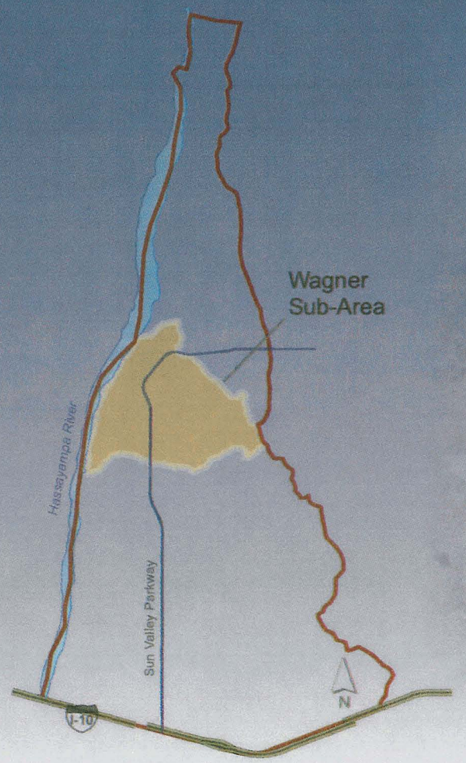
BOOK 15 OF 30

Sun Valley Area Drainage Master Plan



Step 3
Recommended Alternative Report

Volume 3 PART 3 OF 3
WAGNER WASH SUB-AREA

December 2006

Flood Control District of Maricopa County

A211.216

Memorandum **JE Fuller/ Hydrology & Geomorphology, Inc.**

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.

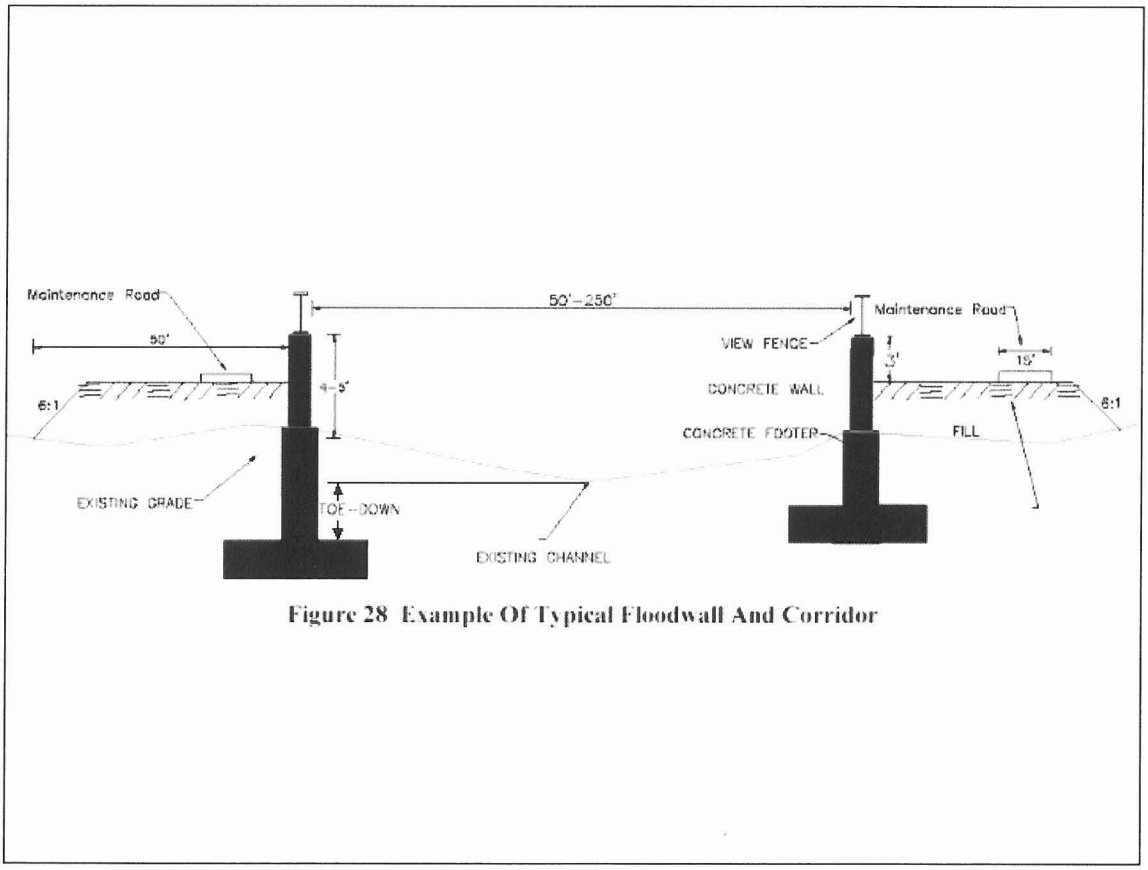


Figure 28 Example Of Typical Floodwall And Corridor

SUN VALLEY AREA DRAINAGE MASTER PLAN

STEP 3 RECOMMENDED ALTERNATIVE REPORT
WAGNER SUB-AREA
VOLUME 3

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

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CONSULTING, INC.

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amec

Richard H. French, Ph.D., P.E.

December 2006

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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

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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.

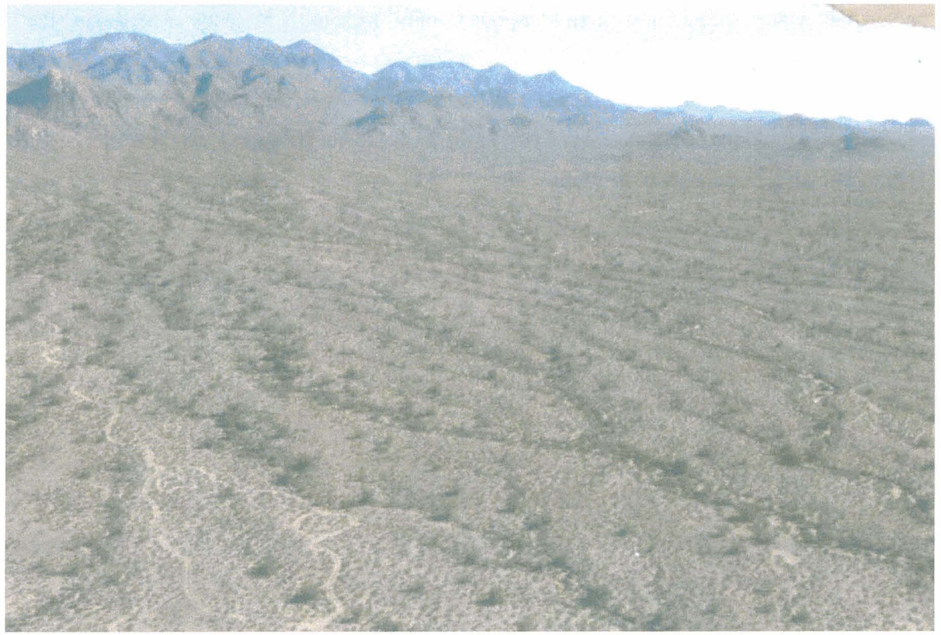

Figure 1 Example Of Sun Valley Piedmont In The Wagner Sub-Area

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 Wagner sub-area and its five alluvial fan systems; Fan Systems 13, 3, 16, 17/18, & 19. 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 Wagner sub-area include three on-line detention basins, five small earthen dikes, and 13.7 miles of walled-levee corridors. The total right of way area needed for the five Wagner fan systems is 370 acres. The estimated total cost of the recommended alternative for the Wagner sub-area is $101.5 million. Implementation is suggested such that the apex detention basins are constructed first for any given fan system. 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 (Volume 2),

3) Wagner Wash (this volume),

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).

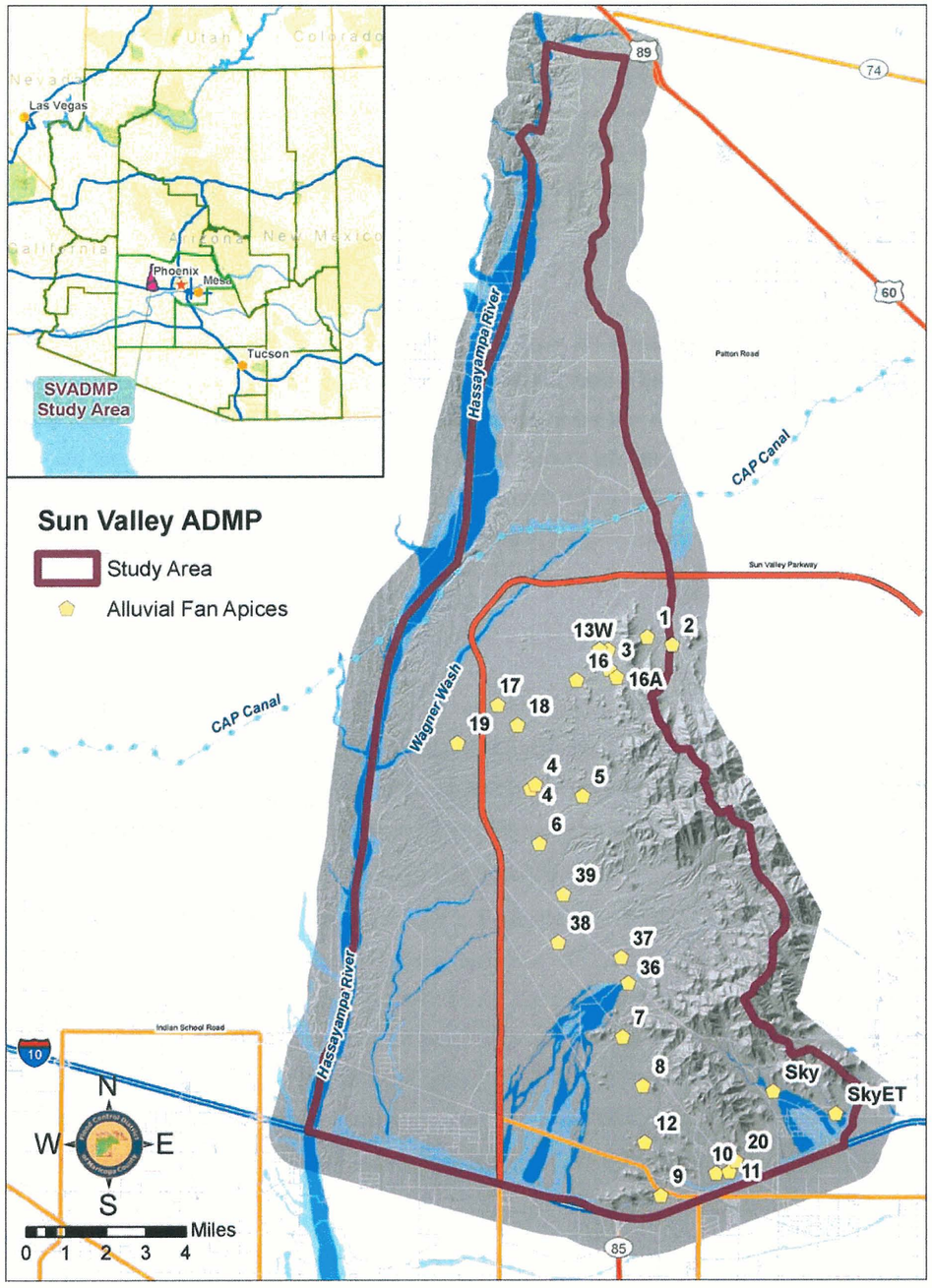

Figure 3 Location Of Study Area

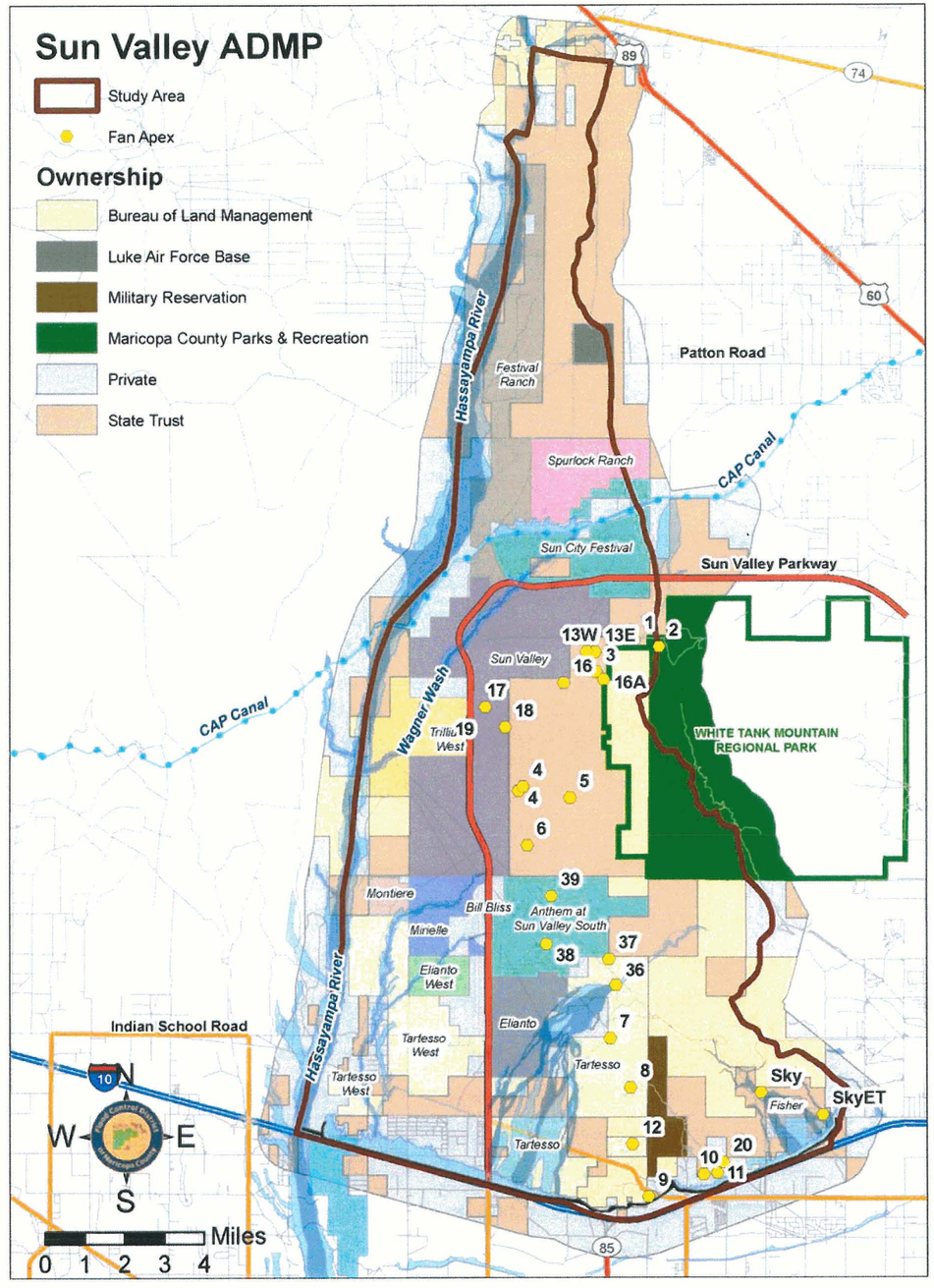

Figure 4 Future Developments In The ADMP Study Area

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.

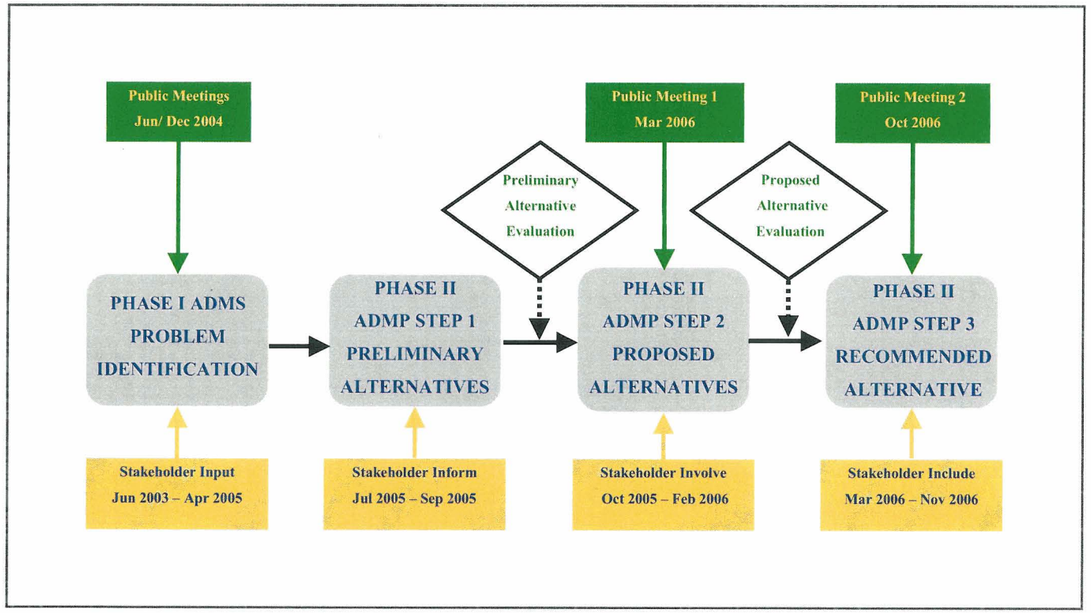

Figure 5 Alternatives Development Process

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 Fan System 3 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 Wagner Wash sub-area was based on the B4-3 Alternative from Step 2. It is composed of three large, on-line detention basins near the alluvial fan apices and walled-levee corridors downstream to Wagner Wash for five fan systems. 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. Wagner Wash is a tributary to the Hassayampa River.

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.

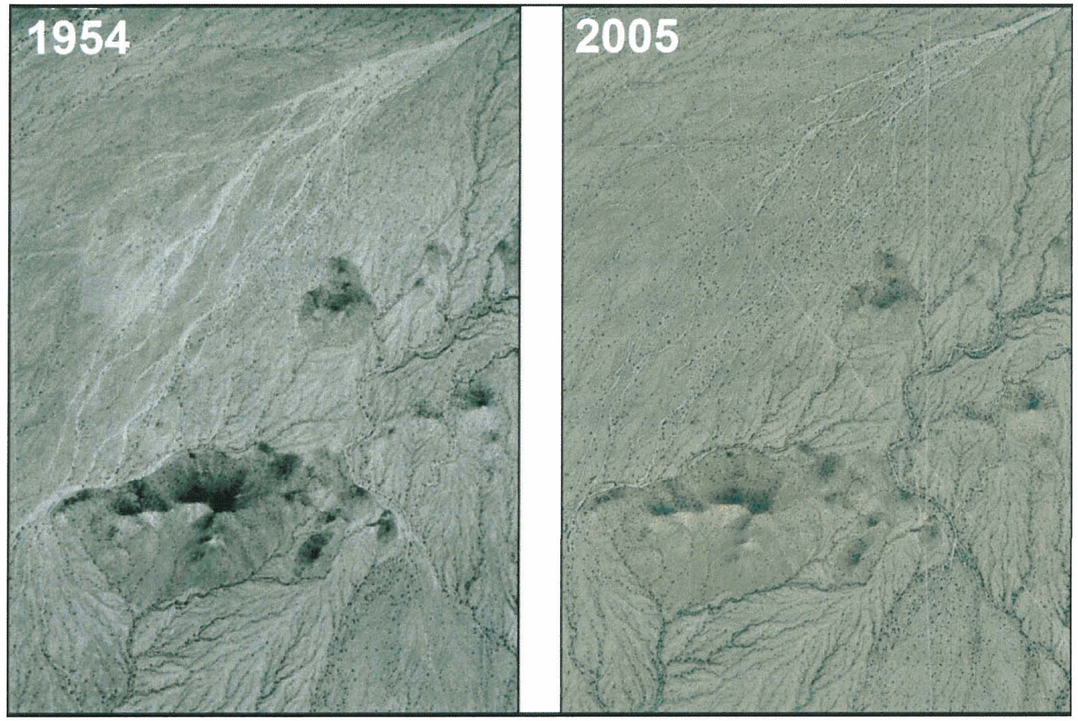

Figure 6 Comparison Of Active Fan Area For Fan 36 - 1954 Vs. 2005

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. Fan Systems 13 and 3 do not cross the Sun Valley Parkway before entering Wagner Wash.

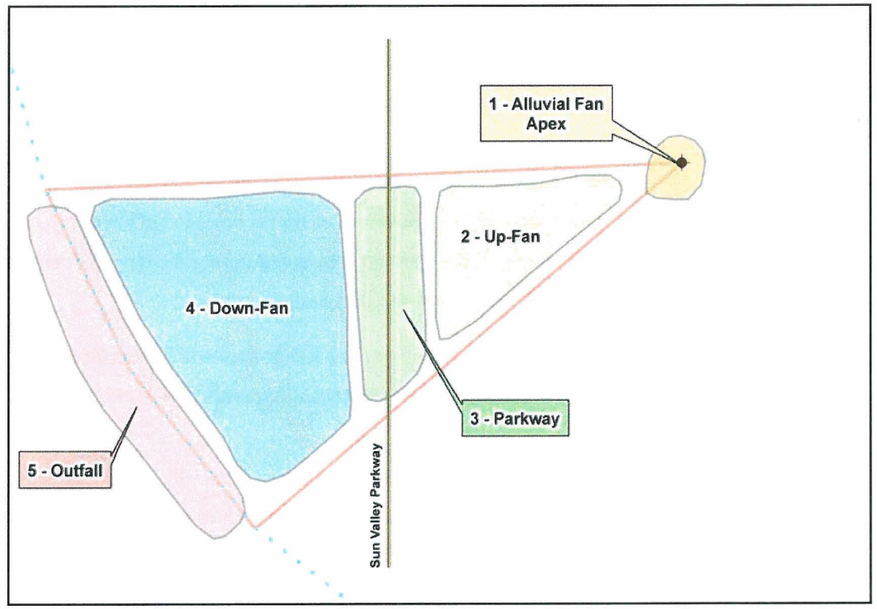

Figure 7 Fan Area Classification

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 Wagner Wash sub-area that means the selection of separate corridor paths for each of six alluvial fan

apices. Apices 17 and 18 drain to a common corridor into Wagner Wash and were therefore treated as a single "fan system." A new corridor was added for Fan 16 rather than combine it with 17 and 18 as shown in Alternative B4-3 in Step 2. This was done to reflect the more general preference for "multiple corridors" resulting from the Step 2 evaluation process.

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 Wagner Wash 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.
- 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 2, and 4-7).

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 Wagner 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 Wagner Sub-Area

Several archeological research projects have already been completed across the Wagner sub-area. None of the five fan systems have yet been totally examined for cultural resources. Ten short, separate sections of GLO Road D and GLO Road E will be totally destroyed by the planned construction of the Fan 3 apex detention basin and various channel crossings of the Fan System 3, 13, and 16 corridors. Site AZ T:6:56 ASM is located only about 325 feet south of the Fan 18 channel and about 800 feet east of an associated proposed dike.

All three of the above archeological sites have been discussed by SAS (2005: p. 57, Fig. 11, Table 6). Accordingly, neither of the two GLO roads has yet been formally recorded. They are simply local historic mining roads that predate 1915. Arizona T:6:56 ASM is a medium-size scatter of late historic trash. It measures 55 meters long and 38 meters wide and dates between 1900 and 1940.

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 specifically, five relevant consequences of this recommendation should 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) all project segments of GLO Road D and GLO Road E should be visited, their physical condition should be evaluated, and, if found undisturbed, they should be formally recorded as forming two true historic sites, 4) the potential archeological significance of GLO Road D and GLO Road E should be evaluated using established government criteria, and, as planned, 5) no construction impacts should be allowed at site AZ T:6:56 ASM.

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 WAGNER 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 (Volume 2),
3) Wagner Wash (this volume),
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. For example, fans that drain to Wagner Wash are included in the Wagner Wash sub-area. The sub-areas also represent the hydrologic watershed for the particular outfall location. The sub-area boundaries are shown in Figure 8.

This report presents the details of the Step 3 Recommended Alternative for the Wagner Wash 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 2 and 4 – 7). This organization is analogous to that used in the Step 2 presentation.

Within the Wagner sub-area, five "fan systems" were further differentiated. (Figure 9) The five fan systems are presented in separate sections within the remainder of this report and summarized as a whole at the end of this report. The five fan systems within the Wagner Wash sub-area are:

- Fan System 13 which controls Fans 13E and 13W
- Fan System 3 which controls Fan 3
- Fan System 16 which controls Fan 16 and 16A
- Fan System 17/18 which addresses Fans 17 and 18
- Fan System 19 which addresses Fan 19

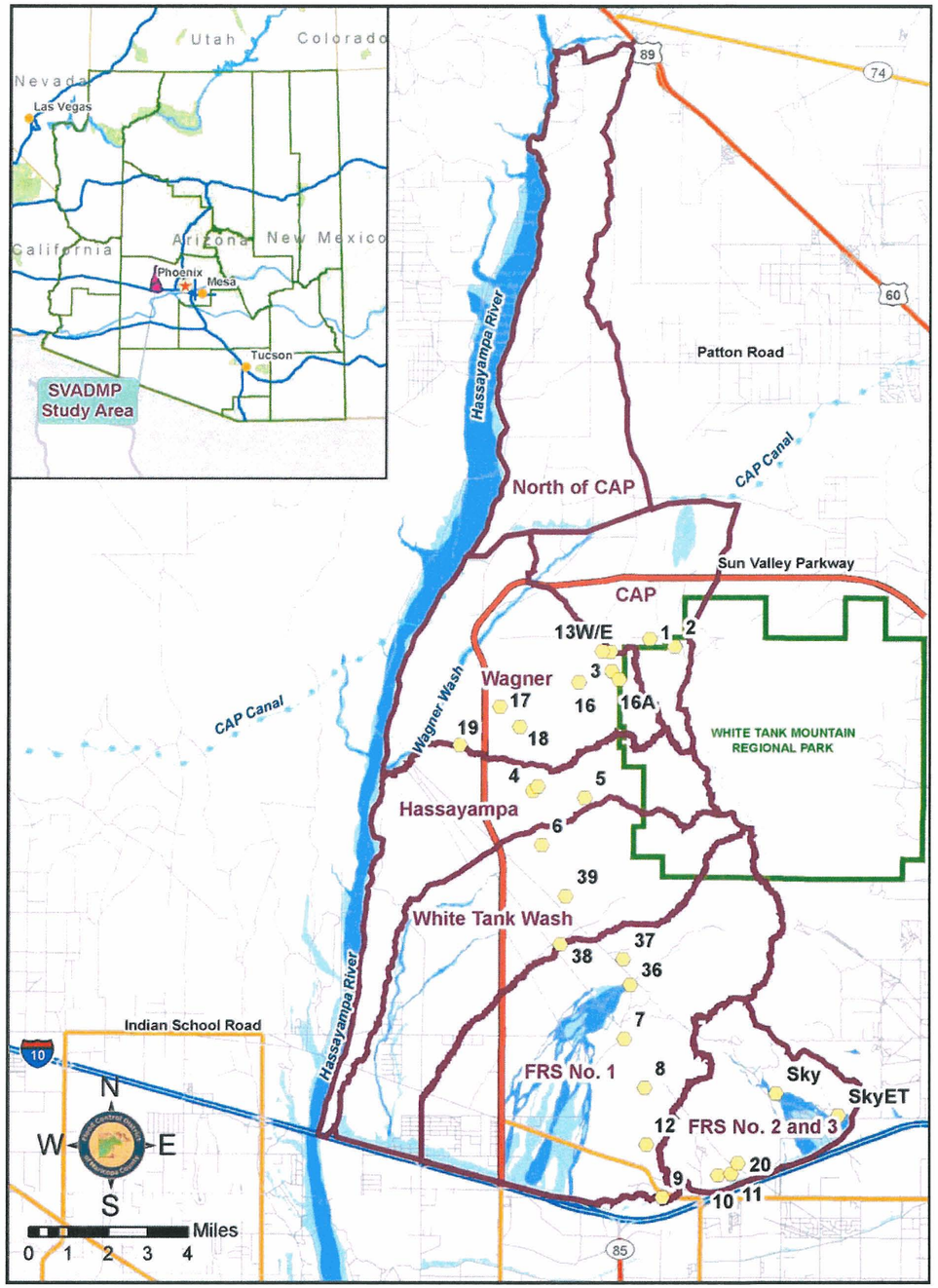

Figure 8 Sun Valley ADMP Sub-Areas

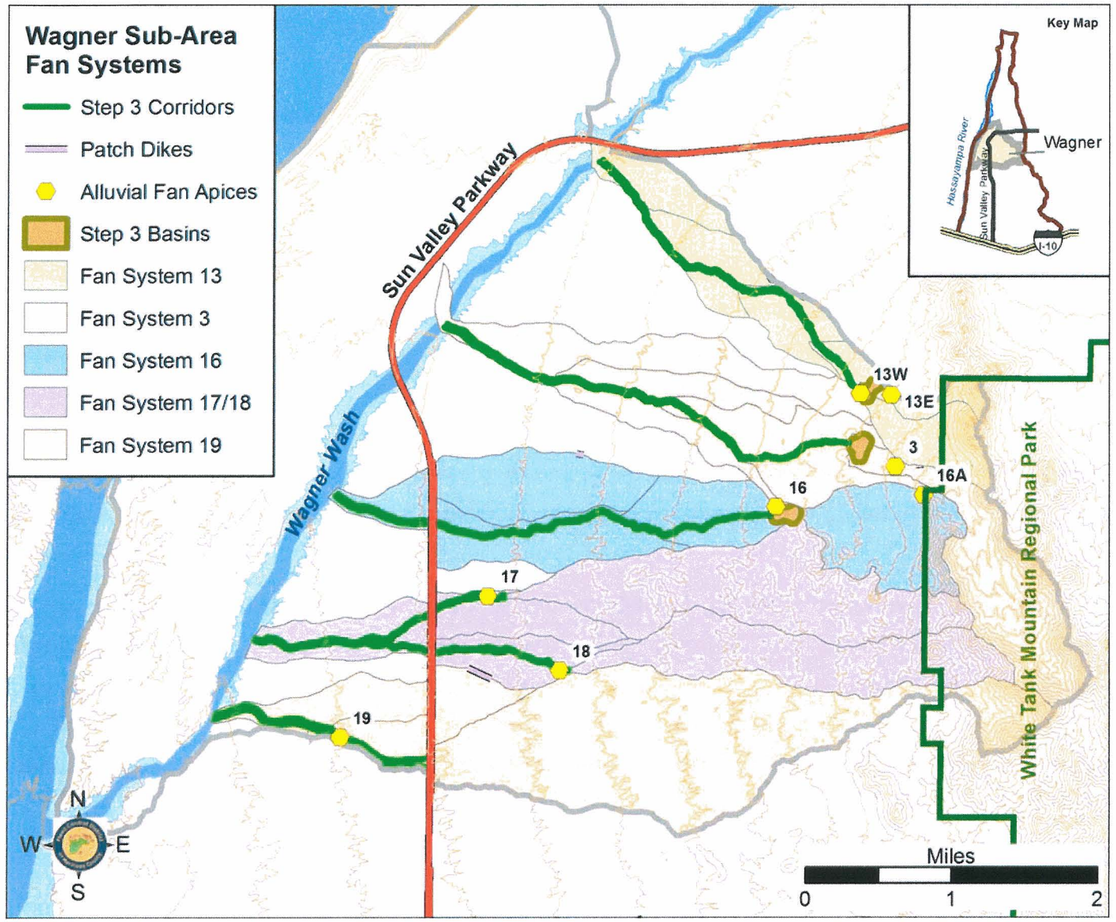

Figure 9 Wagner Sub-Area Fan Systems

The recommended alternative for the Wagner Wash sub-area was refined from Alternative B4-3 in Step 2. It is comprised of three large, on-line detention basins near the alluvial fan apices and walled-levee corridors downstream to Wagner Wash for the five fan systems. Fan Systems 13, 3, and 16 are comprised of one on-line detention basin with a downstream walled-levee corridor for each fan system. Fan Systems 17/18 and 19 are comprised of walled-levee corridors only. 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. Fan Systems' 3 and 13 recommended alternatives also include small containment dike to prevent flow breakouts between the fan system watersheds. 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.

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 Appendices A – E. 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 Appendices A – E. 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. 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 F). A plot of the sediment gradations for all of the samples collected is also provided in Appendix F. 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 the five in the Wagner Wash sub-area.

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 Wagner Wash 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 Appendices A – E.

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 Wagner Wash 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, 2006). 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 Wagner sub-area (JEF, 2006). 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 Appendices A – C 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 the appendix for each fan system.

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 Wagner 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

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 Wagner 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 Section 7, 8-12, & 15.

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 10 shows the recommended alternative located on the existing landscape character units for the Wagner 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 Wagner sub-area, only the Natural Sonoran Desert Theme is recommended for use in the development of flood control facilities of the recommended alternative. The recommended basins are located high on the Bajada and should the design should be sensitive to this location. The general approach to designing facilities with this theme 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 Wagner sub-area cross the Bajada and Valley Plains character units (Figure 10). The discussion of incorporating theme elements to make the facilities sensitive to those units is included 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 12 and Figure 28 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.

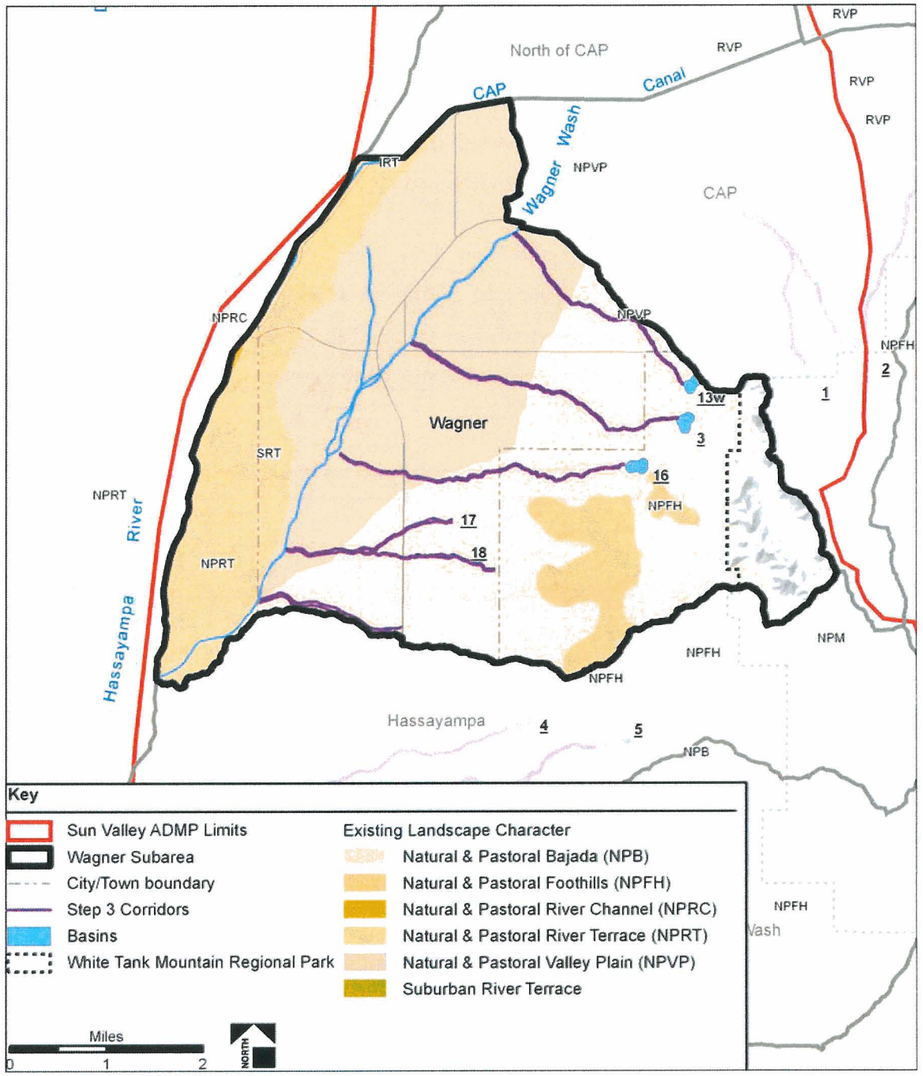

Figure 10 Wagner Sub-area Recommended Alternative and Landscape Character

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.

The natural Sonoran Desert theme incorporates forms, colors, and textures of natural desert into required structural components. Landscape designs will create topography similar to the immediate surrounding area of the character units and will utilize plants, boulders and ground cover in ways that mimic adjacent areas. Applying themes in this way will result in a drainage corridor that extends from the Hassayampa River to the White Tank Mountains that has a high level of context sensitivity with the surrounding area over its entire length.

5.6.4 Landscape Theme Plant Palettes

Preliminary plant palettes have been developed for application of each theme. The plant list for the Wagner sub-area includes only plants for the Natural Sonoran Desert Theme. Table 3 shows 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

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 located just upstream of the fan apex where flows begin to spread out unpredictably into numerous smaller channels. 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.

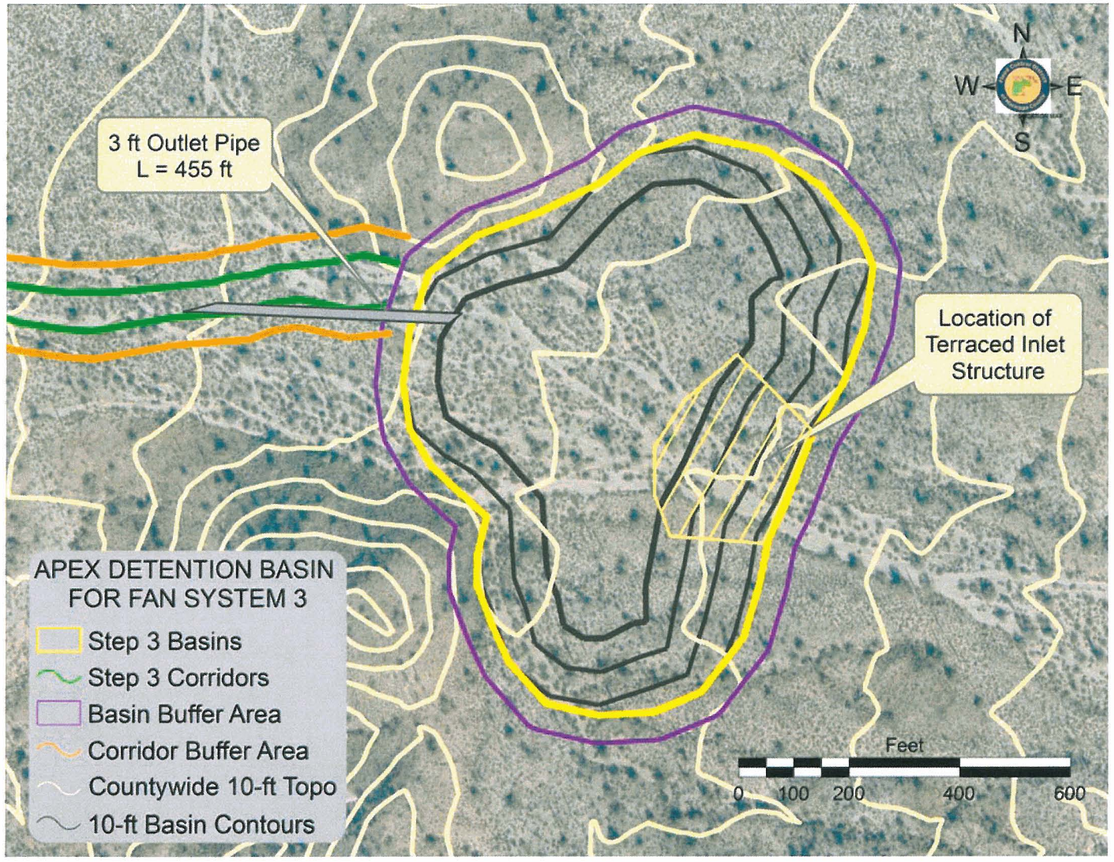

Figure 11 Concept Plan View Of On-Line Basin For Fan System 3

Figure 11 shows the concept plan view of the on-line basin for Fan System 3 on an aerial photo of the area with the existing topography as an example. Figure 12 and Figure 13 show a generic concept basin with the landscape aesthetic treatments.

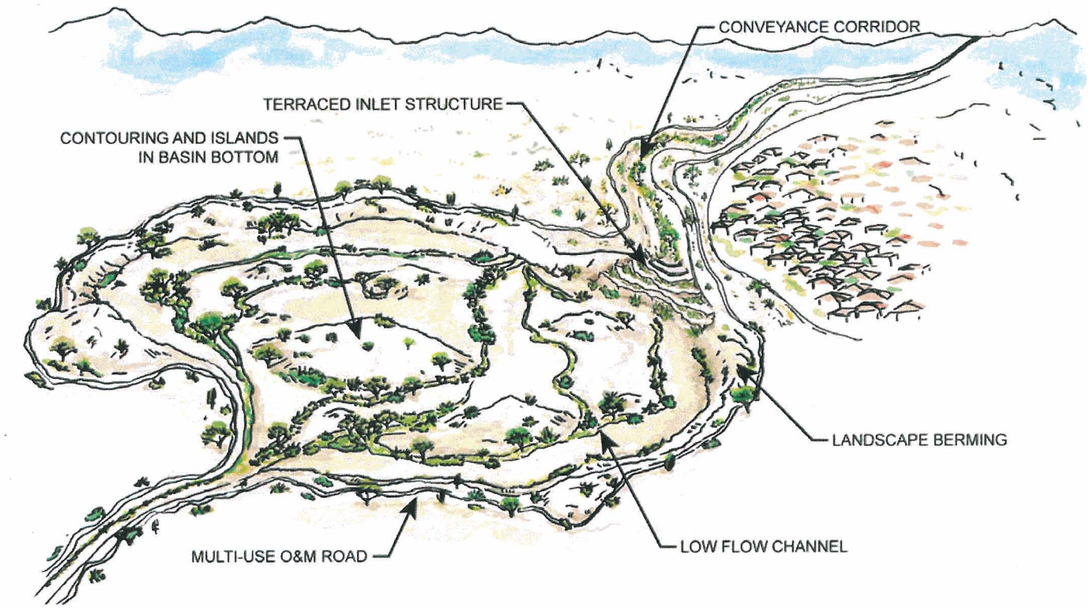

Figure 12 Concept Plan View Of An On-Line Basin

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.

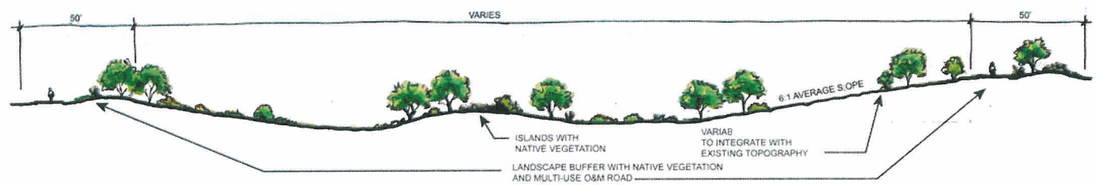

Figure 13 Concept Profile View Of On-Line Basins With Aesthetic Treatments

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.

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 14). 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.

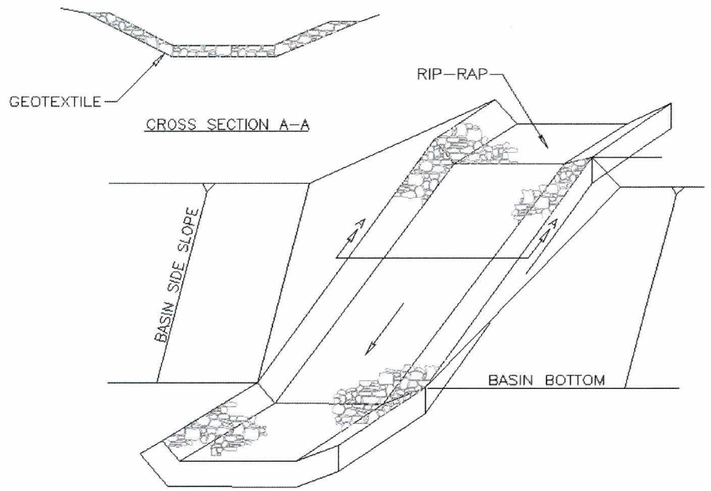

Figure 14 Riprap Spillway

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 15 & Figure 16). Stepped drop structures are constructed of concrete, RCC, soil cement, or gabions, but can also be constructed of large boulders (Figure 17). 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.

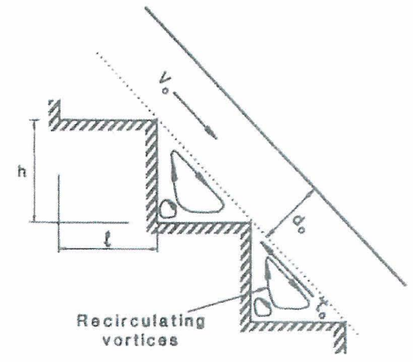

Figure 15 Stepped Drop Structure – Skimming Flow

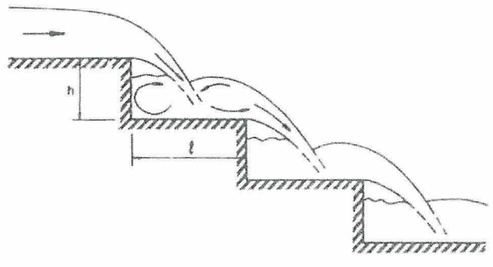

Figure 16 Stepped Drop Structure – Nappe Flow

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.

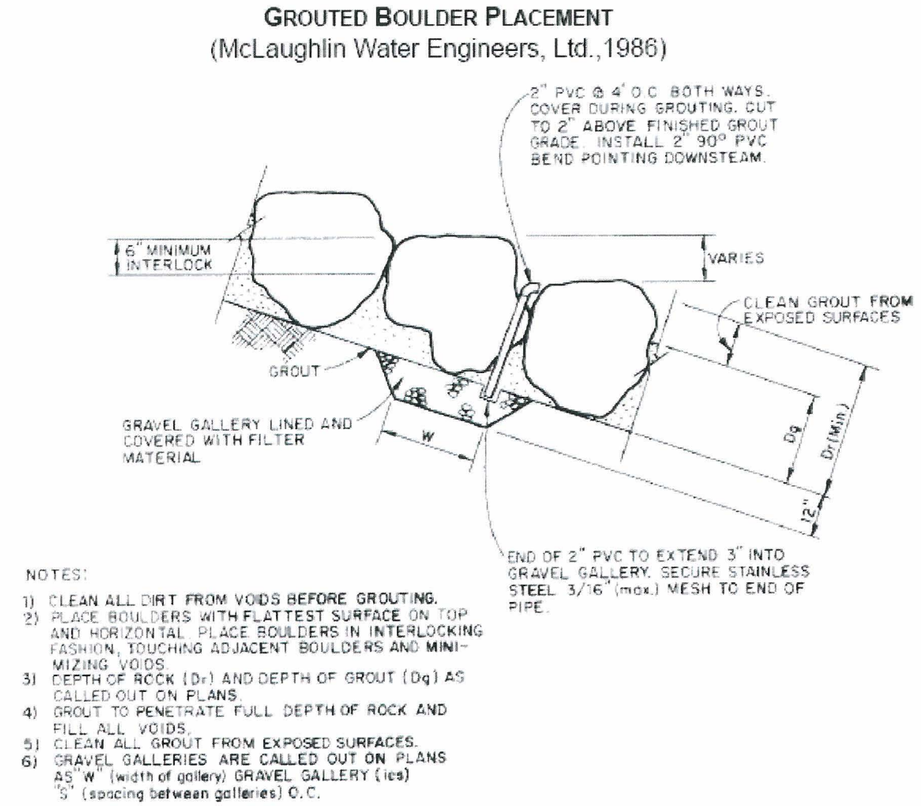

Figure 17 Example of Stepped Boulder Drop Structure (source: Figure 7.19 from FCDMC, 2003a)

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 18). 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.

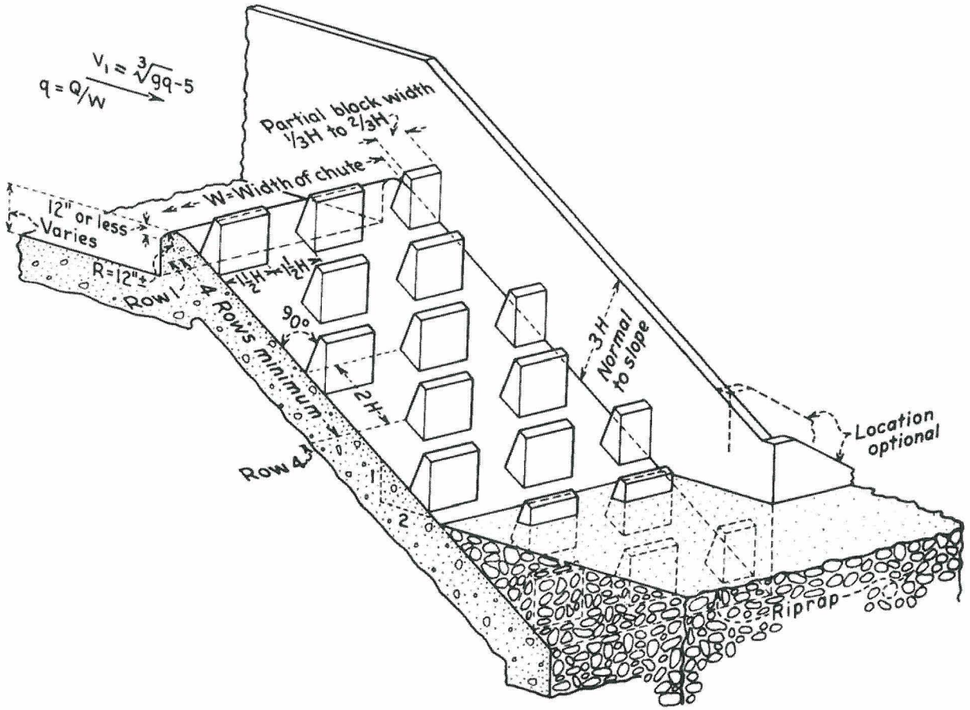

Figure 18 Baffle Chute

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 19. 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.

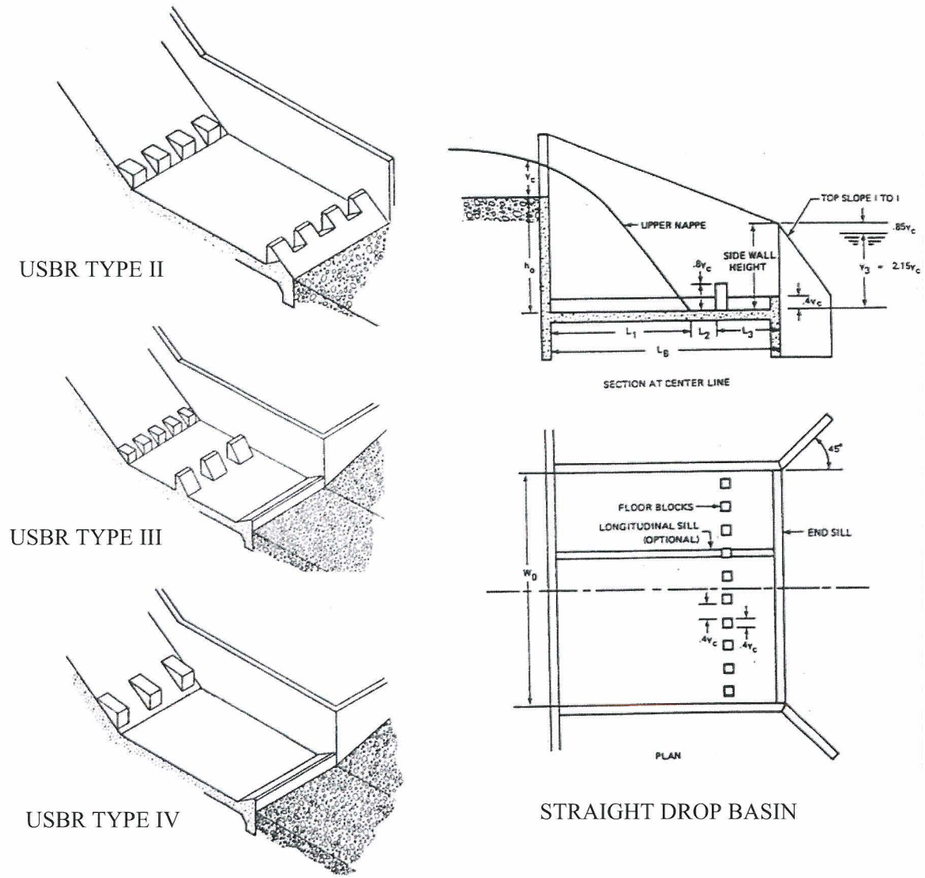

Figure 19 Stilling Basins

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 20 depicts a conceptual terraced inlet with integrated landscaping along the facility. As shown in Figure 21, 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.

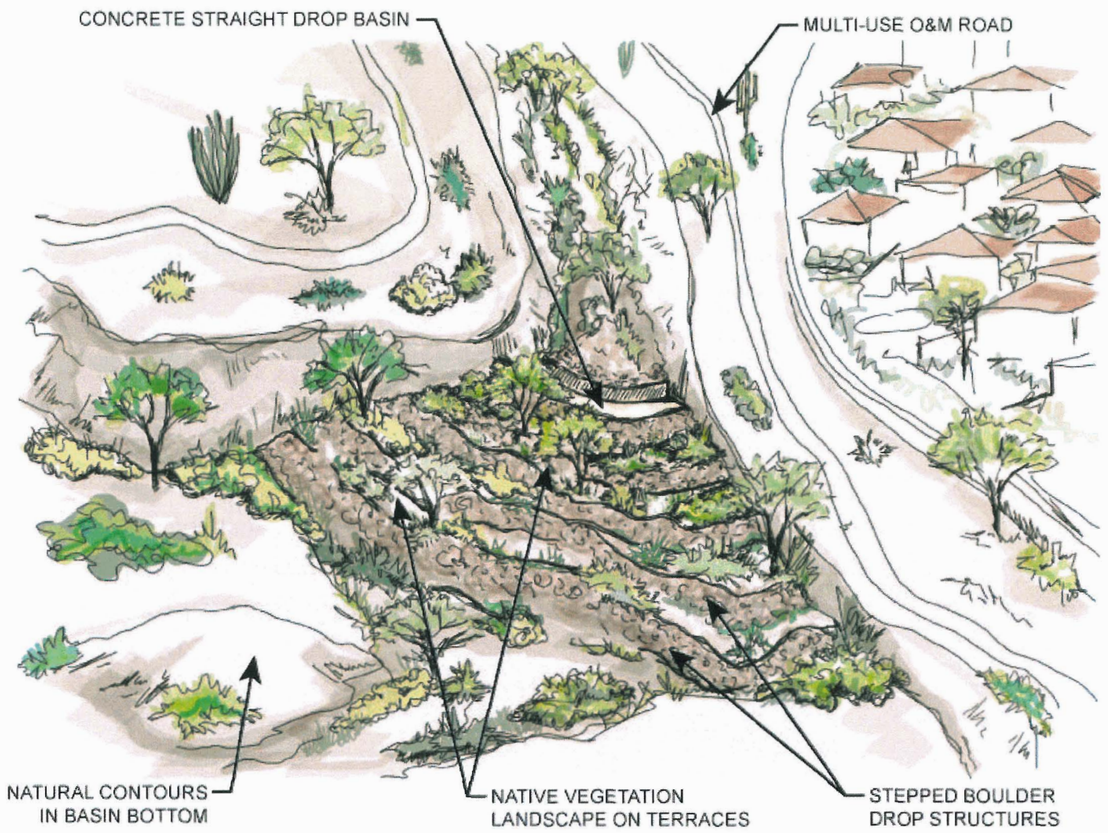

Figure 20 Conceptual Terraced Inlet Rendering

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 11. The existing channel width and 100-year discharge for Fan 3 is shown in Table 4. The computed unit discharge is also shown to determine if a riprap spillway is a consideration.

Table 4 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 21. 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.

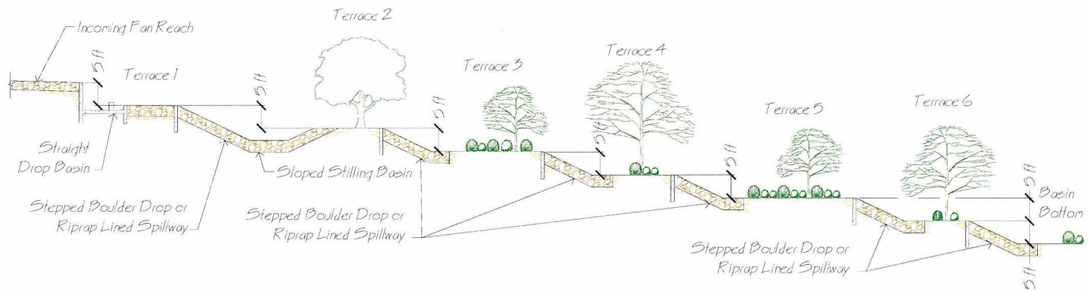

Figure 21 Example Terraced Inlet Concept Profile For Fan System 3, Wagner Sub-Area

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

Table 5 shows a summary of the inlet design concepts and hydraulic decision parameters for each on-line detention basin. Note that Fan Systems 17 & 18 and 19 do not have on-line detention basins as components of the recommended alternative.

Table 5 Summary Of Inlet Design Concepts For Wagner Sub-Area

Fan System	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
13	255	30	8.5	26	Riprap –lined spillway	2	
	524	45	11.6				
3	818	40	20.5	33	Terraced	1	7
16	1008	40	25.2	35	Terraced	1	7

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 22 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.

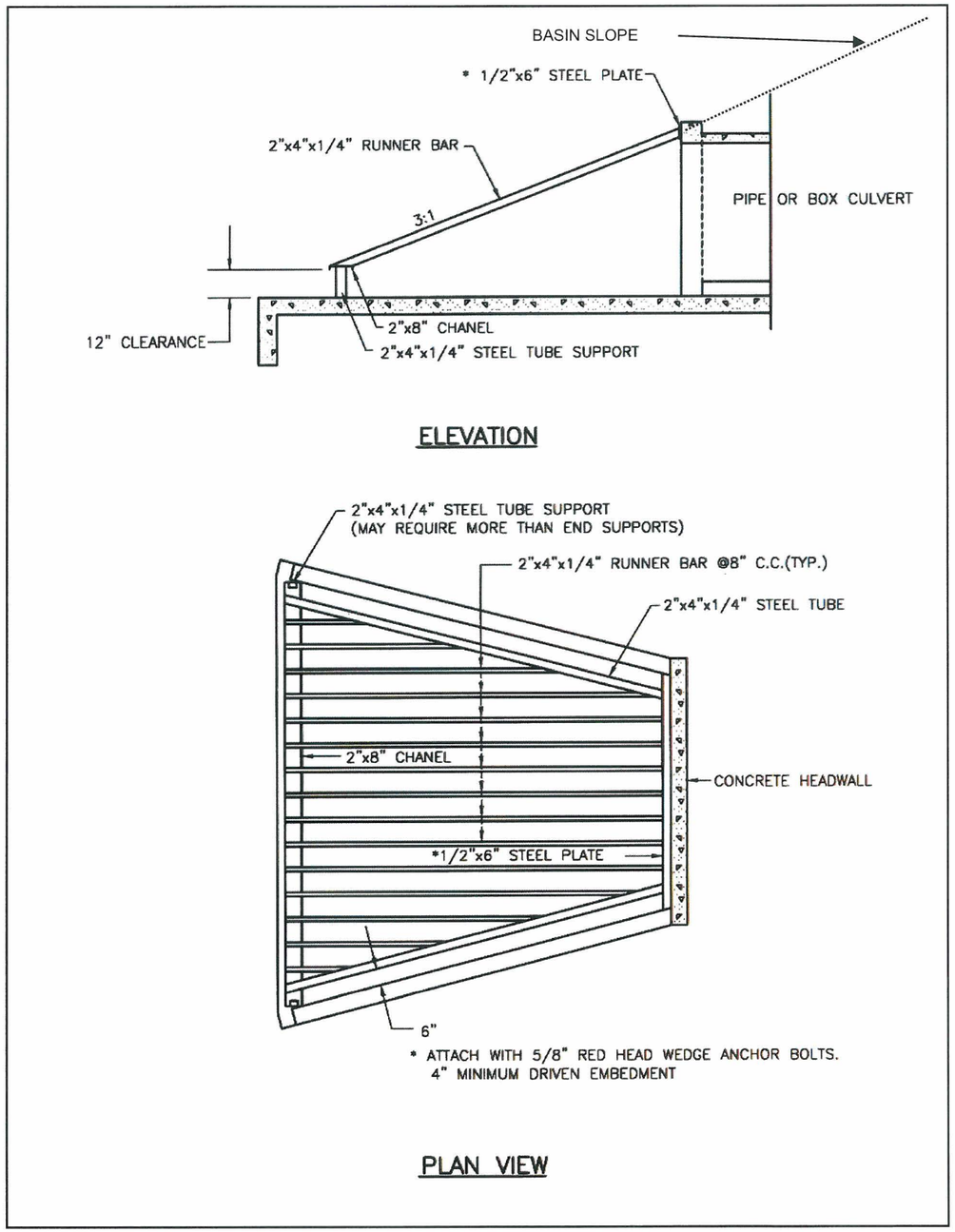

Figure 22 Typical Detail For On-Line Basin Outlet Structure

5.8 Aesthetic Treatments for Detention Basins

5.8.1 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 23 shows an example plan view of a basin with the landscape aesthetic design features.

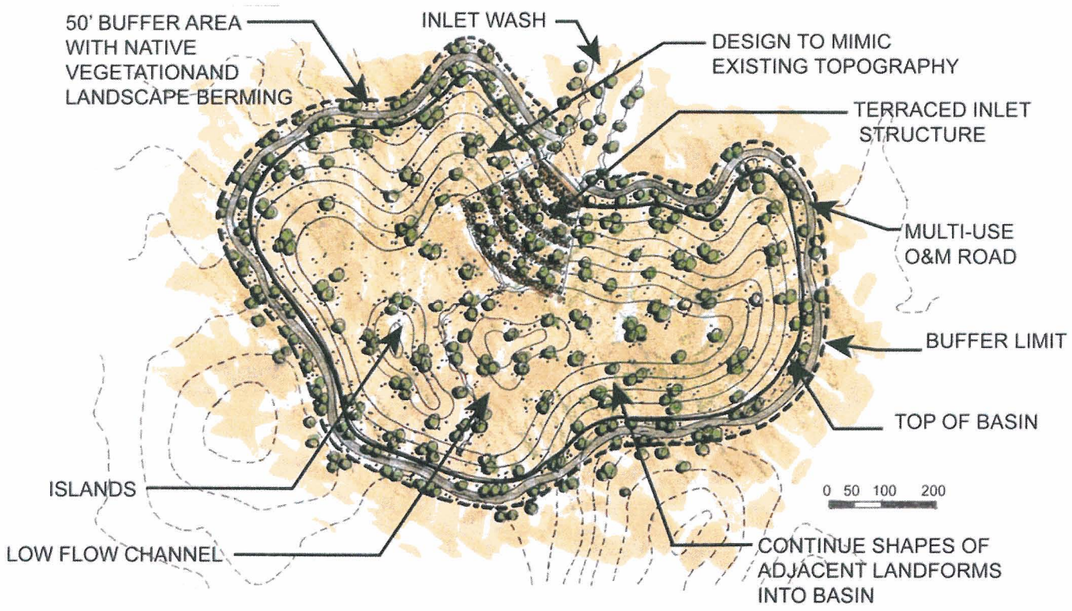

Figure 23 Planimetric View Of On-Line Detention Basin With Landscape Design Features

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 24). 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 25). 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.

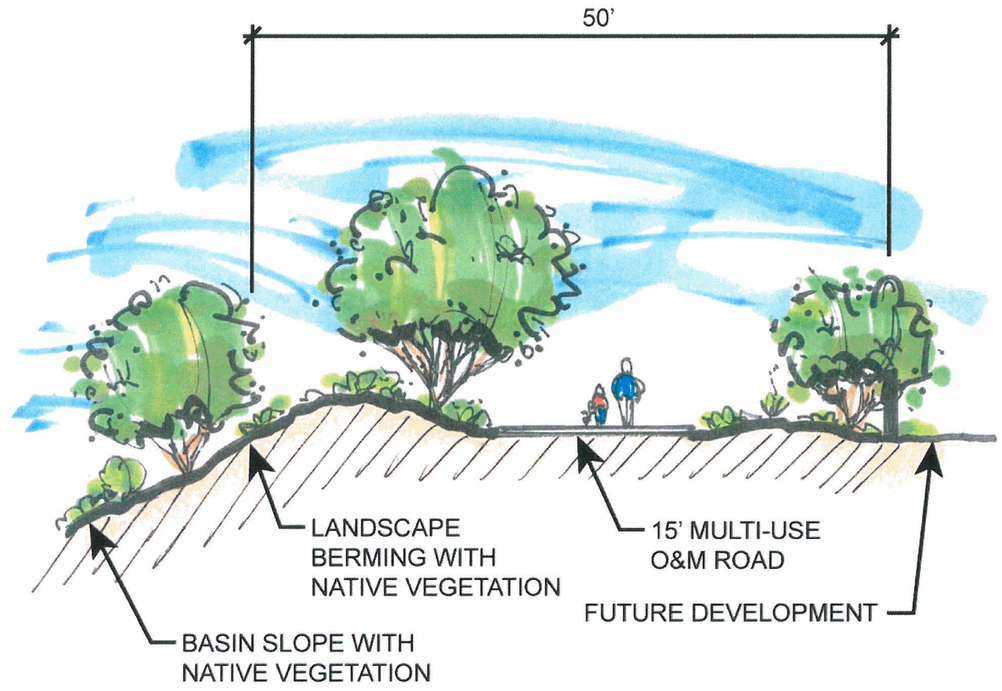

Figure 24 Concept Cross Section Of Basin Buffer Area With Landscape Design Features

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 25 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.

5.8.2 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.

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.

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.

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 natural materials and/or 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.

5.9 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.

5.10 Walled-Levee Corridors

5.10.1 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 26 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.

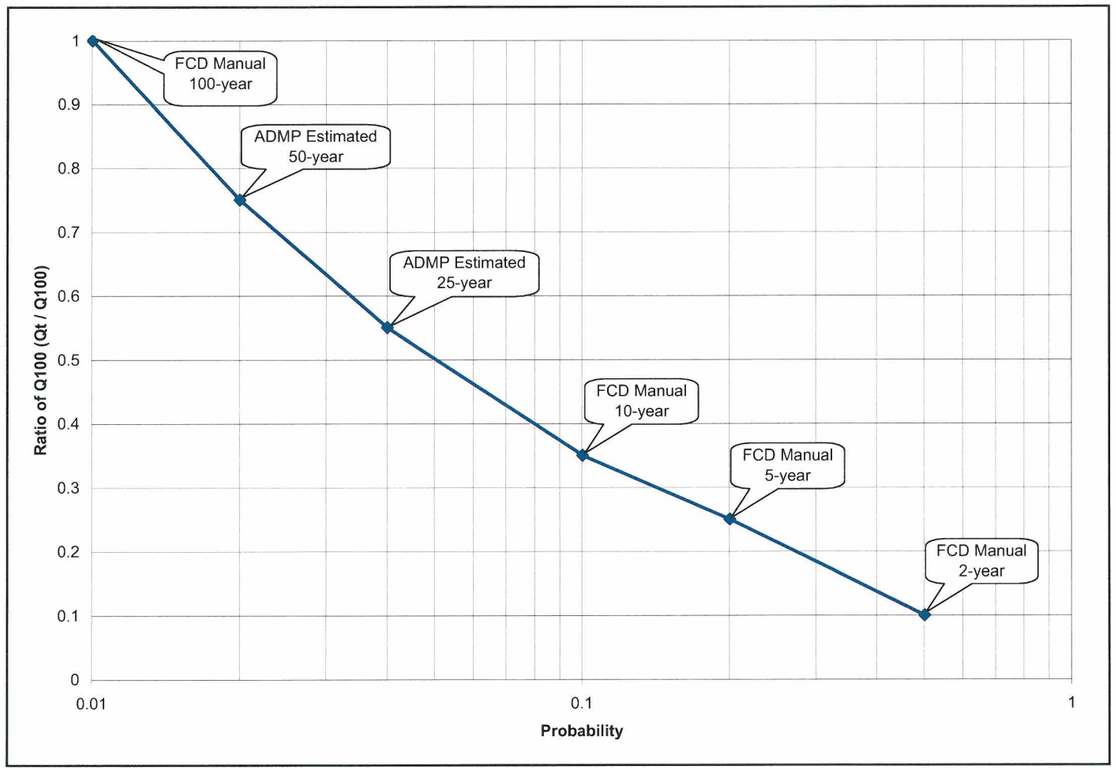

Figure 26 Development Of 25-Year & 50-Year Ratios For SVADMP

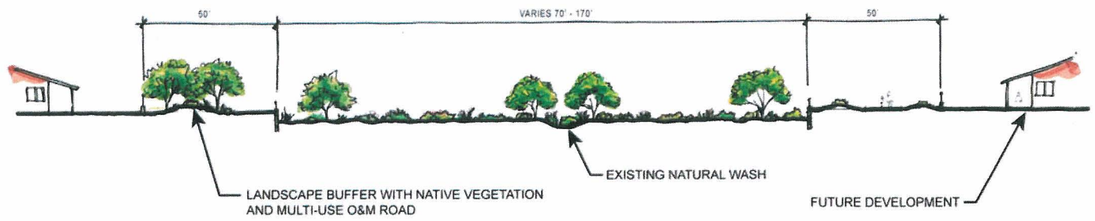

Figure 27 Concept Cross Section For Leveed Corridor With Walls & Landscape Aesthetic Treatments

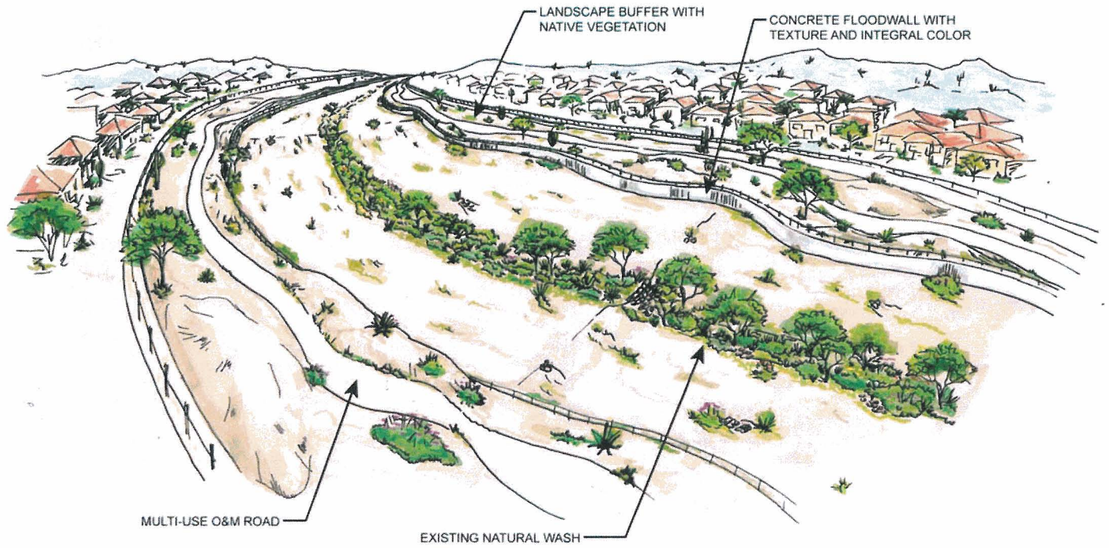

Figure 28 Oblique View Of Walled-Levee Corridor With Landscape Aesthetic Treatments

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 this criterion 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 27 shows a conceptual cross section of the walled-levee corridor. Figure 28 shows an oblique rendering of an example corridor reach.

5.10.2 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.

5.10.3 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.

5.10.3.1 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.

5.10.3.2 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.

5.10.4 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

5.10.5 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 29.

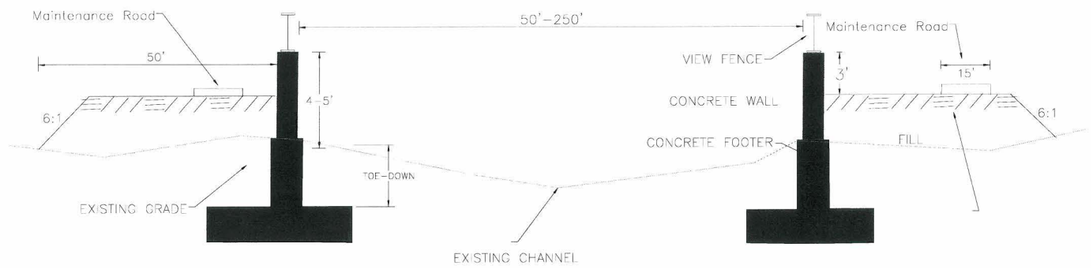

Figure 29 Example Of Typical Floodwall And Corridor

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 6 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.

5.10.6 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.

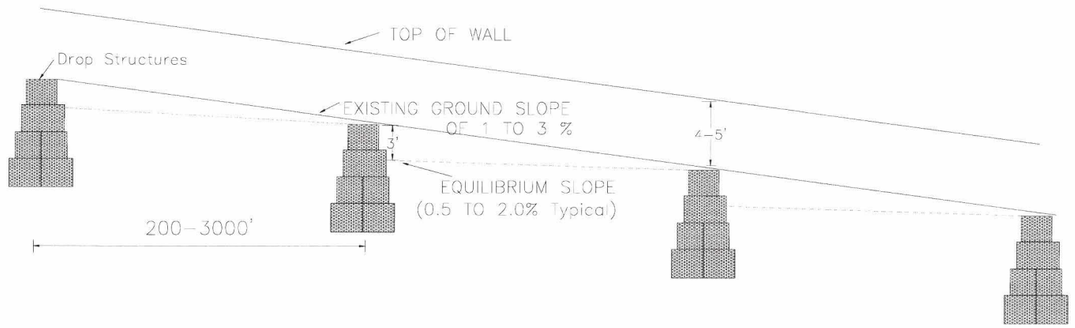

Figure 30 Concept Profile View Of Walled-Levee Corridor

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 30 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 at its confluence with Wagner Wash 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 5.10.4. The total height of the drop structures should include this estimated scour depth.

5.11 Aesthetic Treatments of Walled-Levee Corridors

5.11.1 Floodwalls

The design approach for flood control corridors will retain much 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 architectural enhancement to reduce the visual intrusion into the landscape and be more compatible with the landscape character of future development. These enhancements would 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 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.

While the walls alone would be considered a hard structural with aesthetic treatment method of flood control, the minimal disturbance to the natural wash and the width of the corridors would result in a good level of compatibility with the landscape character and is generally sensitive to the context of the existing and future landscape setting.

An additional setback area of 35 ft was applied to 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.

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.

5.11.2 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.

5.11.3 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 Wagner Sub-area cross two character units, the Valley Plains and the Bajada (Figure 10). 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 31 shows a cross section of a flood wall and adjacent buffer area with the landscape aesthetic treatments. The detailed landscape aesthetic design guidelines for the walled-levee corridors 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.

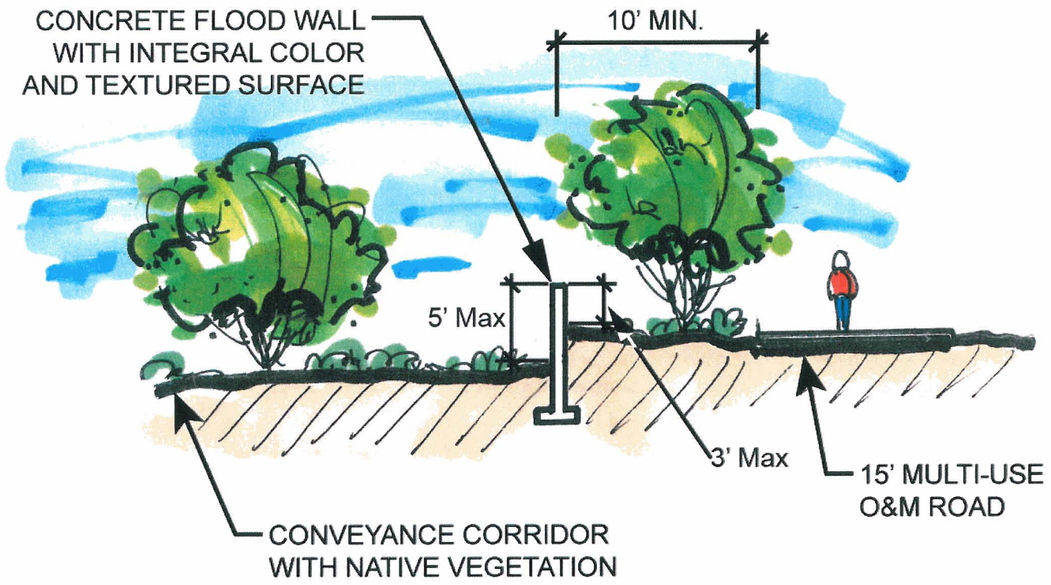

Figure 31 Buffer Area Detail With Landscape Aesthetic Features

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.
- 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 6 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.

Drop Structures

- Use natural boulders to develop stepped drop structures for the final design of the grade control in the corridor (Figure 32).
- Meander stepped drop structures horizontally to reduce linear design when structures become exposed.

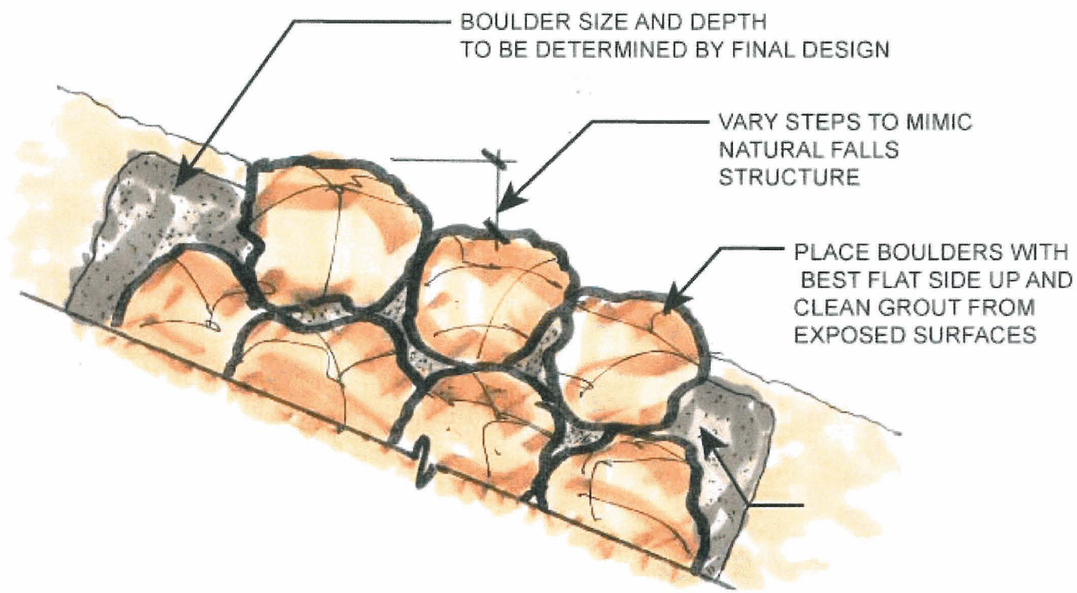

Figure 32 Conceptual Cross Section of a Stepped Boulder Drop

5.12 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 5.10.3) 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 5.10.4).
- 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.

5.13 Targeted Patch Dikes

Small patch dikes are proposed to prevent breakouts or split flows at a few strategic locations outside of the walled-levee corridors. These dikes area proposed to be small earthen structures protected by dumped riprap where necessary. Figure 33 shows an example of a typical patch dike cross section. For Fan System 3, there is an important, but small breakout located about 2200 feet upstream of the proposed on-line detention basin. This dike will prevent about 25 cfs from breaking out to Fan System 13 to the north. The costs were estimated based on a short earth structure with 6:1 side slopes to reflect aesthetic treatment requirements and riprap bank protection where flow is expected adjacent to the dikes. The location of these dikes is shown on the conceptual design planimetric layout sheets in the Appendices.

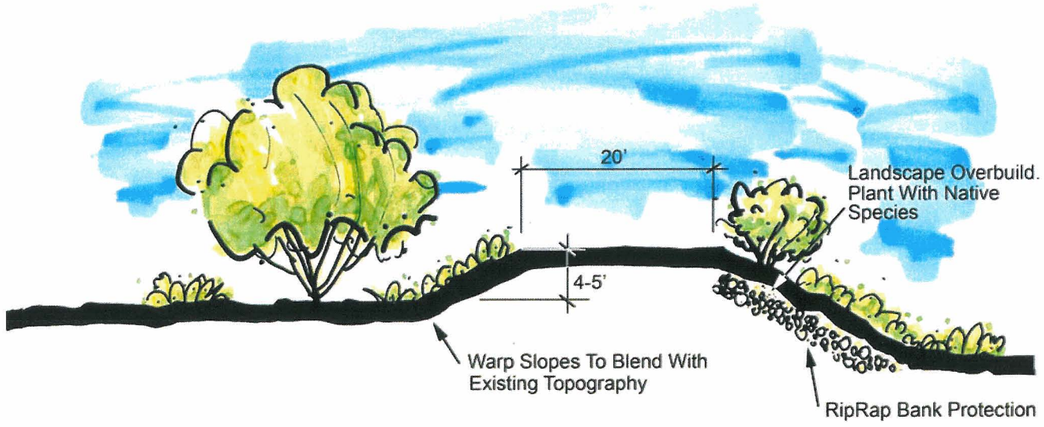

Figure 33 Concept Cross Section For Targeted Patch Dike

5.14 Aesthetic Treatments of Target Patch Dikes

5.14.1 Design Guidelines

The targeted patch dikes will be designed to blend with the surrounding landscape as much as possible. The size and location of the dikes do not present multi-use opportunities, nor are they large intrusion into the landscape. The dikes are generally in vertical scale with potential future development. However, the length of the dikes could create a flood control component that is more highly visible if measures are not taken to design the features to be sensitive to the local landscape context. The design guidelines below will be used to develop the final engineering and landscape design for the patch dikes.

Design and Configuration

- Design the dikes to follow the existing topography and be freeform to blend with the natural topography and vegetation patterns. Top of the dike will undulate with local landforms.
- Meander the horizontal alignment of the dike in an irregular pattern
- Vary the side slopes to mimic the surrounding topography.

- Place rocks and boulders randomly and in groupings in the landscape of the dike and other disturbed areas to blend with the existing patterns of the adjacent desert.
- Vary the vertical profile of the dike to emulate the appearance of low, rolling hill forms in the landscape.

Vegetation

- Preserve existing native desert vegetation and landforms to the maximum extent possible by meandering the horizontal alignment of the dike.
- 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 Bajada character unit.
    - Select specific species native to the dike 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.
- 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

5.15 Recreation and Multiple-Use

Information from the Town of Buckeye, Maricopa County and other planning organizations was 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 Regional Trail Master Plan. 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 Wagner Wash Sub-area

The major trail corridors in the Wagner sub-area are located along Sun Valley Parkway, Wagner Wash, and just east of the Hassayampa River (Figure 34). There are no major trails or parks planned within the Wagner Wash sub-area east of Sun Valley Parkway 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 Wagner Wash and 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, Wagner Wash, and White Tank Mountain Regional Park. Short trail extensions upstream from the proposed basins will be needed to reach the Park boundary. The multiple corridors will also provide good access from throughout the planned developments in the sub-area to the major trails proposed along Sun Valley Parkway and Wagner Wash. All flood control components in this sub-area should be developed according to the Natural Sonoran Desert Theme. If specific open space plans for the adjacent master planned communities would introduce active recreation facilities, the use of the Desert Adapted Park theme should be considered to provide better opportunities to integrate with the development.

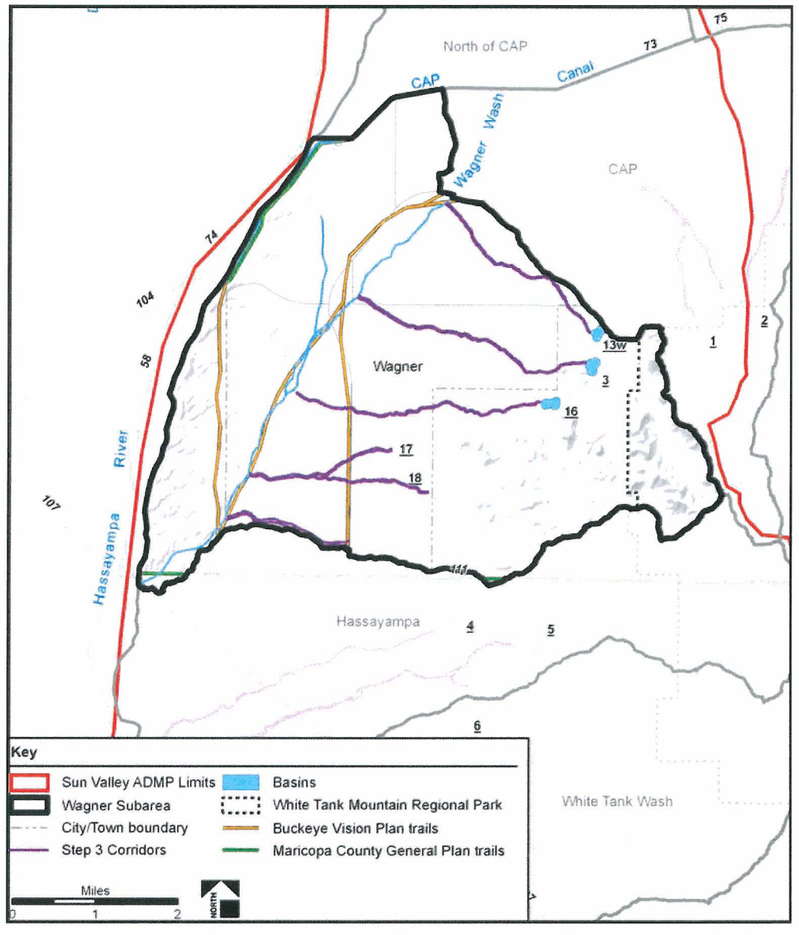

Figure 34 Recommended Alternative And Multiple-Use Opportunities in the Wagner Sub-area

6 WAGNER WASH SUB-AREA & FAN SYSTEM SPECIFIC DESIGN CONSIDERATIONS

The Wagner Wash sub-area is located on the northwestern slope of the White Tank Mountains piedmont. Three major alluvial fans, designated Fan 13 (E and W), Fan 3, and Fan 16, drain from the White Tank Mountain Regional Park onto the piedmont in this sub-area. Three additional areas of large channel divides (distributary channels) are also located in the southern portion of the sub-area and were designated Fans 17, 18, and 19. The entire sub-area drains into Wagner Wash. The piedmont below portions of Fans 16, 17, 18, and 19 is bisected by the Sun Valley Parkway. Existing runoff from Fans 13 and 3 enters Wagner Wash between its two existing Sun Valley Parkway crossings. Runoff from the remainder of the sub-area, including Fans 16 - 19, flows to Wagner Wash via existing drainage facilities along the Sun Valley Parkway. Those facilities consist of culverts of various sizes beneath the roadway at various locations. All of the design concepts for the Wagner sub-area incorporate the existing culverts 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. The result was that the culvert crossing for the corridor on Fan System 16 required an increase in size. The existing 10' x 3' RCB culvert needs four additional same sized culverts to handle the total flow delivered under Sun Valley Parkway safely.

Additional details associated with each of the five fan systems within the Wagner Wash sub-area area provided in the following sections. The conceptual planimetric layout for each fan system is shown in Figure 35. Larger scale, more detailed layout sheets are found in the appendix for each fan system.

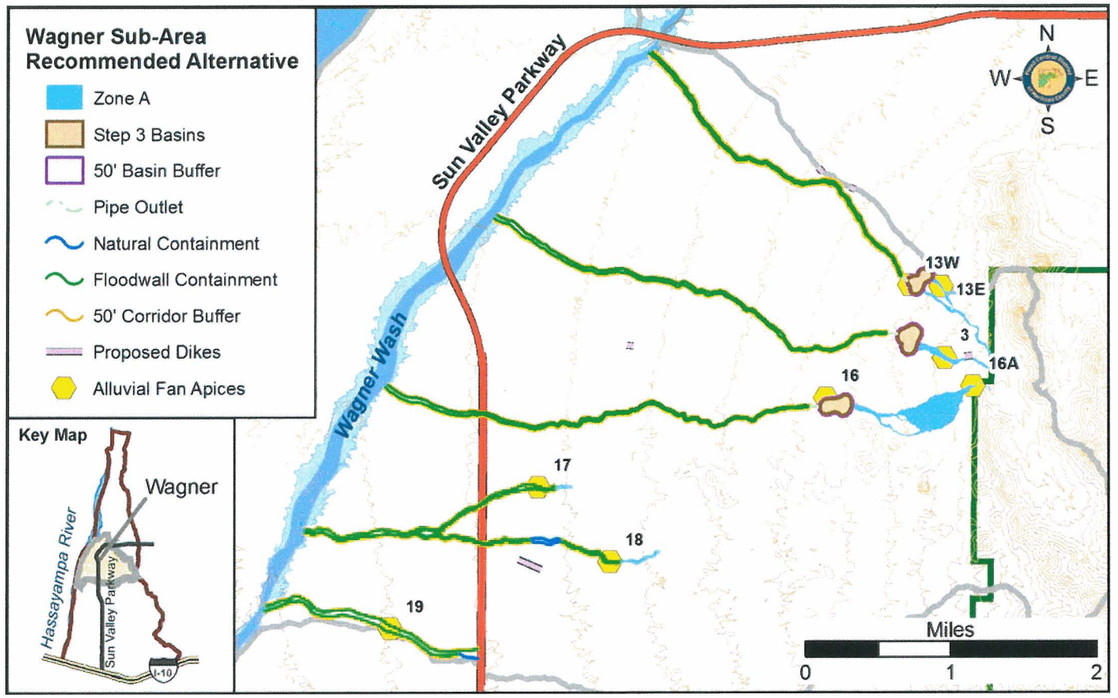

Figure 35 Recommended Alternative Features For Wagner Wash Sub-Area

6.1 Fan System 13

The basin at the apex of Fan System 13 will be approximately 10.5 acres at the top of the basin and will average 8.5 feet deep to retain the required 31.2 acre feet of storage from the drainage area to this fan. The slope of the existing grade will create a height of approximately 26 feet on the uphill side of the basin. Two separate riprap inlet spillway structures will be needed to collect inflows from washes entering the basin.

The outflow from the basin would require a corridor width of approximately 40 feet, which would increase to about 80 feet at the end where the flow rate would be about 900 cfs. The total length of walled-levee corridor is about 2.5 miles. A total of about 14 drop structures would be required to control grade in the corridor. 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 about five feet as the depth of flow varies along the corridor. Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The fill material needed, including that for the small containment dikes, is about 47 ac-ft, which is less than half of the 125 ac-ft of total excavation required for the detention basin. Finally, two small dikes are needed in conjunction with the recommended alternative for Fan System 13. These dikes are required about half way downstream of the on-line basin in order to prevent split flows from the neighboring watershed from entering the Fan System 13 watershed.

6.2 Fan System 3

The basin at the apex of Fan System 3 will be approximately 14 acres at the top of the basin and will average ten feet deep to retain the required 59.3 acre feet of storage from the drainage area to this fan. The basin has been located on the uphill side of two small landforms to reduce visibility of the structure from lower elevations and from areas to the north and south of the basin. The slope of the existing grade will create a height of approximately 33 feet on the uphill side of the basin. About seven terraces would be used on the inlet structure to dissipate the energy of the incoming flow and minimize damage to the basin and inlet structure.

The outflow from the basin would require a corridor width of approximately 60 feet, which would increase to about 150 feet at the end where the flow rate would be about 1750 cfs. The total length of walled-levee corridor is about 3 miles. A total of about 21 drop structures would be required to control grade in the corridor. The height of the walls along the corridor would range from about four feet to about five feet as the depth of flow varies along the corridor. Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The backfill needed is about 46 ac-ft, which is significantly less than the 216 ac-ft of total excavation required for the detention basin. Finally, one small dike is needed in conjunction with the recommended alternative for Fan System 3. The dike required is located about 2200 feet upstream of the detention basin in order to prevent an entrenched split into the Fan System 13 watershed.

6.3 Fan System 16

The basin at the apex of Fan System 16 will be approximately 14 acres at the top of the basin and will average eight feet deep to retain the required 41 acre feet of storage from the drainage area to this fan. The slope of the existing grade will create a height of approximately 35 feet on the uphill side of the basin. About seven terraces would be used on the inlet structure to dissipate the energy of the incoming flow and minimize damage to the basin and inlet structure.

