan.

Structural and non-structural alternatives were refined and costs estimated as part of the Step 3 Recommended Alternative development for the Sun Valley Area Drainage Master Plan (SVADMP). This is the final step of a three-step process to develop a drainage master plan for the Sun Valley area. Four flood control alternative strategies were identified in Step 1 of the ADMP process. Those four strategies were further refined and evaluated in Step 2. The refined alternatives included both non-structural and environmentally friendly, structural flood control measures that are designed to be complementary to the visual character of the study area. Step 3 is a further refinement of the plan elements and cost estimates of the recommended alternative resulting from the Step 2 evaluation process. Special attention has been given to maximizing non-structural, floodplain management approaches along the preferred corridor alignments. Stakeholders and the public have been consulted as to their feedback in an attempt to incorporate existing and imminent developer plans into the drainage master plan for the Sun Valley area. Concept implementation and maintenance plans are also provided with the Step 3 Recommended Alternative.

Figure 2 View Of Skyline Fan In The FRS No. 2 & 3 Sub-Area

In order to achieve the refinement of the recommended alternative, the study area which had been divided into seven geographic sub-areas in Step 2, was further broken up into individual alluvial fan systems. Figure 2 shows an example of the Skyline Fan System in the FRS No. 2 & 3 sub-area. This report presents the results for the CAP sub-area and its one alluvial fan system; Fan System 1 & 2. The other sub-areas within the ADMP study area are presented in separate similar reports. Step 3 of the ADMP concentrated on refinement of the design and cost estimates of the on-line detention basins at the fan apices as well as the use of walled-levee corridors for the conveyance of floodwater downstream. Non-structural, floodplain management approaches were incorporated wherever possible.

The results for the CAP sub-area include two on-line detention basins, two off-line detention basins, and 6.8 miles of walled-levee corridors. The total right of way area needed for the CAP fan systems is 267 acres. The estimated total cost of the recommended alternative for the CAP sub-area is $59.1 million. Implementation is suggested such that the apex detention basins are constructed first. Funding will likely come through a combination of cost-sharing from public and private sources including possible impact fees associated with new master planned communities in the area.

2 INTRODUCTION

2.1 Report Organization

The Step 3 Recommended Alternative Report is presented in seven (7) volumes similar to the Step 2 report. Volume 1 provides an overview of the ADMP, explains the ADMP process, and summarizes the recommended alternative for each sub-area and the entire study area. Volume 1 also provides a discussion of general area-wide flood control issues and potential solutions as well as specific issues and potential solutions for the area north of the Central Arizona Project Canal. The so-called North of CAP sub-area is included in Volume 1 for two reasons: first, the sub-area is not dominated by large alluvial fans like the piedmont sub-areas in the remainder of the study area; second, the recommendations for the North of CAP sub-area are predominantly non-structural in nature.

Volumes 2 through 7 present the recommended alternatives for the piedmont sub-areas as follows:

2) CAP (this volume),

3) Wagner Wash (Volume 3),

4) Hassayampa River (Volume 4),

5) White Tank Wash (Volume 5),

6) FRS #1 (Volume 6), and

7) FRS #2 & #3 (Volume 7).

Volumes 2 through 7 also include site specific data, hydraulic analyses, and cost estimates. It is intended that each Volume of the Step 3 report be able to stand alone so that a reader, such as an interested stakeholder, unfamiliar with the ADMP, or uninterested in other sub-areas, can understand the overall study as well as the details of an individual sub-area of particular interest to them. Excessive detail associated with the design calculations are left out of Volume 1 in order to provide a more digestible document for the reader interested in the Recommended Alternatives Analysis as a whole.

The advantages of this type of report organization are:

- The reduction of reproducible materials required for interested users or stakeholders.
- It provides a condensed overview of the ADMP process and the Recommended Alternative.
- It narrows the focus to a specific sub-area while still providing an overall comprehensive summary of the Step 3 process and recommended alternative descriptions.

2.2 Project Background

The Sun Valley area, located in western Maricopa County, Arizona, is presently experiencing the first stages of accelerated urbanization (Figure 3). Future development is anticipated to occur on the largely undisturbed alluvial fans and piedmont surfaces comprising the western slope of the White Tank Mountains (Figure 4). The upland areas and adjacent watershed drain to the Hassayampa River to the west and the Buckeye Flood Retarding Structure (FRS) Numbers 1, 2, & 3 along Interstate 10 to the south.

The purpose of the Sun Valley Area Drainage Master Plan (SVADMP) is to develop a conceptual drainage plan to serve as a roadmap that jurisdictional authorities and developers can use in planning flood control measures to mitigate flood hazards up to the 100-year event in the area. The SVADMP incorporates development plans for the area and jurisdictional drainage policies to develop a preferred regional flood control solution.

The major objectives of the project include the following:

- Preparation of approximate alluvial fan floodplain delineations, meeting Federal Emergency Management Agency (FEMA) and Flood Control District of Maricopa County (District) standards, for those alluvial fans in the study area not previously delineated (presented in six separate Technical Data Notebooks);
- Plan regional flood hazard mitigation;
- Coordination between the ADMP regional flood control measures and the design of drainage features within the master planned community developments within the study area;
- Preparation of preliminary design of flood control facilities in areas not within master planned communities;
- Design flood control solutions to complement the character and preserve the beauty of the natural desert landscapes of the study area and achieve consistency with the Flood Control District's *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects* (FCDMC, 1993).

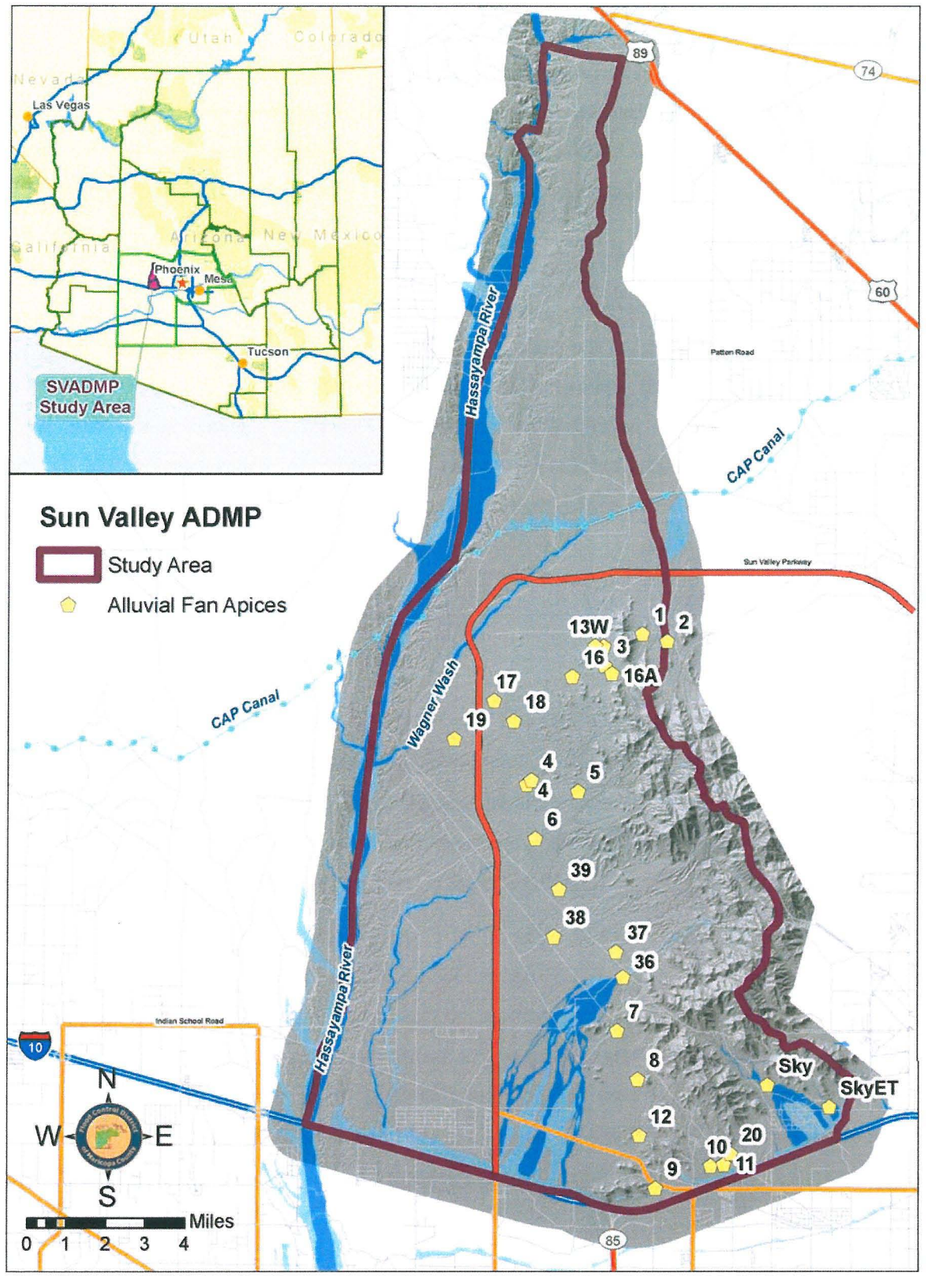

Figure 3 Location Of Study Area

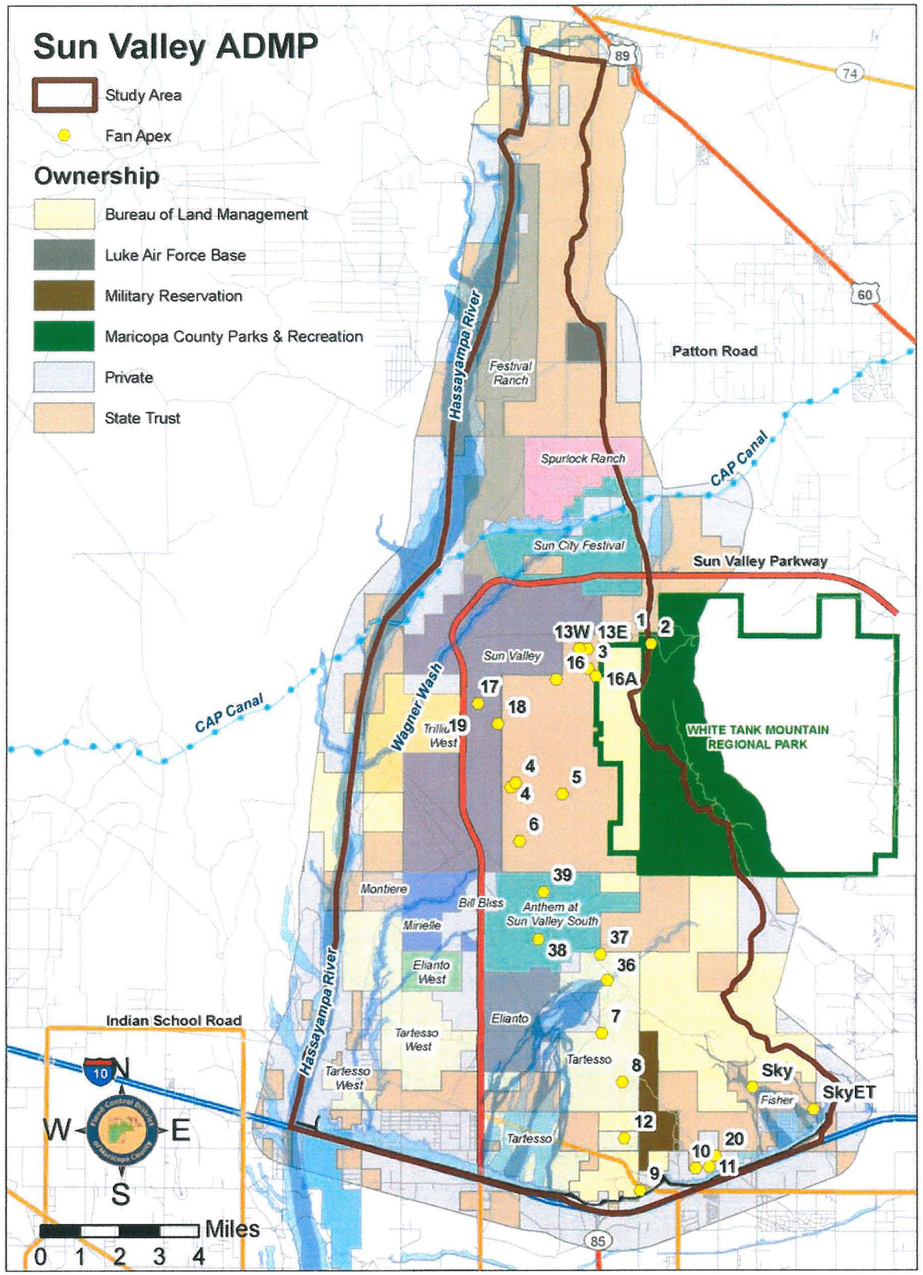

Figure 4 Future Developments In The ADMP Study Area

Previously, the Phase I Buckeye/Sun Valley Area Drainage Master Study (ADMS), conducted by PBS&J, documented and analyzed existing conditions and identified drainage and flooding problems in the study area for the purpose of initial formulation of flood protection alternatives. The Phase II Sun Valley Area Drainage Master Plan builds on the Phase I findings by employing a 3-step process with the goal of developing a Recommended Alternative, consisting of both environmentally friendly structural and non-structural measures, to address flood hazards in the study area. Figure 5 shows a flowchart illustrating the SVADMP alternatives development process.

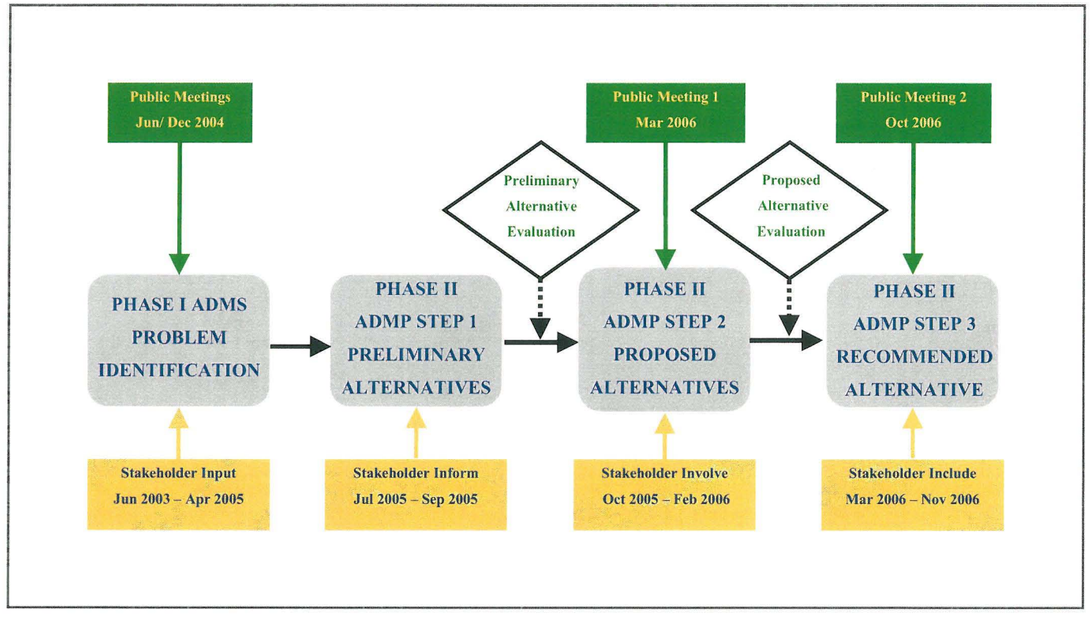

Figure 5 Alternatives Development Process

This report is part of the Phase II ADMP Step 3 Recommended Alternative process which focuses on further refinement of the recommendations of the Step 2 Proposed Alternatives Analysis (JEF, 2006b). The purpose of this study is to present the Step 3 Recommended Alternative for the CAP sub-area in support of the SVADMP.

Based on the recommendations resulting from Step 2 process, the conceptual design of regional, whole-fan solutions were developed. The recommended alternative for the CAP sub-area was based on a modification of the B1 Alternative from Step 2. It is composed of two large, on-line detention basins near the alluvial fan apices, two off-line detention basins near Sun Valley Parkway, and walled-levee corridors downstream. Cost estimates are also provided. The costs include engineering design, major construction items, right-of-way acquisition, major utility relocations, landscape aesthetic treatment requirements, and maintenance costs for a 50-year design life.

2.3 Authority for Study

The current study was authorized by the Flood Control District of Maricopa County (District) under contract FCD 2004C049 as part of the scope of services for the SVADMP. The Town of Buckeye, Arizona was an important project participant. The ADMP was performed by JE Fuller/ Hydrology & Geomorphology, Inc., with subconsultants C.L. Williams Consulting, Inc., Logan Simpson Design, Inc., AMEC Earth & Environmental, EDAW Inc., and Richard H. French, Ph.D., P.E.

2.4 Location of Study Area

Figure 3 shows the location of the study area. The study area has a total watershed area of 183 square miles. Most of the study area is located within the Town of Buckeye. The study area is bounded by the White Tank Mountains and the Trilby Wash watershed on the east, the Hassayampa River on the west, the Buckeye Flood Retarding Structures on the south, and Gates Road to the north. The watercourses within the study area are all tributaries to the Hassayampa River or the Buckeye Flood Retarding Structures, except Fan 2 in the CAP sub-area, which is a tributary to Trilby Wash.

3 ADMP Process

3.1 Process Overview

The highly dynamic nature of alluvial fan flooding presents significant challenges for the design of engineered flood control measures. The designed drainage infrastructure must effectively and efficiently convey 100-year discharges without creating unwanted sediment aggradation or degradation. Further complexity is added as flood hazards change in type and severity with geographic position on the fan whether the area of interest is located at the apex, mid-fan, or near the outfall; and if the flood event is less than the 100-year event.

Known problems associated with alluvial fan flooding include spatial uncertainty of the flow distribution, lack of containment within the relatively flat topographic relief laterally across the fan, avulsive movement of defined flow paths, flooding along undefined flow paths, sheet flooding, distributary flow, scour, and landform aggradation. In addition, steep channel slopes between fan apices and fan toes result in high flow velocities with the energy to move significant volumes of sediment and debris during large floods. Figure 6 shows an example of widespread channel avulsion on Fan 36 in the FRS No. 1 sub-area. A large flood in August 1951 created all the bright colored new channels seen in the aerial photo from 1954. Compare that to the relative absence of large channels visible today.

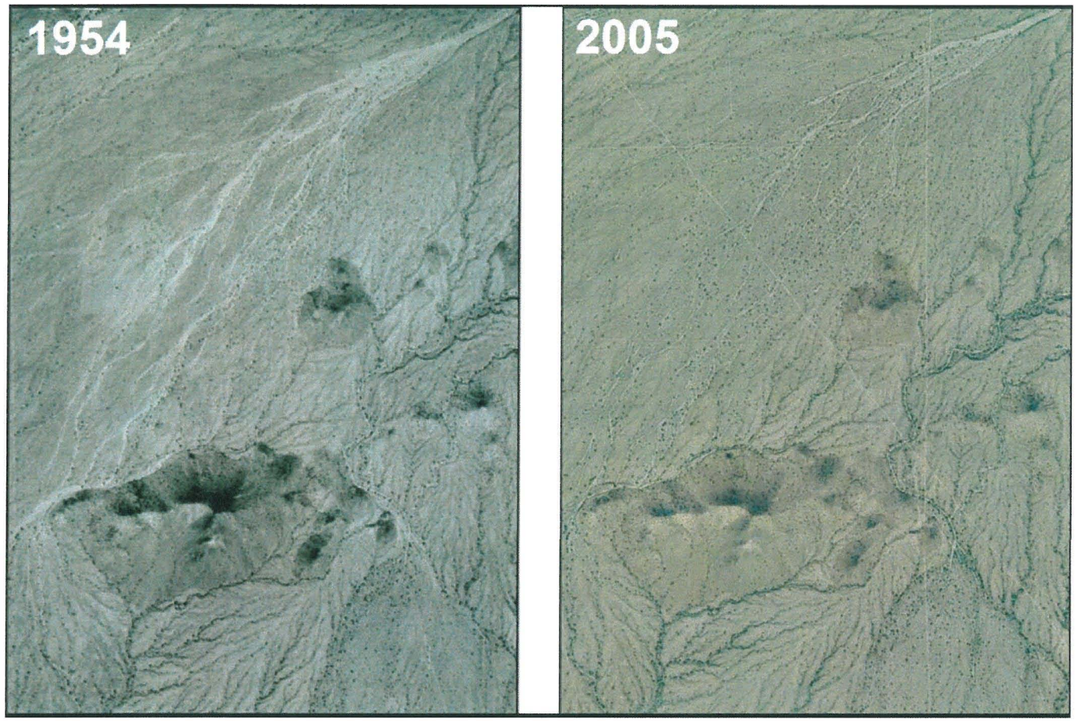

Figure 6 Comparison Of Active Fan Area For Fan 36 - 1954 Vs. 2005

The Step 1 Preliminary Alternatives Evaluation (JEF, 2006a) presented the outline for the alternatives to be analyzed as part of the Step 2 Proposed Alternatives Evaluation (JEF, 2006b) and refined during the Step 3 Recommended Alternatives process. The Step 1 Preliminary Alternatives Evaluation process identified five areas within each fan starting from upstream to downstream: 1) Apex, 2) Up Fan, 3) Parkway, 4) Down Fan, and 5) Outfall (see Figure 7). Flooding and drainage characteristics vary for each of these component areas of the alluvial fan landform. This classification permits the design process to identify potential flood control measures specific to each of these areas which, in combination, comprise a whole-fan solution. Whole-fan solutions were preferred because they provide a regional flood control system which acts as a major trunk system for the adjacent watersheds. The trunk system is designed to convey runoff and sediment inflows from the apex plus that generated from the fan surface itself. Note that most, but not all, of the alluvial fans considered in this study have all the five component areas. However, the overall design considerations are similar for all the fans.

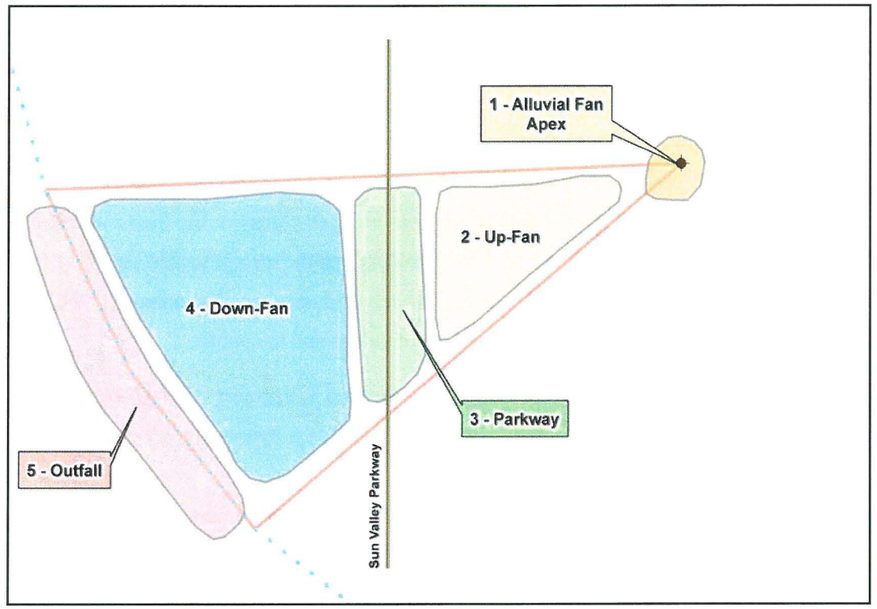

Figure 7 Fan Area Classification

The Step 1 process identified the following design strategies: 1) Conveyance, 2) Storage, 3) Management, and 4) No Measure. These strategies apply to each of the five areas starting from the apex to the outfall and formed the basis of the Preliminary Alternatives. Four major alternatives were identified based on these strategies: Alternative A, Alternative B, Alternative C, and Alternative D. These four alternatives consist of different selections of strategies for each of the different areas from apex to outfall. Each alternative can be described as a particular set of strategies applicable to different areas of the fan. Those four alternatives were considered as part of the Step 2 Proposed Alternatives Evaluation process.

The Alternatives A, B, C, and D formulated in the Step 2 process consisted of particular combinations of detention basins, conveyance corridors, developer-planned drainage improvements, and 'no measure' options applied to different areas of the alluvial fan starting upstream at the apex to the downstream outfall. During the Step 2 process, Alternative B was further subdivided into five similar, but unique alternatives named B1, B2, B3, B4, and B5. This was done to evaluate: 1) the influence of size and type of the apex basin on the design of the downfan system; 2) different channel cross-section types; and 3) various channel alignments.

The result of the Step 2 Proposed Alternatives Evaluation was the selection of a preference for large on-line detention basins (Alternative B1) with leveed downstream corridors. In addition, where multiple alignments were possible, a greater number of paths was preferred to fewer for connectivity and environmental reasons (Alternative B4-3). For the CAP sub-area that means the selection of separate corridor paths for Fan 1 and Fan 2. A new

additional corridor was added connecting Fan 2 with Fan 1 in Step 3. Therefore Fan 1 and 2 are treated as a single "fan system." The new corridor was added to reflect the more general preference for "multiple corridors" resulting from the Step 2 evaluation process. It also allows for better control of one additional tributary channel emanating from the White Tank Mountain Regional Park. The additional corridor was also one of the sub-area specific recommendations from Step 2 for the Step 3 refinements.

In addition to the selection of large, on-line basins with multiple corridors, the Step 2 alternatives evaluation also identified a number of items for consideration in the refinement of the recommended alterative for Step 3 for the CAP sub-area. The recommendations were based on input received during the development of the proposed alternatives, the team evaluation process, and input from stakeholders and the public.

- There is a need to balance earthwork by project. For Step 3, a project will be considered the apex-to-outfall system for an individual alluvial fan (or fan complex if hydraulically connected, referred to as 'fan system' in this report).
- Existing channel conveyance should be quantified and incorporated into the recommended alternative designs. This could result in the elimination of some levee/wall reaches where the existing conveyance is adequate or natural lateral containment exists on one or more sides of the corridor. This will also maximize the use of non-structural or nearly non-structural reach management elements.
- The required landscape aesthetic treatment requirements should be included explicitly in the hydrologic and hydraulic design.
- Enhancement to the existing Sun Valley Parkway channel should be investigated and incorporated into the recommended alternative for Fan 1. This could include landscape aesthetic and/or capacity increases to remove the need for the off-line detention basins proposed along the channel.
- Incorporate the specific sediment data collected in Step 2 into the design calculations.
- Identify the area benefited using the Stage 3 delineations.
- Refine the design details including riprap sizing calculations and the evaluation of basin inlet structures (e.g., energy dissipaters, collection dikes/ ditches, off-line basin outlet structures, etc.)
- Refine the hydrologic models to include more HEC-1 subreaches.
- Discretize the quantities and costs by individual fan system (by "project").

All of these items have been incorporated into the Step 3 refinements as discussed in the remainder of this report. The refinements and designs of the other sub-areas are presented in separate reports (Volumes 3-7).

In addition to the recommendations for Step 3 above, a Value Engineering (VE) process was undertaken by the District external to the ADMP project team at the end of Step 2. The VE process identified the following items for the refinement of the recommended alternative in the CAP sub-area which are also addressed in this report:

- Consider the use of floodwalls rather than earthen levees wherever possible
- Design to the higher end of the range of hydraulic constraints for the leveed corridors
- Optimize the toe-down to grade control relationship

The use of floodwalls was recommended based on the significant cost savings identified in the Step 2 reports. As will be discussed further in the design discussion (see Section 5), the Step 2 hydraulic design targeted a hydraulic depth of one foot and a velocity range of 4 to 6 feet per second. The VE suggestion was to design to the higher end of the velocity range. To accomplish this, the Step 3 design will allow hydraulic depths up to two feet. The toe-down to grade control relationship is further refined in Step 3 through the use of a sediment transport capacity continuity approach to the equilibrium slope assessment for the selection of grade control spacing.

During the Step 3 process, it was recognized that with the migration to a concrete floodwall containment strategy for the levee corridors, the balancing of earthwork objective identified in Step 2 was not feasible. That is, for many fan systems, the excavation requirements far outweigh the fill needs. Therefore, material disposal from the detention basin excavation will be necessary for most of the fan systems.

3.2 Scenery Resource Assessment

The scope of work for the ADMP specifically states that the recommended alternative be "environmentally friendly and blend with the natural landscape of the study area following the District's *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects*". An assessment of the scenic resources, including landscape character, scenic quality, and viewshed sensitivity was undertaken as part of this study (LSD, 2006) utilizing information and guidelines provided by the Flood Control District. The data from this assessment was used to identify a range of flood protection methods that would be compatible with the visual character of the settings of the study area. This data was also used to identify a variety of landscape design themes that could be applied to flood control projects proposed within the study area. The recommended alternative presented in Sections 4 and 5 directly incorporates aesthetic features to ensure that the proposed alternative meet these objectives. In addition, the cost estimates also include the costs associated with the aesthetic and landscaping treatment requirements of the recommended alternative including structure enhancements, additional right of way requirements, grading design requirements, and landscape plantings.

3.3 Cultural Resource Assessment

A separate cultural resource assessment overview was provided in *An Archeological Resource Overview Of The Sun Valley ADMP Area Of West - Central Maricopa County, Arizona* (SAS, 2005). Archival research was the principal tool of that investigation, but it has also included some fieldwork. Together they revealed no fewer than 80 cultural resource investigations have previously been completed across the project area. They began in 1882 and are

of six different types. Significantly, 53 of them are prior intensive field surveys that thoroughly examined roughly 8,842 acres, or 11.7 percent, of the area.

The project inventory of resources consisted of 77 individual sites, all but 23 of which have been disturbed or totally destroyed. They include 17 prehistoric sites, 1 prehistoric-historic site, 58 historic sites, and 1 modern site, which dates 1981-present. The prehistoric sites date A.D. 400-1450 and represent only one unidentifiable and two identifiable cultural themes: residential life and natural resource exploitation, that are attributable to both the Hohokam and the Patayan Indians. The historic sites date exclusively to the Arizona Territorial (1863-1912) and Statehood (1912-1952) phases, and represent nine cultural themes: canal irrigation, community growth and development, farming, homesteading, mining, railway transportation, ranching, roadway transportation, and trash deposition.

3.3.1 Cultural Resource Impacts In The CAP Sub-Area

In the CAP sub-area, only one archeological site is presently known to exist within the proposed impact area here. Informally designated as GLO Road E (SAS, 2005, p. 57, Fig. 11, Table 6), it is simply a historic mining road that predates 1915. A very short segment of this site is presently threatened to be totally destroyed by the proposed construction of the proposed convergent channel draining the Fan 1 and Fan 2 basins.

3.3.2 Implementation Prerequisites

Absolutely no land disturbance activities associated with the construction of any of the proposed construction features of this sub-area should be allowed without having first implemented all pertinent archeological compliance guidelines of the State of Arizona and the United States government. More particularly, four principal consequences of this recommendation need to be emphasized: 1) an updated site records check should be made of all proposed project impact areas, 2) an intensive (100%) field survey should be conducted of all proposed project impact areas that have not been examined for cultural resources in the last 10 years, 3) the project segment of GLO Road E should be visited, its physical condition should be evaluated, and, if suitable, it should be formally recorded as a historic site, and 4) the potential archeological significance of GLO Road E should be evaluated using established government criteria.

3.4 Stakeholder and Public Involvement

The District and ADMP project team conducted an extensive stakeholder and public involvement process as part of the ADMP. Stakeholders included in the process are listed in Table 1. The stakeholder process included Stakeholder Workgroup meetings as well as numerous individual meetings with stakeholders and the project team. The project team received input and maintained two-way communication with stakeholders to ensure clear understanding of the nature of the recommended alternative and study's progress. Ultimately, the close interaction of the project team and stakeholders had a significant impact on the nature of the recommended alternative for the SVADMP including the selection of walled-levee corridors and the location of the preferred corridor alignments.

Table 1 SVADMP Stakeholders

Agencies / Public Entities	Development/ Developers/ Engineers
FCDMC	Capitol Pacific Homes/ CVL
Town of Buckeye	Sun Valley South (West)/ Communities Southwest/ WRG
ADEQ	Festival Ranch/ Lyle Anderson/ WRG
ADOT	Skyline Wash/ Fisher-Williams / PDC
AZ Game & Fish	Elianto/ Lennar/ CVL
ASLD	Anthem/ Pulte/ CMX
AWDR	Tartesso/ Stardust/ DEA
Bureau of Land Management	Tartesso West/ Stardust/ DEA
Bureau of Reclamation	Spurlock Ranch/ Glen Spurlock /
CAP	Sun City Festival/ Pulte/ CVL
Luke Air Force Base	SunCor Arizona
MCDOT	Trillium West/ Gateway/ DEA
MC Parks	Sun Valley/ Vistoso/ Erie & Assoc
NRCS	
Palo Verde Power Plant (APS & SRP)	
US Fish & Wildlife	
Western Power Authority	
White Tanks Concerned Citizens	

4 DESCRIPTION OF RECOMMENDED ALTERNATIVE FOR CAP SUB-AREA

Flood control alternatives for the SVADMP area included both structural and non-structural solutions. Given the landscape compatibility assessment, non-structural solutions are generally preferred whenever possible. However, for the areas impacted by active alluvial fans, the degree, extent, and uncertainties associated with the flood hazards are considered too extreme to make fully non-structural alternatives feasible. Therefore, for the areas impacted by large active alluvial fan flooding, structural measures are central to the recommended flood control alternative.

In Step 2, the study area was divided geographically into seven sub-areas to focus the attention of appropriate structural or non-structural flood control alternatives for the study area.

1) North of CAP (Volume 1)
2) CAP (this volume),
3) Wagner Wash (Volume 3),
4) Hassayampa River (Volume 4),
5) White Tank Wash (Volume 5),
6) FRS #1 (Volume 6), and
7) FRS #2 & #3 (Volume 7).

The sub-areas are based on the outfall locations and the fans discharging to a particular outfall location. The sub-areas represent the hydrologic watershed for the particular outfall location. The CAP sub-area is slightly different as it has two coalescing alluvial fans that outlet to two separate watersheds. Fan 1 drains predominantly to Wagner Wash, while Fan 2 drains predominantly to a tributary of Trilby Wash. The sub-area boundaries are shown in Figure 8.

This report presents the details of the Step 3 Recommended Alternative for the CAP sub-area. Volume 1 provides an overview of the Step 3 Recommended Alternative for the entire study area. Additional details for the other five alluvial fan sub-areas south of the CAP Canal are presented in separate companion reports (Step 3, Volumes 3 – 7). This organization is analogous to that used in the Step 2 presentation.

The recommended alternative for the CAP sub-area was refined from Alternative B1 in Step 2. It is comprised of two large, on-line detention basins near the alluvial fan apices, two off-line detention basin near Sun Valley Parkway, and walled-levee corridors downstream. The walled-levee corridors provide a path not only for the detention basin outflows, but also serve as a trunk system to which the downstream tributary watersheds may also deliver storm water. The recommended alternative for Fan System 1/2 also includes the use of the existing Sun Valley Parkway channel downstream of the Fan 1 walled-levee corridor. Non-structural measures include approximate floodplain delineations of the contained wash reaches upstream from the detention basins to the White Tank Mountain Regional Park boundary.

Additional details of each component of the recommended alternative and their design are provided in the following sections.

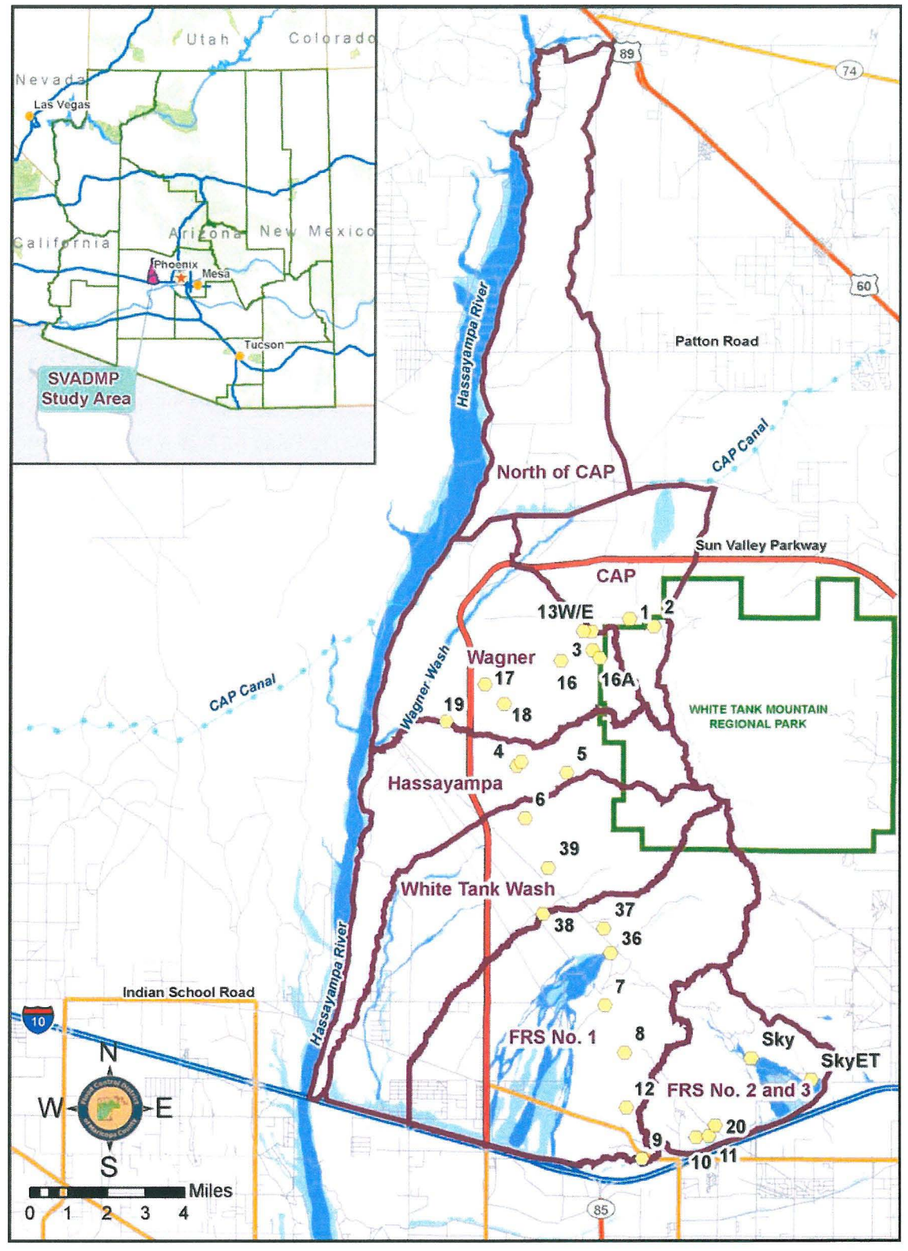

Figure 8 Sun Valley ADMP Sub-Areas

5 STEP 3 CONCEPT DESIGN APPROACH

The details of the design procedure for the recommended alternative are presented in this section. The recommended alternative location, typical sections, and planimetric layout for each fan system are presented in Section 5 and 6 and Appendix A. The design approach used a combination of HEC-1 modeling, normal-depth hydraulics, and GIS through an Excel spreadsheet interface. The conceptual planimetric layout sheets for all elements of the fan system components are provided in Appendix A. Available data and analyses from Step 2 were used whenever appropriate. Additional modifications and data sources are also described below. This discussion is largely identical for each sub-area report. However, distinct elements not utilized in a given sub-area (e.g. off-line basins) are not included if not needed.

5.1 Data Collection

5.1.1 Field Survey Information

Refer to the Flood Control District of Maricopa County (District) for field survey information associated with the 10-foot topographic mapping used in the current study.

5.1.2 Mapping

The District provided 10-foot contour mapping and DTM data for use in the hydrologic and hydraulic calculations. That work was done under separate contract for the District in 2000/2001. The flight dates of that mapping were 12-16-00, 12-17-00, and 12-27-00. A triangulated irregular network (TIN) was developed in ArcGIS software using the 10-ft mass points and breaklines. The TIN and the contours were used to obtain all the elevation data used in this study. It was noted in the use of this topographic data that many wash bottoms were incorrectly shown as ridges rather than valleys. This phenomenon was more prevalent on the relatively low relief downfan areas. These ridges were removed manually from the cross sections used in the design process as described in Section 5.

5.1.3 Aerial Photographs

The Flood Control District provided aerial photographs for use in the GIS applications. The photo dates are November 2004.

5.1.4 Existing Culvert Data at Sun Valley Parkway Crossings

The as-builts for the existing culverts at the Sun Valley Parkway were obtained from MCDOT. Dimensions for the Sun Valley Parkway channel were also taken from the as-builts. The as-builts are included as pdf documents on the disc with this report.

5.1.5 Sediment Gradations

Sediment gradations used in this study are based on data collected at 38 locations throughout the SVADMP study area (Location of samples shown on map in Appendix B). A plot of the sediment gradations for all of the samples collected is also provided in Appendix B. Examination of these data suggested relatively little variation in sediment sizes across the study area. Therefore, an average sediment gradation was taken from 38 samples for use in the sediment transport analyses for the recommended alternative for all fan systems including Fan System 1/2.

The following values were therefore selected for the sediment gradation parameters:

D50 = 0.7 mm D16 = 0.17 mm D65 = 1.2 mm

D84 = 2.7 mm D90 = 4 mm

5.2 Process Overview and Summary of Design Criteria

The following sections provide a brief overview of the design procedures for each structure type in the recommended alternative for the CAP sub-area. Table 2 shows a summary of the important design criteria used for the on-line detention basins and walled-levee corridors. These were refined from the Step 2 process based on the selection of a floodwall corridor containment structure and the input of the external value engineering team. All structures are designed for the maximum peak flow or volume from the 100-year 6-hour or 24-hour event.

Table 2 Summary Of Design Criteria For Step 3 Recommended Alternatives

Apex Treatment	Basin Geometry Criteria	Downstream Channel	Hydraulic Criteria	External Wall Height
On-line Basin; 10% outflow	Average Z = 6:1; D < 12 ft	floodwall	4 - 5 ft levee height; ≤ 6 ft/s; 3 ft min. freeboard	≤ 3 feet

Additional details on the design associated with each structural element are discussed in the following sections with additional details also provided in Section 5 and Appendix A.

5.3 General Procedure Outline

The general design procedure was similar to that used in Step 2. The following outline describes that procedure:

- Identify the fan apex/upstream area location and the preferred channel alignment from the apex to the outfall. These were derived from Step 2 and additional input received from stakeholders following the end of Step 2.

- Design an on-line basin near the apex location using the following criterion: Peak Outflow ≈ 10% Peak Inflow. Start with the Step 2 basin volume and outlet sizes.
- Route flow from on-line basin to the outfall by designing a walled-levee natural channel corridor along the preferred channel alignment (See section 5.12).

5.4 Hydrology

The design of the walled-levee corridors as well the detention basins are based on the 100-year storm. HEC-1 modeling was used to determine the peak discharges as well as the flow volume passing through the designed structures. The existing conditions hydrology model was used for the estimation of peak discharges for the design. The flows computed from the existing conditions model are higher than the future conditions model (JEF, 2006c). Thus, the use of existing conditions discharges represents a more conservative design approach. In addition, the specific phasing of future development is unknown. As a result, it was deemed prudent to be conservative and use the existing conditions hydrology to ensure effective continuous functioning of the recommended flood control system as the area develops.

The HEC-1 models developed for each sub-area in Step 2 were divided into separate models for each fan system. These models were modified to incorporate the basin and channel features associated with the recommended alternative for the 100-year 24-hour and 100-year 6-hour storms. For the purpose of the design, the maximum of the values obtained from the 24-hour and 6-hour results was used to ensure adequate functionality under 6-hour and 24-hour storm scenarios. This means that the design analyses sometimes use the 6-hour value and vice-versa depending on whichever is larger.

The procedure to estimate peak flow and flow volume was iterative in nature. The iteration steps can be briefly described as follows:

- Change in structure dimensions affects the HEC-1 model
- Change in the HEC-1 model affects discharges/volumes
- Change in discharges affects structure dimensions

The HEC-1 models used here were modified from the Step 2 Proposed Alternatives models for the CAP sub-area (JEF, 2006c). The HEC-1 models were refined to provide design peak flows at more locations than the Step 2 models. Nevertheless, some of the long open channel sections were treated as single routing reaches in HEC-1. These reaches were divided into approximately 1000-foot reaches for the hydraulic design. The design discharges and volumes for each 1000-foot reach were estimated using a linear weighting between the upstream and downstream concentration points modeled in HEC-1. This simplified procedure facilitated refined design of multiple channel segments without the need for excessive subdivision of the HEC-1 model.

5.5 Sediment Yield

Sediment contributions from the watershed draining to the on-line detention basins were estimated using a sediment yield approach. The sediment yield was estimated assuming a 3-year maintenance period plus a single 100-year event. The MUSLE method as outlined in the Arizona Department of Water Resources' *Design Manual for Engineering Analysis of Fluvial Systems* (1985; hereafter, "ADWR Manual") and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) *Sediment and Erosion Design Guide* (AMAFCA, 1994) was used to compute the average annual sediment yield and the 100-year single event sediment yield for the subbasin(s) contributing to each on-line detention basin. Each on-line detention basin design sheet in Appendix A contains the MUSLE parameters, calculations, and results for each basin. Peak discharges, runoff volumes, soil, and land use parameters were estimated from the hydrology data. The 10-foot DTM was used to derive the other watershed geometries needed for the MUSLE computations. The total sediment volume estimated was added to the required design volume for each detention basin. The design sediment volumes are provided on the basin design sheets for each basin in Appendix A.

5.6 Aesthetic Treatment Requirements

In order to ensure that the proposed flood control structures are compatible with the landscape character of the study area, incorporation of landscape architectural design as an integral part of the structural design is required. In 1993, the District adopted a "Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects". This policy aims at planning and designing flood control projects that are compatible with the visual character of the adjacent landscape. In addition, the policy aims to integrate recreational opportunities into the planning and design of flood control facilities.

Utilizing the information from the Scenic Resource Assessment (SRA) (LSD, 2006), incorporation of aesthetic features in the project components of the Sun Valley ADMP generally followed a four-step approach to achieve context sensitivity with the visual environment, to the extent possible. The four steps are outlined below and briefly described.

1. Selection of structure types to maximize context sensitivity
2. Selection of flood protection methods (semi-soft structural method and hard structural method with aesthetic treatment) that are most compatible with the character of the landscape
3. Application of most appropriate landscape design theme
4. Development of context sensitive landscape design guidelines

5.6.1 *Selection of Structure Types*

During the development of the recommended alternative, consideration was given to the selection of flood control structure types that most lend themselves to adaptation of their topographic form to the landforms of the study area. The flood storage basins contained in the plan are a structure type that can be designed to mimic the landforms of the piedmont. The walled-levee corridors that are recommended for stormwater conveyance is a hard structural solution that will have relatively low visual impact and can be adapted to the existing landforms of the sub-area, while preserving the natural character of the existing wash corridors. The recommended alternative minimizes the use of large scale excavated channels and flood retarding structures that have a lower capability to be designed to blend with the landforms of the sub-area. The recommended alternative also completely avoids the use of heavily armored (concrete lined) structures that would be completely out of context with the landscape settings of the sub-area.

5.6.2 *Flood Protection Methods*

The Flood Control District has identified six general flood control methods that are routinely evaluated for use on flood projects throughout the County. The selection of flood control methods is driven by the engineering requirements for reducing the risk of flooding and the Scenery Resource Assessment (SRA) prepared for the project (LSD, 2006). The CAP sub-area employs the non-structural, semi-soft structural, and hard structural with aesthetic treatment flood protection methods. A brief overview of each is provided below. Detailed descriptions of all the flood control methods are provided in The Step 3, Volume 1 report prepared for the Sun Valley ADMP. The descriptions are taken from the Flood Protection Methods, Scenery and Recreation Resource Assessment for Maricopa County report (FCDMC, 2006).

Non-structural Structural

The non-structural method of flood protection employs the use of regulatory mechanisms such as erosion control setback zones and zoning regulations as mechanisms for providing flood protection. This method is characterized by an absence of structural elements or features for flood protection. Exceptions may include provision of low standard road facilities for carrying out flood control monitoring, operations and maintenance activities. Natural drainage features such as rivers, washes, and arroyos perform the function of storm water conveyance.

Semi-Soft Structural Method

The semi-soft structural method includes construction of large-scale flood control facilities constructed predominantly of earthen materials. The overall form of the superstructure is designed to emulate the character of natural landforms found in the surrounding landscape (Character Type). Structural components such as grade control structures, energy dissipaters, low flow features, inlets and outlets may be visually evident but their overall form, color, texture and materials usage is designed to remain visually subordinate to and complement the valued character of the landscape settings in which they are located through careful placement, materials usage, and landscape architectural design.

Hard Structural Method with Aesthetic Treatment

The hard structural method with aesthetic treatment includes construction of large-scale flood control structures with superstructures that are fully or partially concrete lined. Structural components are also typically constructed of hardened (concrete) materials. It incorporates landscape design themes, features and materials that complement the valued character of urban and industrial landscape settings. Examples of aesthetic treatments include gracefully meandering the overall form of the superstructure, use of color, textural patterns, rustication techniques, urban art, other architectural embellishments and landscape plantings to establish visual and cultural context sensitivity primarily within urban and industrial settings.

The primary approach will be to utilize naturalistic, free form land shapes and informal arrangements of plant materials reflective of the study area flora in the design of the proposed storage basins within the CAP sub-area. The hard structural with aesthetic treatment method, as employed within the sub-area, will preserve a large amount of the existing natural desert within the walled-levee corridors and, with the architectural treatment proposed for the hard structural elements, will achieve context sensitivity within the surrounding visual environment. As a component of both flood control approaches, landscaped buffer zones and berming will be used around and adjacent to improvements such as basins and corridors to help reduce their visual impact. The setback buffer areas also provide the opportunity to develop multi-use trails and other recreational facilities in conjunction with maintenance roads along basin perimeters and channel corridors. The overall approach will be to reduce the hard engineered appearance of the features to maintain a high level of context sensitivity with the existing and future land use and landscape character in the Sun Valley ADMP area.

In some situations hard structural components will be required to provide the proper level of flood protection and meet the long term maintenance needs of the improvements. The structures used in the recommended alternative include:

- Flood containment walls – Concrete walls at edges of corridors to contain the design flood flows within the drainage corridor.
- Drop structures – Structures that are built within the flood corridors, perpendicular to the flow direction to control the longitudinal slope and flow velocities over an extended period of time.
- Inlet structures – Structures built at the location where the flood flows enter a detention basin and must withstand and dissipate the energy from high volume and high velocity flows to protect the basin from major damage.
- Outlet structures – built at the location of the outlet pipe which drains the detention basins at controlled rates.

The hard structural components, while not a dominant visual element of the entire flood control solution, are an essential part of the long-term success of the system. Through careful design and placement of the structures, the overall flood control method will be maintained as a semi-soft or hard structural with aesthetic treatment method. The design of hard structural features will include the use of architectural or design elements on the constructed features to

reduce their visual impacts. Architectural treatments will include the use of integral color concrete, form liners for texture, use of natural materials, and form modifications to enable the structures to more fully fit the natural contours and landforms of the study area. The use of integral color and form liners in the construction of concrete features would help reduce the visual impacts by incorporating the colors and textures of the natural landscape. Special attention will be paid to use of enhancements in areas of high visibility and public use, such as near intersections, pedestrian access nodes into corridors or basins that would be multiple use areas for recreation facilities.

An overall landscape theme would be applied to the design of the structural features as well as the landscape improvements. The SRA (LSD, 2006) report identified the landscape themes most compatible with the character of the landscape setting of the Sun Valley area. A landscape theme defines the distinctive characteristics of the local landscape setting and establishes the general framework for designing landscape architectural elements that would be consistent with that setting. The theme application as incorporated into the design components would include approaches such as, the selection of colors and textures that can be found in the local landscape, minimizing strong contrasts to existing landforms and selecting plant material that has been identified for the theme.

The development of comprehensive design guidelines is the final step in achieving context sensitivity. The design guidelines describe the methods and criteria for designing the project components in multiple locations and applications so that they are sensitive to the local landscape setting. Detailed design guidelines are provided in each sub-area report and are refined if needed to reflect the design themes for each sub-area.

A brief discussion of the design approach is included in the discussion of each structural component. The aesthetic treatments result in additional costs to the project. The cost differential for the required aesthetic treatments is presented in Sections 7, 8, & 11.

5.6.3 Landscape Themes

During the Scenery Resource Assessment, a variety of landscape design themes were identified for possible application to flood control structures based on an analysis of existing, historic, and planned future landscape character. Landscape design themes are unifying concepts that establish the overall visual design concept and serve as the basis for establishing design guidelines that govern landform grading, plant palettes, use of color, etc. for flood control structures in different settings. The themes were developed as a framework to help integrate flood control components into the existing natural setting and allow flexibility for coordination with the master planned communities developing in the Sun Valley ADMP area. Because flood control components will occur in multiple landscape character areas, the two main themes identified were further divided into sub-themes specific to the landscape character units. Figure 9 shows the recommended alternative located on the existing landscape character units for the CAP sub-area. The theme to be used is outlined below and is discussed in more detail in the Scenery Multi-use Data Collection and Analysis Report (LSD, 2006) prepared for this project. The report also identifies several sub-themes appropriate for the Sun Valley ADMP area. Incorporation of sub-theme elements will be coordinated with the planned communities for consistency with their proposed aesthetic development.

In the CAP sub-area, the Natural Sonoran Desert Theme and the Semi-Natural/Desert Adapted Park theme are recommended for use in the development of flood control facilities of the recommended alternative. Two of the basins are located high on the Bajada, adjacent to the White Tank Mountain Regional Park. The Natural Sonoran Desert Theme will be the most sensitive to this location. There are two off-line basins along Sun Valley Parkway that could be used for active recreation areas and should have the Semi-Natural/Desert Adapted Park theme applied to their final design. The general approach to designing facilities with these themes is identified below and specific design guidelines are contained within the individual facility sections. As the flood control facilities move through the different landscape character units in the Sun Valley planning area, the designs will incorporate specific features of the character units to assure context sensitivity with the adjacent area. The flood control facilities in the CAP sub-area cross Bajada and Valley Plains character units (Figure 9). Incorporation of the theme elements to make the facilities sensitive to each character unit is provided below.

5.6.3.1 Natural Sonoran Desert Theme

The natural Sonoran Desert theme is based on reinforcing the relatively undisturbed, natural landscape of the Sun Valley ADMP area. Landscaping and revegetation will be accomplished using Sonoran desert native species, specifically those found in the Sun Valley area. It will also preserve the existing character, help extend it into future development areas, and provide connectivity to preserved wash corridors and into the White Tank Mountains.

The Natural Sonoran Desert theme should incorporate forms, colors, and textures of the natural desert into required structural components. Landscape designs should create topography and landforms similar to those found in the surrounding natural landscape and utilize plants, boulders and ground cover in ways that mimic the natural desert of the piedmont and valley plains. Figure 11 and Figure 30 show conceptual sketches of the Natural Sonoran Desert theme applied to a basin and channel respectively. Application of the specific character unit themes will be subtle variations of the main theme and are not shown because of the conceptual nature of the sketches.

5.6.3.1.1 Natural Sonoran Desert Valley Plains Sub-Theme

In the Valley Plains character unit, the landscape design will include much shallower slope and mound grading to be consistent with the adjacent, very shallow topography of the Valley Plains unit. Use of large landscape mounding will be minimal to non-existent. Vegetation near the river terrace units will be primarily creosote, to mimic adjacent creosote flats, along with some introduction of shrubs, perennials, and grasses. Flood control features found higher in elevation, near the Bajada character unit, will include palo verde and mixed cacti to integrate with the landscape of the Bajada.

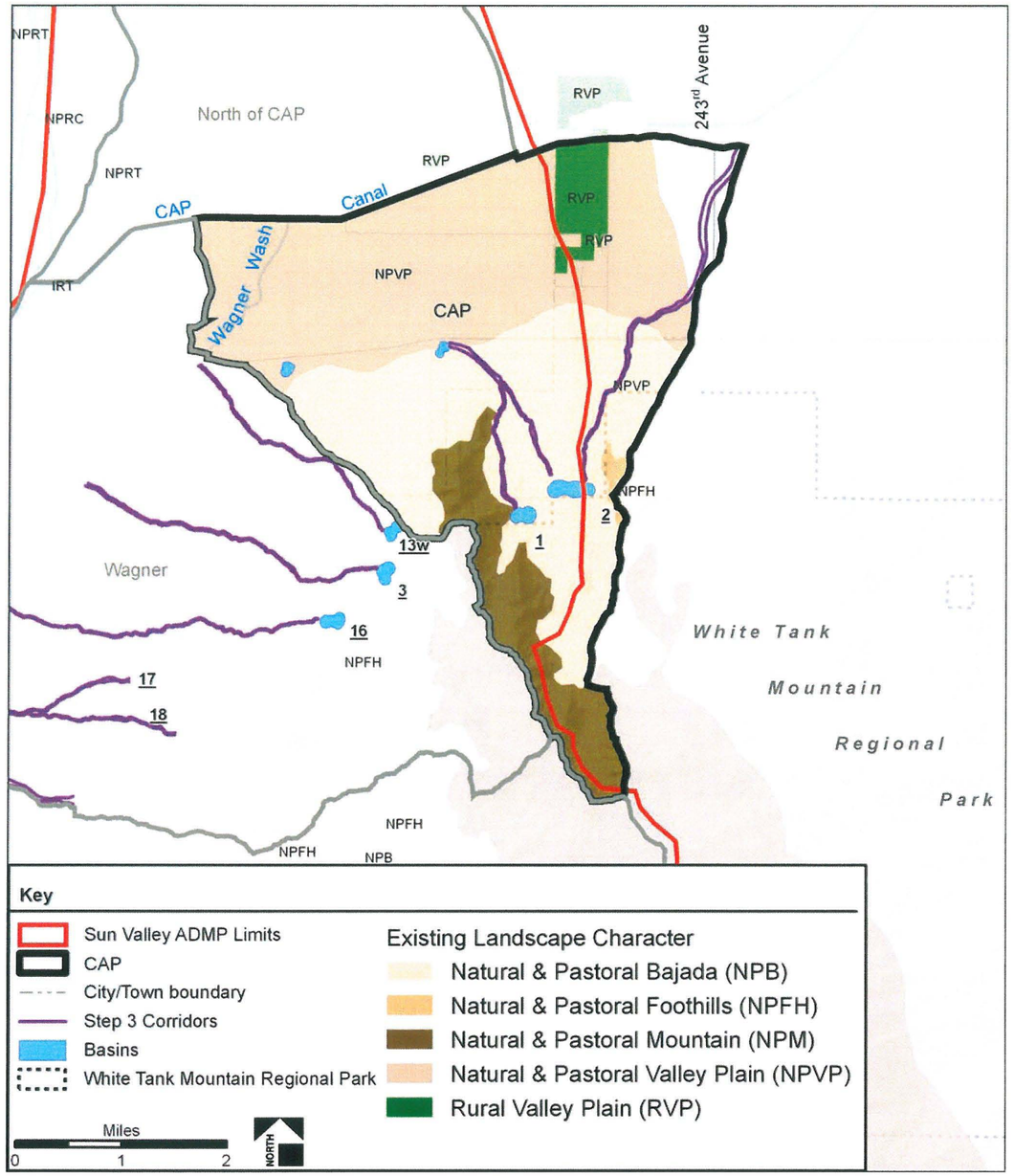

Figure 9 CAP Sub-area Recommended Alternative and Landscape Character

5.6.3.1.2 Natural Sonoran Desert Bajada Sub-Theme

In the Bajada character unit, the Natural Sonoran Desert Theme will include landscape contour grading, use of berms and low flow washes to mimic the adjacent undulating character of the Bajada landforms. Rock and boulder features will be used to help relate flood control structures to the more frequent occurrence of rock outcroppings in the Bajada. Landscape vegetation will include increased use of mixed cacti especially the saguaro as well as higher density of trees such as palo verde and ironwood.

5.6.3.1.3 Natural Sonoran Desert Foothills Sub-Theme

The Foothills character Unit provides a transition form the Bajada to the Mountains character unit. Rock and boulder features will become more prominent than in the Bajada unit and grading will be done to mimic the steeper, more angular landforms of the adjacent foothills and mountains. Planting design will include a wide variety of shrubs and perennials, but fewer grasses. Trees will be focused on the Foothill Palo Verde and Mesquite varieties and mixed cacti will include Barrel cactus, Hedgehog and other species that thrive in rocky, shallow soil areas. Structural components will incorporate the forms, colors and textures of the existing landscape, especially the steep angles and rock outcroppings.

5.6.3.2 Semi-Natural/Desert Adapted Park Theme

The Semi-Natural/Desert Adapted Park theme retains the Natural Sonoran Desert character as its primary focus but includes additional plant material and forms to enhance multi-use opportunities and more easily integrate into the future local development. The theme will only be used on basins. Since the flood control corridors are aligned to preserve existing washes the Natural Sonoran Desert theme will be used on corridors throughout the planning area. Flood control basins that are developed with this theme are located closer to Sun Valley Parkway, in areas that will be developed in moderate to high intensity. The basins will provide opportunities to develop active recreation facilities to support the park and open space needs of the future communities. Use of turf will be limited to play fields and the adjacent areas.

5.6.3.2.1 Semi-Natural/Desert Adapted Valley Plains Park Sub-Theme

The basins on which the Semi-Natural/Desert Adapted Park theme will be applied are located in the Valley Plains character Unit. The landscape design will include shallower slope and mound grading to be consistent with the adjacent, very shallow topography of the Valley Plains unit. Use of large landscape mounding will be minimal to non-existent. Vegetation will include native Sonoran Desert species as well as desert adapted species suitable for use in parks such as more varieties of thornless trees and flowering shrubs and groundcovers.

5.6.4 *Landscape Theme Plant Palettes*

Preliminary plant palettes have been developed for application of each theme. The plants lists for the CAP sub-area include plants for the Natural Sonoran Desert Theme and the Semi-Natural/Desert Adapted Park Theme. Table 3 and Table 4 show the most appropriate plants that will be used based on the character unit in which the flood control facility occurs. The final plant list developed for a design will consider the immediate context of the facility.

Table 3 Plant Palettes for Natural Sonoran Desert Theme

		Character Units			
		River	Valley Plains	Bajada	Foothills
Trees					
Cercidium floridum	Blue Palo Verde	X	X	X	X
Cercidium microphyllum	Foothills Palo Verde			X	X
Chilopsis linearis	Desert Willow	X	X	X	
Olneya tesota	Ironwood	X	X	X	X
Prosopis velutina	Velvet Mesquite	X	X	X	X
Shrubs					
Acacia greggii	Catclaw Acacia	X	X	X	
Ambrosia ambrosioides	Giant Bursage	X	X	X	
Ambrosia deltoidea	Bursage	X	X	X	X
Anisacanthus thurberi	Desert Honeysuckle	X	X	X	X
Bebbia juncea	Sweetbush		X	X	
Calliandra eriophylla	Fairy Duster	X	X	X	
Canotia holacantha	Crucifixion Thorn		X	X	X
Celtis pallida	Desert Hackberry	X	X	X	
Dodonaea viscosa	Hopbush		X	X	X
Encelia farinosa	Brittlebush	X	X	X	X
Ephedra trifurca	Mormon Tea		X	X	X
Ericameria laricifolia	Turpentine Bush	X	X	X	X
Eriogonum fasciculatum	Flattop Buckwheat		X	X	
Hymenoclea salsola	Burro Brush		X	X	
Hyptis emoryi	Desert Lavender	X	X	X	
Larrea tridentata	Creosote Bush		X	X	
Lotus rigidus	Deer Vetch		X	X	X
Lycium fremontii	Thornbush		X	X	X
Simmondsia chinensis	Jojoba		X	X	X
Trixis californica	Trixis		X	X	X
Zizyphus obtusifolia	Greythorn		X	X	X
Herbaceous Perennials					
Aristida purpurea	Purple Threeawn		X	X	
Baileya multiradiata	Desert Marigold		X	X	X
Erigeron divergens	Fleabane Daisy	X	X	X	
Melampodium leucanthum	Blackfoot Daisy	X	X	X	X
Penstemon parryi	Parry's Penstemon	X	X	X	
Penstemon pseudospectabilis	Canyon Penstemon	X	X	X	
Senna covesii	Desert Senna		X	X	X
Sphaeralcea ambigua	Globemallow	X	X	X	X
Verbena gooddingii	Goodding's Verbena	X	X	X	X
Accents					
Agave chrysantha	Golden-flowered Agave			X	X
Agave murpheyi	Hohokam Agave			X	X
Asclepias subulata	Desert Milkweed			X	X
Carnegiea gigantea	Saguaro		X	X	X
Dasylirion wheeleri	Desert Spoon			X	X
Fouquieria splendens	Ocotillo	X	X	X	X
Nolina bigelovii	Beargrass		X	X	X
Opuntia acanthocarpa	Buckhorn Cholla		X	X	X
Opuntia bigelovii	Teddybear Cholla		X	X	X
Opuntia engelmannii	Desert Prickly Pear		X	X	X
Yucca baccata	Banana Yucca			X	X
Yucca elata	Soaptree Yucca			X	X

Table 4 Plant Palettes for Semi-Natural/Desert Adapted Park Theme

		Character Units		
		Valley Plains	Bajada	Foothills
Trees				
Acacia farnesiana	Sweet Acacia	X	X	X
Acacia willardiana	Palo Blanco	X		X
Bauhinia lunarioides	Anacacho Orchid Tree	X		
Brahea armata	Mexican Blue Fan Palm	X		
Caesalpinia cacalaco	Cascalote	X	X	
Cercidium floridum	Blue Palo Verde	X	X	X
Cercidium hybrid	Hybrid Palo Verde	X	X	X
Cercidium microphyllum	Foothills Palo Verde	X	X	X
Cercidium praecox	Palo Brea	X	X	X
Dalbergia sissoo	Sissoo	X		
Lysiloma thornberi	Desert Fern	X	X	X
Olea europaea	Olive (fruitless)	X		
Olneya tesota	Ironwood	X	X	X
Phoenix dactylifera	Date Palm	X		
Pithecellobium flexicaule	Texas Ebony	X	X	X
Prosopis chilensis	Chilean Mesquite	X	X	X
Prosopis glandulosa	Honey Mesquite	X	X	X

		Character Units		
		Valley Plains	Bajada	Foothills
Prosopis velutina	Velvet Mesquite	X	X	X
Sophora secundiflora	Texas Mountain Laurel	X	X	X
Washingtonia filifera	California Fan Palm	X		
Washingtonia robusta	Mexican Fan Palm	X		
Shrubs				
Atriplex canescens	Fourwing Saltbush	X	X	X
Atriplex lentiformis	Quail Bush	X	X	X
Bougainvillea species	Bougainvillea	X	X	
Buddleia marrubifolia	Woolly Butterfly Bush	X	X	
Caesalpinia mexicana	Mexican Bird of Paradise	X	X	X
Caesalpinia pulcherrima	Red Bird of Paradise	X	X	
Calliandra californica	Red Fairy Duster	X	X	X
Calliandra eriophylla	Fairy Duster	X	X	X
Campsis radicans	Trumpet Creeper	X	X	
Chrysactinia mexicana	Damianita	X	X	
Convolvulus cneorum	Bush Morning Glory	X		
Cordia boissieri	Anacahuita	X	X	
Cordia parviflora	Littleleaf Cordia	X	X	X
Dalea frutescens	Black Dalea	X	X	X
Dodonaea viscosa	Hopbush	X	X	
Encelia farinosa	Brittlebush	X	X	X
Eremophila 'Valentine'	Valentine Eremophila	X		
Ericameria laricifolia	Turpentine Bush	X	X	X
Justicia californica	Chuparosa	X	X	X
Justicia spicigera	Mexican Honeysuckle	X	X	
Larrea tridentata	Creosote Bush	X	X	
Leucophyllum candidum	Violet Silverleaf	X	X	
Ruellia peninsularis	Ruellia	X	X	
Simmondsia chinensis	Jojoba	X	X	X
Tagetes palmeri	Mt. Lemmon Marigold	X		
Tecoma 'Orange Jubilee'	Orange Bells	X		
Leucophyllum frutescens	Texas Ranger	X	X	
Leucophyllum laevigatum	Chihuahuan Sage	X	X	X
Portulacaria afra	Elephant's Food	X	X	
Rosmarinus officinalis	Rosemary	X	X	
Tecoma stans	Yellow Bells	X	X	
Thevetia peruviana	Yellow Oleander	X		
Herbaceous Perennials				
Bahia absinthifolia	Bahia	X		
Baileya multiradiata	Desert Marigold	X	X	X
Dicliptera resupinata	Dicliptera	X		
Erigeron divergens	Fleabane Daisy	X	X	X

		Character Units		
		Valley Plains	Bajada	Foothills
Gaura lindheimeri	Gaura	X		
Hymenoxys acaulis	Angelita Daisy	X	X	X
Melampodium leucanthum	Blackfoot Daisy	X	X	X
Muhlenbergia capillaris 'Regal Mist'	Regal Mist	X		
Muhlenbergia rigens	Deer Grass	X		
Penstemon baccharifolius	Rock Penstemon	X	X	X
Penstemon eatoni	Firecracker Penstemon	X	X	X
Penstemon parryi	Parry's Penstemon	X	X	X
Penstemon pseudospectabilis	Canyon Penstemon	X	X	X
Psilostrophe cooperi	Paperflower	X	X	X
Ruellia brittoniana	Ruelllia	X		
Sphaeralcea ambigua	Globemallow	X	X	X
Ground Covers				
Dalea capitata		X	X	
Dalea greggii	Trailing Dalea	X	X	X
Lantana species	Lantana	X		
Verbena pulchella	Moss Verbena	X	X	X
Wedelia trilobata	Yellow Dot	X	X	
Vines				
Antigonon leptopus	Queen's Wreath	X		
Cissus trifoliata	Arizona Grape Ivy	X	X	X
Hardenbergia violacea	Lilac Vine	X		
Macfadyena unguis-cati	Cat's Claw Vine	X	X	
Mascagnia macroptera	Yellow Orchid Vine	X	X	
Merremia aurea	Yellow Morning Glory	X	X	
Accents				
Agave species		X	X	X
Aloe species	Aloe	X	X	
Asclepias subulata	Desert Milkweed	X	X	
Carnegiea gigantea	Saguaro	X	X	X
Cereus peruvianus	Night Blooming Cereus	X	X	
Dasylirion acrotriche	Green Desert Spoon	X	X	X
Dasylirion quadrangulatum	Smooth Desert Spoon	X	X	X
Dasylirion wheeleri	Desert Spoon	X	X	X
Echinocactus grusonii	Golden Barrel	X	X	X
Euphorbia antisyphilitica	Candelilla	X	X	
Euphorbia biglandulosa	Gopher Plant	X	X	
Fouquieria splendens	Ocotillo	X	X	X
Hesperaloe funifera	Gianta Hesperaloe	X	X	X
Hesperaloe parviflora	Red Hesperaloe	X	X	X
Nolina microcarpa	Beargrass	X	X	X
Opuntia basilaris	Beavertail Prickly Pear	X	X	X

		Character Units		
		Valley Plains	Bajada	Foothills
Opuntia engelmannii	Desert Prickly Pear	X	X	X
Opuntia ficus-indica	Indian Fig Prickly Pear	X	X	X
Opuntia santa-rita	Purple Prickly Pear	X	X	X
Pedilanthus macrocarpus	Slipper Plant	X		
Yucca baccata	Banana Yucca	X	X	
Yucca elata	Soaptree Yucca	X	X	X
Yucca rigida	Blue Yucca	X	X	

5.6.5 Landscape Design Guidelines

The development of comprehensive design guidelines is the final step in achieving context sensitivity. The design guidelines are a prescription that identifies the methods and criteria to ensure achievement of the landscape design themes. The design guidelines are specified in the following sections of this report for each structure type. A brief description of the design approach is included in the discussion of each structural component.

5.7 On-line Detention Basins

5.7.1 Design Considerations

The on-line detention basin for each fan system was ideally located just upstream of the fan apex where flows begin to spread out unpredictably into numerous smaller channels. However, for Fan 2, the best location is located within the White Tank Mountain Regional Park. It was decided early in Step 2 that no facilities would be placed within the existing limits of the park. Therefore, the apex basin for Fan 2 is located immediately outside the park boundary and spans the entire active limits of the alluvial fan in order to control Fan 2. The basin volume is created entirely through excavation and designed to be entirely below existing ground. Constant side slopes of 6:1 were assumed to simplify the hydraulic design of the basins and represent an average condition between the steeper and shallower slopes needed to produce the aesthetic treatment objectives.

Figure 10 shows the concept plan view of the on-line basin for Fan System 3 in the Wagner sub-are on an aerial photo of the area with the existing topography as an example. Figure 11 and Figure 12 show a generic concept basin with the landscape aesthetic treatments.

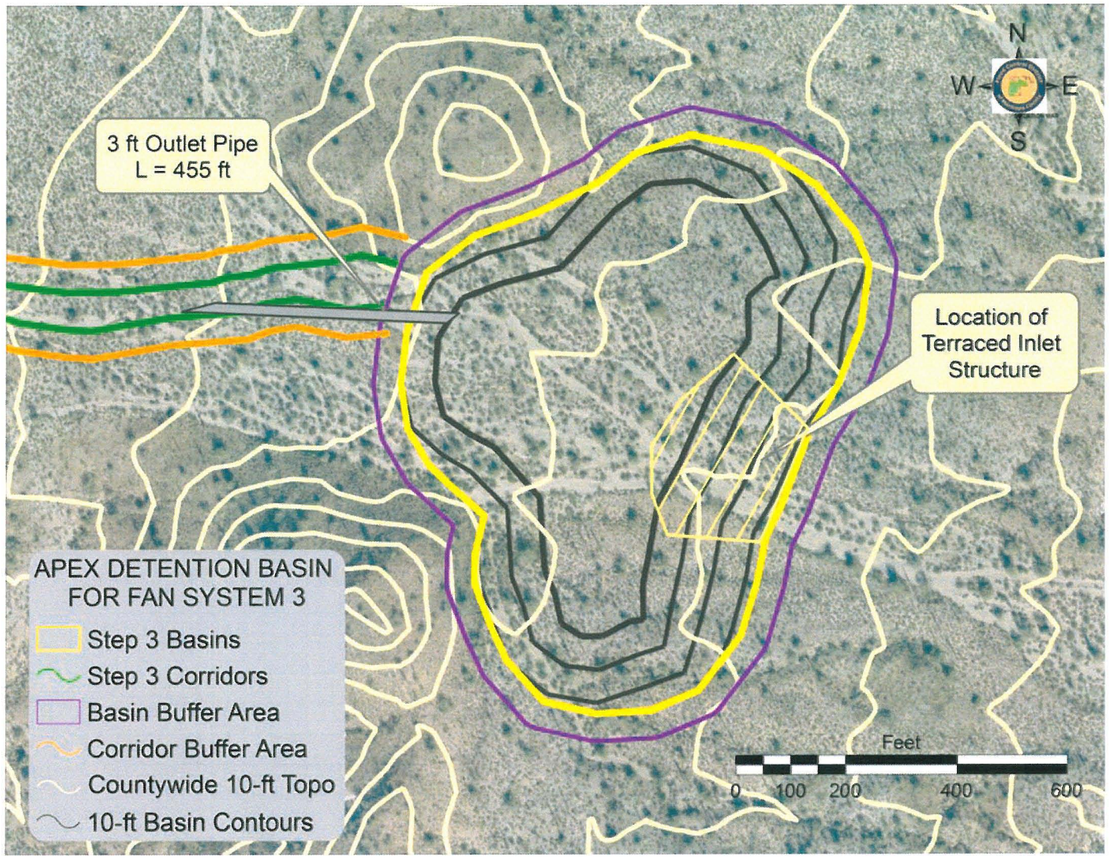

Figure 10 Concept Plan View Of On-Line Basin For Fan System 3, Wagner Sub-Area

The basins were designed to have a peak outflow of approximately 10% of the peak inflow. Ten percent of the peak flow approximates the 2-year flow. Pipe outlets were designed to drain the basins. The Fan 3 basin, for example, requires a 3-foot diameter pipe and discharges about 100 cfs during the 100-year event. Sediment yield from the upstream watershed was estimated using MUSLE according to the approach laid out in the ADWR & AMAFCA Manuals (1985; 1994). The design basin volume includes space for three average year's sediment plus one 100-year event volume.

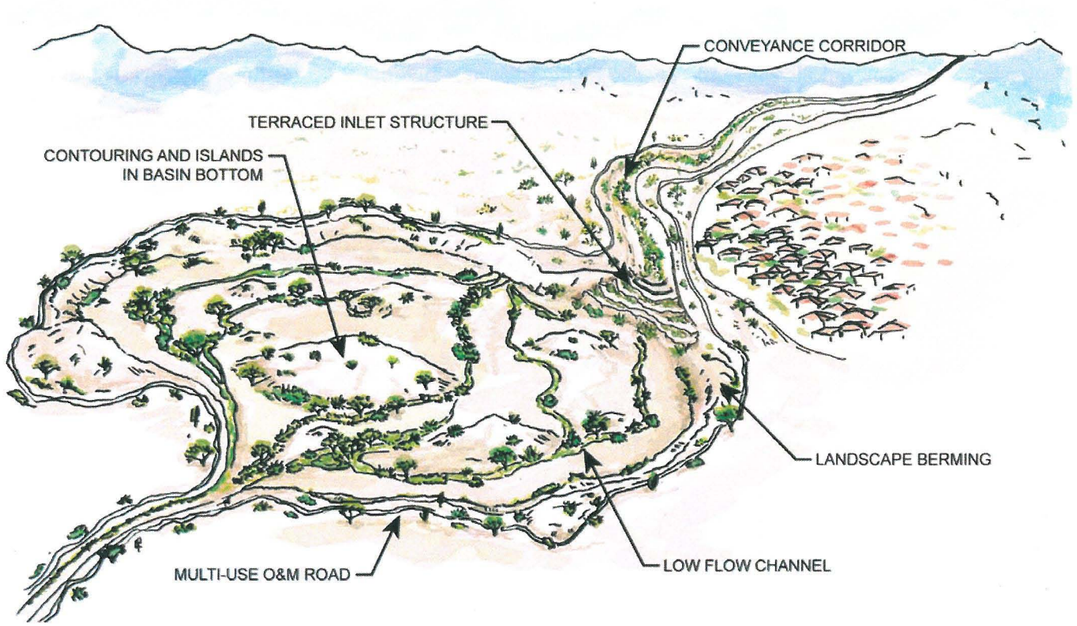

Figure 11 Concept Plan View Of An On-Line Basin

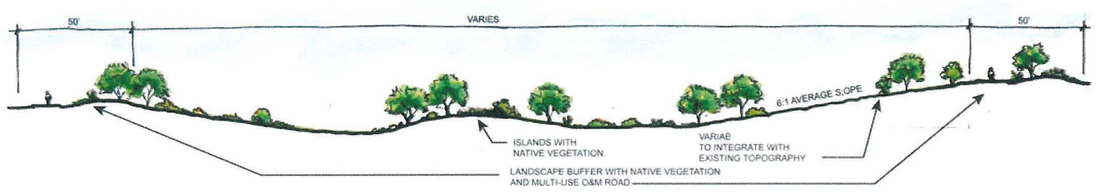

Figure 12 Concept Profile View Of On-Line Basins With Aesthetic Treatments

The basins were designed to be no greater than 12 ft in depth including one foot for freeboard. Average side slopes of 6H:1V were used to represent the average of variations between 8H:1V to 4H:1V needed to meet the landscape aesthetic treatment requirements. One foot of freeboard was applied to accommodate the flow volume as well the sediment volume. A stage-storage relationship was calculated from the 10-foot digital terrain model in GIS based on the irregular top shape and an average side slope of 6H:1V. The stage-discharge relation was computed using HY8 assuming a circular pipe outlet with a side-tapered inlet, and a pipe slope of 0.005. In addition, the stage-storage relation was modified to subtract the estimated sediment yield from the design basin volume from the bottom end of the curve to evaluate the adequacy of the basin design volume. The resulting relationships were entered into the HEC-1 models using SE-SV-SQ records. The HEC-1 model was then run to estimate the peak volume stored in the basin (including the design sediment volume). Basin dimensions were then resized as necessary to hold this maximum volume at peak flow as predicted by HEC-1 such that the resultant peak outflow discharge was about 10 percent of the peak inflow discharge. The process was repeated in an iterative fashion until a satisfactory design was achieved.

For the Fan 2 basin, two outlets were provided in order to feed each of the two downstream corridors. A 50/50 split of the outflows was assumed, i.e. half of the total outflow was routed to each corridor.

5.7.2 Inlet Design Concepts

Various hydraulic inlet structures were assessed to accommodate discharge into the on-line detention basins. The inlet structure design objectives include: public safety, hydraulic performance, aesthetics, cost, and maintenance requirements with an emphasis on blending the facility into the landscape character. Some of the alternatives assessed may not meet all of the design requirements for a particular fan system. Selection of the inlet design concept for each specific fan system could vary depending on the inflow discharge, approach depth, and other site constraints.

Given the basin depths and local topographic slope, the vertical drop from the entering channel invert to the basin bottom ranges from 20 to 60 feet. Erosion protection will be necessary to prevent headcutting and channel degradation for the fan reaches above the basins during flow events. There are two strategies to reduce the erosion potential of flows entering the basin. The first is the use of an energy dissipater structure along the drop. The second is a lined spillway with a stilling basin at the bottom to dissipate the energy immediately below the drop. Some combination of the two strategies is also a possibility.

Three types of energy dissipaters were considered for this assessment and include: a riprap lined spillway, stepped drop structure, and a baffle chute. Lined spillways include the use of concrete or roller compacted concrete (RCC). Stilling basins considered include the USBR Types II, III, IV, and a straight drop basin. The various structure assessments are discussed in the following sections. It should also be noted that all of these energy dissipation structures will also require some kind of additional downstream scour protection in the transition from the structure back to the natural riverbed or soil material. Guidelines for the computation of this additional scour are provided in Pemberton and Lara (1984).

5.7.2.1 Riprap-lined spillways

Riprap-lined spillways consist of dumped riprap on top of a gravel filter and/or geotextile fabric (see Figure 13). Typical spillway sections are trapezoidal normal to the basin side slope. A cut-off wall would be necessary upstream of the spillway to promote an even flow distribution down the spillway and to prevent degradation upstream. A relatively small riprap-lined sloped stilling basin would be required at the bottom of the spillway and would likely serve as the initial sediment trap for the basin. Riprap-lined spillways can provide sufficient energy dissipation for relatively low flow depths down the spillway. The suitability of riprap depends on the size, D_{50}, 100-year design unit

discharge, q (cfs/ft), and the spillway slope. One conservative method for designing riprap-lined spillways can be established with the following relationship (Abt, 1991):

$$q = 0.052 D_{50}^{1.79} S^{-0.77}$$

Using a safety factor of 1.5, the safe maximum slope of 4H:1V, and a D_{50} of 18 inches, the maximum unit discharge that is recommended is approximately 13 cfs/ft. Using this unit discharge for a 40 foot wide channel would limit the total design discharge to approximately 500 cfs. As shown in this example, this application would be limited to fans with smaller design discharges or if measures were taken to distribute the flow into a wider spillway. The riprap depth is usually 2-3 times the D_{50}. Large diameter riprap availability is limited in Arizona; therefore, a material source should be identified prior to design. Construction of riprap spillways is fairly straight forward; however, material and construction inspection would be essential to ensure the quality of the material and stability of the structure. Rock color, texture, and arrangement could be selected so as to minimize visual impacts of the inlet spillway.

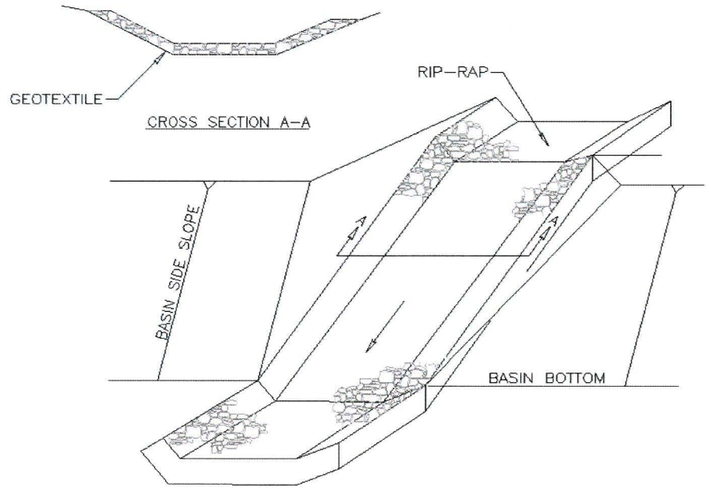

Figure 13 Riprap Spillway

5.7.2.2 Stepped drop structures

Stepped drop structures consist of hardened steps that dissipate energy as flow drops down each step (see Figure 14 & Figure 15). Stepped drop structures are constructed of concrete, RCC, soil cement, or gabions, but can also be constructed of large boulders (Figure 16). Stepped drop structures promote two energy dissipating flow conditions: Nappe flow and Skimming flow.

Nappe flow is when the step height, tread width, to critical depth relationship permits a free-falling nappe and hydraulic jump on each step. Skimming flow occurs when the steps are overcome by flow depth resulting in recirculating vortices and air entrainment. The relationship at which the flow condition is between the nappe and skimming flow regimes is shown by the following equation (Chanson, 1994):

$$\frac{y_c}{h} = 1.057 - 0.465 * \frac{h}{l}$$

where y_c is the critical depth, h is the step height, and l is the tread width.

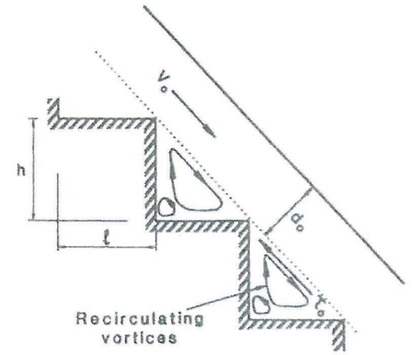

Figure 14 Stepped Drop Structure – Skimming Flow

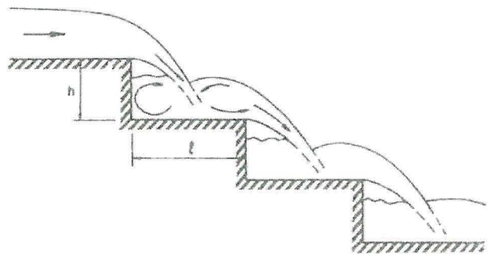

Figure 15 Stepped Drop Structure – Nappe Flow

If a flow condition was in between flow regimes, an increase in y_c would initiate the skimming flow regime. Steps designed for nappe flow are generally much larger and more costly than steeper sloped steps designed for skimming flow (Frizell, 2006). Steps large enough to permit nappe flow may be a public safety concern as well. Given basin side-slopes between 4H:1V and 8H:1V, the flow regime will more than likely be limited to skimming flow. Well established hydraulic design guidelines for stepped drop structures do not exist. Therefore a stepped drop structure design would require research and a careful analysis of the structure to ensure stability, flow containment,

and adequate reduction in residual energy at the bottom of the drop. The step height and tread width should be established to accommodate maintenance, accessibility, and public safety.

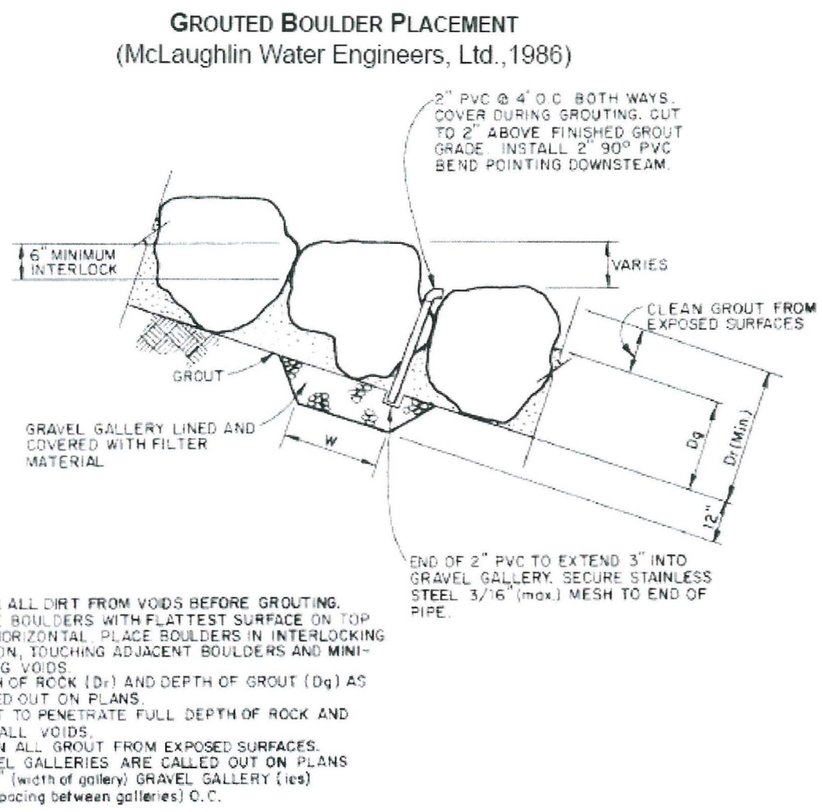

Figure 16 Example of Stepped Boulder Drop Structure
(source: Figure 7.19 from FCDMC, 2003a)

5.7.2.3 Baffle Chute

Baffle chutes have a concrete rectangular or trapezoidal section normal to the basin side slope. The alternating baffles dissipate energy of flow down the slope of the chute (Figure 17). A channel narrowing transition may be desirable upstream of the chute to minimize the width of the structure. Baffle chutes are the most effective means of dissipating energy down a slope and are used extensively on spillways throughout the world. Hydraulic design and analysis methods are documented in the USBR Engineering Monograph No. 25 (Peterka, 1984). Baffle chutes are one of the most cost effective methods for dissipating energy down the basin drop; however, they are not very aesthetically appealing. Potential modification of the baffles to use natural materials such as very large rock emplaced in concrete with steel could provide acceptable aesthetic treatment of such structures.

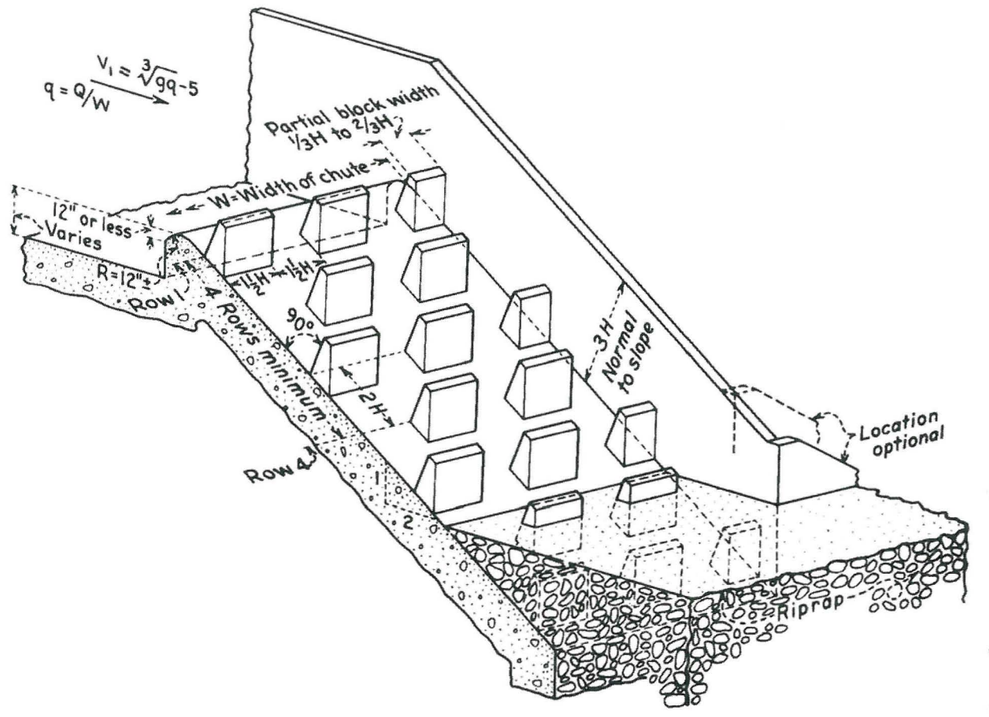

Figure 17 Baffle Chute

5.7.2.4 Lined Spillways

As discussed previously, lined spillways include the use of concrete or RCC and must be designed to consider abrasion due to sediment-laden flow at a very high velocity. Smooth lined spillways have been known to attract juvenile activities, such as skateboarding, that may raise public safety concerns.

5.7.2.5 Stilling Basins

Stilling basins should be used in conjunction with lined spillways to dissipate energy at the basin bottom. It is expected that only hard basins would be practical given the expected velocity and energy of flows at the bottom of the spillway. Stilling basin types considered include the USBR Types II, III, IV, and a straight drop basin, all made of formed concrete as shown in Figure 18. Stilling basins are also constructed out of gabions. Stilling basins are very effective at dissipating energy at the bottom of a spillway and are used extensively throughout the world. Hydraulic design and analysis methods are documented in the HEC-14 manual (FHWA, 1983).

Stilling basins are a cost effective method for dissipating energy down the basin drop; however, they are not very aesthetically appealing and may also raise public safety concerns.

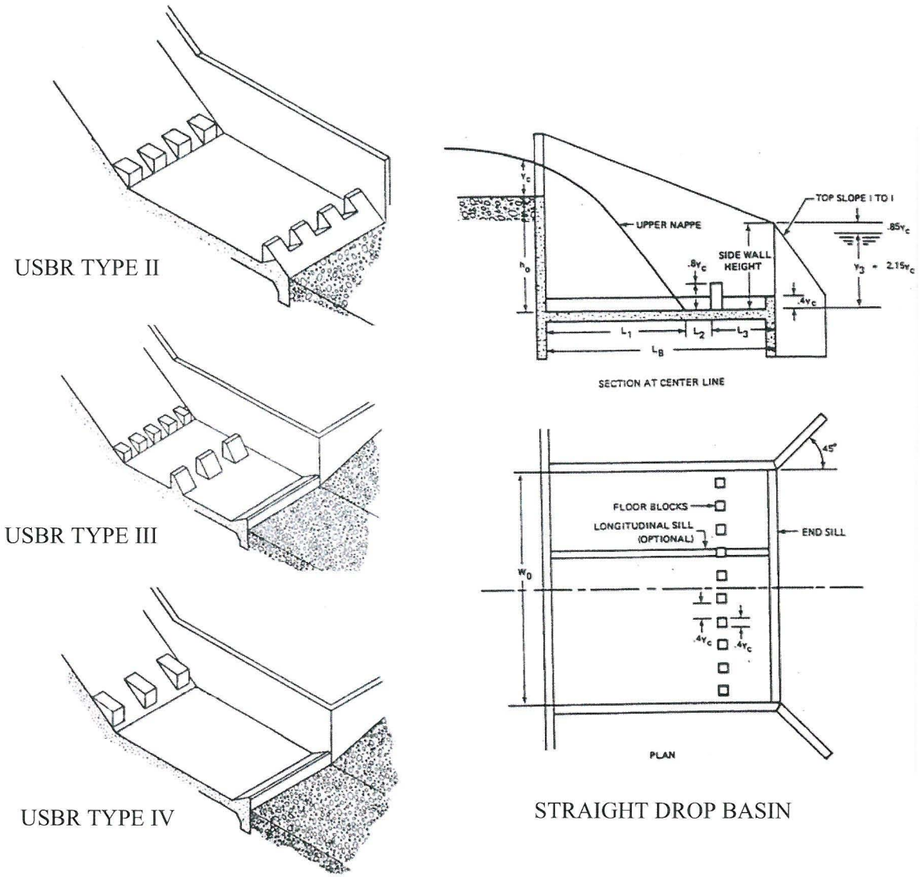

Figure 18 Stilling Basins

5.7.3 Discussion of Inlet Concepts

No non-structural inlet alternatives are recommended given the magnitude of the design discharges. The use of riprap lined spillways is limited by the design unit discharge. The remaining alternatives are therefore limited to hard material types with aesthetic treatment. Given the goal of blending the basin inlet structure into the natural landscape character, various features could be added to hard structures to enhance the appearance such as adding color pigments to concrete, texturing techniques, curvilinear designs, and/or integrating boulders into the structure. The selection and placement of vegetation would also be crucial in softening the appearance of the facilities. Creative inlet geometry could be considered to accommodate additional landscape character to the basins and allow for softer structural alternatives.

For example, the inlet drop could be divided into multiple stepped drops of curved tiers or terraces to spread the flow width to accommodate a riprap spillway and/or allow for more flexibility in landscaping options. Figure 19 depicts a conceptual terraced inlet with integrated landscaping along the facility. As shown in Figure 20, the terrace lengths increase and/or vary as they go down the drop. If the width of flow down each terrace can be successfully increased, the unit discharge over each drop would be reduced allowing for the use of a riprap spillway if desired. Alternately, the terrace steps could be constructed of stepped boulder drops such as those outlined in Chapter 7 of the District's Hydraulics Design Manual (FCDMC, 2003). Stepped boulder drops are considered the preferred aesthetic treatment for drop structures in the ADMP. A notch should be created in each structure to provide a low flow path for frequent flows to focus regular maintenance in a concentrated area. The use of the terraced inlet concept could allow for plantings on the intermediate terraces which would help to screen the engineered structures associated with the drops and stilling basins. The selection of inlet structure alternatives will depend on the inlet channel width, design discharge, and basin layout.

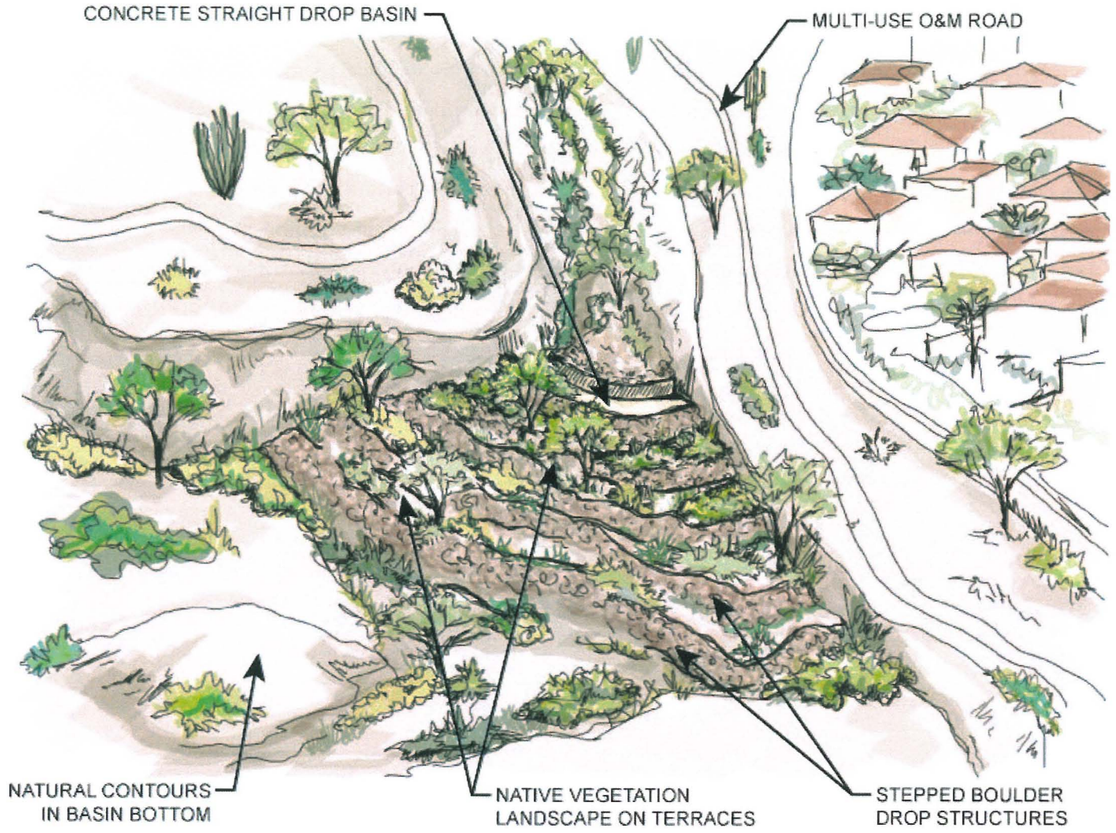

Figure 19 Conceptual Terraced Inlet Rendering

The following two sections present inlet concepts for Fan Systems 13 and 3 by way of example. Similar decision making could be applied to each specific on-line basin when design and implementation of each system move forward following Step 3.

5.7.4 Inlet Concept Example for Fan System 13

5.7.4.1 Example for Fan 13E

A riprap spillway is recommended with a width of 30 feet to match the existing channel width. A concrete cut-off wall should be constructed at the upper lip of the spillway to provide a sill for even flow distribution down the spillway. The D_{50} required will be 18 inches. Assuming a 26 foot drop and the maximum basin side slope of 4H:1V, the length of the spillway will be about 100 feet. An additional 10 feet of riprap at the bottom of the spillway on the basin floor is recommended to minimize the potential for scour hole development. The minimum depth of the riprap spillway should be a minimum of 2 times the D_{50} for a total of 3 feet. The riprap should be laid on top of a 6 inch gravel layer on top of a non-woven geotextile fabric.

5.7.4.2 Example for Fan 13W

A riprap spillway is recommended with a width of 45 feet. A concrete cut-off wall should be constructed at the upper lip of the spillway to provide a sill for even flow distribution down the spillway. The D_{50} required will be 18 inches. Assuming a 26 foot drop and the maximum basin side slope of 4H:1V, the length of the spillway will be 100 feet. An additional 10 feet of riprap at the bottom of the spillway on the basin floor is recommended to minimize the potential for scour hole development. The minimum depth of the riprap spillway should be a minimum of 2 times the D_{50} of 18" for a total of 3 feet. The riprap should be laid on top of a 6 inch gravel layer on top of a non-woven geotextile fabric.

5.7.5 Inlet Concept Example for Fan System 3

Conceptual design for the Fan 3 inlet structure was developed using the menu of alternatives previously discussed. The detention basin layout for Fan 3 is presented in Figure 10. The existing channel width and 100-year discharge for Fan 3 is shown in Table 5. The computed unit discharge is also shown to determine if a riprap spillway is a consideration.

Table 5 Design Data For Fan System 3 Basin Inlet

Fan Reach	100-year Q (cfs)	Channel Width (ft)	Unit Discharge, q (cfs/ft)
3	818	40	20.5

The predominant channel width for Fan System 3 is too narrow to consider a riprap spillway. Therefore, the use of another structural alternative will be necessary and the terraced approach will be considered. An arced 5-foot straight drop basin will be used on the first terrace to dissipate energy and spread the flow out to a width of at least 70 feet to allow for a riprap spillway on the remaining drops.

The recommended alternative for Fan System 3 is an arced terrace facility with seven drops of about 5 feet as shown in Figure 20. The first drop would consist of an arced 5-foot straight drop basin with an arc length of 50 feet at the top of the drop and an arc length of 70 feet at the bottom end sill. The remaining drops would consist of a riprap spillway with increasing widths ascending down the terraces. A concrete cut-off wall should be constructed at the upper lip of each spillway to provide a sill for even flow distribution down the spillway. The D_{50} required will be 18 inches. A 20 foot sloped stilling basin is recommended on Terrace 2 to further distribute the flow across the entire terrace. An additional 10 feet of riprap at the bottom of the spillway on Terraces 3 - 6 and on the basin floor is recommended to minimize the potential for scour hole development. Additional terrace width is recommended on Terraces 2 – 6 to provide room for landscaping to help blend the facility into the natural surroundings. The minimum

depth of each riprap spillway should be a minimum of 2 times the D_{50} of 18" for a total of 3 feet. The riprap should be laid on top of a 6 inch gravel layer on top of a non-woven geotextile fabric.

The use of the terraced inlet concept could allow for plantings on the intermediate terraces which would help to screen the engineered structures associated with the drops and stilling basins. It should also be noted that the intermediate riprap drops could be replaced with stepped boulder drops or straight concrete drops similar to the first terrace if preferred.

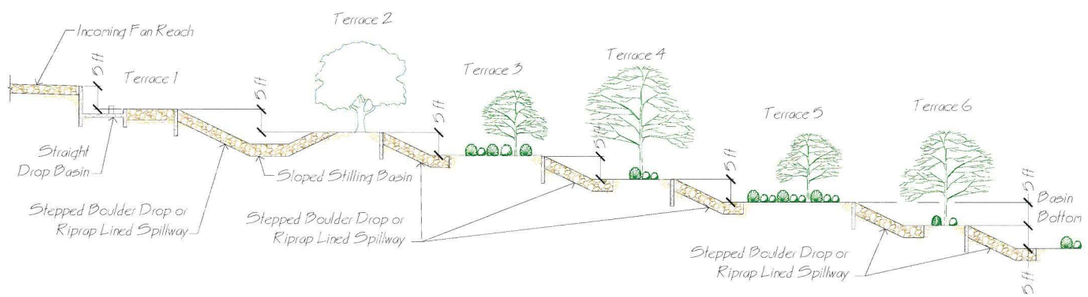

Figure 20 Example Terraced Inlet Concept Profile For Fan System 3, Wagner Sub-Area

5.7.6 Summary of Inlet Design Concepts for Fan Systems in the CAP Sub-area

Table 6 shows a summary of the inlet design concepts and hydraulic decision parameters for each on-line detention basin.