The outflow from the basin would require a corridor width of approximately 50 feet, which would increase to about 130 feet at the end where the flow rate would be about 1365 cfs. The total length of walled-levee corridor is about 3.2 miles. A total of about 15 drop structures would be required to control grade in the corridor. Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The backfill needed is about 56 ac-ft, which is significantly less than the 219 ac-ft of total excavation required for the detention basin. In order to pass flows safely under Sun Valley Parkway, a culvert upgrade at the corridor crossing will be required. Four additional 10 feet wide by 3 feet high reinforced concrete box culverts will be needed to achieve this objective. Finally, one small dike is needed in conjunction with the recommended alternative for Fan System 16. The dike required is located about one mile east of Sun Valley Parkway and one half mile north of the corridor. The dike is needed to prevent inflows from the adjacent watershed into the Fan System 16 watershed.

6.4 Fan System 17/18

The recommended alternative for Fan System 17 & 18 does not include an apex detention basin. The channel avulsion potential associated with Fan 17 & 18 is not as severe as other fans within the study area. However, containment of several channel breakouts is needed. Therefore, a walled-levee corridor is proposed for Fan System 17 & 18.

The required corridor would have a width of approximately 75 feet, which would increase to about 130 feet at the end where the flow rate would be about 1450 cfs. The total length of walled-levee corridor is about 3.4 miles. A total of about five drop structures would be required to control grade in the corridor. Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The backfill needed is about 52 ac-ft. Finally, one small dike is needed in conjunction with the recommended alternative for Fan System 17 & 18. The dike required is located east of Sun Valley Parkway, south of the Fan 18 corridor. The dike is required in order to prevent a secondary breakout to the Fan 19 corridor.

6.5 Fan System 19

The recommended alternative for Fan System 19 does not include an apex detention basin. The channel avulsion potential associated with Fan 19 is not as severe as other fans within the study area. However, containment of several channel breakouts is needed. Therefore, a walled-levee corridor is proposed for Fan System 19.

The required corridor would have a width of approximately 200 feet to contain the flow rate of about 1600 cfs. The total length of walled-levee corridor is about 1.6 miles. A total of about five drop structures would be required to control grade in the corridor. Backfill will be needed along much of floodwall to meet the aesthetic treatment objectives. The backfill needed is about 22 ac-ft to maintain the 3 foot maximum wall exposure on the outside of the corridor.

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 – E. The summary of the unit costs for all the components is presented in Table 7.

7.1.1 Land Cost

The land cost is the second largest cost component after 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.

Table 7 Summary Of Unit Costs

	Construction Units	Construction Cost	Landscaping Units	Landscaping 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.

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 15.

8 FAN SYSTEM 13 DESIGN SUMMARY

The recommended alternative for Fan System 13 in the Wagner Wash 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 landscape 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 13 is a 36 acre-foot on-line detention basin with two riprap-lined inlet structures and a pipe outlet. The basin drains to a 2.5 mile long 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.

A design summary of all the components of the recommended alternative for Fan System 13 is presented below. Table 8 shows a summary of the total cost estimates. Table 9 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 13 is $18.4 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The apex basin cost was estimated at $4.2 million. The walled-levee corridors were estimated at $13.9 million.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 39 percent of the total cost.

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

Table 8 Design Cost Summary – Fan System 13

					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
D13_1	NA	0.2	0.0	0.7	200	39	NA	$ 20	$ 56	$ 6	$ 29	$ 112
D13_2	NA	0.2	0.0	0.8	230	39	NA	$ 20	$ 64	$ 7	$ 34	$ 126
RR13	757	13.8	125.0	0.0	NA	NA	8.5	$ 1,380	$ 1,758	$ 300	$ 775	$ 4,214
H1F1335A_2	184	4.2	0.0	2.6	0.25	141	1.0	$ 420	$ 459	$ 67	$ 261	$ 1,207
H1F1335A_1	257	2.4	0.0	2.3	0.14	141	1.5	$ 240	$ 282	$ 36	$ 147	$ 704
H135A35B_3	349	4.5	0.0	4.1	0.25	151	2.0	$ 450	$ 521	$ 65	$ 256	$ 1,292
H135A35B_2	446	3.7	0.0	3.9	0.19	161	1.7	$ 370	$ 437	$ 50	$ 205	$ 1,062
H135A35B_1	542	5.3	0.0	6.6	0.28	161	2.1	$ 530	$ 653	$ 73	$ 302	$ 1,558
H135B35C_5	638	2.0	0.0	1.9	0.10	161	2.1	$ 200	$ 256	$ 27	$ 115	$ 597
H135B35C_4	671	4.6	0.0	3.7	0.22	171	1.8	$ 460	$ 543	$ 57	$ 240	$ 1,300
H135B35C_3	713	3.9	0.0	3.3	0.19	171	2.3	$ 390	$ 433	$ 51	$ 208	$ 1,082
H135B35C_2	737	3.4	0.0	2.9	0.16	171	2.1	$ 340	$ 399	$ 43	$ 179	$ 961
H135B35C_1	769	5.0	0.0	5.3	0.25	166	2.0	$ 500	$ 631	$ 65	$ 278	$ 1,474
H135C35D_2	814	2.9	0.0	2.9	0.14	171	2.0	$ 290	$ 351	$ 36	$ 156	$ 833
H135C35D_1	904	6.7	0.0	5.8	0.31	181	2.1	$ 670	$ 767	$ 81	$ 340	$ 1,858
	TOTAL	62.8	125.0	46.8				$ 6,280	$ 7,611	$ 965	$ 3,525	**$ 18,380**
All Channels		48.6	0.0	45.3	2.5			$4,860	$ 5,732	$ 651	$2,687	$ 13,929
All Online Basins		13.8	125.0	0.0				$1,380	$ 1,758	$ 300	$ 775	$ 4,214
All Dikes		0.4	0.0	1.5	430			$ 40	$ 121	$ 14	$ 63	$ 237

Table 9 Aesthetic Treatment Differential Costs Summary – Fan System 13

		Aesthetic Treatment Cost Differentials				
Structure ID	Total Cost	Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
D13_1	$ 112	16%	19%	100%	30%	26%
D13_2	$ 126	18%	19%	100%	30%	26%
RR13	$ 4,214	28%	6%	100%	20%	23%
H1F1335A_2	$ 1,207	50%	22%	100%	66%	48%
H1F1335A_1	$ 704	50%	25%	100%	64%	48%
H135A35B_3	$ 1,292	47%	23%	100%	66%	46%
H135A35B_2	$ 1,062	43%	25%	100%	63%	45%
H135A35B_1	$ 1,558	43%	26%	100%	63%	46%
H135B35C_5	$ 597	45%	23%	100%	61%	44%
H135B35C_4	$ 1,300	41%	22%	100%	61%	42%
H135B35C_3	$ 1,082	41%	23%	100%	63%	44%
H135B35C_2	$ 961	41%	23%	100%	62%	43%
H135B35C_1	$ 1,474	42%	24%	100%	61%	43%
H135C35D_2	$ 833	41%	24%	100%	61%	43%
H135C35D_1	$ 1,858	39%	23%	100%	62%	42%
Average	**$ 18,380**	40%	19%	100%	53%	39%

9 FAN SYSTEM 3 DESIGN SUMMARY

The recommended alternative for Fan System 3 in the Wagner Wash 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 3 is a 62 acre-foot on-line detention basin with a terraced inlet structure and pipe outlet. The basin drains to a 3 mile long 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.

A design summary of all the components of the recommended alternative for Fan System 3 is presented below. Table 10 shows a summary of the total cost estimates. Table 11 shows a summary of the differential costs for the aesthetic treatment requirements and landscaping.

Table 10 Design Cost Summary – Fan System 3

					Design Geometry			Costs (in $1000)				
Structure ID	Flow Rate (cfs)	ROW Area (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
D3_1	NA	0.1	0.0	0.5	150	39	NA	$ 10	$ 42	$ 5	$ 22	$ 79
RR150	835	17.3	216.1	0.0	NA	NA	10.0	$ 1,730	$ 2,105	$ 377	$ 1,003	$ 5,215
H1F355A_7	197	5.1	0.0	2.3	0.27	161	0.8	$ 510	$ 460	$ 70	$ 268	$ 1,308
H1F355A_6	297	3.7	0.0	2.1	0.19	161	0.9	$ 370	$ 372	$ 51	$ 197	$ 989
H1F355A_5	392	3.7	0.0	1.7	0.19	161	1.7	$ 370	$ 378	$ 29	$ 143	$ 920
H1F355A_4	491	3.7	0.0	3.3	0.19	161	1.7	$ 370	$ 426	$ 50	$ 205	$ 1,051
H1F355A_3	589	3.7	0.0	3.2	0.19	161	1.6	$ 370	$ 465	$ 50	$ 207	$ 1,093
H1F355A_2	684	4.1	0.0	3.6	0.20	171	1.6	$ 410	$ 492	$ 53	$ 217	$ 1,172
H1F355A_1	789	4.2	0.0	3.9	0.19	181	1.8	$ 420	$ 483	$ 51	$ 213	$ 1,167
H155A55B_4	890	4.4	0.0	3.2	0.19	191	1.8	$ 440	$ 462	$ 49	$ 207	$ 1,158
H155A55B_3	1013	4.8	0.0	2.2	0.20	201	2.0	$ 480	$ 427	$ 52	$ 210	$ 1,169
H155A55B_2	1130	4.7	0.0	2.4	0.19	206	2.3	$ 470	$ 394	$ 51	$ 202	$ 1,117
H155A55B_1	1263	5.0	0.0	2.7	0.20	211	2.2	$ 500	$ 431	$ 52	$ 212	$ 1,196
H155B55C_4	1386	5.0	0.0	3.8	0.19	221	2.3	$ 500	$ 472	$ 49	$ 209	$ 1,230
H155B55C_3	1507	5.3	0.0	3.9	0.19	231	2.2	$ 530	$ 479	$ 50	$ 213	$ 1,272
H155B55C_2	1621	5.5	0.0	3.7	0.19	241	2.2	$ 550	$ 478	$ 50	$ 212	$ 1,290
H155B55C_1	1731	8.5	0.0	3.7	0.28	251	2.3	$ 850	$ 612	$ 74	$ 299	$ 1,835
	TOTAL	88.8	216.1	46.2				$ 8,880	$ 8,979	$ 1,163	$ 4,241	**$ 23,262**
All Channels		71.4	0.0	45.7	3.0			$7,140	$ 6,832	$ 781	$ 3,216	$ 17,968
All Online Basins		17.3	216.1	0.0				$1,730	$ 2,105	$ 377	$ 1,003	$ 5,215
All Dikes		0.1	0.0	0.5	150			$ 10	$ 42	$ 5	$ 22	$ 79

Table 11 Aesthetic Treatment Differential Costs Summary – Fan System 3

		Aesthetic Treatment Cost Differential				
Structure ID	Total Cost	Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
D3_1	$ 79	24%	19%	100%	30%	28%
RR150	$ 5,215	24%	2%	100%	17%	19%
H1F355A_7	$ 1,308	43%	22%	100%	68%	46%
H1F355A_6	$ 989	43%	21%	100%	67%	45%
H1F355A_5	$ 920	43%	20%	100%	53%	39%
H1F355A_4	$ 1,051	43%	24%	100%	63%	45%
H1F355A_3	$ 1,093	43%	22%	100%	63%	43%
H1F355A_2	$ 1,172	41%	22%	100%	63%	43%
H1F355A_1	$ 1,167	38%	23%	100%	62%	42%
H155A55B_4	$ 1,158	36%	22%	100%	62%	41%
H155A55B_3	$ 1,169	35%	21%	100%	64%	40%
H155A55B_2	$ 1,117	34%	22%	100%	65%	41%
H155A55B_1	$ 1,196	34%	22%	100%	63%	40%
H155B55C_4	$ 1,230	32%	24%	100%	61%	39%
H155B55C_3	$ 1,272	30%	24%	100%	61%	38%
H155B55C_2	$ 1,290	29%	23%	100%	61%	38%
H155B55C_1	$ 1,835	28%	21%	100%	64%	37%
	$ 23,262	34%	17%	100%	52%	36%

The estimated total cost of the recommended alternative for Fan System 3 is $23.3 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The apex basin cost was estimated at $5.2 million. The walled-levee corridors were estimated at $18 million.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 36 percent of the total cost.

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

10 FAN SYSTEM 16 DESIGN SUMMARY

The recommended alternative for Fan System 16 in the Wagner Wash 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 16 is a 42 acre-foot on-line detention basin with a terraced inlet structure and pipe outlet. The basin drains to a 3.2 mile long 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.

A design summary of all the components of the recommended alternative for Fan System 16 is presented below. Table 12 shows a summary of the total cost estimates. Table 13 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 16 is $247 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The apex basin cost was estimated at $5.5 million. The walled-levee corridors were estimated at $19.1 million.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 37 percent of the total cost.

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

Table 12 Design Cost Summary – Fan System 16

					Design Geometry			Costs (in $1000)				
Structure ID	Flow Rate (cfs)	ROW Area (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
D16_1	NA	0.2	0.0	0.9	260	39	NA	$ 20	$ 73	$ 8	$ 38	$ 139
RR165	1008	17.4	219.0	0.0	NA	NA	8.0	$ 1,740	$ 2,302	$ 379	$ 1,124	$ 5,545
H1F1670A_5	310	4.3	0.0	4.6	0.238	151	1.4	$ 430	$ 505	$ 63	$ 252	$ 1,250
H1F1670A_4	407	3.7	0.0	3.3	0.2	156	2.1	$ 370	$ 450	$ 53	$ 216	$ 1,088
H1F1670A_3	504	3.9	0.0	4.1	0.206	161	3.4	$ 390	$ 498	$ 54	$ 228	$ 1,170
H1F1670A_2	606	3.6	0.0	2.8	0.181	166	2.5	$ 360	$ 406	$ 48	$ 199	$ 1,013
H1F1670A_1	684	4.6	0.0	3.6	0.221	171	2.4	$ 460	$ 504	$ 58	$ 246	$ 1,267
H170A70B_8	771	3.6	0.0	2.4	0.174	171	1.9	$ 360	$ 417	$ 46	$ 191	$ 1,014
H170A70B_7	795	3.9	0.0	3.0	0.189	171	2.0	$ 390	$ 428	$ 50	$ 209	$ 1,077
H170A70B_6	820	4.0	0.0	3.7	0.189	176	2.3	$ 400	$ 439	$ 50	$ 210	$ 1,099
H170A70B_5	845	4.2	0.0	2.0	0.184	186	2.5	$ 420	$ 403	$ 49	$ 204	$ 1,076
H170A70B_4	868	4.1	0.0	3.7	0.189	181	1.9	$ 410	$ 472	$ 50	$ 210	$ 1,142
H170A70B_3	893	4.6	0.0	3.4	0.195	196	1.8	$ 460	$ 444	$ 52	$ 215	$ 1,170
H170A70B_2	918	3.8	0.0	3.2	0.159	201	2.0	$ 380	$ 399	$ 42	$ 178	$ 999
H170A70B_1	935	3.1	0.0	2.8	0.127	201	2.2	$ 310	$ 326	$ 34	$ 144	$ 813
H170B90B_3	1056	6.4	0.0	4.1	0.263	201	2.0	$ 640	$ 873	$ 69	$ 286	$ 1,868
H170B90B_2	1211	5.4	0.0	3.8	0.205	221	2.0	$ 540	$ 509	$ 54	$ 228	$ 1,331
H170B90B_1	1350	7.3	0.0	4.6	0.261	231	2.2	$ 730	$ 596	$ 69	$ 289	$ 1,684
	TOTAL	88.1	219.0	56.0				$ 8,810	$ 10,043	$ 1,227	$ 4,666	**$ 24,746**
All Channels		70.5	0.0	55.1	3.2			$ 7,050	$ 7,668	$ 840	$ 3,504	$ 19,061
All Online Basins		17.4	219.0	0.0				$ 1,740	$ 2,302	$ 379	$ 1,124	$ 5,545
All Dikes		0.2	0.0	0.9	260			$ 20	$ 73	$ 8	$ 38	$ 139

Table 13 Aesthetic Treatment Differential Costs Summary – Fan System 16

		Aesthetic Treatment Cost Differential				
Structure ID	Total Cost	Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
D16_1	$ 139	21%	19%	100%	30%	27%
RR165	$ 5,545	24%	2%	100%	18%	19%
H1F1670A_5	$ 1,250	47%	25%	100%	65%	47%
H1F1670A_4	$ 1,088	46%	23%	100%	64%	45%
H1F1670A_3	$ 1,170	44%	24%	100%	62%	44%
H1F1670A_2	$ 1,013	42%	23%	100%	62%	44%
H1F1670A_1	$ 1,267	41%	24%	100%	62%	44%
H170A70B_8	$ 1,014	42%	21%	100%	62%	42%
H170A70B_7	$ 1,077	41%	24%	100%	62%	44%
H170A70B_6	$ 1,099	40%	25%	100%	62%	44%
H170A70B_5	$ 1,076	38%	22%	100%	62%	42%
H170A70B_4	$ 1,142	39%	23%	100%	62%	42%
H170A70B_3	$ 1,170	37%	24%	100%	62%	42%
H170A70B_2	$ 999	34%	23%	100%	61%	40%
H170A70B_1	$ 813	35%	24%	100%	60%	41%
H170B90B_3	$ 1,868	34%	16%	100%	63%	35%
H170B90B_2	$ 1,331	31%	23%	100%	62%	39%
H170B90B_1	$ 1,684	30%	24%	100%	62%	39%
	$ 24,746	35%	18%	100%	51%	37%

11 FAN SYSTEM 17/18 DESIGN SUMMARY

The recommended alternative for Fan System 17/18 in the Wagner Wash 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 recommended alternative for Fan System 17/18 does not include an apex detention basin. The channel avulsion potential associated with Fan 17 and 18 is not as severe as other fans within the study area. However, containment of several channel breakouts is needed. Therefore, a walled-levee corridor is proposed for Fan System 17/18. The result was a 3.4 mile long 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.

A design summary of all the components of the recommended alternative for Fan System 17/18 is presented below. Table 14 shows a summary of the total cost estimates. Table 15 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 17/18 is $20 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The walled-levee corridors were estimated at $19.5 million.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 39 percent of the total cost.

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

Table 14 Design Cost Summary – Fan System 17/18

					Design Geometry			Costs (in $1000)				
Structure ID	Flow Rate (cfs)	ROW Area (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
D1718_1	NA	0.9	0.0	3.6	1000	39	NA	$ 90	$ 280	$ 32	$ 147	$ 549
H175A75B_3	863	4.2	0.0	3.5	0.197	176	2.0	$ 420	$ 499	$ 52	$ 222	$ 1,193
H175A75B_2	862	3.8	0.0	4.0	0.18	176	2.1	$ 380	$ 461	$ 47	$ 202	$ 1,090
H175A75B_1	862	3.5	0.0	3.3	0.15	186	2.4	$ 350	$ 388	$ 40	$ 172	$ 950
H175B90I_3	862	5.1	0.0	4.1	0.22	191	1.7	$ 510	$ 550	$ 58	$ 243	$ 1,361
H175B90I_2	862	4.1	0.0	4.0	0.19	181	2.3	$ 410	$ 444	$ 50	$ 211	$ 1,115
H175B90I_1	1455	4.5	0.0	2.8	0.17	226	2.3	$ 450	$ 377	$ 44	$ 182	$ 1,053
H180A80B_5	764	4.6	0.0	2.7	0.21	181	2.0	$ 460	$ 469	$ 55	$ 224	$ 1,208
H180A80B_4	752	5.5	0.0	1.0	0.25	186	1.7	$ 550	$ 451	$ 60	$ 244	$ 1,305
H180A80B_3	742	3.6	0.0	0.0	0.19	160	2.5	$ 360	$ -	$ -	$ 1	$ 361
H180A80B_2	736	3.6	0.0	0.9	0.18	171	2.4	$ 360	$ 369	$ 24	$ 133	$ 885
H180A80B_1	727	4.3	0.0	0.9	0.20	181	3.7	$ 430	$ 386	$ 19	$ 122	$ 958
H180B90I_2	723	3.7	0.0	1.4	0.18	176	1.8	$ 370	$ 343	$ 41	$ 176	$ 931
H180B90I_1	723	7.3	0.0	7.0	0.35	171	2.1	$ 730	$ 888	$ 93	$ 396	$ 2,108
H190I90D_3	1450	6.3	0.0	5.2	0.23	226	2.1	$ 630	$ 590	$ 61	$ 260	$ 1,541
H190I90D_2	1448	5.3	0.0	3.5	0.19	231	2.3	$ 530	$ 472	$ 50	$ 213	$ 1,265
H190I90D_1	1434	8.5	0.0	7.9	0.31	231	3.0	$ 850	$ 873	$ 81	$ 360	$ 2,165
	TOTAL	78.8	0.0	55.8				$ 7,880	$ 7,840	$ 807	$ 3,509	**$ 20,036**
All Channels		77.9	0.0	52.2	3.4			$7,790	$ 7,560	$ 775	$ 3,362	$ 19,487
All Dikes		0.9	0.0	3.6	1000			$ 90	$ 280	$ 32	$ 147	$ 549

Table 15 Aesthetic Treatment Differential Costs Summary – Fan System 17/18

		Aesthetic Treatment Cost Differential				
Structure ID	Total Cost	Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
D1718_1	$ 549	18%	19%	100%	30%	26%
H175A75B_3	$ 1,193	40%	23%	100%	61%	42%
H175A75B_2	$ 1,090	39%	24%	100%	61%	43%
H175A75B_1	$ 950	37%	24%	100%	61%	42%
H175B90I_3	$ 1,361	37%	22%	100%	62%	41%
H175B90I_2	$ 1,115	39%	26%	100%	61%	44%
H175B90I_1	$ 1,053	31%	24%	100%	62%	39%
H180A80B_5	$ 1,208	39%	22%	100%	63%	42%
H180A80B_4	$ 1,305	38%	19%	100%	64%	41%
H180A80B_3	$ 361	0%	0%	0%	10%	0%
H180A80B_2	$ 885	42%	19%	100%	47%	37%
H180A80B_1	$ 958	40%	18%	100%	40%	35%
H180B90I_2	$ 931	41%	22%	100%	61%	42%
H180B90I_1	$ 2,108	41%	24%	100%	61%	43%
H190I90D_3	$ 1,541	32%	24%	100%	61%	39%
H190I90D_2	$ 1,265	30%	23%	100%	61%	38%
H190I90D_1	$ 2,165	31%	25%	100%	58%	38%
	$ 20,036	35%	23%	100%	59%	39%

12 FAN SYSTEM 19 DESIGN SUMMARY

The recommended alternative for Fan System 19 in the Wagner Wash 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 recommended alternative for Fan System 19 does not include an apex detention basin. The channel avulsion potential associated with Fan 19 is not as severe as other fans within the study area. However, containment of several channel breakouts is needed. Therefore, a 1.6 mile long walled-levee corridor confined by poured concrete floodwalls is proposed for Fan System 19. The floodwalls are buffered by 50 foot areas which will also contain maintenance and multiple use access along both sides of the corridor.

A design summary of all the components of the recommended alternative for Fan System 19 is presented below. Table 16 shows a summary of the total cost estimates. Table 17 shows a summary of the differential costs for the aesthetic treatment requirements and landscaping.

Table 16 Design Cost Summary – Fan System 19

Structure ID	Flow Rate (cfs)	ROW Area (acres)	Exc. Vol. (ac. ft)	Fill Vol. (ac. ft)	Design Geometry			Costs (in $1000)				
					Length (ft; mi)	ROW Width (ft)	Depth (ft)	Land Cost	Const. Cost	Lndscp Cost	50-Yr Maint. Cost	Total Cost
H11859F1_5	1651	4.8	0.0	0.0	0.135	296	2.5	$ 480	$ 124	$ 16	$ 62	$ 682
H11859F1_4	1634	5.7	0.0	2.9	0.189	253	2.6	$ 570	$ 462	$ 48	$ 205	$ 1,284
H11859F1_3	1616	5.6	0.0	4.4	0.189	248	2.5	$ 560	$ 490	$ 50	$ 216	$ 1,316
H11859F1_2	1599	6.9	0.0	4.1	0.189	303	2.1	$ 690	$ 481	$ 50	$ 212	$ 1,433
H11859F1_1	1582	6.8	0.0	1.5	0.187	303	2.7	$ 680	$ 351	$ 49	$ 194	$ 1,275
H19F19F2_3	1572	5.7	0.0	2.7	0.17	283	2.0	$ 570	$ 380	$ 45	$ 186	$ 1,181
H19F19F2_2	1574	5.2	0.0	1.8	0.179	243	3.0	$ 520	$ 382	$ 30	$ 144	$ 1,076
H19F19F2_1	1577	10.3	0.0	4.1	0.34	251	3.3	$1,030	$ 768	$ 90	$ 367	$ 2,255
	TOTAL	51.0	0.0	21.5				$5,100	$ 3,438	$ 377	$ 1,585	**$ 10,501**
All Channels		51.0	0.0	21.5	1.6			$5,100	$ 3,438	$ 377	$ 1,585	$ 10,501

Table 17 Aesthetic Treatment Differential Costs Summary – Fan System 19

Structure ID	Total Cost	Aesthetic Treatment Cost Differential				
		Land Cost (%)	Construction Cost (%)	Landscape Cost (%)	Maintenance Cost (%)	Total AT Cost (% of Total Cost)
H11859F1_5	$ 682	13%	15%	100%	68%	21%
H11859F1_4	$ 1,284	28%	22%	100%	60%	36%
H11859F1_3	$ 1,316	29%	25%	100%	60%	38%
H11859F1_2	$ 1,433	23%	24%	100%	61%	34%
H11859F1_1	$ 1,275	24%	20%	100%	66%	34%
H19F19F2_3	$ 1,181	25%	23%	100%	62%	35%
H19F19F2_2	$ 1,076	29%	20%	100%	54%	33%
H19F19F2_1	$ 2,255	28%	21%	100%	64%	36%
	$ 10,501	25%	22%	100%	62%	34%

The estimated total cost of the recommended alternative for Fan System 19 is $10.5 million including right of way, construction, aesthetic treatments, and 50 years' maintenance. The total cost of $10.5 million was estimated.

The additional costs associated with the landscape aesthetic requirements were also estimated. The results indicate that the aesthetic treatment requirements are about 34 percent of the total cost.

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

13 MAINTENANCE PLAN

The primary maintenance concerns for the recommended alternative for the Wagner 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.

14 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.

15 SUMMARY FOR THE WAGNER WASH SUB-AREA

The recommended alternative for the Wagner Wash 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 landscape 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 18 presents a summary of the cost estimates and right-of-way requirements for the recommended alternative for the Wagner sub-area. The recommended alternative for the overall sub-area is comprised of about 13.7 miles of walled-levee corridors. The total right of way requirements for the whole sub-area are about 370 acres including about 49 acres for three detention basins. Total costs for the Wagner Wash sub-area are estimated at about $97 million for the five fan systems. These costs include right of way, construction, landscaping, and maintenance for a 50-year period. Total land costs are similar to the estimated construction costs.

Table 18 Summary Of Wagner 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. %
FAN3	88.8	$ 8.880	$ 8.979	$ 1.163	$ 4.241	$ 23.262	38%	39%	5%	18%
FAN13	62.8	$ 6.280	$ 7.611	$ 0.965	$ 3.525	$ 18.380	34%	41%	5%	19%
FAN16	88.1	$ 8.810	$ 10.043	$ 1.227	$ 4.666	$ 24.746	36%	41%	5%	19%
FAN19	51.0	$ 5.100	$ 3.438	$ 0.377	$ 1.585	$ 10.501	49%	33%	4%	15%
FANS1718	78.8	$ 7.880	$ 7.840	$ 0.807	$ 3.509	$ 20.036	39%	39%	4%	18%
TOTAL	369.5	$ 36.950	$ 37.910	$ 4.540	$ 17.526	**$ 96.9**	38%	39%	5%	18%

The landscaping and other aesthetic treatment costs for the Wagner sub-area were estimated at about 37 percent of the recommended alternative costs. This percentage includes about 5 percent for landscaping. The remaining 32 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 $12.6 million are for additional right of way requirements. The total ROW cost is estimated at about $37 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 well above the cost ceiling ($12.6 / ($37 - $12.6) = 50 %). The total construction costs for the recommended alternative are estimated at about $37.9 million. The portion of the costs attributable to the aesthetic treatment components was estimated at about $7.3 million. This is well 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 36 shows the recommended alternative for the Wagner Wash sub-area. In addition, the existing alluvial fan floodplains are also shown in Figure 36. It can be seen from examination of Figure 36 that a number of benefits would be derived to the Wagner Wash 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 36. Although detailed redelineation of the post-ADMP floodplain is beyond the scope of the current contract, it is anticipated that much of the floodplain will be significantly reduced.

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 the piedmont outfall at Wagner Wash.

Finally, Figure 36 also shows how the control of Fan 3 is critical to the success of the recommended alternative for the Fan 13 and visa versa. Without control of Fan 3 (or 13), additional discharges in excess of the designed quantities could flow toward the Fan 13 corridor. Therefore, the recommended alternative for Fan 3 should be considered an essential element of the implementation for the Fan System 13 and visa versa.

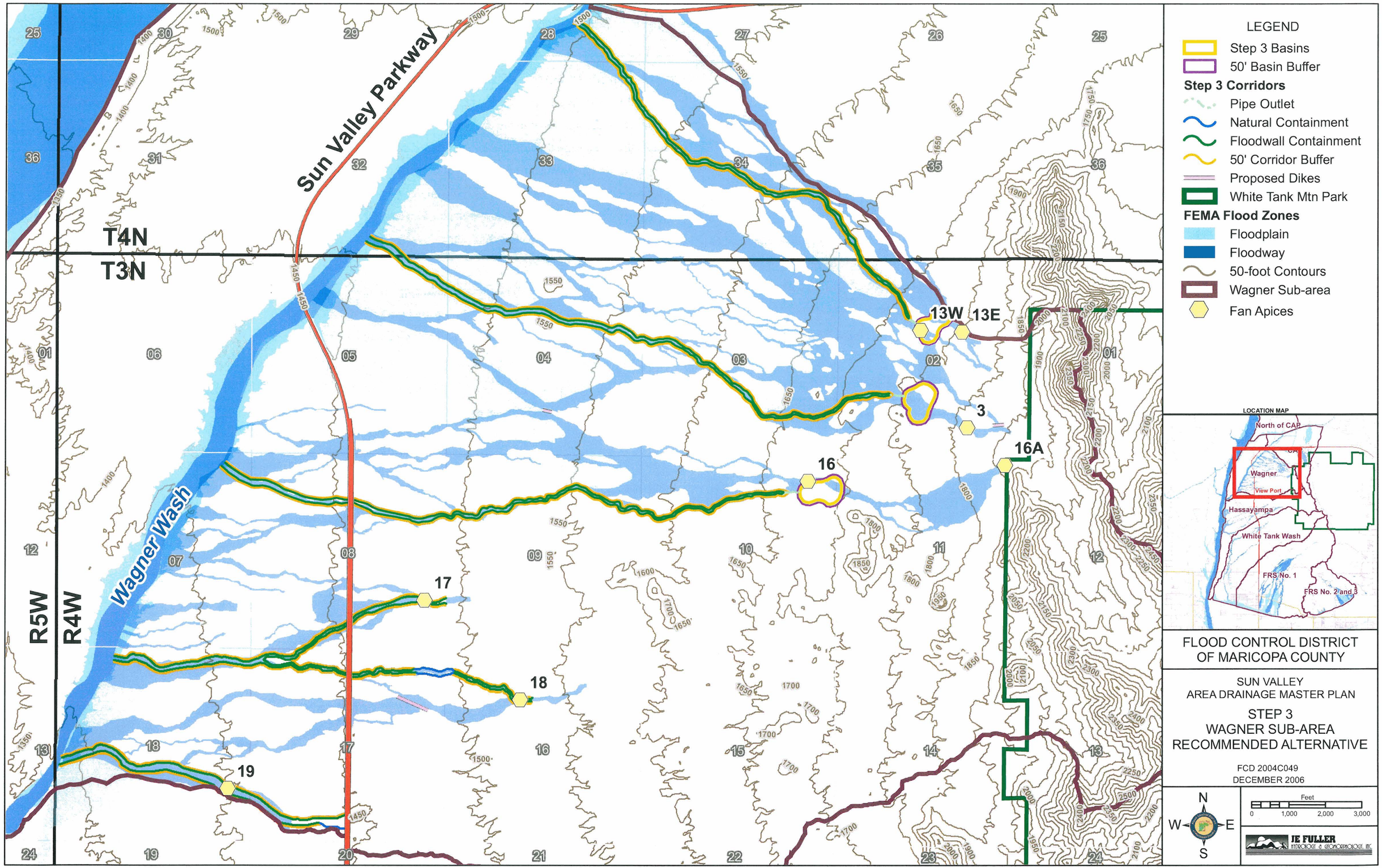

Figure 36 FEMA Floodplains, Recommended Alternative, and Benefited Area

16 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.

17 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.

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Appendix A

Design Analyses

Fan System 13

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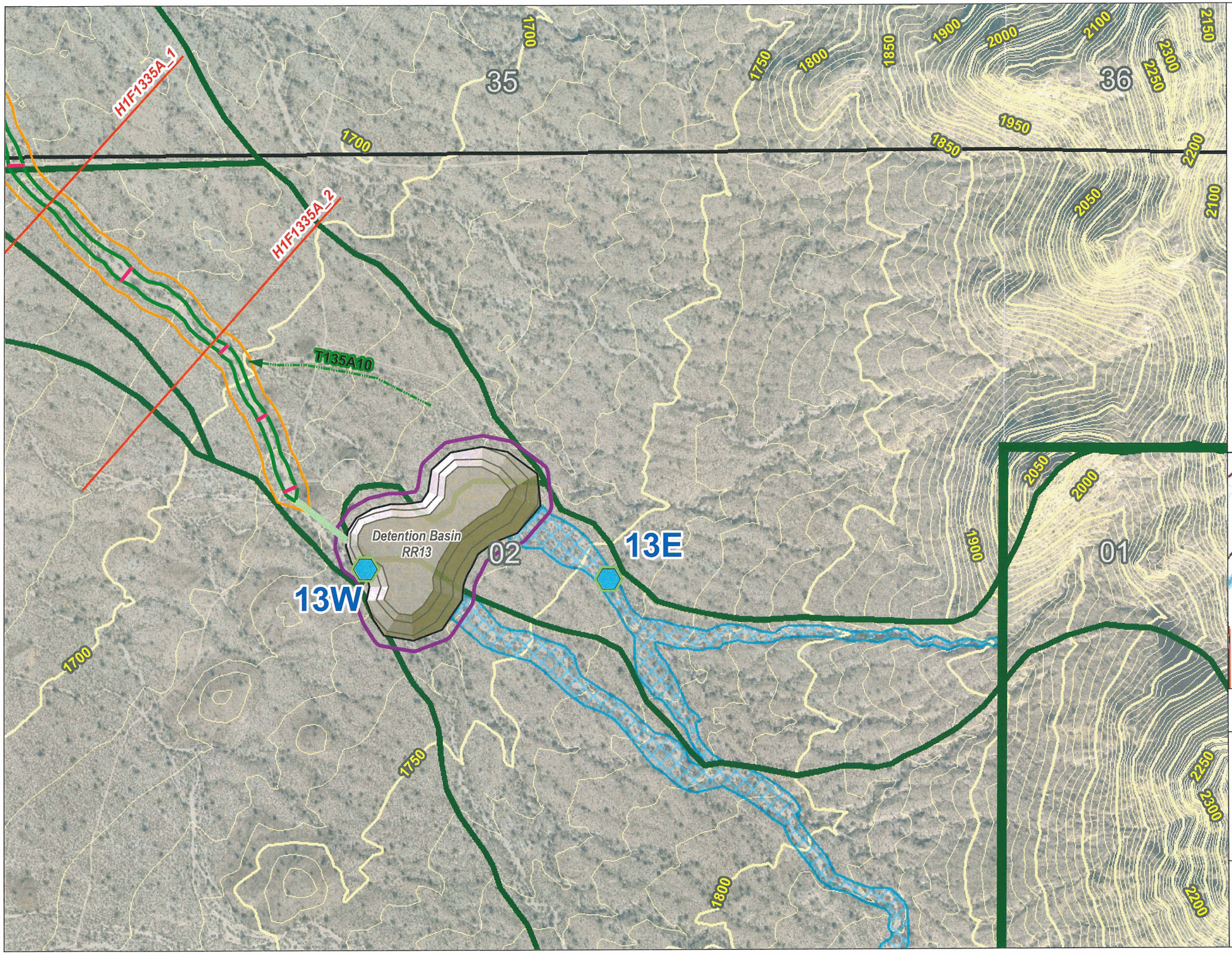


LEGEND

- Step 3 Basins
- 50' Basin Buffer

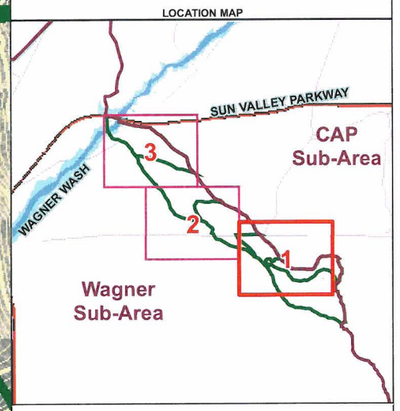
Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones

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

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN

STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 13
RECOMMENDED ALTERNATIVE

SHEET 1 OF 3

FCD 2004C049

DECEMBER 2006

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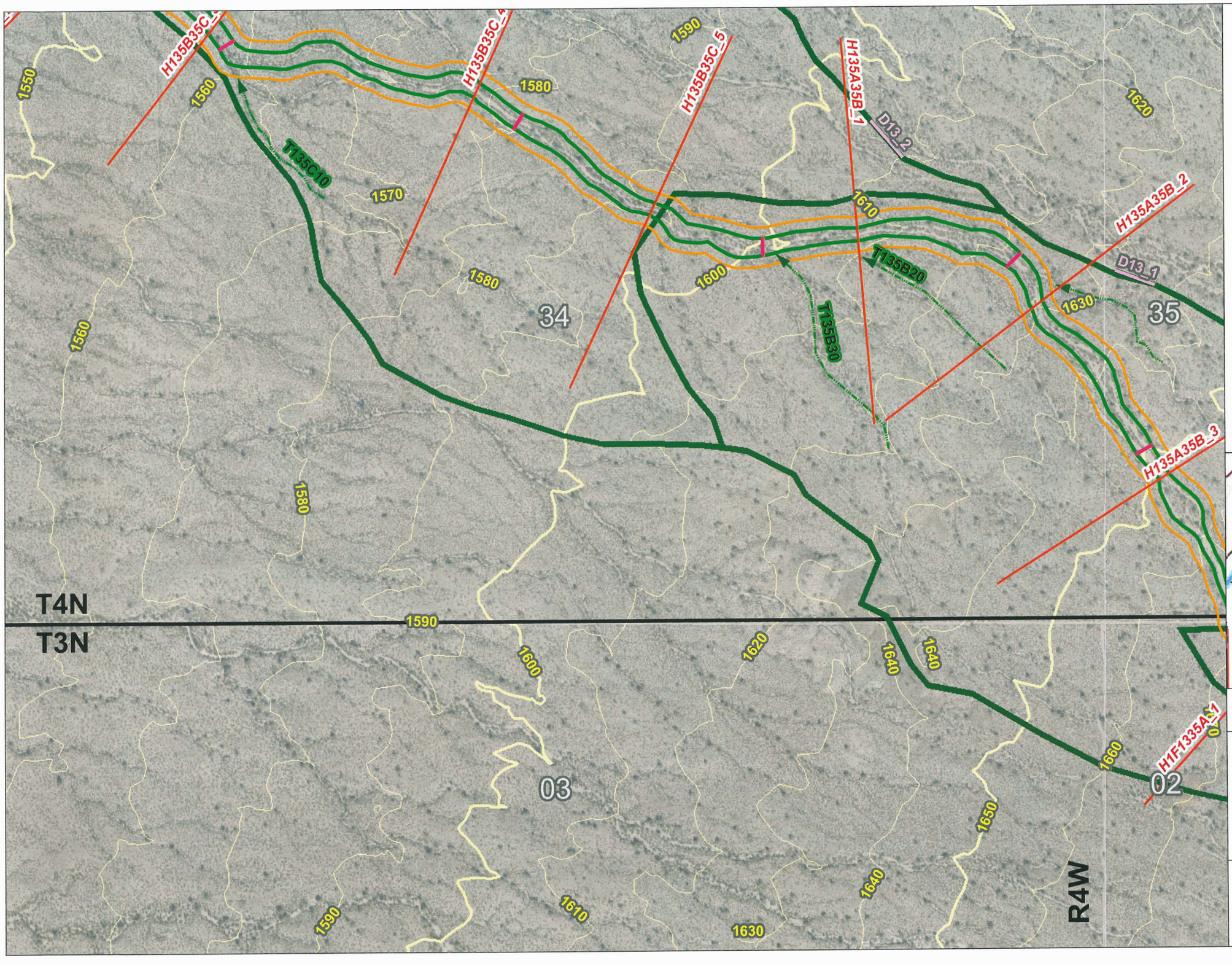

LEGEND

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- 50' Basin Buffer

Step 3 Corridors

- Floodwall
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- Proposed Dikes
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- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones

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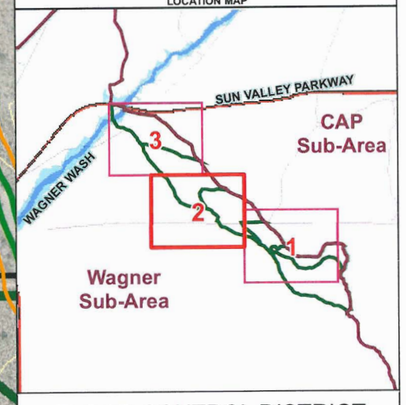
- Floodway
- Subbasin Boundaries
- Cross Section
- Countywide 10-ft Topo
- White Tank Mtn Park
- Trib. Sed. Supply Reaches
- Fan Apices

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 13
RECOMMENDED ALTERNATIVE
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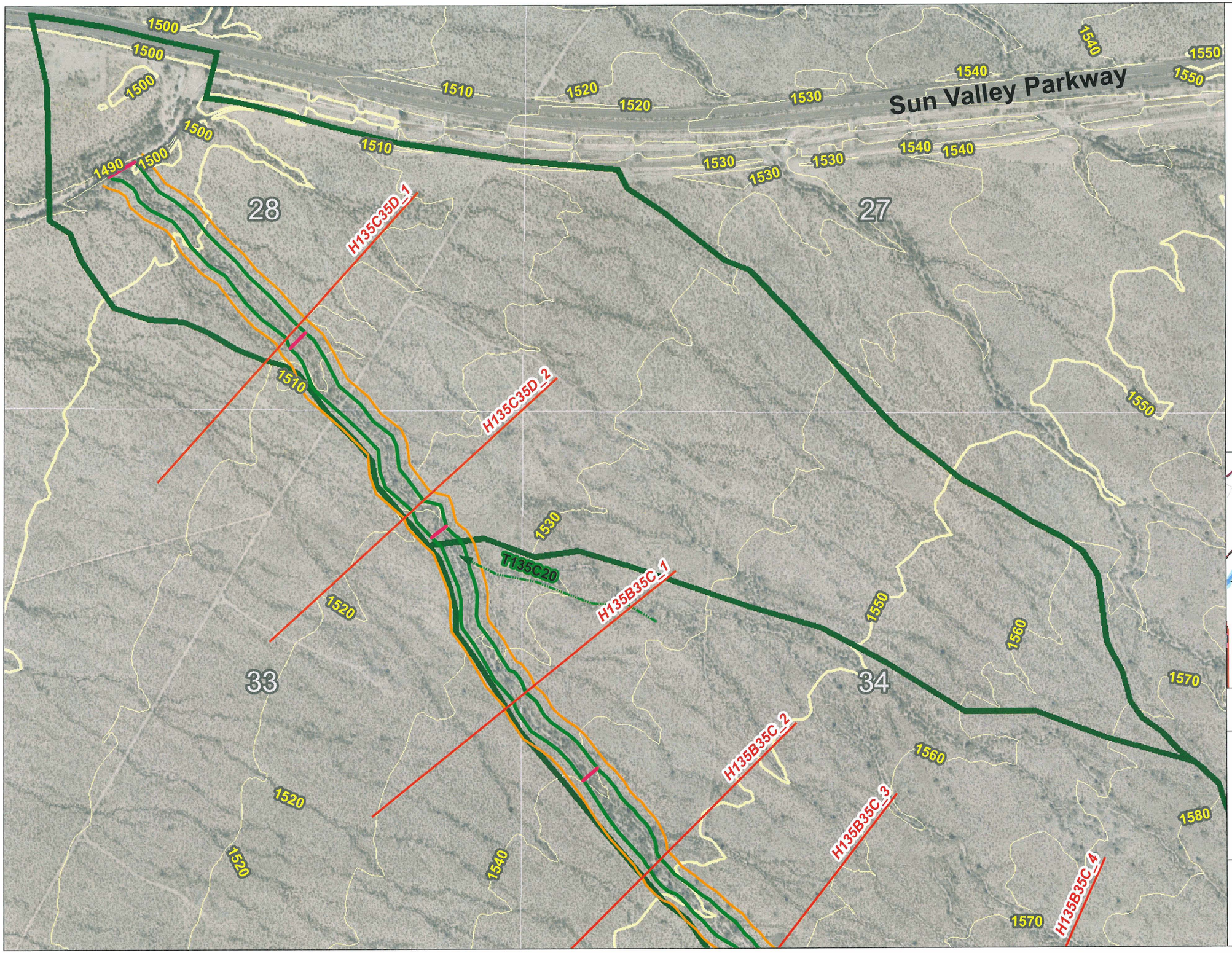

LEGEND

- Step 3 Basins
- 50' Basin Buffer

Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
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- 50' Corridor Buffer
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- Approximate Zone A

FEMA Flood Zones

- Floodway Fringe
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- Subbasin Boundaries
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- Countywide 10-ft Topo
- White Tank Mtn Park
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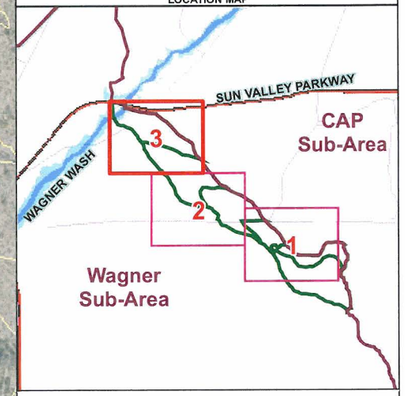
LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN

STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 13
RECOMMENDED ALTERNATIVE

SHEET 3 OF 3

FCD 2004C049

DECEMBER 2006

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Costs Summary

Structure ID	Type	Flow Rate (cfs)	ROW Area (acres)	Excavation Volume (ac. ft)	Fill Volume (ac. ft)	Design Geometry: Length (Dike-ft Channel-miles)	Design Geometry: ROW Width (ft)	Design Geometry: Depth (ft)	Costs ($1000): Land Cost	Construction Cost	Landscaping Cost	50-Year Maintenance Cost	Total Cost	Cost Percentages: 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)
D13_1	Dike	NA	0.2	0.0	0.7	200	39	NA	$ 20	$ 56	$ 6	$ 29	$ 112	18%	50%	6%	26%	1%	16%	19%	100%	30%	26%
D13_2	Dike	NA	0.2	0.0	0.8	230	39	NA	$ 20	$ 64	$ 7	$ 34	$ 126	16%	51%	6%	27%	1%	18%	19%	100%	30%	26%
RR13	Online Basin	757	13.8	125.0	0.0	NA	NA	8.5	$ 1,380	$ 1,758	$ 300	$ 775	$ 4,214	33%	42%	7%	18%	23%	28%	6%	100%	20%	23%
H1F1335A_2	Walled-Levee Corridor	184	4.2	0.0	2.6	0.253	141	1.0	$ 420	$ 459	$ 67	$ 261	$ 1,207	35%	38%	6%	22%	7%	50%	22%	100%	66%	48%
H1F1335A_1	Walled-Levee Corridor	257	2.4	0.0	2.3	0.137	141	1.5	$ 240	$ 282	$ 36	$ 147	$ 704	34%	40%	5%	21%	4%	50%	25%	100%	64%	48%
H135A35B_3	Walled-Levee Corridor	349	4.5	0.0	4.1	0.245	151	2.0	$ 450	$ 521	$ 65	$ 256	$ 1,292	35%	40%	5%	20%	7%	47%	23%	100%	66%	46%
H135A35B_2	Walled-Levee Corridor	446	3.7	0.0	3.9	0.19	161	1.7	$ 370	$ 437	$ 50	$ 205	$ 1,062	35%	41%	5%	19%	6%	43%	25%	100%	63%	45%
H135A35B_1	Walled-Levee Corridor	542	5.3	0.0	6.6	0.277	161	2.1	$ 530	$ 653	$ 73	$ 302	$ 1,558	34%	42%	5%	19%	8%	43%	26%	100%	63%	46%
H135B35C_5	Walled-Levee Corridor	638	2.0	0.0	1.9	0.102	161	2.1	$ 200	$ 256	$ 27	$ 115	$ 597	33%	43%	5%	19%	3%	45%	23%	100%	61%	44%
H135B35C_4	Walled-Levee Corridor	671	4.6	0.0	3.7	0.221	171	1.8	$ 460	$ 543	$ 57	$ 240	$ 1,300	35%	42%	4%	18%	7%	41%	22%	100%	61%	42%
H135B35C_3	Walled-Levee Corridor	713	3.9	0.0	3.3	0.192	171	2.3	$ 390	$ 433	$ 51	$ 208	$ 1,082	36%	40%	5%	19%	6%	41%	23%	100%	63%	44%
H135B35C_2	Walled-Levee Corridor	737	3.4	0.0	2.9	0.161	171	2.1	$ 340	$ 399	$ 43	$ 179	$ 961	35%	42%	4%	19%	5%	41%	23%	100%	62%	43%
H135B35C_1	Walled-Levee Corridor	769	5.0	0.0	5.3	0.248	166	2.0	$ 500	$ 631	$ 65	$ 278	$ 1,474	34%	43%	4%	19%	8%	42%	24%	100%	61%	43%
H135C35D_2	Walled-Levee Corridor	814	2.9	0.0	2.9	0.138	171	2.0	$ 290	$ 351	$ 36	$ 156	$ 833	35%	42%	4%	19%	5%	41%	24%	100%	61%	43%
H135C35D_1	Walled-Levee Corridor	904	6.7	0.0	5.8	0.306	181	2.1	$ 670	$ 767	$ 81	$ 340	$ 1,858	36%	41%	4%	18%	10%	39%	23%	100%	62%	42%
	TOTAL	62.8	125.0	46.8					$ 6,280	$ 7,611	$ 965	$ 3,525	**$ 18,380**	34%	41%	5%	19%	100%	40%	19%	100%	53%	39%
All Channels		48.6	0.0	45.3	2.5				$ 4,860	$ 5,732	$ 651	$ 2,687	$ 13,929	35%	41%	5%	19%	76%					
All Online Basins		13.8	125.0	0.0					$ 1,380	$ 1,758	$ 300	$ 775	$ 4,214	33%	42%	7%	18%	23%					
All Offline Basins		0.0	0.0	0.0					$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Dikes		0.4	0.0	1.5	430				$ 40	$ 121	$ 14	$ 63	$ 237	17%	51%	6%	27%	1%					
Channel Cost per mile (in $1000)		$5,639		Basins Cost per ac. ft. (in $1000)					$33.71														

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
S125	BASIN	255			4.08	0.11	17	4	1	1	1.387	1.388	1.388	1.388	8	8	8	8
S130	BASIN	524			4.17	0.31	48	12	4	2	1.425	1.426	1.426	1.426	24	24	24	24
CFAN13	COMBINE	757			4.08	0.42	64	16	5	2	1.411	1.412	1.412	1.412	32	32	32	32
RR13	STORAGE	91	5.8	24.38	4.67	0.42	57	16	5	2	1.259	1.412	1.412	1.412	28	32	32	32
F1335A	ROUTE	90	100.6	1.44	4.83	0.42	57	16	5	2	1.251	1.412	1.412	1.412	28	32	32	32
S135A	BASIN	257			4	0.08	13	3	1	0	1.468	1.468	1.468	1.468	7	7	7	7
C135A	COMBINE	270			4	0.51	68	19	6	3	1.254	1.416	1.416	1.416	34	38	38	38
35A35B	ROUTE	193	100.8	4.08	4.17	0.51	67	19	6	3	1.231	1.416	1.416	1.416	33	38	38	38
S135B	BASIN	546			4.08	0.22	33	8	3	1	1.362	1.362	1.362	1.362	16	16	16	16
C135B	COMBINE	638			4.08	0.73	94	26	9	4	1.196	1.328	1.328	1.328	47	52	52	52
35B35C	ROUTE	504	101.5	11.38	4.25	0.73	91	26	9	4	1.165	1.328	1.328	1.328	45	52	52	52
S135C	BASIN	652			4.08	0.31	41	10	3	1	1.248	1.248	1.248	1.248	20	20	20	20
C135C	COMBINE	795			4.17	1.04	122	34	11	5	1.093	1.213	1.213	1.213	60	67	67	67
35C35D	ROUTE	772	101.8	7.11	4.25	1.04	121	34	11	5	1.083	1.213	1.213	1.213	60	67	67	67
S135D	BASIN	559			4.08	0.25	36	9	3	1	1.351	1.351	1.351	1.351	18	18	18	18
C135D	COMBINE	965			4.25	1.28	146	40	13	6	1.062	1.17	1.17	1.17	73	80	80	80

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
S125	BASIN	202			12.08	0.11	14	4	1	1	1.164	1.212	1.212	1.212	7	7	7	7
S130	BASIN	415			12.17	0.31	39	10	3	1	1.169	1.217	1.217	1.217	19	20	20	20
CFAN13	COMBINE	599			12.08	0.42	53	14	5	2	1.156	1.203	1.204	1.204	26	27	27	27
RR13	STORAGE	77	4.9	19.39	12.67	0.42	49	14	5	2	1.067	1.204	1.204	1.204	24	27	27	27
F1335A	ROUTE	76	100.6	1.3	12.83	0.42	48	14	5	2	1.059	1.203	1.204	1.204	24	27	27	27
S135A	BASIN	205			12	0.08	11	3	1	0	1.233	1.245	1.245	1.245	6	6	6	6
C135A	COMBINE	216			12	0.51	58	16	5	2	1.057	1.2	1.201	1.201	29	32	32	32
35A35B	ROUTE	152	100.7	3.53	12.17	0.51	56	16	5	2	1.035	1.2	1.201	1.201	28	32	32	32
S135B	BASIN	431			12.08	0.22	27	7	2	1	1.125	1.125	1.125	1.125	13	13	13	13
C135B	COMBINE	557			12.08	0.73	81	23	8	3	1.039	1.165	1.165	1.165	40	45	45	45
35B35C	ROUTE	425	101.3	10.25	12.25	0.73	79	23	8	3	1.01	1.165	1.165	1.165	39	45	45	45
S135C	BASIN	515			12.08	0.31	34	9	3	1	1.036	1.036	1.036	1.036	17	17	17	17
C135C	COMBINE	756			12.17	1.04	111	31	10	4	0.994	1.114	1.115	1.115	55	61	62	62
35C35D	ROUTE	729	101.7	6.87	12.25	1.04	110	31	10	4	0.985	1.114	1.115	1.115	54	61	62	62
S135D	BASIN	444			12.08	0.25	30	7	2	1	1.114	1.114	1.114	1.114	15	15	15	15
C135D	COMBINE	995			12.17	1.28	137	38	13	5	0.993	1.104	1.104	1.104	68	75	76	76

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)
H1F1335A_2	Walled-Levee Corridor	0.0233	0.0198	0.25	40	1.0	0.045	184	41.9	38.5	0.9	1.0	1.0	40	4.8	0.86	No	0.3	0.3	5.1	856
H1F1335A_1	Walled-Levee Corridor	0.0215	0.0161	0.14	40	1.5	0.045	257	42.8	48.6	1.1	1.2	1.5	40	5.3	0.84	No	0.3	0.5	5.3	555
H135A35B_3	Walled-Levee Corridor	0.0217	0.0149	0.25	50	2.0	0.045	349	52.1	63.0	1.2	1.3	2.0	50	5.5	0.87	No	0.5	0.9	5.4	441
H135A35B_2	Walled-Levee Corridor	0.0210	0.0200	0.19	60	1.7	0.045	446	63.0	79.6	1.3	1.3	1.7	60	5.6	0.86	No	0.9	0.9	5.4	3037
H135A35B_1	Walled-Levee Corridor	0.0192	0.0204	0.28	60	2.1	0.045	542	63.2	92.0	1.5	1.5	2.1	60	5.9	0.84	No	1.2	1.1	5.5	N/A
H135B35C_5	Walled-Levee Corridor	0.0135	0.0267	0.10	60	2.1	0.045	638	63.9	113.3	1.8	1.9	2.1	60	5.6	0.72	No	2.3	0.9	5.4	N/A
H135B35C_4	Walled-Levee Corridor	0.0151	0.0134	0.22	70	1.8	0.045	671	73.5	119.4	1.6	1.7	1.8	70	5.6	0.76	No	0.9	1.0	5.4	1767
H135B35C_3	Walled-Levee Corridor	0.0152	0.0153	0.19	70	2.3	0.045	713	73.0	123.2	1.7	1.8	2.3	70	5.8	0.77	No	1.2	1.2	5.5	N/A
H135B35C_2	Walled-Levee Corridor	0.0129	0.0149	0.16	70	2.1	0.045	737	73.7	132.5	1.8	1.9	2.1	70	5.6	0.71	No	1.2	1.0	5.4	N/A
H135B35C_1	Walled-Levee Corridor	0.0140	0.0120	0.25	65	2.0	0.045	769	68.9	129.1	1.9	2.0	2.0	65	6.0	0.74	No	1.0	1.2	5.5	1505
H135C35D_2	Walled-Levee Corridor	0.0128	0.0150	0.14	70	2.0	0.045	814	74.0	141.3	1.9	2.0	2.0	70	5.8	0.71	No	1.4	1.1	5.4	N/A
H135C35D_1	Walled-Levee Corridor	0.0141	0.0119	0.31	80	2.1	0.045	904	83.7	153.4	1.8	1.9	2.1	80	5.9	0.75	No	1.1	1.4	5.5	1369

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)
RR13	Online Basin	0.0280	10.5	2868	8.5	35.7	24.4	32.0	757	91	5.8	1.2	6.9	1.5

Dike Cost Estimates

Structure ID	D13_1

Dike Characteristics	Design	
Dike Length (ft)	200	
Levee Top Width (ft)	15	
Levee Side Slope (ft/ft)	6	
Levee Height (ft)	4	
	Design	Aesthetic Trtmt.
Levee Surface Area (sq. Yd)	1422	378
Levee Volume (cu. Yd)	1156	267

Toe Protection		
Protection Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Protection Length	200	ft
Thickness	1.5	ft
Protection Depth	6	ft
Tie-in Length/Depth	3.0	ft
Total Depth	9.0	ft
Area needed	67	sq. Yd
Volume	200	cu. Yd

Levee Lining		
Lining Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Levee Length (ft)	200	
Levee Lining Width (ft)	24	
Levee Lining Thickness (ft)	1.5	
	Design	Aesthetic Trtmt.
Levee Lining Area (sq. Yd)	533	167
Levee Lining Volume (cu. Yd)	267	84

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	
Levee	Fill	1,156	cu. Yd	$ 7.00	$ 8,092	1,422	sq. Yd	$ 4.50	$ 6,399	1,422	sq. Yd	$ 11.67	$ 16,590	
Levee Lining	Riprap	267	cu. Yd	$ 75.00	$ 20,025	533	sq. Yd	$ -	$ -	533	sq. Yd	$ 20.83	$ 11,104	
Toe Protection	Riprap	200	cu. Yd	$ 75.00	$ 15,000	67	sq. Yd	$ -	$ -	67	sq. Yd	$ 25.00	$ 1,675	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 43,117			Total	$ 6,399			Total	$ 29,369	
		Contingency Cost (25% of Construction Cost)			$ 10,779									
		Engineering Design Cost (5% of Construction Cost)			$ 2,156									
		Total Construction Cost			$ 56,052									
Levee Aesthetic Treatment Cost	Fill	267	cu. Yd	$ 7.00	$ 1,869	1,422	sq. Yd	$ 4.50	$ 6,399	378	sq. Yd	$ 8.33	$ 3,150	
Levee Lining Aesthetic Trtmt. Cost	Riprap	84	cu. Yd	$ 75.00	$ 6,300	533	sq. Yd	$ -	$ -	167	sq. Yd	$ 33.33	$ 5,567	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 8,169			Total	$ 6,399			Total	$ 8,717	
		Contingency Cost (25% of Construction Cost)			$ 2,042									
		Engineering Design Cost (5% of Construction Cost)			$ 408									
		Total Construction Cost			$ 10,620									

Total Structure Aesthetic Trtmt Cost	$ 25,735

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way		0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Levee	39	0.2	$100,000	$ 20,000
Other	0	0	$100,000	$ -
Total	39	0.2		$ 20,000

Total Land Related Aes. Trtmt Cost	$ 3,200

Total Cost	$ 111,820

Total Aesthetic Treatment Cost	$ 28,935

Total Right of Way Cost	$ 20,000

Dike Cost Estimates

Structure ID	D13_2

Dike Characteristics	Design	
Dike Length (ft)	230	
Levee Top Width (ft)	15	
Levee Side Slope (ft/ft)	6	
Levee Height (ft)	4	
	Design	Aesthetic Trtmt.
Levee Surface Area (sq. Yd)	1636	435
Levee Volume (cu. Yd)	1329	307

Toe Protection		
Protection Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Protection Length	230	ft
Thickness	1.5	ft
Protection Depth	6	ft
Tie-in Length/Depth	3.0	ft
Total Depth	9.0	ft
Area needed	77	sq. Yd
Volume	230	cu. Yd

Levee Lining		
Lining Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Levee Length (ft)	230	
Levee Lining Width (ft)	24	
Levee Lining Thickness (ft)	1.5	
	Design	Aesthetic Trtmt.
Levee Lining Area (sq. Yd)	613	192
Levee Lining Volume (cu. Yd)	307	96

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	
Levee	Fill	1,329	cu. Yd	$ 7.00	$ 9,303	1,636	sq. Yd	$ 4.50	$ 7,362	1,636	sq. Yd	$ 11.67	$ 19,087	
Levee Lining	Riprap	307	cu. Yd	$ 75.00	$ 23,025	613	sq. Yd	$ -	$ -	613	sq. Yd	$ 20.83	$ 12,771	
Toe Protection	Riprap	230	cu. Yd	$ 75.00	$ 17,250	77	sq. Yd	$ -	$ -	77	sq. Yd	$ 25.00	$ 1,925	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 49,578			Total	$ 7,362			Total	$ 33,783	
		Contingency Cost (25% of Construction Cost)			$ 12,395									
		Engineering Design Cost (5% of Construction Cost)			$ 2,479									
		Total Construction Cost			$ 64,451									
Levee Aesthetic Treatment Cost	Fill	307	cu. Yd	$ 7.00	$ 2,149	1,636	sq. Yd	$ 4.50	$ 7,362	435	sq. Yd	$ 8.33	$ 3,625	
Levee Lining Aesthetic Trtmt. Cost	Riprap	96	cu. Yd	$ 75.00	$ 7,200	613	sq. Yd	$ -	$ -	192	sq. Yd	$ 33.33	$ 6,400	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 9,349			Total	$ 7,362			Total	$ 10,025	
		Contingency Cost (25% of Construction Cost)			$ 2,337									
		Engineering Design Cost (5% of Construction Cost)			$ 467									
		Total Construction Cost			$ 12,154									

Total Structure Aesthetic Trtmt Cost	$ 29,541

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way		0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Levee	39	0.2	$100,000	$ 20,000
Other	0	0	$100,000	$ -
Total	39	0.2		$ 20,000

Total Land Related Aes. Trtmt Cost	$ 3,680

Total Cost	$ 125,596

Total Aesthetic Treatment Cost	$ 33,221

Total Right of Way Cost	$ 20,000

Online Basin

Structure ID	RR13

HEC1 ID	RR13

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

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

Drainage Area =	0.42 sq. mi.
Area Contributing Sediment =	0.42 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	3	76	95	0.56	2055
Q-5	0.25	8	189	95	0.56	5736
Q-10	0.35	11	265	95	0.56	8361
Q-25	0.55	18	416	95	0.56	13871
Q-50	0.75	24	568	95	0.56	19632
Q-100	1	32	757	95	0.56	27096

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

Soil Map Unit	K	% of Basin
29	0.21	46.4%
100	0.02	26.1%
29	0.21	10.8%
100	0.02	10.6%
115	0.27	5.2%
115	0.27	0.7%
52	0.08	0.2%
Weighted K Factor:	0.14	

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:	250	ft	(Basin Average)
Slope Angles:	24	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	9.09		

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	2055	0.14	9.09	0.32	1.00	872	0.87
Q-5	5736	0.14	9.09	0.32	1.00	2432	2.42
Q-10	8361	0.14	9.09	0.32	1.00	3546	3.52
Q-25	13871	0.14	9.09	0.32	1.00	5882	5.85
Q-50	19632	0.14	9.09	0.32	1.00	8325	8.27
Q-100	27096	0.14	9.09	0.32	1.00	11490	11.42
Weighted Average Annual Sediment Yield:						1651	1.64

Total Sediment Yield Volume (ac. ft)	6.9

Sediment Depth in Basin	1.5 ft

Geometry

Topography slope (ft/ft)	0.028
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	8.5
Freeboard (ft)	1
Top Perimeter (ft)	2867.6
Top Area (acres)	10.5
Bottom elevation (ft)	1714.2
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	35.7
Total Available Volume (ac. ft) (incl. Freeboard)	49.7
Total Excavation Volume (ac. ft)	125.0

Basin Outlet

Diameter	4.00	ft
Invert Elevation	0.00	ft
Number of pipes	1	

Stage-Storage-Discharge

Elevation	0	1	2	4	6	7	8	9	10	11
Storage	0.0	0.0	2.8	13.7	25.8	32.3	39.2	46.4	53.9	68.7
Outflow	0.0	14.2	28.5	60.8	94.9	111.4	126.2	138.8	144.8	184.8

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Total Flow Volume entering Basin (ac. ft)	32.0	27	32.0
Peak Inflow (cfs)	757	599	757.0
Peak Outflow (cfs)	91	77	91.0
Stage at Peak Outflow (ft)	5.8	4.9	5.8
Volume at Peak Outflow (ac. ft)	24.4	19.39	24.4

Volume Check

Total Volume needed	31.2	ac. ft
Total Volume Provided	35.7	ac. ft

Volume OK?	Yes

Stage Check

Depth Needed	8.3	ft
Depth Provided	8.5	ft

Depth OK?	Yes

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	201667	0
Excavated Area (sq. Yd)	50820.0	2708.3
Adjacent Buffer Area (sq. Yd)	15931.1	

Inlet	Terraced	Riprap-lined
Average Inlet Height (ft)		27
Average Inlet Length (ft)		160
Total Width of all inlets (ft)		360
Material Thickness (ft)	0.5	3.0
Total Inlet Area (sq. Yd)	0	6490.5
Total Material Volume (cu. Yd)	0	6490.5
Unit Cost	$ 155.00	$ 75.00
Total Cost	$ -	$ 486,788

Outlet		
Outlet Type	Pipe	
(None, Riprap Weir, Concrete Weir, Pipe)		
Pipe Length	370	ft
Unit Cost	$ 160.00	per ft
Cost per outlet	$ 59,200	
Other Cost	$ -	
Total Cost	$ 59,200	
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		201,667	cu. Yd	$ 4.00	$ 806,668	66,751	sq. Yd	$ 4.50	$ 300,380	66,751	sq. Yd	$ 8.33	$ 556,259
Inlet					$ 486,788				$ -				$ 216,350
Outlet	Pipe	1	EA	$ 59,200	$ 59,200	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 1,352,656			Total	$ 300,380			Total	$ 774,826
		Contingency Cost (25% of Construction Cost)			$ 338,164								
		Engineering Design Cost (5% of Construction Cost)			$ 67,633								
		Total Construction Cost			$ 1,758,452								

Structure Aesthetic Treatment Cost

Basin - Aesthetic Treatment		201,667	cu. Yd	$ -	$ -	66,751	sq. Yd	$ 4.50	$ 300,380	13,223	sq. Yd	$ 8.33	$ 110,190
Inlet - Aesthetic Treatment (20%Inlet)					$ 97,358				$ -				$ 43,270
Outlet -Aesthetic Treatment (5% Outlet)					$ 2,960	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 100,318			Total	$ 300,380			Total	$ 153,571
		Contingency Cost (25% of Construction Cost)			$ 25,079								
		Engineering Design Cost (5% of Construction Cost)			$ 5,016								
		Total Construction Cost			$ 130,413								

Total Structure Aesthetic Trtmt Cost	$ 584,364

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	3.3	$100,000	$ 330,000
Basin	10.5	$100,000	$ 1,050,000
Other		$100,000	$ -
Total	13.8	$100,000	$ 1,380,000

Total Land Related Aes. Trtmt Cost	$ 385,957

Total Cost	$ 4,213,658

Total Aesthetic Treatment Cost	$ 970,320

Total Right of Way Cost	$ 1,380,000

Walled-Levee Corridor

Structure ID	H1F1335A

HEC1 ID	F1335A

Cutline ID	2

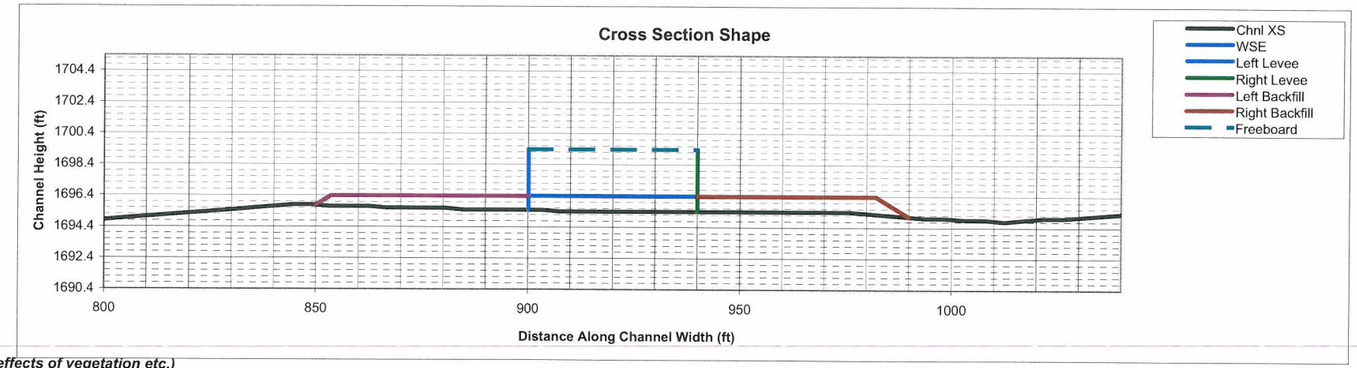
Longitudinal Geometry

Length	1335.5	ft
Initial Channel Slope	0.0233	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0198	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	900	Right Levee Station (ft)	940
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	900	Right Channel Limit Station (ft)	940

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	C135A	RR13								TOTAL
HEC1 Peak-Flow	270	91								
Weighting Factor	0.52	0.48								
Flow into Channel	140	44								184

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
18	40.4	9.5	1695.4	1695.7	1.9	0.3	40.0	0.2	0.2	0.70
55	40.9	18.5	1695.4	1695.9	3.0	0.5	40.0	0.5	0.5	0.77
138	41.5	32.3	1695.4	1696.2	4.3	0.8	40.0	0.8	0.8	0.84
184	41.9	38.5	1695.4	1696.4	4.8	1.0	40.0	0.9	1.0	0.86

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
18	40.4	10.0	1695.4	1695.7	1.8	0.3	40.0	0.2	0.3	0.65
55	40.9	19.4	1695.4	1695.9	2.8	0.5	40.0	0.5	0.5	0.72
138	41.6	33.9	1695.4	1696.3	4.1	0.9	40.0	0.8	0.8	0.78
184	42.0	40.5	1695.4	1696.4	4.5	1.0	40.0	1.0	1.0	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
	T135A10									
55	0.28									0.28

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
18	Stable
55	Stable
138	Stable
184	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	55	cfs
Clear Water	No	
Total Incoming Sediment Load	0.275	cfs
Initial Chnl Sediment Capacity	0.346	cfs
Long-term Equilibrium Slope (ADWR)	0.0198	

Drop Structures

Design Slope	0.0198	ft/ft
Total Drop Needed	4.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.56	
Distance between Structures	856	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)
184	1.1	24.6	1.0	1.0	4.8	0.0233	-0.2	0.6	1.5	0.1	2.0	5.1

Cost Estimates

Channel Characteristics

Channel Length (ft)	1335
Channel Limit-Left Station (ft)	900
Channel Limit-Right Station (ft)	940
Channel Width (ft)	40

Levee

Left Levee Length (ft)	1335
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.9
Right Levee Length (ft)	1335
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4

Left Levee Surface Area (sq. Yd)	579
Left Levee Volume (cu. Yd)	96
Right Levee Surface Area (sq. Yd)	593
Right Levee Volume (cu. Yd)	99
Total Levee Surface Area (sq. Yd)	1172
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)	66773
Left Levee Fill XS area (sq. ft)	37.8
Left Levee Fill Volume (cu. Yd)	1869
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)	66906
Right Levee Fill XS area (sq. ft)	46
Right Levee Fill Volume (cu. Yd)	2274
Total Levee Fill Surface Area (sq. ft)	133679
Total Levee Fill Volume (cu Yd)	4143

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)	5.0	
Structure Height (ft)	8.0	
Number of Structures	1.56	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	11.81	1.18
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,004	$ 100
Area per structure (sq. Yd)	4	0
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	1,335	ft	$ 187	$ 248,998	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,172	sq. Yd	$ -	$ -	1,172	sq. Yd	$ -	$ -	1,172	sq. Yd	$ 75.00	$ 87,900
Adjacent Levee Fill	Fill	4,143	cu. Yd	$ 7.00	$ 29,001	14,833	sq. Yd	$ 4.50	$ 66,750	14,833	sq. Yd	$ 11.67	$ 173,056
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,172	sq. Yd	$ 63.00	$ 73,836	1,172	sq. Yd	$ -	$ -	1,172	sq. Yd	$ -	$ -
Drop Structures	Gabions	2	EA	$ 1,003.85	$ 1,566	4	sq. Yd	$ -	$ -	4	sq. Yd	$ 37.50	$ 167
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 353,401			Total	$ 66,750			Total	$ 261,122
		Contingency Cost (25% of Construction Cost)			$ 88,350								
		Engineering Design Cost (5% of Construction Cost)			$ 17,670								
		Total Construction Cost			$ 459,421								
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,172	sq. Yd	$ 63.00	$ 73,836	1,172	sq. Yd	$ -	$ -	1,172	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,143	cu. Yd	$ 7.00	$ 29,001	14,833	sq. Yd	$ 4.50	$ 66,750	14,833	sq. Yd	$ 11.67	$ 173,056
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 100.30	$ 156	4	sq. Yd	$ -	$ -	0	sq. Yd	$ 37.50	$ 17
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 102,993			Total	$ 66,750			Total	$ 173,072
		Contingency Cost (25% of Construction Cost)			$ 25,748								
		Engineering Design Cost (5% of Construction Cost)			$ 5,150								
		Total Construction Cost			$ 133,892								
Total Structure Aesthetic Trtmt Cost	$ 373,714												

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	40	1.2	$100,000	$ 120,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	141	4.2		$ 420,000

Total Land Related Aes. Trtmt Cost	$ 210,000

Total Cost	$ 1,207,293	Total Aesthetic Treatment Cost	$ 583,714	Total Right of Way Cost	$ 420,000

Walled-Levee Corridor

Structure ID	H1F1335A

HEC1 ID	F1335A

Cutline ID	1

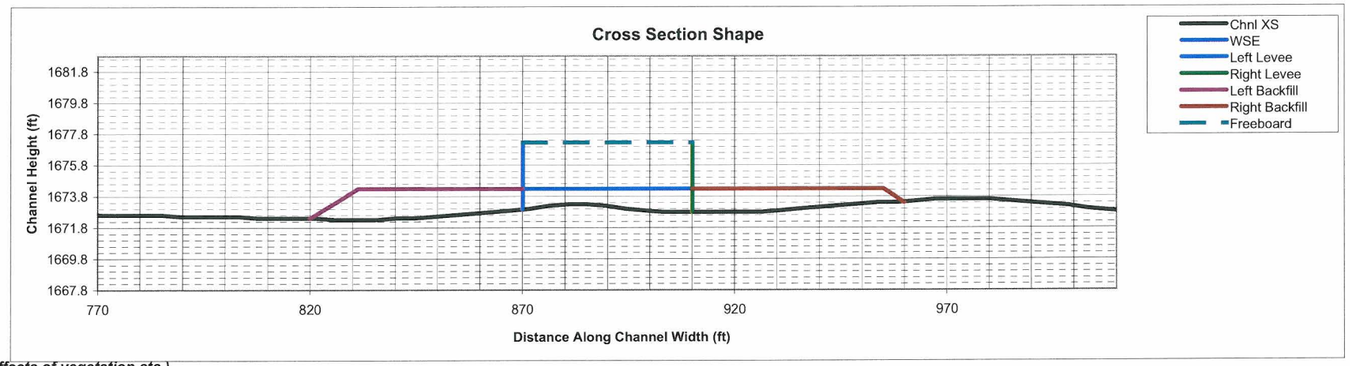
Longitudinal Geometry

Length	721.7	ft
Initial Channel Slope	0.0215	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0161	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	870	Right Levee Station (ft)	910
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	870	Right Channel Limit Station (ft)	910

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	C135A	RR13								TOTAL
HEC1 Peak-Flow	270	91								
Weighting Factor	0.92	0.08								
Flow into Channel	250	7								257

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
26	41.0	12.0	1672.8	1673.4	2.1	0.6	40.0	0.3	0.3	0.69
77	41.5	23.3	1672.8	1673.6	3.3	0.8	40.0	0.6	0.6	0.76
193	42.4	40.8	1672.8	1674.1	4.7	1.3	40.0	1.0	1.0	0.83
257	42.8	48.6	1672.8	1674.3	5.3	1.5	40.0	1.1	1.2	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
26	41.0	13.1	1672.8	1673.4	2.0	0.6	40.0	0.3	0.3	0.60
77	41.6	25.5	1672.8	1673.7	3.0	0.9	40.0	0.6	0.6	0.67
193	42.6	44.5	1672.8	1674.2	4.3	1.4	40.0	1.0	1.1	0.72
257	43.0	53.1	1672.8	1674.4	4.8	1.6	40.0	1.2	1.3	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
	H1F1335A_2									
77	0.35									0.35

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
26	Stable
77	Stable
193	Stable
257	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	77	cfs
Clear Water	No	
Total Incoming Sediment Load	0.346	cfs
Initial Chnl Sediment Capacity	0.504	cfs
Long-term Equilibrium Slope (ADWR)	0.0161	

Drop Structures

Design Slope	0.0161	ft/ft
Total Drop Needed	3.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.30	
Distance between Structures	555	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)
257	1.1	24.6	1.5	1.2	5.3	0.0215	-0.4	0.8	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	722
Channel Limit-Left Station (ft)	870
Channel Limit-Right Station (ft)	910
Channel Width (ft)	40

Levee

Left Levee Length (ft)	722
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.3
Right Levee Length (ft)	722
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	345
Left Levee Volume (cu. Yd)	57
Right Levee Surface Area (sq. Yd)	361
Right Levee Volume (cu. Yd)	60
Total Levee Surface Area (sq. Yd)	706
Total Levee Volume (cu. Yd)	117

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)	36227
Left Levee Fill XS area (sq. ft)	77.3
Left Levee Fill Volume (cu. Yd)	2067
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)	36155
Right Levee Fill XS area (sq. ft)	59.4
Right Levee Fill Volume (cu. Yd)	1588
Total Levee Fill Surface Area (sq. ft)	72382
Total Levee Fill Volume (cu Yd)	3655

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)	5.9	
Structure Height (ft)	8.9	
Number of Structures	1.30	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	13.20	1.32
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,122	$ 112
Area per structure (sq. Yd)	4	0
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	722	ft	$ 201	$ 145,093	117	cu. Yd	$ -	$ -	117	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	706	sq. Yd	$ -	$ -	706	sq. Yd	$ -	$ -	706	sq. Yd	$ 75.00	$ 52,950	
Adjacent Levee Fill	Fill	3,655	cu. Yd	$ 7.00	$ 25,585	8,022	sq. Yd	$ 4.50	$ 36,100	8,022	sq. Yd	$ 11.67	$ 93,593	
Wall Material Aesthetic Treatment Cost	Wall	117	cu. Yd	$ -	$ -	117	cu. Yd	$ -	$ -	117	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	706	sq. Yd	$ 63.00	$ 44,478	706	sq. Yd	$ -	$ -	706	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 1,122.00	$ 1,459	4	sq. Yd	$ -	$ -	4	sq. Yd	$ 37.50	$ 167	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 216,615			Total	$ 36,100			Total	$ 146,709	
		Contingency Cost (25% of Construction Cost)			$ 54,154									
		Engineering Design Cost (5% of Construction Cost)			$ 10,831									
		Total Construction Cost			$ 281,599									
Wall Material Aesthetic Treatment Cost	Wall	117	cu. Yd	$ -	$ -	117	cu. Yd	$ -	$ -	117	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	706	sq. Yd	$ 63.00	$ 44,478	706	sq. Yd	$ -	$ -	706	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,655	cu. Yd	$ 7.00	$ 25,585	8,022	sq. Yd	$ 4.50	$ 36,100	8,022	sq. Yd	$ 11.67	$ 93,593	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 112.20	$ 146	4	sq. Yd	$ -	$ -	0	sq. Yd	$ 37.50	$ 17	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 70,209			Total	$ 36,100			Total	$ 93,609	
		Contingency Cost (25% of Construction Cost)			$ 17,552									
		Engineering Design Cost (5% of Construction Cost)			$ 3,510									
		Total Construction Cost			$ 91,272									
Total Structure Aesthetic Trtmt Cost	$ 220,981													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.2	$100,000	$ 120,000
Maintenance Access	30	0.5	$100,000	$ 50,000
Channel	40	0.7	$100,000	$ 70,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	141	2.4		$ 240,000

Total Land Related Aes. Trtmt Cost	$ 120,000

Total Cost	$ 704,408	Total Aesthetic Treatment Cost	$ 340,981

Total Right of Way Cost	$ 240,000

Walled-Levee Corridor

Structure ID	H135A35B

HEC1 ID	35A35B

Cutline ID	3

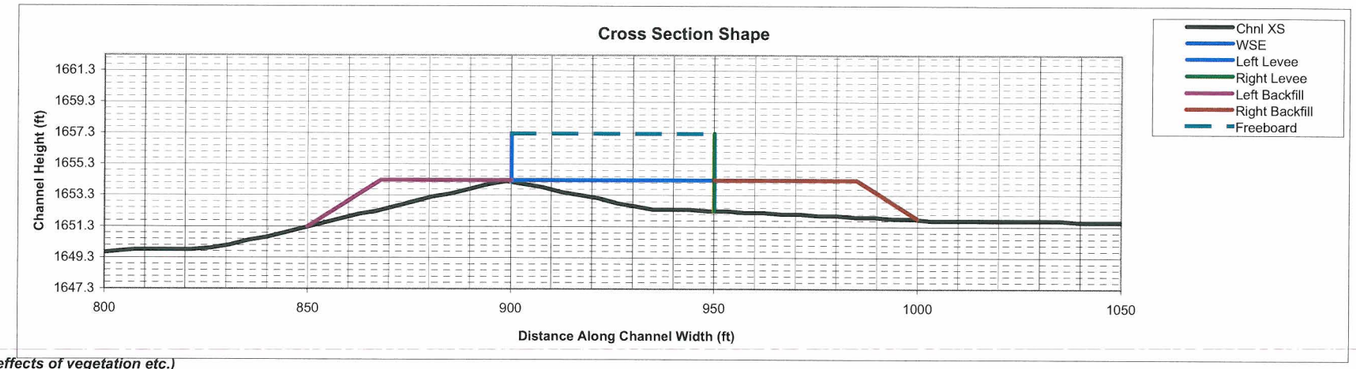
Longitudinal Geometry

Length	1296.0	ft
Initial Channel Slope	0.0217	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0149	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	900	Right Levee Station (ft)	950
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	900	Right Channel Limit Station (ft)	950

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	C135B	C135A								TOTAL
HEC1 Peak-Flow	638	270								
Weighting Factor	0.22	0.78								
Flow into Channel	138	211								349

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
35	27.0	12.2	1652.3	1653.0	2.9	0.7	26.3	0.5	0.5	0.74
105	37.2	26.8	1652.3	1653.4	3.9	1.1	36.1	0.7	0.7	0.80
262	49.3	51.9	1652.3	1654.0	5.0	1.7	47.5	1.1	1.1	0.85
349	52.1	63.0	1652.3	1654.3	5.5	2.0	50.0	1.2	1.3	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
35	28.0	13.8	1652.3	1653.0	2.5	0.7	27.3	0.5	0.5	0.62
105	39.4	30.6	1652.3	1653.5	3.4	1.2	38.1	0.8	0.8	0.67
262	52.0	59.3	1652.3	1654.2	4.4	1.9	50.0	1.1	1.2	0.71
349	52.4	70.7	1652.3	1654.4	4.9	2.1	50.0	1.3	1.4	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
	H1F1335A_1									
105	0.50									0.50

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
35	Stable
105	Stable
262	Erosive
349	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	105	cfs
Clear Water	No	
Total Incoming Sediment Load	0.504	cfs
Initial Chnl Sediment Capacity	0.877	cfs
Long-term Equilibrium Slope (ADWR)	0.0149	

Drop Structures

Design Slope	0.0149	ft/ft
Total Drop Needed	8.8	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.94	
Distance between Structures	441	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)
349	1.1	24.6	2.0	1.3	5.5	0.0217	-0.4	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1296
Channel Limit-Left Station (ft)	900
Channel Limit-Right Station (ft)	950
Channel Width (ft)	50

Levee

Left Levee Length (ft)	1296
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.1
Right Levee Length (ft)	1296
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	446
Left Levee Volume (cu. Yd)	74
Right Levee Surface Area (sq. Yd)	720
Right Levee Volume (cu. Yd)	120
Total Levee Surface Area (sq. Yd)	1166
Total Levee Volume (cu. Yd)	194

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)	65059
Left Levee Fill XS area (sq. ft)	46.1
Left Levee Fill Volume (cu. Yd)	2213
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)	65059
Right Levee Fill XS area (sq. ft)	92.9
Right Levee Fill Volume (cu. Yd)	4459
Total Levee Fill Surface Area (sq. ft)	130118
Total Levee Fill Volume (cu Yd)	6672

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)	6.2	
Structure Height (ft)	9.2	
Number of Structures	2.94	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	16.99	1.70
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,444	$ 145
Area per structure (sq. Yd)	6	1
Total Area (cu. Yd)	16	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	1,296	ft	$ 213	$ 276,548	194	cu. Yd	$ -	$ -	194	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,166	sq. Yd	$ -	$ -	1,166	sq. Yd	$ -	$ -	1,166	sq. Yd	$ 75.00	$ 87,450
Adjacent Levee Fill	Fill	6,672	cu. Yd	$ 7.00	$ 46,704	14,400	sq. Yd	$ 4.50	$ 64,800	14,400	sq. Yd	$ 11.67	$ 168,000
Wall Material Aesthetic Treatment Cost	Wall	194	cu. Yd	$ -	$ -	194	cu. Yd	$ -	$ -	194	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,166	sq. Yd	$ 63.00	$ 73,458	1,166	sq. Yd	$ -	$ -	1,166	sq. Yd	$ -	$ -
Drop Structures	Gabions	3	EA	$ 1,444.15	$ 4,246	6	sq. Yd	$ -	$ -	6	sq. Yd	$ 37.50	$ 208
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 400,956			Total	$ 64,800			Total	$ 255,658
		Contingency Cost (25% of Construction Cost)			$ 100,239								
		Engineering Design Cost (5% of Construction Cost)			$ 20,048								
		Total Construction Cost			$ 521,243								
Wall Material Aesthetic Treatment Cost	Wall	194	cu. Yd	$ -	$ -	194	cu. Yd	$ -	$ -	194	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,166	sq. Yd	$ 63.00	$ 73,458	1,166	sq. Yd	$ -	$ -	1,166	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,672	cu. Yd	$ 7.00	$ 46,704	14,400	sq. Yd	$ 4.50	$ 64,800	14,400	sq. Yd	$ 11.67	$ 168,000
Drop Structures Aesthetic Trtmt. Cost	Gabions	3	EA	$ 144.50	$ 425	6	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 21
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 120,587			Total	$ 64,800			Total	$ 168,021
		Contingency Cost (25% of Construction Cost)			$ 30,147								
		Engineering Design Cost (5% of Construction Cost)			$ 6,029								
		Total Construction Cost			$ 156,763								

Total Structure Aesthetic Trtmt Cost	$ 389,584

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	50	1.5	$100,000	$ 150,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	151	4.5		$ 450,000

Total Land Related Aes. Trtmt Cost	$ 210,000

Total Cost	$ 1,291,701	Total Aesthetic Treatment Cost	$ 599,584	Total Right of Way Cost	$ 450,000

Walled-Levee Corridor

Structure ID	H135A35B

HEC1 ID	35A35B

Cutline ID	2

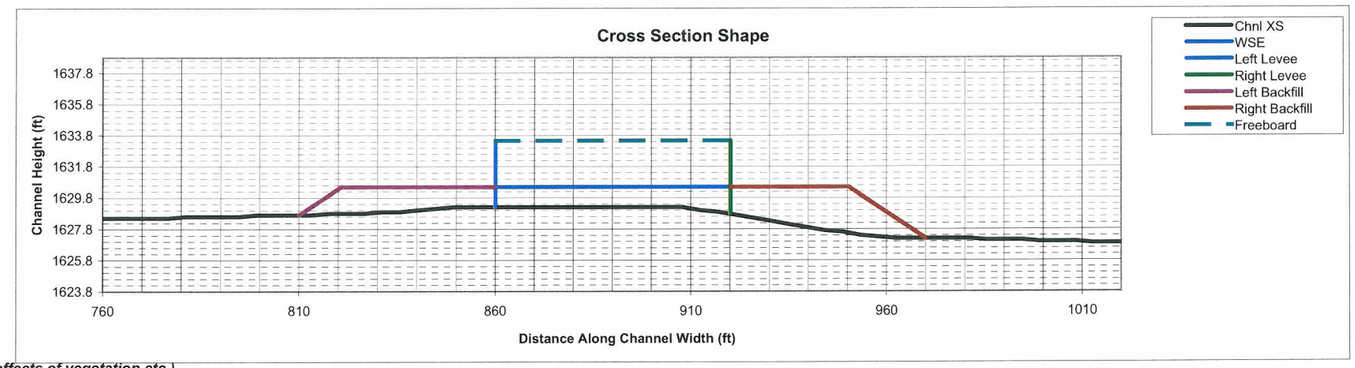
Longitudinal Geometry

Length	1002.4	ft
Initial Channel Slope	0.0210	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0200	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	860	Right Levee Station (ft)	920
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	860	Right Channel Limit Station (ft)	920

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	C135B	C135A							TOTAL
HEC1 Peak-Flow	638	270							
Weighting Factor	0.48	0.52							
Flow into Channel	306	140							446

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	61.0	19.7	1628.8	1629.5	2.3	0.7	60.0	0.3	0.3	0.69
134	61.6	38.3	1628.8	1629.8	3.5	1.0	60.0	0.6	0.6	0.77
335	62.6	66.8	1628.8	1630.3	5.0	1.5	60.0	1.1	1.1	0.84
446	63.0	79.6	1628.8	1630.5	5.6	1.7	60.0	1.3	1.3	0.86

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	61.0	20.0	1628.8	1629.5	2.2	0.7	60.0	0.3	0.3	0.68
134	61.6	38.9	1628.8	1629.8	3.4	1.0	60.0	0.6	0.6	0.75
335	62.6	67.8	1628.8	1630.3	4.9	1.5	60.0	1.1	1.1	0.82
446	63.0	80.8	1628.8	1630.5	5.5	1.7	60.0	1.3	1.3	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
	H135A35B_3									
134	0.88									0.88

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
45	Stable
134	Stable
335	Erosive
446	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	134	cfs
Clear Water	No	
Total Incoming Sediment Load	0.877	cfs
Initial Chnl Sediment Capacity	0.936	cfs
Long-term Equilibrium Slope (ADWR)	0.0200	

Drop Structures

Design Slope	0.0200	ft/ft
Total Drop Needed	1.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.33	
Distance between Structures	3037	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)
446	1.1	24.6	1.7	1.3	5.6	0.0210	-0.4	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1002
Channel Limit-Left Station (ft)	860
Channel Limit-Right Station (ft)	920
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1002
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.3
Right Levee Length (ft)	1002
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	479
Left Levee Volume (cu. Yd)	80
Right Levee Surface Area (sq. Yd)	523
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1002
Total Levee Volume (cu. Yd)	167

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)	50218
Left Levee Fill XS area (sq. ft)	66.6
Left Levee Fill Volume (cu. Yd)	2472
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)	50418
Right Levee Fill XS area (sq. ft)	102.3
Right Levee Fill Volume (cu. Yd)	3796
Total Levee Fill Surface Area (sq. ft)	100636
Total Levee Fill Volume (cu Yd)	6268

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)	6.5	
Structure Height (ft)	9.5	
Number of Structures	0.33	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	21.16	2.12
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,799	$ 180
Area per structure (sq. Yd)	7	1
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	1,002	ft	$ 228	$ 228,286	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,002	sq. Yd	$ -	$ -	1,002	sq. Yd	$ -	$ -	1,002	sq. Yd	$ 75.00	$ 75,150	
Adjacent Levee Fill	Fill	6,268	cu. Yd	$ 7.00	$ 43,876	11,133	sq. Yd	$ 4.50	$ 50,100	11,133	sq. Yd	$ 11.67	$ 129,889	
Wall Material Aesthetic Treatment Cost	Wall	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,002	sq. Yd	$ 63.00	$ 63,126	1,002	sq. Yd	$ -	$ -	1,002	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 1,798.60	$ 594	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 335,882			Total	$ 50,100			Total	$ 205,289	
		Contingency Cost (25% of Construction Cost)			$ 83,970									
		Engineering Design Cost (5% of Construction Cost)			$ 16,794									
		Total Construction Cost			$ 436,646									
Wall Material Aesthetic Treatment Cost	Wall	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,002	sq. Yd	$ 63.00	$ 63,126	1,002	sq. Yd	$ -	$ -	1,002	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,268	cu. Yd	$ 7.00	$ 43,876	11,133	sq. Yd	$ 4.50	$ 50,100	11,133	sq. Yd	$ 11.67	$ 129,889	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 180.20	$ 59	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 107,061			Total	$ 50,100			Total	$ 129,914	
		Contingency Cost (25% of Construction Cost)			$ 26,765									
		Engineering Design Cost (5% of Construction Cost)			$ 5,353									
		Total Construction Cost			$ 139,180									

Total Structure Aesthetic Trtmt Cost	$ 319,194

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	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,062,035	Total Aesthetic Treatment Cost	$ 479,194	Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H135A35B

HEC1 ID	35A35B

Cutline ID	1

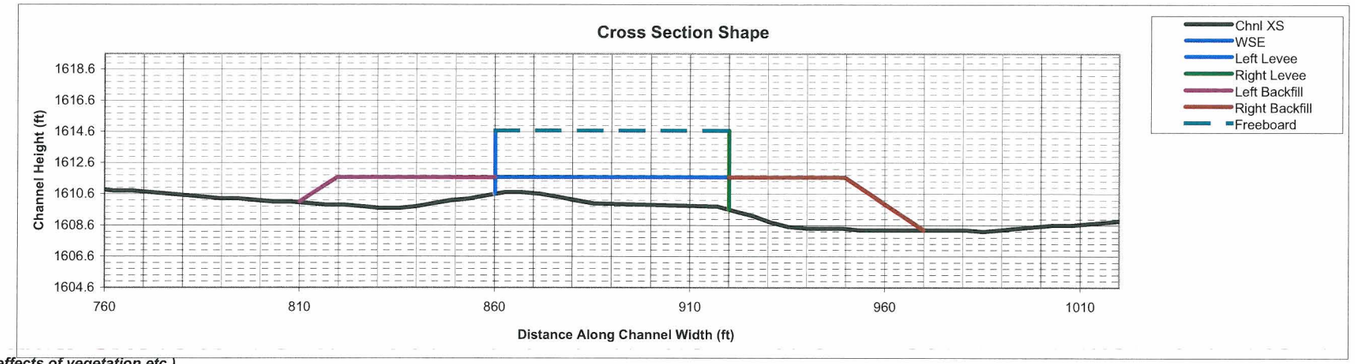
Longitudinal Geometry

Length	1461.7	ft
Initial Channel Slope	0.0192	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0204	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	860	Right Levee Station (ft)	920
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	860	Right Channel Limit Station (ft)	920

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	C135B	C135A								TOTAL
HEC1 Peak-Flow	638	270								
Weighting Factor	0.74	0.26								
Flow into Channel	472	70								542

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	44.8	20.1	1609.6	1610.4	2.7	0.8	44.0	0.4	0.5	0.70
163	61.6	44.2	1609.6	1610.9	3.7	1.3	60.0	0.7	0.7	0.76
407	62.7	77.1	1609.6	1611.4	5.3	1.8	60.0	1.2	1.3	0.82
542	63.2	92.0	1609.6	1611.7	5.9	2.1	60.0	1.5	1.5	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
54	44.6	19.7	1609.6	1610.4	2.7	0.8	43.8	0.4	0.5	0.72
163	61.5	43.4	1609.6	1610.9	3.7	1.3	60.0	0.7	0.7	0.78
407	62.6	75.7	1609.6	1611.4	5.4	1.8	60.0	1.2	1.3	0.84
542	63.1	90.3	1609.6	1611.6	6.0	2.0	60.0	1.4	1.5	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
	H135A35B_2	T135B10								
163	0.94	0.28								1.22

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
54	Stable
163	Stable
407	Erosive
542	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	163	cfs
Clear Water	No	
Total Incoming Sediment Load	1.216	cfs
Initial Chnl Sediment Capacity	1.119	cfs
Long-term Equilibrium Slope (ADWR)	0.0204	

Drop Structures

Design Slope	0.0204	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)
542	1.1	24.6	2.1	1.5	5.9	0.0192	-0.5	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1462
Channel Limit-Left Station (ft)	860
Channel Limit-Right Station (ft)	920
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1462
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.1
Right Levee Length (ft)	1462
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	666
Left Levee Volume (cu. Yd)	111
Right Levee Surface Area (sq. Yd)	828
Right Levee Volume (cu. Yd)	138
Total Levee Surface Area (sq. Yd)	1494
Total Levee Volume (cu. Yd)	249

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)	73229
Left Levee Fill XS area (sq. ft)	76.4
Left Levee Fill Volume (cu. Yd)	4137
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)	73521
Right Levee Fill XS area (sq. ft)	120.9
Right Levee Fill Volume (cu. Yd)	6547
Total Levee Fill Surface Area (sq. ft)	146750
Total Levee Fill Volume (cu Yd)	10684

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)	7.3	
Structure Height (ft)	10.3	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	22.86	2.29
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,943	$ 195
Area per structure (sq. Yd)	7	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	1,462	ft	$ 228	$ 333,088	249	cu. Yd	$ -	$ -	249	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,494	sq. Yd	$ -	$ -	1,494	sq. Yd	$ -	$ -	1,494	sq. Yd	$ 75.00	$ 112,050
Adjacent Levee Fill	Fill	10,684	cu. Yd	$ 7.00	$ 74,788	16,244	sq. Yd	$ 4.50	$ 73,100	16,244	sq. Yd	$ 11.67	$ 189,519
Wall Material Aesthetic Treatment Cost	Wall	249	cu. Yd	$ -	$ -	249	cu. Yd	$ -	$ -	249	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,494	sq. Yd	$ 63.00	$ 94,122	1,494	sq. Yd	$ -	$ -	1,494	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 1,943.10	$ -	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 501,998			Total	$ 73,100			Total	$ 301,819
		Contingency Cost (25% of Construction Cost)			$ 125,500								
		Engineering Design Cost (5% of Construction Cost)			$ 25,100								
		Total Construction Cost			$ 652,598								
Wall Material Aesthetic Treatment Cost	Wall	249	cu. Yd	$ -	$ -	249	cu. Yd	$ -	$ -	249	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,494	sq. Yd	$ 63.00	$ 94,122	1,494	sq. Yd	$ -	$ -	1,494	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	10,684	cu. Yd	$ 7.00	$ 74,788	16,244	sq. Yd	$ 4.50	$ 73,100	16,244	sq. Yd	$ 11.67	$ 189,519
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 194.65	$ -	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 168,910			Total	$ 73,100			Total	$ 189,544
		Contingency Cost (25% of Construction Cost)			$ 42,228								
		Engineering Design Cost (5% of Construction Cost)			$ 8,446								
		Total Construction Cost			$ 219,583								

Total Structure Aesthetic Trtmt Cost	$ 482,227

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.3	$100,000	$ 230,000
Maintenance Access	30	1	$100,000	$ 100,000
Channel	60	2	$100,000	$ 200,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	5.3		$ 530,000

Total Land Related Aes. Trtmt Cost	$ 230,000

Total Cost	$ 1,557,516	Total Aesthetic Treatment Cost	$ 712,227	Total Right of Way Cost	$ 530,000

Walled-Levee Corridor

Structure ID	H135B35C

HEC1 ID	35B35C

Cutline ID	5

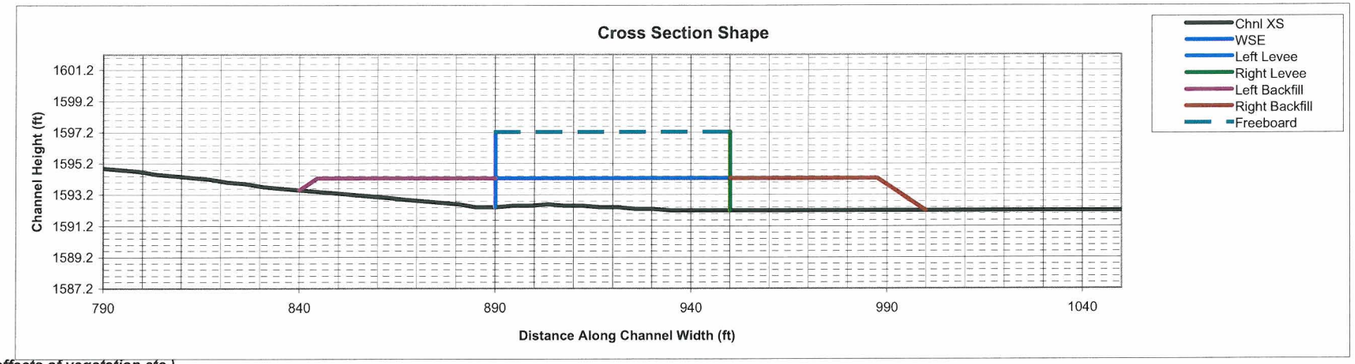
Longitudinal Geometry

Length	539.4	ft
Initial Channel Slope	0.0135	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0267	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	890	Right Levee Station (ft)	950
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	890	Right Channel Limit Station (ft)	950

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	C135B									TOTAL
HEC1 Peak-Flow	638									
Weighting Factor	1.00									
Flow into Channel	638									638

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	61.1	27.9	1592.2	1592.8	2.3	0.6	60.0	0.5	0.5	0.59
191	62.0	54.3	1592.2	1593.3	3.5	1.1	60.0	0.9	0.9	0.65
479	63.3	94.9	1592.2	1594.0	5.0	1.8	60.0	1.5	1.6	0.71
638	63.9	113.3	1592.2	1594.3	5.6	2.1	60.0	1.8	1.9	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
64	60.9	22.7	1592.2	1592.8	2.8	0.6	60.0	0.4	0.4	0.80
191	61.6	44.2	1592.2	1593.1	4.3	0.9	60.0	0.7	0.7	0.89
479	62.7	77.1	1592.2	1593.7	6.2	1.5	60.0	1.2	1.3	0.97
638	63.2	91.9	1592.2	1593.9	6.9	1.7	60.0	1.5	1.5	0.99

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
	H135A35B_1	T135B20	T135B30						
191	1.12	0.70	0.45						2.27

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
64	Stable
191	Stable
479	Erosive
638	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	191	cfs
Clear Water	No	
Total Incoming Sediment Load	2.271	cfs
Initial Chnl Sediment Capacity	0.874	cfs
Long-term Equilibrium Slope (ADWR)	0.0267	

Drop Structures

Design Slope	0.0267	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)
638	1.1	24.6	2.1	1.9	5.6	0.0135	-0.5	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	539
Channel Limit-Left Station (ft)	890
Channel Limit-Right Station (ft)	950
Channel Width (ft)	60

Levee

Left Levee Length (ft)	539
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	539
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	293
Left Levee Volume (cu. Yd)	49
Right Levee Surface Area (sq. Yd)	305
Right Levee Volume (cu. Yd)	51
Total Levee Surface Area (sq. Yd)	598
Total Levee Volume (cu. Yd)	100

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)	27021
Left Levee Fill XS area (sq. ft)	64.4
Left Levee Fill Volume (cu. Yd)	1286
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)	27075
Right Levee Fill XS area (sq. ft)	90.3
Right Levee Fill Volume (cu. Yd)	1803
Total Levee Fill Surface Area (sq. ft)	54096
Total Levee Fill Volume (cu Yd)	3089

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	60	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	24.71	2.47
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,100	$ 210
Area per structure (sq. Yd)	7	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	539	ft	$ 255	$ 137,284	100	cu. Yd	$ -	$ -	100	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	598	sq. Yd	$ -	$ -	598	sq. Yd	$ -	$ -	598	sq. Yd	$ 75.00	$ 44,850
Adjacent Levee Fill	Fill	3,089	cu. Yd	$ 7.00	$ 21,623	5,989	sq. Yd	$ 4.50	$ 26,950	5,989	sq. Yd	$ 11.67	$ 69,870
Wall Material Aesthetic Treatment Cost	Wall	100	cu. Yd	$ -	$ -	100	cu. Yd	$ -	$ -	100	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	598	sq. Yd	$ 63.00	$ 37,674	598	sq. Yd	$ -	$ -	598	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,100.35	$ -	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 196,581			Total	$ 26,950			Total	$ 114,970
		Contingency Cost (25% of Construction Cost)			$ 49,145								
		Engineering Design Cost (5% of Construction Cost)			$ 9,829								
		Total Construction Cost			$ 255,555								
Wall Material Aesthetic Treatment Cost	Wall	100	cu. Yd	$ -	$ -	100	cu. Yd	$ -	$ -	100	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	598	sq. Yd	$ 63.00	$ 37,674	598	sq. Yd	$ -	$ -	598	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,089	cu. Yd	$ 7.00	$ 21,623	5,989	sq. Yd	$ 4.50	$ 26,950	5,989	sq. Yd	$ 11.67	$ 69,870
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 209.95	$ -	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 59,297			Total	$ 26,950			Total	$ 69,895
		Contingency Cost (25% of Construction Cost)			$ 14,824								
		Engineering Design Cost (5% of Construction Cost)			$ 2,965								
		Total Construction Cost			$ 77,086								

Total Structure Aesthetic Trtmt Cost	$ 173,931

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	60	0.7	$100,000	$ 70,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	2		$ 200,000

Total Land Related Aes. Trtmt Cost	$ 90,000

Total Cost	$ 597,476	Total Aesthetic Treatment Cost	$ 263,931	Total Right of Way Cost	$ 200,000

Walled-Levee Corridor

Structure ID	H135B35C

HEC1 ID	35B35C

Cutline ID	4

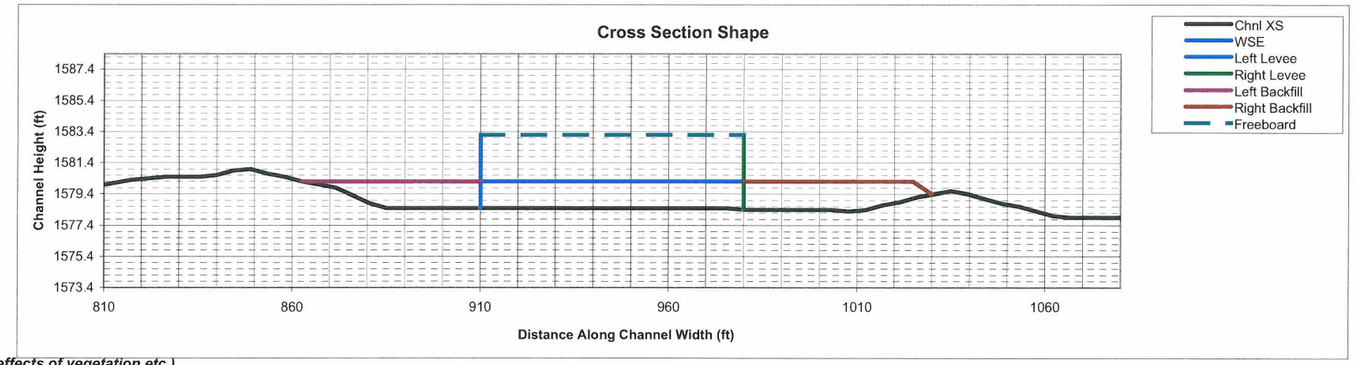
Longitundal Geometry

Length	1166.1	ft
Initial Channel Slope	0.0151	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0134	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	910	Right Levee Station (ft)	980
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	910	Right Channel Limit Station (ft)	980

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	C135C	C135B								TOTAL
HEC1 Peak-Flow	795	638								
Weighting Factor	0.21	0.79								
Flow into Channel	167	504								671

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
67	70.9	29.6	1578.4	1578.9	2.3	0.5	70.0	0.4	0.4	0.62
201	71.7	57.4	1578.4	1579.3	3.5	0.9	70.0	0.8	0.8	0.68
503	72.9	100.1	1578.4	1579.9	5.0	1.5	70.0	1.4	1.4	0.74
671	73.5	119.4	1578.4	1580.2	5.6	1.8	70.0	1.6	1.7	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
67	71.0	30.6	1578.4	1578.9	2.2	0.5	70.0	0.4	0.4	0.58
201	71.8	59.5	1578.4	1579.3	3.4	0.9	70.0	0.8	0.9	0.65
503	73.0	103.8	1578.4	1580.0	4.8	1.6	70.0	1.4	1.5	0.70
671	73.6	123.8	1578.4	1580.3	5.4	1.9	70.0	1.7	1.8	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
	H135B35C_5									
201	0.87									0.87

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
67	Stable
201	Stable
503	Erosive
671	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	201	cfs
Clear Water	No	
Total Incoming Sediment Load	0.874	cfs
Initial Chnl Sediment Capacity	1.029	cfs
Long-term Equilibrium Slope (ADWR)	0.0134	

Drop Structures

Design Slope	0.0134	ft/ft
Total Drop Needed	2.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.66	
Distance between Structures	1767	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)
671	1.1	24.6	1.8	1.7	5.6	0.0151	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1166
Channel Limit-Left Station (ft)	910
Channel Limit-Right Station (ft)	980
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1166
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.7
Right Levee Length (ft)	1166
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.8

Left Levee Surface Area (sq. Yd)	609
Left Levee Volume (cu. Yd)	101
Right Levee Surface Area (sq. Yd)	622
Right Levee Volume (cu. Yd)	104
Total Levee Surface Area (sq. Yd)	1231
Total Levee Volume (cu. Yd)	205

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	47.4
Left Levee Fill Surface Area (sq. ft)	55271
Left Levee Fill XS area (sq. ft)	59.1
Left Levee Fill Volume (cu. Yd)	2552
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)	58419
Right Levee Fill XS area (sq. ft)	79.6
Right Levee Fill Volume (cu. Yd)	3438
Total Levee Fill Surface Area (sq. ft)	113690
Total Levee Fill Volume (cu Yd)	5990

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)	7.3
Structure Height (ft)	10.3
Number of Structures	0.66

	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	26.77	2.68
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,275	$ 228
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	5	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	1,166	ft	$ 255	$ 296,982	205	cu. Yd	$ -	$ -	205	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,231	sq. Yd	$ -	$ -	1,231	sq. Yd	$ -	$ -	1,231	sq. Yd	$ 75.00	$ 92,325	
Adjacent Levee Fill	Fill	5,990	cu. Yd	$ 7.00	$ 41,930	12,619	sq. Yd	$ 4.50	$ 56,784	12,619	sq. Yd	$ 11.67	$ 147,218	
Wall Material Aesthetic Treatment Cost	Wall	205	cu. Yd	$ -	$ -	205	cu. Yd	$ -	$ -	205	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,231	sq. Yd	$ 63.00	$ 77,553	1,231	sq. Yd	$ -	$ -	1,231	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,275.45	$ 1,502	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 417,967			Total	$ 56,784			Total	$ 239,835	
		Contingency Cost (25% of Construction Cost)			$ 104,492									
		Engineering Design Cost (5% of Construction Cost)			$ 20,898									
		Total Construction Cost			$ 543,357									
Wall Material Aesthetic Treatment Cost	Wall	205	cu. Yd	$ -	$ -	205	cu. Yd	$ -	$ -	205	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,231	sq. Yd	$ 63.00	$ 77,553	1,231	sq. Yd	$ -	$ -	1,231	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,990	cu. Yd	$ 7.00	$ 41,930	12,619	sq. Yd	$ 4.50	$ 56,784	12,619	sq. Yd	$ 11.67	$ 147,218	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 227.80	$ 150	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 119,633			Total	$ 56,784			Total	$ 147,247	
		Contingency Cost (25% of Construction Cost)			$ 29,908									
		Engineering Design Cost (5% of Construction Cost)			$ 5,982									
		Total Construction Cost			$ 155,523									

Total Structure Aesthetic Trtmt Cost	$ 359,555

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	70	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	4.6		$ 460,000

Total Land Related Aes. Trtmt Cost	$ 190,000

Total Cost	$ 1,299,976	Total Aesthetic Treatment Cost	$ 549,555	Total Right of Way Cost	$ 460,000

Walled-Levee Corridor

Structure ID	H135B35C

HEC1 ID	35B35C

Cutline ID	3

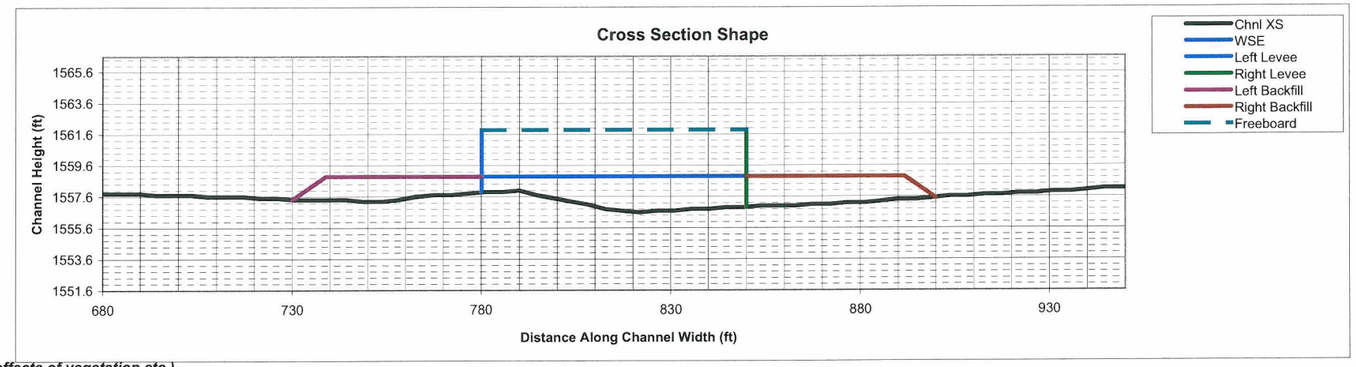
Longitudinal Geometry

Length	1015.8	ft
Initial Channel Slope	0.0152	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0153	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	780	Right Levee Station (ft)	850
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	780	Right Channel Limit Station (ft)	850

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	C135C	C135B								TOTAL
HEC1 Peak-Flow	795	638								
Weighting Factor	0.48	0.52								
Flow into Channel	383	330								713

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
71	48.9	26.4	1556.6	1557.4	2.7	0.8	48.4	0.5	0.5	0.65
214	69.4	58.6	1556.6	1558.0	3.6	1.4	68.2	0.8	0.9	0.69
535	72.5	103.4	1556.6	1558.6	5.2	2.0	70.0	1.4	1.5	0.75
713	73.0	123.2	1556.6	1558.9	5.8	2.3	70.0	1.7	1.8	0.77

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
71	48.9	26.3	1556.6	1557.4	2.7	0.8	48.4	0.5	0.5	0.65
214	69.2	58.5	1556.6	1558.0	3.7	1.4	68.0	0.8	0.9	0.70
535	72.5	103.2	1556.6	1558.6	5.2	2.0	70.0	1.4	1.5	0.75
713	73.0	123.0	1556.6	1558.9	5.8	2.3	70.0	1.7	1.8	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
	H135B35C_4	T135C10								
214	1.03	0.15								1.18

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
71	Stable
214	Stable
535	Erosive
713	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	214	cfs
Clear Water	No	
Total Incoming Sediment Load	1.182	cfs
Initial Chnl Sediment Capacity	1.173	cfs
Long-term Equilibrium Slope (ADWR)	0.0153	

Drop Structures

Design Slope	0.0153	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)
713	1.1	24.6	2.3	1.8	5.8	0.0152	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1016
Channel Limit-Left Station (ft)	780
Channel Limit-Right Station (ft)	850
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1016
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4
Right Levee Length (ft)	1016
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	452
Left Levee Volume (cu. Yd)	75
Right Levee Surface Area (sq. Yd)	564
Right Levee Volume (cu. Yd)	94
Total Levee Surface Area (sq. Yd)	1016
Total Levee Volume (cu. Yd)	169

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)	50889
Left Levee Fill XS area (sq. ft)	62.9
Left Levee Fill Volume (cu. Yd)	2367
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)	50889
Right Levee Fill XS area (sq. ft)	79.8
Right Levee Fill Volume (cu. Yd)	3003
Total Levee Fill Surface Area (sq. ft)	101778
Total Levee Fill Volume (cu Yd)	5370

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)	7.7	
Structure Height (ft)	10.7	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.63	2.76
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,349	$ 235
Area per structure (sq. Yd)	8	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	1,016	ft	$ 228	$ 231,476	169	cu. Yd	$ -	$ -	169	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,016	sq. Yd	$ -	$ -	1,016	sq. Yd	$ -	$ -	1,016	sq. Yd	$ 75.00	$ 76,200
Adjacent Levee Fill	Fill	5,370	cu. Yd	$ 7.00	$ 37,590	11,289	sq. Yd	$ 4.50	$ 50,800	11,289	sq. Yd	$ 11.67	$ 131,704
Wall Material Aesthetic Treatment Cost	Wall	169	cu. Yd	$ -	$ -	169	cu. Yd	$ -	$ -	169	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,016	sq. Yd	$ 63.00	$ 64,008	1,016	sq. Yd	$ -	$ -	1,016	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,348.55	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 333,074			Total	$ 50,800			Total	$ 208,195
		Contingency Cost (25% of Construction Cost)			$ 83,268								
		Engineering Design Cost (5% of Construction Cost)			$ 16,654								
		Total Construction Cost			$ 432,996								
Wall Material Aesthetic Treatment Cost	Wall	169	cu. Yd	$ -	$ -	169	cu. Yd	$ -	$ -	169	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,016	sq. Yd	$ 63.00	$ 64,008	1,016	sq. Yd	$ -	$ -	1,016	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,370	cu. Yd	$ 7.00	$ 37,590	11,289	sq. Yd	$ 4.50	$ 50,800	11,289	sq. Yd	$ 11.67	$ 131,704
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 234.60	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 101,598			Total	$ 50,800			Total	$ 131,733
		Contingency Cost (25% of Construction Cost)			$ 25,400								
		Engineering Design Cost (5% of Construction Cost)			$ 5,080								
		Total Construction Cost			$ 132,077								
Total Structure Aesthetic Trtmt Cost	$ 314,610												

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	70	1.6	$100,000	$ 160,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	3.9		$ 390,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,081,991	Total Aesthetic Treatment Cost	$ 474,610

Total Right of Way Cost	$ 390,000

Walled-Levee Corridor

Structure ID	H135B35C

HEC1 ID	35B35C

Cutline ID	2

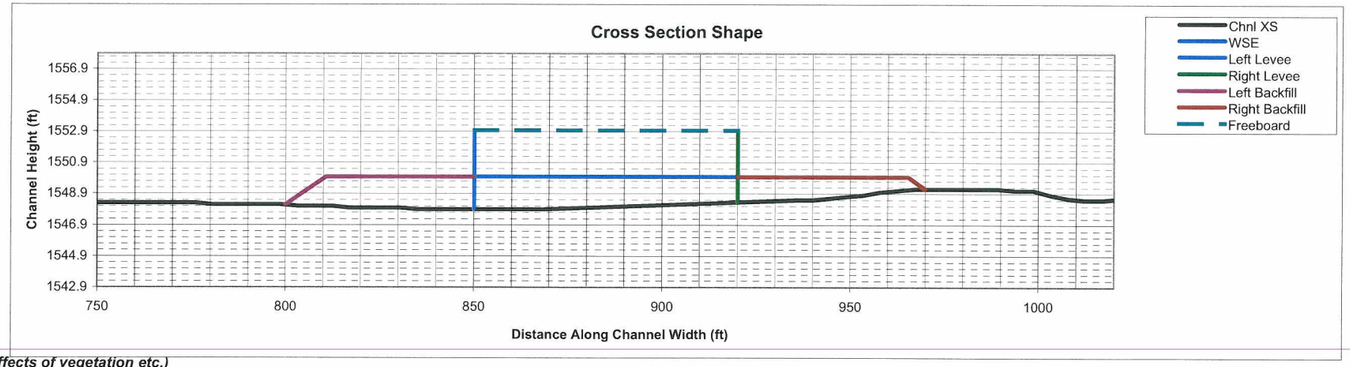
Longitudal Geometry

Length	849.7	ft
Initial Channel Slope	0.0129	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0149	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	850	Right Levee Station (ft)	920
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	850	Right Channel Limit Station (ft)	920

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	C135C	C135B								TOTAL
HEC1 Peak-Flow	795	638								
Weighting Factor	0.63	0.37								
Flow into Channel	501	236								737

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
74	70.8	32.8	1547.9	1548.5	2.2	0.6	70.0	0.5	0.5	0.58
221	71.7	63.7	1547.9	1549.0	3.5	1.1	70.0	0.9	0.9	0.64
553	73.1	111.1	1547.9	1549.7	5.0	1.8	70.0	1.5	1.6	0.70
737	73.7	132.5	1547.9	1550.0	5.6	2.1	70.0	1.8	1.9	0.71

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
74	70.8	31.4	1547.9	1548.5	2.3	0.6	70.0	0.4	0.4	0.62
221	71.6	60.9	1547.9	1548.9	3.6	1.0	70.0	0.9	0.9	0.69
553	72.9	106.3	1547.9	1549.6	5.2	1.7	70.0	1.5	1.5	0.74
737	73.5	126.8	1547.9	1549.9	5.8	2.0	70.0	1.7	1.8	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
	H135B35C_3									
221	1.17									1.17

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
74	Stable
221	Stable
553	Stable
737	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	221	cfs
Clear Water	No	
Total Incoming Sediment Load	1.173	cfs
Initial Chnl Sediment Capacity	0.957	cfs
Long-term Equilibrium Slope (ADWR)	0.0149	

Drop Structures

Design Slope	0.0149	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)
737	1.1	24.6	2.1	1.9	5.6	0.0129	-0.5	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	850
Channel Limit-Left Station (ft)	850
Channel Limit-Right Station (ft)	920
Channel Width (ft)	70

Levee

Left Levee Length (ft)	850
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	850
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	482
Left Levee Volume (cu. Yd)	80
Right Levee Surface Area (sq. Yd)	434
Right Levee Volume (cu. Yd)	72
Total Levee Surface Area (sq. Yd)	916
Total Levee Volume (cu. Yd)	152

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)	42567
Left Levee Fill XS area (sq. ft)	88.9
Left Levee Fill Volume (cu. Yd)	2799
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)	42567
Right Levee Fill XS area (sq. ft)	61.3
Right Levee Fill Volume (cu. Yd)	1930
Total Levee Fill Surface Area (sq. ft)	85134
Total Levee Fill Volume (cu Yd)	4729

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)	7.8	
Structure Height (ft)	10.8	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.96	2.80
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,377	$ 238
Area per structure (sq. Yd)	8	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	850	ft	$ 255	$ 216,496	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	916	sq. Yd	$ -	$ -	916	sq. Yd	$ -	$ -	916	sq. Yd	$ 75.00	$ 68,700
Adjacent Levee Fill	Fill	4,729	cu. Yd	$ 7.00	$ 33,103	9,444	sq. Yd	$ 4.50	$ 42,500	9,444	sq. Yd	$ 11.67	$ 110,185
Wall Material Aesthetic Treatment Cost	Wall	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	916	sq. Yd	$ 63.00	$ 57,708	916	sq. Yd	$ -	$ -	916	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,376.60	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 307,307			Total	$ 42,500			Total	$ 179,177
		Contingency Cost (25% of Construction Cost)			$ 76,827								
		Engineering Design Cost (5% of Construction Cost)			$ 15,365								
		Total Construction Cost			$ 399,499								
Wall Material Aesthetic Treatment Cost	Wall	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	916	sq. Yd	$ 63.00	$ 57,708	916	sq. Yd	$ -	$ -	916	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,729	cu. Yd	$ 7.00	$ 33,103	9,444	sq. Yd	$ 4.50	$ 42,500	9,444	sq. Yd	$ 11.67	$ 110,185
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 238.00	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 90,811			Total	$ 42,500			Total	$ 110,214
		Contingency Cost (25% of Construction Cost)			$ 22,703								
		Engineering Design Cost (5% of Construction Cost)			$ 4,541								
		Total Construction Cost			$ 118,054								
Total Structure Aesthetic Trtmt Cost	$ 270,769												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.4	$100,000	$ 140,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	70	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	3.4		$ 340,000

Total Land Related Aes. Trtmt Cost	$ 140,000

Total Cost	$ 961,176	Total Aesthetic Treatment Cost	$ 410,769	Total Right of Way Cost	$ 340,000

Walled-Levee Corridor

Structure ID	H135B35C

HEC1 ID	35B35C

Cutline ID	1

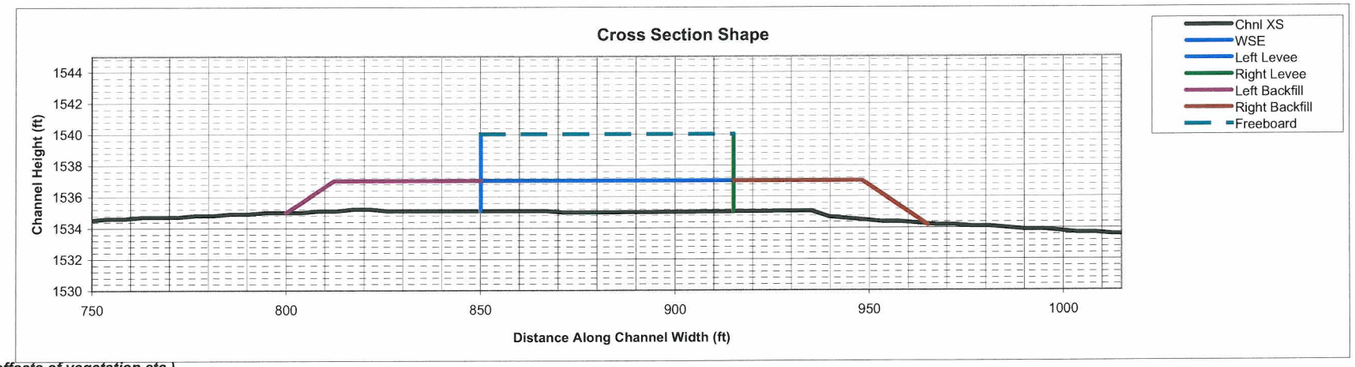
Longitundal Geometry

Length	1309.3	ft
Initial Channel Slope	0.0140	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0120	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	850	Right Levee Station (ft)	915
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	850	Right Channel Limit Station (ft)	915

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	C135C	C135B								TOTAL
HEC1 Peak-Flow	795	638								
Weighting Factor	0.84	0.16								
Flow into Channel	665	104								769

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
77	65.9	31.9	1535.0	1535.5	2.4	0.5	65.0	0.5	0.5	0.61
231	66.8	61.9	1535.0	1536.0	3.7	1.0	65.0	0.9	1.0	0.67
577	68.3	108.3	1535.0	1536.7	5.3	1.7	65.0	1.6	1.7	0.73
769	68.9	129.1	1535.0	1537.0	6.0	2.0	65.0	1.9	2.0	0.74

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
77	66.0	33.4	1535.0	1535.6	2.3	0.6	65.0	0.5	0.5	0.57
231	66.9	64.9	1535.0	1536.0	3.6	1.0	65.0	1.0	1.0	0.63
577	68.4	113.5	1535.0	1536.8	5.1	1.8	65.0	1.7	1.7	0.68
769	69.1	135.4	1535.0	1537.1	5.7	2.1	65.0	2.0	2.1	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
	H135B35C_2								
231	0.96								0.96

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
77	Stable
231	Stable
577	Erosive
769	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	231	cfs
Clear Water	No	
Total Incoming Sediment Load	0.957	cfs
Initial Chnl Sediment Capacity	1.184	cfs
Long-term Equilibrium Slope (ADWR)	0.0120	

Drop Structures

Design Slope	0.0120	ft/ft
Total Drop Needed	2.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.87	
Distance between Structures	1505	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)
769	1.1	24.6	2.0	2.0	6.0	0.0140	-0.4	1.0	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1309
Channel Limit-Left Station (ft)	850
Channel Limit-Right Station (ft)	915
Channel Width (ft)	65

Levee

Left Levee Length (ft)	1309
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1309
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	713
Left Levee Volume (cu. Yd)	119
Right Levee Surface Area (sq. Yd)	727
Right Levee Volume (cu. Yd)	121
Total Levee Surface Area (sq. Yd)	1440
Total Levee Volume (cu. Yd)	240

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)	65727
Left Levee Fill XS area (sq. ft)	84
Left Levee Fill Volume (cu. Yd)	4072
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)	65727
Right Levee Fill XS area (sq. ft)	90.8
Right Levee Fill Volume (cu. Yd)	4402
Total Levee Fill Surface Area (sq. ft)	131454
Total Levee Fill Volume (cu Yd)	8474

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	65	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.87	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	26.90	2.69
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,287	$ 229
Area per structure (sq. Yd)	7	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	1,309	ft	$ 255	$ 333,404	240	cu. Yd	$ -	$ -	240	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,440	sq. Yd	$ -	$ -	1,440	sq. Yd	$ -	$ -	1,440	sq. Yd	$ 75.00	$ 108,000
Adjacent Levee Fill	Fill	8,474	cu. Yd	$ 7.00	$ 59,318	14,544	sq. Yd	$ 4.50	$ 65,450	14,544	sq. Yd	$ 11.67	$ 169,685
Wall Material Aesthetic Treatment Cost	Wall	240	cu. Yd	$ -	$ -	240	cu. Yd	$ -	$ -	240	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,440	sq. Yd	$ 63.00	$ 90,720	1,440	sq. Yd	$ -	$ -	1,440	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 2,286.50	$ 1,989	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 271
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 485,431			Total	$ 65,450			Total	$ 277,956
		Contingency Cost (25% of Construction Cost)			$ 121,358								
		Engineering Design Cost (5% of Construction Cost)			$ 24,272								
		Total Construction Cost			$ 631,061								
Wall Material Aesthetic Treatment Cost	Wall	240	cu. Yd	$ -	$ -	240	cu. Yd	$ -	$ -	240	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,440	sq. Yd	$ 63.00	$ 90,720	1,440	sq. Yd	$ -	$ -	1,440	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	8,474	cu. Yd	$ 7.00	$ 59,318	14,544	sq. Yd	$ 4.50	$ 65,450	14,544	sq. Yd	$ 11.67	$ 169,685
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 228.65	$ 199	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 27
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 150,237			Total	$ 65,450			Total	$ 169,712
		Contingency Cost (25% of Construction Cost)			$ 37,559								
		Engineering Design Cost (5% of Construction Cost)			$ 7,512								
		Total Construction Cost			$ 195,308								
Total Structure Aesthetic Trtmt Cost	$ 430,470												

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	65	2	$100,000	$ 200,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	166	5		$ 500,000

Total Land Related Aes. Trtmt Cost	$ 210,000

Total Cost	$ 1,474,467	Total Aesthetic Treatment Cost	$ 640,470
		Total Right of Way Cost	$ 500,000

Walled-Levee Corridor

Structure ID	H135C35D

HEC1 ID	35C35D

Cutline ID	2

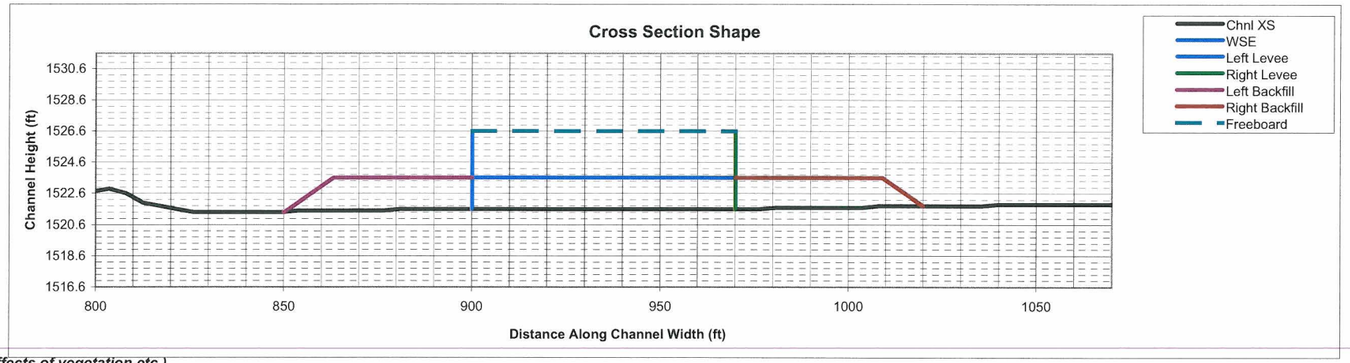
Longitudinal Geometry

Length	728.7	ft
Initial Channel Slope	0.0128	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0150	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	900	Right Levee Station (ft)	970
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	900	Right Channel Limit Station (ft)	970

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	C135D	C135C								TOTAL
HEC1 Peak-Flow	995	795								
Weighting Factor	0.10	0.90								
Flow into Channel	97	717								814

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	71.0	34.9	1521.6	1522.1	2.3	0.5	70.0	0.5	0.5	0.58
244	71.9	67.8	1521.6	1522.6	3.6	1.0	70.0	0.9	1.0	0.64
611	73.4	118.4	1521.6	1523.3	5.2	1.7	70.0	1.6	1.7	0.70
814	74.0	141.3	1521.6	1523.6	5.8	2.0	70.0	1.9	2.0	0.71

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	71.0	33.3	1521.6	1522.1	2.4	0.5	70.0	0.5	0.5	0.63
244	71.8	64.6	1521.6	1522.5	3.8	0.9	70.0	0.9	0.9	0.69
611	73.2	112.8	1521.6	1523.2	5.4	1.6	70.0	1.5	1.6	0.75
814	73.8	134.6	1521.6	1523.5	6.0	1.9	70.0	1.8	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
	H135B35C_1	T135C20								
244	1.18	0.18								1.37

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
81	Stable
244	Stable
611	Erosive
814	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	244	cfs
Clear Water	No	
Total Incoming Sediment Load	1.367	cfs
Initial Chnl Sediment Capacity	1.098	cfs
Long-term Equilibrium Slope (ADWR)	0.0150	

Drop Structures

Design Slope	0.0150	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)
814	1.1	24.6	2.0	2.0	5.8	0.0128	-0.5	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	729
Channel Limit-Left Station (ft)	900
Channel Limit-Right Station (ft)	970
Channel Width (ft)	70

Levee

Left Levee Length (ft)	729
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	729
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	405
Left Levee Volume (cu. Yd)	68
Right Levee Surface Area (sq. Yd)	405
Right Levee Volume (cu. Yd)	68
Total Levee Surface Area (sq. Yd)	810
Total Levee Volume (cu. Yd)	136

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)	36581
Left Levee Fill XS area (sq. ft)	89.4
Left Levee Fill Volume (cu. Yd)	2414
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)	36581
Right Levee Fill XS area (sq. ft)	85.4
Right Levee Fill Volume (cu. Yd)	2306
Total Levee Fill Surface Area (sq. ft)	73162
Total Levee Fill Volume (cu Yd)	4720

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)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	29.12	2.91
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,475	$ 247
Area per structure (sq. Yd)	8	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	729	ft	$ 255	$ 185,677	136	cu. Yd	$ -	$ -	136	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	810	sq. Yd	$ -	$ -	810	sq. Yd	$ -	$ -	810	sq. Yd	$ 75.00	$ 60,750
Adjacent Levee Fill	Fill	4,720	cu. Yd	$ 7.00	$ 33,040	8,100	sq. Yd	$ 4.50	$ 36,450	8,100	sq. Yd	$ 11.67	$ 94,500
Wall Material Aesthetic Treatment Cost	Wall	136	cu. Yd	$ -	$ -	136	cu. Yd	$ -	$ -	136	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	810	sq. Yd	$ 63.00	$ 51,030	810	sq. Yd	$ -	$ -	810	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,475.20	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 269,747			Total	$ 36,450			Total	$ 155,542
		Contingency Cost (25% of Construction Cost)			$ 67,437								
		Engineering Design Cost (5% of Construction Cost)			$ 13,487								
		Total Construction Cost			$ 350,672								
Wall Material Aesthetic Treatment Cost	Wall	136	cu. Yd	$ -	$ -	136	cu. Yd	$ -	$ -	136	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	4,720	cu. Yd	$ 7.00	$ 33,040	8,100	sq. Yd	$ 4.50	$ 36,450	8,100	sq. Yd	$ 11.67	$ 94,500
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 247.35	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 84,070			Total	$ 36,450			Total	$ 94,529
		Contingency Cost (25% of Construction Cost)			$ 21,018								
		Engineering Design Cost (5% of Construction Cost)			$ 4,204								
		Total Construction Cost			$ 109,291								

Total Structure Aesthetic Trtmt Cost	$ 240,270

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.2	$100,000	$ 120,000
Maintenance Access	30	0.5	$100,000	$ 50,000
Channel	70	1.2	$100,000	$ 120,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	2.9		$ 290,000

Total Land Related Aes. Trtmt Cost	$ 120,000

Total Cost	$ 832,663

Total Aesthetic Treatment Cost	$ 360,270

Total Right of Way Cost	$ 290,000

Walled-Levee Corridor

Structure ID	H135C35D

HEC1 ID	35C35D

Cutline ID	1

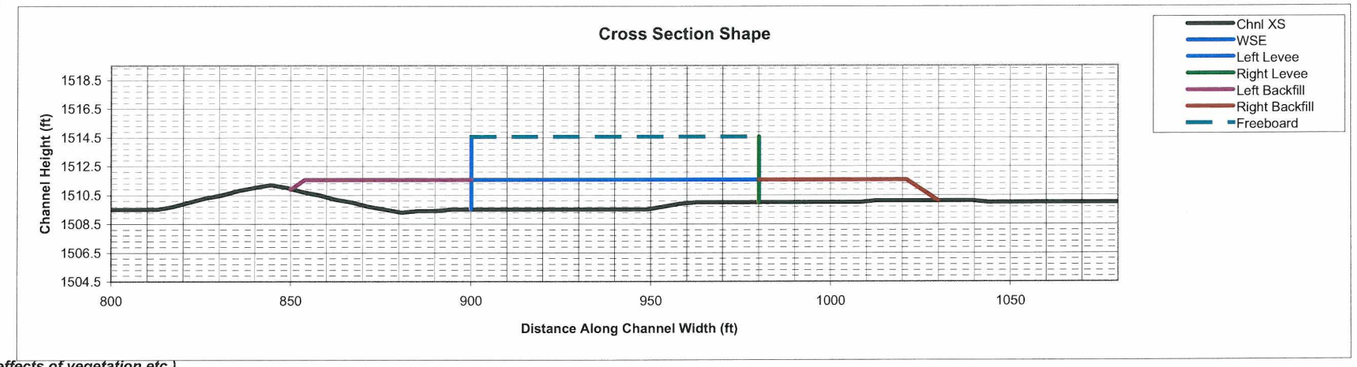
Longitudinal Geometry

Length	1615.9	ft
Initial Channel Slope	0.0141	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0119	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	900	Right Levee Station (ft)	980
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	900	Right Channel Limit Station (ft)	980

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	C135D	C135C								TOTAL
HEC1 Peak-Flow	995	795								
Weighting Factor	0.55	0.45								
Flow into Channel	546	358								904

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
90	80.8	38.0	1509.5	1510.1	2.4	0.6	80.0	0.5	0.5	0.61
271	81.7	73.8	1509.5	1510.6	3.7	1.1	80.0	0.9	0.9	0.67
678	83.0	128.7	1509.5	1511.3	5.3	1.8	80.0	1.6	1.6	0.73
904	83.7	153.4	1509.5	1511.6	5.9	2.1	80.0	1.8	1.9	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
90	80.8	40.0	1509.5	1510.2	2.3	0.7	80.0	0.5	0.5	0.56
271	81.8	77.7	1509.5	1510.6	3.5	1.1	80.0	1.0	1.0	0.62
678	83.2	135.6	1509.5	1511.4	5.0	1.9	80.0	1.6	1.7	0.68
904	83.9	161.6	1509.5	1511.7	5.6	2.2	80.0	1.9	2.0	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
	H135C35D_2									
271	1.10									1.10

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
90	Stable
271	Stable
678	Erosive
904	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	271	cfs
Clear Water	No	
Total Incoming Sediment Load	1.098	cfs
Initial Chnl Sediment Capacity	1.389	cfs
Long-term Equilibrium Slope (ADWR)	0.0119	

Drop Structures

Design Slope	0.0119	ft/ft
Total Drop Needed	3.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.18	
Distance between Structures	1369	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)
904	1.1	24.6	2.1	1.9	5.9	0.0141	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1616
Channel Limit-Left Station (ft)	900
Channel Limit-Right Station (ft)	980
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1616
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	1616
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	916
Left Levee Volume (cu. Yd)	153
Right Levee Surface Area (sq. Yd)	826
Right Levee Volume (cu. Yd)	138
Total Levee Surface Area (sq. Yd)	1742
Total Levee Volume (cu. Yd)	291

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)	80957
Left Levee Fill XS area (sq. ft)	86.1
Left Levee Fill Volume (cu. Yd)	5153
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)	80957
Right Levee Fill XS area (sq. ft)	70.3
Right Levee Fill Volume (cu. Yd)	4208
Total Levee Fill Surface Area (sq. ft)	161914
Total Levee Fill Volume (cu Yd)	9361

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)	8.0	
Structure Height (ft)	11.0	
Number of Structures	1.18	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.50	3.25
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,763	$ 276
Area per structure (sq. Yd)	9	1
Total Area (cu. Yd)	10	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	1,616	ft	$ 255	$ 411,598	291	cu. Yd	$ -	$ -	291	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,742	sq. Yd	$ -	$ -	1,742	sq. Yd	$ -	$ -	1,742	sq. Yd	$ 75.00	$ 130,650
Adjacent Levee Fill	Fill	9,361	cu. Yd	$ 7.00	$ 65,527	17,956	sq. Yd	$ 4.50	$ 80,800	17,956	sq. Yd	$ 11.67	$ 209,481
Wall Material Aesthetic Treatment Cost	Wall	291	cu. Yd	$ -	$ -	291	cu. Yd	$ -	$ -	291	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,742	sq. Yd	$ 63.00	$ 109,746	1,742	sq. Yd	$ -	$ -	1,742	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 2,762.50	$ 3,260	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 590,130			Total	$ 80,800			Total	$ 340,465
		Contingency Cost (25% of Construction Cost)			$ 147,533								
		Engineering Design Cost (5% of Construction Cost)			$ 29,507								
		Total Construction Cost			$ 767,169								
Wall Material Aesthetic Treatment Cost	Wall	291	cu. Yd	$ -	$ -	291	cu. Yd	$ -	$ -	291	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,742	sq. Yd	$ 63.00	$ 109,746	1,742	sq. Yd	$ -	$ -	1,742	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	9,361	cu. Yd	$ 7.00	$ 65,527	17,956	sq. Yd	$ 4.50	$ 80,800	17,956	sq. Yd	$ 11.67	$ 209,481
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 276.25	$ 326	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 175,599			Total	$ 80,800			Total	$ 209,515
		Contingency Cost (25% of Construction Cost)			$ 43,900								
		Engineering Design Cost (5% of Construction Cost)			$ 8,780								
		Total Construction Cost			$ 228,279								

Total Structure Aesthetic Trtmt Cost	$ 518,593

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.6	$100,000	$ 260,000
Maintenance Access	30	1.1	$100,000	$ 110,000
Channel	80	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	6.7		$ 670,000

Total Land Related Aes. Trtmt Cost	$ 260,000

Total Cost	$ 1,858,434	Total Aesthetic Treatment Cost	$ 778,593	Total Right of Way Cost	$ 670,000

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 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN  1998                *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30NOV06  TIME  09:13:37   *
 *                                       *
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*                                    *
*    U.S. ARMY CORPS OF ENGINEERS    *
*    HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616      *
*           (916) 756-1104           *
*                                    *
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X     X  XXXXXXX   XXXXX           X
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X     X  X         X              X
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X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

1 HEC-1 INPUT PAGE 1

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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 13E & 13W
   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: FAN136.DAT
   8          ID
   9          ID   100-YEAR 6-HOUR MODEL
  10          ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
  11          ID            MODELED AREA = 1.3 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          KK    S125   BASIN
  43          KM       Compute runoff from subbasin 125
  44          BA   0.113
  45          LG   0.27    0.35    4.15    0.44       4
  46          UI     70     254     232     133      79      44      27      17       7       6
  47          UI      0       0       0       0       0       0       0       0       0       0
              *
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1 HEC-1 INPUT PAGE 2

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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  48          KK    S130   BASIN
  49          KM       Compute runoff from subbasin 130
  50          BA   0.310
  51          LG   0.21    0.35    4.20    0.43       4
  52          UI     61     239     399     514     313     240     176     128      94      64
  53          UI     49      36      26      19      10      10      10      10       0       0
              *
  54          KK  CFAN13 COMBINE
  55          KM       Combine runoff from S125 and S130 at Fan 13 detention basin
  56          HC     2
  57          ZW               C=FLOW
              *
  58          KK    RR13 STORAGE
  59          KM   PROPOSED DETENTION BASIN
  60          KM    ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT FAN 13
  61          KM    STRUCTURE ID:RR13
  62          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 4 ft
  63          RS       1    STOR      -1
  64          SV     0.0     0.0     2.8    13.7    25.8    32.3    39.2    46.4    53.9    68.7
  65          SE     0.0     1.0     2.0     4.0     6.0     7.0     8.0     9.0    10.0    11.0
  66          SQ     0.0    14.2    28.5    60.8    94.9   111.4   126.2   138.8   144.8   184.8
  67          ZW               C=FLOW
              *
  68          KK  F1335A   ROUTE
  69          KM   PROPOSED CHANNEL
  70          KM       Route flow to C135A.
  71          KM    Slope=(1727.0 - 1669.0) / 2549.0
  72          RS       1    FLOW      -1
  73          RC   0.045   0.045   0.045  2549.0   0.023   104.5
  74          RX     0.0     0.0     0.0     0.0    40.0    40.0    40.0    40.0
  75          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  76          ZW               C=FLOW
              *
  77          KK   S135A   BASIN
  78          KM       Compute runoff from subbasin 135A
  79          BA   0.084
  80          LG    0.35    0.36    5.00    0.28       1
  81          UI     199     325      95      23       0       0       0       0       0       0
              *
  82          KK   C135A COMBINE
  83          KM       Combine runoff from S135A w/ routed outflow from Fan 13 detention basin
  84          HC     2
  85          ZW               C=FLOW
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  86          KK  35A35B   ROUTE
  87          KM   PROPOSED CHANNEL
  88          KM       Route combined flows to C135B.
  89          KM    Slope=(1669.0 - 1589.0) / 3760.0
  90          RS       2    FLOW      -1
  91          RC   0.045   0.045   0.045  3760.0   0.021   104.0
  92          RX     0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
  93          RY   104.0   100.0   100.0   100.0   100.0   100.0   100.0   104.0
  94          ZW               C=FLOW
              *
  95          KK   S135B   BASIN
  96          KM       Compute runoff from subbasin 135B
  97          BA   0.222
  98          LG    0.35    0.35    4.50    0.36       0
  99          UI     147     520     536     275     133      59      25      16       0       0
              *
 100          KK   C135B COMBINE
 101          KM       Combine runoff from S135B with routed flow from C135A
 102          HC     2
 103          ZW               C=FLOW
              *
 104          KK  35B35C   ROUTE
 105          KM   PROPOSED CHANNEL
 106          KM       Route combined flows to C135C.
 107          KM    Slope=(1589.0 - 1522.0) / 4880.0
 108          RS       3    FLOW      -1
 109          RC   0.045   0.045   0.045  4880.0   0.014   104.5
 110          RX     0.0     0.0     0.0     0.0    70.0    70.0    70.0    70.0
 111          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 112          ZW               C=FLOW
              *
 113          KK   S135C   BASIN
 114          KM       Compute runoff from subbasin 135C
 115          BA   0.306
 116          LG    0.35    0.35    4.10    0.46       0
 117          UI     122     467     659     510     282     153      84      46      18      17
 118          UI       0       0       0       0       0       0       0       0       0       0
              *
 119          KK   C135C COMBINE
 120          KM       Combine runoff from S135C with routed flow from C135B
 121          HC     2
 122          ZW               C=FLOW
              *
```

1 HEC-1 INPUT PAGE 4

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

```
            123           KK  35C35D   ROUTE
            124           KM   PROPOSED CHANNEL
            125           KM       Route combined flows to C135D at Wagner Wash.
            126           KM    Slope=(1522.0 - 1487.0) / 2345.0
            127           RS      2    FLOW     -1
            128           RC  0.045   0.045   0.045  2345.0   0.015   104.5
            129           RX    0.0     0.0     0.0     0.0    75.0    75.0    75.0    75.0
            130           RY  104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
            131           ZW                  C=FLOW
                          *
            132           KK   S135D   BASIN
            133           KM       Compute runoff from subbasin 135D
            134           BA   0.247
            135           LG   0.35    0.35    3.95    0.40       0
            136           UI    104     400     548     402     216     115      61      33      14      15
            137           UI      0       0       0       0       0       0       0       0       0       0
                          *
            138           KK   C135D COMBINE
            139           KM       Combine runoff from S135D with routed flow from C135C
            140           KM       This is the total flow at the downstream end of the Fan 13 corridor.
            141           HC      2
            142           ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    42        S125
                .
                .
    48          .        S130
                .          .
                .          .
    54      CFAN13.............
                V
                V
    58        RR13
                V
                V
    68      F1335A
                .
                .
    77          .        S135A
                .          .
                .          .
    82      C135A.............
                V
                V
    86      35A35B
                .
                .
    95          .        S135B
                .          .
                .          .
   100      C135B.............
                V
                V
   104      35B35C
                .
                .
   113          .        S135C
                .          .
                .          .
   119      C135C.............
                V
                V
   123      35C35D
                .
                .
   132          .        S135D
                .          .
                .          .
   138      C135D.............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*          VERSION 4.1                  *
*                                       *
* RUN DATE   30NOV06  TIME  09:13:37    *
*                                       *
*****************************************

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

                    MODELER: TED LEHMAN
                    FILENAME: FAN136.DAT

                    100-YEAR 6-HOUR MODEL
                    EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                            MODELED AREA = 1.3 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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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```
              **************
              *            *
  42 KK       *    S125    *        BASIN
              *            *
              **************
                                Compute runoff from subbasin 125

                 SUBBASIN RUNOFF DATA

  44 BA            SUBBASIN CHARACTERISTICS
                         TAREA          .11  SUBBASIN AREA

  45 LG            GREEN AND AMPT LOSS RATE
                         STRTL          .27  STARTING LOSS
                           DTH          .35  MOISTURE DEFICIT
                          PSIF         4.15  WETTING FRONT SUCTION
                         XKSAT          .44  HYDRAULIC CONDUCTIVITY
                         RTIMP         4.00  PERCENT IMPERVIOUS AREA

  43 UI            INPUT UNITGRAPH,  10 ORDINATES,  VOLUME =  .99
                      70.0     254.0     232.0     133.0      79.0      44.0      27.0      17.0       7.0       6.0
                                                                ***

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

                      HYDROGRAPH AT STATION      S125
                    TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    3.20, TOTAL LOSS =     1.80, TOTAL EXCESS =     1.40

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     255.      4.08                    17.          4.          1.          1.
                          (INCHES)     1.388       1.389       1.389       1.389
                           (AC-FT)        8.          8.          8.          8.

                        CUMULATIVE AREA =      .11 SQ MI

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

                      HYDROGRAPH AT STATION      S125
                    TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =    3.18, TOTAL LOSS =     1.79, TOTAL EXCESS =     1.39

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     254.      4.08                    17.          4.          1.          1.
                          (INCHES)     1.376       1.377       1.377       1.377
                           (AC-FT)        8.          8.          8.          8.

                        CUMULATIVE AREA =      .11 SQ MI

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

                      HYDROGRAPH AT STATION      S125
                    TRANSPOSITION AREA       2.8 SQ MI

   TOTAL RAINFALL =    3.12, TOTAL LOSS =     2.07, TOTAL EXCESS =     1.05

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     123.      4.08                    13.          3.          1.          0.
                          (INCHES)     1.046       1.047       1.047       1.047
                           (AC-FT)        6.          6.          6.          6.

                        CUMULATIVE AREA =      .11 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT      S125

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     255.      4.08                    17.          4.          1.          1.
                          (INCHES)     1.387       1.388       1.388       1.388
                           (AC-FT)        8.          8.          8.          8.

                        CUMULATIVE AREA =      .11 SQ MI

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

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```
              *            *
  48 KK       *    S130    *        BASIN
              *            *
              **************
                                Compute runoff from subbasin 130

                 SUBBASIN RUNOFF DATA

  50 BA            SUBBASIN CHARACTERISTICS
                         TAREA          .31  SUBBASIN AREA

  51 LG            GREEN AND AMPT LOSS RATE
                         STRTL          .21  STARTING LOSS
                           DTH          .35  MOISTURE DEFICIT
                          PSIF         4.20  WETTING FRONT SUCTION
                         XKSAT          .43  HYDRAULIC CONDUCTIVITY
                         RTIMP         4.00  PERCENT IMPERVIOUS AREA

  49 UI            INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                      61.0     239.0     399.0     514.0     313.0     240.0     176.0     128.0      94.0      64.0
                      49.0      36.0      26.0      19.0      10.0      10.0      10.0      10.0
                                                                ***

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

                      HYDROGRAPH AT STATION      S130
                    TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    3.20, TOTAL LOSS =     1.76, TOTAL EXCESS =     1.44

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     527.      4.17                    48.         12.          4.          2.
                          (INCHES)     1.433       1.434       1.434       1.434
                           (AC-FT)       24.         24.         24.         24.

                        CUMULATIVE AREA =      .31 SQ MI

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

                      HYDROGRAPH AT STATION      S130
                    TRANSPOSITION AREA        .5 SQ MI

   TOTAL RAINFALL =    3.18, TOTAL LOSS =     1.76, TOTAL EXCESS =     1.42

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     523.      4.17                    47.         12.          4.          2.
                          (INCHES)     1.422       1.422       1.422       1.422
                           (AC-FT)       24.         24.         24.         24.

                        CUMULATIVE AREA =      .31 SQ MI

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

                      HYDROGRAPH AT STATION      S130
                    TRANSPOSITION AREA       2.8 SQ MI

   TOTAL RAINFALL =    3.12, TOTAL LOSS =     2.03, TOTAL EXCESS =     1.09

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     287.      4.17                    36.          9.          3.          1.
                          (INCHES)     1.087       1.088       1.088       1.088
                           (AC-FT)       18.         18.         18.         18.

                        CUMULATIVE AREA =      .31 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT      S130

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     524.      4.17                    48.         12.          4.          2.
                          (INCHES)     1.425       1.426       1.426       1.426
                           (AC-FT)       24.         24.         24.         24.

                        CUMULATIVE AREA =      .31 SQ MI

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

          **************
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```
                *              *
   54 KK        *    CFAN13    *      COMBINE
                *              *
                ***************
                              Combine runoff from S125 and S130 at Fan 13 detention basin

   56 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***
        ***            ***             ***             ***             ***

                                 HYDROGRAPH AT STATION   CFAN13
                                TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     761.      4.08                  65.          16.          5.           2.
                (INCHES)           1.421        1.422        1.422        1.422
                (AC-FT)             32.          32.          32.          32.

                                 CUMULATIVE AREA =     .42 SQ MI

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

                                 HYDROGRAPH AT STATION   CFAN13
                                TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     756.      4.08                  64.          16.          5.           2.
                (INCHES)           1.410        1.410        1.410        1.410
                (AC-FT)             32.          32.          32.          32.

                                 CUMULATIVE AREA =     .42 SQ MI

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

                                 HYDROGRAPH AT STATION   CFAN13
                                TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     399.      4.08                  49.          12.          4.           2.
                (INCHES)           1.076        1.077        1.077        1.077
                (AC-FT)             24.          24.          24.          24.

                                 CUMULATIVE AREA =     .42 SQ MI

     -----DSS---ZOPEN:  Existing File Opened,  File: FAN136.DSS
                        Unit:  71;  DSS Version: 6-JG
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/08JAN1999/5MIN//
          ***            ***             ***             ***             ***


                                 INTERPOLATED HYDROGRAPH AT   CFAN13

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     757.      4.08                  64.          16.          5.           2.
                (INCHES)           1.411        1.412        1.412        1.412
                (AC-FT)             32.          32.          32.          32.

                                 CUMULATIVE AREA =     .42 SQ MI


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


                *              *
   58 KK        *      RR13    *      STORAGE
                *              *
                ***************
                              PROPOSED DETENTION BASIN
                               ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT FAN 13
                               STRUCTURE ID:RR13
                               OUTLET BASED ON ASSUMED 1 pipe(s), dia: 4 ft

                                 HYDROGRAPH ROUTING DATA

   63 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

   64 SV            STORAGE          .0         .0         2.8        13.7        25.8        32.3        39.2        46.4        53.9        68.7

   65 SE            ELEVATION       .00        1.00       2.00       4.00       6.00        7.00        8.00        9.00       10.00       11.00

   66 SQ            DISCHARGE        0.         14.        29.        61.        95.         111.        126.        139.       145.        185.
                                                                                ***
        ***            ***             ***             ***             ***

                                 HYDROGRAPH AT STATION     RR13
                                TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      92.      4.67                  58.          16.          5.           2.
                (INCHES)           1.267        1.421        1.421        1.421
                (AC-FT)             29.          32.          32.          32.

  PEAK STORAGE  TIME                              MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
       25.      4.67                  13.          3.          1.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
       5.81     4.67                 3.78         1.19         .53          .34

                                 CUMULATIVE AREA =     .42 SQ MI

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

                                 HYDROGRAPH AT STATION     RR13
                                TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      91.      4.67                  57.          16.          5.           2.
                (INCHES)           1.258        1.411        1.411        1.411
                (AC-FT)             28.          32.          32.          32.

  PEAK STORAGE  TIME                              MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
       24.      4.67                  13.          3.          1.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
       5.77     4.67                 3.76         1.06         .35          .15

                                 CUMULATIVE AREA =     .42 SQ MI

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

                                 HYDROGRAPH AT STATION     RR13
                                TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      72.      4.75                  45.          12.          4.           2.
                (INCHES)           .998        1.079        1.079        1.079
                (AC-FT)             23.          24.          24.          24.

  PEAK STORAGE  TIME                              MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
       18.      4.75                  9.           2.          1.           0.

  PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
       4.65     4.75                 3.04         .82          .27          .12

                                 CUMULATIVE AREA =     .42 SQ MI

     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/04JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     RR13

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      91.      4.67                 57.          16.          5.          2.
                (INCHES)          1.259        1.412        1.412       1.412
                (AC-FT)            28.          32.          32.         32.

                CUMULATIVE AREA =     .42 SQ MI



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

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            *            *
   68 KK    *    F1335A  *        ROUTE
            *            *
            **************
                        PROPOSED CHANNEL
                            Route flow to C135A.
                          Slope=(1727.0 - 1669.0) / 2549.0

              HYDROGRAPH ROUTING DATA

   72 RS        STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                     ITYP        FLOW   TYPE OF INITIAL CONDITION
                    RSVRIC       -1.00  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

   73 RC        NORMAL DEPTH CHANNEL
                      ANL        .045  LEFT OVERBANK N-VALUE
                     ANCH        .045  MAIN CHANNEL N-VALUE
                      ANR        .045  RIGHT OVERBANK N-VALUE
                    RLNTH       2549.  REACH LENGTH
                      SEL       .0230  ENERGY SLOPE
                    ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   75 RY       ELEVATION   104.50   100.00   100.00   100.00   100.00   100.00   100.00   104.50
   74 RX       DISTANCE       .00      .00      .00      .00    40.00    40.00    40.00    40.00

                                          ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE        .00      .55     1.11     1.66     2.22     2.77     3.33     3.88     4.43     4.99
              OUTFLOW        .00    18.14    57.36   112.31   180.71   261.11   352.48   454.00   565.03   685.00
            ELEVATION     100.00   100.24   100.47   100.71   100.95   101.18   101.42   101.66   101.89   102.13

              STORAGE       5.54     6.10     6.65     7.21     7.76     8.32     8.87     9.42     9.98    10.53
              OUTFLOW     813.45   949.96  1094.16  1245.73  1404.35  1569.77  1741.73  1920.00  2104.36  2294.62
            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     1404. TO     2295.
                 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   F1335A
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      91.      4.83                 57.          16.          5.          2.
                (INCHES)          1.259        1.421        1.421       1.421
                (AC-FT)            28.          32.          32.         32.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
       1.      4.83                  1.           0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.62      4.83               100.46       100.14      100.05      100.02

                CUMULATIVE AREA =     .42 SQ MI

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                          HYDROGRAPH AT STATION   F1335A
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      90.      4.83                 57.          16.          5.          2.
                (INCHES)          1.250        1.411        1.411       1.411
                (AC-FT)            28.          32.          32.         32.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
       1.      4.83                  1.           0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.61      4.83               100.46       100.14      100.05      100.02

                CUMULATIVE AREA =     .42 SQ MI

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

                          HYDROGRAPH AT STATION   F1335A
                        TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      71.      4.92                 45.          12.          4.          2.
                (INCHES)          .990        1.079        1.079       1.079
                (AC-FT)            22.          24.          24.         24.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
       1.      4.92                  1.           0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.53      4.92               100.40       100.11      100.04      100.02

                CUMULATIVE AREA =     .42 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     F1335A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      90.      4.83                 57.          16.          5.          2.
                (INCHES)          1.251        1.412        1.412       1.412
                (AC-FT)            28.          32.          32.         32.

                CUMULATIVE AREA =     .42 SQ MI



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

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            *            *
   77 KK    *     S135A  *        BASIN
            *            *
            **************
                        Compute runoff from subbasin 135A

              SUBBASIN RUNOFF DATA

   79 BA        SUBBASIN CHARACTERISTICS
                     TAREA         .08  SUBBASIN AREA

   80 LG        GREEN AND AMPT LOSS RATE
                     STRTL         .35  STARTING LOSS
                       DTH         .36  MOISTURE DEFICIT
                      PSIF        5.00  WETTING FRONT SUCTION
                     XKSAT         .28  HYDRAULIC CONDUCTIVITY
                     RTIMP        1.00  PERCENT IMPERVIOUS AREA

   78 UI        INPUT UNITGRAPH,   4 ORDINATES,  VOLUME =  .99
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                    199.0     325.0      95.0      23.0

                                                                  ***

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

                          HYDROGRAPH AT STATION    S135A
                        TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.71, TOTAL EXCESS =    1.49

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     256.      4.00                13.          3.          1.          0.
                (INCHES)          1.467       1.467       1.467       1.467
                (AC-FT)             7.          7.          7.          7.

                          CUMULATIVE AREA =     .08 SQ MI

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

                          HYDROGRAPH AT STATION    S135A
                        TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.71, TOTAL EXCESS =    1.47

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     255.      4.00                13.          3.          1.          0.
                (INCHES)          1.455       1.455       1.455       1.455
                (AC-FT)             7.          7.          7.          7.

                          CUMULATIVE AREA =     .08 SQ MI

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

                          HYDROGRAPH AT STATION    S135A
                        TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.95, TOTAL EXCESS =    1.17

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     115.      4.00                10.          3.          1.          0.
                (INCHES)          1.151       1.151       1.151       1.151
                (AC-FT)             5.          5.          5.          5.

                          CUMULATIVE AREA =     .08 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT    S135A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     257.      4.00                13.          3.          1.          0.
                (INCHES)          1.468       1.468       1.468       1.468
                (AC-FT)             7.          7.          7.          7.

                          CUMULATIVE AREA =     .08 SQ MI


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


            **************
            *            *
 82 KK      *    C135A   *      COMBINE
            *            *
            **************
                          Combine runoff from S135A w/ routed outflow from Fan 13 detention basin

 84 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                          HYDROGRAPH AT STATION    C135A
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
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+     273.      4.00                69.          19.          6.          3.
                (INCHES)          1.265       1.429       1.429       1.429
                (AC-FT)             34.          39.          39.          39.

                          CUMULATIVE AREA =     .51 SQ MI

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

                          HYDROGRAPH AT STATION    C135A
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     271.      4.00                68.          19.          6.          3.
                (INCHES)          1.256       1.419       1.419       1.419
                (AC-FT)             34.          38.          38.          38.

                          CUMULATIVE AREA =     .51 SQ MI

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

                          HYDROGRAPH AT STATION    C135A
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     133.      4.00                55.          15.          5.          2.
                (INCHES)          1.001       1.091       1.091       1.091
                (AC-FT)             27.          29.          29.          29.

                          CUMULATIVE AREA =     .51 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                          INTERPOLATED HYDROGRAPH AT    C135A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     270.      4.00                68.          19.          6.          3.
                (INCHES)          1.254       1.416       1.416       1.416
                (AC-FT)             34.          38.          38.          38.

                          CUMULATIVE AREA =     .51 SQ MI


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


            **************
            *            *
 86 KK      *   35A35B   *      ROUTE
            *            *
            **************
                          PROPOSED CHANNEL
                              Route combined flows to C135B.
                            Slope=(1669.0 - 1589.0) / 3760.0

                        HYDROGRAPH ROUTING DATA

 90 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

 91 RC          NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH       3760.  REACH LENGTH
                        SEL       .0210  ENERGY SLOPE
                      ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 93 RY        ELEVATION    104.00    100.00    100.00    100.00    100.00    100.00    100.00    104.00
 92 RX        DISTANCE        .00       .00       .00       .00     60.00     60.00     60.00     60.00

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                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE       .00      1.09      2.18      3.27      4.36      5.45      6.54      7.63      8.72      9.81
          OUTFLOW       .00     21.40     67.78    132.92    214.19    309.97    419.08    540.61    673.82    818.11
        ELEVATION    100.00    100.21    100.42    100.63    100.84    101.05    101.26    101.47    101.68    101.89

          STORAGE     10.90     11.99     13.08     14.17     15.26     16.35     17.45     18.54     19.63     20.72
          OUTFLOW    972.95   1137.89   1312.51   1496.47   1689.42   1891.08   2101.17   2319.44   2545.65   2779.58
        ELEVATION    102.11    102.32    102.53    102.74    102.95    103.16    103.37    103.58    103.79    104.00

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN       973. TO      2780.
                 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   35A35B
                                 TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR          24-HR         72-HR      166.58-HR
+   (CFS)        (HR)
                               (CFS)
+      195.      4.17                       68.           19.            6.            3.
                             (INCHES)     1.241         1.429         1.429         1.429
                              (AC-FT)       34.           39.           39.           39.

 PEAK STORAGE    TIME                             MAXIMUM AVERAGE STORAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+  (AC-FT)       (HR)
         2.      4.17                        1.            0.            0.            0.

  PEAK STAGE     TIME                               MAXIMUM AVERAGE STAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+   (FEET)       (HR)
     100.79      4.17                    100.40        100.13        100.04        100.02

                                CUMULATIVE AREA =       .51 SQ MI

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

                                  HYDROGRAPH AT STATION   35A35B
                                 TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR          24-HR         72-HR      166.58-HR
+   (CFS)        (HR)
                               (CFS)
+      194.      4.17                       67.           19.            6.            3.
                             (INCHES)     1.233         1.419         1.419         1.419
                              (AC-FT)       33.           38.           38.           38.

 PEAK STORAGE    TIME                             MAXIMUM AVERAGE STORAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+  (AC-FT)       (HR)
         2.      4.17                        1.            0.            0.            0.

  PEAK STAGE     TIME                               MAXIMUM AVERAGE STAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+   (FEET)       (HR)
     100.79      4.17                    100.40        100.12        100.04        100.02

                                CUMULATIVE AREA =       .51 SQ MI

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

                                  HYDROGRAPH AT STATION   35A35B
                                 TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR          24-HR         72-HR      166.58-HR
+   (CFS)        (HR)
                               (CFS)
+      109.      4.25                       53.           15.            5.            2.
                             (INCHES)      .978         1.091         1.091         1.091
                              (AC-FT)       26.           29.           29.           29.

 PEAK STORAGE    TIME                             MAXIMUM AVERAGE STORAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+  (AC-FT)       (HR)
         1.      4.25                        1.            0.            0.            0.

  PEAK STAGE     TIME                               MAXIMUM AVERAGE STAGE
                                          6-HR          24-HR         72-HR      166.58-HR
+   (FEET)       (HR)
     100.56      4.25                    100.35        100.10        100.03        100.01

                                CUMULATIVE AREA =       .51 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/08JAN1999/5MIN//
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           ***            ***            ***            ***            ***

                                  INTERPOLATED HYDROGRAPH AT   35A35B

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR          24-HR         72-HR      166.58-HR
+   (CFS)        (HR)
                               (CFS)
+      193.      4.17                       67.           19.            6.            3.
                             (INCHES)     1.231         1.416         1.416         1.416
                              (AC-FT)       33.           38.           38.           38.

                                CUMULATIVE AREA =       .51 SQ MI

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

                **************
                *            *
   95 KK        *    S135B   *        BASIN
                *            *
                **************

                                 Compute runoff from subbasin 135B

                 SUBBASIN RUNOFF DATA

   97 BA           SUBBASIN CHARACTERISTICS
                         TAREA           .22  SUBBASIN AREA

   98 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

   96 UI           INPUT UNITGRAPH,    8 ORDINATES,  VOLUME = 1.00
                        147.0      520.0      536.0      275.0      133.0       59.0       25.0       16.0
                                                                     ***

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

                                  HYDROGRAPH AT STATION    S135B
                                 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)
+      548.      4.08                       33.            8.            3.            1.
                             (INCHES)     1.368         1.368         1.368         1.368
                              (AC-FT)       16.           16.           16.           16.

                                CUMULATIVE AREA =       .22 SQ MI

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

                                  HYDROGRAPH AT STATION    S135B
                                 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)
+      544.      4.08                       32.            8.            3.            1.
                             (INCHES)     1.356         1.356         1.356         1.356
                              (AC-FT)       16.           16.           16.           16.

                                CUMULATIVE AREA =       .22 SQ MI

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

                                  HYDROGRAPH AT STATION    S135B
                                 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)
+      260.      4.08                       24.            6.            2.            1.
                             (INCHES)     1.025         1.025         1.025         1.025
                              (AC-FT)       12.           12.           12.           12.

                                CUMULATIVE AREA =       .22 SQ MI

           ***            ***            ***            ***            ***
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                    INTERPOLATED HYDROGRAPH AT    S135B

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     546.       4.08                       33.          8.           3.          1.
                          (INCHES)       1.362       1.362        1.362       1.362
                          (AC-FT)          16.         16.          16.         16.

                          CUMULATIVE AREA =     .22 SQ MI


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


           **************
           *            *
 100 KK    *    C135B   *      COMBINE
           *            *
           **************
                              Combine runoff from S135B with routed flow from C135A

 102 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                            ***

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

                     HYDROGRAPH AT STATION    C135B
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     723.       4.08                       99.         28.           9.          4.
                          (INCHES)       1.266       1.411        1.411       1.411
                          (AC-FT)          49.         55.          55.         55.

                          CUMULATIVE AREA =     .73 SQ MI


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

                     HYDROGRAPH AT STATION    C135B
                   TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     718.       4.08                       99.         27.           9.          4.
                          (INCHES)       1.257       1.400        1.400       1.400
                          (AC-FT)          49.         54.          54.         54.

                          CUMULATIVE AREA =     .73 SQ MI


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

                     HYDROGRAPH AT STATION    C135B
                   TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     355.       4.08                       77.         21.           7.          3.
                          (INCHES)        .982       1.071        1.071       1.071
                          (AC-FT)          38.         42.          42.         42.

                          CUMULATIVE AREA =     .73 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/08JAN1999/5MIN//
      ***               ***               ***               ***               ***


                    INTERPOLATED HYDROGRAPH AT    C135B

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     638.       4.08                       94.         26.           9.          4.
                          (INCHES)       1.196       1.328        1.328       1.328
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                          (AC-FT)          47.         52.          52.         52.

                          CUMULATIVE AREA =     .73 SQ MI


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


           **************
           *            *
 104 KK    *   35B35C   *        ROUTE
           *            *
           **************
                       PROPOSED CHANNEL
                            Route combined flows to C135C.
                        Slope=(1589.0 - 1522.0) / 4880.0

               HYDROGRAPH ROUTING DATA

 108 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

 109 RC          NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
                      RLNTH      4880.  REACH LENGTH
                        SEL      .0140  ENERGY SLOPE
                      ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                           CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 111 RY         ELEVATION    104.50     100.00     100.00     100.00     100.00     100.00     100.00     104.50
 110 RX         DISTANCE        .00        .00        .00        .00      70.00      70.00      70.00      70.00

                                                                      ***

                                            COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

             STORAGE        .00       1.86       3.71       5.57       7.43       9.29      11.14      13.00      14.86      16.72
             OUTFLOW        .00      24.81      78.58     154.11     248.37     359.46     486.03     627.02     781.58     949.03
           ELEVATION     100.00     100.24     100.47     100.71     100.95     101.18     101.42     101.66     101.89     102.13

             STORAGE      18.57      20.43      22.29      24.14      26.00      27.86      29.72      31.57      33.43      35.29
             OUTFLOW    1128.73    1320.18    1522.90    1736.47    1960.53    2194.71    2438.72    2692.25    2955.04    3226.83
           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      1129. TO      3227.
                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    35B35C
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     571.       4.25                       97.         28.           9.          4.
                          (INCHES)       1.234       1.411        1.411       1.411
                          (AC-FT)          48.         55.          55.         55.

PEAK STORAGE     TIME                             MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        4.       4.25                        1.          0.           0.          0.

  PEAK STAGE     TIME                               MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
    101.56       4.25                    100.49      100.15       100.05      100.02

                          CUMULATIVE AREA =     .73 SQ MI


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

                     HYDROGRAPH AT STATION    35B35C
                   TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     565.       4.25                       96.         27.           9.          4.
                          (INCHES)       1.225       1.400        1.400       1.400
                          (AC-FT)          48.         54.          54.         54.

PEAK STORAGE     TIME                             MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        4.       4.25                        1.          0.           0.          0.
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  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.55       4.25                100.49       100.15       100.05       100.02

                              CUMULATIVE AREA =      .73 SQ MI


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

                          HYDROGRAPH AT STATION    35B35C
                        TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      304.       4.33                 75.          21.           7.           3.
                                  (INCHES)        .952        1.071        1.071        1.071
                                  (AC-FT)          37.          42.          42.          42.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
         3.       4.33                  1.           0.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.07       4.33                100.42       100.13       100.04       100.02

                              CUMULATIVE AREA =      .73 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                        INTERPOLATED HYDROGRAPH AT    35B35C

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      504.       4.25                 91.          26.           9.           4.
                                  (INCHES)       1.165        1.328        1.328        1.328
                                  (AC-FT)          45.          52.          52.          52.

                              CUMULATIVE AREA =      .73 SQ MI


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


            **************
            *            *
113 KK      *     S135C  *       BASIN
            *            *
            **************
                              Compute runoff from subbasin 135C

                 SUBBASIN RUNOFF DATA

115 BA             SUBBASIN CHARACTERISTICS
                        TAREA          .31  SUBBASIN AREA

116 LG             GREEN AND AMPT LOSS RATE
                        STRTL          .35  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.10  WETTING FRONT SUCTION
                        XKSAT          .46  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

114 UI             INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                       122.0      467.0      659.0      510.0      282.0      153.0       84.0       46.0       18.0       17.0
                                                                                                                      ***

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

                          HYDROGRAPH AT STATION    S135C
                        TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.93, TOTAL EXCESS =     1.26

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      655.       4.08                 41.          10.           3.           1.
                                  (INCHES)       1.255        1.255        1.255        1.255
                                  (AC-FT)          20.          20.          20.          20.

                              CUMULATIVE AREA =      .31 SQ MI


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

                          HYDROGRAPH AT STATION    S135C
                        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)
+      651.       4.08                 41.          10.           3.           1.
                                  (INCHES)       1.245        1.245        1.245        1.245
                                  (AC-FT)          20.          20.          20.          20.

                              CUMULATIVE AREA =      .31 SQ MI


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

                          HYDROGRAPH AT STATION    S135C
                        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)
+      309.       4.08                 30.           7.           2.           1.
                                  (INCHES)        .899         .899         .899         .899
                                  (AC-FT)          15.          15.          15.          15.

                              CUMULATIVE AREA =      .31 SQ MI


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


                        INTERPOLATED HYDROGRAPH AT     S135C

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      652.       4.08                 41.          10.           3.           1.
                                  (INCHES)       1.248        1.248        1.248        1.248
                                  (AC-FT)          20.          20.          20.          20.

                              CUMULATIVE AREA =      .31 SQ MI


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


            **************
            *            *
119 KK      *     C135C  *       COMBINE
            *            *
            **************
                              Combine runoff from S135C with routed flow from C135B

121 HC             HYDROGRAPH COMBINATION
                        ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                                                      ***
       ***           ***           ***           ***           ***

                          HYDROGRAPH AT STATION    C135C
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+     1014.       4.17                137.          38.          13.           5.
                                  (INCHES)       1.228        1.365        1.365        1.365
                                  (AC-FT)          68.          75.          75.          75.

                              CUMULATIVE AREA =     1.04 SQ MI


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

                          HYDROGRAPH AT STATION    C135C
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
```

```
+     1003.       4.17                 136.         38.         13.           5.
                           (INCHES)   1.218       1.354       1.354       1.354
                           (AC-FT)      67.         75.         75.          75.

                            CUMULATIVE AREA =     1.04 SQ MI


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

                             HYDROGRAPH AT STATION     C135C
                           TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      528.       4.25                     103.          28.          9.           4.
                           (INCHES)        .925       1.020       1.020        1.020
                           (AC-FT)          51.          56.         56.          56.

                            CUMULATIVE AREA =     1.04 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/08JAN1999/5MIN//
          ***            ***            ***            ***            ***


                            INTERPOLATED HYDROGRAPH AT     C135C

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      795.       4.17                     122.          34.         11.           5.
                           (INCHES)       1.093       1.213       1.213        1.213
                           (AC-FT)          60.          67.         67.          67.

                            CUMULATIVE AREA =     1.04 SQ MI


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


            **************
            *            *
123 KK      *   35C35D   *       ROUTE
            *            *
            **************
                         PROPOSED CHANNEL
                              Route combined flows to C135D at Wagner Wash.
                          Slope=(1522.0 - 1487.0) / 2345.0

              HYDROGRAPH ROUTING DATA

127 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

128 RC          NORMAL DEPTH CHANNEL
                       ANL       .045  LEFT OVERBANK N-VALUE
                      ANCH       .045  MAIN CHANNEL N-VALUE
                       ANR       .045  RIGHT OVERBANK N-VALUE
                     RLNTH      2345.  REACH LENGTH
                       SEL      .0150  ENERGY SLOPE
                     ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                             CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
130 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
129 RX        DISTANCE        .00       .00       .00       .00     75.00     75.00     75.00     75.00

                                                                     ***

                                              COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE        .00        .96       1.91       2.87       3.82       4.78       5.74       6.69       7.65       8.61
           OUTFLOW        .00      27.52      87.18     170.99     275.61     398.95     539.50     696.10     867.82    1053.89
         ELEVATION     100.00     100.24     100.47     100.71     100.95     101.18     101.42     101.66     101.89     102.13

           STORAGE       9.56      10.52      11.47      12.43      13.39      14.34      15.30      16.26      17.21      18.17
           OUTFLOW    1253.63    1466.46    1691.88    1929.42    2178.67    2439.25    2710.81    2993.03    3285.62    3588.30
         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       399. TO      3588.
                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   35C35D
                           TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      984.       4.25                     136.          38.         13.           5.
                           (INCHES)       1.217       1.365       1.365        1.365
                           (AC-FT)          67.          75.         75.          75.

 PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        4.       4.25                        1.           0.          0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    102.04       4.25                   100.53       100.17      100.06       100.02

                            CUMULATIVE AREA =     1.04 SQ MI


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

                             HYDROGRAPH AT STATION   35C35D
                           TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      974.       4.25                     134.          38.         13.           5.
                           (INCHES)       1.207       1.354       1.354        1.354
                           (AC-FT)          67.          75.         75.          75.

 PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        4.       4.25                        1.           0.          0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    102.03       4.25                   100.53       100.17      100.06       100.02

                            CUMULATIVE AREA =     1.04 SQ MI


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

                             HYDROGRAPH AT STATION   35C35D
                           TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      516.       4.33                     102.          28.          9.           4.
                           (INCHES)        .915       1.020       1.020        1.020
                           (AC-FT)          51.          56.         56.          56.

 PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        3.       4.33                        1.           0.          0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.38       4.33                   100.46       100.14      100.05       100.02

                            CUMULATIVE AREA =     1.04 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/08JAN1999/5MIN//
          ***            ***            ***            ***            ***


                            INTERPOLATED HYDROGRAPH AT   35C35D

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                              (CFS)
+      772.       4.25                     121.          34.         11.           5.
                           (INCHES)       1.083       1.213       1.213        1.213
                           (AC-FT)          60.          67.         67.          67.

                            CUMULATIVE AREA =     1.04 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
132 KK        *    S135D   *        BASIN
              *            *
              **************
                                 Compute runoff from subbasin 135D

               SUBBASIN RUNOFF DATA

134 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .25  SUBBASIN AREA

135 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .35  STARTING LOSS
                        DTH         .35  MOISTURE DEFICIT
                       PSIF        3.95  WETTING FRONT SUCTION
                      XKSAT         .40  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

133 UI          INPUT UNITGRAPH,  10 ORDINATES,   VOLUME = 1.00
                    104.0     400.0     548.0     402.0     216.0     115.0      61.0      33.0      14.0      15.0
                                                                 ***

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

                      HYDROGRAPH AT STATION    S135D
                    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)
+     561.      4.08                    36.           9.           3.           1.
                        (INCHES)     1.358        1.358        1.358        1.358
                        (AC-FT)        18.          18.          18.          18.

                         CUMULATIVE AREA =      .25 SQ MI

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

                      HYDROGRAPH AT STATION    S135D
                    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)
+     557.      4.08                    36.           9.           3.           1.
                        (INCHES)     1.346        1.346        1.346        1.346
                        (AC-FT)        18.          18.          18.          18.

                         CUMULATIVE AREA =      .25 SQ MI

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

                      HYDROGRAPH AT STATION    S135D
                    TRANSPOSITION AREA       2.8 SQ MI

   TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.11, TOTAL EXCESS =    1.01

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+     274.      4.08                    27.           7.           2.           1.
                        (INCHES)     1.010        1.010        1.010        1.010
                        (AC-FT)        13.          13.          13.          13.

                         CUMULATIVE AREA =      .25 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT     S135D

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+     559.      4.08                    36.           9.           3.           1.
                        (INCHES)     1.351        1.351        1.351        1.351
                        (AC-FT)        18.          18.          18.          18.

                         CUMULATIVE AREA =      .25 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
138 KK        *    C135D   *        COMBINE
              *            *
              **************

                                    Combine runoff from S135D with routed flow from C135C
                                    This is the total flow at the downstream end of the Fan 13 corridor.

141 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                 ***

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

                      HYDROGRAPH AT STATION    C135D
                    TRANSPOSITION AREA        .1 SQ MI

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+    1334.      4.17                   170.          47.          16.           7.
                        (INCHES)     1.236        1.363        1.363        1.363
                        (AC-FT)        84.          93.          93.          93.

                         CUMULATIVE AREA =     1.28 SQ MI

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

                      HYDROGRAPH AT STATION    C135D
                    TRANSPOSITION AREA        .5 SQ MI

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+    1320.      4.17                   169.          47.          16.           7.
                        (INCHES)     1.226        1.352        1.352        1.352
                        (AC-FT)        84.          92.          92.          92.