Table 6 Summary Of Inlet Design Concepts For CAP Sub-Area

Fan	Q100 (cfs)	Upstream Channel Width (ft)	Unit Discharge (cfs/ft)	Inlet Height (ft)	Selected Inlet Type	Number of Inlets	Number of Steps for Terraced Inlets
1	662	72	9	42	Riprap lined spillway	1	N/A
2	≈1000*	100	10	20	Riprap lined spillway	1	N/A
* Inflow to Fan 2 basin from two different subbasins. 100 ft inlet width estimated based on upstream channel in park.							

It is anticipated that the inlets for the Fan System 1/2 detention basins will follow the model presented for Fan System 13, that is, riprap-lined spillways since the cfs/foot of inflow is less than 13 cfs/ft. Note that the Fan 2 detention basin will require a broad area of inlet protection due to the fact that it is located outside the White Tank Mountain Regional Park, downstream of the alluvial fan apex.

5.7.7 Outlet Design Concepts

The design concept for the outlets of the on-line detention basins are circular pipes. Reinforced concrete pipes will drain the detention basins to the downstream walled-levee corridor. Inlets will require trash racks to prevent clogging. Inlet headwalls will conform to the basin slope. Figure 21 shows an example of what a basin outlet structure might look like. The outlet pipes will be buried and exit downstream of the detention basin such that the pipe has sufficient slope to adequately discharge flows and maintain an inlet control hydraulic condition. The downstream outlet of the pipes will require scour protection. Riprap is proposed to serve this purpose.

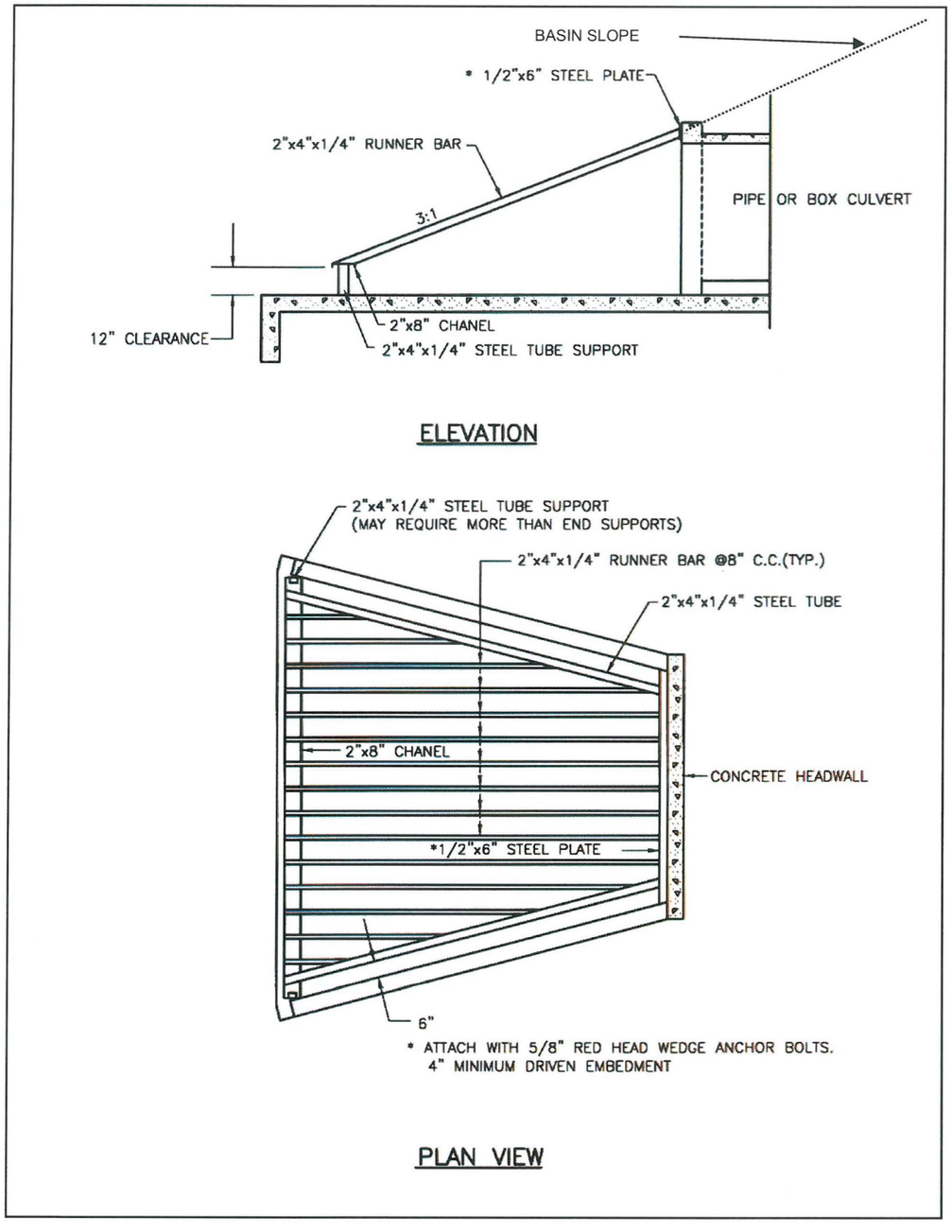

Figure 21 Typical Detail For On-Line Basin Outlet Structure

5.8 Off-line Detention Basins

5.8.1 Design Considerations

Off-line detention basins are designed in places where there is a need to reduce peak flows. In particular, basins were placed upstream of the Sun Valley Parkway channel to reduce flows to the existing channel capacity. Flow will enter the off-line detention basins via a lateral weir. Figure 22 shows the concept plan view of the off-line basins. Figure 23 shows the off-line basin with landscape aesthetic treatments. The Step 3 design process estimated the volume to be diverted using an inflow-outflow diversion relationship. The weirs were sized using an approach suggested by the District using an iterative method combining HECRAS and Hager's equation to compute the side weir coefficient.

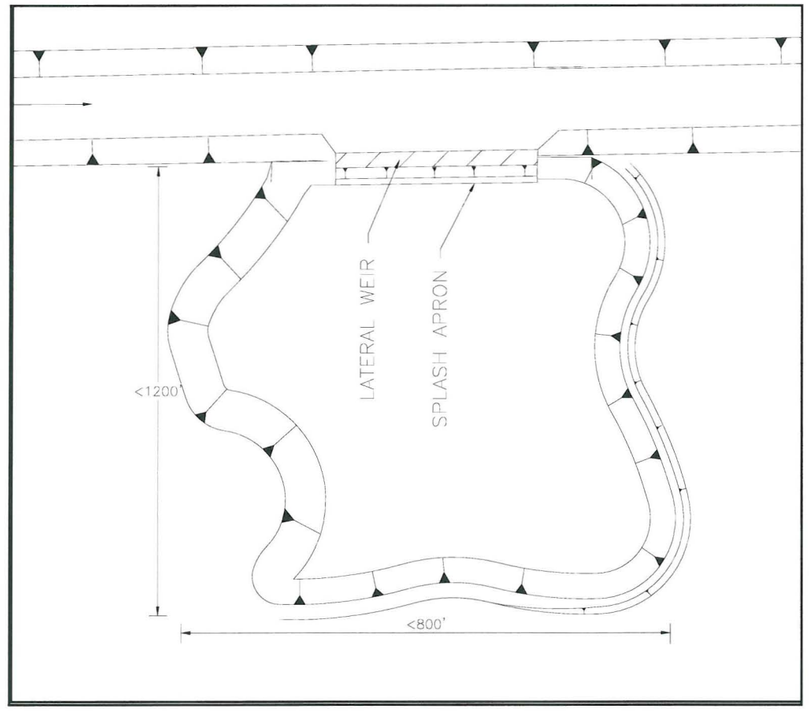

Figure 22 Concept Plan View Of Off-Line Detention Basin

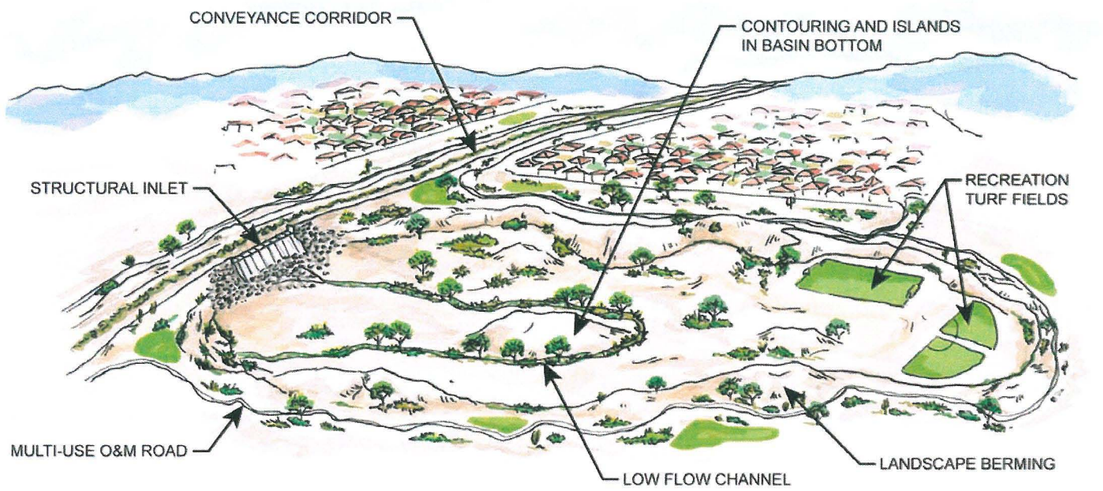

Figure 23 Concept Oblique View Of Off-Line Basins With Aesthetic Treatments

The side weir flow was calculated in RAS by starting with an assumed a lateral weir discharge coefficient in RAS (for example 2.5). RAS is then run to get the parameters required for Hager's equation. A new side weir discharge coefficient is then computed based on Hager's equation and the RAS-generated results. The newly computed side weir discharge coefficient is then placed back into RAS. This process is repeated until the Hager's equation coefficient converges.

5.8.2 Inlet Design Concepts

Inlets to the off-line basins will be side weirs from the adjacent channel. The inlets will be made of concrete and will require scour protection on the inside of the basin below the weir. Energy dissipation schemes similar to those described for the on-line basins should be selected from the menu of options based on the adjacent land use and stakeholder preferences.

5.8.3 Outlet Design Concepts

The design concept for the outlets of the off-line detention basins are small diameter circular pipes. Reinforced concrete pipes will drain the detention basins. The outlet pipes will be buried and exit downstream into the Sun Valley Parkway channel such that the pipe has sufficient slope to adequately discharge flows and maintain an inlet control hydraulic condition. The pipe outlets will be covered with flap gates to prevent backflooding of the detention basin through the pipe (Figure 24). The downstream outlet of the pipes will require scour protection. Riprap is proposed to serve this purpose.

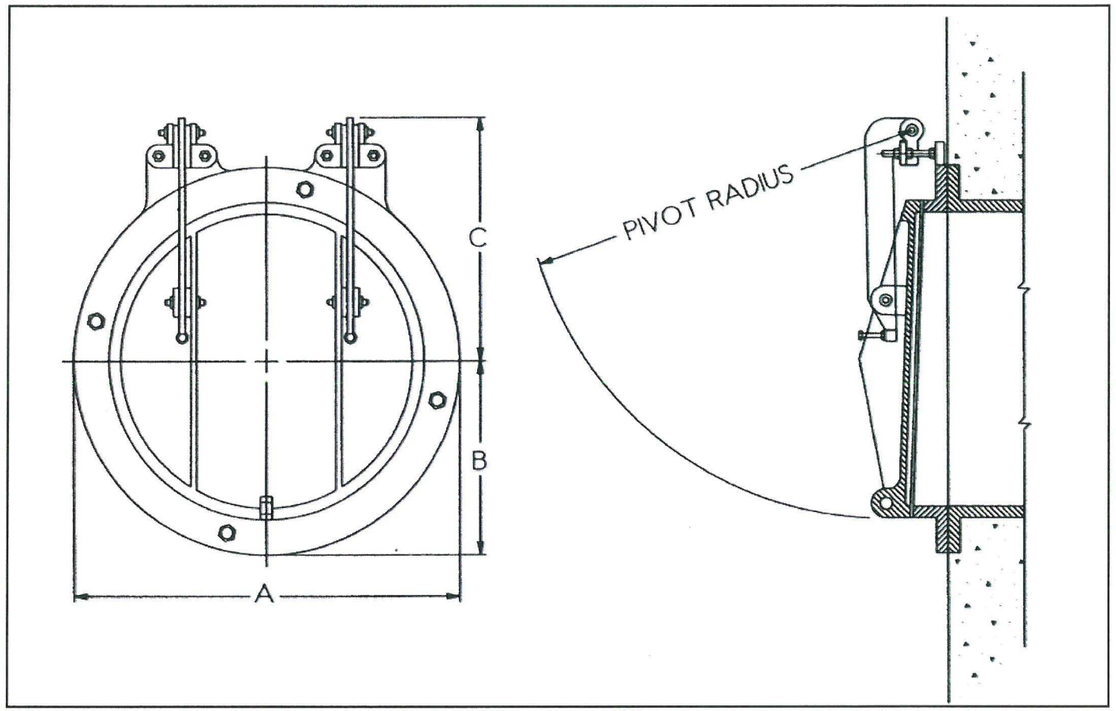

Figure 24 Typical Detail For Flap Gate

5.9 Aesthetic Treatments for Detention Basins

5.9.1 Design Guidelines

The aesthetic treatments for the detention basins include landscape contour grading, slope warping, a buffer area around the basins, and architectural enhancements to inlet and outlet structures. The detention basins to control flood flows from the alluvial fans will be areas of disturbance ranging from about 7 acres to about 83 acres. The basin will be adjusted in final design to best fit the topography of the surrounding landscape of each site. Side slopes will be warped to create an overall organic form that mimics the topographic form of the surrounding landscape. The side slopes of the basins will vary from a maximum of 4:1 to a minimum of about 8:1. The slopes of the basins will be landscaped and seeded using native Sonoran Desert plants. Plant material will be arranged to achieve a natural appearance. Figure 25 shows an example plan view of a basin with the landscape aesthetic design features.

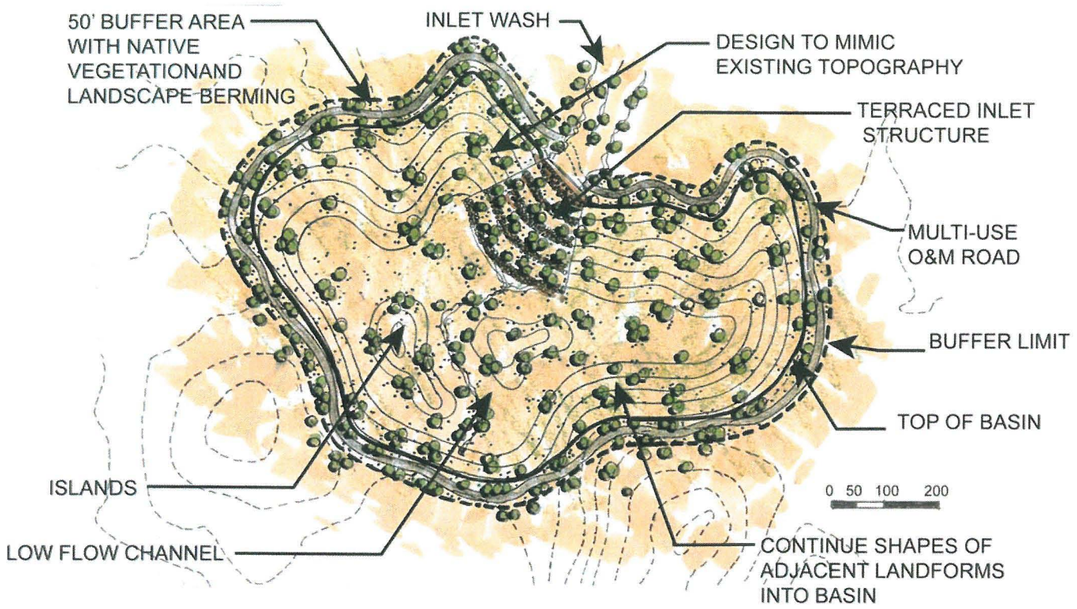

Figure 25 Planimetric View Of On-Line Detention Basin With Landscape Design Features

The bottoms of the basins will undulate to mimic the character of the surrounding landscape. The grading will create a low flow channel from the inlet structure to the outlet of the basin to direct the small flows from frequent events through a simulated natural wash.

A landscaped buffer area of 50' around the perimeter of the basins will be provided to create a visual transition with the surrounding landscape (Figure 26). The buffer area will incorporate landscape berming, vegetative planting and a meandering multi-purpose O&M road to provide open space access and visual integration with future development (Figure 27). The buffer will also provide the necessary area required to provide grading for a transition from the basin to the existing landscape or future development.

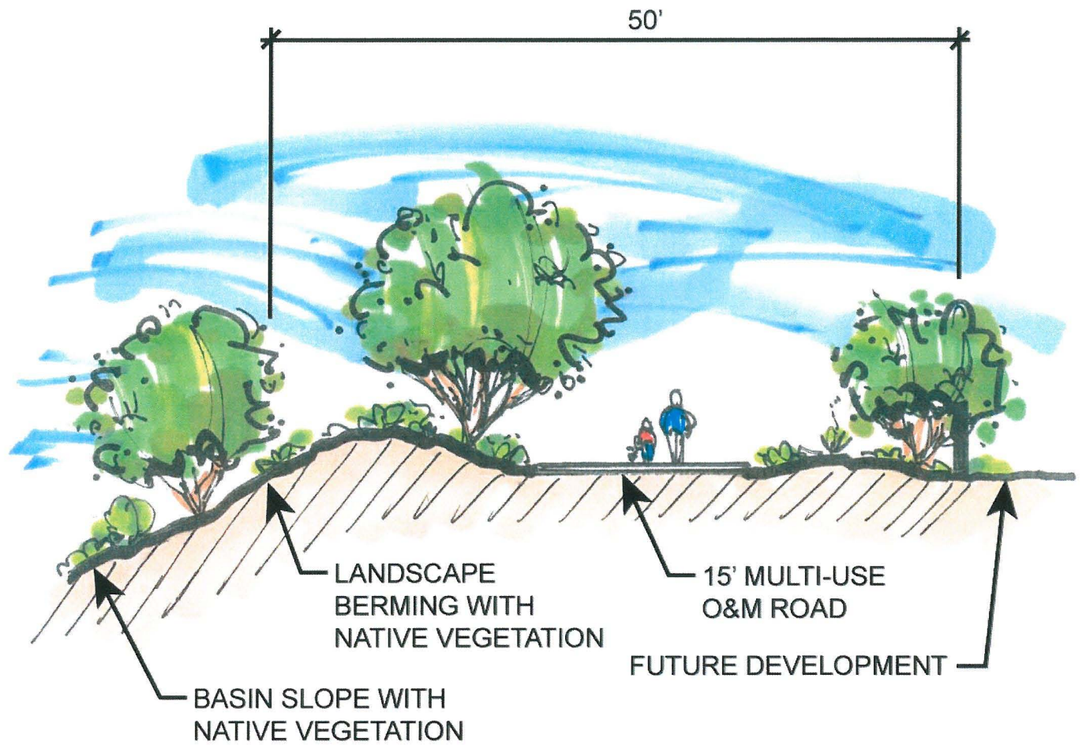

Figure 26 Concept Cross Section Of Basin Buffer Area With Landscape Design Features

The inlet structures for wash flows into the basins present challenges to the aesthetic design of the features because of the high volume of flows in many of the washes. The natural slope of the existing landscape causes average slope heights of about 30 feet up to a maximum of about 60 feet at the inlet of the washes into the basins on the uphill side of the basin. The preferred approach to developing the structural inlet components will be to develop a series of terraces that allow the flow into the basin to occur over several smaller drops of approximately four to six feet. Terraces will also be used to visually reduce the apparent height of the back slopes of the basins by limiting the slope height of any single slope to about 15-20 feet. The inlet structure terraces will range from approximately 10 feet wide to 30 feet wide. After the first one or two drops the energy of the flow should be dissipated enough to allow landscaping and revegetation on the terraces to reduce the visual impact of the structures. The landscape could be subject to some damage during the largest storm events, but once established, should recover similar to the surrounding native desert. In cases where a hard structural with aesthetic treatment solution approach would best meet the requirement for flood control, integral color, form liners for texture would be used to reduce visibility of the feature.

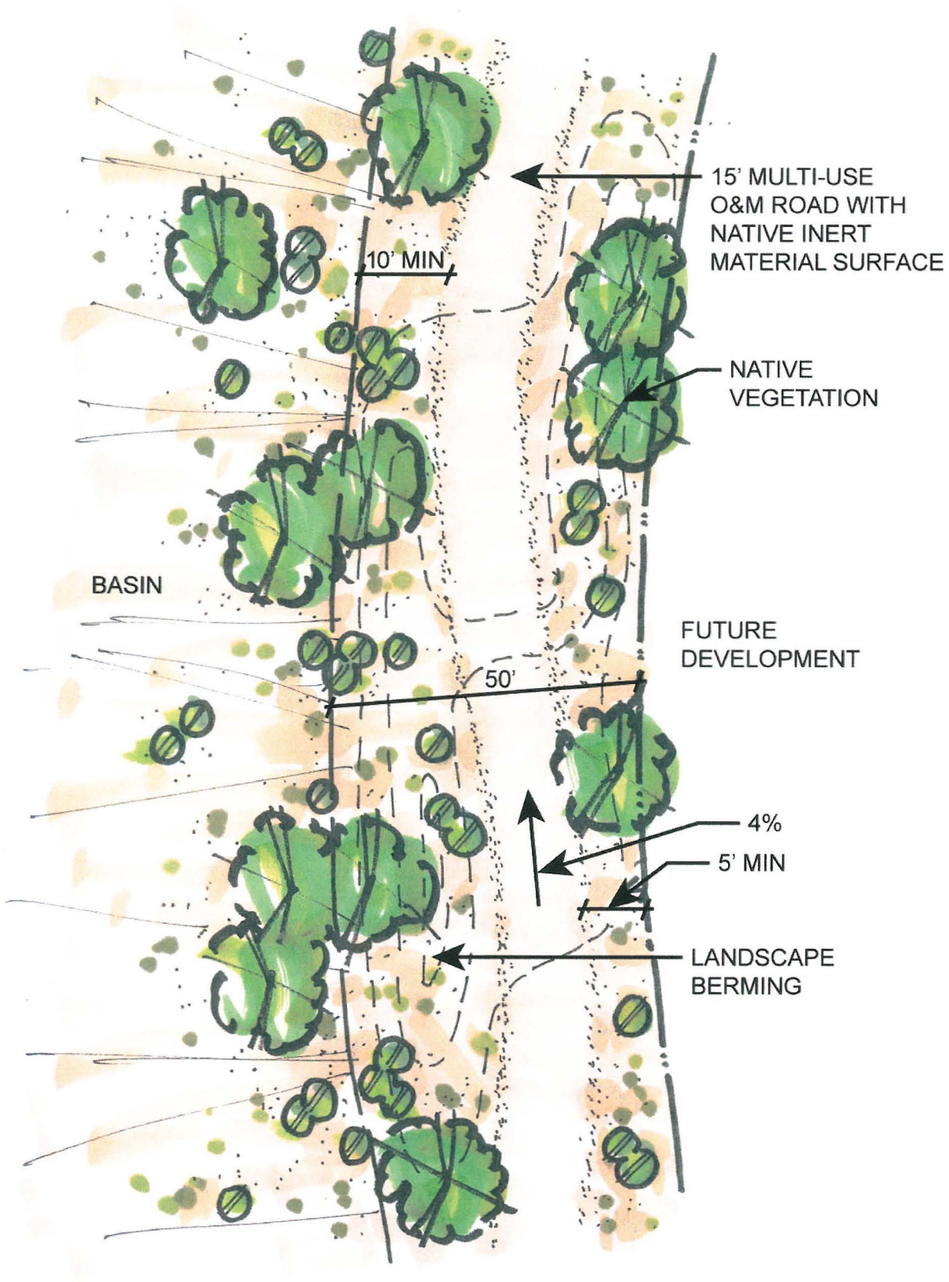

Figure 27 Plan View Of Landscape Design Features For Basin Buffer Area

In the basins with tall slopes on the uphill side, further detailing will be done during the design phase to analyze ways to reduce the visual height of the slopes. In the conceptual designs, these basins would have a reduced level of context sensitivity as compared to the basins that have slopes 35' high or less. Based on current development trends and the planned communities that are under way in the Sun Valley area, future adjacent development will include a substantial number of two-story homes that will reach heights of 25' or more. The final design of the basins should include slopes and structures that are generally in scale with the adjacent homes so that the flood control structures can be as sensitive to the local context as possible. In some situations, close coordination with adjacent development may allow the slopes above the flood detention level to be used for other purposes, such as permanent park improvements or other development associated with the planned community, including residences or other structures.

For the purpose of estimating the aesthetic treatment differential cost estimates, the average side slopes of the basins without aesthetic treatment were increased from 6H:1V to 4H:1V. Although the total storage volume was assumed unchanged, the land area requirements are less for the steeper side slopes. In addition, the setback area of 50 feet around the perimeter of the detention basins was removed. Finally, additional costs were included for architectural enhancements to the inlet and outlet structures which are assumed to be 20% of total cost for the inlet structure and 5% for the outlet structure.

5.9.2 Summary of Detention Basin Design Guidelines for Landscape Aesthetics

The detention basins in the recommended alternative are currently in undisturbed desert areas but most will eventually be adjacent to different types of residential or mixed-use developments. The development will be of various character types including low-density desert neighborhoods and moderate-density, production housing and commercial sites of the various planned area developments. Mature mesquite, palo verde, and ironwood trees and a variety of cacti including saguaros, are prevalent in the native desert areas. Vegetation varies in species composition depending on the landscape character unit. The detention basins occur in the Natural/Pastoral Bajada character unit. The detailed design guidelines below have been developed to help reduce the visual intrusion in the landscape as the basins are developed in the existing natural desert and also to allow them to become open space amenities for future residents of the Sun Valley ADMP area. Guidelines specific to applying the Semi-Natural/Desert Adapted Park Theme are included within the main design sections and will be used in addition to the main guideline where appropriate such as the offline basins along the Sun Valley Parkway.

Perimeter

- Provide a 50-foot landscaped buffer area between the top of the basin and adjacent development.
- Place the operation and maintenance (O&M) road within the buffer area and design to allow for multiple uses such as walking and biking.
    - Avoid cross slopes over 3% and longitudinal slopes over 4%.

- Establish the finish grade of the road surface no higher than 2 inches above the adjacent landscape areas.
- Construct O&M road with native inert material as the finished surface. Material will be stabilized with a polymer stabilizing product.

- Design the O&M road to be curvilinear to mimic the organic basin configuration.
- Provide ADA accessible grades on all road surfaces.
- Construct landscape berming in the buffer area to blend with the natural landforms of the Bajada character unit.
- Minimize disturbance of native vegetation, especially large trees, in the buffer zone to the extent possible.
- Supplement the existing vegetation in the buffer zone to provide a landscape setting for the multi-use O&M road and to blend the vegetation of the basin into the adjacent landscape

Semi-Natural, Desert Adapted Park Theme

- Design O&M road with connections to parking areas adjacent to buffer area.

Configuration

- Design the configuration of the basins to minimize height of cut slopes.
- Design the overall form of the basin to be freeform to blend with the natural topography and reduce visibility and apparent size of the basin.
- Warp and vary side slope ratios from 4:1 to 8:1 in a form to mimic the existing topography. Mix of slopes be approximately: 25%–4:1, 40% –6:1, 8:1-25%, and shallower than 8:1–10%.
- Design basins with irregularly shaped terraces so that the height of any single slope does not exceed 10 vertical feet.
  - Design landscape on terraces to mimic native vegetation patterns.
- Create natural, rounded transitions from side slopes to basin bottom.
- Over-excavate basin bottom areas to a depth of one (1) foot and plate with topsoil and desert varnish.
- Design basin bottom to be irregular and undulating, to mimic the natural topography of the area surrounding the site.
  - Create islands of landscape area in the basin bottom that are above the low flow conditions.
- Round top of basin side slopes and blend grading into berming in the buffer area.
- Develop the low flow drainage feature in the basin bottom to mimic local small washes.

Pre-Construction Activities

- Stockpile rock with desert varnish from all disturbance areas.
- Stockpile topsoil from a minimum of 4-12" depth.

Vegetation

- Use Sonoran desert plant material from the Natural Sonoran Desert Theme plant list provided in Section 5.6.4
  - Plant list will include plants identified as appropriate for the Bajada character unit.
  - Select specific species native to the basin location to respond to the context of the landscape character around the basin.
- Salvage native plants including saguaro and small cactus species, and maintain for replanting in the landscape.
- Design the buffer landscape to transition the density, type, size, form, color, and texture of the plant material with the species found in the surrounding landscape.
- Locate vegetation along both sides of the O&M road to break the view of the line of the road alignment and to provide shade.
- Locate trees in the landscape to maintain view corridors to mountains and nearby landforms.
- Trees, shrubs, and ground covers should be arranged in an irregular pattern along the sides, bottom, and top of the basin side slopes to complement the character of the surrounding natural landscape.
- Consider views from the areas above and below the basin when considering the placement and organization of plant material to reduce the apparent size of the basin.
- Install temporary irrigation system to establish plant material or use tall pot plant material.

Semi-Natural, Desert Adapted Park Theme

- Design plant list will include plants identified as most appropriate for the Valley Plains character unit.
- Include more use of thornless and desert adapted ornamental shrubs and ground covers in proximity to play fields and other high use areas.
- Provide permanent irrigation system for all landscape areas of basin bottoms used for park development.

Inlet Structures

- Design terraced inlet structures with stepped boulder drop structures between terraces. Drop structures will use native desert boulders as much as possible.
- Design the structures to use the materials, shapes, colors and textures that blend with the surrounding desert.
- Colors of materials should not have a light reflective value of more than 5% above the adjacent soil and vegetation values.
- Landscape the terraces of the structure with native species in patterns that mimic the surrounding landscape.

Outlet Structures

- Design structures with integral color concrete to blend with the surrounding landscape.
- Design structures using form liners to provide textures to blend with the surrounding landscape.
- Design headwalls with slopes to follow the proposed grading of the basin slopes.
- Construct grates and metal components of structures with Corten or other steel that will develop a natural weathered color.

5.10 On-line Basin Design Procedure

The on-line detention basins were designed using the following general procedure:

- Determine the upstream sediment yield using MUSLE (see Section 5.5).
- Revise the Step 2 stage-storage discharge relationships using the irregular form basins. Stage-volume relationships derived from the 10-ft DTM in GIS assuming side slopes average 6H:1V. Freeboard was fixed at 1 foot. These parameters determine the total volume provided as well as total head available to achieve the 10% outflow objective. The total sediment for the 3-year maintenance period was removed from the lower portion of the computed stage-volume relationship; that is, the total sediment volume was subtracted from the total excavated stage-storage curve before the curve was input into HEC-1 for the hydrograph storage routing.
- Compute stage-discharge relationship using HY8 to target 10% outflow objective.
- Update the stage-storage-outflow relation in HEC-1 6-hour and 24-hour models.
- Run the 6-hour and 24-hour HEC-1 models.
- Obtain the maximum peak flow volume and peak stage from HEC-1 results.
- Compare results with the designed basin volume and basin depth (includes freeboard and sediment) to see if they are adequate. That is, the total basin depth should be less than 12 feet. The volume and depth are considered adequate if the combination of sediment, runoff, and freeboard fit within the basin.
- Modify basin dimensions and outlet structure parameters, and repeat the process until the basin volume and depth are adequate.

Calculations are provided in the appendix for each fan system.

5.11 Off-line Basin Design Procedure

The off-line detention basins were designed using the following general procedure:

- Run the 6-hour and 24-hour HEC-1 models.
- Obtain the maximum diverted flow volume from HEC-1 results.
- Compare results with the designed basin volume. The volume is considered adequate if the combination of runoff and freeboard fit within the basin.
- Design channel size weir to allow for needed flow diversion.

Calculations are provided in the appendix for each fan system.

5.12 Walled-Levee Corridors

5.12.1 Design Considerations

The walled-levee corridors were designed to act as a regional flood control trunk system and were sized to include local drainage as well as sediment from the adjacent watershed area. As part of the Step 3 design process, four discharge values are analyzed to ensure the applicability of the design to a range of flows. The four flows are simply ratios of the 100-year peak flows: 10%, 30%, 75% and 100%. The 10% flow can be expected to approximately represent the 2-year flow, 30% represent the 5 to 10-year flow, and 75% represent the 50-year flow. These ratios were selected based on guidance in the District's draft Hydrology Manual (2003). Figure 28 shows a plot of the ratios from the District Manual along with the 25-year and 50-year ratios selected for use in the ADMP. The discharge ratios were also used in the sediment yield analyses.

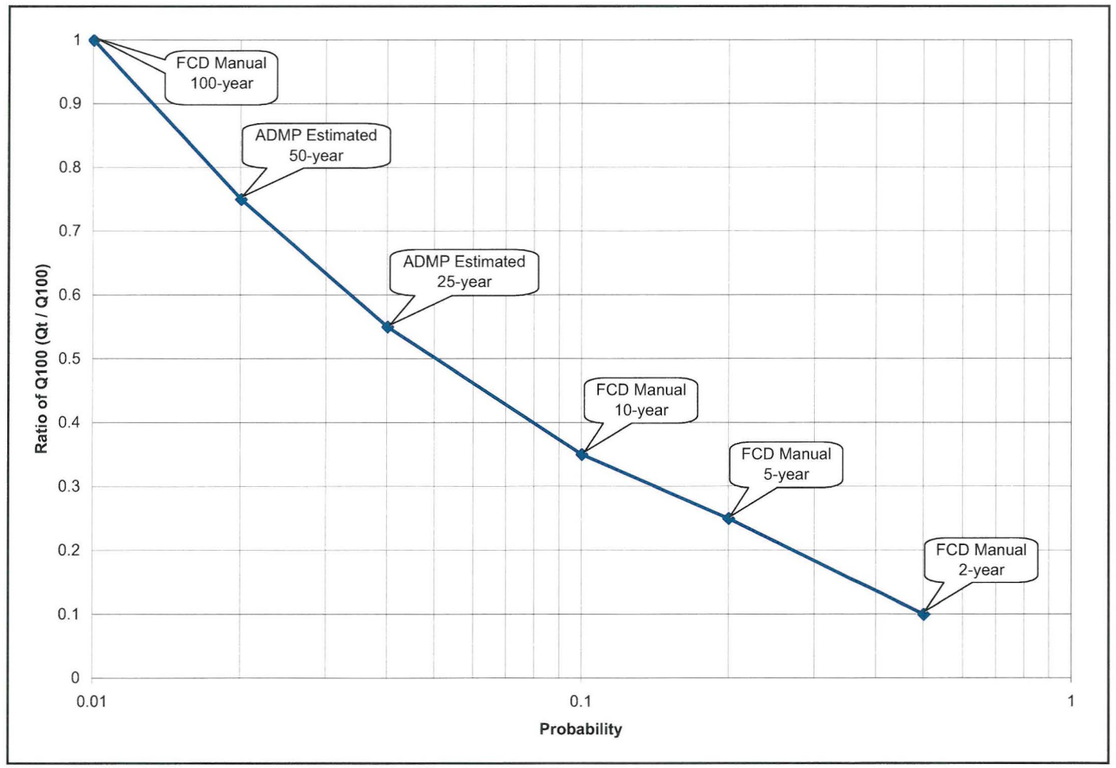

Figure 28 Development Of 25-Year & 50-Year Ratios For SVADMP

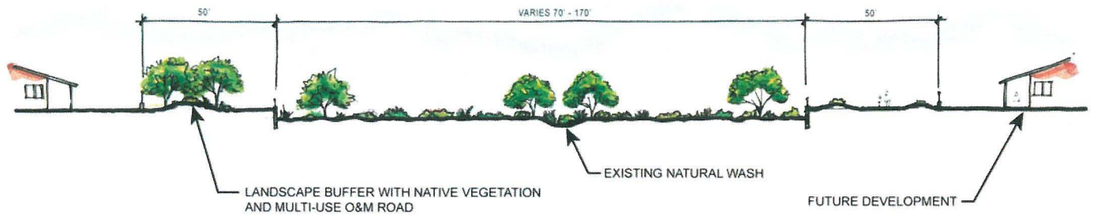

Figure 29 Concept Cross Section For Leveed Corridor With Walls & Aesthetic Treatments

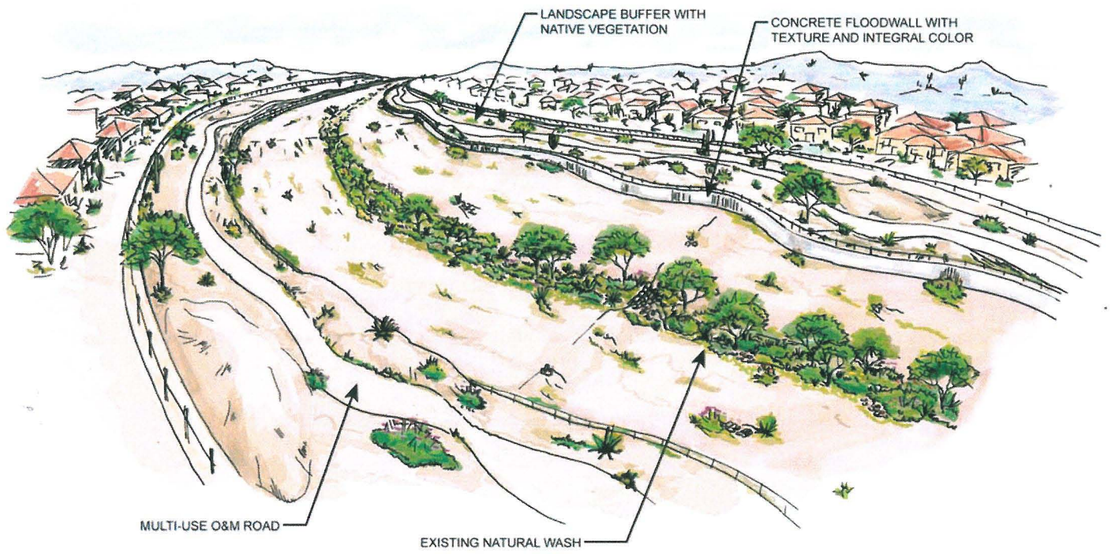

Figure 30 Oblique View Of Walled-Levee Corridor With Aesthetic Treatments

The walled-levee corridors were generally designed for subcritical flow with Froude numbers less than 0.86. Subcritical flows result in flows with lesser velocity and are favorable from public safety point of view. However, for some cross sections, the existing natural channel widths, slopes, and/or depths do not allow the criteria to be met.

Velocity within the walled-levee corridors was designed to be no greater than 6 ft/sec for the 100-year discharge and about 4 ft/sec for the 5 to 10-year discharge. Average flow depth in the corridors was restricted to 2 feet unless the velocity or Froude number requirement could not be met simultaneously. The minimum freeboard for the walled-levee corridors was set to meet the FEMA freeboard requirement of 3 feet for the concept designs.

Figure 29 shows a conceptual cross section of the walled-levee corridor. Figure 30 shows an oblique rendering of an example corridor reach.

5.12.2 Hydraulics

The hydraulics for the walled-levee corridors were performed using Manning's equation (normal-depth assumption). This was done using visual basic macros within an Excel spreadsheet environment. The numerical calculations were performed using the Newton-Raphson method for rapid convergence. In cases where the Newton-Raphson method failed to converge, the bisection method was adopted to ensure accurate results.

Channel geometry data were taken from a digital terrain model based on the 10-foot topography. A Manning's n-value of 0.045 was used for all cross sections. Analyses were performed to ensure adequate conveyance and freeboard for the estimated flow rates at each cross section. Freeboard was assumed to be a minimum of 3 feet for all cross sections.

5.12.3 Equilibrium Slope

The equilibrium slope is defined as the slope at which the channel bed is in equilibrium. It is interpreted as the slope the channel would evolve into, provided continuous flows for a long period of time and provides an idea as to what the long-term channel slope could become.

Following methods were used in Step 3:

- Meyer-Peter, Muller (MPM) for clear water reaches immediately downstream of the on-line detention basins
- ADWR approach for live bed reaches

Equilibrium slope is defined as the slope which causes the channel's sediment transport capacity to equal the incoming sediment supply (ADWR, 1985). If the slope is too steep, channel velocities will be high and net erosion will occur. If the slope is too flat, channel velocities will be low and net deposition will occur. The equilibrium slope is the slope that the undisturbed, natural channel will tend towards over the long term. While there are philosophical and practical problems with applying equilibrium slope concepts to ephemeral streams with variable channel geometry and high flash flood potential, or streams where the natural hydrology has been altered by urbanization, equilibrium slope equations provide a useful order-of-magnitude assessment of the likelihood of vertical channel adjustments.

Design reach-averaged data required for application of the equilibrium slope equations to the study area were derived from the following sources:

- Hydraulic data – normal-depth computations
- Hydrologic data - HEC-1 modeling and area weighting
- Topographic data – 10-foot contour data and DTM

Most equilibrium slope equations are based on the mean annual flood, the "channel-forming," or "bankfull" discharge. On many perennial alluvial streams, particularly in humid climates, the mean annual flood and the channel-forming and bankfull discharges are nearly equivalent. However, on ephemeral streams where flow events are rare, the channel-forming discharge is often difficult to determine. The ADWR Manual suggests use of the 5- to 10-year flow rate to predict expected slope adjustments in ephemeral watercourses like those in the SVADMP study area. Based on ratios of the 100-year flow rate in the District's Hydrology Manual (2003), a value of 30% of the 100-year flow was used to compute equilibrium slope for the corridors in the recommended alternative.

5.12.3.1 Meyer-Peter, Muller Equation

Equilibrium slope for clear water reaches was estimated using the Meyer-Peter, Muller (1948) equation which is based on the incipient motion theory, or the point of initiation of sediment transport. The equation is given by:

$$S_L = K_{mpm} (Q/Q_{bf}) (n_s/D_{90}^{1/6})^{3/2} D / d$$

Where:

S_L = Stable slope (ft/ft)

K_{mpm} = 0.19

Q/Q_{bf} = Ratio of total flow to flow over the channel

Q_{bf} = Dominant discharge (cfs)

n_s = Manning's n for the stream bed

D_{90} = Bed sediment diameter for which 90 percent is smaller (mm)

D = Mean sediment diameter (mm)

d = Channel depth (ft)

The resulting slope was used to compute grade control requirements for the leveed corridors immediately downstream of the on-line detention basins.

5.12.3.2 Sediment Transport Capacity

The sediment transport capacity was used to estimate of the rate of sediment transport. The sediment transport capacity can be used to ensure adequate sediment continuity and provides channel sediment trend when compared with the inflowing sediment transport load. The Zeller-Fullerton equation from the ADWR Manual was used to compute sediment transport capacity for the design corridor reaches. The Zeller-Fullerton Equation is a total bed-material discharge equation, and is formulated as follows:

$$Q_s = 0.0064\, n^{1.77} V^{4.32} G^{0.45} Y_h^{-0.30} D_{50}^{-0.61}$$

Where: Q_s = sediment discharge rate (cfs)

n = Manning's roughness coefficient, channel

V = mean channel velocity (ft/s)

G = gradation coefficient

Y_h = hydraulic depth, channel (ft)

D_{50} = median bed sediment size (mm)

Hydraulic data required to apply the Zeller-Fullerton equation were obtained from the normal-depth hydraulic calculations for each design reach and corridor tributary. The gradation coefficient and D50 were based on the average sediment gradation curve described in Section 5.1.5.

Geometry for the corridor tributaries was estimated from the aerial photographs and 10-foot topography. Tributary slope was measured from the contours approaching the corridor confluence. Cross sections were approximated as rectangular with channel width estimated from the aerial photographs. Channel depths were estimated based on the computed normal-depth velocity. Velocities were targeted to approximately 4 feet per second which were considered appropriate for bankfull depths for these tributary reaches (Moody et al., 2003).

The sediment transport capacity values were used to compute equilibrium slope for live bed reaches based on the sediment transport continuity approach outlined in the ADWR Manual. Sediment transport capacity was computed for each design reach as well as significant tributaries to the leveed corridors.

5.12.4 Scour and Toe Protection

The toe-down for the floodwalls was estimated using scour calculation procedures outlined in the ADWR Manual. The following equation for depth of scour in a stream is given in the ADWR Manual:

$$Z_t = 1.3 (Z_{deg} + Z_{ls} + Z_{gs} + Z_{bs} + Z_i + \tfrac{1}{2} h_a) \qquad \text{(ADWR Eq. 5.28)}$$

where:

Z_t = Design scour depth (ft)

Z_{deg} = Long-term degradation (ft)

Z_{ls} = Local scour depth (ft)

Z_{gs} = General scour depth (ft)

Z_{bs} = Bend scour depth (ft)

Z_i = Low-flow incisement depth (ft)

h_a = Anti-dune height (ft)

1.3 = Safety factor to account for non-uniform flow distribution

Long term degradation, Z_{deg}, was assumed to be controlled by the grade control structures which have a design drop height of 3 feet. Therefore, an average long-term degradation was taken to be 1.5 feet for the purposes of computing toe-down requirements. Consequently, actual long term degradation at a given point could be more or less than 1.5 feet.

Local scour, Z_{ls} , was assumed to be zero for the purposes of the average design scour depth. However, the actual design would need to consider local scour in locations of abrupt transitions, where facilities such as maintenance access ramps protrude into the corridor, or other locations such as roadway crossings.

General scour, Z_{gs}, is the component of scour that represents the mobile portion of the bed-material of the channel bottom. General scour was estimated using the following equation (Zeller, 1981):

$$Z_{gs} = Y_{max} [(0.0685 V_m^{0.8})/(Y_h^{0.4} S_e^{0.3})-1]$$

where:

Z_{gs} = General scour depth (ft)
V_m = Average velocity of flow at design discharge (ft/sec)
Y_{max} = Maximum depth of flow at design discharge (ft)
Y_h = Hydraulic depth of flow at design discharge, (ft)
S_e = Energy slope (ft/ft)

Where Z_{gs} was determined to be negative, the general scour component was assumed to be zero.

Bend scour, Z_{bs}, occurs on the outside of bends in a stream channel, and is caused by spiral transverse currents. Bend scour was estimated using the following equation:

$$Z_{bs} = 0.0685 Y_{max} V_m^{0.8} Y_h^{-0.4} S_e^{-0.3} (2.1 [\sin^2(\alpha/2)/\cos \alpha]^{0.2} - 1)$$

where:

Z_{bs} = Bend-scour component of total scour depth (ft), and
= 0 when $r_c/T > 10.0$, or $\alpha < 17.8^o$
= computed value when $0.5 < r_c/T < 10.0$, or $17.8^o < \alpha < 60^o$
= computed value when $\alpha = 60^o$ when $r_c/T < 0.5$, or $\alpha > 60^o$
Y_{max} = Maximum depth of flow immediately upstream of the bend (ft)
V_m = Average velocity of flow immediately upstream of the bend (ft/sec)
Y_h = Hydraulic depth of flow immediately upstream of the bend (ft)
S_e = Energy slope immediately upstream of the bend (ft/ft)
α = Angle formed by the projection of the channel centerline from the point of curvature to a point which meets a line tangent to the outer bank of the channel (degrees)
r_c = radius of curvature along centerline of channel (ft)
T = channel top width (ft)

The bend angle was computed from the arccosine of the reciprocal of the sinuosity. A sinuosity of 1.1 was assumed for all design reaches.

The low-flow incisement depth, $Z_{i,}$, was taken as 2.0 feet for all design reaches. This generalization was based on field observations of existing low flow channels in the area which were seen to range between one and two feet throughout the ADMP study area. Therefore, a value of two feet was selected for the purposes of estimating scour depth for the concept design and costing of the floodwalls.

Anti-dune height, h_a, is the component of scour caused by movement of dune shaped bed forms along the bottom of the channel. The anti-dune height was estimated using the following equation:

$$h_a = 0.027 V^2_m$$

where:

V_m = Average velocity of flow at design discharge (ft/sec)

Scour depth below drop structures was estimated using the following equation from Pemberton & Lara (1984):

$$D_s = 4.7 h^{0.2} q^{0.57} / d_{90}^{0.32} - d_m$$

where:

D_s = Scour depth below downstream water surface (m)
h = Drop height (m)
q = Unit discharge ($m^3/s/m$)
d_{90} = Bed material size for which 90% of the sample is finer (mm)
d_m = downstream mean water depth

5.12.5 Floodwalls

Where the existing topographic relief and/or the natural channel does not contain the design flow rate, conveyance is provided by floodwalls. While a typical floodwall design is being presented within this concept report, only a coordinated effort between a variety of disciplines including geotechnical engineers, structural engineers and hydraulic engineers will ensure that engineering, economic, and safety considerations are integrated into the overall final design.

The preliminary floodwall design for this project had to account for the following constraints:

- The floodwall had to be extended below the total scour depth anticipated within the channel.

- The floodwall had to have a minimum of 3 feet of freeboard above the maximum computed water surface.
- On the protected side, the maximum of three (3) feet above the final grade could be left exposed. Backfill will be placed to achieve this requirement.
- In no case will the resisting-side earth pressure exceed one-half the passive pressure as calculated using unfactored shear strengths for overturning and bearing capacity and structural design (EM 1110-2-2502).

In addition to the above constraints, several other key assumptions were in the conceptual design of the floodwalls as follows.

1) The backfill will consist of a homogenous layer of clean, non-cohesive soil (c = 0).
2) The resisting side force will be zero for overturning and bearing capacity analyses and for structural design.
3) For any given scenario, the wall will be at at-rest (stable).
4) The ground water will be below the backfill.
5) Runoff generated by the watersheds on the protected side of the wall would be conveyed around the structure such that it will create a surcharge pressure on the opposite side of the wall.

Once the constraints and assumptions were identified, the process of designing the floodwall was undertaken. Using the hydraulics of the channels and the total scour estimates previously discussed, the initial step in the process was to calculate the total height of the proposed floodwall for each cross-section. The height of the wall was taken to be the sum of the scour depth plus the flow depth plus the freeboard amount. The result was rounded to the nearest larger full foot.

The next step was to estimate height of the fill that would be placed above the base of the floodwall. This height has to account for both the adjusted total scour and any additional fill needed to raise the grade such that only three (3) feet of wall could be left exposed on the protected side.

Given the typical wall height of 4 to 5 feet (including the 3 feet of freeboard) and the similar hydraulic design criteria for the cross sections, the range of potential basic floodwall design of nine to fourteen feet was selected. It was also determined that the fill added above the scour depth could either be 1 foot or 2 feet. An intermediate value of 1.5 feet of fill was incorporated into the designs.

From these simple relationships, six separate wall design scenarios were created. In so doing the need for design as unique wall segments for each cross-section was eliminated. It should be noted that in reality, each of these scenarios could be expanded to account for the different flood stages, with the extremes being a completely dry channel that has been scoured to its maximum potential or a channel conveying flow at the maximum flood stage. For the concept designs associated with the ADMP, a conservative approach was taken assuming that the structural loading on the wall would come from the fill on both sides of the wall, plus the loading caused by the 100-year storm event.

The conceptual floodwalls were generated using the assumptions presented in the U.S. Army Corps of Engineers Publication EM 1110-2-2502 *Engineering and Design of Retaining and Flood Walls* supplemented with the *Design Manual for Retrofitting Flood-prone Residential Structures* (FEMA, 1986). In addition, several basic design standards based on past design were also used to complete the design. The typical cross-section along with the basic design criteria for each of the above scenarios is presented on Figure 31.

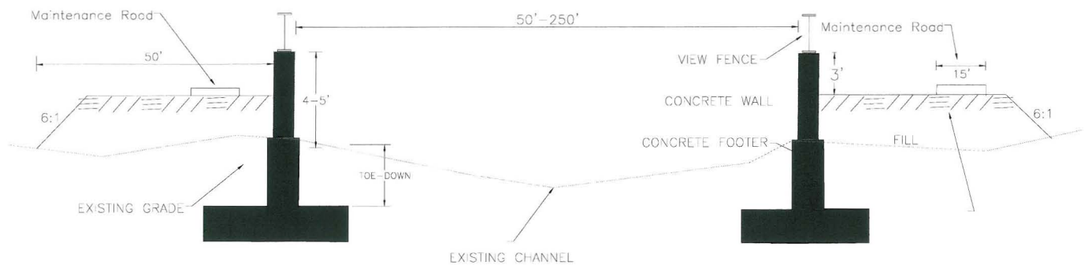

Figure 31 Example Of Typical Floodwall And Corridor

Upon completion of the design, the cost per linear foot was determined. This analysis will serve to provide a means to estimate the preliminary costs for the materials for the construction of the floodwalls. The unit costs are based on past projects bids and could vary considerably from future values. As the reinforcing rebar could not be designed at this phase, a standard price ratio of 15% of the wall cost was used as a base value. A summary table of the costs is provided below. Additional discussion of the cost estimates for the recommended alternative is found in Section 7.

Table 7 Flood Wall Typical Section Properties

(from "Computer Program Users Manual for the Nonstructural Evaluation Program", USCOE, Nov. 1992)												
Wall	Base			Batter			Area		Total	LF	Steel	Total
Height	Toe	Heel	Thickness	Base	Top	length	Base	Wall	Area	Cost	Cost	Unit Cost
A	*C*	*D*	*F*	*E*	*G*	*A-F*	*sf*	*sf*	*cy / lf*	*$155 / cy*	*15%*	*$ / LF wall*
9.0	1.5	2.94	1.08	1.08	1.00	7.92	4.8	8.2	0.48	$75	$11	$86
10.0	1.6	3.22	1.17	1.17	1.00	8.83	5.6	9.6	0.56	$87	$13	$100
11.0	1.89	3.78	1.33	1.33	1.10	9.67	7.5	11.7	0.71	$111	$17	$127
12.0	2.00	4.00	1.50	1.50	1.25	10.50	9.0	14.4	0.87	$135	$20	$155
13.0	2.15	4.30	1.55	1.55	1.28	11.45	10.0	16.2	0.97	$150	$23	$173
14.0	2.28	4.56	1.67	1.67	1.38	12.33	11.4	18.8	1.12	$174	$26	$200

*Note: All wall variables are in feet

In addition to the above costs, a cost of $7 per square foot of wall was added to allow for the use of form liners for aesthetic treatment of the wall surfaces.

5.12.6 Drop Structures

Drop structures are included to limit long-term degradation where necessary. The on-line detention basins collect both sediment and flow volume. As a result, the on-line detention basins also function as sedimentation traps near the fan apices. The result is relatively clear water discharges immediately downstream of the detention basins. Drop structures will be required to limit degradation of the channel in these reaches. Downstream tributaries deliver sediment to the corridors. The inflowing sediment provides supply to offset the reduction in supply due to the on-line detention basin. Clear water conditions were assumed to prevail for the first one or two design sections (generally 1000 to 2000 feet) or until the first tributary enters the corridor.

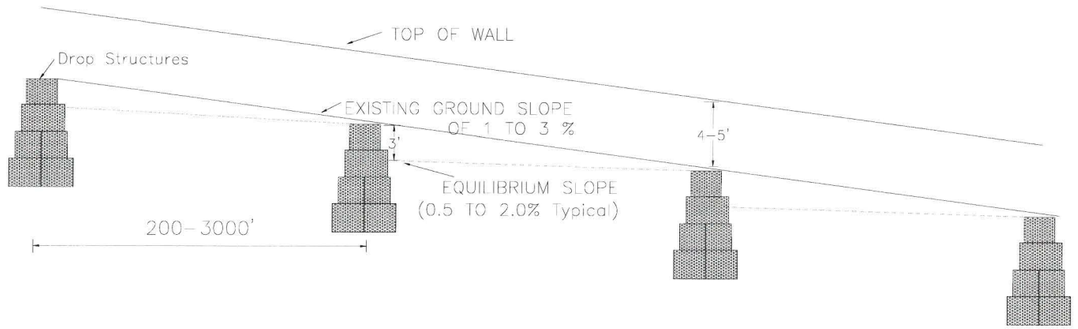

Figure 32 Concept Profile View Of Walled-Levee Corridor

The drop structures were designed to be three feet high and spaced accordingly. This size provides a reasonable height from multiple-use and visual scale points of view. Grade control structures were assumed to be made of buried gabions for the purposes of the cost estimates. The number and spacing of drop structures was determined by using the difference between the existing slope and the anticipated long-term slope for the leveed corridors. Costs were estimated using the fractional number of structures computed for each design reach. The placement of the actual drop structures are shown on the design maps based approximately on the spacing computed rather than strictly on the total number. Therefore, the number of drop structures shown on the maps does not necessarily match the number used in the cost estimates exactly. Figure 32 shows the concept profile view of the leveed channel corridor with the buried grade control structures and the anticipated long-term, or equilibrium, slope.

It is suggested that a grade control structure be placed at the downstream end of the corridor to prevent headcutting into the corridor. Similarly, vertical downcutting of tributaries to the corridor should be prevented by placing grade control structures for the corridor just downstream of significant tributary confluences. Elsewhere, it is anticipated that transportation and utility crossings will provide most of the required grade control needs. Scour below the drop structures should be estimated using the scour equation from Pemberton and Lara (1984) shown in Section 5.11.4. The total height of the drop structures should include this estimated scour depth.

5.13 Aesthetic Treatments of Walled-Levee Corridors

5.13.1 Floodwalls

The design approach for flood control corridors will retain most of the natural character of the existing wash. The use of walls to contain the design flood flows will minimize the disturbance of the area adjacent to the wash corridor but will require the following aesthetic treatments to blend these structures into the landscape. These features will include but not be limited to:

- the use of form liners to add texture to the wall surface;
- the use of integral color in the concrete to blend with the surrounding landscape;
- horizontal undulation to reduce the rigid look of the walls and to avoid major vegetation when possible;
- limit interior wall height to 5 feet whenever possible through meandering the wall with the existing topography;
- installation of trees in a random pattern along the interior base of the walls to reduce their visibility;
- and vertical undulation with the existing terrain to reduce the rigid engineering aspect of the walls and emulate the gently undulating character of the surrounding terrain.

While the walled levee approach is a hard structural with aesthetic treatment method of flood control, the minimal disturbance to the natural wash combined with full implementation of the above listed aesthetic features will result in a structure that is fully context sensitive with the surrounding visual environment.

The walled-levee corridors include a setback area of 35 ft along each side of the conveyance corridor to provide visual screening as well as recreational and/or environmental benefits. This is in addition to 15 feet added for a maintenance road on each side. If flow and freeboard containment can be achieved by natural ground, the maintenance road and setback area are provided within the freeboard area above the 100-year water surface elevation.

It should also be noted that the selection of a walled natural corridor with relatively low floodwalls is integral to the recommended alternative. While the internal wall height was limited to about five feet on average, the external wall height was limited to three feet through the use of backfill behind the floodwall outside the flood channel. This will further reduce the visual impact of the wall structures upon adjacent land use areas and will increase opportunities for public viewing into the wash corridor open space and the mountain uplands forming the scenic back drop. The costs associated with the color, form liners, backfill, and setback area right of way were considered the differential costs required to meet the aesthetic treatment policy requirements. Landscaping of the setback area was also assumed to be required. These costs were computed for comparison with the District's cost guidelines for aesthetic treatment of flood control facilities.

5.13.2 Drop Structures

The planned flows in the drainage corridors will require drop structures to control long-term degradation of the channel. Large boulders will be used as part of the structural design to reduce the visual impact of the structures. If suitable materials for stepped boulder drops are not readily available, concrete with architectural design treatments may be an acceptable alternative. Seeding and revegetation upstream and downstream of the structures will help reestablish native vegetation after construction and further reduce the visual affect to the landscape. A 10% increase in the length of the drop structures was applied for the purpose of assessing the differential cost for the required aesthetic treatments.

5.13.3 Design Guidelines for Landscape Aesthetic Treatment

The walled-levee corridors are located in areas where the natural desert vegetation is mostly undisturbed, but will be in areas of moderately intense development in the future. The corridors in the CAP Sub-area are situated within two landscape character units. However, the largest portion of the corridors lies within the Bajada character unit. A small portion of the corridor for the Fan 2 basin is located in the Valley Plains unit (Figure 9). The corridors will serve as the unifying element that would create an organic pattern of elements connecting the adjacent developments to other major trail corridors. The landscape design of the corridors will include plants from the Natural Sonoran Desert Plant list in Section 5.6.4. The aesthetic design guidelines and criteria for the corridors include developing the corridors in meandering forms, incorporating a multi-use O&M road, using native vegetation along the corridor that is specific to the adjacent character unit, and using stepped boulder drop structures for channel grade control. Figure 33 shows a cross section of a flood wall and adjacent buffer area with the landscape aesthetic treatments. The detailed landscape aesthetic design guidelines are listed below. They have been developed to help reduce the visual effects of the corridors as they are developed in the existing natural desert and also to allow them to become open space amenities for future residents of the Sun Valley ADMP area.

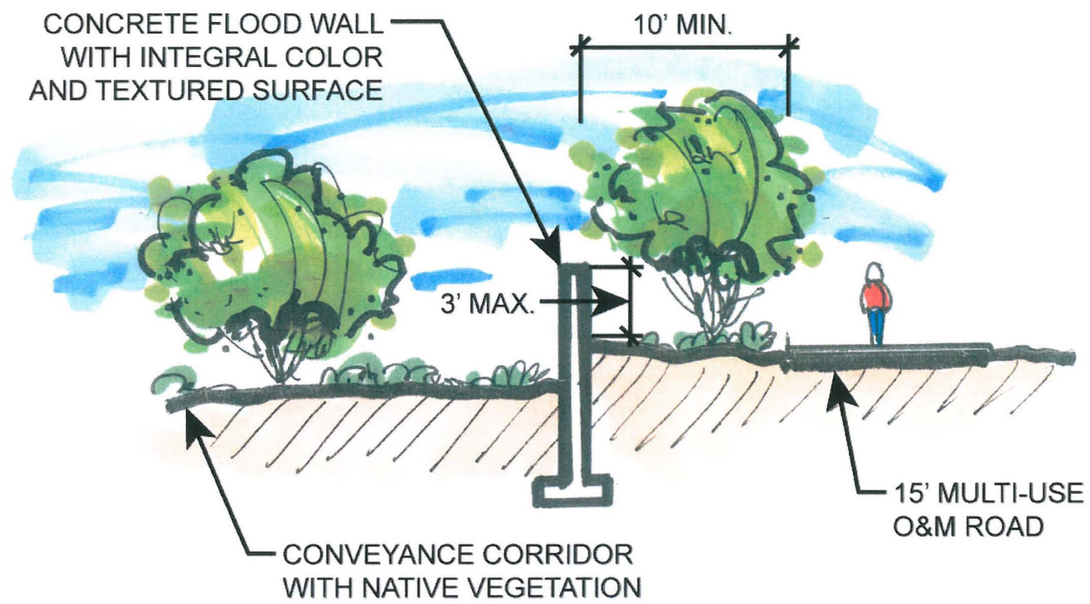

Figure 33 Buffer Area Detail With Landscape Aesthetic Features

Design and Configuration

- Design the corridor to follow the existing wash and be freeform to blend with the natural topography and vegetation patterns.
- Meander the corridor alignment in an irregular pattern, generally following the existing wash in the corridor. The wash should always remain approximately in the middle one-third of the overall corridor.
- Provide a 50-foot landscaped buffer area between the corridor and adjacent development.
- The curvilinear floodwall should be designed with color and texture borrowed from natural landscape and to tie into and blend with natural landforms
- The operation and maintenance (O&M) road will be placed within the buffer area and should be designed to allow for multiple uses such as walking and biking. Avoid cross slopes over 3% and establish final road surface no higher than 2 inches above the adjacent landscape areas.
- Design the grades for all roads to meet ADA standards.
- Place rocks and boulders randomly and in groupings in the landscape buffer and other disturbed areas to blend with the existing patterns of the adjacent desert.

Multi-purpose O&M Road

- Gracefully meander the O&M road and maintain a minimum distance of 10 feet from the edge of the O&M road to the floodwall and a minimum of 5' from the back edge of the buffer zone.
- In areas where floodwalls are not used to control flood flows, the O&M road should be located sensitively in the natural desert to minimize vegetation and landform disturbance.

- Construct O&M road with native inert material obtained from within the study area as the finished surface.

Vegetation

- Preserve existing native desert vegetation and landforms to the maximum extent possible.
- Salvage native plant material including but not limited to; small cacti species (cholla, barrel cactus and prickly pear), saguaro, ocotillo and yuccas and replant on site.
- Use plant material from the Natural Sonoran Desert Plant list provided in Section 5.6.4.
    - Use plants appropriate for the Valley Plains and Bajada character units in the locations of the corridor where it is within those character units.
    - Select specific species native to the corridor location to respond to the context of the surrounding landscape character.
- Transition the density, type, size, form, color, and texture of the plant material to integrate with the plants used in adjacent development. Use transition plantings in the buffer zone only.
- Prune trees adjacent to the multi-use O&M road to allow pedestrians to pass underneath their canopies. Avoid using plant material with notable thorns or those plants considered hazardous to pedestrians adjacent to the multi-use O&M road.
- Design tree plantings in informal arrangements that mimic natural vegetation patterns, while maintaining views of the surrounding mountains and other landscape focal points within the study area.
- Design the placement of trees, shrubs, ground covers, using irregular patterns to mimic adjacent desert areas.
- Install irrigation system to maintain and establish plant material or use tall container planting methods.

Pre-Construction Activities

- Stockpile rock with desert varnish from all disturbance areas.
- Stockpile topsoil from a minimum of 4-12" depth.

Flood Walls

- Use integral colored material and surface treatments that are borrowed from the adjacent desert to blend with the surroundings.
- Place trees randomly near base of walls on interior of corridor to reduce visibility of the walls.
- Design walls with horizontal undulation to reduce the rigid look of the walls and to avoid major vegetation when possible.
- Design walls to limit interior height to 5 feet whenever possible through meandering with the existing topography.
- Design walls with vertical undulation with the existing terrain to reduce the rigid engineering aspect of the walls.
- Design wall to have a maximum vertical height of 3 feet on the exterior side.

Drop Structures

- Use natural boulders to develop stepped drop structures for the final design of the grade control in the corridor (Figure 34).
- Meander stepped drop structures horizontally to reduce linear design when structures become exposed.

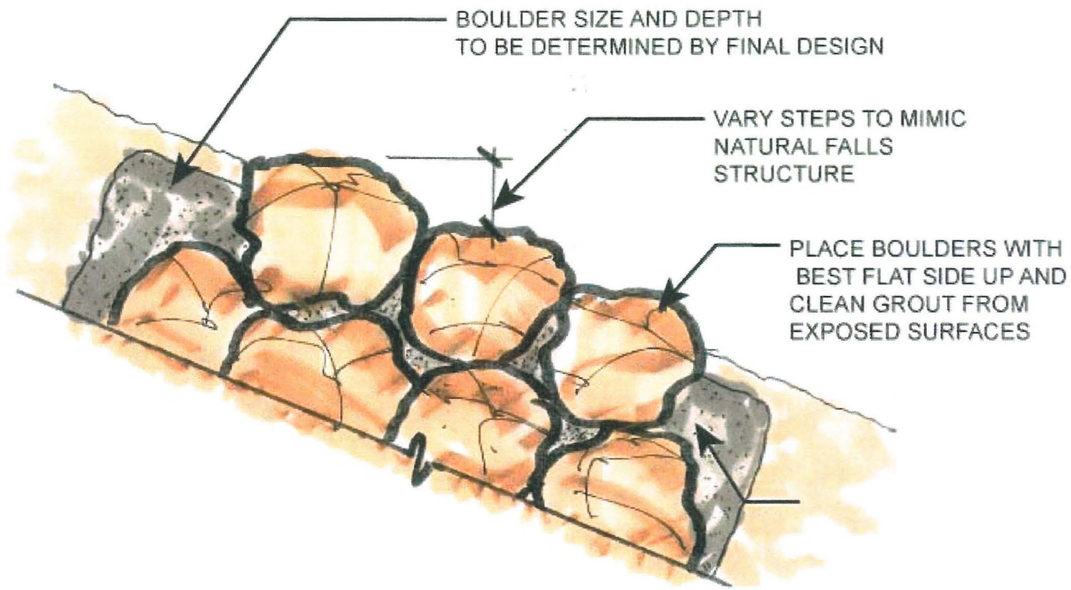

Figure 34 Conceptual Cross Section of a Stepped Boulder Drop

5.14 Walled-Levee Corridor Design Procedure

The walled-levee corridors were designed using the following general procedure:

- Identify the channel alignment.
- Cut cross sections from the 10-ft DTM at approximately 1000 foot intervals.
- Edit cross-section to correct DTM errors in wash bottom areas, if necessary.
- Determine the length and existing slope along the proposed alignment for each cross section.
- Select Manning's n values. A value of 0.045 is assumed for all the leveed corridors.
- Determine sediment gradation parameters such as D_{50}, etc.
- Identify the upstream and downstream concentration points from the HEC-1 model. The HEC-1 model KK IDs for these components are identified and appropriate weighting factors are applied to arrive at the 100-year peak flow for each cross section.
- Identify the upstream reaches and any tributaries that bring sediment flow into the channel. Determine sediment flux entering channel from these upstream channels using the Zeller-Fullerton equation.

- Establish an initial width and depth of the leveed corridor based on the initial Step 2 results and examination of the aerial photograph and cross section plot. Depth of flow in the cross section is targeted at less than or equal to 2 feet and velocity less than or equal to 6 feet per second. In addition, the velocity for the 30% ratio flow should be approximately 4 feet per second.
- Revise the HEC-1 routing reaches to approximate the design widths of the cross sections within the routing reach.
- Run the 6-hour and 24-hour HEC-1 models.
- Check the hydraulic criteria for each design cross section with the revised discharges. Modify the floodwall stationing as necessary and then revise the HEC-1 routing reaches as necessary and rerun the HEC-1 models. Verify that the results meet the hydraulic design criteria, including minimum freeboard requirements.
- Determine the equilibrium slope (see section 5.12.3) for the selected cross-section using the ADWR Manual approach.
- Determine the number of drop structures needed (see section 5) using the length of the channel, existing slope, and the equilibrium slope estimate. A 3-foot drop height is assumed for all drop structures.
- Determine the toe down required for the floodwalls. The toe down is based on the computed scour depth (see section 5.12.4).
- Perform cost estimates (see section 7.1) to arrive at the land cost, construction cost, landscaping cost and maintenance cost. The channel costs are estimated for the following: (a) land cost for the channel area, (b) land cost for the maintenance road, (c) land cost for the setback buffer area, (d) floodwall height including freeboard and scour depth, e) floodwall backfill, and f) drop structures using gabions.

Calculations are provided in the appendix for each fan system.

5.15 Recreation and Multiple-Use

Information from the Town of Buckeye, Maricopa County and other planning organizations were utilized to identify multiple-use and recreation opportunities. Within the study area, numerous multi-use opportunities could be developed in conjunction with existing and planned recreation facilities. A map of the proposed recreation facilities in the Sun Valley Study area is provided in the Volume 1 report. While most all the proposed corridors could be developed with multi-use trails, the ones located in proximity to planned major trails should be developed as major corridors for regional planning purposes as they are consistent with the proposed corridors of Buckeye and/or Maricopa County. The coordination of flood control facilities with local recreation plans will contribute to the integration of regional and local open space systems.

5.15.1 CAP Sub-area Multiple Use

The major trail corridors in the CAP sub-area are located along Sun Valley Parkway and Wagner Wash, north of the Sun Valley Parkway (Figure 35). There are no major trails or parks planned within the CAP sub-area near the proposed flood control corridors or detention basins. However the planned corridors and basins are strategically located to serve as regional open space corridors linking White Tank Mountain Regional Park with the trails along Sun Valley Parkway and Wagner Wash, so that they can interconnect with the trails in the Hassayampa River. The basins and corridors, therefore, should be closely coordinated with the proposed developments to provide open space and trail connections to the corridors along Sun Valley Parkway and eventually to Wagner Wash. The corridors will provide access from the basins near White Tank Mountain Regional Park to Wagner Wash and on to the Hassayampa River. The multiple corridors will also provide good access from throughout the planned developments in the sub-area to the major trail proposed along Sun Valley Parkway.

The off-line basins along Sun Valley Parkway should be used for multiple use active park development to support the open space system of the future development. The location along Sun Valley Parkway will provide good visibility and access and the basins are in shallow slopes conducive to development of large play fields. The basins are approximately four feet deep near Sun Valley Parkway and have uphill slopes of about six feet. The scale of the slopes and flood control features will be in scale with adjacent development.

All flood control components in this sub-area except the off-line basins will be developed according to the Natural Sonoran Desert Theme. The off-line basins will be developed according to the Semi Natural/Desert Adapted Park Theme.

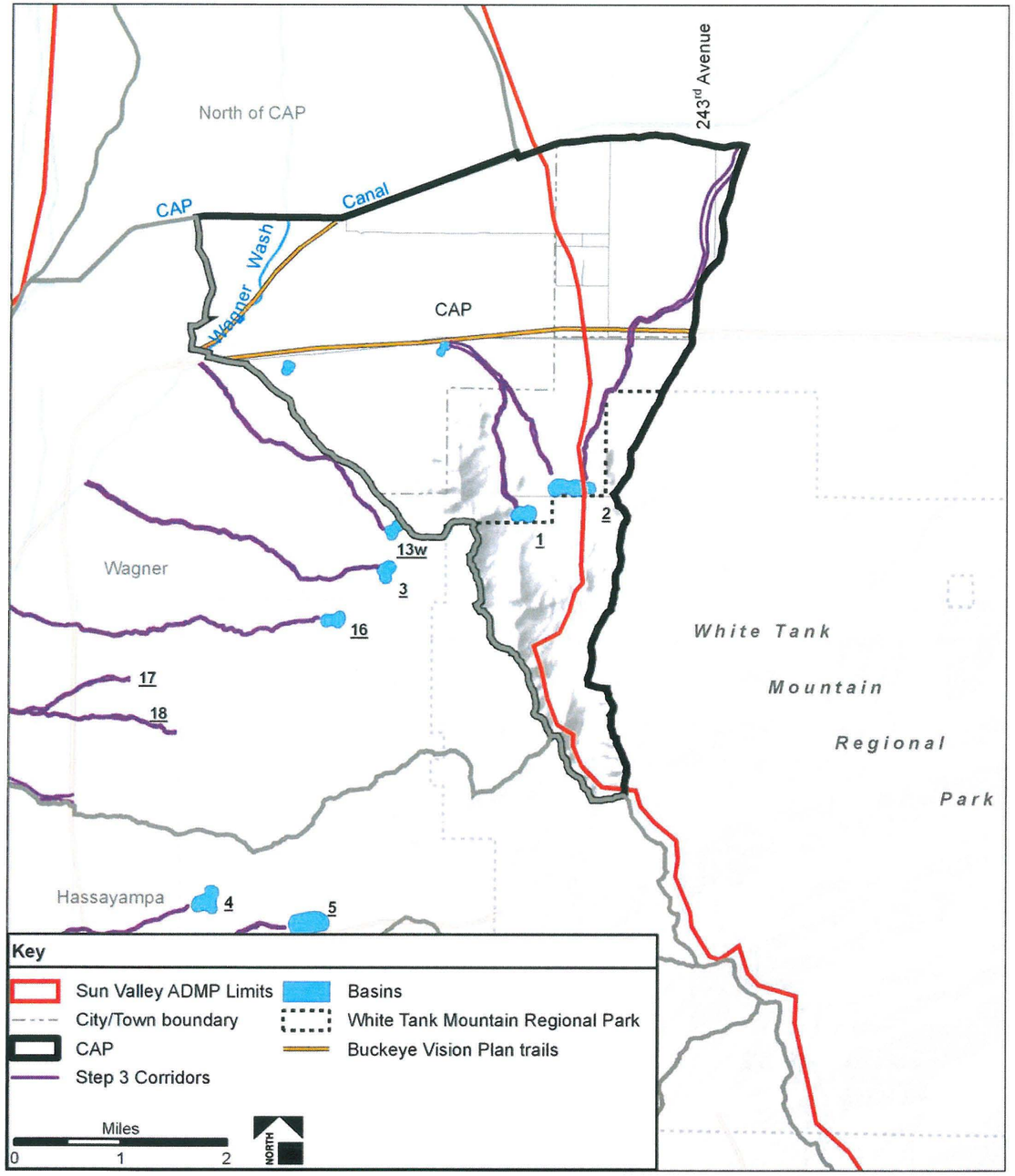

Figure 35 Recommended Alternative And Multiple-Use Opportunities in the CAP Sub-area

6 CAP Sub-area & Fan System Specific Design Considerations

The CAP sub-area is located on the northwestern slope of the White Tank Mountains piedmont. Two major alluvial fans, designated Fan 1 and Fan 2, drain from the White Tank Mountain Regional Park onto the piedmont in this sub-area. These two fans coalesce somewhat in the downslope direction. Fan 1 drains predominantly to the west to Wagner Wash, while Fan 2 drains predominantly to a tributary of Trilby Wash to the east. The piedmont is bisected by the Sun Valley Parkway. Existing runoff from most of Fan 1 flows to Wagner Wash via an existing channel along the south side of Sun Valley Parkway. Runoff reaching the Parkway east of the Parkway channel crosses the road via existing culverts of various sizes beneath the roadway at various locations. The design concepts for the CAP sub-area incorporate the existing roadway drainage facilities without modification. Therefore, design flow rates for channels or conveyance corridors downstream of the Parkway are limited to the existing culvert capacities by off-line detention facilities at or near the Sun Valley Parkway. Culvert capacities were computed assuming a headwater depth equal to one foot greater than the internal culvert height as indicated on the design plan sheets for the Parkway. No off-line basins were required to accommodate the existing culvert capacities. However, two off-line basins were required to limit flow to the existing Sun Valley Parkway channel capacity. One of these basins is located at the end of the Fan 1 walled-levee corridor. The second is located at a primary tributary channel entrance to the channel about ¾ mile upstream of Wagner Wash.

Additional details associated with Fan System 1/2 within the CAP sub-area are provided in the following sections. The conceptual planimetric layout for each fan system is shown in Figure 36. Larger scale, more detailed layout sheets are found in Appendix A.

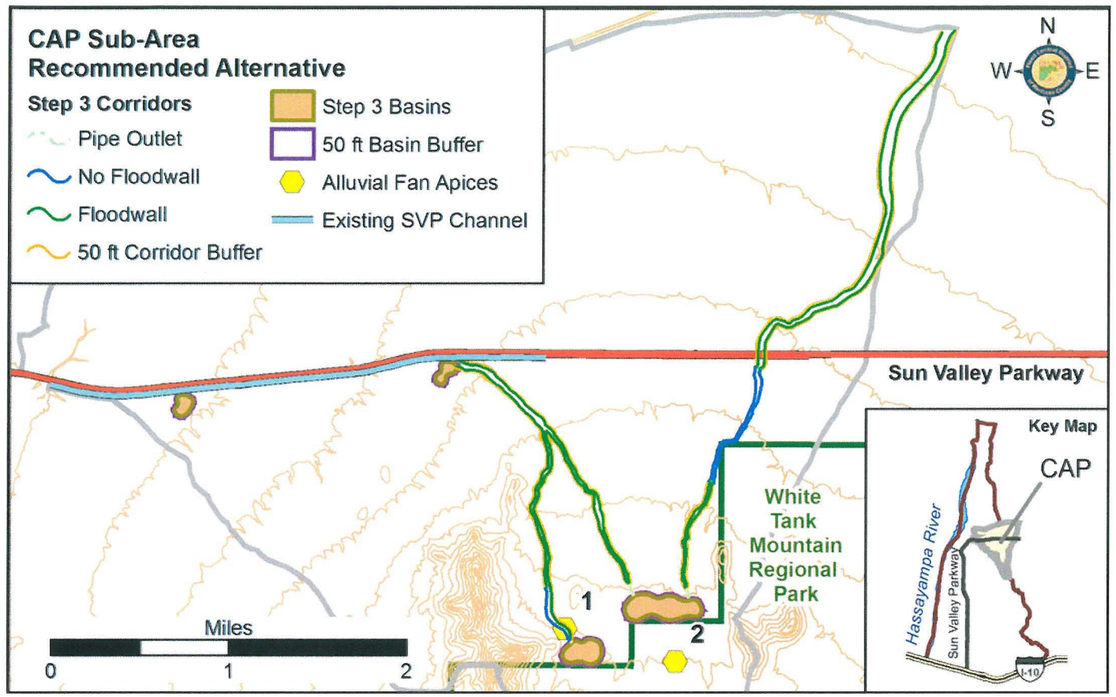

Figure 36 Recommended Alternative Features For CAP Sub-Area

6.1 Fan System 1/2

Fan System 1/2 has two apex detention basins, one for Fan 1 and another for Fan 2. The basin at the apex of Fan 1 will be approximately 16 acres at the top of the basin and will average 7.5 feet deep to retain the required 36 acre feet of storage from its upstream drainage area. The slope of the existing grade will create a height of approximately 42 feet on the uphill side of the basin. One riprap inlet spillway structures will be needed to collect inflows from washes entering the basin.

The basin at the apex of Fan 2 will be approximately 30 acres at the top of the basin and will average 7.5 feet deep to retain the required 118 acre feet of storage from its upstream drainage area. The slope of the existing grade will create a height of approximately 20 feet on the uphill side of the basin. Because the basin is located outside the Regional Park downstream of the fan apex, nearly the entire upstream slope of the basin will require riprap protection to protect the slope and act as inlet spillway structures to collect inflows from washes entering the basin.

The outflow from the Fan 1 basin will require a corridor width of approximately 100 feet, which increases to about 150 feet at its end where it approaches the Sun Valley Parkway channel with a flow rate of about 1400 cfs. The outflow from the Fan 2 basin will require a corridor width of approximately 40 feet, which increases to about 300 feet at its end where it ends at a tributary of Trilby Wash with a flow rate of about 3300 cfs. The total length of walled-levee corridor for the entire Fan System is about 6.8 miles – 3.8 miles from the Fan 2 basin to the Trilby Wash tributary, 1.1 miles from the Fan 2 basin to the Fan 1 corridor, and 1.9 miles from the Fan 1 basin to the Sun Valley Parkway channel.

A total of about 45 drop structures would be required to control grade in the corridors. Some of these are expected to be achieved in conjunction with future transportation or utility crossings. The height of the walls along the corridor would range from about four feet to five feet as the depth of flow varies along the corridors. About ¾ of a mile of the eastern Fan 2 corridor are naturally contained by the existing natural wash.

Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The backfill needed is about 68 ac-ft, which is significantly less than the 712 ac-ft of total excavation required for the detention basins. Therefore, there will be a large amount of material that will require disposal. Some of this material might be used in the vicinity of the basins or elsewhere along the corridors to provide additional visual screening.

7 STEP 3 COST ESTIMATES

7.1 Design Cost Estimates

The costs of the recommended alternative were estimated by establishing unit costs for the various design components. The total cost for each component was obtained by multiplying the quantities associated with each design element with the unit costs. The cost components considered in the design are: 1) Land Cost, 2) Construction Cost, 3) Landscaping Cost, and 4) Maintenance Cost.

The four cost components were estimated for each cost category. A summation of all cost components provides the total cost for the particular channel or basin. The costs for all design elements (channels and basins) are totaled to provide the total cost for the recommended alternative.

The procedures adopted in estimating the cost for each component are presented below. The details of the calculations performed are presented in Appendix A. The summary of the unit costs for all the components is presented in Table 8.

7.1.1 Land Cost

The land cost is the largest cost component followed by construction cost. The land cost was estimated using a unit cost of $100,000 per acre. The land areas considered in the estimates are: 1) the on-line basin footprint and set back area, 2) the leveed channel area between the floodwalls and the adjacent maintenance road and setback area.

7.1.2 Construction Cost

The construction costs were estimated mainly based on unit costs for materials and excavation costs. The unit material cost includes all costs associated with material fully constructed in place. For example, a unit cost of $85 per

cubic yard for gabions for drop structures includes the cost of material as well the cost of constructing the drop structure. A contingency cost of 25% was applied to the estimated construction cost. Similarly, the cost for the engineering design is set at 5% of the construction cost. The sum of the construction cost, contingency cost and the design cost provides the total construction cost.

7.1.3 Landscaping Cost

The landscaping costs were also applied as unit costs for the cost categories where landscaping is needed. The landscaping costs were based on "per area" unit cost with the areas estimated using the design parameters. A landscaping cost of $0.50 per square foot was assumed. Landscaping costs were applied only to the disturbed elements of the design components. For example, the surface area of the backfill behind the floodwalls was assumed to require landscaping. Similarly, the interior slopes of the detention basins were assumed to require landscaping.

7.1.4 Maintenance Cost

The maintenance costs are based on a 3-year maintenance cycle. The costs are estimated for a design life of 50 years. The costs include maintenance costs for a period of 50 years assuming that maintenance will be performed every 3 years.

7.2 Aesthetic Treatment Costs

In order to ensure that the proposed structural flood control measures are compatible with the future landscape character of the area, some modifications to the engineering design were required. The additional costs will be incurred to ensure that the proposed structural flood control measures conform with the future landscape character of the Sun Valley area and meet the aesthetic treatment requirements. The additional costs were estimated based on increased land area, construction, landscaping, and maintenance requirements for the enhanced structures. Details of the computation of the landscape aesthetic treatment costs are provided in the appendix and summarized in Section 11.

Table 8 Summary Of Unit Costs

	Construction Units	Construction Cost	Landscape Units	Landscape Cost	Maintenance Units	3 Year Maintenance Cost
Levee						
Fill	cu. Yd	$ 7.00	sq. Yd	$ 9.00	sq. Yd	$ 0.70
9 ft Floodwall	LF	$ 144	sq. Yd	$ -	sq. Yd	$ 4.50
10 ft Floodwall	LF	$ 168	sq. Yd	$ -	sq. Yd	$ 4.50
11 ft Floodwall	LF	$ 210	sq. Yd	$ -	sq. Yd	$ 4.50
12 ft Floodwall	LF	$ 256	sq. Yd	$ -	sq. Yd	$ 4.50
13 ft Floodwall	LF	$ 286	sq. Yd	$ -	sq. Yd	$ 4.50
14 ft Floodwall	LF	$ 331	sq. Yd	$ -	sq. Yd	$ 4.50
Toe Protection						
Riprap	cu. Yd	$ 75.00	sq. Yd	$ -	sq. Yd	$ 1.50
Gabions	cu. Yd	$ 85.00	sq. Yd	$ -	sq. Yd	$ 1.70
Soil Cement	cu. Yd	$ 50.00	sq. Yd	$ -	sq. Yd	$ 1.50
Concrete	cu. Yd	$ 155.00	sq. Yd	$ -	sq. Yd	$ 2.35
Levee Lining						
Riprap	cu. Yd	$ 75.00	sq. Yd	$ -	sq. Yd	$ 1.25
Drop Structure						
Riprap	cu. Yd	$ 75.00	sq. Yd	$ -	sq. Yd	$ 2.00
Gabions	cu. Yd	$ 85.00	sq. Yd	$ -	sq. Yd	$ 2.25
Soil Cement	cu. Yd	$ 75.00	sq. Yd	$ -	sq. Yd	$ 3.00
Concrete	cu. Yd	$ 155.00	sq. Yd	$ -	sq. Yd	$ 2.50
Basin Inlet						
Riprap	cu. Yd	$ 75.00	sq. Yd	$ -	sq. Yd	$ 2.00
Concrete	cu. Yd	$ 155.00	sq. Yd	$ -	sq. Yd	$ 2.50
Outlet Pipes						
24" RGRCP	LF	$ 55.00	sq. Yd	$ -		$ 0.55
30" & 36" RGRCP	LF	$ 82.00	sq. Yd	$ -		$ 1.20
42" & 48" RGRCP	LF	$ 160.00	sq. Yd	$ -		$ 2.40
54" & 60" RGRCP	LF	$ 183.00	sq. Yd	$ -		$ 2.75
Channel						
Excavated Channel	$ 10.00	cu. Yd	sq. Yd	$ 9.00	sq. Yd	$ 0.50
Basin						
Excavated Basin	$ 4.00	cu. Yd	sq. Yd	$ 9.00	sq. Yd	$ 0.50

Note: Includes aesthetic treatment costs where applicable.

8 FAN SYSTEM 1/2 DESIGN SUMMARY

The recommended alternative for Fan System 1/2 in the CAP sub-area of the SVADMP was developed and refined in Step 3 of the ADMP process. The alternative includes both non-structural and environmentally friendly and aesthetically compatible structural flood control measures. Engineering and aesthetic treatment costs were also estimated for all of the proposed structural components of the recommended alternative. The recommended alternative was arrived at by a collaborative effort of the project team, stakeholders, and the public. The result for Fan System 1/2 is two on-line detention basins with riprap-lined inlet structures and pipe outlets. The basins drain to 6.8 miles of walled-levee corridor confined by poured concrete floodwalls. The floodwalls are buffered by 50 foot areas which will also contain maintenance and multiple use access along both sides of the corridor. Two off-line basins are also required to limit discharges to the existing Sun Valley Parkway Channel.

A design summary of all the components of the recommended alternative for Fan System 1/2 is presented below. Table 9 shows a summary of the total cost estimates. Table 10 shows a summary of the differential costs for the aesthetic treatment requirements and landscaping.

The estimated total cost of the recommended alternative for Fan System 1/2 is $59.1 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The apex basins cost was estimated at $17.7 million. The off-line basins cost was estimated at $3.5 million. The walled-levee corridors were estimated at $37.9 million.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 27 percent of the total cost.

Additional details of the design calculations, hydrologic models, and cost estimates are provided in Appendix A.

Table 9 Design Cost Summary – Fan System 1/2

					Design Geometry			Costs (in $1000)				
Structure ID	Flow Rate (cfs)	ROW (acres)	Exc. Vol. (ac. ft)	Fill Vol. (ac. ft)	Length (ft; mi)	ROW Width (ft)	Depth (ft)	Land Cost	Const. Cost	Lndscp. Cost	50-Yr Maint. Cost	Total Cost
RR900	1416	36.5	377.2	0.0	NA	NA	7.5	$ 3,650	$ 4,716	$ 795	$ 1,943	$ 11,104
H190091A_4	209	1.7	0.0	1.9	0.098	141	1.9	$ 170	$ 225	$ 26	$ 104	$ 525
H190091A_3	289	3.5	0.0	2.9	0.192	151	1.4	$ 350	$ 385	$ 51	$ 203	$ 989
H190091A_2	371	3.5	0.0	0.2	0.191	151	2.0	$ 350	$ 337	$ 13	$ 97	$ 798
H190091A_1	451	5.7	0.0	0.0	0.262	181	2.6	$ 570	$ 352	$ -	$ 63	$ 985
H191A91B_4	558	1.3	0.0	0.0	0.116	92	3.3	$ 130	$ 9	$ -	$ 0	$ 139
H191A91B_3	810	1.4	0.0	0.0	0.191	61	4.6	$ 140	$ 2	$ -	$ 0	$ 142
H191A91B_2	1062	2.2	0.0	0.0	0.176	103	4.6	$ 220	$ 1	$ -	$ 0	$ 221
H191A91B_1	1277	4.7	0.0	0.0	0.258	151	4.8	$ 470	$ -	$ -	$ 1	$ 471
H191B915_4	1555	4.5	0.0	0.1	0.127	291	2.6	$ 450	$ 216	$ 8	$ 59	$ 732
H191B915_3	1753	5.7	0.0	4.0	0.189	251	2.2	$ 570	$ 481	$ 50	$ 214	$ 1,314
H191B915_2	1987	6.8	0.0	4.6	0.202	281	2.3	$ 680	$ 521	$ 53	$ 231	$ 1,485
H191B915_1	2206	4.7	0.0	2.7	0.129	301	2.1	$ 470	$ 329	$ 34	$ 146	$ 979
H191592A_3	2498	10.3	0.0	4.7	0.262	326	2.4	$ 1,030	$ 599	$ 69	$ 285	$ 1,984
H191592A_2	2780	5.2	0.0	0.4	0.189	226	4.3	$ 520	$ 328	$ 15	$ 85	$ 948
H191592A_1	3059	9.3	0.0	0.0	0.285	271	5.4	$ 930	$ 470	$ -	$ 71	$ 1,471
H192A92B_4	3325	4.9	0.0	2.1	0.099	411	2.5	$ 490	$ 251	$ 26	$ 112	$ 880
H192A92B_3	3297	10.0	0.0	2.8	0.192	431	2.2	$ 1,000	$ 425	$ 51	$ 210	$ 1,686
H192A92B_2	3268	9.7	0.0	4.4	0.191	421	2.7	$ 970	$ 530	$ 50	$ 220	$ 1,770
H192A92B_1	3240	23.2	0.0	8.4	0.477	401	2.5	$ 2,320	$ 1,096	$ 126	$ 521	$ 4,063
RR110	662	19.2	251.1	0.0	NA	NA	7.5	$ 1,920	$ 3,131	$ 418	$ 1,106	$ 6,575
H1F115A3_7	138	2.5	0.0	0.3	0.131	160	0.7	$ 250	$ 115	$ 17	$ 65	$ 447
H1F115A3_6	222	4.9	0.0	1.2	0.197	207	0.9	$ 490	$ 183	$ 26	$ 101	$ 800
H1F115A3_5	306	4.4	0.0	1.5	0.189	191	1.4	$ 440	$ 341	$ 25	$ 126	$ 932
H1F115A3_4	387	4.3	0.0	0.0	0.188	191	1.2	$ 430	$ 253	$ 0	$ 48	$ 731
H1F115A3_3	472	4.9	0.0	1.6	0.194	211	1.2	$ 490	$ 344	$ 51	$ 199	$ 1,084
H1F115A3_2	554	5.0	0.0	1.7	0.201	206	1.6	$ 500	$ 359	$ 31	$ 149	$ 1,039
H1F115A3_1	637	5.8	0.0	2.9	0.239	201	1.4	$ 580	$ 467	$ 63	$ 250	$ 1,360
H1F215A2_6	124	2.2	0.0	1.3	0.106	171	1.4	$ 220	$ 197	$ 28	$ 109	$ 554
H1F215A2_5	228	4.2	0.0	1.0	0.188	186	0.8	$ 420	$ 301	$ 45	$ 178	$ 944
H1F215A2_4	332	5.7	0.0	1.4	0.192	246	1.1	$ 570	$ 318	$ 32	$ 142	$ 1,062
H1F215A2_3	438	4.5	0.0	1.8	0.193	196	1.5	$ 450	$ 352	$ 51	$ 198	$ 1,052
H1F215A2_2	541	4.4	0.0	2.3	0.189	191	1.4	$ 440	$ 369	$ 50	$ 198	$ 1,058
H1F215A2_1	644	5.7	0.0	3.1	0.222	211	1.4	$ 570	$ 443	$ 59	$ 234	$ 1,305
H115A15B_3	1341	4.9	0.0	1.9	0.15	271	1.9	$ 490	$ 303	$ 40	$ 160	$ 992
H115A15B_2	1401	6.0	0.0	3.1	0.192	261	1.8	$ 600	$ 432	$ 51	$ 209	$ 1,292
H115A15B_1	1461	7.5	0.0	3.4	0.25	251	2.1	$ 750	$ 600	$ 66	$ 274	$ 1,690
D115B	1519	7.6	37.6	0.0	NA	NA	0.0	$ 760	$ 390	$ 166	$ 324	$ 1,640
D120A	1719	8.0	46.2	0.0	NA	NA	0.0	$ 800	$ 570	$ 174	$ 346	$ 1,891
TOTAL		266.5	712.1	67.7				$ 26,650	$ 20,741	$ 2,760	$ 8,982	**$ 59,132**
All Channels		195.2	0.0	67.7	6.8			$ 19,520	$ 11,934	$ 1,206	$ 5,263	$ 37,923
All Online Basins		55.7	628.3	0.0				$ 5,570	$ 7,847	$ 1,213	$ 3,049	$ 17,679
All Offline Basins		15.6	83.8	0.0				$ 1,560	$ 960	$ 341	$ 670	$ 3,530

Table 10 Aesthetic Treatment Differential Costs Summary – Fan System 1/2

		Aesthetic Treatment Cost Differentials				
Structure ID	Total Cost	Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
RR900	$ 11,104	20%	5%	100%	16%	19%
H190091A_4	$ 525	47%	24%	100%	64%	46%
H190091A_3	$ 989	46%	24%	100%	65%	47%
H190091A_2	$ 798	46%	16%	100%	35%	35%
H190091A_1	$ 985	39%	15%	0%	0%	29%
H191A91B_4	$ 139	0%	8%	0%	10%	1%
H191A91B_3	$ 142	0%	8%	0%	10%	0%
H191A91B_2	$ 221	0%	8%	0%	10%	0%
H191A91B_1	$ 471	0%	0%	0%	10%	0%
H191B915_4	$ 732	24%	16%	100%	35%	25%
H191B915_3	$ 1,314	28%	24%	100%	61%	37%
H191B915_2	$ 1,485	25%	25%	100%	60%	36%
H191B915_1	$ 979	23%	24%	100%	61%	34%
H191592A_3	$ 1,984	21%	24%	100%	63%	33%
H191592A_2	$ 948	31%	14%	100%	45%	29%
H191592A_1	$ 1,471	26%	13%	0%	0%	22%
H192A92B_4	$ 880	16%	24%	100%	61%	29%
H192A92B_3	$ 1,686	16%	23%	100%	63%	28%
H192A92B_2	$ 1,770	16%	23%	100%	59%	28%
H192A92B_1	$ 4,063	17%	24%	100%	63%	29%
RR110	$ 6,575	22%	5%	100%	17%	19%
H1F115A3_7	$ 447	24%	18%	100%	69%	33%
H1F115A3_6	$ 800	16%	23%	100%	67%	29%
H1F115A3_5	$ 932	36%	20%	100%	51%	36%
H1F115A3_4	$ 731	37%	16%	100%	2%	29%
H1F115A3_3	$ 1,084	33%	21%	100%	67%	41%
H1F115A3_2	$ 1,039	34%	21%	100%	54%	37%
H1F115A3_1	$ 1,360	34%	22%	100%	65%	41%
H1F215A2_6	$ 554	41%	23%	100%	67%	45%
H1F215A2_5	$ 944	38%	20%	100%	66%	43%
H1F215A2_4	$ 1,062	28%	21%	100%	58%	34%
H1F215A2_3	$ 1,052	36%	22%	100%	67%	42%
H1F215A2_2	$ 1,058	36%	23%	100%	65%	42%
H1F215A2_1	$ 1,305	33%	23%	100%	65%	41%
H115A15B_3	$ 992	27%	23%	100%	64%	37%
H115A15B_2	$ 1,292	27%	23%	100%	63%	37%
H115A15B_1	$ 1,690	28%	21%	100%	62%	36%
D115B	$ 1,640	0%	0%	100%	28%	0%
D120A	$ 1,891	0%	0%	100%	22%	0%
	$ 59,132	23%	14%	100%	42%	27%

9 MAINTENANCE PLAN

The primary maintenance concerns for the recommended alternative for the CAP sub-area are the maintenance cycle, funding, and operation responsibilities. As discussed in the cost estimates, a maintenance period of 3 years and a design life of 50 years were assumed. Maintenance also includes regular, periodic and post-storm monitoring of all the flood control facilities. Monitoring includes periodic physical inspections as well as instrumentation of hydraulic performance (e.g. stream/rain gauges). If monitoring indicates the occurrence of a large storm or flood, the entire system should be inspected to verify the post-storm condition of the facilities. There is one item of special note with respect to sediment maintenance of the on-line detention basins. Given the long-term clear water discharge condition downstream of the basin, it is suggested that sediment removed from the basin be moved to the downstream channel to help offset the long-term sediment deficit in this reach. Finally, in order to ensure long-term safe performance of the proposed facilities, funding and execution of the monitoring and maintenance needs to be provided by a public entity. A more detailed discussion of maintenance can be found in Appendix B of Volume 1 of the Step 3 Report in the Preliminary Maintenance Plan.

10 IMPLEMENTATION PLAN

The implementation plan for the recommended alternative involves funding, phasing, and responsibility. While the funds may come from a creative blend of public and private sources, the specifics of such a funding plan are beyond the scope of the ADMP. Given the large dollar amounts associated with these projects, funding will likely come from multiple sources including possible impact fees, various improvement districts, and multiple public agencies.

It is suggested in general that the on-line apex detention basins be constructed first. This will provide for significant protection of the downstream area as the walled-levee corridors are constructed with future development of the area. The large on-line basins provide storage of about 80 percent of the 100-year event for most fan systems.

Any projects constructed to control alluvial fan flooding most likely will require publicly-backed maintenance schemes. For a more detailed discussion of implementation see Appendix A of Volume 1 of the Step 3 Report; Implementation and Stakeholder Involvement Summary. Therein lay more details regarding stakeholder involvement during the ADMP as well as information regarding possible temporal phasing needs and cost sharing opportunities.

11 SUMMARY FOR THE CAP SUB-AREA

The recommended alternative for the CAP sub-area of the SVADMP was developed and refined in Step 3 of the ADMP process. The alternative includes both non-structural and environmentally friendly and aesthetically compatible structural flood control measures. Engineering and aesthetic treatment costs were also estimated for all of the proposed structural components of the recommended alternative. The recommended alternative was arrived at by a collaborative effort of the project team, stakeholders, and the public.

Table 11 presents a summary of the cost estimates and right-of-way requirements for the recommended alternative for the CAP sub-area. The recommended alternative for the overall sub-area is comprised of about 6.8 miles of walled-levee corridors including about ¾ mile which is naturally contained along the eastern Fan 2 corridor path. The total right of way requirements for the whole sub-area are about 267 acres including 71 acres for four detention basins. Total costs for the CAP sub-area are estimated at about $59.1 million. These costs include right of way, construction, landscaping, and maintenance for a 50-year period. Total land costs are largest portion of the total project cost.

Table 11 Summary Of CAP Sub-Area Costs For Recommended Alternative

		Costs (in millions of $)					Cost Percentages			
Fan System	ROW Area (ac)	Land (ROW)	Constr.	Lndscp.	50-Yr Maint.	Total Cost	Land %	Const. %	Lndscp. %	50-Yr Maint. %
FANS1_2	266.5	$26.650	$ 20.741	$ 2.760	$ 8.982	$ 59.132	45%	35%	5%	15%
TOTAL	266.5	$26.650	$ 20.741	$ 2.760	$ 8.982	**$ 59.1**	45%	35%	5%	15%

The landscaping and other aesthetic treatment costs for the CAP sub-area were estimated at about 27 percent of the recommended alternative costs. This percentage includes about 5 percent for landscaping. The remaining 22 percent is for other aesthetic treatments including additional right of way, integral color, form liners, and additional excavation. The landscaping costs are about half of the District's maximum cost guidelines at about $20,000 per acre. Of the remaining aesthetic treatment costs, about $6.1 million are for additional right of way requirements. The total ROW cost is estimated at about $26.6 million. The District's additional right of way cost ceiling for aesthetic treatment is 30 percent. Therefore, the additional ROW for the recommended alternative are at the cost ceiling ($6.1 / ($26.6 - $6.1) = 30 %). The total construction costs for the recommended alternative are estimated at about $20.7 million. The portion of the costs attributable to the aesthetic treatment components was estimated at about $2.9 million. This is in excess of the 4 to 10 percent cost ceiling provided in Table 2 of the District's Policy for Aesthetic Treatment and Landscaping of Flood Control Projects.

Figure 37 shows the recommended structural alternative for the CAP sub-area. In addition, the existing alluvial fan floodplains are also shown in Figure 37. It can be seen from examination of Figure 37 that a number of benefits would be derived to the CAP sub-area as a result of the implementation of the ADMP recommended alternative. Specifically, the presence of the on-line detention basins eliminates the alluvial fan uncertainty from the flood hazards downstream of the detention basins. The elimination of alluvial fan uncertainty would allow future infrastructure in the area to be designed using conventional engineering analytic approaches and reduce the need for potentially redundant systems downstream. In particular, transportation crossings and underground utilities could be sized for just the downstream contributing drainage area without need to anticipate potential channel instability from the alluvial fan(s) upstream.

Another benefit would be the reduction of the downstream floodplain from that shown in Figure 37. Although detailed redelineation of the post-ADMP floodplain is beyond the scope of the current contract, it can be seen that the recommended corridors would result in the elimination a large area of floodway downstream of the fan apices. While some downstream flooding will still occur following the implementation of the recommended alternative, the degree and extent would be greatly reduced.

Finally, in addition to the elimination of alluvial fan uncertainty, the ADMP recommended alternative provides a trunk system to which the downstream development could deliver tributary drainage. A trunk system provides a regional flood control facility that provides controlled connectivity from the alluvial fan apices to their outfalls.