                         CUMULATIVE AREA =     1.28 SQ MI

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

                      HYDROGRAPH AT STATION    C135D
                    TRANSPOSITION AREA       2.8 SQ MI

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+     706.      4.25                   128.          35.          12.           5.
                        (INCHES)      .927        1.018        1.018        1.018
                        (AC-FT)        63.          70.          70.          70.

                         CUMULATIVE AREA =     1.28 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT     C135D

 PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+  (CFS)        (HR)
                         (CFS)
+     965.      4.25                   146.          40.          13.           6.
                        (INCHES)     1.062        1.170        1.170        1.170
                        (AC-FT)        73.          80.          80.          80.

                         CUMULATIVE AREA =     1.28 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
+                             S125          255.      4.08          17.          4.           1.         .11

           HYDROGRAPH AT
+                             S130          524.      4.17          48.         12.           4.         .31

           2 COMBINED AT
+                            CFAN13         757.      4.08          64.         16.           5.         .42

           ROUTED TO
```

+	RR13	91.	4.67	57.	16.	5.	.42
	ROUTED TO						
+	F1335A	90.	4.83	57.	16.	5.	.42
	HYDROGRAPH AT						
+	S135A	257.	4.00	13.	3.	1.	.08
	2 COMBINED AT						
+	C135A	270.	4.00	68.	19.	6.	.51
	ROUTED TO						
+	35A35B	193.	4.17	67.	19.	6.	.51
	HYDROGRAPH AT						
+	S135B	546.	4.08	33.	8.	3.	.22
	2 COMBINED AT						
+	C135B	638.	4.08	94.	26.	9.	.73
	ROUTED TO						
+	35B35C	504.	4.25	91.	26.	9.	.73
	HYDROGRAPH AT						
+	S135C	652.	4.08	41.	10.	3.	.31
	2 COMBINED AT						
+	C135C	795.	4.17	122.	34.	11.	1.04
	ROUTED TO						
+	35C35D	772.	4.25	121.	34.	11.	1.04
	HYDROGRAPH AT						
+	S135D	559.	4.08	36.	9.	3.	.25
	2 COMBINED AT						
+	C135D	965.	4.25	146.	40.	13.	1.28

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

-----DSS---ZCLOSE Unit: 71, File: FAN136.DSS
Pointer Utilization: .31
Number of Records: 72
File Size: 131.9 Kbytes
Percent Inactive: .0

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN  1998                 *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   30NOV06  TIME  09:13:38   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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 13E & 13W
    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: FAN1324.DAT
    8         ID
    9         ID   100-YEAR 24-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID            MODELED AREA = 1.3 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         KK    S125   BASIN
   43         KM       Compute runoff from subbasin 125
   44         BA   0.113
   45         LG   0.27    0.35    4.15    0.44      4
   46         UI     70     254     232     133      79      44      27      17       7       6
   47         UI      0       0       0       0       0       0       0       0       0       0
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   48         KK    S130   BASIN
   49         KM       Compute runoff from subbasin 130
   50         BA   0.310
   51         LG   0.21    0.35    4.20    0.43      4
   52         UI     61     239     399     514     313     240     176     128      94      64
   53         UI     49      36      26      19      10      10      10      10       0       0
              *
   54         KK  CFAN13 COMBINE
   55         KM       Combine runoff from S125 and S130 at Fan 13 detention basin
   56         HC     2
   57         ZW               C=FLOW
              *
   58         KK   RR13 STORAGE
   59         KM  PROPOSED DETENTION BASIN
   60         KM   ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT FAN 13
   61         KM   STRUCTURE ID:RR13
   62         KM   OUTLET BASED ON ASSUMED 1 pipe(s), dia: 4 ft
   63         RS     1    STOR      -1
   64         SV   0.0     0.0     2.8    13.7    25.8    32.3    39.2    46.4    53.9    68.7
   65         SE   0.0     1.0     2.0     4.0     6.0     7.0     8.0     9.0    10.0    11.0
   66         SQ   0.0    14.2    28.5    60.8    94.9   111.4   126.2   138.8   144.8   184.8
   67         ZW               C=FLOW
              *
   68         KK  F1335A   ROUTE
   69         KM  PROPOSED CHANNEL
   70         KM       Route flow to C135A.
   71         KM   Slope=(1727.0 - 1669.0) / 2549.0
   72         RS     1    FLOW      -1
   73         RC  0.045   0.045   0.045  2549.0   0.023   104.5
   74         RX    0.0     0.0     0.0     0.0    40.0    40.0    40.0    40.0
   75         RY  104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   76         ZW               C=FLOW
              *
   77         KK   S135A   BASIN
   78         KM       Compute runoff from subbasin 135A
   79         BA   0.084
   80         LG   0.35    0.36    5.00    0.28      1
   81         UI    199     325      95      23       0       0       0       0       0       0
              *
   82         KK   C135A COMBINE
   83         KM       Combine runoff from S135A w/ routed outflow from Fan 13 detention basin
   84         HC     2
   85         ZW               C=FLOW
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   86         KK  35A35B   ROUTE
   87         KM   PROPOSED CHANNEL
   88         KM       Route combined flows to C135B.
   89         KM   Slope=(1669.0 - 1589.0) / 3760.0
   90         RS     2    FLOW      -1
   91         RC  0.045   0.045   0.045  3760.0   0.021   104.0
   92         RX    0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
   93         RY  104.0   100.0   100.0   100.0   100.0   100.0   100.0   104.0
   94         ZW               C=FLOW
              *
   95         KK   S135B   BASIN
   96         KM       Compute runoff from subbasin 135B
   97         BA   0.222
   98         LG   0.35    0.35    4.50    0.36      0
   99         UI    147     520     536     275     133      59      25      16       0       0
              *
  100         KK   C135B COMBINE
  101         KM       Combine runoff from S135B with routed flow from C135A
  102         HC     2
  103         ZW               C=FLOW
              *
  104         KK  35B35C   ROUTE
  105         KM  PROPOSED CHANNEL
  106         KM       Route combined flows to C135C.
  107         KM   Slope=(1589.0 - 1522.0) / 4880.0
  108         RS     3    FLOW      -1
  109         RC  0.045   0.045   0.045  4880.0   0.014   104.5
  110         RX    0.0     0.0     0.0     0.0    70.0    70.0    70.0    70.0
  111         RY  104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  112         ZW               C=FLOW
              *
  113         KK   S135C   BASIN
  114         KM       Compute runoff from subbasin 135C
  115         BA   0.306
  116         LG   0.35    0.35    4.10    0.46      0
  117         UI    122     467     659     510     282     153      84      46      18      17
  118         UI      0       0       0       0       0       0       0       0       0       0
              *
  119         KK   C135C COMBINE
  120         KM       Combine runoff from S135C with routed flow from C135B
  121         HC     2
  122         ZW               C=FLOW
              *
```

1 HEC-1 INPUT PAGE 4

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

```
 123          KK  35C35D   ROUTE
 124          KM   PROPOSED CHANNEL
 125          KM        Route combined flows to C135D at Wagner Wash.
 126          KM     Slope=(1522.0 - 1487.0) / 2345.0
 127          RS       2    FLOW       -1
 128          RC   0.045   0.045   0.045  2345.0   0.015   104.5
 129          RX     0.0     0.0     0.0     0.0    75.0    75.0    75.0    75.0
 130          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 131          ZW                C=FLOW
              *

 132          KK   S135D   BASIN
 133          KM        Compute runoff from subbasin 135D
 134          BA   0.247
 135          LG    0.35    0.35    3.95    0.40       0
 136          UI     104     400     548     402     216     115      61      33      14      15
 137          UI       0       0       0       0       0       0       0       0       0       0
              *

 138          KK   C135D COMBINE
 139          KM        Combine runoff from S135D with routed flow from C135C
 140          KM        This is the total flow at the downstream end of the Fan 13 corridor.
 141          HC       2
 142          ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

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

   42        S125
               .
               .
   48          .          S130
               .            .
               .            .
   54      CFAN13...........
               V
               V
   58        RR13
               V
               V
   68      F1335A
               .
               .
   77          .         S135A
               .            .
               .            .
   82        C135A...........
               V
               V
   86      35A35B
               .
               .
   95          .         S135B
               .            .
               .            .
  100        C135B...........
               V
               V
  104      35B35C
               .
               .
  113          .         S135C
               .            .
               .            .
  119        C135C...........
               V
               V
  123      35C35D
               .
               .
  132          .         S135D
               .            .
               .            .
  138        C135D...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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    30NOV06  TIME  09:13:38  *                    *           (916) 756-1104             *
 *                                       *                    *                                      *
 *****************************************                    ****************************************


                     HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
                         - FAN SYSTEM 13E & 13W

                     SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                     JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
```

```
                    MODELER: TED LEHMAN
                    FILENAME: FAN1324.DAT

                    100-YEAR 24-HOUR MODEL
                    EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                             MODELED AREA = 1.3 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
                  .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       .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       .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       .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
                  .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       .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       .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       .00
                  .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
                  .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       .00       .00       .00       .00       .00       .00       .00
                  .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    .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
 .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
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 .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    .00    .00    .00    .00    .00

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

          **************
          *            *
  42 KK   *    S125    *      BASIN
          *            *
          **************
                          Compute runoff from subbasin 125

               SUBBASIN RUNOFF DATA

  44 BA          SUBBASIN CHARACTERISTICS
                   TAREA          .11  SUBBASIN AREA

  45 LG          GREEN AND AMPT LOSS RATE
                   STRTL          .27  STARTING LOSS
                     DTH          .35  MOISTURE DEFICIT
                    PSIF         4.15  WETTING FRONT SUCTION
                  XKSAT           .44  HYDRAULIC CONDUCTIVITY
                   RTIMP         4.00  PERCENT IMPERVIOUS AREA

  43 UI          INPUT UNITGRAPH,  10 ORDINATES,  VOLUME =  .99
                    70.0     254.0     232.0     133.0      79.0      44.0      27.0      17.0       7.0       6.0
                                                                  ***

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

                   HYDROGRAPH AT STATION      S125
                 TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =     2.97, TOTAL EXCESS =     1.22

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     203.     12.08               14.            4.            1.            1.
                    (INCHES)     1.166         1.215         1.215         1.215
                     (AC-FT)        7.            7.            7.            7.

                      CUMULATIVE AREA =       .11 SQ MI

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

                   HYDROGRAPH AT STATION      S125
                 TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =     2.86, TOTAL EXCESS =     1.13

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     189.     12.08               13.            3.            1.            0.
                    (INCHES)     1.072         1.118         1.119         1.119
                     (AC-FT)        6.            7.            7.            7.

                      CUMULATIVE AREA =       .11 SQ MI

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


                   INTERPOLATED HYDROGRAPH AT      S125

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     202.     12.08               14.            4.            1.            1.
                    (INCHES)     1.164         1.212         1.212         1.212
                     (AC-FT)        7.            7.            7.            7.
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                      CUMULATIVE AREA =       .11 SQ MI

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

          **************
          *            *
  48 KK   *    S130    *      BASIN
          *            *
          **************
                          Compute runoff from subbasin 130

               SUBBASIN RUNOFF DATA

  50 BA          SUBBASIN CHARACTERISTICS
                   TAREA          .31  SUBBASIN AREA

  51 LG          GREEN AND AMPT LOSS RATE
                   STRTL          .21  STARTING LOSS
                     DTH          .35  MOISTURE DEFICIT
                    PSIF         4.20  WETTING FRONT SUCTION
                  XKSAT           .43  HYDRAULIC CONDUCTIVITY
                   RTIMP         4.00  PERCENT IMPERVIOUS AREA

  49 UI          INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                    61.0     239.0     399.0     514.0     313.0     240.0     176.0     128.0      94.0      64.0
                    49.0      36.0      26.0      19.0      10.0      10.0      10.0      10.0
                                                                  ***

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

                   HYDROGRAPH AT STATION      S130
                 TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =     2.96, TOTAL EXCESS =     1.24

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     422.     12.17               40.           10.            3.            1.
                    (INCHES)     1.192         1.240         1.241         1.241
                     (AC-FT)       20.           21.           21.           21.

                      CUMULATIVE AREA =       .31 SQ MI

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

                   HYDROGRAPH AT STATION      S130
                 TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =     2.84, TOTAL EXCESS =     1.15

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     392.     12.17               37.           10.            3.            1.
                    (INCHES)     1.099         1.145         1.145         1.145
                     (AC-FT)       18.           19.           19.           19.

                      CUMULATIVE AREA =       .31 SQ MI

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


                   INTERPOLATED HYDROGRAPH AT      S130

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                 6-HR          24-HR         72-HR      166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     415.     12.17               39.           10.            3.            1.
                    (INCHES)     1.169         1.217         1.217         1.217
                     (AC-FT)       19.           20.           20.           20.

                      CUMULATIVE AREA =       .31 SQ MI


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

          **************
          *            *
  54 KK   *   CFAN13   *      COMBINE
          *            *
          **************
                          Combine runoff from S125 and S130 at Fan 13 detention basin

  56 HC          HYDROGRAPH COMBINATION
                   ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
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                                                                      ***

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

                          HYDROGRAPH AT STATION    CFAN13
                         TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                        (CFS)
+      613.      12.08                54.          14.           5.           2.
                         (INCHES)     1.185        1.233        1.234        1.234
                         (AC-FT)       27.          28.          28.          28.

                          CUMULATIVE AREA =      .42 SQ MI


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

                          HYDROGRAPH AT STATION    CFAN13
                         TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                        (CFS)
+      568.      12.08                50.          13.           4.           2.
                         (INCHES)     1.092        1.138        1.138        1.138
                         (AC-FT)       25.          26.          26.          26.

                          CUMULATIVE AREA =      .42 SQ MI

    -----DSS---ZOPEN:  Existing File Opened,  File: FAN1324.DSS
                       Unit:  71;  DSS Version: 6-JG
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   53:  //CFAN13/FLOW/08JAN1999/5MIN//
          ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT    CFAN13

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                        (CFS)
+      599.      12.08                53.          14.           5.           2.
                         (INCHES)     1.156        1.203        1.204        1.204
                         (AC-FT)       26.          27.          27.          27.

                          CUMULATIVE AREA =      .42 SQ MI



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


              **************
              *            *
   58 KK      *      RR13  *      STORAGE
              *            *
              **************
                          PROPOSED DETENTION BASIN
                           ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT FAN 13
                           STRUCTURE ID:RR13
                           OUTLET BASED ON ASSUMED 1 pipe(s), dia: 4 ft

                     HYDROGRAPH ROUTING DATA

   63 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

   64 SV                 STORAGE         .0       .0       2.8      13.7      25.8      32.3      39.2      46.4      53.9      68.7

   65 SE                 ELEVATION      .00     1.00     2.00     4.00     6.00     7.00     8.00     9.00    10.00    11.00

   66 SQ                 DISCHARGE       0.      14.      29.      61.      95.     111.     126.     139.     145.     185.

                                                                      ***

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

                          HYDROGRAPH AT STATION     RR13
                         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)
+       78.      12.67                50.          14.           5.           2.
                         (INCHES)     1.089        1.233        1.233        1.233
                         (AC-FT)       25.          28.          28.          28.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        20.      12.67                10.          3.           1.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
        5.03     12.67                3.29         1.05         .49          .32

                          CUMULATIVE AREA =      .42 SQ MI


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

                          HYDROGRAPH AT STATION     RR13
                         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.      12.67                46.          13.           4.           2.
                         (INCHES)     1.018        1.139        1.139        1.139
                         (AC-FT)       23.          26.          26.          26.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        18.      12.67                9.           2.           1.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
        4.75     12.67                3.09         .86          .29          .12

                          CUMULATIVE AREA =      .42 SQ MI

     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   51:  //RR13/FLOW/08JAN1999/5MIN//
          ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT     RR13

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                        (CFS)
+       77.      12.67                49.          14.           5.           2.
                         (INCHES)     1.067        1.204        1.204        1.204
                         (AC-FT)       24.          27.          27.          27.

                          CUMULATIVE AREA =      .42 SQ MI



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


              **************
              *            *
   68 KK      *    F1335A  *        ROUTE
              *            *
              **************
                          PROPOSED CHANNEL
                              Route flow to C135A.
                            Slope=(1727.0 - 1669.0) / 2549.0

                     HYDROGRAPH ROUTING DATA

   72 RS               STORAGE ROUTING
                            NSTPS          1  NUMBER OF SUBREACHES
                             ITYP       FLOW  TYPE OF INITIAL CONDITION
                           RSVRIC      -1.00  INITIAL CONDITION
                                X        .00 WORKING R AND D COEFFICIENT

   73 RC               NORMAL DEPTH CHANNEL
                              ANL       .045  LEFT OVERBANK N-VALUE
                             ANCH       .045  MAIN CHANNEL N-VALUE
                              ANR       .045  RIGHT OVERBANK N-VALUE
                            RLNTH      2549.  REACH LENGTH
                              SEL      .0230  ENERGY SLOPE
                            ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION
```

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                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 75 RY       ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 74 RX       DISTANCE        .00       .00       .00       .00     40.00     40.00     40.00     40.00

                                          ***

                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .55      1.11      1.66      2.22      2.77      3.33      3.88      4.43      4.99
          OUTFLOW        .00     18.14     57.36    112.31    180.71    261.11    352.48    454.00    565.03    685.00
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE       5.54      6.10      6.65      7.21      7.76      8.32      8.87      9.42      9.98     10.53
          OUTFLOW     813.45    949.96   1094.16   1245.73   1404.35   1569.77   1741.73   1920.00   2104.36   2294.62
        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     1404. TO     2295.
                 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   F1335A
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+      78.     12.83                49.         14.          5.          2.
                            (INCHES)     1.081       1.233       1.233       1.233
                            (AC-FT)        24.         28.         28.         28.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
         1.     12.83                 1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+    (FEET)     (HR)
     100.56     12.83              100.42      100.13      100.04      100.02

                          CUMULATIVE AREA =      .42 SQ MI

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

                          HYDROGRAPH AT STATION   F1335A
                        TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+      73.     12.83                46.         13.          4.          2.
                            (INCHES)     1.009       1.138       1.139       1.139
                            (AC-FT)        23.         26.         26.         26.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
         1.     12.83                 1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+    (FEET)     (HR)
     100.54     12.83              100.40      100.12      100.04      100.02

                          CUMULATIVE AREA =      .42 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   51:  //F1335A/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***

                          INTERPOLATED HYDROGRAPH AT   F1335A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+      76.     12.83                48.         14.          5.          2.
                            (INCHES)     1.059       1.203       1.204       1.204
                            (AC-FT)        24.         27.         27.         27.

                          CUMULATIVE AREA =      .42 SQ MI
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 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

                **************
                *            *
 77 KK          *    S135A   *        BASIN
                *            *
                **************
                          Compute runoff from subbasin 135A

                    SUBBASIN RUNOFF DATA

 79 BA                SUBBASIN CHARACTERISTICS
                           TAREA         .08  SUBBASIN AREA

 80 LG                GREEN AND AMPT LOSS RATE
                           STRTL         .35  STARTING LOSS
                             DTH         .36  MOISTURE DEFICIT
                            PSIF        5.00  WETTING FRONT SUCTION
                           XKSAT         .28  HYDRAULIC CONDUCTIVITY
                           RTIMP        1.00  PERCENT IMPERVIOUS AREA

 78 UI                INPUT UNITGRAPH,   4 ORDINATES,   VOLUME =  .99
                         199.0     325.0      95.0      23.0

                                                                  ***

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

                          HYDROGRAPH AT STATION    S135A
                        TRANSPOSITION AREA       .1 SQ MI

        TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.94, TOTAL EXCESS =    1.26

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+     204.     12.00                11.         3.          1.          0.
                            (INCHES)     1.229       1.241       1.241       1.241
                            (AC-FT)         6.          6.          6.          6.

                          CUMULATIVE AREA =      .08 SQ MI

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

                          HYDROGRAPH AT STATION    S135A
                        TRANSPOSITION AREA      10.0 SQ MI

        TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.84, TOTAL EXCESS =    1.15

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+     191.     12.00                10.         3.          1.          0.
                            (INCHES)     1.125       1.137       1.137       1.137
                            (AC-FT)         5.          5.          5.          5.

                          CUMULATIVE AREA =      .08 SQ MI

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

                          INTERPOLATED HYDROGRAPH AT    S135A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)      (HR)
                              (CFS)
+     205.     12.00                11.         3.          1.          0.
                            (INCHES)     1.233       1.245       1.245       1.245
                            (AC-FT)         6.          6.          6.          6.

                          CUMULATIVE AREA =      .08 SQ MI


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

                **************
                *            *
 82 KK          *    C135A   *        COMBINE
                *            *
                **************
                          Combine runoff from S135A w/ routed outflow from Fan 13 detention basin

 84 HC                HYDROGRAPH COMBINATION
                           ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                          HYDROGRAPH AT STATION    C135A
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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)
+     221.     12.00                 59.         17.          6.          2.
                (INCHES)          1.083       1.234       1.235       1.235
                 (AC-FT)           29.          33.         33.         33.

                  CUMULATIVE AREA =     .51 SQ MI


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

                    HYDROGRAPH AT STATION    C135A
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     207.     12.00                 55.         16.          5.          2.
                (INCHES)          1.010       1.138       1.139       1.139
                 (AC-FT)           27.          31.         31.         31.

                  CUMULATIVE AREA =     .51 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135A/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                  INTERPOLATED HYDROGRAPH AT    C135A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     216.     12.00                 58.         16.          5.          2.
                (INCHES)          1.057       1.200       1.201       1.201
                 (AC-FT)           29.          32.         32.         32.

                  CUMULATIVE AREA =     .51 SQ MI


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


          **************
          *            *
 86 KK    *    35A35B  *        ROUTE
          *            *
          **************
                    PROPOSED CHANNEL
                        Route combined flows to C135B.
                     Slope=(1669.0 - 1589.0) / 3760.0

            HYDROGRAPH ROUTING DATA

 90 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

 91 RC        NORMAL DEPTH CHANNEL
                     ANL        .045  LEFT OVERBANK N-VALUE
                    ANCH        .045  MAIN CHANNEL N-VALUE
                     ANR        .045  RIGHT OVERBANK N-VALUE
                   RLNTH       3760.  REACH LENGTH
                     SEL       .0210  ENERGY SLOPE
                   ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                  --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 93 RY      ELEVATION   104.00   100.00   100.00   100.00   100.00   100.00   100.00   104.00
 92 RX      DISTANCE       .00      .00      .00      .00    60.00    60.00    60.00    60.00

                                       ***

                            COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

      STORAGE       .00     1.09     2.18     3.27     4.36     5.45     6.54     7.63     8.72     9.81
      OUTFLOW       .00    21.40    67.78   132.92   214.19   309.97   419.08   540.61   673.82   818.11
    ELEVATION    100.00   100.21   100.42   100.63   100.84   101.05   101.26   101.47   101.68   101.89

      STORAGE     10.90    11.99    13.08    14.17    15.26    16.35    17.45    18.54    19.63    20.72
      OUTFLOW    972.95  1137.89  1312.51  1496.47  1689.42  1891.08  2101.17  2319.44  2545.65  2779.58
    ELEVATION    102.11   102.32   102.53   102.74   102.95   103.16   103.37   103.58   103.79   104.00
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*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      973. TO     2780.
                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   35A35B
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     157.     12.17                 58.         17.          6.          2.
                (INCHES)          1.061       1.234       1.235       1.235
                 (AC-FT)           29.          33.         33.         33.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)     (HR)
        2.     12.17                  1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.69     12.17               100.37      100.11      100.04      100.02

                  CUMULATIVE AREA =     .51 SQ MI

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

                    HYDROGRAPH AT STATION   35A35B
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     143.     12.17                 54.         16.          5.          2.
                (INCHES)           .988       1.138       1.139       1.139
                 (AC-FT)           27.          31.         31.         31.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)     (HR)
        2.     12.17                  1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    100.66     12.17               100.35      100.11      100.04      100.02

                  CUMULATIVE AREA =     .51 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35A35B/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                  INTERPOLATED HYDROGRAPH AT   35A35B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     152.     12.17                 56.         16.          5.          2.
                (INCHES)          1.035       1.200       1.201       1.201
                 (AC-FT)           28.          32.         32.         32.

                  CUMULATIVE AREA =     .51 SQ MI


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


          **************
          *            *
 95 KK    *     S135B  *        BASIN
          *            *
          **************
                        Compute runoff from subbasin 135B

            SUBBASIN RUNOFF DATA

 97 BA        SUBBASIN CHARACTERISTICS
                   TAREA         .22  SUBBASIN AREA

 98 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

 96 UI          INPUT UNITGRAPH,    8 ORDINATES,  VOLUME = 1.00
                    147.0     520.0     536.0     275.0     133.0      59.0      25.0      16.0
                                                                  ***
     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    S135B
                     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)
+     436.     12.08                       27.         7.          2.          1.
                (INCHES)                 1.141       1.141       1.141       1.141
                (AC-FT)                    14.         14.         14.         14.

                CUMULATIVE AREA =     .22 SQ MI

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

                      HYDROGRAPH AT STATION    S135B
                     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)
+     406.     12.08                       25.         6.          2.          1.
                (INCHES)                 1.049       1.049       1.049       1.049
                (AC-FT)                    12.         12.         12.         12.

                CUMULATIVE AREA =     .22 SQ MI

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


                   INTERPOLATED HYDROGRAPH AT    S135B

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     431.     12.08                       27.         7.          2.          1.
                (INCHES)                 1.125       1.125       1.125       1.125
                (AC-FT)                    13.         13.         13.         13.

                CUMULATIVE AREA =     .22 SQ MI


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

            **************
            *            *
 100 KK     *     C135B  *      COMBINE
            *            *
            **************
                        Combine runoff from S135B with routed flow from C135A

 102 HC           HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                  ***
     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    C135B
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     576.     12.08                       84.         24.         8.          3.
                (INCHES)                 1.073       1.206       1.206       1.206
                (AC-FT)                    42.         47.         47.         47.

                CUMULATIVE AREA =     .73 SQ MI

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

                      HYDROGRAPH AT STATION    C135B
                     TRANSPOSITION AREA      10.0 SQ MI
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  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     532.     12.08                       78.         22.         7.          3.
                (INCHES)                  .995       1.111       1.111       1.111
                (AC-FT)                    39.         43.         43.         43.

                CUMULATIVE AREA =     .73 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135B/FLOW/08JAN1999/5MIN//
      ***            ***            ***            ***            ***


                   INTERPOLATED HYDROGRAPH AT    C135B

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     557.     12.08                       81.         23.         8.          3.
                (INCHES)                 1.039       1.165       1.165       1.165
                (AC-FT)                    40.         45.         45.         45.

                CUMULATIVE AREA =     .73 SQ MI


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

            **************
            *            *
 104 KK     *    35B35C  *       ROUTE
            *            *
            **************
                        PROPOSED CHANNEL
                           Route combined flows to C135C.
                         Slope=(1589.0 - 1522.0) / 4880.0

                     HYDROGRAPH ROUTING DATA

 108 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

 109 RC           NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
                       RLNTH     4880.  REACH LENGTH
                        SEL      .0140  ENERGY SLOPE
                       ELMAX     104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 111 RY        ELEVATION   104.50   100.00   100.00   100.00   100.00   100.00   100.00   104.50
 110 RX        DISTANCE       .00      .00      .00      .00    70.00    70.00    70.00    70.00
                                                                  ***
                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                STORAGE       .00     1.86     3.71     5.57     7.43     9.29    11.14    13.00    14.86    16.72
                OUTFLOW       .00    24.81    78.58   154.11   248.37   359.46   486.03   627.02   781.58   949.03
              ELEVATION    100.00   100.24   100.47   100.71   100.95   101.18   101.42   101.66   101.89   102.13

                STORAGE     18.57    20.43    22.29    24.14    26.00    27.86    29.72    31.57    33.43    35.29
                OUTFLOW   1128.73  1320.18  1522.90  1736.47  1960.53  2194.71  2438.72  2692.25  2955.04  3226.83
              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     1129. TO     3227.
                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   35B35C
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     446.     12.25                       82.         24.         8.          3.
                (INCHES)                 1.043       1.206       1.206       1.206
                (AC-FT)                    41.         47.         47.         47.
```

```
 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                       6-HR       24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
       4.      12.25                     1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR       24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.35     12.25                  100.45      100.14      100.05      100.02

                            CUMULATIVE AREA =     .73 SQ MI


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

                             HYDROGRAPH AT STATION    35B35C
                           TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     398.     12.25                     76.         22.          7.          3.
                           (INCHES)     .966       1.111       1.111       1.111
                            (AC-FT)      38.         43.         43.         43.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                       6-HR       24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
       3.      12.25                      1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR       24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.26     12.25                  100.43      100.13      100.04      100.02

                            CUMULATIVE AREA =     .73 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35B35C/FLOW/08JAN1999/5MIN//
         ***              ***             ***             ***             ***


                            INTERPOLATED HYDROGRAPH AT    35B35C

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     425.     12.25                     79.         23.          8.          3.
                           (INCHES)    1.010       1.165       1.165       1.165
                            (AC-FT)      39.         45.         45.         45.

                            CUMULATIVE AREA =     .73 SQ MI


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


            **************
            *            *
 113 KK     *    S135C   *        BASIN
            *            *
            **************
                                Compute runoff from subbasin 135C

              SUBBASIN RUNOFF DATA

 115 BA         SUBBASIN CHARACTERISTICS
                      TAREA          .31  SUBBASIN AREA

 116 LG         GREEN AND AMPT LOSS RATE
                      STRTL          .35  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         4.10  WETTING FRONT SUCTION
                      XKSAT          .46  HYDRAULIC CONDUCTIVITY
                      RTIMP          .00  PERCENT IMPERVIOUS AREA

 114 UI         INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                    122.0     467.0     659.0     510.0     282.0     153.0      84.0      46.0      18.0      17.0
                                                                                ***

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

                              HYDROGRAPH AT STATION     S135C
                           TRANSPOSITION AREA         .1 SQ MI

    TOTAL RAINFALL =     4.20, TOTAL LOSS =      3.13, TOTAL EXCESS =      1.06

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     524.     12.08                     35.          9.          3.          1.
                           (INCHES)    1.058       1.058       1.058       1.058
                            (AC-FT)      17.         17.         17.         17.

                            CUMULATIVE AREA =     .31 SQ MI


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

                              HYDROGRAPH AT STATION     S135C
                           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)
+     485.     12.08                     32.          8.          3.          1.
                           (INCHES)     .965        .965        .965        .965
                            (AC-FT)      16.         16.         16.         16.

                            CUMULATIVE AREA =     .31 SQ MI

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


                            INTERPOLATED HYDROGRAPH AT     S135C

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     515.     12.08                     34.          9.          3.          1.
                           (INCHES)    1.036       1.036       1.036       1.036
                            (AC-FT)      17.         17.         17.         17.

                            CUMULATIVE AREA =     .31 SQ MI


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


            **************
            *            *
 119 KK     *    C135C   *        COMBINE
            *            *
            **************
                                Combine runoff from S135C with routed flow from C135B

 121 HC        HYDROGRAPH COMBINATION
                     ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                ***

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

                              HYDROGRAPH AT STATION     C135C
                           TRANSPOSITION AREA         .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     799.     12.17                    115.         32.         11.          5.
                           (INCHES)    1.035       1.162       1.163       1.163
                            (AC-FT)      57.         64.         64.         64.

                            CUMULATIVE AREA =    1.04 SQ MI


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

                              HYDROGRAPH AT STATION     C135C
                           TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                             (CFS)
+     715.     12.17                    106.         30.         10.          4.
                           (INCHES)     .954       1.067       1.068       1.068
                            (AC-FT)      53.         59.         59.         59.

                            CUMULATIVE AREA =    1.04 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //C135C/FLOW/08JAN1999/5MIN//
```

```
      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT     C135C

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      756.      12.17                    111.         31.          10.           4.
                (INCHES)                  .994        1.114        1.115         1.115
                 (AC-FT)                   55.          61.          62.           62.

                          CUMULATIVE AREA =     1.04 SQ MI


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


           ***************
           *             *
123 KK     *    35C35D   *         ROUTE
           *             *
           ***************
                          PROPOSED CHANNEL
                              Route combined flows to C135D at Wagner Wash.
                           Slope=(1522.0 - 1487.0) / 2345.0

             HYDROGRAPH ROUTING DATA

127 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

128 RC         NORMAL DEPTH CHANNEL
                      ANL        .045  LEFT OVERBANK N-VALUE
                     ANCH        .045  MAIN CHANNEL N-VALUE
                      ANR        .045  RIGHT OVERBANK N-VALUE
                    RLNTH       2345.  REACH LENGTH
                      SEL       .0150  ENERGY SLOPE
                    ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
130 RY       ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
129 RX       DISTANCE        .00       .00       .00       .00     75.00     75.00     75.00     75.00

                                          ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .96      1.91      2.87      3.82      4.78      5.74      6.69      7.65      8.61
          OUTFLOW        .00     27.52     87.18    170.99    275.61    398.95    539.50    696.10    867.82   1053.89
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE       9.56     10.52     11.47     12.43     13.39     14.34     15.30     16.26     17.21     18.17
          OUTFLOW    1253.63   1466.46   1691.88   1929.42   2178.67   2439.25   2710.81   2993.03   3285.62   3588.30
        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      399. TO     3588.
                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    35C35D
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      771.      12.25                    114.         32.          11.           5.
                (INCHES)                 1.026       1.162        1.163         1.163
                 (AC-FT)                   57.          64.          64.           64.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
         4.      12.25                      1.           0.           0.            0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.76      12.25                  100.48       100.15       100.05        100.02

                          CUMULATIVE AREA =     1.04 SQ MI

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

                          HYDROGRAPH AT STATION    35C35D
                        TRANSPOSITION AREA      10.0 SQ MI
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```
  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      688.      12.25                    105.         30.          10.           4.
                (INCHES)                  .945        1.067        1.068         1.068
                 (AC-FT)                   52.          59.          59.           59.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
         3.      12.25                      1.           0.           0.            0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                          6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.65      12.25                  100.46       100.15       100.05        100.02

                          CUMULATIVE AREA =     1.04 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   51:  //35C35D/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT     35C35D

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      729.      12.25                    110.         31.          10.           4.
                (INCHES)                  .985        1.114        1.115         1.115
                 (AC-FT)                   54.          61.          62.           62.

                          CUMULATIVE AREA =     1.04 SQ MI


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


           ***************
           *             *
132 KK     *    S135D    *         BASIN
           *             *
           ***************
                          Compute runoff from subbasin 135D

             SUBBASIN RUNOFF DATA

134 BA         SUBBASIN CHARACTERISTICS
                    TAREA         .25  SUBBASIN AREA

135 LG         GREEN AND AMPT LOSS RATE
                    STRTL         .35  STARTING LOSS
                      DTH         .35  MOISTURE DEFICIT
                     PSIF        3.95  WETTING FRONT SUCTION
                    XKSAT         .40  HYDRAULIC CONDUCTIVITY
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

133 UI         INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                  104.0     400.0     548.0     402.0     216.0     115.0      61.0      33.0      14.0      15.0

                                          ***

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

                          HYDROGRAPH AT STATION    S135D
                        TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.06, TOTAL EXCESS =    1.13

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+      450.      12.08                     30.          8.           3.            1.
                (INCHES)                 1.132       1.132        1.132         1.132
                 (AC-FT)                   15.          15.          15.           15.

                          CUMULATIVE AREA =     .25 SQ MI

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

                          HYDROGRAPH AT STATION    S135D
                        TRANSPOSITION AREA      10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.95, TOTAL EXCESS =    1.04

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
```

```
                                        6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     418.      12.08                    28.          7.          2.          1.
                    (INCHES)         1.039       1.039       1.039       1.039
                    (AC-FT)             14.         14.         14.         14.

                                CUMULATIVE AREA =     .25 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT    S135D

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     444.      12.08                    30.          7.          2.          1.
                    (INCHES)         1.114       1.114       1.114       1.114
                    (AC-FT)             15.         15.         15.         15.

                                CUMULATIVE AREA =     .25 SQ MI



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


                 **************
                 *            *
138 KK           *     C135D  *      COMBINE
                 *            *
                 **************

                              Combine runoff from S135D with routed flow from C135C
                              This is the total flow at the downstream end of the Fan 13 corridor.

141 HC                HYDROGRAPH COMBINATION
                           ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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


                            HYDROGRAPH AT STATION    C135D
                           TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    1053.      12.17                   143.         40.         13.          6.
                    (INCHES)         1.039       1.156       1.157       1.157
                    (AC-FT)             71.         79.         79.         79.

                                CUMULATIVE AREA =    1.28 SQ MI

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


                            HYDROGRAPH AT STATION    C135D
                           TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     948.      12.17                   132.         37.         12.          5.
                    (INCHES)          .956       1.062       1.062       1.062
                    (AC-FT)             65.         73.         73.         73.

                                CUMULATIVE AREA =    1.28 SQ MI

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


                              INTERPOLATED HYDROGRAPH AT    C135D

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     995.      12.17                   137.         38.         13.          5.
                    (INCHES)          .993       1.104       1.104       1.104
                    (AC-FT)             68.         75.         76.         76.

                                CUMULATIVE AREA =    1.28 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
                              S125        202.   12.08          14.          4.          1.         .11
+   HYDROGRAPH AT
                              S130        415.   12.17          39.         10.          3.         .31
+   2 COMBINED AT
                             CFAN13       599.   12.08          53.         14.          5.         .42
+   ROUTED TO
                              RR13         77.   12.67          49.         14.          5.         .42
+   ROUTED TO
                            F1335A         76.   12.83          48.         14.          5.         .42
+   HYDROGRAPH AT
                             S135A        205.   12.00          11.          3.          1.         .08
+   2 COMBINED AT
                             C135A        216.   12.00          58.         16.          5.         .51
+   ROUTED TO
                            35A35B        152.   12.17          56.         16.          5.         .51
+   HYDROGRAPH AT
                             S135B        431.   12.08          27.          7.          2.         .22
+   2 COMBINED AT
                             C135B        557.   12.08          81.         23.          8.         .73
+   ROUTED TO
                            35B35C        425.   12.25          79.         23.          8.         .73
+   HYDROGRAPH AT
                             S135C        515.   12.08          34.          9.          3.         .31
+   2 COMBINED AT
                             C135C        756.   12.17         111.         31.         10.        1.04
+   ROUTED TO
                            35C35D        729.   12.25         110.         31.         10.        1.04
+   HYDROGRAPH AT
                             S135D        444.   12.08          30.          7.          2.         .25
+   2 COMBINED AT
                             C135D        995.   12.17         137.         38.         13.        1.28


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

-----DSS---ZCLOSE Unit:  71,   File: FAN1324.DSS
           Pointer Utilization:    .31
           Number of Records:     72
           File Size:    131.9  Kbytes
           Percent Inactive:     .0
```

CURRENT DATE: 10-17-2006
CURRENT TIME: 13:49:31

FILE DATE: 10-17-2006
FILE NAME: RR13

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	98.20	370.00	1 RCP	4.00	4.00	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: RR13 DATE: 10-17-2006

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
102.81	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
105.10	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.52	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
108.71	160.0	135.3	0.0	0.0	0.0	0.0	0.0	23.57	6
108.89	200.0	137.5	0.0	0.0	0.0	0.0	0.0	61.21	4
109.04	240.0	139.3	0.0	0.0	0.0	0.0	0.0	99.99	4
109.08	250.0	139.7	0.0	0.0	0.0	0.0	0.0	109.49	3
109.29	320.0	142.2	0.0	0.0	0.0	0.0	0.0	175.20	3
109.40	360.0	143.6	0.0	0.0	0.0	0.0	0.0	214.77	3
109.51	400.0	144.8	0.0	0.0	0.0	0.0	0.0	253.90	3
108.50	132.7	132.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: RR13 DATE: 10-17-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
100.00	0.000	0.00	0.00	0.00
102.81	0.000	40.00	0.00	0.00
105.10	0.000	80.00	0.00	0.00
107.52	0.000	120.00	0.00	0.00
108.71	-0.010	160.00	1.17	0.73
108.89	-0.004	200.00	1.29	0.64
109.04	-0.008	240.00	0.70	0.29
109.08	-0.008	250.00	0.80	0.32
109.29	-0.006	320.00	2.59	0.81
109.40	-0.004	360.00	1.69	0.47
109.51	-0.003	400.00	1.33	0.33

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

CURRENT DATE: 10-17-2006
CURRENT TIME: 13:49:31

FILE DATE: 10-17-2006
FILE NAME: RR13

PERFORMANCE CURVE FOR CULVERT 1 - 1(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	102.81	2.81	2.81	1-S2n	1.67	1.88	1.58	0.44	8.67	2.96
80.00	105.10	5.10	5.10	5-S2n	2.55	2.70	2.54	0.67	9.51	3.88
120.00	107.52	7.52	5.60	2-M2c	4.00	3.28	3.28	0.86	10.90	4.53
135.26	108.70	8.70	6.54	2-M2c	4.00	3.44	3.44	1.02	11.80	5.05
137.50	108.88	8.88	6.75	2-M2c	4.00	3.46	3.46	1.17	11.93	5.49
139.31	109.03	9.03	6.91	2-M2c	4.00	3.48	3.48	1.30	12.03	5.88
139.71	109.07	9.07	6.95	2-M2c	4.00	3.49	3.49	1.34	12.05	5.97
142.21	109.28	9.28	7.28	2-M2c	4.00	3.51	3.51	1.55	12.19	6.55
143.55	109.40	9.40	7.39	2-M2c	4.00	3.53	3.53	1.66	12.26	6.84
144.78	109.50	9.50	7.49	2-M2c	4.00	3.54	3.54	1.77	12.33	7.11

El. inlet face invert 100.00 ft El. outlet invert 98.20 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	370.00 ft
OUTLET ELEVATION	98.20 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0049
CULVERT LENGTH ALONG SLOPE	370.00 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: 10-17-2006
CURRENT TIME: 13:49:31

FILE DATE: 10-17-2006
FILE NAME: RR13

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	30.00 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	98.20 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	98.20 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	98.20	0.000	0.00	0.00	0.00
40.00	98.64	0.783	0.44	2.96	0.68
80.00	98.87	0.832	0.67	3.88	1.03
120.00	99.06	0.861	0.86	4.53	1.32
160.00	99.22	0.881	1.02	5.05	1.57
200.00	99.37	0.896	1.17	5.49	1.79
240.00	99.50	0.908	1.30	5.88	2.00
250.00	99.54	0.911	1.34	5.97	2.05
320.00	99.75	0.927	1.55	6.55	2.38
360.00	99.86	0.935	1.66	6.84	2.55
400.00	99.97	0.941	1.77	7.11	2.72

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	108.50 ft

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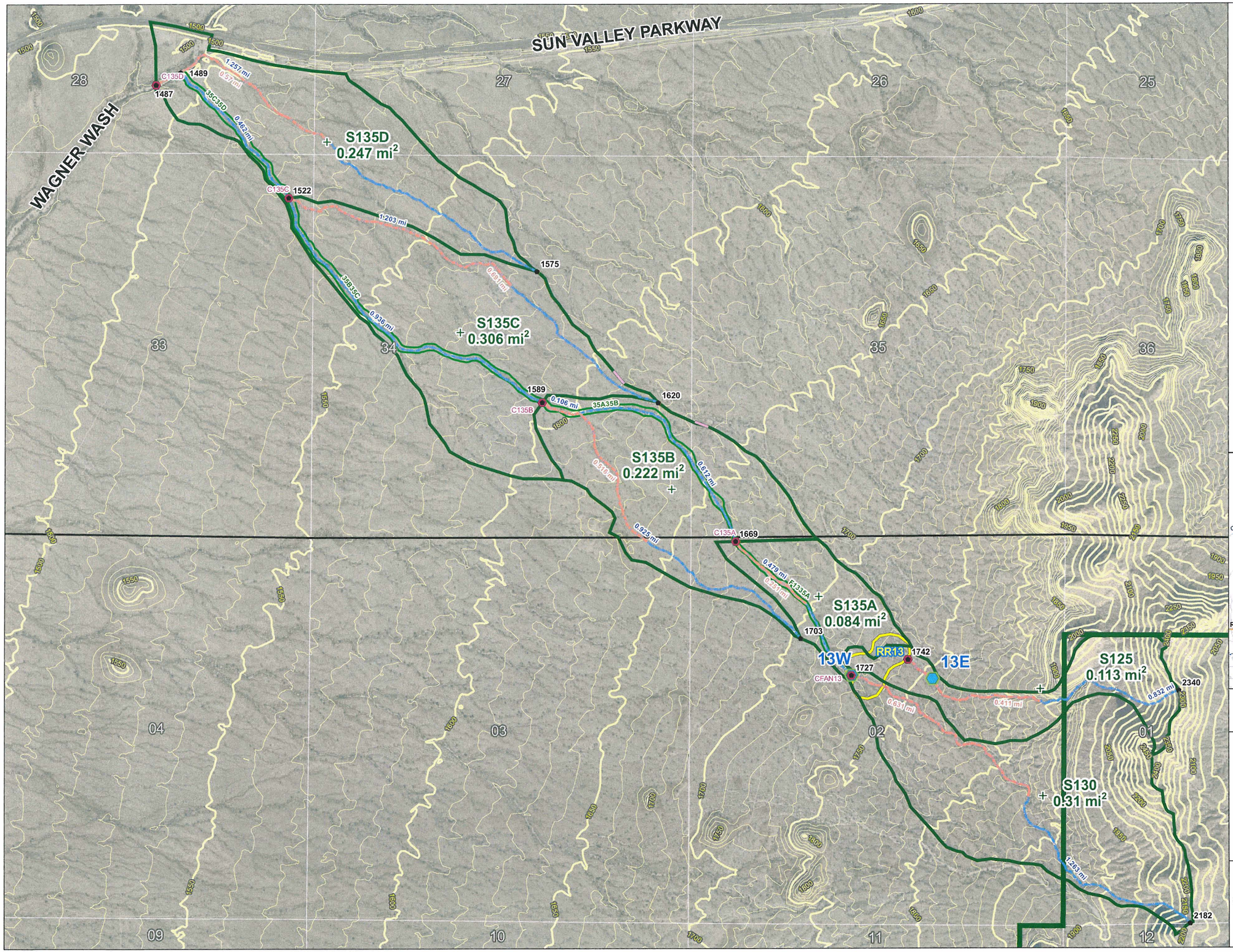


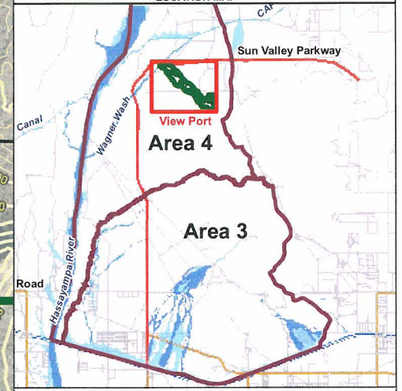
LEGEND

- Subbasin Boundaries
- Subbasin Centroids
- Lca Paths
- Lag & Routing Paths
- Elevation Points
- Concentration Points
- Step 3 Basins

Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 13
SUBBASIN MAP

FCD 2004C049
DECEMBER 2006

N W E S

Feet
0 600 1,200 1,800

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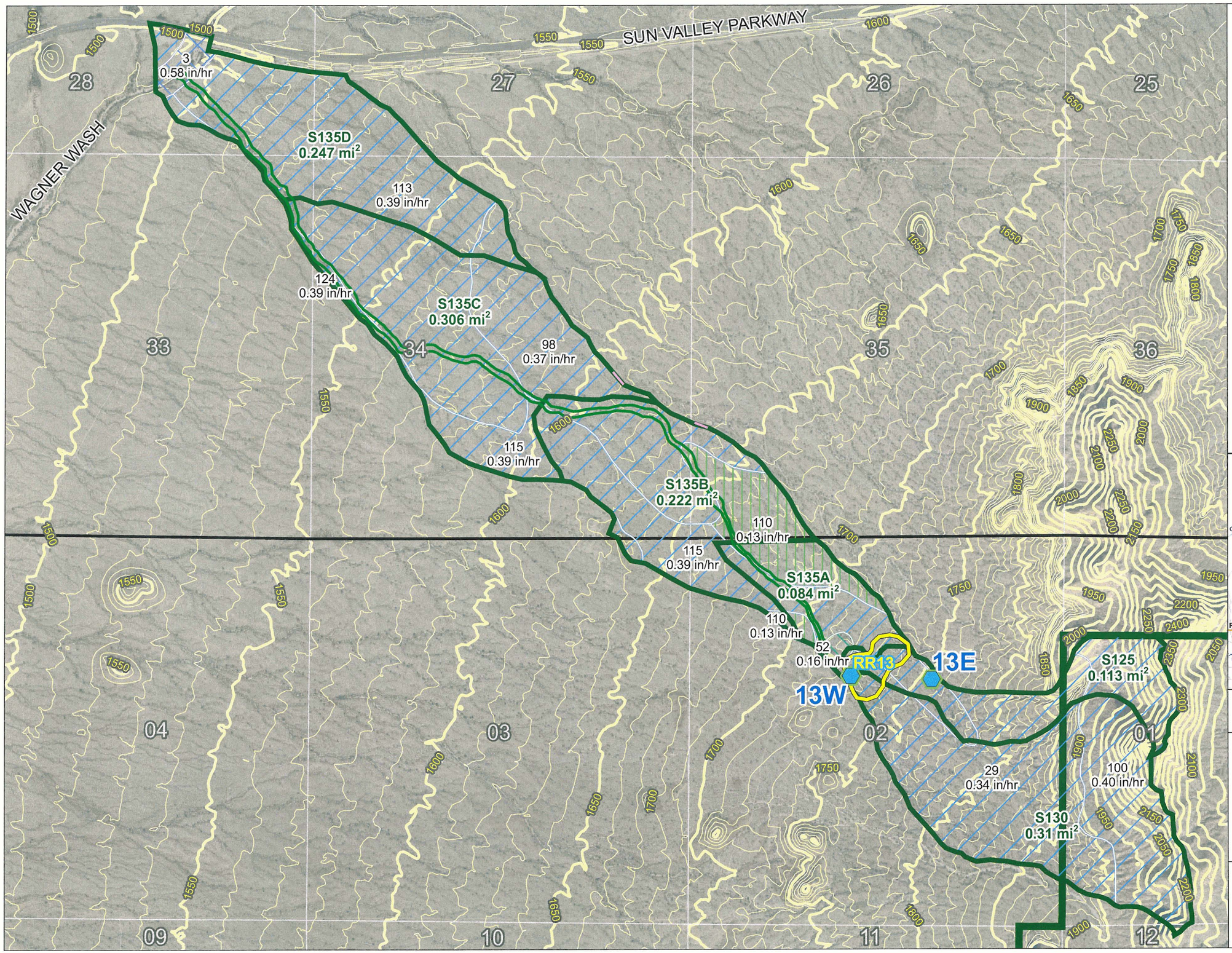


LEGEND

NRCS Soil Data

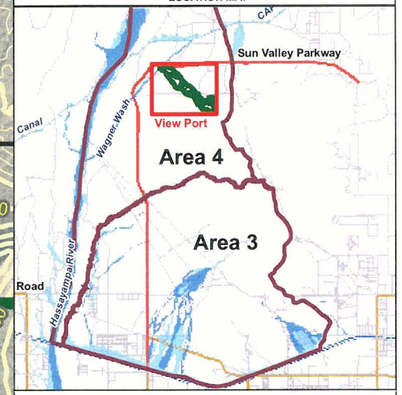
XKSAT (in/hr)

- 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
- Basin Outlet Pipe
- Step 3 Basins
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 13
SOIL MAP

FCD 2004C049
DECEMBER 2006

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Feet
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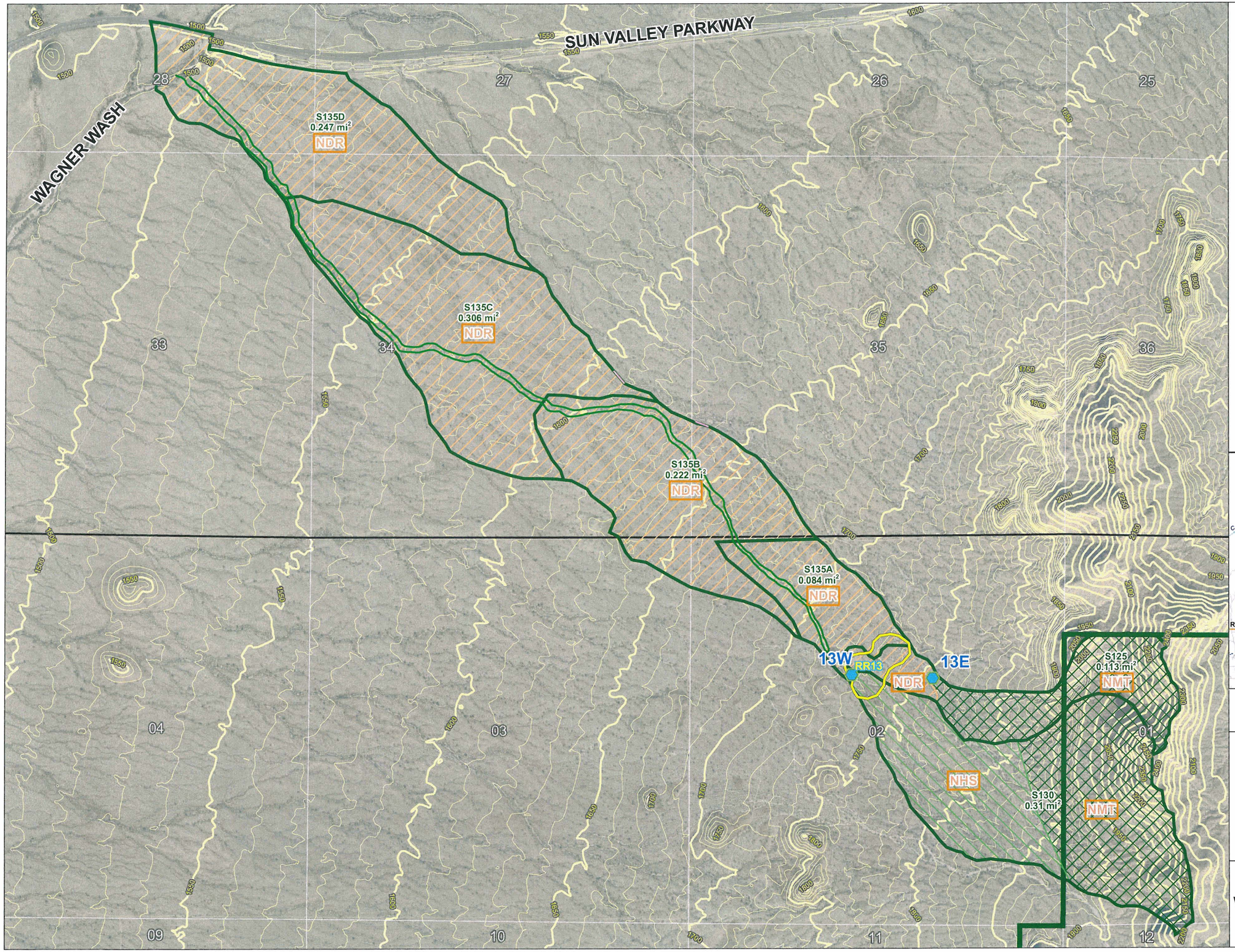


LEGEND

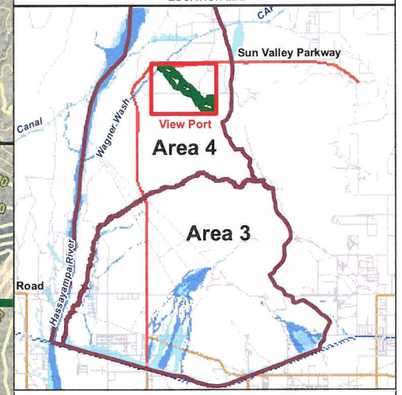
Existing Land Use

- Desert Rangeland (NDR), <5% Slopes
- Hillslopes (NHS), 5-10% slopes
- Mountain Terrain (NMT), >10% Slopes
- Subbasin Boundaries
- Proposed Dikes

Step 3 Corridors

- 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
WAGNER SUB-AREA
FAN SYSTEM 13
LAND USE MAP

FCD 2004C049
DECEMBER 2006

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Feet
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Appendix B

Design Analyses

Fan System 3

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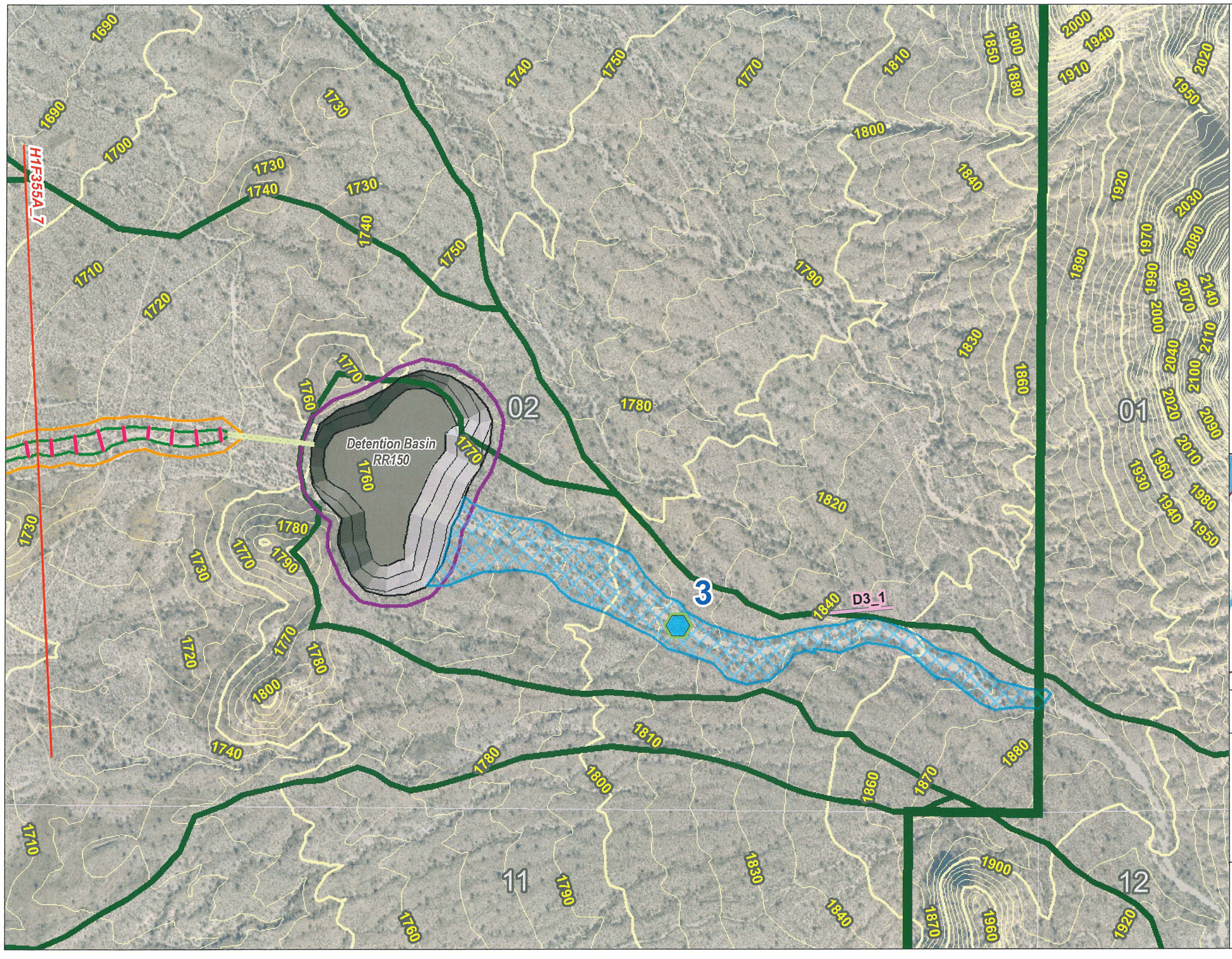


LEGEND

- Step 3 Basins
- 50' Basin Buffer

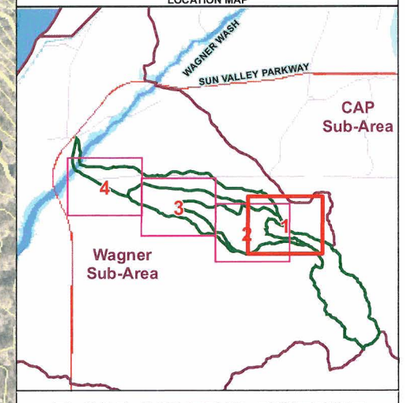
Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 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 - WAGNER SUB-AREA
FAN SYSTEM 3
RECOMMENDED ALTERNATIVE

SHEET 1 OF 4

FCD 2004C049

DECEMBER 2006

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Feet
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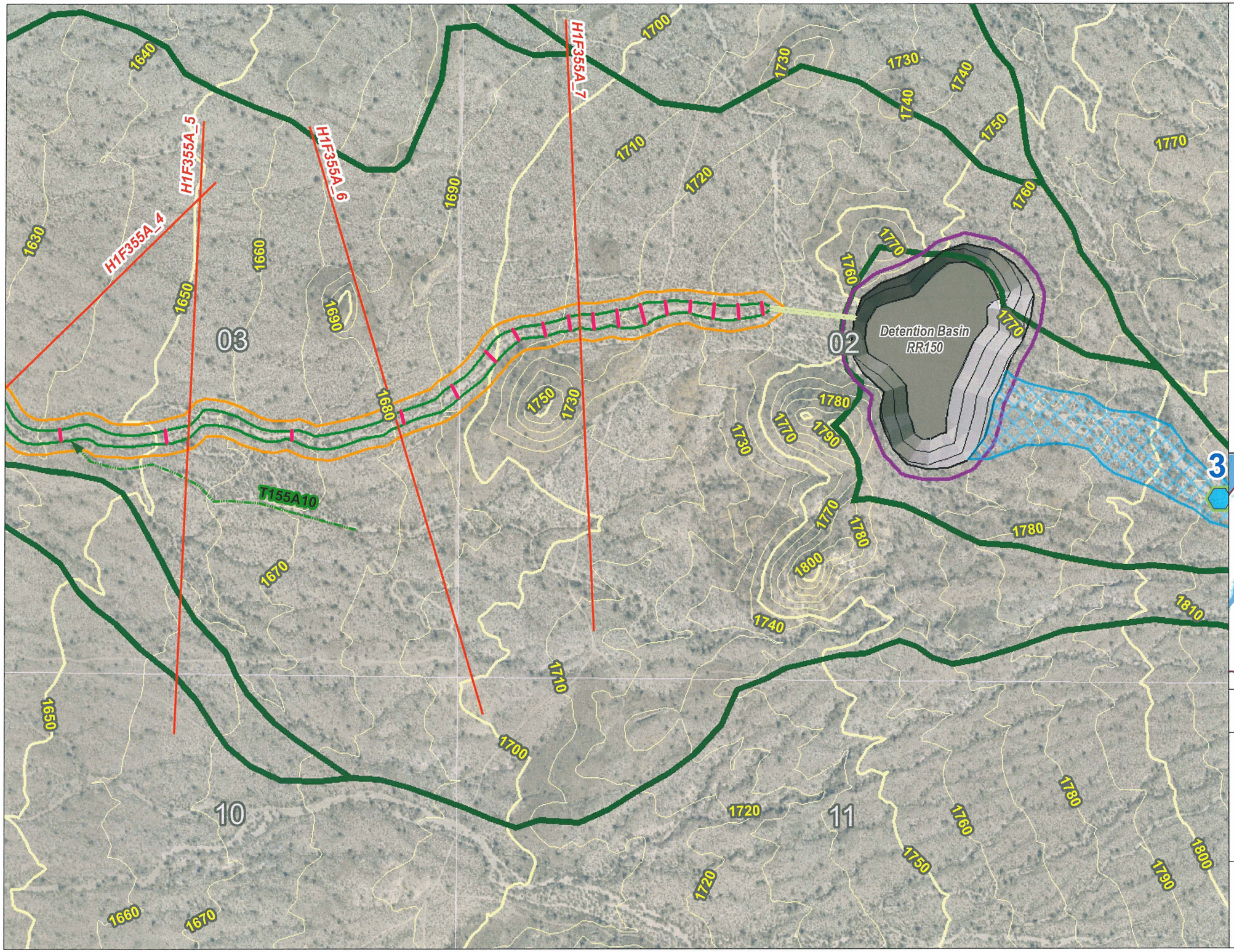


LEGEND

- Step 3 Basins
- 50' Basin Buffer

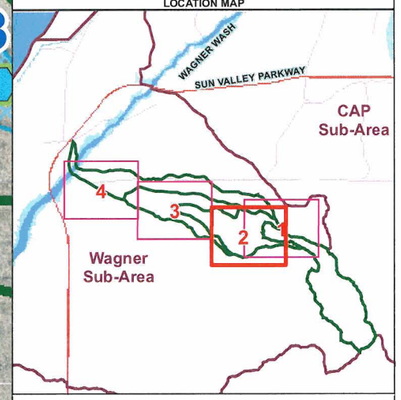
Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 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 - WAGNER SUB-AREA
FAN SYSTEM 3
RECOMMENDED ALTERNATIVE

SHEET 2 OF 4

FCD 2004C049

DECEMBER 2006

N W E S

Feet
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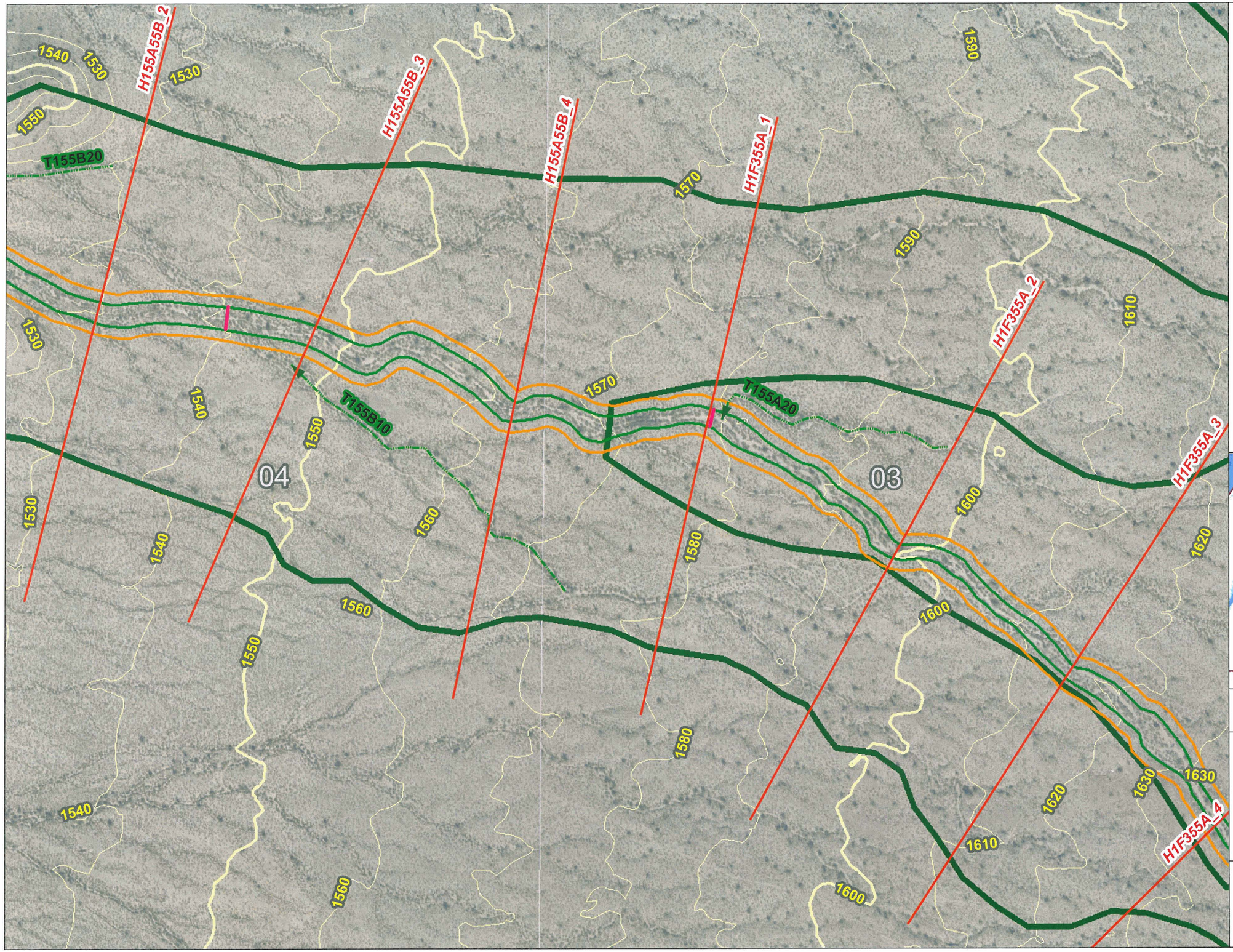

LEGEND

- Step 3 Basins
- 50' Basin Buffer

Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones

- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Countywide 10-ft Topo
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- White Tank Mtn Park
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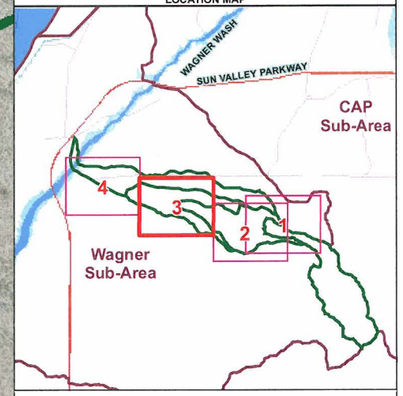
LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 3
RECOMMENDED ALTERNATIVE

SHEET 3 OF 4
FCD 2004C049
DECEMBER 2006

N
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Feet
0 200 400 600

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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)
D3_1	Dike	NA	0.1	0.0	0.5	150	39	NA	$ 10	$ 42	$ 5	$ 22	$ 79	13%	53%	6%	28%	0%	24%	19%	100%	30%	28%
RR150	Online Basin	835	17.3	216.1	0.0	NA	NA	10.0	$ 1,730	$ 2,105	$ 377	$ 1,003	$ 5,215	33%	40%	7%	19%	22%	24%	2%	100%	17%	19%
H1F355A_7	Walled-Levee Corridor	197	5.1	0.0	2.3	0.265	161	0.8	$ 510	$ 460	$ 70	$ 268	$ 1,308	39%	35%	5%	20%	6%	43%	22%	100%	68%	46%
H1F355A_6	Walled-Levee Corridor	297	3.7	0.0	2.1	0.191	161	0.9	$ 370	$ 372	$ 51	$ 197	$ 989	37%	38%	5%	20%	4%	43%	21%	100%	67%	45%
H1F355A_5	Walled-Levee Corridor	392	3.7	0.0	1.7	0.19	161	1.7	$ 370	$ 378	$ 29	$ 143	$ 920	40%	41%	3%	15%	4%	43%	20%	100%	53%	39%
H1F355A_4	Walled-Levee Corridor	491	3.7	0.0	3.3	0.189	161	1.7	$ 370	$ 426	$ 50	$ 205	$ 1,051	35%	41%	5%	20%	5%	43%	24%	100%	63%	45%
H1F355A_3	Walled-Levee Corridor	589	3.7	0.0	3.2	0.19	161	1.6	$ 370	$ 465	$ 50	$ 207	$ 1,093	34%	43%	5%	19%	5%	43%	22%	100%	63%	43%
H1F355A_2	Walled-Levee Corridor	684	4.1	0.0	3.6	0.199	171	1.6	$ 410	$ 492	$ 53	$ 217	$ 1,172	35%	42%	4%	19%	5%	41%	22%	100%	63%	43%
H1F355A_1	Walled-Levee Corridor	789	4.2	0.0	3.9	0.194	181	1.8	$ 420	$ 483	$ 51	$ 213	$ 1,167	36%	41%	4%	18%	5%	38%	23%	100%	62%	42%
H155A55B_4	Walled-Levee Corridor	890	4.4	0.0	3.2	0.188	191	1.8	$ 440	$ 462	$ 49	$ 207	$ 1,158	38%	40%	4%	18%	5%	36%	22%	100%	62%	41%
H155A55B_3	Walled-Levee Corridor	1013	4.8	0.0	2.2	0.197	201	2.0	$ 480	$ 427	$ 52	$ 210	$ 1,169	41%	37%	4%	18%	5%	35%	21%	100%	64%	40%
H155A55B_2	Walled-Levee Corridor	1130	4.7	0.0	2.4	0.192	206	2.3	$ 470	$ 394	$ 51	$ 202	$ 1,117	42%	35%	5%	18%	5%	34%	22%	100%	65%	41%
H155A55B_1	Walled-Levee Corridor	1263	5.0	0.0	2.7	0.196	211	2.2	$ 500	$ 431	$ 52	$ 212	$ 1,196	42%	36%	4%	18%	5%	34%	22%	100%	63%	40%
H155B55C_4	Walled-Levee Corridor	1386	5.0	0.0	3.8	0.187	221	2.3	$ 500	$ 472	$ 49	$ 209	$ 1,230	41%	38%	4%	17%	5%	32%	24%	100%	61%	39%
H155B55C_3	Walled-Levee Corridor	1507	5.3	0.0	3.9	0.19	231	2.2	$ 530	$ 479	$ 50	$ 213	$ 1,272	42%	38%	4%	17%	5%	30%	24%	100%	61%	38%
H155B55C_2	Walled-Levee Corridor	1621	5.5	0.0	3.7	0.19	241	2.2	$ 550	$ 478	$ 50	$ 212	$ 1,290	43%	37%	4%	16%	6%	29%	23%	100%	61%	38%
H155B55C_1	Walled-Levee Corridor	1731	8.5	0.0	3.7	0.281	251	2.3	$ 850	$ 612	$ 74	$ 299	$ 1,835	46%	33%	4%	16%	8%	28%	21%	100%	64%	37%
	TOTAL	88.8	216.1	46.2					$ 8,880	$ 8,979	$ 1,163	$ 4,241	**$ 23,262**	38%	39%	5%	18%	100%	34%	17%	100%	52%	36%
All Channels			71.4	0.0	45.7	3.0			$ 7,140	$ 6,832	$ 781	$ 3,216	$ 17,968	40%	38%	4%	18%	77%					
All Online Basins			17.3	216.1	0.0				$ 1,730	$ 2,105	$ 377	$ 1,003	$ 5,215	33%	40%	7%	19%	22%					
All Offline Basins			0.0	0.0	0.0				$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Dikes			0.1	0.0	0.5	150			$ 10	$ 42	$ 5	$ 22	$ 79	13%	53%	6%	28%	0%					
Channel Cost per mile (in $1000)			$5,913		Basins Cost per ac. ft. (in $1000)				$24.13														

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
S150	BASIN	835			4.42	0.84	134	34	11	5	1.479	1.483	1.483	1.483	66	67	67	67
RR150	STORAGE	75	8	52.9	5.83	0.84	67	33	11	5	0.735	1.478	1.482	1.482	33	66	67	67
F355A	ROUTE	75	100.4	4.76	6.42	0.84	66	33	11	5	0.729	1.475	1.482	1.482	33	66	67	67
S155A	BASIN	1028			4.17	0.57	86	21	7	3	1.396	1.396	1.396	1.396	43	43	43	43
C155A	COMBINE	781			4.17	1.41	126	50	17	7	0.832	1.319	1.324	1.324	63	99	100	100
55A55B	ROUTE	720	101.4	13.26	4.33	1.41	124	50	17	7	0.814	1.319	1.324	1.324	61	99	100	100
S155B	BASIN	916			4.17	0.49	72	18	6	3	1.349	1.349	1.349	1.349	36	36	36	36
C155B	COMBINE	1155			4.25	1.91	174	63	21	9	0.85	1.22	1.224	1.224	86	124	124	124
55B55C	ROUTE	1066	101.6	21.69	4.42	1.91	170	63	21	9	0.83	1.219	1.224	1.224	84	124	124	124
S155C	BASIN	911			4.25	0.7	99	25	8	4	1.315	1.315	1.315	1.315	49	49	49	49
C155C	COMBINE	1512			4.42	2.61	239	80	27	11	0.852	1.136	1.138	1.138	118	158	158	158

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
S150	BASIN	733			12.42	0.84	115	30	10	4	1.274	1.345	1.346	1.346	57	60	60	60
RR150	STORAGE	68	7	44.4	13.75	0.84	60	30	10	4	0.662	1.318	1.346	1.346	30	59	60	60
F355A	ROUTE	68	100.4	4.45	14.33	0.84	59	30	10	4	0.655	1.316	1.346	1.346	29	59	60	60
S155A	BASIN	846			12.17	0.57	71	18	6	3	1.163	1.186	1.187	1.187	35	36	36	36
C155A	COMBINE	840			12.17	1.41	119	47	16	7	0.781	1.244	1.267	1.267	59	94	95	95
55A55B	ROUTE	752	101.5	13.61	12.33	1.41	116	47	16	7	0.764	1.244	1.267	1.267	58	94	95	95
S155B	BASIN	726			12.17	0.49	59	15	5	2	1.11	1.122	1.122	1.122	29	30	30	30
C155B	COMBINE	1327			12.25	1.91	171	61	21	9	0.832	1.199	1.217	1.217	85	122	124	124
55B55C	ROUTE	1193	101.7	23.19	12.42	1.91	167	61	21	9	0.813	1.198	1.217	1.217	83	122	124	124
S155C	BASIN	791			12.25	0.7	84	21	7	3	1.124	1.136	1.136	1.136	42	42	42	42
C155C	COMBINE	1845			12.33	2.61	246	82	28	12	0.877	1.167	1.183	1.183	122	162	164	164

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)
H1F355A_7	Walled-Levee Corridor	0.0301	0.0050	0.27	60	0.8	0.045	197	61.5	43.3	0.7	0.7	0.8	60	4.5	0.94	Yes	0.0	0.4	5.0	120
H1F355A_6	Walled-Levee Corridor	0.0283	0.0195	0.19	60	0.9	0.045	297	61.9	56.6	0.9	0.9	0.9	60	5.2	0.95	No	0.4	0.8	5.2	341
H1F355A_5	Walled-Levee Corridor	0.0227	0.0196	0.19	60	1.7	0.045	392	62.1	71.5	1.2	1.2	1.7	60	5.5	0.88	No	0.8	1.0	5.3	965
H1F355A_4	Walled-Levee Corridor	0.0187	0.0224	0.19	60	1.7	0.045	491	63.1	87.4	1.4	1.5	1.7	60	5.6	0.82	No	1.2	0.9	5.4	N/A
H1F355A_3	Walled-Levee Corridor	0.0182	0.0153	0.19	60	1.6	0.045	589	63.3	98.3	1.6	1.6	1.6	60	6.0	0.82	No	0.9	1.2	5.4	1035
H1F355A_2	Walled-Levee Corridor	0.0183	0.0162	0.20	70	1.6	0.045	684	73.3	113.8	1.6	1.6	1.6	70	6.0	0.83	No	1.2	1.4	5.4	1423
H1F355A_1	Walled-Levee Corridor	0.0170	0.0192	0.19	80	1.8	0.045	789	83.4	133.5	1.6	1.7	1.8	80	5.9	0.81	No	1.7	1.5	5.5	N/A
H155A55B_4	Walled-Levee Corridor	0.0146	0.0155	0.19	90	1.8	0.045	890	93.6	157.3	1.7	1.7	1.8	90	5.7	0.75	No	1.5	1.3	5.4	N/A
H155A55B_3	Walled-Levee Corridor	0.0159	0.0129	0.20	100	2.0	0.045	1013	102.7	172.0	1.7	1.7	2.0	100	5.9	0.79	No	1.3	1.8	5.5	998
H155A55B_2	Walled-Levee Corridor	0.0152	0.0147	0.19	105	2.3	0.045	1130	107.5	189.6	1.8	1.8	2.3	105	6.0	0.78	No	2.0	2.1	5.5	5952
H155A55B_1	Walled-Levee Corridor	0.0140	0.0155	0.20	110	2.2	0.045	1263	113.0	212.0	1.9	1.9	2.2	110	6.0	0.76	No	2.4	2.0	5.5	N/A
H155B55C_4	Walled-Levee Corridor	0.0136	0.0140	0.19	120	2.3	0.045	1386	123.9	234.5	1.9	2.0	2.3	120	5.9	0.75	No	2.2	2.1	5.5	N/A
H155B55C_3	Walled-Levee Corridor	0.0121	0.0127	0.19	130	2.2	0.045	1507	133.9	263.5	2.0	2.0	2.2	130	5.7	0.71	No	2.1	1.9	5.5	N/A
H155B55C_2	Walled-Levee Corridor	0.0127	0.0115	0.19	140	2.2	0.045	1621	143.8	279.1	1.9	2.0	2.2	140	5.8	0.72	No	1.9	2.2	5.5	2505
H155B55C_1	Walled-Levee Corridor	0.0126	0.0119	0.28	150	2.3	0.045	1731	152.6	298.0	2.0	2.0	2.3	150	5.8	0.73	No	2.2	2.4	5.5	4236

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)
RR150	Online Basin	0.0270	13.9	2985	10.0	61.8	52.9	67.0	835	75	8.0	1.0	6.4	1.0

Dike Cost Estimates

Structure ID	D3_1

Dike Characteristics	Design
Dike Length (ft)	150
Levee Top Width (ft)	15
Levee Side Slope (ft/ft)	6
Levee Height (ft)	4

	Design	Aesthetic Trtmt.
Levee Surface Area (sq. Yd)	1067	284
Levee Volume (cu. Yd)	867	200

Toe Protection

Protection Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Protection Length	150	ft
Thickness	1.5	ft
Protection Depth	6	ft
Tie-in Length/Depth	3.0	ft
Total Depth	9.0	ft
Area needed	50	sq. Yd
Volume	150	cu. Yd

Levee Lining

Lining Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Levee Length (ft)	150	
Levee Lining Width (ft)	24	
Levee Lining Thickness (ft)	1.5	

	Design	Aesthetic Trtmt.
Levee Lining Area (sq. Yd)	400	125
Levee Lining Volume (cu. Yd)	200	63

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
Levee	Fill	867	cu. Yd	$ 7.00	$ 6,069	1,067	sq. Yd	$ 4.50	$ 4,802	1,067	sq. Yd	$ 11.67	$ 12,448
Levee Lining	Riprap	200	cu. Yd	$ 75.00	$ 15,000	400	sq. Yd	$ -	$ -	400	sq. Yd	$ 20.83	$ 8,333
Toe Protection	Riprap	150	cu. Yd	$ 75.00	$ 11,250	50	sq. Yd	$ -	$ -	50	sq. Yd	$ 25.00	$ 1,250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 32,319			Total	$ 4,802			Total	$ 22,032
		Contingency Cost (25% of Construction Cost)			$ 8,080								
		Engineering Design Cost (5% of Construction Cost)			$ 1,616								
		Total Construction Cost			$ 42,015								
Levee Aesthetic Treatment Cost	Fill	200	cu. Yd	$ 7.00	$ 1,400	1,067	sq. Yd	$ 4.50	$ 4,802	284	sq. Yd	$ 8.33	$ 2,367
Levee Lining Aesthetic Trtmt. Cost	Riprap	63	cu. Yd	$ 75.00	$ 4,725	400	sq. Yd	$ -	$ -	125	sq. Yd	$ 33.33	$ 4,167
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 6,125			Total	$ 4,802			Total	$ 6,533
		Contingency Cost (25% of Construction Cost)			$ 1,531								
		Engineering Design Cost (5% of Construction Cost)			$ 306								
		Total Construction Cost			$ 7,963								

Total Structure Aesthetic Trtmt Cost	$ 19,297

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way		0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Levee	39	0.1	$100,000	$ 10,000
Other	0	0	$100,000	$ -
Total	39	0.1		$ 10,000

Total Land Related Aes. Trtmt Cost	$ 2,400

Total Cost	$ 78,848

Total Aesthetic Treatment Cost	$ 21,697

Total Right of Way Cost	$ 10,000

Online Basin

Structure ID	RR150

HEC1 ID	RR150

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

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

Drainage Area =	0.84 sq. mi.
Area Contributing Sediment =	0.84 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	7	84	95	0.56	3285
Q-5	0.25	17	209	95	0.56	9166
Q-10	0.35	23	292	95	0.56	13361
Q-25	0.55	37	459	95	0.56	22165
Q-50	0.75	50	626	95	0.56	31372
Q-100	1	67	835	95	0.56	43298

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

Soil Map Unit	K	% of Basin
100	0.02	61.2%
49	0.08	19.1%
29	0.21	10.1%
14	0.10	3.4%
123	0.20	2.1%
115	0.27	1.7%
47	0.13	1.7%
110	0.20	0.4%
52	0.08	0.4%
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:	275	ft	(Basin Average)
Slope Angles:	27.4	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	12.05		

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	3285	0.06	12.05	0.32	1.00	817	0.41
Q-5	9166	0.06	12.05	0.32	1.00	2281	1.13
Q-10	13361	0.06	12.05	0.32	1.00	3325	1.65
Q-25	22165	0.06	12.05	0.32	1.00	5516	2.74
Q-50	31372	0.06	12.05	0.32	1.00	7808	3.88
Q-100	43298	0.06	12.05	0.32	1.00	10776	5.35
Weighted Average Annual Sediment Yield:						1549	0.77

Total Sediment Yield Volume (ac. ft)	6.4

Sediment Depth in Basin	1 ft

Geometry

Topography slope (ft/ft)	0.027
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	10
Freeboard (ft)	1
Top Perimeter (ft)	2985.3
Top Area (acres)	13.9
Bottom elevation (ft)	1739.5
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	61.8
Total Available Volume (ac. ft) (incl. Freeboard)	77.4
Total Excavation Volume (ac. ft)	216.1

Basin Outlet

Diameter	3.00	ft
Invert Elevation	0.00	ft
Number of pipes	1	

Stage-Storage-Discharge

Elevation	0	1	3	5	7	8	9	9.5	10	11
Storage	0.0	0.0	13.5	28.3	44.4	52.9	61.8	66.3	71.0	80.5
Outflow	0.0	9.3	29.7	51.9	67.6	75.4	82.0	84.3	86.6	116.6

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Total Flow Volume entering Basin (ac. ft)	67.0	60	67.0
Peak Inflow (cfs)	835	733	835.0
Peak Outflow (cfs)	75	68	75.0
Stage at Peak Outflow (ft)	8.0	7	8.0
Volume at Peak Outflow (ac. ft)	52.9	44.4	52.9

Volume Check

Total Volume needed	59.3	ac. ft
Total Volume Provided	61.8	ac. ft

Volume OK?	Yes

Stage Check

Depth Needed	10.0	ft
Depth Provided	10	ft

Depth OK?	Yes

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	348641	0
Excavated Area (sq. Yd)	67276.0	3317
Adjacent Buffer Area (sq. Yd)	16585	

Inlet	Terraced	Riprap-lined
Average Inlet Height (ft)	33	
Average Inlet Length (ft)	200	
Total Width of all inlets (ft)	280	
Material Thickness (ft)	0.5	3.0
Total Inlet Area (sq. Yd)	7248.9	0
Total Material Volume (cu. Yd)	1208.2	0
Unit Cost	$ 155.00	$ 75.00
Total Cost	$ 187,271	$ -

Outlet		
Outlet Type	Pipe	
(None, Riprap Weir, Concrete Weir, Pipe)		
Pipe Length	455	ft
Unit Cost	$ 82.00	per ft
Cost per outlet	$ 37,310	
Other Cost	$ -	
Total Cost	$ 37,310	
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		348,641	cu. Yd	$ 4.00	$ 1,394,564	83,861	sq. Yd	$ 4.50	$ 377,375	83,861	sq. Yd	$ 8.33	$ 698,842
Inlet					$ 187,271				$ -				$ 302,038
Outlet	Pipe	1	EA	$ 37,310	$ 37,310	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 1,619,145			Total	$ 377,375			Total	$ 1,003,096
		Contingency Cost (25% of Construction Cost)			$ 404,786								
		Engineering Design Cost (5% of Construction Cost)			$ 80,957								
		Total Construction Cost			$ 2,104,889								

Structure Aesthetic Treatment Cost

Basin - Aesthetic Treatment		348,641	cu. Yd	$ -	$ -	83,861	sq. Yd	$ 4.50	$ 377,375	13,268	sq. Yd	$ 8.33	$ 110,567
Inlet - Aesthetic Treatment (20%Inlet)					$ 37,454				$ -				$ 60,408
Outlet -Aesthetic Treatment (5% Outlet)					$ 1,866	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 39,320			Total	$ 377,375			Total	$ 171,085
		Contingency Cost (25% of Construction Cost)			$ 9,830								
		Engineering Design Cost (5% of Construction Cost)			$ 1,966								
		Total Construction Cost			$ 51,116								
Total Structure Aesthetic Trtmt Cost	$ 599,575												

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	3.4	$100,000	$ 340,000
Basin	13.9	$100,000	$ 1,390,000
Other		$100,000	$ -
Total	17.3	$100,000	$ 1,730,000

Total Land Related Aes. Trtmt Cost	$ 408,533				
Total Cost	$ 5,215,359	Total Aesthetic Treatment Cost	$ 1,008,108	Total Right of Way Cost	$ 1,730,000

Walled-Levee Corridor

Structure ID	H1F355A	HEC1 ID	F355A	Cutline ID	7

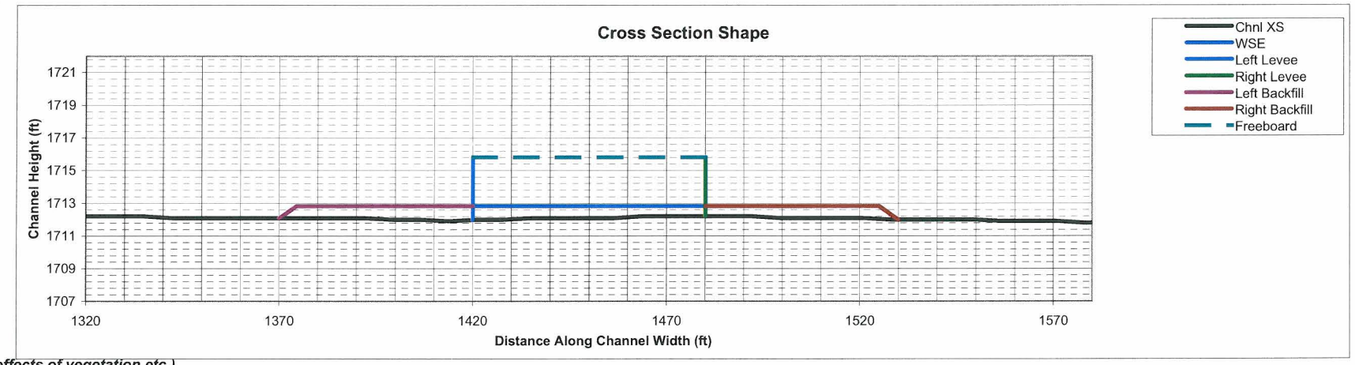
Longitudinal Geometry

Length	1398.7	ft
Initial Channel Slope	0.0301	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0050	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1420	Right Levee Station (ft)	1480
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1420	Right Channel Limit Station (ft)	1480

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.16	0.84								
Flow into Channel	134	63								197

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
20	60.4	10.8	1712.0	1712.3	1.8	0.3	60.0	0.2	0.2	0.76
59	60.7	20.9	1712.0	1712.5	2.8	0.5	60.0	0.3	0.3	0.84
148	61.3	36.4	1712.0	1712.7	4.1	0.7	60.0	0.6	0.6	0.92
197	61.5	43.3	1712.0	1712.8	4.5	0.8	60.0	0.7	0.7	0.94

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
20	60.7	18.5	1712.0	1712.4	1.1	0.4	60.0	0.3	0.3	0.34
59	61.2	36.0	1712.0	1712.7	1.6	0.7	60.0	0.6	0.6	0.37
148	62.1	62.7	1712.0	1713.2	2.4	1.2	60.0	1.0	1.0	0.41
197	62.5	74.7	1712.0	1713.4	2.6	1.4	60.0	1.2	1.2	0.42

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
59										0.00

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
20	Stable
59	Stable
148	Stable
197	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	59	cfs
Clear Water	Yes	
Total Incoming Sediment Load	0.000	cfs
Initial Chnl Sediment Capacity	0.447	cfs
Long-term Equilibrium Slope (MPM)	0.0050	

Drop Structures

Design Slope	0.0050	ft/ft
Total Drop Needed	35.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	11.70	
Distance between Structures	120	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)
197	1.1	24.6	0.8	0.7	4.5	0.0301	-0.2	0.6	1.5	0.1	2.0	5.0

Cost Estimates

Channel Characteristics

Channel Length (ft)	1399
Channel Limit-Left Station (ft)	1420
Channel Limit-Right Station (ft)	1480
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1399
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.8
Right Levee Length (ft)	1399
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.6

Left Levee Surface Area (sq. Yd)	591
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)	1151
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)	70075
Left Levee Fill XS area (sq. ft)	38.3
Left Levee Fill Volume (cu. Yd)	1985
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)	70075
Right Levee Fill XS area (sq. ft)	33.7
Right Levee Fill Volume (cu. Yd)	1746
Total Levee Fill Surface Area (sq. ft)	140150
Total Levee Fill Volume (cu Yd)	3731

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)	3.7	
Structure Height (ft)	6.7	
Number of Structures	11.70	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	14.87	1.49
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,264	$ 127
Area per structure (sq. Yd)	7	1
Total Area (cu. Yd)	78	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	1,399	ft	$ 172	$ 240,727	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,151	sq. Yd	$ -	$ -	1,151	sq. Yd	$ -	$ -	1,151	sq. Yd	$ 75.00	$ 86,325	
Adjacent Levee Fill	Fill	3,731	cu. Yd	$ 7.00	$ 26,117	15,544	sq. Yd	$ 4.50	$ 69,950	15,544	sq. Yd	$ 11.67	$ 181,352	
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,151	sq. Yd	$ 63.00	$ 72,513	1,151	sq. Yd	$ -	$ -	1,151	sq. Yd	$ -	$ -	
Drop Structures	Gabions	12	EA	$ 1,263.95	$ 14,788	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 354,145			Total	$ 69,950			Total	$ 267,927	
		Contingency Cost (25% of Construction Cost)			$ 88,536									
		Engineering Design Cost (5% of Construction Cost)			$ 17,707									
		Total Construction Cost			$ 460,389									
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,151	sq. Yd	$ 63.00	$ 72,513	1,151	sq. Yd	$ -	$ -	1,151	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,731	cu. Yd	$ 7.00	$ 26,117	15,544	sq. Yd	$ 4.50	$ 69,950	15,544	sq. Yd	$ 11.67	$ 181,352	
Drop Structures Aesthetic Trtmt. Cost	Gabions	12	EA	$ 126.65	$ 1,482	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 100,112			Total	$ 69,950			Total	$ 181,377	
		Contingency Cost (25% of Construction Cost)			$ 25,028									
		Engineering Design Cost (5% of Construction Cost)			$ 5,006									
		Total Construction Cost			$ 130,145									

Total Structure Aesthetic Trtmt Cost	$ 381,472

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	60	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	5.1		$ 510,000

Total Land Related Aes. Trtmt Cost	$ 220,000

Total Cost	$ 1,308,265	Total Aesthetic Treatment Cost	$ 601,472	Total Right of Way Cost	$ 510,000

Walled-Levee Corridor

Structure ID	H1F355A

HEC1 ID	F355A

Cutline ID	6

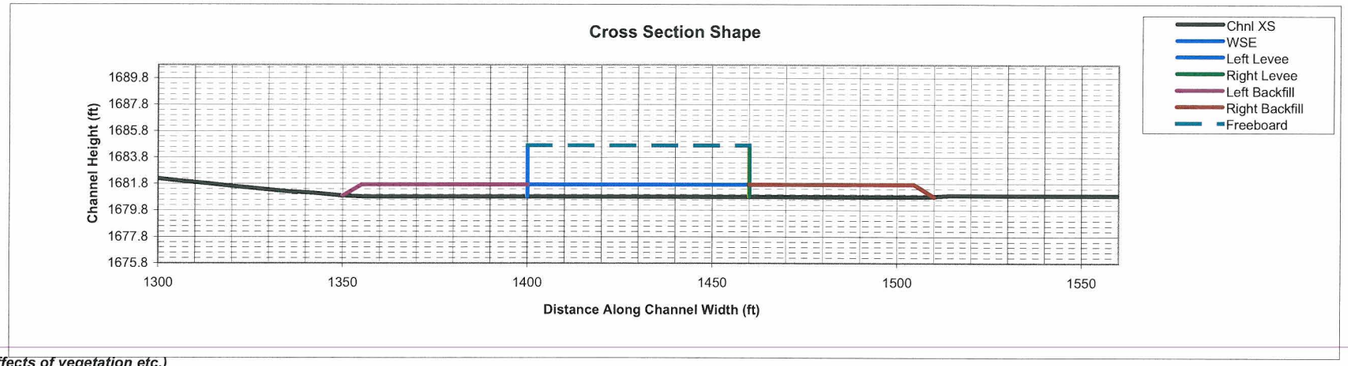
Longitundal Geometry

Length	1010.4	ft
Initial Channel Slope	0.0283	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0195	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1400	Right Levee Station (ft)	1460
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1400	Right Channel Limit Station (ft)	1460

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.29	0.71								
Flow into Channel	244	53								297

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
30	60.5	14.1	1680.8	1681.0	2.1	0.2	60.0	0.2	0.2	0.77
89	60.9	27.3	1680.8	1681.3	3.3	0.5	60.0	0.4	0.5	0.85
223	61.6	47.5	1680.8	1681.6	4.7	0.8	60.0	0.8	0.8	0.93
297	61.9	56.6	1680.8	1681.7	5.2	0.9	60.0	0.9	0.9	0.95

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
30	60.5	15.8	1680.8	1681.1	1.9	0.3	60.0	0.3	0.3	0.65
89	61.0	30.6	1680.8	1681.3	2.9	0.5	60.0	0.5	0.5	0.72
223	61.8	53.2	1680.8	1681.7	4.2	0.9	60.0	0.9	0.9	0.78
297	62.1	63.4	1680.8	1681.9	4.7	1.1	60.0	1.0	1.1	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
	H1F355A_7									
89	0.45									0.45

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel
Discharge (cfs)	**FHWA Max. Permissible Velocity Table**
30	Stable
89	Stable
223	Stable
297	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	89	cfs
Clear Water	No	
Total Incoming Sediment Load	0.447	cfs
Initial Chnl Sediment Capacity	0.770	cfs
Long-term Equilibrium Slope (ADWR)	0.0195	

Drop Structures

Design Slope	0.0195	ft/ft
Total Drop Needed	8.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.96	
Distance between Structures	341	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)
297	1.1	24.6	0.9	0.9	5.2	0.0283	-0.2	0.7	1.5	0.1	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1010
Channel Limit-Left Station (ft)	1400
Channel Limit-Right Station (ft)	1460
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1010
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.9
Right Levee Length (ft)	1010
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.9

Left Levee Surface Area (sq. Yd)	438
Left Levee Volume (cu. Yd)	73
Right Levee Surface Area (sq. Yd)	438
Right Levee Volume (cu. Yd)	73
Total Levee Surface Area (sq. Yd)	876
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)	50621
Left Levee Fill XS area (sq. ft)	44.7
Left Levee Fill Volume (cu. Yd)	1672
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)	50621
Right Levee Fill XS area (sq. ft)	44.7
Right Levee Fill Volume (cu. Yd)	1672
Total Levee Fill Surface Area (sq. ft)	101242
Total Levee Fill Volume (cu Yd)	3344

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	60	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	5.2	
Structure Height (ft)	8.2	
Number of Structures	2.96	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	18.19	1.82
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,546	$ 155
Area per structure (sq. Yd)	7	1
Total Area (cu. Yd)	20	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	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	876	sq. Yd	$ -	$ -	876	sq. Yd	$ -	$ -	876	sq. Yd	$ 75.00	$ 65,700
Adjacent Levee Fill	Fill	3,344	cu. Yd	$ 7.00	$ 23,408	11,222	sq. Yd	$ 4.50	$ 50,500	11,222	sq. Yd	$ 11.67	$ 130,926
Wall Material Aesthetic Treatment Cost	Wall	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	876	sq. Yd	$ 63.00	$ 55,188	876	sq. Yd	$ -	$ -	876	sq. Yd	$ -	$ -
Drop Structures	Gabions	3	EA	$ 1,546.15	$ 4,577	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 286,142			Total	$ 50,500			Total	$ 196,876
		Contingency Cost (25% of Construction Cost)			$ 71,535								
		Engineering Design Cost (5% of Construction Cost)			$ 14,307								
		Total Construction Cost			$ 371,984								
Wall Material Aesthetic Treatment Cost	Wall	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -	146	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	876	sq. Yd	$ 63.00	$ 55,188	876	sq. Yd	$ -	$ -	876	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,344	cu. Yd	$ 7.00	$ 23,408	11,222	sq. Yd	$ 4.50	$ 50,500	11,222	sq. Yd	$ 11.67	$ 130,926
Drop Structures Aesthetic Trtmt. Cost	Gabions	3	EA	$ 154.70	$ 458	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 79,054			Total	$ 50,500			Total	$ 130,951
		Contingency Cost (25% of Construction Cost)			$ 19,763								
		Engineering Design Cost (5% of Construction Cost)			$ 3,953								
		Total Construction Cost			$ 102,770								
Total Structure Aesthetic Trtmt Cost	$ 284,221												

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	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 989,360	Total Aesthetic Treatment Cost	$ 444,221	Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H1F355A	HEC1 ID	F355A	Cutline ID	5

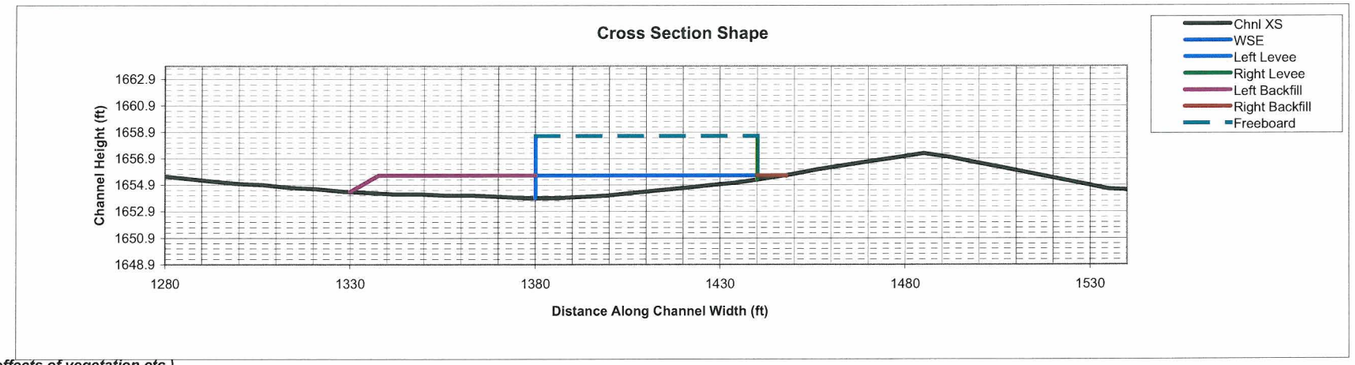
Longitudinal Geometry

Length	1003.9	ft
Initial Channel Slope	0.0227	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0196	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1380	Right Levee Station (ft)	1440
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1380	Right Channel Limit Station (ft)	1440

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.41	0.59								
Flow into Channel	348	44								392

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	35.7	14.4	1653.9	1654.5	2.7	0.6	35.1	0.4	0.4	0.75
118	51.0	32.1	1653.9	1655.0	3.7	1.1	49.9	0.6	0.6	0.81
294	61.7	60.0	1653.9	1655.4	4.9	1.5	60.0	1.0	1.0	0.86
392	62.1	71.5	1653.9	1655.6	5.5	1.7	60.0	1.2	1.2	0.88

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	36.5	15.2	1653.9	1654.6	2.6	0.7	35.9	0.4	0.4	0.70
118	52.3	33.9	1653.9	1655.0	3.5	1.1	51.2	0.6	0.7	0.75
294	61.8	62.8	1653.9	1655.5	4.7	1.6	60.0	1.0	1.0	0.81
392	62.2	74.8	1653.9	1655.7	5.2	1.8	60.0	1.2	1.2	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
	H1F355A_6								
118	0.77								0.77

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
39	Stable
118	Stable
294	Stable
392	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	118	cfs
Clear Water	No	
Total Incoming Sediment Load	0.770	cfs
Initial Chnl Sediment Capacity	0.954	cfs
Long-term Equilibrium Slope (ADWR)	0.0196	

Drop Structures

Design Slope	0.0196	ft/ft
Total Drop Needed	3.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.04	
Distance between Structures	965	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)
392	1.1	24.6	1.7	1.2	5.5	0.0227	-0.4	0.8	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	1004
Channel Limit-Left Station (ft)	1380
Channel Limit-Right Station (ft)	1440
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1004
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.7
Right Levee Length (ft)	1004
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.3

Left Levee Surface Area (sq. Yd)	524
Left Levee Volume (cu. Yd)	87
Right Levee Surface Area (sq. Yd)	368
Right Levee Volume (cu. Yd)	61
Total Levee Surface Area (sq. Yd)	892
Total Levee Volume (cu. Yd)	148

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)	50295
Left Levee Fill XS area (sq. ft)	70.5
Left Levee Fill Volume (cu. Yd)	2622
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	7.9
Right Levee Fill Surface Area (sq. ft)	7931
Right Levee Fill XS area (sq. ft)	1.3
Right Levee Fill Volume (cu. Yd)	48
Total Levee Fill Surface Area (sq. ft)	58226
Total Levee Fill Volume (cu Yd)	2670

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	60	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	6.1	
Structure Height (ft)	9.1	
Number of Structures	1.04	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	20.14	2.01
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,712	$ 171
Area per structure (sq. Yd)	7	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	1,004	ft	$ 213	$ 214,240	148	cu. Yd	$ -	$ -	148	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	892	sq. Yd	$ -	$ -	892	sq. Yd	$ -	$ -	892	sq. Yd	$ 75.00	$ 66,900
Adjacent Levee Fill	Fill	2,670	cu. Yd	$ 7.00	$ 18,690	6,459	sq. Yd	$ 4.50	$ 29,066	6,459	sq. Yd	$ 11.67	$ 75,356
Wall Material Aesthetic Treatment Cost	Wall	148	cu. Yd	$ -	$ -	148	cu. Yd	$ -	$ -	148	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	892	sq. Yd	$ 63.00	$ 56,196	892	sq. Yd	$ -	$ -	892	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 1,711.90	$ 1,780	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 290,906			Total	$ 29,066			Total	$ 142,506
		Contingency Cost (25% of Construction Cost)			$ 72,726								
		Engineering Design Cost (5% of Construction Cost)			$ 14,545								
		Total Construction Cost			$ 378,178								
Wall Material Aesthetic Treatment Cost	Wall	148	cu. Yd	$ -	$ -	148	cu. Yd	$ -	$ -	148	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	892	sq. Yd	$ 63.00	$ 56,196	892	sq. Yd	$ -	$ -	892	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,670	cu. Yd	$ 7.00	$ 18,690	6,459	sq. Yd	$ 4.50	$ 29,066	6,459	sq. Yd	$ 11.67	$ 75,356
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 170.85	$ 178	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 75,064			Total	$ 29,066			Total	$ 75,381
		Contingency Cost (25% of Construction Cost)			$ 18,766								
		Engineering Design Cost (5% of Construction Cost)			$ 3,753								
		Total Construction Cost			$ 97,583								

Total Structure Aesthetic Trtmt Cost	$ 202,029

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	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 919,749	Total Aesthetic Treatment Cost	$ 362,029	Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H1F355A

HEC1 ID	F355A

Cutline ID	4

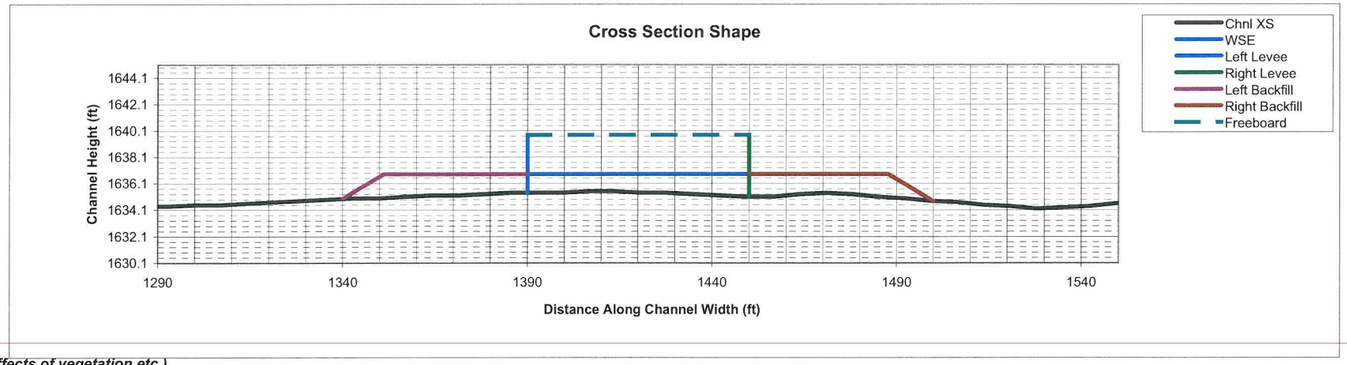
Longitundal Geometry

Length	997.8	ft
Initial Channel Slope	0.0187	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0224	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1390	Right Levee Station (ft)	1450
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1390	Right Channel Limit Station (ft)	1450

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.54	0.46								
Flow into Channel	457	34								491

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
49	61.0	21.6	1635.1	1635.7	2.3	0.6	60.0	0.4	0.4	0.67
147	61.6	42.0	1635.1	1636.1	3.5	1.0	60.0	0.7	0.7	0.74
368	62.7	73.3	1635.1	1636.6	5.0	1.5	60.0	1.2	1.2	0.80
491	63.1	87.4	1635.1	1636.8	5.6	1.7	60.0	1.4	1.5	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
49	60.9	20.5	1635.1	1635.7	2.4	0.6	60.0	0.3	0.3	0.72
147	61.6	39.8	1635.1	1636.0	3.7	0.9	60.0	0.6	0.7	0.80
368	62.6	69.4	1635.1	1636.5	5.3	1.4	60.0	1.1	1.2	0.87
491	63.0	82.7	1635.1	1636.7	5.9	1.6	60.0	1.3	1.4	0.89

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
	H1F355A_5	T155A10								
147	0.95	0.25								1.20

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
49	Stable
147	Stable
368	Erosive
491	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	147	cfs
Clear Water	No	
Total Incoming Sediment Load	1.203	cfs
Initial Chnl Sediment Capacity	0.924	cfs
Long-term Equilibrium Slope (ADWR)	0.0224	

Drop Structures

Design Slope	0.0224	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)
491	1.1	24.6	1.7	1.5	5.6	0.0187	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	998
Channel Limit-Left Station (ft)	1390
Channel Limit-Right Station (ft)	1450
Channel Width (ft)	60

Levee

Left Levee Length (ft)	998
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.4
Right Levee Length (ft)	998
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	488
Left Levee Volume (cu. Yd)	81
Right Levee Surface Area (sq. Yd)	521
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1009
Total Levee Volume (cu. Yd)	168

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)	50087
Left Levee Fill XS area (sq. ft)	71.8
Left Levee Fill Volume (cu. Yd)	2654
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)	50087
Right Levee Fill XS area (sq. ft)	70.7
Right Levee Fill Volume (cu. Yd)	2613
Total Levee Fill Surface Area (sq. ft)	100174
Total Levee Fill Volume (cu Yd)	5267

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)	6.9	
Structure Height (ft)	9.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	22.08	2.21
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,877	$ 188
Area per structure (sq. Yd)	7	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	998	ft	$ 228	$ 227,375	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,009	sq. Yd	$ -	$ -	1,009	sq. Yd	$ -	$ -	1,009	sq. Yd	$ 75.00	$ 75,675
Adjacent Levee Fill	Fill	5,267	cu. Yd	$ 7.00	$ 36,869	11,089	sq. Yd	$ 4.50	$ 49,900	11,089	sq. Yd	$ 11.67	$ 129,370
Wall Material Aesthetic Treatment Cost	Wall	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,009	sq. Yd	$ 63.00	$ 63,567	1,009	sq. Yd	$ -	$ -	1,009	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 1,876.80	$ -	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 327,811			Total	$ 49,900			Total	$ 205,295
		Contingency Cost (25% of Construction Cost)			$ 81,953								
		Engineering Design Cost (5% of Construction Cost)			$ 16,391								
		Total Construction Cost			$ 426,154								
Wall Material Aesthetic Treatment Cost	Wall	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,009	sq. Yd	$ 63.00	$ 63,567	1,009	sq. Yd	$ -	$ -	1,009	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	5,267	cu. Yd	$ 7.00	$ 36,869	11,089	sq. Yd	$ 4.50	$ 49,900	11,089	sq. Yd	$ 11.67	$ 129,370
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 187.85	$ -	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 100,436			Total	$ 49,900			Total	$ 129,395
		Contingency Cost (25% of Construction Cost)			$ 25,109								
		Engineering Design Cost (5% of Construction Cost)			$ 5,022								
		Total Construction Cost			$ 130,567								

Total Structure Aesthetic Trtmt Cost	$ 309,862

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	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,051,350	Total Aesthetic Treatment Cost	$ 469,862
		Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H1F355A	HEC1 ID	F355A	Cutline ID	3

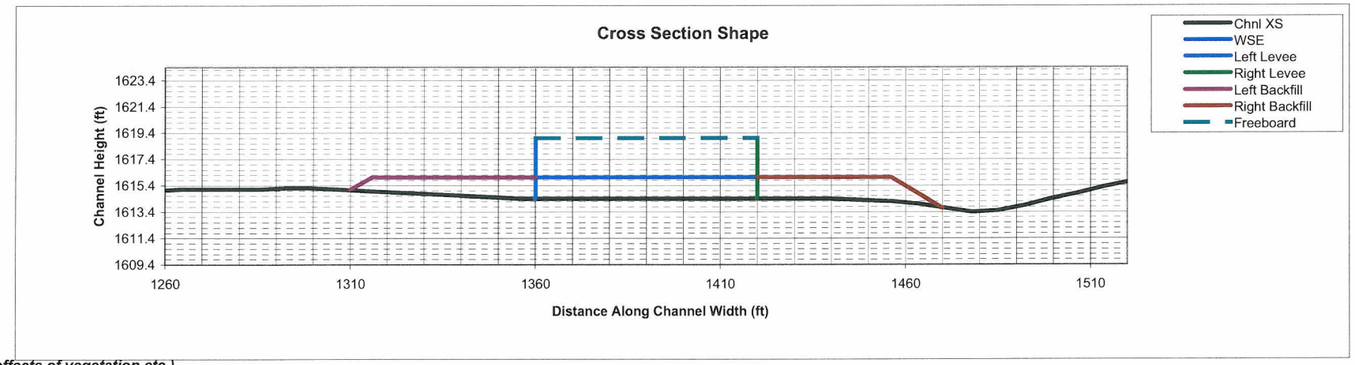
Longitudinal Geometry

Length	1004.0	ft
Initial Channel Slope	0.0182	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0153	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1360	Right Levee Station (ft)	1420
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1360	Right Channel Limit Station (ft)	1420

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.67	0.33								
Flow into Channel	564	25								589

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
59	60.8	24.3	1614.4	1614.8	2.4	0.4	60.0	0.4	0.4	0.67
177	61.6	47.2	1614.4	1615.2	3.7	0.8	60.0	0.8	0.8	0.74
442	62.7	82.4	1614.4	1615.8	5.4	1.4	60.0	1.3	1.4	0.81
589	63.3	98.3	1614.4	1616.0	6.0	1.6	60.0	1.6	1.6	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
59	60.9	25.6	1614.4	1614.8	2.3	0.4	60.0	0.4	0.4	0.62
177	61.7	49.8	1614.4	1615.2	3.6	0.8	60.0	0.8	0.8	0.69
442	62.9	86.9	1614.4	1615.8	5.1	1.4	60.0	1.4	1.4	0.74
589	63.5	103.7	1614.4	1616.1	5.7	1.7	60.0	1.6	1.7	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
	H1F355A_4									
177	0.92									0.92

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
59	Stable
177	Stable
442	Erosive
589	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	177	cfs
Clear Water	No	
Total Incoming Sediment Load	0.924	cfs
Initial Chnl Sediment Capacity	1.182	cfs
Long-term Equilibrium Slope (ADWR)	0.0153	

Drop Structures

Design Slope	0.0153	ft/ft
Total Drop Needed	2.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.97	
Distance between Structures	1035	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)
589	1.1	24.6	1.6	1.6	6.0	0.0182	-0.4	1.0	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1004
Channel Limit-Left Station (ft)	1360
Channel Limit-Right Station (ft)	1420
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1004
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.6
Right Levee Length (ft)	1004
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	513
Left Levee Volume (cu. Yd)	86
Right Levee Surface Area (sq. Yd)	513
Right Levee Volume (cu. Yd)	86
Total Levee Surface Area (sq. Yd)	1026
Total Levee Volume (cu. Yd)	172

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)	50300
Left Levee Fill XS area (sq. ft)	63.8
Left Levee Fill Volume (cu. Yd)	2372
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)	50401
Right Levee Fill XS area (sq. ft)	73.1
Right Levee Fill Volume (cu. Yd)	2718
Total Levee Fill Surface Area (sq. ft)	100701
Total Levee Fill Volume (cu Yd)	5090

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)	7.5	
Structure Height (ft)	10.5	
Number of Structures	0.97	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	23.32	2.33
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,982	$ 198
Area per structure (sq. Yd)	7	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	1,004	ft	$ 255	$ 255,720	172	cu. Yd	$ -	$ -	172	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,026	sq. Yd	$ -	$ -	1,026	sq. Yd	$ -	$ -	1,026	sq. Yd	$ 75.00	$ 76,950
Adjacent Levee Fill	Fill	5,090	cu. Yd	$ 7.00	$ 35,630	11,156	sq. Yd	$ 4.50	$ 50,200	11,156	sq. Yd	$ 11.67	$ 130,148
Wall Material Aesthetic Treatment Cost	Wall	172	cu. Yd	$ -	$ -	172	cu. Yd	$ -	$ -	172	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,026	sq. Yd	$ 63.00	$ 64,638	1,026	sq. Yd	$ -	$ -	1,026	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 1,982.20	$ 1,923	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 357,911			Total	$ 50,200			Total	$ 207,348
		Contingency Cost (25% of Construction Cost)			$ 89,478								
		Engineering Design Cost (5% of Construction Cost)			$ 17,896								
		Total Construction Cost			$ 465,284								
Wall Material Aesthetic Treatment Cost	Wall	172	cu. Yd	$ -	$ -	172	cu. Yd	$ -	$ -	172	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,026	sq. Yd	$ 63.00	$ 64,638	1,026	sq. Yd	$ -	$ -	1,026	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,090	cu. Yd	$ 7.00	$ 35,630	11,156	sq. Yd	$ 4.50	$ 50,200	11,156	sq. Yd	$ 11.67	$ 130,148
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 198.05	$ 192	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 100,460			Total	$ 50,200			Total	$ 130,173
		Contingency Cost (25% of Construction Cost)			$ 25,115								
		Engineering Design Cost (5% of Construction Cost)			$ 5,023								
		Total Construction Cost			$ 130,598								

Total Structure Aesthetic Trtmt Cost	$ 310,971

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	60	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,092,832

Total Aesthetic Treatment Cost	$ 470,971

Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H1F355A

HEC1 ID	F355A

Cutline ID	2

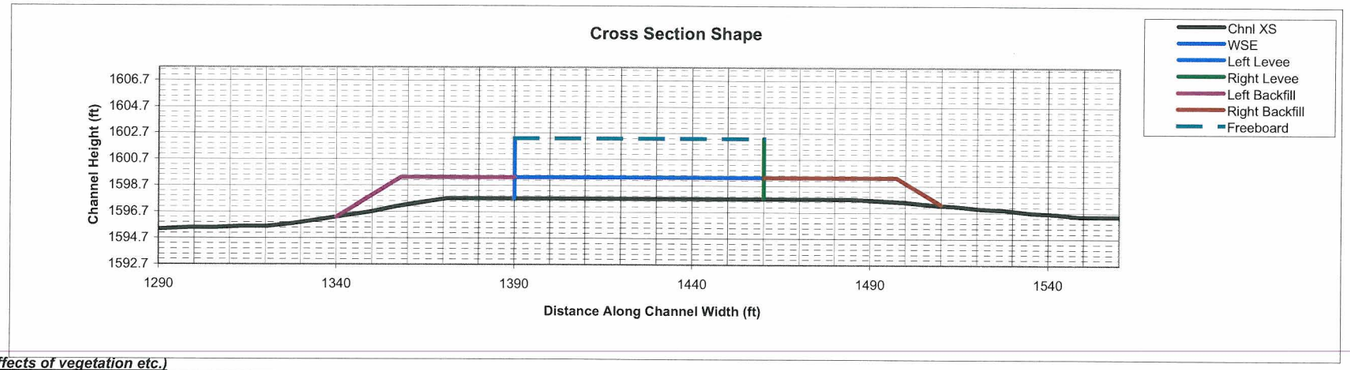
Longitudinal Geometry

Length	1053.0	ft
Initial Channel Slope	0.0183	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0162	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1390	Right Levee Station (ft)	1460
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1390	Right Channel Limit Station (ft)	1460

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.80	0.20								
Flow into Channel	669	15								684

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
68	70.8	28.2	1597.7	1598.1	2.4	0.4	70.0	0.4	0.4	0.67
205	71.6	54.8	1597.7	1598.5	3.7	0.8	70.0	0.8	0.8	0.75
513	72.7	95.5	1597.7	1599.1	5.4	1.4	70.0	1.3	1.4	0.81
684	73.3	113.8	1597.7	1599.3	6.0	1.6	70.0	1.6	1.6	0.83

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
68	70.8	29.3	1597.7	1598.1	2.3	0.4	70.0	0.4	0.4	0.64
205	71.6	56.8	1597.7	1598.5	3.6	0.8	70.0	0.8	0.8	0.71
513	72.8	99.1	1597.7	1599.1	5.2	1.4	70.0	1.4	1.4	0.77
684	73.4	118.1	1597.7	1599.4	5.8	1.7	70.0	1.6	1.7	0.79

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
	H1F355A_3									
205	1.18									1.18

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
68	Stable
205	Stable
513	Erosive
684	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	205	cfs
Clear Water	No	
Total Incoming Sediment Load	1.182	cfs
Initial Chnl Sediment Capacity	1.389	cfs
Long-term Equilibrium Slope (ADWR)	0.0162	

Drop Structures

Design Slope	0.0162	ft/ft
Total Drop Needed	2.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.74	
Distance between Structures	1423	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)
684	1.1	24.6	1.6	1.6	6.0	0.0183	-0.3	1.0	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1053
Channel Limit-Left Station (ft)	1390
Channel Limit-Right Station (ft)	1460
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1053
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.6
Right Levee Length (ft)	1053
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	538
Left Levee Volume (cu. Yd)	90
Right Levee Surface Area (sq. Yd)	538
Right Levee Volume (cu. Yd)	90
Total Levee Surface Area (sq. Yd)	1076
Total Levee Volume (cu. Yd)	180

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)	52963
Left Levee Fill XS area (sq. ft)	75.2
Left Levee Fill Volume (cu. Yd)	2933
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)	52858
Right Levee Fill XS area (sq. ft)	73.4
Right Levee Fill Volume (cu. Yd)	2863
Total Levee Fill Surface Area (sq. ft)	105821
Total Levee Fill Volume (cu Yd)	5796

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)	7.5	
Structure Height (ft)	10.5	
Number of Structures	0.74	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.24	2.72
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,315	$ 231
Area per structure (sq. Yd)	8	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	1,053	ft	$ 255	$ 268,201	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,076	sq. Yd	$ -	$ -	1,076	sq. Yd	$ -	$ -	1,076	sq. Yd	$ 75.00	$ 80,700
Adjacent Levee Fill	Fill	5,796	cu. Yd	$ 7.00	$ 40,572	11,700	sq. Yd	$ 4.50	$ 52,650	11,700	sq. Yd	$ 11.67	$ 136,500
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,076	sq. Yd	$ 63.00	$ 67,788	1,076	sq. Yd	$ -	$ -	1,076	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 2,315.40	$ 1,713	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 378,274			Total	$ 52,650			Total	$ 217,492
		Contingency Cost (25% of Construction Cost)			$ 94,568								
		Engineering Design Cost (5% of Construction Cost)			$ 18,914								
		Total Construction Cost			$ 491,756								
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,076	sq. Yd	$ 63.00	$ 67,788	1,076	sq. Yd	$ -	$ -	1,076	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	5,796	cu. Yd	$ 7.00	$ 40,572	11,700	sq. Yd	$ 4.50	$ 52,650	11,700	sq. Yd	$ 11.67	$ 136,500
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 231.20	$ 171	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 108,531			Total	$ 52,650			Total	$ 136,529
		Contingency Cost (25% of Construction Cost)			$ 27,133								
		Engineering Design Cost (5% of Construction Cost)			$ 5,427								
		Total Construction Cost			$ 141,090								

Total Structure Aesthetic Trtmt Cost	$ 330,270

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	70	1.7	$100,000	$ 170,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	4.1		$ 410,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,171,898	Total Aesthetic Treatment Cost	$ 500,270	Total Right of Way Cost	$ 410,000

Walled-Levee Corridor

Structure ID	H1F355A

HEC1 ID	F355A

Cutline ID	1

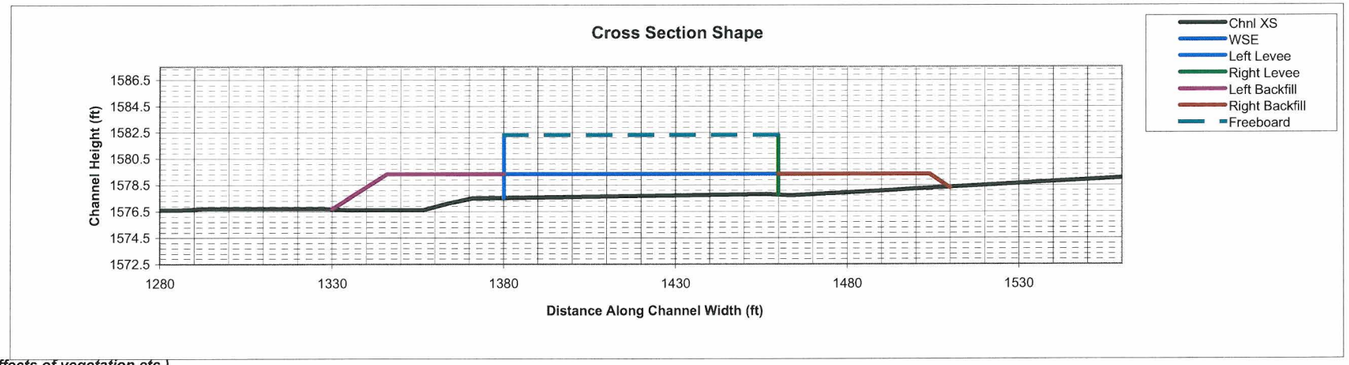
Longitudinal Geometry

Length	1023.3	ft
Initial Channel Slope	0.0170	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0192	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1380	Right Levee Station (ft)	1460
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1380	Right Channel Limit Station (ft)	1460

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	C155A	RR150								TOTAL
HEC1 Peak-Flow	840	75								
Weighting Factor	0.93	0.07								
Flow into Channel	784	5								789

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
79	80.9	33.1	1577.5	1578.1	2.4	0.6	80.0	0.4	0.4	0.65
237	81.7	64.3	1577.5	1578.5	3.7	1.0	80.0	0.8	0.8	0.72
592	82.9	112.1	1577.5	1579.1	5.3	1.6	80.0	1.4	1.4	0.79
789	83.4	133.5	1577.5	1579.3	5.9	1.8	80.0	1.6	1.7	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
79	80.9	31.9	1577.5	1578.1	2.5	0.6	80.0	0.4	0.4	0.69
237	81.6	62.0	1577.5	1578.4	3.8	0.9	80.0	0.8	0.8	0.76
592	82.8	108.0	1577.5	1579.0	5.5	1.5	80.0	1.3	1.4	0.83
789	83.3	128.7	1577.5	1579.3	6.1	1.8	80.0	1.5	1.6	0.85

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
	H1F355A_2	T155A20								
237	1.39	0.34								1.73

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
79	Stable
237	Stable
592	Erosive
789	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	237	cfs
Clear Water	No	
Total Incoming Sediment Load	1.727	cfs
Initial Chnl Sediment Capacity	1.458	cfs
Long-term Equilibrium Slope (ADWR)	0.0192	

Drop Structures

Design Slope	0.0192	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)
789	1.1	24.6	1.8	1.7	5.9	0.0170	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1023
Channel Limit-Left Station (ft)	1380
Channel Limit-Right Station (ft)	1460
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1023
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	1023
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	546
Left Levee Volume (cu. Yd)	91
Right Levee Surface Area (sq. Yd)	523
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1069
Total Levee Volume (cu. Yd)	178

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)	51370
Left Levee Fill XS area (sq. ft)	100.3
Left Levee Fill Volume (cu. Yd)	3800
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)	51267
Right Levee Fill XS area (sq. ft)	63.9
Right Levee Fill Volume (cu. Yd)	2421
Total Levee Fill Surface Area (sq. ft)	102637
Total Levee Fill Volume (cu Yd)	6221

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)	7.6	
Structure Height (ft)	10.6	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	31.51	3.15
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,678	$ 268
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	1,023	ft	$ 255	$ 260,560	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,069	sq. Yd	$ -	$ -	1,069	sq. Yd	$ -	$ -	1,069	sq. Yd	$ 75.00	$ 80,175	
Adjacent Levee Fill	Fill	6,221	cu. Yd	$ 7.00	$ 43,547	11,367	sq. Yd	$ 4.50	$ 51,150	11,367	sq. Yd	$ 11.67	$ 132,611	
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,069	sq. Yd	$ 63.00	$ 67,347	1,069	sq. Yd	$ -	$ -	1,069	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,678.35	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 371,454			Total	$ 51,150			Total	$ 213,119	
		Contingency Cost (25% of Construction Cost)			$ 92,863									
		Engineering Design Cost (5% of Construction Cost)			$ 18,573									
		Total Construction Cost			$ 482,890									
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,069	sq. Yd	$ 63.00	$ 67,347	1,069	sq. Yd	$ -	$ -	1,069	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,221	cu. Yd	$ 7.00	$ 43,547	11,367	sq. Yd	$ 4.50	$ 51,150	11,367	sq. Yd	$ 11.67	$ 132,611	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 267.75	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 110,894			Total	$ 51,150			Total	$ 132,644	
		Contingency Cost (25% of Construction Cost)			$ 27,724									
		Engineering Design Cost (5% of Construction Cost)			$ 5,545									
		Total Construction Cost			$ 144,162									
Total Structure Aesthetic Trtmt Cost	$ 327,957													

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	80	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	4.2		$ 420,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,167,159	Total Aesthetic Treatment Cost	$ 487,957	Total Right of Way Cost	$ 420,000

Walled-Levee Corridor

Structure ID	H155A55B

HEC1 ID	55A55B

Cutline ID	4

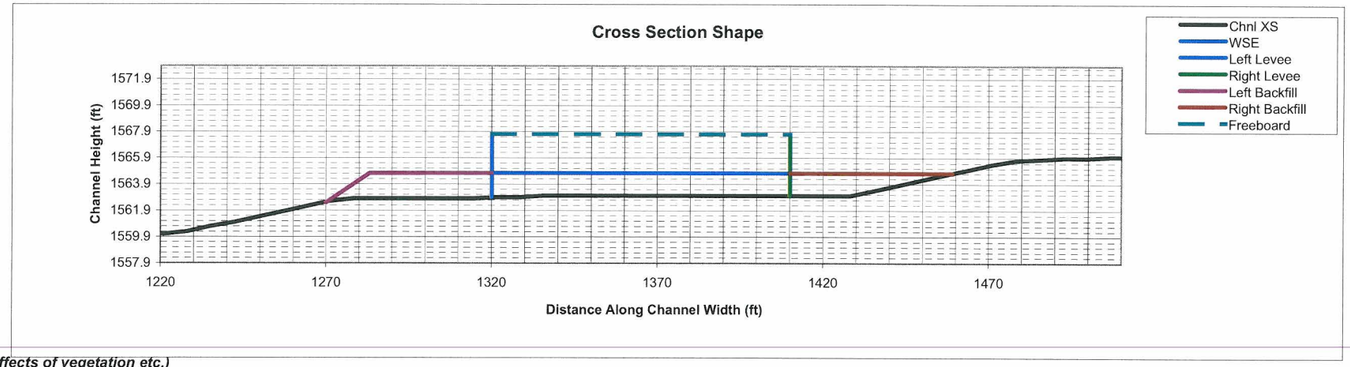
Longitundal Geometry

Length	994.3	ft
Initial Channel Slope	0.0146	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0155	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1320	Right Levee Station (ft)	1410
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1320	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	C155B	C155A								TOTAL
HEC1 Peak-Flow	1327	840								
Weighting Factor	0.10	0.90								
Flow into Channel	135	755								890

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
89	91.0	39.1	1562.9	1563.4	2.3	0.5	90.0	0.4	0.4	0.61
267	91.8	75.8	1562.9	1563.8	3.5	0.9	90.0	0.8	0.8	0.68
668	93.0	132.1	1562.9	1564.5	5.1	1.6	90.0	1.4	1.5	0.74
890	93.6	157.3	1562.9	1564.7	5.7	1.8	90.0	1.7	1.7	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
89	90.9	38.4	1562.9	1563.4	2.3	0.5	90.0	0.4	0.4	0.63
267	91.7	74.4	1562.9	1563.8	3.6	0.9	90.0	0.8	0.8	0.69
668	93.0	129.7	1562.9	1564.4	5.1	1.5	90.0	1.4	1.4	0.76
890	93.5	154.5	1562.9	1564.7	5.8	1.8	90.0	1.7	1.7	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
	H1F355A_1									
267	1.46									1.46

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
89	Stable
267	Stable
668	Erosive
890	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	267	cfs
Clear Water	No	
Total Incoming Sediment Load	1.458	cfs
Initial Chnl Sediment Capacity	1.337	cfs
Long-term Equilibrium Slope (ADWR)	0.0155	

Drop Structures

Design Slope	0.0155	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)
890	1.1	24.6	1.8	1.7	5.7	0.0146	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	994
Channel Limit-Left Station (ft)	1320
Channel Limit-Right Station (ft)	1410
Channel Width (ft)	90

Levee

Left Levee Length (ft)	994
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	994
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	530
Left Levee Volume (cu. Yd)	88
Right Levee Surface Area (sq. Yd)	519
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1049
Total Levee Volume (cu. Yd)	175

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)	49914
Left Levee Fill XS area (sq. ft)	83.1
Left Levee Fill Volume (cu. Yd)	3059
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	49
Right Levee Fill Surface Area (sq. ft)	48721
Right Levee Fill XS area (sq. ft)	58.1
Right Levee Fill Volume (cu. Yd)	2139
Total Levee Fill Surface Area (sq. ft)	98635
Total Levee Fill Volume (cu Yd)	5198

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)	7.5	
Structure Height (ft)	10.5	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	35.14	3.51
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,987	$ 298
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	994	ft	$ 255	$ 253,173	175	cu. Yd	$ -	$ -	175	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,049	sq. Yd	$ -	$ -	1,049	sq. Yd	$ -	$ -	1,049	sq. Yd	$ 75.00	$ 78,675
Adjacent Levee Fill	Fill	5,198	cu. Yd	$ 7.00	$ 36,386	10,934	sq. Yd	$ 4.50	$ 49,203	10,934	sq. Yd	$ 11.67	$ 127,563
Wall Material Aesthetic Treatment Cost	Wall	175	cu. Yd	$ -	$ -	175	cu. Yd	$ -	$ -	175	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,049	sq. Yd	$ 63.00	$ 66,087	1,049	sq. Yd	$ -	$ -	1,049	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,986.90	$ -	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 375
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 355,646			Total	$ 49,203			Total	$ 206,613
		Contingency Cost (25% of Construction Cost)			$ 88,912								
		Engineering Design Cost (5% of Construction Cost)			$ 17,782								
		Total Construction Cost			$ 462,340								
Wall Material Aesthetic Treatment Cost	Wall	175	cu. Yd	$ -	$ -	175	cu. Yd	$ -	$ -	175	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,049	sq. Yd	$ 63.00	$ 66,087	1,049	sq. Yd	$ -	$ -	1,049	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,198	cu. Yd	$ 7.00	$ 36,386	10,934	sq. Yd	$ 4.50	$ 49,203	10,934	sq. Yd	$ 11.67	$ 127,563
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 298.35	$ -	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 102,473			Total	$ 49,203			Total	$ 127,601
		Contingency Cost (25% of Construction Cost)			$ 25,618								
		Engineering Design Cost (5% of Construction Cost)			$ 5,124								
		Total Construction Cost			$ 133,215								

Total Structure Aesthetic Trtmt Cost	$ 310,019

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	$ 1,158,156

Total Aesthetic Treatment Cost	$ 470,019

Total Right of Way Cost	$ 440,000

Walled-Levee Corridor

Structure ID	H155A55B

HEC1 ID	55A55B

Cutline ID	3

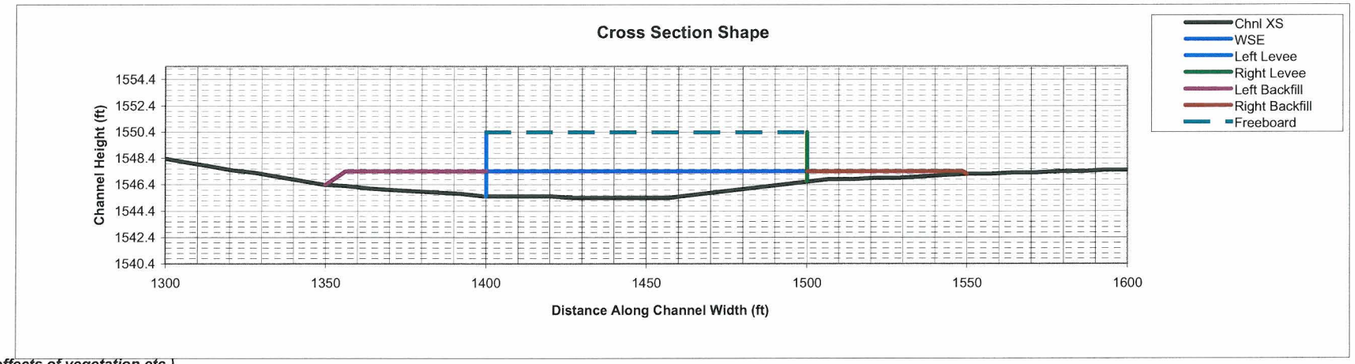
Longitudal Geometry

Length	1038.4	ft
Initial Channel Slope	0.0159	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0129	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1400	Right Levee Station (ft)	1500
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1400	Right Channel Limit Station (ft)	1500

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	C155B	C155A								TOTAL
HEC1 Peak-Flow	1327	840								
Weighting Factor	0.35	0.65								
Flow into Channel	471	542								1013

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
101	78.9	38.9	1545.4	1546.0	2.6	0.6	78.4	0.5	0.5	0.65
304	96.9	81.6	1545.4	1546.5	3.7	1.1	95.9	0.8	0.9	0.71
760	102.2	144.5	1545.4	1547.1	5.3	1.7	100.0	1.4	1.4	0.77
1013	102.7	172.0	1545.4	1547.4	5.9	2.0	100.0	1.7	1.7	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
101	80.2	41.7	1545.4	1546.0	2.4	0.6	79.7	0.5	0.5	0.59
304	99.2	87.7	1545.4	1546.6	3.5	1.2	98.1	0.9	0.9	0.65
760	102.4	153.9	1545.4	1547.2	4.9	1.8	100.0	1.5	1.5	0.70
1013	102.9	183.3	1545.4	1547.5	5.5	2.1	100.0	1.8	1.8	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
	H155A55B_4									
304	1.34									1.34

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
101	Stable
304	Stable
760	Erosive
1013	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	304	cfs
Clear Water	No	
Total Incoming Sediment Load	1.337	cfs
Initial Chnl Sediment Capacity	1.805	cfs
Long-term Equilibrium Slope (ADWR)	0.0129	

Drop Structures

Design Slope	0.0129	ft/ft
Total Drop Needed	3.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.04	
Distance between Structures	998	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)
1013	1.1	24.6	2.0	1.7	5.9	0.0159	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1038
Channel Limit-Left Station (ft)	1400
Channel Limit-Right Station (ft)	1500
Channel Width (ft)	100

Levee

Left Levee Length (ft)	1038
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1038
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.8

Left Levee Surface Area (sq. Yd)	565
Left Levee Volume (cu. Yd)	94
Right Levee Surface Area (sq. Yd)	438
Right Levee Volume (cu. Yd)	73
Total Levee Surface Area (sq. Yd)	1003
Total Levee Volume (cu. Yd)	167

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)	52021
Left Levee Fill XS area (sq. ft)	69.6
Left Levee Fill Volume (cu. Yd)	2676
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)	51918
Right Levee Fill XS area (sq. ft)	24.2
Right Levee Fill Volume (cu. Yd)	930
Total Levee Fill Surface Area (sq. ft)	103939
Total Levee Fill Volume (cu Yd)	3606

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)	7.6	
Structure Height (ft)	10.6	
Number of Structures	1.04	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	39.09	3.91
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,323	$ 332
Area per structure (sq. Yd)	11	1
Total Area (cu. Yd)	12	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	1,038	ft	$ 228	$ 236,488	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,003	sq. Yd	$ -	$ -	1,003	sq. Yd	$ -	$ -	1,003	sq. Yd	$ 75.00	$ 75,225	
Adjacent Levee Fill	Fill	3,606	cu. Yd	$ 7.00	$ 25,242	11,533	sq. Yd	$ 4.50	$ 51,900	11,533	sq. Yd	$ 11.67	$ 134,556	
Wall Material Aesthetic Treatment Cost	Wall	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,003	sq. Yd	$ 63.00	$ 63,189	1,003	sq. Yd	$ -	$ -	1,003	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 3,322.65	$ 3,456	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 417	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 328,375			Total	$ 51,900			Total	$ 210,197	
		Contingency Cost (25% of Construction Cost)			$ 82,094									
		Engineering Design Cost (5% of Construction Cost)			$ 16,419									
		Total Construction Cost			$ 426,887									
Wall Material Aesthetic Treatment Cost	Wall	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	167	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,003	sq. Yd	$ 63.00	$ 63,189	1,003	sq. Yd	$ -	$ -	1,003	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,606	cu. Yd	$ 7.00	$ 25,242	11,533	sq. Yd	$ 4.50	$ 51,900	11,533	sq. Yd	$ 11.67	$ 134,556	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 332.35	$ 346	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 42	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 88,777			Total	$ 51,900			Total	$ 134,597	
		Contingency Cost (25% of Construction Cost)			$ 22,194									
		Engineering Design Cost (5% of Construction Cost)			$ 4,439									
		Total Construction Cost			$ 115,410									

Total Structure Aesthetic Trtmt Cost	$ 301,907

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	100	2.4	$100,000	$ 240,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	201	4.8		$ 480,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,168,984	Total Aesthetic Treatment Cost	$ 471,907	Total Right of Way Cost	$ 480,000

Walled-Levee Corridor

Structure ID	H155A55B

HEC1 ID	55A55B

Cutline ID	2

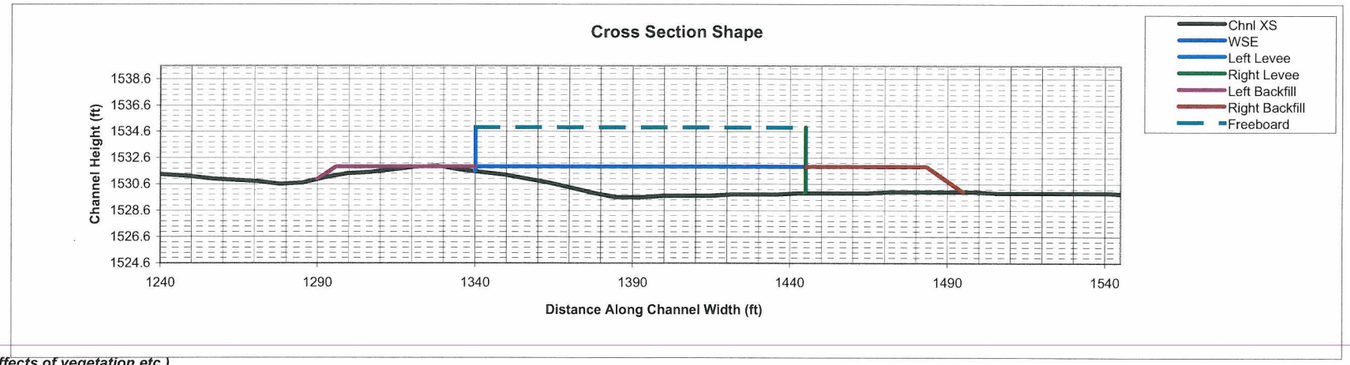
Longitudal Geometry

Length	1011.9	ft
Initial Channel Slope	0.0152	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0147	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1340	Right Levee Station (ft)	1445
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1340	Right Channel Limit Station (ft)	1445

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	C155B	C155A								TOTAL
HEC1 Peak-Flow	1327	840								
Weighting Factor	0.60	0.40								
Flow into Channel	791	339								1130

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
113	75.1	41.3	1529.6	1530.3	2.7	0.7	74.7	0.5	0.6	0.65
339	86.4	84.4	1529.6	1530.9	4.0	1.3	85.4	1.0	1.0	0.71
848	106.9	159.2	1529.6	1531.7	5.3	2.1	105.0	1.5	1.5	0.76
1130	107.5	189.6	1529.6	1531.9	6.0	2.3	105.0	1.8	1.8	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
113	75.2	41.7	1529.6	1530.3	2.7	0.7	74.8	0.6	0.6	0.64
339	86.7	85.3	1529.6	1530.9	4.0	1.3	85.6	1.0	1.0	0.70
848	106.9	160.8	1529.6	1531.7	5.3	2.1	105.0	1.5	1.5	0.75
1130	107.5	191.5	1529.6	1532.0	5.9	2.4	105.0	1.8	1.8	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
	H155A55B_3	T155B10								
339	1.81	0.24								2.04

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
113	Stable
339	Stable
848	Erosive
1130	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	339	cfs
Clear Water	No	
Total Incoming Sediment Load	2.043	cfs
Initial Chnl Sediment Capacity	2.136	cfs
Long-term Equilibrium Slope (ADWR)	0.0147	

Drop Structures

Design Slope	0.0147	ft/ft
Total Drop Needed	0.5	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.17	
Distance between Structures	5952	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)
1130	1.1	24.6	2.3	1.8	6.0	0.0152	-0.5	1.0	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1012
Channel Limit-Left Station (ft)	1340
Channel Limit-Right Station (ft)	1445
Channel Width (ft)	105

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)	5

Left Levee Surface Area (sq. Yd)	382
Left Levee Volume (cu. Yd)	64
Right Levee Surface Area (sq. Yd)	562
Right Levee Volume (cu. Yd)	94
Total Levee Surface Area (sq. Yd)	944
Total Levee Volume (cu. Yd)	158

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)	50696
Left Levee Fill XS area (sq. ft)	13.5
Left Levee Fill Volume (cu. Yd)	506
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)	50797
Right Levee Fill XS area (sq. ft)	88.2
Right Levee Fill Volume (cu. Yd)	3306
Total Levee Fill Surface Area (sq. ft)	101493
Total Levee Fill Volume (cu Yd)	3812

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)	7.9	
Structure Height (ft)	10.9	
Number of Structures	0.17	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	42.36	4.24
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,601	$ 360
Area per structure (sq. Yd)	12	1
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	1,012	ft	$ 213	$ 215,947	158	cu. Yd	$ -	$ -	158	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	944	sq. Yd	$ -	$ -	944	sq. Yd	$ -	$ -	944	sq. Yd	$ 75.00	$ 70,800
Adjacent Levee Fill	Fill	3,812	cu. Yd	$ 7.00	$ 26,684	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Wall Material Aesthetic Treatment Cost	Wall	158	cu. Yd	$ -	$ -	158	cu. Yd	$ -	$ -	158	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	944	sq. Yd	$ 63.00	$ 59,472	944	sq. Yd	$ -	$ -	944	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 3,600.60	$ 612	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 438
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 302,715			Total	$ 50,600			Total	$ 202,423
		Contingency Cost (25% of Construction Cost)			$ 75,679								
		Engineering Design Cost (5% of Construction Cost)			$ 15,136								
		Total Construction Cost			$ 393,529								
Wall Material Aesthetic Treatment Cost	Wall	158	cu. Yd	$ -	$ -	158	cu. Yd	$ -	$ -	158	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	944	sq. Yd	$ 63.00	$ 59,472	944	sq. Yd	$ -	$ -	944	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,812	cu. Yd	$ 7.00	$ 26,684	11,244	sq. Yd	$ 4.50	$ 50,600	11,244	sq. Yd	$ 11.67	$ 131,185
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 360.40	$ 61	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 44
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 86,217			Total	$ 50,600			Total	$ 131,229
		Contingency Cost (25% of Construction Cost)			$ 21,554								
		Engineering Design Cost (5% of Construction Cost)			$ 4,311								
		Total Construction Cost			$ 112,082								
Total Structure Aesthetic Trtmt Cost	$ 293,911												

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	105	2.4	$100,000	$ 240,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	206	4.7		$ 470,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,116,552	Total Aesthetic Treatment Cost	$ 453,911	Total Right of Way Cost	$ 470,000

Walled-Levee Corridor

Structure ID	H155A55B

HEC1 ID	55A55B

Cutline ID	1

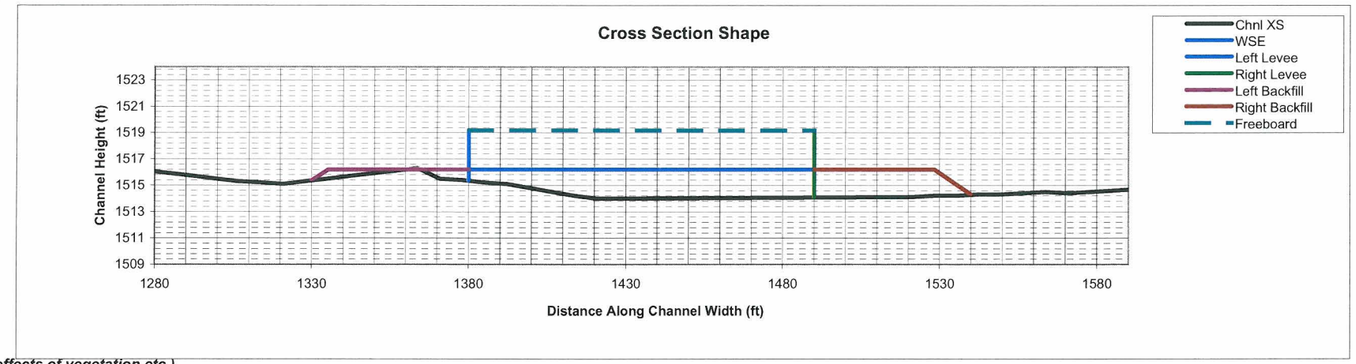
Longitundal Geometry

Length	1036.0	ft
Initial Channel Slope	0.0140	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0155	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1380	Right Levee Station (ft)	1490
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1380	Right Channel Limit Station (ft)	1490

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	C155B	C155A								TOTAL
HEC1 Peak-Flow	1327	840								
Weighting Factor	0.87	0.13								
Flow into Channel	1153	110								1263

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
126	87.3	48.0	1514.0	1514.6	2.6	0.6	86.8	0.5	0.6	0.62
379	105.7	100.2	1514.0	1515.2	3.8	1.2	104.6	0.9	1.0	0.68
947	112.4	178.0	1514.0	1515.9	5.3	1.9	110.0	1.6	1.6	0.74
1263	113.0	212.0	1514.0	1516.2	6.0	2.2	110.0	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
126	86.9	46.5	1514.0	1514.6	2.7	0.6	86.3	0.5	0.5	0.65
379	102.9	96.1	1514.0	1515.2	3.9	1.2	101.8	0.9	0.9	0.71
947	112.3	172.6	1514.0	1515.9	5.5	1.9	110.0	1.5	1.6	0.77
1263	112.9	205.5	1514.0	1516.2	6.1	2.2	110.0	1.8	1.9	0.79

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
	H155A55B_2	T155B20								
379	2.14	0.24								2.38

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
126	Stable
379	Stable
947	Erosive
1263	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	379	cfs
Clear Water	No	
Total Incoming Sediment Load	2.376	cfs
Initial Chnl Sediment Capacity	2.029	cfs
Long-term Equilibrium Slope (ADWR)	0.0155	

Drop Structures

Design Slope	0.0155	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)
1263	1.1	24.6	2.2	1.9	6.0	0.0140	-0.5	1.0	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1036
Channel Limit-Left Station (ft)	1380
Channel Limit-Right Station (ft)	1490
Channel Width (ft)	110

Levee

Left Levee Length (ft)	1036
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.9
Right Levee Length (ft)	1036
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	449
Left Levee Volume (cu. Yd)	75
Right Levee Surface Area (sq. Yd)	587
Right Levee Volume (cu. Yd)	98
Total Levee Surface Area (sq. Yd)	1036
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)	51901
Left Levee Fill XS area (sq. ft)	20.3
Left Levee Fill Volume (cu. Yd)	779
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)	52005
Right Levee Fill XS area (sq. ft)	93.2
Right Levee Fill Volume (cu. Yd)	3576
Total Levee Fill Surface Area (sq. ft)	103906
Total Levee Fill Volume (cu Yd)	4355

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)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	45.68	4.57
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,883	$ 388
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	1,036	ft	$ 228	$ 236,032	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,036	sq. Yd	$ -	$ -	1,036	sq. Yd	$ -	$ -	1,036	sq. Yd	$ 75.00	$ 77,700
Adjacent Levee Fill	Fill	4,355	cu. Yd	$ 7.00	$ 30,485	11,511	sq. Yd	$ 4.50	$ 51,800	11,511	sq. Yd	$ 11.67	$ 134,296
Wall Material Aesthetic Treatment Cost	Wall	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,036	sq. Yd	$ 63.00	$ 65,268	1,036	sq. Yd	$ -	$ -	1,036	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 3,882.80	$ -	12	sq. Yd	$ -	$ -	12	sq. Yd	$ 37.50	$ 458
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 331,785			Total	$ 51,800			Total	$ 212,455
		Contingency Cost (25% of Construction Cost)			$ 82,946								
		Engineering Design Cost (5% of Construction Cost)			$ 16,589								
		Total Construction Cost			$ 431,321								
Wall Material Aesthetic Treatment Cost	Wall	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -	173	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,036	sq. Yd	$ 63.00	$ 65,268	1,036	sq. Yd	$ -	$ -	1,036	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,355	cu. Yd	$ 7.00	$ 30,485	11,511	sq. Yd	$ 4.50	$ 51,800	11,511	sq. Yd	$ 11.67	$ 134,296
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 388.45	$ -	12	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 46
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 95,753			Total	$ 51,800			Total	$ 134,342
		Contingency Cost (25% of Construction Cost)			$ 23,938								
		Engineering Design Cost (5% of Construction Cost)			$ 4,788								
		Total Construction Cost			$ 124,479								
Total Structure Aesthetic Trtmt Cost	$ 310,621												

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	110	2.6	$100,000	$ 260,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	211	5		$ 500,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,195,576	Total Aesthetic Treatment Cost	$ 480,621	Total Right of Way Cost	$ 500,000

Walled-Levee Corridor

Structure ID	H155B55C

HEC1 ID	55B55C

Cutline ID	4

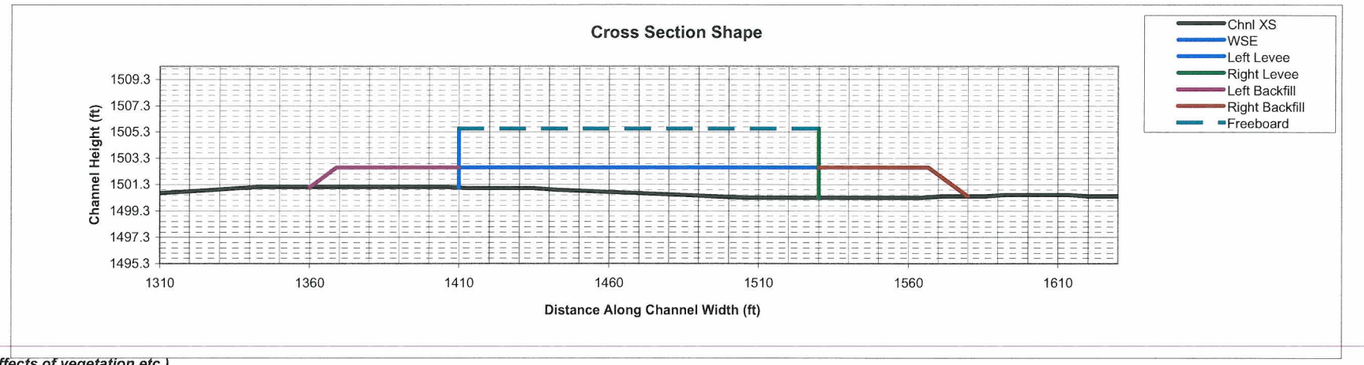
Longitudinal Geometry

Length	989.0	ft
Initial Channel Slope	0.0136	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0140	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1410	Right Levee Station (ft)	1530
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1410	Right Channel Limit Station (ft)	1530

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	C155C	C155B								TOTAL
HEC1 Peak-Flow	1845	1327								
Weighting Factor	0.11	0.89								
Flow into Channel	210	1176								1386

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
139	120.9	58.3	1500.3	1501.1	2.4	0.8	120.0	0.5	0.5	0.60
416	121.8	113.1	1500.3	1501.6	3.7	1.3	120.0	0.9	0.9	0.67
1040	123.2	196.9	1500.3	1502.3	5.3	2.0	120.0	1.6	1.6	0.73
1386	123.9	234.5	1500.3	1502.6	5.9	2.3	120.0	1.9	2.0	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
139	120.9	57.8	1500.3	1501.1	2.4	0.8	120.0	0.5	0.5	0.61
416	121.8	112.1	1500.3	1501.6	3.7	1.3	120.0	0.9	0.9	0.68
1040	123.2	195.2	1500.3	1502.3	5.3	2.0	120.0	1.6	1.6	0.74
1386	123.8	232.5	1500.3	1502.6	6.0	2.3	120.0	1.9	1.9	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
	H155A55B_1	T155B30								
416	2.03	0.13								2.16

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
139	Stable
416	Stable
1040	Erosive
1386	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	416	cfs
Clear Water	No	
Total Incoming Sediment Load	2.159	cfs
Initial Chnl Sediment Capacity	2.071	cfs
Long-term Equilibrium Slope (ADWR)	0.0140	

Drop Structures

Design Slope	0.0140	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)
1386	1.1	24.6	2.3	2.0	5.9	0.0136	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	989
Channel Limit-Left Station (ft)	1410
Channel Limit-Right Station (ft)	1530
Channel Width (ft)	120

Levee

Left Levee Length (ft)	989
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.5
Right Levee Length (ft)	989
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.3

Left Levee Surface Area (sq. Yd)	495
Left Levee Volume (cu. Yd)	82
Right Levee Surface Area (sq. Yd)	582
Right Levee Volume (cu. Yd)	97
Total Levee Surface Area (sq. Yd)	1077
Total Levee Volume (cu. Yd)	179

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)	49546
Left Levee Fill XS area (sq. ft)	68.4
Left Levee Fill Volume (cu. Yd)	2505
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)	49645
Right Levee Fill XS area (sq. ft)	99.2
Right Levee Fill Volume (cu. Yd)	3634
Total Levee Fill Surface Area (sq. ft)	99191
Total Levee Fill Volume (cu Yd)	6139

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	120	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	49.68	4.97
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,223	$ 422
Area per structure (sq. Yd)	13	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	989	ft	$ 255	$ 251,900	179	cu. Yd	$ -	$ -	179	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ 75.00	$ 80,775	
Adjacent Levee Fill	Fill	6,139	cu. Yd	$ 7.00	$ 42,973	10,989	sq. Yd	$ 4.50	$ 49,450	10,989	sq. Yd	$ 11.67	$ 128,204	
Wall Material Aesthetic Treatment Cost	Wall	179	cu. Yd	$ -	$ -	179	cu. Yd	$ -	$ -	179	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,077	sq. Yd	$ 63.00	$ 67,851	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 4,222.80	$ -	13	sq. Yd	$ -	$ -	13	sq. Yd	$ 37.50	$ 500	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 362,724			Total	$ 49,450			Total	$ 209,479	
		Contingency Cost (25% of Construction Cost)			$ 90,681									
		Engineering Design Cost (5% of Construction Cost)			$ 18,136									
		Total Construction Cost			$ 471,541									
Wall Material Aesthetic Treatment Cost	Wall	179	cu. Yd	$ -	$ -	179	cu. Yd	$ -	$ -	179	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,077	sq. Yd	$ 63.00	$ 67,851	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,139	cu. Yd	$ 7.00	$ 42,973	10,989	sq. Yd	$ 4.50	$ 49,450	10,989	sq. Yd	$ 11.67	$ 128,204	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 422.45	$ -	13	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 50	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 110,824			Total	$ 49,450			Total	$ 128,254	
		Contingency Cost (25% of Construction Cost)			$ 27,706									
		Engineering Design Cost (5% of Construction Cost)			$ 5,541									
		Total Construction Cost			$ 144,071									
Total Structure Aesthetic Trtmt Cost	$ 321,775													

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	120	2.7	$100,000	$ 270,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	221	5		$ 500,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,230,470	Total Aesthetic Treatment Cost	$ 481,775
		Total Right of Way Cost	$ 500,000

Walled-Levee Corridor

Structure ID	H155B55C	HEC1 ID	55B55C	Cutline ID	3

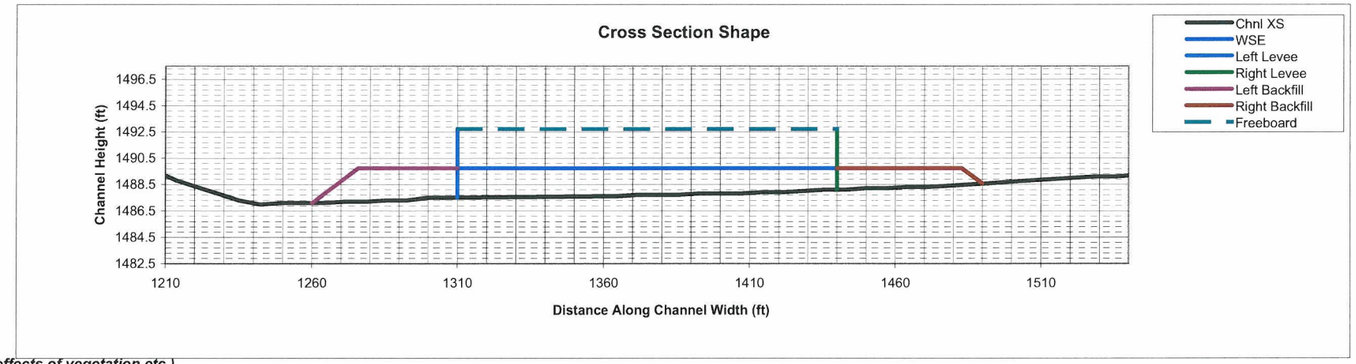
Longitundal Geometry

Length	1003.8	ft
Initial Channel Slope	0.0121	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0127	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1310	Right Levee Station (ft)	1440
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1310	Right Channel Limit Station (ft)	1440

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	C155C	C155B								TOTAL
HEC1 Peak-Flow	1845	1327								
Weighting Factor	0.35	0.65								
Flow into Channel	643	864								1507

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
151	130.8	65.6	1487.5	1488.2	2.3	0.7	130.0	0.5	0.5	0.57
452	131.8	127.1	1487.5	1488.7	3.6	1.2	130.0	1.0	1.0	0.63
1130	133.2	221.3	1487.5	1489.4	5.1	1.9	130.0	1.7	1.7	0.69
1507	133.9	263.5	1487.5	1489.7	5.7	2.2	130.0	2.0	2.0	0.71

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
151	130.8	64.6	1487.5	1488.2	2.3	0.7	130.0	0.5	0.5	0.58
452	131.8	125.3	1487.5	1488.7	3.6	1.2	130.0	1.0	1.0	0.65
1130	133.2	218.1	1487.5	1489.4	5.2	1.9	130.0	1.6	1.7	0.71
1507	133.8	259.6	1487.5	1489.7	5.8	2.2	130.0	1.9	2.0	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
	H155B55C_4									
452	2.07									2.07

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
151	Stable
452	Stable
1130	Erosive
1507	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	452	cfs
Clear Water	No	
Total Incoming Sediment Load	2.071	cfs
Initial Chnl Sediment Capacity	1.924	cfs
Long-term Equilibrium Slope (ADWR)	0.0127	

Drop Structures

Design Slope	0.0127	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)
1507	1.1	24.6	2.2	2.0	5.7	0.0121	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1004
Channel Limit-Left Station (ft)	1310
Channel Limit-Right Station (ft)	1440
Channel Width (ft)	130

Levee

Left Levee Length (ft)	1004
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.2
Right Levee Length (ft)	1004
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	580
Left Levee Volume (cu. Yd)	97
Right Levee Surface Area (sq. Yd)	513
Right Levee Volume (cu. Yd)	86
Total Levee Surface Area (sq. Yd)	1093
Total Levee Volume (cu. Yd)	183

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)	50388
Left Levee Fill XS area (sq. ft)	101.4
Left Levee Fill Volume (cu. Yd)	3771
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)	50288
Right Levee Fill XS area (sq. ft)	68.3
Right Levee Fill Volume (cu. Yd)	2540
Total Levee Fill Surface Area (sq. ft)	100676
Total Levee Fill Volume (cu Yd)	6311

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	130	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	53.63	5.36
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,559	$ 456
Area per structure (sq. Yd)	14	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	1,004	ft	$ 255	$ 255,720	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,093	sq. Yd	$ -	$ -	1,093	sq. Yd	$ -	$ -	1,093	sq. Yd	$ 75.00	$ 81,975
Adjacent Levee Fill	Fill	6,311	cu. Yd	$ 7.00	$ 44,177	11,156	sq. Yd	$ 4.50	$ 50,200	11,156	sq. Yd	$ 11.67	$ 130,148
Wall Material Aesthetic Treatment Cost	Wall	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,093	sq. Yd	$ 63.00	$ 68,859	1,093	sq. Yd	$ -	$ -	1,093	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,558.55	$ -	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 542
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 368,756			Total	$ 50,200			Total	$ 212,665
		Contingency Cost (25% of Construction Cost)			$ 92,189								
		Engineering Design Cost (5% of Construction Cost)			$ 18,438								
		Total Construction Cost			$ 479,383								
Wall Material Aesthetic Treatment Cost	Wall	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,093	sq. Yd	$ 63.00	$ 68,859	1,093	sq. Yd	$ -	$ -	1,093	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,311	cu. Yd	$ 7.00	$ 44,177	11,156	sq. Yd	$ 4.50	$ 50,200	11,156	sq. Yd	$ 11.67	$ 130,148
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 455.60	$ -	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 54
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 113,036			Total	$ 50,200			Total	$ 130,202
		Contingency Cost (25% of Construction Cost)			$ 28,259								
		Engineering Design Cost (5% of Construction Cost)			$ 5,652								
		Total Construction Cost			$ 146,947								
Total Structure Aesthetic Trtmt Cost	$ 327,349												

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	130	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	231	5.3		$ 530,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,272,248

Total Aesthetic Treatment Cost	$ 487,349

Total Right of Way Cost	$ 530,000

Walled-Levee Corridor

Structure ID	H155B55C

HEC1 ID	55B55C

Cutline ID	2

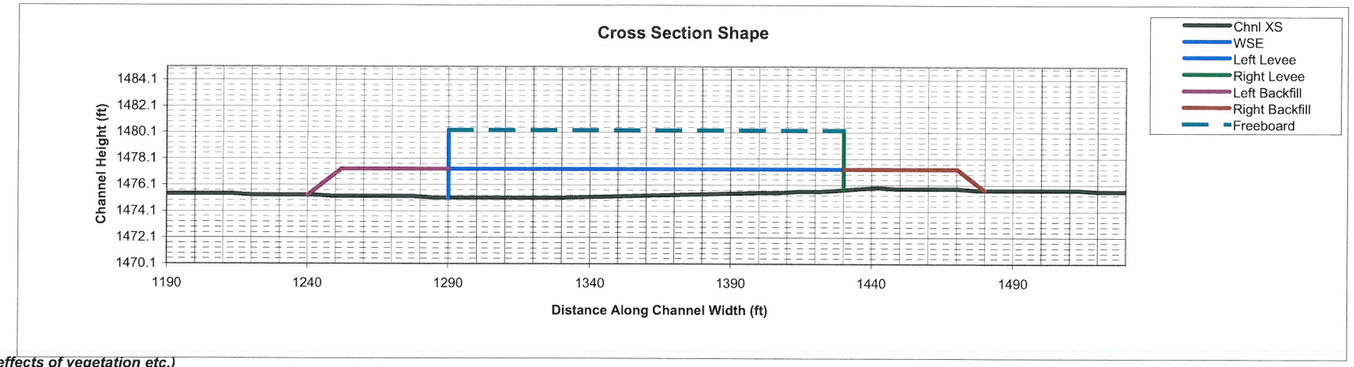
Longitudinal Geometry

Length	1002.1	ft
Initial Channel Slope	0.0127	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0115	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1290	Right Levee Station (ft)	1430
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1290	Right Channel Limit Station (ft)	1430

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	C155C	C155B								TOTAL
HEC1 Peak-Flow	1845	1327								
Weighting Factor	0.57	0.43								
Flow into Channel	1046	575								1621

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
162	140.8	69.5	1475.1	1475.8	2.3	0.7	140.0	0.5	0.5	0.58
486	141.7	134.8	1475.1	1476.3	3.6	1.2	140.0	1.0	1.0	0.65
1216	143.1	234.5	1475.1	1477.0	5.2	1.9	140.0	1.6	1.7	0.71
1621	143.8	279.1	1475.1	1477.3	5.8	2.2	140.0	1.9	2.0	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
162	140.8	71.6	1475.1	1475.8	2.3	0.7	140.0	0.5	0.5	0.56
486	141.8	138.9	1475.1	1476.3	3.5	1.2	140.0	1.0	1.0	0.62
1216	143.2	241.6	1475.1	1477.0	5.0	1.9	140.0	1.7	1.7	0.67
1621	143.9	287.7	1475.1	1477.4	5.6	2.3	140.0	2.0	2.1	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
	H155B55C_3									
486	1.92									1.92

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
162	Stable
486	Stable
1216	Erosive
1621	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	486	cfs
Clear Water	No	
Total Incoming Sediment Load	1.924	cfs
Initial Chnl Sediment Capacity	2.218	cfs
Long-term Equilibrium Slope (ADWR)	0.0115	

Drop Structures

Design Slope	0.0115	ft/ft
Total Drop Needed	1.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.40	
Distance between Structures	2505	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeq + 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)
1621	1.1	24.6	2.2	2.0	5.8	0.0127	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1002
Channel Limit-Left Station (ft)	1290
Channel Limit-Right Station (ft)	1430
Channel Width (ft)	140

Levee

Left Levee Length (ft)	1002
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.2
Right Levee Length (ft)	1002
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	579
Left Levee Volume (cu. Yd)	96
Right Levee Surface Area (sq. Yd)	512
Right Levee Volume (cu. Yd)	85
Total Levee Surface Area (sq. Yd)	1091
Total Levee Volume (cu. Yd)	181

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)	50305
Left Levee Fill XS area (sq. ft)	93.3
Left Levee Fill Volume (cu. Yd)	3462
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)	50205
Right Levee Fill XS area (sq. ft)	67.4
Right Levee Fill Volume (cu. Yd)	2501
Total Levee Fill Surface Area (sq. ft)	100510
Total Levee Fill Volume (cu Yd)	5963

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	140	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.40	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	57.43	5.74
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,882	$ 488
Area per structure (sq. Yd)	16	2
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	1,002	ft	$ 255	$ 255,211	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,091	sq. Yd	$ -	$ -	1,091	sq. Yd	$ -	$ -	1,091	sq. Yd	$ 75.00	$ 81,825
Adjacent Levee Fill	Fill	5,963	cu. Yd	$ 7.00	$ 41,741	11,133	sq. Yd	$ 4.50	$ 50,100	11,133	sq. Yd	$ 11.67	$ 129,889
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,091	sq. Yd	$ 63.00	$ 68,733	1,091	sq. Yd	$ -	$ -	1,091	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,881.55	$ 1,953	16	sq. Yd	$ -	$ -	16	sq. Yd	$ 37.50	$ 583
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 367,637			Total	$ 50,100			Total	$ 212,297
		Contingency Cost (25% of Construction Cost)			$ 91,909								
		Engineering Design Cost (5% of Construction Cost)			$ 18,382								
		Total Construction Cost			$ 477,929								
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,091	sq. Yd	$ 63.00	$ 68,733	1,091	sq. Yd	$ -	$ -	1,091	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,963	cu. Yd	$ 7.00	$ 41,741	11,133	sq. Yd	$ 4.50	$ 50,100	11,133	sq. Yd	$ 11.67	$ 129,889
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 487.90	$ 195	16	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 58
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 110,669			Total	$ 50,100			Total	$ 129,947
		Contingency Cost (25% of Construction Cost)			$ 27,667								
		Engineering Design Cost (5% of Construction Cost)			$ 5,533								
		Total Construction Cost			$ 143,870								

Total Structure Aesthetic Trtmt Cost	$ 323,917

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	140	3.2	$100,000	$ 320,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	241	5.5		$ 550,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,290,326	Total Aesthetic Treatment Cost	$ 483,917	Total Right of Way Cost	$ 550,000

Walled-Levee Corridor

Structure ID	H155B55C

HEC1 ID	55B55C

Cutline ID	1

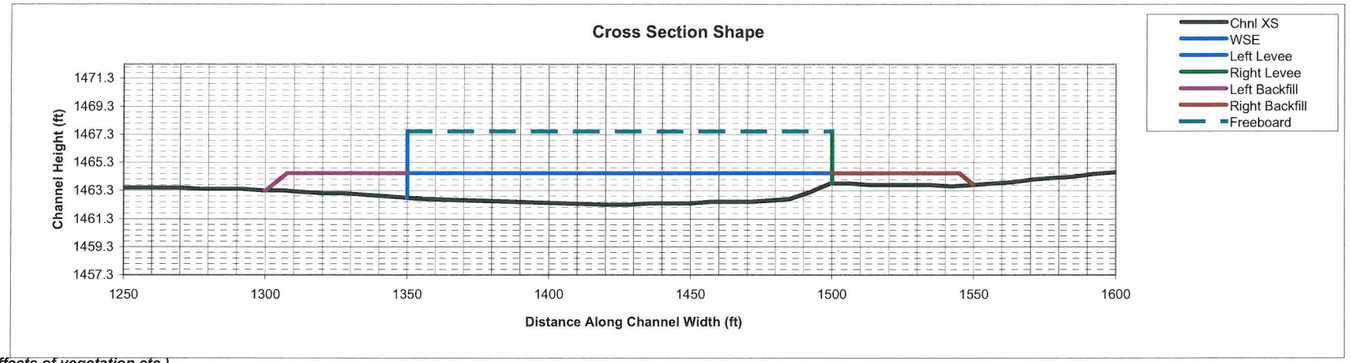
Longitudinal Geometry

Length	1482.7	ft
Initial Channel Slope	0.0126	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0119	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1350	Right Levee Station (ft)	1500
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1350	Right Channel Limit Station (ft)	1500

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	C155C	C155B								TOTAL
HEC1 Peak-Flow	1845	1327								
Weighting Factor	0.78	0.22								
Flow into Channel	1439	292								1731

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
173	140.0	72.3	1462.3	1463.0	2.4	0.7	139.7	0.5	0.5	0.59
519	146.7	142.5	1462.3	1463.5	3.6	1.2	146.0	1.0	1.0	0.65
1298	151.9	250.4	1462.3	1464.2	5.2	1.9	150.0	1.6	1.7	0.71
1731	152.6	298.0	1462.3	1464.6	5.8	2.3	150.0	2.0	2.0	0.73

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
173	140.1	73.6	1462.3	1463.0	2.4	0.7	139.9	0.5	0.5	0.57
519	147.0	145.0	1462.3	1463.5	3.6	1.2	146.2	1.0	1.0	0.63
1298	152.0	254.7	1462.3	1464.3	5.1	2.0	150.0	1.7	1.7	0.69
1731	152.6	303.2	1462.3	1464.6	5.7	2.3	150.0	2.0	2.0	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
	H155B55C_2									
519	2.22									2.22

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
173	Stable
519	Stable
1298	Erosive
1731	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	519	cfs
Clear Water	No	
Total Incoming Sediment Load	2.218	cfs
Initial Chnl Sediment Capacity	2.405	cfs
Long-term Equilibrium Slope (ADWR)	0.0119	

Drop Structures

Design Slope	0.0119	ft/ft
Total Drop Needed	1.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.35	
Distance between Structures	4236	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)
1731	1.1	24.6	2.3	2.0	5.8	0.0126	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1483
Channel Limit-Left Station (ft)	1350
Channel Limit-Right Station (ft)	1500
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1483
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	1483
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.8

Left Levee Surface Area (sq. Yd)	791
Left Levee Volume (cu. Yd)	132
Right Levee Surface Area (sq. Yd)	626
Right Levee Volume (cu. Yd)	104
Total Levee Surface Area (sq. Yd)	1417
Total Levee Volume (cu. Yd)	236

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)	74283
Left Levee Fill XS area (sq. ft)	68.6
Left Levee Fill Volume (cu. Yd)	3768
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)	74283
Right Levee Fill XS area (sq. ft)	40.2
Right Levee Fill Volume (cu. Yd)	2208
Total Levee Fill Surface Area (sq. ft)	148566
Total Levee Fill Volume (cu Yd)	5976

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)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.35	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	61.61	6.16
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,237	$ 524
Area per structure (sq. Yd)	17	2
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	1,483	ft	$ 228	$ 337,873	236	cu. Yd	$ -	$ -	236	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,417	sq. Yd	$ -	$ -	1,417	sq. Yd	$ -	$ -	1,417	sq. Yd	$ 75.00	$ 106,275
Adjacent Levee Fill	Fill	5,976	cu. Yd	$ 7.00	$ 41,832	16,478	sq. Yd	$ 4.50	$ 74,150	16,478	sq. Yd	$ 11.67	$ 192,241
Wall Material Aesthetic Treatment Cost	Wall	236	cu. Yd	$ -	$ -	236	cu. Yd	$ -	$ -	236	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,417	sq. Yd	$ 63.00	$ 89,271	1,417	sq. Yd	$ -	$ -	1,417	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 5,236.85	$ 1,833	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 470,809			Total	$ 74,150			Total	$ 299,141
		Contingency Cost (25% of Construction Cost)			$ 117,702								
		Engineering Design Cost (5% of Construction Cost)			$ 23,540								
		Total Construction Cost			$ 612,051								
Wall Material Aesthetic Treatment Cost	Wall	236	cu. Yd	$ -	$ -	236	cu. Yd	$ -	$ -	236	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,417	sq. Yd	$ 63.00	$ 89,271	1,417	sq. Yd	$ -	$ -	1,417	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,976	cu. Yd	$ 7.00	$ 41,832	16,478	sq. Yd	$ 4.50	$ 74,150	16,478	sq. Yd	$ 11.67	$ 192,241
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 523.60	$ 183	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 131,286			Total	$ 74,150			Total	$ 192,303
		Contingency Cost (25% of Construction Cost)			$ 32,822								
		Engineering Design Cost (5% of Construction Cost)			$ 6,564								
		Total Construction Cost			$ 170,672								

Total Structure Aesthetic Trtmt Cost	$ 437,125

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	150	5.1	$100,000	$ 510,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	251	8.5		$ 850,000

Total Land Related Aes. Trtmt Cost	$ 240,000

Total Cost	$ 1,835,342	Total Aesthetic Treatment Cost	$ 677,125	Total Right of Way Cost	$ 850,000

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 *             JUN   1998             *
 *           VERSION 4.1              *
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*                                    *
*    U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER    *
*         609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616      *
*           (916) 756-1104           *
*                                    *
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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

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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 3
    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: FAN36.DAT
    8         ID
    9         ID   100-YEAR 6-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID             MODELED AREA = 2.6 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    S150   BASIN
   51         KM       Compute runoff from subbasin 150
   52         BA   0.842
   53         LG    0.25    0.35    4.65    0.32       6
   54         UI      70      92     241     379     491     577     788     616     442     399
   55         UI     351     307     267     221     180     167     150     116      93      85
   56         UI      78      59      55      48      34      35      34      23      13      14
   57         UI      13      14      13      14      13      14      13       0       0       0
   58         ZW                 C=FLOW
              *

   59         KK   RR150 STORAGE
   60         KM   PROPOSED DETENTION BASIN
   61         KM    ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT APEX 3
   62         KM    STRUCTURE ID:RR150
   63         KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 3 ft
   64         RS       1    STOR      -1
   65         SV     0.0     0.0    13.5    28.3    44.4    52.9    61.8    66.3    71.0    80.5
   66         SE     0.0     1.0     3.0     5.0     7.0     8.0     9.0     9.5    10.0    11.0
   67         SQ     0.0     9.3    29.7    51.9    67.6    75.4    82.0    84.3    86.6   116.6
   68         ZW                 C=FLOW
              *

   69         KK   F355A   ROUTE
   70         KM    PROPOSED CHANNEL
   71         KM     ROUTE OUTFLOW FROM RR150 TO C155A
   72         KM     Slope=(1748.0 - 1570.0) / 7862.0
   73         RS       5    FLOW      -1
   74         RC   0.045   0.045   0.045  7862.0   0.023   104.5
   75         RX     0.0     0.0     0.0     0.0    65.0    65.0    65.0    65.0
   76         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   77         ZW                 C=FLOW
              *

   78         KK   S155A   BASIN
   79         KM       Compute runoff from subbasin 155A
   80         BA   0.571
   81         LG    0.35    0.35    4.60    0.34       2
   82         UI     112     448     778     922     781     500     321     208     129      83
   83         UI      57      24      23      25       0       0       0       0       0       0
              *

   84         KK   C155A COMBINE
   85         KM       Combine runoff from S155A w/ routed outflow from Fan 3 detention basin
   86         HC       2
   87         ZW                 C=FLOW
              *

   88         KK  55A55B   ROUTE
   89         KM    PROPOSED CHANNEL
   90         KM     ROUTE COMBINED FLOW FROM C155A TO C155B
   91         KM     Slope=(1570.0 - 1509.0) / 4080.0
   92         RS       3    FLOW      -1
   93         RC   0.045   0.045   0.045  4080.0   0.015   105.0
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   94         RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
   95         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
   96         ZW                 C=FLOW
              *

   97         KK   S155B   BASIN
   98         KM       Compute runoff from subbasin 155B
   99         BA   0.494
  100         LG    0.35    0.35    4.40    0.38       1
  101         UI     107     422     714     823     659     412     257     164     104      64
  102         UI      36      22      21       0       0       0       0       0       0       0
              *

  103         KK   C155B COMBINE
  104         KM       Combine runoff from S155B with routed flow from C155A
  105         HC       2
  106         ZW                 C=FLOW
              *

  107         KK  55B55C   ROUTE
  108         KM    PROPOSED CHANNEL
  109         KM     ROUTE COMBINED FLOW FROM C155B TO C155C
  110         KM     Slope=(1509.0 - 1452.0) / 4478.0
  111         RS       3    FLOW      -1
  112         RC   0.045   0.045   0.045  4478.0   0.013   105.0
  113         RX     0.0     0.0     0.0     0.0   135.0   135.0   135.0   135.0
  114         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
  115         ZW                 C=FLOW
              *

  116         KK   S155C   BASIN
  117         KM       Compute runoff from subbasin 155C
  118         BA   0.698
  119         LG    0.35    0.35    4.50    0.36       1
  120         UI      85     227     476     680     802     784     641     469     344     249
  121         UI     178     137      92      68      57      26      21      20      21      20
  122         UI       0       0       0       0       0       0       0       0       0       0
              *

  123         KK   C155C COMBINE
  124         KM       Combine runoff from S155C with routed flow from C155B
  125         KM       This is the total flow at the downstream end of the Fan 3 corridor.
  126         HC       2
  127         ZZ
```

1 INPUT SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    50        S150
              V
              V
    59       RR150
              V
              V
    69       F355A
             .
             .
    78        .       S155A
              .          .
              .          .
    84       C155A.....
              V
              V
    88       55A55B
             .
             .
    97        .       S155B
              .          .
              .          .
   103       C155B.....
              V
              V
   107       55B55C
             .
             .
   116        .       S155C
              .          .
              .          .
   123       C155C.....

  (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN  1998                *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30NOV06  TIME  09:40:26   *
 *                                       *
 *****************************************

*****************************************
*                                       *
*    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 3

                        SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                        JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                        MODELER: TED LEHMAN
                        FILENAME: FAN36.DAT

                        100-YEAR 6-HOUR MODEL
                        EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                               MODELED AREA = 2.6 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         *    S150    *       BASIN
              *            *
              **************
                                  Compute runoff from subbasin 150

                 SUBBASIN RUNOFF DATA

52 BA            SUBBASIN CHARACTERISTICS
                      TAREA        .84  SUBBASIN AREA

53 LG            GREEN AND AMPT LOSS RATE
                     STRTL        .25  STARTING LOSS
                       DTH        .35  MOISTURE DEFICIT
                      PSIF       4.65  WETTING FRONT SUCTION
```

```
                    XKSAT          .32  HYDRAULIC CONDUCTIVITY
                    RTIMP         6.00  PERCENT IMPERVIOUS AREA

  51 UI          INPUT UNITGRAPH,  37 ORDINATES,  VOLUME = 1.00
                    70.0      92.0     241.0     379.0     491.0     577.0     788.0     616.0     442.0     399.0
                   351.0     307.0     267.0     221.0     180.0     167.0     150.0     116.0      93.0      85.0
                    78.0      59.0      55.0      48.0      34.0      35.0      34.0      23.0      13.0      14.0
                    13.0      14.0      13.0      14.0      13.0      14.0      13.0
                                                                                  ***

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

                      HYDROGRAPH AT STATION     S150
                     TRANSPOSITION AREA        .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.61, TOTAL EXCESS =    1.59

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     939.      4.42                144.         36.         12.          5.
                        (INCHES)    1.585       1.589       1.589       1.589
                        (AC-FT)      71.         71.         71.         71.