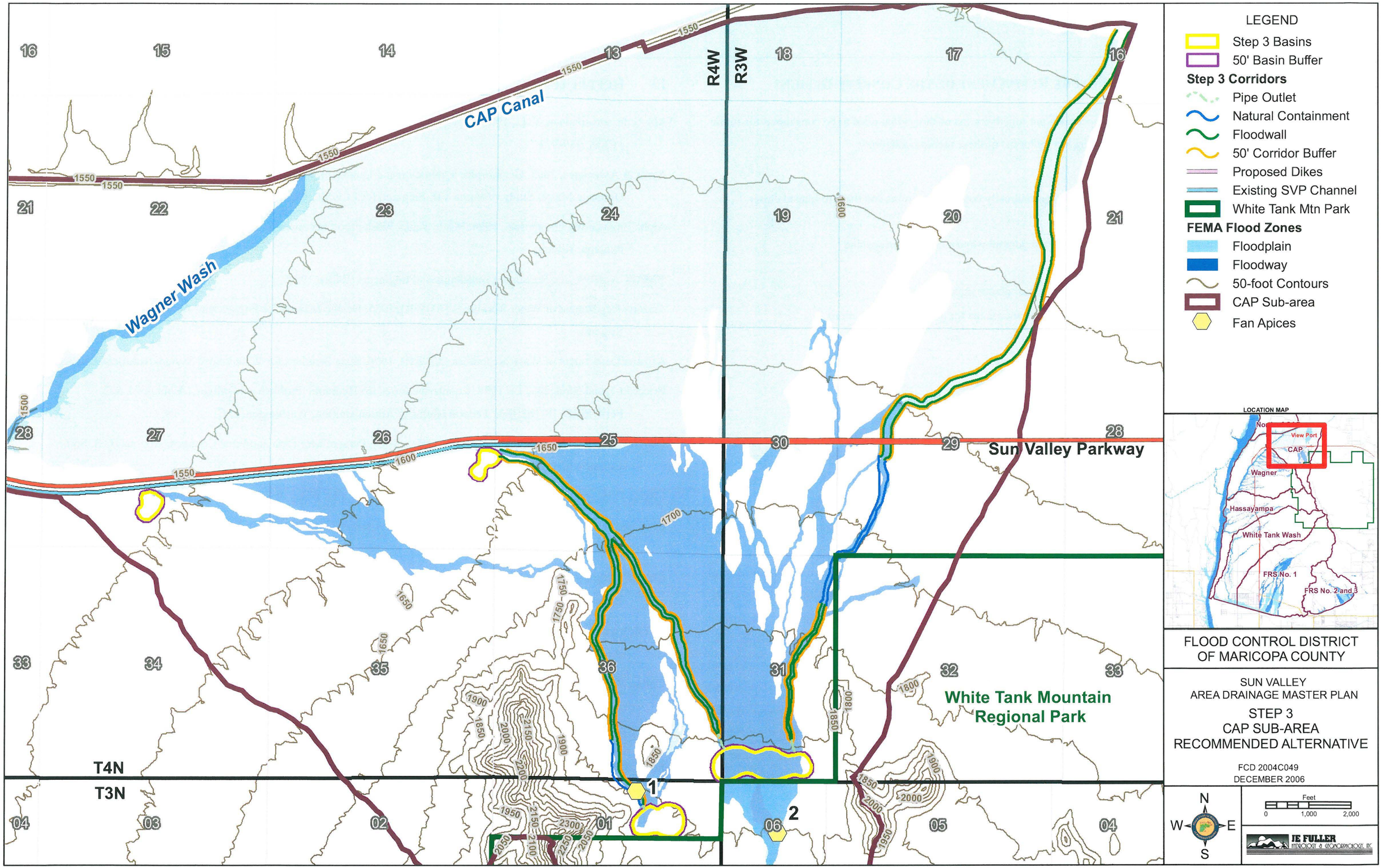

Figure 37 FEMA Floodplains, Recommended Alternative, and Benefited Area

12 RECOMMENDATIONS FOR FUTURE REFINEMENT OF THE CONCEPT DESIGNS

While working on the ADMP, the project team put together a list of things that need to be considered for future refinement of the concept design. The following is a bullet list of these recommendations:

- More detailed topographic information
- More cross sections that are site specific for hydraulically complex locations and that are spaced closer together
- Reevaluate existing channel capacity with new topography and cross section spacing
- Environmental permitting
- Cut/fill balance (including project phasing to make balance make sense)
- Use of roadway crossings and construction disturbance areas for grade control locations
- Site specific geotechnical analysis for construction.
- Incorporation of 50' buffer area into development plans
- Resolution of potential excavation issues such as depth to bedrock
- Consideration of access issues for basin and channel maintenance
- Construction phasing issues relative to urbanization schedule and flood control needs
- Refinement of structure design based on material available such as large rock for stepped boulder drops
- Right-of-way acquisition for facilities needs to occur immediately so that development does not interfere
- Site specific design of floodwalls should be pursued
- Operation and maintenance issues need to be addressed. A publicly-backed entity will be required to assume these responsibilities.

It should be emphasized that the critical elements of the Sun Valley ADMP are the preferred flood control methods, (i.e. on-line detention basins near the alluvial fan apices with downstream flood containment corridors), the alignments selected for the walled-levee flood containment corridors (selected with specific input and coordination with the area stakeholders) and the continued floodplain management of Wagner Wash. Site specific details of the detention basins and the corridors can and should be reevaluated prior to going forward with preliminary and final design. Given more detailed answers to some of the above items, the specifics of the engineering design of individual fan systems or fan system components, and their costs, are likely to change. For example, walled-levees may give way to no floodwalls given more specific topographic depiction of existing channel capacity. The specific sizing of individual detention basins could be optimized to reflect the more accurate depiction of the existing downstream capacity. The concept plans presented in this ADMP report should be considered just that – concepts.

13 REFERENCES

Abt, S. R. and Johnson, T. L., 1991, Riprap Design for Overtopping Flow, ASCE Journal of Hydraulic Engineering. 117(8): 959-972.

Ayres & Associates, 2005, Geomorphic Evaluation and Landform Stability Assessment Buckeye/Sun Valley Area Drainage Master Study, Volume VII, Prepared for FCDMC, FCD Contract No. 2002C027, Phoenix, Arizona.

Alpha Engineering Group, Inc., 1994, White Tanks Wash Flood Insurance Study, FCD No. 90-64: for FCDMC, Phoenix, Arizona.

AMAFCA, 1994, See Resource Consultants and Engineers (RCE), 1994

Arizona Department of Water Resources (ADWR), 1985, Design Manual for Engineering Analysis of Fluvial Systems.

Arizona Department of Water Resources (ADWR), 1996, State Standard for Watercourse System Sediment Balance.

Brice, J.C., and Blodgett, J.C., 1978, Countermeasures for Hydraulic Problems at Bridges," Volumes 1 & 2, FHWA/RD-78-162,163. Federal Highway Administration, Washington, D.C.

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

Chang, H.H., 1988, Fluvial Processes in River Engineering, John Wiley & Sons, New York.

Chanson, H., 1994, Hydraulics of skimming flows over stepped channels and spillways, Journal of Hydraulic Research, Vol. 32, 1994, No. 3: 445-460.

City of Tucson Engineering, 1989, *Standards Manual for Drainage Design and Floodplain Management.* Manual Prepared by Simons Li and Associates.

Coe & Van Loo Consultants Inc., 2005, Preliminary Sedimentation Report For Elianto-Village IV, Town of Buckeye, Arizona, Volume 1 of 2, May 2005.

Collar, Williams, & White Engineering, 1987, Drainage Report Sun Valley Parkway Phase III – 291st Avenue From I-I-10 to Northern Avenue, Prepared for The Adams Group, Revised April 1987.

Collar, Williams, & White Engineering, 1987, Various design documents for Sun Valley Parkway

DEI Professional Services Inc., 1998, Skyline Wash and Tributaries FDS, FCD 96-06.

Entellus, 2005, Wittman Area Drainage Master Study Update, Sun Valley Parkway Culvert Evaluation, Volume SV, Contract FCD 2002C029, March 2005.

FCDMC, 2003a, draft Drainage Design Manual, Volume II, Hydraulics, draft revisions to the 1996 edition.

FCDMC, 2003b, draft Drainage Design Manual, Volume I, Hydrology, draft revisions to the 1995 edition.

FCDMC, 2002, Aesthetic and Multiple-Use Design Guidelines, revision 6, Dennis Holcomb, May 28, 2002.

FCDMC, 1995, Drainage Design Manual, Volume I, Hydrology, as revised January 1, 1995.

FCDMC, 1993, Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects, Dec. 16, 1992, adopted by resolution 93-03, May 3, 1993.

FCDMC, 1991, A Hydrologic Analysis of Wagner Wash Watershed, a report prepared by the Flood Control District of Maricopa County, Hydrology Division, Watershed Management Branch, dated April 1990, revised Jan. 1991.

FEMA, 1986, Design Manual for Retrofitting Flood-prone Residential Structures, September 1986.

FHWA, Federal Highway Administration, 1991, Stream Stability at Highway Structures, Hydrologic Engineering Circular No. 20. FHWA Publication No. FHWA-IP-90-014. McLean, Virginia.

FHWA, 1984, Hydraulic Design of Energy Dissipaters for Culverts and Channels, Hydraulic Engineering Circular No. 14.

Frizell, Kathleen H., June 2006, Research State-of-the-Art and Needs for Hydraulic Design of Stepped Spillways, United States of the Interior, Bureau of Reclamation.

Hager, W.H., 1987, Lateral Outflow Over Side Weirs, Journal of Hydraulic Engineering, Vol. 113, No. 4, April 1987, p. 491 – 504.

Hartman, G.W., 1977, Soil Survey of Maricopa County, Central Part: Soil Conservation Service, USDA, 117 p., 128 maps, scale 1:20,000.

Hjalmarson, H.W., 1994, Potential flood hazards and hydraulic characteristics of distributary-flow areas in Maricopa County, Arizona: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

Hjalmarson, H.W., and Kemna, S.P., 1991, Flood hazards of distributary-flow areas in southwestern Arizona: U.S. Geological Survey Water Resources Investigations Report 91-4171, 68 p.

JE Fuller/ Hydrology & Geomorphology, Inc., 2006a, Step 1 Alternatives Formulation and Preliminary Analysis, SVADMP, prepared for the Flood Control District of Maricopa County, under contract FCD2004C049.

JE Fuller/ Hydrology & Geomorphology, Inc., 2006b, Step 2 Proposed Alternatives Analysis – Volumes 1 - 8, SVADMP, prepared for the Flood Control District of Maricopa County, under contract FCD2004C049.

JE Fuller/ Hydrology & Geomorphology, Inc., 2006c, Area 4 Hydrology, SVADMP, prepared for the Flood Control District of Maricopa County, under contract FCD2004C049.

Lane, E.W., 1952, Progress Report on Studies in the Design of Stable Channels of the Bureau of Reclamation, HYD-352, Vol. 79.

Lane, E.W., 1955, The Importance of Fluvial Morphology in Hydraulic Engineering, ASCE Proceedings, Volume 81, No. 745.

Lane, E.W., and Carlson, E.J., 1953, "Some Factors Affecting the Stability of Canals Constructed in Coarse Granular Materials." Proceedings Minnesota International Hydraulics Conference, Joint Meeting IAHR and ASCE Hydraulics Division.

Logan Simpson Design, 2006, Scenery Multi-use Data Collection and Analysis Report, prepared for JE Fuller/ Hydrology & Geomorphology, Inc. as part of the Sun Valley ADMP,. FCD Contract No. 2004C049.

Meyer-Peter, E., and Muller, R., 1948, Formulas for Bed-Load Transport, International Association for Hydraulic Structures, Second Meeting, Stockholm.

Moody, T. et al.., 2003, Regional Relationships for Bankfull Stage in Natural Channels of the Arid Southwest, report prepared by Natural Channel Design, Inc., Flagstaff, AZ, March 2003.

PBSJ, 2005, Buckeye-Sun Valley ADMS, Technical Data Notebook, Volume V-A: Area 3 Hydrology Report, prepared for FCDMC under contract No. FCD 2002C027.

Pemberton, E.L. and J. M. Lara, 1984, Computing Degradation and Local Scour, Technical Guideline for the Bureau of Reclamation.

Peterka, A. J., 1984, Hydraulic Design of Stilling Basins and Energy Dissipaters, United States of the Interior, Bureau of Reclamation.

RCE, Resource Consultants & Engineers, Inc., 1994, Sediment and Erosion Design Guide, Manual prepared for the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

SAS, 2005, An Archeological Resource Overview Of The Sun Valley ADMP Area Of West - Central Maricopa County, Arizona, report prepared for the FCDMC.

U.S. Bureau of Reclamation, 1988, ACER Technical Memorandum 11, Downstream Hazard Classification Guidelines, Assistant Commissioner – Engineering Research, Denver, CO.

U.S. Army Corps of Engineers, 1990, HEC-1 Flood Hydrograph Package, User's Manual, CPD-1A

U.S. Army Corps of Engineers, 1989, EM 1110-2-2502 Engineering and Design of Retaining and Flood Walls

Yang, C.T., 1996, Sediment Transport Theory and Practice, McGraw Hill, New York.

Zeller, M.E., 1981, Scour Depth Formula for Estimation of Toe Protection Against General Scour, Pima County Department of Transportation and Flood Control District, Tucson, Arizona.

Appendix A

Design Analyses

Fan System 1/2

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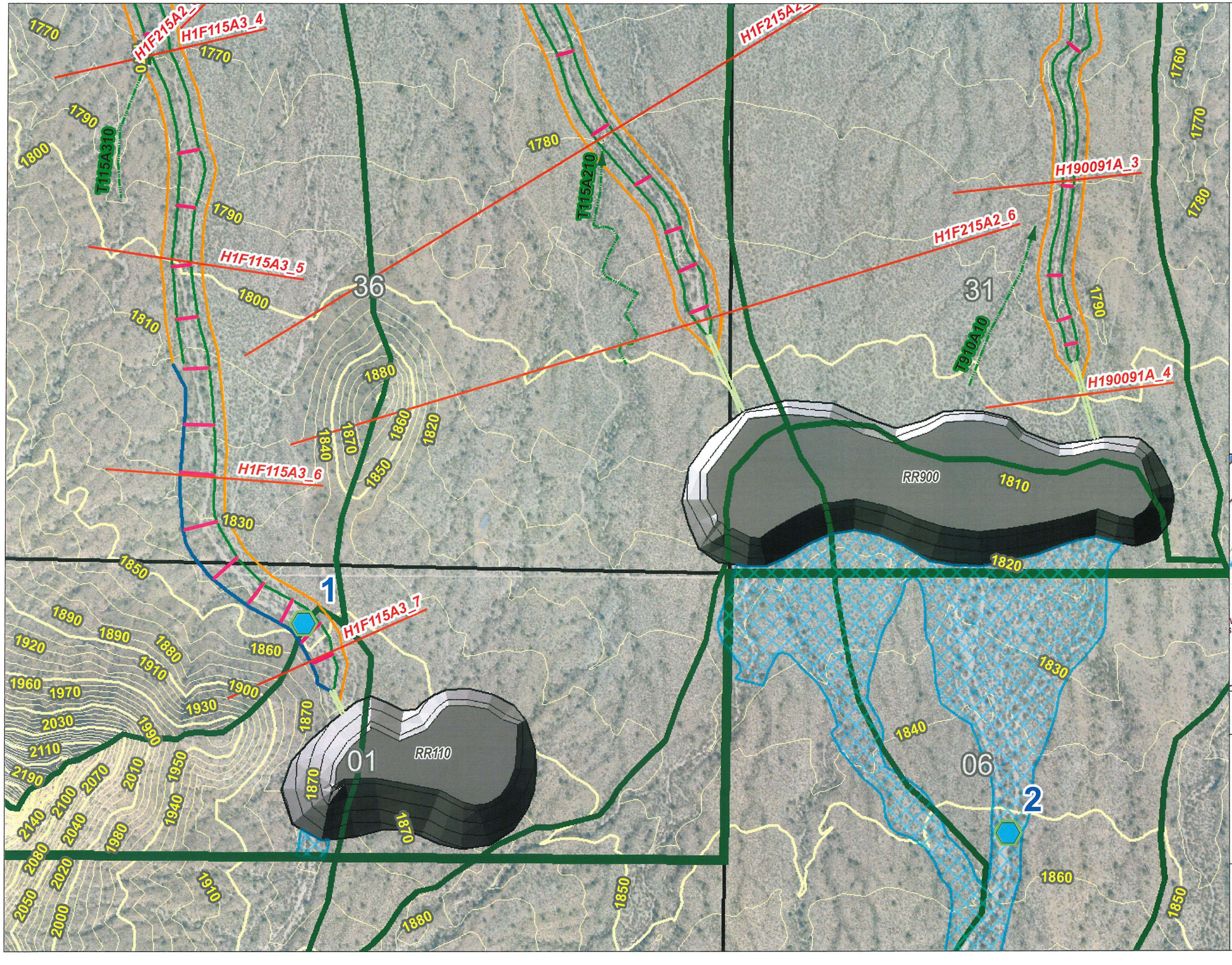
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LEGEND
Step 3 Basins
50' Basin Buffer
Step 3 Corridors
Floodwall
No Floodwall
Basin Outlet Pipe
50' Corridor Buffer
Grade Control Structure
Approximate Zone A
FEMA Flood Zones
Floodway Fringe
Floodway
Subbasin Boundaries
Cross Section
Countywide 10-ft Topo
Trib. Sed. Supply Reaches
White Tank Mtn Park
Fan Apices
LOCATION MAP
WAGNER WASH
SUN VALLEY PARKWAY
Wagner Sub-Area
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - CAP SUB-AREA
FAN SYSTEM 1 & 2
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HYDROLOGY & GEOMORPHOLOGY, INC.

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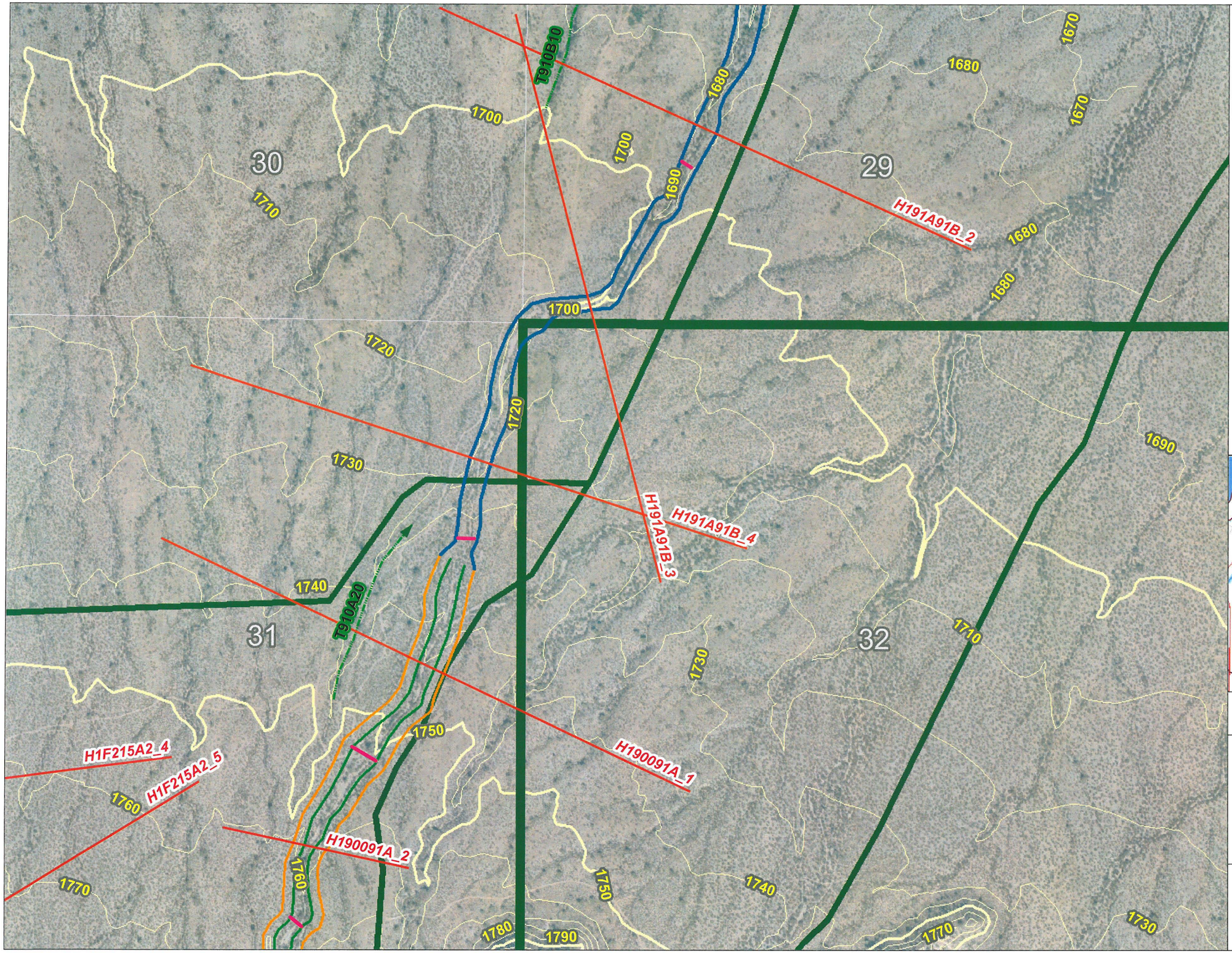


LEGEND

- Step 3 Basins
- 50' Basin Buffer

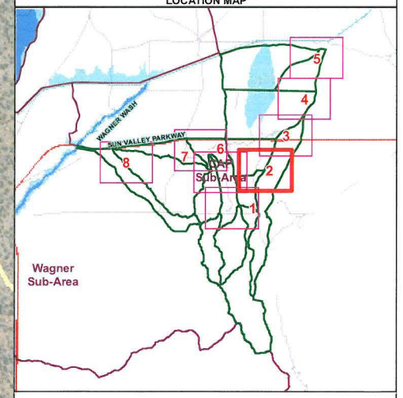
Step 3 Corridors

- Floodwall
- No Floodwall
- Basin Outlet Pipe
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones

- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Countywide 10-ft Topo
- Trib. Sed. Supply Reaches
- White Tank Mtn Park
- Fan Apices

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - CAP SUB-AREA
FAN SYSTEM 1 & 2
RECOMMENDED ALTERNATIVE

SHEET 2 OF 8

FCD 2004C049

DECEMBER 2006

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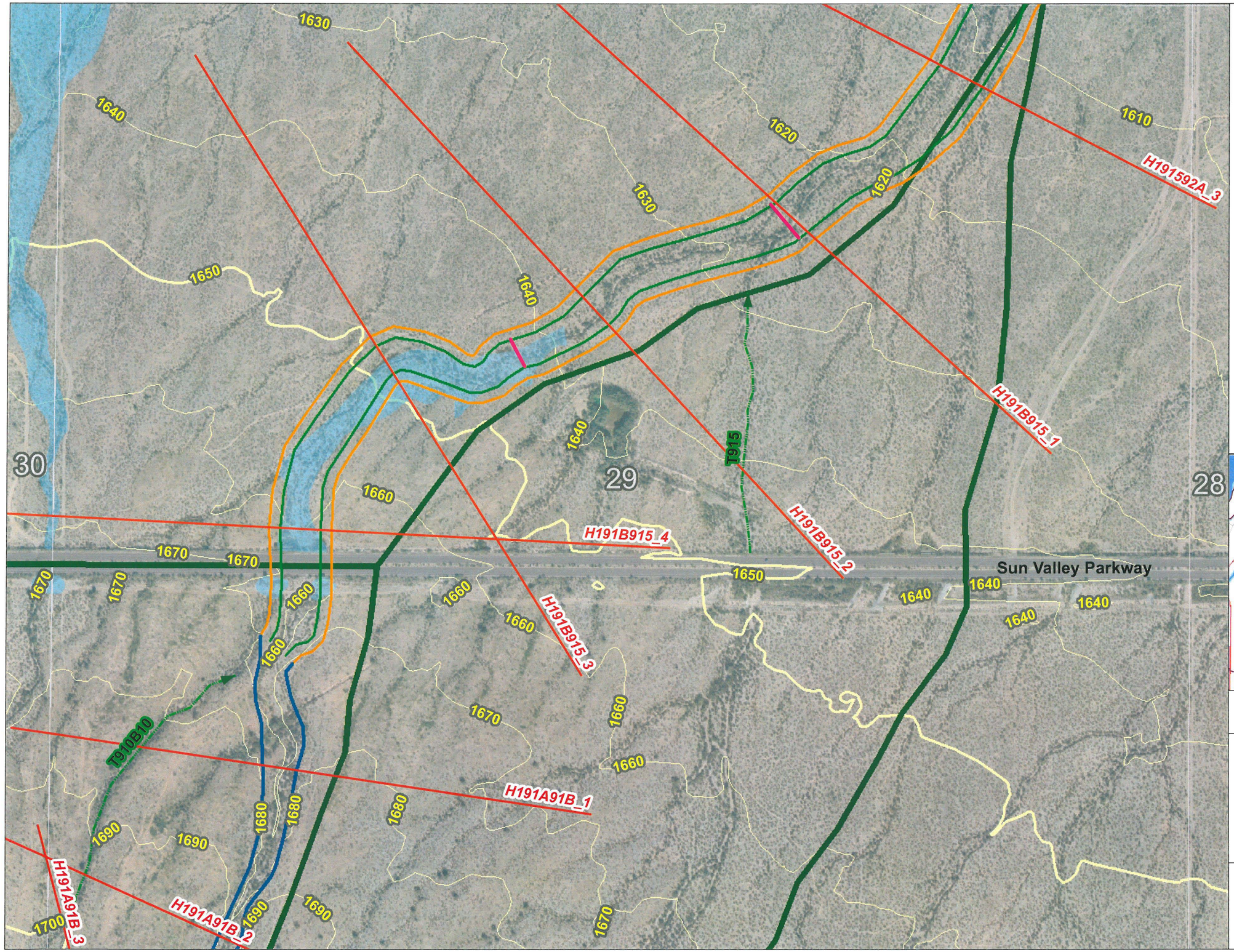

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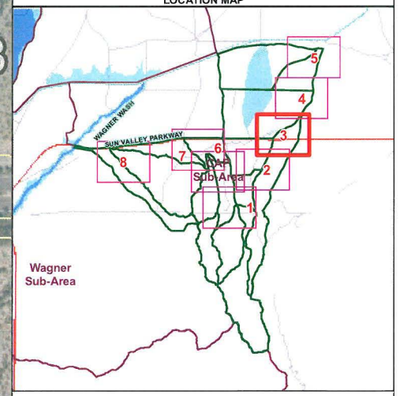

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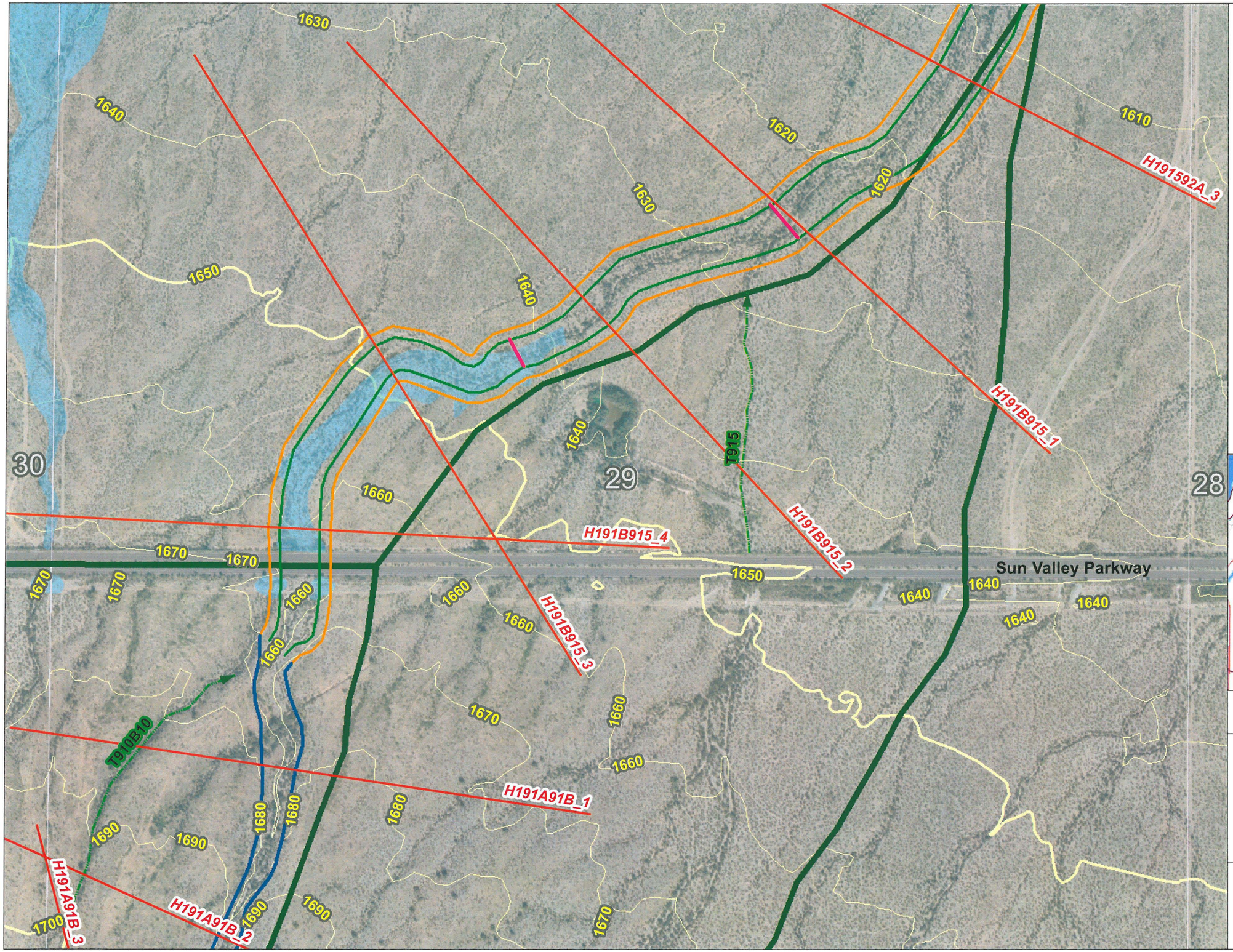

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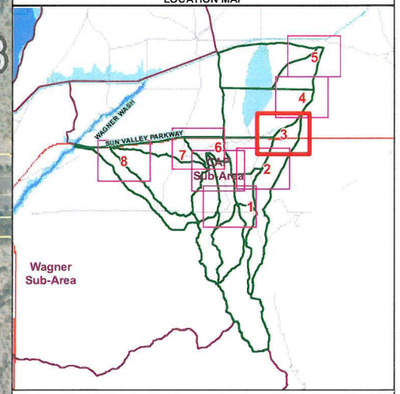

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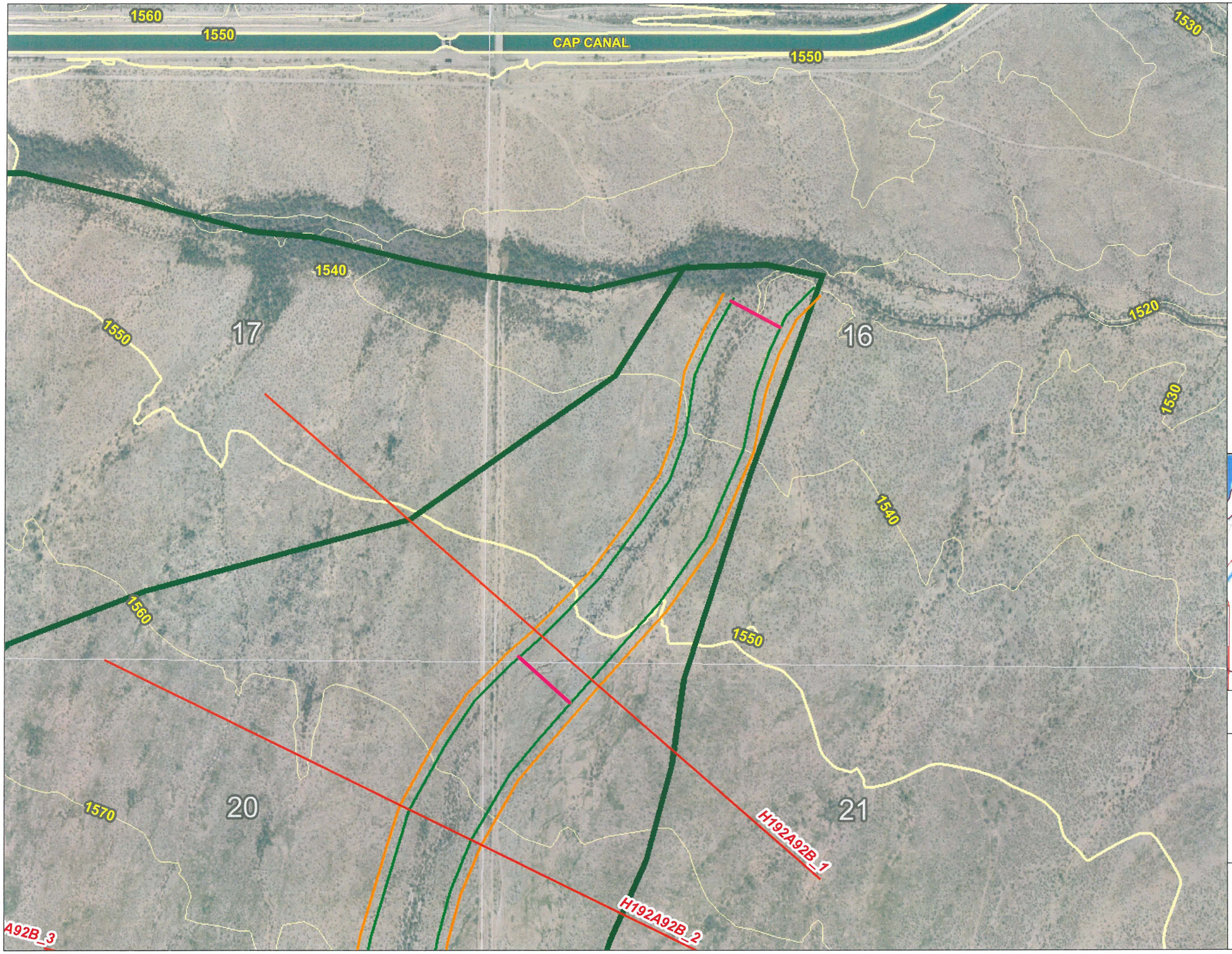

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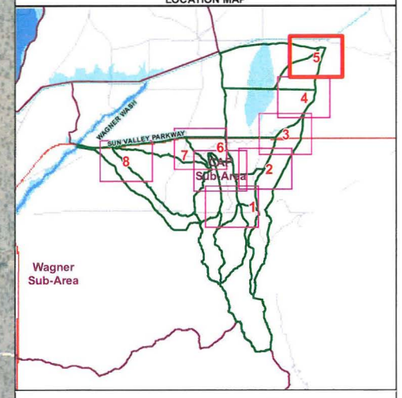

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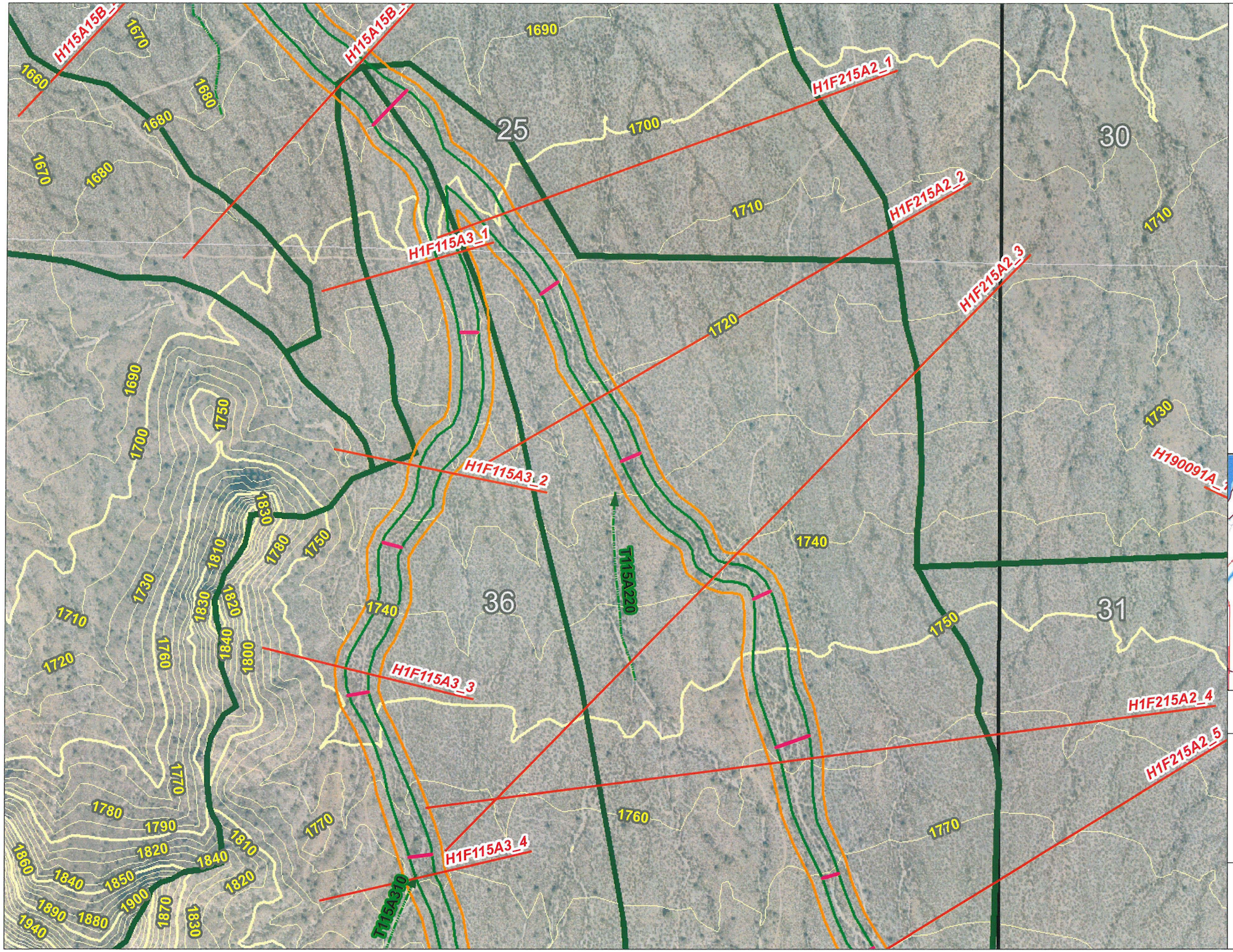

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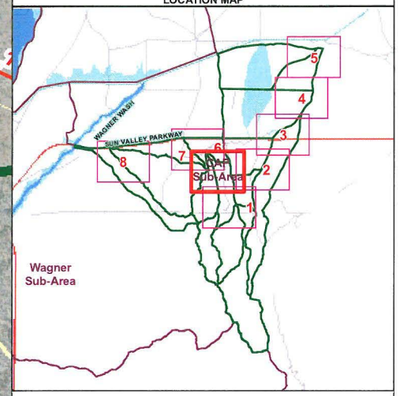

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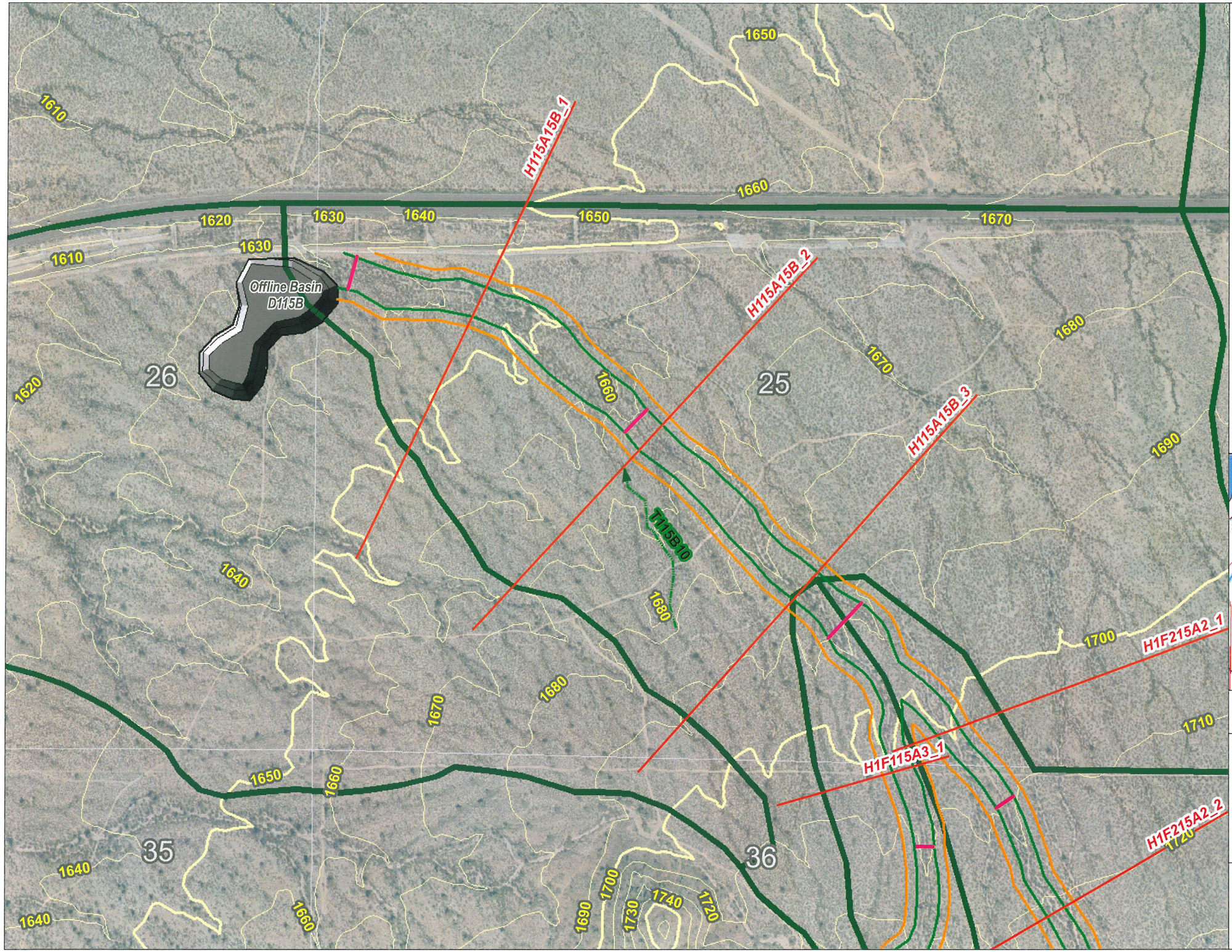

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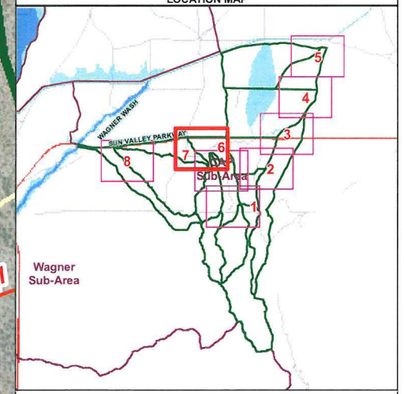

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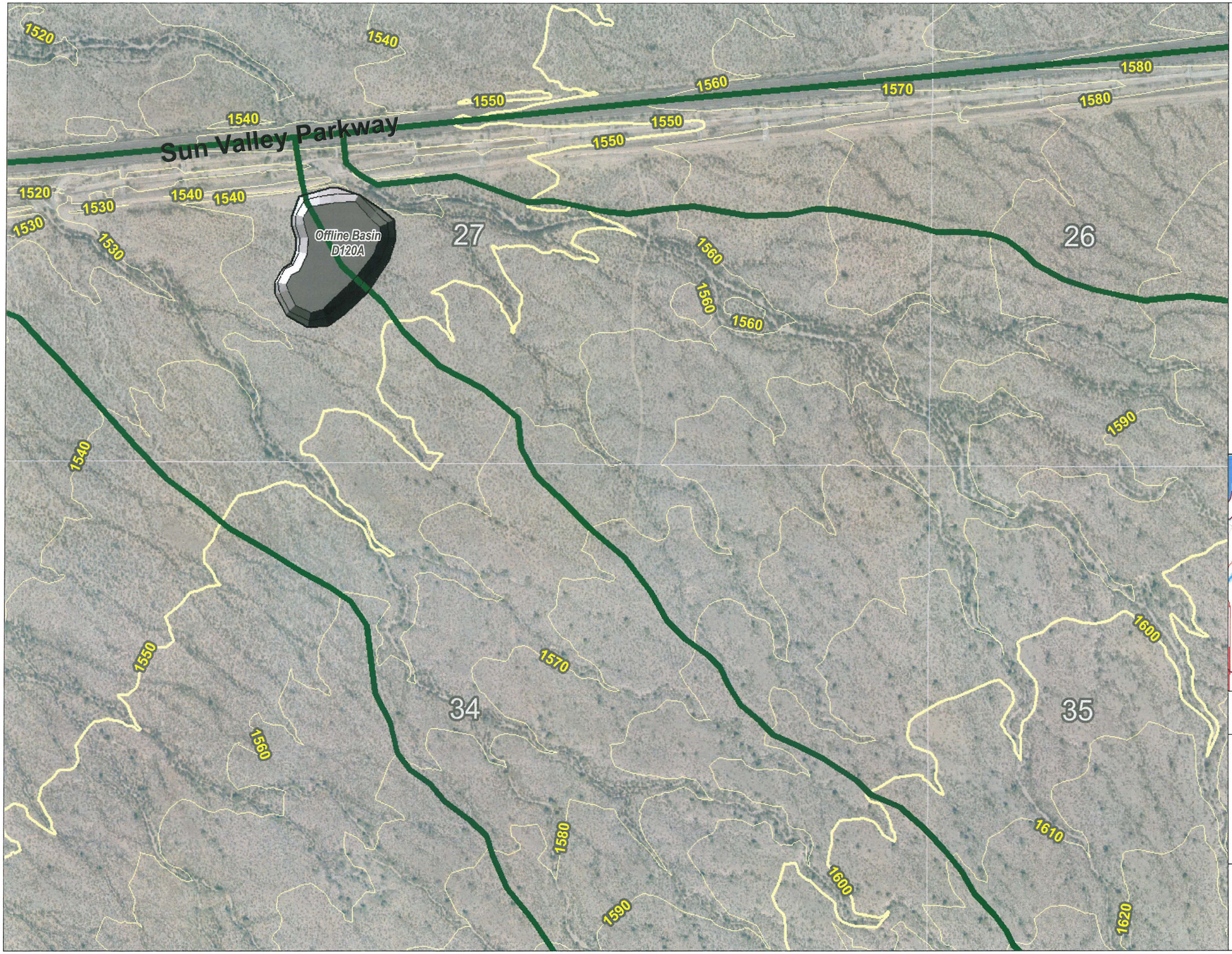

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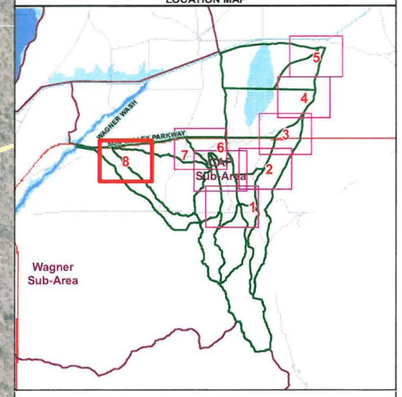

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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Costs Summary

						Design Geometry			Costs (in $1000)					Cost Percentages								
Structure ID	Type	Flow Rate (cfs)	ROW Area (acres)	Excavation Volume (ac. ft)	Fill Volume (ac. ft)	Length (Dike-ft Channel-miles)	ROW Width (ft)	Depth (ft)	Land Cost	Construction Cost	Landscaping Cost	50-Year Maintenance Cost	Total Cost	Land Cost %	Construction Cost %	Landscaping Cost %	50-Yr Maintenance Cost %	% of Fan System Total Cost	Aesthetic Treatment Land Cost Percentage	Aesthetic Treatment Construction Cost Percentage	Aesthetic Treatment Landscaping Cost Percentage	Aesthetic Treatment Maintenance Cost Percentage	Aesthetic Treatment Cost (% of Total Cost)
RR900	Online Basin	1416	36.5	377.2	0.0	NA	NA	7.5	$ 3,650	$ 4,716	$ 795	$ 1,943	$ 11,104	33%	42%	7%	17%	19%	20%	5%	100%	16%	19%
H190091A_4	Walled-Levee Corridor	209	1.7	0.0	1.9	0.098	141	1.9	$ 170	$ 225	$ 26	$ 104	$ 525	32%	43%	5%	20%	1%	47%	24%	100%	64%	46%
H190091A_3	Walled-Levee Corridor	289	3.5	0.0	2.9	0.192	151	1.4	$ 350	$ 385	$ 51	$ 203	$ 989	35%	39%	5%	21%	2%	46%	24%	100%	65%	47%
H190091A_2	Walled-Levee Corridor	371	3.5	0.0	0.2	0.191	151	2.0	$ 350	$ 337	$ 13	$ 97	$ 798	44%	42%	2%	12%	1%	46%	16%	100%	35%	35%
H190091A_1	Walled-Levee Corridor	451	5.7	0.0	0.0	0.262	181	2.6	$ 570	$ 352	$ -	$ 63	$ 985	58%	36%	0%	6%	2%	39%	15%	0%	0%	29%
H191A91B_4	Walled-Levee Corridor	558	1.3	0.0	0.0	0.116	92	3.3	$ 130	$ 9	$ -	$ 0	$ 139	93%	6%	0%	0%	0%	0%	8%	0%	10%	1%
H191A91B_3	Walled-Levee Corridor	810	1.4	0.0	0.0	0.191	61	4.6	$ 140	$ 2	$ -	$ 0	$ 142	98%	2%	0%	0%	0%	0%	8%	0%	10%	0%
H191A91B_2	Walled-Levee Corridor	1062	2.2	0.0	0.0	0.176	103	4.6	$ 220	$ 1	$ -	$ 0	$ 221	100%	0%	0%	0%	0%	0%	8%	0%	10%	0%
H191A91B_1	Walled-Levee Corridor	1277	4.7	0.0	0.0	0.258	151	4.8	$ 470	$ -	$ -	$ 1	$ 471	100%	0%	0%	0%	1%	0%	0%	0%	10%	0%
H191B915_4	Walled-Levee Corridor	1555	4.5	0.0	0.1	0.127	291	2.6	$ 450	$ 216	$ 8	$ 59	$ 732	61%	29%	1%	8%	1%	24%	16%	100%	35%	25%
H191B915_3	Walled-Levee Corridor	1753	5.7	0.0	4.0	0.189	251	2.2	$ 570	$ 481	$ 50	$ 214	$ 1,314	43%	37%	4%	16%	2%	28%	24%	100%	61%	37%
H191B915_2	Walled-Levee Corridor	1987	6.8	0.0	4.6	0.202	281	2.3	$ 680	$ 521	$ 53	$ 231	$ 1,485	46%	35%	4%	16%	3%	25%	25%	100%	60%	36%
H191B915_1	Walled-Levee Corridor	2206	4.7	0.0	2.7	0.129	301	2.1	$ 470	$ 329	$ 34	$ 146	$ 979	48%	34%	3%	15%	2%	23%	24%	100%	61%	34%
H191592A_3	Walled-Levee Corridor	2498	10.3	0.0	4.7	0.262	326	2.4	$ 1,030	$ 599	$ 69	$ 285	$ 1,984	52%	30%	3%	14%	3%	21%	24%	100%	63%	33%
H191592A_2	Walled-Levee Corridor	2780	5.2	0.0	0.4	0.189	226	4.3	$ 520	$ 328	$ 15	$ 85	$ 948	55%	35%	2%	9%	2%	31%	14%	100%	45%	29%
H191592A_1	Walled-Levee Corridor	3059	9.3	0.0	0.0	0.285	271	5.4	$ 930	$ 470	$ -	$ 71	$ 1,471	63%	32%	0%	5%	2%	26%	13%	0%	0%	22%
H192A92B_4	Walled-Levee Corridor	3325	4.9	0.0	2.1	0.099	411	2.5	$ 490	$ 251	$ 26	$ 112	$ 880	56%	29%	3%	13%	1%	16%	24%	100%	61%	29%
H192A92B_3	Walled-Levee Corridor	3297	10.0	0.0	2.8	0.192	431	2.2	$ 1,000	$ 425	$ 51	$ 210	$ 1,686	59%	25%	3%	12%	3%	16%	23%	100%	63%	28%
H192A92B_2	Walled-Levee Corridor	3268	9.7	0.0	4.4	0.191	421	2.7	$ 970	$ 530	$ 50	$ 220	$ 1,770	55%	30%	3%	12%	3%	16%	23%	100%	59%	28%
H192A92B_1	Walled-Levee Corridor	3240	23.2	0.0	8.4	0.477	401	2.5	$ 2,320	$ 1,096	$ 126	$ 521	$ 4,063	57%	27%	3%	13%	7%	17%	24%	100%	63%	29%
RR110	Online Basin	662	19.2	251.1	0.0	NA	NA	7.5	$ 1,920	$ 3,131	$ 418	$ 1,106	$ 6,575	29%	48%	6%	17%	11%	22%	5%	100%	17%	19%
H1F115A3_7	Walled-Levee Corridor	138	2.5	0.0	0.3	0.131	160	0.7	$ 250	$ 115	$ 17	$ 65	$ 447	56%	26%	4%	15%	1%	24%	18%	100%	69%	33%
H1F115A3_6	Walled-Levee Corridor	222	4.9	0.0	1.2	0.197	207	0.9	$ 490	$ 183	$ 26	$ 101	$ 800	61%	23%	3%	13%	1%	16%	23%	100%	67%	29%
H1F115A3_5	Walled-Levee Corridor	306	4.4	0.0	1.5	0.189	191	1.4	$ 440	$ 341	$ 25	$ 126	$ 932	47%	37%	3%	14%	2%	36%	20%	100%	51%	36%
H1F115A3_4	Walled-Levee Corridor	387	4.3	0.0	0.0	0.188	191	1.2	$ 430	$ 253	$ 0	$ 48	$ 731	59%	35%	0%	7%	1%	37%	16%	100%	2%	29%
H1F115A3_3	Walled-Levee Corridor	472	4.9	0.0	1.6	0.194	211	1.2	$ 490	$ 344	$ 51	$ 199	$ 1,084	45%	32%	5%	18%	2%	33%	21%	100%	67%	41%
H1F115A3_2	Walled-Levee Corridor	554	5.0	0.0	1.7	0.201	206	1.6	$ 500	$ 359	$ 31	$ 149	$ 1,039	48%	35%	3%	14%	2%	34%	21%	100%	54%	37%
H1F115A3_1	Walled-Levee Corridor	637	5.8	0.0	2.9	0.239	201	1.4	$ 580	$ 467	$ 63	$ 250	$ 1,360	43%	34%	5%	18%	2%	34%	22%	100%	65%	41%
H1F215A2_6	Walled-Levee Corridor	124	2.2	0.0	1.3	0.106	171	1.4	$ 220	$ 197	$ 28	$ 109	$ 554	40%	36%	5%	20%	1%	41%	23%	100%	67%	45%
H1F215A2_5	Walled-Levee Corridor	228	4.2	0.0	1.0	0.188	186	0.8	$ 420	$ 301	$ 45	$ 178	$ 944	44%	32%	5%	19%	2%	38%	20%	100%	66%	43%
H1F215A2_4	Walled-Levee Corridor	332	5.7	0.0	1.4	0.192	246	1.1	$ 570	$ 318	$ 32	$ 142	$ 1,062	54%	30%	3%	13%	2%	28%	21%	100%	58%	34%
H1F215A2_3	Walled-Levee Corridor	438	4.5	0.0	1.8	0.193	196	1.5	$ 450	$ 352	$ 51	$ 198	$ 1,052	43%	34%	5%	19%	2%	36%	22%	100%	67%	42%
H1F215A2_2	Walled-Levee Corridor	541	4.4	0.0	2.3	0.189	191	1.4	$ 440	$ 369	$ 50	$ 198	$ 1,058	42%	35%	5%	19%	2%	36%	23%	100%	65%	42%
H1F215A2_1	Walled-Levee Corridor	644	5.7	0.0	3.1	0.222	211	1.4	$ 570	$ 443	$ 59	$ 234	$ 1,305	44%	34%	4%	18%	2%	33%	23%	100%	65%	41%
H115A15B_3	Walled-Levee Corridor	1341	4.9	0.0	1.9	0.15	271	1.9	$ 490	$ 303	$ 40	$ 160	$ 992	49%	31%	4%	16%	2%	27%	23%	100%	64%	37%
H115A15B_2	Walled-Levee Corridor	1401	6.0	0.0	3.1	0.192	261	1.8	$ 600	$ 432	$ 51	$ 209	$ 1,292	46%	33%	4%	16%	2%	27%	23%	100%	63%	37%
H115A15B_1	Walled-Levee Corridor	1461	7.5	0.0	3.4	0.25	251	2.1	$ 750	$ 600	$ 66	$ 274	$ 1,690	44%	35%	4%	16%	3%	28%	21%	100%	62%	36%
D115B	Offline Basin	1519	7.6	37.6	0.0	NA	NA	0.0	$ 760	$ 390	$ 166	$ 324	$ 1,640	46%	24%	10%	20%	3%	0%	0%	100%	28%	0%
D120A	Offline Basin	1719	8.0	46.2	0.0	NA	NA	0.0	$ 800	$ 570	$ 174	$ 346	$ 1,891	42%	30%	9%	18%	3%	0%	0%	100%	22%	0%
	TOTAL	266.5	712.1	67.7					$ 26,650	$ 20,741	$ 2,760	$ 8,982	**$ 59,132**	45%	35%	5%	15%	100%	23%	14%	100%	42%	27%
All Channels		195.2	0.0	67.7	6.8				$ 19,520	$ 11,934	$ 1,206	$ 5,263	$ 37,923	51%	31%	3%	14%	64%					
All Online Basins		55.7	628.3	0.0					$ 5,570	$ 7,847	$ 1,213	$ 3,049	$ 17,679	32%	44%	7%	17%	30%					
All Offline Basins		15.6	83.8	0.0					$ 1,560	$ 960	$ 341	$ 670	$ 3,530	44%	27%	10%	19%	6%					
All Dikes		0.0	0.0	0.0	0				$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
Channel Cost per mile (in $1000)		$5,539		Basins Cost per ac. ft. (in $1000)					$29.78														

Hydrology - 6-hr Storm HEC1 Model Results

KK CARD	Type	Peak Flow	Peak Stage (ft)	Peak Storage	Time	Cum.Area (sq. miles)	MAX. Average Flow (cfs)				MAX. Average Rainfall Depth (Inches)				Total Runoff Volume (ac. ft)			
							6-HR	24-HR	72-HR	MAX-HR	6-HR	24-HR	72-HR	MAX-HR	6-HR	24-HR	72-HR	MAX-HR
S900	BASIN	971			4.5	1.15	186	47	16	7	1.506	1.512	1.512	1.512	92	92	92	92
S115A1	BASIN	988			4.17	0.59	107	27	9	4	1.681	1.682	1.682	1.682	53	53	53	53
CFAN2	COMBINE	1388			4.33	1.74	273	69	23	10	1.462	1.468	1.468	1.468	135	136	136	136
RR900	STORAGE	173	5.4	108.89	5.75	1.74	142	63	23	10	0.758	1.353	1.466	1.468	70	125	136	136
TOFAN1	DIVER	59			5.75	1.74	48	21	8	3	0.258	0.46	0.499	0.499	24	43	46	46
TOFAN2		114			5.75	1.74	93	42	15	7	0.5	0.893	0.968	0.969	46	83	90	90
90091A	ROUTE	114	100.6	3.22	6	1.74	93	42	15	7	0.498	0.891	0.968	0.969	46	83	90	90
S910A	BASIN	680			4.08	0.27	39	10	3	1	1.345	1.345	1.345	1.345	20	20	20	20
C910A	COMBINE	463			4.08	1.42	116	51	18	8	0.763	1.328	1.429	1.43	58	101	108	108
91A91B	ROUTE	394	101.3	7.21	4.17	1.42	114	50	18	8	0.747	1.323	1.429	1.43	57	100	108	108
S910B	BASIN	1444			4.08	0.6	90	22	7	3	1.402	1.402	1.402	1.402	45	45	45	45
C910B	COMBINE	1167			4.08	2.02	181	67	24	10	0.834	1.24	1.314	1.315	90	133	141	141
91B915	ROUTE	995	101.3	18.56	4.25	2.02	176	67	24	10	0.81	1.236	1.314	1.315	87	133	141	141
S915	BASIN	1308			4.42	1.13	197	49	16	7	1.626	1.626	1.626	1.626	98	98	98	98
C915	COMBINE	1822			4.33	3.14	341	108	37	16	1.008	1.274	1.325	1.325	169	214	222	222
91592A	ROUTE	1746	101.9	28.96	4.42	3.14	336	107	37	16	0.993	1.272	1.325	1.325	166	213	222	222
S920A	BASIN	2040			4.17	1.53	188	47	16	7	1.145	1.145	1.145	1.145	93	93	93	93
C920A	COMBINE	2591			4.33	4.67	468	141	48	21	0.932	1.119	1.154	1.154	232	279	287	288
92A92B	ROUTE	2402	101.7	59.7	4.58	4.67	459	140	48	21	0.914	1.117	1.154	1.154	228	278	287	288
S920B	BASIN	1148			4.08	0.48	81	20	7	3	1.563	1.563	1.563	1.563	40	40	40	40
C920B	COMBINE	2553			4.5	5.15	508	153	53	23	0.917	1.106	1.141	1.141	252	304	313	313
S920C	BASIN	1622			4.33	1.28	217	54	18	8	1.569	1.569	1.569	1.569	108	108	108	108
C920C	COMBINE	3498			4.5	6.43	673	194	66	29	0.972	1.12	1.147	1.147	334	384	394	394
S110	BASIN	662			4.25	0.43	76	19	6	3	1.639	1.64	1.64	1.64	38	38	38	38
RR110	STORAGE	96	4.6	28.97	5	0.43	57	19	6	3	1.235	1.63	1.64	1.64	28	37	38	38
F115A3	ROUTE	94	100.4	5.59	5.58	0.43	56	19	6	3	1.205	1.63	1.64	1.64	28	37	38	38
S115A3	BASIN	815			4.17	0.46	71	18	6	3	1.459	1.46	1.46	1.46	35	35	35	35
C115A3	COMBINE	697			4.17	0.88	112	34	11	5	1.179	1.437	1.445	1.445	56	68	68	68
DRR900	RETRIEV	59			5.75	1.74	48	21	8	3	0.258	0.46	0.499	0.499	24	43	46	46
F215A2	ROUTE	58	100.3	3.89	6.33	1.74	47	21	8	3	0.252	0.459	0.499	0.499	23	42	46	46
S115A2	BASIN	877			4.17	0.43	69	17	6	2	1.504	1.504	1.504	1.504	34	34	34	34
C115A2	COMBINE	717			4.17	1.02	104	38	14	6	0.949	1.403	1.48	1.481	52	76	80	81
C115A	COMBINE	1115			4.17	1.9	197	67	23	10	0.961	1.299	1.344	1.345	98	132	137	137
15A15B	ROUTE	1050	101.3	15.13	4.25	1.9	194	67	23	10	0.944	1.298	1.344	1.345	96	132	137	137
S115B	BASIN	763			4.08	0.33	46	11	4	2	1.289	1.289	1.289	1.289	23	23	23	23
C115B	COMBINE	1255			4.25	2.24	222	74	25	11	0.925	1.23	1.269	1.269	110	147	151	151
DOUT	DIVERT	205			4.25	2.24	8	2	1	0	0.035	0.035	0.035	0.035	4	4	4	4
D115B		1050			4.17	2.24	214	72	25	11	0.89	1.195	1.234	1.234	106	142	147	147
15B15C	ROUTE	878	102.1	42.93	4.75	2.24	208	71	25	11	0.867	1.189	1.234	1.234	103	142	147	147
S115C	BASIN	668			4.17	0.43	58	14	5	2	1.246	1.246	1.246	1.246	29	29	29	29
C115CR	COMBINE	983			4.67	2.66	242	81	28	12	0.846	1.131	1.169	1.17	120	161	166	166
S120A	BASIN	1683			4.25	1.37	193	48	16	7	1.309	1.31	1.31	1.31	96	96	96	96
DOUT	DIVERT	733			4.25	1.37	41	10	3	1	0.278	0.278	0.278	0.278	20	20	20	20
D120A		950			4.08	1.37	152	38	13	5	1.031	1.032	1.032	1.032	76	76	76	76
C115C	COMBINE	1645			4.5	4.04	374	113	39	17	0.861	1.044	1.072	1.072	185	225	231	231
115120	ROUTE	1569	102.9	35.6	4.67	4.04	371	113	39	17	0.855	1.043	1.072	1.072	184	225	231	231
S120B	BASIN	835			4.25	0.64	91	23	8	3	1.315	1.315	1.315	1.315	45	45	45	45
C120B	COMBINE	1803			4.58	4.68	426	127	43	19	0.847	1.011	1.036	1.036	211	252	259	259

Hydrology - 24-hr Storm HEC1 Model Results

KK CARD	Type	Peak Flow	Peak Stage (ft)	Peak Storage	Time	Cum.Area (sq. miles)	MAX. Average Flow (cfs)				MAX. Average Rainfall Depth (Inches)				Total Runoff Volume (ac. ft)			
							6-HR	24-HR	72-HR	MAX-HR	6-HR	24-HR	72-HR	MAX-HR	6-HR	24-HR	72-HR	MAX-HR
S900	BASIN	907			12.5	1.15	165	43	15	6	1.339	1.41	1.411	1.411	82	86	86	86
S115A1	BASIN	830			12.17	0.59	90	23	8	3	1.414	1.462	1.462	1.462	44	46	46	46
CFAN2	COMBINE	1416			12.25	1.74	252	66	22	10	1.349	1.412	1.413	1.413	125	131	131	131
RR900	STORAGE	160	5.1	101.02	13.75	1.74	132	60	22	10	0.709	1.286	1.41	1.413	66	119	131	131
TOFAN1	DIVER	54			13.75	1.74	45	20	7	3	0.241	0.437	0.479	0.48	22	41	44	45
TOFAN2		106			13.75	1.74	87	40	14	6	0.468	0.849	0.931	0.933	43	79	86	86
90091A	ROUTE	105	100.6	3.06	13.92	1.74	87	40	14	6	0.466	0.847	0.931	0.933	43	79	86	86
S910A	BASIN	533			12.08	0.27	33	8	3	1	1.11	1.11	1.11	1.11	16	16	16	16
C910A	COMBINE	523			12.08	1.42	108	47	17	7	0.707	1.242	1.349	1.352	54	94	102	102
91A91B	ROUTE	432	101.4	7.64	12.17	1.42	106	47	17	7	0.693	1.238	1.349	1.352	53	94	102	102
S910B	BASIN	1191			12.08	0.6	75	19	6	3	1.165	1.165	1.165	1.165	37	37	37	37
C910B	COMBINE	1507			12.08	2.02	175	65	23	10	0.805	1.202	1.281	1.283	87	129	138	138
91B915	ROUTE	1206	101.5	20.8	12.17	2.02	170	65	23	10	0.783	1.199	1.281	1.283	84	129	138	138
S915	BASIN	1210			12.42	1.13	172	43	14	6	1.419	1.431	1.431	1.431	85	86	86	86
C915	COMBINE	2242			12.25	3.14	335	107	37	16	0.992	1.263	1.319	1.321	166	212	221	221
91592A	ROUTE	2063	102.1	32.06	12.42	3.14	330	107	37	16	0.977	1.261	1.319	1.321	164	211	221	221
S920A	BASIN	2270			12.17	1.53	179	45	15	6	1.09	1.09	1.09	1.09	89	89	89	89
C920A	COMBINE	3327			12.25	4.67	499	150	52	22	0.993	1.191	1.231	1.232	247	297	307	307
92A92B	ROUTE	3017	101.9	68.53	12.42	4.67	490	149	52	22	0.975	1.189	1.231	1.232	243	296	307	307
S920B	BASIN	922			12.08	0.48	67	17	6	2	1.291	1.291	1.291	1.291	33	33	33	33
C920B	COMBINE	3183			12.42	5.15	548	165	57	25	0.989	1.191	1.229	1.23	271	327	338	338
S920C	BASIN	1583			12.33	1.28	194	48	16	7	1.402	1.402	1.402	1.402	96	96	96	96
C920C	COMBINE	4583			12.42	6.43	733	211	72	31	1.059	1.221	1.252	1.253	364	419	430	430
S110	BASIN	532			12.17	0.43	62	16	5	2	1.35	1.422	1.422	1.422	31	33	33	33
RR110	STORAGE	79	3.9	23.76	13	0.43	47	16	5	2	1.015	1.395	1.422	1.422	23	32	33	33
F115A3	ROUTE	77	100.3	4.94	13.58	0.43	46	16	5	2	0.992	1.395	1.422	1.422	23	32	33	33
S115A3	BASIN	649			12.17	0.46	59	15	5	2	1.197	1.244	1.245	1.245	29	30	30	30
C115A3	COMBINE	645			12.17	0.88	98	31	10	5	1.031	1.293	1.315	1.315	49	61	62	62
DRR900	RETRIEV	54			13.75	1.74	45	20	7	3	0.241	0.437	0.479	0.48	22	41	44	45
F215A2	ROUTE	54	100.3	3.75	14.25	1.74	44	20	7	3	0.236	0.436	0.479	0.48	22	40	44	45
S115A2	BASIN	701			12.17	0.43	57	14	5	2	1.24	1.24	1.24	1.24	28	28	28	28
C115A2	COMBINE	693			12.17	1.02	92	35	12	5	0.841	1.258	1.337	1.339	46	68	73	73
C115A	COMBINE	1323			12.17	1.9	188	64	22	10	0.917	1.253	1.311	1.312	93	127	133	133
15A15B	ROUTE	1224	101.4	16.61	12.25	1.9	185	64	22	10	0.901	1.253	1.311	1.312	92	127	133	133
S115B	BASIN	599			12.08	0.33	38	9	3	1	1.065	1.065	1.065	1.065	19	19	19	19
C115B	COMBINE	1519			12.17	2.24	219	73	25	11	0.91	1.216	1.266	1.267	108	145	151	151
DOUT	DIVERT	469			12.17	2.24	18	5	2	1	0.076	0.076	0.076	0.076	9	9	9	9
D115B		1050			12.08	2.24	201	69	24	10	0.834	1.141	1.19	1.191	99	136	142	142
15B15C	ROUTE	864	102.1	42.46	12.67	2.24	196	68	24	10	0.813	1.138	1.19	1.191	97	136	142	142
S115C	BASIN	534			12.17	0.43	47	12	4	2	1.028	1.028	1.028	1.028	24	24	24	24
C115CR	COMBINE	950			12.67	2.66	236	80	28	12	0.822	1.111	1.156	1.157	117	158	164	164
S120A	BASIN	1719			12.25	1.37	176	45	15	6	1.194	1.218	1.218	1.218	88	89	89	89
DOUT	DIVERT	769			12.25	1.37	38	10	3	1	0.257	0.257	0.257	0.257	19	19	19	19
D120A		950			12.08	1.37	138	35	12	5	0.937	0.96	0.961	0.961	69	70	70	70
C115C	COMBINE	1675			12.5	4.04	369	113	39	17	0.849	1.045	1.081	1.082	183	225	233	233
115120	ROUTE	1591	102.9	35.93	12.58	4.04	366	113	39	17	0.843	1.045	1.081	1.082	182	225	233	233
S120B	BASIN	711			12.25	0.64	77	19	6	3	1.112	1.124	1.124	1.124	38	39	39	39
C120B	COMBINE	2033			12.42	4.68	437	132	45	20	0.869	1.047	1.08	1.08	217	261	270	270

Channels Summary

		Design Geometry						Hydraulics									Sedimentation				
Structure ID	Type	Initial Slope (ft/ft)	Long-term Slope (ft/ft)	Length (stor-ft; chl-mi)	Width (ft)	Depth (ft)	Chnl Mannings n	Flow Rate (cfs)	Wetted Perimeter (ft)	Wetted XS Area (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Flow Depth (ft)	Top Width (ft)	Velocity (ft/s)	Froude Number	Incoming Clear Water?	Incoming Sediment Discharge (cfs)	Channel Sediment Discharge Capacity (cfs)	Toe Protection/Scour Depth (ft)	Drop structure Distance (ft)
H190091A_4	Walled-Levee Corridor	0.0195	0.0020	0.10	40	1.9	0.045	209	42.8	44.2	1.0	1.1	1.9	40	4.7	0.79	Yes	0.0	0.3	5.2	172
H190091A_3	Walled-Levee Corridor	0.0215	0.0223	0.19	50	1.4	0.045	289	52.6	56.6	1.1	1.1	1.4	50	5.1	0.84	No	0.6	0.5	5.2	N/A
H190091A_2	Walled-Levee Corridor	0.0175	0.0156	0.19	50	2.0	0.045	371	51.5	69.4	1.3	1.4	2.0	50	5.3	0.80	No	0.5	0.6	5.4	1578
H190091A_1	Walled-Levee Corridor	0.0165	0.0138	0.26	80	2.6	0.045	451	72.2	90.9	1.3	1.3	2.6	72	5.0	0.78	No	0.6	0.8	5.4	1115
H191A91B_4	Walled-Levee Corridor	0.0239	0.0129	0.12	91	3.3	0.045	558	48.0	78.5	1.6	1.7	3.3	48	7.1	0.97	No	0.9	2.4	6.0	273
H191A91B_3	Walled-Levee Corridor	0.0171	0.0152	0.19	60	4.6	0.045	810	40.7	101.6	2.5	2.6	4.6	39	8.0	0.87	No	2.4	2.8	6.4	1578
H191A91B_2	Walled-Levee Corridor	0.0152	0.0148	0.18	102	4.6	0.045	1062	63.3	147.8	2.3	2.4	4.6	63	7.2	0.82	No	2.8	2.9	6.2	7743
H191A91B_1	Walled-Levee Corridor	0.0081	0.0139	0.26	150	4.8	0.045	1277	97.5	237.0	2.4	2.4	4.8	97	5.4	0.61	No	2.9	1.3	5.8	N/A
H191B915_4	Walled-Levee Corridor	0.0162	0.0101	0.13	190	2.6	0.045	1555	190.7	283.4	1.5	1.5	2.6	190	5.5	0.79	No	1.5	3.0	5.5	491
H191B915_3	Walled-Levee Corridor	0.0142	0.0147	0.19	150	2.2	0.045	1753	154.0	290.8	1.9	1.9	2.2	150	6.0	0.76	No	3.0	2.8	5.5	N/A
H191B915_2	Walled-Levee Corridor	0.0111	0.0132	0.20	180	2.3	0.045	1987	184.4	362.7	2.0	2.0	2.3	180	5.5	0.68	No	2.8	2.2	5.4	N/A
H191B915_1	Walled-Levee Corridor	0.0113	0.0110	0.13	200	2.1	0.045	2206	204.0	400.0	2.0	2.0	2.1	200	5.5	0.69	No	2.4	2.5	5.4	9755
H191592A_3	Walled-Levee Corridor	0.0107	0.0095	0.26	225	2.4	0.045	2498	228.2	458.3	2.0	2.0	2.4	225	5.5	0.67	No	2.5	3.0	5.5	2515
H191592A_2	Walled-Levee Corridor	0.0142	0.0076	0.19	125	4.3	0.045	2780	119.3	346.2	2.9	2.9	4.3	118	8.0	0.82	No	3.0	7.6	6.4	455
H191592A_1	Walled-Levee Corridor	0.0110	0.0129	0.29	170	5.4	0.045	3059	163.7	449.3	2.7	2.8	5.4	163	6.8	0.72	No	7.6	6.0	6.2	N/A
H192A92B_4	Walled-Levee Corridor	0.0100	0.0157	0.10	310	2.5	0.045	3325	314.0	630.8	2.0	2.0	2.5	310	5.3	0.65	No	6.0	3.2	5.4	N/A
H192A92B_3	Walled-Levee Corridor	0.0091	0.0103	0.19	330	2.2	0.045	3297	333.2	661.1	2.0	2.0	2.2	330	5.0	0.62	No	3.2	2.7	5.3	N/A
H192A92B_2	Walled-Levee Corridor	0.0095	0.0094	0.19	320	2.7	0.045	3268	324.5	642.3	2.0	2.0	2.7	320	5.1	0.63	No	2.7	2.8	5.4	33523
H192A92B_1	Walled-Levee Corridor	0.0107	0.0093	0.48	300	2.5	0.045	3240	303.3	600.1	2.0	2.0	2.5	300	5.4	0.67	No	2.8	3.4	5.5	2136
H1F115A3_7	Walled-Levee Corridor	0.0255	0.0061	0.13	109	0.7	0.045	138	86.7	42.2	0.5	0.5	0.7	86	3.3	0.82	Yes	0.0	0.2	4.8	155
H1F115A3_6	Walled-Levee Corridor	0.0250	0.0160	0.20	156	0.9	0.045	222	100.5	59.9	0.6	0.6	0.9	100	3.7	0.84	No	0.2	0.3	4.9	333
H1F115A3_5	Walled-Levee Corridor	0.0270	0.0157	0.19	90	1.4	0.045	306	69.5	61.2	0.9	0.9	1.4	68	5.0	0.93	No	0.3	0.7	5.2	266
H1F115A3_4	Walled-Levee Corridor	0.0268	0.0285	0.19	90	1.2	0.045	387	88.2	77.7	0.9	0.9	1.2	88	5.0	0.93	No	1.1	1.0	5.2	N/A
H1F115A3_3	Walled-Levee Corridor	0.0225	0.0256	0.19	110	1.2	0.045	472	111.8	101.4	0.9	0.9	1.2	110	4.7	0.85	No	1.0	0.8	5.1	N/A
H1F115A3_2	Walled-Levee Corridor	0.0189	0.0174	0.20	105	1.6	0.045	554	106.8	115.5	1.1	1.1	1.6	105	4.8	0.81	No	0.8	0.9	5.2	2000
H1F115A3_1	Walled-Levee Corridor	0.0183	0.0169	0.24	100	1.4	0.045	637	102.2	124.6	1.2	1.2	1.4	100	5.1	0.81	No	0.9	1.0	5.2	2136
H1F215A2_6	Walled-Levee Corridor	0.0156	0.0029	0.11	70	1.4	0.045	124	71.8	42.5	0.6	0.6	1.4	70	2.9	0.66	Yes	0.0	0.1	4.9	236
H1F215A2_5	Walled-Levee Corridor	0.0186	0.0302	0.19	85	0.8	0.045	228	86.3	62.6	0.7	0.7	0.8	85	3.6	0.75	No	0.5	0.2	4.9	N/A
H1F215A2_4	Walled-Levee Corridor	0.0194	0.0139	0.19	145	1.1	0.045	332	146.0	95.5	0.7	0.7	1.1	145	3.5	0.75	No	0.2	0.4	4.9	544
H1F215A2_3	Walled-Levee Corridor	0.0191	0.0119	0.19	95	1.5	0.045	438	96.8	96.2	1.0	1.0	1.5	95	4.6	0.80	No	0.4	0.8	5.1	417
H1F215A2_2	Walled-Levee Corridor	0.0177	0.0265	0.19	90	1.4	0.045	541	92.4	109.6	1.2	1.2	1.4	90	4.9	0.79	No	1.4	0.8	5.2	N/A
H1F215A2_1	Walled-Levee Corridor	0.0174	0.0158	0.22	110	1.4	0.045	644	112.4	132.3	1.2	1.2	1.4	110	4.9	0.78	No	0.8	0.9	5.2	1887
H115A15B_3	Walled-Levee Corridor	0.0193	0.0156	0.15	170	1.9	0.045	1341	172.7	236.4	1.4	1.4	1.9	170	5.7	0.85	No	2.0	2.7	5.4	815
H115A15B_2	Walled-Levee Corridor	0.0192	0.0180	0.19	160	1.8	0.045	1401	163.2	237.7	1.5	1.5	1.8	160	5.9	0.85	No	2.7	2.9	5.5	2531
H115A15B_1	Walled-Levee Corridor	0.0181	0.0182	0.25	150	2.1	0.045	1461	153.4	242.0	1.6	1.6	2.1	150	6.0	0.84	No	3.2	3.2	5.5	N/A

Basins Summary

			Design Geometry				Hydraulics						Sedimentation	
Structure ID	Type	Adjacent Topo. Slope (ft/ft)	Top Area (acres)	Perimeter (ft)	Depth (ft)	Storage Volume Provided	Peak Storage (ac. Ft)	Total Vol. Entering Basin (ac. ft)	Peak Inflow into Basin (cfs)	Peak flow d/s of Basin (cfs)	Peak Stage (ft)	Available Freeboard (ft)	Sediment Volume (ac. ft)	Sediment Depth (ft)
RR900	Online Basin	0.0222	30.2	5489	7.5	123.6	108.9	136.0	1416	173	5.4	1.6	8.6	0.5
RR110	Online Basin	0.0333	15.5	3234	7.5	36.9	29.0	38.0	662	96	4.6	1.9	5.8	1.0
D115B	Offline Basin	0.0182	5.2	2116	4.0	9.4	9.0	9.0	1519	1050	2.9	1.1	0.0	0.0
D120A	Offline Basin	0.0132	5.8	1926	6.5	20.9	20.0	20.0	1719	950	5.3	1.2	0.0	0.0

Online Basin

Structure ID	RR900

HEC1 ID	RR900

Design Sediment Yield (MUSLE) Ys = Rw * K * LS * C * P

Rw, Storm Energy Runoff Factor; Rw = a(V*q)^b

Drainage Area =	1.74 sq. mi.
Area Contributing Sediment =	1.74 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	14	142	95	0.56	6563
Q-5	0.25	34	354	95	0.56	18314
Q-10	0.35	48	496	95	0.56	26697
Q-25	0.55	75	779	95	0.56	44290
Q-50	0.75	102	1062	95	0.56	62686
Q-100	1	136	1416	95	0.56	86517

K, Soil Erodibility Factor: Table 14, Camp, 1986

Soil Map Unit	K	% of Basin
3	0.16	3.7%
48	0.08	25.1%
100	0.02	49.8%
49	0.08	19.0%
115	0.27	2.5%
Weighted K Factor:	0.06	

C, Cover and Management Factor; Figures 5-7, SCS Ag. Handbook #537

Cover Type	% of Basin	Canopy Factor	Mulch Factor	Root Factor	Composite C Factor	Weighted C Factor
	100	0.90	0.90	0.40	0.32	0.32
			Composite Weighted C Factor=			0.324

LS, Topographic Factor; LS = ((L/72.6)^n)*(0.065+0.0454*S+0.0065*S^2)

Slope Lengths:	200	ft	(Basin Average)
Slope Angles:	25.3	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	8.92		

P, Erosion Control Factor

No Practice, Natural or Regulated	
Weighted P for Contributing Watershed	1

Weighted Average Annual Sediment Yield:

Recurrence Interval	Rw	K	LS	C	P	Ys (tons)	Unit Ys (AF/sq.mi)
Q-2	6563	0.06	8.92	0.32	1.00	1088	0.26
Q-5	18314	0.06	8.92	0.32	1.00	3036	0.73
Q-10	26697	0.06	8.92	0.32	1.00	4426	1.06
Q-25	44290	0.06	8.92	0.32	1.00	7343	1.76
Q-50	62686	0.06	8.92	0.32	1.00	10393	2.49
Q-100	86517	0.06	8.92	0.32	1.00	14344	3.44
Weighted Average Annual Sediment Yield:						2061	0.49

Total Sediment Yield Volume (ac. ft)	8.6

Sediment Depth in Basin	0.5 ft

Geometry

Topography slope (ft/ft)	0.022
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	7.5
Freeboard (ft)	1
Top Perimeter (ft)	5489.1
Top Area (acres)	30.2
Bottom elevation (ft)	1794.4
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	123.6
Total Available Volume (ac. ft) (incl. Freeboard)	155.0
Total Excavation Volume (ac. ft)	377.2

Basin Outlet

Diameter	4.00	ft
Invert Elevation	0.00	ft
Number of pipes	2	

Stage-Storage-Discharge

Elevation	0	1	2	3	4	5	6	7	8	10
Volume	0.0	18.5	37.7	57.5	78.0	99.2	121.0	143.5	166.7	215.3
Outflow	0.0	21.9	46.9	87.9	126.9	157.0	193.0	224.4	252.9	282.9

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Total Flow Volume entering Basin (ac. ft)	136.0	131	136.0
Peak Inflow (cfs)	1388	1416	1416.0
Peak Outflow (cfs)	173	160	173.0
Stage at Peak Outflow (ft)	5.4	5.1	5.4
Volume at Peak Outflow (ac. ft)	108.9	101.02	108.9

Volume Check

Total Volume needed	117.5	ac. ft
Total Volume Provided	123.6	ac. ft

Volume OK?	Yes

Stage Check

Depth Needed	6.9	ft
Depth Provided	7.5	ft

Depth OK?	Yes

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	608549	0
Excavated Area (sq. Yd)	146168.0	4574.3
Adjacent Buffer Area (sq. Yd)	30495	

Inlet	Terraced	Riprap-lined
Average Inlet Height (ft)		20
Average Inlet Length (ft)		120
Total Width of all inlets (ft)		1040
Material Thickness (ft)	0.5	3.0
Total Inlet Area (sq. Yd)	0	14057.9
Total Material Volume (cu. Yd)	0	14057.9
Unit Cost	$ 155.00	$ 75.00
Total Cost	$ -	$ 1,054,343

Outlet		
Outlet Type	Pipe	
(None, Riprap Weir, Concrete Weir, Pipe)		
Pipe Length	435	ft
Unit Cost	$ 160.00	per ft
Cost per outlet	$ 69,600	
Other Cost	$ -	
Total Cost	$ 69,600	
Outlet Area	133	sq. Yd

Structure Cost

Structure Type	Structure Cost												
		Excavation/Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Basin		608,549	cu. Yd	$ 4.00	$ 2,434,196	176,663	sq. Yd	$ 4.50	$ 794,984	176,663	sq. Yd	$ 8.33	$ 1,472,192
Inlet					$ 1,054,343				$ -				$ 468,597
Outlet	Pipe	2	EA	$ 69,600	$ 139,200	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 3,627,739			Total	$ 794,984			Total	$ 1,943,005
		Contingency Cost (25% of Construction Cost)			$ 906,935								
		Engineering Design Cost (5% of Construction Cost)			$ 181,387								
		Total Construction Cost			$ 4,716,060								

Structure Aesthetic Treatment Cost

Basin - Aesthetic Treatment		608,549	cu. Yd	$ -	$ -	176,663	sq. Yd	$ 4.50	$ 794,984	25,921	sq. Yd	$ 8.33	$ 216,007
Inlet - Aesthetic Treatment (20%Inlet)					$ 210,869				$ -				$ 93,719
Outlet -Aesthetic Treatment (5% Outlet)					$ 6,960	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 217,829			Total	$ 794,984			Total	$ 309,837
		Contingency Cost (25% of Construction Cost)			$ 54,457								
		Engineering Design Cost (5% of Construction Cost)			$ 10,891								
		Total Construction Cost			$ 283,177								

Total Structure Aesthetic Trtmt Cost	$ 1,387,997

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	6.3	$100,000	$ 630,000
Basin	30.2	$100,000	$ 3,020,000
Other		$100,000	$ -
Total	36.5	$100,000	$ 3,650,000

Total Land Related Aes. Trtmt Cost	$ 724,510

Total Cost	$ 11,104,049

Total Aesthetic Treatment Cost	$ 2,112,508

Total Right of Way Cost	$ 3,650,000

Walled-Levee Corridor

Structure ID	H190091A

HEC1 ID	90091A

Cutline ID	4

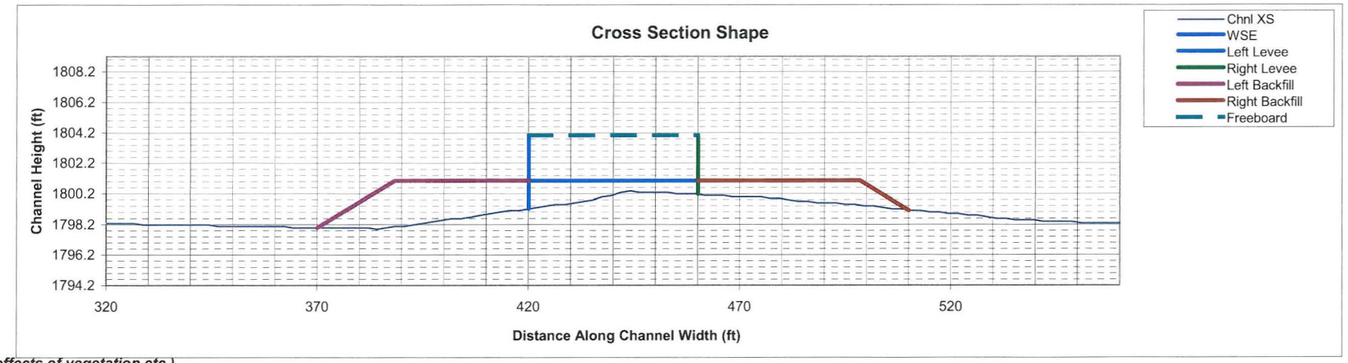
Longitudinal Geometry

Length	514.9	ft
Initial Channel Slope	0.0195	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0020	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	420	Right Levee Station (ft)	460
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	420	Right Channel Limit Station (ft)	460

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910A	RR900								TOTAL
HEC1 Peak-Flow	523	173								
Weighting Factor	0.10	0.90								
Flow into Channel	54	155								209

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
21	18.5	7.9	1799.2	1800.0	2.6	0.8	17.7	0.4	0.4	0.69
63	41.6	21.2	1799.2	1800.5	3.0	1.3	40.0	0.5	0.5	0.71
157	42.4	37.1	1799.2	1800.9	4.2	1.7	40.0	0.9	0.9	0.77
209	42.8	44.2	1799.2	1801.1	4.7	1.9	40.0	1.0	1.1	0.79

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
21	41.6	21.8	1799.2	1800.5	1.0	1.3	40.0	0.5	0.5	0.23
63	42.7	42.5	1799.2	1801.0	1.5	1.8	40.0	1.0	1.1	0.25
157	44.3	74.7	1799.2	1801.8	2.1	2.6	40.0	1.7	1.9	0.27
209	45.0	89.4	1799.2	1802.2	2.3	3.0	40.0	2.0	2.2	0.28

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
63										0.00

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
21	Stable
63	Stable
157	Stable
209	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	63	cfs
Clear Water	Yes	
Total Incoming Sediment Load	0.000	cfs
Initial Chnl Sediment Capacity	0.319	cfs
Long-term Equilibrium Slope (MPM)	0.0020	

Drop Structures

Design Slope	0.0020	ft/ft
Total Drop Needed	9.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	3.00	
Distance between Structures	172	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
209	1.1	24.6	1.9	1.1	4.7	0.0195	-0.5	0.6	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	515
Channel Limit-Left Station (ft)	420
Channel Limit-Right Station (ft)	460
Channel Width (ft)	40

Levee

Left Levee Length (ft)	515
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	515
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.9

Left Levee Surface Area (sq. Yd)	275
Left Levee Volume (cu. Yd)	46
Right Levee Surface Area (sq. Yd)	223
Right Levee Volume (cu. Yd)	37
Total Levee Surface Area (sq. Yd)	498
Total Levee Volume (cu. Yd)	83

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	25897
Left Levee Fill XS area (sq. ft)	104.5
Left Levee Fill Volume (cu. Yd)	1993
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	25845
Right Levee Fill XS area (sq. ft)	56.1
Right Levee Fill Volume (cu. Yd)	1070
Total Levee Fill Surface Area (sq. ft)	51742
Total Levee Fill Volume (cu Yd)	3063

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	40	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	4.2	
Structure Height (ft)	7.2	
Number of Structures	3.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	10.67	1.07
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 907	$ 91
Area per structure (sq. Yd)	4	0
Total Area (cu. Yd)	13	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	515	ft	$ 228	$ 117,333	83	cu. Yd	$ -	$ -	83	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	498	sq. Yd	$ -	$ -	498	sq. Yd	$ -	$ -	498	sq. Yd	$ 75.00	$ 37,350
Adjacent Levee Fill	Fill	3,063	cu. Yd	$ 7.00	$ 21,441	5,722	sq. Yd	$ 4.50	$ 25,750	5,722	sq. Yd	$ 11.67	$ 66,759
Wall Material Aesthetic Treatment Cost	Wall	83	cu. Yd	$ -	$ -	83	cu. Yd	$ -	$ -	83	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	498	sq. Yd	$ 63.00	$ 31,374	498	sq. Yd	$ -	$ -	498	sq. Yd	$ -	$ -
Drop Structures	Gabions	3	EA	$ 906.95	$ 2,721	4	sq. Yd	$ -	$ -	4	sq. Yd	$ 37.50	$ 167
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 172,869			Total	$ 25,750			Total	$ 104,276
		Contingency Cost (25% of Construction Cost)			$ 43,217								
		Engineering Design Cost (5% of Construction Cost)			$ 8,643								
		Total Construction Cost			$ 224,729								
Wall Material Aesthetic Treatment Cost	Wall	83	cu. Yd	$ -	$ -	83	cu. Yd	$ -	$ -	83	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	498	sq. Yd	$ 63.00	$ 31,374	498	sq. Yd	$ -	$ -	498	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,063	cu. Yd	$ 7.00	$ 21,441	5,722	sq. Yd	$ 4.50	$ 25,750	5,722	sq. Yd	$ 11.67	$ 66,759
Drop Structures Aesthetic Trtmt. Cost	Gabions	3	EA	$ 90.95	$ 273	4	sq. Yd	$ -	$ -	0	sq. Yd	$ 37.50	$ 17
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 53,088			Total	$ 25,750			Total	$ 66,776
		Contingency Cost (25% of Construction Cost)			$ 13,272								
		Engineering Design Cost (5% of Construction Cost)			$ 2,654								
		Total Construction Cost			$ 69,014								

Total Structure Aesthetic Trtmt Cost	$ 161,540

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	0.8	$100,000	$ 80,000
Maintenance Access	30	0.4	$100,000	$ 40,000
Channel	40	0.5	$100,000	$ 50,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	141	1.7		$ 170,000

Total Land Related Aes. Trtmt Cost	$ 80,000

Total Cost	$ 524,755	Total Aesthetic Treatment Cost	$ 241,540	Total Right of Way Cost	$ 170,000

Walled-Levee Corridor

Structure ID	H190091A

HEC1 ID	90091A

Cutline ID	3

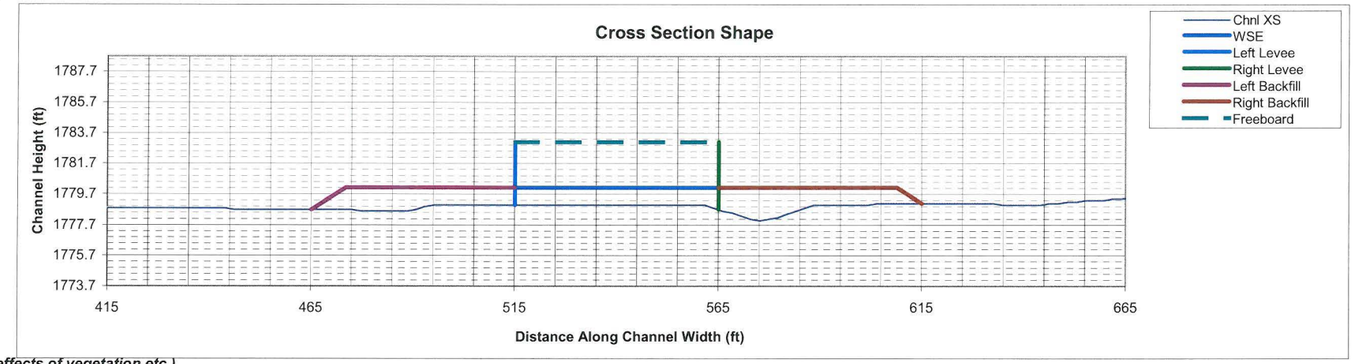
Longitudal Geometry

Length	1012.4	ft
Initial Channel Slope	0.0215	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0223	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	515	Right Levee Station (ft)	565
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	515	Right Channel Limit Station (ft)	565

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910A	RR900								TOTAL
HEC1 Peak-Flow	523	173								
Weighting Factor	0.33	0.67								
Flow into Channel	174	115								289

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
29	50.9	14.0	1778.7	1779.3	2.1	0.6	50.0	0.3	0.3	0.68
87	51.4	27.3	1778.7	1779.5	3.2	0.8	50.0	0.5	0.5	0.76
217	52.2	47.5	1778.7	1779.9	4.6	1.2	50.0	0.9	1.0	0.82
289	52.6	56.6	1778.7	1780.1	5.1	1.4	50.0	1.1	1.1	0.84

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
29	50.8	13.9	1778.7	1779.3	2.1	0.6	50.0	0.3	0.3	0.70
87	51.4	27.0	1778.7	1779.5	3.2	0.8	50.0	0.5	0.5	0.77
217	52.2	47.0	1778.7	1779.9	4.6	1.2	50.0	0.9	0.9	0.84
289	52.5	56.0	1778.7	1780.1	5.2	1.4	50.0	1.1	1.1	0.86

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H190091A_4	T910A10								
87	0.32	0.25								0.57

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
29	Stable
87	Stable
217	Stable
289	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	87	cfs
Clear Water	No	
Total Incoming Sediment Load	0.573	cfs
Initial Chnl Sediment Capacity	0.545	cfs
Long-term Equilibrium Slope (ADWR)	0.0223	

Drop Structures

Design Slope	0.0223	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
289	1.1	24.6	1.4	1.1	5.1	0.0215	-0.3	0.7	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1012
Channel Limit-Left Station (ft)	515
Channel Limit-Right Station (ft)	565
Channel Width (ft)	50

Levee

Left Levee Length (ft)	1012
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.1
Right Levee Length (ft)	1012
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.4

Left Levee Surface Area (sq. Yd)	461
Left Levee Volume (cu. Yd)	77
Right Levee Surface Area (sq. Yd)	495
Right Levee Volume (cu. Yd)	82
Total Levee Surface Area (sq. Yd)	956
Total Levee Volume (cu. Yd)	159

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50719
Left Levee Fill XS area (sq. ft)	59.6
Left Levee Fill Volume (cu. Yd)	2234
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50719
Right Levee Fill XS area (sq. ft)	65.9
Right Levee Fill Volume (cu. Yd)	2470
Total Levee Fill Surface Area (sq. ft)	101438
Total Levee Fill Volume (cu Yd)	4704

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	50	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.7	
Structure Height (ft)	8.7	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	16.11	1.61
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,369	$ 137
Area per structure (sq. Yd)	6	1
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,012	ft	$ 201	$ 203,371	159	cu. Yd	$ -	$ -	159	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	956	sq. Yd	$ -	$ -	956	sq. Yd	$ -	$ -	956	sq. Yd	$ 75.00	$ 71,700
Adjacent Levee Fill	Fill	4,704	cu. Yd	$ 7.00	$ 32,928	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Wall Material Aesthetic Treatment Cost	Wall	159	cu. Yd	$ -	$ -	159	cu. Yd	$ -	$ -	159	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	956	sq. Yd	$ 63.00	$ 60,228	956	sq. Yd	$ -	$ -	956	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 1,369.35	$ -	6	sq. Yd	$ -	$ -	6	sq. Yd	$ 37.50	$ 208
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 296,527			Total	$ 50,600			Total	$ 203,094
		Contingency Cost (25% of Construction Cost)			$ 74,132								
		Engineering Design Cost (5% of Construction Cost)			$ 14,826								
		Total Construction Cost			$ 385,485								
Wall Material Aesthetic Treatment Cost	Wall	159	cu. Yd	$ -	$ -	159	cu. Yd	$ -	$ -	159	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	956	sq. Yd	$ 63.00	$ 60,228	956	sq. Yd	$ -	$ -	956	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,704	cu. Yd	$ 7.00	$ 32,928	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 136.85	$ -	6	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 21
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 93,156			Total	$ 50,600			Total	$ 131,206
		Contingency Cost (25% of Construction Cost)			$ 23,289								
		Engineering Design Cost (5% of Construction Cost)			$ 4,658								
		Total Construction Cost			$ 121,103								

Total Structure Aesthetic Trtmt Cost	$ 302,909

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	50	1.2	$100,000	$ 120,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	151	3.5		$ 350,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 989,179	Total Aesthetic Treatment Cost	$ 462,909	Total Right of Way Cost	$ 350,000

Walled-Levee Corridor

Structure ID	H190091A

HEC1 ID	90091A

Cutline ID	2

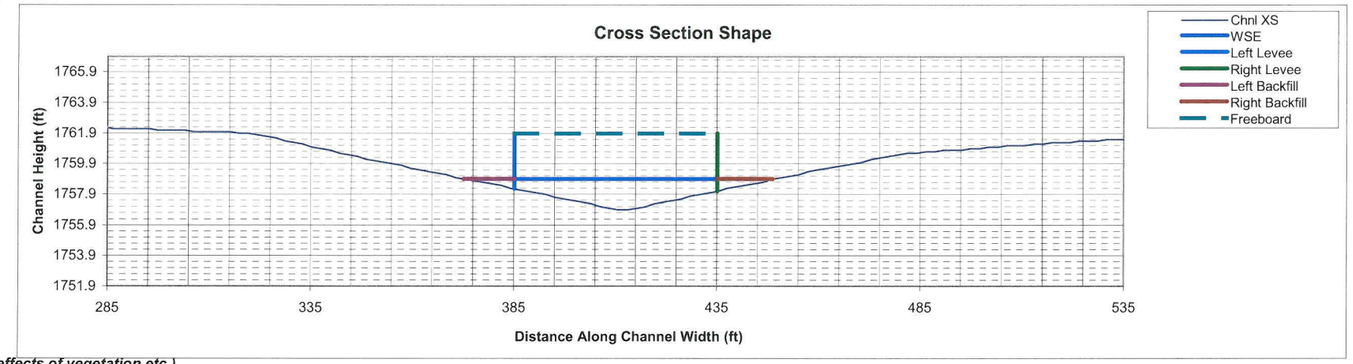
Longitudinal Geometry

Length	1009.7	ft
Initial Channel Slope	0.0175	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0156	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	385	Right Levee Station (ft)	435
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	385	Right Channel Limit Station (ft)	435

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910A	RR900								TOTAL
HEC1 Peak-Flow	523	173								
Weighting Factor	0.57	0.43								
Flow into Channel	296	75								371

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
37	32.8	14.6	1756.9	1757.7	2.5	0.8	32.8	0.4	0.4	0.67
111	48.4	32.9	1756.9	1758.2	3.4	1.3	48.3	0.7	0.7	0.72
278	51.1	58.2	1756.9	1758.7	4.8	1.8	50.0	1.1	1.2	0.78
371	51.5	69.4	1756.9	1758.9	5.3	2.0	50.0	1.3	1.4	0.80

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
37	33.2	15.1	1756.9	1757.7	2.4	0.8	33.2	0.5	0.5	0.64
111	49.1	34.2	1756.9	1758.2	3.3	1.3	48.9	0.7	0.7	0.69
278	51.2	60.3	1756.9	1758.7	4.6	1.8	50.0	1.2	1.2	0.74
371	51.6	71.9	1756.9	1759.0	5.2	2.1	50.0	1.4	1.4	0.76

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H190091A_3								
111	0.55								0.55

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
37	Stable
111	Stable
278	Stable
371	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	111	cfs
Clear Water	No	
Total Incoming Sediment Load	0.545	cfs
Initial Chnl Sediment Capacity	0.643	cfs
Long-term Equilibrium Slope (ADWR)	0.0156	

Drop Structures

Design Slope	0.0156	ft/ft
Total Drop Needed	1.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.64	
Distance between Structures	1578	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
371	1.1	24.6	2.0	1.4	5.3	0.0175	-0.5	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1010
Channel Limit-Left Station (ft)	385
Channel Limit-Right Station (ft)	435
Channel Width (ft)	50

Levee

Left Levee Length (ft)	1010
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.7
Right Levee Length (ft)	1010
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.8

Left Levee Surface Area (sq. Yd)	415
Left Levee Volume (cu. Yd)	69
Right Levee Surface Area (sq. Yd)	426
Right Levee Volume (cu. Yd)	71
Total Levee Surface Area (sq. Yd)	841
Total Levee Volume (cu. Yd)	140

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	12.3
Left Levee Fill Surface Area (sq. ft)	12419
Left Levee Fill XS area (sq. ft)	3.6
Left Levee Fill Volume (cu. Yd)	135
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	13.7
Right Levee Fill Surface Area (sq. ft)	13833
Right Levee Fill XS area (sq. ft)	5.6
Right Levee Fill Volume (cu. Yd)	209
Total Levee Fill Surface Area (sq. ft)	26252
Total Levee Fill Volume (cu Yd)	344