                      CUMULATIVE AREA =     .84 SQ MI

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

                      HYDROGRAPH AT STATION     S150
                     TRANSPOSITION AREA        .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.60, TOTAL EXCESS =    1.58

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     933.      4.42                142.         36.         12.          5.
                        (INCHES)    1.573       1.576       1.576       1.576
                        (AC-FT)      71.         71.         71.         71.

                      CUMULATIVE AREA =     .84 SQ MI

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

                      HYDROGRAPH AT STATION     S150
                     TRANSPOSITION AREA       2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.85, TOTAL EXCESS =    1.27

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     611.      4.42                114.         29.         10.          4.
                        (INCHES)    1.264       1.268       1.268       1.268
                        (AC-FT)      57.         57.         57.         57.

                      CUMULATIVE AREA =     .84 SQ MI

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

                      HYDROGRAPH AT STATION     S150
                     TRANSPOSITION AREA      16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.98, TOTAL EXCESS =     .97

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     440.      4.42                 87.         22.          7.          3.
                        (INCHES)     .963        .968        .968        .968
                        (AC-FT)      43.         43.         43.         43.

                      CUMULATIVE AREA =     .84 SQ MI

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

                      HYDROGRAPH AT STATION     S150
                     TRANSPOSITION AREA      90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.03, TOTAL EXCESS =     .56

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     245.      4.42                 50.         13.          4.          2.
                        (INCHES)     .556        .562        .562        .562
                        (AC-FT)      25.         25.         25.         25.

                      CUMULATIVE AREA =     .84 SQ MI
```



```
     -----DSS---ZOPEN:  Existing File Opened,  File: FAN36.DSS
                        Unit:  71;  DSS Version: 6-JG
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   36:  //S150/FLOW/08JAN1999/5MIN//
          ***           ***           ***           ***           ***


                        INTERPOLATED HYDROGRAPH AT     S150

     PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+      (CFS)       (HR)
                             (CFS)
+       835.      4.42                134.         34.         11.          5.
                           (INCHES)    1.479       1.483       1.483       1.483
                           (AC-FT)      66.         67.         67.         67.

                         CUMULATIVE AREA =     .84 SQ MI


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

               **************
               *            *
     59 KK     *     RR150  *      STORAGE
               *            *
               **************
                         PROPOSED DETENTION BASIN
                          ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT APEX 3
                          STRUCTURE ID:RR150
                          OUTLET BASED ON ASSUMED 1 pipe(s), dia: 3 ft

                    HYDROGRAPH ROUTING DATA

     64 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

     65 SV          STORAGE          .0        .0       13.5       28.3       44.4       52.9       61.8       66.3       71.0       80.5

     66 SE          ELEVATION       .00       1.00       3.00       5.00       7.00       8.00       9.00       9.50      10.00      11.00

     67 SQ          DISCHARGE        0.        9.        30.        52.        68.        75.        82.        84.        87.       117.

                                                                                  ***

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

                        HYDROGRAPH AT STATION    RR150
                       TRANSPOSITION AREA        .1 SQ MI

     PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+      (CFS)       (HR)
                             (CFS)
+        79.      5.75                 70.         36.         12.          5.
                           (INCHES)     .773       1.583       1.588       1.588
                           (AC-FT)      35.         71.         71.         71.

     PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                         6-HR       24-HR       72-HR    166.58-HR
+     (AC-FT)      (HR)
           58.     5.83                 47.         20.          7.          3.

     PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                         6-HR       24-HR       72-HR    166.58-HR
+     (FEET)       (HR)
          8.52     5.83                7.33        3.69        1.66        1.08

                         CUMULATIVE AREA =     .84 SQ MI

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

                        HYDROGRAPH AT STATION    RR150
                       TRANSPOSITION AREA        .5 SQ MI

     PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR       72-HR    166.58-HR
+      (CFS)       (HR)
                             (CFS)
+        78.      5.75                 70.         36.         12.          5.
                           (INCHES)     .769       1.571       1.576       1.576
                           (AC-FT)      35.         71.         71.         71.
```

```
 PEAK STORAGE   TIME                                 MAXIMUM AVERAGE STORAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
       57.       5.75                          47.          19.           7.           3.

  PEAK STAGE    TIME                                 MAXIMUM AVERAGE STAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+    (FEET)      (HR)
      8.47       5.75                         7.28         3.68         1.80         1.26

                             CUMULATIVE AREA =       .84 SQ MI


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

                              HYDROGRAPH AT STATION    RR150
                            TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                              6-HR        24-HR        72-HR    166.58-HR
+    (CFS)       (HR)
                                  (CFS)
+       68.      5.83                          59.          29.          10.           4.
                              (INCHES)        .656        1.267        1.267        1.267
                               (AC-FT)         29.          57.          57.          57.

 PEAK STORAGE   TIME                                 MAXIMUM AVERAGE STORAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
       45.       5.83                          36.          14.           5.           2.

  PEAK STAGE    TIME                                 MAXIMUM AVERAGE STAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+    (FEET)      (HR)
      7.04       5.83                         5.97         2.99         1.56         1.15

                             CUMULATIVE AREA =       .84 SQ MI


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

                              HYDROGRAPH AT STATION    RR150
                            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.      5.83                          48.          22.           7.           3.
                              (INCHES)        .527         .968         .968         .968
                               (AC-FT)         24.          43.          43.          43.

 PEAK STORAGE   TIME                                 MAXIMUM AVERAGE STORAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
       33.       5.83                          26.          10.           3.           1.

  PEAK STAGE    TIME                                 MAXIMUM AVERAGE STAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+    (FEET)      (HR)
      5.57       5.83                         4.67         2.19          .73          .32

                             CUMULATIVE AREA =       .84 SQ MI


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

                              HYDROGRAPH AT STATION    RR150
                            TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                              6-HR        24-HR        72-HR    166.58-HR
+    (CFS)       (HR)
                                  (CFS)
+       36.      5.75                          30.          13.           4.           2.
                              (INCHES)        .327         .562         .562         .562
                               (AC-FT)         15.          25.          25.          25.

 PEAK STORAGE   TIME                                 MAXIMUM AVERAGE STORAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
       18.       5.75                          13.           4.           1.           1.

  PEAK STAGE    TIME                                 MAXIMUM AVERAGE STAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+    (FEET)      (HR)
      3.55       5.75                         2.98         1.30          .43          .19

                             CUMULATIVE AREA =       .84 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   34:  //RR150/FLOW/08JAN1999/5MIN//
         ***            ***            ***            ***            ***
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                              INTERPOLATED HYDROGRAPH AT    RR150

  PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                              6-HR        24-HR        72-HR    166.58-HR
+    (CFS)       (HR)
                                  (CFS)
+       75.      5.83                          67.          33.          11.           5.
                              (INCHES)        .735        1.478        1.482        1.482
                               (AC-FT)         33.          66.          67.          67.

                             CUMULATIVE AREA =       .84 SQ MI


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

             **************
             *            *
  69 KK      *   F355A    *       ROUTE
             *            *
             **************

                PROPOSED CHANNEL
                 ROUTE OUTFLOW FROM RR150 TO C155A
                 Slope=(1748.0 - 1570.0) / 7862.0

             HYDROGRAPH ROUTING DATA

  73 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

  74 RC          NORMAL DEPTH CHANNEL
                        ANL       .045  LEFT OVERBANK N-VALUE
                       ANCH       .045  MAIN CHANNEL N-VALUE
                        ANR       .045  RIGHT OVERBANK N-VALUE
                      RLNTH      7862.  REACH LENGTH
                        SEL      .0230  ENERGY SLOPE
                      ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                       CROSS-SECTION DATA
                  --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  76 RY        ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
  75 RX        DISTANCE       .00       .00       .00       .00     65.00     65.00     65.00     65.00

                                                ***

                                     COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

               STORAGE       .00      2.78      5.56      8.34     11.11     13.89     16.67     19.45     22.23     25.01
               OUTFLOW       .00     29.52     93.49    183.33    295.41    427.46    577.87    745.38    928.98   1127.81
             ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

               STORAGE     27.79     30.56     33.34     36.12     38.90     41.68     44.46     47.23     50.01     52.79
               OUTFLOW   1341.15   1568.38   1808.92   2062.28   2328.00   2605.67   2894.91   3195.37   3506.73   3828.68
             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       578. TO      3829.
                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    F355A
                            TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                              6-HR        24-HR        72-HR    166.58-HR
+    (CFS)       (HR)
                                  (CFS)
+       79.      6.42                          70.          36.          12.           5.
                              (INCHES)        .768        1.580        1.588        1.588
                               (AC-FT)         34.          71.          71.          71.

 PEAK STORAGE   TIME                                 MAXIMUM AVERAGE STORAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
        1.       6.25                           1.           1.           0.           0.

  PEAK STAGE    TIME                                 MAXIMUM AVERAGE STAGE
                                              6-HR        24-HR        72-HR    166.58-HR
+    (FEET)      (HR)
    100.42       6.42                       100.38       100.23       100.08       100.03

                             CUMULATIVE AREA =       .84 SQ MI


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

                              HYDROGRAPH AT STATION    F355A
                            TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                              6-HR        24-HR        72-HR    166.58-HR
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+    (CFS)        (HR)
                   (CFS)
+       78.       6.42                69.          35.          12.           5.
                 (INCHES)             .763        1.568        1.576         1.576
                  (AC-FT)             34.          70.          71.           71.

 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR      166.58-HR
+   (AC-FT)       (HR)
         1.       6.25                 1.           1.           0.            0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR      166.58-HR
+    (FEET)       (HR)
     100.42       6.42              100.38       100.23       100.08        100.03

                          CUMULATIVE AREA =      .84 SQ MI


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

                        HYDROGRAPH AT STATION    F355A
                       TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+       68.       6.42                59.          29.          10.           4.
                 (INCHES)             .650        1.266        1.267         1.267
                  (AC-FT)             29.          57.          57.           57.

 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)
     100.38       6.42              100.35       100.19       100.06        100.03

                          CUMULATIVE AREA =      .84 SQ MI


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

                        HYDROGRAPH AT STATION    F355A
                       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.       6.42                47.          22.           7.           3.
                 (INCHES)             .519         .968         .968          .968
                  (AC-FT)             23.          43.          43.           43.

 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)
     100.34       6.42              100.30       100.16       100.05        100.02

                          CUMULATIVE AREA =      .84 SQ MI


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

                        HYDROGRAPH AT STATION    F355A
                       TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+       36.       6.42                29.          13.           4.           2.
                 (INCHES)             .321         .562         .562          .562
                  (AC-FT)             14.          25.          25.           25.

 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR      166.58-HR
+   (AC-FT)       (HR)
         1.       6.33                 1.           0.           0.            0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR      166.58-HR
+    (FEET)       (HR)
     100.26       6.42              100.23       100.10       100.03        100.01

                          CUMULATIVE AREA =      .84 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //F355A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT    F355A

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+       75.       6.42                66.          33.          11.           5.
                 (INCHES)             .729        1.475        1.482         1.482
                  (AC-FT)             33.          66.          67.           67.

                          CUMULATIVE AREA =      .84 SQ MI


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

               **************
               *            *
 78 KK         *    S155A   *        BASIN
               *            *
               **************
                          Compute runoff from subbasin 155A

                    SUBBASIN RUNOFF DATA

 80 BA                SUBBASIN CHARACTERISTICS
                           TAREA         .57  SUBBASIN AREA

 81 LG                GREEN AND AMPT LOSS RATE
                           STRTL         .35  STARTING LOSS
                             DTH         .35  MOISTURE DEFICIT
                            PSIF        4.60  WETTING FRONT SUCTION
                           XKSAT         .34  HYDRAULIC CONDUCTIVITY
                           RTIMP        2.00  PERCENT IMPERVIOUS AREA

 79 UI                INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                        112.0     448.0     778.0     922.0     781.0     500.0     321.0     208.0     129.0      83.0
                         57.0      24.0      23.0      25.0

                                                                                                                      ***

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

                        HYDROGRAPH AT STATION    S155A
                       TRANSPOSITION AREA       .1 SQ MI

                  TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.44

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+     1073.       4.17                88.          22.           7.           3.
                 (INCHES)            1.433        1.433        1.433         1.433
                  (AC-FT)             44.          44.          44.           44.

                          CUMULATIVE AREA =      .57 SQ MI


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

                        HYDROGRAPH AT STATION    S155A
                       TRANSPOSITION AREA       .5 SQ MI

                  TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.42

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+     1065.       4.17                87.          22.           7.           3.
                 (INCHES)            1.421        1.421        1.421         1.421
                  (AC-FT)             43.          43.          43.           43.

                          CUMULATIVE AREA =      .57 SQ MI


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

                        HYDROGRAPH AT STATION    S155A
                       TRANSPOSITION AREA      2.8 SQ MI

                  TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.02, TOTAL EXCESS =    1.10

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR      166.58-HR
+    (CFS)        (HR)
                   (CFS)
+      585.       4.17                68.          17.           6.           2.
                 (INCHES)            1.100        1.100        1.100         1.100
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                    (AC-FT)        33.          34.          34.          34.

                    CUMULATIVE AREA =      .57 SQ MI


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

                    HYDROGRAPH AT STATION    S155A
                  TRANSPOSITION AREA     16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.15, TOTAL EXCESS =     .80

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     405.       4.17                49.          12.           4.           2.
                (INCHES)           .802          .803          .803          .803
                 (AC-FT)             24.           24.           24.           24.

                    CUMULATIVE AREA =      .57 SQ MI


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

                    HYDROGRAPH AT STATION    S155A
                  TRANSPOSITION AREA     90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.19, TOTAL EXCESS =     .41

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     206.       4.17                25.           6.           2.           1.
                (INCHES)           .405          .406          .406          .406
                 (AC-FT)             12.           12.           12.           12.

                    CUMULATIVE AREA =      .57 SQ MI


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


                  INTERPOLATED HYDROGRAPH AT    S155A

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+    1028.       4.17                86.          21.           7.           3.
                (INCHES)          1.396         1.396         1.396         1.396
                 (AC-FT)             43.           43.           43.           43.

                    CUMULATIVE AREA =      .57 SQ MI



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


            **************
            *            *
   84 KK    *     C155A  *      COMBINE
            *            *
            **************
                          Combine runoff from S155A w/ routed outflow from Fan 3 detention basin

   86 HC          HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                  ***

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

                    HYDROGRAPH AT STATION    C155A
                  TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+    1078.       4.17               145.          58.          19.           8.
                (INCHES)           .953         1.518         1.526         1.526
                 (AC-FT)             72.          114.          115.          115.

                    CUMULATIVE AREA =    1.41 SQ MI


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

                    HYDROGRAPH AT STATION    C155A
                  TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+    1071.       4.17               144.          57.          19.           8.
                (INCHES)           .946         1.506         1.513         1.513
                 (AC-FT)             71.          114.          114.          114.

                    CUMULATIVE AREA =    1.41 SQ MI


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

                    HYDROGRAPH AT STATION    C155A
                  TRANSPOSITION AREA     2.8 SQ MI

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     591.       4.17               115.          46.          15.           7.
                (INCHES)           .758         1.199         1.200         1.200
                 (AC-FT)             57.           90.           90.           90.

                    CUMULATIVE AREA =    1.41 SQ MI


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

                    HYDROGRAPH AT STATION    C155A
                  TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     413.       4.17                88.          34.          11.           5.
                (INCHES)           .578          .901          .901          .901
                 (AC-FT)             44.           68.           68.           68.

                    CUMULATIVE AREA =    1.41 SQ MI


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

                    HYDROGRAPH AT STATION    C155A
                  TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     214.       4.17                49.          19.           6.           3.
                (INCHES)           .320          .499          .499          .499
                 (AC-FT)             24.           38.           38.           38.

                    CUMULATIVE AREA =    1.41 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   34:  //C155A/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                  INTERPOLATED HYDROGRAPH AT    C155A

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR         24-HR         72-HR      166.58-HR
+    (CFS)       (HR)
                   (CFS)
+     781.       4.17               126.          50.          17.           7.
                (INCHES)           .832         1.319         1.324         1.324
                 (AC-FT)             63.           99.          100.          100.

                    CUMULATIVE AREA =    1.41 SQ MI



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


            **************
            *            *
   88 KK    *    55A55B  *       ROUTE
            *            *
            **************
                          PROPOSED CHANNEL
                           ROUTE COMBINED FLOW FROM C155A TO C155B
                           Slope=(1570.0 - 1509.0) / 4080.0

                  HYDROGRAPH ROUTING DATA

   92 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
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 93 RC          NORMAL DEPTH CHANNEL
                       ANL        .045  LEFT OVERBANK N-VALUE
                      ANCH        .045  MAIN CHANNEL N-VALUE
                       ANR        .045  RIGHT OVERBANK N-VALUE
                     RLNTH       4080.  REACH LENGTH
                       SEL       .0150  ENERGY SLOPE
                     ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                         CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 95 RY        ELEVATION   105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 94 RX        DISTANCE       .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                                              ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE         .00      2.46      4.93      7.39      9.86     12.32     14.79     17.25     19.72     22.18
              OUTFLOW         .00     43.75    138.65    272.05    438.65    635.16    859.22   1109.00   1383.05   1680.15
            ELEVATION      100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

              STORAGE       24.65     27.11     29.58     32.04     34.51     36.97     39.44     41.90     44.37     46.83
              OUTFLOW     1999.25   2339.45   2699.94   3080.02   3479.04   3896.41   4331.58   4784.07   5253.42   5739.19
            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       859. TO      5739.
                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    55A55B
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     972.       4.33                142.        58.         19.          8.
                        (INCHES)     .934       1.518       1.526       1.526
                         (AC-FT)      70.        114.        115.        115.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        5.       4.33                  1.          1.          0.          0.

  PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.70       4.33              100.46      100.24      100.08      100.04

                   CUMULATIVE AREA =    1.41 SQ MI

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

                    HYDROGRAPH AT STATION    55A55B
                  TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     966.       4.33                141.        57.         19.          8.
                        (INCHES)     .928       1.506       1.513       1.513
                         (AC-FT)      70.        113.        114.        114.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        5.       4.33                  1.          1.          0.          0.

  PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    101.69       4.33              100.46      100.24      100.08      100.04

                   CUMULATIVE AREA =    1.41 SQ MI

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

                    HYDROGRAPH AT STATION    55A55B
                  TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     559.       4.33                113.        46.         15.          7.
                        (INCHES)     .741       1.198       1.200       1.200
                         (AC-FT)      56.         90.         90.         90.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        4.       4.33                  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)
    101.21       4.33              100.42      100.21      100.07      100.03

                   CUMULATIVE AREA =    1.41 SQ MI

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

                    HYDROGRAPH AT STATION    55A55B
                  TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     380.       4.33                 86.        34.         11.          5.
                        (INCHES)     .563        .901        .901        .901
                         (AC-FT)      42.         68.         68.         68.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        3.       4.33                  1.          1.          0.          0.

  PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    100.96       4.33              100.36      100.17      100.06      100.02

                   CUMULATIVE AREA =    1.41 SQ MI

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

                    HYDROGRAPH AT STATION    55A55B
                  TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     188.       4.50                 48.        19.          6.          3.
                        (INCHES)     .313        .499        .499        .499
                         (AC-FT)      24.         38.         38.         38.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        2.       4.50                  1.          0.          0.          0.

  PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR        72-HR     166.58-HR
+   (FEET)       (HR)
    100.62       4.50              100.24      100.10      100.03      100.01

                   CUMULATIVE AREA =    1.41 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55A55B/FLOW/08JAN1999/5MIN//
       ***         ***         ***         ***         ***


                   INTERPOLATED HYDROGRAPH AT    55A55B

  PEAK FLOW      TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     720.       4.33                124.        50.         17.          7.
                        (INCHES)     .814       1.319       1.324       1.324
                         (AC-FT)      61.         99.        100.        100.

                   CUMULATIVE AREA =    1.41 SQ MI



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

             **************
             *            *
  97 KK      *    S155B   *        BASIN
             *            *
             **************
                                     Compute runoff from subbasin 155B

             SUBBASIN RUNOFF DATA

  99 BA        SUBBASIN CHARACTERISTICS
                     TAREA         .49  SUBBASIN AREA
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 100 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.40  WETTING FRONT SUCTION
                       XKSAT         .38  HYDRAULIC CONDUCTIVITY
                       RTIMP        1.00  PERCENT IMPERVIOUS AREA

  98 UI          INPUT UNITGRAPH,  13 ORDINATES,  VOLUME =  .99
                     107.0     422.0     714.0     823.0     659.0     412.0     257.0     164.0     104.0      64.0
                      36.0      22.0      21.0

                                                                          ***

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

                                  HYDROGRAPH AT STATION    S155B
                                TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.83, TOTAL EXCESS =     1.37

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +      923.      4.17                        72.           18.            6.            3.
                                (INCHES)     1.361         1.361         1.361         1.361
                                 (AC-FT)       36.           36.           36.           36.

                                 CUMULATIVE AREA =      .49 SQ MI


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

                                  HYDROGRAPH AT STATION    S155B
                                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)
 +      916.      4.17                        72.           18.            6.            3.
                                (INCHES)     1.349         1.349         1.349         1.349
                                 (AC-FT)       36.           36.           36.           36.

                                 CUMULATIVE AREA =      .49 SQ MI


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

                                  HYDROGRAPH AT STATION    S155B
                                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)
 +      490.      4.17                        54.           14.            5.            2.
                                (INCHES)     1.018         1.018         1.018         1.018
                                 (AC-FT)       27.           27.           27.           27.

                                 CUMULATIVE AREA =      .49 SQ MI


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

                                  HYDROGRAPH AT STATION    S155B
                                TRANSPOSITION AREA     16.0 SQ MI

     TOTAL RAINFALL =     2.95, TOTAL LOSS =     2.23, TOTAL EXCESS =      .72

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +      333.      4.17                        38.           10.            3.            1.
                                (INCHES)      .717          .717          .717          .717
                                 (AC-FT)       19.           19.           19.           19.

                                 CUMULATIVE AREA =      .49 SQ MI


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

                                  HYDROGRAPH AT STATION    S155B
                                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)
 +      160.      4.17                        18.            4.            1.            1.
                                (INCHES)      .333          .333          .333          .333
                                 (AC-FT)        9.            9.            9.            9.

                                 CUMULATIVE AREA =      .49 SQ MI

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


                                 INTERPOLATED HYDROGRAPH AT    S155B

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +      916.      4.17                        72.           18.            6.            3.
                                (INCHES)     1.349         1.349         1.349         1.349
                                 (AC-FT)       36.           36.           36.           36.

                                 CUMULATIVE AREA =      .49 SQ MI



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             *            *
  103 KK     *    C155B   *     COMBINE
             *            *
             **************
                                Combine runoff from S155B with routed flow from C155A

  105 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                          ***

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

                                  HYDROGRAPH AT STATION    C155B
                                TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +     1750.      4.25                       212.           76.           25.           11.
                                (INCHES)     1.032         1.476         1.483         1.483
                                 (AC-FT)      105.          150.          151.          151.

                                 CUMULATIVE AREA =     1.91 SQ MI


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

                                  HYDROGRAPH AT STATION    C155B
                                TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +     1736.      4.25                       210.           75.           25.           11.
                                (INCHES)     1.024         1.464         1.471         1.471
                                 (AC-FT)      104.          149.          150.          150.

                                 CUMULATIVE AREA =     1.91 SQ MI


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

                                  HYDROGRAPH AT STATION    C155B
                                TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +      989.      4.25                       164.           59.           20.            9.
                                (INCHES)      .800         1.151         1.153         1.153
                                 (AC-FT)       81.          117.          117.          117.

                                 CUMULATIVE AREA =     1.91 SQ MI


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

                                  HYDROGRAPH AT STATION    C155B
                                TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW      TIME                                 MAXIMUM AVERAGE FLOW
                                             6-HR         24-HR         72-HR    166.58-HR
 +   (CFS)        (HR)
                                 (CFS)
 +      658.      4.25                       122.           44.           15.            6.
                                (INCHES)      .593          .853          .854          .854
                                 (AC-FT)       60.           87.           87.           87.

                                 CUMULATIVE AREA =     1.91 SQ MI
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      ***            ***            ***            ***            ***

                          HYDROGRAPH AT STATION    C155B
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+     304.      4.42             64.          23.           8.           3.
                            (INCHES)        .311         .456         .456         .456
                              (AC-FT)         32.          46.          46.          46.

                          CUMULATIVE AREA =    1.91 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //C155B/FLOW/08JAN1999/5MIN//
      ***            ***            ***            ***            ***

                          INTERPOLATED HYDROGRAPH AT    C155B

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+    1155.      4.25            174.          63.          21.           9.
                            (INCHES)        .850        1.220        1.224        1.224
                              (AC-FT)         86.         124.         124.         124.

                          CUMULATIVE AREA =    1.91 SQ MI


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


           **************
           *            *
 107 KK    *    55B55C  *        ROUTE
           *            *
           **************
                         PROPOSED CHANNEL
                          ROUTE COMBINED FLOW FROM C155B TO C155C
                          Slope=(1509.0 - 1452.0) / 4478.0

                     HYDROGRAPH ROUTING DATA

 111 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

 112 RC              NORMAL DEPTH CHANNEL
                            ANL        .045  LEFT OVERBANK N-VALUE
                           ANCH        .045  MAIN CHANNEL N-VALUE
                            ANR        .045  RIGHT OVERBANK N-VALUE
                          RLNTH       4478.  REACH LENGTH
                            SEL       .0130  ENERGY SLOPE
                          ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                               --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 114 RY        ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 113 RX        DISTANCE        .00       .00       .00       .00    135.00    135.00    135.00    135.00

                                              ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE        .00      3.65      7.30     10.96     14.61     18.26     21.91     25.57     29.22     32.87
              OUTFLOW        .00     55.01    174.41    342.37    552.29    800.06   1082.76   1398.15   1744.42   2120.07
            ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

              STORAGE      36.52     40.17     43.83     47.48     51.13     54.78     58.43     62.09     65.74     69.39
              OUTFLOW    2523.82   2954.56   3411.31   3893.21   4399.45   4929.34   5482.21   6057.45   6654.52   7272.90
            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     1744. TO     7273.
                 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    55B55C
                        TRANSPOSITION AREA      .1 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+    1576.      4.42            207.          76.          25.          11.
                            (INCHES)       1.010        1.475        1.483        1.483
                              (AC-FT)        103.         150.         151.         151.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+ (AC-FT)       (HR)
       9.       4.42              2.           1.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.98      4.42           100.48       100.23       100.08       100.03

                          CUMULATIVE AREA =    1.91 SQ MI

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

                          HYDROGRAPH AT STATION    55B55C
                        TRANSPOSITION AREA      .5 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+    1564.      4.42            205.          75.          25.          11.
                            (INCHES)       1.002        1.463        1.471        1.471
                              (AC-FT)        102.         149.         150.         150.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+ (AC-FT)       (HR)
       9.       4.42              2.           1.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.97      4.42           100.48       100.23       100.08       100.03

                          CUMULATIVE AREA =    1.91 SQ MI

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

                          HYDROGRAPH AT STATION    55B55C
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+     923.      4.42            160.          59.          20.           9.
                            (INCHES)        .781        1.151        1.153        1.153
                              (AC-FT)         79.         117.         117.         117.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+ (AC-FT)       (HR)
       7.       4.42              2.           1.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.43      4.42           100.43       100.20       100.07       100.03

                          CUMULATIVE AREA =    1.91 SQ MI

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

                          HYDROGRAPH AT STATION    55B55C
                        TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                              (CFS)
+     611.      4.50            119.          44.          15.           6.
                            (INCHES)        .578         .853         .854         .854
                              (AC-FT)          59.          87.          87.          87.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+ (AC-FT)       (HR)
       5.       4.50              2.           1.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.11      4.50           100.37       100.16       100.05       100.02

                          CUMULATIVE AREA =    1.91 SQ MI

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

                          HYDROGRAPH AT STATION    55B55C
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                         TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      262.      4.67                     62.           23.            8.            3.
                            (INCHES)     .304          .456          .456          .456
                             (AC-FT)      31.           46.           46.           46.

 PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR     166.58-HR

+  (AC-FT)       (HR)
         3.      4.67                      1.            0.            0.            0.

  PEAK STAGE     TIME                                MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR     166.58-HR

+   (FEET)       (HR)
     100.66      4.67                  100.24        100.10        100.03        100.01

                          CUMULATIVE AREA =     1.91 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   34:  //55B55C/FLOW/08JAN1999/5MIN//
      ***          ***          ***          ***          ***


                          INTERPOLATED HYDROGRAPH AT   55B55C

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+     1066.      4.42                    170.           63.           21.            9.
                            (INCHES)     .830         1.219         1.224         1.224
                             (AC-FT)      84.          124.          124.          124.

                          CUMULATIVE AREA =     1.91 SQ MI


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           **************
           *            *
 116 KK    *   S155C    *        BASIN
           *            *
           **************
                               Compute runoff from subbasin 155C

           SUBBASIN RUNOFF DATA

 118 BA      SUBBASIN CHARACTERISTICS
                  TAREA          .70  SUBBASIN AREA

 119 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         1.00  PERCENT IMPERVIOUS AREA

 117 UI      INPUT UNITGRAPH,  20 ORDINATES,  VOLUME = 1.00
                  85.0    227.0    476.0    680.0    802.0    784.0    641.0    469.0    344.0    249.0
                 178.0    137.0     92.0     68.0     57.0     26.0     21.0     20.0     21.0     20.0
                                                                   ***

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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.80, TOTAL EXCESS =    1.39

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      995.      4.25                    104.           26.            9.            4.
                            (INCHES)    1.391         1.391         1.391         1.391
                             (AC-FT)      52.           52.           52.           52.

                          CUMULATIVE AREA =      .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.80, TOTAL EXCESS =    1.38

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      988.      4.25                    103.           26.            9.            4.
                            (INCHES)    1.378         1.379         1.379         1.379
                             (AC-FT)      51.           51.           51.           51.

                          CUMULATIVE AREA =      .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.07, TOTAL EXCESS =    1.05

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      592.      4.33                     79.           20.            7.            3.
                            (INCHES)    1.049         1.049         1.049         1.049
                             (AC-FT)      39.           39.           39.           39.

                          CUMULATIVE AREA =      .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.20, TOTAL EXCESS =     .75

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      409.      4.33                     56.           14.            5.            2.
                            (INCHES)     .749          .750          .750          .750
                             (AC-FT)      28.           28.           28.           28.

                          CUMULATIVE AREA =      .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA     90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.23, TOTAL EXCESS =     .36

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      203.      4.33                     27.            7.            2.            1.
                            (INCHES)     .358          .359          .359          .359
                             (AC-FT)      13.           13.           13.           13.

                          CUMULATIVE AREA =      .70 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT    S155C

  PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR

+   (CFS)        (HR)
                              (CFS)
+      911.      4.25                     99.           25.            8.            4.
                            (INCHES)    1.315         1.315         1.315         1.315
                             (AC-FT)      49.           49.           49.           49.

                          CUMULATIVE AREA =      .70 SQ MI


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

           **************
           *            *
 123 KK    *   C155C    *        COMBINE
           *            *
           **************

                 Combine runoff from S155C with routed flow from C155B
                 This is the total flow at the downstream end of the Fan 3 corridor.

 126 HC      HYDROGRAPH COMBINATION
                  ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                              ***
```

```
        ***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION     C155C
                    TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    2492.       4.33                308.         102.          34.          15.
                          (INCHES)   1.101        1.451        1.458        1.458
                           (AC-FT)    153.         202.         203.         203.

                           CUMULATIVE AREA =     2.61 SQ MI

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

                    HYDROGRAPH AT STATION     C155C
                    TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    2467.       4.33                306.         101.          34.          15.
                          (INCHES)   1.091        1.439        1.446        1.446
                           (AC-FT)    152.         200.         201.         201.

                           CUMULATIVE AREA =     2.61 SQ MI

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

                    HYDROGRAPH AT STATION     C155C
                    TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    1475.       4.42                236.          79.          26.          11.
                          (INCHES)    .842        1.123        1.125        1.125
                           (AC-FT)    117.         156.         156.         156.

                           CUMULATIVE AREA =     2.61 SQ MI

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

                    HYDROGRAPH AT STATION     C155C
                    TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     954.       4.42                172.          58.          19.           8.
                          (INCHES)    .615         .825         .826         .826
                           (AC-FT)     85.         115.         115.         115.

                           CUMULATIVE AREA =     2.61 SQ MI

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

                    HYDROGRAPH AT STATION     C155C
                    TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     397.       4.58                 87.          30.          10.           4.
                          (INCHES)    .312         .430         .430         .430
                           (AC-FT)     43.          60.          60.          60.

                           CUMULATIVE AREA =     2.61 SQ MI
        ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT     C155C

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    1512.       4.42                239.          80.          27.          11.
                          (INCHES)    .852        1.136        1.138        1.138
                           (AC-FT)    118.         158.         158.         158.

                           CUMULATIVE AREA =     2.61 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	S150	835.	4.42	134.	34.	11.	.84		
+	ROUTED TO	RR150	75.	5.83	67.	33.	11.	.84		
+	ROUTED TO	F355A	75.	6.42	66.	33.	11.	.84		
+	HYDROGRAPH AT	S155A	1028.	4.17	86.	21.	7.	.57		
+	2 COMBINED AT	C155A	781.	4.17	126.	50.	17.	1.41		
+	ROUTED TO	55A55B	720.	4.33	124.	50.	17.	1.41		
+	HYDROGRAPH AT	S155B	916.	4.17	72.	18.	6.	.49		
+	2 COMBINED AT	C155B	1155.	4.25	174.	63.	21.	1.91		
+	ROUTED TO	55B55C	1066.	4.42	170.	63.	21.	1.91		
+	HYDROGRAPH AT	S155C	911.	4.25	99.	25.	8.	.70		
+	2 COMBINED AT	C155C	1512.	4.42	239.	80.	27.	2.61		

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


    -----DSS---ZCLOSE Unit:  71,    File: FAN36.DSS
              Pointer Utilization:    .33
              Number of Records:      56
              File Size:      103.4  Kbytes
              Percent Inactive:      .0
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30NOV06  TIME  09:40:26   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*   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 3
   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: FAN324.DAT
   8          ID
   9          ID   100-YEAR 24-HOUR MODEL
  10          ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
  11          ID            MODELED AREA = 2.6 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          JD   3.654    60.0
  44          JD   3.578    90.0
              *
  45          KK   S150   BASIN
  46          KM        Compute runoff from subbasin 150
  47          BA   0.842
  48          LG    0.25    0.35    4.65    0.32       6
  49          UI      70      92     241     379     491     577     788     616     442     399
  50          UI     351     307     267     221     180     167     150     116      93      85
  51          UI      78      59      55      48      34      35      34      23      13      14
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  52          UI      13      14      13      14      13      14      13       0       0       0
  53          ZW                  C=FLOW
              *
```

```
  54          KK   RR150 STORAGE
  55          KM   PROPOSED DETENTION BASIN
  56          KM    ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT APEX 3
  57          KM    STRUCTURE ID:RR150
  58          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 3 ft
  59          RS       1    STOR      -1
  60          SV     0.0     0.0    13.5    28.3    44.4    52.9    61.8    66.3    71.0    80.5
  61          SE     0.0     1.0     3.0     5.0     7.0     8.0     9.0     9.5    10.0    11.0
  62          SQ     0.0     9.3    29.7    51.9    67.6    75.4    82.0    84.3    86.6   116.6
  63          ZW                  C=FLOW
              *
  64          KK  F355A   ROUTE
  65          KM   PROPOSED CHANNEL
  66          KM    ROUTE OUTFLOW FROM RR150 TO C155A
  67          KM    Slope=(1748.0 - 1570.0) / 7862.0
  68          RS       5    FLOW      -1
  69          RC   0.045   0.045   0.045  7862.0   0.023   104.5
  70          RX     0.0     0.0     0.0     0.0    65.0    65.0    65.0    65.0
  71          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  72          ZW                  C=FLOW
              *
  73          KK   S155A   BASIN
  74          KM        Compute runoff from subbasin 155A
  75          BA   0.571
  76          LG    0.35    0.35    4.60    0.34       2
  77          UI     112     448     778     922     781     500     321     208     129      83
  78          UI      57      24      23      25       0       0       0       0       0       0
              *
  79          KK   C155A COMBINE
  80          KM        Combine runoff from S155A w/ routed outflow from Fan 3 detention basin
  81          HC       2
  82          ZW                  C=FLOW
              *
  83          KK  55A55B   ROUTE
  84          KM   PROPOSED CHANNEL
  85          KM    ROUTE COMBINED FLOW FROM C155A TO C155B
  86          KM    Slope=(1570.0 - 1509.0) / 4080.0
  87          RS       3    FLOW      -1
  88          RC   0.045   0.045   0.045  4080.0   0.015   105.0
  89          RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
  90          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
  91          ZW                  C=FLOW
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  92          KK   S155B   BASIN
  93          KM        Compute runoff from subbasin 155B
  94          BA   0.494
  95          LG    0.35    0.35    4.40    0.38       1
  96          UI     107     422     714     823     659     412     257     164     104      64
  97          UI      36      22      21       0       0       0       0       0       0       0
              *
  98          KK   C155B COMBINE
  99          KM        Combine runoff from S155B with routed flow from C155A
 100          HC       2
 101          ZW                  C=FLOW
              *
 102          KK  55B55C   ROUTE
 103          KM   PROPOSED CHANNEL
 104          KM    ROUTE COMBINED FLOW FROM C155B TO C155C
 105          KM    Slope=(1509.0 - 1452.0) / 4478.0
 106          RS       3    FLOW      -1
 107          RC   0.045   0.045   0.045  4478.0   0.013   105.0
 108          RX     0.0     0.0     0.0     0.0   135.0   135.0   135.0   135.0
 109          RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
 110          ZW                  C=FLOW
              *
 111          KK   S155C   BASIN
 112          KM        Compute runoff from subbasin 155C
 113          BA   0.698
 114          LG    0.35    0.35    4.50    0.36       1
 115          UI      85     227     476     680     802     784     641     469     344     249
 116          UI     178     137      92      68      57      26      21      20      21      20
 117          UI       0       0       0       0       0       0       0       0       0       0
              *
 118          KK   C155C COMBINE
 119          KM        Combine runoff from S155C with routed flow from C155B
 120          KM        This is the total flow at the downstream end of the Fan 3 corridor.
 121          HC       2
 122          ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW
NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 45        S150
```

```
              V
              V
   54       RR150
              V
              V
   64      F355A
              .
              .
   73         .          S155A
              .            .
              .            .
   79       C155A............
              V
              V
   83      55A55B
              .
              .
   92         .          S155B
              .            .
              .            .
   98       C155B............
              V
              V
  102      55B55C
              .
              .
  111         .          S155C
              .            .
              .            .
  118       C155C............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1****************************************
*                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*             JUN   1998                 *
*           VERSION 4.1                  *
*                                        *
* RUN DATE   30NOV06   TIME  09:40:26    *
*                                        *
******************************************
```

```
***************************************
*                                     *
*   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 3

                    SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                    MODELER: TED LEHMAN
                    FILENAME: FAN324.DAT

                    100-YEAR 24-HOUR MODEL
                    EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                             MODELED AREA = 2.6 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
                 .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     .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
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                 .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
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                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .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
                 .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
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                 .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
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                 .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                 .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
                 .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
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                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00

  43 JD       INDEX STORM NO. 4
                STRM        3.65  PRECIPITATION DEPTH
                TRDA       60.00  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
                .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      .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      .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      .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
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                .00      .00      .00      .00      .00      .00      .00      .00

  44 JD       INDEX STORM NO. 5
                STRM        3.58  PRECIPITATION DEPTH
                TRDA       90.00  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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                .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      .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
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  45 KK     *    S150    *       BASIN
            *            *
            **************
                         Compute runoff from subbasin 150

               SUBBASIN RUNOFF DATA

  47 BA          SUBBASIN CHARACTERISTICS
                   TAREA          .84  SUBBASIN AREA

  48 LG          GREEN AND AMPT LOSS RATE
                   STRTL          .25  STARTING LOSS
                     DTH          .35  MOISTURE DEFICIT
                    PSIF         4.65  WETTING FRONT SUCTION
                   XKSAT          .32  HYDRAULIC CONDUCTIVITY
                   RTIMP         6.00  PERCENT IMPERVIOUS AREA

  46 UI          INPUT UNITGRAPH,  37 ORDINATES,  VOLUME = 1.00
                  70.0     92.0    241.0    379.0    491.0    577.0    788.0    616.0    442.0    399.0
                 351.0    307.0    267.0    221.0    180.0    167.0    150.0    116.0     93.0     85.0
                  78.0     59.0     55.0     48.0     34.0     35.0     34.0     23.0     13.0     14.0
                  13.0     14.0     13.0     14.0     13.0     14.0     13.0

                                            ***

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

                    HYDROGRAPH AT STATION      S150
                    TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.80, TOTAL EXCESS =    1.40

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                          (CFS)
 +     759.      12.42                120.          32.          11.          5.
                       (INCHES)      1.322       1.395        1.396       1.396
                        (AC-FT)        59.          63.          63.         63.

                       CUMULATIVE AREA =      .84 SQ MI

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

                    HYDROGRAPH AT STATION      S150
                    TRANSPOSITION AREA      10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.70, TOTAL EXCESS =    1.29

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                          (CFS)
 +     703.      12.42                110.          29.          10.          4.
                       (INCHES)      1.218       1.287        1.288       1.288
                        (AC-FT)        55.          58.          58.         58.

                       CUMULATIVE AREA =      .84 SQ MI

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

                    HYDROGRAPH AT STATION      S150
                    TRANSPOSITION AREA      30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.59, TOTAL EXCESS =    1.19

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                          (CFS)
 +     650.      12.42                101.          27.           9.          4.
                       (INCHES)      1.120       1.186        1.187       1.187
                        (AC-FT)        50.          53.          53.         53.

                       CUMULATIVE AREA =      .84 SQ MI

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

                    HYDROGRAPH AT STATION      S150
                    TRANSPOSITION AREA      60.0 SQ MI

     TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.53, TOTAL EXCESS =    1.13

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                          (CFS)
 +     617.      12.42                 96.          25.           9.          4.
                       (INCHES)      1.062       1.126        1.127       1.127
                        (AC-FT)        48.          51.          51.         51.

                       CUMULATIVE AREA =      .84 SQ MI

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

                    HYDROGRAPH AT STATION      S150
                    TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.49, TOTAL EXCESS =    1.09

   PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                          (CFS)
 +     598.      12.42                 93.          25.           8.          4.
                       (INCHES)      1.027       1.089        1.090       1.090
                        (AC-FT)        46.          49.          49.         49.

                       CUMULATIVE AREA =      .84 SQ MI
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   -----DSS---ZOPEN:  Existing File Opened,  File: FAN324.DSS
                      Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   38:  //S150/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                      INTERPOLATED HYDROGRAPH AT     S150

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     733.      12.42                115.          30.         10.          4.
                          (INCHES)  1.274        1.345       1.346       1.346
                           (AC-FT)    57.          60.         60.         60.

                      CUMULATIVE AREA =      .84 SQ MI


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


            **************
            *            *
  54 KK     *    RR150   *      STORAGE
            *            *
            **************
                        PROPOSED DETENTION BASIN
                         ROUTE FLOWS THROUGH PROPOSED DETENTION BASIN AT APEX 3
                         STRUCTURE ID:RR150
                         OUTLET BASED ON ASSUMED 1 pipe(s), dia: 3 ft

              HYDROGRAPH ROUTING DATA

  59 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

  60 SV          STORAGE          .0        .0      13.5      28.3      44.4      52.9      61.8      66.3      71.0      80.5

  61 SE          ELEVATION       .00      1.00      3.00      5.00      7.00      8.00      9.00      9.50     10.00     11.00

  62 SQ          DISCHARGE        0.        9.       30.       52.       68.       75.       82.       84.       87.      117.

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

                     HYDROGRAPH AT STATION    RR150
                    TRANSPOSITION AREA      .1 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+      70.      13.75                 62.          31.         11.          5.
                          (INCHES)   .680        1.368       1.396       1.396
                           (AC-FT)    31.          61.         63.         63.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
       47.      13.75                 38.          16.          5.          2.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
      7.27      13.75                6.23         3.13        1.07         .46

                      CUMULATIVE AREA =      .84 SQ MI


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

                     HYDROGRAPH AT STATION    RR150
                    TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+      66.      13.75                 58.          29.         10.          4.
                          (INCHES)   .641        1.264       1.287       1.287
                           (AC-FT)    29.          57.         58.         58.
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 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
       43.      13.75                 35.          14.          5.          2.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
      6.80      13.75                5.80         2.91        1.36         .90

                      CUMULATIVE AREA =      .84 SQ MI


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

                     HYDROGRAPH AT STATION    RR150
                    TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+      62.      13.75                 54.          26.          9.          4.
                          (INCHES)   .602        1.168       1.187       1.187
                           (AC-FT)    27.          52.         53.         53.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
       39.      13.75                 32.          12.          4.          2.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
      6.34      13.75                5.39         2.65         .90         .40

                      CUMULATIVE AREA =      .84 SQ MI


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

                     HYDROGRAPH AT STATION    RR150
                    TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+      60.      13.75                 52.          25.          9.          4.
                          (INCHES)   .578        1.110       1.127       1.127
                           (AC-FT)    26.          50.         51.         51.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
       37.      13.75                 30.          12.          4.          2.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
      6.07      13.75                5.15         2.52         .85         .37

                      CUMULATIVE AREA =      .84 SQ MI


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

                     HYDROGRAPH AT STATION    RR150
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                            (CFS)
+      59.      13.75                 51.          24.          8.          4.
                          (INCHES)   .563        1.075       1.090       1.090
                           (AC-FT)    25.          48.         49.         49.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
       36.      13.75                 29.          11.          4.          2.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
      5.90      13.75                5.00         2.44         .83         .36

                      CUMULATIVE AREA =      .84 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //RR150/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***
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                    INTERPOLATED HYDROGRAPH AT    RR150

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      68.     13.75                60.         30.         10.          4.
                (INCHES)          .662       1.318       1.346        1.346
                (AC-FT)            30.         59.         60.          60.

                CUMULATIVE AREA =     .84 SQ MI


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


          **************
          *            *
 64 KK    *    F355A   *       ROUTE
          *            *
          **************
                    PROPOSED CHANNEL
                     ROUTE OUTFLOW FROM RR150 TO C155A
                     Slope=(1748.0 - 1570.0) / 7862.0

              HYDROGRAPH ROUTING DATA

 68 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

 69 RC          NORMAL DEPTH CHANNEL
                       ANL        .045  LEFT OVERBANK N-VALUE
                      ANCH        .045  MAIN CHANNEL N-VALUE
                       ANR        .045  RIGHT OVERBANK N-VALUE
                     RLNTH       7862.  REACH LENGTH
                       SEL       .0230  ENERGY SLOPE
                     ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 71 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 70 RX        DISTANCE        .00       .00       .00       .00     65.00     65.00     65.00     65.00

                                          ***

                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE         .00      2.78      5.56      8.34     11.11     13.89     16.67     19.45     22.23     25.01
          OUTFLOW         .00     29.52     93.49    183.33    295.41    427.46    577.87    745.38    928.98   1127.81
        ELEVATION      100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE       27.79     30.56     33.34     36.12     38.90     41.68     44.46     47.23     50.01     52.79
          OUTFLOW     1341.15   1568.38   1808.92   2062.28   2328.00   2605.67   2894.91   3195.37   3506.73   3828.68
        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      578. TO     3829.
                 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   F355A
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      69.     14.33                61.         31.         11.          5.
                (INCHES)          .674       1.365       1.396        1.396
                (AC-FT)            30.         61.         63.          63.

 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)
     100.38    14.33             100.35      100.21      100.07       100.03

                CUMULATIVE AREA =     .84 SQ MI


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

                    HYDROGRAPH AT STATION   F355A
                  TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      66.     14.33                57.         29.         10.          4.
                (INCHES)          .634       1.261       1.287        1.287
                (AC-FT)            28.         57.         58.          58.

 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)
     100.37    14.33             100.34      100.19      100.07       100.03

                CUMULATIVE AREA =     .84 SQ MI


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

                    HYDROGRAPH AT STATION   F355A
                  TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      62.     14.33                54.         26.          9.          4.
                (INCHES)          .594       1.165       1.187        1.187
                (AC-FT)            27.         52.         53.          53.

 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)
     100.36    14.33             100.33      100.18      100.06       100.03

                CUMULATIVE AREA =     .84 SQ MI


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

                    HYDROGRAPH AT STATION   F355A
                  TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      60.     14.33                52.         25.          9.          4.
                (INCHES)          .570       1.107       1.127        1.127
                (AC-FT)            26.         50.         51.          51.

 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)
     100.35    14.33             100.32      100.18      100.06       100.03

                CUMULATIVE AREA =     .84 SQ MI


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

                    HYDROGRAPH AT STATION   F355A
                  TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+      59.     14.33                50.         24.          8.          4.
                (INCHES)          .554       1.072       1.090        1.090
                (AC-FT)            25.         48.         49.          49.

 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)
     100.34    14.33             100.31      100.17      100.06       100.03

                CUMULATIVE AREA =     .84 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/04JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //F355A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT   F355A

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+      68.     14.33               59.          30.         10.          4.
                                (INCHES)       .655        1.316       1.346       1.346
                                 (AC-FT)       29.          59.         60.         60.

                                CUMULATIVE AREA =     .84 SQ MI


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

            **************
            *            *
   73 KK    *     S155A  *       BASIN
            *            *
            **************
                                Compute runoff from subbasin 155A

               SUBBASIN RUNOFF DATA

   75 BA         SUBBASIN CHARACTERISTICS
                       TAREA         .57  SUBBASIN AREA

   76 LG         GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.60  WETTING FRONT SUCTION
                       XKSAT         .34  HYDRAULIC CONDUCTIVITY
                       RTIMP        2.00  PERCENT IMPERVIOUS AREA

   74 UI         INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                   112.0     448.0     778.0     922.0     781.0     500.0     321.0     208.0     129.0      83.0
                    57.0      24.0      23.0      25.0

                                                    ***

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

                        HYDROGRAPH AT STATION    S155A
                      TRANSPOSITION AREA        .1 SQ MI

            TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.97, TOTAL EXCESS =    1.23

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     869.     12.17               74.          19.         6.           3.
                                (INCHES)      1.199       1.223       1.223       1.223
                                 (AC-FT)      36.          37.         37.         37.

                                CUMULATIVE AREA =     .57 SQ MI


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

                        HYDROGRAPH AT STATION    S155A
                      TRANSPOSITION AREA     10.0 SQ MI

            TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.86, TOTAL EXCESS =    1.13

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     807.     12.17               68.          17.         6.           2.
                                (INCHES)      1.104       1.127       1.127       1.127
                                 (AC-FT)      34.          34.         34.         34.

                                CUMULATIVE AREA =     .57 SQ MI


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

                        HYDROGRAPH AT STATION    S155A
                      TRANSPOSITION AREA     30.0 SQ MI

            TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.75, TOTAL EXCESS =    1.03

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     744.     12.17               62.          16.         5.           2.
                                (INCHES)      1.008       1.030       1.030       1.030
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                                 (AC-FT)       31.          31.         31.          31.

                                CUMULATIVE AREA =     .57 SQ MI

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

                        HYDROGRAPH AT STATION    S155A
                      TRANSPOSITION AREA     60.0 SQ MI

            TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.68, TOTAL EXCESS =     .97

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     706.     12.17               58.          15.         5.           2.
                                (INCHES)       .949        .971        .971        .971
                                 (AC-FT)       29.          30.         30.         30.

                                CUMULATIVE AREA =     .57 SQ MI


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

                        HYDROGRAPH AT STATION    S155A
                      TRANSPOSITION AREA     90.0 SQ MI

            TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.64, TOTAL EXCESS =     .94

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     683.     12.17               56.          14.         5.           2.
                                (INCHES)       .914        .935        .935        .935
                                 (AC-FT)       28.          28.         28.         28.

                                CUMULATIVE AREA =     .57 SQ MI


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


                        INTERPOLATED HYDROGRAPH AT    S155A

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     846.     12.17               71.          18.         6.           3.
                                (INCHES)      1.163       1.186       1.187       1.187
                                 (AC-FT)      35.          36.         36.         36.

                                CUMULATIVE AREA =     .57 SQ MI


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

            **************
            *            *
   79 KK    *     C155A  *       COMBINE
            *            *
            **************
                                Combine runoff from S155A w/ routed outflow from Fan 3 detention basin

   81 HC         HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

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

                        HYDROGRAPH AT STATION    C155A
                      TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     876.     12.17              124.          49.         17.          7.
                                (INCHES)       .813        1.302       1.326       1.326
                                 (AC-FT)       61.          98.         100.        100.

                                CUMULATIVE AREA =    1.41 SQ MI


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

                        HYDROGRAPH AT STATION    C155A
                      TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                  (CFS)
+     814.     12.17              115.          46.         15.          7.
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                    (INCHES)       .756       1.203       1.223       1.223
                    (AC-FT)         57.         91.         92.         92.

                  CUMULATIVE AREA =    1.41 SQ MI


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

                  HYDROGRAPH AT STATION    C155A
                 TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     751.      12.17                106.         42.         14.          6.
                    (INCHES)       .700       1.107       1.123       1.123
                    (AC-FT)         53.         83.         85.         85.

                  CUMULATIVE AREA =    1.41 SQ MI


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

                  HYDROGRAPH AT STATION    C155A
                 TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     713.      12.17                101.         40.         13.          6.
                    (INCHES)       .665       1.049       1.064       1.064
                    (AC-FT)         50.         79.         80.         80.

                  CUMULATIVE AREA =    1.41 SQ MI


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

                  HYDROGRAPH AT STATION    C155A
                 TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     689.      12.17                 98.         39.         13.          6.
                    (INCHES)       .644       1.014       1.028       1.028
                    (AC-FT)         49.         76.         77.         77.

                  CUMULATIVE AREA =    1.41 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   36:  //C155A/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                  INTERPOLATED HYDROGRAPH AT    C155A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     840.      12.17                119.         47.         16.          7.
                    (INCHES)       .781       1.244       1.267       1.267
                    (AC-FT)         59.         94.         95.         95.

                  CUMULATIVE AREA =    1.41 SQ MI


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


            **************
            *            *
   83 KK    *    55A55B  *        ROUTE
            *            *
            **************
                        PROPOSED CHANNEL
                         ROUTE COMBINED FLOW FROM C155A TO C155B
                         Slope=(1570.0 - 1509.0) / 4080.0

                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       4080.  REACH LENGTH
                         SEL       .0150  ENERGY SLOPE
                       ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   90 RY       ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
   89 RX       DISTANCE        .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                             ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.46      4.93      7.39      9.86     12.32     14.79     17.25     19.72     22.18
          OUTFLOW        .00     43.75    138.65    272.05    438.65    635.16    859.22   1109.00   1383.05   1680.15
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      24.65     27.11     29.58     32.04     34.51     36.97     39.44     41.90     44.37     46.83
          OUTFLOW    1999.25   2339.45   2699.94   3080.02   3479.04   3896.41   4331.58   4784.07   5253.42   5739.19
        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      859. TO     5739.
                 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   55A55B
                 TRANSPOSITION AREA      .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     785.      12.33                121.         49.         17.          7.
                    (INCHES)       .796       1.301       1.326       1.326
                    (AC-FT)         60.         98.        100.        100.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)     (HR)
                5.      12.33         1.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
              101.49    12.33       100.43      100.22      100.08      100.03

                  CUMULATIVE AREA =    1.41 SQ MI


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

                  HYDROGRAPH AT STATION   55A55B
                 TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     728.      12.33                112.         46.         15.          7.
                    (INCHES)       .740       1.202       1.223       1.223
                    (AC-FT)         56.         91.         92.         92.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)     (HR)
                4.      12.33         1.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
              101.43    12.33       100.41      100.21      100.07      100.03

                  CUMULATIVE AREA =    1.41 SQ MI


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

                  HYDROGRAPH AT STATION   55A55B
                 TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                      (CFS)
+     668.      12.33                104.         42.         14.          6.
                    (INCHES)       .684       1.106       1.123       1.123
                    (AC-FT)         52.         83.         85.         85.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (AC-FT)     (HR)
                4.      12.33         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)
     101.35      12.33                100.39       100.19       100.07       100.03

                                CUMULATIVE AREA =     1.41 SQ MI

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

                              HYDROGRAPH AT STATION    55A55B
                             TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      630.      12.33                 99.          40.          13.           6.
                                  (INCHES)        .649        1.048        1.064        1.064
                                    (AC-FT)         49.          79.          80.          80.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
         4.      12.33                  1.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.31      12.33                100.38       100.19       100.06       100.03

                                CUMULATIVE AREA =     1.41 SQ MI

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

                              HYDROGRAPH AT STATION    55A55B
                             TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      608.      12.33                 95.          38.          13.           6.
                                  (INCHES)        .628        1.013        1.028        1.028
                                    (AC-FT)         47.          76.          77.          77.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
         4.      12.33                  1.           1.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.28      12.33                100.37       100.18       100.06       100.03

                                CUMULATIVE AREA =     1.41 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55A55B/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***

                          INTERPOLATED HYDROGRAPH AT    55A55B

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      752.      12.33                116.          47.          16.           7.
                                  (INCHES)        .764        1.244        1.267        1.267
                                    (AC-FT)         58.          94.          95.          95.

                                CUMULATIVE AREA =     1.41 SQ MI

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

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            *            *
  92 KK     *     S155B  *        BASIN
            *            *
            **************
                          Compute runoff from subbasin 155B

               SUBBASIN RUNOFF DATA

  94 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .49  SUBBASIN AREA

  95 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.40  WETTING FRONT SUCTION
                       XKSAT         .38  HYDRAULIC CONDUCTIVITY
                       RTIMP        1.00  PERCENT IMPERVIOUS AREA

  93 UI          INPUT UNITGRAPH,  13 ORDINATES,  VOLUME =  .99
                    107.0     422.0     714.0     823.0     659.0     412.0     257.0     164.0     104.0      64.0
                     36.0      22.0      21.0

                                                                                                                  ***

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

                              HYDROGRAPH AT STATION    S155B
                             TRANSPOSITION AREA       .1 SQ MI

                TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.04, TOTAL EXCESS =    1.16

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      745.      12.17                 61.          15.           5.           2.
                                  (INCHES)       1.142        1.155        1.155        1.155
                                    (AC-FT)         30.          30.          30.          30.

                                CUMULATIVE AREA =     .49 SQ MI

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

                              HYDROGRAPH AT STATION    S155B
                             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)
+      691.      12.17                 56.          14.           5.           2.
                                  (INCHES)       1.049        1.061        1.061        1.061
                                    (AC-FT)         28.          28.          28.          28.

                                CUMULATIVE AREA =     .49 SQ MI

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

                              HYDROGRAPH AT STATION    S155B
                             TRANSPOSITION AREA      30.0 SQ MI

                TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.81, TOTAL EXCESS =     .97

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      636.      12.17                 51.          13.           4.           2.
                                  (INCHES)        .954        .964         .965         .965
                                    (AC-FT)         25.          25.          25.          25.

                                CUMULATIVE AREA =     .49 SQ MI

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

                              HYDROGRAPH AT STATION    S155B
                             TRANSPOSITION AREA      60.0 SQ MI

                TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.74, TOTAL EXCESS =     .91

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      603.      12.17                 48.          12.           4.           2.
                                  (INCHES)        .895        .906         .906         .906
                                    (AC-FT)         24.          24.          24.          24.

                                CUMULATIVE AREA =     .49 SQ MI

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

                              HYDROGRAPH AT STATION    S155B
                             TRANSPOSITION AREA      90.0 SQ MI

                TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.70, TOTAL EXCESS =     .88

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                                    (CFS)
+      583.      12.17                 46.          12.           4.           2.
                                  (INCHES)        .860        .871         .871         .871
                                    (AC-FT)         23.          23.          23.          23.
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                    CUMULATIVE AREA =     .49 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT    S155B

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     726.     12.17                59.         15.          5.          2.
                (INCHES)       1.110       1.122       1.122       1.122
                (AC-FT)           29.         30.         30.         30.

                    CUMULATIVE AREA =     .49 SQ MI



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


           **************
           *            *
 98 KK     *     C155B  *      COMBINE
           *            *
           **************
                    Combine runoff from S155B with routed flow from C155A

100 HC           HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                          ***
      ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION    C155B
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1401.     12.25               179.         65.         22.          9.
                (INCHES)       .874       1.261       1.282       1.282
                (AC-FT)           89.        128.        130.        130.

                    CUMULATIVE AREA =    1.91 SQ MI

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

                    HYDROGRAPH AT STATION    C155B
                  TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1286.     12.25               166.         60.         20.          9.
                (INCHES)       .809       1.164       1.181       1.181
                (AC-FT)           82.        118.        120.        120.

                    CUMULATIVE AREA =    1.91 SQ MI

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

                    HYDROGRAPH AT STATION    C155B
                  TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1166.     12.25               152.         55.         18.          8.
                (INCHES)       .743       1.068       1.082       1.082
                (AC-FT)           76.        109.        110.        110.

                    CUMULATIVE AREA =    1.91 SQ MI

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

                    HYDROGRAPH AT STATION    C155B
                  TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1092.     12.25               144.         52.         17.          8.
                (INCHES)       .703       1.010       1.023       1.023
                (AC-FT)           72.        103.        104.        104.

                    CUMULATIVE AREA =    1.91 SQ MI
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      ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION    C155B
                  TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1046.     12.25               139.         50.         17.          7.
                (INCHES)       .679        .975        .987        .987
                (AC-FT)           69.         99.        100.        100.

                    CUMULATIVE AREA =    1.91 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //C155B/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                    INTERPOLATED HYDROGRAPH AT    C155B

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1327.     12.25               171.         61.         21.          9.
                (INCHES)       .832       1.199       1.217       1.217
                (AC-FT)           85.        122.        124.        124.

                    CUMULATIVE AREA =    1.91 SQ MI



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


           **************
           *            *
102 KK     *    55B55C  *       ROUTE
           *            *
           **************
                    PROPOSED CHANNEL
                     ROUTE COMBINED FLOW FROM C155B TO C155C
                     Slope=(1509.0 - 1452.0) / 4478.0

                HYDROGRAPH ROUTING DATA

106 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

107 RC          NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH        4478.  REACH LENGTH
                        SEL       .0130  ENERGY SLOPE
                      ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
109 RY          ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
108 RX          DISTANCE        .00       .00       .00       .00    135.00    135.00    135.00    135.00

                                                          ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      3.65      7.30     10.96     14.61     18.26     21.91     25.57     29.22     32.87
          OUTFLOW        .00     55.01    174.41    342.37    552.29    800.06   1082.76   1398.15   1744.42   2120.07
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      36.52     40.17     43.83     47.48     51.13     54.78     58.43     62.09     65.74     69.39
          OUTFLOW    2523.82   2954.56   3411.31   3893.21   4399.45   4929.34   5482.21   6057.45   6654.52   7272.90
        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     1744. TO     7273.
                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   55B55C
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                6-HR       24-HR       72-HR    166.58-HR
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+   (CFS)      (HR)
                          (CFS)
+   1262.     12.42                  175.        65.        22.         9.
                          (INCHES)   .855       1.261      1.282      1.282
                          (AC-FT)     87.        128.       130.       130.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+  (AC-FT)      (HR)
      8.       12.42                   2.         1.         0.         0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+   (FEET)      (HR)
    101.73     12.42                100.44     100.21     100.07     100.03

                        CUMULATIVE AREA =     1.91 SQ MI


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

                         HYDROGRAPH AT STATION     55B55C
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+   1154.     12.42                  162.        60.        20.         9.
                          (INCHES)   .789       1.163      1.181      1.181
                          (AC-FT)     80.        118.       120.       120.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+  (AC-FT)      (HR)
      8.       12.42                   2.         1.         0.         0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+   (FEET)      (HR)
    101.64     12.42                100.43     100.20     100.07     100.03

                        CUMULATIVE AREA =     1.91 SQ MI


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

                         HYDROGRAPH AT STATION     55B55C
                       TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+   1037.     12.42                  149.        55.        18.         8.
                          (INCHES)   .725       1.067      1.082      1.082
                          (AC-FT)     74.        109.       110.       110.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+  (AC-FT)      (HR)
      7.       12.42                   2.         1.         0.         0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+   (FEET)      (HR)
    101.54     12.42                100.41     100.19     100.06     100.03

                        CUMULATIVE AREA =     1.91 SQ MI


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

                         HYDROGRAPH AT STATION     55B55C
                       TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+    966.     12.42                  141.        52.        17.         8.
                          (INCHES)   .686       1.010      1.023      1.023
                          (AC-FT)     70.        103.       104.       104.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+  (AC-FT)      (HR)
      7.       12.42                   2.         1.         0.         0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+   (FEET)      (HR)
    101.47     12.42                100.40     100.18     100.06     100.03

                        CUMULATIVE AREA =     1.91 SQ MI


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

                         HYDROGRAPH AT STATION     55B55C
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                       TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+    919.     12.42                  136.        50.        17.         7.
                          (INCHES)   .662        .975       .987       .987
                          (AC-FT)     67.         99.       100.       100.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+  (AC-FT)      (HR)
      7.       12.42                   2.         1.         0.         0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                      6-HR      24-HR      72-HR   166.58-HR
+   (FEET)      (HR)
    101.43     12.42                100.39     100.17     100.06     100.03

                        CUMULATIVE AREA =     1.91 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   36:  //55B55C/FLOW/08JAN1999/5MIN//
        ***            ***            ***            ***            ***


                        INTERPOLATED HYDROGRAPH AT    55B55C

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+   1193.     12.42                  167.        61.        21.         9.
                          (INCHES)   .813       1.198      1.217      1.217
                          (AC-FT)     83.        122.       124.       124.

                        CUMULATIVE AREA =     1.91 SQ MI


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

              **************
              *            *
 111 KK       *    S155C   *        BASIN
              *            *
              **************
                                 Compute runoff from subbasin 155C

          SUBBASIN RUNOFF DATA

 113 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .70  SUBBASIN AREA

 114 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        1.00  PERCENT IMPERVIOUS AREA

 112 UI          INPUT UNITGRAPH,  20 ORDINATES,  VOLUME = 1.00
                       85.0     227.0     476.0     680.0     802.0     784.0     641.0     469.0     344.0     249.0
                      178.0     137.0      92.0      68.0      57.0      26.0      21.0      20.0      21.0      20.0
                                                               ***

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

                         HYDROGRAPH AT STATION     S155C
                       TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.02, TOTAL EXCESS =    1.18

  PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                      6-HR      24-HR      72-HR   166.58-HR
+   (CFS)      (HR)
                          (CFS)
+    817.     12.25                   87.        22.         7.         3.
                          (INCHES)  1.163       1.175      1.175      1.175
                          (AC-FT)     43.         44.        44.        44.

                        CUMULATIVE AREA =      .70 SQ MI


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

                         HYDROGRAPH AT STATION     S155C
                       TRANSPOSITION AREA      10.0 SQ MI
```

```
      TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.91, TOTAL EXCESS =    1.08

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     755.       12.25                80.         20.          7.          3.
                         (INCHES)    1.070       1.081       1.081       1.081
                          (AC-FT)      40.         40.         40.         40.

                           CUMULATIVE AREA =     .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA     30.0 SQ MI

      TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.79, TOTAL EXCESS =     .99

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     692.       12.25                73.         18.          6.          3.
                         (INCHES)     .974        .985        .985        .985
                          (AC-FT)      36.         37.         37.         37.

                           CUMULATIVE AREA =     .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA     60.0 SQ MI

      TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.73, TOTAL EXCESS =     .93

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     654.       12.25                69.         17.          6.          3.
                         (INCHES)     .916        .926        .927        .927
                          (AC-FT)      34.         34.         34.         34.

                           CUMULATIVE AREA =     .70 SQ MI


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

                          HYDROGRAPH AT STATION    S155C
                        TRANSPOSITION AREA     90.0 SQ MI

      TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.69, TOTAL EXCESS =     .89

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     631.       12.25                66.         17.          6.          2.
                         (INCHES)     .881        .891        .891        .891
                          (AC-FT)      33.         33.         33.         33.

                           CUMULATIVE AREA =     .70 SQ MI

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



                          INTERPOLATED HYDROGRAPH AT     S155C

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     791.       12.25                84.         21.          7.          3.
                         (INCHES)    1.124       1.136       1.136       1.136
                          (AC-FT)      42.         42.         42.         42.

                           CUMULATIVE AREA =     .70 SQ MI



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


              **************
              *            *
 118 KK       *   C155C    *       COMBINE
              *            *
              **************
                                   Combine runoff from S155C with routed flow from C155B
                                   This is the total flow at the downstream end of the Fan 3 corridor.

 121 HC              HYDROGRAPH COMBINATION
                         ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                 ***
```

```
        ***            ***            ***            ***            ***

                          HYDROGRAPH AT STATION    C155C
                        TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1986.       12.33               260.         87.         29.         13.
                         (INCHES)     .928       1.236       1.253       1.253
                          (AC-FT)     129.        172.        174.        174.

                           CUMULATIVE AREA =    2.61 SQ MI


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

                          HYDROGRAPH AT STATION    C155C
                        TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1786.       12.33               240.         80.         27.         12.
                         (INCHES)     .855       1.139       1.154       1.154
                          (AC-FT)     119.        158.        160.        160.

                           CUMULATIVE AREA =    2.61 SQ MI


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

                          HYDROGRAPH AT STATION    C155C
                        TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1596.       12.42               219.         73.         25.         11.
                         (INCHES)     .782       1.044       1.056       1.056
                          (AC-FT)     109.        145.        147.        147.

                           CUMULATIVE AREA =    2.61 SQ MI


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

                          HYDROGRAPH AT STATION    C155C
                        TRANSPOSITION AREA     60.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1497.       12.42               207.         69.         23.         10.
                         (INCHES)     .738        .986        .997        .997
                          (AC-FT)     103.        137.        139.        139.

                           CUMULATIVE AREA =    2.61 SQ MI


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

                          HYDROGRAPH AT STATION    C155C
                        TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1432.       12.42               199.         67.         22.         10.
                         (INCHES)     .711        .951        .961        .961
                          (AC-FT)      99.        132.        134.        134.

                           CUMULATIVE AREA =    2.61 SQ MI

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


                          INTERPOLATED HYDROGRAPH AT     C155C

   PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +    1845.       12.33               246.         82.         28.         12.
                         (INCHES)     .877       1.167       1.183       1.183
                          (AC-FT)     122.        162.        164.        164.

                           CUMULATIVE AREA =    2.61 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									
+		S150	733.	12.42	115.	30.	10.	.84		
	ROUTED TO									
+		RR150	68.	13.75	60.	30.	10.	.84		
	ROUTED TO									
+		F355A	68.	14.33	59.	30.	10.	.84		
	HYDROGRAPH AT									
+		S155A	846.	12.17	71.	18.	6.	.57		
	2 COMBINED AT									
+		C155A	840.	12.17	119.	47.	16.	1.41		
	ROUTED TO									
+		55A55B	752.	12.33	116.	47.	16.	1.41		
	HYDROGRAPH AT									
+		S155B	726.	12.17	59.	15.	5.	.49		
	2 COMBINED AT									
+		C155B	1327.	12.25	171.	61.	21.	1.91		
	ROUTED TO									
+		55B55C	1193.	12.42	167.	61.	21.	1.91		
	HYDROGRAPH AT									
+		S155C	791.	12.25	84.	21.	7.	.70		
	2 COMBINED AT									
+		C155C	1845.	12.33	246.	82.	28.	2.61		

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

-----DSS---ZCLOSE Unit: 71, File: FAN324.DSS
Pointer Utilization: .33
Number of Records: 56
File Size: 103.4 Kbytes
Percent Inactive: .0

CURRENT DATE: 10-09-2006
CURRENT TIME: 18:02:38

FILE DATE: 10-09-2006
FILE NAME: RR150

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	97.70	455.01	1 RCP	3.00	3.00	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: RR150 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
102.15	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
103.90	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
104.76	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.00	1
108.58	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
110.13	100.0	87.2	0.0	0.0	0.0	0.0	0.0	12.20	10
110.25	120.0	87.8	0.0	0.0	0.0	0.0	0.0	31.64	5
110.35	140.0	88.2	0.0	0.0	0.0	0.0	0.0	50.92	4
110.43	160.0	88.6	0.0	0.0	0.0	0.0	0.0	70.79	4
110.50	180.0	88.9	0.0	0.0	0.0	0.0	0.0	89.39	3
110.58	200.0	89.2	0.0	0.0	0.0	0.0	0.0	109.06	3
110.00	86.6	86.6	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: RR150 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
102.15	0.000	20.00	0.00	0.00
103.90	0.000	40.00	0.00	0.00
104.76	0.000	50.00	0.00	0.00
108.58	0.000	80.00	0.00	0.00
110.13	-0.007	100.00	0.59	0.59
110.25	-0.005	120.00	0.60	0.50
110.35	-0.008	140.00	0.89	0.64
110.43	-0.006	160.00	0.63	0.39
110.50	-0.005	180.00	1.70	0.94
110.58	-0.004	200.00	1.71	0.86

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

CURRENT DATE: 10-09-2006
CURRENT TIME: 18:02:38

FILE DATE: 10-09-2006
FILE NAME: RR150

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (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	-0.08	0.00	0.00
20.00	102.15	2.15	2.15	1-S2n	1.29	1.43	1.23	0.10	7.34	1.83
40.00	103.90	3.90	3.90	5-S2n	1.98	2.06	1.86	0.20	8.72	2.41
50.00	104.76	4.76	3.67	2-M2c	2.38	2.29	2.29	0.24	8.64	2.63
80.00	108.58	8.49	8.58	2-M2c	3.00	2.81	2.81	0.34	11.71	3.17
87.21	110.13	9.65	10.13	2-M2c	3.00	2.92	2.92	0.40	12.51	3.46
87.76	110.25	9.74	10.25	2-M2c	3.00	2.93	2.93	0.45	12.57	3.72
88.19	110.34	9.81	10.34	2-M2c	3.00	2.94	2.94	0.51	12.61	3.95
88.58	110.43	9.88	10.43	2-M2c	3.00	2.94	2.94	0.55	12.65	4.16
88.91	110.50	9.93	10.50	2-M2c	3.00	2.95	2.95	0.60	12.69	4.36
89.23	110.57	9.99	10.57	2-M2c	3.00	2.95	2.95	0.64	12.72	4.55

El. inlet face invert 100.00 ft El. outlet invert 97.70 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	455.00 ft
OUTLET ELEVATION	97.70 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0051
CULVERT LENGTH ALONG SLOPE	455.01 ft

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

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 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	3.00 ft
SIDE TAPER (4:1 TO 6:1) (X:1)	4.00
FACE HEIGHT	3.00 ft

CURRENT DATE: 10-09-2006
CURRENT TIME: 18:02:38

FILE DATE: 10-09-2006
FILE NAME: RR150

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

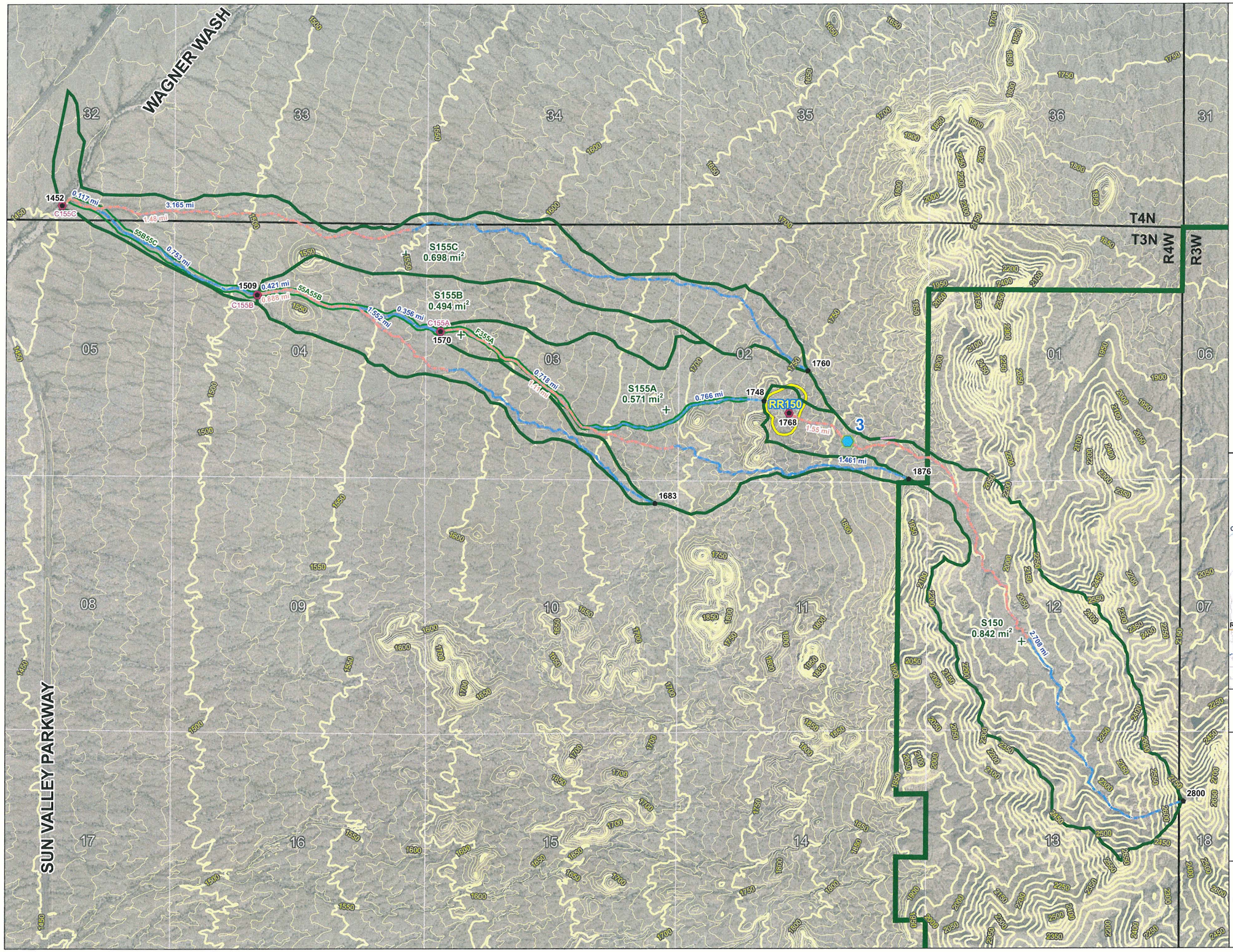
BOTTOM WIDTH	60.00 ft
SIDE SLOPE H/V (X:1)	1.0
CHANNEL SLOPE V/H (ft/ft)	0.030
MANNING'S n (.01-0.1)	0.045
CHANNEL INVERT ELEVATION	97.62 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	97.70 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	97.62	0.000	0.00	0.00	0.00
20.00	97.80	0.755	0.18	1.83	0.34
40.00	97.90	0.808	0.28	2.41	0.52
50.00	97.93	0.826	0.31	2.63	0.59
80.00	98.04	0.864	0.42	3.17	0.78
100.00	98.10	0.882	0.48	3.46	0.89
120.00	98.15	0.898	0.53	3.72	1.00
140.00	98.21	0.911	0.58	3.95	1.10
160.00	98.25	0.922	0.63	4.16	1.19
180.00	98.30	0.932	0.68	4.36	1.27
200.00	98.34	0.941	0.72	4.55	1.36

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	110.00 ft


WAGNER WASH
SUN VALLEY PARKWAY
T4N
T3N
R4W
R3W
1452
C155C
0.117 mi
3.165 mi
1.48 mi
55B55C
0.753 mi
1509
C155B
0.421 mi
0.888 mi
55A55B
1.552 mi
0.356 mi
C155A
1570
F355A
0.718 mi
1.11 mi
S155C
0.698 mi²
S155B
0.494 mi²
S155A
0.571 mi²
0.766 mi
1748
RR150
1768
1.55 mi
3
1.461 mi
1876
1760
1683
S150
0.842 mi²
2.709 mi
2800
LEGEND
Subbasin Boundaries
Subbasin Centroids
Lca Paths
Lag & Routing Paths
Elevation Points
Concentration Points
Step 3 Basins
Step 3 Corridors
Floodwall
Basin Outlet Pipe
Proposed Dikes
Countywide 10-ft Topo
White Tank Mtn Park
Fan Apices
LOCATION MAP
Sun Valley Parkway
Canal
Wagner Wash
View Port
Area 4
Area 3
Hassayampa River
Road
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - HYDROLOGY
WAGNER SUB-AREA
FAN SYSTEM 3
SUBBASIN MAP
FCD 2004C049
DECEMBER 2006
N
W
E
S
Feet
0
900
1,800
2,700
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WAGNER WASH

SUN VALLEY PARKWAY

T4N
T3N
R4W
R3W

113
0.39 in/hr

3
0.58 in/hr

55
0.27 in/hr

S155C
0.698 mi²

52
0.16 in/hr

112
0.39 in/hr

98
0.37 in/hr

52
0.16 in/hr

S155B
0.494 mi²

110
0.13 in/hr

100
0.40 in/hr

52
0.16 in/hr

115
0.39 in/hr

S155A
0.571 mi²

RR150

3

100
0.40 in/hr

47
0.11 in/hr

29
0.34 in/hr

14
1.04 in/hr

123
0.37 in/hr

S150
0.842 mi²

49
0.06 in/hr

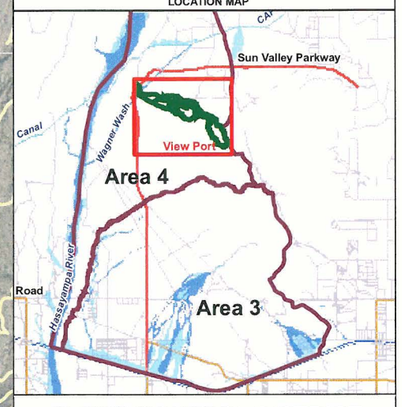
100
0.40 in/hr

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
- Basin Outlet Pipe
- Step 3 Basins
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 3
SOIL MAP
FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 900 1,800 2,700

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WAGNER WASH

SUN VALLEY PARKWAY

S155C
0.698 mi²
NDR

S155B
0.494 mi²
NDR

S155A
0.571 mi²
NDR

RR150

3

S150
0.842 mi²
NMT

T4N
T3N
R4W
R3W

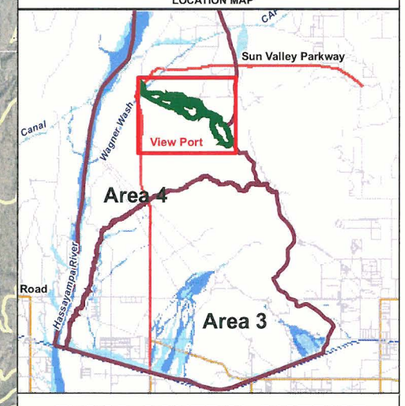
LEGEND

Existing Land Use
- Desert Rangeland (NDR), <5% Slopes
- Mountain Terrain (NMT), >10% Slopes

Subbasin Boundaries
Proposed Dikes

Step 3 Corridors
- 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
WAGNER SUB-AREA
FAN SYSTEM 3
LAND USE MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 900 1,800 2,700

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Appendix C

Design Analyses

Fan System 16

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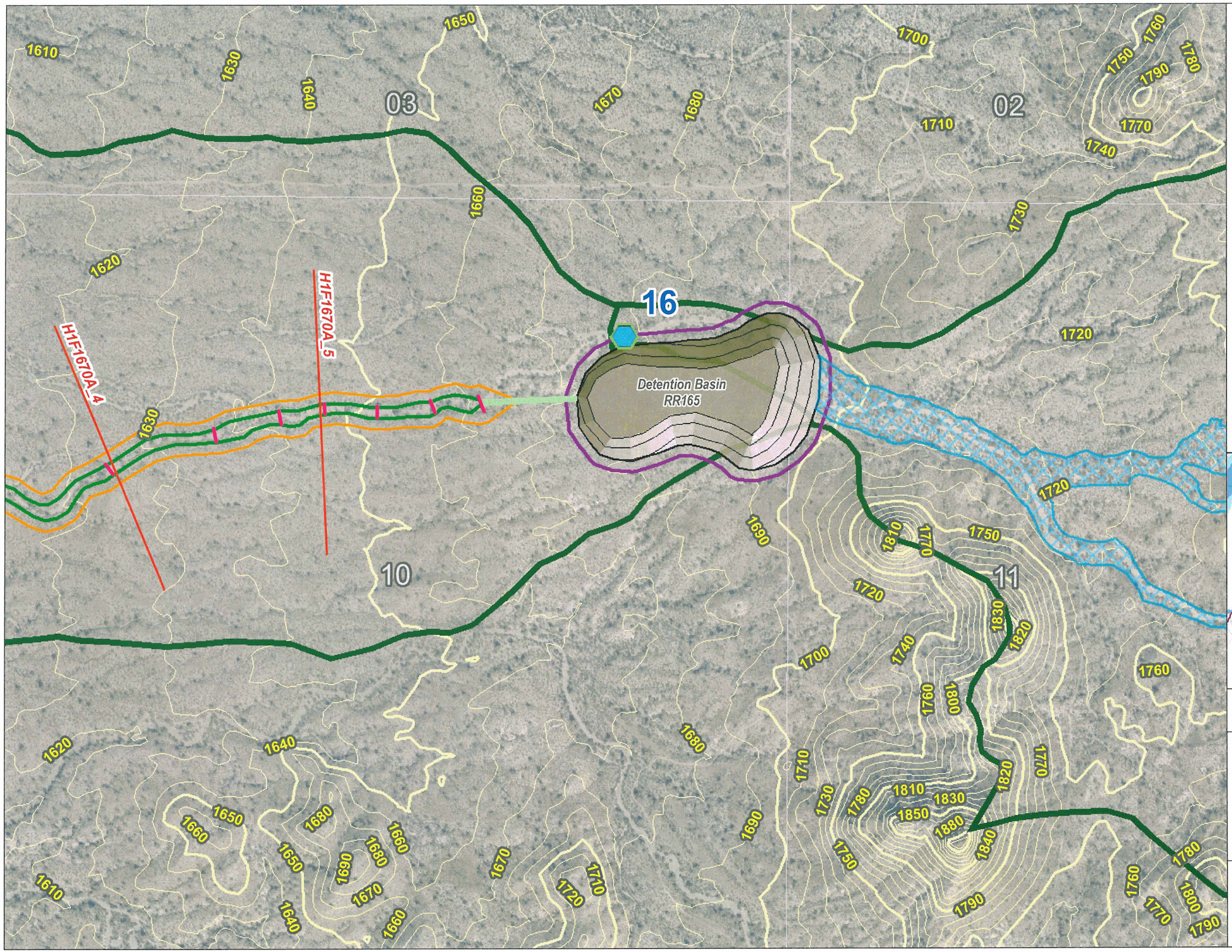


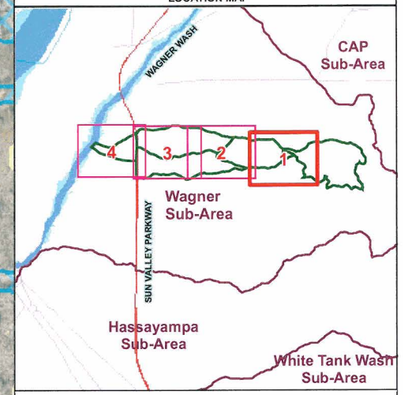
LEGEND

- Step 3 Basins
- 50' Basin Buffer

Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A
- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Countywide 10-ft Topo
- White Tank Mtn Park
- Trib. Sed. Supply Reaches
- Fan Apices

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 16
RECOMMENDED ALTERNATIVE

SHEET 1 OF 4

FCD 2004C049
DECEMBER 2006

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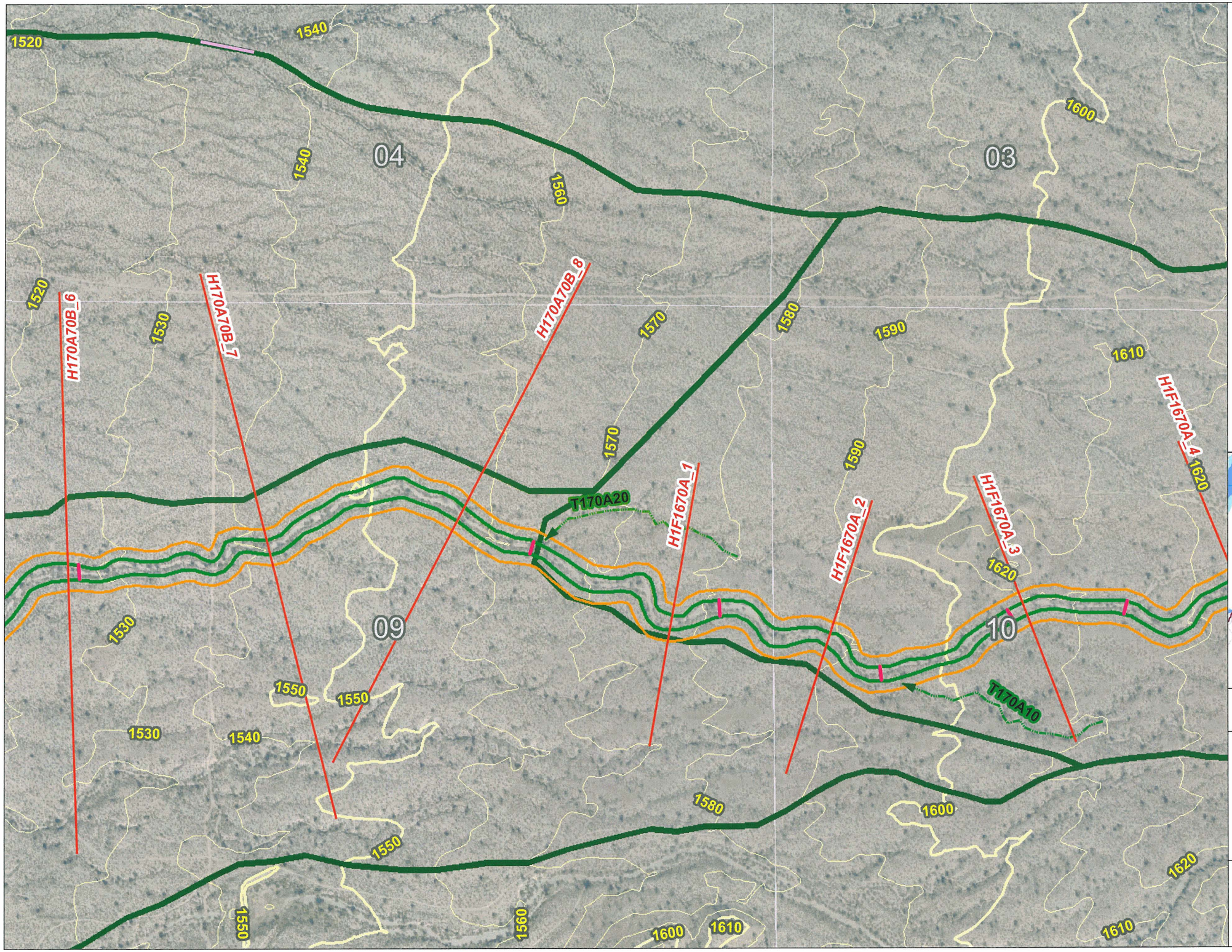

LEGEND

- Step 3 Basins
- 50' Basin Buffer

Step 3 Corridors

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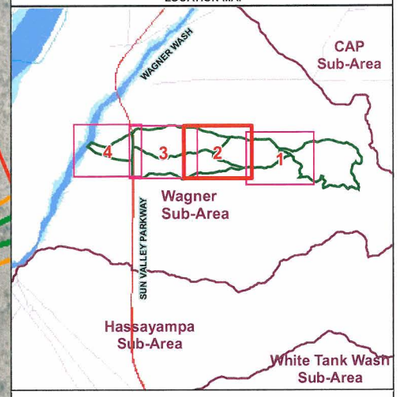

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 16
RECOMMENDED ALTERNATIVE

SHEET 2 OF 4

FCD 2004C049
DECEMBER 2006

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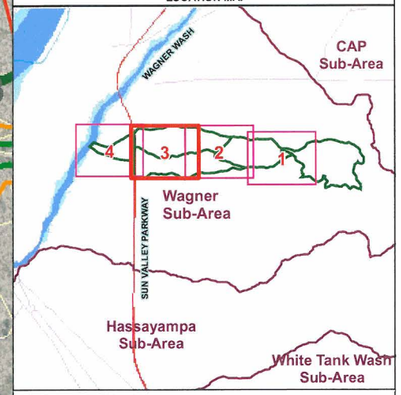