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	50	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	6.4	
Structure Height (ft)	9.4	
Number of Structures	0.64	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	17.45	1.74
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,483	$ 148
Area per structure (sq. Yd)	6	1
Total Area (cu. Yd)	4	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,010	ft	$ 201	$ 202,969	140	cu. Yd	$ -	$ -	140	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	841	sq. Yd	$ -	$ -	841	sq. Yd	$ -	$ -	841	sq. Yd	$ 75.00	$ 63,075
Adjacent Levee Fill	Fill	344	cu. Yd	$ 7.00	$ 2,408	2,918	sq. Yd	$ 4.50	$ 13,130	2,918	sq. Yd	$ 11.67	$ 34,041
Wall Material Aesthetic Treatment Cost	Wall	140	cu. Yd	$ -	$ -	140	cu. Yd	$ -	$ -	140	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	841	sq. Yd	$ 63.00	$ 52,983	841	sq. Yd	$ -	$ -	841	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 1,483.25	$ 949	6	sq. Yd	$ -	$ -	6	sq. Yd	$ 37.50	$ 208
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 259,310			Total	$ 13,130			Total	$ 97,324
		Contingency Cost (25% of Construction Cost)			$ 64,827								
		Engineering Design Cost (5% of Construction Cost)			$ 12,965								
		Total Construction Cost			$ 337,102								
Wall Material Aesthetic Treatment Cost	Wall	140	cu. Yd	$ -	$ -	140	cu. Yd	$ -	$ -	140	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	841	sq. Yd	$ 63.00	$ 52,983	841	sq. Yd	$ -	$ -	841	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	344	cu. Yd	$ 7.00	$ 2,408	2,918	sq. Yd	$ 4.50	$ 13,130	2,918	sq. Yd	$ 11.67	$ 34,041
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 147.90	$ 95	6	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 21
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 55,486			Total	$ 13,130			Total	$ 34,062
		Contingency Cost (25% of Construction Cost)			$ 13,871								
		Engineering Design Cost (5% of Construction Cost)			$ 2,774								
		Total Construction Cost			$ 72,131								
Total Structure Aesthetic Trtmt Cost	$ 119,323												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	50	1.2	$100,000	$ 120,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	151	3.5		$ 350,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 797,557	Total Aesthetic Treatment Cost	$ 279,323	Total Right of Way Cost	$ 350,000

Walled-Levee Corridor

Structure ID	H190091A

HEC1 ID	90091A

Cutline ID	1

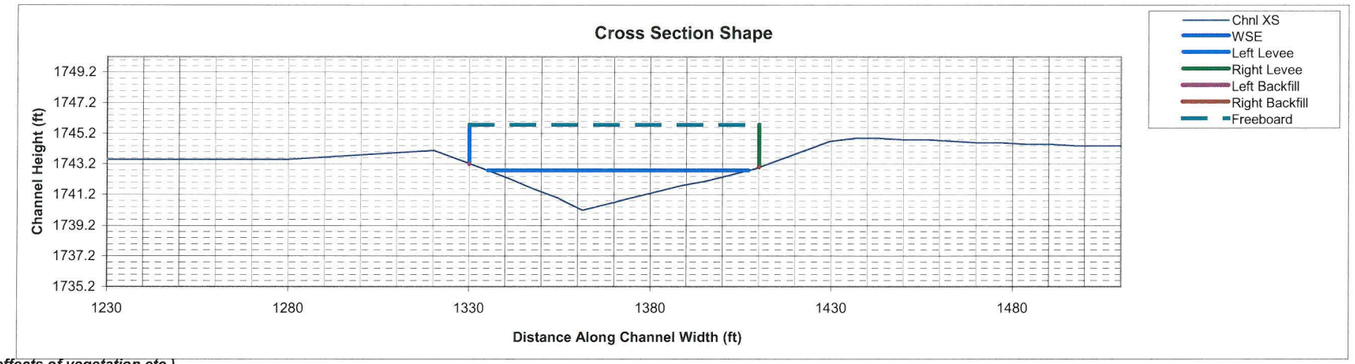
Longitudal Geometry

Length	1382.5	ft
Initial Channel Slope	0.0165	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0138	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1330	Right Levee Station (ft)	1410
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1330	Right Channel Limit Station (ft)	1410

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910A	RR900								TOTAL
HEC1 Peak-Flow	523	173								
Weighting Factor	0.80	0.20								
Flow into Channel	416	35								451

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
45	29.5	16.0	1740.2	1741.3	2.8	1.1	29.4	0.5	0.5	0.68
135	45.3	36.6	1740.2	1741.9	3.7	1.7	45.2	0.8	0.8	0.72
338	64.9	73.3	1740.2	1742.5	4.6	2.3	64.7	1.1	1.1	0.76
451	72.2	90.9	1740.2	1742.8	5.0	2.6	72.0	1.3	1.3	0.78

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
45	30.6	17.1	1740.2	1741.3	2.6	1.1	30.5	0.6	0.6	0.62
135	47.2	39.3	1740.2	1741.9	3.4	1.7	47.1	0.8	0.8	0.66
338	67.1	78.4	1740.2	1742.6	4.3	2.4	66.9	1.2	1.2	0.70
451	74.7	97.2	1740.2	1742.9	4.6	2.7	74.5	1.3	1.3	0.72

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H190091A_2								
135	0.64								0.64

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
45	Stable
135	Stable
338	Stable
451	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	135	cfs
Clear Water	No	
Total Incoming Sediment Load	0.643	cfs
Initial Chnl Sediment Capacity	0.832	cfs
Long-term Equilibrium Slope (ADWR)	0.0138	

Drop Structures

Design Slope	0.0138	ft/ft
Total Drop Needed	3.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.24	
Distance between Structures	1115	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
451	1.1	24.6	2.6	1.3	5.0	0.0165	-0.6	0.7	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1383
Channel Limit-Left Station (ft)	1330
Channel Limit-Right Station (ft)	1410
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1383
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	2.6
Right Levee Length (ft)	1383
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	2.8

Left Levee Surface Area (sq. Yd)	400
Left Levee Volume (cu. Yd)	67
Right Levee Surface Area (sq. Yd)	430
Right Levee Volume (cu. Yd)	72
Total Levee Surface Area (sq. Yd)	830
Total Levee Volume (cu. Yd)	139

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	80	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.7	
Structure Height (ft)	8.7	
Number of Structures	1.24	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	25.77	2.58
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,190	$ 219
Area per structure (sq. Yd)	9	1
Total Area (cu. Yd)	11	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,383	ft	$ 156	$ 215,797	139	cu. Yd	$ -	$ -	139	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	830	sq. Yd	$ -	$ -	830	sq. Yd	$ -	$ -	830	sq. Yd	$ 75.00	$ 62,250	
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Wall Material Aesthetic Treatment Cost	Wall	139	cu. Yd	$ -	$ -	139	cu. Yd	$ -	$ -	139	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	830	sq. Yd	$ 63.00	$ 52,290	830	sq. Yd	$ -	$ -	830	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,190.45	$ 2,716	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 270,803			Total	$ -			Total	$ 62,583	
		Contingency Cost (25% of Construction Cost)			$ 67,701									
		Engineering Design Cost (5% of Construction Cost)			$ 13,540									
		Total Construction Cost			$ 352,044									
Wall Material Aesthetic Treatment Cost	Wall	139	cu. Yd	$ -	$ -	139	cu. Yd	$ -	$ -	139	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	830	sq. Yd	$ 63.00	$ 52,290	830	sq. Yd	$ -	$ -	830	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 219.30	$ 272	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 52,562			Total	$ -			Total	$ 33	
		Contingency Cost (25% of Construction Cost)			$ 13,140									
		Engineering Design Cost (5% of Construction Cost)			$ 2,628									
		Total Construction Cost			$ 68,331									

Total Structure Aesthetic Trtmt Cost	$ 68,364

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.2	$100,000	$ 220,000
Maintenance Access	30	1	$100,000	$ 100,000
Channel	80	2.5	$100,000	$ 250,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 220,000

Total Cost	$ 984,627	Total Aesthetic Treatment Cost	$ 288,364	Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H191A91B

HEC1 ID	91A91B

Cutline ID	4

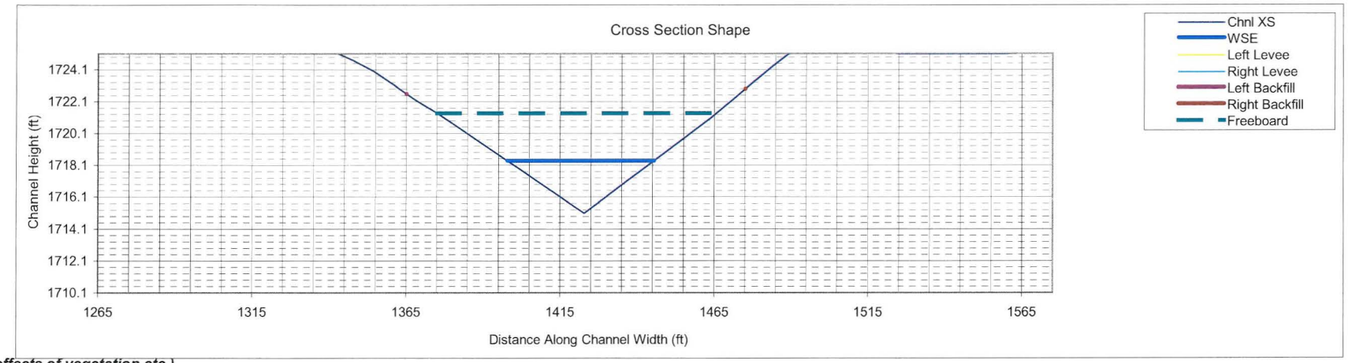
Longitudinal Geometry

Length	614.2	ft
Initial Channel Slope	0.0239	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0129	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1365	Right Levee Station (ft)	1475
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	0
Left Channel Limit Station (ft)	1375	Right Channel Limit Station (ft)	1466

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910B	C910A								TOTAL
HEC1 Peak-Flow	1507	523								
Weighting Factor	0.04	0.96								
Flow into Channel	53	505								558

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
56	20.3	14.0	1715.1	1716.5	4.0	1.4	20.1	0.7	0.7	0.84
167	30.6	31.9	1715.1	1717.2	5.3	2.1	30.3	1.0	1.1	0.90
419	43.1	63.3	1715.1	1718.1	6.6	3.0	42.7	1.5	1.5	0.96
558	48.0	78.5	1715.1	1718.4	7.1	3.3	47.6	1.6	1.7	0.97

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
56	22.8	17.6	1715.1	1716.7	3.2	1.6	22.6	0.8	0.8	0.63
167	34.3	40.1	1715.1	1717.5	4.2	2.4	34.0	1.2	1.2	0.68
419	48.4	79.8	1715.1	1718.4	5.2	3.3	47.9	1.6	1.7	0.72
558	54.0	99.0	1715.1	1718.8	5.6	3.7	53.4	1.8	1.9	0.73

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H190091A_1	T910A20							
167	0.83	0.11							0.94

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
56	Stable
167	Stable
419	Erosive
558	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	167	cfs
Clear Water	No	
Total Incoming Sediment Load	0.944	cfs
Initial Chnl Sediment Capacity	2.376	cfs
Long-term Equilibrium Slope (ADWR)	0.0129	

Drop Structures

Design Slope	0.0129	ft/ft
Total Drop Needed	6.8	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.25	
Distance between Structures	273	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
558	1.1	24.6	3.3	1.7	7.1	0.0239	-0.6	1.4	1.5	0.4	2.0	6.0

Cost Estimates

Channel Characteristics

Channel Length (ft)	614
Channel Limit-Left Station (ft)	1375
Channel Limit-Right Station (ft)	1466
Channel Width (ft)	91

Levee

Left Levee Length (ft)	614
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	614
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	0

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	0
Right Levee Volume (cu. Yd)	0
Total Levee Surface Area (sq. Yd)	0
Total Levee Volume (cu. Yd)	0

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	91	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.7	
Structure Height (ft)	10.7	
Number of Structures	2.25	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	36.06	3.61
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,065	$ 307
Area per structure (sq. Yd)	10	1
Total Area (cu. Yd)	23	0

Structure Cost

Structure Type	Construction					Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	614	ft	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ 75.00	$ -
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Drop Structures	Gabions	2	EA	$ 3,065.10	$ 6,896	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 379
Other					$ -				$ -				$ -
	Total without Contingency & Engineering Design Cost				$ 6,896			Total	$ -			Total	$ 379
	Contingency Cost (25% of Construction Cost)				$ 1,724								
	Engineering Design Cost (5% of Construction Cost)				$ 345								
	Total Construction Cost				$ 8,965								
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 306.85	$ 690	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38
Other					$ -				$ -				$ -
	Total without Contingency & Engineering Design Cost				$ 690			Total	$ -			Total	$ 38
	Contingency Cost (25% of Construction Cost)				$ 173								
	Engineering Design Cost (5% of Construction Cost)				$ 35								
	Total Construction Cost				$ 898								

Total Structure Aesthetic Trtmt Cost	$ 935

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Channel	91	1.3	$100,000	$ 130,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	92	1.3		$ 130,000

Total Land Related Aes. Trtmt Cost	$ -

Total Cost	$ 139,345	Total Aesthetic Treatment Cost	$ 935	Total Right of Way Cost	$ 130,000

Walled-Levee Corridor

Structure ID	H191A91B

HEC1 ID	91A91B

Cutline ID	3

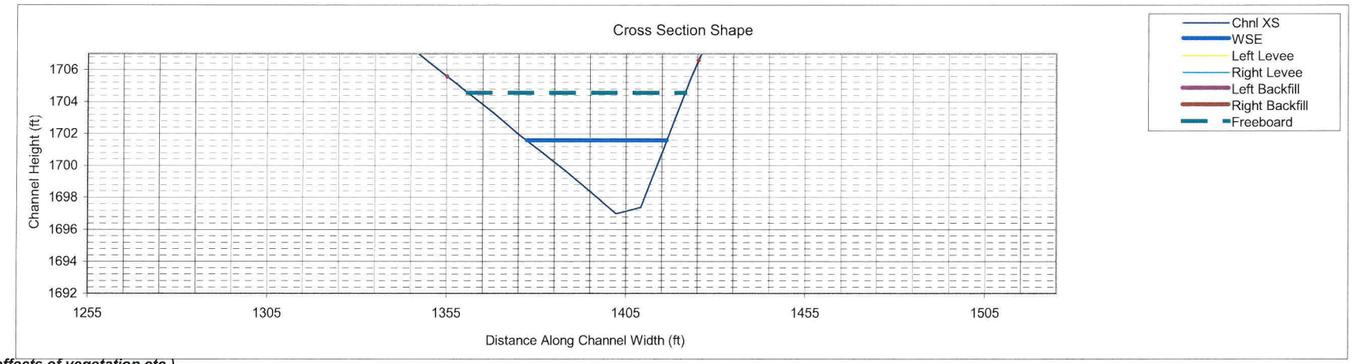
Longitudal Geometry

Length	1010.2	ft
Initial Channel Slope	0.0171	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0152	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1355	Right Levee Station (ft)	1425
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	0
Left Channel Limit Station (ft)	1361	Right Channel Limit Station (ft)	1421

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910B	C910A								TOTAL
HEC1 Peak-Flow	1507	523								
Weighting Factor	0.29	0.71								
Flow into Channel	440	370								810

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
81	18.2	18.5	1697.0	1698.7	4.4	1.7	17.7	1.0	1.0	0.75
243	26.1	41.3	1697.0	1699.7	5.9	2.7	25.2	1.6	1.6	0.81
608	36.6	81.9	1697.0	1701.1	7.4	4.1	35.2	2.2	2.3	0.86
810	40.7	101.6	1697.0	1701.6	8.0	4.6	39.1	2.5	2.6	0.87

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
81	18.5	19.3	1697.0	1698.7	4.2	1.7	18.0	1.0	1.1	0.71
243	26.7	43.2	1697.0	1699.8	5.6	2.8	25.8	1.6	1.7	0.77
608	37.4	85.6	1697.0	1701.2	7.1	4.2	36.0	2.3	2.4	0.81
810	41.6	106.2	1697.0	1701.7	7.6	4.7	40.0	2.6	2.7	0.82

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191A91B_4									
243	2.38									2.38

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
81	Stable
243	Stable
608	Erosive
810	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	243	cfs
Clear Water	No	
Total Incoming Sediment Load	2.376	cfs
Initial Chnl Sediment Capacity	2.808	cfs
Long-term Equilibrium Slope (ADWR)	0.0152	

Drop Structures

Design Slope	0.0152	ft/ft
Total Drop Needed	1.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.64	
Distance between Structures	1578	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
810	1.1	24.6	4.6	2.6	8.0	0.0171	-0.8	1.7	1.5	0.6	2.0	6.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1010
Channel Limit-Left Station (ft)	1361
Channel Limit-Right Station (ft)	1421
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1010
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	1010
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	0

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	0
Right Levee Volume (cu. Yd)	0
Total Levee Surface Area (sq. Yd)	0
Total Levee Volume (cu. Yd)	0

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	60	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	11.3	
Structure Height (ft)	14.3	
Number of Structures	0.64	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	31.72	3.17
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,696	$ 269
Area per structure (sq. Yd)	7	1
Total Area (cu. Yd)	4	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,010	ft	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ 75.00	$ -
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 2,696.20	$ 1,726	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 1,726			Total	$ -			Total	$ 250
		Contingency Cost (25% of Construction Cost)			$ 431								
		Engineering Design Cost (5% of Construction Cost)			$ 86								
		Total Construction Cost			$ 2,243								
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 269.45	$ 172	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 172			Total	$ -			Total	$ 25
		Contingency Cost (25% of Construction Cost)			$ 43								
		Engineering Design Cost (5% of Construction Cost)			$ 9								
		Total Construction Cost			$ 224								

Total Structure Aesthetic Trtmt Cost	$ 249

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Channel	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	61	1.4		$ 140,000

Total Land Related Aes. Trtmt Cost	$ -

Total Cost	$ 142,493	Total Aesthetic Treatment Cost	$ 249	Total Right of Way Cost	$ 140,000

Walled-Levee Corridor

Structure ID	H191A91B

HEC1 ID	91A91B

Cutline ID	2

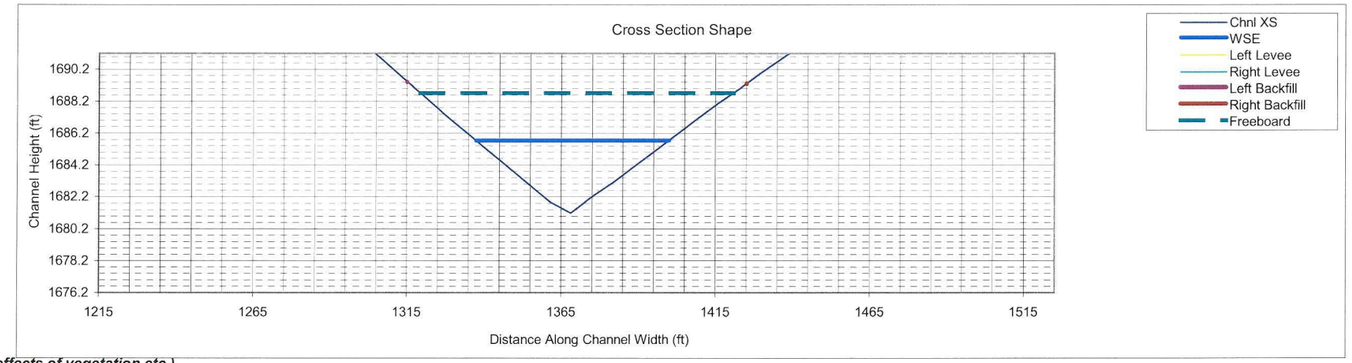
Longitudinal Geometry

Length	929.2	ft
Initial Channel Slope	0.0152	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0148	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1315	Right Levee Station (ft)	1425
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	0
Left Channel Limit Station (ft)	1319	Right Channel Limit Station (ft)	1421

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910B	C910A								TOTAL
HEC1 Peak-Flow	1507	523								
Weighting Factor	0.55	0.45								
Flow into Channel	826	236								1062

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
106	27.8	26.7	1681.2	1683.1	4.0	1.9	27.5	1.0	1.0	0.71
319	40.8	60.2	1681.2	1684.1	5.3	2.9	40.4	1.5	1.5	0.76
797	57.0	119.3	1681.2	1685.3	6.7	4.1	56.4	2.1	2.1	0.81
1062	63.3	147.8	1681.2	1685.8	7.2	4.6	62.6	2.3	2.4	0.82

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
106	27.9	27.0	1681.2	1683.1	3.9	1.9	27.7	1.0	1.0	0.70
319	41.0	60.8	1681.2	1684.1	5.2	2.9	40.6	1.5	1.5	0.75
797	57.3	120.5	1681.2	1685.3	6.6	4.1	56.7	2.1	2.1	0.80
1062	63.6	149.3	1681.2	1685.8	7.1	4.6	62.9	2.3	2.4	0.81

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H191A91B_3								
319	2.81								2.81

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
106	Stable
319	Stable
797	Erosive
1062	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	319	cfs
Clear Water	No	
Total Incoming Sediment Load	2.808	cfs
Initial Chnl Sediment Capacity	2.935	cfs
Long-term Equilibrium Slope (ADWR)	0.0148	

Drop Structures

Design Slope	0.0148	ft/ft
Total Drop Needed	0.4	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.12	
Distance between Structures	7743	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1062	1.1	24.6	4.6	2.4	7.2	0.0152	-0.8	1.4	1.5	0.6	2.0	6.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	929
Channel Limit-Left Station (ft)	1319
Channel Limit-Right Station (ft)	1421
Channel Width (ft)	102

Levee

Left Levee Length (ft)	929
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	929
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	0

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	0
Right Levee Volume (cu. Yd)	0
Total Levee Surface Area (sq. Yd)	0
Total Levee Volume (cu. Yd)	0

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	102	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	10.2	
Structure Height (ft)	13.2	
Number of Structures	0.12	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	49.80	4.98
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,233	$ 423
Area per structure (sq. Yd)	11	1
Total Area (cu. Yd)	1	0

Structure Cost

Structure Type	Structure Type	Construction: Quantity	Units	Unit Cost	Cost Subtotal	Landscape: Quantity	Units	Unit Cost	Landscape Cost	Maintenance: Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	929	ft	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ 75.00	$ -
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,233.00	$ 508	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 425
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 508			Total	$ -			Total	$ 425
		Contingency Cost (25% of Construction Cost)			$ 127								
		Engineering Design Cost (5% of Construction Cost)			$ 25								
		Total Construction Cost			$ 660								
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 423.30	$ 51	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 43
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 51			Total	$ -			Total	$ 43
		Contingency Cost (25% of Construction Cost)			$ 13								
		Engineering Design Cost (5% of Construction Cost)			$ 3								
		Total Construction Cost			$ 66								

Total Structure Aesthetic Trtmt Cost	$ 109

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Channel	102	2.2	$100,000	$ 220,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	103	2.2		$ 220,000

Total Land Related Aes. Trtmt Cost	$ -

Total Cost	$ 221,085	Total Aesthetic Treatment Cost	$ 109	Total Right of Way Cost	$ 220,000

Walled-Levee Corridor

Structure ID	H191A91B

HEC1 ID	91A91B

Cutline ID	1

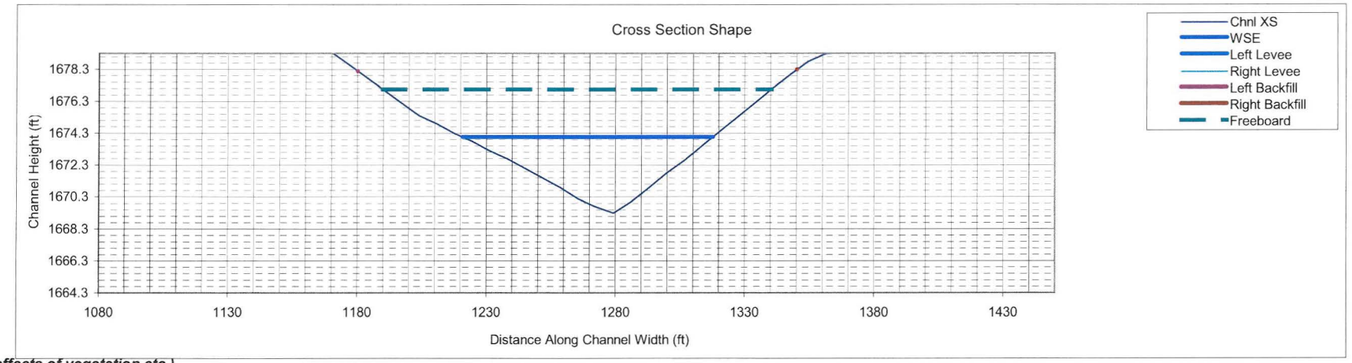
Longitudal Geometry

Length	1360.8	ft
Initial Channel Slope	0.0081	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0139	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1180	Right Levee Station (ft)	1350
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	0
Left Channel Limit Station (ft)	1190	Right Channel Limit Station (ft)	1340

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C910B	C910A								TOTAL
HEC1 Peak-Flow	1507	523								
Weighting Factor	0.77	0.23								
Flow into Channel	1155	122								1277

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
128	40.4	41.9	1669.3	1671.2	3.1	1.9	40.2	1.0	1.0	0.53
383	61.2	95.5	1669.3	1672.3	4.0	3.0	60.9	1.6	1.6	0.56
958	87.2	190.8	1669.3	1673.6	5.0	4.3	86.8	2.2	2.2	0.60
1277	97.5	237.0	1669.3	1674.1	5.4	4.8	97.0	2.4	2.4	0.61

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
128	36.6	34.2	1669.3	1671.0	3.7	1.7	36.4	0.9	0.9	0.68
383	55.0	77.9	1669.3	1672.0	4.9	2.7	54.8	1.4	1.4	0.73
958	79.1	156.0	1669.3	1673.1	6.1	3.8	78.7	2.0	2.0	0.77
1277	87.8	193.3	1669.3	1673.6	6.6	4.3	87.3	2.2	2.2	0.78

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191A91B_2									
383	2.94									2.94

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
128	Stable
383	Stable
958	Erosive
1277	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	383	cfs
Clear Water	No	
Total Incoming Sediment Load	2.935	cfs
Initial Chnl Sediment Capacity	1.315	cfs
Long-term Equilibrium Slope (ADWR)	0.0139	

Drop Structures

Design Slope	0.0139	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1277	1.1	24.6	4.8	2.4	5.4	0.0081	-1.0	0.8	1.5	0.6	2.0	5.8

Cost Estimates

Channel Characteristics

Channel Length (ft)	1361
Channel Limit-Left Station (ft)	1190
Channel Limit-Right Station (ft)	1340
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1361
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	1361
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	0

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	0
Right Levee Volume (cu. Yd)	0
Total Levee Surface Area (sq. Yd)	0
Total Levee Volume (cu. Yd)	0

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	150	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	9.4	
Structure Height (ft)	12.4	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	68.65	6.87
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,835	$ 584
Area per structure (sq. Yd)	17	2
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,361	ft	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ 75.00	$ -	
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,835.25	$ -	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ -			Total	$ -			Total	$ 625	
		Contingency Cost (25% of Construction Cost)			$ -									
		Engineering Design Cost (5% of Construction Cost)			$ -									
		Total Construction Cost			$ -									
Wall Material Aesthetic Treatment Cost	Wall	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	0	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	0	sq. Yd	$ 63.00	$ -	0	sq. Yd	$ -	$ -	0	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 583.95	$ -	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ -			Total	$ -			Total	$ 63	
		Contingency Cost (25% of Construction Cost)			$ -									
		Engineering Design Cost (5% of Construction Cost)			$ -									
		Total Construction Cost			$ -									

Total Structure Aesthetic Trtmt Cost	$ 63

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Channel	150	4.7	$100,000	$ 470,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	151	4.7		$ 470,000

Total Land Related Aes. Trtmt Cost	$ -

Total Cost	$ 470,625	Total Aesthetic Treatment Cost	$ 63	Total Right of Way Cost	$ 470,000

Walled-Levee Corridor

Structure ID	H191B915

HEC1 ID	91B915

Cutline ID	4

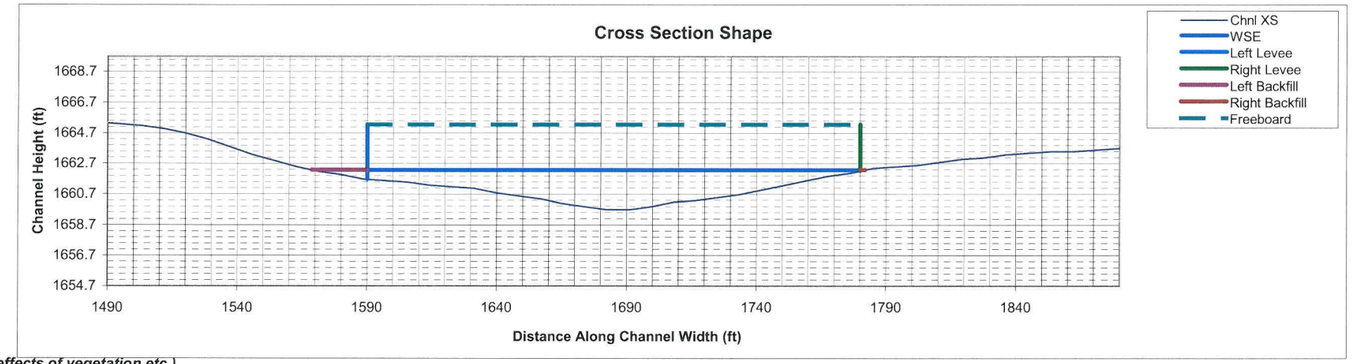
Longitundal Geometry

Length	673.1	ft
Initial Channel Slope	0.0162	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0101	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1590	Right Levee Station (ft)	1780
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1590	Right Channel Limit Station (ft)	1780

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C915	C910B								TOTAL
HEC1 Peak-Flow	2242	1507								
Weighting Factor	0.07	0.93								
Flow into Channel	147	1408								1555

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
156	93.6	53.6	1659.7	1660.8	2.9	1.1	93.6	0.6	0.6	0.68
467	140.4	121.7	1659.7	1661.4	3.8	1.7	140.4	0.9	0.9	0.73
1166	184.0	235.0	1659.7	1662.0	5.0	2.3	183.5	1.3	1.3	0.77
1555	190.7	283.4	1659.7	1662.3	5.5	2.6	190.0	1.5	1.5	0.79

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
156	100.0	63.4	1659.7	1660.9	2.5	1.2	100.0	0.6	0.6	0.54
467	152.2	144.9	1659.7	1661.5	3.2	1.8	152.1	1.0	1.0	0.58
1166	190.6	274.7	1659.7	1662.2	4.2	2.5	190.0	1.4	1.4	0.62
1555	191.2	326.9	1659.7	1662.5	4.8	2.8	190.0	1.7	1.7	0.64

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H191A91B_1	T910B10							
467	1.32	0.17							1.48

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
156	Stable
467	Stable
1166	Stable
1555	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	467	cfs
Clear Water	No	
Total Incoming Sediment Load	1.481	cfs
Initial Chnl Sediment Capacity	2.975	cfs
Long-term Equilibrium Slope (ADWR)	0.0101	

Drop Structures

Design Slope	0.0101	ft/ft
Total Drop Needed	4.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.37	
Distance between Structures	491	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1555	1.1	24.6	2.6	1.5	5.5	0.0162	-0.6	0.8	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	673
Channel Limit-Left Station (ft)	1590
Channel Limit-Right Station (ft)	1780
Channel Width (ft)	190

Levee

Left Levee Length (ft)	673
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.6
Right Levee Length (ft)	673
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.1

Left Levee Surface Area (sq. Yd)	269
Left Levee Volume (cu. Yd)	45
Right Levee Surface Area (sq. Yd)	232
Right Levee Volume (cu. Yd)	39
Total Levee Surface Area (sq. Yd)	501
Total Levee Volume (cu. Yd)	84

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	21.3
Left Levee Fill Surface Area (sq. ft)	14337
Left Levee Fill XS area (sq. ft)	6.5
Left Levee Fill Volume (cu. Yd)	162
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	1.8
Right Levee Fill Surface Area (sq. ft)	1212
Right Levee Fill XS area (sq. ft)	0.1
Right Levee Fill Volume (cu. Yd)	2
Total Levee Fill Surface Area (sq. ft)	15549
Total Levee Fill Volume (cu Yd)	164

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	190	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	6.6	
Structure Height (ft)	9.6	
Number of Structures	1.37	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	67.50	6.75
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,738	$ 574
Area per structure (sq. Yd)	21	2
Total Area (cu. Yd)	29	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	673	ft	$ 187	$ 125,525	84	cu. Yd	$ -	$ -	84	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	501	sq. Yd	$ -	$ -	501	sq. Yd	$ -	$ -	501	sq. Yd	$ 75.00	$ 37,575	
Adjacent Levee Fill	Fill	164	cu. Yd	$ 7.00	$ 1,148	1,727	sq. Yd	$ 4.50	$ 7,773	1,727	sq. Yd	$ 11.67	$ 20,153	
Wall Material Aesthetic Treatment Cost	Wall	84	cu. Yd	$ -	$ -	84	cu. Yd	$ -	$ -	84	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	501	sq. Yd	$ 63.00	$ 31,563	501	sq. Yd	$ -	$ -	501	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 5,737.50	$ 7,860	21	sq. Yd	$ -	$ -	21	sq. Yd	$ 37.50	$ 792	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 166,096			Total	$ 7,773			Total	$ 58,519	
	Contingency Cost (25% of Construction Cost)				$ 41,524									
	Engineering Design Cost (5% of Construction Cost)				$ 8,305									
	Total Construction Cost				$ 215,925									
Wall Material Aesthetic Treatment Cost	Wall	84	cu. Yd	$ -	$ -	84	cu. Yd	$ -	$ -	84	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	501	sq. Yd	$ 63.00	$ 31,563	501	sq. Yd	$ -	$ -	501	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	164	cu. Yd	$ 7.00	$ 1,148	1,727	sq. Yd	$ 4.50	$ 7,773	1,727	sq. Yd	$ 11.67	$ 20,153	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 573.75	$ 786	21	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 79	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 33,497			Total	$ 7,773			Total	$ 20,232	
	Contingency Cost (25% of Construction Cost)				$ 8,374									
	Engineering Design Cost (5% of Construction Cost)				$ 1,675									
	Total Construction Cost				$ 43,546									

Total Structure Aesthetic Trtmt Cost	$ 71,551

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.1	$100,000	$ 110,000
Maintenance Access	30	0.5	$100,000	$ 50,000
Channel	190	2.9	$100,000	$ 290,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	291	4.5		$ 450,000

Total Land Related Aes. Trtmt Cost	$ 110,000

Total Cost	$ 732,217	Total Aesthetic Treatment Cost	$ 181,551	Total Right of Way Cost	$ 450,000

Walled-Levee Corridor

Structure ID	H191B915

HEC1 ID	91B915

Cutline ID	3

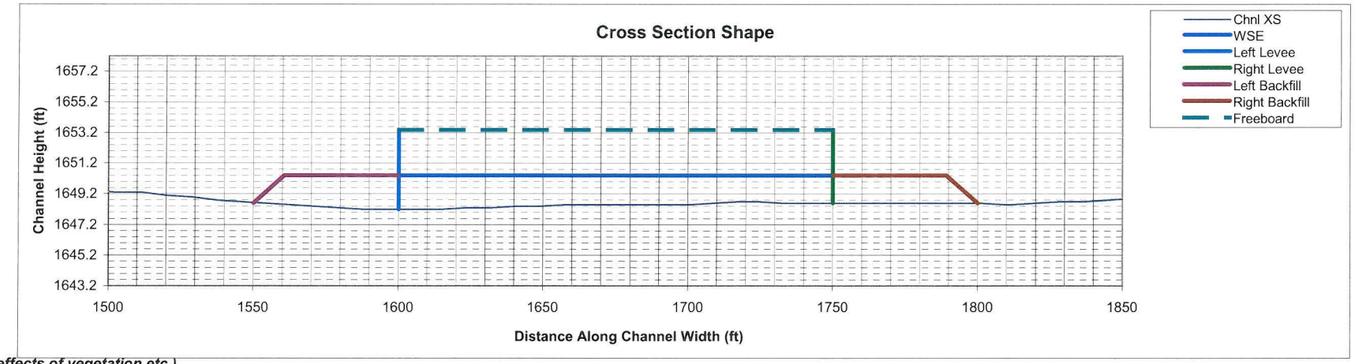
Longitudinal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0142	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0147	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1600	Right Levee Station (ft)	1750
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1600	Right Channel Limit Station (ft)	1750

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C915	C910B								TOTAL
HEC1 Peak-Flow	2242	1507								
Weighting Factor	0.33	0.67								
Flow into Channel	751	1002								1753

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
175	151.1	72.5	1648.2	1649.0	2.4	0.8	150.0	0.5	0.5	0.61
526	152.0	140.5	1648.2	1649.4	3.7	1.2	150.0	0.9	0.9	0.68
1315	153.4	244.3	1648.2	1650.1	5.4	1.9	150.0	1.6	1.6	0.74
1753	154.0	290.8	1648.2	1650.4	6.0	2.2	150.0	1.9	1.9	0.76

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
175	151.1	71.7	1648.2	1648.9	2.4	0.7	150.0	0.5	0.5	0.62
526	152.0	139.0	1648.2	1649.4	3.8	1.2	150.0	0.9	0.9	0.69
1315	153.4	241.8	1648.2	1650.1	5.4	1.9	150.0	1.6	1.6	0.75
1753	154.0	287.8	1648.2	1650.4	6.1	2.2	150.0	1.9	1.9	0.77

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H191B915_4								
526	2.98								2.98

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
175	Stable
526	Stable
1315	Erosive
1753	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	526	cfs
Clear Water	No	
Total Incoming Sediment Load	2.975	cfs
Initial Chnl Sediment Capacity	2.808	cfs
Long-term Equilibrium Slope (ADWR)	0.0147	

Drop Structures

Design Slope	0.0147	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1753	1.1	24.6	2.2	1.9	6.0	0.0142	-0.5	1.0	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1600
Channel Limit-Right Station (ft)	1750
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.2
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.8

Left Levee Surface Area (sq. Yd)	578
Left Levee Volume (cu. Yd)	96
Right Levee Surface Area (sq. Yd)	533
Right Levee Volume (cu. Yd)	89
Total Levee Surface Area (sq. Yd)	1111
Total Levee Volume (cu. Yd)	185

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50100
Left Levee Fill XS area (sq. ft)	92.6
Left Levee Fill Volume (cu. Yd)	3430
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50100
Right Levee Fill XS area (sq. ft)	80.7
Right Levee Fill Volume (cu. Yd)	2989
Total Levee Fill Surface Area (sq. ft)	100200
Total Levee Fill Volume (cu Yd)	6419

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	150	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.3	
Structure Height (ft)	11.3	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	62.58	6.26
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,319	$ 532
Area per structure (sq. Yd)	17	2
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,000	ft	$ 255	$ 254,701	185	cu. Yd	$ -	$ -	185	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,111	sq. Yd	$ -	$ -	1,111	sq. Yd	$ -	$ -	1,111	sq. Yd	$ 75.00	$ 83,325	
Adjacent Levee Fill	Fill	6,419	cu. Yd	$ 7.00	$ 44,933	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Wall Material Aesthetic Treatment Cost	Wall	185	cu. Yd	$ -	$ -	185	cu. Yd	$ -	$ -	185	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,111	sq. Yd	$ 63.00	$ 69,993	1,111	sq. Yd	$ -	$ -	1,111	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,319.30	$ -	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 369,627			Total	$ 50,000			Total	$ 213,580	
		Contingency Cost (25% of Construction Cost)			$ 92,407									
		Engineering Design Cost (5% of Construction Cost)			$ 18,481									
		Total Construction Cost			$ 480,516									
Wall Material Aesthetic Treatment Cost	Wall	185	cu. Yd	$ -	$ -	185	cu. Yd	$ -	$ -	185	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,111	sq. Yd	$ 63.00	$ 69,993	1,111	sq. Yd	$ -	$ -	1,111	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,419	cu. Yd	$ 7.00	$ 44,933	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 532.10	$ -	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 114,926			Total	$ 50,000			Total	$ 129,692	
		Contingency Cost (25% of Construction Cost)			$ 28,732									
		Engineering Design Cost (5% of Construction Cost)			$ 5,746									
		Total Construction Cost			$ 149,404									
Total Structure Aesthetic Trtmt Cost	$ 329,096													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	150	3.4	$100,000	$ 340,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	251	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,314,095	Total Aesthetic Treatment Cost	$ 489,096
		Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H191B915

HEC1 ID	91B915

Cutline ID	2

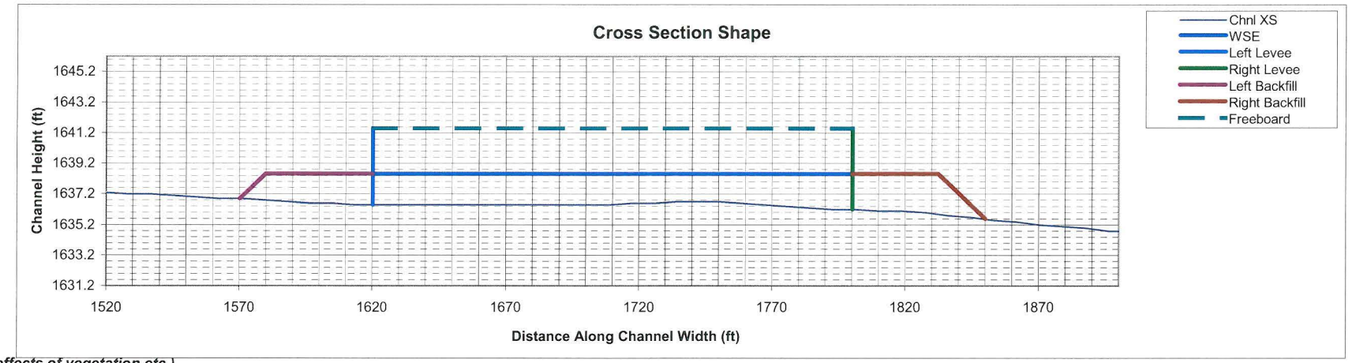
Longitudinal Geometry

Length	1067.0	ft
Initial Channel Slope	0.0111	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0132	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1620	Right Levee Station (ft)	1800
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1620	Right Channel Limit Station (ft)	1800

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

C915	C915	C910B								TOTAL
HEC1 Peak-Flow	2242	1507								
Weighting Factor	0.65	0.35								
Flow into Channel	1465	522								1987

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
199	181.3	90.5	1636.2	1637.0	2.2	0.8	180.0	0.5	0.5	0.55
596	182.3	175.3	1636.2	1637.5	3.4	1.3	180.0	1.0	1.0	0.61
1490	183.7	304.8	1636.2	1638.2	4.9	2.0	180.0	1.7	1.7	0.66
1987	184.4	362.7	1636.2	1638.5	5.5	2.3	180.0	2.0	2.0	0.68

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
199	181.3	85.9	1636.2	1637.0	2.3	0.8	180.0	0.5	0.5	0.59
596	182.2	166.4	1636.2	1637.4	3.6	1.2	180.0	0.9	0.9	0.66
1490	183.5	289.3	1636.2	1638.1	5.2	1.9	180.0	1.6	1.6	0.72
1987	184.1	344.2	1636.2	1638.4	5.8	2.2	180.0	1.9	1.9	0.74

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191B915_3									
596	2.81									2.81

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
199	Stable
596	Stable
1490	Stable
1987	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	596	cfs
Clear Water	No	
Total Incoming Sediment Load	2.808	cfs
Initial Chnl Sediment Capacity	2.196	cfs
Long-term Equilibrium Slope (ADWR)	0.0132	

Drop Structures

Design Slope	0.0132	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1987	1.1	24.6	2.3	2.0	5.5	0.0111	-0.5	0.8	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1067
Channel Limit-Left Station (ft)	1620
Channel Limit-Right Station (ft)	1800
Channel Width (ft)	180

Levee

Left Levee Length (ft)	1067
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	1067
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.3

Left Levee Surface Area (sq. Yd)	593
Left Levee Volume (cu. Yd)	99
Right Levee Surface Area (sq. Yd)	628
Right Levee Volume (cu. Yd)	105
Total Levee Surface Area (sq. Yd)	1221
Total Levee Volume (cu. Yd)	204

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	53454
Left Levee Fill XS area (sq. ft)	85.1
Left Levee Fill Volume (cu. Yd)	3363
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	53561
Right Levee Fill XS area (sq. ft)	102.1
Right Levee Fill Volume (cu. Yd)	4035
Total Levee Fill Surface Area (sq. ft)	107015
Total Levee Fill Volume (cu Yd)	7398

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	180	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.9	
Structure Height (ft)	10.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	72.97	7.30
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 6,202	$ 621
Area per structure (sq. Yd)	20	2
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,067	ft	$ 255	$ 271,766	204	cu. Yd	$ -	$ -	204	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,221	sq. Yd	$ -	$ -	1,221	sq. Yd	$ -	$ -	1,221	sq. Yd	$ 75.00	$ 91,575
Adjacent Levee Fill	Fill	7,398	cu. Yd	$ 7.00	$ 51,786	11,856	sq. Yd	$ 4.50	$ 53,350	11,856	sq. Yd	$ 11.67	$ 138,315
Wall Material Aesthetic Treatment Cost	Wall	204	cu. Yd	$ -	$ -	204	cu. Yd	$ -	$ -	204	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,221	sq. Yd	$ 63.00	$ 76,923	1,221	sq. Yd	$ -	$ -	1,221	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 6,202.45	$ -	20	sq. Yd	$ -	$ -	20	sq. Yd	$ 37.50	$ 750
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 400,475			Total	$ 53,350			Total	$ 230,640
		Contingency Cost (25% of Construction Cost)			$ 100,119								
		Engineering Design Cost (5% of Construction Cost)			$ 20,024								
		Total Construction Cost			$ 520,618								
Wall Material Aesthetic Treatment Cost	Wall	204	cu. Yd	$ -	$ -	204	cu. Yd	$ -	$ -	204	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,221	sq. Yd	$ 63.00	$ 76,923	1,221	sq. Yd	$ -	$ -	1,221	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,398	cu. Yd	$ 7.00	$ 51,786	11,856	sq. Yd	$ 4.50	$ 53,350	11,856	sq. Yd	$ 11.67	$ 138,315
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 620.50	$ -	20	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 75
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 128,709			Total	$ 53,350			Total	$ 138,390
		Contingency Cost (25% of Construction Cost)			$ 32,177								
		Engineering Design Cost (5% of Construction Cost)			$ 6,435								
		Total Construction Cost			$ 167,322								

Total Structure Aesthetic Trtmt Cost	$ 359,062

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.7	$100,000	$ 170,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	180	4.4	$100,000	$ 440,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	281	6.8		$ 680,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,484,608	Total Aesthetic Treatment Cost	$ 529,062	Total Right of Way Cost	$ 680,000

Walled-Levee Corridor

Structure ID	H191B915

HEC1 ID	91B915

Cutline ID	1

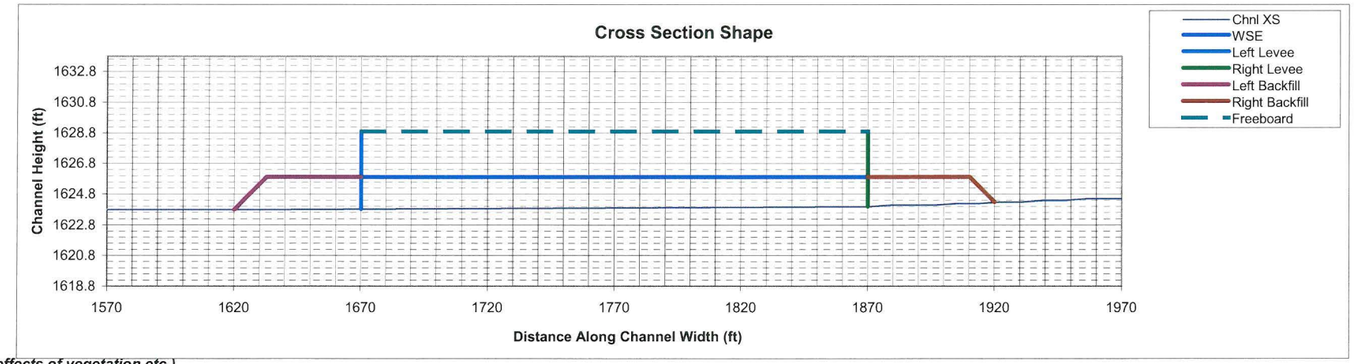
Longitudinal Geometry

Length	682.9	ft
Initial Channel Slope	0.0113	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0110	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1670	Right Levee Station (ft)	1870
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1670	Right Channel Limit Station (ft)	1870

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C915	C910B								TOTAL
HEC1 Peak-Flow	2242	1507								
Weighting Factor	0.95	0.05								
Flow into Channel	2132	74								2206

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
221	201.0	99.9	1623.8	1624.4	2.2	0.6	200.0	0.5	0.5	0.55
662	201.9	193.5	1623.8	1624.9	3.4	1.1	200.0	1.0	1.0	0.61
1655	203.4	336.2	1623.8	1625.6	4.9	1.8	200.0	1.7	1.7	0.67
2206	204.0	400.0	1623.8	1625.9	5.5	2.1	200.0	2.0	2.0	0.69

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
221	201.0	100.7	1623.8	1624.4	2.2	0.6	200.0	0.5	0.5	0.54
662	202.0	195.0	1623.8	1624.9	3.4	1.1	200.0	1.0	1.0	0.61
1655	203.4	338.9	1623.8	1625.6	4.9	1.8	200.0	1.7	1.7	0.66
2206	204.0	403.3	1623.8	1625.9	5.5	2.1	200.0	2.0	2.0	0.68

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191B915_2	T915								
662	2.20	0.24								2.43

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
221	Stable
662	Stable
1655	Stable
2206	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	662	cfs
Clear Water	No	
Total Incoming Sediment Load	2.431	cfs
Initial Chnl Sediment Capacity	2.512	cfs
Long-term Equilibrium Slope (ADWR)	0.0110	

Drop Structures

Design Slope	0.0110	ft/ft
Total Drop Needed	0.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.07	
Distance between Structures	9755	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
2206	1.1	24.6	2.1	2.0	5.5	0.0113	-0.5	0.8	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	683
Channel Limit-Left Station (ft)	1670
Channel Limit-Right Station (ft)	1870
Channel Width (ft)	200

Levee

Left Levee Length (ft)	683
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	683
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.9

Left Levee Surface Area (sq. Yd)	387
Left Levee Volume (cu. Yd)	65
Right Levee Surface Area (sq. Yd)	372
Right Levee Volume (cu. Yd)	62
Total Levee Surface Area (sq. Yd)	759
Total Levee Volume (cu. Yd)	127

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	34279
Left Levee Fill XS area (sq. ft)	91.6
Left Levee Fill Volume (cu. Yd)	2317
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	34211
Right Levee Fill XS area (sq. ft)	81.1
Right Levee Fill Volume (cu. Yd)	2052
Total Levee Fill Surface Area (sq. ft)	68490
Total Levee Fill Volume (cu Yd)	4369

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	200	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.8	
Structure Height (ft)	10.8	
Number of Structures	0.07	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	80.27	8.03
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 6,823	$ 683
Area per structure (sq. Yd)	22	2
Total Area (cu. Yd)	2	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	683	ft	$ 255	$ 173,961	127	cu. Yd	$ -	$ -	127	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	759	sq. Yd	$ -	$ -	759	sq. Yd	$ -	$ -	759	sq. Yd	$ 75.00	$ 56,925	
Adjacent Levee Fill	Fill	4,369	cu. Yd	$ 7.00	$ 30,583	7,589	sq. Yd	$ 4.50	$ 34,150	7,589	sq. Yd	$ 11.67	$ 88,537	
Wall Material Aesthetic Treatment Cost	Wall	127	cu. Yd	$ -	$ -	127	cu. Yd	$ -	$ -	127	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	759	sq. Yd	$ 63.00	$ 47,817	759	sq. Yd	$ -	$ -	759	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 6,822.95	$ 478	22	sq. Yd	$ -	$ -	22	sq. Yd	$ 37.50	$ 833	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 252,839			Total	$ 34,150			Total	$ 146,295	
		Contingency Cost (25% of Construction Cost)			$ 63,210									
		Engineering Design Cost (5% of Construction Cost)			$ 12,642									
		Total Construction Cost			$ 328,690									
Wall Material Aesthetic Treatment Cost	Wall	127	cu. Yd	$ -	$ -	127	cu. Yd	$ -	$ -	127	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	759	sq. Yd	$ 63.00	$ 47,817	759	sq. Yd	$ -	$ -	759	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	4,369	cu. Yd	$ 7.00	$ 30,583	7,589	sq. Yd	$ 4.50	$ 34,150	7,589	sq. Yd	$ 11.67	$ 88,537	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 682.55	$ 48	22	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 83	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 78,448			Total	$ 34,150			Total	$ 88,620	
		Contingency Cost (25% of Construction Cost)			$ 19,612									
		Engineering Design Cost (5% of Construction Cost)			$ 3,922									
		Total Construction Cost			$ 101,982									

Total Structure Aesthetic Trtmt Cost	$ 224,752

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.1	$100,000	$ 110,000
Maintenance Access	30	0.5	$100,000	$ 50,000
Channel	200	3.1	$100,000	$ 310,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	301	4.7		$ 470,000

Total Land Related Aes. Trtmt Cost	$ 110,000

Total Cost	$ 979,136	Total Aesthetic Treatment Cost	$ 334,752	Total Right of Way Cost	$ 470,000

Walled-Levee Corridor

Structure ID	H191592A

HEC1 ID	91592A

Cutline ID	3

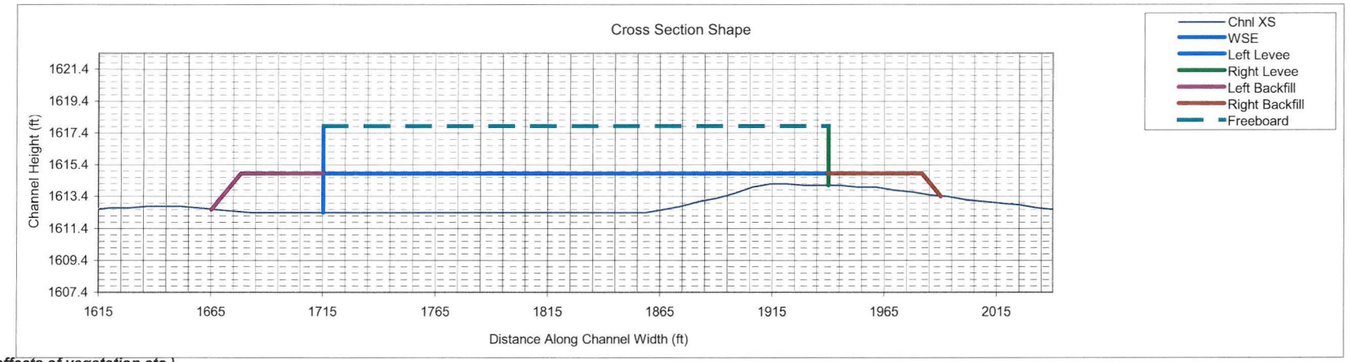
Longitudinal Geometry

Length	1383.5	ft
Initial Channel Slope	0.0107	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0095	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1715	Right Levee Station (ft)	1940
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1715	Right Channel Limit Station (ft)	1940

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920A	C915								TOTAL
HEC1 Peak-Flow	3327	2242								
Weighting Factor	0.24	0.76								
Flow into Channel	785	1713								2498

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
250	166.5	101.5	1612.4	1613.1	2.5	0.7	165.8	0.6	0.6	0.55
749	185.0	204.6	1612.4	1613.6	3.7	1.2	183.7	1.1	1.1	0.61
1874	227.6	385.2	1612.4	1614.5	4.9	2.1	225.0	1.7	1.7	0.66
2498	228.2	458.3	1612.4	1614.8	5.5	2.4	225.0	2.0	2.0	0.67

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
250	167.1	105.3	1612.4	1613.1	2.4	0.7	166.4	0.6	0.6	0.53
749	185.8	212.4	1612.4	1613.7	3.5	1.3	184.5	1.1	1.2	0.58
1874	227.7	399.2	1612.4	1614.6	4.7	2.2	225.0	1.8	1.8	0.62
2498	228.4	475.0	1612.4	1614.9	5.3	2.5	225.0	2.1	2.1	0.64

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191B915_1									
749	2.51									2.51

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
250	Stable
749	Stable
1874	Stable
2498	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	749	cfs
Clear Water	No	
Total Incoming Sediment Load	2.512	cfs
Initial Chnl Sediment Capacity	2.973	cfs
Long-term Equilibrium Slope (ADWR)	0.0095	

Drop Structures

Design Slope	0.0095	ft/ft
Total Drop Needed	1.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.55	
Distance between Structures	2515	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
2498	1.1	24.6	2.4	2.0	5.5	0.0107	-0.5	0.8	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1383
Channel Limit-Left Station (ft)	1715
Channel Limit-Right Station (ft)	1940
Channel Width (ft)	225

Levee

Left Levee Length (ft)	1383
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.4
Right Levee Length (ft)	1383
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.7

Left Levee Surface Area (sq. Yd)	830
Left Levee Volume (cu. Yd)	138
Right Levee Surface Area (sq. Yd)	569
Right Levee Volume (cu. Yd)	95
Total Levee Surface Area (sq. Yd)	1399
Total Levee Volume (cu. Yd)	233

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	69449
Left Levee Fill XS area (sq. ft)	105.5
Left Levee Fill Volume (cu. Yd)	5404
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	69311
Right Levee Fill XS area (sq. ft)	43.9
Right Levee Fill Volume (cu. Yd)	2249
Total Levee Fill Surface Area (sq. ft)	138760
Total Levee Fill Volume (cu Yd)	7653

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	225	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.8	
Structure Height (ft)	10.8	
Number of Structures	0.55	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	89.82	8.98
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 7,635	$ 763
Area per structure (sq. Yd)	25	3
Total Area (cu. Yd)	14	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,383	ft	$ 228	$ 315,090	233	cu. Yd	$ -	$ -	233	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,399	sq. Yd	$ -	$ -	1,399	sq. Yd	$ -	$ -	1,399	sq. Yd	$ 75.00	$ 104,925
Adjacent Levee Fill	Fill	7,653	cu. Yd	$ 7.00	$ 53,571	15,367	sq. Yd	$ 4.50	$ 69,150	15,367	sq. Yd	$ 11.67	$ 179,278
Wall Material Aesthetic Treatment Cost	Wall	233	cu. Yd	$ -	$ -	233	cu. Yd	$ -	$ -	233	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,399	sq. Yd	$ 63.00	$ 88,137	1,399	sq. Yd	$ -	$ -	1,399	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 7,634.70	$ 4,199	25	sq. Yd	$ -	$ -	25	sq. Yd	$ 37.50	$ 938
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 460,997			Total	$ 69,150			Total	$ 285,140
		Contingency Cost (25% of Construction Cost)			$ 115,249								
		Engineering Design Cost (5% of Construction Cost)			$ 23,050								
		Total Construction Cost			$ 599,296								
Wall Material Aesthetic Treatment Cost	Wall	233	cu. Yd	$ -	$ -	233	cu. Yd	$ -	$ -	233	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,399	sq. Yd	$ 63.00	$ 88,137	1,399	sq. Yd	$ -	$ -	1,399	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,653	cu. Yd	$ 7.00	$ 53,571	15,367	sq. Yd	$ 4.50	$ 69,150	15,367	sq. Yd	$ 11.67	$ 179,278
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 763.30	$ 420	25	sq. Yd	$ -	$ -	3	sq. Yd	$ 37.50	$ 94
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 142,128			Total	$ 69,150			Total	$ 179,372
		Contingency Cost (25% of Construction Cost)			$ 35,532								
		Engineering Design Cost (5% of Construction Cost)			$ 7,106								
		Total Construction Cost			$ 184,766								

Total Structure Aesthetic Trtmt Cost	$ 433,288

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.2	$100,000	$ 220,000
Maintenance Access	30	1	$100,000	$ 100,000
Channel	225	7.1	$100,000	$ 710,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	326	10.3		$ 1,030,000

Total Land Related Aes. Trtmt Cost	$ 220,000

Total Cost	$ 1,983,586	Total Aesthetic Treatment Cost	$ 653,288	Total Right of Way Cost	$ 1,030,000

Walled-Levee Corridor

Structure ID	H191592A

HEC1 ID	91592A

Cutline ID	2

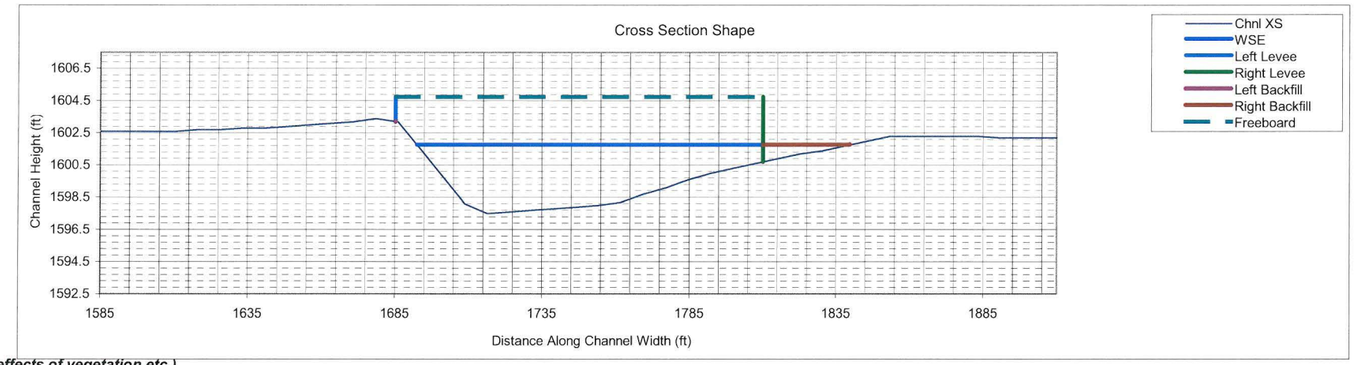
Longitudinal Geometry

Length	997.4	ft
Initial Channel Slope	0.0142	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0076	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1685	Right Levee Station (ft)	1810
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1685	Right Channel Limit Station (ft)	1810

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920A	C915								TOTAL
HEC1 Peak-Flow	3327	2242								
Weighting Factor	0.50	0.50								
Flow into Channel	1651	1129								2780

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
278	70.7	70.6	1597.5	1599.0	3.9	1.5	70.5	1.0	1.0	0.69
834	92.5	151.9	1597.5	1600.0	5.5	2.5	92.2	1.6	1.6	0.75
2085	116.5	288.6	1597.5	1601.3	7.2	3.8	115.5	2.5	2.5	0.81
2780	119.3	346.2	1597.5	1601.8	8.0	4.3	117.7	2.9	2.9	0.82

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
278	75.6	87.4	1597.5	1599.2	3.2	1.7	75.4	1.2	1.2	0.52
834	104.9	192.7	1597.5	1600.4	4.3	2.9	104.6	1.8	1.8	0.56
2085	119.5	351.8	1597.5	1601.8	5.9	4.3	117.9	2.9	3.0	0.60
2780	122.9	422.6	1597.5	1602.4	6.6	4.9	120.6	3.4	3.5	0.62

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H191592A_3								
834	2.97								2.97

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
278	Stable
834	Stable
2085	Erosive
2780	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	834	cfs
Clear Water	No	
Total Incoming Sediment Load	2.973	cfs
Initial Chnl Sediment Capacity	7.627	cfs
Long-term Equilibrium Slope (ADWR)	0.0076	

Drop Structures

Design Slope	0.0076	ft/ft
Total Drop Needed	6.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.19	
Distance between Structures	455	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
2780	1.1	24.6	4.3	2.9	8.0	0.0142	-0.7	1.7	1.5	0.6	2.0	6.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	997
Channel Limit-Left Station (ft)	1685
Channel Limit-Right Station (ft)	1810
Channel Width (ft)	125

Levee

Left Levee Length (ft)	997
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	1.5
Right Levee Length (ft)	997
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.1

Left Levee Surface Area (sq. Yd)	166
Left Levee Volume (cu. Yd)	28
Right Levee Surface Area (sq. Yd)	454
Right Levee Volume (cu. Yd)	76
Total Levee Surface Area (sq. Yd)	620
Total Levee Volume (cu. Yd)	104

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	29.6
Right Levee Fill Surface Area (sq. ft)	29523
Right Levee Fill XS area (sq. ft)	15.6
Right Levee Fill Volume (cu. Yd)	576
Total Levee Fill Surface Area (sq. ft)	29523
Total Levee Fill Volume (cu Yd)	576

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	125	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	11.5	
Structure Height (ft)	14.5	
Number of Structures	2.19	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	67.11	6.71
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,704	$ 570
Area per structure (sq. Yd)	14	1
Total Area (cu. Yd)	30	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	997	ft	$ 197	$ 196,759	104	cu. Yd	$ -	$ -	104	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	620	sq. Yd	$ -	$ -	620	sq. Yd	$ -	$ -	620	sq. Yd	$ 75.00	$ 46,500	
Adjacent Levee Fill	Fill	576	cu. Yd	$ 7.00	$ 4,032	3,279	sq. Yd	$ 4.50	$ 14,756	3,279	sq. Yd	$ 11.67	$ 38,255	
Wall Material Aesthetic Treatment Cost	Wall	104	cu. Yd	$ -	$ -	104	cu. Yd	$ -	$ -	104	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	620	sq. Yd	$ 63.00	$ 39,060	620	sq. Yd	$ -	$ -	620	sq. Yd	$ -	$ -	
Drop Structures	Gabions	2	EA	$ 5,704.35	$ 12,493	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 521	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 252,343			Total	$ 14,756			Total	$ 85,276	
		Contingency Cost (25% of Construction Cost)			$ 63,086									
		Engineering Design Cost (5% of Construction Cost)			$ 12,617									
		Total Construction Cost			$ 328,046									
Wall Material Aesthetic Treatment Cost	Wall	104	cu. Yd	$ -	$ -	104	cu. Yd	$ -	$ -	104	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	620	sq. Yd	$ 63.00	$ 39,060	620	sq. Yd	$ -	$ -	620	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	576	cu. Yd	$ 7.00	$ 4,032	3,279	sq. Yd	$ 4.50	$ 14,756	3,279	sq. Yd	$ 11.67	$ 38,255	
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 570.35	$ 1,249	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 52	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 44,341			Total	$ 14,756			Total	$ 38,307	
		Contingency Cost (25% of Construction Cost)			$ 11,085									
		Engineering Design Cost (5% of Construction Cost)			$ 2,217									
		Total Construction Cost			$ 57,643									
Total Structure Aesthetic Trtmt Cost	$ 110,706													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	125	2.9	$100,000	$ 290,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	226	5.2		$ 520,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 948,078	Total Aesthetic Treatment Cost	$ 270,706
		Total Right of Way Cost	$ 520,000

Walled-Levee Corridor

Structure ID	H191592A

HEC1 ID	91592A

Cutline ID	1

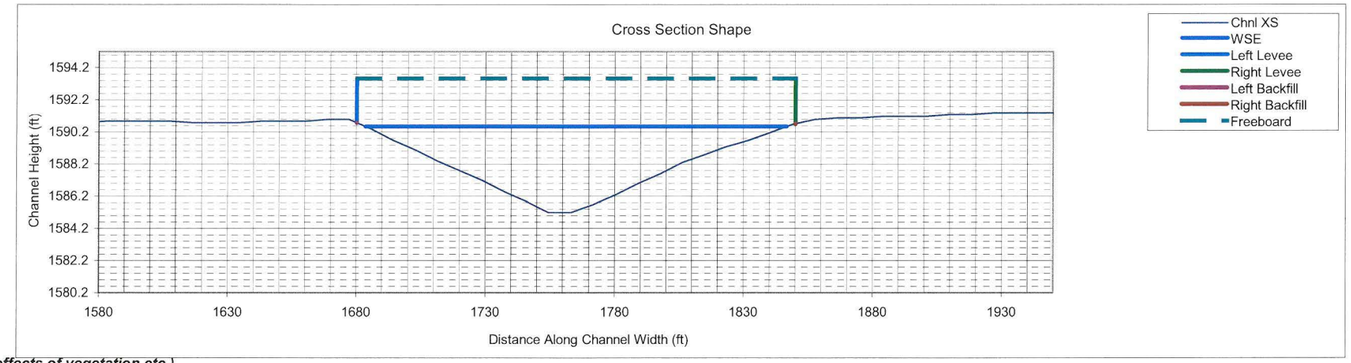
Longitudinal Geometry

Length	1506.5	ft
Initial Channel Slope	0.0110	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0129	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1680	Right Levee Station (ft)	1850
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1680	Right Channel Limit Station (ft)	1850

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920A	C915								TOTAL
HEC1 Peak-Flow	3327	2242								
Weighting Factor	0.75	0.25								
Flow into Channel	2504	555								3059

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
306	65.4	78.2	1585.2	1587.3	3.9	2.1	65.2	1.2	1.2	0.63
918	99.5	178.8	1585.2	1588.5	5.1	3.3	99.2	1.8	1.8	0.67
2294	146.6	361.8	1585.2	1590.0	6.3	4.8	146.3	2.5	2.5	0.71
3059	163.7	449.3	1585.2	1590.6	6.8	5.4	163.3	2.7	2.8	0.72

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
306	63.3	73.6	1585.2	1587.2	4.2	2.0	63.2	1.2	1.2	0.68
918	96.3	168.2	1585.2	1588.4	5.5	3.2	96.0	1.7	1.8	0.73
2294	142.3	340.8	1585.2	1589.8	6.7	4.6	142.0	2.4	2.4	0.77
3059	158.5	422.9	1585.2	1590.4	7.2	5.2	158.1	2.7	2.7	0.78

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191592A_2									
918	7.63									7.63

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
306	Stable
918	Stable
2294	Erosive
3059	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	918	cfs
Clear Water	No	
Total Incoming Sediment Load	7.627	cfs
Initial Chnl Sediment Capacity	5.972	cfs
Long-term Equilibrium Slope (ADWR)	0.0129	

Drop Structures

Design Slope	0.0129	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
3059	1.1	24.6	5.4	2.8	6.8	0.0110	-1.0	1.3	1.5	0.7	2.0	6.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1506
Channel Limit-Left Station (ft)	1680
Channel Limit-Right Station (ft)	1850
Channel Width (ft)	170

Levee

Left Levee Length (ft)	1506
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	2.8
Right Levee Length (ft)	1506
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	2.8

Left Levee Surface Area (sq. Yd)	469
Left Levee Volume (cu. Yd)	78
Right Levee Surface Area (sq. Yd)	469
Right Levee Volume (cu. Yd)	78
Total Levee Surface Area (sq. Yd)	938
Total Levee Volume (cu. Yd)	156

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	0
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	170	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	10.9	
Structure Height (ft)	13.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	87.51	8.75
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 7,438	$ 744
Area per structure (sq. Yd)	19	2
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,506	ft	$ 201	$ 302,645	156	cu. Yd	$ -	$ -	156	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	938	sq. Yd	$ -	$ -	938	sq. Yd	$ -	$ -	938	sq. Yd	$ 75.00	$ 70,350	
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Wall Material Aesthetic Treatment Cost	Wall	156	cu. Yd	$ -	$ -	156	cu. Yd	$ -	$ -	156	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	938	sq. Yd	$ 63.00	$ 59,094	938	sq. Yd	$ -	$ -	938	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 7,438.35	$ -	19	sq. Yd	$ -	$ -	19	sq. Yd	$ 37.50	$ 708	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 361,739			Total	$ -			Total	$ 71,058	
		Contingency Cost (25% of Construction Cost)			$ 90,435									
		Engineering Design Cost (5% of Construction Cost)			$ 18,087									
		Total Construction Cost			$ 470,261									
Wall Material Aesthetic Treatment Cost	Wall	156	cu. Yd	$ -	$ -	156	cu. Yd	$ -	$ -	156	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	938	sq. Yd	$ 63.00	$ 59,094	938	sq. Yd	$ -	$ -	938	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	0	sq. Yd	$ 4.50	$ -	0	sq. Yd	$ 11.67	$ -	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 743.75	$ -	19	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 71	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 59,094			Total	$ -			Total	$ 71	
		Contingency Cost (25% of Construction Cost)			$ 14,774									
		Engineering Design Cost (5% of Construction Cost)			$ 2,955									
		Total Construction Cost			$ 76,822									

Total Structure Aesthetic Trtmt Cost	$ 76,893

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.4	$100,000	$ 240,000
Maintenance Access	30	1	$100,000	$ 100,000
Channel	170	5.9	$100,000	$ 590,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	271	9.3		$ 930,000

Total Land Related Aes. Trtmt Cost	$ 240,000

Total Cost	$ 1,471,319	Total Aesthetic Treatment Cost	$ 316,893	Total Right of Way Cost	$ 930,000

Walled-Levee Corridor

Structure ID	H192A92B

HEC1 ID	92A92B

Cutline ID	4

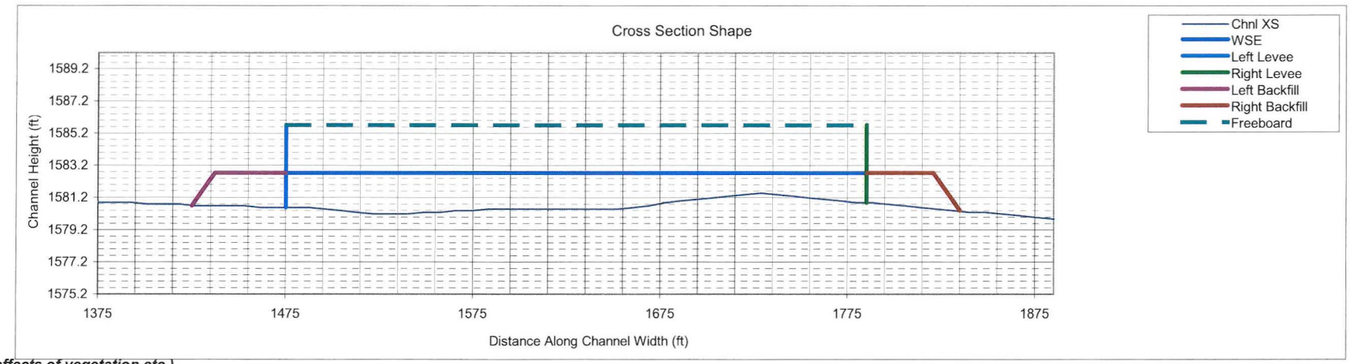
Longitudal Geometry

Length	522.2	ft
Initial Channel Slope	0.0100	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0157	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1475	Right Levee Station (ft)	1785
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1475	Right Channel Limit Station (ft)	1785

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920B	C920A								TOTAL
HEC1 Peak-Flow	3183	3327								
Weighting Factor	0.01	0.99								
Flow into Channel	31	3294								3325

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
333	248.5	144.3	1580.2	1581.1	2.3	0.9	247.7	0.6	0.6	0.53
998	311.9	305.5	1580.2	1581.7	3.3	1.5	310.0	1.0	1.0	0.58
2494	313.4	530.3	1580.2	1582.4	4.7	2.2	310.0	1.7	1.7	0.63
3325	314.0	630.8	1580.2	1582.7	5.3	2.5	310.0	2.0	2.0	0.65

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
333	232.9	122.8	1580.2	1581.0	2.7	0.8	232.3	0.5	0.5	0.66
998	311.7	266.7	1580.2	1581.6	3.7	1.4	310.0	0.9	0.9	0.71
2494	312.9	462.9	1580.2	1582.2	5.4	2.0	310.0	1.5	1.5	0.78
3325	313.5	550.6	1580.2	1582.5	6.0	2.3	310.0	1.8	1.8	0.80

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H191592A_1									
998	5.97									5.97

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
333	Stable
998	Stable
2494	Stable
3325	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	998	cfs
Clear Water	No	
Total Incoming Sediment Load	5.972	cfs
Initial Chnl Sediment Capacity	3.168	cfs
Long-term Equilibrium Slope (ADWR)	0.0157	

Drop Structures

Design Slope	0.0157	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
3325	1.1	24.6	2.5	2.0	5.3	0.0100	-0.6	0.8	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	522
Channel Limit-Left Station (ft)	1475
Channel Limit-Right Station (ft)	1785
Channel Width (ft)	310

Levee

Left Levee Length (ft)	522
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	522
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.8

Left Levee Surface Area (sq. Yd)	296
Left Levee Volume (cu. Yd)	49
Right Levee Surface Area (sq. Yd)	278
Right Levee Volume (cu. Yd)	46
Total Levee Surface Area (sq. Yd)	574
Total Levee Volume (cu. Yd)	95

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	26212
Left Levee Fill XS area (sq. ft)	91.7
Left Levee Fill Volume (cu. Yd)	1773
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	26212
Right Levee Fill XS area (sq. ft)	87.6
Right Levee Fill Volume (cu. Yd)	1694
Total Levee Fill Surface Area (sq. ft)	52424
Total Levee Fill Volume (cu Yd)	3467

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	310	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.9	
Structure Height (ft)	10.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	125.40	12.54
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 10,659	$ 1,066
Area per structure (sq. Yd)	34	3
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	522	ft	$ 255	$ 132,954	95	cu. Yd	$ -	$ -	95	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	574	sq. Yd	$ -	$ -	574	sq. Yd	$ -	$ -	574	sq. Yd	$ 75.00	$ 43,050	
Adjacent Levee Fill	Fill	3,467	cu. Yd	$ 7.00	$ 24,269	5,800	sq. Yd	$ 4.50	$ 26,100	5,800	sq. Yd	$ 11.67	$ 67,667	
Wall Material Aesthetic Treatment Cost	Wall	95	cu. Yd	$ -	$ -	95	cu. Yd	$ -	$ -	95	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	574	sq. Yd	$ 63.00	$ 36,162	574	sq. Yd	$ -	$ -	574	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 10,659.00	$ -	34	sq. Yd	$ -	$ -	34	sq. Yd	$ 37.50	$ 1,292	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 193,385			Total	$ 26,100			Total	$ 112,008	
	Contingency Cost (25% of Construction Cost)				$ 48,346									
	Engineering Design Cost (5% of Construction Cost)				$ 9,669									
	Total Construction Cost				$ 251,401									
Wall Material Aesthetic Treatment Cost	Wall	95	cu. Yd	$ -	$ -	95	cu. Yd	$ -	$ -	95	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	574	sq. Yd	$ 63.00	$ 36,162	574	sq. Yd	$ -	$ -	574	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,467	cu. Yd	$ 7.00	$ 24,269	5,800	sq. Yd	$ 4.50	$ 26,100	5,800	sq. Yd	$ 11.67	$ 67,667	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 1,065.90	$ -	34	sq. Yd	$ -	$ -	3	sq. Yd	$ 37.50	$ 129	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 60,431			Total	$ 26,100			Total	$ 67,796	
	Contingency Cost (25% of Construction Cost)				$ 15,108									
	Engineering Design Cost (5% of Construction Cost)				$ 3,022									
	Total Construction Cost				$ 78,560									

Total Structure Aesthetic Trtmt Cost	$ 172,456

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	0.8	$100,000	$ 80,000
Maintenance Access	30	0.4	$100,000	$ 40,000
Channel	310	3.7	$100,000	$ 370,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	411	4.9		$ 490,000

Total Land Related Aes. Trtmt Cost	$ 80,000

Total Cost	$ 879,509	Total Aesthetic Treatment Cost	$ 252,456	Total Right of Way Cost	$ 490,000

Walled-Levee Corridor

Structure ID	H192A92B

HEC1 ID	92A92B

Cutline ID	3

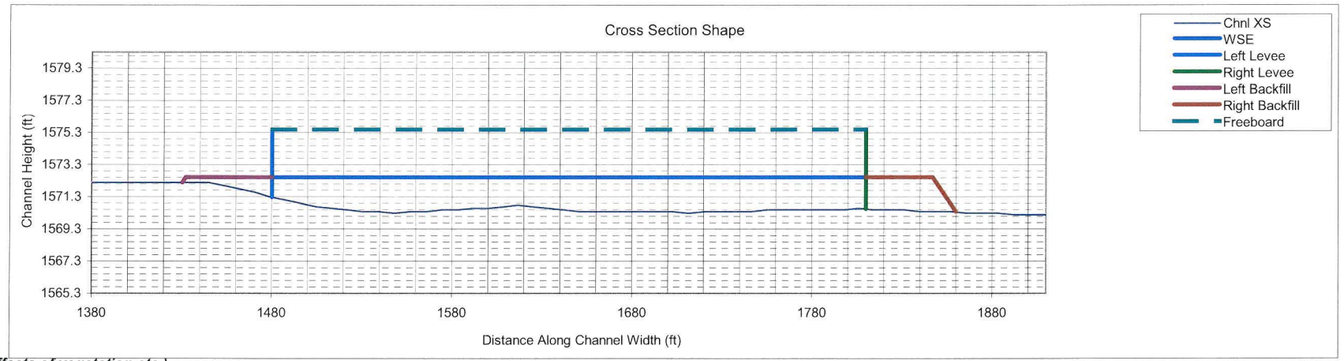
Longitudinal Geometry

Length	1012.4	ft
Initial Channel Slope	0.0091	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0103	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1480	Right Levee Station (ft)	1810
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1480	Right Channel Limit Station (ft)	1810

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920B	C920A								TOTAL
HEC1 Peak-Flow	3183	3327								
Weighting Factor	0.21	0.79								
Flow into Channel	657	2640								3297

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
330	318.8	163.2	1570.3	1571.0	2.0	0.7	318.4	0.5	0.5	0.50
989	331.2	320.2	1570.3	1571.5	3.1	1.2	330.0	1.0	1.0	0.55
2473	332.6	555.9	1570.3	1572.2	4.4	1.9	330.0	1.7	1.7	0.60
3297	333.2	661.1	1570.3	1572.5	5.0	2.2	330.0	2.0	2.0	0.62

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
330	318.0	157.0	1570.3	1571.0	2.1	0.7	317.5	0.5	0.5	0.53
989	331.1	308.5	1570.3	1571.5	3.2	1.2	330.0	0.9	0.9	0.58
2473	332.5	535.5	1570.3	1572.1	4.6	1.8	330.0	1.6	1.6	0.64
3297	333.1	636.9	1570.3	1572.5	5.2	2.2	330.0	1.9	1.9	0.66

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H192A92B_4									
989	3.17									3.17

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
330	Stable
989	Stable
2473	Stable
3297	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	989	cfs
Clear Water	No	
Total Incoming Sediment Load	3.168	cfs
Initial Chnl Sediment Capacity	2.664	cfs
Long-term Equilibrium Slope (ADWR)	0.0103	

Drop Structures

Design Slope	0.0103	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
3297	1.1	24.6	2.2	2.0	5.0	0.0091	-0.5	0.7	1.5	0.3	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	1012
Channel Limit-Left Station (ft)	1480
Channel Limit-Right Station (ft)	1810
Channel Width (ft)	330

Levee

Left Levee Length (ft)	1012
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.2
Right Levee Length (ft)	1012
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	472
Left Levee Volume (cu. Yd)	79
Right Levee Surface Area (sq. Yd)	562
Right Levee Volume (cu. Yd)	94
Total Levee Surface Area (sq. Yd)	1034
Total Levee Volume (cu. Yd)	173

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50620
Left Levee Fill XS area (sq. ft)	30.8
Left Levee Fill Volume (cu. Yd)	1154
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50822
Right Levee Fill XS area (sq. ft)	89.6
Right Levee Fill Volume (cu. Yd)	3358
Total Levee Fill Surface Area (sq. ft)	101442
Total Levee Fill Volume (cu Yd)	4512

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	330	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.4	
Structure Height (ft)	10.4	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	126.90	12.69
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 10,787	$ 1,079
Area per structure (sq. Yd)	37	4
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,012	ft	$ 228	$ 230,565	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,034	sq. Yd	$ -	$ -	1,034	sq. Yd	$ -	$ -	1,034	sq. Yd	$ 75.00	$ 77,550
Adjacent Levee Fill	Fill	4,512	cu. Yd	$ 7.00	$ 31,584	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Wall Material Aesthetic Treatment Cost	Wall	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,034	sq. Yd	$ 63.00	$ 65,142	1,034	sq. Yd	$ -	$ -	1,034	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 10,786.50	$ -	37	sq. Yd	$ -	$ -	37	sq. Yd	$ 37.50	$ 1,375
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 327,291			Total	$ 50,600			Total	$ 210,110
		Contingency Cost (25% of Construction Cost)			$ 81,823								
		Engineering Design Cost (5% of Construction Cost)			$ 16,365								
		Total Construction Cost			$ 425,478								
Wall Material Aesthetic Treatment Cost	Wall	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,034	sq. Yd	$ 63.00	$ 65,142	1,034	sq. Yd	$ -	$ -	1,034	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,512	cu. Yd	$ 7.00	$ 31,584	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 1,078.65	$ -	37	sq. Yd	$ -	$ -	4	sq. Yd	$ 37.50	$ 138
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 96,726			Total	$ 50,600			Total	$ 131,323
		Contingency Cost (25% of Construction Cost)			$ 24,182								
		Engineering Design Cost (5% of Construction Cost)			$ 4,836								
		Total Construction Cost			$ 125,744								

Total Structure Aesthetic Trtmt Cost	$ 307,666

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	330	7.7	$100,000	$ 770,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	431	10		$ 1,000,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,686,188	Total Aesthetic Treatment Cost	$ 467,666	Total Right of Way Cost	$ 1,000,000

Walled-Levee Corridor

Structure ID	H192A92B

HEC1 ID	92A92B

Cutline ID	2

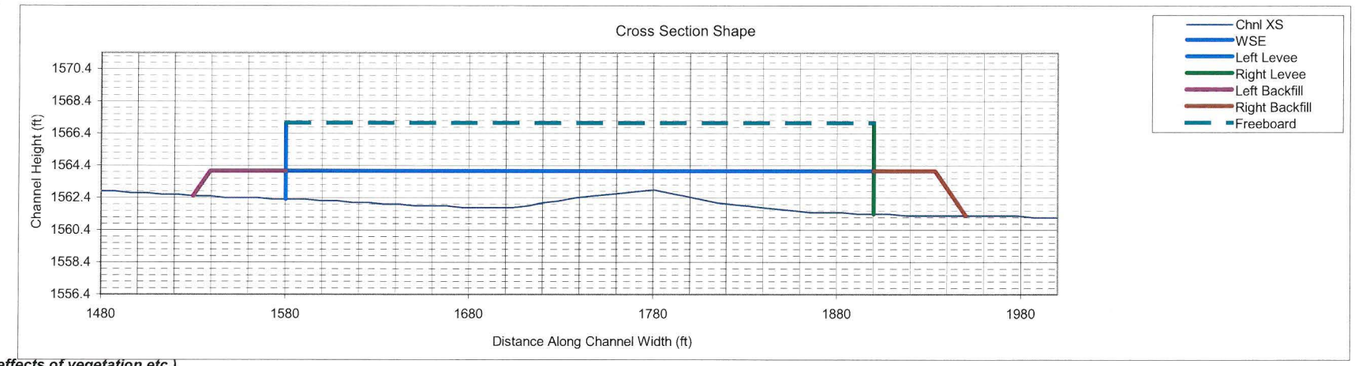
Longitudinal Geometry

Length	1005.7	ft
Initial Channel Slope	0.0095	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0094	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1580	Right Levee Station (ft)	1900
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1580	Right Channel Limit Station (ft)	1900

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920B	C920A								TOTAL
HEC1 Peak-Flow	3183	3327								
Weighting Factor	0.41	0.59								
Flow into Channel	1289	1979								3268

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
327	269.7	149.8	1561.4	1562.5	2.2	1.1	268.4	0.6	0.6	0.51
980	322.4	311.1	1561.4	1563.0	3.2	1.6	320.0	1.0	1.0	0.56
2451	323.8	540.0	1561.4	1563.8	4.5	2.4	320.0	1.7	1.7	0.62
3268	324.5	642.3	1561.4	1564.1	5.1	2.7	320.0	2.0	2.0	0.63

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
327	270.0	150.4	1561.4	1562.5	2.2	1.1	268.6	0.6	0.6	0.51
980	322.4	312.1	1561.4	1563.0	3.1	1.6	320.0	1.0	1.0	0.56
2451	323.8	541.8	1561.4	1563.8	4.5	2.4	320.0	1.7	1.7	0.61
3268	324.5	644.4	1561.4	1564.1	5.1	2.7	320.0	2.0	2.0	0.63

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H192A92B_3	T920B10								
980	2.66	0.09								2.75

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
327	Stable
980	Stable
2451	Stable
3268	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	980	cfs
Clear Water	No	
Total Incoming Sediment Load	2.749	cfs
Initial Chnl Sediment Capacity	2.816	cfs
Long-term Equilibrium Slope (ADWR)	0.0094	

Drop Structures

Design Slope	0.0094	ft/ft
Total Drop Needed	0.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.03	
Distance between Structures	33523	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
3268	1.1	24.6	2.7	2.0	5.1	0.0095	-0.6	0.7	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1006
Channel Limit-Left Station (ft)	1580
Channel Limit-Right Station (ft)	1900
Channel Width (ft)	320

Levee

Left Levee Length (ft)	1006
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	1006
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.7

Left Levee Surface Area (sq. Yd)	537
Left Levee Volume (cu. Yd)	89
Right Levee Surface Area (sq. Yd)	637
Right Levee Volume (cu. Yd)	106
Total Levee Surface Area (sq. Yd)	1174
Total Levee Volume (cu. Yd)	195

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50386
Left Levee Fill XS area (sq. ft)	75.9
Left Levee Fill Volume (cu. Yd)	2828
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50486
Right Levee Fill XS area (sq. ft)	114.2
Right Levee Fill Volume (cu. Yd)	4255
Total Levee Fill Surface Area (sq. ft)	100872
Total Levee Fill Volume (cu Yd)	7083

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	320	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.4	
Structure Height (ft)	10.4	
Number of Structures	0.03	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	123.46	12.35
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 10,494	$ 1,050
Area per structure (sq. Yd)	36	4
Total Area (cu. Yd)	1	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,006	ft	$ 282	$ 283,774	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,174	sq. Yd	$ -	$ -	1,174	sq. Yd	$ -	$ -	1,174	sq. Yd	$ 75.00	$ 88,050	
Adjacent Levee Fill	Fill	7,083	cu. Yd	$ 7.00	$ 49,581	11,178	sq. Yd	$ 4.50	$ 50,300	11,178	sq. Yd	$ 11.67	$ 130,407	
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,174	sq. Yd	$ 63.00	$ 73,962	1,174	sq. Yd	$ -	$ -	1,174	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 10,494.10	$ 315	36	sq. Yd	$ -	$ -	36	sq. Yd	$ 37.50	$ 1,333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 407,632			Total	$ 50,300			Total	$ 219,791	
		Contingency Cost (25% of Construction Cost)			$ 101,908									
		Engineering Design Cost (5% of Construction Cost)			$ 20,382									
		Total Construction Cost			$ 529,922									
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,174	sq. Yd	$ 63.00	$ 73,962	1,174	sq. Yd	$ -	$ -	1,174	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,083	cu. Yd	$ 7.00	$ 49,581	11,178	sq. Yd	$ 4.50	$ 50,300	11,178	sq. Yd	$ 11.67	$ 130,407	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 1,049.75	$ 31	36	sq. Yd	$ -	$ -	4	sq. Yd	$ 37.50	$ 133	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 123,574			Total	$ 50,300			Total	$ 130,541	
		Contingency Cost (25% of Construction Cost)			$ 30,894									
		Engineering Design Cost (5% of Construction Cost)			$ 6,179									
		Total Construction Cost			$ 160,647									

Total Structure Aesthetic Trtmt Cost	$ 341,488

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	320	7.4	$100,000	$ 740,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	421	9.7		$ 970,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,770,012	Total Aesthetic Treatment Cost	$ 501,488	Total Right of Way Cost	$ 970,000

Walled-Levee Corridor

Structure ID	H192A92B

HEC1 ID	92A92B

Cutline ID	1

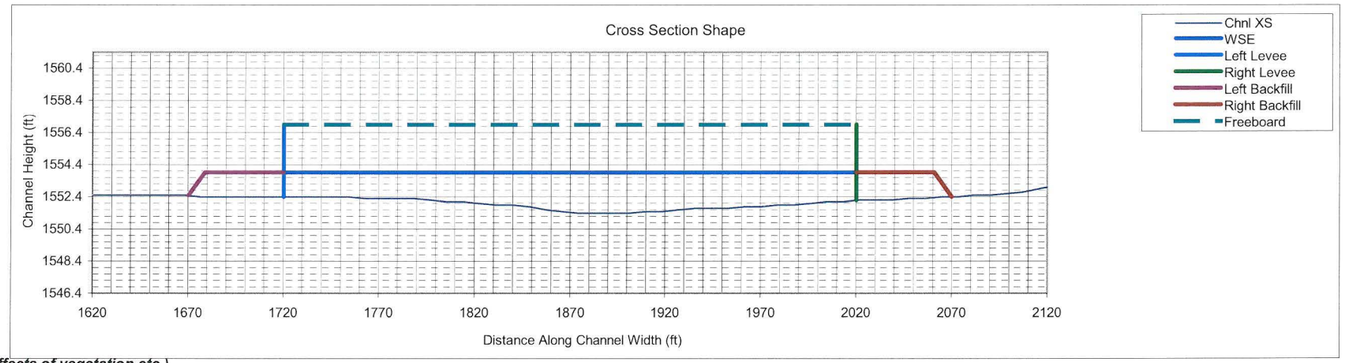
Longitudinal Geometry

Length	2520.3	ft
Initial Channel Slope	0.0107	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0093	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1720	Right Levee Station (ft)	2020
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1720	Right Channel Limit Station (ft)	2020

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C920B	C920A								TOTAL
HEC1 Peak-Flow	3183	3327								
Weighting Factor	0.60	0.40								
Flow into Channel	1916	1324								3240

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
324	300.3	150.2	1551.4	1552.4	2.2	1.0	300.0	0.5	0.5	0.54
972	301.2	290.6	1551.4	1552.9	3.3	1.5	300.0	1.0	1.0	0.60
2430	302.6	504.6	1551.4	1553.6	4.8	2.2	300.0	1.7	1.7	0.65
3240	303.3	600.1	1551.4	1553.9	5.4	2.5	300.0	2.0	2.0	0.67

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
324	300.3	156.6	1551.4	1552.4	2.1	1.0	300.0	0.5	0.5	0.50
972	301.3	303.2	1551.4	1552.9	3.2	1.5	300.0	1.0	1.0	0.56
2430	302.8	526.4	1551.4	1553.7	4.6	2.3	300.0	1.7	1.8	0.61
3240	303.4	626.1	1551.4	1554.0	5.2	2.6	300.0	2.1	2.1	0.63

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H192A92B_2									
972	2.82									2.82

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
324	Stable
972	Stable
2430	Stable
3240	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	972	cfs
Clear Water	No	
Total Incoming Sediment Load	2.816	cfs
Initial Chnl Sediment Capacity	3.417	cfs
Long-term Equilibrium Slope (ADWR)	0.0093	

Drop Structures

Design Slope	0.0093	ft/ft
Total Drop Needed	3.5	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.18	
Distance between Structures	2136	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
3240	1.1	24.6	2.5	2.0	5.4	0.0107	-0.6	0.8	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	2520
Channel Limit-Left Station (ft)	1720
Channel Limit-Right Station (ft)	2020
Channel Width (ft)	300

Levee

Left Levee Length (ft)	2520
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.5
Right Levee Length (ft)	2520
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	1260
Left Levee Volume (cu. Yd)	210
Right Levee Surface Area (sq. Yd)	1316
Right Levee Volume (cu. Yd)	219
Total Levee Surface Area (sq. Yd)	2576
Total Levee Volume (cu. Yd)	429

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	126265
Left Levee Fill XS area (sq. ft)	69.4
Left Levee Fill Volume (cu. Yd)	6477
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	126265
Right Levee Fill XS area (sq. ft)	75.2
Right Levee Fill Volume (cu. Yd)	7019
Total Levee Fill Surface Area (sq. ft)	252530
Total Levee Fill Volume (cu Yd)	13496

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	300	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.6	
Structure Height (ft)	10.6	
Number of Structures	1.18	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	118.32	11.83
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 10,057	$ 1,006
Area per structure (sq. Yd)	33	3
Total Area (cu. Yd)	39	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	2,520	ft	$ 228	$ 574,133	429	cu. Yd	$ -	$ -	429	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	2,576	sq. Yd	$ -	$ -	2,576	sq. Yd	$ -	$ -	2,576	sq. Yd	$ 75.00	$ 193,200	
Adjacent Levee Fill	Fill	13,496	cu. Yd	$ 7.00	$ 94,472	28,000	sq. Yd	$ 4.50	$ 126,000	28,000	sq. Yd	$ 11.67	$ 326,667	
Wall Material Aesthetic Treatment Cost	Wall	429	cu. Yd	$ -	$ -	429	cu. Yd	$ -	$ -	429	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	2,576	sq. Yd	$ 63.00	$ 162,288	2,576	sq. Yd	$ -	$ -	2,576	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 10,057.20	$ 11,867	33	sq. Yd	$ -	$ -	33	sq. Yd	$ 37.50	$ 1,250	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 842,761			Total	$ 126,000			Total	$ 521,117	
		Contingency Cost (25% of Construction Cost)			$ 210,690									
		Engineering Design Cost (5% of Construction Cost)			$ 42,138									
		Total Construction Cost			$ 1,095,589									
Wall Material Aesthetic Treatment Cost	Wall	429	cu. Yd	$ -	$ -	429	cu. Yd	$ -	$ -	429	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	2,576	sq. Yd	$ 63.00	$ 162,288	2,576	sq. Yd	$ -	$ -	2,576	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	13,496	cu. Yd	$ 7.00	$ 94,472	28,000	sq. Yd	$ 4.50	$ 126,000	28,000	sq. Yd	$ 11.67	$ 326,667	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 1,005.55	$ 1,187	33	sq. Yd	$ -	$ -	3	sq. Yd	$ 37.50	$ 125	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 257,947			Total	$ 126,000			Total	$ 326,792	
		Contingency Cost (25% of Construction Cost)			$ 64,487									
		Engineering Design Cost (5% of Construction Cost)			$ 12,897									
		Total Construction Cost			$ 335,331									
Total Structure Aesthetic Trtmt Cost	$ 788,122													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	4	$100,000	$ 400,000
Maintenance Access	30	1.7	$100,000	$ 170,000
Channel	300	17.4	$100,000	$ 1,740,000
Levee	1	0.1	$100,000	$ 10,000
Other	0	0	$100,000	$ -
Total	401	23.2		$ 2,320,000

Total Land Related Aes. Trtmt Cost	$ 400,000

Total Cost	$ 4,062,705

Total Aesthetic Treatment Cost	$ 1,188,122

Total Right of Way Cost	$ 2,320,000

Online Basin

Structure ID	RR110

HEC1 ID	RR110

Design Sediment Yield (MUSLE) Ys = Rw * K * LS * C * P

Rw, Storm Energy Runoff Factor; Rw = a(V*q)^b

Drainage Area =	0.43 sq. mi.
Area Contributing Sediment =	0.43 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	4	66	95	0.56	2099
Q-5	0.25	10	166	95	0.56	5858
Q-10	0.35	13	232	95	0.56	8540
Q-25	0.55	21	364	95	0.56	14167
Q-50	0.75	29	497	95	0.56	20052
Q-100	1	38	662	95	0.56	27675

K, Soil Erodibility Factor: Table 14, Camp, 1986

Soil Map Unit	K	% of Basin
48	0.08	0.0827
100	0.02	0.5626
110	0.20	0.2591
49	0.08	0.0956
Weighted K Factor:	0.08	

C, Cover and Management Factor; Figures 5-7, SCS Ag. Handbook #537

Cover Type	% of Basin	Canopy Factor	Mulch Factor	Root Factor	Composite C Factor	Weighted C Factor
	100	0.90	0.90	0.40	0.32	0.32
			Composite Weighted C Factor=			0.324

LS, Topographic Factor; LS = ((L/72.6)^n)*(0.065+0.0454*S+0.0065*S^2)

Slope Lengths:	200	ft	(Basin Average)
Slope Angles:	32.5	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	13.95		

P, Erosion Control Factor

No Practice, Natural or Regulated	
Weighted P for Contributing Watershed	1

Weighted Average Annual Sediment Yield:

Recurrence Interval	Rw	K	LS	C	P	Ys (tons)	Unit Ys (AF/sq.mi)
Q-2	2099	0.08	13.95	0.32	1.00	732	0.71
Q-5	5858	0.08	13.95	0.32	1.00	2043	1.98
Q-10	8540	0.08	13.95	0.32	1.00	2979	2.89
Q-25	14167	0.08	13.95	0.32	1.00	4941	4.80
Q-50	20052	0.08	13.95	0.32	1.00	6994	6.79
Q-100	27675	0.08	13.95	0.32	1.00	9653	9.37
Weighted Average Annual Sediment Yield:						1387	1.35

Total Sediment Yield Volume (ac. ft)	5.8

Sediment Depth in Basin	1 ft

Geometry

Topography slope (ft/ft)	0.033
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	7.5
Freeboard (ft)	1
Top Perimeter (ft)	3234.1
Top Area (acres)	15.5
Bottom elevation (ft)	1835.6
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	36.9
Total Available Volume (ac. ft) (incl. Freeboard)	50.4
Total Excavation Volume (ac. ft)	251.1

Basin Outlet

Diameter	5.00	ft
Invert Elevation	0.00	ft
Number of pipes	1	

Stage-Storage-Discharge

Elevation	0	1	2	3	4	5	6	7	8	9
Volume	0.0	5.7	11.7	18.1	24.7	31.6	38.9	46.5	54.4	62.7
Outflow	0.0	16.3	32.7	55.4	82.6	104.1	127.5	156.5	180.6	210.6

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Total Flow Volume entering Basin (ac. ft)	38.0	33	38.0
Peak Inflow (cfs)	662	532	662.0
Peak Outflow (cfs)	96	79	96.0
Stage at Peak Outflow (ft)	4.6	3.9	4.6
Volume at Peak Outflow (ac. ft)	29.0	23.76	29.0

Volume Check

Total Volume needed	34.7	ac. ft
Total Volume Provided	36.9	ac. ft

Volume OK?	Yes

Stage Check

Depth Needed	6.6	ft
Depth Provided	7.5	ft

Depth OK?	Yes

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	405108	0
Excavated Area (sq. Yd)	75020.0	2695.1
Adjacent Buffer Area (sq. Yd)	17967.2	

Inlet	Terraced	Riprap-lined
Average Inlet Height (ft)		42
Average Inlet Length (ft)		250
Total Width of all inlets (ft)		350
Material Thickness (ft)	0.5	3.0
Total Inlet Area (sq. Yd)	0	9858.5
Total Material Volume (cu. Yd)	0	9858.5
Unit Cost	$ 155.00	$ 75.00
Total Cost	$ -	$ 739,388

Outlet		
Outlet Type	Pipe	
(None, Riprap Weir, Concrete Weir, Pipe)		
Pipe Length	265	ft
Unit Cost	$ 183.00	per ft
Cost per outlet	$ 48,495	
Other Cost	$ -	
Total Cost	$ 48,495	
Outlet Area	133	sq. Yd

Structure Cost

Structure Type	Structure Cost												
		Excavation/Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Basin		405,108	cu. Yd	$ 4.00	$ 1,620,432	92,987	sq. Yd	$ 4.50	$ 418,442	92,987	sq. Yd	$ 8.33	$ 774,893
Inlet					$ 739,388				$ -				$ 328,617
Outlet	Pipe	1	EA	$ 48,495	$ 48,495	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 2,408,315			Total	$ 418,442			Total	$ 1,105,727
		Contingency Cost (25% of Construction Cost)			$ 602,079								
		Engineering Design Cost (5% of Construction Cost)			$ 120,416								
		Total Construction Cost			$ 3,130,809								

Structure Aesthetic Treatment Cost

Basin - Aesthetic Treatment		405,108	cu. Yd	$ -	$ -	92,987	sq. Yd	$ 4.50	$ 418,442	15,272	sq. Yd	$ 8.33	$ 127,268
Inlet - Aesthetic Treatment (20%Inlet)					$ 147,878				$ -				$ 65,723
Outlet -Aesthetic Treatment (5% Outlet)					$ 2,425	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 150,302			Total	$ 418,442			Total	$ 193,102
		Contingency Cost (25% of Construction Cost)			$ 37,576								
		Engineering Design Cost (5% of Construction Cost)			$ 7,515								
		Total Construction Cost			$ 195,393								
Total Structure Aesthetic Trtmt Cost	$ 806,937												

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	3.7	$100,000	$ 370,000
Basin	15.5	$100,000	$ 1,550,000
Other		$100,000	$ -
Total	19.2	$100,000	$ 1,920,000

Total Land Related Aes. Trtmt Cost	$ 425,684

Total Cost	$ 6,574,978

Total Aesthetic Treatment Cost	$ 1,232,621

Total Right of Way Cost	$ 1,920,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	7

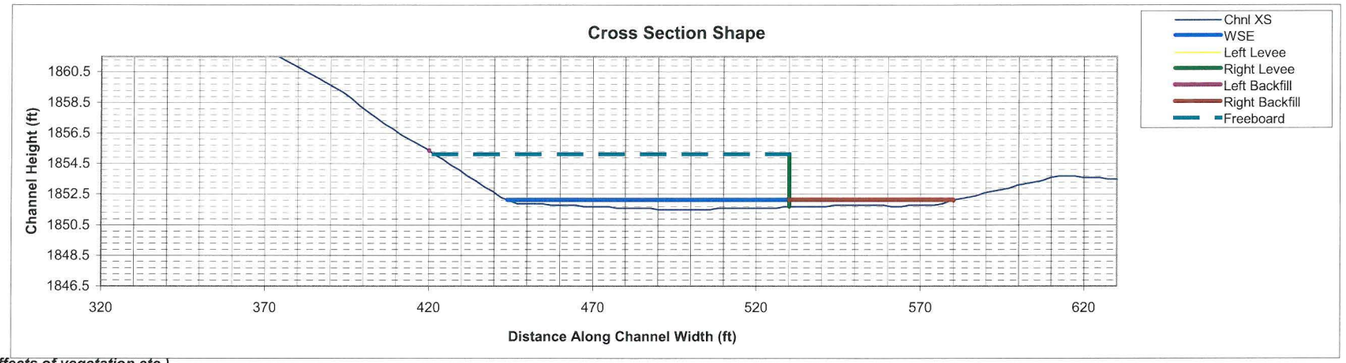
Longitudinal Geometry

Length	691.5	ft
Initial Channel Slope	0.0255	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0061	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	420	Right Levee Station (ft)	530
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	421	Right Channel Limit Station (ft)	530

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.07	0.93								
Flow into Channel	49	89								138

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
14	63.7	9.4	1851.5	1851.7	1.5	0.2	63.6	0.1	0.1	0.68
41	75.1	19.3	1851.5	1851.9	2.1	0.4	74.9	0.3	0.3	0.74
104	85.6	35.3	1851.5	1852.1	2.9	0.6	85.2	0.4	0.4	0.80
138	86.7	42.2	1851.5	1852.2	3.3	0.7	86.2	0.5	0.5	0.82

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
14	73.6	15.2	1851.5	1851.8	0.9	0.3	73.5	0.2	0.2	0.35
41	84.9	31.2	1851.5	1852.0	1.3	0.5	84.6	0.4	0.4	0.38
104	88.6	55.0	1851.5	1852.3	1.9	0.8	88.0	0.6	0.6	0.42
138	89.6	65.6	1851.5	1852.4	2.1	0.9	88.8	0.7	0.7	0.43

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
41										0.00

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
14	Stable
41	Stable
104	Stable
138	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	41	cfs
Clear Water	Yes	
Total Incoming Sediment Load	0.000	cfs
Initial Chnl Sediment Capacity	0.185	cfs
Long-term Equilibrium Slope (MPM)	0.0061	

Drop Structures

Design Slope	0.0061	ft/ft
Total Drop Needed	13.4	ft
Height of Drop Structure	3	ft
No. of Drop Structures	4.47	
Distance between Structures	155	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
138	1.1	24.6	0.7	0.5	3.3	0.0255	-0.2	0.3	1.5	0.1	2.0	4.8

Cost Estimates

Channel Characteristics

Channel Length (ft)	691
Channel Limit-Left Station (ft)	421
Channel Limit-Right Station (ft)	530
Channel Width (ft)	109

Levee

Left Levee Length (ft)	691
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	691
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.5

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	269
Right Levee Volume (cu. Yd)	45
Total Levee Surface Area (sq. Yd)	269
Total Levee Volume (cu. Yd)	45

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	34573
Right Levee Fill XS area (sq. ft)	18.5
Right Levee Fill Volume (cu. Yd)	473
Total Levee Fill Surface Area (sq. ft)	34573
Total Levee Fill Volume (cu Yd)	473

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	109	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	2.5	
Structure Height (ft)	5.5	
Number of Structures	4.47	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	22.14	2.21
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,882	$ 188
Area per structure (sq. Yd)	12	1
Total Area (cu. Yd)	54	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	691	ft	$ 86	$ 59,450	45	cu. Yd	$ -	$ -	45	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	269	sq. Yd	$ -	$ -	269	sq. Yd	$ -	$ -	269	sq. Yd	$ 75.00	$ 20,175	
Adjacent Levee Fill	Fill	473	cu. Yd	$ 7.00	$ 3,311	3,839	sq. Yd	$ 4.50	$ 17,275	3,839	sq. Yd	$ 11.67	$ 44,787	
Wall Material Aesthetic Treatment Cost	Wall	45	cu. Yd	$ -	$ -	45	cu. Yd	$ -	$ -	45	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	269	sq. Yd	$ 63.00	$ 16,947	269	sq. Yd	$ -	$ -	269	sq. Yd	$ -	$ -	
Drop Structures	Gabions	4	EA	$ 1,881.90	$ 8,412	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 454	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 88,121			Total	$ 17,275			Total	$ 65,416	
	Contingency Cost (25% of Construction Cost)				$ 22,030									
	Engineering Design Cost (5% of Construction Cost)				$ 4,406									
	Total Construction Cost				$ 114,557									
Wall Material Aesthetic Treatment Cost	Wall	45	cu. Yd	$ -	$ -	45	cu. Yd	$ -	$ -	45	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	269	sq. Yd	$ 63.00	$ 16,947	269	sq. Yd	$ -	$ -	269	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	473	cu. Yd	$ 7.00	$ 3,311	3,839	sq. Yd	$ 4.50	$ 17,275	3,839	sq. Yd	$ 11.67	$ 44,787	
Drop Structures Aesthetic Trtmt. Cost	Gabions	4	EA	$ 187.85	$ 840	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 45	
Other					$ -				$ -				$ -	
	Total without Contingency & Engineering Design Cost				$ 21,098			Total	$ 17,275			Total	$ 44,832	
	Contingency Cost (25% of Construction Cost)				$ 5,274									
	Engineering Design Cost (5% of Construction Cost)				$ 1,055									
	Total Construction Cost				$ 27,427									

Total Structure Aesthetic Trtmt Cost	$ 89,534

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	35	0.6	$100,000	$ 60,000
Maintenance Access	15	0.2	$100,000	$ 20,000
Channel	109	1.7	$100,000	$ 170,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	160	2.5		$ 250,000

Total Land Related Aes. Trtmt Cost	$ 60,000

Total Cost	$ 447,248

Total Aesthetic Treatment Cost	$ 149,534

Total Right of Way Cost	$ 250,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	6

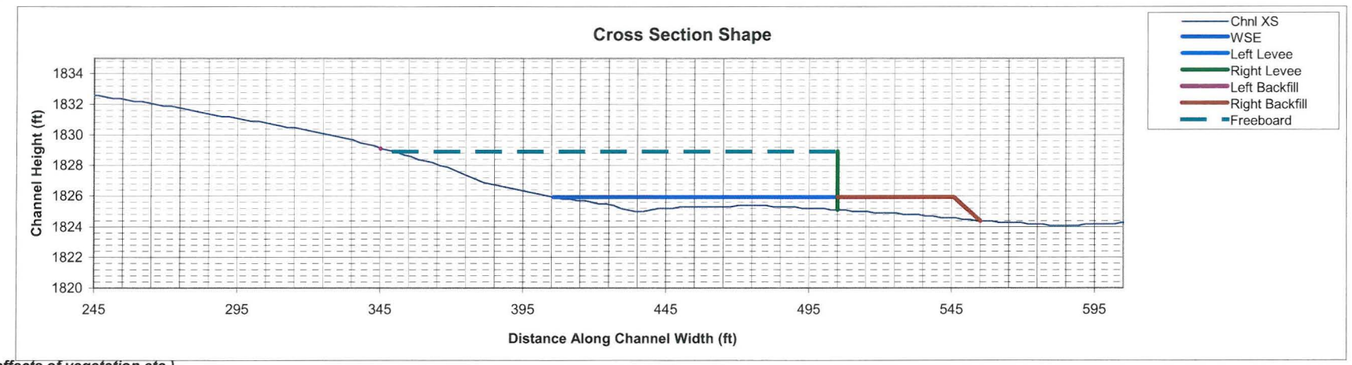
Longitudnal Geometry

Length	1042.2	ft
Initial Channel Slope	0.0250	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0160	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	345	Right Levee Station (ft)	505
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	349	Right Channel Limit Station (ft)	505

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.21	0.79								
Flow into Channel	146	76								222

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
22	79.3	13.7	1825.0	1825.4	1.6	0.4	78.9	0.2	0.2	0.69
67	86.2	27.3	1825.0	1825.6	2.4	0.6	85.7	0.3	0.3	0.76
167	97.9	49.9	1825.0	1825.8	3.3	0.8	97.1	0.5	0.5	0.82
222	100.5	59.9	1825.0	1825.9	3.7	0.9	99.6	0.6	0.6	0.84

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
22	80.0	15.7	1825.0	1825.5	1.4	0.5	79.6	0.2	0.2	0.56
67	87.4	31.4	1825.0	1825.6	2.1	0.6	86.9	0.4	0.4	0.62
167	99.9	57.5	1825.0	1825.9	2.9	0.9	99.0	0.6	0.6	0.67
222	102.9	69.1	1825.0	1826.0	3.2	1.0	102.0	0.7	0.7	0.69

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_7									
67	0.19									0.19

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
22	Stable
67	Stable
167	Stable
222	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	67	cfs
Clear Water	No	
Total Incoming Sediment Load	0.185	cfs
Initial Chnl Sediment Capacity	0.346	cfs
Long-term Equilibrium Slope (ADWR)	0.0160	

Drop Structures

Design Slope	0.0160	ft/ft
Total Drop Needed	9.4	ft
Height of Drop Structure	3	ft
No. of Drop Structures	3.13	
Distance between Structures	333	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
222	1.1	24.6	0.9	0.6	3.7	0.0250	-0.3	0.4	1.5	0.1	2.0	4.9

Cost Estimates

Channel Characteristics

Channel Length (ft)	1042
Channel Limit-Left Station (ft)	349
Channel Limit-Right Station (ft)	505
Channel Width (ft)	156

Levee

Left Levee Length (ft)	1042
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	1042
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.8

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	440
Right Levee Volume (cu. Yd)	73
Total Levee Surface Area (sq. Yd)	440
Total Levee Volume (cu. Yd)	73

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	52212
Right Levee Fill XS area (sq. ft)	50.7
Right Levee Fill Volume (cu. Yd)	1957
Total Levee Fill Surface Area (sq. ft)	52212
Total Levee Fill Volume (cu Yd)	1957

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	156	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	3.2	
Structure Height (ft)	6.2	
Number of Structures	3.13	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	35.99	3.60
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,059	$ 306
Area per structure (sq. Yd)	17	2
Total Area (cu. Yd)	54	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,042	ft	$ 86	$ 89,649	73	cu. Yd	$ -	$ -	73	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	440	sq. Yd	$ -	$ -	440	sq. Yd	$ -	$ -	440	sq. Yd	$ 75.00	$ 33,000	
Adjacent Levee Fill	Fill	1,957	cu. Yd	$ 7.00	$ 13,699	5,789	sq. Yd	$ 4.50	$ 26,050	5,789	sq. Yd	$ 11.67	$ 67,537	
Wall Material Aesthetic Treatment Cost	Wall	73	cu. Yd	$ -	$ -	73	cu. Yd	$ -	$ -	73	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	440	sq. Yd	$ 63.00	$ 27,720	440	sq. Yd	$ -	$ -	440	sq. Yd	$ -	$ -	
Drop Structures	Gabions	3	EA	$ 3,059.15	$ 9,575	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 650	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 140,643			Total	$ 26,050			Total	$ 101,187	
		Contingency Cost (25% of Construction Cost)			$ 35,161									
		Engineering Design Cost (5% of Construction Cost)			$ 7,032									
		Total Construction Cost			$ 182,836									
Wall Material Aesthetic Treatment Cost	Wall	73	cu. Yd	$ -	$ -	73	cu. Yd	$ -	$ -	73	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	440	sq. Yd	$ 63.00	$ 27,720	440	sq. Yd	$ -	$ -	440	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	1,957	cu. Yd	$ 7.00	$ 13,699	5,789	sq. Yd	$ 4.50	$ 26,050	5,789	sq. Yd	$ 11.67	$ 67,537	
Drop Structures Aesthetic Trtmt. Cost	Gabions	3	EA	$ 306.00	$ 958	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 65	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 42,377			Total	$ 26,050			Total	$ 67,602	
		Contingency Cost (25% of Construction Cost)			$ 10,594									
		Engineering Design Cost (5% of Construction Cost)			$ 2,119									
		Total Construction Cost			$ 55,090									

Total Structure Aesthetic Trtmt Cost	$ 148,742

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	35	0.8	$100,000	$ 80,000
Maintenance Access	15	0.4	$100,000	$ 40,000
Channel	156	3.7	$100,000	$ 370,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	207	4.9		$ 490,000

Total Land Related Aes. Trtmt Cost	$ 80,000

Total Cost	$ 800,073	Total Aesthetic Treatment Cost	$ 228,742	Total Right of Way Cost	$ 490,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	5

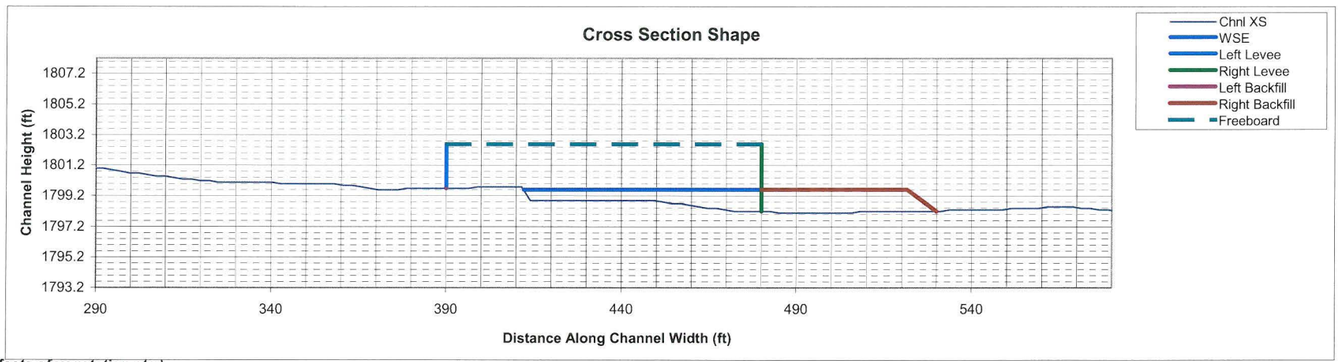
Longitudnal Geometry

Length	999.4	ft
Initial Channel Slope	0.0270	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0157	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	390	Right Levee Station (ft)	480
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	390	Right Channel Limit Station (ft)	480

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.35	0.65								
Flow into Channel	243	63								306

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
31	66.8	15.1	1798.2	1798.9	2.0	0.7	66.1	0.2	0.2	0.74
92	67.7	29.4	1798.2	1799.1	3.1	0.9	66.7	0.4	0.4	0.83
230	69.0	51.3	1798.2	1799.5	4.5	1.3	67.6	0.7	0.8	0.90
306	69.5	61.2	1798.2	1799.6	5.0	1.4	68.0	0.9	0.9	0.93

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
31	67.0	17.8	1798.2	1799.0	1.7	0.8	66.2	0.3	0.3	0.58
92	68.0	34.7	1798.2	1799.2	2.6	1.0	66.9	0.5	0.5	0.65
230	69.5	60.6	1798.2	1799.6	3.8	1.4	68.0	0.9	0.9	0.71
306	92.0	80.6	1798.2	1799.9	3.8	1.7	90.0	0.9	0.9	0.71

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_6									
92	0.35									0.35

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
31	Stable
92	Stable
230	Stable
306	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	92	cfs
Clear Water	No	
Total Incoming Sediment Load	0.346	cfs
Initial Chnl Sediment Capacity	0.714	cfs
Long-term Equilibrium Slope (ADWR)	0.0157	

Drop Structures

Design Slope	0.0157	ft/ft
Total Drop Needed	11.3	ft
Height of Drop Structure	3	ft
No. of Drop Structures	3.76	
Distance between Structures	266	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
306	1.1	24.6	1.4	0.9	5.0	0.0270	-0.3	0.7	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	999
Channel Limit-Left Station (ft)	390
Channel Limit-Right Station (ft)	480
Channel Width (ft)	90

Levee

Left Levee Length (ft)	999
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	2.9
Right Levee Length (ft)	999
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.4

Left Levee Surface Area (sq. Yd)	322
Left Levee Volume (cu. Yd)	54
Right Levee Surface Area (sq. Yd)	488
Right Levee Volume (cu. Yd)	81
Total Levee Surface Area (sq. Yd)	810
Total Levee Volume (cu. Yd)	135

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0
Left Levee Fill Surface Area (sq. ft)	0
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50070
Right Levee Fill XS area (sq. ft)	67.1
Right Levee Fill Volume (cu. Yd)	2483
Total Levee Fill Surface Area (sq. ft)	50070
Total Levee Fill Volume (cu Yd)	2483

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	90	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	4.1	
Structure Height (ft)	7.1	
Number of Structures	3.76	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	23.81	2.38
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,024	$ 202
Area per structure (sq. Yd)	10	1
Total Area (cu. Yd)	38	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	999	ft	$ 187	$ 186,329	135	cu. Yd	$ -	$ -	135	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	810	sq. Yd	$ -	$ -	810	sq. Yd	$ -	$ -	810	sq. Yd	$ 75.00	$ 60,750	
Adjacent Levee Fill	Fill	2,483	cu. Yd	$ 7.00	$ 17,381	5,550	sq. Yd	$ 4.50	$ 24,975	5,550	sq. Yd	$ 11.67	$ 64,750	
Wall Material Aesthetic Treatment Cost	Wall	135	cu. Yd	$ -	$ -	135	cu. Yd	$ -	$ -	135	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	810	sq. Yd	$ 63.00	$ 51,030	810	sq. Yd	$ -	$ -	810	sq. Yd	$ -	$ -	
Drop Structures	Gabions	4	EA	$ 2,023.85	$ 7,610	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 375	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 262,349			Total	$ 24,975			Total	$ 125,875	
		Contingency Cost (25% of Construction Cost)			$ 65,587									
		Engineering Design Cost (5% of Construction Cost)			$ 13,117									
		Total Construction Cost			$ 341,054									
Wall Material Aesthetic Treatment Cost	Wall	135	cu. Yd	$ -	$ -	135	cu. Yd	$ -	$ -	135	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	810	sq. Yd	$ 63.00	$ 51,030	810	sq. Yd	$ -	$ -	810	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,483	cu. Yd	$ 7.00	$ 17,381	5,550	sq. Yd	$ 4.50	$ 24,975	5,550	sq. Yd	$ 11.67	$ 64,750	
Drop Structures Aesthetic Trtmt. Cost	Gabions	4	EA	$ 202.30	$ 761	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 69,172			Total	$ 24,975			Total	$ 64,788	
		Contingency Cost (25% of Construction Cost)			$ 17,293									
		Engineering Design Cost (5% of Construction Cost)			$ 3,459									
		Total Construction Cost			$ 89,923									

Total Structure Aesthetic Trtmt Cost	$ 179,686

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	90	2.1	$100,000	$ 210,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	191	4.4		$ 440,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 931,904	Total Aesthetic Treatment Cost	$ 339,686	Total Right of Way Cost	$ 440,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	4

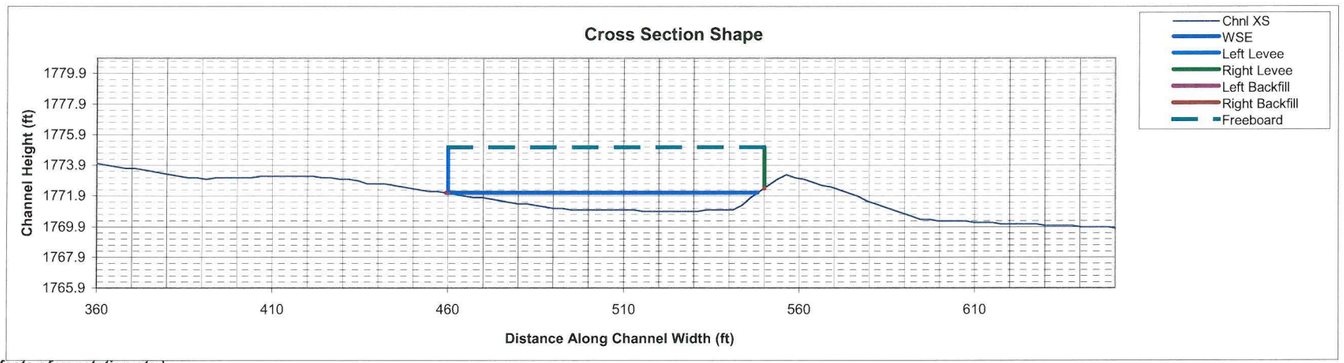
Longitudinal Geometry

Length	991.8	ft
Initial Channel Slope	0.0268	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0285	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	460	Right Levee Station (ft)	550
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	460	Right Channel Limit Station (ft)	550

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.49	0.51								
Flow into Channel	338	49								387

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
39	57.9	16.5	1770.9	1771.3	2.3	0.4	57.9	0.3	0.3	0.77
116	69.0	34.2	1770.9	1771.6	3.4	0.7	68.9	0.5	0.5	0.85
290	83.7	64.0	1770.9	1772.0	4.5	1.1	83.6	0.8	0.8	0.91
387	88.2	77.7	1770.9	1772.1	5.0	1.2	88.1	0.9	0.9	0.93

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
39	57.7	16.2	1770.9	1771.3	2.4	0.4	57.7	0.3	0.3	0.80
116	68.7	33.5	1770.9	1771.6	3.5	0.7	68.6	0.5	0.5	0.87
290	83.2	62.7	1770.9	1771.9	4.6	1.0	83.1	0.8	0.8	0.94
387	88.1	76.2	1770.9	1772.1	5.1	1.2	87.9	0.9	0.9	0.96

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_5	T115A310								
116	0.71	0.41								1.12

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
39	Stable
116	Stable
290	Stable
387	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	116	cfs
Clear Water	No	
Total Incoming Sediment Load	1.120	cfs
Initial Chnl Sediment Capacity	1.024	cfs
Long-term Equilibrium Slope (ADWR)	0.0285	

Drop Structures

Design Slope	0.0285	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
387	1.1	24.6	1.2	0.9	5.0	0.0268	-0.3	0.7	1.5	0.1	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	992
Channel Limit-Left Station (ft)	460
Channel Limit-Right Station (ft)	550
Channel Width (ft)	90

Levee

Left Levee Length (ft)	992
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3
Right Levee Length (ft)	992
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	2.7

Left Levee Surface Area (sq. Yd)	331
Left Levee Volume (cu. Yd)	55
Right Levee Surface Area (sq. Yd)	298
Right Levee Volume (cu. Yd)	50
Total Levee Surface Area (sq. Yd)	629
Total Levee Volume (cu. Yd)	105

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	0.6
Left Levee Fill Surface Area (sq. ft)	595
Left Levee Fill XS area (sq. ft)	0
Left Levee Fill Volume (cu. Yd)	0
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0
Right Levee Fill Surface Area (sq. ft)	0
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	595
Total Levee Fill Volume (cu Yd)	0

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	90	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.0	
Structure Height (ft)	8.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	26.56	2.66
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,258	$ 226
Area per structure (sq. Yd)	10	1
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	992	ft	$ 156	$ 154,787	105	cu. Yd	$ -	$ -	105	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	629	sq. Yd	$ -	$ -	629	sq. Yd	$ -	$ -	629	sq. Yd	$ 75.00	$ 47,175	
Adjacent Levee Fill	Fill	0	cu. Yd	$ 7.00	$ -	66	sq. Yd	$ 4.50	$ 298	66	sq. Yd	$ 11.67	$ 772	
Wall Material Aesthetic Treatment Cost	Wall	105	cu. Yd	$ -	$ -	105	cu. Yd	$ -	$ -	105	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	629	sq. Yd	$ 63.00	$ 39,627	629	sq. Yd	$ -	$ -	629	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,257.60	$ -	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 375	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 194,414			Total	$ 298			Total	$ 48,322	
		Contingency Cost (25% of Construction Cost)			$ 48,604									
		Engineering Design Cost (5% of Construction Cost)			$ 9,721									
		Total Construction Cost			$ 252,738									
Wall Material Aesthetic Treatment Cost	Wall	105	cu. Yd	$ -	$ -	105	cu. Yd	$ -	$ -	105	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	629	sq. Yd	$ 63.00	$ 39,627	629	sq. Yd	$ -	$ -	629	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	0	cu. Yd	$ 7.00	$ -	66	sq. Yd	$ 4.50	$ 298	66	sq. Yd	$ 11.67	$ 772	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 226.10	$ -	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 39,627			Total	$ 298			Total	$ 809	
		Contingency Cost (25% of Construction Cost)			$ 9,907									
		Engineering Design Cost (5% of Construction Cost)			$ 1,981									
		Total Construction Cost			$ 51,515									

Total Structure Aesthetic Trtmt Cost	$ 52,622

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	90	2	$100,000	$ 200,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	191	4.3		$ 430,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 731,357	Total Aesthetic Treatment Cost	$ 212,622	Total Right of Way Cost	$ 430,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	3

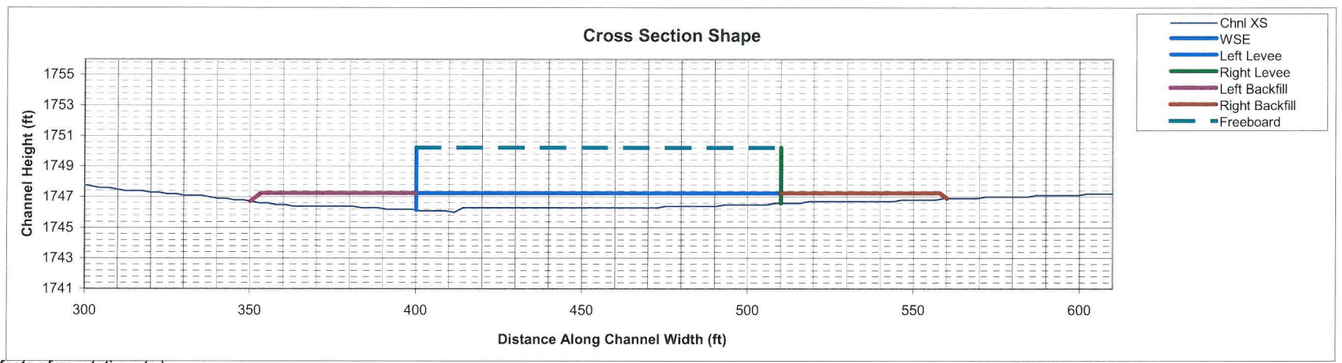
Longitudinal Geometry

Length	1024.5	ft
Initial Channel Slope	0.0225	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0256	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	400	Right Levee Station (ft)	510
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	400	Right Channel Limit Station (ft)	510

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.63	0.37								
Flow into Channel	436	36								472

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
47	107.3	25.1	1746.0	1746.6	1.9	0.6	106.9	0.2	0.2	0.69
142	110.8	49.1	1746.0	1746.8	2.9	0.8	110.0	0.4	0.4	0.76
354	111.5	85.2	1746.0	1747.1	4.2	1.1	110.0	0.8	0.8	0.83
472	111.8	101.4	1746.0	1747.2	4.7	1.2	110.0	0.9	0.9	0.85

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
47	107.0	24.1	1746.0	1746.5	2.0	0.5	106.6	0.2	0.2	0.73
142	110.8	47.2	1746.0	1746.8	3.0	0.8	110.0	0.4	0.4	0.81
354	111.4	82.0	1746.0	1747.1	4.3	1.1	110.0	0.7	0.7	0.88
472	111.7	97.5	1746.0	1747.2	4.8	1.2	110.0	0.9	0.9	0.91

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_4									
142	1.02									1.02

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
47	Stable
142	Stable
354	Stable
472	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	142	cfs
Clear Water	No	
Total Incoming Sediment Load	1.024	cfs
Initial Chnl Sediment Capacity	0.836	cfs
Long-term Equilibrium Slope (ADWR)	0.0256	

Drop Structures

Design Slope	0.0256	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
472	1.1	24.6	1.2	0.9	4.7	0.0225	-0.3	0.6	1.5	0.1	2.0	5.1

Cost Estimates

Channel Characteristics

Channel Length (ft)	1025
Channel Limit-Left Station (ft)	400
Channel Limit-Right Station (ft)	510
Channel Width (ft)	110

Levee

Left Levee Length (ft)	1025
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.1
Right Levee Length (ft)	1025
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.6

Left Levee Surface Area (sq. Yd)	467
Left Levee Volume (cu. Yd)	78
Right Levee Surface Area (sq. Yd)	410
Right Levee Volume (cu. Yd)	68
Total Levee Surface Area (sq. Yd)	877
Total Levee Volume (cu. Yd)	146

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	51225
Left Levee Fill XS area (sq. ft)	42.4
Left Levee Fill Volume (cu. Yd)	1610
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	51225
Right Levee Fill XS area (sq. ft)	26
Right Levee Fill Volume (cu. Yd)	987
Total Levee Fill Surface Area (sq. ft)	102450
Total Levee Fill Volume (cu Yd)	2597

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	110	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	4.9	
Structure Height (ft)	7.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.05	3.20
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,724	$ 272
Area per structure (sq. Yd)	12	1
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,025	ft	$ 187	$ 191,178	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	877	sq. Yd	$ -	$ -	877	sq. Yd	$ -	$ -	877	sq. Yd	$ 75.00	$ 65,775	
Adjacent Levee Fill	Fill	2,597	cu. Yd	$ 7.00	$ 18,179	11,389	sq. Yd	$ 4.50	$ 51,250	11,389	sq. Yd	$ 11.67	$ 132,870	
Wall Material Aesthetic Treatment Cost	Wall	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	877	sq. Yd	$ 63.00	$ 55,251	877	sq. Yd	$ -	$ -	877	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,724.25	$ -	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 458	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 264,608			Total	$ 51,250			Total	$ 199,104	
		Contingency Cost (25% of Construction Cost)			$ 66,152									
		Engineering Design Cost (5% of Construction Cost)			$ 13,230									
		Total Construction Cost			$ 343,990									
Wall Material Aesthetic Treatment Cost	Wall	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	877	sq. Yd	$ 63.00	$ 55,251	877	sq. Yd	$ -	$ -	877	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,597	cu. Yd	$ 7.00	$ 18,179	11,389	sq. Yd	$ 4.50	$ 51,250	11,389	sq. Yd	$ 11.67	$ 132,870	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 272.00	$ -	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 46	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 73,430			Total	$ 51,250			Total	$ 132,916	
		Contingency Cost (25% of Construction Cost)			$ 18,358									
		Engineering Design Cost (5% of Construction Cost)			$ 3,672									
		Total Construction Cost			$ 95,459									

Total Structure Aesthetic Trtmt Cost	$ 279,625

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	110	2.6	$100,000	$ 260,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	211	4.9		$ 490,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,084,344	Total Aesthetic Treatment Cost	$ 439,625	Total Right of Way Cost	$ 490,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	2

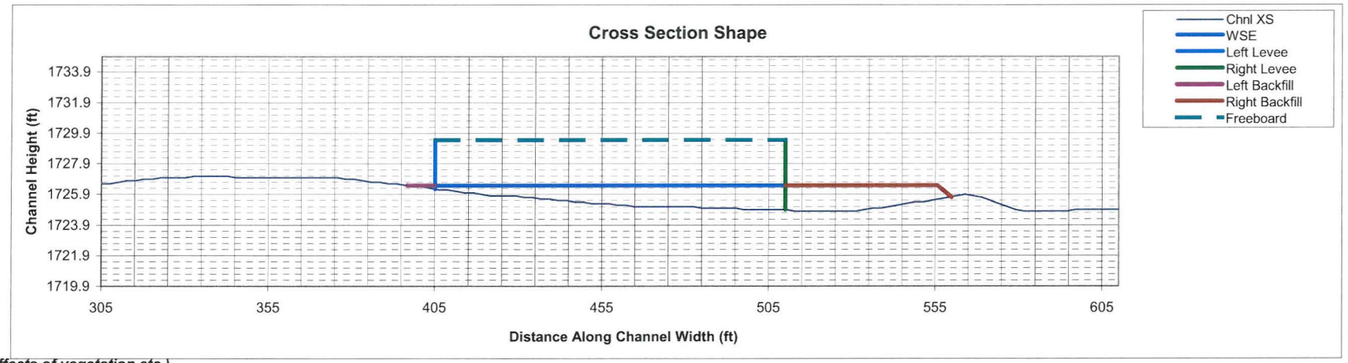
Longitudinal Geometry

Length	1060.1	ft
Initial Channel Slope	0.0189	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0174	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	405	Right Levee Station (ft)	510
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	405	Right Channel Limit Station (ft)	510

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.76	0.24								
Flow into Channel	531	23								554

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
55	65.2	23.8	1724.9	1725.5	2.3	0.6	64.6	0.4	0.4	0.68
166	90.5	52.5	1724.9	1725.8	3.2	0.9	89.5	0.6	0.6	0.73
416	106.5	97.1	1724.9	1726.3	4.3	1.4	105.0	0.9	0.9	0.78
554	106.8	115.5	1724.9	1726.5	4.8	1.6	105.0	1.1	1.1	0.81

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
55	65.5	24.5	1724.9	1725.5	2.3	0.6	64.9	0.4	0.4	0.65
166	90.9	53.9	1724.9	1725.9	3.1	1.0	89.9	0.6	0.6	0.70
416	106.5	99.5	1724.9	1726.3	4.2	1.4	105.0	0.9	0.9	0.76
554	106.9	118.4	1724.9	1726.5	4.7	1.6	105.0	1.1	1.1	0.78

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_3									
166	0.84									0.84

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
55	Stable
166	Stable
416	Stable
554	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	166	cfs
Clear Water	No	
Total Incoming Sediment Load	0.836	cfs
Initial Chnl Sediment Capacity	0.936	cfs
Long-term Equilibrium Slope (ADWR)	0.0174	

Drop Structures

Design Slope	0.0174	ft/ft
Total Drop Needed	1.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.53	
Distance between Structures	2000	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
554	1.1	24.6	1.6	1.1	4.8	0.0189	-0.4	0.6	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1060
Channel Limit-Left Station (ft)	405
Channel Limit-Right Station (ft)	510
Channel Width (ft)	105

Levee

Left Levee Length (ft)	1060
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.2
Right Levee Length (ft)	1060
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	377
Left Levee Volume (cu. Yd)	63
Right Levee Surface Area (sq. Yd)	542
Right Levee Volume (cu. Yd)	90
Total Levee Surface Area (sq. Yd)	919
Total Levee Volume (cu. Yd)	153

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	8.2
Left Levee Fill Surface Area (sq. ft)	8692
Left Levee Fill XS area (sq. ft)	0.8
Left Levee Fill Volume (cu. Yd)	31
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	53109
Right Levee Fill XS area (sq. ft)	68.7
Right Levee Fill Volume (cu. Yd)	2697
Total Levee Fill Surface Area (sq. ft)	61801
Total Levee Fill Volume (cu Yd)	2728

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	105	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.3	
Structure Height (ft)	8.3	
Number of Structures	0.53	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.45	3.24
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,758	$ 275
Area per structure (sq. Yd)	12	1
Total Area (cu. Yd)	6	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,060	ft	$ 187	$ 197,706	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -	919	sq. Yd	$ 75.00	$ 68,925	
Adjacent Levee Fill	Fill	2,728	cu. Yd	$ 7.00	$ 19,096	6,855	sq. Yd	$ 4.50	$ 30,846	6,855	sq. Yd	$ 11.67	$ 79,971	
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	919	sq. Yd	$ 63.00	$ 57,897	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,758.25	$ 1,462	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 438	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 276,161			Total	$ 30,846			Total	$ 149,334	
		Contingency Cost (25% of Construction Cost)			$ 69,040									
		Engineering Design Cost (5% of Construction Cost)			$ 13,808									
		Total Construction Cost			$ 359,009									
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	919	sq. Yd	$ 63.00	$ 57,897	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,728	cu. Yd	$ 7.00	$ 19,096	6,855	sq. Yd	$ 4.50	$ 30,846	6,855	sq. Yd	$ 11.67	$ 79,971	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 275.40	$ 146	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 44	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 77,139			Total	$ 30,846			Total	$ 80,015	
		Contingency Cost (25% of Construction Cost)			$ 19,285									
		Engineering Design Cost (5% of Construction Cost)			$ 3,857									
		Total Construction Cost			$ 100,281									

Total Structure Aesthetic Trtmt Cost	$ 211,142

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.7	$100,000	$ 170,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	105	2.6	$100,000	$ 260,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	206	5		$ 500,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,039,189	Total Aesthetic Treatment Cost	$ 381,142	Total Right of Way Cost	$ 500,000

Walled-Levee Corridor

Structure ID	H1F115A3

HEC1 ID	F115A3

Cutline ID	1

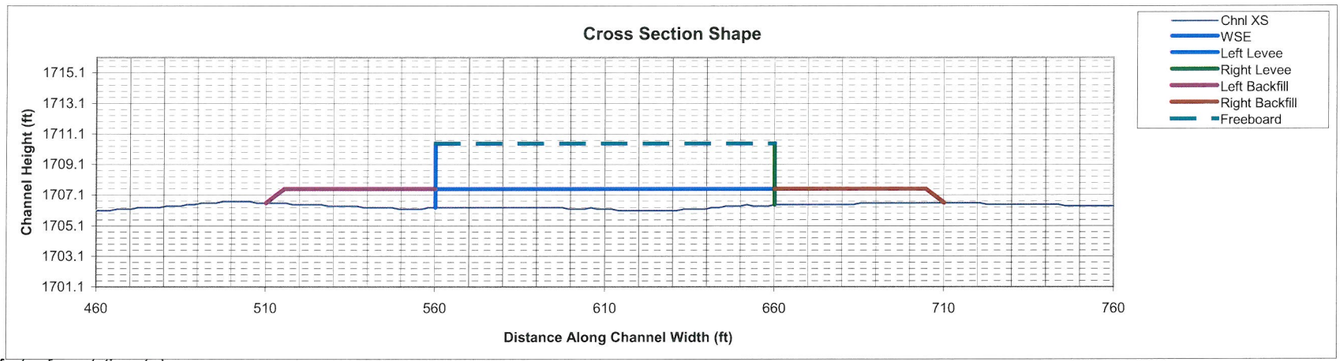
Longitudinal Geometry

Length	1260.2	ft
Initial Channel Slope	0.0183	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0169	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	560	Right Levee Station (ft)	660
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	560	Right Channel Limit Station (ft)	660

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A3	RR110								TOTAL
HEC1 Peak-Flow	697	96								
Weighting Factor	0.90	0.10								
Flow into Channel	627	10								637

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
64	100.4	31.1	1706.1	1706.6	2.0	0.5	100.0	0.3	0.3	0.65
191	101.0	60.2	1706.1	1706.9	3.2	0.8	100.0	0.6	0.6	0.72
478	101.8	104.7	1706.1	1707.3	4.6	1.2	100.0	1.0	1.0	0.79
637	102.2	124.6	1706.1	1707.5	5.1	1.4	100.0	1.2	1.2	0.81

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
64	100.4	31.8	1706.1	1706.6	2.0	0.5	100.0	0.3	0.3	0.63
191	101.0	61.7	1706.1	1706.9	3.1	0.8	100.0	0.6	0.6	0.70
478	101.9	107.3	1706.1	1707.3	4.5	1.2	100.0	1.1	1.1	0.76
637	102.3	127.7	1706.1	1707.5	5.0	1.4	100.0	1.2	1.3	0.78

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_2									
191	0.94									0.94

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
64	Stable
191	Stable
478	Stable
637	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	191	cfs
Clear Water	No	
Total Incoming Sediment Load	0.936	cfs
Initial Chnl Sediment Capacity	1.048	cfs
Long-term Equilibrium Slope (ADWR)	0.0169	

Drop Structures

Design Slope	0.0169	ft/ft
Total Drop Needed	1.8	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.59	
Distance between Structures	2136	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
637	1.1	24.6	1.4	1.2	5.1	0.0183	-0.3	0.7	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1260
Channel Limit-Left Station (ft)	560
Channel Limit-Right Station (ft)	660
Channel Width (ft)	100

Levee

Left Levee Length (ft)	1260
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.2
Right Levee Length (ft)	1260
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4

Left Levee Surface Area (sq. Yd)	588
Left Levee Volume (cu. Yd)	98
Right Levee Surface Area (sq. Yd)	560
Right Levee Volume (cu. Yd)	93
Total Levee Surface Area (sq. Yd)	1148
Total Levee Volume (cu. Yd)	191

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	63136
Left Levee Fill XS area (sq. ft)	53.5
Left Levee Fill Volume (cu. Yd)	2497
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	63136
Right Levee Fill XS area (sq. ft)	45.3
Right Levee Fill Volume (cu. Yd)	2114
Total Levee Fill Surface Area (sq. ft)	126272
Total Levee Fill Volume (cu Yd)	4611

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	100	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.9	
Structure Height (ft)	8.9	
Number of Structures	0.59	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	33.07	3.31
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,811	$ 281
Area per structure (sq. Yd)	11	1
Total Area (cu. Yd)	7	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,260	ft	$ 201	$ 253,209	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,148	sq. Yd	$ -	$ -	1,148	sq. Yd	$ -	$ -	1,148	sq. Yd	$ 75.00	$ 86,100	
Adjacent Levee Fill	Fill	4,611	cu. Yd	$ 7.00	$ 32,277	14,000	sq. Yd	$ 4.50	$ 63,000	14,000	sq. Yd	$ 11.67	$ 163,333	
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,148	sq. Yd	$ 63.00	$ 72,324	1,148	sq. Yd	$ -	$ -	1,148	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,810.95	$ 1,658	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 417	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 359,469			Total	$ 63,000			Total	$ 249,850	
		Contingency Cost (25% of Construction Cost)			$ 89,867									
		Engineering Design Cost (5% of Construction Cost)			$ 17,973									
		Total Construction Cost			$ 467,309									
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,148	sq. Yd	$ 63.00	$ 72,324	1,148	sq. Yd	$ -	$ -	1,148	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	4,611	cu. Yd	$ 7.00	$ 32,277	14,000	sq. Yd	$ 4.50	$ 63,000	14,000	sq. Yd	$ 11.67	$ 163,333	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 281.35	$ 166	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 42	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 104,767			Total	$ 63,000			Total	$ 163,375	
		Contingency Cost (25% of Construction Cost)			$ 26,192									
		Engineering Design Cost (5% of Construction Cost)			$ 5,238									
		Total Construction Cost			$ 136,197									

Total Structure Aesthetic Trtmt Cost	$ 362,572

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2	$100,000	$ 200,000
Maintenance Access	30	0.9	$100,000	$ 90,000
Channel	100	2.9	$100,000	$ 290,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	201	5.8		$ 580,000

Total Land Related Aes. Trtmt Cost	$ 200,000

Total Cost	$ 1,360,159	Total Aesthetic Treatment Cost	$ 562,572	Total Right of Way Cost	$ 580,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	6

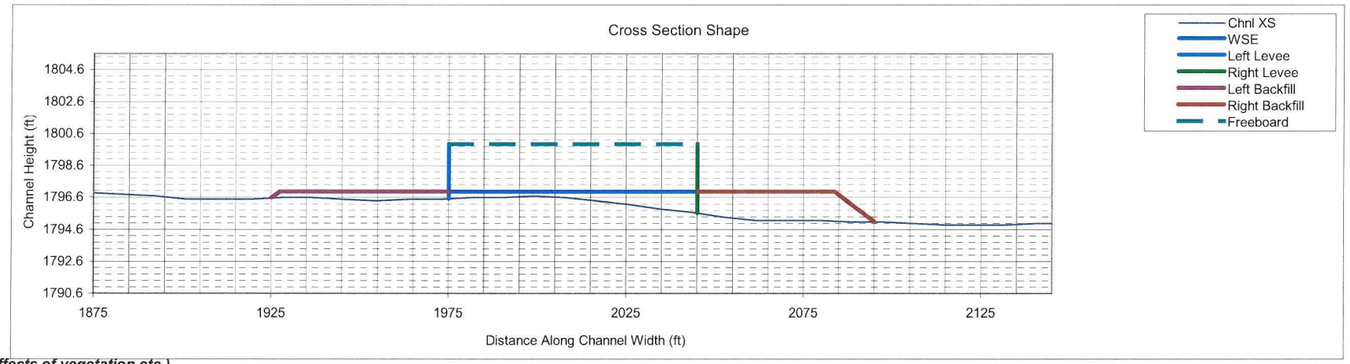
Longitundal Geometry

Length	558.9	ft
Initial Channel Slope	0.0156	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0029	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1975	Right Levee Station (ft)	2045
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1975	Right Channel Limit Station (ft)	2045

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.10	0.90								
Flow into Channel	71	53								124

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
12	21.9	6.6	1795.6	1796.2	1.9	0.6	21.3	0.3	0.3	0.59
37	59.0	19.1	1795.6	1796.6	1.9	1.0	57.9	0.3	0.3	0.60
93	71.6	35.7	1795.6	1796.9	2.6	1.3	70.0	0.5	0.5	0.64
124	71.8	42.5	1795.6	1797.0	2.9	1.4	70.0	0.6	0.6	0.66

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
12	32.6	12.9	1795.6	1796.5	1.0	0.9	31.7	0.4	0.4	0.27
37	71.5	34.2	1795.6	1796.9	1.1	1.3	70.0	0.5	0.5	0.27
93	72.3	59.4	1795.6	1797.2	1.6	1.6	70.0	0.8	0.8	0.30
124	72.6	70.7	1795.6	1797.4	1.8	1.8	70.0	1.0	1.0	0.31

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
37										0.00

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
12	Stable
37	Stable
93	Stable
124	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	37	cfs
Clear Water	Yes	
Total Incoming Sediment Load	0.000	cfs
Initial Chnl Sediment Capacity	0.088	cfs
Long-term Equilibrium Slope (MPM)	0.0029	

Drop Structures

Design Slope	0.0029	ft/ft
Total Drop Needed	7.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.37	
Distance between Structures	236	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
124	1.1	24.6	1.4	0.6	2.9	0.0156	-0.4	0.2	1.5	0.1	2.0	4.9

Cost Estimates

Channel Characteristics

Channel Length (ft)	559
Channel Limit-Left Station (ft)	1975
Channel Limit-Right Station (ft)	2045
Channel Width (ft)	70

Levee

Left Levee Length (ft)	559
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.4
Right Levee Length (ft)	559
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	211
Left Levee Volume (cu. Yd)	35
Right Levee Surface Area (sq. Yd)	267
Right Levee Volume (cu. Yd)	45
Total Levee Surface Area (sq. Yd)	478
Total Levee Volume (cu. Yd)	80

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	27943
Left Levee Fill XS area (sq. ft)	22.4
Left Levee Fill Volume (cu. Yd)	464
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	28054
Right Levee Fill XS area (sq. ft)	76.1
Right Levee Fill Volume (cu. Yd)	1576
Total Levee Fill Surface Area (sq. ft)	55997
Total Levee Fill Volume (cu Yd)	2040

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	70	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	2.5	
Structure Height (ft)	5.5	
Number of Structures	2.37	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	14.16	1.42
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,204	$ 121
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	18	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	559	ft	$ 187	$ 104,262	80	cu. Yd	$ -	$ -	80	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	478	sq. Yd	$ -	$ -	478	sq. Yd	$ -	$ -	478	sq. Yd	$ 75.00	$ 35,850	
Adjacent Levee Fill	Fill	2,040	cu. Yd	$ 7.00	$ 14,280	6,211	sq. Yd	$ 4.50	$ 27,950	6,211	sq. Yd	$ 11.67	$ 72,463	
Wall Material Aesthetic Treatment Cost	Wall	80	cu. Yd	$ -	$ -	80	cu. Yd	$ -	$ -	80	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	478	sq. Yd	$ 63.00	$ 30,114	478	sq. Yd	$ -	$ -	478	sq. Yd	$ -	$ -	
Drop Structures	Gabions	2	EA	$ 1,203.60	$ 2,853	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 151,509			Total	$ 27,950			Total	$ 108,605	
		Contingency Cost (25% of Construction Cost)			$ 37,877									
		Engineering Design Cost (5% of Construction Cost)			$ 7,575									
		Total Construction Cost			$ 196,961									
Wall Material Aesthetic Treatment Cost	Wall	80	cu. Yd	$ -	$ -	80	cu. Yd	$ -	$ -	80	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	478	sq. Yd	$ 63.00	$ 30,114	478	sq. Yd	$ -	$ -	478	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,040	cu. Yd	$ 7.00	$ 14,280	6,211	sq. Yd	$ 4.50	$ 27,950	6,211	sq. Yd	$ 11.67	$ 72,463	
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 120.70	$ 286	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 44,680			Total	$ 27,950			Total	$ 72,492	
		Contingency Cost (25% of Construction Cost)			$ 11,170									
		Engineering Design Cost (5% of Construction Cost)			$ 2,234									
		Total Construction Cost			$ 58,084									
Total Structure Aesthetic Trtmt Cost	$ 158,526													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	0.9	$100,000	$ 90,000
Maintenance Access	30	0.4	$100,000	$ 40,000
Channel	70	0.9	$100,000	$ 90,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	2.2		$ 220,000

Total Land Related Aes. Trtmt Cost	$ 90,000

Total Cost	$ 553,516	Total Aesthetic Treatment Cost	$ 248,526	Total Right of Way Cost	$ 220,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	5

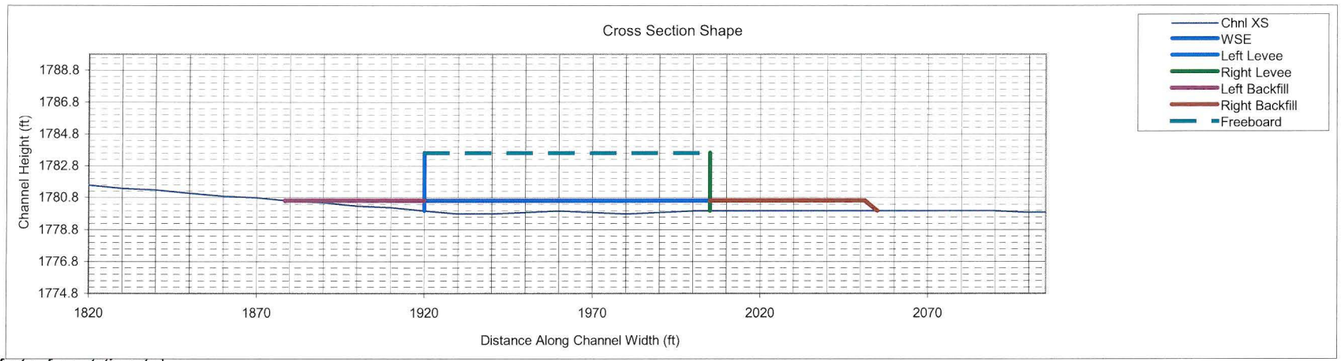
Longitudinal Geometry

Length	993.2	ft
Initial Channel Slope	0.0186	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0302	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1920	Right Levee Station (ft)	2005
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1920	Right Channel Limit Station (ft)	2005

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.26	0.74								
Flow into Channel	184	44								228

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
23	85.2	15.6	1779.8	1780.1	1.5	0.3	85.0	0.2	0.2	0.60
68	85.5	30.3	1779.8	1780.3	2.3	0.5	85.0	0.4	0.4	0.67
171	86.0	52.6	1779.8	1780.5	3.3	0.7	85.0	0.6	0.6	0.73
228	86.3	62.6	1779.8	1780.6	3.6	0.8	85.0	0.7	0.7	0.75

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
23	85.1	13.5	1779.8	1780.1	1.7	0.3	85.0	0.2	0.2	0.75
68	85.4	26.2	1779.8	1780.2	2.6	0.4	85.0	0.3	0.3	0.83
171	85.9	45.4	1779.8	1780.4	3.8	0.6	85.0	0.5	0.5	0.91
228	86.1	54.0	1779.8	1780.5	4.2	0.7	85.0	0.6	0.6	0.93

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H1F215A2_6	T115A210							
68	0.09	0.38							0.47

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
23	Stable
68	Stable
171	Stable
228	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	68	cfs
Clear Water	No	
Total Incoming Sediment Load	0.471	cfs
Initial Chnl Sediment Capacity	0.240	cfs
Long-term Equilibrium Slope (ADWR)	0.0302	

Drop Structures

Design Slope	0.0302	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
228	1.1	24.6	0.8	0.7	3.6	0.0186	-0.2	0.4	1.5	0.1	2.0	4.9

Cost Estimates

Channel Characteristics

Channel Length (ft)	993
Channel Limit-Left Station (ft)	1920
Channel Limit-Right Station (ft)	2005
Channel Width (ft)	85

Levee

Left Levee Length (ft)	993
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.6
Right Levee Length (ft)	993
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.6

Left Levee Surface Area (sq. Yd)	397
Left Levee Volume (cu. Yd)	66
Right Levee Surface Area (sq. Yd)	397
Right Levee Volume (cu. Yd)	66
Total Levee Surface Area (sq. Yd)	794
Total Levee Volume (cu. Yd)	132

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	41.5
Left Levee Fill Surface Area (sq. ft)	41218
Left Levee Fill XS area (sq. ft)	12.2
Left Levee Fill Volume (cu. Yd)	449
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	49759
Right Levee Fill XS area (sq. ft)	30.3
Right Levee Fill Volume (cu. Yd)	1114
Total Levee Fill Surface Area (sq. ft)	90977
Total Levee Fill Volume (cu Yd)	1563

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	85	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	3.8	
Structure Height (ft)	6.8	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	21.30	2.13
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,811	$ 181
Area per structure (sq. Yd)	9	1
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	993	ft	$ 172	$ 170,866	132	cu. Yd	$ -	$ -	132	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	794	sq. Yd	$ -	$ -	794	sq. Yd	$ -	$ -	794	sq. Yd	$ 75.00	$ 59,550
Adjacent Levee Fill	Fill	1,563	cu. Yd	$ 7.00	$ 10,941	10,096	sq. Yd	$ 4.50	$ 45,430	10,096	sq. Yd	$ 11.67	$ 117,781
Wall Material Aesthetic Treatment Cost	Wall	132	cu. Yd	$ -	$ -	132	cu. Yd	$ -	$ -	132	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	794	sq. Yd	$ 63.00	$ 50,022	794	sq. Yd	$ -	$ -	794	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 1,810.50	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 354
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 231,829			Total	$ 45,430			Total	$ 177,685
		Contingency Cost (25% of Construction Cost)			$ 57,957								
		Engineering Design Cost (5% of Construction Cost)			$ 11,591								
		Total Construction Cost			$ 301,378								
Wall Material Aesthetic Treatment Cost	Wall	132	cu. Yd	$ -	$ -	132	cu. Yd	$ -	$ -	132	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	794	sq. Yd	$ 63.00	$ 50,022	794	sq. Yd	$ -	$ -	794	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	1,563	cu. Yd	$ 7.00	$ 10,941	10,096	sq. Yd	$ 4.50	$ 45,430	10,096	sq. Yd	$ 11.67	$ 117,781
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 181.05	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 35
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 60,963			Total	$ 45,430			Total	$ 117,816
		Contingency Cost (25% of Construction Cost)			$ 15,241								
		Engineering Design Cost (5% of Construction Cost)			$ 3,048								
		Total Construction Cost			$ 79,252								
Total Structure Aesthetic Trtmt Cost	$ 242,498												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	85	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	186	4.2		$ 420,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 944,493	Total Aesthetic Treatment Cost	$ 402,498	Total Right of Way Cost	$ 420,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	4

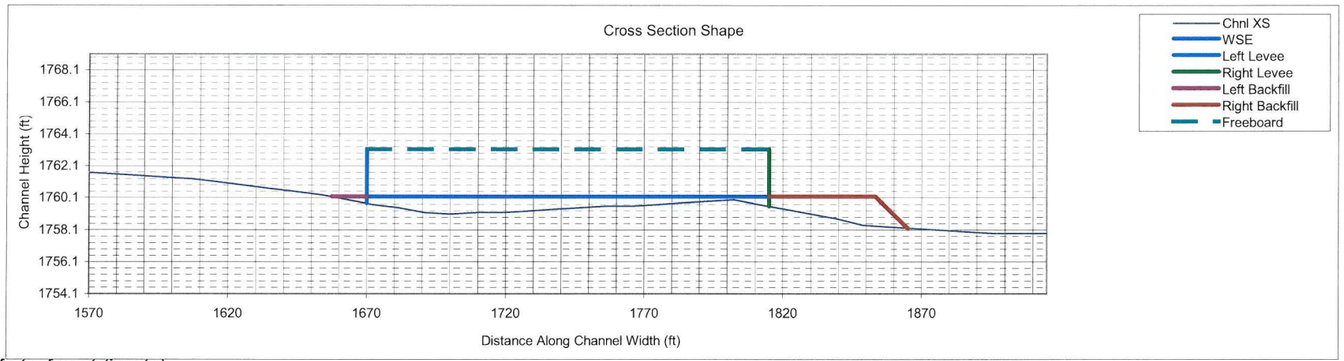
Longitudinal Geometry

Length	1011.9	ft
Initial Channel Slope	0.0194	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0139	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1670	Right Levee Station (ft)	1815
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1670	Right Channel Limit Station (ft)	1815

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.42	0.58								
Flow into Channel	298	34								332

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
33	71.5	18.0	1759.1	1759.5	1.8	0.4	71.5	0.3	0.3	0.65
100	120.2	42.9	1759.1	1759.8	2.3	0.7	120.0	0.4	0.4	0.68
249	145.8	80.3	1759.1	1760.1	3.1	1.0	145.0	0.6	0.6	0.73
332	146.0	95.5	1759.1	1760.2	3.5	1.1	145.0	0.7	0.7	0.75

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
33	76.0	20.4	1759.1	1759.6	1.6	0.5	76.0	0.3	0.3	0.55
100	125.8	48.3	1759.1	1759.8	2.1	0.7	125.4	0.4	0.4	0.59
249	145.9	88.8	1759.1	1760.1	2.8	1.0	145.0	0.6	0.6	0.63
332	146.2	105.6	1759.1	1760.2	3.1	1.1	145.0	0.7	0.7	0.65

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F215A2_5									
100	0.24									0.24

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
33	Stable
100	Stable
249	Stable
332	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	100	cfs
Clear Water	No	
Total Incoming Sediment Load	0.240	cfs
Initial Chnl Sediment Capacity	0.380	cfs
Long-term Equilibrium Slope (ADWR)	0.0139	

Drop Structures

Design Slope	0.0139	ft/ft
Total Drop Needed	5.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.86	
Distance between Structures	544	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
332	1.1	24.6	1.1	0.7	3.5	0.0194	-0.3	0.3	1.5	0.1	2.0	4.9

Cost Estimates

Channel Characteristics

Channel Length (ft)	1012
Channel Limit-Left Station (ft)	1670
Channel Limit-Right Station (ft)	1815
Channel Width (ft)	145

Levee

Left Levee Length (ft)	1012
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.4
Right Levee Length (ft)	1012
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.6

Left Levee Surface Area (sq. Yd)	382
Left Levee Volume (cu. Yd)	64
Right Levee Surface Area (sq. Yd)	405
Right Levee Volume (cu. Yd)	67
Total Levee Surface Area (sq. Yd)	787
Total Levee Volume (cu. Yd)	131

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	12.6
Left Levee Fill Surface Area (sq. ft)	12749
Left Levee Fill XS area (sq. ft)	2.6
Left Levee Fill Volume (cu. Yd)	97
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50795
Right Levee Fill XS area (sq. ft)	57.7
Right Levee Fill Volume (cu. Yd)	2163
Total Levee Fill Surface Area (sq. ft)	63544
Total Levee Fill Volume (cu Yd)	2260

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	145	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	3.3	
Structure Height (ft)	6.3	
Number of Structures	1.86	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	33.80	3.38
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,873	$ 287
Area per structure (sq. Yd)	16	2
Total Area (cu. Yd)	30	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,012	ft	$ 172	$ 174,136	131	cu. Yd	$ -	$ -	131	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	787	sq. Yd	$ -	$ -	787	sq. Yd	$ -	$ -	787	sq. Yd	$ 75.00	$ 59,025
Adjacent Levee Fill	Fill	2,260	cu. Yd	$ 7.00	$ 15,820	7,039	sq. Yd	$ 4.50	$ 31,676	7,039	sq. Yd	$ 11.67	$ 82,122
Wall Material Aesthetic Treatment Cost	Wall	131	cu. Yd	$ -	$ -	131	cu. Yd	$ -	$ -	131	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	787	sq. Yd	$ 63.00	$ 49,581	787	sq. Yd	$ -	$ -	787	sq. Yd	$ -	$ -
Drop Structures	Gabions	2	EA	$ 2,873.00	$ 5,344	16	sq. Yd	$ -	$ -	16	sq. Yd	$ 37.50	$ 604
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 244,880			Total	$ 31,676			Total	$ 141,751
		Contingency Cost (25% of Construction Cost)			$ 61,220								
		Engineering Design Cost (5% of Construction Cost)			$ 12,244								
		Total Construction Cost			$ 318,344								
Wall Material Aesthetic Treatment Cost	Wall	131	cu. Yd	$ -	$ -	131	cu. Yd	$ -	$ -	131	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	787	sq. Yd	$ 63.00	$ 49,581	787	sq. Yd	$ -	$ -	787	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,260	cu. Yd	$ 7.00	$ 15,820	7,039	sq. Yd	$ 4.50	$ 31,676	7,039	sq. Yd	$ 11.67	$ 82,122
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 287.30	$ 534	16	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 60
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 65,935			Total	$ 31,676			Total	$ 82,182
		Contingency Cost (25% of Construction Cost)			$ 16,484								
		Engineering Design Cost (5% of Construction Cost)			$ 3,297								
		Total Construction Cost			$ 85,716								

Total Structure Aesthetic Trtmt Cost	$ 199,574

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	145	3.4	$100,000	$ 340,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	246	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,061,771	Total Aesthetic Treatment Cost	$ 359,574	Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	3

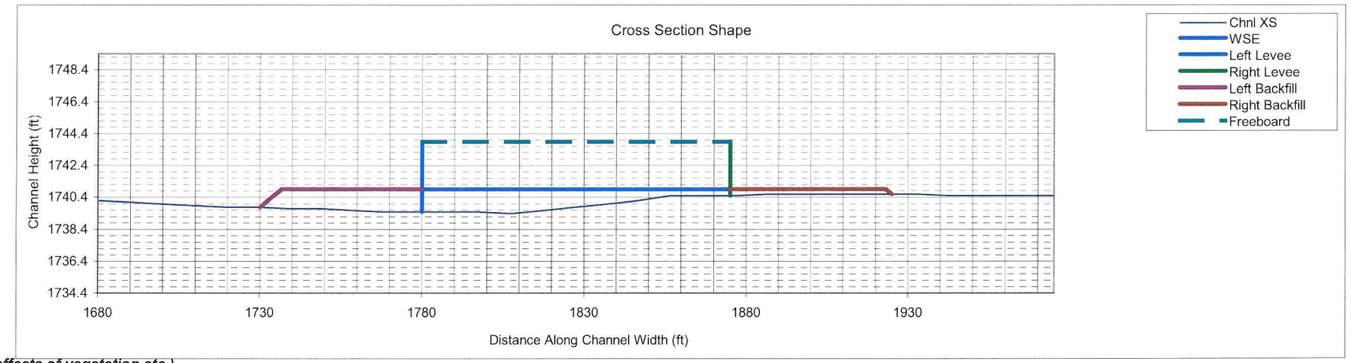
Longitudinal Geometry

Length	1017.5	ft
Initial Channel Slope	0.0191	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0119	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1780	Right Levee Station (ft)	1875
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1780	Right Channel Limit Station (ft)	1875

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.58	0.42								
Flow into Channel	413	25								438

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
44	53.7	19.1	1739.4	1739.9	2.3	0.5	53.2	0.4	0.4	0.68
131	69.9	41.0	1739.4	1740.3	3.2	0.9	69.1	0.6	0.6	0.73
329	96.5	80.8	1739.4	1740.8	4.1	1.4	95.0	0.8	0.9	0.78
438	96.8	96.2	1739.4	1740.9	4.6	1.5	95.0	1.0	1.0	0.80

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
44	56.7	22.5	1739.4	1740.0	1.9	0.6	56.2	0.4	0.4	0.54
131	73.3	48.1	1739.4	1740.4	2.7	1.0	72.4	0.7	0.7	0.59
329	96.8	93.2	1739.4	1740.9	3.5	1.5	95.0	1.0	1.0	0.63
438	97.2	111.0	1739.4	1741.1	3.9	1.7	95.0	1.1	1.2	0.64

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)								TOTAL
	H1F215A2_4								
131	0.38								0.38

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
44	Stable
131	Stable
329	Stable
438	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	131	cfs
Clear Water	No	
Total Incoming Sediment Load	0.380	cfs
Initial Chnl Sediment Capacity	0.760	cfs
Long-term Equilibrium Slope (ADWR)	0.0119	

Drop Structures

Design Slope	0.0119	ft/ft
Total Drop Needed	7.3	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.44	
Distance between Structures	417	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
438	1.1	24.6	1.5	1.0	4.6	0.0191	-0.4	0.6	1.5	0.2	2.0	5.1

Cost Estimates

Channel Characteristics

Channel Length (ft)	1017
Channel Limit-Left Station (ft)	1780
Channel Limit-Right Station (ft)	1875
Channel Width (ft)	95

Levee

Left Levee Length (ft)	1017
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.4
Right Levee Length (ft)	1017
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.4

Left Levee Surface Area (sq. Yd)	497
Left Levee Volume (cu. Yd)	83
Right Levee Surface Area (sq. Yd)	384
Right Levee Volume (cu. Yd)	64
Total Levee Surface Area (sq. Yd)	881
Total Levee Volume (cu. Yd)	147

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50974
Left Levee Fill XS area (sq. ft)	60.8
Left Levee Fill Volume (cu. Yd)	2290
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50873
Right Levee Fill XS area (sq. ft)	16
Right Levee Fill Volume (cu. Yd)	603
Total Levee Fill Surface Area (sq. ft)	101847
Total Levee Fill Volume (cu Yd)	2893

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	95	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	4.8	
Structure Height (ft)	7.8	
Number of Structures	2.44	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.53	2.75
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,340	$ 234
Area per structure (sq. Yd)	11	1
Total Area (cu. Yd)	26	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	1,017	ft	$ 187	$ 189,686	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	881	sq. Yd	$ -	$ -	881	sq. Yd	$ -	$ -	881	sq. Yd	$ 75.00	$ 66,075
Adjacent Levee Fill	Fill	2,893	cu. Yd	$ 7.00	$ 20,251	11,300	sq. Yd	$ 4.50	$ 50,850	11,300	sq. Yd	$ 11.67	$ 131,833
Wall Material Aesthetic Treatment Cost	Wall	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	881	sq. Yd	$ 63.00	$ 55,503	881	sq. Yd	$ -	$ -	881	sq. Yd	$ -	$ -
Drop Structures	Gabions	2	EA	$ 2,340.05	$ 5,710	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 396
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 271,150			Total	$ 50,850			Total	$ 198,304
		Contingency Cost (25% of Construction Cost)			$ 67,787								
		Engineering Design Cost (5% of Construction Cost)			$ 13,557								
		Total Construction Cost			$ 352,495								
Wall Material Aesthetic Treatment Cost	Wall	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	881	sq. Yd	$ 63.00	$ 55,503	881	sq. Yd	$ -	$ -	881	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,893	cu. Yd	$ 7.00	$ 20,251	11,300	sq. Yd	$ 4.50	$ 50,850	11,300	sq. Yd	$ 11.67	$ 131,833
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 233.75	$ 570	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 40
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 76,324			Total	$ 50,850			Total	$ 131,873
		Contingency Cost (25% of Construction Cost)			$ 19,081								
		Engineering Design Cost (5% of Construction Cost)			$ 3,816								
		Total Construction Cost			$ 99,222								

Total Structure Aesthetic Trtmt Cost	$ 281,945

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	95	2.2	$100,000	$ 220,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	196	4.5		$ 450,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,051,649	Total Aesthetic Treatment Cost	$ 441,945	Total Right of Way Cost	$ 450,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	2

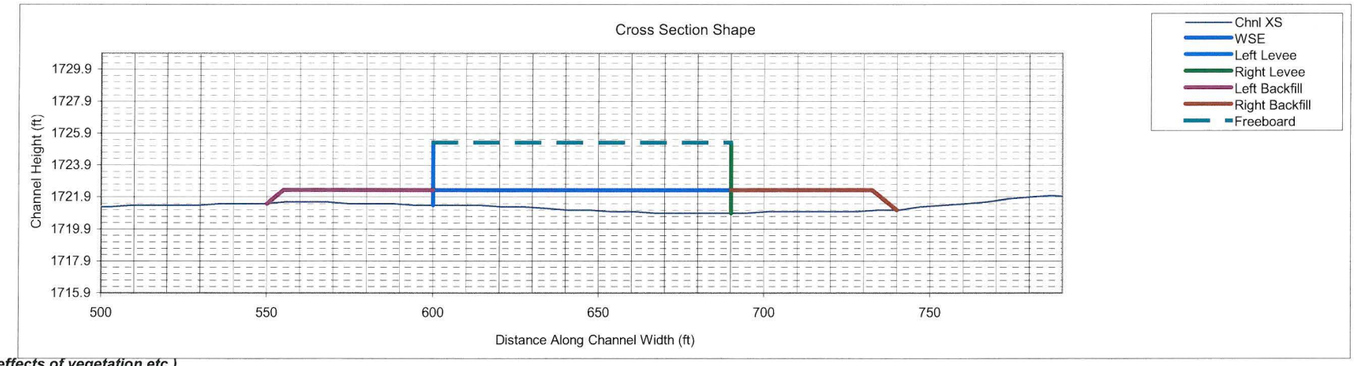
Longitudnal Geometry

Length	996.2	ft
Initial Channel Slope	0.0177	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0265	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	600	Right Levee Station (ft)	690
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	600	Right Channel Limit Station (ft)	690

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.73	0.27								
Flow into Channel	525	16								541

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
54	90.6	27.3	1720.9	1721.4	2.0	0.5	90.0	0.3	0.3	0.63
162	91.1	52.9	1720.9	1721.7	3.1	0.8	90.0	0.6	0.6	0.70
406	92.0	92.1	1720.9	1722.1	4.4	1.2	90.0	1.0	1.0	0.77
541	92.4	109.6	1720.9	1722.3	4.9	1.4	90.0	1.2	1.2	0.79

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
54	73.5	22.3	1720.9	1721.4	2.4	0.5	73.0	0.3	0.3	0.78
162	91.0	46.9	1720.9	1721.6	3.5	0.7	90.0	0.5	0.5	0.85
406	91.8	81.5	1720.9	1722.0	5.0	1.1	90.0	0.9	0.9	0.92
541	92.1	97.0	1720.9	1722.2	5.6	1.3	90.0	1.1	1.1	0.95

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F215A2_3	T115A220								
162	0.76	0.68								1.44

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
54	Stable
162	Stable
406	Stable
541	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	162	cfs
Clear Water	No	
Total Incoming Sediment Load	1.437	cfs
Initial Chnl Sediment Capacity	0.818	cfs
Long-term Equilibrium Slope (ADWR)	0.0265	

Drop Structures

Design Slope	0.0265	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
541	1.1	24.6	1.4	1.2	4.9	0.0177	-0.3	0.7	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	996
Channel Limit-Left Station (ft)	600
Channel Limit-Right Station (ft)	690
Channel Width (ft)	90

Levee

Left Levee Length (ft)	996
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.9
Right Levee Length (ft)	996
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.4

Left Levee Surface Area (sq. Yd)	432
Left Levee Volume (cu. Yd)	72
Right Levee Surface Area (sq. Yd)	487
Right Levee Volume (cu. Yd)	81
Total Levee Surface Area (sq. Yd)	919
Total Levee Volume (cu. Yd)	153

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	49910
Left Levee Fill XS area (sq. ft)	39
Left Levee Fill Volume (cu. Yd)	1439
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	49910
Right Levee Fill XS area (sq. ft)	62.3
Right Levee Fill Volume (cu. Yd)	2298
Total Levee Fill Surface Area (sq. ft)	99820
Total Levee Fill Volume (cu Yd)	3737

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	90	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.9	
Structure Height (ft)	8.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	29.65	2.96
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,520	$ 252
Area per structure (sq. Yd)	10	1
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost												
		Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Wall Material Cost	Wall	996	ft	$ 201	$ 200,156	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -	919	sq. Yd	$ 75.00	$ 68,925
Adjacent Levee Fill	Fill	3,737	cu. Yd	$ 7.00	$ 26,159	11,067	sq. Yd	$ 4.50	$ 49,800	11,067	sq. Yd	$ 11.67	$ 129,111
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	919	sq. Yd	$ 63.00	$ 57,897	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,520.25	$ -	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 375
Other					$ -				$ -				$ -
	Total without Contingency & Engineering Design Cost				$ 284,212			Total	$ 49,800			Total	$ 198,411
	Contingency Cost (25% of Construction Cost)				$ 71,053								
	Engineering Design Cost (5% of Construction Cost)				$ 14,211								
	Total Construction Cost				$ 369,475								
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	919	sq. Yd	$ 63.00	$ 57,897	919	sq. Yd	$ -	$ -	919	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,737	cu. Yd	$ 7.00	$ 26,159	11,067	sq. Yd	$ 4.50	$ 49,800	11,067	sq. Yd	$ 11.67	$ 129,111
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 251.60	$ -	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38
Other					$ -				$ -				$ -
	Total without Contingency & Engineering Design Cost				$ 84,056			Total	$ 49,800			Total	$ 129,149
	Contingency Cost (25% of Construction Cost)				$ 21,014								
	Engineering Design Cost (5% of Construction Cost)				$ 4,203								
	Total Construction Cost				$ 109,273								

Total Structure Aesthetic Trtmt Cost	$ 288,221

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	90	2.1	$100,000	$ 210,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	191	4.4		$ 440,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,057,687

Total Aesthetic Treatment Cost	$ 448,221

Total Right of Way Cost	$ 440,000

Walled-Levee Corridor

Structure ID	H1F215A2

HEC1 ID	F215A2

Cutline ID	1

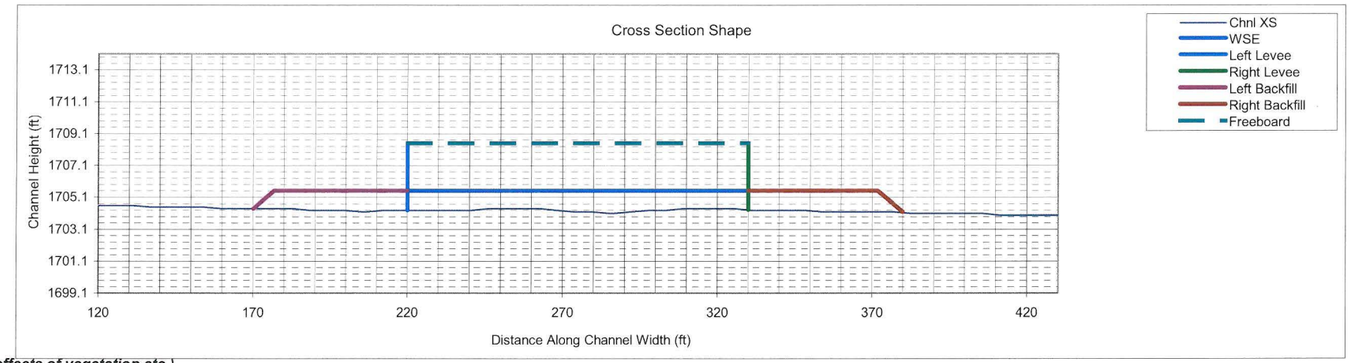
Longitudal Geometry

Length	1169.9	ft
Initial Channel Slope	0.0174	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0158	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	220	Right Levee Station (ft)	330
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	220	Right Channel Limit Station (ft)	330

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115A2	DRR900								TOTAL
HEC1 Peak-Flow	717	59								
Weighting Factor	0.89	0.11								
Flow into Channel	637	7								644

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
64	110.6	33.0	1704.1	1704.6	2.0	0.5	110.0	0.3	0.3	0.63
193	111.2	64.0	1704.1	1704.9	3.0	0.8	110.0	0.6	0.6	0.70
483	112.0	111.2	1704.1	1705.3	4.3	1.2	110.0	1.0	1.0	0.76
644	112.4	132.3	1704.1	1705.5	4.9	1.4	110.0	1.2	1.2	0.78

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
64	110.6	34.0	1704.1	1704.6	1.9	0.5	110.0	0.3	0.3	0.60
193	111.2	65.8	1704.1	1704.9	2.9	0.8	110.0	0.6	0.6	0.67
483	112.1	114.5	1704.1	1705.4	4.2	1.3	110.0	1.0	1.0	0.73
644	112.5	136.2	1704.1	1705.6	4.7	1.5	110.0	1.2	1.2	0.75

Sediment Data

D16 (mm)	0.17		G	3.99
D50 (mm)	0.7			
D65 (mm)	1.2			
D84 (mm)	2.7			
D90 (mm)	4			

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F215A2_2									
193	0.82									0.82

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
64	Stable
193	Stable
483	Stable
644	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	193	cfs
Clear Water	No	
Total Incoming Sediment Load	0.818	cfs
Initial Chnl Sediment Capacity	0.941	cfs
Long-term Equilibrium Slope (ADWR)	0.0158	

Drop Structures

Design Slope	0.0158	ft/ft
Total Drop Needed	1.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.62	
Distance between Structures	1887	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
644	1.1	24.6	1.4	1.2	4.9	0.0174	-0.3	0.6	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1170
Channel Limit-Left Station (ft)	220
Channel Limit-Right Station (ft)	330
Channel Width (ft)	110

Levee

Left Levee Length (ft)	1170
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.2
Right Levee Length (ft)	1170
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.2

Left Levee Surface Area (sq. Yd)	546
Left Levee Volume (cu. Yd)	91
Right Levee Surface Area (sq. Yd)	546
Right Levee Volume (cu. Yd)	91
Total Levee Surface Area (sq. Yd)	1092
Total Levee Volume (cu. Yd)	182

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	58609
Left Levee Fill XS area (sq. ft)	56.1
Left Levee Fill Volume (cu. Yd)	2431
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	58609
Right Levee Fill XS area (sq. ft)	58.2
Right Levee Fill Volume (cu. Yd)	2522
Total Levee Fill Surface Area (sq. ft)	117218
Total Levee Fill Volume (cu Yd)	4953

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	110	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.6	
Structure Height (ft)	8.6	
Number of Structures	0.62	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	35.16	3.52
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,989	$ 299
Area per structure (sq. Yd)	12	1
Total Area (cu. Yd)	8	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,170	ft	$ 201	$ 235,123	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,092	sq. Yd	$ -	$ -	1,092	sq. Yd	$ -	$ -	1,092	sq. Yd	$ 75.00	$ 81,900	
Adjacent Levee Fill	Fill	4,953	cu. Yd	$ 7.00	$ 34,671	13,000	sq. Yd	$ 4.50	$ 58,500	13,000	sq. Yd	$ 11.67	$ 151,667	
Wall Material Aesthetic Treatment Cost	Wall	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,092	sq. Yd	$ 63.00	$ 68,796	1,092	sq. Yd	$ -	$ -	1,092	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,988.60	$ 1,853	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 458	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 340,443			Total	$ 58,500			Total	$ 234,025	
		Contingency Cost (25% of Construction Cost)			$ 85,111									
		Engineering Design Cost (5% of Construction Cost)			$ 17,022									
		Total Construction Cost			$ 442,576									
Wall Material Aesthetic Treatment Cost	Wall	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,092	sq. Yd	$ 63.00	$ 68,796	1,092	sq. Yd	$ -	$ -	1,092	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,953	cu. Yd	$ 7.00	$ 34,671	13,000	sq. Yd	$ 4.50	$ 58,500	13,000	sq. Yd	$ 11.67	$ 151,667	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 299.20	$ 186	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 46	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 103,653			Total	$ 58,500			Total	$ 151,713	
		Contingency Cost (25% of Construction Cost)			$ 25,913									
		Engineering Design Cost (5% of Construction Cost)			$ 5,183									
		Total Construction Cost			$ 134,748									

Total Structure Aesthetic Trtmt Cost	$ 344,961

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.9	$100,000	$ 190,000
Maintenance Access	30	0.8	$100,000	$ 80,000
Channel	110	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	211	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 190,000

Total Cost	$ 1,305,101	Total Aesthetic Treatment Cost	$ 534,961	Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H115A15B

HEC1 ID	15A15B

Cutline ID	3

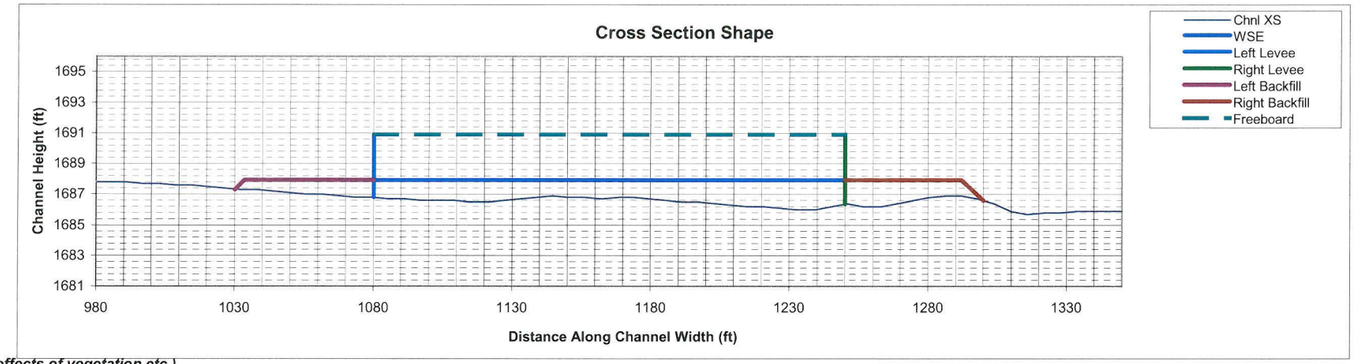
Longitundal Geometry

Length	790.3	ft
Initial Channel Slope	0.0193	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0156	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1080	Right Levee Station (ft)	1250
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1080	Right Channel Limit Station (ft)	1250

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115B	C115A								TOTAL
HEC1 Peak-Flow	1519	1323								
Weighting Factor	0.09	0.91								
Flow into Channel	137	1204								1341

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
134	167.8	58.7	1686.0	1686.9	2.3	0.9	167.2	0.3	0.4	0.68
402	171.3	114.4	1686.0	1687.2	3.5	1.2	170.0	0.7	0.7	0.76
1006	172.3	198.8	1686.0	1687.7	5.1	1.7	170.0	1.2	1.2	0.82
1341	172.7	236.4	1686.0	1687.9	5.7	1.9	170.0	1.4	1.4	0.85

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
134	170.7	63.0	1686.0	1686.9	2.1	0.9	170.0	0.4	0.4	0.62
402	171.4	122.0	1686.0	1687.2	3.3	1.2	170.0	0.7	0.7	0.69
1006	172.4	211.9	1686.0	1687.8	4.7	1.8	170.0	1.2	1.2	0.75
1341	172.9	252.1	1686.0	1688.0	5.3	2.0	170.0	1.5	1.5	0.77

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H1F115A3_1	H1F215A2_1								
402	1.05	0.94								1.99

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
134	Stable
402	Stable
1006	Erosive
1341	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	402	cfs
Clear Water	No	
Total Incoming Sediment Load	1.989	cfs
Initial Chnl Sediment Capacity	2.679	cfs
Long-term Equilibrium Slope (ADWR)	0.0156	

Drop Structures

Design Slope	0.0156	ft/ft
Total Drop Needed	2.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.97	
Distance between Structures	815	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1341	1.1	24.6	1.9	1.4	5.7	0.0193	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	790
Channel Limit-Left Station (ft)	1080
Channel Limit-Right Station (ft)	1250
Channel Width (ft)	170

Levee

Left Levee Length (ft)	790
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.1
Right Levee Length (ft)	790
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	360
Left Levee Volume (cu. Yd)	60
Right Levee Surface Area (sq. Yd)	395
Right Levee Volume (cu. Yd)	66
Total Levee Surface Area (sq. Yd)	755
Total Levee Volume (cu. Yd)	126

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	39515
Left Levee Fill XS area (sq. ft)	42.3
Left Levee Fill Volume (cu. Yd)	1238
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	39594
Right Levee Fill XS area (sq. ft)	62.4
Right Levee Fill Volume (cu. Yd)	1826
Total Levee Fill Surface Area (sq. ft)	79109
Total Levee Fill Volume (cu Yd)	3064

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	170	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	6.7	
Structure Height (ft)	9.7	
Number of Structures	0.97	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	60.80	6.08
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,168	$ 517
Area per structure (sq. Yd)	19	2
Total Area (cu. Yd)	18	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	790	ft	$ 201	$ 158,758	126	cu. Yd	$ -	$ -	126	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	755	sq. Yd	$ -	$ -	755	sq. Yd	$ -	$ -	755	sq. Yd	$ 75.00	$ 56,625	
Adjacent Levee Fill	Fill	3,064	cu. Yd	$ 7.00	$ 21,448	8,778	sq. Yd	$ 4.50	$ 39,500	8,778	sq. Yd	$ 11.67	$ 102,407	
Wall Material Aesthetic Treatment Cost	Wall	126	cu. Yd	$ -	$ -	126	cu. Yd	$ -	$ -	126	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	755	sq. Yd	$ 63.00	$ 47,565	755	sq. Yd	$ -	$ -	755	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 5,168.00	$ 5,013	19	sq. Yd	$ -	$ -	19	sq. Yd	$ 37.50	$ 708	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 232,784			Total	$ 39,500			Total	$ 159,741	
		Contingency Cost (25% of Construction Cost)			$ 58,196									
		Engineering Design Cost (5% of Construction Cost)			$ 11,639									
		Total Construction Cost			$ 302,619									
Wall Material Aesthetic Treatment Cost	Wall	126	cu. Yd	$ -	$ -	126	cu. Yd	$ -	$ -	126	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	755	sq. Yd	$ 63.00	$ 47,565	755	sq. Yd	$ -	$ -	755	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,064	cu. Yd	$ 7.00	$ 21,448	8,778	sq. Yd	$ 4.50	$ 39,500	8,778	sq. Yd	$ 11.67	$ 102,407	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 516.80	$ 501	19	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 71	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 69,514			Total	$ 39,500			Total	$ 102,478	
		Contingency Cost (25% of Construction Cost)			$ 17,379									
		Engineering Design Cost (5% of Construction Cost)			$ 3,476									
		Total Construction Cost			$ 90,369									

Total Structure Aesthetic Trtmt Cost	$ 232,347

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.3	$100,000	$ 130,000
Maintenance Access	30	0.5	$100,000	$ 50,000
Channel	170	3.1	$100,000	$ 310,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	271	4.9		$ 490,000

Total Land Related Aes. Trtmt Cost	$ 130,000

Total Cost	$ 991,860	Total Aesthetic Treatment Cost	$ 362,347
		Total Right of Way Cost	$ 490,000

Walled-Levee Corridor

Structure ID	H115A15B

HEC1 ID	15A15B

Cutline ID	2

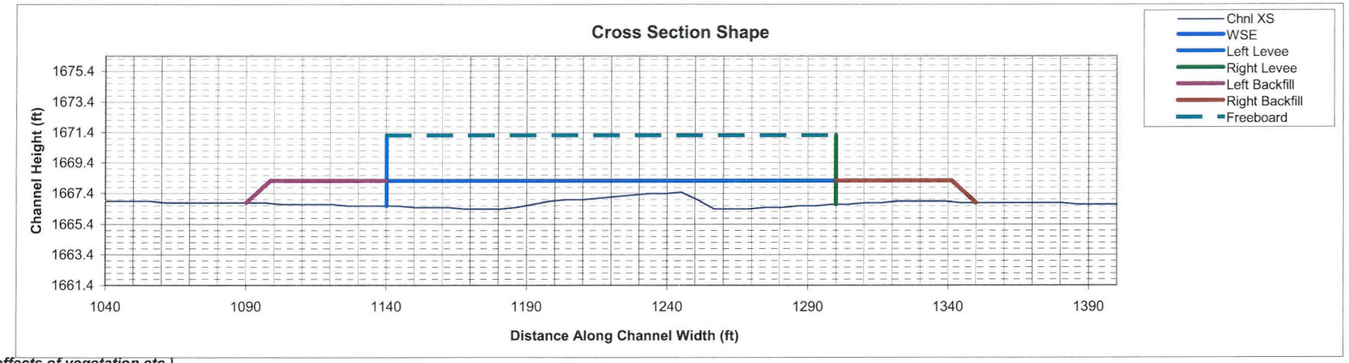
Longitudinal Geometry

Length	1012.4	ft
Initial Channel Slope	0.0192	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0180	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1140	Right Levee Station (ft)	1300
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1140	Right Channel Limit Station (ft)	1300

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115B	C115A								TOTAL
HEC1 Peak-Flow	1519	1323								
Weighting Factor	0.40	0.60								
Flow into Channel	604	797								1401

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
140	120.9	53.0	1666.4	1667.0	2.6	0.6	120.1	0.4	0.4	0.70
420	159.5	114.4	1666.4	1667.5	3.7	1.1	157.8	0.7	0.7	0.76
1051	162.8	199.8	1666.4	1668.0	5.3	1.6	160.0	1.2	1.2	0.83
1401	163.2	237.7	1666.4	1668.2	5.9	1.8	160.0	1.5	1.5	0.85

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
140	121.6	54.1	1666.4	1667.0	2.6	0.6	120.8	0.4	0.4	0.68
420	160.7	116.9	1666.4	1667.5	3.6	1.1	158.9	0.7	0.7	0.74
1051	162.8	203.7	1666.4	1668.0	5.2	1.6	160.0	1.3	1.3	0.81
1401	163.3	242.4	1666.4	1668.3	5.8	1.9	160.0	1.5	1.5	0.83

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H115A15B_3									
420	2.68									2.68

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
140	Stable
420	Stable
1051	Erosive
1401	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	420	cfs
Clear Water	No	
Total Incoming Sediment Load	2.679	cfs
Initial Chnl Sediment Capacity	2.947	cfs
Long-term Equilibrium Slope (ADWR)	0.0180	

Drop Structures

Design Slope	0.0180	ft/ft
Total Drop Needed	1.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.40	
Distance between Structures	2531	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1401	1.1	24.6	1.8	1.5	5.9	0.0192	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1012
Channel Limit-Left Station (ft)	1140
Channel Limit-Right Station (ft)	1300
Channel Width (ft)	160

Levee

Left Levee Length (ft)	1012
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.6
Right Levee Length (ft)	1012
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	517
Left Levee Volume (cu. Yd)	86
Right Levee Surface Area (sq. Yd)	506
Right Levee Volume (cu. Yd)	84
Total Levee Surface Area (sq. Yd)	1023
Total Levee Volume (cu. Yd)	170

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	50719
Left Levee Fill XS area (sq. ft)	71.3
Left Levee Fill Volume (cu. Yd)	2672
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	50719
Right Levee Fill XS area (sq. ft)	64.1
Right Levee Fill Volume (cu. Yd)	2403
Total Levee Fill Surface Area (sq. ft)	101438
Total Levee Fill Volume (cu Yd)	5075

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	160	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.1	
Structure Height (ft)	10.1	
Number of Structures	0.40	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	59.99	6.00
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,099	$ 510
Area per structure (sq. Yd)	18	2
Total Area (cu. Yd)	7	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,012	ft	$ 228	$ 230,565	170	cu. Yd	$ -	$ -	170	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,023	sq. Yd	$ -	$ -	1,023	sq. Yd	$ -	$ -	1,023	sq. Yd	$ 75.00	$ 76,725	
Adjacent Levee Fill	Fill	5,075	cu. Yd	$ 7.00	$ 35,525	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185	
Wall Material Aesthetic Treatment Cost	Wall	170	cu. Yd	$ -	$ -	170	cu. Yd	$ -	$ -	170	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,023	sq. Yd	$ 63.00	$ 64,449	1,023	sq. Yd	$ -	$ -	1,023	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,099.15	$ 2,040	18	sq. Yd	$ -	$ -	18	sq. Yd	$ 37.50	$ 667	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 332,578			Total	$ 50,600			Total	$ 208,577	
		Contingency Cost (25% of Construction Cost)			$ 83,145									
		Engineering Design Cost (5% of Construction Cost)			$ 16,629									
		Total Construction Cost			$ 432,352									
Wall Material Aesthetic Treatment Cost	Wall	170	cu. Yd	$ -	$ -	170	cu. Yd	$ -	$ -	170	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,023	sq. Yd	$ 63.00	$ 64,449	1,023	sq. Yd	$ -	$ -	1,023	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,075	cu. Yd	$ 7.00	$ 35,525	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 510.00	$ 204	18	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 67	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 100,178			Total	$ 50,600			Total	$ 131,252	
		Contingency Cost (25% of Construction Cost)			$ 25,045									
		Engineering Design Cost (5% of Construction Cost)			$ 5,009									
		Total Construction Cost			$ 130,231									

Total Structure Aesthetic Trtmt Cost	$ 312,083

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.6	$100,000	$ 160,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	160	3.7	$100,000	$ 370,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	261	6		$ 600,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,291,529	Total Aesthetic Treatment Cost	$ 472,083	Total Right of Way Cost	$ 600,000

Walled-Levee Corridor

Structure ID	H115A15B

HEC1 ID	15A15B

Cutline ID	1

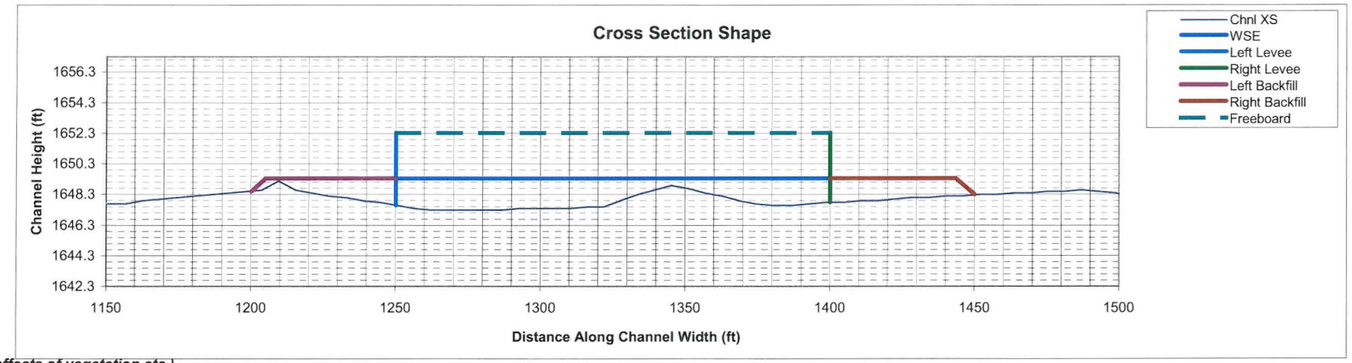
Longitudal Geometry

Length	1321.1	ft
Initial Channel Slope	0.0181	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0182	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1250	Right Levee Station (ft)	1400
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1250	Right Channel Limit Station (ft)	1400

Channel XS Geometry



Mannings n (includes effects of vegetation etc.)