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 16
RECOMMENDED ALTERNATIVE

SHEET 3 OF 4

FCD 2004C049
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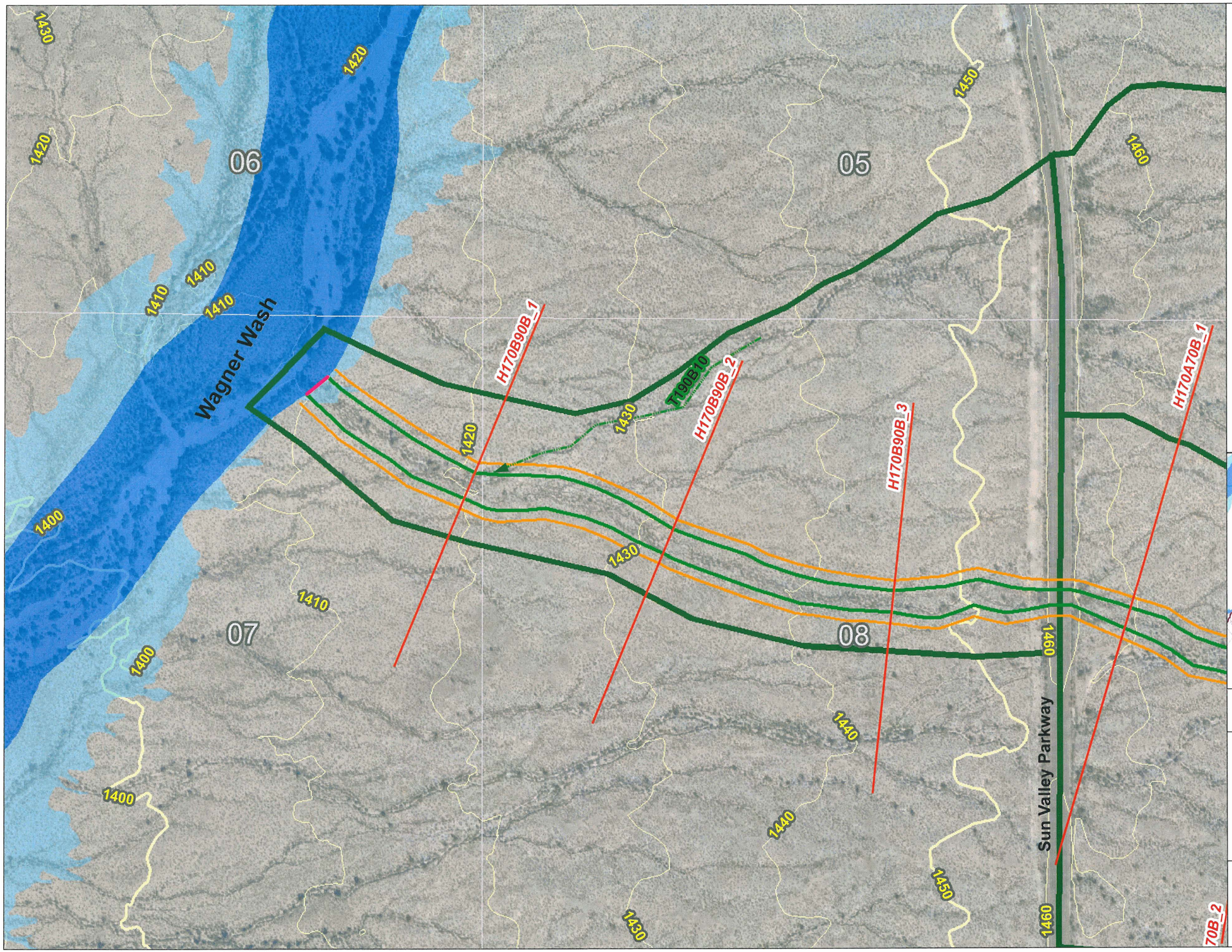

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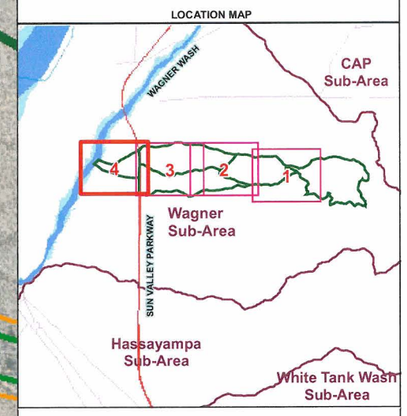

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 16
RECOMMENDED ALTERNATIVE

SHEET 4 OF 4

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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)
D16_1	Dike	NA	0.2	0.0	0.9	260	39	NA	$ 20	$ 73	$ 8	$ 38	$ 139	14%	52%	6%	27%	1%	21%	19%	100%	30%	27%
RR165	Online Basin	1008	17.4	219.0	0.0	NA	NA	8.0	$ 1,740	$ 2,302	$ 379	$ 1,124	$ 5,545	31%	42%	7%	20%	22%	24%	2%	100%	18%	19%
H1F1670A_5	Walled-Levee Corridor	310	4.3	0.0	4.6	0.238	151	1.4	$ 430	$ 505	$ 63	$ 252	$ 1,250	34%	40%	5%	20%	5%	47%	25%	100%	65%	47%
H1F1670A_4	Walled-Levee Corridor	407	3.7	0.0	3.3	0.2	156	2.1	$ 370	$ 450	$ 53	$ 216	$ 1,088	34%	41%	5%	20%	4%	46%	23%	100%	64%	45%
H1F1670A_3	Walled-Levee Corridor	504	3.9	0.0	4.1	0.206	161	3.4	$ 390	$ 498	$ 54	$ 228	$ 1,170	33%	43%	5%	19%	5%	44%	24%	100%	62%	44%
H1F1670A_2	Walled-Levee Corridor	606	3.6	0.0	2.8	0.181	166	2.5	$ 360	$ 406	$ 48	$ 199	$ 1,013	36%	40%	5%	20%	4%	42%	23%	100%	62%	44%
H1F1670A_1	Walled-Levee Corridor	684	4.6	0.0	3.6	0.221	171	2.4	$ 460	$ 504	$ 58	$ 246	$ 1,267	36%	40%	5%	19%	5%	41%	24%	100%	62%	44%
H170A70B_8	Walled-Levee Corridor	771	3.6	0.0	2.4	0.174	171	1.9	$ 360	$ 417	$ 46	$ 191	$ 1,014	36%	41%	5%	19%	4%	42%	21%	100%	62%	42%
H170A70B_7	Walled-Levee Corridor	795	3.9	0.0	3.0	0.189	171	2.0	$ 390	$ 428	$ 50	$ 209	$ 1,077	36%	40%	5%	19%	4%	41%	24%	100%	62%	44%
H170A70B_6	Walled-Levee Corridor	820	4.0	0.0	3.7	0.189	176	2.3	$ 400	$ 439	$ 50	$ 210	$ 1,099	36%	40%	5%	19%	4%	40%	25%	100%	62%	44%
H170A70B_5	Walled-Levee Corridor	845	4.2	0.0	2.0	0.184	186	2.5	$ 420	$ 403	$ 49	$ 204	$ 1,076	39%	37%	5%	19%	4%	38%	22%	100%	62%	42%
H170A70B_4	Walled-Levee Corridor	868	4.1	0.0	3.7	0.189	181	1.9	$ 410	$ 472	$ 50	$ 210	$ 1,142	36%	41%	4%	18%	5%	39%	23%	100%	62%	42%
H170A70B_3	Walled-Levee Corridor	893	4.6	0.0	3.4	0.195	196	1.8	$ 460	$ 444	$ 52	$ 215	$ 1,170	39%	38%	4%	18%	5%	37%	24%	100%	62%	42%
H170A70B_2	Walled-Levee Corridor	918	3.8	0.0	3.2	0.159	201	2.0	$ 380	$ 399	$ 42	$ 178	$ 999	38%	40%	4%	18%	4%	34%	23%	100%	61%	40%
H170A70B_1	Walled-Levee Corridor	935	3.1	0.0	2.8	0.127	201	2.2	$ 310	$ 326	$ 34	$ 144	$ 813	38%	40%	4%	18%	3%	35%	24%	100%	60%	41%
H170B90B_3	Walled-Levee Corridor	1056	6.4	0.0	4.1	0.263	201	2.0	$ 640	$ 873	$ 69	$ 286	$ 1,868	34%	47%	4%	15%	8%	34%	16%	100%	63%	35%
H170B90B_2	Walled-Levee Corridor	1211	5.4	0.0	3.8	0.205	221	2.0	$ 540	$ 509	$ 54	$ 228	$ 1,331	41%	38%	4%	17%	5%	31%	23%	100%	62%	39%
H170B90B_1	Walled-Levee Corridor	1350	7.3	0.0	4.6	0.261	231	2.2	$ 730	$ 596	$ 69	$ 289	$ 1,684	43%	35%	4%	17%	7%	30%	24%	100%	62%	39%
	TOTAL	88.1	219.0	56.0					$ 8,810	$ 10,043	$ 1,227	$ 4,666	**$ 24,746**	36%	41%	5%	19%	100%	35%	18%	100%	51%	37%
All Channels		70.5	0.0	55.1	3.2				$ 7,050	$ 7,668	$ 840	$ 3,504	$ 19,061	37%	40%	4%	18%	77%					
All Online Basins		17.4	219.0	0.0					$ 1,740	$ 2,302	$ 379	$ 1,124	$ 5,545	31%	42%	7%	20%	22%					
All Offline Basins		0.0	0.0	0.0					$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Dikes		0.2	0.0	0.9	260				$ 20	$ 73	$ 8	$ 38	$ 139	14%	52%	6%	27%	1%					
Channel Cost per mile (in $1000)		$5,992		Basins Cost per ac. ft. (in $1000)					$25.32														

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
S165	BASIN	1008			4.17	0.62	94	23	8	3	1.416	1.417	1.417	1.417	47	47	47	47
RR165	STORAGE	135	6.2	36.36	4.75	0.62	79	23	8	3	1.186	1.417	1.417	1.417	39	47	47	47
F1670A	ROUTE	132	100.6	5.36	5.17	0.62	77	23	8	3	1.163	1.417	1.417	1.417	38	47	47	47
S170A	BASIN	952			4.08	0.41	63	16	5	2	1.444	1.444	1.444	1.444	31	31	31	31
C170A	COMBINE	760			4.08	1.02	125	36	12	5	1.135	1.317	1.317	1.317	62	72	72	72
70A70B	ROUTE	567	101.4	20.04	4.42	1.02	120	36	12	5	1.092	1.317	1.317	1.317	60	72	72	72
S170B	BASIN	922			4.17	0.5	72	18	6	3	1.349	1.349	1.349	1.349	36	36	36	36
C170B	COMBINE	944			4.33	1.52	171	49	16	7	1.046	1.208	1.208	1.208	85	98	98	98
70B90B	ROUTE	865	101.5	16.63	4.42	1.52	168	49	16	7	1.026	1.208	1.208	1.208	83	98	98	98
S170C	BASIN	999			4.17	0.56	73	18	6	3	1.222	1.222	1.222	1.222	36	36	36	36
70C90B	ROUTE	823	102.2	18.36	4.33	0.56	73	18	6	3	1.222	1.222	1.222	1.222	36	36	36	36
S190B	BASIN	389			4.08	0.16	22	5	2	1	1.239	1.239	1.239	1.239	11	11	11	11
C190B	COMBINE	1279			4.42	2.24	228	65	22	9	0.945	1.071	1.071	1.071	113	128	128	128

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
S165	BASIN	842			12.17	0.62	78	20	7	3	1.183	1.219	1.219	1.219	39	40	40	40
RR165	STORAGE	113	5.4	30	12.75	0.62	66	20	7	3	1.003	1.217	1.219	1.219	33	40	40	40
F1670A	ROUTE	111	100.6	4.81	13.17	0.62	65	20	7	3	0.981	1.217	1.219	1.219	32	40	40	40
S170A	BASIN	757			12.08	0.41	52	13	4	2	1.181	1.181	1.181	1.181	26	26	26	26
C170A	COMBINE	750			12.08	1.02	111	33	11	5	1.01	1.188	1.189	1.189	55	65	65	65
70A70B	ROUTE	534	101.3	19.31	12.42	1.02	107	33	11	5	0.968	1.188	1.189	1.189	53	65	65	65
S170B	BASIN	732			12.17	0.5	59	15	5	2	1.105	1.105	1.105	1.105	29	29	29	29
C170B	COMBINE	941			12.33	1.52	161	47	16	7	0.984	1.148	1.149	1.149	80	93	93	93
70B90B	ROUTE	889	101.5	16.9	12.42	1.52	158	47	16	7	0.965	1.148	1.149	1.149	78	93	93	93
S170C	BASIN	807			12.17	0.56	61	15	5	2	1.023	1.023	1.023	1.023	30	30	30	30
70C90B	ROUTE	652	102	15.77	12.33	0.56	61	15	5	2	1.023	1.023	1.023	1.023	30	30	30	30
S190B	BASIN	304			12.08	0.16	18	5	2	1	1.03	1.03	1.03	1.03	9	9	9	9
C190B	COMBINE	1486			12.42	2.24	232	66	22	9	0.961	1.092	1.092	1.092	115	131	131	131

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)
H1F1670A_5	Walled-Levee Corridor	0.0209	0.0030	0.24	50	1.4	0.045	310	52.5	59.6	1.1	1.2	1.4	50	5.2	0.84	Yes	0.0	0.6	5.2	168
H1F1670A_4	Walled-Levee Corridor	0.0188	0.0159	0.20	55	2.1	0.045	407	57.9	75.3	1.3	1.4	2.1	55	5.4	0.81	No	0.6	0.8	5.4	1037
H1F1670A_3	Walled-Levee Corridor	0.0162	0.0133	0.21	60	3.4	0.045	504	63.7	92.9	1.5	1.5	3.4	60	5.4	0.77	No	0.8	1.0	5.6	1036
H1F1670A_2	Walled-Levee Corridor	0.0157	0.0190	0.18	65	2.5	0.045	606	68.4	107.9	1.6	1.7	2.5	65	5.6	0.77	No	1.3	1.0	5.5	N/A
H1F1670A_1	Walled-Levee Corridor	0.0171	0.0141	0.22	70	2.4	0.045	684	73.8	116.5	1.6	1.7	2.4	70	5.9	0.80	No	1.0	1.2	5.5	996
H170A70B_8	Walled-Levee Corridor	0.0149	0.0175	0.17	70	1.9	0.045	771	73.5	130.2	1.8	1.9	1.9	70	5.9	0.76	No	1.6	1.3	5.5	N/A
H170A70B_7	Walled-Levee Corridor	0.0149	0.0144	0.19	70	2.0	0.045	795	73.5	132.7	1.8	1.9	2.0	70	6.0	0.77	No	1.3	1.3	5.5	5882
H170A70B_6	Walled-Levee Corridor	0.0158	0.0148	0.19	75	2.3	0.045	820	78.6	136.5	1.7	1.8	2.3	75	6.0	0.79	No	1.3	1.4	5.5	3030
H170A70B_5	Walled-Levee Corridor	0.0160	0.0148	0.18	85	2.5	0.045	845	88.8	145.3	1.6	1.7	2.5	85	5.8	0.78	No	1.4	1.6	5.5	2488
H170A70B_4	Walled-Levee Corridor	0.0151	0.0164	0.19	80	1.9	0.045	868	83.7	146.7	1.8	1.8	1.9	80	5.9	0.77	No	1.6	1.4	5.5	N/A
H170A70B_3	Walled-Levee Corridor	0.0129	0.0155	0.20	95	1.8	0.045	893	98.4	167.0	1.7	1.8	1.8	95	5.3	0.71	No	1.4	1.1	5.3	N/A
H170A70B_2	Walled-Levee Corridor	0.0092	0.0148	0.16	100	2.0	0.045	918	103.8	191.9	1.8	1.9	2.0	100	4.8	0.61	No	1.4	0.7	5.3	N/A
H170A70B_1	Walled-Levee Corridor	0.0082	0.0090	0.13	100	2.2	0.045	935	104.0	201.0	1.9	2.0	2.2	100	4.7	0.58	No	0.7	0.6	5.3	N/A
H170B90B_3	Walled-Levee Corridor	0.0157	0.0071	0.26	100	2.0	0.045	1056	103.2	177.4	1.7	1.8	2.0	100	6.0	0.79	No	0.6	1.8	5.5	349
H170B90B_2	Walled-Levee Corridor	0.0113	0.0145	0.21	120	2.0	0.045	1211	123.7	228.5	1.8	1.9	2.0	120	5.3	0.68	No	1.8	1.3	5.4	N/A
H170B90B_1	Walled-Levee Corridor	0.0105	0.0118	0.26	130	2.2	0.045	1350	133.5	257.1	1.9	2.0	2.2	130	5.3	0.66	No	1.6	1.3	5.4	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)
RR165	Online Basin	0.0200	13.8	3138	8.0	42.2	36.4	47.0	1008	135	6.2	1.1	4.2	0.7

Dike Cost Estimates

Structure ID	D16_1

Dike Characteristics	Design
Dike Length (ft)	260
Levee Top Width (ft)	15
Levee Side Slope (ft/ft)	6
Levee Height (ft)	4

	Design	Aesthetic Trtmt.
Levee Surface Area (sq. Yd)	1849	491
Levee Volume (cu. Yd)	1502	346

Toe Protection

Protection Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Protection Length	260	ft
Thickness	1.5	ft
Protection Depth	6	ft
Tie-in Length/Depth	3.0	ft
Total Depth	9.0	ft
Area needed	87	sq. Yd
Volume	260	cu. Yd

Levee Lining

Lining Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Levee Length (ft)	260	
Levee Lining Width (ft)	24	
Levee Lining Thickness (ft)	1.5	

	Design	Aesthetic Trtmt.
Levee Lining Area (sq. Yd)	693	217
Levee Lining Volume (cu. Yd)	347	109

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
Levee	Fill	1,502	cu. Yd	$ 7.00	$ 10,514	1,849	sq. Yd	$ 4.50	$ 8,321	1,849	sq. Yd	$ 11.67	$ 21,572
Levee Lining	Riprap	347	cu. Yd	$ 75.00	$ 26,025	693	sq. Yd	$ -	$ -	693	sq. Yd	$ 20.83	$ 14,438
Toe Protection	Riprap	260	cu. Yd	$ 75.00	$ 19,500	87	sq. Yd	$ -	$ -	87	sq. Yd	$ 25.00	$ 2,175
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 56,039			Total	$ 8,321			Total	$ 38,184
		Contingency Cost (25% of Construction Cost)			$ 14,010								
		Engineering Design Cost (5% of Construction Cost)			$ 2,802								
		Total Construction Cost			$ 72,851								
Levee Aesthetic Treatment Cost	Fill	346	cu. Yd	$ 7.00	$ 2,422	1,849	sq. Yd	$ 4.50	$ 8,321	491	sq. Yd	$ 8.33	$ 4,092
Levee Lining Aesthetic Trtmt. Cost	Riprap	109	cu. Yd	$ 75.00	$ 8,175	693	sq. Yd	$ -	$ -	217	sq. Yd	$ 33.33	$ 7,233
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 10,597			Total	$ 8,321			Total	$ 11,325
		Contingency Cost (25% of Construction Cost)			$ 2,649								
		Engineering Design Cost (5% of Construction Cost)			$ 530								
		Total Construction Cost			$ 13,776								

Total Structure Aesthetic Trtmt Cost	$ 33,422

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way		0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Levee	39	0.2	$100,000	$ 20,000
Other	0	0	$100,000	$ -
Total	39	0.2		$ 20,000

Total Land Related Aes. Trtmt Cost	$ 4,160

Total Cost	$ 139,355

Total Aesthetic Treatment Cost	$ 37,582

Total Right of Way Cost	$ 20,000

Online Basin

Structure ID	RR165

HEC1 ID	RR165

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

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

Drainage Area =	0.62 sq. mi.
Area Contributing Sediment =	0.62 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	5	101	95	0.56	2993
Q-5	0.25	12	252	95	0.56	8351
Q-10	0.35	16	353	95	0.56	12173
Q-25	0.55	26	554	95	0.56	20195
Q-50	0.75	35	756	95	0.56	28583
Q-100	1	47	1008	95	0.56	39449

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

Soil Map Unit	K	% of Basin
100	0.02	0.2594
115	0.27	0.0012
29	0.21	0.0038
98	0.17	0.0031
123	0.20	0.4866
47	0.13	0.2273
14	0.10	0.0186
Weighted K Factor:	0.13	

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:	250	ft	(Basin Average)
Slope Angles:	14.91	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	4.06		

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	2993	0.13	4.06	0.32	1.00	530	0.36
Q-5	8351	0.13	4.06	0.32	1.00	1480	1.00
Q-10	12173	0.13	4.06	0.32	1.00	2158	1.45
Q-25	20195	0.13	4.06	0.32	1.00	3580	2.41
Q-50	28583	0.13	4.06	0.32	1.00	5066	3.41
Q-100	39449	0.13	4.06	0.32	1.00	6993	4.71
Weighted Average Annual Sediment Yield:						1005	0.68

Total Sediment Yield Volume (ac. ft)	4.2

Sediment Depth in Basin	0.7 ft

Geometry

Topography slope (ft/ft)	0.02
Side Slope (?H:1V) (ft/ft)	6
Total Depth (ft)	8
Freeboard (ft)	1
Top Perimeter (ft)	3138.1
Top Area (acres)	13.8
Bottom elevation (ft)	1662.4
Adjacent Buffer Width (ft)	50.0

Allocated Storage Volume (ac. ft)	42.2
Total Available Volume (ac. ft) (incl. Freeboard)	54.3
Total Excavation Volume (ac. ft)	219.0

Basin Outlet

Diameter	5.00	ft
Invert Elevation	0.00	ft
Number of pipes	1	

Stage-Storage-Discharge

Elevation	0	1	3	5	6	7	8	9	10	11
Volume	0.00	1.42	13.72	27.32	34.52	42.22	50.12	58.52	67.22	76.22
Outflow	0.0	16.3	55.4	104.1	127.5	156.5	179.7	201.7	220.8	250.8

HEC1 Results

	6-hr Event	24-hr Event	Maximum
Total Flow Volume entering Basin (ac. ft)	47.0	40	47.0
Peak Inflow (cfs)	1008	842	1008.0
Peak Outflow (cfs)	135	113	135.0
Stage at Peak Outflow (ft)	6.2	5.4	6.2
Volume at Peak Outflow (ac. ft)	36.4	30	36.4

Volume Check

Total Volume needed	40.5	ac. ft
Total Volume Provided	42.2	ac. ft

Volume OK?	Yes

Stage Check

Depth Needed	7.9	ft
Depth Provided	8	ft

Depth OK?	Yes

Cost Estimates

Storage Basin Excavation	Design	Aesthetic Trtmt.
Excavation Volume (cu Yd)	353320	0
Excavated Area (sq. Yd)	66792.0	2789.4
Adjacent Buffer Area (sq. Yd)	17433.9	

Inlet	Terraced	Riprap-lined
Average Inlet Height (ft)	35	
Average Inlet Length (ft)	210	
Total Width of all inlets (ft)	370	
Material Thickness (ft)	0.5	3.0
Total Inlet Area (sq. Yd)	10072.2	
Total Material Volume (cu. Yd)	1678.7	
Unit Cost	$ 155.00	$ 75.00
Total Cost	$ 260,199	$ -

Outlet		
Outlet Type	Pipe	
(None, Riprap Weir, Concrete Weir, Pipe)		
Pipe Length	533	ft
Unit Cost	$ 183.00	per ft
Cost per outlet	$ 97,539	
Other Cost	$ -	
Total Cost	$ 97,539	
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		353,320	cu. Yd	$ 4.00	$ 1,413,280	84,226	sq. Yd	$ 4.50	$ 379,017	84,226	sq. Yd	$ 8.33	$ 701,883
Inlet					$ 260,199				$ -				$ 419,675
Outlet	Pipe	1	EA	$ 97,539	$ 97,539	133	sq. Yd	$ -	$ -	133	sq. Yd	$ 16.67	$ 2,217
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 1,771,018			Total	$ 379,017			Total	$ 1,123,774
		Contingency Cost (25% of Construction Cost)			$ 442,754								
		Engineering Design Cost (5% of Construction Cost)			$ 88,551								
		Total Construction Cost			$ 2,302,323								

Structure Aesthetic Treatment Cost

Basin - Aesthetic Treatment		353,320	cu. Yd	$ -	$ -	84,226	sq. Yd	$ 4.50	$ 379,017	14,645	sq. Yd	$ 8.33	$ 122,038
Inlet - Aesthetic Treatment (20%Inlet)					$ 52,040				$ -				$ 83,935
Outlet -Aesthetic Treatment (5% Outlet)					$ 4,877	133	sq. Yd	$ -	$ -				$ 111
Other					$ -	0			$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 56,917			Total	$ 379,017			Total	$ 206,083
		Contingency Cost (25% of Construction Cost)			$ 14,229								
		Engineering Design Cost (5% of Construction Cost)			$ 2,846								
		Total Construction Cost			$ 73,992								

Total Structure Aesthetic Trtmt Cost	$ 659,092

Land Cost

Land Cost Component	Area (acre)	Unit Cost	Cost
Misc. Right of Way		$100,000	$ -
Adjacent Buffer Area	3.6	$100,000	$ 360,000
Basin	13.8	$100,000	$ 1,380,000
Other		$100,000	$ -
Total	17.4	$100,000	$ 1,740,000

Total Land Related Aes. Trtmt Cost	$ 417,632

Total Cost	$ 5,545,113

Total Aesthetic Treatment Cost	$ 1,076,724

Total Right of Way Cost	$ 1,740,000

Walled-Levee Corridor

Structure ID	H1F1670A

HEC1 ID	F1670A

Cutline ID	5

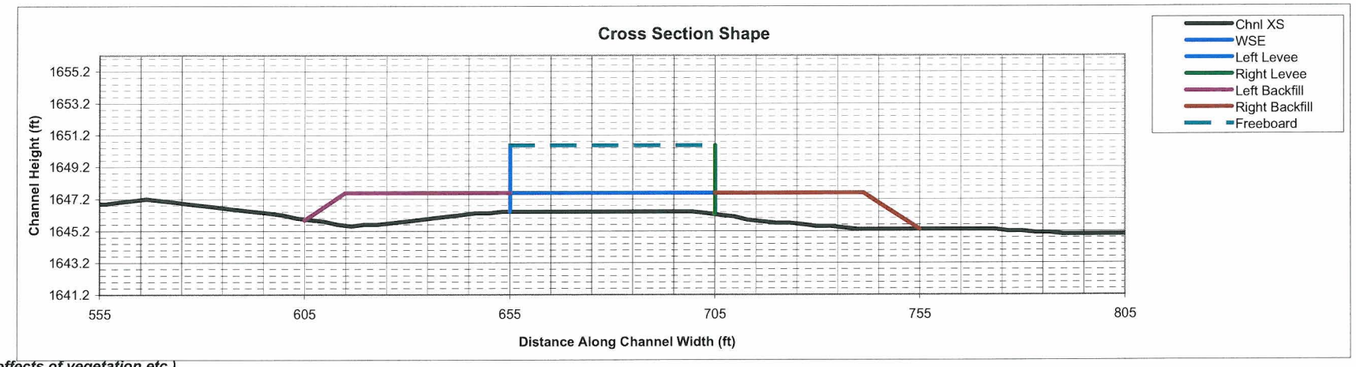
Longitudinal Geometry

Length	1257.2	ft
Initial Channel Slope	0.0209	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0030	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	655	Right Levee Station (ft)	705
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	655	Right Channel Limit Station (ft)	705

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	C170A	RR165								TOTAL
HEC1 Peak-Flow	760	135								
Weighting Factor	0.28	0.72								
Flow into Channel	213	97								310

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	50.7	14.8	1646.2	1646.7	2.1	0.5	50.0	0.3	0.3	0.68
93	51.3	28.6	1646.2	1647.0	3.2	0.8	50.0	0.6	0.6	0.76
233	52.1	50.0	1646.2	1647.4	4.7	1.2	50.0	1.0	1.0	0.82
310	52.5	59.6	1646.2	1647.6	5.2	1.4	50.0	1.1	1.2	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
31	51.2	26.5	1646.2	1646.9	1.2	0.7	50.0	0.5	0.5	0.28
93	52.2	51.7	1646.2	1647.4	1.8	1.2	50.0	1.0	1.0	0.31
233	53.8	90.6	1646.2	1648.2	2.6	2.0	50.0	1.7	1.8	0.34
310	54.5	108.2	1646.2	1648.6	2.9	2.4	50.0	2.0	2.2	0.34

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
93										0.00

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
31	Stable
93	Stable
233	Stable
310	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	93	cfs
Clear Water	Yes	
Total Incoming Sediment Load	0.000	cfs
Initial Chnl Sediment Capacity	0.586	cfs
Long-term Equilibrium Slope (MPM)	0.0030	

Drop Structures

Design Slope	0.0030	ft/ft
Total Drop Needed	22.5	ft
Height of Drop Structure	3	ft
No. of Drop Structures	7.50	
Distance between Structures	168	ft

Total Scour Calculations: Zt = 1.3(Zgs + 1/2ha + Zdeq + 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)	Zdeq (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
310	1.1	24.6	1.4	1.2	5.2	0.0209	-0.3	0.7	1.5	0.2	2.0	5.2

Cost Estimates

Channel Characteristics

Channel Length (ft)	1257
Channel Limit-Left Station (ft)	655
Channel Limit-Right Station (ft)	705
Channel Width (ft)	50

Levee

Left Levee Length (ft)	1257
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.2
Right Levee Length (ft)	1257
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	587
Left Levee Volume (cu. Yd)	98
Right Levee Surface Area (sq. Yd)	601
Right Levee Volume (cu. Yd)	100
Total Levee Surface Area (sq. Yd)	1188
Total Levee Volume (cu. Yd)	198

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)	62983
Left Levee Fill XS area (sq. ft)	75.2
Left Levee Fill Volume (cu. Yd)	3501
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)	63109
Right Levee Fill XS area (sq. ft)	84.1
Right Levee Fill Volume (cu. Yd)	3915
Total Levee Fill Surface Area (sq. ft)	126092
Total Levee Fill Volume (cu Yd)	7416

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)	4.9	
Structure Height (ft)	7.9	
Number of Structures	7.50	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	14.69	1.47
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,249	$ 125
Area per structure (sq. Yd)	6	1
Total Area (cu. Yd)	42	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	1,257	ft	$ 201	$ 252,606	198	cu. Yd	$ -	$ -	198	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,188	sq. Yd	$ -	$ -	1,188	sq. Yd	$ -	$ -	1,188	sq. Yd	$ 75.00	$ 89,100
Adjacent Levee Fill	Fill	7,416	cu. Yd	$ 7.00	$ 51,912	13,967	sq. Yd	$ 4.50	$ 62,850	13,967	sq. Yd	$ 11.67	$ 162,944
Wall Material Aesthetic Treatment Cost	Wall	198	cu. Yd	$ -	$ -	198	cu. Yd	$ -	$ -	198	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,188	sq. Yd	$ 63.00	$ 74,844	1,188	sq. Yd	$ -	$ -	1,188	sq. Yd	$ -	$ -
Drop Structures	Gabions	8	EA	$ 1,248.65	$ 9,365	6	sq. Yd	$ -	$ -	6	sq. Yd	$ 37.50	$ 208
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 388,727			Total	$ 62,850			Total	$ 252,253
		Contingency Cost (25% of Construction Cost)			$ 97,182								
		Engineering Design Cost (5% of Construction Cost)			$ 19,436								
		Total Construction Cost			$ 505,345								
Wall Material Aesthetic Treatment Cost	Wall	198	cu. Yd	$ -	$ -	198	cu. Yd	$ -	$ -	198	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,188	sq. Yd	$ 63.00	$ 74,844	1,188	sq. Yd	$ -	$ -	1,188	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,416	cu. Yd	$ 7.00	$ 51,912	13,967	sq. Yd	$ 4.50	$ 62,850	13,967	sq. Yd	$ 11.67	$ 162,944
Drop Structures Aesthetic Trtmt. Cost	Gabions	8	EA	$ 124.95	$ 937	6	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 21
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 127,693			Total	$ 62,850			Total	$ 162,965
		Contingency Cost (25% of Construction Cost)			$ 31,923								
		Engineering Design Cost (5% of Construction Cost)			$ 6,385								
		Total Construction Cost			$ 166,001								

Total Structure Aesthetic Trtmt Cost	$ 391,816

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	50	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	151	4.3		$ 430,000

Total Land Related Aes. Trtmt Cost	$ 200,000

Total Cost	$ 1,250,448	Total Aesthetic Treatment Cost	$ 591,816	Total Right of Way Cost	$ 430,000

Walled-Levee Corridor

Structure ID	H1F1670A

HEC1 ID	F1670A

Cutline ID	4

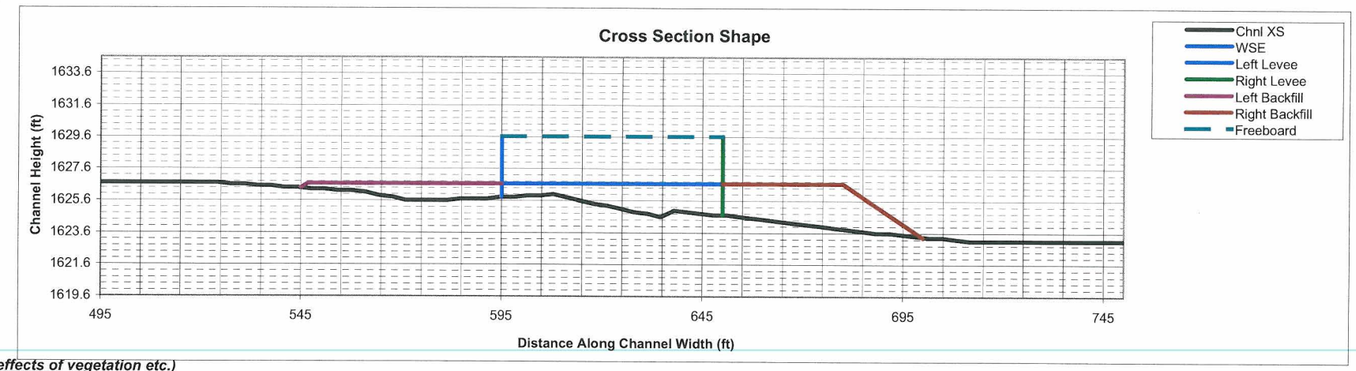
Longitundal Geometry

Length	1057.4	ft
Initial Channel Slope	0.0188	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0159	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	595	Right Levee Station (ft)	650
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	595	Right Channel Limit Station (ft)	650

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	C170A	RR165								TOTAL
HEC1 Peak-Flow	760	135								
Weighting Factor	0.43	0.57								
Flow into Channel	331	76								407

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
41	32.6	15.0	1624.6	1625.4	2.7	0.8	31.8	0.5	0.5	0.70
122	52.7	35.2	1624.6	1625.9	3.5	1.3	51.3	0.7	0.7	0.74
305	57.4	63.1	1624.6	1626.4	4.8	1.8	55.0	1.1	1.1	0.80
407	57.9	75.3	1624.6	1626.7	5.4	2.1	55.0	1.3	1.4	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
41	33.2	15.9	1624.6	1625.4	2.6	0.8	32.4	0.5	0.5	0.64
122	55.2	37.7	1624.6	1626.0	3.2	1.4	53.7	0.7	0.7	0.68
305	57.6	66.4	1624.6	1626.5	4.6	1.9	55.0	1.2	1.2	0.74
407	58.0	79.2	1624.6	1626.7	5.1	2.1	55.0	1.4	1.4	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
	H1F1670A_5									
122	0.59									0.59

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
41	Stable
122	Stable
305	Stable
407	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	122	cfs
Clear Water	No	
Total Incoming Sediment Load	0.586	cfs
Initial Chnl Sediment Capacity	0.758	cfs
Long-term Equilibrium Slope (ADWR)	0.0159	

Drop Structures

Design Slope	0.0159	ft/ft
Total Drop Needed	3.1	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.02	
Distance between Structures	1037	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)
407	1.1	24.6	2.1	1.4	5.4	0.0188	-0.5	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1057
Channel Limit-Left Station (ft)	595
Channel Limit-Right Station (ft)	650
Channel Width (ft)	55

Levee

Left Levee Length (ft)	1057
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	3.9
Right Levee Length (ft)	1057
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	458
Left Levee Volume (cu. Yd)	76
Right Levee Surface Area (sq. Yd)	587
Right Levee Volume (cu. Yd)	98
Total Levee Surface Area (sq. Yd)	1045
Total Levee Volume (cu. Yd)	174

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)	52868
Left Levee Fill XS area (sq. ft)	38.3
Left Levee Fill Volume (cu. Yd)	1499
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)	53185
Right Levee Fill XS area (sq. ft)	99.4
Right Levee Fill Volume (cu. Yd)	3891
Total Levee Fill Surface Area (sq. ft)	106053
Total Levee Fill Volume (cu Yd)	5390

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	55	
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	1.02	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	19.16	1.92
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,629	$ 163
Area per structure (sq. Yd)	6	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	1,057	ft	$ 228	$ 240,817	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ 75.00	$ 78,375
Adjacent Levee Fill	Fill	5,390	cu. Yd	$ 7.00	$ 37,730	11,744	sq. Yd	$ 4.50	$ 52,850	11,744	sq. Yd	$ 11.67	$ 137,019
Wall Material Aesthetic Treatment Cost	Wall	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,045	sq. Yd	$ 63.00	$ 65,835	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -
Drop Structures	Gabions	1	EA	$ 1,628.60	$ 1,661	6	sq. Yd	$ -	$ -	6	sq. Yd	$ 37.50	$ 229
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 346,043			Total	$ 52,850			Total	$ 215,623
		Contingency Cost (25% of Construction Cost)			$ 86,511								
		Engineering Design Cost (5% of Construction Cost)			$ 17,302								
		Total Construction Cost			$ 449,856								
Wall Material Aesthetic Treatment Cost	Wall	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,045	sq. Yd	$ 63.00	$ 65,835	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,390	cu. Yd	$ 7.00	$ 37,730	11,744	sq. Yd	$ 4.50	$ 52,850	11,744	sq. Yd	$ 11.67	$ 137,019
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 163.20	$ 166	6	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 23
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 103,731			Total	$ 52,850			Total	$ 137,041
		Contingency Cost (25% of Construction Cost)			$ 25,933								
		Engineering Design Cost (5% of Construction Cost)			$ 5,187								
		Total Construction Cost			$ 134,851								

Total Structure Aesthetic Trtmt Cost	$ 324,742

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	55	1.3	$100,000	$ 130,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	156	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,088,329	Total Aesthetic Treatment Cost	$ 494,742	Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H1F1670A

HEC1 ID	F1670A

Cutline ID	3

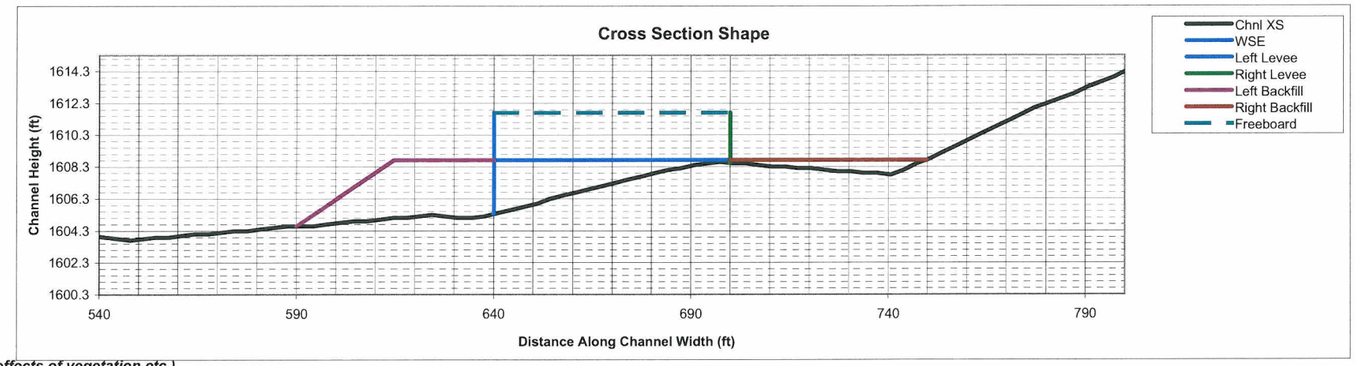
Longitudnal Geometry

Length	1087.7	ft
Initial Channel Slope	0.0162	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0133	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	640	Right Levee Station (ft)	700
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	640	Right Channel Limit Station (ft)	700

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	C170A	RR165								TOTAL
HEC1 Peak-Flow	760	135								
Weighting Factor	0.59	0.41								
Flow into Channel	449	55								504

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
50	23.3	15.6	1605.3	1606.8	3.2	1.5	21.9	0.7	0.7	0.67
151	36.1	36.0	1605.3	1607.5	4.2	2.2	33.9	1.0	1.1	0.72
378	53.4	72.9	1605.3	1608.4	5.2	3.1	50.3	1.4	1.4	0.76
504	63.7	92.9	1605.3	1608.7	5.4	3.4	60.0	1.5	1.5	0.77

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
50	24.3	16.9	1605.3	1606.8	3.0	1.5	22.8	0.7	0.7	0.61
151	37.6	38.8	1605.3	1607.6	3.9	2.3	35.3	1.0	1.1	0.66
378	57.3	79.6	1605.3	1608.5	4.8	3.2	54.1	1.4	1.5	0.69
504	63.9	98.7	1605.3	1608.8	5.1	3.5	60.0	1.5	1.6	0.70

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
	H1F1670A_4									
151	0.76									0.76

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
50	Stable
151	Stable
378	Erosive
504	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	151	cfs
Clear Water	No	
Total Incoming Sediment Load	0.758	cfs
Initial Chnl Sediment Capacity	1.008	cfs
Long-term Equilibrium Slope (ADWR)	0.0133	

Drop Structures

Design Slope	0.0133	ft/ft
Total Drop Needed	3.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.05	
Distance between Structures	1036	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)
504	1.1	24.6	3.4	1.5	5.4	0.0162	-0.8	0.8	1.5	0.4	2.0	5.6

Cost Estimates

Channel Characteristics

Channel Length (ft)	1088
Channel Limit-Left Station (ft)	640
Channel Limit-Right Station (ft)	700
Channel Width (ft)	60

Levee

Left Levee Length (ft)	1088
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	6.4
Right Levee Length (ft)	1088
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.2

Left Levee Surface Area (sq. Yd)	774
Left Levee Volume (cu. Yd)	129
Right Levee Surface Area (sq. Yd)	387
Right Levee Volume (cu. Yd)	64
Total Levee Surface Area (sq. Yd)	1161
Total Levee Volume (cu. Yd)	193

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)	54711
Left Levee Fill XS area (sq. ft)	135.4
Left Levee Fill Volume (cu. Yd)	5456
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	49.8
Right Levee Fill Surface Area (sq. ft)	54167
Right Levee Fill XS area (sq. ft)	26.9
Right Levee Fill Volume (cu. Yd)	1084
Total Levee Fill Surface Area (sq. ft)	108878
Total Levee Fill Volume (cu Yd)	6540

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)	6.8	
Structure Height (ft)	9.8	
Number of Structures	1.05	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	21.76	2.18
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 1,850	$ 185
Area per structure (sq. Yd)	7	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	1,088	ft	$ 241	$ 261,954	193	cu. Yd	$ -	$ -	193	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,161	sq. Yd	$ -	$ -	1,161	sq. Yd	$ -	$ -	1,161	sq. Yd	$ 75.00	$ 87,075	
Adjacent Levee Fill	Fill	6,540	cu. Yd	$ 7.00	$ 45,780	12,065	sq. Yd	$ 4.50	$ 54,291	12,065	sq. Yd	$ 11.67	$ 140,755	
Wall Material Aesthetic Treatment Cost	Wall	193	cu. Yd	$ -	$ -	193	cu. Yd	$ -	$ -	193	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,161	sq. Yd	$ 63.00	$ 73,143	1,161	sq. Yd	$ -	$ -	1,161	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 1,849.60	$ 1,942	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 250	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 382,819			Total	$ 54,291			Total	$ 228,080	
		Contingency Cost (25% of Construction Cost)			$ 95,705									
		Engineering Design Cost (5% of Construction Cost)			$ 19,141									
		Total Construction Cost			$ 497,664									
Wall Material Aesthetic Treatment Cost	Wall	193	cu. Yd	$ -	$ -	193	cu. Yd	$ -	$ -	193	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,161	sq. Yd	$ 63.00	$ 73,143	1,161	sq. Yd	$ -	$ -	1,161	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,540	cu. Yd	$ 7.00	$ 45,780	12,065	sq. Yd	$ 4.50	$ 54,291	12,065	sq. Yd	$ 11.67	$ 140,755	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 185.30	$ 195	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 25	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 119,118			Total	$ 54,291			Total	$ 140,780	
		Contingency Cost (25% of Construction Cost)			$ 29,779									
		Engineering Design Cost (5% of Construction Cost)			$ 5,956									
		Total Construction Cost			$ 154,853									
Total Structure Aesthetic Trtmt Cost	$ 349,924													

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	60	1.5	$100,000	$ 150,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	161	3.9		$ 390,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,170,036	Total Aesthetic Treatment Cost	$ 519,924	Total Right of Way Cost	$ 390,000

Walled-Levee Corridor

Structure ID	H1F1670A

HEC1 ID	F1670A

Cutline ID	2

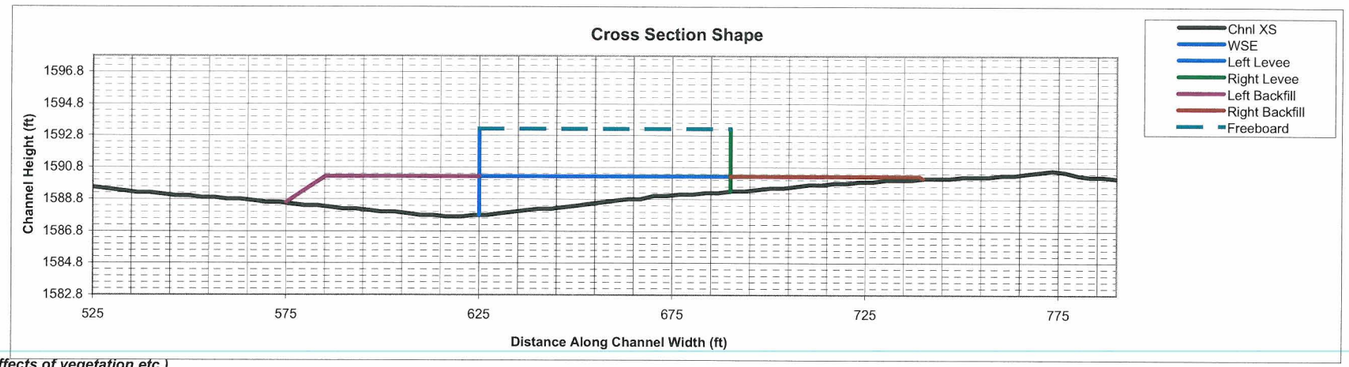
Longitudinal Geometry

Length	953.7	ft
Initial Channel Slope	0.0157	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0190	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	625	Right Levee Station (ft)	690
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	625	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	C170A	RR165								TOTAL
HEC1 Peak-Flow	760	135								
Weighting Factor	0.75	0.25								
Flow into Channel	573	33								606

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
61	43.7	22.6	1587.8	1588.9	2.7	1.1	42.6	0.5	0.5	0.65
182	66.7	51.8	1587.8	1589.4	3.5	1.6	65.0	0.8	0.8	0.69
455	67.9	90.5	1587.8	1590.0	5.0	2.2	65.0	1.3	1.4	0.75
606	68.4	107.9	1587.8	1590.3	5.6	2.5	65.0	1.6	1.7	0.77

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
61	43.1	21.3	1587.8	1588.8	2.8	1.0	42.1	0.5	0.5	0.71
182	66.6	48.9	1587.8	1589.3	3.7	1.5	65.0	0.7	0.8	0.75
455	67.7	85.4	1587.8	1589.9	5.3	2.1	65.0	1.3	1.3	0.82
606	68.2	101.7	1587.8	1590.2	6.0	2.4	65.0	1.5	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
	H1F1670A_3	T170A10								
182	1.01	0.27								1.27

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
61	Stable
182	Stable
455	Erosive
606	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	182	cfs
Clear Water	No	
Total Incoming Sediment Load	1.274	cfs
Initial Chnl Sediment Capacity	0.963	cfs
Long-term Equilibrium Slope (ADWR)	0.0190	

Drop Structures

Design Slope	0.0190	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)
606	1.1	24.6	2.5	1.7	5.6	0.0157	-0.6	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	954
Channel Limit-Left Station (ft)	625
Channel Limit-Right Station (ft)	690
Channel Width (ft)	65

Levee

Left Levee Length (ft)	954
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.5
Right Levee Length (ft)	954
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4

Left Levee Surface Area (sq. Yd)	583
Left Levee Volume (cu. Yd)	97
Right Levee Surface Area (sq. Yd)	424
Right Levee Volume (cu. Yd)	71
Total Levee Surface Area (sq. Yd)	1007
Total Levee Volume (cu. Yd)	168

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)	47778
Left Levee Fill XS area (sq. ft)	101.1
Left Levee Fill Volume (cu. Yd)	3572
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)	47683
Right Levee Fill XS area (sq. ft)	26.5
Right Levee Fill Volume (cu. Yd)	936
Total Levee Fill Surface Area (sq. ft)	95461
Total Levee Fill Volume (cu Yd)	4508

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	65	
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)	25.01	2.50
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,126	$ 213
Area per structure (sq. Yd)	7	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	954	ft	$ 228	$ 217,350	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,007	sq. Yd	$ -	$ -	1,007	sq. Yd	$ -	$ -	1,007	sq. Yd	$ 75.00	$ 75,525
Adjacent Levee Fill	Fill	4,508	cu. Yd	$ 7.00	$ 31,556	10,600	sq. Yd	$ 4.50	$ 47,700	10,600	sq. Yd	$ 11.67	$ 123,667
Wall Material Aesthetic Treatment Cost	Wall	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,007	sq. Yd	$ 63.00	$ 63,441	1,007	sq. Yd	$ -	$ -	1,007	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,125.85	$ -	7	sq. Yd	$ -	$ -	7	sq. Yd	$ 37.50	$ 271
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 312,347			Total	$ 47,700			Total	$ 199,463
		Contingency Cost (25% of Construction Cost)			$ 78,087								
		Engineering Design Cost (5% of Construction Cost)			$ 15,617								
		Total Construction Cost			$ 406,052								
Wall Material Aesthetic Treatment Cost	Wall	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -	168	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,007	sq. Yd	$ 63.00	$ 63,441	1,007	sq. Yd	$ -	$ -	1,007	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,508	cu. Yd	$ 7.00	$ 31,556	10,600	sq. Yd	$ 4.50	$ 47,700	10,600	sq. Yd	$ 11.67	$ 123,667
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 212.50	$ -	7	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 27
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 94,997			Total	$ 47,700			Total	$ 123,694
		Contingency Cost (25% of Construction Cost)			$ 23,749								
		Engineering Design Cost (5% of Construction Cost)			$ 4,750								
		Total Construction Cost			$ 123,496								
Total Structure Aesthetic Trtmt Cost	$ 294,890												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	65	1.4	$100,000	$ 140,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	166	3.6		$ 360,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 1,013,214	Total Aesthetic Treatment Cost	$ 444,890	Total Right of Way Cost	$ 360,000

Walled-Levee Corridor

Structure ID	H1F1670A	HEC1 ID	F1670A	Cutline ID	1

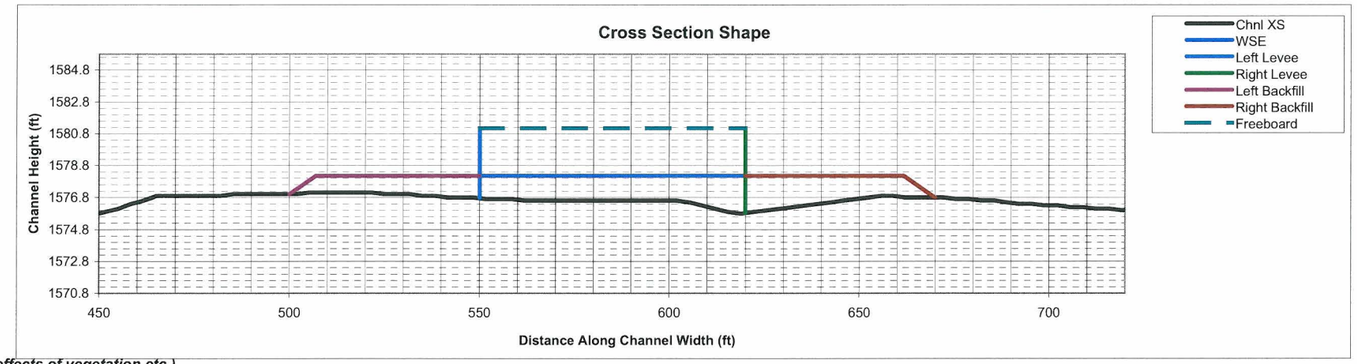
Longitudal Geometry

Length	1165.2	ft
Initial Channel Slope	0.0171	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0141	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	550	Right Levee Station (ft)	620
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	550	Right Channel Limit Station (ft)	620

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	C170A	RR165								TOTAL
HEC1 Peak-Flow	760	135								
Weighting Factor	0.88	0.12								
Flow into Channel	668	16								684

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
68	71.3	28.9	1575.8	1576.9	2.4	1.1	70.0	0.4	0.4	0.65
205	72.0	56.0	1575.8	1577.3	3.7	1.5	70.0	0.8	0.8	0.72
513	73.2	97.7	1575.8	1577.9	5.2	2.1	70.0	1.3	1.4	0.78
684	73.8	116.5	1575.8	1578.2	5.9	2.4	70.0	1.6	1.7	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
68	71.3	30.6	1575.8	1576.9	2.2	1.1	70.0	0.4	0.4	0.60
205	72.1	59.4	1575.8	1577.4	3.5	1.6	70.0	0.8	0.8	0.66
513	73.4	103.7	1575.8	1578.0	4.9	2.2	70.0	1.4	1.5	0.72
684	74.0	123.6	1575.8	1578.3	5.5	2.5	70.0	1.7	1.8	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
	H1F1670A_2									
205	0.96									0.96

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
68	Stable
205	Stable
513	Erosive
684	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	205	cfs
Clear Water	No	
Total Incoming Sediment Load	0.963	cfs
Initial Chnl Sediment Capacity	1.249	cfs
Long-term Equilibrium Slope (ADWR)	0.0141	

Drop Structures

Design Slope	0.0141	ft/ft
Total Drop Needed	3.5	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.17	
Distance between Structures	996	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)
684	1.1	24.6	2.4	1.7	5.9	0.0171	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1165
Channel Limit-Left Station (ft)	550
Channel Limit-Right Station (ft)	620
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1165
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.4
Right Levee Length (ft)	1165
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.3

Left Levee Surface Area (sq. Yd)	570
Left Levee Volume (cu. Yd)	95
Right Levee Surface Area (sq. Yd)	686
Right Levee Volume (cu. Yd)	114
Total Levee Surface Area (sq. Yd)	1256
Total Levee Volume (cu. Yd)	209

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)	58374
Left Levee Fill XS area (sq. ft)	55.1
Left Levee Fill Volume (cu. Yd)	2377
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)	58374
Right Levee Fill XS area (sq. ft)	77.9
Right Levee Fill Volume (cu. Yd)	3361
Total Levee Fill Surface Area (sq. ft)	116748
Total Levee Fill Volume (cu Yd)	5738

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)	7.4	
Structure Height (ft)	10.4	
Number of Structures	1.17	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.04	2.70
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,298	$ 230
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	9	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	1,165	ft	$ 228	$ 265,423	209	cu. Yd	$ -	$ -	209	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,256	sq. Yd	$ -	$ -	1,256	sq. Yd	$ -	$ -	1,256	sq. Yd	$ 75.00	$ 94,200	
Adjacent Levee Fill	Fill	5,738	cu. Yd	$ 7.00	$ 40,166	12,944	sq. Yd	$ 4.50	$ 58,250	12,944	sq. Yd	$ 11.67	$ 151,019	
Wall Material Aesthetic Treatment Cost	Wall	209	cu. Yd	$ -	$ -	209	cu. Yd	$ -	$ -	209	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,256	sq. Yd	$ 63.00	$ 79,128	1,256	sq. Yd	$ -	$ -	1,256	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,298.40	$ 2,689	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 387,406			Total	$ 58,250			Total	$ 245,510	
		Contingency Cost (25% of Construction Cost)			$ 96,851									
		Engineering Design Cost (5% of Construction Cost)			$ 19,370									
		Total Construction Cost			$ 503,627									
Wall Material Aesthetic Treatment Cost	Wall	209	cu. Yd	$ -	$ -	209	cu. Yd	$ -	$ -	209	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,256	sq. Yd	$ 63.00	$ 79,128	1,256	sq. Yd	$ -	$ -	1,256	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,738	cu. Yd	$ 7.00	$ 40,166	12,944	sq. Yd	$ 4.50	$ 58,250	12,944	sq. Yd	$ 11.67	$ 151,019	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 229.50	$ 269	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 119,563			Total	$ 58,250			Total	$ 151,048	
		Contingency Cost (25% of Construction Cost)			$ 29,891									
		Engineering Design Cost (5% of Construction Cost)			$ 5,978									
		Total Construction Cost			$ 155,431									
Total Structure Aesthetic Trtmt Cost	$ 364,729													

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	70	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	4.6		$ 460,000

Total Land Related Aes. Trtmt Cost	$ 190,000

Total Cost	$ 1,267,388	Total Aesthetic Treatment Cost	$ 554,729

Total Right of Way Cost	$ 460,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	8

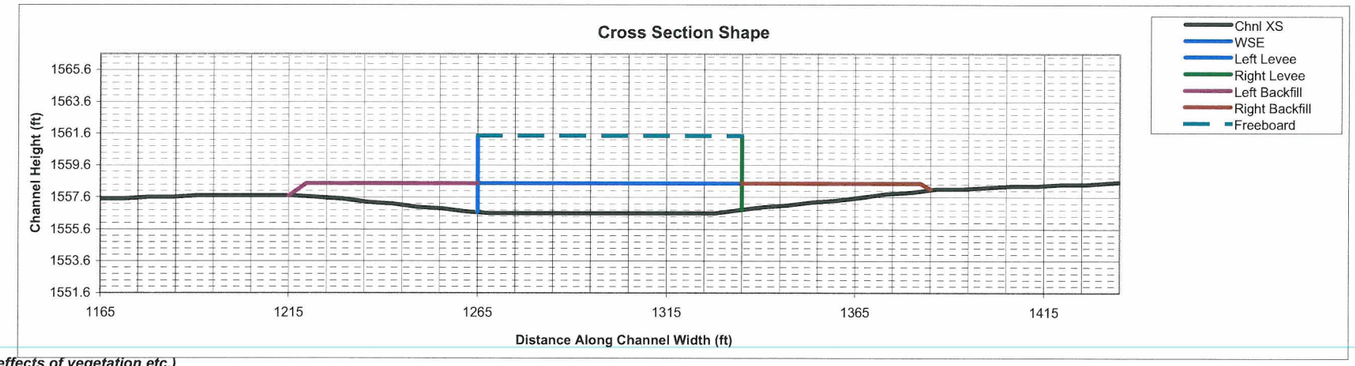
Longitudinal Geometry

Length	917.3	ft
Initial Channel Slope	0.0149	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0175	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1265	Right Levee Station (ft)	1335
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1265	Right Channel Limit Station (ft)	1335

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.06	0.94								
Flow into Channel	55	716								771

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
77	70.7	32.2	1556.6	1557.1	2.4	0.5	70.0	0.5	0.5	0.62
231	71.5	62.6	1556.6	1557.5	3.7	0.9	70.0	0.9	0.9	0.69
578	72.9	109.2	1556.6	1558.2	5.3	1.6	70.0	1.5	1.6	0.75
771	73.5	130.2	1556.6	1558.5	5.9	1.9	70.0	1.8	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
77	70.6	30.7	1556.6	1557.1	2.5	0.5	70.0	0.4	0.4	0.67
231	71.5	59.6	1556.6	1557.5	3.9	0.9	70.0	0.8	0.9	0.74
578	72.7	104.0	1556.6	1558.1	5.6	1.5	70.0	1.4	1.5	0.80
771	73.3	124.0	1556.6	1558.4	6.2	1.8	70.0	1.7	1.8	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
	H1F1670A_1	T170A20								
231	1.25	0.32								1.57

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
77	Stable
231	Stable
578	Erosive
771	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	231	cfs
Clear Water	No	
Total Incoming Sediment Load	1.572	cfs
Initial Chnl Sediment Capacity	1.259	cfs
Long-term Equilibrium Slope (ADWR)	0.0175	

Drop Structures

Design Slope	0.0175	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)
771	1.1	24.6	1.9	1.9	5.9	0.0149	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	917
Channel Limit-Left Station (ft)	1265
Channel Limit-Right Station (ft)	1335
Channel Width (ft)	70

Levee

Left Levee Length (ft)	917
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	917
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	489
Left Levee Volume (cu. Yd)	82
Right Levee Surface Area (sq. Yd)	469
Right Levee Volume (cu. Yd)	78
Total Levee Surface Area (sq. Yd)	958
Total Levee Volume (cu. Yd)	160

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)	45957
Left Levee Fill XS area (sq. ft)	60.7
Left Levee Fill Volume (cu. Yd)	2062
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)	45865
Right Levee Fill XS area (sq. ft)	51.4
Right Levee Fill Volume (cu. Yd)	1746
Total Levee Fill Surface Area (sq. ft)	91822
Total Levee Fill Volume (cu Yd)	3808

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)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.71	2.87
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,440	$ 244
Area per structure (sq. Yd)	8	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	917	ft	$ 255	$ 233,561	160	cu. Yd	$ -	$ -	160	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	958	sq. Yd	$ -	$ -	958	sq. Yd	$ -	$ -	958	sq. Yd	$ 75.00	$ 71,850
Adjacent Levee Fill	Fill	3,808	cu. Yd	$ 7.00	$ 26,656	10,189	sq. Yd	$ 4.50	$ 45,850	10,189	sq. Yd	$ 11.67	$ 118,870
Wall Material Aesthetic Treatment Cost	Wall	160	cu. Yd	$ -	$ -	160	cu. Yd	$ -	$ -	160	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	958	sq. Yd	$ 63.00	$ 60,354	958	sq. Yd	$ -	$ -	958	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,440.35	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 320,571			Total	$ 45,850			Total	$ 191,012
		Contingency Cost (25% of Construction Cost)			$ 80,143								
		Engineering Design Cost (5% of Construction Cost)			$ 16,029								
		Total Construction Cost			$ 416,743								
Wall Material Aesthetic Treatment Cost	Wall	160	cu. Yd	$ -	$ -	160	cu. Yd	$ -	$ -	160	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	958	sq. Yd	$ 63.00	$ 60,354	958	sq. Yd	$ -	$ -	958	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,808	cu. Yd	$ 7.00	$ 26,656	10,189	sq. Yd	$ 4.50	$ 45,850	10,189	sq. Yd	$ 11.67	$ 118,870
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 243.95	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 87,010			Total	$ 45,850			Total	$ 118,900
		Contingency Cost (25% of Construction Cost)			$ 21,753								
		Engineering Design Cost (5% of Construction Cost)			$ 4,351								
		Total Construction Cost			$ 113,113								
Total Structure Aesthetic Trtmt Cost	$ 277,863												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	70	1.5	$100,000	$ 150,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	3.6		$ 360,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 1,013,605	Total Aesthetic Treatment Cost	$ 427,863	Total Right of Way Cost	$ 360,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	7

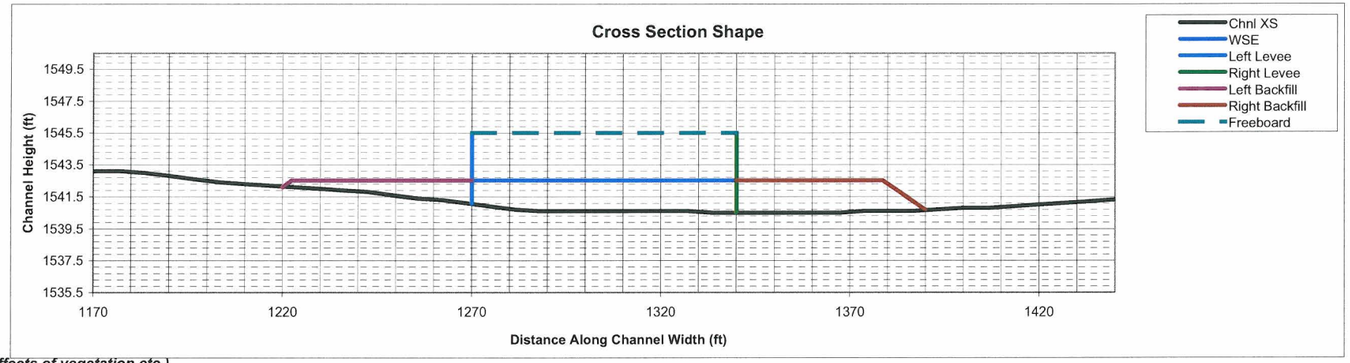
Longitundal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0149	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0144	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1270	Right Levee Station (ft)	1340
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1270	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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.19	0.81								
Flow into Channel	180	615								795

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
80	70.7	32.8	1540.5	1541.1	2.4	0.6	70.0	0.5	0.5	0.62
239	71.5	63.7	1540.5	1541.5	3.7	1.0	70.0	0.9	0.9	0.69
596	72.9	111.3	1540.5	1542.2	5.4	1.7	70.0	1.5	1.6	0.75
795	73.5	132.7	1540.5	1542.5	6.0	2.0	70.0	1.8	1.9	0.77

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
80	70.7	33.1	1540.5	1541.1	2.4	0.6	70.0	0.5	0.5	0.61
239	71.6	64.4	1540.5	1541.6	3.7	1.1	70.0	0.9	0.9	0.68
596	72.9	112.4	1540.5	1542.2	5.3	1.7	70.0	1.5	1.6	0.74
795	73.6	134.1	1540.5	1542.6	5.9	2.1	70.0	1.8	1.9	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
	H170A70B_8									
239	1.26									1.26

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
80	Stable
239	Stable
596	Erosive
795	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	239	cfs
Clear Water	No	
Total Incoming Sediment Load	1.259	cfs
Initial Chnl Sediment Capacity	1.320	cfs
Long-term Equilibrium Slope (ADWR)	0.0144	

Drop Structures

Design Slope	0.0144	ft/ft
Total Drop Needed	0.5	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.17	
Distance between Structures	5882	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)
795	1.1	24.6	2.0	1.9	6.0	0.0149	-0.4	1.0	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1270
Channel Limit-Right Station (ft)	1340
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.5
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	500
Left Levee Volume (cu. Yd)	83
Right Levee Surface Area (sq. Yd)	556
Right Levee Volume (cu. Yd)	93
Total Levee Surface Area (sq. Yd)	1056
Total Levee Volume (cu. Yd)	176

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)	50000
Left Levee Fill XS area (sq. ft)	42.7
Left Levee Fill Volume (cu. Yd)	1581
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)	50200
Right Levee Fill XS area (sq. ft)	89
Right Levee Fill Volume (cu. Yd)	3296
Total Levee Fill Surface Area (sq. ft)	100200
Total Levee Fill Volume (cu Yd)	4877

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)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.17	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.79	2.88
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,447	$ 245
Area per structure (sq. Yd)	8	1
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	1,000	ft	$ 228	$ 227,831	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,056	sq. Yd	$ -	$ -	1,056	sq. Yd	$ -	$ -	1,056	sq. Yd	$ 75.00	$ 79,200
Adjacent Levee Fill	Fill	4,877	cu. Yd	$ 7.00	$ 34,139	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Wall Material Aesthetic Treatment Cost	Wall	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,056	sq. Yd	$ 63.00	$ 66,528	1,056	sq. Yd	$ -	$ -	1,056	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,447.15	$ 416	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 328,914			Total	$ 50,000			Total	$ 209,121
		Contingency Cost (25% of Construction Cost)			$ 82,228								
		Engineering Design Cost (5% of Construction Cost)			$ 16,446								
		Total Construction Cost			$ 427,588								
Wall Material Aesthetic Treatment Cost	Wall	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,056	sq. Yd	$ 63.00	$ 66,528	1,056	sq. Yd	$ -	$ -	1,056	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,877	cu. Yd	$ 7.00	$ 34,139	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 244.80	$ 42	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 100,709			Total	$ 50,000			Total	$ 129,659
		Contingency Cost (25% of Construction Cost)			$ 25,177								
		Engineering Design Cost (5% of Construction Cost)			$ 5,035								
		Total Construction Cost			$ 130,921								
Total Structure Aesthetic Trtmt Cost	$ 310,580												

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	70	1.6	$100,000	$ 160,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	3.9		$ 390,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,076,709

Total Aesthetic Treatment Cost	$ 470,580

Total Right of Way Cost	$ 390,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	6

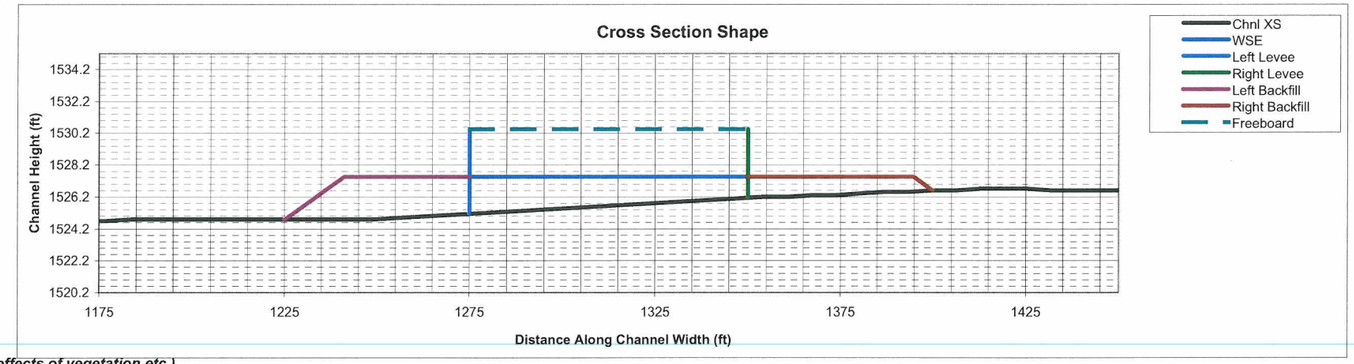
Longitudinal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0158	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0148	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1275	Right Levee Station (ft)	1350
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1275	Right Channel Limit Station (ft)	1350

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.33	0.67								
Flow into Channel	308	512								820

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
82	71.5	33.0	1525.2	1526.1	2.5	0.9	70.6	0.5	0.5	0.64
246	76.8	65.6	1525.2	1526.5	3.7	1.3	75.0	0.9	0.9	0.71
615	78.1	114.5	1525.2	1527.2	5.4	2.0	75.0	1.5	1.5	0.77
820	78.6	136.5	1525.2	1527.5	6.0	2.3	75.0	1.7	1.8	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
82	72.4	33.8	1525.2	1526.1	2.4	0.9	71.4	0.5	0.5	0.62
246	76.8	66.9	1525.2	1526.5	3.7	1.3	75.0	0.9	0.9	0.69
615	78.1	116.8	1525.2	1527.2	5.3	2.0	75.0	1.5	1.6	0.74
820	78.7	139.2	1525.2	1527.5	5.9	2.3	75.0	1.8	1.9	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
	H170A70B_7									
246	1.32									1.32

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
82	Stable
246	Stable
615	Erosive
820	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	246	cfs
Clear Water	No	
Total Incoming Sediment Load	1.320	cfs
Initial Chnl Sediment Capacity	1.442	cfs
Long-term Equilibrium Slope (ADWR)	0.0148	

Drop Structures

Design Slope	0.0148	ft/ft
Total Drop Needed	1.0	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.33	
Distance between Structures	3030	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)
820	1.1	24.6	2.3	1.8	6.0	0.0158	-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)	1275
Channel Limit-Right Station (ft)	1350
Channel Width (ft)	75

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.3
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	589
Left Levee Volume (cu. Yd)	98
Right Levee Surface Area (sq. Yd)	478
Right Levee Volume (cu. Yd)	80
Total Levee Surface Area (sq. Yd)	1067
Total Levee Volume (cu. Yd)	178

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)	50200
Left Levee Fill XS area (sq. ft)	107.5
Left Levee Fill Volume (cu. Yd)	3981
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)	53.4
Right Levee Fill Volume (cu. Yd)	1978
Total Levee Fill Surface Area (sq. ft)	100300
Total Levee Fill Volume (cu Yd)	5959

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	75	
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	0.33	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	30.41	3.04
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,585	$ 258
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	3	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	$ 228	$ 227,831	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,067	sq. Yd	$ -	$ -	1,067	sq. Yd	$ -	$ -	1,067	sq. Yd	$ 75.00	$ 80,025	
Adjacent Levee Fill	Fill	5,959	cu. Yd	$ 7.00	$ 41,713	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,067	sq. Yd	$ 63.00	$ 67,221	1,067	sq. Yd	$ -	$ -	1,067	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,584.85	$ 853	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 313	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 337,618			Total	$ 50,000			Total	$ 209,967	
		Contingency Cost (25% of Construction Cost)			$ 84,404									
		Engineering Design Cost (5% of Construction Cost)			$ 16,881									
		Total Construction Cost			$ 438,903									
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,067	sq. Yd	$ 63.00	$ 67,221	1,067	sq. Yd	$ -	$ -	1,067	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,959	cu. Yd	$ 7.00	$ 41,713	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 258.40	$ 85	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 31	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 109,019			Total	$ 50,000			Total	$ 129,661	
		Contingency Cost (25% of Construction Cost)			$ 27,255									
		Engineering Design Cost (5% of Construction Cost)			$ 5,451									
		Total Construction Cost			$ 141,725									

Total Structure Aesthetic Trtmt Cost	$ 321,386

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	75	1.7	$100,000	$ 170,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	176	4		$ 400,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,098,870	Total Aesthetic Treatment Cost	$ 481,386	Total Right of Way Cost	$ 400,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	5

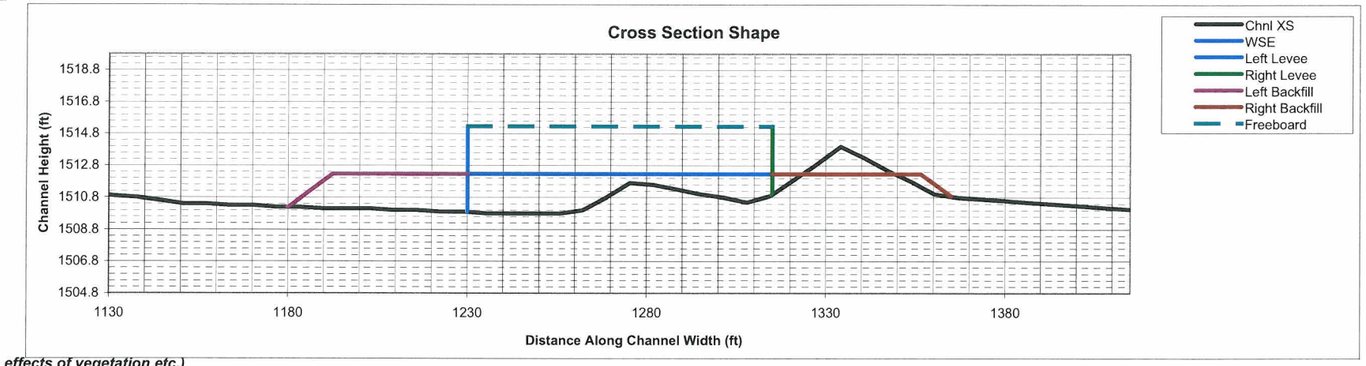
Longitudinal Geometry

Length	970.2	ft
Initial Channel Slope	0.0160	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0148	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1230	Right Levee Station (ft)	1315
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1230	Right Channel Limit Station (ft)	1315

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.46	0.54								
Flow into Channel	434	411								845

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
85	42.5	27.2	1509.8	1510.6	3.1	0.8	41.7	0.6	0.7	0.68
254	70.0	64.1	1509.8	1511.3	4.0	1.5	68.2	0.9	0.9	0.72
634	88.3	122.0	1509.8	1512.0	5.2	2.2	85.0	1.4	1.4	0.76
845	88.8	145.3	1509.8	1512.3	5.8	2.5	85.0	1.6	1.7	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
85	43.5	28.1	1509.8	1510.6	3.0	0.8	42.7	0.6	0.7	0.65
254	70.8	66.0	1509.8	1511.3	3.8	1.5	68.9	0.9	1.0	0.69
634	88.4	124.9	1509.8	1512.0	5.1	2.2	85.0	1.4	1.5	0.74
845	88.9	148.8	1509.8	1512.3	5.7	2.5	85.0	1.7	1.8	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
	H170A70B_6									
254	1.44									1.44

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
85	Stable
254	Stable
634	Erosive
845	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	254	cfs
Clear Water	No	
Total Incoming Sediment Load	1.442	cfs
Initial Chnl Sediment Capacity	1.612	cfs
Long-term Equilibrium Slope (ADWR)	0.0148	

Drop Structures

Design Slope	0.0148	ft/ft
Total Drop Needed	1.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.39	
Distance between Structures	2488	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)
845	1.1	24.6	2.5	1.7	5.8	0.0160	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	970
Channel Limit-Left Station (ft)	1230
Channel Limit-Right Station (ft)	1315
Channel Width (ft)	85

Levee

Left Levee Length (ft)	970
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.4
Right Levee Length (ft)	970
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	582
Left Levee Volume (cu. Yd)	97
Right Levee Surface Area (sq. Yd)	463
Right Levee Volume (cu. Yd)	77
Total Levee Surface Area (sq. Yd)	1045
Total Levee Volume (cu. Yd)	174

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)	48702
Left Levee Fill XS area (sq. ft)	98.6
Left Levee Fill Volume (cu. Yd)	3542
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)	48605
Right Levee Fill XS area (sq. ft)	-9.6
Right Levee Fill Volume (cu. Yd)	-345
Total Levee Fill Surface Area (sq. ft)	97307
Total Levee Fill Volume (cu Yd)	3197

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)	7.5	
Structure Height (ft)	10.5	
Number of Structures	0.39	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	33.17	3.32
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,819	$ 282
Area per structure (sq. Yd)	9	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	970	ft	$ 228	$ 220,996	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ 75.00	$ 78,375
Adjacent Levee Fill	Fill	3,197	cu. Yd	$ 7.00	$ 22,379	10,778	sq. Yd	$ 4.50	$ 48,500	10,778	sq. Yd	$ 11.67	$ 125,741
Wall Material Aesthetic Treatment Cost	Wall	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,045	sq. Yd	$ 63.00	$ 65,835	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,819.45	$ 1,100	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 354
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 310,309			Total	$ 48,500			Total	$ 204,470
		Contingency Cost (25% of Construction Cost)			$ 77,577								
		Engineering Design Cost (5% of Construction Cost)			$ 15,515								
		Total Construction Cost			$ 403,402								
Wall Material Aesthetic Treatment Cost	Wall	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -	174	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,045	sq. Yd	$ 63.00	$ 65,835	1,045	sq. Yd	$ -	$ -	1,045	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	3,197	cu. Yd	$ 7.00	$ 22,379	10,778	sq. Yd	$ 4.50	$ 48,500	10,778	sq. Yd	$ 11.67	$ 125,741
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 282.20	$ 110	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 35
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 88,324			Total	$ 48,500			Total	$ 125,776
		Contingency Cost (25% of Construction Cost)			$ 22,081								
		Engineering Design Cost (5% of Construction Cost)			$ 4,416								
		Total Construction Cost			$ 114,821								

Total Structure Aesthetic Trtmt Cost	$ 289,097

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	$ 1,076,372	Total Aesthetic Treatment Cost	$ 449,097	Total Right of Way Cost	$ 420,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	4

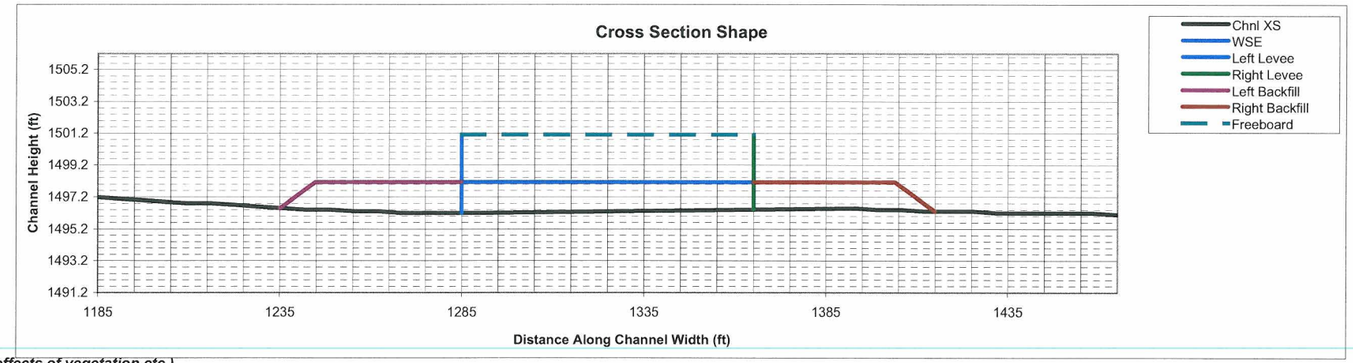
Longitudnal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0151	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0164	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1285	Right Levee Station (ft)	1365
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1285	Right Channel Limit Station (ft)	1365

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.59	0.41								
Flow into Channel	553	315								868

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
87	80.9	36.4	1496.2	1496.8	2.4	0.6	80.0	0.4	0.5	0.62
260	81.8	70.6	1496.2	1497.2	3.7	1.0	80.0	0.9	0.9	0.69
651	83.1	123.1	1496.2	1497.8	5.3	1.6	80.0	1.5	1.5	0.75
868	83.7	146.7	1496.2	1498.1	5.9	1.9	80.0	1.8	1.8	0.77

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
87	80.9	35.5	1496.2	1496.7	2.4	0.5	80.0	0.4	0.4	0.65
260	81.7	68.8	1496.2	1497.2	3.8	1.0	80.0	0.8	0.9	0.72
651	83.0	120.0	1496.2	1497.8	5.4	1.6	80.0	1.4	1.5	0.78
868	83.6	143.1	1496.2	1498.1	6.1	1.9	80.0	1.7	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
	H170A70B_5									
260	1.61									1.61

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
87	Stable
260	Stable
651	Erosive
868	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	260	cfs
Clear Water	No	
Total Incoming Sediment Load	1.612	cfs
Initial Chnl Sediment Capacity	1.432	cfs
Long-term Equilibrium Slope (ADWR)	0.0164	

Drop Structures

Design Slope	0.0164	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)
868	1.1	24.6	1.9	1.8	5.9	0.0151	-0.4	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1285
Channel Limit-Right Station (ft)	1365
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	544
Left Levee Volume (cu. Yd)	91
Right Levee Surface Area (sq. Yd)	522
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1066
Total Levee Volume (cu. Yd)	178

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)	83.8
Left Levee Fill Volume (cu. Yd)	3104
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)	50200
Right Levee Fill XS area (sq. ft)	75.4
Right Levee Fill Volume (cu. Yd)	2793
Total Levee Fill Surface Area (sq. ft)	100300
Total Levee Fill Volume (cu Yd)	5897

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)	8.0	
Structure Height (ft)	11.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.51	3.25
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,763	$ 276
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	1,000	ft	$ 255	$ 254,701	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,066	sq. Yd	$ -	$ -	1,066	sq. Yd	$ -	$ -	1,066	sq. Yd	$ 75.00	$ 79,950	
Adjacent Levee Fill	Fill	5,897	cu. Yd	$ 7.00	$ 41,279	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,066	sq. Yd	$ 63.00	$ 67,158	1,066	sq. Yd	$ -	$ -	1,066	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,763.35	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 363,138			Total	$ 50,000			Total	$ 209,913	
		Contingency Cost (25% of Construction Cost)			$ 90,785									
		Engineering Design Cost (5% of Construction Cost)			$ 18,157									
		Total Construction Cost			$ 472,080									
Wall Material Aesthetic Treatment Cost	Wall	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	178	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,066	sq. Yd	$ 63.00	$ 67,158	1,066	sq. Yd	$ -	$ -	1,066	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,897	cu. Yd	$ 7.00	$ 41,279	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 276.25	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 108,437			Total	$ 50,000			Total	$ 129,663	
		Contingency Cost (25% of Construction Cost)			$ 27,109									
		Engineering Design Cost (5% of Construction Cost)			$ 5,422									
		Total Construction Cost			$ 140,968									

Total Structure Aesthetic Trtmt Cost	$ 320,631

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	80	1.8	$100,000	$ 180,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	4.1		$ 410,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,141,993	Total Aesthetic Treatment Cost	$ 480,631	Total Right of Way Cost	$ 410,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	3

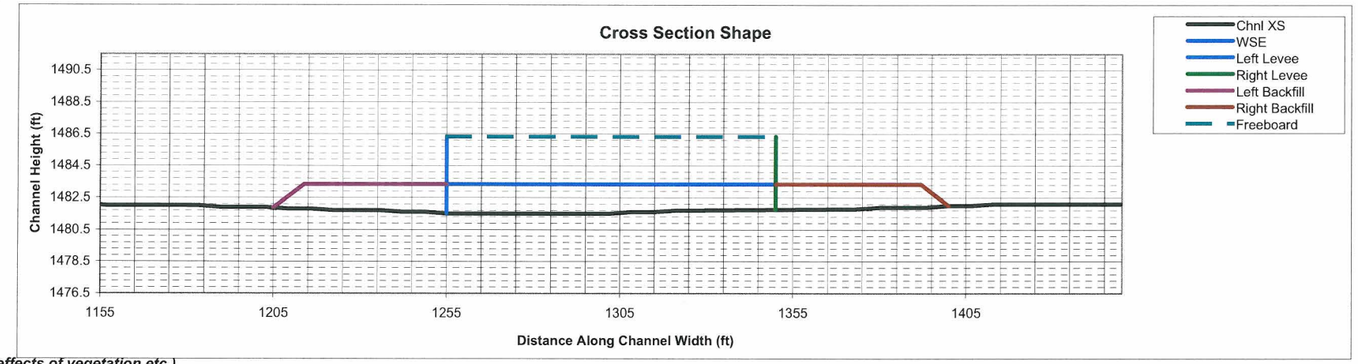
Longitudal Geometry

Length	1029.9	ft
Initial Channel Slope	0.0129	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0155	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1255	Right Levee Station (ft)	1350
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1255	Right Channel Limit Station (ft)	1350

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.73	0.27								
Flow into Channel	684	209								893

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
89	95.8	41.5	1481.5	1482.0	2.2	0.5	95.0	0.4	0.4	0.57
268	96.6	80.5	1481.5	1482.4	3.3	0.9	95.0	0.8	0.8	0.64
670	97.9	140.2	1481.5	1483.1	4.8	1.6	95.0	1.4	1.5	0.69
893	98.4	167.0	1481.5	1483.3	5.3	1.8	95.0	1.7	1.8	0.71

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
89	95.7	39.3	1481.5	1482.0	2.3	0.5	95.0	0.4	0.4	0.62
268	96.5	76.1	1481.5	1482.4	3.5	0.9	95.0	0.8	0.8	0.69
670	97.7	132.6	1481.5	1483.0	5.1	1.5	95.0	1.4	1.4	0.75
893	98.2	157.9	1481.5	1483.3	5.7	1.8	95.0	1.6	1.7	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
	H170A70B_4									
268	1.43									1.43

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel
Discharge (cfs)	**FHWA Max. Permissible Velocity Table**
89	Stable
268	Stable
670	Stable
893	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	268	cfs
Clear Water	No	
Total Incoming Sediment Load	1.432	cfs
Initial Chnl Sediment Capacity	1.104	cfs
Long-term Equilibrium Slope (ADWR)	0.0155	

Drop Structures

Design Slope	0.0155	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 + Zdeq + 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)	Zdeq (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
893	1.1	24.6	1.8	1.8	5.3	0.0129	-0.4	0.8	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	1030
Channel Limit-Left Station (ft)	1255
Channel Limit-Right Station (ft)	1350
Channel Width (ft)	95

Levee

Left Levee Length (ft)	1030
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	1030
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.6

Left Levee Surface Area (sq. Yd)	549
Left Levee Volume (cu. Yd)	92
Right Levee Surface Area (sq. Yd)	526
Right Levee Volume (cu. Yd)	88
Total Levee Surface Area (sq. Yd)	1075
Total Levee Volume (cu. Yd)	180

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)	51595
Left Levee Fill XS area (sq. ft)	76
Left Levee Fill Volume (cu. Yd)	2899
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)	51595
Right Levee Fill XS area (sq. ft)	69.7
Right Levee Fill Volume (cu. Yd)	2659
Total Levee Fill Surface Area (sq. ft)	103190
Total Levee Fill Volume (cu Yd)	5558

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)	7.3	
Structure Height (ft)	10.3	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	36.36	3.64
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,091	$ 309
Area per structure (sq. Yd)	11	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	1,030	ft	$ 228	$ 234,665	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,075	sq. Yd	$ -	$ -	1,075	sq. Yd	$ -	$ -	1,075	sq. Yd	$ 75.00	$ 80,625
Adjacent Levee Fill	Fill	5,558	cu. Yd	$ 7.00	$ 38,906	11,444	sq. Yd	$ 4.50	$ 51,500	11,444	sq. Yd	$ 11.67	$ 133,519
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,075	sq. Yd	$ 63.00	$ 67,725	1,075	sq. Yd	$ -	$ -	1,075	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 3,090.60	$ -	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 396
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 341,296			Total	$ 51,500			Total	$ 214,539
		Contingency Cost (25% of Construction Cost)			$ 85,324								
		Engineering Design Cost (5% of Construction Cost)			$ 17,065								
		Total Construction Cost			$ 443,685								
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,075	sq. Yd	$ 63.00	$ 67,725	1,075	sq. Yd	$ -	$ -	1,075	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,558	cu. Yd	$ 7.00	$ 38,906	11,444	sq. Yd	$ 4.50	$ 51,500	11,444	sq. Yd	$ 11.67	$ 133,519
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 309.40	$ -	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 40
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 106,631			Total	$ 51,500			Total	$ 133,558
		Contingency Cost (25% of Construction Cost)			$ 26,658								
		Engineering Design Cost (5% of Construction Cost)			$ 5,332								
		Total Construction Cost			$ 138,620								

Total Structure Aesthetic Trtmt Cost	$ 323,678

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	95	2.2	$100,000	$ 220,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	196	4.6		$ 460,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,169,725	Total Aesthetic Treatment Cost	$ 493,678	Total Right of Way Cost	$ 460,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	2

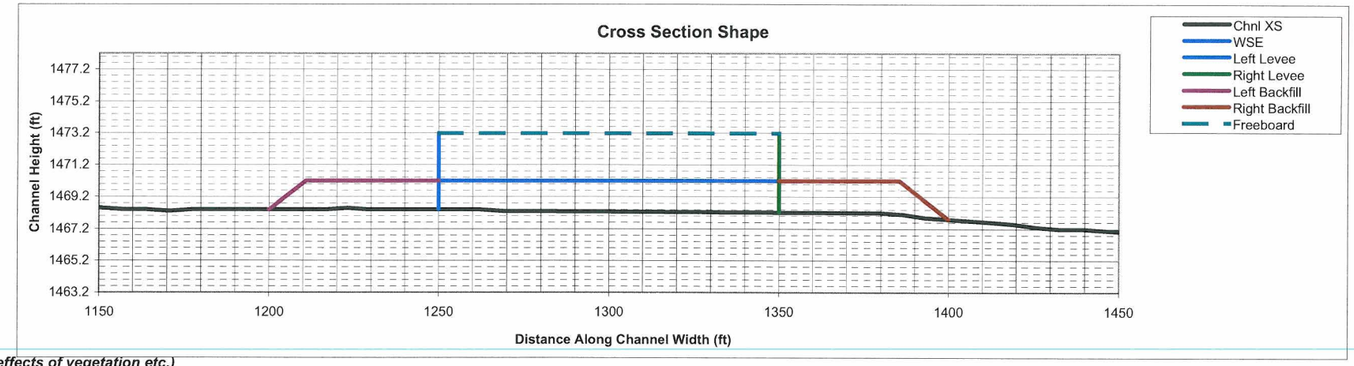
Longitudinal Geometry

Length	838.4	ft
Initial Channel Slope	0.0092	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0148	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1250	Right Levee Station (ft)	1350
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1250	Right Channel Limit Station (ft)	1350