Location	Initial	Long-term
Mannings n	0.045	0.045

HEC1 Results Used to Determine Design Peak Flows

Contributing HEC1 ID	C115B	C115A								TOTAL
HEC1 Peak-Flow	1519	1323								
Weighting Factor	0.71	0.29								
Flow into Channel	1072	389								1461

Initial Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
146	112.1	53.6	1647.3	1648.0	2.7	0.7	111.5	0.5	0.5	0.69
438	132.1	110.7	1647.3	1648.5	4.0	1.2	130.5	0.8	0.8	0.76
1096	152.9	203.4	1647.3	1649.1	5.4	1.8	150.0	1.3	1.4	0.82
1461	153.4	242.0	1647.3	1649.4	6.0	2.1	150.0	1.6	1.6	0.84

Long-term Channel Normal Depth Hydraulics

Discharge (cfs)	Wetted Perimeter (ft)	Wetted Area (sq. ft)	Min.Chnl Elev. (ft)	Water Surface Elevation	Velocity (ft/s)	Depth (ft)	Flow Topwidth (ft)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Froude Number
146	112.0	53.5	1647.3	1648.0	2.7	0.7	111.5	0.5	0.5	0.69
438	132.0	110.5	1647.3	1648.5	4.0	1.2	130.5	0.8	0.8	0.76
1096	152.9	203.0	1647.3	1649.1	5.4	1.8	150.0	1.3	1.4	0.82
1461	153.4	241.6	1647.3	1649.4	6.0	2.1	150.0	1.6	1.6	0.84

Sediment Data

D16 (mm)	0.17	G	3.99
D50 (mm)	0.7		
D65 (mm)	1.2		
D84 (mm)	2.7		
D90 (mm)	4		

Inflowing Sediment Load from U/S Reaches

Dominant Discharge (cfs)	Sediment Inflow (cfs) Contributions from Upstream (Identified using Structure ID)									TOTAL
	H115A15B_2	T115B10								
438	2.95	0.28								3.23

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
146	Stable
438	Stable
1096	Erosive
1461	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	438	cfs
Clear Water	No	
Total Incoming Sediment Load	3.226	cfs
Initial Chnl Sediment Capacity	3.209	cfs
Long-term Equilibrium Slope (ADWR)	0.0182	

Drop Structures

Design Slope	0.0182	ft/ft
Total Drop Needed	0.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.00	
Distance between Structures	N/A	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeg + Zbs + Zi)

Discharge	Sinuosity	Bend	Max. Depth	Hyd. Depth	Avg Vel	Slope	General Scour	Antidune Wave Height	LongTerm Scour	Bend Scour	Low Flow Incision	Total
Q (cfs)		Angle (deg)	Ymax (ft)	Yh (ft)	Vm (ft/s)	Se	Zgs (ft)	ha (ft)	Zdeg (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1461	1.1	24.6	2.1	1.6	6.0	0.0181	-0.4	1.0	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1321
Channel Limit-Left Station (ft)	1250
Channel Limit-Right Station (ft)	1400
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1321
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.7
Right Levee Length (ft)	1321
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	690
Left Levee Volume (cu. Yd)	115
Right Levee Surface Area (sq. Yd)	675
Right Levee Volume (cu. Yd)	113
Total Levee Surface Area (sq. Yd)	1365
Total Levee Volume (cu. Yd)	228

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	50
Left Levee Fill Surface Area (sq. ft)	66185
Left Levee Fill XS area (sq. ft)	50.1
Left Levee Fill Volume (cu. Yd)	2451
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	50
Right Levee Fill Surface Area (sq. ft)	66185
Right Levee Fill XS area (sq. ft)	63.1
Right Levee Fill Volume (cu. Yd)	3087
Total Levee Fill Surface Area (sq. ft)	132370
Total Levee Fill Volume (cu Yd)	5538

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	150	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.6	
Structure Height (ft)	10.6	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	58.71	5.87
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,990	$ 499
Area per structure (sq. Yd)	17	2
Total Area (cu. Yd)	0	0

Structure Type	Structure Cost													
		Construction				Landscape				Maintenance				
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost	
Wall Material Cost	Wall	1,321	ft	$ 255	$ 336,461	228	cu. Yd	$ -	$ -	228	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,365	sq. Yd	$ -	$ -	1,365	sq. Yd	$ -	$ -	1,365	sq. Yd	$ 75.00	$ 102,375	
Adjacent Levee Fill	Fill	5,538	cu. Yd	$ 7.00	$ 38,766	14,678	sq. Yd	$ 4.50	$ 66,050	14,678	sq. Yd	$ 11.67	$ 171,241	
Wall Material Aesthetic Treatment Cost	Wall	228	cu. Yd	$ -	$ -	228	cu. Yd	$ -	$ -	228	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,365	sq. Yd	$ 63.00	$ 85,995	1,365	sq. Yd	$ -	$ -	1,365	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 4,990.35	$ -	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 461,222			Total	$ 66,050			Total	$ 274,241	
		Contingency Cost (25% of Construction Cost)			$ 115,305									
		Engineering Design Cost (5% of Construction Cost)			$ 23,061									
		Total Construction Cost			$ 599,588									
Wall Material Aesthetic Treatment Cost	Wall	228	cu. Yd	$ -	$ -	228	cu. Yd	$ -	$ -	228	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,365	sq. Yd	$ 63.00	$ 85,995	1,365	sq. Yd	$ -	$ -	1,365	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,538	cu. Yd	$ 7.00	$ 38,766	14,678	sq. Yd	$ 4.50	$ 66,050	14,678	sq. Yd	$ 11.67	$ 171,241	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 498.95	$ -	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 124,761			Total	$ 66,050			Total	$ 171,303	
		Contingency Cost (25% of Construction Cost)			$ 31,190									
		Engineering Design Cost (5% of Construction Cost)			$ 6,238									
		Total Construction Cost			$ 162,189									

Total Structure Aesthetic Trtmt Cost	$ 399,543

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.1	$100,000	$ 210,000
Maintenance Access	30	0.9	$100,000	$ 90,000
Channel	150	4.5	$100,000	$ 450,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	251	7.5		$ 750,000

Total Land Related Aes. Trtmt Cost	$ 210,000

Total Cost	$ 1,689,879	Total Aesthetic Treatment Cost	$ 609,543	Total Right of Way Cost	$ 750,000

Offline Basin

Structure ID	D115B

HEC1 ID	D115B

Geometry

Topography slope (ft/ft)	0.018
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	4
Freeboard (ft)	1
Top Perimeter (ft)	2116.4
Top Area (acres)	5.2
Bottom elevation (ft)	1624.6
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	9.4
Total Available Volume (ac. ft) (incl. Freeboard)	13.0
Total Excavation Volume (ac. ft)	37.6

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Peak flow before diversion (cfs)	1255	1519	1519
Peak flow after diversion (cfs)	1050	1050	1050
Diverted Peak Flow (cfs)	205	469	469
Total Diverted Flow Volume (ac. ft)	4.0	9.0	9.0
Peak Stage	1.4	2.9	2.9

Volume Check			***Stage Check***	
Total Volume needed	9.0	ac. ft	Depth Needed	3.9
Total Volume Provided	9.4	ac. ft	Depth Provided	4

Volume OK?	Yes	Depth OK?	Yes

Diversion Records

Inflow (cfs)	0	200	400	600	800	1050	1100	1200	1500	2000	2500	3000
Outflow (cfs)	0	0	0	0	0	0	50	150	450	950	1450	1950

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	60661	0
Excavated Area (sq. Yd)	25168.0	940.6
Adjacent Buffer Area (sq. Yd)	11757.8	

Inlet			***Outlet***		
Inlet Type	Concrete		Outlet Type	Pipe	
(Riprap, Concrete)			(None, Riprap Weir, Concrete Weir, Pipe)		
			Pipe Length	303	ft
Inlet Length	200	ft	Unit Cost	$ 160.00	per ft
Inlet Width	15	ft	Cost per outlet	$ 48,480	
Material Thickness	0.5	ft	Other Cost	$ -	
Inlet Area	333	sq. Yd	Total Cost	$ 48,480	
Material Volume	56	cu. Yd	Outlet Area	133	sq. Yd

Structure Cost

Structure Type	Structure Cost												
		Excavation/Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Basin		60,661	cu. Yd	$ 4.00	$ 242,644	36,926	sq. Yd	$ 4.50	$ 166,166	36,926	sq. Yd	$ 8.33	$ 307,715
Inlet	Concrete	56	sq. Yd	$ 155.00	$ 8,680	333	sq. Yd	$ -	$ -	333	sq. Yd	$ 41.67	$ 13,875
Outlet	Pipe	1	EA	$ 48,480	$ 48,480	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 299,804			Total	$ 166,166			Total	$ 323,807
		Contingency Cost (25% of Construction Cost)			$ 74,951								
		Engineering Design Cost (5% of Construction Cost)			$ 14,990								
		Total Construction Cost			$ 389,745								
Basin - Aesthetic Treatment		60,661	cu. Yd	$ -	$ -	36,926	sq. Yd	$ 4.50	$ 166,166	10,817	sq. Yd	$ 8.33	$ 90,143
Inlet - Aesthetic Treatment (20%Inlet)					$ 1,736	333	sq. Yd	$ -	$ -				$ 2,775
Outlet -Aesthetic Treatment (5% Outlet)					$ 2,424	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 4,160			Total	$ 166,166			Total	$ 93,029
		Contingency Cost (25% of Construction Cost)			$ 1,040								
		Engineering Design Cost (5% of Construction Cost)			$ 208								
		Total Construction Cost			$ 5,408								
Total Structure Aesthetic Trtmt Cost	$ 264,603												

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	2.4	$100,000	$ 240,000
Basin	5.2	$100,000	$ 520,000
Other		$100,000	$ -
Total	7.6	$100,000	$ 760,000

Total Land Related Aes. Trtmt Cost	$ 259,434				
Total Cost	$ 1,639,718	Total Aesthetic Treatment Cost	$ 524,037	Total Right of Way Cost	$ 760,000

Offline Basin

Structure ID	D120A

HEC1 ID	D120A

Geometry

Topography slope (ft/ft)	0.013
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	6.5
Freeboard (ft)	1
Top Perimeter (ft)	1925.5
Top Area (acres)	5.8
Bottom elevation (ft)	1533.3
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	20.9
Total Available Volume (ac. ft) (incl. Freeboard)	25.4
Total Excavation Volume (ac. ft)	46.2

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Peak flow before diversion (cfs)	1683	1719	1719
Peak flow after diversion (cfs)	950	950	950
Diverted Peak Flow (cfs)	733	769	769
Total Diverted Flow Volume (ac. ft)	20.0	19.0	20.0
Peak Stage	5.3	5.1	5.3

Volume Check

Total Volume needed	20.0	ac. ft	Depth Needed	6.3
Total Volume Provided	20.9	ac. ft	Depth Provided	6.5

Stage Check

Volume OK?	Yes	Depth OK?	Yes

Diversion Records

Inflow (cfs)	0	200	400	600	750	950	1000	1150	1450	1950	2450	2950
Outflow (cfs)	0	0	0	0	0	0	50	200	500	1000	1500	2000

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	74536	0
Excavated Area (sq. Yd)	28072.0	1390.6
Adjacent Buffer Area (sq. Yd)	10697.2	

Inlet			***Outlet***		
Inlet Type	Concrete		Outlet Type	Pipe	
(Riprap, Concrete)			(None, Riprap Weir, Concrete Weir, Pipe)		
			Pipe Length	797	ft
Inlet Length	300	ft	Unit Cost	$ 160.00	per ft
Inlet Width	15	ft	Cost per outlet	$ 127,520	
Material Thickness	0.5	ft	Other Cost	$ -	
Inlet Area	500	sq. Yd	Total Cost	$ 127,520	
Material Volume	83	cu. Yd	Outlet Area	133	sq. Yd

Structure Cost

Structure Type	Structure Cost												
		Excavation/Construction				Landscape				Maintenance			
	Structure Type	Quantity	Units	Unit Cost	Cost Subtotal	Quantity	Units	Unit Cost	Landscape Cost	Quantity	Units	Unit Cost	Maintenance Cost
Basin		74,536	cu. Yd	$ 4.00	$ 298,144	38,769	sq. Yd	$ 4.50	$ 174,461	38,769	sq. Yd	$ 8.33	$ 323,077
Inlet	Concrete	83	sq. Yd	$ 155.00	$ 12,865	500	sq. Yd	$ -	$ -	500	sq. Yd	$ 41.67	$ 20,833
Outlet	Pipe	1	EA	$ 127,520	$ 127,520	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 438,529			Total	$ 174,461			Total	$ 346,127
		Contingency Cost (25% of Construction Cost)			$ 109,632								
		Engineering Design Cost (5% of Construction Cost)			$ 21,926								
		Total Construction Cost			$ 570,088								
Basin - Aesthetic Treatment		74,536	cu. Yd	$ -	$ -	38,769	sq. Yd	$ 4.50	$ 174,461	9,307	sq. Yd	$ 8.33	$ 77,555
Inlet - Aesthetic Treatment (20%Inlet)					$ 2,573	500	sq. Yd	$ -	$ -				$ 4,167
Outlet -Aesthetic Treatment (5% Outlet)					$ 6,376	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 8,949			Total	$ 174,461			Total	$ 81,833
		Contingency Cost (25% of Construction Cost)			$ 2,237								
		Engineering Design Cost (5% of Construction Cost)			$ 447								
		Total Construction Cost			$ 11,634								
Total Structure Aesthetic Trtmt Cost	$ 267,928												

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	2.2	$100,000	$ 220,000
Basin	5.8	$100,000	$ 580,000
Other		$100,000	$ -
Total	8.0	$100,000	$ 800,000

Total Land Related Aes. Trtmt Cost	$ 248,731

Total Cost	$ 1,890,676

Total Aesthetic Treatment Cost	$ 516,659

Total Right of Way Cost	$ 800,000

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1****************************************                    ****************************************
 *                                      *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1               *                    *        609 SECOND STREET             *
 *                                      *                    *     DAVIS, CALIFORNIA 95616          *
 * RUN DATE   19DEC06  TIME  17:52:01   *                    *          (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
```

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1                                     HEC-1 INPUT                                         PAGE  1

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

          1         ID   HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
          2         ID        - FAN SYSTEM 1 & 2
          3         ID
          4         ID   SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
          5         ID   JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
          6         ID   MODELER: TED LEHMAN
          7         ID   FILENAME: FANS126.DAT
          8         ID
          9         ID   100-YEAR 6-HOUR MODEL
         10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
         11         ID            MODELED AREA = 11.1 SQ. MILES
         12         ID
         13         ID   GREEN-AMPT LOSS METHOD
         14         ID
         15         ID   S-GRAPH UNIT HYDROGRAPHS
         16         ID     - MOUNTAIN
         17         ID     - DESERT/RANGELAND
         18         ID
         19         ID   NORMAL-DEPTH CHANNEL ROUTING
         20         ID
         21         ID   LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
         22         ID     - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
         23         ID     - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
         24         ID     - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
         25         ID
         26         ID   SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
         27         IT       5  1JAN99    1200    2000
         28         IN      15
         29         IO       3
                    *DIAGRAM
                    *
         30         JD   3.196  0.1000
         31         PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
         32         PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
         33         PC   0.962   0.972   0.983   0.991   1.000
         34         JD   3.181  0.5000
         35         PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
         36         PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
         37         PC   0.962   0.972   0.983   0.991   1.000
         38         JD   3.120     2.8
         39         PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
         40         PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
         41         PC   0.950   0.963   0.975   0.988   1.000
         42         JD   2.950    16.0
         43         PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
         44         PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
         45         PC   0.946   0.960   0.973   0.987   1.000
         46         JD   2.592    90.0
         47         PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
         48         PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
         49         PC   0.927   0.945   0.964   0.982   1.000
                    *
1                                     HEC-1 INPUT                                         PAGE  2

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

         50         KK    S900   BASIN
         51         KM         Compute runoff from subbasin 900
         52         BA   1.147
         53         LG    0.26    0.37    5.30    0.24       6
         54         UI      79      81     192     329     471     553     629     801     886     579
         55         UI     495     447     398     367     320     285     242     205     188     176
         56         UI     150     128     103      97      87      79      61      61      53      39
         57         UI      39      39      39      19      16      15      15      15      16      15
         58         UI      15      15      15      16       0       0       0       0       0       0
                    *

         59         KK  S115A1   BASIN
         60         KM         Compute runoff from subbasin 115A1
         61         BA   0.590
         62         LG    0.30    0.38    6.40    0.16       4
         63         UI      85     311     576     841     685     477     385     298     215     177
         64         UI     124      98      72      58      42      37      17      16      16      17
         65         UI      16       0       0       0       0       0       0       0       0       0
                    *

         66         KK   CFAN2 COMBINE
         67         KM         Combine runoff from S115A1 and S900 at Fan 2 detention basin
         68         HC       2
         69         ZW                  C=FLOW
                    *

         70         KK   RR900 STORAGE
         71         KM   Proposed Detention Basin
         72         KM    ROUTE RUNOFF FROM S900 THROUGH PROPOSED DETENTION BASIN AT APEX FOR
         73         KM    ALLUVIAL FAN NO. 2
         74         KM    STRUCTURE ID:RR900
         75         KM    OUTLET BASED ON ASSUMED 2 pipe(s), dia: 4 ft
         76         RS       1    STOR      -1
         77         SV     0.0    18.5    37.7    57.5    78.0    99.2   121.0   143.5   166.7   215.3
         78         SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0     7.0     8.0    10.0
         79         SQ     0.0    21.9    46.9    87.9   126.9   157.0   193.0   224.4   252.9   282.9
         80         ZW                  C=FLOW
                    *

         81         KK  TOFAN2   DIVERT
         82         KM      DIVERT OUTFLOWS TO FAN 1 (DIVERSION BASED ON RATIO OF INFLOWING DRAINAGE
         83         KM      AREAS FROM S115A1 (0.59 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 1)
         84         KM      AND S900 (1.147 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 2)
         85         KM      OUTLETS OF RR900 DESIGNED TO APPROXIMATE THIS 34% RATIO.
         86         DT  TOFAN1
         87         DI       0   10000
         88         DQ       0    3400
         89         ZW                  C=FLOW
                    *
1                                     HEC-1 INPUT                                         PAGE  3

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

         90         KK  90091A   ROUTE
         91         KM   Proposed Channel
         92         KM        Route outflow from RR900 through subbasin 910A
         93         KM    Slope=(1808.0 - 1720.0) / 4336.0
         94         RS       3    FLOW      -1
         95         RC   0.045   0.045   0.045  4336.0    0.02   104.5
         96         RX     0.0     0.0     0.0     0.0    50.0    50.0    50.0    50.0
         97         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
         98         ZW                  C=FLOW
                    *

         99         KK   S910A   BASIN
        100         KM        Compute runoff from subbasin 910A
        101         BA   0.273
        102         LG    0.35    0.35    4.45    0.37       0
        103         UI     229     752     635     285     127      50      21       0       0       0
                    *

        104         KK   C910A COMBINE
        105         KM        Combine runoff from S910A with routed outflow from Fan 2 detention basin
        106         HC       2    1.42
        107         ZW                  C=FLOW
                    *

        108         KK  91A91B   ROUTE
        109         KM   Proposed Channel
        110         KM        Route combined flow from C910A through subbasin 910B
        111         KM    Slope=(1720.0 - 1660.0) / 3893.0
        112         RS       2    FLOW      -1
        113         RC   0.045   0.045   0.045  3893.0   0.015   104.5
        114         RX     0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
        115         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
        116         ZW                  C=FLOW
                    *

        117         KK   S910B   BASIN
        118         KM        Compute runoff from subbasin 910B
        119         BA   0.597
        120         LG    0.35    0.35    4.80    0.30       0
        121         UI     489    1615    1398     638     283     117      46       0       0       0
                    *

        122         KK   C910B COMBINE
        123         KM        Combine runoff from S910B with routed flow from C910A at Sun Valley Prky
        124         HC       2   2.017
        125         ZW                  C=FLOW
                    *

        126         KK  91B915   ROUTE
        127         KM   Proposed Channel
        128         KM        Route combined flow to C915
```

```
          129          KM    Slope=(1660.0 - 1623.0) / 3390.0
          130          RS       2    FLOW      -1
          131          RC   0.045   0.045   0.045  3390.0   0.011   105.0
1                                          HEC-1 INPUT                                              PAGE  4

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

          132          RX     0.0     0.0     0.0     0.0   180.0   180.0   180.0   180.0
          133          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
          134          ZW                 C=FLOW
                       *

          135          KK    S915   BASIN
          136          KM    Compute runoff from subbasin 915
          137          BA   1.126
          138          LG    0.25    0.37    6.60    0.14       1
          139          UI     102     163     397     611     809     929     977     949     801     634
          140          UI     506     395     311     248     194     158     113      96      70      71
          141          UI      32      25      25      25      25      26      25       0       0       0
                       *

          142          KK    C915 COMBINE
          143          KM      Combine runoff from S915 with routed flow from C910B
          144          HC       2   3.143
          145          ZW                 C=FLOW
                       *

          146          KK  91592A   ROUTE
          147          KM   Proposed Channel
          148          KM        Route combined flow to C920A
          149          KM    Slope=(1623.0 - 1580.0) / 3859.0
          150          RS       2    FLOW      -1
          151          RC   0.045   0.045   0.045  3859.0   0.011   105.0
          152          RX     0.0     0.0     0.0     0.0   170.0   170.0   170.0   170.0
          153          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
          154          ZW                 C=FLOW
                       *

          155          KK   S920A   BASIN
          156          KM        Compute runoff from subbasin 920A
          157          BA   1.527
          158          LG    0.35    0.35    4.50    0.36       0
          159          UI     375    1465    2447    2631    1917    1163     715     450     262     175
          160          UI      70      69      69       0       0       0       0       0       0       0
                       *

          161          KK   C920A COMBINE
          162          KM        Combine runoff from S920A with routed flow from C915
          163          HC       2    4.67
          164          ZW                 C=FLOW
                       *

          165          KK  92A92B   ROUTE
          166          KM   Proposed Channel
          167          KM        Route combined flow to C920B, outlet at Trilby Wash tributary.
          168          KM    Slope=(1580.0 - 1530.0) / 5003.0
          169          RS       3    FLOW      -1
          170          RC   0.045   0.045   0.045  5003.0    0.01   105.0
          171          RX     0.0     0.0     0.0     0.0   315.0   315.0   315.0   315.0
          172          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
          173          ZW                 C=FLOW
                       *
1                                          HEC-1 INPUT                                              PAGE  5

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

          174          KK   S920B   BASIN
          175          KM        Compute runoff from subbasin 920B
          176          BA   0.479
          177          LG    0.35    0.39    5.80    0.19       0
          178          UI     193     746    1039     787     440     235     128      71      27      27
          179          UI       0       0       0       0       0       0       0       0       0       0
                       *

          180          KK   C920B COMBINE
          181          KM        Combine runoff from S920B with routed flow from C920A
          182          KM        This is the total flow at the downstream end of the Fan 2 corridor.
          183          HC       2   5.149
                       *

          184          KK   S920C   BASIN
          185          KM        Compute runoff from subbasin 920C
          186          BA   1.285
          187          LG    0.35    0.36    6.80    0.13       0
          188          UI     140     311     701    1023    1274    1342    1246     979     738     552
          189          UI     423     304     238     176     134      96      83      34      34      35
          190          UI      34      34       0       0       0       0       0       0       0       0
                       *

          191          KK   C920C COMBINE
          192          KM        Combine runoff from S920C with flow from C920B.  This is the total flow
          193          KM        in the Trilby Wash tributary.
          194          HC       2   6.434
                       *

          195          KK    S110   BASIN
          196          KM        Compute runoff from subbasin 110
          197          BA   0.430
          198          LG    0.25    0.37    5.20    0.25       6
          199          UI      56     166     335     449     587     358     291     241     188     140
          200          UI     121      86      68      56      43      32      27      22      11      11
          201          UI      10      11      11       0       0       0       0       0       0       0
          202          ZW                 C=FLOW
                       *

          203          KK   RR110 STORAGE
          204          KM   Proposed Detention Basin
          205          KM    ROUTE COMBINED RUNOFF AT S110 THROUGH PROPOSED (BIG) DETENTION BASIN
          206          KM    AT ALLUVIAL FAN APEX NO. 1
          207          KM    STRUCTURE ID:RR110
          208          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft
          209          RS       1    STOR      -1
          210          SV     0.0     5.7    11.7    18.1    24.7    31.6    38.9    46.5    54.4    62.7
          211          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0     7.0     8.0     9.0
          212          SQ     0.0    16.3    32.7    55.4    82.6   104.1   127.5   156.5   180.6   210.6
          213          ZW                 C=FLOW
                       *
1                                          HEC-1 INPUT                                              PAGE  6

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

          214          KK  F115A3   ROUTE
          215          KM   Proposed Channel
          216          KM        Route flow from RR110 through subbasin 115A3
          217          KM    Slope=(1865.0 - 1682.0) / 7199.0
          218          RS       5    FLOW      -1
          219          RC   0.045   0.045   0.045  7199.0   0.025   104.5
          220          RX     0.0     0.0     0.0     0.0    95.0    95.0    95.0    95.0
          221          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
          222          ZW                 C=FLOW
                       *

          223          KK  S115A3   BASIN
          224          KM        Compute runoff from subbasin 115A3
          225          BA   0.455
          226          LG    0.30    0.35    4.50    0.36       4
          227          UI      75     307     550     680     636     434     291     190     127      84
          228          UI      53      34      18      18      18       0       0       0       0       0
                       *

          229          KK  C115A3 COMBINE
          230          KM        Combine runoff from S115A3 w/ routed outflow from Fan 1 detention basin
          231          HC       2
                       *

          232          KK  DRR900 RETRIEVE
          233          KM        RETRIEVE DIVERTED OUTFLOW FROM RR900 (FLOW TO FAN 1 FROM FAN 2 BASIN)
          234          DR  TOFAN1
          235          ZW                 C=FLOW
                       *

          236          KK  F215A2   ROUTE
          237          KM   Proposed Channel
          238          KM        Route FAN 2 BASIN OUTFLOWS THRU SUBBASIN S115A2
          239          KM    Slope=(1815.0 - 1682.0) / 6201.0
          240          RS       4    FLOW      -1
          241          RC   0.045   0.045   0.045  6201.0   0.021   104.5
          242          RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
          243          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
          244          ZW                 C=FLOW
                       *

          245          KK  S115A2   BASIN
          246          KM        Compute runoff from subbasin 115A2
          247          BA   0.429
          248          LG    0.35    0.38    5.40    0.23       0
          249          UI     111     434     708     755     521     313     192     118      69      43
          250          UI      20      19       0       0       0       0       0       0       0       0
                       *
1                                          HEC-1 INPUT                                              PAGE  7

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

          251          KK  C115A2 COMBINE
          252          KM        Combine runoff from S115A2 with routed outflow from Fan 2 detention basi
          253          HC       2    1.02
                       *

          254          KK   C115A COMBINE
          255          KM        Combine all flows at C115A (C115A2 + C115A3)
          256          HC       2
          257          ZW                 C=FLOW
                       *

          258          KK  15A15B   ROUTE
          259          KM   Proposed Channel
          260          KM        Route flows to Sun Valley Parkway
          261          KM    Slope=(1682.0 - 1622.0) / 3257.0
          262          RS       2    FLOW      -1
          263          RC   0.045   0.045   0.045  3257.0   0.018   104.5
          264          RX     0.0     0.0     0.0     0.0   160.0   160.0   160.0   160.0
          265          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
          266          ZW                 C=FLOW
                       *

          267          KK   S115B   BASIN
          268          KM        Compute runoff from subbasin 115B
```

```
          269          BA   0.331
          270          LG    0.35    0.35    3.78    0.45       0
          271          UI     169     626     786     483     251     125      66      25      20       0
                       *

          272          KK   C115B COMBINE
          273          KM        Combine runoff from S115B with routed flow from C115A
          274          KM        This is the total inflow to the SVP channel from the Fan 1 corridor.
          275          HC       2
          276          ZW                 C=FLOW
                       *

          277          KK   D115B  DIVERT
          278          KM   Proposed Detention Basin
          279          KM   limit flow to capacity of existing Sun Valley Parkway
          280          KM    STRUCTURE ID:D115B
          281          DT    DOUT
          282          DI     0.0   200.0   400.0   600.0   800.0  1050.0  1100.0  1200.0  1500.0  2000.0
          283          DI  2500.0  3000.0
          284          DQ     0.0     0.0     0.0     0.0     0.0     0.0    50.0   150.0   450.0   950.0
          285          DQ  1450.0  1950.0
          286          ZW                 C=FLOW
                       *

          287          KK  15B15C   ROUTE
          288          KM   This is existing SV PKWY Channel
          289          KM   Note the routing slope is the channel design slope not
          290          KM   the general (adjacent) ground slope.
          291          KM        Route flows in existing Sun Valley Parkway channel
          292          RS       5    FLOW      -1
1                                          HEC-1 INPUT                                          PAGE  8

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

          293          RC    0.03    0.03    0.03  7899.0  0.0015   103.5
          294          RX     0.0    14.0    38.0    44.0    64.0    70.0    94.0   108.0
          295          RY   103.5   100.0   100.0    98.0    98.0   100.0   100.0   103.5
                       *

          296          KK   S115C   BASIN
          297          KM        Compute runoff from subbasin 115C
          298          BA   0.429
          299          LG    0.35    0.35    4.00    0.47       0
          300          UI      64     250     457     595     594     444     299     208     135      93
          301          UI      62      44      23      15      16      16       0       0       0       0
                       *

          302          KK  C115CR COMBINE
          303          KM        Combine runoff from S115C with routed flow from C115B
          304          HC       2
                       *

          305          KK   S120A   BASIN
          306          KM        Compute runoff from subbasin 120A
          307          BA   1.374
          308          LG    0.32    0.35    4.80    0.30       2
          309          UI     180     559    1100    1547    1740    1553    1160     826     580     409
          310          UI     305     205     141     123      43      44      45      44       0       0
          311          ZW                 C=FLOW
                       *

          312          KK   D120A  DIVERT
          313          KM   Proposed Detention Basin
          314          KM   limit flow to capacity of existing Sun Valley Parkway
          315          KM    STRUCTURE ID:D120A
          316          DT    DOUT
          317          DI     0.0   200.0   400.0   600.0   750.0   950.0  1000.0  1150.0  1450.0  1950.0
          318          DI  2450.0  2950.0
          319          DQ     0.0     0.0     0.0     0.0     0.0     0.0    50.0   200.0   500.0  1000.0
          320          DQ  1500.0  2000.0
          321          ZW                 C=FLOW
                       *

          322          KK   C115C COMBINE
          323          KM        Combine non-diverted runoff from S120A with flow from C115CR
          324          HC       2
                       *

          325          KK  115120   ROUTE
          326          KM   This is existing SV PKWY Channel
          327          KM   Note the routing slope is the channel design slope not
          328          KM   the general (adjacent) ground slope.
          329          KM        Route total flows from C115C to C120.
          330          RS       3    FLOW      -1
          331          RC    0.03    0.03    0.03  4136.0  0.0015   104.5
          332          RX     0.0    18.0    52.0    58.0    78.0    84.0   118.0   136.0
          333          RY   104.5   100.0   100.0    98.0    98.0   100.0   100.0   104.5
                       *
1                                          HEC-1 INPUT                                          PAGE  9

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

          334          KK   S120B   BASIN
          335          KM        Compute runoff from subbasin 120B
          336          BA   0.643
          337          LG    0.33    0.35    4.40    0.38       1
          338          UI      77     200     420     606     725     711     600     445     322     239
          339          UI     172     130      91      68      52      33      19      18      19      18
          340          UI       0       0       0       0       0       0       0       0       0       0
                       *

          341          KK   C120B COMBINE
          342          KM        Combine runoff from S120B with routed flow from C120A
          343          KM        This is the total flow at the end of the SVP channel at Wagner Wash.
          344          HC       2   4.681
          345          ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW
   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    50        S900
                .
                .
    59          .       S115A1
                .           .
                .           .
    66        CFAN2.............
                V
                V
    70        RR900
                .
                .
    86          .-------->  TOFAN1
    81        TOFAN2
                V
                V
    90        90091A
                .
                .
    99          .       S910A
                .           .
                .           .
   104        C910A.............
                V
                V
   108        91A91B
                .
                .
   117          .       S910B
                .           .
                .           .
   122        C910B.............
                V
                V
   126        91B915
                .
                .
   135          .       S915
                .           .
                .           .
   142        C915.............
                V
                V
   146        91592A
                .
                .
   155          .       S920A
                .           .
                .           .
   161        C920A.............
                V
                V
   165        92A92B
                .
                .
   174          .       S920B
                .           .
                .           .
   180        C920B.............
                .
                .
   184          .       S920C
                .           .
                .           .
   191        C920C.............
                .
                .
   195          .        S110
                .          V
                .          V
   203          .       RR110
                .          V
                .          V
   214          .       F115A3
                .           .
                .           .
   223          .           .       S115A3
                .           .           .
                .           .           .
   229          .       C115A3............
                .           .
                .           .
   234          .           .           .<-------  TOFAN1
   232          .           .       DRR900
                .           .          V
                .           .          V
```

```
236          .           .       F215A2
             .           .            .
             .           .            .
245          .           .            .      S115A2
             .           .            .            .
             .           .            .            .
251          .           .       C115A2.............
             .           .            .
             .           .            .
254          .       C115A.............
             .           V            .
             .           V            .
258          .      15A15B            .
             .           .            .
             .           .            .
267          .           .        S115B            .
             .           .            .            .
             .           .            .            .
272          .       C115B.............            .
             .           .                         .
             .           .                         .
281          .           .-------->     DOUT       .
277          .       D115B                         .
             .           V                         .
             .           V                         .
287          .      15B15C                         .
             .           .                         .
             .           .                         .
296          .           .        S115C            .
             .           .            .            .
             .           .            .            .
302          .       C115CR............            .
             .           .                         .
             .           .                         .
305          .           .        S120A            .
             .           .            .            .
             .           .            .            .
316          .           .            .-------->     DOUT
312          .           .        D120A
             .           .            .
             .           .            .
322          .       C115C.............
             .           V
             .           V
325          .      115120
             .           .
             .           .
334          .           .        S120B
             .           .            .
             .           .            .
341          .       C120B.............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   19DEC06  TIME  17:52:01   *
*                                       *
*****************************************
```

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

HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
- FAN SYSTEM 1 & 2

SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
MODELER: TED LEHMAN
FILENAME: FANS126.DAT

100-YEAR 6-HOUR MODEL
EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
MODELED AREA = 11.1 SQ. MILES

GREEN-AMPT LOSS METHOD

S-GRAPH UNIT HYDROGRAPHS
- MOUNTAIN
- DESERT/RANGELAND

NORMAL-DEPTH CHANNEL ROUTING

LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
- UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
- HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
- MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %

SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)

```
 29 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

 28 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE     1JAN99  STARTING DATE
                     JXTIME       1200  STARTING TIME

    IT          HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1JAN99  STARTING DATE
                     ITIME       1200  STARTING TIME
                       NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     8JAN99  ENDING DATE
                     NDTIME       1035  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

 30 JD          INDEX STORM NO. 1
                     STRM        3.20  PRECIPITATION DEPTH
                     TRDA         .10  TRANSPOSITION DRAINAGE AREA

 31 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 34 JD          INDEX STORM NO. 2
                     STRM        3.18  PRECIPITATION DEPTH
                     TRDA         .50  TRANSPOSITION DRAINAGE AREA

 35 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 38 JD          INDEX STORM NO. 3
                     STRM        3.12  PRECIPITATION DEPTH
                     TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 39 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 42 JD          INDEX STORM NO. 4
                     STRM        2.95  PRECIPITATION DEPTH
                     TRDA       16.00  TRANSPOSITION DRAINAGE AREA

 43 PI           PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 46 JD          INDEX STORM NO. 5
                     STRM        2.59  PRECIPITATION DEPTH
                     TRDA       90.00  TRANSPOSITION DRAINAGE AREA

 47 PI           PRECIPITATION PATTERN
                    .01       .01       .01       .00       .00       .00       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .05       .05       .05       .05       .05       .05       .04       .04
                    .04       .02       .02       .02       .02       .02       .02       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                    .01       .01

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
                **************
                *            *
  50 KK         *    S900    *        BASIN
                *            *
                **************
                              Compute runoff from subbasin 900

                SUBBASIN RUNOFF DATA

  52 BA           SUBBASIN CHARACTERISTICS
                        TAREA         1.15  SUBBASIN AREA

  53 LG           GREEN AND AMPT LOSS RATE
                        STRTL          .26  STARTING LOSS
                          DTH          .37  MOISTURE DEFICIT
                         PSIF         5.30  WETTING FRONT SUCTION
                        XKSAT          .24  HYDRAULIC CONDUCTIVITY
                        RTIMP         6.00  PERCENT IMPERVIOUS AREA

  51 UI           INPUT UNITGRAPH,  44 ORDINATES,  VOLUME = 1.00
                      79.0      81.0     192.0     329.0     471.0     553.0     629.0     801.0     886.0     579.0
                     495.0     447.0     398.0     367.0     320.0     285.0     242.0     205.0     188.0     176.0
                     150.0     128.0     103.0      97.0      87.0      79.0      61.0      61.0      53.0      39.0
                      39.0      39.0      39.0      19.0      16.0      15.0      15.0      15.0      16.0      15.0
                      15.0      15.0      15.0      16.0
                                                                                                              ***
       ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION      S900
                           TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.53, TOTAL EXCESS =     1.66

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+     1153.        4.50                   204.          51.           17.           7.
                (INCHES)                1.657         1.662         1.662         1.662
                 (AC-FT)                 101.          102.          102.          102.

                           CUMULATIVE AREA =     1.15 SQ MI

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

                            HYDROGRAPH AT STATION      S900
                           TRANSPOSITION AREA        .5 SQ MI

     TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.53, TOTAL EXCESS =     1.65

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+     1146.        4.50                   203.          51.           17.           7.
                (INCHES)                1.645         1.650         1.650         1.650
                 (AC-FT)                 101.          101.          101.          101.

                           CUMULATIVE AREA =     1.15 SQ MI

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

                            HYDROGRAPH AT STATION      S900
                           TRANSPOSITION AREA       2.8 SQ MI

     TOTAL RAINFALL =     3.12, TOTAL LOSS =     1.76, TOTAL EXCESS =     1.36

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+      783.        4.50                   167.          42.           14.           6.
                (INCHES)                1.356         1.363         1.363         1.363
                 (AC-FT)                 83.           83.           83.           83.

                           CUMULATIVE AREA =     1.15 SQ MI

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

                            HYDROGRAPH AT STATION      S900
                           TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =     2.95, TOTAL LOSS =     1.89, TOTAL EXCESS =     1.06

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+      582.        4.58                   130.          33.           11.           5.
                (INCHES)                1.055         1.063         1.063         1.063
                 (AC-FT)                 65.           65.           65.           65.

                           CUMULATIVE AREA =     1.15 SQ MI
```

```
       ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION      S900
                           TRANSPOSITION AREA       90.0 SQ MI

     TOTAL RAINFALL =     2.59, TOTAL LOSS =     1.93, TOTAL EXCESS =      .66

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+      347.        4.58                    80.           20.            7.           3.
                (INCHES)                 .648          .658          .658          .658
                 (AC-FT)                 40.           40.           40.           40.

                           CUMULATIVE AREA =     1.15 SQ MI

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

                            INTERPOLATED HYDROGRAPH AT      S900

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+      971.        4.50                   186.          47.           16.           7.
                (INCHES)                1.506         1.512         1.512         1.512
                 (AC-FT)                 92.           92.           92.           92.

                           CUMULATIVE AREA =     1.15 SQ MI


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

                **************
                *            *
  59 KK         *   S115A1   *        BASIN
                *            *
                **************
                              Compute runoff from subbasin 115A1

                SUBBASIN RUNOFF DATA

  61 BA           SUBBASIN CHARACTERISTICS
                        TAREA          .59  SUBBASIN AREA

  62 LG           GREEN AND AMPT LOSS RATE
                        STRTL          .30  STARTING LOSS
                          DTH          .38  MOISTURE DEFICIT
                         PSIF         6.40  WETTING FRONT SUCTION
                        XKSAT          .16  HYDRAULIC CONDUCTIVITY
                        RTIMP         4.00  PERCENT IMPERVIOUS AREA

  60 UI           INPUT UNITGRAPH,  21 ORDINATES,  VOLUME = 1.00
                      85.0     311.0     576.0     841.0     685.0     477.0     385.0     298.0     215.0     177.0
                     124.0      98.0      72.0      58.0      42.0      37.0      17.0      16.0      16.0      17.0
                      16.0
                                                                                                              ***
       ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION    S115A1
                           TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.47, TOTAL EXCESS =     1.72

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+     1033.        4.17                   109.          27.            9.           4.
                (INCHES)                1.719         1.720         1.720         1.720
                 (AC-FT)                 54.           54.           54.           54.

                           CUMULATIVE AREA =      .59 SQ MI

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

                            HYDROGRAPH AT STATION    S115A1
                           TRANSPOSITION AREA        .5 SQ MI

     TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.47, TOTAL EXCESS =     1.71

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR     166.58-HR
+    (CFS)         (HR)
                    (CFS)
+     1026.        4.17                   108.          27.            9.           4.
                (INCHES)                1.707         1.708         1.708         1.708
                 (AC-FT)                 54.           54.           54.           54.

                           CUMULATIVE AREA =      .59 SQ MI
```

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

                          HYDROGRAPH AT STATION   S115A1
                        TRANSPOSITION AREA      2.8 SQ MI

      TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.67, TOTAL EXCESS =    1.45

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     628.       4.25                 92.         23.          8.          3.
                 (INCHES)          1.443       1.444       1.444       1.444
                 (AC-FT)             45.         45.         45.         45.

                          CUMULATIVE AREA =     .59 SQ MI

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

                          HYDROGRAPH AT STATION   S115A1
                        TRANSPOSITION AREA     16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.79, TOTAL EXCESS =    1.16

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     468.       4.25                 73.         18.          6.          3.
                 (INCHES)          1.154       1.156       1.156       1.156
                 (AC-FT)             36.         36.         36.         36.

                          CUMULATIVE AREA =     .59 SQ MI

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

                          HYDROGRAPH AT STATION   S115A1
                        TRANSPOSITION AREA     90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.85, TOTAL EXCESS =     .74

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     291.       4.25                 47.         12.          4.          2.
                 (INCHES)           .739        .741        .741        .741
                 (AC-FT)             23.         23.         23.         23.

                          CUMULATIVE AREA =     .59 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT   S115A1

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     988.       4.17                107.         27.          9.          4.
                 (INCHES)          1.681       1.682       1.682       1.682
                 (AC-FT)             53.         53.         53.         53.

                          CUMULATIVE AREA =     .59 SQ MI



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


            **************
            *            *
   66 KK    *     CFAN2  *      COMBINE
            *            *
            **************
                          Combine runoff from S115A1 and S900 at Fan 2 detention basin

   68 HC           HYDROGRAPH COMBINATION
                         ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                         ***

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

                          HYDROGRAPH AT STATION    CFAN2
                        TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+    1774.       4.25                313.         79.         26.         11.
                 (INCHES)          1.676       1.682       1.682       1.682
                 (AC-FT)             155.        156.        156.        156.

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    CFAN2
                        TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+    1762.       4.25                311.         78.         26.         11.
                 (INCHES)          1.664       1.670       1.670       1.670
                 (AC-FT)             154.        155.        155.        155.

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    CFAN2
                        TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+    1271.       4.42                259.         65.         22.          9.
                 (INCHES)          1.384       1.391       1.391       1.391
                 (AC-FT)             128.        129.        129.        129.

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    CFAN2
                        TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     953.       4.42                203.         51.         17.          7.
                 (INCHES)          1.087       1.095       1.095       1.095
                 (AC-FT)             101.        101.        101.        101.

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    CFAN2
                        TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+     583.       4.42                127.         32.         11.          5.
                 (INCHES)           .677        .686        .686        .686
                 (AC-FT)              63.         64.         64.         64.

                          CUMULATIVE AREA =     1.74 SQ MI

     -----DSS---ZOPEN:  Existing File Opened,  File: FANS126.DSS
                        Unit:  71;  DSS Version: 6-JG
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   40:  //CFAN2/FLOW/08JAN1999/5MIN//
          ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT    CFAN2

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                    (CFS)
+    1388.       4.33                273.         69.         23.         10.
                 (INCHES)          1.462       1.468       1.468       1.468
                 (AC-FT)             135.        136.        136.        136.

                          CUMULATIVE AREA =     1.74 SQ MI



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


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              *             *
   70 KK      *    RR900    *      STORAGE
              *             *
              ***************
                             Proposed Detention Basin
                              ROUTE RUNOFF FROM S900 THROUGH PROPOSED DETENTION BASIN AT APEX FOR
                              ALLUVIAL FAN NO. 2
                              STRUCTURE ID:RR900
                              OUTLET BASED ON ASSUMED 2 pipe(s), dia: 4 ft

                HYDROGRAPH ROUTING DATA

   76 RS          STORAGE ROUTING
                        NSTPS          1  NUMBER OF SUBREACHES
                         ITYP       STOR  TYPE OF INITIAL CONDITION
                       RSVRIC      -1.00  INITIAL CONDITION
                            X        .00 WORKING R AND D COEFFICIENT

   77 SV           STORAGE        .0      18.5      37.7      57.5      78.0      99.2     121.0     143.5     166.7     215.3

   78 SE          ELEVATION      .00      1.00      2.00      3.00      4.00      5.00      6.00      7.00      8.00     10.00

   79 SQ          DISCHARGE       0.       22.       47.       88.      127.      157.      193.      224.      253.      283.

                                                                ***

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

                          HYDROGRAPH AT STATION    RR900
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+     199.       5.75                     163.          73.          26.          11.
                             (INCHES)     .871        1.555        1.680        1.682
                              (AC-FT)      81.         144.         156.         156.

 PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       125.      5.75                     102.          49.          18.           8.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
       6.18      5.75                     5.12         2.53          .93          .40

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    RR900
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+     197.       5.75                     162.          72.          26.          11.
                             (INCHES)     .865        1.544        1.668        1.670
                              (AC-FT)      80.         143.         155.         155.

 PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       124.      5.75                     101.          49.          18.           8.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
       6.14      5.75                     5.09         2.52          .93          .40

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    RR900
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+     163.       5.75                     134.          60.          22.           9.
                             (INCHES)     .717        1.279        1.389        1.391
                              (AC-FT)      66.         119.         129.         129.

 PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       103.      5.75                      84.          41.          15.           7.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
       5.17      5.75                     4.28         2.15          .79          .34

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    RR900
                        TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+     131.       5.83                     104.          47.          17.           7.
                             (INCHES)     .556        1.000        1.094        1.095
                              (AC-FT)      51.          93.         101.         101.

 PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        81.      5.83                      66.          33.          12.           5.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
       4.13      5.83                     3.42         1.75          .65          .28

                          CUMULATIVE AREA =     1.74 SQ MI

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

                          HYDROGRAPH AT STATION    RR900
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+      75.       5.92                      58.          29.          11.           5.
                             (INCHES)     .313         .617         .685         .686
                              (AC-FT)      29.          57.          63.          64.

 PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        51.      5.92                      43.          23.           8.           4.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
       2.68      5.92                     2.27         1.20          .45          .19

                          CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR900/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***

                          INTERPOLATED HYDROGRAPH AT    RR900

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                               (CFS)
+     173.       5.75                     142.          63.          23.          10.
                             (INCHES)     .758        1.353        1.466        1.468
                              (AC-FT)      70.         125.         136.         136.

                          CUMULATIVE AREA =     1.74 SQ MI

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

              ***************
              *             *
   81 KK      *   TOFAN2    *      DIVERT
              *             *
              ***************
                             DIVERT OUTFLOWS TO FAN 1 (DIVERSION BASED ON RATIO OF INFLOWING DRAINAGE
                             AREAS FROM S115A1 (0.59 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 1)
                             AND S900 (1.147 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 2)
                             OUTLETS OF RR900 DESIGNED TO APPROXIMATE THIS 34% RATIO.

      DT          DIVERSION
                      ISTAD       TOFAN1  DIVERSION HYDROGRAPH IDENTIFICATION
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      DI             INFLOW          .00  10000.00

      DQ       DIVERTED FLOW         .00   3400.00

                                                                  ***

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

                          DIVERSION HYDROGRAPH   TOFAN1
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      68.      5.75                55.          25.           9.           4.
                (INCHES)          .296         .529         .571         .572
                 (AC-FT)           27.          49.          53.          53.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                          HYDROGRAPH AT STATION   TOFAN2
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     131.      5.75               107.          48.          17.           7.
                (INCHES)          .575        1.026        1.109        1.110
                 (AC-FT)           53.          95.         103.         103.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                          DIVERSION HYDROGRAPH   TOFAN1
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      67.      5.75                55.          25.           9.           4.
                (INCHES)          .294         .525         .567         .568
                 (AC-FT)           27.          49.          53.          53.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                          HYDROGRAPH AT STATION   TOFAN2
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     130.      5.75               107.          48.          17.           7.
                (INCHES)          .571        1.019        1.101        1.102
                 (AC-FT)           53.          94.         102.         102.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                          DIVERSION HYDROGRAPH   TOFAN1
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      55.      5.75                46.          20.           7.           3.
                (INCHES)          .244         .435         .472         .473
                 (AC-FT)           23.          40.          44.          44.
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                                CUMULATIVE AREA =    1.74 SQ MI

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

                          HYDROGRAPH AT STATION   TOFAN2
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     108.      5.75                88.          39.          14.           6.
                (INCHES)          .473         .844         .917         .918
                 (AC-FT)           44.          78.          85.          85.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                          DIVERSION HYDROGRAPH   TOFAN1
                        TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      44.      5.83                35.          16.           6.           3.
                (INCHES)          .189         .340         .372         .372
                 (AC-FT)           18.          32.          34.          34.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                          HYDROGRAPH AT STATION   TOFAN2
                        TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      86.      5.83                69.          31.          11.           5.
                (INCHES)          .367         .660         .722         .723
                 (AC-FT)           34.          61.          67.          67.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                          DIVERSION HYDROGRAPH   TOFAN1
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      25.      5.92                20.          10.           4.           2.
                (INCHES)          .106         .210         .233         .233
                 (AC-FT)           10.          19.          22.          22.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                          HYDROGRAPH AT STATION   TOFAN2
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      49.      5.92                39.          19.           7.           3.
                (INCHES)          .207         .407         .452         .453
                 (AC-FT)           19.          38.          42.          42.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/02JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //TOFAN2/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                            INTERPOLATED DIVERSION HYDROGRAPH AT   TOFAN1

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +       59.      5.75                   48.          21.           8.           3.
                                (INCHES) .258         .460         .499         .499
                                 (AC-FT)  24.          43.          46.          46.

                                 CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //TOFAN2/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                                INTERPOLATED HYDROGRAPH AT   TOFAN2

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +      114.      5.75                   93.          42.          15.           7.
                                (INCHES) .500         .893         .968         .969
                                 (AC-FT)  46.          83.          90.          90.

                                 CUMULATIVE AREA =     1.74 SQ MI


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


          **************
          *            *
   90 KK  *    90091A  *        ROUTE
          *            *
          **************
                          Proposed Channel
                               Route outflow from RR900 through subbasin 910A
                           Slope=(1808.0 - 1720.0) / 4336.0

             HYDROGRAPH ROUTING DATA

   94 RS          STORAGE ROUTING
                         NSTPS          3  NUMBER OF SUBREACHES
                          ITYP       FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC      -1.00  INITIAL CONDITION
                             X        .00 WORKING R AND D COEFFICIENT

   95 RC          NORMAL DEPTH CHANNEL
                           ANL       .045  LEFT OVERBANK N-VALUE
                          ANCH       .045  MAIN CHANNEL N-VALUE
                           ANR       .045  RIGHT OVERBANK N-VALUE
                         RLNTH      4336.  REACH LENGTH
                           SEL      .0200  ENERGY SLOPE
                         ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   97 RY        ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
   96 RX        DISTANCE       .00       .00       .00       .00     50.00     50.00     50.00     50.00

                                                               ***

                                           COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE         .00       1.18       2.36       3.54       4.72       5.89       7.07       8.25       9.43      10.61
              OUTFLOW         .00      21.16      66.97     131.22     211.29     305.53     412.75     532.03     662.62     803.89
            ELEVATION      100.00     100.24     100.47     100.71     100.95     101.18     101.42     101.66     101.89     102.13

              STORAGE       11.79      12.97      14.15      15.32      16.50      17.68      18.86      20.04      21.22      22.40
              OUTFLOW      955.32    1116.43    1286.80    1466.06    1653.88    1849.95    2053.98    2265.72    2484.92    2711.36
            ELEVATION      102.37     102.61     102.84     103.08     103.32     103.55     103.79     104.03     104.26     104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      413. TO      2711.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

      ***           ***           ***           ***           ***
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                            HYDROGRAPH AT STATION   90091A
                           TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +      131.      5.92                  107.          48.          17.           7.
                                (INCHES) .573        1.024        1.109        1.110
                                 (AC-FT)  53.          95.         103.         103.

  PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          1.      5.92                    1.           1.           0.           0.

   PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.71      5.92                 100.62       100.34       100.13       100.06

                                 CUMULATIVE AREA =     1.74 SQ MI


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

                            HYDROGRAPH AT STATION   90091A
                           TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +      130.      5.92                  106.          47.          17.           7.
                                (INCHES) .569        1.017        1.101        1.102
                                 (AC-FT)  53.          94.         102.         102.

  PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          1.      5.92                    1.           1.           0.           0.

   PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.71      5.92                 100.62       100.34       100.13       100.06

                                 CUMULATIVE AREA =     1.74 SQ MI


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

                            HYDROGRAPH AT STATION   90091A
                           TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +      107.      6.00                   88.          39.          14.           6.
                                (INCHES) .471         .843         .917         .918
                                 (AC-FT)  44.          78.          85.          85.

  PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          1.      5.92                    1.           1.           0.           0.

   PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.62      6.00                 100.55       100.30       100.11       100.05

                                 CUMULATIVE AREA =     1.74 SQ MI


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

                            HYDROGRAPH AT STATION   90091A
                           TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                  (CFS)
 +       86.      6.00                   68.          31.          11.           5.
                                (INCHES) .365         .659         .722         .723
                                 (AC-FT)  34.          61.          67.          67.

  PEAK STORAGE    TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          1.      5.92                    1.           0.           0.           0.

   PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.54      6.08                 100.47       100.26       100.10       100.04
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                              CUMULATIVE AREA =     1.74 SQ MI

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

                               HYDROGRAPH AT STATION    90091A
                             TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      49.       6.25                     38.          19.           7.           3.
                              (INCHES)    .205         .406         .452         .453
                               (AC-FT)     19.          38.          42.          42.

  PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          1.      6.17                      1.           0.           0.           0.

   PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
      100.38      6.25                  100.33       100.19       100.07       100.03

                              CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //90091A/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***

                              INTERPOLATED HYDROGRAPH AT    90091A

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     114.       6.00                     93.          42.          15.           7.
                              (INCHES)    .498         .891         .968         .969
                               (AC-FT)     46.          83.          90.          90.

                              CUMULATIVE AREA =     1.74 SQ MI


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

              **************
              *            *
   99 KK      *   S910A    *       BASIN
              *            *
              **************
                                   Compute runoff from subbasin 910A

                 SUBBASIN RUNOFF DATA

  101 BA           SUBBASIN CHARACTERISTICS
                        TAREA          .27  SUBBASIN AREA

  102 LG           GREEN AND AMPT LOSS RATE
                        STRTL          .35  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.45  WETTING FRONT SUCTION
                        XKSAT          .37  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

  100 UI           INPUT UNITGRAPH,    7 ORDINATES,   VOLUME =  .99
                      229.0     752.0     635.0     285.0     127.0      50.0      21.0
                                                                     ***

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

                              HYDROGRAPH AT STATION    S910A
                            TRANSPOSITION AREA      .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.83, TOTAL EXCESS =     1.36

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     682.       4.08                     40.          10.           3.           1.
                              (INCHES)   1.352        1.352        1.352        1.352
                               (AC-FT)     20.          20.          20.          20.

                              CUMULATIVE AREA =      .27 SQ MI

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

                              HYDROGRAPH AT STATION    S910A
                            TRANSPOSITION AREA      .5 SQ MI

     TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.83, TOTAL EXCESS =     1.35

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     678.       4.08                     39.          10.           3.           1.
                              (INCHES)   1.340        1.340        1.340        1.340
                               (AC-FT)     20.          20.          20.          20.

                              CUMULATIVE AREA =      .27 SQ MI

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

                              HYDROGRAPH AT STATION    S910A
                            TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =     3.12, TOTAL LOSS =     2.10, TOTAL EXCESS =     1.02

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     321.       4.08                     30.           7.           2.           1.
                              (INCHES)   1.009        1.009        1.009        1.009
                               (AC-FT)     15.          15.          15.          15.

                              CUMULATIVE AREA =      .27 SQ MI

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

                              HYDROGRAPH AT STATION    S910A
                            TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =     2.95, TOTAL LOSS =     2.24, TOTAL EXCESS =      .71

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     218.       4.08                     21.           5.           2.           1.
                              (INCHES)    .708         .708         .708         .708
                               (AC-FT)     10.          10.          10.          10.

                              CUMULATIVE AREA =      .27 SQ MI

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

                              HYDROGRAPH AT STATION    S910A
                            TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =     2.59, TOTAL LOSS =     2.27, TOTAL EXCESS =      .32

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     109.       4.08                      9.           2.           1.           0.
                              (INCHES)    .322         .322         .322         .322
                               (AC-FT)      5.           5.           5.           5.

                              CUMULATIVE AREA =      .27 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT    S910A

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     680.       4.08                     39.          10.           3.           1.
                              (INCHES)   1.345        1.345        1.345        1.345
                               (AC-FT)     20.          20.          20.          20.

                              CUMULATIVE AREA =      .27 SQ MI


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

              **************
              *            *
  104 KK      *   C910A    *       COMBINE
              *            *
              **************

                                   Combine runoff from S910A with routed outflow from Fan 2 detention basin
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 106 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

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

                         HYDROGRAPH AT STATION    C910A
                        TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      684.      4.08                134.          58.          21.           9.
                (INCHES)              .878        1.506        1.617         1.618
                 (AC-FT)               66.         114.         122.          123.

                 CUMULATIVE AREA =     1.42 SQ MI

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

                         HYDROGRAPH AT STATION    C910A
                        TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      680.      4.08                133.          57.          20.           9.
                (INCHES)              .871        1.495        1.604         1.606
                 (AC-FT)               66.         113.         122.          122.

                 CUMULATIVE AREA =     1.42 SQ MI

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

                         HYDROGRAPH AT STATION    C910A
                        TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      322.      4.08                106.          47.          17.           7.
                (INCHES)              .694        1.219        1.315         1.316
                 (AC-FT)               53.          92.         100.          100.

                 CUMULATIVE AREA =     1.42 SQ MI

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

                         HYDROGRAPH AT STATION    C910A
                        TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      220.      4.08                 80.          36.          13.           6.
                (INCHES)              .525         .938        1.019         1.020
                 (AC-FT)               40.          71.          77.           77.

                 CUMULATIVE AREA =     1.42 SQ MI

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

                         HYDROGRAPH AT STATION    C910A
                        TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      111.      4.08                 43.          21.           8.           3.
                (INCHES)              .279         .556         .615          .616
                 (AC-FT)               21.          42.          47.           47.

                 CUMULATIVE AREA =     1.42 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   40:  //C910A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                         INTERPOLATED HYDROGRAPH AT    C910A

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      463.      4.08                116.          51.          18.           8.
                (INCHES)              .763        1.328        1.429         1.430
                 (AC-FT)               58.         101.         108.          108.

                 CUMULATIVE AREA =     1.42 SQ MI


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

              **************
              *            *
 108 KK       *    91A91B  *        ROUTE
              *            *
              **************
                        Proposed Channel
                           Route combined flow from C910A through subbasin 910B
                         Slope=(1720.0 - 1660.0) / 3893.0

                    HYDROGRAPH ROUTING DATA

 112 RS           STORAGE ROUTING
                       NSTPS           2  NUMBER OF SUBREACHES
                       ITYP        FLOW   TYPE OF INITIAL CONDITION
                      RSVRIC       -1.00  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

 113 RC           NORMAL DEPTH CHANNEL
                        ANL         .045  LEFT OVERBANK N-VALUE
                       ANCH         .045  MAIN CHANNEL N-VALUE
                        ANR         .045  RIGHT OVERBANK N-VALUE
                      RLNTH        3893.  REACH LENGTH
                        SEL        .0150  ENERGY SLOPE
                      ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 115 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 114 RX        DISTANCE        .00       .00       .00       .00     60.00     60.00     60.00     60.00

                                                    ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      1.27      2.54      3.81      5.08      6.35      7.62      8.89     10.16     11.43
          OUTFLOW        .00     22.00     69.67    136.58    220.03    318.34    430.26    554.88    691.42    839.25
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE      12.70     13.97     15.24     16.51     17.78     19.05     20.32     21.59     22.86     24.13
          OUTFLOW     997.82   1166.65   1345.33   1533.48   1730.75   1936.83   2151.44   2374.31   2605.20   2843.88
        ELEVATION     102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     1345. TO     2844.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                         HYDROGRAPH AT STATION   91A91B
                        TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      577.      4.17                131.          57.          21.           9.
                (INCHES)              .859        1.501        1.617         1.618
                 (AC-FT)               65.         114.         122.          123.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        5.      4.17                  2.          1.           0.            0.

   PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.70     4.17               100.67      100.37       100.14        100.06

                 CUMULATIVE AREA =     1.42 SQ MI

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

                         HYDROGRAPH AT STATION   91A91B
                        TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                   (CFS)
+      572.      4.17                130.          57.          20.           9.
                (INCHES)              .853        1.490        1.604         1.606
                 (AC-FT)               65.         113.         122.          122.
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 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)      (HR)
       5.       4.17                       2.           1.            0.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+   (FEET)      (HR)
    101.69      4.17                    100.66        100.37        100.14       100.06

                          CUMULATIVE AREA =     1.42 SQ MI


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

                            HYDROGRAPH AT STATION    91A91B
                          TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     278.      4.17                      104.           46.           17.           7.
                         (INCHES)         .679         1.214         1.315        1.316
                          (AC-FT)          51.           92.          100.         100.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)      (HR)
       3.       4.17                       2.           1.            0.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+   (FEET)      (HR)
    101.09      4.17                    100.59        100.33        100.12       100.05

                          CUMULATIVE AREA =     1.42 SQ MI


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

                            HYDROGRAPH AT STATION    91A91B
                          TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     183.      4.25                       78.           36.           13.           6.
                         (INCHES)         .512          .934         1.019        1.020
                          (AC-FT)          39.           71.           77.          77.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)      (HR)
       2.       4.25                       1.           1.            0.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+   (FEET)      (HR)
    100.84      4.25                    100.50        100.28        100.10       100.04

                          CUMULATIVE AREA =     1.42 SQ MI


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

                            HYDROGRAPH AT STATION    91A91B
                          TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+      77.      4.33                       41.           21.            8.           3.
                         (INCHES)         .270          .554          .615         .616
                          (AC-FT)          20.           42.           47.          47.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)      (HR)
       1.       4.33                       1.           1.            0.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR         24-HR         72-HR    166.58-HR
+   (FEET)      (HR)
    100.50      4.33                    100.33        100.20        100.07       100.03

                          CUMULATIVE AREA =     1.42 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //91A91B/FLOW/08JAN1999/5MIN//
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                          INTERPOLATED HYDROGRAPH AT    91A91B

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     394.      4.17                      114.           50.           18.           8.
                         (INCHES)         .747         1.323         1.429        1.430
                          (AC-FT)          57.          100.          108.         108.

                          CUMULATIVE AREA =     1.42 SQ MI


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              *            *
 117 KK       *    S910B   *        BASIN
              *            *
              **************

                          Compute runoff from subbasin 910B

                SUBBASIN RUNOFF DATA

 119 BA           SUBBASIN CHARACTERISTICS
                        TAREA        .60  SUBBASIN AREA

 120 LG           GREEN AND AMPT LOSS RATE
                        STRTL        .35  STARTING LOSS
                          DTH        .35  MOISTURE DEFICIT
                         PSIF       4.80  WETTING FRONT SUCTION
                        XKSAT        .30  HYDRAULIC CONDUCTIVITY
                        RTIMP        .00  PERCENT IMPERVIOUS AREA

 118 UI           INPUT UNITGRAPH,    7 ORDINATES,  VOLUME =  .99
                     489.0    1615.0    1398.0     638.0     283.0     117.0      46.0
                                                                   ***

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

                            HYDROGRAPH AT STATION     S910B
                          TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.74, TOTAL EXCESS =     1.46

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1534.      4.08                       93.           23.            8.           3.
                         (INCHES)        1.446         1.446         1.446        1.446
                          (AC-FT)          46.           46.           46.          46.

                          CUMULATIVE AREA =      .60 SQ MI


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

                            HYDROGRAPH AT STATION     S910B
                          TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.74, TOTAL EXCESS =     1.45

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1524.      4.08                       92.           23.            8.           3.
                         (INCHES)        1.434         1.434         1.434        1.434
                          (AC-FT)          46.           46.           46.          46.

                          CUMULATIVE AREA =      .60 SQ MI


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

                            HYDROGRAPH AT STATION     S910B
                          TRANSPOSITION AREA       2.8 SQ MI

   TOTAL RAINFALL =     3.12, TOTAL LOSS =     1.99, TOTAL EXCESS =     1.13

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     744.      4.08                       72.           18.            6.           3.
                         (INCHES)        1.122         1.122         1.122        1.122
                          (AC-FT)          36.           36.           36.          36.

                          CUMULATIVE AREA =      .60 SQ MI


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                    HYDROGRAPH AT STATION    S910B
                  TRANSPOSITION AREA     16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.12, TOTAL EXCESS =     .83

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +    521.       4.08                    53.         13.          4.           2.
                           (INCHES)    .822        .822        .822         .822
                            (AC-FT)     26.         26.         26.          26.

                          CUMULATIVE AREA =     .60 SQ MI


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

                    HYDROGRAPH AT STATION    S910B
                  TRANSPOSITION AREA     90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.17, TOTAL EXCESS =     .42

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +    283.       4.08                    27.          7.          2.           1.
                           (INCHES)    .419        .419        .419         .419
                            (AC-FT)     13.         13.         13.          13.

                          CUMULATIVE AREA =     .60 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT     S910B

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +   1444.       4.08                    90.         22.          7.           3.
                           (INCHES)   1.402       1.402       1.402        1.402
                            (AC-FT)     45.         45.         45.          45.

                          CUMULATIVE AREA =     .60 SQ MI


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              *            *
 122 KK       *    C910B   *       COMBINE
              *            *
              **************
                                   Combine runoff from S910B with routed flow from C910A at Sun Valley Prky

 124 HC           HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

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

                    HYDROGRAPH AT STATION    C910B
                  TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +   1986.       4.08                   220.         80.         28.          12.
                           (INCHES)   1.014       1.483       1.566        1.567
                            (AC-FT)    109.        160.        168.         169.

                          CUMULATIVE AREA =    2.02 SQ MI


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

                    HYDROGRAPH AT STATION    C910B
                  TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +   1971.       4.08                   218.         80.         28.          12.
                           (INCHES)   1.005       1.471       1.554        1.555
                            (AC-FT)    108.        158.        167.         167.

                          CUMULATIVE AREA =    2.02 SQ MI


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                    HYDROGRAPH AT STATION    C910B
                  TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +    978.       4.08                   172.         64.         23.          10.
                           (INCHES)    .794       1.185       1.258        1.259
                            (AC-FT)     85.        128.        135.         135.

                          CUMULATIVE AREA =    2.02 SQ MI


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

                    HYDROGRAPH AT STATION    C910B
                  TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +    656.       4.08                   128.         49.         17.           8.
                           (INCHES)    .590        .900        .961         .961
                            (AC-FT)     64.         97.        103.         103.

                          CUMULATIVE AREA =    2.02 SQ MI


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

                    HYDROGRAPH AT STATION    C910B
                  TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +    314.       4.08                    66.         28.         10.           4.
                           (INCHES)    .305        .513        .557         .557
                            (AC-FT)     33.         55.         60.          60.

                          CUMULATIVE AREA =    2.02 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C910B/FLOW/08JAN1999/5MIN//
         ***          ***          ***          ***          ***


                    INTERPOLATED HYDROGRAPH AT     C910B

   PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +   1167.       4.08                   181.         67.         24.          10.
                           (INCHES)    .834       1.240       1.314        1.315
                            (AC-FT)     90.        133.        141.         141.

                          CUMULATIVE AREA =    2.02 SQ MI


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


              **************
              *            *
 126 KK       *   91B915   *       ROUTE
              *            *
              **************
                         Proposed Channel
                              Route combined flow to C915
                          Slope=(1660.0 - 1623.0) / 3390.0

      HYDROGRAPH ROUTING DATA

 130 RS          STORAGE ROUTING
                       NSTPS           2  NUMBER OF SUBREACHES
                        ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC       -1.00  INITIAL CONDITION
                           X         .00  WORKING R AND D COEFFICIENT

 131 RC          NORMAL DEPTH CHANNEL
                         ANL        .045  LEFT OVERBANK N-VALUE
                        ANCH        .045  MAIN CHANNEL N-VALUE
                         ANR        .045  RIGHT OVERBANK N-VALUE
                       RLNTH       3390.  REACH LENGTH
                         SEL       .0110  ENERGY SLOPE
                       ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
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                                             CROSS-SECTION DATA
                             --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 133 RY         ELEVATION   105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 132 RX         DISTANCE       .00       .00       .00       .00    180.00    180.00    180.00    180.00

                                                             ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                  STORAGE       .00      3.69      7.37     11.06     14.75     18.43     22.12     25.80     29.49     33.18
                  OUTFLOW       .00     67.49    214.05    420.32    678.25    982.85   1330.56   1718.67   2145.00   2607.74
                ELEVATION    100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

                  STORAGE     36.86     40.55     44.24     47.92     51.61     55.30     58.98     62.67     66.36     70.04
                  OUTFLOW   3105.34   3636.47   4199.95   4794.74   5419.90   6074.57   6757.97   7469.38   8208.13   8973.62
                ELEVATION    102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     3636. TO     8974.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                     HYDROGRAPH AT STATION    91B915
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    1634.      4.17                    215.           80.           28.           12.
                         (INCHES)       .990         1.479         1.566         1.567
                          (AC-FT)       106.          159.          168.          169.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+  (AC-FT)      (HR)
       13.      4.17                      3.            2.            1.            0.

  PEAK STAGE    TIME                               MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+   (FEET)      (HR)
    101.78      4.17                  100.46        100.22        100.08        100.03

                      CUMULATIVE AREA =     2.02 SQ MI


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

                     HYDROGRAPH AT STATION    91B915
                  TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    1618.      4.17                    213.           80.           28.           12.
                         (INCHES)       .981         1.467         1.554         1.555
                          (AC-FT)       106.          158.          167.          167.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+  (AC-FT)      (HR)
       12.      4.17                      3.            1.            1.            0.

  PEAK STAGE    TIME                               MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+   (FEET)      (HR)
    101.77      4.17                  100.45        100.21        100.08        100.03

                      CUMULATIVE AREA =     2.02 SQ MI


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

                     HYDROGRAPH AT STATION    91B915
                  TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     862.      4.25                    167.           64.           23.           10.
                         (INCHES)       .770         1.182         1.258         1.259
                          (AC-FT)        83.          127.          135.          135.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+  (AC-FT)      (HR)
        8.      4.25                      3.            1.            0.            0.

  PEAK STAGE    TIME                               MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+   (FEET)      (HR)
    101.21      4.25                  100.41        100.19        100.07        100.03

                      CUMULATIVE AREA =     2.02 SQ MI
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       ***          ***          ***          ***          ***

                     HYDROGRAPH AT STATION    91B915
                  TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     561.      4.25                    124.           49.           17.            8.
                         (INCHES)       .570          .897          .961          .961
                          (AC-FT)        61.           96.          103.          103.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+  (AC-FT)      (HR)
        7.      4.25                      2.            1.            0.            0.

  PEAK STAGE    TIME                               MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+   (FEET)      (HR)
    100.93      4.25                  100.35        100.16        100.06        100.02

                      CUMULATIVE AREA =     2.02 SQ MI


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

                     HYDROGRAPH AT STATION    91B915
                  TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     249.      4.42                     64.           28.           10.            4.
                         (INCHES)       .294          .511          .557          .557
                          (AC-FT)        32.           55.           60.           60.

 PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+  (AC-FT)      (HR)
        4.      4.42                      1.            1.            0.            0.

  PEAK STAGE    TIME                               MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR      166.58-HR
+   (FEET)      (HR)
    100.57      4.42                  100.21        100.10        100.04        100.02

                      CUMULATIVE AREA =     2.02 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91B915/FLOW/08JAN1999/5MIN//
       ***          ***          ***          ***          ***


                      INTERPOLATED HYDROGRAPH AT   91B915

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     995.      4.25                    176.           67.           24.           10.
                         (INCHES)       .810         1.236         1.314         1.315
                          (AC-FT)        87.          133.          141.          141.

                      CUMULATIVE AREA =     2.02 SQ MI


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


            **************
            *            *
 135 KK     *     S915   *        BASIN
            *            *
            **************
                         Compute runoff from subbasin 915

               SUBBASIN RUNOFF DATA

 137 BA          SUBBASIN CHARACTERISTICS
                        TAREA         1.13  SUBBASIN AREA

 138 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .25  STARTING LOSS
                          DTH          .37  MOISTURE DEFICIT
                         PSIF         6.60  WETTING FRONT SUCTION
                        XKSAT          .14  HYDRAULIC CONDUCTIVITY
                        RTIMP         1.00  PERCENT IMPERVIOUS AREA
```

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136 UI         INPUT UNITGRAPH,  27 ORDINATES,  VOLUME = 1.00
                  102.0     163.0     397.0     611.0     809.0     929.0     977.0     949.0     801.0     634.0
                  506.0     395.0     311.0     248.0     194.0     158.0     113.0      96.0      70.0      71.0
                   32.0      25.0      25.0      25.0      25.0      26.0      25.0
                                                        ***

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

                     HYDROGRAPH AT STATION      S915
                   TRANSPOSITION AREA        .1 SQ MI

      TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.44, TOTAL EXCESS =     1.75

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1523.        4.42                212.          53.          18.            8.
                           (INCHES)   1.752        1.752        1.752         1.752
                            (AC-FT)    105.         105.         105.          105.

                        CUMULATIVE AREA =     1.13 SQ MI

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

                     HYDROGRAPH AT STATION      S915
                   TRANSPOSITION AREA        .5 SQ MI

      TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.44, TOTAL EXCESS =     1.74

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1513.        4.42                211.          53.          18.            8.
                           (INCHES)   1.740        1.740        1.740         1.740
                            (AC-FT)    104.         104.         104.          104.

                        CUMULATIVE AREA =     1.13 SQ MI

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

                     HYDROGRAPH AT STATION      S915
                   TRANSPOSITION AREA       2.8 SQ MI

      TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.62, TOTAL EXCESS =     1.50

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1079.        4.42                181.          45.          15.            7.
                           (INCHES)   1.498        1.499        1.499         1.499
                            (AC-FT)     90.          90.          90.           90.

                        CUMULATIVE AREA =     1.13 SQ MI

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

                     HYDROGRAPH AT STATION      S915
                   TRANSPOSITION AREA      16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.74, TOTAL EXCESS =     1.21

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +     820.        4.42                146.          37.          12.            5.
                           (INCHES)   1.208        1.209        1.209         1.209
                            (AC-FT)     73.          73.          73.           73.

                        CUMULATIVE AREA =     1.13 SQ MI

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

                     HYDROGRAPH AT STATION      S915
                   TRANSPOSITION AREA      90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.80, TOTAL EXCESS =      .79

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +     523.        4.42                 96.          24.           8.            3.
                           (INCHES)    .789         .790         .790          .790
                            (AC-FT)     47.          47.          47.           47.

                        CUMULATIVE AREA =     1.13 SQ MI

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                     INTERPOLATED HYDROGRAPH AT      S915

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1308.        4.42                197.          49.          16.            7.
                           (INCHES)   1.626        1.626        1.626         1.626
                            (AC-FT)     98.          98.          98.           98.

                        CUMULATIVE AREA =     1.13 SQ MI


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


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                 *            *
   142 KK        *     C915   *       COMBINE
                 *            *
                 **************
                                    Combine runoff from S915 with routed flow from C910B

   144 HC             HYDROGRAPH COMBINATION
                           ICOMP              2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                   ***

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

                     HYDROGRAPH AT STATION      C915
                   TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    2913.        4.25                424.         133.          46.           20.
                           (INCHES)   1.254        1.575        1.633         1.633
                            (AC-FT)    210.         264.         274.          274.

                        CUMULATIVE AREA =     3.14 SQ MI

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

                     HYDROGRAPH AT STATION      C915
                   TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    2891.        4.25                421.         132.          46.           20.
                           (INCHES)   1.245        1.563        1.620         1.621
                            (AC-FT)    209.         262.         272.          272.

                        CUMULATIVE AREA =     3.14 SQ MI

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

                     HYDROGRAPH AT STATION      C915
                   TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1856.        4.33                346.         109.          38.           16.
                           (INCHES)   1.023        1.293        1.344         1.345
                            (AC-FT)    172.         217.         225.          225.

                        CUMULATIVE AREA =     3.14 SQ MI

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

                     HYDROGRAPH AT STATION      C915
                   TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW       TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)         (HR)
                              (CFS)
 +    1348.        4.33                267.          85.          30.           13.
                           (INCHES)    .791        1.006        1.050         1.050
                            (AC-FT)    133.         169.         176.          176.

                        CUMULATIVE AREA =     3.14 SQ MI

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

                     HYDROGRAPH AT STATION      C915
                   TRANSPOSITION AREA      90.0 SQ MI
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   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +      772.       4.42                   157.          51.          18.           8.
                             (INCHES)     .465         .608         .640         .641
                              (AC-FT)      78.         102.         107.         107.

                              CUMULATIVE AREA =    3.14 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C915/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                              INTERPOLATED HYDROGRAPH AT      C915

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     1822.       4.33                   341.         108.          37.          16.
                             (INCHES)    1.008        1.274        1.325        1.325
                              (AC-FT)     169.         214.         222.         222.

                              CUMULATIVE AREA =    3.14 SQ MI


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              **************
              *            *
 146 KK       *   91592A   *        ROUTE
              *            *
              **************
                            Proposed Channel
                                 Route combined flow to C920A
                             Slope=(1623.0 - 1580.0) / 3859.0

            HYDROGRAPH ROUTING DATA

 150 RS         STORAGE ROUTING
                      NSTPS            2  NUMBER OF SUBREACHES
                       ITYP         FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC        -1.00  INITIAL CONDITION
                          X          .00  WORKING R AND D COEFFICIENT

 151 RC         NORMAL DEPTH CHANNEL
                        ANL         .045  LEFT OVERBANK N-VALUE
                       ANCH         .045  MAIN CHANNEL N-VALUE
                        ANR         .045  RIGHT OVERBANK N-VALUE
                      RLNTH        3859.  REACH LENGTH
                        SEL        .0110  ENERGY SLOPE
                      ELMAX        105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                         CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 153 RY         ELEVATION   105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 152 RX          DISTANCE      .00       .00       .00       .00    170.00    170.00    170.00    170.00

                                                            ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE        .00       3.96       7.93      11.89      15.85      19.82      23.78      27.74      31.71      35.67
              OUTFLOW        .00      63.73     202.14     396.90     640.42     927.98    1256.21    1622.55    2024.92    2461.61
            ELEVATION     100.00     100.26     100.53     100.79     101.05     101.32     101.58     101.84     102.11     102.37

              STORAGE      39.63      43.60      47.56      51.52      55.49      59.45      63.41      67.38      71.34      75.30
              OUTFLOW    2931.16    3432.31    3963.94    4525.06    5114.77    5732.27    6376.81    7047.71    7744.34    8466.11
            ELEVATION     102.63     102.89     103.16     103.42     103.68     103.95     104.21     104.47     104.74     105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      4525. TO      8466.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                              HYDROGRAPH AT STATION    91592A
                            TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     2695.       4.33                   418.         133.          46.          20.
                             (INCHES)    1.238        1.572        1.632        1.633
                              (AC-FT)     207.         263.         274.         274.

 PEAK STORAGE     TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
        19.        4.33                     5.           2.           1.           0.

   PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     102.50        4.33                 100.67       100.28       100.10       100.04

                              CUMULATIVE AREA =    3.14 SQ MI


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

                              HYDROGRAPH AT STATION    91592A
                            TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     2671.       4.33                   415.         132.          46.          20.
                             (INCHES)    1.228        1.560        1.620        1.621
                              (AC-FT)     206.         262.         272.         272.

 PEAK STORAGE     TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
        19.        4.33                     5.           2.           1.           0.

   PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     102.49        4.33                 100.67       100.28       100.10       100.04

                              CUMULATIVE AREA =    3.14 SQ MI


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

                              HYDROGRAPH AT STATION    91592A
                            TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     1782.       4.42                   341.         109.          38.          16.
                             (INCHES)    1.008        1.291        1.344        1.345
                              (AC-FT)     169.         216.         225.         225.

 PEAK STORAGE     TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
        15.        4.42                     5.           2.           1.           0.

   PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     101.95        4.42                 100.61       100.25       100.09       100.04

                              CUMULATIVE AREA =    3.14 SQ MI


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

                              HYDROGRAPH AT STATION    91592A
                            TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     1290.       4.50                   263.          85.          30.          13.
                             (INCHES)     .777        1.004        1.050        1.050
                              (AC-FT)     130.         168.         176.         176.

 PEAK STORAGE     TIME                            MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
        12.        4.50                     4.           2.           1.           0.

   PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     101.60        4.50                 100.52       100.21       100.08       100.03

                              CUMULATIVE AREA =    3.14 SQ MI


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

                              HYDROGRAPH AT STATION    91592A
                            TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
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+     716.      4.58                  154.          51.          18.           8.
                          (INCHES)    .457         .607         .640         .641
                          (AC-FT)      77.         102.         107.         107.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
       8.       4.58               3.           1.           0.           0.

  PEAK STAGE    TIME                     MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.12      4.58            100.37       100.15       100.05       100.02

                         CUMULATIVE AREA =     3.14 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //91592A/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                         INTERPOLATED HYDROGRAPH AT    91592A

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1746.      4.42              336.         107.          37.          16.
                          (INCHES)    .993        1.272        1.325        1.325
                          (AC-FT)     166.         213.         222.         222.

                         CUMULATIVE AREA =     3.14 SQ MI


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


            **************
            *            *
 155 KK     *   S920A    *        BASIN
            *            *
            **************
                                Compute runoff from subbasin 920A

               SUBBASIN RUNOFF DATA

 157 BA          SUBBASIN CHARACTERISTICS
                       TAREA          1.53  SUBBASIN AREA

 158 LG          GREEN AND AMPT LOSS RATE
                       STRTL           .35  STARTING LOSS
                         DTH           .35  MOISTURE DEFICIT
                        PSIF          4.50  WETTING FRONT SUCTION
                       XKSAT           .36  HYDRAULIC CONDUCTIVITY
                       RTIMP           .00  PERCENT IMPERVIOUS AREA

 156 UI          INPUT UNITGRAPH,  13 ORDINATES,   VOLUME = 1.00
                    375.0     1465.0     2447.0     2631.0     1917.0     1163.0      715.0      450.0      262.0      175.0
                     70.0       69.0       69.0
                                                                            ***

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

                          HYDROGRAPH AT STATION     S920A
                        TRANSPOSITION AREA         .1 SQ MI

    TOTAL RAINFALL =     3.20, TOTAL LOSS =      1.82, TOTAL EXCESS =      1.37

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2944.      4.17              225.          56.          19.           8.
                          (INCHES)   1.373        1.373        1.373        1.373
                          (AC-FT)     112.         112.         112.         112.

                         CUMULATIVE AREA =     1.53 SQ MI

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

                          HYDROGRAPH AT STATION     S920A
                        TRANSPOSITION AREA         .5 SQ MI

    TOTAL RAINFALL =     3.18, TOTAL LOSS =      1.82, TOTAL EXCESS =      1.36

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2923.      4.17              223.          56.          19.           8.
                          (INCHES)   1.361        1.361        1.361        1.361
                          (AC-FT)     111.         111.         111.         111.

                         CUMULATIVE AREA =     1.53 SQ MI


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

                          HYDROGRAPH AT STATION     S920A
                        TRANSPOSITION AREA        2.8 SQ MI

    TOTAL RAINFALL =     3.12, TOTAL LOSS =      2.09, TOTAL EXCESS =      1.03

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1560.      4.17              169.          42.          14.           6.
                          (INCHES)   1.029        1.029        1.029        1.029
                          (AC-FT)      84.          84.          84.          84.

                         CUMULATIVE AREA =     1.53 SQ MI


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

                          HYDROGRAPH AT STATION     S920A
                        TRANSPOSITION AREA       16.0 SQ MI

    TOTAL RAINFALL =     2.95, TOTAL LOSS =      2.22, TOTAL EXCESS =       .73

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1068.      4.17              120.          30.          10.           4.
                          (INCHES)    .728         .728         .728         .728
                          (AC-FT)      59.          59.          59.          59.

                         CUMULATIVE AREA =     1.53 SQ MI


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

                          HYDROGRAPH AT STATION     S920A
                        TRANSPOSITION AREA       90.0 SQ MI

    TOTAL RAINFALL =     2.59, TOTAL LOSS =      2.26, TOTAL EXCESS =       .34

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     526.      4.17               55.          14.           5.           2.
                          (INCHES)    .336         .336         .336         .336
                          (AC-FT)      27.          27.          27.          27.

                         CUMULATIVE AREA =     1.53 SQ MI

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


                         INTERPOLATED HYDROGRAPH AT    S920A

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2040.      4.17              188.          47.          16.           7.
                          (INCHES)   1.145        1.145        1.145        1.145
                          (AC-FT)      93.          93.          93.          93.

                         CUMULATIVE AREA =     1.53 SQ MI



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


            **************
            *            *
 161 KK     *   C920A    *        COMBINE
            *            *
            **************
                                Combine runoff from S920A with routed flow from C915

 163 HC          HYDROGRAPH COMBINATION
                       ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                            ***

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

                          HYDROGRAPH AT STATION     C920A
                        TRANSPOSITION AREA         .1 SQ MI

  PEAK FLOW     TIME                     MAXIMUM AVERAGE FLOW
```

```
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    4577.        4.25               639.         189.          65.          28.
                            (INCHES)    1.272        1.506        1.548        1.548
                            (AC-FT)      317.         375.         385.         386.

                             CUMULATIVE AREA =     4.67 SQ MI

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

                             HYDROGRAPH AT STATION     C920A
                            TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    4531.        4.25               634.         188.          64.          28.
                            (INCHES)    1.262        1.494        1.535        1.536
                            (AC-FT)      314.         372.         382.         383.

                             CUMULATIVE AREA =     4.67 SQ MI

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

                             HYDROGRAPH AT STATION     C920A
                            TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    2866.        4.33               506.         151.          52.          22.
                            (INCHES)    1.006        1.205        1.241        1.241
                            (AC-FT)      251.         300.         309.         309.

                             CUMULATIVE AREA =     4.67 SQ MI

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

                             HYDROGRAPH AT STATION     C920A
                            TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    1929.        4.42               379.         115.          40.          17.
                            (INCHES)     .754         .913         .944         .945
                            (AC-FT)      188.         228.         235.         235.

                             CUMULATIVE AREA =     4.67 SQ MI

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

                             HYDROGRAPH AT STATION     C920A
                            TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     941.        4.42               208.          65.          23.          10.
                            (INCHES)     .414         .518         .541         .541
                            (AC-FT)      103.         129.         135.         135.

                             CUMULATIVE AREA =     4.67 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   40:  //C920A/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***


                             INTERPOLATED HYDROGRAPH AT     C920A

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    2591.        4.33               468.         141.          48.          21.
                            (INCHES)     .932        1.119        1.154        1.154
                            (AC-FT)      232.         279.         287.         288.

                             CUMULATIVE AREA =     4.67 SQ MI
```

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

               **************
               *            *
165 KK         *   92A92B   *        ROUTE
               *            *
               **************
                              Proposed Channel
                                  Route combined flow to C920B, outlet at Trilby Wash tributary.
                               Slope=(1580.0 - 1530.0) / 5003.0

                   HYDROGRAPH ROUTING DATA

169 RS               STORAGE ROUTING
                          NSTPS           3  NUMBER OF SUBREACHES
                           ITYP        FLOW  TYPE OF INITIAL CONDITION
                         RSVRIC       -1.00  INITIAL CONDITION
                              X         .00  WORKING R AND D COEFFICIENT

170 RC               NORMAL DEPTH CHANNEL
                            ANL        .045  LEFT OVERBANK N-VALUE
                           ANCH        .045  MAIN CHANNEL N-VALUE
                            ANR        .045  RIGHT OVERBANK N-VALUE
                          RLNTH       5003.  REACH LENGTH
                            SEL       .0100  ENERGY SLOPE
                          ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                           CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
172 RY         ELEVATION    105.00     100.00     100.00     100.00     100.00     100.00     100.00     105.00
171 RX         DISTANCE        .00        .00        .00        .00     315.00     315.00     315.00     315.00

                                                       ***

                                            COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE        .00       9.52      19.04      28.56      38.08      47.60      57.12      66.65      76.17      85.69
           OUTFLOW        .00     112.65     357.45     702.20    1133.58    1643.35    2225.65    2876.04    3590.93    4367.38
         ELEVATION     100.00     100.26     100.53     100.79     101.05     101.32     101.58     101.84     102.11     102.37

           STORAGE      95.21     104.73     114.25     123.77     133.29     142.81     152.33     161.85     171.37     180.90
           OUTFLOW    5202.88    6095.26    7042.60    8043.23    9095.63   10198.41   11350.32   12550.22   13797.02   15089.76
         ELEVATION     102.63     102.89     103.16     103.42     103.68     103.95     104.21     104.47     104.74     105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      6095. TO     15090.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                             HYDROGRAPH AT STATION     92A92B
                            TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    4228.        4.42               627.         189.          65.          28.
                            (INCHES)    1.248        1.503        1.548        1.548
                            (AC-FT)      311.         374.         385.         386.

 PEAK STORAGE      TIME                         MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)       (HR)
        28.       4.42                 7.           3.           1.           0.

   PEAK STAGE      TIME                         MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
      102.32      4.42              100.59       100.22       100.08       100.03

                             CUMULATIVE AREA =     4.67 SQ MI

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

                             HYDROGRAPH AT STATION     92A92B
                            TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    4187.        4.42               622.         187.          64.          28.
                            (INCHES)    1.238        1.491        1.535        1.536
                            (AC-FT)      308.         371.         382.         383.

 PEAK STORAGE      TIME                         MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)       (HR)
        28.       4.42                 7.           3.           1.           0.

   PEAK STAGE      TIME                         MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
      102.31      4.42              100.59       100.22       100.08       100.03

                             CUMULATIVE AREA =     4.67 SQ MI
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      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION   92A92B
                TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+     2683.      4.50              496.         151.          52.          22.
                (INCHES)          .987        1.202        1.241        1.241
                 (AC-FT)          246.         299.         309.         309.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       21.      4.50                6.           2.           1.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.76     4.50              100.53       100.19       100.07       100.03

                CUMULATIVE AREA =     4.67 SQ MI

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

                  HYDROGRAPH AT STATION   92A92B
                TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+     1812.      4.58              371.         114.          40.          17.
                (INCHES)          .739         .911         .944         .945
                 (AC-FT)          184.         227.         235.         235.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       17.      4.58                5.           2.           1.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.39     4.58              100.44       100.16       100.06       100.02

                CUMULATIVE AREA =     4.67 SQ MI

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

                  HYDROGRAPH AT STATION   92A92B
                TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+      852.      4.75              204.          65.          23.          10.
                (INCHES)          .406         .517         .541         .541
                 (AC-FT)          101.         129.         135.         135.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
       11.      4.75                4.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     100.88     4.75              100.30       100.11       100.04       100.02

                CUMULATIVE AREA =     4.67 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //92A92B/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***

                INTERPOLATED HYDROGRAPH AT   92A92B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+     2402.      4.58              459.         140.          48.          21.
                (INCHES)          .914        1.117        1.154        1.154
                 (AC-FT)          228.         278.         287.         288.
```



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                CUMULATIVE AREA =     4.67 SQ MI


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

              **************
              *              *
 174 KK       *     S920B    *        BASIN
              *              *
              **************
                          Compute runoff from subbasin 920B

                SUBBASIN RUNOFF DATA

 176 BA           SUBBASIN CHARACTERISTICS
                       TAREA         .48  SUBBASIN AREA

 177 LG           GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .39  MOISTURE DEFICIT
                        PSIF        5.80  WETTING FRONT SUCTION
                       XKSAT         .19  HYDRAULIC CONDUCTIVITY
                       RTIMP         .00  PERCENT IMPERVIOUS AREA

 175 UI           INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                     193.0     746.0    1039.0     787.0     440.0     235.0     128.0      71.0      27.0      27.0
                                                                 ***
      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION    S920B
                TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.61, TOTAL EXCESS =    1.58

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+     1155.      4.08              81.          20.           7.           3.
                (INCHES)         1.575        1.575        1.575        1.575
                 (AC-FT)          40.          40.          40.          40.

                CUMULATIVE AREA =     .48 SQ MI

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

                  HYDROGRAPH AT STATION    S920B
                TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.61, TOTAL EXCESS =    1.57

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+     1148.      4.08              80.          20.           7.           3.
                (INCHES)         1.562        1.562        1.562        1.562
                 (AC-FT)          40.          40.          40.          40.

                CUMULATIVE AREA =     .48 SQ MI

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

                  HYDROGRAPH AT STATION    S920B
                TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.83, TOTAL EXCESS =    1.29

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+      611.      4.08              66.          16.           5.           2.
                (INCHES)         1.280        1.280        1.280        1.280
                 (AC-FT)          33.          33.          33.          33.

                CUMULATIVE AREA =     .48 SQ MI

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

                  HYDROGRAPH AT STATION    S920B
                TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.97, TOTAL EXCESS =     .98

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)      (HR)
                     (CFS)
+      442.      4.08              50.          13.           4.           2.
                (INCHES)          .979         .979         .979         .979
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                           (AC-FT)        25.        25.        25.        25.

                           CUMULATIVE AREA =     .48 SQ MI


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

                            HYDROGRAPH AT STATION     S920B
                          TRANSPOSITION AREA      90.0 SQ MI

      TOTAL RAINFALL =     2.59, TOTAL LOSS =     2.02, TOTAL EXCESS =      .58

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     257.       4.08                      30.          7.           2.          1.
                          (INCHES)        .573         .573         .573        .573
                           (AC-FT)         15.          15.          15.         15.

                           CUMULATIVE AREA =     .48 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT     S920B

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    1148.       4.08                      81.         20.           7.          3.
                          (INCHES)       1.563        1.563        1.563       1.563
                           (AC-FT)         40.          40.          40.         40.

                           CUMULATIVE AREA =     .48 SQ MI


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

                **************
                *            *
  180 KK        *    C920B   *      COMBINE
                *            *
                **************
                                    Combine runoff from S920B with routed flow from C920A
                                    This is the total flow at the downstream end of the Fan 2 corridor.

  183 HC          HYDROGRAPH COMBINATION
                        ICOMP           2   NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                   ***

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

                            HYDROGRAPH AT STATION     C920B
                          TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    4477.       4.42                     702.        209.          72.         31.
                          (INCHES)       1.268        1.509        1.550       1.551
                           (AC-FT)        348.         414.         426.        426.

                           CUMULATIVE AREA =    5.15 SQ MI


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

                            HYDROGRAPH AT STATION     C920B
                          TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    4433.       4.42                     696.        207.          71.         31.
                          (INCHES)       1.258        1.497        1.538       1.538
                           (AC-FT)        345.         411.         422.        422.

                           CUMULATIVE AREA =    5.15 SQ MI


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

                            HYDROGRAPH AT STATION     C920B
                          TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    2903.       4.50                     557.        167.          57.         25.
                          (INCHES)       1.005        1.208        1.245       1.245
```

```
                           (AC-FT)        276.         332.         342.        342.

                           CUMULATIVE AREA =    5.15 SQ MI


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

                            HYDROGRAPH AT STATION     C920B
                          TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    1950.       4.58                     418.        127.          44.         19.
                          (INCHES)        .754         .917         .948        .948
                           (AC-FT)        207.         252.         260.        260.

                           CUMULATIVE AREA =    5.15 SQ MI


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

                            HYDROGRAPH AT STATION     C920B
                          TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     885.       4.75                     230.         72.          25.         11.
                          (INCHES)        .416         .522         .544        .544
                           (AC-FT)        114.         143.         149.        149.

                           CUMULATIVE AREA =    5.15 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT     C920B

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    2553.       4.50                     508.        153.          53.         23.
                          (INCHES)        .917        1.106        1.141       1.141
                           (AC-FT)        252.         304.         313.        313.

                           CUMULATIVE AREA =    5.15 SQ MI


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

                **************
                *            *
  184 KK        *    S920C   *      BASIN
                *            *
                **************
                                    Compute runoff from subbasin 920C

              SUBBASIN RUNOFF DATA

  186 BA          SUBBASIN CHARACTERISTICS
                        TAREA         1.28  SUBBASIN AREA

  187 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .35  STARTING LOSS
                          DTH          .36  MOISTURE DEFICIT
                         PSIF         6.80  WETTING FRONT SUCTION
                        XKSAT          .13  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

  185 UI          INPUT UNITGRAPH,  22 ORDINATES,  VOLUME = 1.00
                    140.0     311.0     701.0    1023.0    1274.0    1342.0    1246.0     979.0     738.0     552.0
                    423.0     304.0     238.0     176.0     134.0      96.0      83.0      34.0      34.0      35.0
                     34.0      34.0
                                                                                   ***

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

                            HYDROGRAPH AT STATION     S920C
                          TRANSPOSITION AREA       .1 SQ MI

      TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.48, TOTAL EXCESS =     1.72

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR        72-HR      166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    1983.       4.33                     237.         59.          20.          9.
                          (INCHES)       1.713        1.713        1.713       1.713
                           (AC-FT)        117.         117.         117.        117.

                           CUMULATIVE AREA =    1.28 SQ MI
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          ***               ***               ***               ***               ***

                              HYDROGRAPH AT STATION    S920C
                            TRANSPOSITION AREA         .5 SQ MI

          TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.48, TOTAL EXCESS =    1.70

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    1971.         4.33                      235.           59.           20.           8.
                                (INCHES)     1.701         1.701         1.701        1.701
                                 (AC-FT)      117.          117.          117.         117.

                                   CUMULATIVE AREA =    1.28 SQ MI

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

                              HYDROGRAPH AT STATION    S920C
                            TRANSPOSITION AREA        2.8 SQ MI

          TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.66, TOTAL EXCESS =    1.46

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    1335.         4.33                      202.           50.           17.           7.
                                (INCHES)     1.460         1.460         1.460        1.460
                                 (AC-FT)      100.          100.          100.         100.

                                   CUMULATIVE AREA =    1.28 SQ MI

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

                              HYDROGRAPH AT STATION    S920C
                            TRANSPOSITION AREA       16.0 SQ MI

          TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.77, TOTAL EXCESS =    1.18

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    1009.         4.33                      163.           41.           14.           6.
                                (INCHES)     1.176         1.176         1.176        1.176
                                 (AC-FT)       81.           81.           81.          81.

                                   CUMULATIVE AREA =    1.28 SQ MI

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

                              HYDROGRAPH AT STATION    S920C
                            TRANSPOSITION AREA       90.0 SQ MI

          TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.83, TOTAL EXCESS =     .76

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +     638.         4.33                      105.           26.            9.           4.
                                (INCHES)      .762          .762          .762         .762
                                 (AC-FT)       52.           52.           52.          52.

                                   CUMULATIVE AREA =    1.28 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT      S920C

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    1622.         4.33                      217.           54.           18.           8.
                                (INCHES)     1.569         1.569         1.569        1.569
                                 (AC-FT)      108.          108.          108.         108.

                                   CUMULATIVE AREA =    1.28 SQ MI


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


               **************
               *            *
 191 KK        *    C920C   *        COMBINE
               *            *
               **************
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                                   Combine runoff from S920C with flow from C920B.  This is the total flow
                                   in the Trilby Wash tributary.

 194 HC              HYDROGRAPH COMBINATION
                          ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                         ***

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

                              HYDROGRAPH AT STATION    C920C
                            TRANSPOSITION AREA         .1 SQ MI

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    6313.         4.42                      938.          268.           91.          39.
                                (INCHES)     1.356         1.549         1.583        1.583
                                 (AC-FT)      465.          532.          543.         543.

                                   CUMULATIVE AREA =    6.43 SQ MI

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

                              HYDROGRAPH AT STATION    C920C
                            TRANSPOSITION AREA         .5 SQ MI

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    6257.         4.42                      931.          266.           91.          39.
                                (INCHES)     1.345         1.537         1.570        1.571
                                 (AC-FT)      462.          528.          539.         539.

                                   CUMULATIVE AREA =    6.43 SQ MI

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

                              HYDROGRAPH AT STATION    C920C
                            TRANSPOSITION AREA        2.8 SQ MI

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    4110.         4.42                      758.          218.           74.          32.
                                (INCHES)     1.095         1.259         1.288        1.288
                                 (AC-FT)      376.          432.          442.         442.

                                   CUMULATIVE AREA =    6.43 SQ MI

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

                              HYDROGRAPH AT STATION    C920C
                            TRANSPOSITION AREA       16.0 SQ MI

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    2832.         4.50                      580.          168.           57.          25.
                                (INCHES)      .838          .969          .993         .994
                                 (AC-FT)      287.          332.          341.         341.

                                   CUMULATIVE AREA =    6.43 SQ MI

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

                              HYDROGRAPH AT STATION    C920C
                            TRANSPOSITION AREA       90.0 SQ MI

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    1363.         4.67                      335.           99.           34.          15.
                                (INCHES)      .484          .570          .587         .588
                                 (AC-FT)      166.          195.          202.         202.

                                   CUMULATIVE AREA =    6.43 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT      C920C

      PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                              6-HR          24-HR         72-HR    166.58-HR
  +    (CFS)         (HR)
                                  (CFS)
  +    3498.         4.50                      673.          194.           66.          29.
                                (INCHES)      .972         1.120         1.147        1.147
                                 (AC-FT)      334.          384.          394.         394.
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                    CUMULATIVE AREA =     6.43 SQ MI


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

            **************
            *            *
 195 KK     *      S110  *        BASIN
            *            *
            **************
                          Compute runoff from subbasin 110

                SUBBASIN RUNOFF DATA

 197 BA           SUBBASIN CHARACTERISTICS
                       TAREA          .43  SUBBASIN AREA

 198 LG           GREEN AND AMPT LOSS RATE
                       STRTL          .25  STARTING LOSS
                         DTH          .37  MOISTURE DEFICIT
                        PSIF         5.20  WETTING FRONT SUCTION
                       XKSAT          .25  HYDRAULIC CONDUCTIVITY
                       RTIMP         6.00  PERCENT IMPERVIOUS AREA

 196 UI           INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                      56.0     166.0     335.0     449.0     587.0     358.0     291.0     241.0     188.0     140.0
                     121.0      86.0      68.0      56.0      43.0      32.0      27.0      22.0      11.0      11.0
                      10.0      11.0      11.0
                                                                  ***

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

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA        .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.54, TOTAL EXCESS =    1.66

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     666.      4.25                  76.         19.          6.          3.
                          (INCHES)   1.650       1.651       1.651       1.651
                          (AC-FT)     38.         38.         38.         38.

                       CUMULATIVE AREA =     .43 SQ MI

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

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA        .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.54, TOTAL EXCESS =    1.64

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     662.      4.25                  76.         19.          6.          3.
                          (INCHES)   1.638       1.639       1.639       1.639
                          (AC-FT)     38.         38.         38.         38.

                       CUMULATIVE AREA =     .43 SQ MI

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

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA       2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.77, TOTAL EXCESS =    1.35

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     413.      4.25                  62.         16.          5.          2.
                          (INCHES)   1.347       1.349       1.349       1.349
                          (AC-FT)     31.         31.         31.         31.

                       CUMULATIVE AREA =     .43 SQ MI

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

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA      16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.90, TOTAL EXCESS =    1.05

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     301.      4.25                  48.         12.          4.          2.
                          (INCHES)   1.047       1.050       1.050       1.050
                          (AC-FT)     24.         24.         24.         24.

                       CUMULATIVE AREA =     .43 SQ MI

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

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA      90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.95, TOTAL EXCESS =     .65

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     176.      4.25                  30.          7.          2.          1.
                          (INCHES)    .642        .644        .644        .644
                          (AC-FT)     15.         15.         15.         15.

                       CUMULATIVE AREA =     .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //S110/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT     S110

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     662.      4.25                  76.         19.          6.          3.
                          (INCHES)   1.639       1.640       1.640       1.640
                          (AC-FT)     38.         38.         38.         38.

                       CUMULATIVE AREA =     .43 SQ MI

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

            **************
            *            *
 203 KK     *      RR110 *      STORAGE
            *            *
            **************
                          Proposed Detention Basin
                           ROUTE COMBINED RUNOFF AT S110 THROUGH PROPOSED (BIG) DETENTION BASIN
                           AT ALLUVIAL FAN APEX NO. 1
                           STRUCTURE ID:RR110
                           OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft

                HYDROGRAPH ROUTING DATA

 209 RS           STORAGE ROUTING
                       NSTPS          1  NUMBER OF SUBREACHES
                        ITYP       STOR  TYPE OF INITIAL CONDITION
                       RSVRIC      -1.00  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

 210 SV             STORAGE          .0       5.7      11.7      18.1      24.7      31.6      38.9      46.5      54.4      62.7

 211 SE             ELEVATION       .00      1.00      2.00      3.00      4.00      5.00      6.00      7.00      8.00      9.00

 212 SQ             DISCHARGE        0.       16.       33.       55.       83.      104.      128.      157.      181.      211.
                                                                  ***

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

                       HYDROGRAPH AT STATION    RR110
                      TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      97.      5.00                  58.         19.          6.          3.
                          (INCHES)   1.244       1.641       1.651       1.651
                          (AC-FT)     29.         38.         38.         38.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)     (HR)
```

```
        29.      5.00                  18.          6.          2.          1.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
       4.66      5.00                 3.02        1.04         .35         .15

                          CUMULATIVE AREA =      .43 SQ MI

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

                          HYDROGRAPH AT STATION     RR110
                         TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       96.      5.00                 57.         19.          6.          3.
                          (INCHES)   1.234       1.629       1.639       1.639
                          (AC-FT)      28.         37.         38.         38.

 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)      (HR)
        29.      5.00                 18.          6.          2.          1.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
       4.63      5.00                 3.00        1.03         .35         .15

                          CUMULATIVE AREA =      .43 SQ MI

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

                          HYDROGRAPH AT STATION     RR110
                         TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       78.      5.08                 46.         15.          5.          2.
                          (INCHES)    .998       1.340       1.349       1.349
                          (AC-FT)      23.         31.         31.         31.

 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)      (HR)
        24.      5.08                 15.          5.          2.          1.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
       3.83      5.08                 2.53         .87         .29         .13

                          CUMULATIVE AREA =      .43 SQ MI

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

                          HYDROGRAPH AT STATION     RR110
                         TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       56.      5.08                 35.         12.          4.          2.
                          (INCHES)    .760       1.042       1.050       1.050
                          (AC-FT)      17.         24.         24.         24.

 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)      (HR)
        18.      5.08                 12.          4.          1.          1.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
       3.03      5.08                 2.04         .71         .24         .10

                          CUMULATIVE AREA =      .43 SQ MI

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

                          HYDROGRAPH AT STATION     RR110
                         TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       31.      5.17                 21.          7.          2.          1.
                          (INCHES)    .457        .639        .644        .644
                          (AC-FT)      10.         15.         15.         15.
```



```
  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)      (HR)
        11.      5.17                 7.          3.          1.          0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
       1.90      5.17                 1.29         .45         .15         .07

                          CUMULATIVE AREA =      .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //RR110/FLOW/08JAN1999/5MIN//
        ***              ***           ***           ***           ***


                          INTERPOLATED HYDROGRAPH AT     RR110

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       96.      5.00                 57.         19.          6.          3.
                          (INCHES)   1.235       1.630       1.640       1.640
                          (AC-FT)      28.         37.         38.         38.

                          CUMULATIVE AREA =      .43 SQ MI


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


              **************
              *            *
  214 KK      *    F115A3  *        ROUTE
              *            *
              **************
                          Proposed Channel
                              Route flow from RR110 through subbasin 115A3
                           Slope=(1865.0 - 1682.0) / 7199.0

                          HYDROGRAPH ROUTING DATA

  218 RS          STORAGE ROUTING
                        NSTPS          5  NUMBER OF SUBREACHES
                        ITYP        FLOW  TYPE OF INITIAL CONDITION
                       RSVRIC      -1.00  INITIAL CONDITION
                            X        .00 WORKING R AND D COEFFICIENT

  219 RC          NORMAL DEPTH CHANNEL
                         ANL       .045  LEFT OVERBANK N-VALUE
                        ANCH       .045  MAIN CHANNEL N-VALUE
                         ANR       .045  RIGHT OVERBANK N-VALUE
                       RLNTH       7199. REACH LENGTH
                         SEL      .0250  ENERGY SLOPE
                       ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  221 RY        ELEVATION   104.50   100.00   100.00   100.00   100.00   100.00   100.00   104.50
  220 RX        DISTANCE       .00      .00      .00      .00    95.00    95.00    95.00    95.00

                                                 ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                STORAGE        .00     3.72     7.44    11.16    14.87    18.59    22.31    26.03    29.75    33.47
                OUTFLOW        .00    45.02   142.68   279.99   451.49   653.81   884.53  1141.77  1424.04  1730.10
              ELEVATION     100.00   100.24   100.47   100.71   100.95   101.18   101.42   101.66   101.89   102.13

                STORAGE      37.18    40.90    44.62    48.34    52.06    55.78    59.50    63.21    66.93    70.65
                OUTFLOW    2058.86  2409.42  2780.94  3172.69  3584.02  4014.33  4463.06  4929.70  5413.79  5914.89
              ELEVATION     102.37   102.61   102.84   103.08   103.32   103.55   103.79   104.03   104.26   104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      654. TO     5915.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                          HYDROGRAPH AT STATION   F115A3
                         TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       95.      5.58                 56.         19.          6.          3.
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                        (INCHES)      1.214       1.641       1.651       1.651
                        (AC-FT)         28.         38.         38.         38.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)       (HR)
        1.        5.50                   1.          0.          0.          0.

   PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+    (FEET)       (HR)
     100.36       5.58                100.25      100.09      100.03      100.01

                          CUMULATIVE AREA =      .43 SQ MI


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

                      HYDROGRAPH AT STATION    F115A3
                     TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       94.       5.58                  56.         19.          6.          3.
                        (INCHES)      1.205       1.629       1.639       1.639
                        (AC-FT)         28.         37.         38.         38.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)       (HR)
        1.        5.50                   1.          0.          0.          0.

   PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+    (FEET)       (HR)
     100.36       5.58                100.25      100.09      100.03      100.01

                          CUMULATIVE AREA =      .43 SQ MI


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

                      HYDROGRAPH AT STATION    F115A3
                     TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       76.       5.67                  45.         15.          5.          2.
                        (INCHES)       .977       1.340       1.349       1.349
                        (AC-FT)         22.         31.         31.         31.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)       (HR)
        1.        5.58                   1.          0.          0.          0.

   PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+    (FEET)       (HR)
     100.31       5.67                100.22      100.08      100.03      100.01

                          CUMULATIVE AREA =      .43 SQ MI


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

                      HYDROGRAPH AT STATION    F115A3
                     TRANSPOSITION AREA       16.0 SQ MI

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       54.       5.83                  34.         12.          4.          2.
                        (INCHES)       .745       1.041       1.050       1.050
                        (AC-FT)         17.         24.         24.         24.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)       (HR)
        1.        5.83                   1.          0.          0.          0.

   PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+    (FEET)       (HR)
     100.26       5.83                100.18      100.06      100.02      100.01

                          CUMULATIVE AREA =      .43 SQ MI


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

                      HYDROGRAPH AT STATION    F115A3
                     TRANSPOSITION AREA       90.0 SQ MI

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
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                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       29.       6.42                  21.          7.          2.          1.
                        (INCHES)       .448        .639        .644        .644
                        (AC-FT)         10.         15.         15.         15.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)       (HR)
        0.        6.33                   0.          0.          0.          0.

   PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+    (FEET)       (HR)
     100.15       6.42                100.11      100.04      100.01      100.01

                          CUMULATIVE AREA =      .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F115A3/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                      INTERPOLATED HYDROGRAPH AT    F115A3

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+       94.       5.58                  56.         19.          6.          3.
                        (INCHES)      1.205       1.630       1.640       1.640
                        (AC-FT)         28.         37.         38.         38.

                          CUMULATIVE AREA =      .43 SQ MI


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

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              *            *
223 KK        *    S115A3  *        BASIN
              *            *
              **************
                          Compute runoff from subbasin 115A3

              SUBBASIN RUNOFF DATA

225 BA             SUBBASIN CHARACTERISTICS
                        TAREA          .46  SUBBASIN AREA

226 LG             GREEN AND AMPT LOSS RATE
                        STRTL          .30  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.50  WETTING FRONT SUCTION
                        XKSAT          .36  HYDRAULIC CONDUCTIVITY
                        RTIMP         4.00  PERCENT IMPERVIOUS AREA

224 UI             INPUT UNITGRAPH,  15 ORDINATES,  VOLUME = 1.00
                       75.0      307.0      550.0      680.0      636.0      434.0      291.0      190.0      127.0       84.0
                       53.0       34.0       18.0       18.0       18.0
                                                                                ***

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

                      HYDROGRAPH AT STATION    S115A3
                     TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.72, TOTAL EXCESS =    1.47

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                          (CFS)
+      821.       4.17                  72.         18.          6.          3.
                        (INCHES)      1.470       1.471       1.471       1.471
                        (AC-FT)         36.         36.         36.         36.

                          CUMULATIVE AREA =      .46 SQ MI


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

                      HYDROGRAPH AT STATION    S115A3
                     TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.72, TOTAL EXCESS =    1.46

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
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                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      815.       4.17                              71.         18.          6.          3.
                (INCHES)          1.458       1.459       1.459       1.459
                (AC-FT)             35.         35.         35.         35.

                                CUMULATIVE AREA =      .46 SQ MI


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

                          HYDROGRAPH AT STATION    S115A3
                        TRANSPOSITION AREA       2.8 SQ MI

     TOTAL RAINFALL =     3.12, TOTAL LOSS =     1.98, TOTAL EXCESS =     1.14

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      456.       4.17                              56.         14.          5.          2.
                (INCHES)          1.135       1.136       1.136       1.136
                (AC-FT)             28.         28.         28.         28.

                                CUMULATIVE AREA =      .46 SQ MI


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

                          HYDROGRAPH AT STATION    S115A3
                        TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =     2.95, TOTAL LOSS =     2.11, TOTAL EXCESS =      .84

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      317.       4.17                              41.         10.          3.          1.
                (INCHES)          .836        .837        .837        .837
                (AC-FT)             20.         20.         20.         20.

                                CUMULATIVE AREA =      .46 SQ MI


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

                          HYDROGRAPH AT STATION    S115A3
                        TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =     2.59, TOTAL LOSS =     2.15, TOTAL EXCESS =      .45

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      163.       4.25                              22.          5.          2.          1.
                (INCHES)          .443        .444        .444        .444
                (AC-FT)             11.         11.         11.         11.

                                CUMULATIVE AREA =      .46 SQ MI


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


                          INTERPOLATED HYDROGRAPH AT    S115A3

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      815.       4.17                              71.         18.          6.          3.
                (INCHES)          1.459       1.460       1.460       1.460
                (AC-FT)             35.         35.         35.         35.

                                CUMULATIVE AREA =      .46 SQ MI


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


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            *            *
229 KK      *    C115A3  *      COMBINE
            *            *
            **************
                          Combine runoff from S115A3 w/ routed outflow from Fan 1 detention basin

231 HC            HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                ***

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

                          HYDROGRAPH AT STATION    C115A3
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                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      822.       4.17                             122.         37.         12.          5.
                (INCHES)          1.280       1.550       1.559       1.559
                (AC-FT)             60.         73.         74.         74.

                                CUMULATIVE AREA =      .88 SQ MI


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

                          HYDROGRAPH AT STATION    C115A3
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      816.       4.17                             121.         37.         12.          5.
                (INCHES)          1.270       1.538       1.547       1.547
                (AC-FT)             60.         73.         73.         73.

                                CUMULATIVE AREA =      .88 SQ MI


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

                          HYDROGRAPH AT STATION    C115A3
                        TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      458.       4.17                              95.         29.         10.          4.
                (INCHES)          .997        1.232       1.239       1.239
                (AC-FT)             47.         58.         59.         59.

                                CUMULATIVE AREA =      .88 SQ MI


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

                          HYDROGRAPH AT STATION    C115A3
                        TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      318.       4.17                              70.         22.          7.          3.
                (INCHES)          .737        .935        .940        .940
                (AC-FT)             35.         44.         44.         44.

                                CUMULATIVE AREA =      .88 SQ MI


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

                          HYDROGRAPH AT STATION    C115A3
                        TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      165.       4.25                              39.         13.          4.          2.
                (INCHES)          .406        .538        .542        .542
                (AC-FT)             19.         25.         26.         26.

                                CUMULATIVE AREA =      .88 SQ MI


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


                          INTERPOLATED HYDROGRAPH AT    C115A3

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      697.       4.17                             112.         34.         11.          5.
                (INCHES)          1.179       1.437       1.445       1.445
                (AC-FT)             56.         68.         68.         68.

                                CUMULATIVE AREA =      .88 SQ MI


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232 KK      *   DRR900  *      RETRIEVE
            *           *
            **************
                               RETRIEVE DIVERTED OUTFLOW FROM RR900 (FLOW TO FAN 1 FROM FAN 2 BASIN)

                                                                          ***

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

                         HYDROGRAPH AT STATION   DRR900
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       68.      5.75                     55.        25.          9.          4.
                            (INCHES)      .581       1.038       1.121       1.122
                             (AC-FT)      27.        49.         53.         53.

                           CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //DRR900/FLOW/08JAN1999/5MIN//

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

                         HYDROGRAPH AT STATION   DRR900
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       67.      5.75                     55.        25.          9.          4.
                            (INCHES)      .577       1.030       1.113       1.114
                             (AC-FT)      27.        49.         53.         53.

                           CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //DRR900/FLOW/08JAN1999/5MIN//

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

                         HYDROGRAPH AT STATION   DRR900
                       TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       55.      5.75                     46.        20.          7.          3.
                            (INCHES)      .478        .854        .927        .928
                             (AC-FT)      23.        40.         44.         44.

                           CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //DRR900/FLOW/08JAN1999/5MIN//

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

                         HYDROGRAPH AT STATION   DRR900
                       TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       44.      5.83                     35.        16.          6.          3.
                            (INCHES)      .371        .668        .730        .731
                             (AC-FT)      18.        32.         34.         34.

                           CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //DRR900/FLOW/08JAN1999/5MIN//

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

                         HYDROGRAPH AT STATION   DRR900
                       TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       25.      5.92                     20.        10.          4.          2.
                            (INCHES)      .209        .412        .457        .458
                             (AC-FT)      10.        19.         22.         22.

                           CUMULATIVE AREA =     1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //DRR900/FLOW/08JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //DRR900/FLOW/08JAN1999/5MIN//
        ***            ***            ***            ***            ***

                         INTERPOLATED HYDROGRAPH AT   DRR900

  PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+       59.      5.75                     48.        21.          8.          3.
                            (INCHES)      .258        .460        .499        .499
                             (AC-FT)      24.        43.         46.         46.

                           CUMULATIVE AREA =     1.74 SQ MI


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

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                 *            *
 236 KK          *   F215A2   *        ROUTE
                 *            *
                 **************
                              Proposed Channel
                                   Route FAN 2 BASIN OUTFLOWS THRU SUBBASIN S115A2
                               Slope=(1815.0 - 1682.0) / 6201.0

              HYDROGRAPH ROUTING DATA

 240 RS          STORAGE ROUTING
                      NSTPS          4  NUMBER OF SUBREACHES
                       ITYP       FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 241 RC          NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
                      RLNTH      6201.  REACH LENGTH
                        SEL      .0210  ENERGY SLOPE
                      ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 243 RY        ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 242 RX         DISTANCE      .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                                      ***

                                           COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE       .00      3.37      6.74     10.11     13.49     16.86     20.23     23.60     26.97     30.34
            OUTFLOW       .00     43.43    137.67    270.18    435.72    631.03    853.77   1102.15   1374.74   1670.34
          ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

            STORAGE     33.72     37.09     40.46     43.83     47.20     50.57     53.94     57.32     60.69     64.06
            OUTFLOW   1987.91   2326.56   2685.52   3064.07   3461.59   3877.49   4311.26   4762.40   5230.46   5715.03
          ELEVATION    102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      854. TO     5715.
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THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                  HYDROGRAPH AT STATION   F215A2
                 TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       67.      6.25                54.         25.          9.          4.
                (INCHES)            .289        .527         .571        .572
                (AC-FT)             27.         49.          53.         53.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
          1.     6.17                 1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
      100.30     6.25              100.26      100.13      100.05      100.02

                  CUMULATIVE AREA =    1.74 SQ MI

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

                  HYDROGRAPH AT STATION   F215A2
                 TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       67.      6.25                54.         24.          9.          4.
                (INCHES)            .287        .523         .567        .568
                (AC-FT)             27.         48.          53.         53.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
          1.     6.17                 1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
      100.30     6.25              100.26      100.13      100.05      100.02

                  CUMULATIVE AREA =    1.74 SQ MI

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

                  HYDROGRAPH AT STATION   F215A2
                 TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       55.      6.33                45.         20.          7.          3.
                (INCHES)            .239        .434         .472        .473
                (AC-FT)             22.         40.          44.         44.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
          1.     6.25                 1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
      100.27     6.33              100.23      100.11      100.04      100.02

                  CUMULATIVE AREA =    1.74 SQ MI

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

                  HYDROGRAPH AT STATION   F215A2
                 TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       43.      7.00                35.         16.          6.          3.
                (INCHES)            .185        .339         .372        .372
                (AC-FT)             17.         31.          34.         34.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
          1.     6.92                 1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
      100.23     7.00              100.19      100.09      100.03      100.01

                  CUMULATIVE AREA =    1.74 SQ MI

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

                  HYDROGRAPH AT STATION   F215A2
                 TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       25.      7.00                20.         10.          4.          2.
                (INCHES)            .105        .209         .233        .233
                (AC-FT)             10.         19.          22.         22.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
          0.     6.92                 0.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
      100.13     7.00              100.11      100.05      100.02      100.01

                  CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //F215A2/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                  INTERPOLATED HYDROGRAPH AT   F215A2

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       58.      6.33                47.         21.          8.          3.
                (INCHES)            .252        .459         .499        .499
                (AC-FT)             23.         42.          46.         46.

                  CUMULATIVE AREA =    1.74 SQ MI


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

                 **************
                 *            *
 245 KK          *    S115A2  *        BASIN
                 *            *
                 **************
                          Compute runoff from subbasin 115A2

             SUBBASIN RUNOFF DATA

 247 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .43  SUBBASIN AREA

 248 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .38  MOISTURE DEFICIT
                        PSIF        5.40  WETTING FRONT SUCTION
                       XKSAT         .23  HYDRAULIC CONDUCTIVITY
                       RTIMP         .00  PERCENT IMPERVIOUS AREA

 246 UI          INPUT UNITGRAPH,  12 ORDINATES,  VOLUME =  .99
                     111.0      434.0      708.0      755.0      521.0      313.0      192.0      118.0       69.0       43.0
                      20.0       19.0

                                                        ***

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

                  HYDROGRAPH AT STATION   S115A2
                 TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.67, TOTAL EXCESS =    1.52

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                  (CFS)
+      883.      4.17                70.         17.          6.          3.
                (INCHES)           1.515       1.515        1.515       1.515
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                    (AC-FT)        35.         35.         35.          35.

                    CUMULATIVE AREA =      .43 SQ MI

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

                     HYDROGRAPH AT STATION    S115A2
                   TRANSPOSITION AREA        .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.67, TOTAL EXCESS =    1.51

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    877.        4.17                 69.         17.         6.          2.
                       (INCHES)    1.503       1.503       1.503       1.503
                        (AC-FT)      34.         34.         34.         34.

                    CUMULATIVE AREA =      .43 SQ MI

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

                     HYDROGRAPH AT STATION    S115A2
                   TRANSPOSITION AREA       2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.91, TOTAL EXCESS =    1.21

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    490.        4.17                 56.         14.         5.          2.
                       (INCHES)    1.208       1.208       1.208       1.208
                        (AC-FT)      28.         28.         28.         28.

                    CUMULATIVE AREA =      .43 SQ MI

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

                     HYDROGRAPH AT STATION    S115A2
                   TRANSPOSITION AREA      16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.04, TOTAL EXCESS =     .91

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    351.        4.17                 42.         10.         3.          2.
                       (INCHES)     .908        .908        .908        .908
                        (AC-FT)      21.         21.         21.         21.

                    CUMULATIVE AREA =      .43 SQ MI

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

                     HYDROGRAPH AT STATION    S115A2
                   TRANSPOSITION AREA      90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.09, TOTAL EXCESS =     .51

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    199.        4.17                 23.          6.         2.          1.
                       (INCHES)     .503        .503        .503        .503
                        (AC-FT)      12.         12.         12.         12.

                    CUMULATIVE AREA =      .43 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT    S115A2

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    877.        4.17                 69.         17.         6.          2.
                       (INCHES)    1.504       1.504       1.504       1.504
                        (AC-FT)      34.         34.         34.         34.

                    CUMULATIVE AREA =      .43 SQ MI


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

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251 KK        *    C115A2  *      COMBINE
              *            *
              **************
                                  Combine runoff from S115A2 with routed outflow from Fan 2 detention basi

253 HC          HYDROGRAPH COMBINATION
                      ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                        ***

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

                     HYDROGRAPH AT STATION    C115A2
                   TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    883.        4.17                114.         42.         15.         6.
                       (INCHES)    1.039       1.529       1.610       1.611
                        (AC-FT)      57.         83.         88.         88.

                    CUMULATIVE AREA =     1.02 SQ MI

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

                     HYDROGRAPH AT STATION    C115A2
                   TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    877.        4.17                113.         42.         15.         6.
                       (INCHES)    1.031       1.517       1.598       1.599
                        (AC-FT)      56.         83.         87.         87.

                    CUMULATIVE AREA =     1.02 SQ MI

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

                     HYDROGRAPH AT STATION    C115A2
                   TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    491.        4.17                 91.         34.         12.         5.
                       (INCHES)     .833       1.241       1.312       1.313
                        (AC-FT)      45.         68.         71.         71.

                    CUMULATIVE AREA =     1.02 SQ MI

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

                     HYDROGRAPH AT STATION    C115A2
                   TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    352.        4.17                 70.         26.          9.         4.
                       (INCHES)     .636        .955       1.015       1.016
                        (AC-FT)      35.         52.         55.         55.

                    CUMULATIVE AREA =     1.02 SQ MI

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

                     HYDROGRAPH AT STATION    C115A2
                   TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    199.        4.17                 39.         16.          6.         2.
                       (INCHES)     .356        .565        .608        .609
                        (AC-FT)      19.         31.         33.         33.

                    CUMULATIVE AREA =     1.02 SQ MI

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

                    INTERPOLATED HYDROGRAPH AT    C115A2

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    717.        4.17                104.         38.         14.         6.
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                        (INCHES)       .949        1.403        1.480        1.481
                         (AC-FT)        52.          76.          80.          81.

                        CUMULATIVE AREA =     1.02 SQ MI



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

            **************
            *            *
 254 KK     *     C115A  *      COMBINE
            *            *
            **************
                          Combine all flows at C115A (C115A2 + C115A3)

 256 HC           HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                       HYDROGRAPH AT STATION    C115A
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1705.      4.17                236.          79.          27.          12.
                (INCHES)       1.151        1.536        1.586        1.587
                 (AC-FT)       117.          156.         161.         161.

                       CUMULATIVE AREA =     1.90 SQ MI

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

                       HYDROGRAPH AT STATION    C115A
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1694.      4.17                234.          78.          27.          12.
                (INCHES)       1.142        1.524        1.574        1.574
                 (AC-FT)       116.          155.         160.         160.

                       CUMULATIVE AREA =     1.90 SQ MI

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

                       HYDROGRAPH AT STATION    C115A
                      TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     949.      4.17                186.          63.          22.           9.
                (INCHES)       .909         1.234        1.278        1.279
                 (AC-FT)       92.           125.         130.         130.

                       CUMULATIVE AREA =     1.90 SQ MI

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

                       HYDROGRAPH AT STATION    C115A
                      TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     671.      4.17                140.          48.          17.           7.
                (INCHES)       .683         .941         .980         .981
                 (AC-FT)       69.           96.          100.         100.

                       CUMULATIVE AREA =     1.90 SQ MI

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

                       HYDROGRAPH AT STATION    C115A
                      TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     362.      4.17                78.           28.          10.           4.
                (INCHES)       .379         .547         .577         .578
                 (AC-FT)       39.           56.          59.          59.
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                       CUMULATIVE AREA =     1.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115A/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***

                       INTERPOLATED HYDROGRAPH AT    C115A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1115.      4.17                197.          67.          23.          10.
                (INCHES)       .961         1.299        1.344        1.345
                 (AC-FT)       98.           132.         137.         137.

                       CUMULATIVE AREA =     1.90 SQ MI



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

            **************
            *            *
 258 KK     *    15A15B  *       ROUTE
            *            *
            **************
                          Proposed Channel
                              Route flows to Sun Valley Parkway
                           Slope=(1682.0 - 1622.0) / 3257.0

                     HYDROGRAPH ROUTING DATA

 262 RS           STORAGE ROUTING
                        NSTPS           2  NUMBER OF SUBREACHES
                         ITYP        FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC      -1.00  INITIAL CONDITION
                            X         .00 WORKING R AND D COEFFICIENT

 263 RC           NORMAL DEPTH CHANNEL
                         ANL        .045  LEFT OVERBANK N-VALUE
                        ANCH        .045  MAIN CHANNEL N-VALUE
                         ANR        .045  RIGHT OVERBANK N-VALUE
                       RLNTH      3257.  REACH LENGTH
                         SEL       .0180  ENERGY SLOPE
                       ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 265 RY       ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 264 RX       DISTANCE        .00       .00       .00       .00    160.00    160.00    160.00    160.00

                                                  ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

      STORAGE        .00      2.83      5.67      8.50     11.33     14.17     17.00     19.83     22.67     25.50
      OUTFLOW        .00     64.38    204.18    400.93    646.96    937.49   1269.15   1639.32   2045.95   2487.28
    ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

      STORAGE      28.33     31.17     34.00     36.83     39.67     42.50     45.33     48.17     51.00     53.83
      OUTFLOW    2961.86   3468.42   4005.81   4573.06   5169.25   5793.58   6445.29   7123.70   7828.17   8558.12
    ELEVATION     102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     2046. TO     8558.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                       HYDROGRAPH AT STATION   15A15B
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1597.      4.25                232.          79.          27.          12.
                (INCHES)       1.135        1.535        1.586        1.587
                 (AC-FT)       115.          156.         161.         161.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+ (AC-FT)       (HR)
        10.     4.25                  3.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
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     101.63      4.25              100.45      100.19      100.06       100.03

                        CUMULATIVE AREA =     1.90 SQ MI


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

                         HYDROGRAPH AT STATION    15A15B
                       TRANSPOSITION AREA        .5 SQ MI

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +     1585.        4.25                   231.          78.          27.          12.
                                  (INCHES)  1.126         1.523        1.574        1.574
                                   (AC-FT)   114.          155.         160.         160.

    PEAK STORAGE      TIME                       MAXIMUM AVERAGE STORAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +   (AC-FT)        (HR)
          10.         4.25                     3.            1.           0.           0.

     PEAK STAGE       TIME                       MAXIMUM AVERAGE STAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (FEET)        (HR)
        101.62        4.25                 100.44        100.18       100.06       100.03

                        CUMULATIVE AREA =     1.90 SQ MI


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

                         HYDROGRAPH AT STATION    15A15B
                       TRANSPOSITION AREA       2.8 SQ MI

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +      896.        4.25                   183.          63.          22.           9.
                                  (INCHES)   .893         1.234        1.278        1.279
                                   (AC-FT)    91.          125.         130.         130.

    PEAK STORAGE      TIME                       MAXIMUM AVERAGE STORAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +   (AC-FT)        (HR)
           7.         4.25                     2.            1.           0.           0.

     PEAK STAGE       TIME                       MAXIMUM AVERAGE STAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (FEET)        (HR)
        101.15        4.25                 100.40        100.16       100.06       100.02

                        CUMULATIVE AREA =     1.90 SQ MI


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

                         HYDROGRAPH AT STATION    15A15B
                       TRANSPOSITION AREA      16.0 SQ MI

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +      629.        4.33                   137.          48.          17.           7.
                                  (INCHES)   .669          .941         .980         .981
                                   (AC-FT)    68.           96.         100.         100.

    PEAK STORAGE      TIME                       MAXIMUM AVERAGE STORAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +   (AC-FT)        (HR)
           6.         4.33                     2.            1.           0.           0.

     PEAK STAGE       TIME                       MAXIMUM AVERAGE STAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (FEET)        (HR)
        100.93        4.33                 100.34        100.14       100.05       100.02

                        CUMULATIVE AREA =     1.90 SQ MI


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

                         HYDROGRAPH AT STATION    15A15B
                       TRANSPOSITION AREA      90.0 SQ MI

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +      328.        4.42                    76.          28.          10.           4.
                                  (INCHES)   .372          .547         .577         .578
                                   (AC-FT)    38.           56.          59.          59.

    PEAK STORAGE      TIME                       MAXIMUM AVERAGE STORAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +   (AC-FT)        (HR)
           4.         4.42                     1.            1.           0.           0.
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     PEAK STAGE       TIME                       MAXIMUM AVERAGE STAGE
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (FEET)        (HR)
        100.62        4.42                 100.22        100.09       100.03       100.01

                        CUMULATIVE AREA =     1.90 SQ MI

   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/01JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/02JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/03JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/04JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/05JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/06JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/07JAN1999/5MIN//
   -----DSS---ZWRITE Unit   71; Vers.   40:  //15A15B/FLOW/08JAN1999/5MIN//
         ***           ***           ***           ***           ***


                        INTERPOLATED HYDROGRAPH AT    15A15B

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +     1050.        4.25                   194.          67.          23.          10.
                                  (INCHES)   .944         1.298        1.344        1.345
                                   (AC-FT)    96.          132.         137.         137.

                        CUMULATIVE AREA =     1.90 SQ MI


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

               **************
               *            *
   267 KK      *    S115B   *        BASIN
               *            *
               **************
                                  Compute runoff from subbasin 115B

                  SUBBASIN RUNOFF DATA

   269 BA           SUBBASIN CHARACTERISTICS
                          TAREA          .33  SUBBASIN AREA

   270 LG           GREEN AND AMPT LOSS RATE
                          STRTL          .35  STARTING LOSS
                            DTH          .35  MOISTURE DEFICIT
                           PSIF         3.78  WETTING FRONT SUCTION
                          XKSAT          .45  HYDRAULIC CONDUCTIVITY
                          RTIMP          .00  PERCENT IMPERVIOUS AREA

   268 UI           INPUT UNITGRAPH,    9 ORDINATES,   VOLUME = 1.00
                       169.0      626.0      786.0      483.0      251.0      125.0       66.0       25.0       20.0
                                                                    ***

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

                         HYDROGRAPH AT STATION    S115B
                       TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.89, TOTAL EXCESS =     1.30

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +      767.        4.08                    46.          12.           4.           2.
                                  (INCHES)  1.298         1.298        1.298        1.298
                                   (AC-FT)    23.           23.          23.          23.

                        CUMULATIVE AREA =      .33 SQ MI


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

                         HYDROGRAPH AT STATION    S115B
                       TRANSPOSITION AREA        .5 SQ MI

     TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.89, TOTAL EXCESS =     1.29

      PEAK FLOW       TIME                         MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR        72-HR      166.58-HR
   +    (CFS)         (HR)
                                    (CFS)
   +      762.        4.08                    46.          11.           4.           2.
                                  (INCHES)  1.286         1.286        1.286        1.286
                                   (AC-FT)    23.           23.          23.          23.

                        CUMULATIVE AREA =      .33 SQ MI


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                           HYDROGRAPH AT STATION     S115B
                         TRANSPOSITION AREA       2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.17, TOTAL EXCESS =     .95

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     360.        4.08                    34.           8.           3.           1.
                          (INCHES)      .948         .948         .948         .948
                           (AC-FT)       17.          17.          17.          17.

                         CUMULATIVE AREA =     .33 SQ MI

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

                           HYDROGRAPH AT STATION     S115B
                         TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.31, TOTAL EXCESS =     .64

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     239.        4.08                    23.           6.           2.           1.
                          (INCHES)      .632         .632         .632         .632
                           (AC-FT)       11.          11.          11.          11.

                         CUMULATIVE AREA =     .33 SQ MI

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

                           HYDROGRAPH AT STATION     S115B
                         TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.33, TOTAL EXCESS =     .26

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     108.        4.08                     9.           2.           1.           0.
                          (INCHES)      .261         .261         .261         .261
                           (AC-FT)        5.           5.           5.           5.

                         CUMULATIVE AREA =     .33 SQ MI

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


                         INTERPOLATED HYDROGRAPH AT     S115B

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     763.        4.08                    46.          11.           4.           2.
                          (INCHES)     1.289        1.289        1.289        1.289
                           (AC-FT)       23.          23.          23.          23.

                         CUMULATIVE AREA =     .33 SQ MI

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

              **************
              *            *
 272 KK       *    C115B   *    COMBINE
              *            *
              **************

                                Combine runoff from S115B with routed flow from C115A
                                This is the total inflow to the SVP channel from the Fan 1 corridor.

 275 HC        HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                        ***

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

                           HYDROGRAPH AT STATION     C115B
                         TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    1994.        4.17                   277.          90.          31.          13.
                          (INCHES)     1.151        1.500        1.543        1.544
                           (AC-FT)      137.         179.         184.         184.

                         CUMULATIVE AREA =    2.24 SQ MI

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

                           HYDROGRAPH AT STATION     C115B
                         TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    1977.        4.17                   275.          89.          31.          13.
                          (INCHES)     1.142        1.488        1.531        1.532
                           (AC-FT)      136.         177.         183.         183.

                         CUMULATIVE AREA =    2.24 SQ MI

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

                           HYDROGRAPH AT STATION     C115B
                         TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    1153.        4.25                   215.          72.          25.          11.
                          (INCHES)      .893        1.191        1.229        1.230
                           (AC-FT)      106.         142.         147.         147.

                         CUMULATIVE AREA =    2.24 SQ MI

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

                           HYDROGRAPH AT STATION     C115B
                         TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     787.        4.25                   158.          54.          19.           8.
                          (INCHES)      .657         .895         .929         .929
                           (AC-FT)       78.         107.         111.         111.

                         CUMULATIVE AREA =    2.24 SQ MI

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

                           HYDROGRAPH AT STATION     C115B
                         TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+     391.        4.33                    85.          30.          11.           5.
                          (INCHES)      .353         .505         .530         .531
                           (AC-FT)       42.          60.          63.          63.

                         CUMULATIVE AREA =    2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   40:  //C115B/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                         INTERPOLATED HYDROGRAPH AT     C115B

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
+    (CFS)        (HR)
                            (CFS)
+    1255.        4.25                   222.          74.          25.          11.
                          (INCHES)      .925        1.230        1.269        1.269
                           (AC-FT)      110.         147.         151.         151.

                         CUMULATIVE AREA =    2.24 SQ MI

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

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              *            *
 277 KK       *    D115B   *    DIVERT
              *            *
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                    Proposed Detention Basin
                    limit flow to capacity of existing Sun Valley Parkway
                     STRUCTURE ID:D115B

     DT          DIVERSION
                      ISTAD        DOUT  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW         .00    200.00    400.00    600.00    800.00   1050.00   1100.00   1200.00   1500.00   2000.00
                                2500.00   3000.00

     DQ       DIVERTED FLOW         .00       .00       .00       .00       .00       .00     50.00    150.00    450.00    950.00
                                1450.00   1950.00

                                                        ***

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

                        DIVERSION HYDROGRAPH     DOUT
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     944.      4.17                44.          11.           4.           2.
                  (INCHES)         .183         .183         .183         .183
                   (AC-FT)         22.          22.          22.          22.

                  CUMULATIVE AREA =    2.24 SQ MI

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

                        HYDROGRAPH AT STATION    D115B
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1050.      4.08                233.          79.          27.          12.
                  (INCHES)         .968        1.317        1.360        1.361
                   (AC-FT)         115.         157.         162.         162.

                  CUMULATIVE AREA =    2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  235:  //D115B/FLOW/08JAN1999/5MIN//

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

                        DIVERSION HYDROGRAPH     DOUT
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     927.      4.17                 43.          11.           4.           2.
                  (INCHES)         .179         .179         .179         .179
                   (AC-FT)         21.          21.          21.          21.

                  CUMULATIVE AREA =    2.24 SQ MI

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

                        HYDROGRAPH AT STATION    D115B
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1050.      4.08                231.          79.          27.          12.
                  (INCHES)         .962        1.309        1.352        1.353
                   (AC-FT)         115.         156.         161.         161.

                  CUMULATIVE AREA =    2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  236:  //D115B/FLOW/08JAN1999/5MIN//

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

                        DIVERSION HYDROGRAPH     DOUT
                       TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     103.      4.25                  3.           1.           0.           0.
                  (INCHES)         .013         .013         .013         .013
                   (AC-FT)         2.           2.           2.           2.

                  CUMULATIVE AREA =    2.24 SQ MI

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

                        HYDROGRAPH AT STATION    D115B
                       TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1050.      4.17                211.          71.          24.          11.
                  (INCHES)         .879        1.178        1.216        1.216
                   (AC-FT)         105.         140.         145.         145.

                  CUMULATIVE AREA =    2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  237:  //D115B/FLOW/08JAN1999/5MIN//

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

                        DIVERSION HYDROGRAPH     DOUT
                       TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+       0.       .00                  0.           0.           0.           0.
                  (INCHES)         .000         .000         .000         .000
                   (AC-FT)         0.           0.           0.           0.

                  CUMULATIVE AREA =    2.24 SQ MI

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

                        HYDROGRAPH AT STATION    D115B
                       TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     787.      4.25                158.          54.          19.           8.
                  (INCHES)         .657         .895         .929         .929
                   (AC-FT)         78.          107.         111.         111.

                  CUMULATIVE AREA =    2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  238:  //D115B/FLOW/08JAN1999/5MIN//

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

                        DIVERSION HYDROGRAPH     DOUT
                       TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+       0.       .00                  0.           0.           0.           0.
                  (INCHES)         .000         .000         .000         .000
                   (AC-FT)         0.           0.           0.           0.

                  CUMULATIVE AREA =    2.24 SQ MI

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

                        HYDROGRAPH AT STATION    D115B
                       TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
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+     391.      4.33                 85.          30.          11.           5.
                     (INCHES)      .353         .505         .530         .531
                      (AC-FT)       42.          60.          63.          63.

                      CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  239:  //D115B/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                   INTERPOLATED DIVERSION HYDROGRAPH AT     DOUT

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     205.      4.25                   8.           2.           1.           0.
                     (INCHES)      .035         .035         .035         .035
                      (AC-FT)        4.           4.           4.           4.

                      CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  240:  //D115B/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                      INTERPOLATED HYDROGRAPH AT    D115B

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+    1050.      4.17                 214.          72.          25.          11.
                     (INCHES)      .890        1.195        1.234        1.234
                      (AC-FT)       106.         142.         147.         147.

                      CUMULATIVE AREA =     2.24 SQ MI


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

           **************
           *            *
 287 KK    *   15B15C   *       ROUTE
           *            *
           **************
                     This is existing SV PKWY Channel
                     Note the routing slope is the channel design slope not
                     the general (adjacent) ground slope.
                          Route flows in existing Sun Valley Parkway channel

             HYDROGRAPH ROUTING DATA

 292 RS        STORAGE ROUTING
                     NSTPS            5  NUMBER OF SUBREACHES
                      ITYP         FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC        -1.00  INITIAL CONDITION
                         X          .00 WORKING R AND D COEFFICIENT

 293 RC        NORMAL DEPTH CHANNEL
                       ANL         .030  LEFT OVERBANK N-VALUE
                      ANCH         .030  MAIN CHANNEL N-VALUE
                       ANR         .030  RIGHT OVERBANK N-VALUE
                     RLNTH        7899.  REACH LENGTH
                       SEL        .0015  ENERGY SLOPE
                     ELMAX        103.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 295 RY      ELEVATION   103.50    100.00    100.00     98.00     98.00    100.00    100.00    103.50
 294 RX      DISTANCE       .00     14.00     38.00     44.00     64.00     70.00     94.00    108.00

                                                       ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

             STORAGE        .00      1.10      2.28      3.56      4.93      6.39      7.94      9.81     14.08     18.48
             OUTFLOW        .00      4.93     15.89     31.73     52.10     76.89    106.07    140.33    197.04    271.86
           ELEVATION      98.00     98.29     98.58     98.87     99.16     99.45     99.74    100.03    100.32    100.61

             STORAGE      22.99     27.63     32.38     37.26     42.26     47.39     52.63     57.99     63.48     69.09
             OUTFLOW     362.00    466.24    583.90    714.52    857.81   1013.56   1181.64   1361.95   1554.44   1759.10
           ELEVATION     100.89    101.18    101.47    101.76    102.05    102.34    102.63    102.92    103.21    103.50

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

                        HYDROGRAPH AT STATION   15B15C
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     921.      4.75                 226.          79.          27.          12.
                     (INCHES)      .941        1.311        1.360        1.361
                      (AC-FT)       112.         156.         162.         162.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        9.      4.75                   3.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
    102.17      4.75                100.23        99.14        98.44        98.19

                      CUMULATIVE AREA =     2.24 SQ MI

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

                        HYDROGRAPH AT STATION   15B15C
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     919.      4.75                 225.          78.          27.          12.
                     (INCHES)      .935        1.303        1.352        1.353
                      (AC-FT)       112.         155.         161.         161.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        9.      4.75                   3.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
    102.17      4.75                100.23        99.13        98.43        98.19

                      CUMULATIVE AREA =     2.24 SQ MI

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

                        HYDROGRAPH AT STATION   15B15C
                      TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     872.      4.75                 206.          70.          24.          11.
                     (INCHES)      .857        1.172        1.216        1.216
                      (AC-FT)       102.         140.         145.         145.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        9.      4.75                   3.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
    102.08      4.75                100.09        99.05        98.40        98.17

                      CUMULATIVE AREA =     2.24 SQ MI

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

                        HYDROGRAPH AT STATION   15B15C
                      TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     592.      4.83                 154.          54.          19.           8.
                     (INCHES)      .639         .891         .929         .929
                      (AC-FT)        76.         106.         111.         111.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        7.      4.83                   2.           1.           0.           0.
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 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
+  (FEET)      (HR)
    101.49     4.83               99.84        98.92        98.35        98.15

                      CUMULATIVE AREA =     2.24 SQ MI


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

                    HYDROGRAPH AT STATION   15B15C
                   TRANSPOSITION AREA      90.0 SQ MI

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     259.     5.08                 82.          30.          11.           5.
                       (INCHES)    .340         .503         .530         .531
                        (AC-FT)     41.          60.          63.          63.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)     (HR)
        4.     5.08                  1.           1.           0.           0.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
+  (FEET)      (HR)
    100.55     5.08               99.37        98.70        98.27        98.12

                      CUMULATIVE AREA =     2.24 SQ MI

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


                      INTERPOLATED HYDROGRAPH AT    15B15C

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     878.     4.75                208.          71.          25.          11.
                       (INCHES)    .867        1.189        1.234        1.234
                        (AC-FT)    103.         142.         147.         147.

                      CUMULATIVE AREA =     2.24 SQ MI


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


             **************
             *            *
 296 KK      *   S115C    *        BASIN
             *            *
             **************
                          Compute runoff from subbasin 115C

               SUBBASIN RUNOFF DATA

 298 BA          SUBBASIN CHARACTERISTICS
                      TAREA          .43  SUBBASIN AREA

 299 LG          GREEN AND AMPT LOSS RATE
                      STRTL          .35  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         4.00  WETTING FRONT SUCTION
                     XKSAT           .47  HYDRAULIC CONDUCTIVITY
                     RTIMP           .00  PERCENT IMPERVIOUS AREA

 297 UI          INPUT UNITGRAPH,  16 ORDINATES,   VOLUME = 1.00
                    64.0     250.0     457.0     595.0     594.0     444.0     299.0     208.0     135.0      93.0
                    62.0      44.0      23.0      15.0      16.0      16.0
                                                                ***

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

                    HYDROGRAPH AT STATION    S115C
                   TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.94, TOTAL EXCESS =    1.26

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     672.     4.17                 58.          14.           5.           2.
                       (INCHES)   1.256        1.256        1.256        1.256
                        (AC-FT)     29.          29.          29.          29.

                      CUMULATIVE AREA =      .43 SQ MI

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                    HYDROGRAPH AT STATION    S115C
                   TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.93, TOTAL EXCESS =    1.25

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     667.     4.17                 57.          14.           5.           2.
                       (INCHES)   1.245        1.245        1.245        1.245
                        (AC-FT)     28.          28.          28.          28.

                      CUMULATIVE AREA =      .43 SQ MI


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

                    HYDROGRAPH AT STATION    S115C
                   TRANSPOSITION AREA       2.8 SQ MI

   TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.22, TOTAL EXCESS =     .90

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     358.     4.25                 41.          10.           3.           1.
                       (INCHES)    .896         .896         .896         .896
                        (AC-FT)     21.          21.          21.          21.

                      CUMULATIVE AREA =      .43 SQ MI


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

                    HYDROGRAPH AT STATION    S115C
                   TRANSPOSITION AREA      16.0 SQ MI

   TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.37, TOTAL EXCESS =     .58

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     233.     4.25                 27.           7.           2.           1.
                       (INCHES)    .581         .581         .581         .581
                        (AC-FT)     13.          13.          13.          13.

                      CUMULATIVE AREA =      .43 SQ MI


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

                    HYDROGRAPH AT STATION    S115C
                   TRANSPOSITION AREA      90.0 SQ MI

   TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.38, TOTAL EXCESS =     .21

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+      94.     4.25                 10.           2.           1.           0.
                       (INCHES)    .214         .214         .214         .214
                        (AC-FT)      5.           5.           5.           5.

                      CUMULATIVE AREA =      .43 SQ MI

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


                      INTERPOLATED HYDROGRAPH AT    S115C

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+  (CFS)       (HR)
                         (CFS)
+     668.     4.17                 58.          14.           5.           2.
                       (INCHES)   1.246        1.246        1.246        1.246
                        (AC-FT)     29.          29.          29.          29.

                      CUMULATIVE AREA =      .43 SQ MI


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


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             *            *
 302 KK      *  C115CR    *        COMBINE
             *            *
             **************
                          Combine runoff from S115C with routed flow from C115B

 304 HC          HYDROGRAPH COMBINATION
                      ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
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*** *** *** *** ***

HYDROGRAPH AT STATION C115CR
TRANSPOSITION AREA .1 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1035.	4.67	278.	93.	32.	14.
			(INCHES) .971	1.300	1.343	1.344
			(AC-FT) 138.	185.	191.	191.

CUMULATIVE AREA = 2.66 SQ MI

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

HYDROGRAPH AT STATION C115CR
TRANSPOSITION AREA .5 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1032.	4.67	277.	93.	32.	14.
			(INCHES) .965	1.292	1.335	1.335
			(AC-FT) 137.	184.	190.	190.

CUMULATIVE AREA = 2.66 SQ MI

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

HYDROGRAPH AT STATION C115CR
TRANSPOSITION AREA 2.8 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	982.	4.67	241.	81.	28.	12.
			(INCHES) .842	1.126	1.164	1.165
			(AC-FT) 120.	160.	166.	166.

CUMULATIVE AREA = 2.66 SQ MI

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

HYDROGRAPH AT STATION C115CR
TRANSPOSITION AREA 16.0 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	638.	4.75	175.	60.	21.	9.
			(INCHES) .612	.840	.873	.873
			(AC-FT) 87.	119.	124.	124.

CUMULATIVE AREA = 2.66 SQ MI

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

HYDROGRAPH AT STATION C115CR
TRANSPOSITION AREA 90.0 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	263.	5.00	89.	33.	11.	5.
			(INCHES) .309	.456	.479	.480
			(AC-FT) 44.	65.	68.	68.

CUMULATIVE AREA = 2.66 SQ MI

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

INTERPOLATED HYDROGRAPH AT C115CR

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	983.	4.67	242.	81.	28.	12.
			(INCHES) .846	1.131	1.169	1.170
			(AC-FT) 120.	161.	166.	166.

CUMULATIVE AREA = 2.66 SQ MI

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305 KK S120A BASIN

Compute runoff from subbasin 120A

SUBBASIN RUNOFF DATA

307 BA SUBBASIN CHARACTERISTICS
TAREA 1.37 SUBBASIN AREA

308 LG GREEN AND AMPT LOSS RATE
STRTL .32 STARTING LOSS
DTH .35 MOISTURE DEFICIT
PSIF 4.80 WETTING FRONT SUCTION
XKSAT .30 HYDRAULIC CONDUCTIVITY
RTIMP 2.00 PERCENT IMPERVIOUS AREA

306 UI INPUT UNITGRAPH, 18 ORDINATES, VOLUME = 1.00
180.0 559.0 1100.0 1547.0 1740.0 1553.0 1160.0 826.0 580.0 409.0
305.0 205.0 141.0 123.0 43.0 44.0 45.0 44.0

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

HYDROGRAPH AT STATION S120A
TRANSPOSITION AREA .1 SQ MI

TOTAL RAINFALL = 3.20, TOTAL LOSS = 1.69, TOTAL EXCESS = 1.51

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	2204.	4.25	222.	56.	19.	8.
			(INCHES) 1.503	1.504	1.504	1.504
			(AC-FT) 110.	110.	110.	110.

CUMULATIVE AREA = 1.37 SQ MI

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

HYDROGRAPH AT STATION S120A
TRANSPOSITION AREA .5 SQ MI

TOTAL RAINFALL = 3.18, TOTAL LOSS = 1.68, TOTAL EXCESS = 1.50

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	2189.	4.25	220.	55.	18.	8.
			(INCHES) 1.491	1.492	1.492	1.492
			(AC-FT) 109.	109.	109.	109.

CUMULATIVE AREA = 1.37 SQ MI

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

HYDROGRAPH AT STATION S120A
TRANSPOSITION AREA 2.8 SQ MI

TOTAL RAINFALL = 3.12, TOTAL LOSS = 1.93, TOTAL EXCESS = 1.19

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1326.	4.25	175.	44.	15.	6.
			(INCHES) 1.181	1.182	1.182	1.182
			(AC-FT) 87.	87.	87.	87.

CUMULATIVE AREA = 1.37 SQ MI

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

HYDROGRAPH AT STATION S120A
TRANSPOSITION AREA 16.0 SQ MI

TOTAL RAINFALL = 2.95, TOTAL LOSS = 2.07, TOTAL EXCESS = .88

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	941.	4.25	130.	33.	11.	5.
			(INCHES) .881	.881	.881	.881
			(AC-FT) 65.	65.	65.	65.

CUMULATIVE AREA = 1.37 SQ MI

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

                        HYDROGRAPH AT STATION    S120A
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.11, TOTAL EXCESS =     .48

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     509.      4.25                70.         18.          6.          3.
                     (INCHES)       .475        .476        .476        .476
                     (AC-FT)         35.         35.         35.         35.

                       CUMULATIVE AREA =    1.37 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   19:  //S120A/FLOW/08JAN1999/5MIN//
        ***            ***            ***            ***            ***


                       INTERPOLATED HYDROGRAPH AT    S120A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+    1683.      4.25                193.         48.         16.          7.
                     (INCHES)      1.309       1.310       1.310       1.310
                     (AC-FT)         96.         96.         96.         96.

                       CUMULATIVE AREA =    1.37 SQ MI



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            **************
            *            *
 312 KK     *     D120A  *       DIVERT
            *            *
            **************
                       Proposed Detention Basin
                       limit flow to capacity of existing Sun Valley Parkway
                        STRUCTURE ID:D120A

       DT          DIVERSION
                      ISTAD        DOUT  DIVERSION HYDROGRAPH IDENTIFICATION

       DI             INFLOW         .00    200.00    400.00    600.00    750.00    950.00   1000.00   1150.00   1450.00   1950.00
                                   2450.00   2950.00

       DQ       DIVERTED FLOW        .00       .00       .00       .00       .00       .00     50.00    200.00    500.00   1000.00
                                   1500.00   2000.00

                                                                    ***

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

                       DIVERSION HYDROGRAPH     DOUT
                      TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+    1254.      4.25                72.         18.          6.          3.
                     (INCHES)       .488        .488        .488        .488
                     (AC-FT)         36.         36.         36.         36.

                       CUMULATIVE AREA =    1.37 SQ MI


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

                       HYDROGRAPH AT STATION    D120A
                      TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     950.      4.00                150.         38.         13.          5.
                     (INCHES)      1.015       1.016       1.016       1.016
                     (AC-FT)         74.         74.         74.         74.

                       CUMULATIVE AREA =    1.37 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/01JAN1999/5MIN//
```



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  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  109:  //D120A/FLOW/08JAN1999/5MIN//

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

                       DIVERSION HYDROGRAPH     DOUT
                      TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+    1239.      4.25                71.         18.          6.          3.
                     (INCHES)       .479        .479        .479        .479
                     (AC-FT)         35.         35.         35.         35.

                       CUMULATIVE AREA =    1.37 SQ MI


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

                       HYDROGRAPH AT STATION    D120A
                      TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     950.      4.00                150.         37.         12.          5.
                     (INCHES)      1.012       1.012       1.012       1.012
                     (AC-FT)         74.         74.         74.         74.

                       CUMULATIVE AREA =    1.37 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  110:  //D120A/FLOW/08JAN1999/5MIN//

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

                       DIVERSION HYDROGRAPH     DOUT
                      TRANSPOSITION AREA        2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     376.      4.25                20.          5.          2.          1.
                     (INCHES)       .136        .136        .136        .136
                     (AC-FT)         10.         10.         10.         10.

                       CUMULATIVE AREA =    1.37 SQ MI


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

                       HYDROGRAPH AT STATION    D120A
                      TRANSPOSITION AREA        2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     950.      4.08                154.         39.         13.          6.
                     (INCHES)      1.045       1.046       1.046       1.046
                     (AC-FT)         77.         77.         77.         77.

                       CUMULATIVE AREA =    1.37 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.  111:  //D120A/FLOW/08JAN1999/5MIN//

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

                       DIVERSION HYDROGRAPH     DOUT
                      TRANSPOSITION AREA       16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                     (CFS)
+       0.       .00                 0.          0.          0.          0.
                     (INCHES)       .000        .000        .000        .000
                     (AC-FT)          0.          0.          0.          0.
```

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                    CUMULATIVE AREA =    1.37 SQ MI


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

                  HYDROGRAPH AT STATION    D120A
                 TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     941.      4.25              130.         33.         11.          5.
                (INCHES)         .881        .881        .881         .881
                 (AC-FT)          65.         65.         65.          65.

                    CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  112:  //D120A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                  DIVERSION HYDROGRAPH     DOUT
                 TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+       0.       .00                0.          0.          0.           0.
                (INCHES)         .000        .000        .000         .000
                 (AC-FT)           0.          0.          0.           0.

                    CUMULATIVE AREA =    1.37 SQ MI

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

                  HYDROGRAPH AT STATION    D120A
                 TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     509.      4.25               70.         18.          6.           3.
                (INCHES)         .475        .476        .476         .476
                 (AC-FT)          35.         35.         35.          35.

                    CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  113:  //D120A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                INTERPOLATED DIVERSION HYDROGRAPH AT     DOUT

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     733.      4.25               41.         10.          3.           1.
                (INCHES)         .278        .278        .278         .278
                 (AC-FT)          20.         20.         20.          20.

                    CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.  114:  //D120A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                INTERPOLATED HYDROGRAPH AT    D120A

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
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                 (CFS)
+     950.      4.08              152.         38.         13.          5.
                (INCHES)         1.031       1.032       1.032        1.032
                 (AC-FT)          76.         76.         76.          76.

                    CUMULATIVE AREA =    1.37 SQ MI


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

              **************
              *            *
 322 KK       *    C115C   *     COMBINE
              *            *
              **************
                    Combine non-diverted runoff from S120A with flow from C115CR

 324 HC           HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                          ***
      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION    C115C
                 TRANSPOSITION AREA      .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1881.      4.58              425.        130.         45.         19.
                (INCHES)         .978       1.201       1.232        1.232
                 (AC-FT)         211.        259.        265.         265.

                    CUMULATIVE AREA =    4.04 SQ MI

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

                  HYDROGRAPH AT STATION    C115C
                 TRANSPOSITION AREA      .5 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1869.      4.58              422.        130.         44.         19.
                (INCHES)         .972       1.194       1.225        1.225
                 (AC-FT)         209.        257.        264.         264.

                    CUMULATIVE AREA =    4.04 SQ MI

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

                  HYDROGRAPH AT STATION    C115C
                 TRANSPOSITION AREA     2.8 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1771.      4.50              393.        119.         41.         18.
                (INCHES)         .905       1.096       1.124        1.124
                 (AC-FT)         195.        236.        242.         242.

                    CUMULATIVE AREA =    4.04 SQ MI

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

                  HYDROGRAPH AT STATION    C115C
                 TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1242.      4.33              302.         92.         32.         14.
                (INCHES)         .696        .850        .876         .876
                 (AC-FT)         150.        183.        189.         189.

                    CUMULATIVE AREA =    4.04 SQ MI

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

                  HYDROGRAPH AT STATION    C115C
                 TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     613.      4.33              155.         50.         17.          7.
                (INCHES)         .357        .459        .478         .479
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                    (AC-FT)        77.         99.        103.        103.

                    CUMULATIVE AREA =     4.04 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT    C115C

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+    1645.       4.50              374.         113.         39.          17.
                  (INCHES)         .861        1.044       1.072        1.072
                  (AC-FT)         185.         225.        231.         231.

                    CUMULATIVE AREA =     4.04 SQ MI


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


          **************
          *            *
325 KK    *    115120  *        ROUTE
          *            *
          **************
                    This is existing SV PKWY Channel
                    Note the routing slope is the channel design slope not
                    the general (adjacent) ground slope.
                         Route total flows from C115C to C120.

                  HYDROGRAPH ROUTING DATA

330 RS            STORAGE ROUTING
                       NSTPS           3  NUMBER OF SUBREACHES
                        ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC       -1.00  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

331 RC            NORMAL DEPTH CHANNEL
                         ANL        .030  LEFT OVERBANK N-VALUE
                        ANCH        .030  MAIN CHANNEL N-VALUE
                         ANR        .030  RIGHT OVERBANK N-VALUE
                       RLNTH       4136.  REACH LENGTH
                         SEL       .0015  ENERGY SLOPE
                       ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
333 RY        ELEVATION   104.50    100.00    100.00     98.00     98.00    100.00    100.00    104.50
332 RX        DISTANCE       .00     18.00     52.00     58.00     78.00     84.00    118.00    136.00

                                             ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .68      1.43      2.25      3.13      4.08      5.44      8.74     12.14     15.62
          OUTFLOW        .00      6.53     21.11     42.29     69.69    103.23    144.82    223.98    334.11    470.28
        ELEVATION      98.00     98.34     98.68     99.03     99.37     99.71    100.05    100.39    100.74    101.08

          STORAGE      19.20     22.86     26.61     30.45     34.38     38.40     42.50     46.70     50.98     55.35
          OUTFLOW     630.31    812.88   1017.13   1242.45   1488.43   1754.77   2041.24   2347.71   2674.09   3020.31
        ELEVATION     101.42    101.76    102.11    102.45    102.79    103.13    103.47    103.82    104.16    104.50

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


                    HYDROGRAPH AT STATION   115120
                    TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+    1806.       4.67              422.         130.         45.          19.
                  (INCHES)         .971        1.199       1.232        1.232
                  (AC-FT)         209.         258.        265.         265.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       13.      4.67                4.           1.          1.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     103.19     4.67              100.62       99.27       98.49        98.21

                    CUMULATIVE AREA =     4.04 SQ MI


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


                    HYDROGRAPH AT STATION   115120
                    TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+    1797.       4.67              419.         130.         44.          19.
                  (INCHES)         .966        1.192       1.225        1.225
                  (AC-FT)         208.         257.        264.         264.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       13.      4.67                4.           1.          1.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     103.18     4.67              100.62       99.27       98.48        98.21

                    CUMULATIVE AREA =     4.04 SQ MI


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


                    HYDROGRAPH AT STATION   115120
                    TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+    1674.       4.75              390.         119.         41.          18.
                  (INCHES)         .899        1.095       1.124        1.124
                  (AC-FT)         194.         236.        242.         242.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       12.      4.75                4.           1.          0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     103.03     4.75              100.50       99.19       98.45        98.20

                    CUMULATIVE AREA =     4.04 SQ MI


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


                    HYDROGRAPH AT STATION   115120
                    TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+    1189.       4.58              300.         92.         32.          14.
                  (INCHES)         .691         .850        .876         .876
                  (AC-FT)         149.         183.        189.         189.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       10.      4.58                3.           1.          0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     102.37     4.58              100.23       99.06       98.40        98.17

                    CUMULATIVE AREA =     4.04 SQ MI


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


                    HYDROGRAPH AT STATION   115120
                    TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                      (CFS)
+     549.       4.67              154.         50.         17.           7.
                  (INCHES)         .354         .458        .478         .479
                  (AC-FT)          76.          99.        103.         103.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
        6.      4.67                2.           1.          0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     101.25     4.67              99.71        98.82       98.31        98.13

                    CUMULATIVE AREA =     4.04 SQ MI


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                    INTERPOLATED HYDROGRAPH AT   115120

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1569.       4.67                 371.        113.         39.          17.
                          (INCHES)    .855       1.043        1.072        1.072
                          (AC-FT)     184.        225.         231.         231.

                          CUMULATIVE AREA =     4.04 SQ MI


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

               **************
               *            *
 334 KK        *    S120B   *        BASIN
               *            *
               **************
                                       Compute runoff from subbasin 120B

                SUBBASIN RUNOFF DATA

 336 BA          SUBBASIN CHARACTERISTICS
                      TAREA          .64  SUBBASIN AREA

 337 LG          GREEN AND AMPT LOSS RATE
                      STRTL          .33  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         4.40  WETTING FRONT SUCTION
                      XKSAT          .38  HYDRAULIC CONDUCTIVITY
                      RTIMP         1.00  PERCENT IMPERVIOUS AREA

 335 UI          INPUT UNITGRAPH,  20 ORDINATES,  VOLUME = 1.00
                     77.0     200.0     420.0     606.0     725.0     711.0     600.0     445.0     322.0     239.0
                    172.0     130.0      91.0      68.0      52.0      33.0      19.0      18.0      19.0      18.0
                                                                ***

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

                        HYDROGRAPH AT STATION     S120B
                      TRANSPOSITION AREA         .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.82, TOTAL EXCESS =    1.38

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     893.       4.25                  95.         24.          8.           3.
                          (INCHES)   1.376       1.376        1.376        1.376
                          (AC-FT)      47.         47.         47.          47.

                          CUMULATIVE AREA =      .64 SQ MI

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

                        HYDROGRAPH AT STATION     S120B
                      TRANSPOSITION AREA         .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.81, TOTAL EXCESS =    1.37

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     887.       4.25                  94.         24.          8.           3.
                          (INCHES)   1.363       1.364        1.364        1.364
                          (AC-FT)      47.         47.         47.          47.

                          CUMULATIVE AREA =      .64 SQ MI

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

                        HYDROGRAPH AT STATION     S120B
                      TRANSPOSITION AREA        2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.09, TOTAL EXCESS =    1.03

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     535.       4.33                  71.         18.          6.           3.
                          (INCHES)   1.030       1.031        1.031        1.031
                          (AC-FT)      35.         35.         35.          35.

                          CUMULATIVE AREA =      .64 SQ MI
```

```
        ***           ***           ***           ***           ***

                        HYDROGRAPH AT STATION     S120B
                      TRANSPOSITION AREA       16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.22, TOTAL EXCESS =     .73

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     367.       4.33                  50.         13.          4.           2.
                          (INCHES)    .727        .728         .728         .728
                          (AC-FT)      25.         25.         25.          25.

                          CUMULATIVE AREA =      .64 SQ MI

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

                        HYDROGRAPH AT STATION     S120B
                      TRANSPOSITION AREA       90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.25, TOTAL EXCESS =     .34

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     178.       4.33                  24.          6.          2.           1.
                          (INCHES)    .342        .342         .342         .342
                          (AC-FT)      12.         12.         12.          12.

                          CUMULATIVE AREA =      .64 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT     S120B

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     835.       4.25                  91.         23.          8.           3.
                          (INCHES)   1.315       1.315        1.315        1.315
                          (AC-FT)      45.         45.         45.          45.

                          CUMULATIVE AREA =      .64 SQ MI


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

               **************
               *            *
 341 KK        *    C120B   *        COMBINE
               *            *
               **************

                                       Combine runoff from S120B with routed flow from C120A
                                       This is the total flow at the end of the SVP channel at Wagner Wash.

 344 HC          HYDROGRAPH COMBINATION
                      ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                ***

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

                        HYDROGRAPH AT STATION     C120B
                      TRANSPOSITION AREA         .1 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2383.       4.42                 514.        154.         53.          23.
                          (INCHES)   1.022       1.223        1.252        1.252
                          (AC-FT)     255.        305.         313.         313.

                          CUMULATIVE AREA =     4.68 SQ MI

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

                        HYDROGRAPH AT STATION     C120B
                      TRANSPOSITION AREA         .5 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    2369.       4.42                 511.        153.         52.          23.
                          (INCHES)   1.015       1.215        1.244        1.245
                          (AC-FT)     253.        303.         311.         311.

                          CUMULATIVE AREA =     4.68 SQ MI
```

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

HYDROGRAPH AT STATION C120B
TRANSPOSITION AREA 2.8 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1959.	4.67	459.	137.	47.	20.
			(INCHES) .912	1.085	1.111	1.112
			(AC-FT) 228.	271.	277.	278.

CUMULATIVE AREA = 4.68 SQ MI

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

HYDROGRAPH AT STATION C120B
TRANSPOSITION AREA 16.0 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1476.	4.50	348.	105.	36.	16.
			(INCHES) .691	.832	.855	.856
			(AC-FT) 173.	208.	214.	214.

CUMULATIVE AREA = 4.68 SQ MI

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

HYDROGRAPH AT STATION C120B
TRANSPOSITION AREA 90.0 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	673.	4.58	176.	56.	19.	8.
			(INCHES) .349	.442	.460	.460
			(AC-FT) 87.	110.	115.	115.

CUMULATIVE AREA = 4.68 SQ MI

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

INTERPOLATED HYDROGRAPH AT C120B

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1803.	4.58	426.	127.	43.	19.
			(INCHES) .847	1.011	1.036	1.036
			(AC-FT) 211.	252.	259.	259.

CUMULATIVE AREA = 4.68 SQ MI

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	S900	971.	4.50	186.	47.	16.	1.15		
+	HYDROGRAPH AT	S115A1	988.	4.17	107.	27.	9.	.59		
+	2 COMBINED AT	CFAN2	1388.	4.33	273.	69.	23.	1.74		
+	ROUTED TO	RR900	173.	5.75	142.	63.	23.	1.74		
+	DIVERSION TO	TOFAN1	59.	5.75	48.	21.	8.	1.74		
+	HYDROGRAPH AT	TOFAN2	114.	5.75	93.	42.	15.	1.74		
+	ROUTED TO	90091A	114.	6.00	93.	42.	15.	1.74		
+	HYDROGRAPH AT	S910A	680.	4.08	39.	10.	3.	.27		
+	2 COMBINED AT	C910A	463.	4.08	116.	51.	18.	1.42		
+	ROUTED TO	91A91B	394.	4.17	114.	50.	18.	1.42		
+	HYDROGRAPH AT	S910B	1444.	4.08	90.	22.	7.	.60		
+	2 COMBINED AT	C910B	1167.	4.08	181.	67.	24.	2.02		
+	ROUTED TO	91B915	995.	4.25	176.	67.	24.	2.02		
+	HYDROGRAPH AT	S915	1308.	4.42	197.	49.	16.	1.13		
+	2 COMBINED AT	C915	1822.	4.33	341.	108.	37.	3.14		
+	ROUTED TO	91592A	1746.	4.42	336.	107.	37.	3.14		
+	HYDROGRAPH AT	S920A	2040.	4.17	188.	47.	16.	1.53		
+	2 COMBINED AT	C920A	2591.	4.33	468.	141.	48.	4.67		
+	ROUTED TO	92A92B	2402.	4.58	459.	140.	48.	4.67		
+	HYDROGRAPH AT	S920B	1148.	4.08	81.	20.	7.	.48		
+	2 COMBINED AT	C920B	2553.	4.50	508.	153.	53.	5.15		
+	HYDROGRAPH AT	S920C	1622.	4.33	217.	54.	18.	1.28		
+	2 COMBINED AT	C920C	3498.	4.50	673.	194.	66.	6.43		
+	HYDROGRAPH AT	S110	662.	4.25	76.	19.	6.	.43		
+	ROUTED TO	RR110	96.	5.00	57.	19.	6.	.43		
+	ROUTED TO	F115A3	94.	5.58	56.	19.	6.	.43		
+	HYDROGRAPH AT	S115A3	815.	4.17	71.	18.	6.	.46		
+	2 COMBINED AT	C115A3	697.	4.17	112.	34.	11.	.88		
+	HYDROGRAPH AT	DRR900	59.	5.75	48.	21.	8.	1.74		
+	ROUTED TO	F215A2	58.	6.33	47.	21.	8.	1.74		
+	HYDROGRAPH AT	S115A2	877.	4.17	69.	17.	6.	.43		
+	2 COMBINED AT	C115A2	717.	4.17	104.	38.	14.	1.02		
+	2 COMBINED AT	C115A	1115.	4.17	197.	67.	23.	1.90		
+	ROUTED TO	15A15B	1050.	4.25	194.	67.	23.	1.90		
+	HYDROGRAPH AT	S115B	763.	4.08	46.	11.	4.	.33		
+	2 COMBINED AT	C115B	1255.	4.25	222.	74.	25.	2.24		
+	DIVERSION TO	DOUT	205.	4.25	8.	2.	1.	2.24		
+	HYDROGRAPH AT	D115B	1050.	4.17	214.	72.	25.	2.24		
+	ROUTED TO	15B15C	878.	4.75	208.	71.	25.	2.24		
+	HYDROGRAPH AT	S115C	668.	4.17	58.	14.	5.	.43		
+	2 COMBINED AT	C115CR	983.	4.67	242.	81.	28.	2.66		
+	HYDROGRAPH AT	S120A	1683.	4.25	193.	48.	16.	1.37		

```
          DIVERSION TO
+                         DOUT      733.    4.25       41.       10.        3.      1.37

          HYDROGRAPH AT
+                         D120A     950.    4.08      152.       38.       13.      1.37

          2 COMBINED AT
+                         C115C    1645.    4.50      374.      113.       39.      4.04

          ROUTED TO
+                        115120    1569.    4.67      371.      113.       39.      4.04

          HYDROGRAPH AT
+                         S120B     835.    4.25       91.       23.        8.       .64

          2 COMBINED AT
+                         C120B    1803.    4.58      426.      127.       43.      4.68


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


    -----DSS---ZCLOSE Unit:  71,   File: FANS126.DSS
               Pointer Utilization:    .46
               Number of Records:    248
               File Size:    407.2  Kbytes
               Percent Inactive:    .0
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN  1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   19DEC06  TIME  17:52:02   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
    1         ID   HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
    2         ID        - FAN SYSTEM 1 & 2
    3         ID
    4         ID   SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
    5         ID   JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
    6         ID   MODELER: TED LEHMAN
    7         ID   FILENAME: FANS1224.DAT
    8         ID
    9         ID   100-YEAR 24-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID            MODELED AREA = 11.1 SQ. MILES
   12         ID
   13         ID   GREEN-AMPT LOSS METHOD
   14         ID
   15         ID   S-GRAPH UNIT HYDROGRAPHS
   16         ID     - MOUNTAIN
   17         ID     - DESERT/RANGELAND
   18         ID
   19         ID   NORMAL-DEPTH CHANNEL ROUTING
   20         ID
   21         ID   LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
   22         ID     - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
   23         ID     - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
   24         ID     - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
   25         ID
   26         ID   SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
   27         IT       5  1JAN99    1200    2000
   28         IN      15
   29         IO       3
              *DIAGRAM
              *
   30         JD   4.198  0.1000
   31         PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
   32         PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
   33         PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
   34         PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
   35         PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
   36         PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
   37         PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
   38         PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
   39         PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
   40         PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
   41         JD   3.990    10.0
   42         JD   3.780    30.0
              *
   43         KK    S900   BASIN
   44         KM        Compute runoff from subbasin 900
   45         BA   1.147
   46         LG    0.26    0.37    5.30    0.24       6
   47         UI      79      81     192     329     471     553     629     801     886     579
   48         UI     495     447     398     367     320     285     242     205     188     176
   49         UI     150     128     103      97      87      79      61      61      53      39
   50         UI      39      39      39      19      16      15      15      15      16      15
   51         UI      15      15      15      16       0       0       0       0       0       0
              *
```

1 HEC-1 INPUT PAGE 2

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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   52         KK  S115A1   BASIN
   53         KM        Compute runoff from subbasin 115A1
   54         BA   0.590
   55         LG    0.30    0.38    6.40    0.16       4
   56         UI      85     311     576     841     685     477     385     298     215     177
   57         UI     124      98      72      58      42      37      17      16      16      17
   58         UI      16       0       0       0       0       0       0       0       0       0
              *
   59         KK   CFAN2 COMBINE
   60         KM        Combine runoff from S115A1 and S900 at Fan 2 detention basin
   61         HC       2
   62         ZW                 C=FLOW
              *
   63         KK   RR900 STORAGE
   64         KM   Proposed Detention Basin
   65         KM    ROUTE RUNOFF FROM S900 THROUGH PROPOSED DETENTION BASIN AT APEX FOR
   66         KM    ALLUVIAL FAN NO. 2
   67         KM    STRUCTURE ID:RR900
   68         KM    OUTLET BASED ON ASSUMED 2 pipe(s), dia: 4 ft
   69         RS       1    STOR      -1
   70         SV     0.0    18.5    37.7    57.5    78.0    99.2   121.0   143.5   166.7   215.3
   71         SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0     7.0     8.0    10.0
   72         SQ     0.0    21.9    46.9    87.9   126.9   157.0   193.0   224.4   252.9   282.9
   73         ZW                 C=FLOW
              *
   74         KK  TOFAN2   DIVERT
   75         KM     DIVERT OUTFLOWS TO FAN 1 (DIVERSION BASED ON RATIO OF INFLOWING DRAINAGE
   76         KM     AREAS FROM S115A1 (0.59 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 1)
   77         KM     AND S900 (1.147 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 2)
   78         KM     OUTLETS OF RR900 DESIGNED TO APPROXIMATE THIS 34% RATIO.
   79         DT  TOFAN1
   80         DI       0   10000
   81         DQ       0    3400
   82         ZW                 C=FLOW
              *
   83         KK  90091A   ROUTE
   84         KM   Proposed Channel
   85         KM        Route outflow from RR900 through subbasin 910A
   86         KM    Slope=(1808.0 - 1720.0) / 4336.0
   87         RS       3    FLOW      -1
   88         RC   0.045   0.045   0.045  4336.0    0.02   104.5
   89         RX     0.0     0.0     0.0     0.0    50.0    50.0    50.0    50.0
   90         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   91         ZW                 C=FLOW
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   92         KK   S910A   BASIN
   93         KM        Compute runoff from subbasin 910A
   94         BA   0.273
   95         LG    0.35    0.35    4.45    0.37       0
   96         UI     229     752     635     285     127      50      21       0       0       0
              *
   97         KK   C910A COMBINE
   98         KM        Combine runoff from S910A with routed outflow from Fan 2 detention basin
   99         HC       2    1.42
  100         ZW                 C=FLOW
              *
  101         KK  91A91B   ROUTE
  102         KM   Proposed Channel
  103         KM        Route combined flow from C910A through subbasin 910B
  104         KM    Slope=(1720.0 - 1660.0) / 3893.0
  105         RS       2    FLOW      -1
  106         RC   0.045   0.045   0.045  3893.0   0.015   104.5
  107         RX     0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
  108         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  109         ZW                 C=FLOW
              *
  110         KK   S910B   BASIN
  111         KM        Compute runoff from subbasin 910B
  112         BA   0.597
  113         LG    0.35    0.35    4.80    0.30       0
  114         UI     489    1615    1398     638     283     117      46       0       0       0
              *
  115         KK   C910B COMBINE
  116         KM        Combine runoff from S910B with routed flow from C910A at Sun Valley Prky
  117         HC       2   2.017
  118         ZW                 C=FLOW
              *
  119         KK  91B915   ROUTE
  120         KM   Proposed Channel
  121         KM        Route combined flow to C915
  122         KM    Slope=(1660.0 - 1623.0) / 3390.0
  123         RS       2    FLOW      -1
  124         RC   0.045   0.045   0.045  3390.0   0.011   105.0
  125         RX     0.0     0.0     0.0     0.0   180.0   180.0   180.0   180.0
  126         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
  127         ZW                 C=FLOW
              *
```

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 128          KK   S915   BASIN
 129          KM   Compute runoff from subbasin 915
 130          BA   1.126
 131          LG    0.25    0.37    6.60    0.14       1
 132          UI     102     163     397     611     809     929     977     949     801     634
 133          UI     506     395     311     248     194     158     113      96      70      71
1                                      HEC-1 INPUT                                          PAGE  4

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

 134          UI      32      25      25      25      25      26      25       0       0       0
              *

 135          KK   C915 COMBINE
 136          KM      Combine runoff from S915 with routed flow from C910B
 137          HC      2   3.143
 138          ZW                C=FLOW
              *

 139          KK  91592A   ROUTE
 140          KM   Proposed Channel
 141          KM        Route combined flow to C920A
 142          KM    Slope=(1623.0 - 1580.0) / 3859.0
 143          RS       2    FLOW      -1
 144          RC   0.045   0.045   0.045  3859.0   0.011   105.0
 145          RX     0.0     0.0     0.0     0.0   170.0   170.0   170.0   170.0
 146          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
 147          ZW                C=FLOW
              *

 148          KK   S920A   BASIN
 149          KM        Compute runoff from subbasin 920A
 150          BA   1.527
 151          LG    0.35    0.35    4.50    0.36       0
 152          UI     375    1465    2447    2631    1917    1163     715     450     262     175
 153          UI      70      69      69       0       0       0       0       0       0       0
              *

 154          KK   C920A COMBINE
 155          KM        Combine runoff from S920A with routed flow from C915
 156          HC       2    4.67
 157          ZW                C=FLOW
              *

 158          KK  92A92B   ROUTE
 159          KM   Proposed Channel
 160          KM        Route combined flow to C920B, outlet at Trilby Wash tributary.
 161          KM    Slope=(1580.0 - 1530.0) / 5003.0
 162          RS       3    FLOW      -1
 163          RC   0.045   0.045   0.045  5003.0    0.01   105.0
 164          RX     0.0     0.0     0.0     0.0   315.0   315.0   315.0   315.0
 165          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
 166          ZW                C=FLOW
              *

 167          KK   S920B   BASIN
 168          KM        Compute runoff from subbasin 920B
 169          BA   0.479
 170          LG    0.35    0.39    5.80    0.19       0
 171          UI     193     746    1039     787     440     235     128      71      27      27
 172          UI       0       0       0       0       0       0       0       0       0       0
              *
1                                      HEC-1 INPUT                                          PAGE  5

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

 173          KK   C920B COMBINE
 174          KM        Combine runoff from S920B with routed flow from C920A
 175          KM        This is the total flow at the downstream end of the Fan 2 corridor.
 176          HC       2   5.149
              *

 177          KK   S920C   BASIN
 178          KM        Compute runoff from subbasin 920C
 179          BA   1.285
 180          LG    0.35    0.36    6.80    0.13       0
 181          UI     140     311     701    1023    1274    1342    1246     979     738     552
 182          UI     423     304     238     176     134      96      83      34      34      35
 183          UI      34      34       0       0       0       0       0       0       0       0
              *

 184          KK   C920C COMBINE
 185          KM        Combine runoff from S920C with flow from C920B.  This is the total flow
 186          KM        in the Trilby Wash tributary.
 187          HC       2   6.434
              *

 188          KK    S110   BASIN
 189          KM        Compute runoff from subbasin 110
 190          BA   0.430
 191          LG    0.25    0.37    5.20    0.25       6
 192          UI      56     166     335     449     587     358     291     241     188     140
 193          UI     121      86      68      56      43      32      27      22      11      11
 194          UI      10      11      11       0       0       0       0       0       0       0
 195          ZW                C=FLOW
              *

 196          KK   RR110 STORAGE
 197          KM   Proposed Detention Basin
 198          KM    ROUTE COMBINED RUNOFF AT S110 THROUGH PROPOSED (BIG) DETENTION BASIN
 199          KM    AT ALLUVIAL FAN APEX NO. 1
 200          KM    STRUCTURE ID:RR110
 201          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft
 202          RS       1    STOR      -1
 203          SV     0.0     5.7    11.7    18.1    24.7    31.6    38.9    46.5    54.4    62.7
 204          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0     7.0     8.0     9.0
 205          SQ     0.0    16.3    32.7    55.4    82.6   104.1   127.5   156.5   180.6   210.6
 206          ZW                C=FLOW
              *

 207          KK  F115A3   ROUTE
 208          KM   Proposed Channel
 209          KM        Route flow from RR110 through subbasin 115A3
 210          KM    Slope=(1865.0 - 1682.0) / 7199.0
 211          RS       5    FLOW      -1
 212          RC   0.045   0.045   0.045  7199.0   0.025   104.5
 213          RX     0.0     0.0     0.0     0.0    95.0    95.0    95.0    95.0
 214          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 215          ZW                C=FLOW
              *
1                                      HEC-1 INPUT                                          PAGE  6

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

 216          KK  S115A3   BASIN
 217          KM        Compute runoff from subbasin 115A3
 218          BA   0.455
 219          LG    0.30    0.35    4.50    0.36       4
 220          UI      75     307     550     680     636     434     291     190     127      84
 221          UI      53      34      18      18      18       0       0       0       0       0
              *

 222          KK  C115A3 COMBINE
 223          KM        Combine runoff from S115A3 w/ routed outflow from Fan 1 detention basin
 224          HC       2
              *

 225          KK  DRR900 RETRIEVE
 226          KM        RETRIEVE DIVERTED OUTFLOW FROM RR900 (FLOW TO FAN 1 FROM FAN 2 BASIN)
 227          DR  TOFAN1
 228          ZW                C=FLOW
              *

 229          KK  F215A2   ROUTE
 230          KM   Proposed Channel
 231          KM        Route FAN 2 BASIN OUTFLOWS THRU SUBBASIN S115A2
 232          KM    Slope=(1815.0 - 1682.0) / 6201.0
 233          RS       4    FLOW      -1
 234          RC   0.045   0.045   0.045  6201.0   0.021   104.5
 235          RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
 236          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 237          ZW                C=FLOW
              *

 238          KK  S115A2   BASIN
 239          KM        Compute runoff from subbasin 115A2
 240          BA   0.429
 241          LG    0.35    0.38    5.40    0.23       0
 242          UI     111     434     708     755     521     313     192     118      69      43
 243          UI      20      19       0       0       0       0       0       0       0       0
              *

 244          KK  C115A2 COMBINE
 245          KM        Combine runoff from S115A2 with routed outflow from Fan 2 detention basi
 246          HC       2    1.02
              *

 247          KK   C115A COMBINE
 248          KM        Combine all flows at C115A (C115A2 + C115A3)
 249          HC       2
 250          ZW                C=FLOW
              *
1                                      HEC-1 INPUT                                          PAGE  7

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

 251          KK  15A15B   ROUTE
 252          KM   Proposed Channel
 253          KM        Route flows to Sun Valley Parkway
 254          KM    Slope=(1682.0 - 1622.0) / 3257.0
 255          RS       2    FLOW      -1
 256          RC   0.045   0.045   0.045  3257.0   0.018   104.5
 257          RX     0.0     0.0     0.0     0.0   160.0   160.0   160.0   160.0
 258          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 259          ZW                C=FLOW
              *

 260          KK   S115B   BASIN
 261          KM        Compute runoff from subbasin 115B
 262          BA   0.331
 263          LG    0.35    0.35    3.78    0.45       0
 264          UI     169     626     786     483     251     125      66      25      20       0
              *

 265          KK   C115B COMBINE
 266          KM        Combine runoff from S115B with routed flow from C115A
```

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          267          KM        This is the total inflow to the SVP channel from the Fan 1 corridor.
          268          HC       2
          269          ZW                 C=FLOW
                       *

          270          KK   D115B  DIVERT
          271          KM   Proposed Detention Basin
          272          KM   limit flow to capacity of existing Sun Valley Parkway
          273          KM    STRUCTURE ID:D115B
          274          DT    DOUT
          275          DI     0.0   200.0   400.0   600.0   800.0  1050.0  1100.0  1200.0  1500.0  2000.0
          276          DI  2500.0  3000.0
          277          DQ     0.0     0.0     0.0     0.0     0.0     0.0    50.0   150.0   450.0   950.0
          278          DQ  1450.0  1950.0
          279          ZW                 C=FLOW
                       *

          280          KK  15B15C   ROUTE
          281          KM   This is existing SV PKWY Channel
          282          KM   Note the routing slope is the channel design slope not
          283          KM   the general (adjacent) ground slope.
          284          KM        Route flows in existing Sun Valley Parkway channel
          285          RS      5    FLOW      -1
          286          RC    0.03    0.03    0.03  7899.0  0.0015   103.5
          287          RX     0.0    14.0    38.0    44.0    64.0    70.0    94.0   108.0
          288          RY   103.5   100.0   100.0    98.0    98.0   100.0   100.0   103.5
                       *

          289          KK   S115C   BASIN
          290          KM        Compute runoff from subbasin 115C
          291          BA   0.429
          292          LG    0.35    0.35    4.00    0.47       0
          293          UI      64     250     457     595     594     444     299     208     135      93
          294          UI      62      44      23      15      16      16       0       0       0       0
                       *
1                                          HEC-1 INPUT                                          PAGE  8

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

          295          KK  C115CR COMBINE
          296          KM        Combine runoff from S115C with routed flow from C115B
          297          HC       2
                       *

          298          KK   S120A   BASIN
          299          KM        Compute runoff from subbasin 120A
          300          BA   1.374
          301          LG    0.32    0.35    4.80    0.30       2
          302          UI     180     559    1100    1547    1740    1553    1160     826     580     409
          303          UI     305     205     141     123      43      44      45      44       0       0
          304          ZW                 C=FLOW
                       *

          305          KK   D120A  DIVERT
          306          KM   Proposed Detention Basin
          307          KM   limit flow to capacity of existing Sun Valley Parkway
          308          KM    STRUCTURE ID:D120A
          309          DT    DOUT
          310          DI     0.0   200.0   400.0   600.0   750.0   950.0  1000.0  1150.0  1450.0  1950.0
          311          DI  2450.0  2950.0
          312          DQ     0.0     0.0     0.0     0.0     0.0     0.0    50.0   200.0   500.0  1000.0
          313          DQ  1500.0  2000.0
          314          ZW                 C=FLOW
                       *

          315          KK   C115C COMBINE
          316          KM        Combine non-diverted runoff from S120A with flow from C115CR
          317          HC       2
                       *

          318          KK  115120   ROUTE
          319          KM   This is existing SV PKWY Channel
          320          KM   Note the routing slope is the channel design slope not
          321          KM   the general (adjacent) ground slope.
          322          KM        Route total flows from C115C to C120.
          323          RS      3    FLOW      -1
          324          RC    0.03    0.03    0.03  4136.0  0.0015   104.5
          325          RX     0.0    18.0    52.0    58.0    78.0    84.0   118.0   136.0
          326          RY   104.5   100.0   100.0    98.0    98.0   100.0   100.0   104.5
                       *

          327          KK   S120B   BASIN
          328          KM        Compute runoff from subbasin 120B
          329          BA   0.643
          330          LG    0.33    0.35    4.40    0.38       1
          331          UI      77     200     420     606     725     711     600     445     322     239
          332          UI     172     130      91      68      52      33      19      18      19      18
          333          UI       0       0       0       0       0       0       0       0       0       0
                       *
1                                          HEC-1 INPUT                                          PAGE  9

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

          334          KK   C120B COMBINE
          335          KM        Combine runoff from S120B with routed flow from C120A
          336          KM        This is the total flow at the end of the SVP channel at Wagner Wash.
          337          HC       2   4.681
          338          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO. — (V) ROUTING (.) CONNECTOR (---->) DIVERSION OR PUMP FLOW (<----) RETURN OF DIVERTED OR PUMPED FLOW

```
 43        S900
             .
             .
 52           .      S115A1
              .          .
              .          .
 59       CFAN2.....
             V
             V
 63       RR900
             .
             .
 79           .-------->  TOFAN1
 74       TOFAN2
             V
             V
 83       90091A
             .
             .
 92           .      S910A
              .          .
              .          .
 97       C910A.....
             V
             V
101       91A91B
             .
             .
110           .      S910B
              .          .
              .          .
115       C910B.....
             V
             V
119       91B915
             .
             .
128           .       S915
              .          .
              .          .
135       C915.....
             V
             V
139       91592A
             .
             .
148           .      S920A
              .          .
              .          .
154       C920A.....
             V
             V
158       92A92B
             .
             .
167           .      S920B
              .          .
              .          .
173       C920B.....
             .
             .
177           .      S920C
              .          .
              .          .
184       C920C.....
             .
             .
188           .       S110
              .         V
              .         V
196           .       RR110
              .         V
              .         V
207           .      F115A3
              .          .
              .          .
216           .          .      S115A3
              .          .         .
              .          .         .
222           .      C115A3.....
              .          .
              .          .
227           .          .           .<-------  TOFAN1
225           .          .      DRR900
              .          .         V
              .          .         V
229           .          .      F215A2
              .          .         .
              .          .         .
238           .          .         .      S115A2
              .          .         .         .
              .          .         .         .
244           .          .      C115A2.....
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              .          .          .
              .          .          .
 247          .       C115A...........
              .          V
              .          V
 251          .      15A15B
              .          .
              .          .
 260          .          .       S115B
              .          .          .
              .          .          .
 265          .       C115B...........
              .          .
              .          .
 274          .          .------->    DOUT
 270          .       D115B
              .          V
              .          V
 280          .      15B15C
              .          .
              .          .
 289          .          .       S115C
              .          .          .
              .          .          .
 295          .      C115CR...........
              .          .
              .          .
 298          .          .       S120A
              .          .          .
              .          .          .
 309          .          .          .------->    DOUT
 305          .          .       D120A
              .          .          .
              .          .          .
 315          .       C115C...........
              .          V
              .          V
 318          .      115120
              .          .
              .          .
 327          .          .       S120B
              .          .          .
              .          .          .
 334          .       C120B...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
 *           JUN   1998                  *
 *         VERSION 4.1                   *
 *                                       *
 * RUN DATE   19DEC06  TIME  17:52:02    *
 *                                       *
 *****************************************

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


                    HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
                       - FAN SYSTEM 1 & 2

                    SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                    MODELER: TED LEHMAN
                    FILENAME: FANS1224.DAT

                    100-YEAR 24-HOUR MODEL
                    EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                             MODELED AREA = 11.1 SQ. MILES

                    GREEN-AMPT LOSS METHOD

                    S-GRAPH UNIT HYDROGRAPHS
                      - MOUNTAIN
                      - DESERT/RANGELAND

                    NORMAL-DEPTH CHANNEL ROUTING

                    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
                      - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
                      - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
                      - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %

                    SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)

 29 IO        OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

 28 IN        TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE     1JAN99  STARTING DATE
                    JXTIME       1200  STARTING TIME

   IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1JAN99  STARTING DATE
                     ITIME       1200  STARTING TIME
                        NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     8JAN99  ENDING DATE
                    NDTIME       1035  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

 30 JD        INDEX STORM NO. 1
                     STRM        4.20  PRECIPITATION DEPTH
                     TRDA         .10  TRANSPOSITION DRAINAGE AREA

 31 PI         PRECIPITATION PATTERN
                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                  .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
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                  .00     .00     .00     .00     .00     .00     .00     .00

 41 JD        INDEX STORM NO. 2
                     STRM        3.99  PRECIPITATION DEPTH
                     TRDA       10.00  TRANSPOSITION DRAINAGE AREA

  0 PI         PRECIPITATION PATTERN
                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                  .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
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                  .00     .00     .00     .00     .00     .00     .00     .00

 42 JD        INDEX STORM NO. 3
                     STRM        3.78  PRECIPITATION DEPTH
                     TRDA       30.00  TRANSPOSITION DRAINAGE AREA

  0 PI         PRECIPITATION PATTERN
                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                  .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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                    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                    .00     .00     .00     .00     .00     .00     .00     .01     .00     .01
                    .01     .01     .01     .01     .01     .01     .01     .01     .03     .03
                    .03     .09     .09     .09     .01     .01     .01     .01     .01     .01
                    .01     .01     .01     .01     .01     .01     .00     .00     .00     .00
                    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                    .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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           *            *
  43 KK    *    S900    *        BASIN
           *            *
           **************
                             Compute runoff from subbasin 900

              SUBBASIN RUNOFF DATA

  45 BA         SUBBASIN CHARACTERISTICS
                      TAREA        1.15  SUBBASIN AREA

  46 LG         GREEN AND AMPT LOSS RATE
                      STRTL         .26  STARTING LOSS
                        DTH         .37  MOISTURE DEFICIT
                       PSIF        5.30  WETTING FRONT SUCTION
                      XKSAT         .24  HYDRAULIC CONDUCTIVITY
                      RTIMP        6.00  PERCENT IMPERVIOUS AREA

  44 UI         INPUT UNITGRAPH,  44 ORDINATES,  VOLUME = 1.00
                    79.0     81.0    192.0    329.0    471.0    553.0    629.0    801.0    886.0    579.0
                   495.0    447.0    398.0    367.0    320.0    285.0    242.0    205.0    188.0    176.0
                   150.0    128.0    103.0     97.0     87.0     79.0     61.0     61.0     53.0     39.0
                    39.0     39.0     39.0     19.0     16.0     15.0     15.0     15.0     16.0     15.0
                    15.0     15.0     15.0     16.0

                                                         ***

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

                  HYDROGRAPH AT STATION      S900
                  TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =     2.73, TOTAL EXCESS =     1.47

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    943.      12.50                 172.          45.          15.           7.
                       (INCHES)     1.395        1.467        1.469        1.469
                        (AC-FT)       85.          90.          90.          90.

                         CUMULATIVE AREA =      1.15 SQ MI

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

                  HYDROGRAPH AT STATION      S900
                  TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =     2.63, TOTAL EXCESS =     1.36

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    875.      12.50                 159.          42.          14.           6.
                       (INCHES)     1.290        1.359        1.360        1.360
                        (AC-FT)       79.          83.          83.          83.

                         CUMULATIVE AREA =      1.15 SQ MI

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

                  HYDROGRAPH AT STATION      S900
                  TRANSPOSITION AREA      30.0 SQ MI

   TOTAL RAINFALL =    3.78, TOTAL LOSS =     2.53, TOTAL EXCESS =     1.25

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    807.      12.50                 146.          38.          13.           6.
                       (INCHES)     1.183        1.248        1.249        1.249
                        (AC-FT)       72.          76.          76.          76.

                         CUMULATIVE AREA =      1.15 SQ MI

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


                         INTERPOLATED HYDROGRAPH AT      S900

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    907.      12.50                 165.          43.          15.           6.
                       (INCHES)     1.339        1.410        1.411        1.411
                        (AC-FT)       82.          86.          86.          86.

                         CUMULATIVE AREA =      1.15 SQ MI

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           **************
           *            *
  52 KK    *   S115A1   *        BASIN
           *            *
           **************
                             Compute runoff from subbasin 115A1

              SUBBASIN RUNOFF DATA

  54 BA         SUBBASIN CHARACTERISTICS
                      TAREA         .59  SUBBASIN AREA

  55 LG         GREEN AND AMPT LOSS RATE
                      STRTL         .30  STARTING LOSS
                        DTH         .38  MOISTURE DEFICIT
                       PSIF        6.40  WETTING FRONT SUCTION
                      XKSAT         .16  HYDRAULIC CONDUCTIVITY
                      RTIMP        4.00  PERCENT IMPERVIOUS AREA

  53 UI         INPUT UNITGRAPH,  21 ORDINATES,  VOLUME = 1.00
                    85.0    311.0    576.0    841.0    685.0    477.0    385.0    298.0    215.0    177.0
                   124.0     98.0     72.0     58.0     42.0     37.0     17.0     16.0     16.0     17.0
                    16.0

                                                         ***

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

                  HYDROGRAPH AT STATION    S115A1
                  TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =     2.69, TOTAL EXCESS =     1.51

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    852.      12.17                  92.          24.           8.           3.
                       (INCHES)     1.456        1.504        1.504        1.504
                        (AC-FT)       46.          47.          47.          47.

                         CUMULATIVE AREA =       .59 SQ MI

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

                  HYDROGRAPH AT STATION    S115A1
                  TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =     2.59, TOTAL EXCESS =     1.40

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    796.      12.17                  86.          22.           7.           3.
                       (INCHES)     1.347        1.394        1.394        1.394
                        (AC-FT)       42.          44.          44.          44.

                         CUMULATIVE AREA =       .59 SQ MI

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

                  HYDROGRAPH AT STATION    S115A1
                  TRANSPOSITION AREA      30.0 SQ MI

   TOTAL RAINFALL =    3.78, TOTAL LOSS =     2.49, TOTAL EXCESS =     1.29
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  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      740.      12.17                    79.          20.          7.          3.
                            (INCHES)    1.242        1.285       1.286       1.286
                             (AC-FT)      39.          40.         40.         40.

                           CUMULATIVE AREA =      .59 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT    S115A1

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      830.      12.17                    90.          23.          8.          3.
                            (INCHES)    1.414        1.462       1.462       1.462
                             (AC-FT)      44.          46.         46.         46.

                           CUMULATIVE AREA =      .59 SQ MI


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              *            *
  59 KK       *    CFAN2   *     COMBINE
              *            *
              **************
                          Combine runoff from S115A1 and S900 at Fan 2 detention basin

  61 HC         HYDROGRAPH COMBINATION
                     ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                         ***

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

                             HYDROGRAPH AT STATION    CFAN2
                           TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     1481.      12.25                   264.          69.         23.         10.
                            (INCHES)    1.415        1.480       1.481       1.481
                             (AC-FT)     131.         137.        137.        137.

                           CUMULATIVE AREA =    1.74 SQ MI

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

                             HYDROGRAPH AT STATION    CFAN2
                           TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     1377.      12.25                   245.          64.         21.          9.
                            (INCHES)    1.309        1.371       1.372       1.372
                             (AC-FT)     121.         127.        127.        127.

                           CUMULATIVE AREA =    1.74 SQ MI

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

                             HYDROGRAPH AT STATION    CFAN2
                           TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     1270.      12.25                   225.          59.         20.          8.
                            (INCHES)    1.202        1.261       1.262       1.262
                             (AC-FT)     111.         117.        117.        117.

                           CUMULATIVE AREA =    1.74 SQ MI

   -----DSS---ZOPEN:  Existing File Opened,  File: FANS1224.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //CFAN2/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                           INTERPOLATED HYDROGRAPH AT    CFAN2

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     1416.      12.25                   252.          66.         22.         10.
                            (INCHES)    1.349        1.412       1.413       1.413
                             (AC-FT)     125.         131.        131.        131.

                           CUMULATIVE AREA =    1.74 SQ MI


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

              **************
              *            *
  63 KK       *    RR900   *     STORAGE
              *            *
              **************
                         Proposed Detention Basin
                          ROUTE RUNOFF FROM S900 THROUGH PROPOSED DETENTION BASIN AT APEX FOR
                          ALLUVIAL FAN NO. 2
                          STRUCTURE ID:RR900
                          OUTLET BASED ON ASSUMED 2 pipe(s), dia: 4 ft

            HYDROGRAPH ROUTING DATA

  69 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

  70 SV            STORAGE        .0      18.5     37.7     57.5     78.0     99.2    121.0    143.5    166.7    215.3

  71 SE          ELEVATION       .00      1.00     2.00     3.00     4.00     5.00     6.00     7.00     8.00    10.00

  72 SQ          DISCHARGE        0.       22.      47.      88.     127.     157.     193.     224.     253.     283.

                                                                         ***

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

                             HYDROGRAPH AT STATION    RR900
                           TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      168.      13.75                   139.          63.         23.         10.
                            (INCHES)     .744        1.350       1.478       1.481
                             (AC-FT)      69.         125.        137.        137.

 PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
      106.       13.75                    87.          43.         16.          7.

  PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
      5.30       13.75                   4.42         2.25         .84         .36

                           CUMULATIVE AREA =    1.74 SQ MI

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

                             HYDROGRAPH AT STATION    RR900
                           TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      155.      13.75                   128.          58.         21.          9.
                            (INCHES)     .688        1.247       1.369       1.372
                             (AC-FT)      64.         116.        127.        127.

 PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       98.       13.75                    81.          40.         15.          7.

  PEAK STAGE     TIME                            MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
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     4.94     13.75                 4.11        2.11          .79          .34

                          CUMULATIVE AREA =    1.74 SQ MI


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

                           HYDROGRAPH AT STATION    RR900
                         TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     144.      13.67                   118.          53.          20.          8.
                           (INCHES)      .630         1.145        1.259        1.262
                            (AC-FT)       58.          106.         117.         117.

   PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
       90.       13.67                    74.           37.          14.          6.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      4.56       13.67                   3.80          1.96          .73          .32

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR900/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***


                          INTERPOLATED HYDROGRAPH AT     RR900

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     160.      13.75                   132.          60.          22.         10.
                           (INCHES)      .709         1.286        1.410        1.413
                            (AC-FT)       66.          119.         131.         131.

                          CUMULATIVE AREA =    1.74 SQ MI



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

           **************
           *            *
   74 KK   *   TOFAN2   *        DIVERT
           *            *
           **************
                            DIVERT OUTFLOWS TO FAN 1 (DIVERSION BASED ON RATIO OF INFLOWING DRAINAGE
                            AREAS FROM S115A1 (0.59 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 1)
                            AND S900 (1.147 SQ.MI. ASSUMED TO CONTRIBUTE PRIMARILY TO FAN 2)
                            OUTLETS OF RR900 DESIGNED TO APPROXIMATE THIS 34% RATIO.

     DT          DIVERSION
                     ISTAD       TOFAN1  DIVERSION HYDROGRAPH IDENTIFICATION

     DI              INFLOW         .00  10000.00

     DQ      DIVERTED FLOW          .00   3400.00
                                                                    ***

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

                           DIVERSION HYDROGRAPH    TOFAN1
                         TRANSPOSITION AREA      .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +      57.      13.75                    47.          21.           8.          3.
                           (INCHES)      .253          .459         .502         .503
                            (AC-FT)       23.           43.          47.          47.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                           HYDROGRAPH AT STATION    TOFAN2
                         TRANSPOSITION AREA      .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     111.      13.75                    92.          42.          15.          7.
                           (INCHES)      .491          .891         .975         .977
                            (AC-FT)       45.           83.          90.          91.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                           DIVERSION HYDROGRAPH    TOFAN1
                         TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +      53.      13.75                    44.          20.           7.          3.
                           (INCHES)      .234          .424         .465         .466
                            (AC-FT)       22.           39.          43.          43.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                           HYDROGRAPH AT STATION    TOFAN2
                         TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     102.      13.75                    85.          38.          14.          6.
                           (INCHES)      .454          .823         .903         .905
                            (AC-FT)       42.           76.          84.          84.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //TOFAN2/FLOW/08JAN1999/5MIN//

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

                           DIVERSION HYDROGRAPH    TOFAN1
                         TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +      49.      13.67                    40.          18.           7.          3.
                           (INCHES)      .214          .389         .428         .429
                            (AC-FT)       20.           36.          40.          40.

                          CUMULATIVE AREA =    1.74 SQ MI


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

                           HYDROGRAPH AT STATION    TOFAN2
                         TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +      95.      13.67                    78.          35.          13.          6.
                           (INCHES)      .416          .756         .831         .833
                            (AC-FT)       39.           70.          77.          77.

                          CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //TOFAN2/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***
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                    INTERPOLATED DIVERSION HYDROGRAPH AT    TOFAN1

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +       54.     13.75                   45.          20.           7.            3.
                              (INCHES)  .241         .437         .479          .480
                               (AC-FT)   22.          41.          44.           45.

                              CUMULATIVE AREA =      1.74 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   80:  //TOFAN2/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                         INTERPOLATED HYDROGRAPH AT    TOFAN2

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +      106.     13.75                   87.          40.          14.            6.
                              (INCHES)  .468         .849         .931          .933
                               (AC-FT)   43.          79.          86.           86.

                              CUMULATIVE AREA =      1.74 SQ MI


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

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            *            *
   83 KK    *   90091A   *        ROUTE
            *            *
            **************
                        Proposed Channel
                             Route outflow from RR900 through subbasin 910A
                         Slope=(1808.0 - 1720.0) / 4336.0

             HYDROGRAPH ROUTING DATA

   87 RS          STORAGE ROUTING
                        NSTPS          3  NUMBER OF SUBREACHES
                         ITYP       FLOW  TYPE OF INITIAL CONDITION
                       RSVRIC      -1.00  INITIAL CONDITION
                            X        .00 WORKING R AND D COEFFICIENT

   88 RC          NORMAL DEPTH CHANNEL
                          ANL       .045  LEFT OVERBANK N-VALUE
                         ANCH       .045  MAIN CHANNEL N-VALUE
                          ANR       .045  RIGHT OVERBANK N-VALUE
                        RLNTH      4336.  REACH LENGTH
                          SEL      .0200  ENERGY SLOPE
                        ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                       --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   90 RY        ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
   89 RX        DISTANCE       .00       .00       .00       .00     50.00     50.00     50.00     50.00

                                                          ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

               STORAGE       .00      1.18      2.36      3.54      4.72      5.89      7.07      8.25      9.43     10.61
               OUTFLOW       .00     21.16     66.97    131.22    211.29    305.53    412.75    532.03    662.62    803.89
             ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

               STORAGE     11.79     12.97     14.15     15.32     16.50     17.68     18.86     20.04     21.22     22.40
               OUTFLOW    955.32   1116.43   1286.80   1466.06   1653.88   1849.95   2053.98   2265.72   2484.92   2711.36
             ELEVATION    102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      413. TO      2711.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                          HYDROGRAPH AT STATION    90091A
                        TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +      111.     13.92                   91.          42.          15.            7.
                              (INCHES)  .488         .889         .975          .977
                               (AC-FT)   45.          82.          90.           91.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)        (HR)
          1.     13.92                    1.           1.           0.            0.

   PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)        (HR)
      100.63     13.92                100.56       100.32       100.12        100.05

                              CUMULATIVE AREA =      1.74 SQ MI


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

                          HYDROGRAPH AT STATION    90091A
                        TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +      102.     13.92                   84.          38.          14.            6.
                              (INCHES)  .452         .822         .903          .905
                               (AC-FT)   42.          76.          84.           84.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)        (HR)
          1.     13.83                    1.           0.           0.            0.

   PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)        (HR)
      100.60     13.92                100.54       100.30       100.11        100.05

                              CUMULATIVE AREA =      1.74 SQ MI


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

                          HYDROGRAPH AT STATION    90091A
                        TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +       95.     13.92                   77.          35.          13.            6.
                              (INCHES)  .414         .754         .831          .833
                               (AC-FT)   38.          70.          77.           77.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)        (HR)
          1.     13.83                    1.           0.           0.            0.

   PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)        (HR)
      100.58     13.92                100.51       100.28       100.11        100.05

                              CUMULATIVE AREA =      1.74 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   20:  //90091A/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***


                         INTERPOLATED HYDROGRAPH AT    90091A

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)        (HR)
                                 (CFS)
 +      105.     13.92                   87.          40.          14.            6.
                              (INCHES)  .466         .847         .931          .933
                               (AC-FT)   43.          79.          86.           86.

                              CUMULATIVE AREA =      1.74 SQ MI


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 92 KK      *     S910A  *        BASIN
            *            *
            **************
                          Compute runoff from subbasin 910A

                SUBBASIN RUNOFF DATA

 94 BA           SUBBASIN CHARACTERISTICS
                      TAREA         .27  SUBBASIN AREA

 95 LG           GREEN AND AMPT LOSS RATE
                     STRTL         .35  STARTING LOSS
                      DTH          .35  MOISTURE DEFICIT
                     PSIF         4.45  WETTING FRONT SUCTION
                    XKSAT          .37  HYDRAULIC CONDUCTIVITY
                    RTIMP          .00  PERCENT IMPERVIOUS AREA

 93 UI           INPUT UNITGRAPH,   7 ORDINATES,  VOLUME =  .99
                     229.0     752.0     635.0     285.0     127.0      50.0      21.0
                                                                      ***

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

                        HYDROGRAPH AT STATION    S910A
                       TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.06, TOTAL EXCESS =    1.14

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      541.     12.08                  33.          8.           3.           1.
                (INCHES)            1.130        1.130        1.130        1.130
                 (AC-FT)              16.          16.          16.          16.

                CUMULATIVE AREA =     .27 SQ MI


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

                        HYDROGRAPH AT STATION    S910A
                       TRANSPOSITION AREA      10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.94, TOTAL EXCESS =    1.05

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      504.     12.08                  30.          8.           3.           1.
                (INCHES)            1.038        1.038        1.038        1.038
                 (AC-FT)              15.          15.          15.          15.

                CUMULATIVE AREA =     .27 SQ MI


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

                        HYDROGRAPH AT STATION    S910A
                       TRANSPOSITION AREA      30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.83, TOTAL EXCESS =     .95

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      467.     12.08                  28.          7.           2.           1.
                (INCHES)             .943         .943         .943         .943
                 (AC-FT)              14.          14.          14.          14.

                CUMULATIVE AREA =     .27 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT    S910A

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      533.     12.08                  33.          8.           3.           1.
                (INCHES)            1.110        1.110        1.110        1.110
                 (AC-FT)              16.          16.          16.          16.

                CUMULATIVE AREA =     .27 SQ MI


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


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            *            *
 97 KK      *     C910A  *      COMBINE
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            *            *
            **************
                Combine runoff from S910A with routed outflow from Fan 2 detention basin

 99 HC          HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                      ***
      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    C910A
                       TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      544.     12.08                 113.         50.          18.           8.
                (INCHES)             .740        1.300        1.410        1.413
                 (AC-FT)              56.          98.         107.         107.

                CUMULATIVE AREA =    1.42 SQ MI


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

                        HYDROGRAPH AT STATION    C910A
                       TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      507.     12.08                 104.         46.          17.           7.
                (INCHES)             .683        1.200        1.305        1.307
                 (AC-FT)              52.          91.          99.          99.

                CUMULATIVE AREA =    1.42 SQ MI


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

                        HYDROGRAPH AT STATION    C910A
                       TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      470.     12.08                  96.         42.          15.           7.
                (INCHES)             .626        1.099        1.198        1.200
                 (AC-FT)              47.          83.          91.          91.

                CUMULATIVE AREA =    1.42 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910A/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT    C910A

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      523.     12.08                 108.         47.          17.           7.
                (INCHES)             .707        1.242        1.349        1.352
                 (AC-FT)              54.          94.         102.         102.

                CUMULATIVE AREA =    1.42 SQ MI


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


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            *            *
101 KK      *    91A91B  *       ROUTE
            *            *
            **************
                          Proposed Channel
                              Route combined flow from C910A through subbasin 910B
                           Slope=(1720.0 - 1660.0) / 3893.0

                HYDROGRAPH ROUTING DATA

105 RS          STORAGE ROUTING
                     NSTPS          2  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
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                  RSVRIC       -1.00  INITIAL CONDITION
                       X         .00 WORKING R AND D COEFFICIENT

 106 RC          NORMAL DEPTH CHANNEL
                     ANL         .045  LEFT OVERBANK N-VALUE
                    ANCH         .045  MAIN CHANNEL N-VALUE
                     ANR         .045  RIGHT OVERBANK N-VALUE
                   RLNTH        3893.  REACH LENGTH
                     SEL        .0150  ENERGY SLOPE
                   ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                            --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 108 RY         ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 107 RX         DISTANCE       .00       .00       .00       .00     60.00     60.00     60.00     60.00

                                                                ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE       .00      1.27      2.54      3.81      5.08      6.35      7.62      8.89     10.16     11.43
           OUTFLOW       .00     22.00     69.67    136.58    220.03    318.34    430.26    554.88    691.42    839.25
         ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

           STORAGE     12.70     13.97     15.24     16.51     17.78     19.05     20.32     21.59     22.86     24.13
           OUTFLOW    997.82   1166.65   1345.33   1533.48   1730.75   1936.83   2151.44   2374.31   2605.20   2843.88
         ELEVATION    102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      1345. TO      2844.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                  HYDROGRAPH AT STATION     91A91B
                TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     455.      12.17                   111.          49.          18.           8.
                           (INCHES)     .726        1.295        1.410        1.413
                            (AC-FT)      55.          98.         107.         107.

  PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        4.      12.17                     2.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.47      12.17                 100.60       100.34       100.13       100.06

                      CUMULATIVE AREA =     1.42 SQ MI

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

                  HYDROGRAPH AT STATION     91A91B
                TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     416.      12.17                   102.          46.          17.           7.
                           (INCHES)     .669        1.196        1.304        1.307
                            (AC-FT)      51.          91.          99.          99.

  PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        4.      12.17                     2.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.39      12.17                 100.57       100.32       100.12       100.05

                      CUMULATIVE AREA =     1.42 SQ MI

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

                  HYDROGRAPH AT STATION     91A91B
                TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     374.      12.17                    93.          42.          15.           7.
                           (INCHES)     .612        1.096        1.198        1.200
                            (AC-FT)      46.          83.          91.          91.

  PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        3.      12.17                     1.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.30      12.17                 100.54       100.31       100.12       100.05

                      CUMULATIVE AREA =     1.42 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   20:  //91A91B/FLOW/08JAN1999/5MIN//
      ***            ***            ***            ***            ***

                  INTERPOLATED HYDROGRAPH AT    91A91B

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     432.      12.17                   106.          47.          17.           7.
                           (INCHES)     .693        1.238        1.349        1.352
                            (AC-FT)      53.          94.         102.         102.

                      CUMULATIVE AREA =     1.42 SQ MI

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

              **************
              *            *
 110 KK       *    S910B   *        BASIN
              *            *
              **************
                                   Compute runoff from subbasin 910B

                SUBBASIN RUNOFF DATA

 112 BA           SUBBASIN CHARACTERISTICS
                        TAREA          .60  SUBBASIN AREA

 113 LG           GREEN AND AMPT LOSS RATE
                        STRTL          .35  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.80  WETTING FRONT SUCTION
                        XKSAT          .30  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

 111 UI           INPUT UNITGRAPH,    7 ORDINATES,  VOLUME =  .99
                     489.0    1615.0    1398.0     638.0     283.0     117.0      46.0
                                                                  ***

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

                  HYDROGRAPH AT STATION     S910B
                TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.98, TOTAL EXCESS =     1.21

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    1222.      12.08                    77.          19.           6.           3.
                           (INCHES)    1.205        1.205        1.205        1.205
                            (AC-FT)      38.          38.          38.          38.

                      CUMULATIVE AREA =      .60 SQ MI

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

                  HYDROGRAPH AT STATION     S910B
                TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.88, TOTAL EXCESS =     1.11

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    1141.      12.08                    71.          18.           6.           3.
                           (INCHES)    1.102        1.102        1.102        1.102
                            (AC-FT)      35.          35.          35.          35.

                      CUMULATIVE AREA =      .60 SQ MI
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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    S910B
                       TRANSPOSITION AREA     30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.77, TOTAL EXCESS =    1.01

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1060.      12.08                65.          16.           5.           2.
                (INCHES)          1.006        1.006        1.006        1.006
                 (AC-FT)           32.          32.          32.          32.

                CUMULATIVE AREA =     .60 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT    S910B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1191.      12.08                75.          19.           6.           3.
                (INCHES)          1.165        1.165        1.165        1.165
                 (AC-FT)           37.          37.          37.          37.

                CUMULATIVE AREA =     .60 SQ MI



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


           **************
           *            *
 115 KK    *     C910B  *      COMBINE
           *            *
           **************
                        Combine runoff from S910B with routed flow from C910A at Sun Valley Prky

 117 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

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

                        HYDROGRAPH AT STATION    C910B
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1589.      12.08               185.          69.          24.          11.
                (INCHES)          .851        1.267        1.350        1.351
                 (AC-FT)           92.         136.         145.         145.

                CUMULATIVE AREA =     2.02 SQ MI

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

                        HYDROGRAPH AT STATION    C910B
                       TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1463.      12.08               169.          63.          23.          10.
                (INCHES)          .781        1.167        1.245        1.246
                 (AC-FT)           84.         126.         134.         134.

                CUMULATIVE AREA =     2.02 SQ MI

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

                        HYDROGRAPH AT STATION    C910B
                       TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1338.      12.08               155.          58.          21.           9.
                (INCHES)          .713        1.068        1.141        1.142
                 (AC-FT)           77.         115.         123.         123.

                CUMULATIVE AREA =     2.02 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/02JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C910B/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT    C910B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1507.      12.08               175.          65.          23.          10.
                (INCHES)          .805        1.202        1.281        1.283
                 (AC-FT)           87.         129.         138.         138.

                CUMULATIVE AREA =     2.02 SQ MI



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


           **************
           *            *
 119 KK    *    91B915  *       ROUTE
           *            *
           **************
                        Proposed Channel
                            Route combined flow to C915
                         Slope=(1660.0 - 1623.0) / 3390.0

                    HYDROGRAPH ROUTING DATA

 123 RS          STORAGE ROUTING
                      NSTPS           2  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC      -1.00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

 124 RC          NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH       3390.  REACH LENGTH
                        SEL       .0110  ENERGY SLOPE
                      ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 126 RY       ELEVATION   105.00   100.00   100.00   100.00   100.00   100.00   100.00   105.00
 125 RX       DISTANCE       .00      .00      .00      .00   180.00   180.00   180.00   180.00

                                                ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00     3.69     7.37    11.06    14.75    18.43    22.12    25.80    29.49    33.18
          OUTFLOW        .00    67.49   214.05   420.32   678.25   982.85  1330.56  1718.67  2145.00  2607.74
        ELEVATION     100.00   100.26   100.53   100.79   101.05   101.32   101.58   101.84   102.11   102.37

          STORAGE      36.86    40.55    44.24    47.92    51.61    55.30    58.98    62.67    66.36    70.04
          OUTFLOW    3105.34  3636.47  4199.95  4794.74  5419.90  6074.57  6757.97  7469.38  8208.13  8973.62
        ELEVATION     102.63   102.89   103.16   103.42   103.68   103.95   104.21   104.47   104.74   105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     3636. TO     8974.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                        HYDROGRAPH AT STATION   91B915
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1292.      12.17               180.          69.          24.          11.
                (INCHES)          .828        1.264        1.350        1.351
                 (AC-FT)           89.         136.         145.         145.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+ (AC-FT)        (HR)
       11.     12.17                 3.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
     101.55     12.17              100.41       100.20       100.07       100.03

                CUMULATIVE AREA =     2.02 SQ MI
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      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION   91B915
                TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1159.      12.17                165.          63.          22.          10.
                       (INCHES)      .759        1.164        1.245        1.246
                       (AC-FT)        82.         125.         134.         134.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)     (HR)
       10.      12.17                 3.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
     101.45     12.17              100.39       100.18       100.07       100.03

                CUMULATIVE AREA =     2.02 SQ MI

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

                  HYDROGRAPH AT STATION   91B915
                TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1042.      12.25                150.          58.          21.          9.
                       (INCHES)      .692        1.065        1.141        1.142
                       (AC-FT)        74.         115.         123.         123.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)     (HR)
       10.      12.25                 3.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
     101.36     12.25              100.38       100.17       100.06       100.03

                CUMULATIVE AREA =     2.02 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91B915/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                  INTERPOLATED HYDROGRAPH AT   91B915

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1206.      12.17                170.          65.          23.          10.
                       (INCHES)      .783        1.199        1.281        1.283
                       (AC-FT)        84.         129.         138.         138.

                CUMULATIVE AREA =     2.02 SQ MI


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


            **************
            *            *
 128 KK     *      S915  *       BASIN
            *            *
            **************
                        Compute runoff from subbasin 915

               SUBBASIN RUNOFF DATA

 130 BA           SUBBASIN CHARACTERISTICS
                        TAREA        1.13  SUBBASIN AREA

 131 LG           GREEN AND AMPT LOSS RATE
                        STRTL         .25  STARTING LOSS
                          DTH         .37  MOISTURE DEFICIT
                         PSIF        6.60  WETTING FRONT SUCTION
                        XKSAT         .14  HYDRAULIC CONDUCTIVITY
                        RTIMP        1.00  PERCENT IMPERVIOUS AREA
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 129 UI          INPUT UNITGRAPH,  27 ORDINATES,  VOLUME = 1.00
                    102.0     163.0     397.0     611.0     809.0     929.0     977.0     949.0     801.0     634.0
                    506.0     395.0     311.0     248.0     194.0     158.0     113.0      96.0      70.0      71.0
                     32.0      25.0      25.0      25.0      25.0      26.0      25.0

                                                                                ***

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

                  HYDROGRAPH AT STATION     S915
                TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.71, TOTAL EXCESS =    1.49

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1254.      12.42                179.          45.          15.          6.
                       (INCHES)     1.477        1.489        1.489        1.489
                       (AC-FT)        89.          89.          89.          89.

                CUMULATIVE AREA =     1.13 SQ MI

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

                  HYDROGRAPH AT STATION     S915
                TRANSPOSITION AREA      10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.61, TOTAL EXCESS =    1.38

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1170.      12.42                166.          42.          14.          6.
                       (INCHES)     1.367        1.378        1.379        1.379
                       (AC-FT)        82.          83.          83.          83.

                CUMULATIVE AREA =     1.13 SQ MI

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

                  HYDROGRAPH AT STATION     S915
                TRANSPOSITION AREA      30.0 SQ MI

    TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.51, TOTAL EXCESS =    1.27

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1085.      12.42                152.          38.          13.          6.
                       (INCHES)     1.256        1.267        1.267        1.267
                       (AC-FT)        75.          76.          76.          76.

                CUMULATIVE AREA =     1.13 SQ MI

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


                  INTERPOLATED HYDROGRAPH AT     S915

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1210.      12.42                172.          43.          14.          6.
                       (INCHES)     1.419        1.431        1.431        1.431
                       (AC-FT)        85.          86.          86.          86.

                CUMULATIVE AREA =     1.13 SQ MI


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


            **************
            *            *
 135 KK     *      C915  *      COMBINE
            *            *
            **************
                        Combine runoff from S915 with routed flow from C910B

 137 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                      ***

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

                  HYDROGRAPH AT STATION     C915
                TRANSPOSITION AREA       .1 SQ MI
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  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2378.     12.25                356.        113.         39.         17.
                (INCHES)          1.055       1.341       1.399       1.401
                (AC-FT)           177.        225.        235.        235.

                CUMULATIVE AREA =    3.14 SQ MI


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

                  HYDROGRAPH AT STATION     C915
                TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2197.     12.25                328.        105.         36.         16.
                (INCHES)          .971       1.237       1.292       1.294
                (AC-FT)           163.        207.        217.        217.

                CUMULATIVE AREA =    3.14 SQ MI

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

                  HYDROGRAPH AT STATION     C915
                TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2018.     12.25                300.         96.         33.         14.
                (INCHES)          .889       1.134       1.186       1.187
                (AC-FT)           149.        190.        199.        199.

                CUMULATIVE AREA =    3.14 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C915/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                  INTERPOLATED HYDROGRAPH AT     C915

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2242.     12.25                335.        107.         37.         16.
                (INCHES)          .992       1.263       1.319       1.321
                (AC-FT)           166.        212.        221.        221.

                CUMULATIVE AREA =    3.14 SQ MI


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


            **************
            *            *
139 KK      *    91592A  *        ROUTE
            *            *
            **************
                        Proposed Channel
                            Route combined flow to C920A
                          Slope=(1623.0 - 1580.0) / 3859.0

              HYDROGRAPH ROUTING DATA

143 RS          STORAGE ROUTING
                      NSTPS          2  NUMBER OF SUBREACHES
                       ITYP       FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC     -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

144 RC          NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
                      RLNTH      3859.  REACH LENGTH
                        SEL      .0110  ENERGY SLOPE
                      ELMAX      105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------- MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
146 RY        ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
```



```
145 RX        DISTANCE       .00       .00       .00       .00    170.00    170.00    170.00    170.00
                                                  ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                STORAGE        .00      3.96      7.93     11.89     15.85     19.82     23.78     27.74     31.71     35.67
                OUTFLOW        .00     63.73    202.14    396.90    640.42    927.98   1256.21   1622.55   2024.92   2461.61
              ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

                STORAGE      39.63     43.60     47.56     51.52     55.49     59.45     63.41     67.38     71.34     75.30
                OUTFLOW    2931.16   3432.31   3963.94   4525.06   5114.77   5732.27   6376.81   7047.71   7744.34   8466.11
              ELEVATION     102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     4525. TO     8466.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                  HYDROGRAPH AT STATION   91592A
                TRANSPOSITION AREA      .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2189.     12.42                351.        113.         39.         17.
                (INCHES)          1.039       1.339       1.399       1.401
                (AC-FT)           174.        224.        235.        235.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
      17.     12.42                  5.          2.          1.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    102.20    12.42             100.61      100.25      100.09      100.04

                CUMULATIVE AREA =    3.14 SQ MI

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

                  HYDROGRAPH AT STATION   91592A
                TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2021.     12.42                323.        104.         36.         16.
                (INCHES)          .956       1.235       1.292       1.294
                (AC-FT)           160.        207.        217.        217.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
      16.     12.42                  4.          2.          1.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    102.10    12.42             100.58      100.24      100.09      100.04

                CUMULATIVE AREA =    3.14 SQ MI

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

                  HYDROGRAPH AT STATION   91592A
                TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1857.     12.42                295.         96.         33.         14.
                (INCHES)          .874       1.132       1.186       1.187
                (AC-FT)           147.        190.        199.        199.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
      15.     12.42                  4.          2.          1.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    102.00    12.42             100.55      100.23      100.08      100.04

                CUMULATIVE AREA =    3.14 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/04JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //91592A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                     INTERPOLATED HYDROGRAPH AT   91592A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2063.     12.42               330.         107.          37.          16.
                   (INCHES)       .977        1.261        1.319        1.321
                   (AC-FT)         164.         211.         221.         221.

                   CUMULATIVE AREA =     3.14 SQ MI


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


            **************
            *            *
 148 KK     *     S920A  *        BASIN
            *            *
            **************
                        Compute runoff from subbasin 920A

               SUBBASIN RUNOFF DATA

 150 BA          SUBBASIN CHARACTERISTICS
                       TAREA        1.53  SUBBASIN AREA

 151 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.50  WETTING FRONT SUCTION
                       XKSAT         .36  HYDRAULIC CONDUCTIVITY
                       RTIMP         .00  PERCENT IMPERVIOUS AREA

 149 UI          INPUT UNITGRAPH,  13 ORDINATES,  VOLUME = 1.00
                    375.0    1465.0    2447.0    2631.0    1917.0    1163.0     715.0     450.0     262.0     175.0
                     70.0      69.0      69.0

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


                     HYDROGRAPH AT STATION    S920A
                    TRANSPOSITION AREA       .1 SQ MI

          TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.05, TOTAL EXCESS =    1.15

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2370.     12.17               188.          47.          16.           7.
                   (INCHES)      1.145        1.145        1.145        1.145
                   (AC-FT)          93.          93.          93.          93.

                   CUMULATIVE AREA =     1.53 SQ MI


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


                     HYDROGRAPH AT STATION    S920A
                    TRANSPOSITION AREA      10.0 SQ MI

          TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.94, TOTAL EXCESS =    1.05

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2201.     12.17               173.          43.          14.           6.
                   (INCHES)      1.052        1.052        1.052        1.052
                   (AC-FT)          86.          86.          86.          86.

                   CUMULATIVE AREA =     1.53 SQ MI


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


                     HYDROGRAPH AT STATION    S920A
                    TRANSPOSITION AREA      30.0 SQ MI

          TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.82, TOTAL EXCESS =     .96

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2029.     12.17               157.          39.          13.           6.
                   (INCHES)       .957         .957         .957         .957
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                   (AC-FT)         157.         157.         157.         157.

                   CUMULATIVE AREA =     1.53 SQ MI

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


                     INTERPOLATED HYDROGRAPH AT    S920A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2270.     12.17               179.          45.          15.           6.
                   (INCHES)      1.090        1.090        1.090        1.090
                   (AC-FT)          89.          89.          89.          89.

                   CUMULATIVE AREA =     1.53 SQ MI


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


            **************
            *            *
 154 KK     *     C920A  *      COMBINE
            *            *
            **************
                        Combine runoff from S920A with routed flow from C915

 156 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***
       ***             ***             ***             ***             ***


                     HYDROGRAPH AT STATION    C920A
                    TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    3620.     12.25               535.         160.          55.          24.
                   (INCHES)      1.064        1.275        1.316        1.317
                   (AC-FT)          265.         317.         328.         328.

                   CUMULATIVE AREA =     4.67 SQ MI


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


                     HYDROGRAPH AT STATION    C920A
                    TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    3269.     12.25               492.         147.          51.          22.
                   (INCHES)       .979        1.174        1.214        1.215
                   (AC-FT)          244.         293.         302.         303.

                   CUMULATIVE AREA =     4.67 SQ MI


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


                     HYDROGRAPH AT STATION    C920A
                    TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2921.     12.25               449.         135.          47.          20.
                   (INCHES)       .894        1.074        1.111        1.112
                   (AC-FT)          223.         268.         277.         277.

                   CUMULATIVE AREA =     4.67 SQ MI


 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C920A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                     INTERPOLATED HYDROGRAPH AT    C920A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     3327.      12.25                499.         150.          52.          22.
                (INCHES)               .993        1.191         1.231        1.232
                 (AC-FT)              247.         297.          307.         307.

                CUMULATIVE AREA =     4.67 SQ MI
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            **************
            *            *
158 KK      *    92A92B  *        ROUTE
            *            *
            **************
                        Proposed Channel
                            Route combined flow to C920B, outlet at Trilby Wash tributary.
                         Slope=(1580.0 - 1530.0) / 5003.0

                  HYDROGRAPH ROUTING DATA

162 RS            STORAGE ROUTING
                        NSTPS          3  NUMBER OF SUBREACHES
                         ITYP       FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC      -1.00  INITIAL CONDITION
                            X         .00 WORKING R AND D COEFFICIENT

163 RC            NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH       5003.  REACH LENGTH
                          SEL       .0100  ENERGY SLOPE
                        ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
165 RY          ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
164 RX          DISTANCE        .00       .00       .00       .00    315.00    315.00    315.00    315.00

                                                   ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                STORAGE         .00      9.52     19.04     28.56     38.08     47.60     57.12     66.65     76.17     85.69
                OUTFLOW         .00    112.65    357.45    702.20   1133.58   1643.35   2225.65   2876.04   3590.93   4367.38
              ELEVATION      100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

                STORAGE       95.21    104.73    114.25    123.77    133.29    142.81    152.33    161.85    171.37    180.90
                OUTFLOW     5202.88   6095.26   7042.60   8043.23   9095.63  10198.41  11350.32  12550.22  13797.02  15089.76
              ELEVATION      102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     6095. TO    15090.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                    HYDROGRAPH AT STATION   92A92B
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     3309.      12.42                525.         160.          55.          24.
                (INCHES)              1.045        1.272         1.316        1.317
                 (AC-FT)              260.         317.          328.         328.

 PEAK STORAGE   TIME                 MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       24.      12.42                  6.           2.            1.           0.

  PEAK STAGE    TIME                 MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)       (HR)
     102.00     12.42               100.54       100.20        100.07       100.03

                CUMULATIVE AREA =     4.67 SQ MI

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

                    HYDROGRAPH AT STATION   92A92B
                  TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     2959.      12.42                483.         147.          51.          22.
                (INCHES)              .961        1.172         1.214        1.215
                 (AC-FT)              239.         292.          302.         303.
```



```
 PEAK STORAGE   TIME                 MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       23.      12.42                  6.           2.            1.           0.

  PEAK STAGE    TIME                 MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)       (HR)
     101.87     12.42               100.51       100.19        100.07       100.03

                CUMULATIVE AREA =     4.67 SQ MI

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

                    HYDROGRAPH AT STATION   92A92B
                  TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     2663.      12.50                440.         135.          47.          20.
                (INCHES)              .877        1.072         1.111        1.112
                 (AC-FT)              218.         267.          277.         277.

 PEAK STORAGE   TIME                 MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       21.      12.50                  6.           2.            1.           0.

  PEAK STAGE    TIME                 MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR     166.58-HR
+    (FEET)       (HR)
     101.76     12.50               100.48       100.18        100.06       100.03

                CUMULATIVE AREA =     4.67 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //92A92B/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                    INTERPOLATED HYDROGRAPH AT   92A92B

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     3017.      12.42                490.         149.          52.          22.
                (INCHES)              .975        1.189         1.231        1.232
                 (AC-FT)              243.         296.          307.         307.

                CUMULATIVE AREA =     4.67 SQ MI
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            **************
            *            *
167 KK      *     S920B  *        BASIN
            *            *
            **************
                        Compute runoff from subbasin 920B

                  SUBBASIN RUNOFF DATA

169 BA            SUBBASIN CHARACTERISTICS
                        TAREA         .48  SUBBASIN AREA

170 LG            GREEN AND AMPT LOSS RATE
                        STRTL         .35  STARTING LOSS
                          DTH         .39  MOISTURE DEFICIT
                         PSIF        5.80  WETTING FRONT SUCTION
                        XKSAT         .19  HYDRAULIC CONDUCTIVITY
                        RTIMP         .00  PERCENT IMPERVIOUS AREA

168 UI            INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                     193.0     746.0    1039.0     787.0     440.0     235.0     128.0      71.0      27.0      27.0

                                                   ***

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

                    HYDROGRAPH AT STATION    S920B
                  TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.87, TOTAL EXCESS =    1.33
```

```
  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+     943.      12.08                           68.          17.          6.           2.
                              (INCHES)       1.327        1.327       1.327        1.327
                               (AC-FT)         34.          34.         34.          34.

                              CUMULATIVE AREA =       .48 SQ MI


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

                                HYDROGRAPH AT STATION     S920B
                              TRANSPOSITION AREA     10.0 SQ MI

      TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.76, TOTAL EXCESS =     1.23

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+     882.      12.08                           63.          16.          5.           2.
                              (INCHES)       1.223        1.223       1.223        1.223
                               (AC-FT)         31.          31.         31.          31.

                              CUMULATIVE AREA =       .48 SQ MI


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

                                HYDROGRAPH AT STATION     S920B
                              TRANSPOSITION AREA     30.0 SQ MI

      TOTAL RAINFALL =     3.78, TOTAL LOSS =     2.66, TOTAL EXCESS =     1.12

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+     819.      12.08                           58.          14.          5.           2.
                              (INCHES)       1.117        1.117       1.117        1.117
                               (AC-FT)         29.          29.         29.          29.

                              CUMULATIVE AREA =       .48 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT     S920B

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+     922.      12.08                           67.          17.          6.           2.
                              (INCHES)       1.291        1.291       1.291        1.291
                               (AC-FT)         33.          33.         33.          33.

                              CUMULATIVE AREA =       .48 SQ MI



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


             **************
             *            *
  173 KK     *    C920B   *      COMBINE
             *            *
             **************
                                 Combine runoff from S920B with routed flow from C920A
                                 This is the total flow at the downstream end of the Fan 2 corridor.

  176 HC          HYDROGRAPH COMBINATION
                        ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

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

                                HYDROGRAPH AT STATION     C920B
                              TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+    3498.      12.42                          588.         177.         61.          26.
                              (INCHES)       1.061        1.276       1.317        1.318
                               (AC-FT)        291.         351.        362.         362.

                              CUMULATIVE AREA =     5.15 SQ MI


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

                                HYDROGRAPH AT STATION     C920B
                              TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+    3130.      12.42                          541.         163.         56.          24.
                              (INCHES)        .976        1.176       1.215        1.215
                               (AC-FT)        268.         323.        334.         334.

                              CUMULATIVE AREA =     5.15 SQ MI


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

                                HYDROGRAPH AT STATION     C920B
                              TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+    2766.      12.42                          493.         149.         51.          22.
                              (INCHES)        .891        1.075       1.112        1.112
                               (AC-FT)        245.         295.        305.         305.

                              CUMULATIVE AREA =     5.15 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT     C920B

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+    3183.      12.42                          548.         165.         57.          25.
                              (INCHES)        .989        1.191       1.229        1.230
                               (AC-FT)        271.         327.        338.         338.

                              CUMULATIVE AREA =     5.15 SQ MI



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


             **************
             *            *
  177 KK     *    S920C   *      BASIN
             *            *
             **************
                              Compute runoff from subbasin 920C

               SUBBASIN RUNOFF DATA

  179 BA          SUBBASIN CHARACTERISTICS
                        TAREA         1.28  SUBBASIN AREA

  180 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .35  STARTING LOSS
                          DTH          .36  MOISTURE DEFICIT
                         PSIF         6.80  WETTING FRONT SUCTION
                        XKSAT          .13  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

  178 UI          INPUT UNITGRAPH,  22 ORDINATES,  VOLUME = 1.00
                     140.0     311.0     701.0    1023.0    1274.0    1342.0    1246.0     979.0     738.0     552.0
                     423.0     304.0     238.0     176.0     134.0      96.0      83.0      34.0      34.0      35.0
                      34.0      34.0
                                                                   ***

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

                                HYDROGRAPH AT STATION     S920C
                              TRANSPOSITION AREA        .1 SQ MI

      TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.73, TOTAL EXCESS =     1.47

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                               6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                                 (CFS)
+    1643.      12.33                          202.          51.         17.           7.
                              (INCHES)       1.465        1.465       1.465        1.465
                               (AC-FT)        100.         100.        100.         100.

                              CUMULATIVE AREA =     1.28 SQ MI


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

                                HYDROGRAPH AT STATION     S920C
                              TRANSPOSITION AREA     10.0 SQ MI

      TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.64, TOTAL EXCESS =     1.35
```

```
  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    1535.      12.33                     187.           47.           16.            7.
                          (INCHES)       1.352         1.352         1.352         1.352
                           (AC-FT)         93.           93.           93.           93.

                            CUMULATIVE AREA =      1.28 SQ MI


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

                              HYDROGRAPH AT STATION     S920C
                            TRANSPOSITION AREA      30.0 SQ MI

     TOTAL RAINFALL =     3.78, TOTAL LOSS =     2.54, TOTAL EXCESS =     1.24

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    1424.      12.33                     171.           43.           14.            6.
                          (INCHES)       1.240         1.240         1.240         1.240
                           (AC-FT)         85.           85.           85.           85.

                            CUMULATIVE AREA =      1.28 SQ MI

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


                            INTERPOLATED HYDROGRAPH AT     S920C

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    1583.      12.33                     194.           48.           16.            7.
                          (INCHES)       1.402         1.402         1.402         1.402
                           (AC-FT)         96.           96.           96.           96.

                            CUMULATIVE AREA =      1.28 SQ MI


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

                 **************
                 *            *
 184 KK          *    C920C   *    COMBINE
                 *            *
                 **************

                                   Combine runoff from S920C with flow from C920B.  This is the total flow
                                   in the Trilby Wash tributary.

 187 HC          HYDROGRAPH COMBINATION
                      ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                    ***

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

                              HYDROGRAPH AT STATION     C920C
                            TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    5008.      12.42                     790.          227.           78.           34.
                          (INCHES)       1.141         1.314         1.347         1.347
                           (AC-FT)        392.          451.          462.          462.

                            CUMULATIVE AREA =      6.43 SQ MI


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

                              HYDROGRAPH AT STATION     C920C
                            TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    4538.      12.42                     727.          210.           72.           31.
                          (INCHES)       1.051         1.211         1.242         1.243
                           (AC-FT)        361.          416.          426.          426.

                            CUMULATIVE AREA =      6.43 SQ MI


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

                              HYDROGRAPH AT STATION     C920C
                            TRANSPOSITION AREA      30.0 SQ MI
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```
  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    4070.      12.42                     664.          192.           66.           28.
                          (INCHES)        .960         1.108         1.137         1.138
                           (AC-FT)        329.          380.          390.          390.

                            CUMULATIVE AREA =      6.43 SQ MI

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


                            INTERPOLATED HYDROGRAPH AT     C920C

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+    4583.      12.42                     733.          211.           72.           31.
                          (INCHES)       1.059         1.221         1.252         1.253
                           (AC-FT)        364.          419.          430.          430.

                            CUMULATIVE AREA =      6.43 SQ MI


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

                 **************
                 *            *
 188 KK          *    S110    *        BASIN
                 *            *
                 **************

                                   Compute runoff from subbasin 110

                       SUBBASIN RUNOFF DATA

 190 BA                  SUBBASIN CHARACTERISTICS
                        TAREA           .43  SUBBASIN AREA

 191 LG                  GREEN AND AMPT LOSS RATE
                        STRTL           .25  STARTING LOSS
                          DTH           .37  MOISTURE DEFICIT
                         PSIF          5.20  WETTING FRONT SUCTION
                        XKSAT           .25  HYDRAULIC CONDUCTIVITY
                        RTIMP          6.00  PERCENT IMPERVIOUS AREA

 189 UI                  INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                          56.0     166.0     335.0     449.0     587.0     358.0     291.0     241.0     188.0     140.0
                         121.0      86.0      68.0      56.0      43.0      32.0      27.0      22.0      11.0      11.0
                          10.0      11.0      11.0
                                                                                    ***

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

                              HYDROGRAPH AT STATION      S110
                            TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.74, TOTAL EXCESS =     1.46

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+     543.      12.17                      64.           17.            6.            2.
                          (INCHES)       1.383         1.456         1.457         1.457
                           (AC-FT)         32.           33.           33.           33.

                            CUMULATIVE AREA =       .43 SQ MI


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

                              HYDROGRAPH AT STATION      S110
                            TRANSPOSITION AREA      10.0 SQ MI

     TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.64, TOTAL EXCESS =     1.35

  PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                          6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                             (CFS)
+     506.      12.17                      59.           16.            5.            2.
                          (INCHES)       1.279         1.348         1.348         1.348
                           (AC-FT)         29.           31.           31.           31.

                            CUMULATIVE AREA =       .43 SQ MI


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

                              HYDROGRAPH AT STATION      S110
                            TRANSPOSITION AREA      30.0 SQ MI
```

```
     TOTAL RAINFALL =     3.78, TOTAL LOSS =     2.54, TOTAL EXCESS =     1.24

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+      468.     12.17                 54.          14.          5.           2.
                (INCHES)          1.172        1.237        1.238        1.238
                 (AC-FT)           27.          28.          28.          28.

                CUMULATIVE AREA =     .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S110/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                INTERPOLATED HYDROGRAPH AT     S110

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+      532.     12.17                 62.          16.          5.           2.
                (INCHES)          1.350        1.422        1.422        1.422
                 (AC-FT)           31.          33.          33.          33.

                CUMULATIVE AREA =     .43 SQ MI



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


            **************
            *            *
 196 KK     *     RR110  *      STORAGE
            *            *
            **************
                        Proposed Detention Basin
                        ROUTE COMBINED RUNOFF AT S110 THROUGH PROPOSED (BIG) DETENTION BASIN
                        AT ALLUVIAL FAN APEX NO. 1
                        STRUCTURE ID:RR110
                        OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft

               HYDROGRAPH ROUTING DATA

 202 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 203 SV            STORAGE          .0       5.7      11.7      18.1      24.7      31.6      38.9      46.5      54.4      62.7

 204 SE          ELEVATION         .00      1.00      2.00      3.00      4.00      5.00      6.00      7.00      8.00      9.00

 205 SQ          DISCHARGE          0.       16.       33.       55.       83.      104.      128.      157.      181.      211.

                                                        ***

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


                  HYDROGRAPH AT STATION    RR110
                 TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+       81.     13.00                 48.          17.          6.           2.
                (INCHES)          1.042        1.428        1.457        1.457
                 (AC-FT)           24.          33.          33.          33.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        24.     13.00                 16.          5.           2.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
       3.96     13.00                2.61         .93          .32          .14

                CUMULATIVE AREA =     .43 SQ MI

      ***             ***             ***             ***             ***
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                  HYDROGRAPH AT STATION    RR110
                 TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+       74.     13.00                 44.          15.          5.           2.
                (INCHES)          .958        1.322        1.348        1.348
                 (AC-FT)           22.          30.          31.          31.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        23.     13.00                 15.          5.           2.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
       3.69     13.00                2.45         .87          .30          .13

                CUMULATIVE AREA =     .43 SQ MI

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


                  HYDROGRAPH AT STATION    RR110
                 TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+       67.     13.00                 40.          14.          5.           2.
                (INCHES)          .874        1.213        1.238        1.238
                 (AC-FT)           20.          28.          28.          28.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        21.     13.00                 14.          5.           2.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
       3.41     13.00                2.28         .81          .28          .12

                CUMULATIVE AREA =     .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //RR110/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                INTERPOLATED HYDROGRAPH AT     RR110

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+       79.     13.00                 47.          16.          5.           2.
                (INCHES)          1.015        1.395        1.422        1.422
                 (AC-FT)           23.          32.          33.          33.

                CUMULATIVE AREA =     .43 SQ MI



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


            **************
            *            *
 207 KK     *    F115A3  *       ROUTE
            *            *
            **************
                        Proposed Channel
                            Route flow from RR110 through subbasin 115A3
                         Slope=(1865.0 - 1682.0) / 7199.0

               HYDROGRAPH ROUTING DATA

 211 RS          STORAGE ROUTING
                      NSTPS          5  NUMBER OF SUBREACHES
                       ITYP       FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 212 RC          NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
```

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                    RLNTH       7199.  REACH LENGTH
                      SEL       .0250  ENERGY SLOPE
                    ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
214 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
213 RX        DISTANCE        .00       .00       .00       .00     95.00     95.00     95.00     95.00

                                                ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      3.72      7.44     11.16     14.87     18.59     22.31     26.03     29.75     33.47
          OUTFLOW        .00     45.02    142.68    279.99    451.49    653.81    884.53   1141.77   1424.04   1730.10
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE      37.18     40.90     44.62     48.34     52.06     55.78     59.50     63.21     66.93     70.65
          OUTFLOW    2058.86   2409.42   2780.94   3172.69   3584.02   4014.33   4463.06   4929.70   5413.79   5914.89
        ELEVATION     102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50


*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      654. TO     5915.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                      HYDROGRAPH AT STATION   F115A3
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       79.     13.58              47.         17.          6.          2.
                (INCHES)        1.018       1.428       1.457       1.457
                (AC-FT)           23.         33.         33.         33.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
          1.    13.58               1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+    (FEET)      (HR)
     100.32     13.58            100.22      100.08      100.03      100.01

                CUMULATIVE AREA =     .43 SQ MI

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

                      HYDROGRAPH AT STATION   F115A3
                     TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       72.     13.58              43.         15.          5.          2.
                (INCHES)        .936       1.322       1.348       1.348
                (AC-FT)           21.         30.         31.         31.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
          1.    13.58               1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+    (FEET)      (HR)
     100.30     13.58            100.21      100.08      100.03      100.01

                CUMULATIVE AREA =     .43 SQ MI

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

                      HYDROGRAPH AT STATION   F115A3
                     TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       64.     13.67              39.         14.          5.          2.
                (INCHES)        .854       1.213       1.238       1.238
                (AC-FT)           20.         28.         28.         28.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
          1.    13.58               1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR       24-HR       72-HR    166.58-HR
+    (FEET)      (HR)
     100.28     13.67            100.20      100.07      100.02      100.01
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                CUMULATIVE AREA =     .43 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F115A3/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***

                      INTERPOLATED HYDROGRAPH AT   F115A3

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+       77.     13.58              46.         16.          5.          2.
                (INCHES)        .992       1.395       1.422       1.422
                (AC-FT)           23.         32.         33.         33.

                CUMULATIVE AREA =     .43 SQ MI


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

              **************
              *            *
216 KK        *    S115A3  *        BASIN
              *            *
              **************
                          Compute runoff from subbasin 115A3

                SUBBASIN RUNOFF DATA

218 BA            SUBBASIN CHARACTERISTICS
                        TAREA         .46  SUBBASIN AREA

219 LG            GREEN AND AMPT LOSS RATE
                        STRTL         .30  STARTING LOSS
                          DTH         .35  MOISTURE DEFICIT
                         PSIF        4.50  WETTING FRONT SUCTION
                        XKSAT         .36  HYDRAULIC CONDUCTIVITY
                        RTIMP        4.00  PERCENT IMPERVIOUS AREA

217 UI          INPUT UNITGRAPH,  15 ORDINATES,  VOLUME = 1.00
                     75.0      307.0      550.0      680.0      636.0      434.0      291.0      190.0      127.0       84.0
                     53.0       34.0       18.0       18.0       18.0
                                                ***

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

                      HYDROGRAPH AT STATION   S115A3
                     TRANSPOSITION AREA       .1 SQ MI

       TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.92, TOTAL EXCESS =    1.28

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+      665.     12.17              60.         16.          5.          2.
                (INCHES)        1.227       1.276       1.276       1.276
                (AC-FT)           30.         31.         31.         31.

                CUMULATIVE AREA =     .46 SQ MI

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

                      HYDROGRAPH AT STATION   S115A3
                     TRANSPOSITION AREA      10.0 SQ MI

       TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.81, TOTAL EXCESS =    1.18

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+      618.     12.17              55.         14.          5.          2.
                (INCHES)        1.133       1.180       1.180       1.180
                (AC-FT)           28.         29.         29.         29.

                CUMULATIVE AREA =     .46 SQ MI

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

                      HYDROGRAPH AT STATION   S115A3
                     TRANSPOSITION AREA      30.0 SQ MI

       TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.70, TOTAL EXCESS =    1.08
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```
  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     569.      12.17                     51.         13.          4.          2.
                          (INCHES)      1.037       1.081       1.081       1.081
                           (AC-FT)        25.         26.         26.         26.

                           CUMULATIVE AREA =      .46 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT    S115A3

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     649.      12.17                     59.         15.          5.          2.
                          (INCHES)      1.197       1.244       1.245       1.245
                           (AC-FT)        29.         30.         30.         30.

                           CUMULATIVE AREA =      .46 SQ MI


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

               **************
               *            *
  222 KK       *   C115A3   *       COMBINE
               *            *
               **************
                                    Combine runoff from S115A3 w/ routed outflow from Fan 1 detention basin

  224 HC          HYDROGRAPH COMBINATION
                        ICOMP            2   NUMBER OF HYDROGRAPHS TO COMBINE
                                                                      ***

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

                            HYDROGRAPH AT STATION    C115A3
                          TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     667.      12.17                    102.         32.         11.          5.
                          (INCHES)      1.071       1.341       1.364       1.364
                           (AC-FT)        51.         63.         64.         64.

                           CUMULATIVE AREA =      .88 SQ MI

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

                            HYDROGRAPH AT STATION    C115A3
                          TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     620.      12.17                     94.         30.         10.          4.
                          (INCHES)       .986       1.240       1.262       1.262
                           (AC-FT)        47.         59.         60.         60.

                           CUMULATIVE AREA =      .88 SQ MI

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

                            HYDROGRAPH AT STATION    C115A3
                          TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     571.      12.17                     86.         27.          9.          4.
                          (INCHES)       .900       1.137       1.157       1.157
                           (AC-FT)        42.         54.         55.         55.

                           CUMULATIVE AREA =      .88 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT    C115A3

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     645.      12.17                     98.         31.         10.          5.
                          (INCHES)      1.031       1.293       1.315       1.315
                           (AC-FT)        49.         61.         62.         62.

                           CUMULATIVE AREA =      .88 SQ MI


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

               **************
               *            *
  225 KK       *   DRR900   *       RETRIEVE
               *            *
               **************
                                    RETRIEVE DIVERTED OUTFLOW FROM RR900 (FLOW TO FAN 1 FROM FAN 2 BASIN)
                                                                      ***

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

                            HYDROGRAPH AT STATION    DRR900
                          TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+      57.      13.75                     47.         21.          8.          3.
                          (INCHES)       .496        .901        .986        .988
                           (AC-FT)        23.         43.         47.         47.

                           CUMULATIVE AREA =     1.74 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   77:  //DRR900/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                            HYDROGRAPH AT STATION    DRR900
                          TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+      53.      13.75                     44.         20.          7.          3.
                          (INCHES)       .459        .832        .913        .915
                           (AC-FT)        22.         39.         43.         43.

                           CUMULATIVE AREA =     1.74 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   78:  //DRR900/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                            HYDROGRAPH AT STATION    DRR900
                          TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+      49.      13.67                     40.         18.          7.          3.
                          (INCHES)       .421        .764        .840        .842
                           (AC-FT)        20.         36.         40.         40.

                           CUMULATIVE AREA =     1.74 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   79:  //DRR900/FLOW/08JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/06JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //DRR900/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***



                        INTERPOLATED HYDROGRAPH AT   DRR900

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      54.    13.75                   45.         20.          7.          3.
                        (INCHES)      .241        .437        .479        .480
                        (AC-FT)       22.         41.         44.         45.

                        CUMULATIVE AREA =    1.74 SQ MI



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


            **************
            *            *
  229 KK    *    F215A2  *        ROUTE
            *            *
            **************
                         Proposed Channel
                             Route FAN 2 BASIN OUTFLOWS THRU SUBBASIN S115A2
                          Slope=(1815.0 - 1682.0) / 6201.0

                HYDROGRAPH ROUTING DATA

  233 RS          STORAGE ROUTING
                        NSTPS           4  NUMBER OF SUBREACHES
                         ITYP        FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC      -1.00  INITIAL CONDITION
                            X         .00 WORKING R AND D COEFFICIENT

  234 RC          NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH       6201.  REACH LENGTH
                          SEL       .0210  ENERGY SLOPE
                        ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                            --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  236 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
  235 RX        DISTANCE        .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                                  ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE        .00      3.37      6.74     10.11     13.49     16.86     20.23     23.60     26.97     30.34
              OUTFLOW        .00     43.43    137.67    270.18    435.72    631.03    853.77   1102.15   1374.74   1670.34
            ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

              STORAGE      33.72     37.09     40.46     43.83     47.20     50.57     53.94     57.32     60.69     64.06
              OUTFLOW    1987.91   2326.56   2685.52   3064.07   3461.59   3877.49   4311.26   4762.40   5230.46   5715.03
            ELEVATION     102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      854. TO     5715.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                          HYDROGRAPH AT STATION   F215A2
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      57.    14.25                   46.         21.          8.          3.
                        (INCHES)      .247        .458        .502        .503
                        (AC-FT)       23.         42.         47.         47.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
        1.    14.17                    1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.27    14.25                100.24      100.11      100.04      100.02

                        CUMULATIVE AREA =    1.74 SQ MI

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

                          HYDROGRAPH AT STATION   F215A2
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                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      52.    14.33                   43.         20.          7.          3.
                        (INCHES)      .229        .423        .465        .466
                        (AC-FT)       21.         39.         43.         43.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
        1.    14.25                    1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.26    14.33                100.23      100.11      100.04      100.02

                        CUMULATIVE AREA =    1.74 SQ MI

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

                          HYDROGRAPH AT STATION   F215A2
                        TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      48.    14.42                   39.         18.          7.          3.
                        (INCHES)      .210        .388        .428        .429
                        (AC-FT)       19.         36.         40.         40.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
        1.    14.33                    1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.25    14.42                100.21      100.10      100.04      100.02

                        CUMULATIVE AREA =    1.74 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //F215A2/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***



                        INTERPOLATED HYDROGRAPH AT   F215A2

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      54.    14.25                   44.         20.          7.          3.
                        (INCHES)      .236        .436        .479        .480
                        (AC-FT)       22.         40.         44.         45.

                        CUMULATIVE AREA =    1.74 SQ MI



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


            **************
            *            *
  238 KK    *    S115A2  *        BASIN
            *            *
            **************
                         Compute runoff from subbasin 115A2

                SUBBASIN RUNOFF DATA

  240 BA          SUBBASIN CHARACTERISTICS
                        TAREA         .43  SUBBASIN AREA

  241 LG          GREEN AND AMPT LOSS RATE
                        STRTL         .35  STARTING LOSS
                          DTH         .38  MOISTURE DEFICIT
                         PSIF        5.40  WETTING FRONT SUCTION
                        XKSAT         .23  HYDRAULIC CONDUCTIVITY
                        RTIMP         .00  PERCENT IMPERVIOUS AREA

  239 UI          INPUT UNITGRAPH,  12 ORDINATES,  VOLUME =  .99
                     111.0     434.0     708.0     755.0     521.0     313.0     192.0     118.0      69.0      43.0
                      20.0      19.0
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      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION   S115A2
                        TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.92, TOTAL EXCESS =    1.28

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     716.     12.08                 59.          15.          5.           2.
                (INCHES)          1.273        1.273        1.273        1.273
                (AC-FT)            29.          29.          29.          29.

                          CUMULATIVE AREA =     .43 SQ MI

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

                          HYDROGRAPH AT STATION   S115A2
                        TRANSPOSITION AREA      10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.81, TOTAL EXCESS =    1.18

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     667.     12.17                 54.          13.          4.           2.
                (INCHES)          1.169        1.169        1.169        1.169
                (AC-FT)            27.          27.          27.          27.

                          CUMULATIVE AREA =     .43 SQ MI

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

                          HYDROGRAPH AT STATION   S115A2
                        TRANSPOSITION AREA      30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.71, TOTAL EXCESS =    1.07

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     616.     12.17                 49.          12.          4.           2.
                (INCHES)          1.062        1.062        1.062        1.062
                (AC-FT)            24.          24.          24.          24.

                          CUMULATIVE AREA =     .43 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT   S115A2

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     701.     12.17                 57.          14.          5.           2.
                (INCHES)          1.240        1.240        1.240        1.240
                (AC-FT)            28.          28.          28.          28.

                          CUMULATIVE AREA =     .43 SQ MI


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

              **************
              *            *
 244 KK       *    C115A2  *      COMBINE
              *            *
              **************
                          Combine runoff from S115A2 with routed outflow from Fan 2 detention basi

 246 HC           HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                      ***

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

                          HYDROGRAPH AT STATION   C115A2
                        TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     718.     12.17                 96.          36.          13.          6.
                (INCHES)          .875        1.310        1.391        1.393
                (AC-FT)            48.          71.          76.          76.

                          CUMULATIVE AREA =     1.02 SQ MI

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

                          HYDROGRAPH AT STATION   C115A2
                        TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     668.     12.17                 89.          33.          12.          5.
                (INCHES)          .807        1.207        1.284        1.286
                (AC-FT)            44.          66.          70.          70.

                          CUMULATIVE AREA =     1.02 SQ MI

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

                          HYDROGRAPH AT STATION   C115A2
                        TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     618.     12.17                 81.          30.          11.          5.
                (INCHES)          .737        1.104        1.176        1.177
                (AC-FT)            40.          60.          64.          64.

                          CUMULATIVE AREA =     1.02 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT   C115A2

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+     693.     12.17                 92.          35.          12.          5.
                (INCHES)          .841        1.258        1.337        1.339
                (AC-FT)            46.          68.          73.          73.

                          CUMULATIVE AREA =     1.02 SQ MI


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

              **************
              *            *
 247 KK       *    C115A  *      COMBINE
              *            *
              **************
                          Combine all flows at C115A (C115A2 + C115A3)

 249 HC           HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                      ***

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

                          HYDROGRAPH AT STATION    C115A
                        TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1385.     12.17                198.          68.          24.          10.
                (INCHES)          .966        1.318        1.378        1.379
                (AC-FT)            98.         134.         140.         140.

                          CUMULATIVE AREA =     1.90 SQ MI

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

                          HYDROGRAPH AT STATION    C115A
                        TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1288.     12.17                182.          62.          22.          9.
                (INCHES)          .890        1.217        1.273        1.275
                (AC-FT)            90.         124.         129.         129.
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                         CUMULATIVE AREA =     1.90 SQ MI


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

                          HYDROGRAPH AT STATION     C115A
                        TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1189.      12.17                   167.         57.          20.          9.
                               (INCHES)  .813        1.113        1.167       1.168
                                (AC-FT)   83.         113.         119.        119.

                         CUMULATIVE AREA =     1.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                         INTERPOLATED HYDROGRAPH AT     C115A

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1323.      12.17                   188.         64.          22.         10.
                               (INCHES)  .917        1.253        1.311       1.312
                                (AC-FT)   93.         127.         133.        133.

                         CUMULATIVE AREA =     1.90 SQ MI


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


           **************
           *            *
 251 KK    *   15A15B   *        ROUTE
           *            *
           **************
                         Proposed Channel
                              Route flows to Sun Valley Parkway
                          Slope=(1682.0 - 1622.0) / 3257.0

            HYDROGRAPH ROUTING DATA

 255 RS          STORAGE ROUTING
                      NSTPS           2  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC       -1.00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

 256 RC          NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH       3257.  REACH LENGTH
                        SEL       .0180  ENERGY SLOPE
                      ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                     CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 258 RY        ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 257 RX         DISTANCE      .00       .00       .00       .00    160.00    160.00    160.00    160.00

                                                        ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

               STORAGE       .00      2.83      5.67      8.50     11.33     14.17     17.00     19.83     22.67     25.50
               OUTFLOW       .00     64.38    204.18    400.93    646.96    937.49   1269.15   1639.32   2045.95   2487.28
             ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

               STORAGE     28.33     31.17     34.00     36.83     39.67     42.50     45.33     48.17     51.00     53.83
               OUTFLOW   2961.86   3468.42   4005.81   4573.06   5169.25   5793.58   6445.29   7123.70   7828.17   8558.12
             ELEVATION    102.37    102.61    102.84    103.08    103.32    103.55    103.79    104.03    104.26    104.50

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      2046. TO      8558.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                          HYDROGRAPH AT STATION    15A15B
                        TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1286.      12.25                   195.         68.          24.         10.
                               (INCHES)  .950        1.318        1.378       1.379
                                (AC-FT)   96.         134.         140.        140.

  PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          9.     12.25                     2.           1.           0.          0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.43     12.25                 100.40       100.17       100.06      100.03

                         CUMULATIVE AREA =     1.90 SQ MI


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

                          HYDROGRAPH AT STATION    15A15B
                        TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1190.      12.25                   179.         62.          22.          9.
                               (INCHES)  .874        1.216        1.273       1.275
                                (AC-FT)   89.         124.         129.        129.

  PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          8.     12.25                     2.           1.           0.          0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.36     12.25                 100.38       100.16       100.06      100.02

                         CUMULATIVE AREA =     1.90 SQ MI


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

                          HYDROGRAPH AT STATION    15A15B
                        TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1088.      12.25                   163.         57.          20.          9.
                               (INCHES)  .798        1.113        1.167       1.168
                                (AC-FT)   81.         113.         119.        119.

  PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
          8.     12.25                     2.           1.           0.          0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.29     12.25                 100.36       100.15       100.05      100.02

                         CUMULATIVE AREA =     1.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //15A15B/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                         INTERPOLATED HYDROGRAPH AT    15A15B

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1224.      12.25                   185.         64.          22.         10.
                               (INCHES)  .901        1.253        1.311       1.312
                                (AC-FT)   92.         127.         133.        133.

                         CUMULATIVE AREA =     1.90 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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                **************
                *            *
260 KK          *     S115B  *        BASIN
                *            *
                **************
                                Compute runoff from subbasin 115B

                   SUBBASIN RUNOFF DATA

262 BA               SUBBASIN CHARACTERISTICS
                           TAREA         .33  SUBBASIN AREA

263 LG               GREEN AND AMPT LOSS RATE
                         STRTL         .35  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                          PSIF        3.78  WETTING FRONT SUCTION
                         XKSAT         .45  HYDRAULIC CONDUCTIVITY
                         RTIMP         .00  PERCENT IMPERVIOUS AREA

261 UI               INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                        169.0     626.0     786.0     483.0     251.0     125.0      66.0      25.0      20.0
                                                                                                    ***

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

                              HYDROGRAPH AT STATION    S115B
                             TRANSPOSITION AREA        .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.10, TOTAL EXCESS =    1.09

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+     610.      12.08                  39.           10.           3.            1.
                (INCHES)           1.089         1.089         1.089         1.089
                (AC-FT)              19.           19.           19.           19.

                             CUMULATIVE AREA =     .33 SQ MI

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

                              HYDROGRAPH AT STATION    S115B
                             TRANSPOSITION AREA      10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.99, TOTAL EXCESS =    1.00

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+     566.      12.08                  35.            9.           3.            1.
                (INCHES)           .997          .997          .997          .997
                (AC-FT)              18.           18.           18.           18.

                             CUMULATIVE AREA =     .33 SQ MI

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

                              HYDROGRAPH AT STATION    S115B
                             TRANSPOSITION AREA      30.0 SQ MI

    TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.87, TOTAL EXCESS =     .91

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+     522.      12.08                  32.            8.           3.            1.
                (INCHES)           .902          .902          .902          .902
                (AC-FT)              16.           16.           16.           16.

                             CUMULATIVE AREA =     .33 SQ MI

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


                           INTERPOLATED HYDROGRAPH AT    S115B

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+     599.      12.08                  38.            9.           3.            1.
                (INCHES)         1.065         1.065         1.065         1.065
                (AC-FT)              19.           19.           19.           19.

                             CUMULATIVE AREA =     .33 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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                **************
                *            *
265 KK          *     C115B  *      COMBINE
                *            *
                **************
                                Combine runoff from S115B with routed flow from C115A
                                This is the total inflow to the SVP channel from the Fan 1 corridor.

268 HC                HYDROGRAPH COMBINATION
                           ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                  ***

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

                              HYDROGRAPH AT STATION    C115B
                             TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+    1613.      12.17                 231.           77.          27.           12.
                (INCHES)           .962         1.284         1.335         1.336
                (AC-FT)             115.          153.          159.          159.

                             CUMULATIVE AREA =     2.24 SQ MI

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

                              HYDROGRAPH AT STATION    C115B
                             TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+    1474.      12.17                 213.           71.          25.           11.
                (INCHES)           .885         1.184         1.232         1.233
                (AC-FT)             105.          141.          147.          147.

                             CUMULATIVE AREA =     2.24 SQ MI

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

                              HYDROGRAPH AT STATION    C115B
                             TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+    1328.      12.17                 194.           65.          23.           10.
                (INCHES)           .806         1.082         1.128         1.129
                (AC-FT)              96.          129.          134.          135.

                             CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //C115B/FLOW/08JAN1999/5MIN//
       ***               ***               ***               ***               ***


                           INTERPOLATED HYDROGRAPH AT    C115B

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR      166.58-HR
+   (CFS)         (HR)
                    (CFS)
+    1519.      12.17                 219.           73.          25.           11.
                (INCHES)           .910         1.216         1.266         1.267
                (AC-FT)             108.          145.          151.          151.

                             CUMULATIVE AREA =     2.24 SQ MI


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


                **************
                *            *
270 KK          *     D115B  *       DIVERT
                *            *
                **************
                                Proposed Detention Basin
                                limit flow to capacity of existing Sun Valley Parkway
                                 STRUCTURE ID:D115B
```

```
      DT            DIVERSION
                         ISTAD          DOUT  DIVERSION HYDROGRAPH IDENTIFICATION

      DI                INFLOW           .00    200.00    400.00    600.00    800.00   1050.00   1100.00   1200.00   1500.00   2000.00
                                     2500.00   3000.00

      DQ        DIVERTED FLOW            .00       .00       .00       .00       .00       .00     50.00    150.00    450.00    950.00
                                     1450.00   1950.00

                                                                               ***

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

                           DIVERSION HYDROGRAPH      DOUT
                         TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      563.     12.17                      23.          6.           2.           1.
                              (INCHES)     .094         .094         .094         .094
                               (AC-FT)      11.          11.          11.          11.

                             CUMULATIVE AREA =     2.24 SQ MI


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

                           HYDROGRAPH AT STATION     D115B
                         TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     1050.     12.08                     209.          72.          25.          11.
                              (INCHES)     .867        1.190        1.241        1.242
                               (AC-FT)     103.         142.         148.         148.

                             CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D115B/FLOW/08JAN1999/5MIN//

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

                           DIVERSION HYDROGRAPH      DOUT
                         TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      424.     12.17                      16.          4.           1.           1.
                              (INCHES)     .066         .066         .066         .066
                               (AC-FT)       8.          8.           8.           8.

                             CUMULATIVE AREA =     2.24 SQ MI


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

                           HYDROGRAPH AT STATION     D115B
                         TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     1050.     12.08                     197.          67.          23.          10.
                              (INCHES)     .818        1.117        1.166        1.167
                               (AC-FT)      98.         133.         139.         139.

                             CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D115B/FLOW/08JAN1999/5MIN//

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

                           DIVERSION HYDROGRAPH      DOUT
                         TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      278.     12.17                       9.          2.           1.           0.
                              (INCHES)     .038         .038         .038         .038
                               (AC-FT)       5.          5.           5.           5.

                             CUMULATIVE AREA =     2.24 SQ MI


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

                           HYDROGRAPH AT STATION     D115B
                         TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     1050.     12.08                     185.          63.          22.           9.
                              (INCHES)     .768        1.044        1.090        1.090
                               (AC-FT)      92.         124.         130.         130.

                             CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D115B/FLOW/08JAN1999/5MIN//
        ***             ***             ***             ***             ***


                    INTERPOLATED DIVERSION HYDROGRAPH AT      DOUT

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      469.     12.17                      18.          5.           2.           1.
                              (INCHES)     .076         .076         .076         .076
                               (AC-FT)       9.          9.           9.           9.

                             CUMULATIVE AREA =     2.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D115B/FLOW/08JAN1999/5MIN//
        ***             ***             ***             ***             ***


                             INTERPOLATED HYDROGRAPH AT     D115B

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     1050.     12.08                     201.          69.          24.          10.
                              (INCHES)     .834        1.141        1.190        1.191
                               (AC-FT)      99.         136.         142.         142.

                             CUMULATIVE AREA =     2.24 SQ MI



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


             **************
             *            *
   280 KK    *   15B15C   *         ROUTE
             *            *
             **************
                              This is existing SV PKWY Channel
                              Note the routing slope is the channel design slope not
                              the general (adjacent) ground slope.
                                   Route flows in existing Sun Valley Parkway channel

               HYDROGRAPH ROUTING DATA

   285 RS          STORAGE ROUTING
                         NSTPS           5  NUMBER OF SUBREACHES
                          ITYP        FLOW  TYPE OF INITIAL CONDITION
                        RSVRIC       -1.00  INITIAL CONDITION
                             X         .00 WORKING R AND D COEFFICIENT

   286 RC          NORMAL DEPTH CHANNEL
                           ANL        .030  LEFT OVERBANK N-VALUE
                          ANCH        .030  MAIN CHANNEL N-VALUE
                           ANR        .030  RIGHT OVERBANK N-VALUE
                         RLNTH       7899.  REACH LENGTH
                           SEL       .0015  ENERGY SLOPE
```

ELMAX 103.5 MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---	+	------ MAIN CHANNEL -------	+	--- RIGHT OVERBANK ---	
288 RY	ELEVATION	103.50 100.00	100.00	98.00	98.00	100.00	100.00 103.50
287 RX	DISTANCE	.00 14.00	38.00	44.00	64.00	70.00	94.00 108.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	1.10	2.28	3.56	4.93	6.39	7.94	9.81	14.08	18.48
OUTFLOW	.00	4.93	15.89	31.73	52.10	76.89	106.07	140.33	197.04	271.86
ELEVATION	98.00	98.29	98.58	98.87	99.16	99.45	99.74	100.03	100.32	100.61
STORAGE	22.99	27.63	32.38	37.26	42.26	47.39	52.63	57.99	63.48	69.09
OUTFLOW	362.00	466.24	583.90	714.52	857.81	1013.56	1181.64	1361.95	1554.44	1759.10
ELEVATION	100.89	101.18	101.47	101.76	102.05	102.34	102.63	102.92	103.21	103.50

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

HYDROGRAPH AT STATION 15B15C
TRANSPOSITION AREA .1 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 886.	12.67		203.	71.	25.	11.
		(INCHES)	.846	1.187	1.241	1.242
		(AC-FT)	101.	142.	148.	148.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)					
9.	12.67		3.	1.	0.	0.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)					
102.10	12.67		100.10	99.08	98.42	98.18

CUMULATIVE AREA = 2.24 SQ MI

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

HYDROGRAPH AT STATION 15B15C
TRANSPOSITION AREA 10.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 853.	12.67		192.	67.	23.	10.
		(INCHES)	.797	1.114	1.166	1.167
		(AC-FT)	95.	133.	139.	139.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)					
8.	12.67		2.	1.	0.	0.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)					
102.04	12.67		100.03	99.04	98.41	98.18

CUMULATIVE AREA = 2.24 SQ MI

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

HYDROGRAPH AT STATION 15B15C
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 818.	12.67		180.	63.	22.	9.
		(INCHES)	.747	1.041	1.090	1.090
		(AC-FT)	89.	124.	130.	130.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)					
8.	12.67		2.	1.	0.	0.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)					
101.97	12.67		99.95	98.99	98.39	98.17

CUMULATIVE AREA = 2.24 SQ MI

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

INTERPOLATED HYDROGRAPH AT 15B15C

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 864.	12.67		196.	68.	24.	10.
		(INCHES)	.813	1.138	1.190	1.191
		(AC-FT)	97.	136.	142.	142.

CUMULATIVE AREA = 2.24 SQ MI

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              **************
              *            *
289 KK        *    S115C   *       BASIN
              *            *
              **************
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Compute runoff from subbasin 115C

SUBBASIN RUNOFF DATA

```
291 BA          SUBBASIN CHARACTERISTICS
                     TAREA          .43  SUBBASIN AREA

292 LG          GREEN AND AMPT LOSS RATE
                     STRTL          .35  STARTING LOSS
                       DTH          .35  MOISTURE DEFICIT
                      PSIF         4.00  WETTING FRONT SUCTION
                     XKSAT          .47  HYDRAULIC CONDUCTIVITY
                     RTIMP          .00  PERCENT IMPERVIOUS AREA

290 UI          INPUT UNITGRAPH,  16 ORDINATES,  VOLUME = 1.00
                    64.0     250.0     457.0     595.0     594.0     444.0     299.0     208.0     135.0      93.0
                    62.0      44.0      23.0      15.0      16.0      16.0
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*** *** *** *** ***

HYDROGRAPH AT STATION S115C
TRANSPOSITION AREA .1 SQ MI

TOTAL RAINFALL = 4.20, TOTAL LOSS = 3.14, TOTAL EXCESS = 1.06

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 548.	12.17		49.	12.	4.	2.
		(INCHES)	1.058	1.058	1.058	1.058
		(AC-FT)	24.	24.	24.	24.

CUMULATIVE AREA = .43 SQ MI

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

HYDROGRAPH AT STATION S115C
TRANSPOSITION AREA 10.0 SQ MI

TOTAL RAINFALL = 3.99, TOTAL LOSS = 3.02, TOTAL EXCESS = .97

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 503.	12.17		44.	11.	4.	2.
		(INCHES)	.964	.964	.964	.964
		(AC-FT)	22.	22.	22.	22.

CUMULATIVE AREA = .43 SQ MI

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

HYDROGRAPH AT STATION S115C
TRANSPOSITION AREA 30.0 SQ MI

TOTAL RAINFALL = 3.78, TOTAL LOSS = 2.91, TOTAL EXCESS = .87

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 458.	12.17		40.	10.	3.	1.
		(INCHES)	.868	.868	.868	.868
		(AC-FT)	20.	20.	20.	20.

CUMULATIVE AREA = .43 SQ MI

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

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                          INTERPOLATED HYDROGRAPH AT    S115C

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     534.     12.17                     47.          12.           4.           2.
                          (INCHES)    1.028        1.028        1.028        1.028
                           (AC-FT)      24.          24.          24.          24.

                          CUMULATIVE AREA =      .43 SQ MI


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


              **************
              *            *
  295 KK      *   C115CR   *      COMBINE
              *            *
              **************
                                Combine runoff from S115C with routed flow from C115B

  297 HC          HYDROGRAPH COMBINATION
                         ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                    ***

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

                            HYDROGRAPH AT STATION   C115CR
                          TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     978.     12.67                    247.          83.          29.          13.
                          (INCHES)     .862        1.165        1.211        1.212
                           (AC-FT)     122.         166.         172.         172.

                           CUMULATIVE AREA =    2.66 SQ MI


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

                            HYDROGRAPH AT STATION   C115CR
                          TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     938.     12.67                    231.          78.          27.          12.
                          (INCHES)     .806        1.089        1.133        1.134
                           (AC-FT)     115.         155.         161.         161.

                           CUMULATIVE AREA =    2.66 SQ MI


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

                            HYDROGRAPH AT STATION   C115CR
                          TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     897.     12.67                    215.          73.          25.          11.
                          (INCHES)     .750        1.012        1.054        1.055
                           (AC-FT)     107.         144.         150.         150.

                           CUMULATIVE AREA =    2.66 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT    C115CR

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     950.     12.67                    236.          80.          28.          12.
                          (INCHES)     .822        1.111        1.156        1.157
                           (AC-FT)     117.         158.         164.         164.

                           CUMULATIVE AREA =    2.66 SQ MI


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              **************
              *            *
  298 KK      *    S120A   *        BASIN
              *            *
              **************
                                Compute runoff from subbasin 120A

                 SUBBASIN RUNOFF DATA

  300 BA          SUBBASIN CHARACTERISTICS
                        TAREA         1.37  SUBBASIN AREA

  301 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .32  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.80  WETTING FRONT SUCTION
                        XKSAT          .30  HYDRAULIC CONDUCTIVITY
                        RTIMP         2.00  PERCENT IMPERVIOUS AREA

  299 UI          INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                     180.0      559.0     1100.0     1547.0     1740.0     1553.0     1160.0      826.0      580.0      409.0
                     305.0      205.0      141.0      123.0       43.0       44.0       45.0       44.0
                                                                          ***

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

                            HYDROGRAPH AT STATION    S120A
                          TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.92, TOTAL EXCESS =     1.28

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1794.     12.25                    185.          47.          16.           7.
                          (INCHES)    1.253        1.278        1.278        1.278
                           (AC-FT)      92.          94.          94.          94.

                           CUMULATIVE AREA =    1.37 SQ MI


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

                            HYDROGRAPH AT STATION    S120A
                          TRANSPOSITION AREA     10.0 SQ MI

   TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.81, TOTAL EXCESS =     1.18

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1662.     12.25                    170.          43.          14.           6.
                          (INCHES)    1.149        1.172        1.172        1.172
                           (AC-FT)      84.          86.          86.          86.

                           CUMULATIVE AREA =    1.37 SQ MI


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

                            HYDROGRAPH AT STATION    S120A
                          TRANSPOSITION AREA     30.0 SQ MI

   TOTAL RAINFALL =     3.78, TOTAL LOSS =     2.70, TOTAL EXCESS =     1.08

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1534.     12.25                    155.          40.          13.           6.
                          (INCHES)    1.051        1.073        1.073        1.073
                           (AC-FT)      77.          79.          79.          79.

                           CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   20:  //S120A/FLOW/08JAN1999/5MIN//
     ***           ***           ***           ***           ***


                          INTERPOLATED HYDROGRAPH AT    S120A

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1719.     12.25                    176.          45.          15.           6.
                          (INCHES)    1.194        1.218        1.218        1.218
                           (AC-FT)      88.          89.          89.          89.
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                    CUMULATIVE AREA =    1.37 SQ MI



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


            **************
            *            *
 305 KK     *     D120A  *       DIVERT
            *            *
            **************
                        Proposed Detention Basin
                        limit flow to capacity of existing Sun Valley Parkway
                         STRUCTURE ID:D120A

     DT          DIVERSION
                      ISTAD        DOUT  DIVERSION HYDROGRAPH IDENTIFICATION

     DI            INFLOW          .00    200.00    400.00    600.00    750.00    950.00   1000.00   1150.00   1450.00   1950.00
                                2450.00   2950.00

     DQ      DIVERTED FLOW         .00       .00       .00       .00       .00       .00     50.00    200.00    500.00   1000.00
                                1500.00   2000.00

                                                          ***

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


                      DIVERSION HYDROGRAPH     DOUT
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     844.     12.25                43.          11.           4.           2.
                     (INCHES)      .291         .291         .291         .291
                      (AC-FT)       21.          21.          21.          21.

                     CUMULATIVE AREA =    1.37 SQ MI


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


                      HYDROGRAPH AT STATION    D120A
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     950.     12.00                142.          36.          12.           5.
                     (INCHES)      .963         .987         .987         .987
                      (AC-FT)       71.          72.          72.          72.

                     CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   77:  //D120A/FLOW/08JAN1999/5MIN//

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


                      DIVERSION HYDROGRAPH     DOUT
                     TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     712.     12.25                34.          9.           3.           1.
                     (INCHES)      .232         .232         .232         .232
                      (AC-FT)       17.          17.          17.          17.

                     CUMULATIVE AREA =    1.37 SQ MI


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


                      HYDROGRAPH AT STATION    D120A
                     TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     950.     12.08                136.          35.          12.           5.
                     (INCHES)      .917         .940         .941         .941
                      (AC-FT)       67.          69.          69.          69.

                     CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   78:  //D120A/FLOW/08JAN1999/5MIN//

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


                      DIVERSION HYDROGRAPH     DOUT
                     TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     584.     12.25                26.          7.           2.           1.
                     (INCHES)      .178         .178         .178         .178
                      (AC-FT)       13.          13.          13.          13.

                     CUMULATIVE AREA =    1.37 SQ MI


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


                      HYDROGRAPH AT STATION    D120A
                     TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     950.     12.08                129.          33.          11.           5.
                     (INCHES)      .873         .895         .895         .895
                      (AC-FT)       64.          66.          66.          66.

                     CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   79:  //D120A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                 INTERPOLATED DIVERSION HYDROGRAPH AT     DOUT

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     769.     12.25                38.          10.           3.           1.
                     (INCHES)      .257         .257         .257         .257
                      (AC-FT)       19.          19.          19.          19.

                     CUMULATIVE AREA =    1.37 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   80:  //D120A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                 INTERPOLATED HYDROGRAPH AT     D120A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     950.     12.08                138.          35.          12.           5.
                     (INCHES)      .937         .960         .961         .961
                      (AC-FT)       69.          70.          70.          70.

                     CUMULATIVE AREA =    1.37 SQ MI



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


            **************
            *            *
 315 KK     *     C115C  *      COMBINE
            *            *
            **************
                        Combine non-diverted runoff from S120A with flow from C115CR
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 317 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

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

                        HYDROGRAPH AT STATION     C115C
                      TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1790.      12.50                387.         119.          41.          18.
                 (INCHES)             .891        1.098        1.135        1.136
                   (AC-FT)            192.         236.         244.         245.

                      CUMULATIVE AREA =     4.04 SQ MI

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

                        HYDROGRAPH AT STATION     C115C
                      TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1647.      12.50                364.         112.          39.          17.
                 (INCHES)             .839        1.032        1.068        1.068
                   (AC-FT)            181.         222.         230.         230.

                      CUMULATIVE AREA =     4.04 SQ MI

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

                        HYDROGRAPH AT STATION     C115C
                      TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1529.      12.42                342.         105.          36.          16.
                 (INCHES)             .787         .966        1.000        1.000
                   (AC-FT)            169.         208.         215.         216.

                      CUMULATIVE AREA =     4.04 SQ MI

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


                      INTERPOLATED HYDROGRAPH AT     C115C

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1675.      12.50                369.         113.          39.          17.
                 (INCHES)             .849        1.045        1.081        1.082
                   (AC-FT)            183.         225.         233.         233.

                      CUMULATIVE AREA =     4.04 SQ MI


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


            **************
            *            *
 318 KK     *    115120  *        ROUTE
            *            *
            **************
                         This is existing SV PKWY Channel
                         Note the routing slope is the channel design slope not
                         the general (adjacent) ground slope.
                              Route total flows from C115C to C120.

                    HYDROGRAPH ROUTING DATA

 323 RS           STORAGE ROUTING
                       NSTPS           3  NUMBER OF SUBREACHES
                        ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC       -1.00  INITIAL CONDITION
                           X         .00 WORKING R AND D COEFFICIENT

 324 RC           NORMAL DEPTH CHANNEL
                         ANL        .030  LEFT OVERBANK N-VALUE
                        ANCH        .030  MAIN CHANNEL N-VALUE
                         ANR        .030  RIGHT OVERBANK N-VALUE
                       RLNTH       4136.  REACH LENGTH
                         SEL       .0015  ENERGY SLOPE
                       ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
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```
                          CROSS-SECTION DATA
                  --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
326 RY     ELEVATION   104.50    100.00    100.00     98.00     98.00    100.00    100.00    104.50
325 RX     DISTANCE       .00     18.00     52.00     58.00     78.00     84.00    118.00    136.00

                                      ***

                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

     STORAGE        .00       .68      1.43      2.25      3.13      4.08      5.44      8.74     12.14     15.62
     OUTFLOW        .00      6.53     21.11     42.29     69.69    103.23    144.82    223.98    334.11    470.28
   ELEVATION      98.00     98.34     98.68     99.03     99.37     99.71    100.05    100.39    100.74    101.08

     STORAGE       19.20     22.86     26.61     30.45     34.38     38.40     42.50     46.70     50.98     55.35
     OUTFLOW      630.31    812.88   1017.13   1242.45   1488.43   1754.77   2041.24   2347.71   2674.09   3020.31
   ELEVATION      101.42    101.76    102.11    102.45    102.79    103.13    103.47    103.82    104.16    104.50

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

                        HYDROGRAPH AT STATION    115120
                      TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1673.      12.67                384.         119.          41.          18.
                 (INCHES)             .885        1.097        1.135        1.136
                   (AC-FT)            191.         236.         244.         245.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
        12.      12.67                  4.           1.           0.           0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     103.03      12.67               100.50        99.21        98.48        98.21

                      CUMULATIVE AREA =     4.04 SQ MI

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

                        HYDROGRAPH AT STATION    115120
                      TRANSPOSITION AREA       10.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1574.      12.58                362.         112.          39.          17.
                 (INCHES)             .833        1.032        1.068        1.068
                   (AC-FT)            179.         222.         230.         230.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
        12.      12.58                  4.           1.           0.           0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     102.90      12.58               100.42        99.17        98.46        98.20

                      CUMULATIVE AREA =     4.04 SQ MI

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

                        HYDROGRAPH AT STATION    115120
                      TRANSPOSITION AREA       30.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1489.      12.58                339.         105.          36.          16.
                 (INCHES)             .781         .966        1.000        1.000
                   (AC-FT)            168.         208.         215.         216.

  PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
        11.      12.58                  3.           1.           0.           0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     102.79      12.58               100.34        99.13        98.44        98.19

                      CUMULATIVE AREA =     4.04 SQ MI

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


                      INTERPOLATED HYDROGRAPH AT    115120
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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     1591.     12.58                366.         113.          39.          17.
                     (INCHES)       .843        1.045        1.081        1.082
                     (AC-FT)         182.         225.         233.         233.

                    CUMULATIVE AREA =     4.04 SQ MI
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            **************
            *            *
 327 KK     *     S120B  *        BASIN
            *            *
            **************
                          Compute runoff from subbasin 120B

              SUBBASIN RUNOFF DATA

 329 BA          SUBBASIN CHARACTERISTICS
                      TAREA          .64  SUBBASIN AREA

 330 LG          GREEN AND AMPT LOSS RATE
                      STRTL          .33  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         4.40  WETTING FRONT SUCTION
                      XKSAT          .38  HYDRAULIC CONDUCTIVITY
                      RTIMP         1.00  PERCENT IMPERVIOUS AREA

 328 UI          INPUT UNITGRAPH,  20 ORDINATES,  VOLUME = 1.00
                     77.0     200.0     420.0     606.0     725.0     711.0     600.0     445.0     322.0     239.0
                    172.0     130.0      91.0      68.0      52.0      33.0      19.0      18.0      19.0      18.0

                                                          ***

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

                        HYDROGRAPH AT STATION    S120B
                       TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.03, TOTAL EXCESS =    1.17

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+      733.     12.25                 80.          20.           7.           3.
                     (INCHES)      1.150        1.162        1.162        1.162
                     (AC-FT)          39.          40.          40.          40.

                    CUMULATIVE AREA =     .64 SQ MI

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

                        HYDROGRAPH AT STATION    S120B
                       TRANSPOSITION AREA      10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.92, TOTAL EXCESS =    1.07

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+      677.     12.25                 73.          18.           6.           3.
                     (INCHES)      1.057        1.068        1.068        1.068
                     (AC-FT)          36.          37.          37.          37.

                    CUMULATIVE AREA =     .64 SQ MI

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

                        HYDROGRAPH AT STATION    S120B
                       TRANSPOSITION AREA      30.0 SQ MI

    TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.80, TOTAL EXCESS =     .98

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+      620.     12.25                 66.          17.           6.           2.
                     (INCHES)       .961         .972         .972         .972
                     (AC-FT)          33.          33.          33.          33.

                    CUMULATIVE AREA =     .64 SQ MI

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

                    INTERPOLATED HYDROGRAPH AT    S120B
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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+      711.     12.25                 77.          19.           6.           3.
                     (INCHES)      1.112        1.124        1.124        1.124
                     (AC-FT)          38.          39.          39.          39.

                    CUMULATIVE AREA =     .64 SQ MI
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*** ***

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            **************
            *            *
 334 KK     *     C120B  *      COMBINE
            *            *
            **************
                          Combine runoff from S120B with routed flow from C120A
                          This is the total flow at the end of the SVP channel at Wagner Wash.

 337 HC           HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                        HYDROGRAPH AT STATION    C120B
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     2125.     12.42                461.         139.          48.          21.
                     (INCHES)       .916        1.105        1.139        1.139
                     (AC-FT)         229.         276.         284.         284.

                    CUMULATIVE AREA =     4.68 SQ MI

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

                        HYDROGRAPH AT STATION    C120B
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     2014.     12.42                433.         130.          45.          19.
                     (INCHES)       .859        1.036        1.068        1.069
                     (AC-FT)         215.         259.         267.         267.

                    CUMULATIVE AREA =     4.68 SQ MI

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

                        HYDROGRAPH AT STATION    C120B
                       TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     1901.     12.42                404.         122.          42.          18.
                     (INCHES)       .802         .966         .996         .997
                     (AC-FT)         200.         241.         249.         249.

                    CUMULATIVE AREA =     4.68 SQ MI

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

                    INTERPOLATED HYDROGRAPH AT    C120B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                     (CFS)
+     2033.     12.42                437.         132.          45.          20.
                     (INCHES)       .869        1.047        1.080        1.080
                     (AC-FT)         217.         261.         270.         270.

                    CUMULATIVE AREA =     4.68 SQ MI

1
                                    RUNOFF SUMMARY
                              FLOW IN CUBIC FEET PER SECOND
                          TIME IN HOURS,  AREA IN SQUARE MILES

                                                PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM      TIME OF
          OPERATION      STATION                FLOW   PEAK                                           AREA      STAGE     MAX STAGE
```

				6-HOUR	24-HOUR	72-HOUR	
+	HYDROGRAPH AT	S900	907.	12.50	165.	43.	15.	1.15
+	HYDROGRAPH AT	S115A1	830.	12.17	90.	23.	8.	.59
+	2 COMBINED AT	CFAN2	1416.	12.25	252.	66.	22.	1.74
+	ROUTED TO	RR900	160.	13.75	132.	60.	22.	1.74
+	DIVERSION TO	TOFAN1	54.	13.75	45.	20.	7.	1.74
+	HYDROGRAPH AT	TOFAN2	106.	13.75	87.	40.	14.	1.74
+	ROUTED TO	90091A	105.	13.92	87.	40.	14.	1.74
+	HYDROGRAPH AT	S910A	533.	12.08	33.	8.	3.	.27
+	2 COMBINED AT	C910A	523.	12.08	108.	47.	17.	1.42
+	ROUTED TO	91A91B	432.	12.17	106.	47.	17.	1.42
+	HYDROGRAPH AT	S910B	1191.	12.08	75.	19.	6.	.60
+	2 COMBINED AT	C910B	1507.	12.08	175.	65.	23.	2.02
+	ROUTED TO	91B915	1206.	12.17	170.	65.	23.	2.02
+	HYDROGRAPH AT	S915	1210.	12.42	172.	43.	14.	1.13
+	2 COMBINED AT	C915	2242.	12.25	335.	107.	37.	3.14
+	ROUTED TO	91592A	2063.	12.42	330.	107.	37.	3.14
+	HYDROGRAPH AT	S920A	2270.	12.17	179.	45.	15.	1.53
+	2 COMBINED AT	C920A	3327.	12.25	499.	150.	52.	4.67
+	ROUTED TO	92A92B	3017.	12.42	490.	149.	52.	4.67
+	HYDROGRAPH AT	S920B	922.	12.08	67.	17.	6.	.48
+	2 COMBINED AT	C920B	3183.	12.42	548.	165.	57.	5.15
+	HYDROGRAPH AT	S920C	1583.	12.33	194.	48.	16.	1.28
+	2 COMBINED AT	C920C	4583.	12.42	733.	211.	72.	6.43
+	HYDROGRAPH AT	S110	532.	12.17	62.	16.	5.	.43
+	ROUTED TO	RR110	79.	13.00	47.	16.	5.	.43
+	ROUTED TO	F115A3	77.	13.58	46.	16.	5.	.43
+	HYDROGRAPH AT	S115A3	649.	12.17	59.	15.	5.	.46
+	2 COMBINED AT	C115A3	645.	12.17	98.	31.	10.	.88
+	HYDROGRAPH AT	DRR900	54.	13.75	45.	20.	7.	1.74
+	ROUTED TO	F215A2	54.	14.25	44.	20.	7.	1.74
+	HYDROGRAPH AT	S115A2	701.	12.17	57.	14.	5.	.43
+	2 COMBINED AT	C115A2	693.	12.17	92.	35.	12.	1.02
+	2 COMBINED AT	C115A	1323.	12.17	188.	64.	22.	1.90
+	ROUTED TO	15A15B	1224.	12.25	185.	64.	22.	1.90
+	HYDROGRAPH AT	S115B	599.	12.08	38.	9.	3.	.33
+	2 COMBINED AT	C115B	1519.	12.17	219.	73.	25.	2.24
+	DIVERSION TO	DOUT	469.	12.17	18.	5.	2.	2.24
+	HYDROGRAPH AT	D115B	1050.	12.08	201.	69.	24.	2.24
+	ROUTED TO	15B15C	864.	12.67	196.	68.	24.	2.24
+	HYDROGRAPH AT	S115C	534.	12.17	47.	12.	4.	.43
+	2 COMBINED AT	C115CR	950.	12.67	236.	80.	28.	2.66
+	HYDROGRAPH AT	S120A	1719.	12.25	176.	45.	15.	1.37
+	DIVERSION TO	DOUT	769.	12.25	38.	10.	3.	1.37
+	HYDROGRAPH AT	D120A	950.	12.08	138.	35.	12.	1.37
+	2 COMBINED AT	C115C	1675.	12.50	369.	113.	39.	4.04
+	ROUTED TO	115120	1591.	12.58	366.	113.	39.	4.04
+	HYDROGRAPH AT	S120B	711.	12.25	77.	19.	6.	.64
+	2 COMBINED AT	C120B	2033.	12.42	437.	132.	45.	4.68

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

```
-----DSS---ZCLOSE Unit:  71,   File: FANS1224.DSS
          Pointer Utilization:   .46
          Number of Records:    232
          File Size:    381.4  Kbytes
          Percent Inactive:     .0
```

1********** **********
1

CURRENT DATE: 10-09-2006
CURRENT TIME: 21:26:24

FILE DATE: 10-09-2006
FILE NAME: RR900

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	100.00	97.20	435.01	2 RCP	4.00	4.00	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: RR900 DATE: 10-09-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
101.83	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
102.81	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
103.77	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
105.10	160.0	160.0	0.0	0.0	0.0	0.0	0.0	0.00	1
106.19	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.45	240.0	237.9	0.0	0.0	0.0	0.0	0.0	0.00	12
107.59	250.0	241.9	0.0	0.0	0.0	0.0	0.0	6.61	6
107.92	320.0	250.7	0.0	0.0	0.0	0.0	0.0	67.73	4
108.05	360.0	254.3	0.0	0.0	0.0	0.0	0.0	103.09	3
108.18	400.0	257.5	0.0	0.0	0.0	0.0	0.0	140.25	3
107.50	239.4	239.4	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: RR900 DATE: 10-09-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
100.00	0.000	0.00	0.00	0.00
101.83	0.000	40.00	0.00	0.00
102.81	0.000	80.00	0.00	0.00
103.77	0.000	120.00	0.00	0.00
105.10	0.000	160.00	0.00	0.00
106.19	0.000	200.00	0.00	0.00
107.45	-0.009	240.00	2.06	0.86
107.59	-0.005	250.00	1.50	0.60
107.92	-0.005	320.00	1.60	0.50
108.05	-0.007	360.00	2.66	0.74
108.18	-0.005	400.00	2.27	0.57

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

2

CURRENT DATE: 10-09-2006
CURRENT TIME: 21:26:24

FILE DATE: 10-09-2006
FILE NAME: RR900

PERFORMANCE CURVE FOR CULVERT 1 - 2(4.00 (ft) BY 4.00 (ft)) RCP

DISCHARGE FLOW (cfs)	HEADWATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	100.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
40.00	101.83	1.83	1.83	1-S2n	1.07	1.31	1.01	0.40	8.01	2.49
80.00	102.81	2.81	2.81	1-S2n	1.55	1.88	1.48	0.60	9.45	3.27
120.00	103.77	3.77	3.77	1-S2n	1.95	2.33	1.93	0.77	10.00	3.83
160.00	105.10	5.10	5.10	5-S2n	2.33	2.70	2.33	0.91	10.51	4.28
200.00	106.19	6.19	6.19	5-S2n	2.71	3.02	2.62	1.05	11.49	4.66
237.94	107.44	7.44	7.44	5-S2n	3.13	3.27	3.07	1.17	11.52	5.00
241.89	107.59	7.59	7.59	5-S2n	3.18	3.29	3.09	1.19	11.63	5.08
250.67	107.92	7.92	7.92	5-S2n	3.32	3.34	3.24	1.39	11.49	5.58
254.25	108.05	8.05	5.75	2-M2c	3.39	3.36	3.36	1.49	11.33	5.83
257.48	108.18	8.18	5.79	2-M2c	3.45	3.37	3.37	1.59	11.43	6.07

El. inlet face invert 100.00 ft El. outlet invert 97.20 ft
El. inlet throat invert 100.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********
INLET STATION 0.00 ft
INLET ELEVATION 100.00 ft
OUTLET STATION 435.00 ft
OUTLET ELEVATION 97.20 ft
NUMBER OF BARRELS 2
SLOPE (V/H) 0.0064
CULVERT LENGTH ALONG SLOPE 435.01 ft

***** CULVERT DATA SUMMARY **********
BARREL SHAPE CIRCULAR
BARREL DIAMETER 4.00 ft
BARREL MATERIAL CONCRETE
BARREL MANNING'S n 0.012
INLET TYPE IMPR SDT CIRC
INLET EDGE AND WALL SQUARE EDGE TOP (26-90 DEG WINGWALL)
INLET DEPRESSION NONE

***** SIDE-TAPERED CIRCULAR IMPROVED INLET *******
FACE WIDTH 4.00 ft
SIDE TAPER (4:1 TO 6:1) (X:1) 4.00
FACE HEIGHT 4.00 ft

CURRENT DATE: 10-09-2006
CURRENT TIME: 21:26:24

FILE DATE: 10-09-2006
FILE NAME: RR900

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	40.00 ft
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (ft/ft)	0.020
MANNING'S n (.01-0.1)	0.045
CHANNEL INVERT ELEVATION	97.20 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	97.20 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	97.20	0.000	0.00	0.00	0.00
40.00	97.60	0.697	0.40	2.49	0.50
80.00	97.80	0.743	0.60	3.27	0.75
120.00	97.97	0.770	0.77	3.83	0.96
160.00	98.11	0.789	0.91	4.28	1.14
200.00	98.25	0.804	1.05	4.66	1.30
240.00	98.37	0.816	1.17	5.00	1.46
250.00	98.39	0.819	1.19	5.08	1.49
320.00	98.59	0.835	1.39	5.58	1.73
360.00	98.69	0.843	1.49	5.83	1.86
400.00	98.79	0.850	1.59	6.07	1.98

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	107.50 ft

CURRENT DATE: 10-09-2006
CURRENT TIME: 21:20:09

FILE DATE: 10-09-2006
FILE NAME: RR110

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	100.00	98.68	265.00	1 RCP	5.00	5.00	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: RR110 DATE: 10-09-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
102.45	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
103.88	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
105.74	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.12	160.0	160.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.72	200.0	174.2	0.0	0.0	0.0	0.0	0.0	25.18	6
107.89	240.0	178.2	0.0	0.0	0.0	0.0	0.0	60.69	4
107.93	250.0	179.0	0.0	0.0	0.0	0.0	0.0	69.79	3
108.16	320.0	184.3	0.0	0.0	0.0	0.0	0.0	135.09	4
108.28	360.0	186.8	0.0	0.0	0.0	0.0	0.0	171.60	3
108.39	400.0	189.2	0.0	0.0	0.0	0.0	0.0	209.34	3
107.50	169.1	169.1	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: RR110 DATE: 10-09-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
100.00	0.000	0.00	0.00	0.00
102.45	0.000	40.00	0.00	0.00
103.88	0.000	80.00	0.00	0.00
105.74	0.000	120.00	0.00	0.00
107.12	0.000	160.00	0.00	0.00
107.72	-0.009	200.00	0.59	0.29
107.89	-0.003	240.00	1.12	0.47
107.93	-0.003	250.00	1.16	0.46
108.16	-0.008	320.00	0.60	0.19
108.28	-0.004	360.00	1.59	0.44
108.39	-0.003	400.00	1.48	0.37

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

CURRENT DATE: 10-09-2006 FILE DATE: 10-09-2006
CURRENT TIME: 21:20:09 FILE NAME: RR110

PERFORMANCE CURVE FOR CULVERT 1 - 1(5.00 (ft) BY 5.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	100.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
40.00	102.45	2.45	2.45	1-S2n	1.52	1.75	1.45	0.21	8.46	1.79
80.00	103.88	3.88	3.88	1-S2n	2.19	2.53	2.13	0.31	10.03	2.37
120.00	105.74	5.74	5.74	5-S2n	2.79	3.12	2.72	0.40	10.99	2.78
160.00	107.12	7.12	7.12	5-S2n	3.39	3.62	3.32	0.47	11.59	3.12
174.22	107.71	7.71	7.71	5-S2n	3.62	3.77	3.57	0.54	11.64	3.40
178.18	107.89	7.89	7.89	5-S2n	3.69	3.81	3.61	0.60	11.76	3.66
179.04	107.92	7.92	7.92	5-S2n	3.71	3.82	3.62	0.61	11.78	3.72
184.30	108.16	8.16	8.16	5-S2n	3.80	3.87	3.67	0.71	11.94	4.10
186.81	108.28	8.28	8.28	5-S2n	3.85	3.90	3.80	0.76	11.69	4.30
189.18	108.39	8.39	8.39	5-S2n	3.89	3.93	3.83	0.81	11.76	4.48

El. inlet face invert 100.00 ft El. outlet invert 98.68 ft
El. inlet throat invert 100.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	100.00 ft
OUTLET STATION	265.00 ft
OUTLET ELEVATION	98.68 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0050
CULVERT LENGTH ALONG SLOPE	265.00 ft

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

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	5.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	IMPR SDT CIRC
INLET EDGE AND WALL	SQUARE EDGE TOP (26-90 DEG WINGWALL)
INLET DEPRESSION	NONE

***** SIDE-TAPERED CIRCULAR IMPROVED INLET *******

FACE WIDTH	5.00 ft
SIDE TAPER (4:1 TO 6:1) (X:1)	4.00
FACE HEIGHT	5.00 ft

CURRENT DATE: 10-09-2006 FILE DATE: 10-09-2006
CURRENT TIME: 21:20:09 FILE NAME: RR110

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

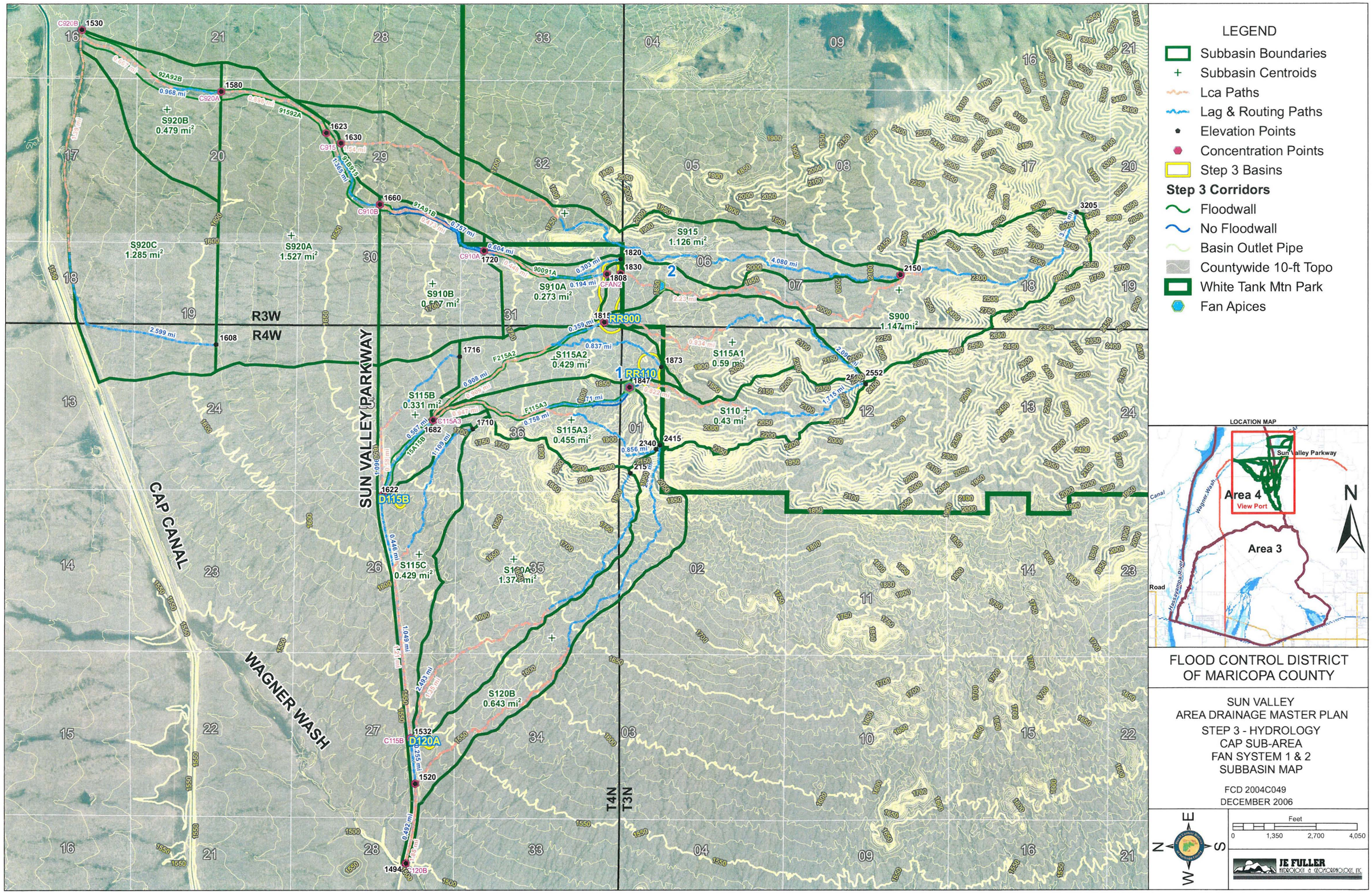
BOTTOM WIDTH	110.00 ft
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (ft/ft)	0.025
MANNING'S n (.01-0.1)	0.045
CHANNEL INVERT ELEVATION	98.68 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	98.68 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	98.68	0.000	0.00	0.00	0.00
40.00	98.88	0.703	0.20	1.79	0.32
80.00	98.99	0.753	0.31	2.37	0.48
120.00	99.07	0.783	0.39	2.78	0.61
160.00	99.14	0.805	0.46	3.12	0.73
200.00	99.21	0.823	0.53	3.40	0.83
240.00	99.27	0.838	0.59	3.66	0.93
250.00	99.29	0.841	0.61	3.72	0.95
320.00	99.39	0.861	0.71	4.10	1.10
360.00	99.44	0.871	0.76	4.30	1.18
400.00	99.49	0.880	0.81	4.48	1.26

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	107.50 ft


LEGEND
Subbasin Boundaries
Subbasin Centroids
Lca Paths
Lag & Routing Paths
Elevation Points
Concentration Points
Step 3 Basins
Step 3 Corridors
Floodwall
No Floodwall
Basin Outlet Pipe
Countywide 10-ft Topo
White Tank Mtn Park
Fan Apices
LOCATION MAP
Sun Valley Parkway
Area 4
View Port
Area 3
Wagner Wash
Canal
Road
N
SUN VALLEY PARKWAY
CAP CANAL
WAGNER WASH
R3W
R4W
T4N
T3N
S920B 0.479 mi²
S920C 1.285 mi²
S920A 1.527 mi²
S910B 0.707 mi²
S910A 0.273 mi²
S915 1.126 mi²
S900 1.147 mi²
S115A2 0.429 mi²
S115A1 0.59 mi²
S115B 0.331 mi²
S115A3 0.455 mi²
S110 0.43 mi²
S115C 0.429 mi²
S120A 1.374 mi²
S120B 0.643 mi²
RR900
RR110
D115B
D120A
1 RR110
2
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - HYDROLOGY
CAP SUB-AREA
FAN SYSTEM 1 & 2
SUBBASIN MAP
FCD 2004C049
DECEMBER 2006
Feet
0
1,350
2,700
4,050
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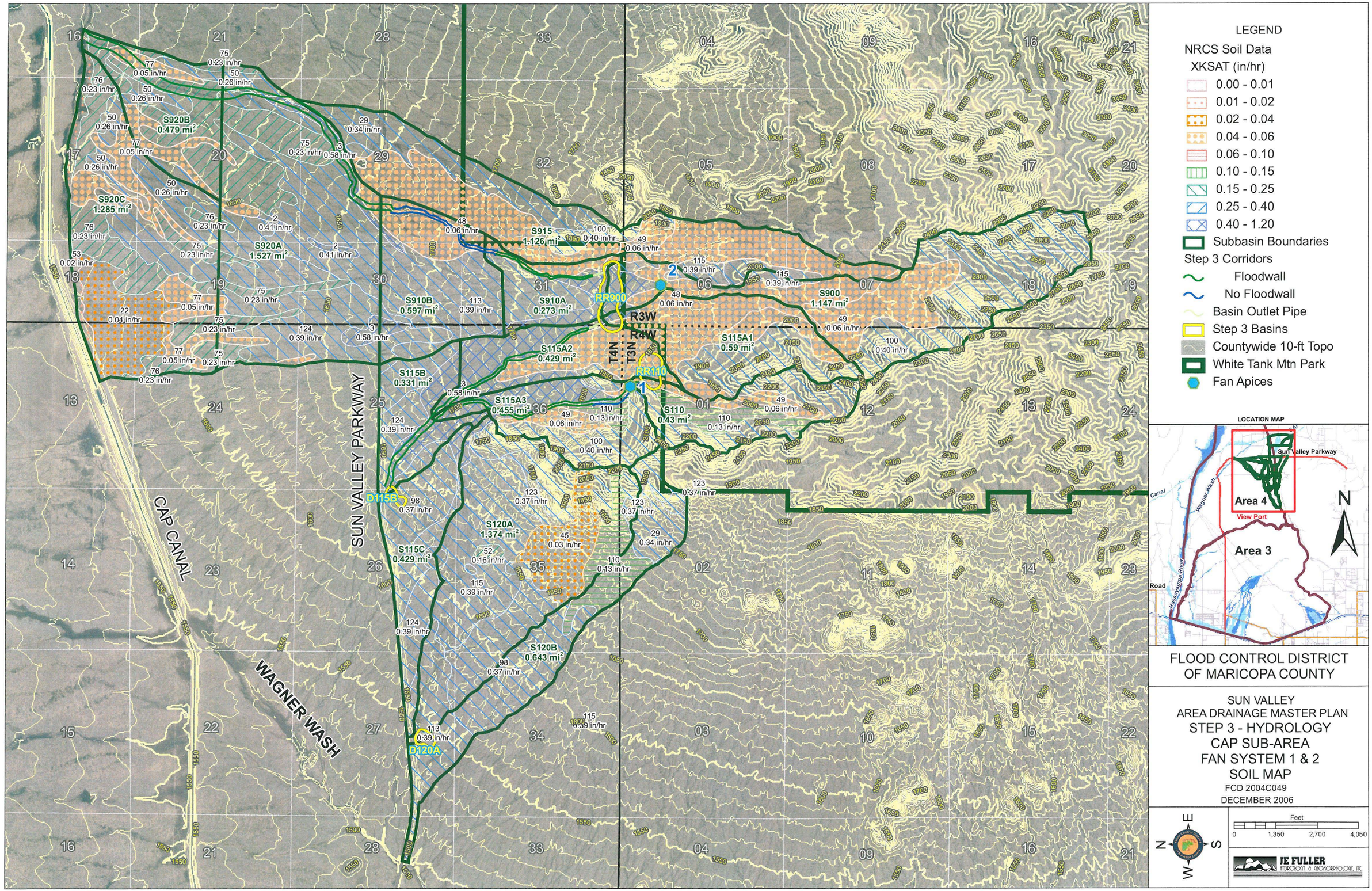

LEGEND

NRCS Soil Data
XKSAT (in/hr)

- 0.00 - 0.01
- 0.01 - 0.02
- 0.02 - 0.04
- 0.04 - 0.06
- 0.06 - 0.10
- 0.10 - 0.15
- 0.15 - 0.25
- 0.25 - 0.40
- 0.40 - 1.20
- Subbasin Boundaries

Step 3 Corridors

- Floodwall
- No Floodwall
- Basin Outlet Pipe
- Step 3 Basins
- Countywide 10-ft Topo
- White Tank Mtn Park
- Fan Apices

LOCATION MAP

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - HYDROLOGY
CAP SUB-AREA
FAN SYSTEM 1 & 2
SOIL MAP
FCD 2004C049
DECEMBER 2006

Feet
0 1,350 2,700 4,050

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S920B
0.479 mi²
NDR
S920C
1.285 mi²
NDR
S920A
1.527 mi²
NDR
NDR
S915
1.126 mi²
NDR
NDR
S910B
0.597 mi²
S910A
0.273 mi²
NDR
RR900
2
NHS
NMT
S900
1.147 mi²
R3W
R4W
NDR
S115A2
0.429 mi²
NDR
NMT
S115A1
0.59 mi²
RR110
1
S110
0.43 mi²
S115A3
0.455 mi²
NDR
NMT
NDR
S115B
0.331 mi²
NMT
D115B
NMT
NMT
S120A
1.374 mi²
S120B
0.643 mi²
S115C
0.429 mi²
NDR
NDR
NDR
D120A
SUN VALLEY PARKWAY
CAP CANAL
WAGNER WASH
T4N
T3N

LEGEND

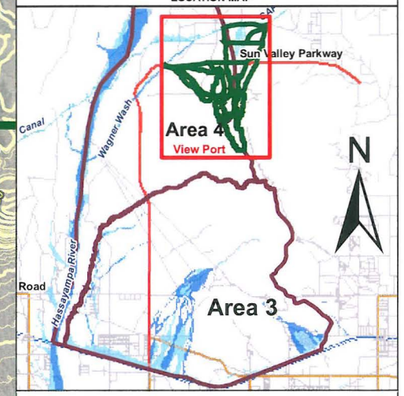
Existing Land Use

- Desert Rangeland (NDR), <5% Slopes
- Hillslopes (NHS), 5-10% slopes
- Mountain Terrain (NMT), >10% Slopes
- Subbasin Boundaries

Step 3 Corridors

- Floodwall
- No Floodwall
- Basin Outlet Pipe
- Step 3 Basins
- White Tank Mtn Park
- Countywide 10-ft Topo
- Fan Apices

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - HYDROLOGY
CAP SUB-AREA
FAN SYSTEM 1 & 2
LAND USE MAP

FCD 2004C049
DECEMBER 2006

Feet
0 1,350 2,700 4,050

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Appendix B

Miscellaneous Additional Materials

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SVADMP Sediment Sample Location Map

Sediment Sampling Points

Ownership

- Bureau of Land Management
- Luke Air Force Base
- Military Reservation
- Parks & Recreation
- Private
- State Trust
- Sub-areas
- Step 3 Corridors
- Step 3 Basins
- Fan Apices

Hassayampa River

CAP Canal

CAP

Wagner

Wagner Wash

Hassayampa

White Tank Wash

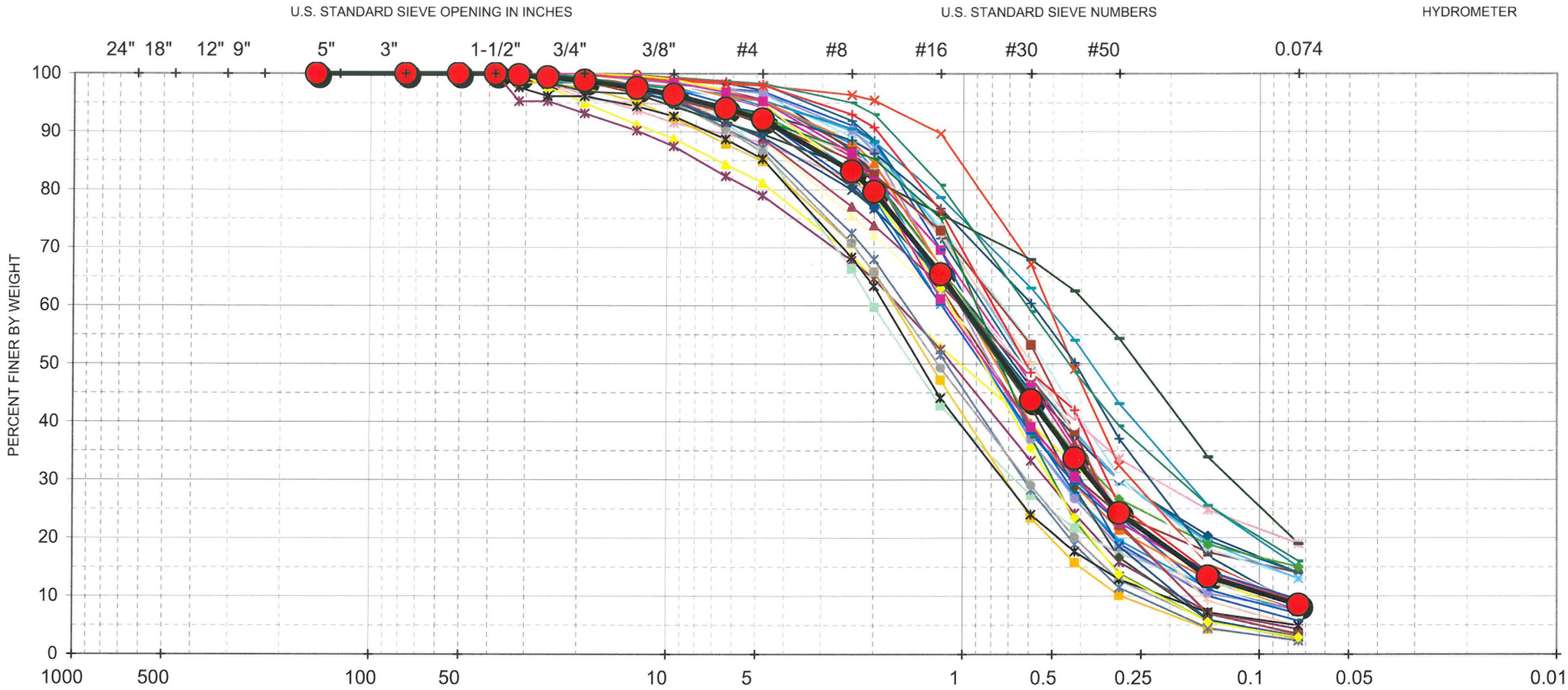
WHITE TANK MOUNTAIN REGIONAL PARK

FRS No. 1

FRS No. 2 and 3

N W E S

0 0.45 0.9 1.8 2.7 Miles



Hassayampa 8 — Hassayampa 9 — Hassayampa 10 — Hassayampa 11 — Hassayampa 12 — CAP 5 — CAP 6
CAP 8 — Wagner 1 — Wagner 7 — Wagner 8 — Wagner 9 — Wagner 10 — Wagner 11
Wagner 12 — FRS 1 - 2 — FRS 1 - 3 — FRS 1 - 7 — FRS 1 - 9 — FRS 1 - 10 — FRS 1 - 12
FRS 1 - 14 — FRS 1 - 15 — FRS 1 - 16 — FRS 1 - 17 — FRS 1 - 18 — White Tank 5 — White Tank 8
White Tank 9 — White Tank 10 — White Tank 11 — White Tank 12 — FRS 2 & 3 - 2 — FRS 2 & 3 - 5 — FRS 2 & 3 - 6
FRS 2 & 3 - 9 — FRS 2 & 3 - 19 — FRS 2 & 3 - 20 — Average — + Log Scale — + Sizes Labels

Sun Valley ADMP

JE Fuller Hydrology and Geomorphology Inc.
Tempe Arizona

Flood Control District of Maricopa County

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

C.L. Williams Consulting, Inc.

LOGAN SIMPSON DESIGN INC.

EDAW

amec

Richard H. French, Ph.D., P.E.