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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.86	0.14								
Flow into Channel	811	107								918

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
92	100.9	47.7	1468.2	1468.8	1.9	0.6	100.0	0.5	0.5	0.49
275	101.8	92.5	1468.2	1469.2	3.0	1.0	100.0	0.9	0.9	0.55
689	103.2	161.1	1468.2	1469.9	4.3	1.7	100.0	1.6	1.6	0.59
918	103.8	191.9	1468.2	1470.2	4.8	2.0	100.0	1.8	1.9	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
92	100.8	41.3	1468.2	1468.7	2.2	0.5	100.0	0.4	0.4	0.61
275	101.5	80.1	1468.2	1469.1	3.4	0.9	100.0	0.8	0.8	0.68
689	102.7	139.4	1468.2	1469.7	4.9	1.5	100.0	1.4	1.4	0.74
918	103.3	166.0	1468.2	1469.9	5.5	1.7	100.0	1.6	1.7	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
	H170A70B_3	T170B10								
275	1.10	0.27								1.37

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
92	Stable
275	Stable
689	Stable
918	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	275	cfs
Clear Water	No	
Total Incoming Sediment Load	1.370	cfs
Initial Chnl Sediment Capacity	0.700	cfs
Long-term Equilibrium Slope (ADWR)	0.0148	

Drop Structures

Design Slope	0.0148	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)
918	1.1	24.6	2.0	1.9	4.8	0.0092	-0.5	0.6	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	838
Channel Limit-Left Station (ft)	1250
Channel Limit-Right Station (ft)	1350
Channel Width (ft)	100

Levee

Left Levee Length (ft)	838
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	838
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	447
Left Levee Volume (cu. Yd)	74
Right Levee Surface Area (sq. Yd)	466
Right Levee Volume (cu. Yd)	78
Total Levee Surface Area (sq. Yd)	913
Total Levee Volume (cu. Yd)	152

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)	42004
Left Levee Fill XS area (sq. ft)	79.8
Left Levee Fill Volume (cu. Yd)	2477
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)	42088
Right Levee Fill XS area (sq. ft)	86.5
Right Levee Fill Volume (cu. Yd)	2685
Total Levee Fill Surface Area (sq. ft)	84092
Total Levee Fill Volume (cu Yd)	5162

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)	7.2	
Structure Height (ft)	10.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	37.83	3.78
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,216	$ 321
Area per structure (sq. Yd)	11	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	838	ft	$ 255	$ 213,440	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	913	sq. Yd	$ -	$ -	913	sq. Yd	$ -	$ -	913	sq. Yd	$ 75.00	$ 68,475	
Adjacent Levee Fill	Fill	5,162	cu. Yd	$ 7.00	$ 36,134	9,311	sq. Yd	$ 4.50	$ 41,900	9,311	sq. Yd	$ 11.67	$ 108,630	
Wall Material Aesthetic Treatment Cost	Wall	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	913	sq. Yd	$ 63.00	$ 57,519	913	sq. Yd	$ -	$ -	913	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 3,215.55	$ -	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 417	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 307,093			Total	$ 41,900			Total	$ 177,521	
		Contingency Cost (25% of Construction Cost)			$ 76,773									
		Engineering Design Cost (5% of Construction Cost)			$ 15,355									
		Total Construction Cost			$ 399,221									
Wall Material Aesthetic Treatment Cost	Wall	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	152	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	913	sq. Yd	$ 63.00	$ 57,519	913	sq. Yd	$ -	$ -	913	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,162	cu. Yd	$ 7.00	$ 36,134	9,311	sq. Yd	$ 4.50	$ 41,900	9,311	sq. Yd	$ 11.67	$ 108,630	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 321.30	$ -	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 42	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 93,653			Total	$ 41,900			Total	$ 108,671	
		Contingency Cost (25% of Construction Cost)			$ 23,413									
		Engineering Design Cost (5% of Construction Cost)			$ 4,683									
		Total Construction Cost			$ 121,749									

Total Structure Aesthetic Trtmt Cost	$ 272,320

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	0.6	$100,000	$ 60,000
Channel	100	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	201	3.8		$ 380,000

Total Land Related Aes. Trtmt Cost	$ 130,000

Total Cost	$ 998,642	Total Aesthetic Treatment Cost	$ 402,320	Total Right of Way Cost	$ 380,000

Walled-Levee Corridor

Structure ID	H170A70B

HEC1 ID	70A70B

Cutline ID	1

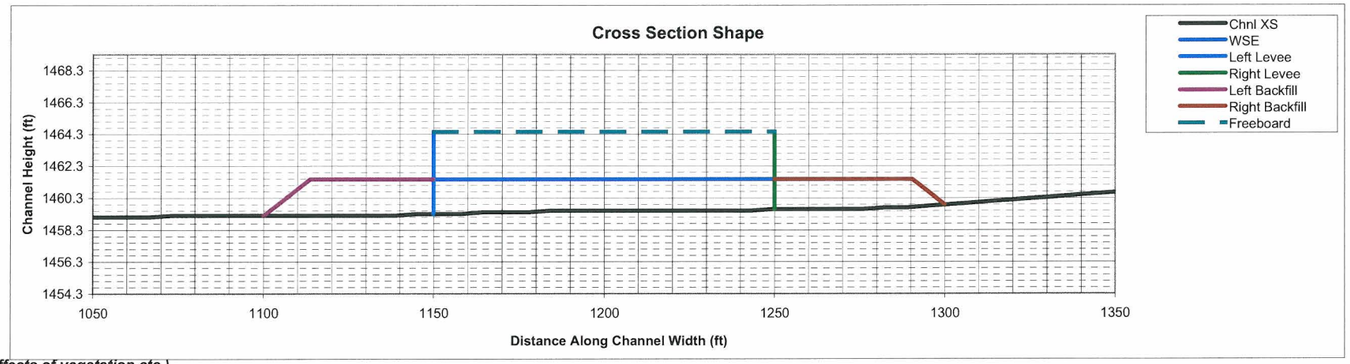
Longitudinal Geometry

Length	673.1	ft
Initial Channel Slope	0.0082	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0090	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1150	Right Levee Station (ft)	1250
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1150	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	C170B	C170A								TOTAL
HEC1 Peak-Flow	944	760								
Weighting Factor	0.95	0.05								
Flow into Channel	898	37								935

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
94	101.0	49.9	1459.3	1460.0	1.9	0.7	100.0	0.5	0.5	0.47
281	102.0	96.8	1459.3	1460.4	2.9	1.1	100.0	0.9	1.0	0.52
701	103.4	168.7	1459.3	1461.2	4.2	1.9	100.0	1.6	1.7	0.56
935	104.0	201.0	1459.3	1461.5	4.7	2.2	100.0	1.9	2.0	0.58

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
94	101.0	48.5	1459.3	1459.9	1.9	0.6	100.0	0.5	0.5	0.49
281	101.9	94.1	1459.3	1460.4	3.0	1.1	100.0	0.9	0.9	0.54
701	103.3	164.0	1459.3	1461.1	4.3	1.8	100.0	1.6	1.6	0.59
935	103.9	195.4	1459.3	1461.4	4.8	2.1	100.0	1.9	2.0	0.60

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
	H170A70B_2									
281	0.70									0.70

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
94	Stable
281	Stable
701	Stable
935	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	281	cfs
Clear Water	No	
Total Incoming Sediment Load	0.700	cfs
Initial Chnl Sediment Capacity	0.612	cfs
Long-term Equilibrium Slope (ADWR)	0.0090	

Drop Structures

Design Slope	0.0090	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)
935	1.1	24.6	2.2	2.0	4.7	0.0082	-0.5	0.6	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	673
Channel Limit-Left Station (ft)	1150
Channel Limit-Right Station (ft)	1250
Channel Width (ft)	100

Levee

Left Levee Length (ft)	673
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.2
Right Levee Length (ft)	673
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.9

Left Levee Surface Area (sq. Yd)	389
Left Levee Volume (cu. Yd)	65
Right Levee Surface Area (sq. Yd)	366
Right Levee Volume (cu. Yd)	61
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)	33790
Left Levee Fill XS area (sq. ft)	97.3
Left Levee Fill Volume (cu. Yd)	2425
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)	33722
Right Levee Fill XS area (sq. ft)	82.8
Right Levee Fill Volume (cu. Yd)	2064
Total Levee Fill Surface Area (sq. ft)	67512
Total Levee Fill Volume (cu Yd)	4489

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)	7.0	
Structure Height (ft)	10.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	37.09	3.71
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,153	$ 315
Area per structure (sq. Yd)	11	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	673	ft	$ 255	$ 171,414	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	4,489	cu. Yd	$ 7.00	$ 31,423	7,478	sq. Yd	$ 4.50	$ 33,650	7,478	sq. Yd	$ 11.67	$ 87,241	
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	0	EA	$ 3,152.65	$ -	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 417	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 250,402			Total	$ 33,650			Total	$ 144,282	
		Contingency Cost (25% of Construction Cost)			$ 62,601									
		Engineering Design Cost (5% of Construction Cost)			$ 12,520									
		Total Construction Cost			$ 325,523									
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	4,489	cu. Yd	$ 7.00	$ 31,423	7,478	sq. Yd	$ 4.50	$ 33,650	7,478	sq. Yd	$ 11.67	$ 87,241	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 315.35	$ -	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 42	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 78,988			Total	$ 33,650			Total	$ 87,282	
		Contingency Cost (25% of Construction Cost)			$ 19,747									
		Engineering Design Cost (5% of Construction Cost)			$ 3,949									
		Total Construction Cost			$ 102,684									
Total Structure Aesthetic Trtmt Cost	$ 223,617													

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	100	1.5	$100,000	$ 150,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	201	3.1		$ 310,000

Total Land Related Aes. Trtmt Cost	$ 110,000

Total Cost	$ 813,455

Total Aesthetic Treatment Cost	$ 333,617

Total Right of Way Cost	$ 310,000

Walled-Levee Corridor

Structure ID	H170B90B

HEC1 ID	70B90B

Cutline ID	3

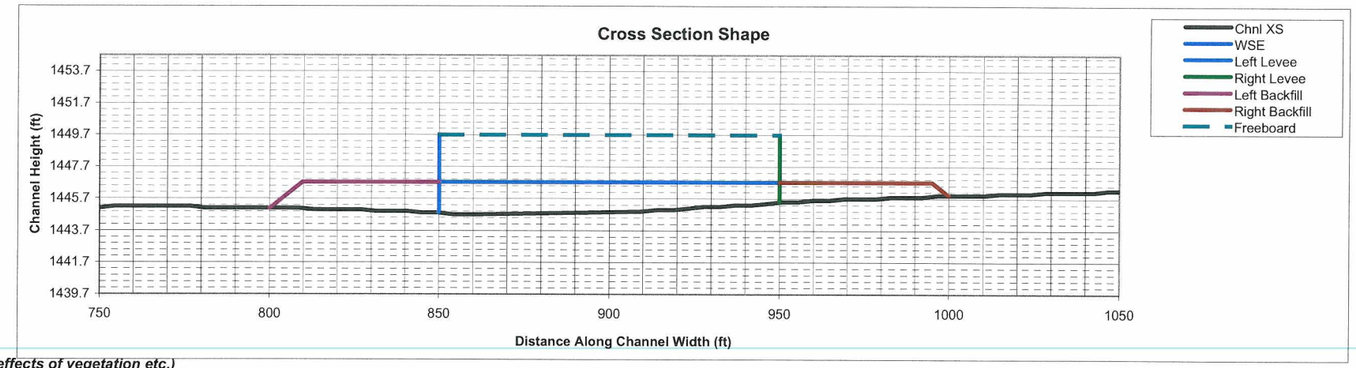
Longitudinal Geometry

Length	1389.0	ft
Initial Channel Slope	0.0157	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0071	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	850	Right Levee Station (ft)	950
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	850	Right Channel Limit Station (ft)	950

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	C190B	C170B								TOTAL
HEC1 Peak-Flow	1486	944								
Weighting Factor	0.21	0.79								
Flow into Channel	307	749								1056

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	95.6	43.2	1444.7	1445.4	2.4	0.7	95.0	0.5	0.5	0.64
317	101.3	85.5	1444.7	1445.8	3.7	1.1	100.0	0.8	0.9	0.71
792	102.6	148.9	1444.7	1446.4	5.3	1.7	100.0	1.5	1.5	0.77
1056	103.2	177.4	1444.7	1446.7	6.0	2.0	100.0	1.7	1.8	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
106	100.7	56.0	1444.7	1445.5	1.9	0.8	100.0	0.6	0.6	0.44
317	101.8	108.7	1444.7	1446.0	2.9	1.3	100.0	1.1	1.1	0.49
792	103.4	189.5	1444.7	1446.8	4.2	2.1	100.0	1.8	1.9	0.53
1056	104.1	225.9	1444.7	1447.2	4.7	2.5	100.0	2.2	2.3	0.55

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
	H170A70B_1									
317	0.61									0.61

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
106	Stable
317	Stable
792	Erosive
1056	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	317	cfs
Clear Water	No	
Total Incoming Sediment Load	0.612	cfs
Initial Chnl Sediment Capacity	1.840	cfs
Long-term Equilibrium Slope (ADWR)	0.0071	

Drop Structures

Design Slope	0.0071	ft/ft
Total Drop Needed	11.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	3.98	
Distance between Structures	349	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)
1056	1.1	24.6	2.0	1.8	6.0	0.0157	-0.4	1.0	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1389
Channel Limit-Left Station (ft)	850
Channel Limit-Right Station (ft)	950
Channel Width (ft)	100

Levee

Left Levee Length (ft)	1389
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1389
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.2

Left Levee Surface Area (sq. Yd)	756
Left Levee Volume (cu. Yd)	126
Right Levee Surface Area (sq. Yd)	648
Right Levee Volume (cu. Yd)	108
Total Levee Surface Area (sq. Yd)	1404
Total Levee Volume (cu. Yd)	234

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)	69586
Left Levee Fill XS area (sq. ft)	79.9
Left Levee Fill Volume (cu. Yd)	4110
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)	69586
Right Levee Fill XS area (sq. ft)	48.9
Right Levee Fill Volume (cu. Yd)	2516
Total Levee Fill Surface Area (sq. ft)	139172
Total Levee Fill Volume (cu Yd)	6626

Drop Structures

Structure Type (Riprap, Gabions, Soil cement, Concrete,None)	Gabions	
Structure Length (ft)	100	
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	3.98	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	38.34	3.83
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 3,259	$ 326
Area per structure (sq. Yd)	11	1
Total Area (cu. Yd)	44	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	1,389	ft	$ 228	$ 316,457	234	cu. Yd	$ -	$ -	234	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,404	sq. Yd	$ -	$ -	1,404	sq. Yd	$ -	$ -	1,404	sq. Yd	$ 75.00	$ 105,300
Adjacent Levee Fill	Fill	6,626	cu. Yd	$ 7.00	$ 46,382	15,433	sq. Yd	$ 4.50	$ 69,450	15,433	sq. Yd	$ 11.67	$ 180,056
Wall Material Aesthetic Treatment Cost	Wall	234	cu. Yd	$ -	$ -	234	cu. Yd	$ -	$ -	234	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,404	sq. Yd	$ 63.00	$ 88,452	1,404	sq. Yd	$ -	$ -	1,404	sq. Yd	$ -	$ -
Drop Structures	Gabions	4	EA	$ 3,258.90	$ 12,970	11	sq. Yd	$ -	$ -	11	sq. Yd	$ 37.50	$ 417
New Culvert Upgrade (4 - 3 x 10 RCB)		13,800	ft/sq.ft.	$ 15.00	$ 207,000				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 671,261			Total	$ 69,450			Total	$ 285,772
		Contingency Cost (25% of Construction Cost)			$ 167,815								
		Engineering Design Cost (5% of Construction Cost)			$ 33,563								
		Total Construction Cost			$ 872,639								
Wall Material Aesthetic Treatment Cost	Wall	234	cu. Yd	$ -	$ -	234	cu. Yd	$ -	$ -	234	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,404	sq. Yd	$ 63.00	$ 88,452	1,404	sq. Yd	$ -	$ -	1,404	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,626	cu. Yd	$ 7.00	$ 46,382	15,433	sq. Yd	$ 4.50	$ 69,450	15,433	sq. Yd	$ 11.67	$ 180,056
Drop Structures Aesthetic Trtmt. Cost	Gabions	4	EA	$ 325.55	$ 1,296	11	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 42
Other		0	ft/sq.ft.	$ -	$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 136,130			Total	$ 69,450			Total	$ 180,097
		Contingency Cost (25% of Construction Cost)			$ 34,032								
		Engineering Design Cost (5% of Construction Cost)			$ 6,806								
		Total Construction Cost			$ 176,969								

Total Structure Aesthetic Trtmt Cost	$ 426,516

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	100	3.2	$100,000	$ 320,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	201	6.4		$ 640,000

Total Land Related Aes. Trtmt Cost	$ 220,000

Total Cost	$ 1,867,862

Total Aesthetic Treatment Cost	$ 646,516

Total Right of Way Cost	$ 640,000

Walled-Levee Corridor

Structure ID	H170B90B

HEC1 ID	70B90B

Cutline ID	2

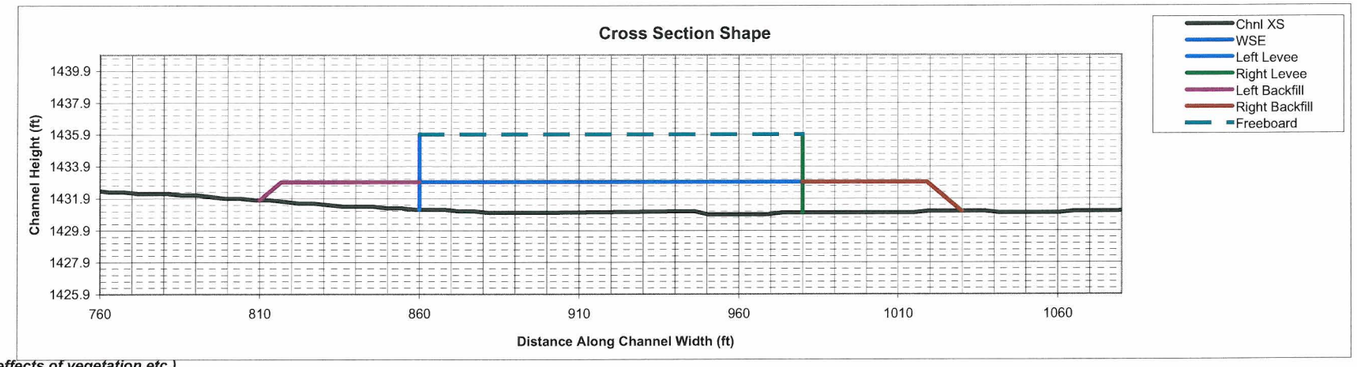
Longitudinal Geometry

Length	1082.5	ft
Initial Channel Slope	0.0113	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0145	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	860	Right Levee Station (ft)	980
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	860	Right Channel Limit Station (ft)	980

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	C190B	C170B								TOTAL
HEC1 Peak-Flow	1486	944								
Weighting Factor	0.49	0.51								
Flow into Channel	731	480								1211

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
121	120.8	56.9	1430.9	1431.5	2.1	0.6	120.0	0.5	0.5	0.55
363	121.7	110.2	1430.9	1431.9	3.3	1.0	120.0	0.9	0.9	0.61
908	123.1	191.9	1430.9	1432.6	4.7	1.7	120.0	1.6	1.6	0.66
1211	123.7	228.5	1430.9	1432.9	5.3	2.0	120.0	1.8	1.9	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
121	120.7	52.8	1430.9	1431.5	2.3	0.6	120.0	0.4	0.4	0.61
363	121.6	102.3	1430.9	1431.9	3.6	1.0	120.0	0.8	0.9	0.68
908	122.8	177.9	1430.9	1432.5	5.1	1.6	120.0	1.4	1.5	0.74
1211	123.4	211.8	1430.9	1432.8	5.7	1.9	120.0	1.7	1.8	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
	H170B90B_3									
363	1.84									1.84

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
121	Stable
363	Stable
908	Stable
1211	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	363	cfs
Clear Water	No	
Total Incoming Sediment Load	1.840	cfs
Initial Chnl Sediment Capacity	1.303	cfs
Long-term Equilibrium Slope (ADWR)	0.0145	

Drop Structures

Design Slope	0.0145	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)
1211	1.1	24.6	2.0	1.9	5.3	0.0113	-0.5	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1083
Channel Limit-Left Station (ft)	860
Channel Limit-Right Station (ft)	980
Channel Width (ft)	120

Levee

Left Levee Length (ft)	1083
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.7
Right Levee Length (ft)	1083
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.9

Left Levee Surface Area (sq. Yd)	566
Left Levee Volume (cu. Yd)	94
Right Levee Surface Area (sq. Yd)	590
Right Levee Volume (cu. Yd)	98
Total Levee Surface Area (sq. Yd)	1156
Total Levee Volume (cu. Yd)	192

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)	54233
Left Levee Fill XS area (sq. ft)	68.4
Left Levee Fill Volume (cu. Yd)	2744
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)	54342
Right Levee Fill XS area (sq. ft)	85.3
Right Levee Fill Volume (cu. Yd)	3421
Total Levee Fill Surface Area (sq. ft)	108575
Total Levee Fill Volume (cu Yd)	6165

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	120	
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)	47.12	4.71
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,005	$ 400
Area per structure (sq. Yd)	13	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	1,083	ft	$ 255	$ 275,842	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ 75.00	$ 86,700	
Adjacent Levee Fill	Fill	6,165	cu. Yd	$ 7.00	$ 43,155	12,033	sq. Yd	$ 4.50	$ 54,150	12,033	sq. Yd	$ 11.67	$ 140,389	
Wall Material Aesthetic Treatment Cost	Wall	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,156	sq. Yd	$ 63.00	$ 72,828	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 4,005.20	$ -	13	sq. Yd	$ -	$ -	13	sq. Yd	$ 37.50	$ 500	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 391,825			Total	$ 54,150			Total	$ 227,589	
		Contingency Cost (25% of Construction Cost)			$ 97,956									
		Engineering Design Cost (5% of Construction Cost)			$ 19,591									
		Total Construction Cost			$ 509,372									
Wall Material Aesthetic Treatment Cost	Wall	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,156	sq. Yd	$ 63.00	$ 72,828	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,165	cu. Yd	$ 7.00	$ 43,155	12,033	sq. Yd	$ 4.50	$ 54,150	12,033	sq. Yd	$ 11.67	$ 140,389	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 400.35	$ -	13	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 50	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 115,983			Total	$ 54,150			Total	$ 140,439	
		Contingency Cost (25% of Construction Cost)			$ 28,996									
		Engineering Design Cost (5% of Construction Cost)			$ 5,799									
		Total Construction Cost			$ 150,778									
Total Structure Aesthetic Trtmt Cost	$ 345,367													

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	120	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	221	5.4		$ 540,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,331,111	Total Aesthetic Treatment Cost	$ 515,367	Total Right of Way Cost	$ 540,000

Walled-Levee Corridor

Structure ID	H170B90B	HEC1 ID	70B90B	Cutline ID	1

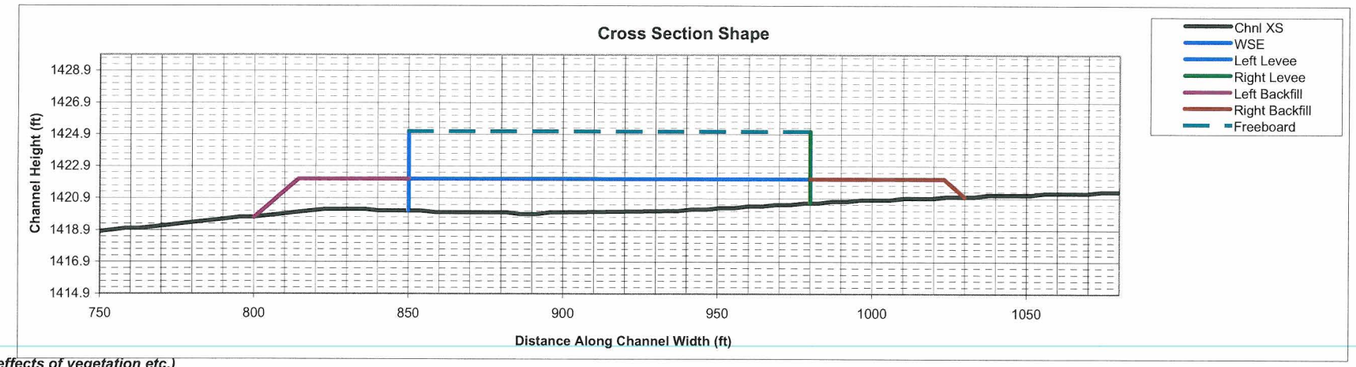
Longitudinal Geometry

Length	1379.9	ft
Initial Channel Slope	0.0105	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0118	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	850	Right Levee Station (ft)	980
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	850	Right Channel Limit Station (ft)	980

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	C190B	C170B								TOTAL
HEC1 Peak-Flow	1486	944								
Weighting Factor	0.75	0.25								
Flow into Channel	1112	238								1350

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
135	130.6	64.0	1419.9	1420.6	2.1	0.7	130.0	0.5	0.5	0.53
405	131.5	124.1	1419.9	1421.1	3.3	1.2	130.0	0.9	1.0	0.59
1013	132.9	215.9	1419.9	1421.8	4.7	1.9	130.0	1.6	1.7	0.64
1350	133.5	257.1	1419.9	1422.1	5.3	2.2	130.0	1.9	2.0	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
135	130.5	61.8	1419.9	1420.6	2.2	0.7	130.0	0.5	0.5	0.56
405	131.4	119.8	1419.9	1421.1	3.4	1.2	130.0	0.9	0.9	0.62
1013	132.8	208.4	1419.9	1421.7	4.9	1.8	130.0	1.6	1.6	0.68
1350	133.4	248.2	1419.9	1422.0	5.4	2.1	130.0	1.9	1.9	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
	H170B90B_2	T190B10								
405	1.30	0.27								1.58

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
135	Stable
405	Stable
1013	Stable
1350	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	405	cfs
Clear Water	No	
Total Incoming Sediment Load	1.577	cfs
Initial Chnl Sediment Capacity	1.339	cfs
Long-term Equilibrium Slope (ADWR)	0.0118	

Drop Structures

Design Slope	0.0118	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)
1350	1.1	24.6	2.2	2.0	5.3	0.0105	-0.5	0.7	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1380
Channel Limit-Left Station (ft)	850
Channel Limit-Right Station (ft)	980
Channel Width (ft)	130

Levee

Left Levee Length (ft)	1380
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	1380
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	767
Left Levee Volume (cu. Yd)	128
Right Levee Surface Area (sq. Yd)	690
Right Levee Volume (cu. Yd)	115
Total Levee Surface Area (sq. Yd)	1457
Total Levee Volume (cu. Yd)	243

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)	69268
Left Levee Fill XS area (sq. ft)	85
Left Levee Fill Volume (cu. Yd)	4344
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)	69130
Right Levee Fill XS area (sq. ft)	60.8
Right Levee Fill Volume (cu. Yd)	3108
Total Levee Fill Surface Area (sq. ft)	138398
Total Levee Fill Volume (cu Yd)	7452

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	130	
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)	51.09	5.11
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,343	$ 434
Area per structure (sq. Yd)	14	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	1,380	ft	$ 228	$ 314,406	243	cu. Yd	$ -	$ -	243	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,457	sq. Yd	$ -	$ -	1,457	sq. Yd	$ -	$ -	1,457	sq. Yd	$ 75.00	$ 109,275
Adjacent Levee Fill	Fill	7,452	cu. Yd	$ 7.00	$ 52,164	15,333	sq. Yd	$ 4.50	$ 69,000	15,333	sq. Yd	$ 11.67	$ 178,889
Wall Material Aesthetic Treatment Cost	Wall	243	cu. Yd	$ -	$ -	243	cu. Yd	$ -	$ -	243	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,457	sq. Yd	$ 63.00	$ 91,791	1,457	sq. Yd	$ -	$ -	1,457	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,342.65	$ -	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 542
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 458,361			Total	$ 69,000			Total	$ 288,706
		Contingency Cost (25% of Construction Cost)			$ 114,590								
		Engineering Design Cost (5% of Construction Cost)			$ 22,918								
		Total Construction Cost			$ 595,870								
Wall Material Aesthetic Treatment Cost	Wall	243	cu. Yd	$ -	$ -	243	cu. Yd	$ -	$ -	243	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,457	sq. Yd	$ 63.00	$ 91,791	1,457	sq. Yd	$ -	$ -	1,457	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,452	cu. Yd	$ 7.00	$ 52,164	15,333	sq. Yd	$ 4.50	$ 69,000	15,333	sq. Yd	$ 11.67	$ 178,889
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 434.35	$ -	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 54
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 143,955			Total	$ 69,000			Total	$ 178,943
		Contingency Cost (25% of Construction Cost)			$ 35,989								
		Engineering Design Cost (5% of Construction Cost)			$ 7,198								
		Total Construction Cost			$ 187,142								
Total Structure Aesthetic Trtmt Cost	$ 435,085												

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	130	4.1	$100,000	$ 410,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	231	7.3		$ 730,000

Total Land Related Aes. Trtmt Cost	$ 220,000

Total Cost	$ 1,683,575	Total Aesthetic Treatment Cost	$ 655,085	Total Right of Way Cost	$ 730,000

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 *                JUN  1998              *
 *             VERSION 4.1               *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
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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

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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 16
   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: FAN166.DAT
   8          ID
   9          ID   100-YEAR 6-HOUR MODEL
  10          ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
  11          ID             MODELED AREA = 2.2 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    S165    BASIN
  51          KM       Compute runoff from subbasin 165
  52          BA   0.616
  53          LG    0.30    0.35    4.55    0.35       3
  54          UI     121     477     809    1022     617     474     347     254     185     127
```

```
  55          UI      96      69      52      36      20      20      20      20       0       0
  56          ZW                C=FLOW
              *

  57          KK   RR165 STORAGE
  58          KM   PROPOSED DETENTION BASIN
  59          KM    ROUTE RUNOFF FROM S165 THROUGH PROPOSED DETENTION BASIN
  60          KM    STRUCTURE ID:RR165
  61          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft
  62          RS       1    STOR      -1
  63          SV     0.0     1.4    13.7    27.3    34.5    42.2    50.1    58.5    67.2    76.2
  64          SE     0.0     1.0     3.0     5.0     6.0     7.0     8.0     9.0    10.0    11.0
  65          SQ     0.0    16.3    55.4   104.1   127.5   156.5   179.7   201.7   220.8   250.8
  66          ZW                C=FLOW
              *

  67          KK  F1670A   ROUTE
  68          KM   PROPOSED CHANNEL
  69          KM    ROUTE OUTFLOW FROM RR165 TO C170A
  70          KM    Slope=(1670.0 - 1563.0) / 6056.0
  71          RS       4    FLOW      -1
  72          RC   0.045   0.045   0.045  6056.0   0.019   104.5
  73          RX     0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
  74          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  75          ZW                C=FLOW
              *

  76          KK   S170A   BASIN
  77          KM        Compute runoff from subbasin 170A
  78          BA   0.407
  79          LG    0.35    0.35    4.80    0.30       0
  80          UI     176     664     915     651     355     188      96      53      23      24
              *

  81          KK   C170A COMBINE
  82          KM        Combine runoff from S170A w/ routed outflow from Fan 16 detention basin
  83          HC       2
  84          ZW                C=FLOW
              *

  85          KK  70A70B   ROUTE
  86          KM   PROPOSED CHANNEL
  87          KM    ROUTE combined FLOW FROM C170A to C170B
  88          KM    Slope=(1563.0 - 1456.0) / 7426.0
  89          RS       5    FLOW      -1
  90          RC   0.045   0.045   0.045  7426.0   0.014   104.5
  91          RX     0.0     0.0     0.0     0.0    85.0    85.0    85.0    85.0
  92          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  93          ZW                C=FLOW
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  94          KK   S170B   BASIN
  95          KM        Compute runoff from subbasin 170B
  96          BA   0.498
  97          LG    0.35    0.35    4.45    0.37       0
  98          UI     107     419     718     822     666     418     265     167     105      65
  99          UI      39      21      21      22       0       0       0       0       0       0
              *

 100          KK   C170B COMBINE
 101          KM        Combine runoff from S170B with routed flow from C170A
 102          KM        This is the total flow at Sun Valley Parkway on the Fan 16 corridor.
 103          HC       2
 104          ZW                C=FLOW
              *

 105          KK  70B90B   ROUTE
 106          KM   PROPOSED CHANNEL
 107          KM    ROUTE combined FLOW FROM C170B to C190B
 108          KM    Slope=(1456.0 - 1410.0) / 3986.0
 109          RS       3    FLOW      -1
 110          RC   0.045   0.045   0.045  3986.0   0.012   104.5
 111          RX     0.0     0.0     0.0     0.0   120.0   120.0   120.0   120.0
 112          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 113          ZW                C=FLOW
              *

 114          KK   S170C   BASIN
 115          KM        Compute runoff from subbasin 170C
 116          BA   0.558
 117          LG    0.35    0.35    4.10    0.46       0
 118          UI     147     563     944     971     677     406     246     150      89      53
 119          UI      27      25       0       0       0       0       0       0       0       0
              *

 120          KK  70C90B   ROUTE
 121          KM    ROUTE runoff FROM S170C TO C190B
 122          KM    Slope=(1460 - 1410) / 4155
 123          RS       3    FLOW      -1
 124          RC   0.045   0.045   0.045    4155   0.012     104
 125          RX     0.0      20      80      84      99     103     163     183
 126          RY     104     101     101     100     100     101     101     104
              *

 127          KK   S190B   BASIN
 128          KM        Compute runoff from subbasin 190B
```

```
          129           BA   0.164
          130           LG    0.35    0.35    3.55    0.52       0
          131           UI     118     405     395     194      88      41      14      12       0       0
                        *
1                                          HEC-1 INPUT                                                  PAGE  4

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


          132           KK   C190B COMBINE
          133           KM        Combine runoff from S190B with routed flows from C170B & S170C
          134           KM        This is the total flow at the downstream end of the Fan 16 corridor.
          135           HC       3
          136           ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    50        S165
              V
              V
    57       RR165
              V
              V
    67      F1670A
              .
              .
    76            .       S170A
                  .          .
                  .          .
    81       C170A............
              V
              V
    85      70A70B
              .
              .
    94            .       S170B
                  .          .
                  .          .
   100       C170B............
              V
              V
   105      70B90B
              .
              .
   114           .       S170C
                 .          V
                 .          V
   120           .      70C90B
                 .          .
                 .          .
   127           .          .       S190B
                 .          .          .
                 .          .          .
   132       C190B.........................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   30NOV06  TIME  09:55:01  *
*                                      *
****************************************

****************************************
*                                      *
*    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 16

 SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
 JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
 MODELER: TED LEHMAN
 FILENAME: FAN166.DAT

 100-YEAR 6-HOUR MODEL
 EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
         MODELED AREA = 2.2 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     .00     .00     .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    *     S165   *       BASIN
           *            *
           **************
                         Compute runoff from subbasin 165

             SUBBASIN RUNOFF DATA

  52 BA        SUBBASIN CHARACTERISTICS
                     TAREA         .62  SUBBASIN AREA

  53 LG        GREEN AND AMPT LOSS RATE
                     STRTL         .30  STARTING LOSS
                       DTH         .35  MOISTURE DEFICIT
                      PSIF        4.55  WETTING FRONT SUCTION
                     XKSAT         .35  HYDRAULIC CONDUCTIVITY
                     RTIMP        3.00  PERCENT IMPERVIOUS AREA

  51 UI        INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                   121.0     477.0     809.0    1022.0     617.0     474.0     347.0     254.0     185.0     127.0
                    96.0      69.0      52.0      36.0      20.0      20.0      20.0      20.0
                                                                        ***

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

                      HYDROGRAPH AT STATION      S165
                     TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.73, TOTAL EXCESS =    1.47

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                           (CFS)
 +    1072.      4.17                    97.         24.          8.           4.
                         (INCHES)      1.467       1.468       1.468        1.468
                          (AC-FT)        48.         48.         48.          48.

                           CUMULATIVE AREA =      .62 SQ MI


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

                      HYDROGRAPH AT STATION      S165
                     TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.72, TOTAL EXCESS =    1.46

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                           (CFS)
 +    1064.      4.17                    96.         24.          8.           3.
                         (INCHES)      1.455       1.456       1.456        1.456
                          (AC-FT)        48.         48.         48.          48.

                           CUMULATIVE AREA =      .62 SQ MI


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

                      HYDROGRAPH AT STATION      S165
                     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)
 +     595.      4.17                    75.         19.          6.           3.
                         (INCHES)      1.131       1.132       1.132        1.132
                          (AC-FT)        37.         37.         37.          37.

                           CUMULATIVE AREA =      .62 SQ MI


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

                      HYDROGRAPH AT STATION      S165
                     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)
 +     414.      4.17                    55.         14.          5.           2.
                         (INCHES)       .831        .832        .832         .832
                          (AC-FT)        27.         27.         27.          27.

                           CUMULATIVE AREA =      .62 SQ MI


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

                      HYDROGRAPH AT STATION      S165
                     TRANSPOSITION AREA     90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.16, TOTAL EXCESS =     .44

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                           (CFS)
 +     213.      4.17                    29.          7.          2.           1.
                         (INCHES)       .434        .435        .435         .435
                          (AC-FT)        14.         14.         14.          14.

                           CUMULATIVE AREA =      .62 SQ MI

    -----DSS---ZOPEN:  Existing File Opened,  File: FAN166.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                           INTERPOLATED HYDROGRAPH AT      S165

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                           (CFS)
 +    1008.      4.17                    94.         23.          8.           3.
                         (INCHES)      1.416       1.417       1.417        1.417
                          (AC-FT)        47.         47.         47.          47.

                           CUMULATIVE AREA =      .62 SQ MI


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


           **************
           *            *
  57 KK    *    RR165   *      STORAGE
           *            *
           **************
                          PROPOSED DETENTION BASIN
                           ROUTE RUNOFF FROM S165 THROUGH PROPOSED DETENTION BASIN
                           STRUCTURE ID:RR165
                           OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft

             HYDROGRAPH ROUTING DATA

  62 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

  63 SV          STORAGE          .0       1.4      13.7      27.3      34.5      42.2      50.1      58.5      67.2      76.2

  64 SE        ELEVATION         .00      1.00      3.00      5.00      6.00      7.00      8.00      9.00     10.00     11.00

  65 SQ        DISCHARGE          0.       16.       55.      104.      128.      157.      180.      202.      221.      251.

                                                                        ***

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

                      HYDROGRAPH AT STATION     RR165
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                           (CFS)
 +     140.      4.75                    81.         24.          8.           4.
                         (INCHES)      1.227       1.468       1.468        1.468
                          (AC-FT)        40.         48.         48.          48.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
 +  (AC-FT)      (HR)
       38.       4.75                    21.          6.          2.           1.
```

```
  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
       6.43     4.75                    4.03         1.24          .41           .18

                              CUMULATIVE AREA =      .62 SQ MI


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

                              HYDROGRAPH AT STATION     RR165
                             TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                               (CFS)
+     139.      4.75                     81.          24.           8.            3.
                             (INCHES)   1.218        1.456        1.456         1.456
                              (AC-FT)    40.          48.          48.           48.

  PEAK STORAGE  TIME                               MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
       37.      4.75                     21.           6.           2.            1.

  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
       6.39     4.75                    4.00         1.23          .41           .18

                              CUMULATIVE AREA =      .62 SQ MI


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

                              HYDROGRAPH AT STATION     RR165
                             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.      4.83                     63.          19.           6.            3.
                             (INCHES)    .955        1.132        1.132         1.132
                              (AC-FT)    31.          37.          37.           37.

  PEAK STORAGE  TIME                               MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
       28.      4.83                     16.           4.           1.            1.

  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
       5.14     4.83                    3.25          .99          .33           .14

                              CUMULATIVE AREA =      .62 SQ MI


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

                              HYDROGRAPH AT STATION     RR165
                             TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                               (CFS)
+      79.      4.83                     47.          14.           5.            2.
                             (INCHES)    .716         .832         .832          .832
                              (AC-FT)    24.          27.          27.           27.

  PEAK STORAGE  TIME                               MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
       20.      4.83                     11.           3.           1.            0.

  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
       3.96     4.83                    2.55          .75          .25           .11

                              CUMULATIVE AREA =      .62 SQ MI


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

                              HYDROGRAPH AT STATION     RR165
                             TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                               (CFS)
+      43.      4.83                     27.           7.           2.            1.
                             (INCHES)    .401         .435         .435          .435
                              (AC-FT)    13.          14.          14.           14.

  PEAK STORAGE  TIME                               MAXIMUM AVERAGE STORAGE
```

```
                                        6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
       10.      4.83                      5.           1.           0.            0.

  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
       2.38     4.83                    1.52          .41          .14           .06

                              CUMULATIVE AREA =      .62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***


                              INTERPOLATED HYDROGRAPH AT     RR165

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                               (CFS)
+     135.      4.75                     79.          23.           8.            3.
                             (INCHES)   1.186        1.417        1.417         1.417
                              (AC-FT)    39.          47.          47.           47.

                              CUMULATIVE AREA =      .62 SQ MI

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

              **************
              *            *
 67 KK        *   F1670A   *        ROUTE
              *            *
              **************
                               PROPOSED CHANNEL
                                ROUTE OUTFLOW FROM RR165 TO C170A
                                Slope=(1670.0 - 1563.0) / 6056.0

            HYDROGRAPH ROUTING DATA

 71 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

 72 RC         NORMAL DEPTH CHANNEL
                       ANL       .045  LEFT OVERBANK N-VALUE
                      ANCH       .045  MAIN CHANNEL N-VALUE
                       ANR       .045  RIGHT OVERBANK N-VALUE
                     RLNTH      6056.  REACH LENGTH
                       SEL      .0190  ENERGY SLOPE
                     ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                      --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 74 RY       ELEVATION  104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 73 RX       DISTANCE      .00       .00       .00       .00     60.00     60.00     60.00     60.00

                                                         ***

                                       COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE       .00      1.98      3.95      5.93      7.90      9.88     11.85     13.83     15.80     17.78
            OUTFLOW       .00     24.76     78.41    153.72    247.64    358.27    484.25    624.50    778.17    944.54
          ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

            STORAGE     19.76     21.73     23.71     25.68     27.66     29.63     31.61     33.59     35.56     37.54
            OUTFLOW   1123.01   1313.02   1514.12   1725.87   1947.89   2179.83   2421.36   2672.20   2932.05   3200.68
          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      624. TO      3201.
                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    F1670A
                             TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                               (CFS)
+     137.      5.17                     80.          24.           8.            4.
                             (INCHES)   1.204        1.468        1.468         1.468
                              (AC-FT)    40.          48.          48.           48.
```

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    PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         1.       5.08               1.           0.           0.           0.

    PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.66      5.17           100.46       100.16       100.05       100.02

                       CUMULATIVE AREA =       .62 SQ MI


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

                        HYDROGRAPH AT STATION    F1670A
                        TRANSPOSITION AREA       .5 SQ MI

    PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +      136.      5.17                79.          24.           8.           3.
                         (INCHES)    1.195        1.456        1.456        1.456
                         (AC-FT)       39.          48.          48.          48.

    PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         1.       5.08               1.           0.           0.           0.

    PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.66      5.17           100.46       100.15       100.05       100.02

                       CUMULATIVE AREA =       .62 SQ MI


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

                        HYDROGRAPH AT STATION    F1670A
                        TRANSPOSITION AREA      2.8 SQ MI

    PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +      106.      5.25                62.          19.           6.           3.
                         (INCHES)     .935        1.132        1.132        1.132
                         (AC-FT)       31.          37.          37.          37.

    PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         1.       5.17               1.           0.           0.           0.

    PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.56      5.25           100.40       100.13       100.04       100.02

                       CUMULATIVE AREA =       .62 SQ MI


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

                        HYDROGRAPH AT STATION    F1670A
                        TRANSPOSITION AREA     16.0 SQ MI

    PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +       76.      5.42                46.          14.           5.           2.
                         (INCHES)     .699         .832         .832         .832
                         (AC-FT)       23.          27.          27.          27.

    PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         1.       5.42               1.           0.           0.           0.

    PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.47      5.42           100.33       100.10       100.03       100.01

                       CUMULATIVE AREA =       .62 SQ MI


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

                        HYDROGRAPH AT STATION    F1670A
                        TRANSPOSITION AREA     90.0 SQ MI

    PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +       42.      5.42                26.           7.           2.           1.
                         (INCHES)     .393         .435         .435         .435
                         (AC-FT)       13.          14.          14.          14.

    PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         1.       5.42               0.           0.           0.           0.

    PEAK STAGE     TIME                         MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      100.31      5.42           100.23       100.06       100.02       100.01

                       CUMULATIVE AREA =       .62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***


                       INTERPOLATED HYDROGRAPH AT    F1670A

    PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +      132.      5.17                77.          23.           8.           3.
                         (INCHES)    1.163        1.417        1.417        1.417
                         (AC-FT)       38.          47.          47.          47.

                       CUMULATIVE AREA =       .62 SQ MI


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

              **************
              *            *
   76 KK      *   S170A    *         BASIN
              *            *
              **************
                                 Compute runoff from subbasin 170A

                   SUBBASIN RUNOFF DATA

   78 BA             SUBBASIN CHARACTERISTICS
                           TAREA          .41  SUBBASIN AREA

   79 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

   77 UI             INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                          176.0     664.0     915.0     651.0     355.0     188.0      96.0      53.0      23.0      24.0
                                                                   ***

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

                        HYDROGRAPH AT STATION    S170A
                        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)
 +      957.      4.08                64.          16.           5.           2.
                         (INCHES)    1.454        1.454        1.454        1.454
                         (AC-FT)       32.          32.          32.          32.

                       CUMULATIVE AREA =       .41 SQ MI


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

                        HYDROGRAPH AT STATION    S170A
                        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)
```

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+      951.       4.08                    63.          16.          5.          2.
                                 (INCHES)      1.442        1.442        1.442        1.442
                                 (AC-FT)         31.          31.          31.          31.

                                CUMULATIVE AREA =      .41 SQ MI


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

                              HYDROGRAPH AT STATION     S170A
                             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)
+      483.       4.08                    49.          12.          4.          2.
                                 (INCHES)      1.128        1.128        1.128        1.128
                                 (AC-FT)         24.          24.          24.          24.

                                CUMULATIVE AREA =      .41 SQ MI


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

                              HYDROGRAPH AT STATION     S170A
                             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)
+      338.       4.08                    36.          9.           3.          1.
                                 (INCHES)       .827         .827         .827         .827
                                 (AC-FT)         18.          18.          18.          18.

                                CUMULATIVE AREA =      .41 SQ MI


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

                              HYDROGRAPH AT STATION     S170A
                             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)
+      180.       4.08                    18.          5.           2.          1.
                                 (INCHES)       .421         .421         .421         .421
                                 (AC-FT)          9.           9.           9.           9.

                                CUMULATIVE AREA =      .41 SQ MI


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


                           INTERPOLATED HYDROGRAPH AT     S170A

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      952.       4.08                    63.          16.          5.          2.
                                 (INCHES)      1.444        1.444        1.444        1.444
                                 (AC-FT)         31.          31.          31.          31.

                                CUMULATIVE AREA =      .41 SQ MI



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               ***************
               *             *
  81 KK        *     C170A   *      COMBINE
               *             *
               ***************
                              Combine runoff from S170A w/ routed outflow from Fan 16 detention basin

  83 HC             HYDROGRAPH COMBINATION
                         ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                              HYDROGRAPH AT STATION     C170A
                             TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
```

```
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      960.       4.08                   139.          40.          13.          6.
                                 (INCHES)      1.260        1.463        1.463        1.463
                                 (AC-FT)         69.          80.          80.          80.

                                CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION     C170A
                             TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      954.       4.08                   137.          40.          13.          6.
                                 (INCHES)      1.250        1.450        1.450        1.450
                                 (AC-FT)         68.          79.          79.          79.

                                CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION     C170A
                             TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      486.       4.08                   107.          31.          10.          4.
                                 (INCHES)       .976        1.131        1.131        1.131
                                 (AC-FT)         53.          62.          62.          62.

                                CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION     C170A
                             TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      342.       4.08                    79.          23.          8.          3.
                                 (INCHES)       .721         .830         .830         .830
                                 (AC-FT)         39.          45.          45.          45.

                                CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION     C170A
                             TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      183.       4.08                    43.          12.          4.          2.
                                 (INCHES)       .391         .429         .429         .429
                                 (AC-FT)         21.          23.          23.          23.

                                CUMULATIVE AREA =     1.02 SQ MI


 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                           INTERPOLATED HYDROGRAPH AT     C170A

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+      760.       4.08                   125.          36.          12.          5.
                                 (INCHES)      1.135        1.317        1.317        1.317
                                 (AC-FT)         62.          72.          72.          72.

                                CUMULATIVE AREA =     1.02 SQ MI
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
 85 KK     *   70A70B   *        ROUTE
           *            *
           **************
                        PROPOSED CHANNEL
                         ROUTE combined FLOW FROM C170A to C170B
                         Slope=(1563.0 - 1456.0) / 7426.0

             HYDROGRAPH ROUTING DATA

 89 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

 90 RC         NORMAL DEPTH CHANNEL
                       ANL       .045  LEFT OVERBANK N-VALUE
                      ANCH       .045  MAIN CHANNEL N-VALUE
                       ANR       .045  RIGHT OVERBANK N-VALUE
                     RLNTH      7426.  REACH LENGTH
                       SEL      .0140  ENERGY SLOPE
                     ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 92 RY         ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 91 RX         DISTANCE       .00       .00       .00       .00     85.00     85.00     85.00     85.00

                                                               ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE        .00      3.43      6.86     10.30     13.73     17.16     20.59     24.02     27.46     30.89
              OUTFLOW        .00     30.14     95.50    187.36    302.07    437.34    591.56    763.46    952.02   1156.41
            ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

              STORAGE      34.32     37.75     41.18     44.62     48.05     51.48     54.91     58.34     61.77     65.21
              OUTFLOW    1375.91   1609.88   1857.77   2119.09   2393.39   2680.26   2979.33   3290.25   3612.70   3946.39
            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      952. TO     3946.
                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   70A70B
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     714.      4.33                 134.           40.           13.            6.
                        (INCHES)    1.214         1.463         1.463         1.463
                         (AC-FT)      66.           80.           80.           80.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        5.      4.33                   2.            1.            0.            0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
     101.59     4.33               100.53        100.19        100.06        100.03

                      CUMULATIVE AREA =     1.02 SQ MI

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

                    HYDROGRAPH AT STATION   70A70B
                  TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     706.      4.33                 132.           40.           13.            6.
                        (INCHES)    1.204         1.450         1.450         1.450
                         (AC-FT)      66.           79.           79.           79.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        5.      4.33                   2.            1.            0.            0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
     101.58     4.33               100.53        100.18        100.06        100.03

                      CUMULATIVE AREA =     1.02 SQ MI

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

                    HYDROGRAPH AT STATION   70A70B
                  TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     403.      4.42                 103.           31.           10.            4.
                        (INCHES)     .934         1.131         1.131         1.131
                         (AC-FT)      51.           62.           62.           62.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        3.      4.42                   1.            0.            0.            0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
     101.12     4.42               100.46        100.16        100.05        100.02

                      CUMULATIVE AREA =     1.02 SQ MI

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

                    HYDROGRAPH AT STATION   70A70B
                  TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     270.      4.50                  75.           23.            8.            3.
                        (INCHES)     .684          .830          .830          .830
                         (AC-FT)      37.           45.           45.           45.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        3.      4.50                   1.            0.            0.            0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
     100.88     4.50               100.38        100.13        100.04        100.02

                      CUMULATIVE AREA =     1.02 SQ MI

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

                    HYDROGRAPH AT STATION   70A70B
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     125.      4.67                  41.           12.            4.            2.
                        (INCHES)     .369          .429          .429          .429
                         (AC-FT)      20.           23.           23.           23.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        2.      4.67                   1.            0.            0.            0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
     100.55     4.67               100.27        100.08        100.03        100.01

                      CUMULATIVE AREA =     1.02 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/08JAN1999/5MIN//
     ***            ***            ***            ***            ***


                      INTERPOLATED HYDROGRAPH AT   70A70B

  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                     6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+     567.      4.42                 120.           36.           12.            5.
                        (INCHES)    1.092         1.317         1.317         1.317
                         (AC-FT)      60.           72.           72.           72.
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                    CUMULATIVE AREA =     1.02 SQ MI


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


          **************
          *            *
 94 KK    *     S170B  *        BASIN
          *            *
          **************
                          Compute runoff from subbasin 170B

                SUBBASIN RUNOFF DATA

 96 BA            SUBBASIN CHARACTERISTICS
                       TAREA         .50  SUBBASIN AREA

 97 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

 95 UI            INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                      107.0     419.0     718.0     822.0     666.0     418.0     265.0     167.0     105.0      65.0
                       39.0      21.0      21.0      22.0
                                                                 ***
     ***              ***               ***               ***              ***

                        HYDROGRAPH AT STATION    S170B
                       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)
+     929.       4.17                 73.         18.          6.          3.
                (INCHES)            1.362       1.362       1.362       1.362
                 (AC-FT)             36.         36.         36.         36.

                CUMULATIVE AREA =     .50 SQ MI

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

                        HYDROGRAPH AT STATION    S170B
                       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)
+     922.       4.17                 72.         18.          6.          3.
                (INCHES)            1.349       1.349       1.349       1.349
                 (AC-FT)             36.         36.         36.         36.

                CUMULATIVE AREA =     .50 SQ MI

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

                        HYDROGRAPH AT STATION    S170B
                       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)
+     494.       4.17                 54.         14.          5.          2.
                (INCHES)            1.015       1.015       1.015       1.015
                 (AC-FT)             27.         27.         27.         27.

                CUMULATIVE AREA =     .50 SQ MI

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

                        HYDROGRAPH AT STATION    S170B
                       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)
+     337.       4.17                 38.         10.          3.          1.
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                (INCHES)      .713        .713        .713        .713
                 (AC-FT)       19.         19.         19.         19.

                CUMULATIVE AREA =     .50 SQ MI

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

                        HYDROGRAPH AT STATION    S170B
                       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)
+     162.       4.17                 17.          4.          1.          1.
                (INCHES)            .324        .324        .324        .324
                 (AC-FT)             9.          9.          9.          9.

                CUMULATIVE AREA =     .50 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT    S170B

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                   (CFS)
+     922.       4.17                 72.         18.          6.          3.
                (INCHES)            1.349       1.349       1.349       1.349
                 (AC-FT)             36.         36.         36.         36.

                CUMULATIVE AREA =     .50 SQ MI


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


          **************
          *            *
100 KK    *     C170B  *      COMBINE
          *            *
          **************
                          Combine runoff from S170B with routed flow from C170A
                          This is the total flow at Sun Valley Parkway on the Fan 16 corridor.

103 HC           HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                 ***
     ***              ***               ***               ***              ***

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                   (CFS)
+    1285.       4.33                204.         58.         19.          8.
                (INCHES)            1.244       1.430       1.430       1.430
                 (AC-FT)            101.        116.        116.        116.

                CUMULATIVE AREA =    1.52 SQ MI

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

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                   (CFS)
+    1273.       4.33                202.         58.         19.          8.
                (INCHES)            1.233       1.417       1.417       1.417
                 (AC-FT)            100.        115.        115.        115.

                CUMULATIVE AREA =    1.52 SQ MI

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

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                   (CFS)
+     764.       4.33                154.         45.         15.          6.
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                    (INCHES)       .944        1.093        1.093        1.093
                    (AC-FT)         77.          89.          89.          89.

                    CUMULATIVE AREA =     1.52 SQ MI


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

                    HYDROGRAPH AT STATION     C170B
                   TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      483.      4.42                111.          32.          11.           5.
                    (INCHES)       .679         .792         .792         .792
                    (AC-FT)         55.          64.          64.          64.

                    CUMULATIVE AREA =     1.52 SQ MI


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

                    HYDROGRAPH AT STATION     C170B
                   TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      181.      4.50                 56.          16.           5.           2.
                    (INCHES)       .343         .395         .395         .395
                    (AC-FT)         28.          32.          32.          32.

                    CUMULATIVE AREA =     1.52 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                    INTERPOLATED HYDROGRAPH AT     C170B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      944.      4.33                171.          49.          16.           7.
                    (INCHES)      1.046        1.208        1.208        1.208
                    (AC-FT)         85.          98.          98.          98.

                    CUMULATIVE AREA =     1.52 SQ MI


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


            **************
            *            *
 105 KK     *    70B90B  *        ROUTE
            *            *
            **************
                         PROPOSED CHANNEL
                          ROUTE combined FLOW FROM C170B to C190B
                          Slope=(1456.0 - 1410.0) / 3986.0

                    HYDROGRAPH ROUTING DATA

 109 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

 110 RC           NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH       3986.  REACH LENGTH
                          SEL       .0120  ENERGY SLOPE
                        ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                           --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 112 RY         ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 111 RX         DISTANCE        .00       .00       .00       .00    120.00    120.00    120.00    120.00

                                                  ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                    STORAGE       .00      2.60      5.20      7.80     10.40     13.00     15.60     18.20     20.81     23.41
                    OUTFLOW       .00     39.41    124.95    245.28    395.66    573.16    775.67   1001.60   1249.63   1518.71
                  ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

                    STORAGE     26.01     28.61     31.21     33.81     36.41     39.01     41.61     44.21     46.81     49.41
                    OUTFLOW   1807.91   2116.43   2443.58   2788.73   3151.30   3530.80   3926.75   4338.72   4766.31   5209.14
                  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     1250. TO     5209.
                 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   70B90B
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+     1220.      4.42                200.          58.          19.           8.
                    (INCHES)      1.223        1.430        1.430        1.430
                    (AC-FT)         99.         116.         116.         116.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        7.      4.42                  2.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.87     4.42              100.55       100.19       100.06       100.03

                    CUMULATIVE AREA =     1.52 SQ MI


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

                    HYDROGRAPH AT STATION   70B90B
                   TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+     1207.      4.42                198.          58.          19.           8.
                    (INCHES)      1.212        1.417        1.417        1.417
                    (AC-FT)         98.         115.         115.         115.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        7.      4.42                  2.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.85     4.42              100.55       100.19       100.06       100.03

                    CUMULATIVE AREA =     1.52 SQ MI


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

                    HYDROGRAPH AT STATION   70B90B
                   TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      717.      4.50                151.          45.          15.           6.
                    (INCHES)       .924        1.093        1.093        1.093
                    (AC-FT)         75.          89.          89.          89.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+  (AC-FT)       (HR)
        5.      4.50                  2.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR         24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     101.35     4.50              100.47       100.16       100.05       100.02

                    CUMULATIVE AREA =     1.52 SQ MI


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

                    HYDROGRAPH AT STATION   70B90B
                   TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
```

```
                                 (CFS)
+     451.      4.58                         108.          32.          11.           5.
                               (INCHES)      .663         .792         .792         .792
                               (AC-FT)        54.          64.          64.          64.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR        72-HR      166.58-HR
+    (AC-FT)     (HR)
         4.      4.58                    1.           0.           0.           0.

   PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR        72-HR      166.58-HR
+    (FEET)      (HR)
      101.02     4.58               100.39       100.13       100.04       100.02

                              CUMULATIVE AREA =     1.52 SQ MI


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

                               HYDROGRAPH AT STATION    70B90B
                             TRANSPOSITION AREA       90.0 SQ MI

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+     171.       4.75                         55.          16.           5.           2.
                               (INCHES)      .333         .395         .395         .395
                               (AC-FT)        27.          32.          32.          32.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR        72-HR      166.58-HR
+    (AC-FT)     (HR)
         2.      4.75                    1.           0.           0.           0.

   PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR        72-HR      166.58-HR
+    (FEET)      (HR)
      100.56     4.75               100.26       100.08       100.03       100.01

                              CUMULATIVE AREA =     1.52 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/08JAN1999/5MIN//
          ***           ***           ***           ***           ***


                             INTERPOLATED HYDROGRAPH AT    70B90B

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+     865.       4.42                        168.          49.          16.           7.
                               (INCHES)     1.026        1.208        1.208        1.208
                               (AC-FT)        83.          98.          98.          98.

                              CUMULATIVE AREA =     1.52 SQ MI


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


               **************
               *            *
 114 KK        *    S170C   *        BASIN
               *            *
               **************
                                    Compute runoff from subbasin 170C

                 SUBBASIN RUNOFF DATA

 116 BA          SUBBASIN CHARACTERISTICS
                       TAREA          .56  SUBBASIN AREA

 117 LG          GREEN AND AMPT LOSS RATE
                       STRTL          .35  STARTING LOSS
                         DTH          .35  MOISTURE DEFICIT
                        PSIF         4.10  WETTING FRONT SUCTION
                       XKSAT          .46  HYDRAULIC CONDUCTIVITY
                       RTIMP          .00  PERCENT IMPERVIOUS AREA

 115 UI          INPUT UNITGRAPH,  12 ORDINATES,  VOLUME =  .99
                   147.0     563.0     944.0     971.0     677.0     406.0     246.0     150.0      89.0      53.0
                    27.0      25.0
                                                                              ***

          ***           ***           ***           ***           ***
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                               HYDROGRAPH AT STATION     S170C
                             TRANSPOSITION AREA          .1 SQ MI

      TOTAL RAINFALL =    3.20, TOTAL LOSS =     1.93, TOTAL EXCESS =     1.26

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+    1039.       4.17                         75.          19.           6.           3.
                               (INCHES)     1.255        1.255        1.255        1.255
                               (AC-FT)        37.          37.          37.          37.

                              CUMULATIVE AREA =      .56 SQ MI


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

                               HYDROGRAPH AT STATION     S170C
                             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)
+    1031.       4.17                         75.          19.           6.           3.
                               (INCHES)     1.244        1.244        1.244        1.244
                               (AC-FT)        37.          37.          37.          37.

                              CUMULATIVE AREA =      .56 SQ MI


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

                               HYDROGRAPH AT STATION     S170C
                             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)
+     521.       4.17                         54.          13.           4.           2.
                               (INCHES)      .898         .898         .898         .898
                               (AC-FT)        27.          27.          27.          27.

                              CUMULATIVE AREA =      .56 SQ MI


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

                               HYDROGRAPH AT STATION     S170C
                             TRANSPOSITION AREA        16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =     2.36, TOTAL EXCESS =      .59

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+     340.       4.17                         35.           9.           3.           1.
                               (INCHES)      .584         .584         .584         .584
                               (AC-FT)        17.          17.          17.          17.

                              CUMULATIVE AREA =      .56 SQ MI


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

                               HYDROGRAPH AT STATION     S170C
                             TRANSPOSITION AREA        90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =     2.37, TOTAL EXCESS =      .22

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+     141.       4.17                         13.           3.           1.           0.
                               (INCHES)      .218         .218         .218         .218
                               (AC-FT)         6.           6.           6.           6.

                              CUMULATIVE AREA =      .56 SQ MI

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


                             INTERPOLATED HYDROGRAPH AT    S170C

    PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR        72-HR      166.58-HR
+     (CFS)      (HR)
                                 (CFS)
+     999.       4.17                         73.          18.           6.           3.
                               (INCHES)     1.222        1.222        1.222        1.222
                               (AC-FT)        36.          36.          36.          36.
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                    CUMULATIVE AREA =      .56 SQ MI


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

             **************
             *            *
 120 KK      *   70C90B   *        ROUTE
             *            *
             **************
                     ROUTE runoff FROM S170C TO C190B
                     Slope=(1460 - 1410) / 4155

             HYDROGRAPH ROUTING DATA

 123 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

 124 RC         NORMAL DEPTH CHANNEL
                       ANL        .045  LEFT OVERBANK N-VALUE
                      ANCH        .045  MAIN CHANNEL N-VALUE
                       ANR        .045  RIGHT OVERBANK N-VALUE
                     RLNTH       4155.  REACH LENGTH
                       SEL       .0120  ENERGY SLOPE
                     ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                      --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 126 RY        ELEVATION    104.00    101.00    101.00    100.00    100.00    101.00    101.00    104.00
 125 RX         DISTANCE       .00     20.00     80.00     84.00     99.00    103.00    163.00    183.00

                                                    ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE       .00       .32       .67      1.06      1.48      2.53      5.45      8.42     11.44     14.53
           OUTFLOW       .00      4.13     13.37     26.88     44.44     70.00    142.78    254.61    398.90    572.49
         ELEVATION    100.00    100.21    100.42    100.63    100.84    101.05    101.26    101.47    101.68    101.89

           STORAGE     17.66     20.86     24.11     27.42     30.79     34.21     37.68     41.22     44.81     48.46
           OUTFLOW    773.43   1000.36   1252.28   1528.44   1828.25   2151.24   2497.06   2865.40   3256.03   3668.77
         ELEVATION    102.11    102.32    102.53    102.74    102.95    103.16    103.37    103.58    103.79    104.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      2151. TO      3669.
                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    70C90B
                  TRANSPOSITION AREA        .1 SQ MI

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+    857.        4.33                   75.           19.           6.            3.
                          (INCHES)    1.255         1.255         1.255         1.255
                           (AC-FT)      37.           37.           37.           37.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         6.      4.33                    1.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    102.18       4.33                100.39        100.10        100.03        100.01

                    CUMULATIVE AREA =      .56 SQ MI


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

                    HYDROGRAPH AT STATION    70C90B
                  TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+    849.        4.33                   75.           19.           6.            3.
                          (INCHES)    1.244         1.244         1.244         1.244
                           (AC-FT)      37.           37.           37.           37.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         6.      4.33                    1.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)                 100.39        100.10        100.03        100.01
    102.18       4.33

                    CUMULATIVE AREA =      .56 SQ MI


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

                    HYDROGRAPH AT STATION    70C90B
                  TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+    444.        4.42                   54.           13.           4.            2.
                          (INCHES)     .898          .898          .898          .898
                           (AC-FT)      27.           27.           27.           27.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         4.      4.42                    1.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.74       4.42                100.39        100.10        100.03        100.01

                    CUMULATIVE AREA =      .56 SQ MI


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

                    HYDROGRAPH AT STATION    70C90B
                  TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+    265.        4.50                   35.            9.           3.            1.
                          (INCHES)     .584          .584          .584          .584
                           (AC-FT)      17.           17.           17.           17.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         3.      4.42                    0.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.49       4.50                100.34        100.08        100.03        100.01

                    CUMULATIVE AREA =      .56 SQ MI


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

                    HYDROGRAPH AT STATION    70C90B
                  TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+     93.        4.58                   13.            3.           1.            0.
                          (INCHES)     .218          .218          .218          .218
                           (AC-FT)       6.            6.           6.            6.

 PEAK STORAGE    TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         1.      4.58                    0.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.12       4.58                100.23        100.06        100.02        100.01

                    CUMULATIVE AREA =      .56 SQ MI


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


                    INTERPOLATED HYDROGRAPH AT    70C90B

  PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                            (CFS)
+    823.        4.33                   73.           18.           6.            3.
                          (INCHES)    1.222         1.222         1.222         1.222
                           (AC-FT)      36.           36.           36.           36.

                    CUMULATIVE AREA =      .56 SQ MI
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           **************
           *            *
 127 KK    *     S190B  *        BASIN
           *            *
           **************
                              Compute runoff from subbasin 190B

              SUBBASIN RUNOFF DATA

 129 BA         SUBBASIN CHARACTERISTICS
                     TAREA          .16  SUBBASIN AREA

 130 LG         GREEN AND AMPT LOSS RATE
                     STRTL          .35  STARTING LOSS
                       DTH          .35  MOISTURE DEFICIT
                      PSIF         3.55  WETTING FRONT SUCTION
                     XKSAT          .52  HYDRAULIC CONDUCTIVITY
                     RTIMP          .00  PERCENT IMPERVIOUS AREA

 128 UI         INPUT UNITGRAPH,   8 ORDINATES,  VOLUME = 1.00
                    118.0     405.0     395.0     194.0      88.0      41.0      14.0      12.0
                                                                  ***

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

                       HYDROGRAPH AT STATION    S190B
                      TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.95, TOTAL EXCESS =    1.25

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     390.      4.08                   22.         5.          2.          1.
                (INCHES)      1.243       1.243       1.243       1.243
                (AC-FT)         11.         11.         11.         11.

                CUMULATIVE AREA =     .16 SQ MI


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

                       HYDROGRAPH AT STATION    S190B
                      TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.95, TOTAL EXCESS =    1.24

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     387.      4.08                   22.         5.          2.          1.
                (INCHES)      1.232       1.232       1.232       1.232
                (AC-FT)         11.         11.         11.         11.

                CUMULATIVE AREA =     .16 SQ MI


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

                       HYDROGRAPH AT STATION    S190B
                      TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.24, TOTAL EXCESS =     .88

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     173.      4.08                   15.         4.          1.          1.
                (INCHES)       .874        .874        .874        .874
                (AC-FT)          8.          8.          8.          8.

                CUMULATIVE AREA =     .16 SQ MI


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

                       HYDROGRAPH AT STATION    S190B
                      TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.39, TOTAL EXCESS =     .56

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     112.      4.08                   10.         2.          1.          0.
                (INCHES)       .557        .557        .557        .557
                (AC-FT)          5.          5.          5.          5.

                CUMULATIVE AREA =     .16 SQ MI
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      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION    S190B
                      TRANSPOSITION AREA      90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.40, TOTAL EXCESS =     .19

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      46.      4.08                    3.          1.          0.          0.
                (INCHES)       .192        .192        .192        .192
                (AC-FT)          2.          2.          2.          2.

                CUMULATIVE AREA =     .16 SQ MI


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


                    INTERPOLATED HYDROGRAPH AT    S190B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     389.      4.08                   22.         5.          2.          1.
                (INCHES)      1.239       1.239       1.239       1.239
                (AC-FT)         11.         11.         11.         11.

                CUMULATIVE AREA =     .16 SQ MI
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           **************
           *            *
 132 KK    *     C190B  *      COMBINE
           *            *
           **************
                              Combine runoff from S190B with routed flows from C170B & S170C
                              This is the total flow at the downstream end of the Fan 16 corridor.

 135 HC         HYDROGRAPH COMBINATION
                     ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                  ***

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

                       HYDROGRAPH AT STATION    C190B
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2034.      4.33                  295.         83.         28.         12.
                (INCHES)      1.223       1.372       1.372       1.372
                (AC-FT)         146.        164.        164.        164.

                CUMULATIVE AREA =     2.24 SQ MI


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

                       HYDROGRAPH AT STATION    C190B
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    2011.      4.33                  293.         82.         27.         12.
                (INCHES)      1.213       1.361       1.361       1.361
                (AC-FT)         145.        163.        163.        163.

                CUMULATIVE AREA =     2.24 SQ MI


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

                       HYDROGRAPH AT STATION    C190B
                      TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1174.      4.42                  218.         62.         21.          9.
                (INCHES)       .905       1.028       1.028       1.028
                (AC-FT)         108.        123.        123.        123.

                CUMULATIVE AREA =     2.24 SQ MI
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      ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION    C190B
                   TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                                (CFS)
+     716.      4.50              152.          44.          15.           6.
                             (INCHES)        .628         .723         .723
                              (AC-FT)          75.          86.          86.

                    CUMULATIVE AREA =     2.24 SQ MI

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

                    HYDROGRAPH AT STATION    C190B
                   TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                                (CFS)
+     262.      4.67              70.          20.           7.           3.
                             (INCHES)        .290         .336         .336
                              (AC-FT)          35.          40.          40.

                    CUMULATIVE AREA =     2.24 SQ MI

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


                    INTERPOLATED HYDROGRAPH AT    C190B

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                                (CFS)
+    1279.      4.42             228.          65.          22.           9.
                             (INCHES)        .945        1.071        1.071        1.071
                              (AC-FT)         113.         128.         128.         128.

                    CUMULATIVE AREA =     2.24 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       6-HOUR      24-HOUR      72-HOUR      AREA      STAGE    MAX STAGE
        HYDROGRAPH AT
+                         S165    1008.   4.17         94.          23.           8.        .62
        ROUTED TO
+                         RR165    135.   4.75         79.          23.           8.        .62
        ROUTED TO
+                         F1670A   132.   5.17         77.          23.           8.        .62
        HYDROGRAPH AT
+                         S170A    952.   4.08         63.          16.           5.        .41
        2 COMBINED AT
+                         C170A    760.   4.08        125.          36.          12.       1.02
        ROUTED TO
+                         70A70B   567.   4.42        120.          36.          12.       1.02
        HYDROGRAPH AT
+                         S170B    922.   4.17         72.          18.           6.        .50
        2 COMBINED AT
+                         C170B    944.   4.33        171.          49.          16.       1.52
        ROUTED TO
+                         70B90B   865.   4.42        168.          49.          16.       1.52
        HYDROGRAPH AT
+                         S170C    999.   4.17         73.          18.           6.        .56
        ROUTED TO
+                         70C90B   823.   4.33         73.          18.           6.        .56
        HYDROGRAPH AT
+                         S190B    389.   4.08         22.           5.           2.        .16
        3 COMBINED AT
+                         C190B   1279.   4.42        228.          65.          22.       2.24

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

```
-----DSS---ZCLOSE Unit:  71,   File: FAN166.DSS
          Pointer Utilization:   .33
          Number of Records:     64
          File Size:    121.6  Kbytes
          Percent Inactive:    .0
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN  1998                *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30NOV06  TIME  09:55:02   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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 16
   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: FAN1624.DAT
   8          ID
   9          ID   100-YEAR 24-HOUR MODEL
  10          ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
  11          ID          MODELED AREA = 2.2 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          JD   3.654    60.0
  44          JD   3.578    90.0
              *
  45          KK    S165   BASIN
  46          KM        Compute runoff from subbasin 165
  47          BA   0.616
  48          LG    0.30    0.35    4.55    0.35       3
  49          UI     121     477     809    1022     617     474     347     254     185     127
  50          UI      96      69      52      36      20      20      20      20       0       0
  51          ZW                 C=FLOW
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  52          KK   RR165 STORAGE
  53          KM   PROPOSED DETENTION BASIN
  54          KM    ROUTE RUNOFF FROM S165 THROUGH PROPOSED DETENTION BASIN
  55          KM    STRUCTURE ID:RR165
  56          KM    OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft
  57          RS       1    STOR      -1
  58          SV     0.0     1.4    13.7    27.3    34.5    42.2    50.1    58.5    67.2    76.2
  59          SE     0.0     1.0     3.0     5.0     6.0     7.0     8.0     9.0    10.0    11.0
  60          SQ     0.0    16.3    55.4   104.1   127.5   156.5   179.7   201.7   220.8   250.8
  61          ZW                 C=FLOW
              *
  62          KK  F1670A   ROUTE
  63          KM   PROPOSED CHANNEL
  64          KM    ROUTE OUTFLOW FROM RR165 TO C170A
  65          KM    Slope=(1670.0 - 1563.0) / 6056.0
  66          RS       4    FLOW      -1
  67          RC   0.045   0.045   0.045  6056.0   0.019   104.5
  68          RX     0.0     0.0     0.0     0.0    60.0    60.0    60.0    60.0
  69          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  70          ZW                 C=FLOW
              *
  71          KK   S170A   BASIN
  72          KM        Compute runoff from subbasin 170A
  73          BA   0.407
  74          LG    0.35    0.35    4.80    0.30       0
  75          UI     176     664     915     651     355     188      96      53      23      24
              *
  76          KK   C170A COMBINE
  77          KM        Combine runoff from S170A w/ routed outflow from Fan 16 detention basin
  78          HC       2
  79          ZW                 C=FLOW
              *
  80          KK  70A70B   ROUTE
  81          KM   PROPOSED CHANNEL
  82          KM    ROUTE combined FLOW FROM C170A to C170B
  83          KM    Slope=(1563.0 - 1456.0) / 7426.0
  84          RS       5    FLOW      -1
  85          RC   0.045   0.045   0.045  7426.0   0.014   104.5
  86          RX     0.0     0.0     0.0     0.0    85.0    85.0    85.0    85.0
  87          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  88          ZW                 C=FLOW
              *
  89          KK   S170B   BASIN
  90          KM        Compute runoff from subbasin 170B
  91          BA   0.498
  92          LG    0.35    0.35    4.45    0.37       0
  93          UI     107     419     718     822     666     418     265     167     105      65
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  94          UI      39      21      21      22       0       0       0       0       0       0
              *
  95          KK   C170B COMBINE
  96          KM        Combine runoff from S170B with routed flow from C170A
  97          KM        This is the total flow at Sun Valley Parkway on the Fan 16 corridor.
  98          HC       2
  99          ZW                 C=FLOW
              *
 100          KK  70B90B   ROUTE
 101          KM   PROPOSED CHANNEL
 102          KM    ROUTE combined FLOW FROM C170B to C190B
 103          KM    Slope=(1456.0 - 1410.0) / 3986.0
 104          RS       3    FLOW      -1
 105          RC   0.045   0.045   0.045  3986.0   0.012   104.5
 106          RX     0.0     0.0     0.0     0.0   120.0   120.0   120.0   120.0
 107          RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
 108          ZW                 C=FLOW
              *
 109          KK   S170C   BASIN
 110          KM        Compute runoff from subbasin 170C
 111          BA   0.558
 112          LG    0.35    0.35    4.10    0.46       0
 113          UI     147     563     944     971     677     406     246     150      89      53
 114          UI      27      25       0       0       0       0       0       0       0       0
              *
 115          KK  70C90B   ROUTE
 116          KM    ROUTE runoff FROM S170C TO C190B
 117          KM    Slope=(1460 - 1410) / 4155
 118          RS       3    FLOW      -1
 119          RC   0.045   0.045   0.045  4155    0.012     104
 120          RX     0.0      20      80      84      99     103     163     183
 121          RY     104     101     101     100     100     101     101     104
              *
 122          KK   S190B   BASIN
 123          KM        Compute runoff from subbasin 190B
 124          BA   0.164
 125          LG    0.35    0.35    3.55    0.52       0
 126          UI     118     405     395     194      88      41      14      12       0       0
              *
```

```
         127          KK   C190B COMBINE
         128          KM        Combine runoff from S190B with routed flows from C170B & S170C
         129          KM        This is the total flow at the downstream end of the Fan 16 corridor.
         130          HC        3
         131          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   45        S165
                V
                V
   52       RR165
                V
                V
   62      F1670A
                .
                .
   71           .       S170A
                .           .
                .           .
   76       C170A...........
                V
                V
   80      70A70B
                .
                .
   89           .       S170B
                .           .
                .           .
   95       C170B...........
                V
                V
  100      70B90B
                .
                .
  109           .       S170C
                .           V
                .           V
  115           .      70C90B
                .           .
                .           .
  122           .           .       S190B
                .           .           .
                .           .           .
  127       C190B.......................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                         *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
 *              JUN   1998                 *
 *            VERSION 4.1                  *
 *                                         *
 *   RUN DATE   30NOV06  TIME  09:55:02    *
 *                                         *
 *******************************************

 ***************************************
 *                                     *
 *    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 16

SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
MODELER: TED LEHMAN
FILENAME: FAN1624.DAT

100-YEAR 24-HOUR MODEL
EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
MODELED AREA = 2.2 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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.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
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.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
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.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
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.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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```
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              .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     .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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              .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     .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     .00     .00     .00     .00
              .00     .00     .00     .00     .00     .00     .00     .00

 43 JD        INDEX STORM NO. 4
                 STRM        3.65  PRECIPITATION DEPTH
                 TRDA       60.00  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
              .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     .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     .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     .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
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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     .00

 44 JD        INDEX STORM NO. 5
                 STRM        3.58  PRECIPITATION DEPTH
                 TRDA       90.00  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
              .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
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              .00     .00     .00     .00     .00     .00     .00     .00
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             *            *
  45 KK      *    S165    *       BASIN
             *            *
             **************
                              Compute runoff from subbasin 165

               SUBBASIN RUNOFF DATA

  47 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .62  SUBBASIN AREA

  48 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .30  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.55  WETTING FRONT SUCTION
                       XKSAT         .35  HYDRAULIC CONDUCTIVITY
                       RTIMP        3.00  PERCENT IMPERVIOUS AREA

  46 UI          INPUT UNITGRAPH,  18 ORDINATES,  VOLUME = 1.00
                    121.0     477.0     809.0    1022.0     617.0     474.0     347.0     254.0     185.0     127.0
                     96.0      69.0      52.0      36.0      20.0      20.0      20.0      20.0
                                                                           ***

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

                             HYDROGRAPH AT STATION      S165
                           TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.94, TOTAL EXCESS =     1.26

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                             6-HR        24-HR        72-HR    166.58-HR
 +    (CFS)       (HR)
                              (CFS)
 +     866.      12.17                        81.          21.           7.           3.
                           (INCHES)        1.220        1.257        1.257        1.257
                            (AC-FT)          40.          41.          41.          41.

                            CUMULATIVE AREA =      .62 SQ MI

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

                             HYDROGRAPH AT STATION      S165
                           TRANSPOSITION AREA     10.0 SQ MI

     TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.83, TOTAL EXCESS =     1.16

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                             6-HR        24-HR        72-HR    166.58-HR
 +    (CFS)       (HR)
                              (CFS)
 +     805.      12.17                        75.          19.           6.           3.
                           (INCHES)        1.126        1.160        1.161        1.161
                            (AC-FT)          37.          38.          38.          38.

                            CUMULATIVE AREA =      .62 SQ MI

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

                             HYDROGRAPH AT STATION      S165
                           TRANSPOSITION AREA     30.0 SQ MI

     TOTAL RAINFALL =     3.78, TOTAL LOSS =     2.72, TOTAL EXCESS =     1.06

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                             6-HR        24-HR        72-HR    166.58-HR
 +    (CFS)       (HR)
                              (CFS)
 +     743.      12.17                        68.          18.           6.           3.
                           (INCHES)        1.030        1.063        1.063        1.063
                            (AC-FT)          34.          35.          35.          35.

                            CUMULATIVE AREA =      .62 SQ MI

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

                             HYDROGRAPH AT STATION      S165
                           TRANSPOSITION AREA     60.0 SQ MI

     TOTAL RAINFALL =     3.65, TOTAL LOSS =     2.65, TOTAL EXCESS =     1.01

   PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                             6-HR        24-HR        72-HR    166.58-HR
 +    (CFS)       (HR)
                              (CFS)
 +     705.      12.17                        64.          17.           6.           2.
                           (INCHES)         .972        1.004        1.004        1.004
                            (AC-FT)          32.          33.          33.          33.

                            CUMULATIVE AREA =      .62 SQ MI
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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S165
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.61, TOTAL EXCESS =     .97

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+     682.     12.17                   62.          16.           5.           2.
                                  (INCHES)       .937         .968         .968         .968
                                   (AC-FT)         31.          32.          32.          32.

                                  CUMULATIVE AREA =     .62 SQ MI

    -----DSS---ZOPEN:  Existing File Opened,  File: FAN1624.DSS
                       Unit:  71;  DSS Version: 6-JG
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/01JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/02JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/03JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/04JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/05JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/06JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/07JAN1999/5MIN//
     -----DSS---ZWRITE Unit  71; Vers.   49:  //S165/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     S165

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+     842.     12.17                   78.          20.           7.           3.
                                  (INCHES)      1.183        1.219        1.219        1.219
                                   (AC-FT)         39.          40.          40.          40.

                                  CUMULATIVE AREA =     .62 SQ MI

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

            **************
 52 KK      *      RR165  *      STORAGE
            *             *
            **************
                        PROPOSED DETENTION BASIN
                         ROUTE RUNOFF FROM S165 THROUGH PROPOSED DETENTION BASIN
                         STRUCTURE ID:RR165
                         OUTLET BASED ON ASSUMED 1 pipe(s), dia: 5 ft

                    HYDROGRAPH ROUTING DATA

 57 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

 58 SV            STORAGE          .0       1.4      13.7      27.3      34.5      42.2      50.1      58.5      67.2      76.2


 59 SE            ELEVATION       .00      1.00      3.00      5.00      6.00      7.00      8.00      9.00     10.00     11.00


 60 SQ            DISCHARGE        0.       16.       55.      104.      128.      157.      180.      202.      221.      251.


                                                      ***

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

                        HYDROGRAPH AT STATION     RR165
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+     116.     12.75                   68.          21.           7.           3.
                                  (INCHES)      1.032        1.255        1.257        1.257
                                   (AC-FT)         34.          41.          41.          41.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
         31.    12.75                   17.           5.           2.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
         5.51   12.75                 3.48         1.09          .36          .16

                                  CUMULATIVE AREA =     .62 SQ MI

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

                        HYDROGRAPH AT STATION     RR165
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+     108.     12.75                   63.          19.           6.           3.
                                  (INCHES)       .958        1.159        1.161        1.161
                                   (AC-FT)         31.          38.          38.          38.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
         29.    12.75                   16.           4.           1.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
         5.17   12.75                 3.26         1.01          .34          .15

                                  CUMULATIVE AREA =     .62 SQ MI

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

                        HYDROGRAPH AT STATION     RR165
                       TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+     100.     12.75                   58.          18.           6.           3.
                                  (INCHES)       .883        1.062        1.063        1.063
                                   (AC-FT)         29.          35.          35.          35.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
         26.    12.75                   14.           4.           1.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
         4.82   12.75                 3.04          .94          .31          .14

                                  CUMULATIVE AREA =     .62 SQ MI

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

                        HYDROGRAPH AT STATION     RR165
                       TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+      94.     12.75                   55.          17.           6.           2.
                                  (INCHES)       .837        1.003        1.004        1.004
                                   (AC-FT)         28.          33.          33.          33.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
         25.    12.75                   13.           4.           1.           1.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
         4.60   12.75                 2.91          .89          .30          .13

                                  CUMULATIVE AREA =     .62 SQ MI

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

                        HYDROGRAPH AT STATION     RR165
                       TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                                     (CFS)
+      91.     12.75                   54.          16.           5.           2.
                                  (INCHES)       .810         .967         .968         .968
                                   (AC-FT)         27.          32.          32.          32.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR    166.58-HR
+   (AC-FT)      (HR)
         24.    12.75                   13.           3.           1.           1.
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  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+    (FEET)       (HR)
      4.46      12.75                    2.82           .86           .29          .12

                            CUMULATIVE AREA =      .62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //RR165/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                            INTERPOLATED HYDROGRAPH AT     RR165

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+      113.     12.75                     66.           20.            7.           3.
                            (INCHES)    1.003         1.217         1.219        1.219
                            (AC-FT)       33.           40.           40.          40.

                            CUMULATIVE AREA =      .62 SQ MI


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


           **************
           *            *
  62 KK    *   F1670A   *        ROUTE
           *            *
           **************
                              PROPOSED CHANNEL
                               ROUTE OUTFLOW FROM RR165 TO C170A
                               Slope=(1670.0 - 1563.0) / 6056.0

            HYDROGRAPH ROUTING DATA

  66 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

  67 RC          NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH       6056.  REACH LENGTH
                        SEL       .0190  ENERGY SLOPE
                      ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                             --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  69 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
  68 RX        DISTANCE        .00       .00       .00       .00     60.00     60.00     60.00     60.00

                                                          ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

             STORAGE         .00      1.98      3.95      5.93      7.90      9.88     11.85     13.83     15.80     17.78
             OUTFLOW         .00     24.76     78.41    153.72    247.64    358.27    484.25    624.50    778.17    944.54
           ELEVATION      100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

             STORAGE       19.76     21.73     23.71     25.68     27.66     29.63     31.61     33.59     35.56     37.54
             OUTFLOW     1123.01   1313.02   1514.12   1725.87   1947.89   2179.83   2421.36   2672.20   2932.05   3200.68
           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       624. TO      3201.
                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     F1670A
                          TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+      114.     13.17                     67.           21.            7.           3.
                            (INCHES)    1.011         1.255         1.257        1.257
                            (AC-FT)       33.           41.           41.          41.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)        (HR)
         1.     13.08                      1.            0.            0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+    (FEET)       (HR)
    100.59      13.17                  100.41        100.14        100.05       100.02

                            CUMULATIVE AREA =      .62 SQ MI


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

                            HYDROGRAPH AT STATION     F1670A
                          TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+      106.     13.17                     62.           19.            6.           3.
                            (INCHES)     .936         1.159         1.161        1.161
                            (AC-FT)       31.           38.           38.          38.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)        (HR)
         1.     13.17                      1.            0.            0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+    (FEET)       (HR)
    100.56      13.17                  100.40        100.13        100.04       100.02

                            CUMULATIVE AREA =      .62 SQ MI


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

                            HYDROGRAPH AT STATION     F1670A
                          TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+       98.     13.17                     57.           18.            6.           3.
                            (INCHES)     .861         1.062         1.063        1.063
                            (AC-FT)       28.           35.           35.          35.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)        (HR)
         1.     13.17                      1.            0.            0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+    (FEET)       (HR)
    100.53      13.17                  100.38        100.13        100.04       100.02

                            CUMULATIVE AREA =      .62 SQ MI


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

                            HYDROGRAPH AT STATION     F1670A
                          TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+       92.     13.17                     54.           17.            6.           2.
                            (INCHES)     .815         1.003         1.004        1.004
                            (AC-FT)       27.           33.           33.          33.

  PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+  (AC-FT)        (HR)
         1.     13.17                      1.            0.            0.           0.

  PEAK STAGE     TIME                              MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR    166.58-HR
+    (FEET)       (HR)
    100.52      13.17                  100.36        100.12        100.04       100.02

                            CUMULATIVE AREA =      .62 SQ MI


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

                            HYDROGRAPH AT STATION     F1670A
                          TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR    166.58-HR
+    (CFS)        (HR)
                              (CFS)
+       89.     13.17                     52.           16.            5.           2.
                            (INCHES)     .788          .967          .968         .968
                            (AC-FT)       26.           32.           32.          32.
```

```
 PEAK STORAGE    TIME                    MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
       1.       13.17                1.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR     166.58-HR
+   (FEET)       (HR)
    100.51      13.17              100.36      100.12      100.04      100.02

                        CUMULATIVE AREA =     .62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //F1670A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT    F1670A

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+     111.      13.17                65.         20.          7.          3.
                               (INCHES)       .981       1.217       1.219       1.219
                               (AC-FT)         32.         40.         40.         40.

                        CUMULATIVE AREA =     .62 SQ MI


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


            **************
            *            *
 71 KK      *     S170A  *        BASIN
            *            *
            **************
                        Compute runoff from subbasin 170A

          SUBBASIN RUNOFF DATA

 73 BA          SUBBASIN CHARACTERISTICS
                    TAREA         .41  SUBBASIN AREA

 74 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

 72 UI          INPUT UNITGRAPH,  10 ORDINATES,  VOLUME = 1.00
                   176.0     664.0     915.0     651.0     355.0     188.0      96.0      53.0      23.0      24.0
                                                                         ***
       ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    S170A
                       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)
+     773.      12.08                53.         13.          4.          2.
                               (INCHES)      1.212       1.212       1.212       1.212
                               (AC-FT)         26.         26.         26.         26.

                        CUMULATIVE AREA =     .41 SQ MI


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

                        HYDROGRAPH AT STATION    S170A
                       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)
+     720.      12.08                49.         12.          4.          2.
                               (INCHES)      1.109       1.109       1.109       1.109
                               (AC-FT)         24.         24.         24.         24.

                        CUMULATIVE AREA =     .41 SQ MI

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

                        HYDROGRAPH AT STATION    S170A
                       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)
+     667.      12.08                44.         11.          4.          2.
                               (INCHES)      1.012       1.012       1.012       1.012
                               (AC-FT)         22.         22.         22.         22.

                        CUMULATIVE AREA =     .41 SQ MI

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

                        HYDROGRAPH AT STATION    S170A
                       TRANSPOSITION AREA     60.0 SQ MI

     TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.70, TOTAL EXCESS =     .96

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+     634.      12.08                42.         10.          3.          2.
                               (INCHES)       .955        .955        .955        .955
                               (AC-FT)         21.         21.         21.         21.

                        CUMULATIVE AREA =     .41 SQ MI

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

                        HYDROGRAPH AT STATION    S170A
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.66, TOTAL EXCESS =     .92

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+     615.      12.08                40.         10.          3.          1.
                               (INCHES)       .920        .920        .920        .920
                               (AC-FT)         20.         20.         20.         20.

                        CUMULATIVE AREA =     .41 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT    S170A

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+     757.      12.08                52.         13.          4.          2.
                               (INCHES)      1.181       1.181       1.181       1.181
                               (AC-FT)         26.         26.         26.         26.

                        CUMULATIVE AREA =     .41 SQ MI


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


            **************
            *            *
 76 KK      *     C170A  *        COMBINE
            *            *
            **************
                        Combine runoff from S170A w/ routed outflow from Fan 16 detention basin

 78 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                         ***
       ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    C170A
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                                 (CFS)
+     776.      12.08               116.         34.         11.          5.
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                    (INCHES)      1.052       1.238       1.239       1.239
                    (AC-FT)         57.         68.         68.         68.

                    CUMULATIVE AREA =    1.02 SQ MI

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

                    HYDROGRAPH AT STATION    C170A
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     723.     12.08                107.         31.         10.          5.
                  (INCHES)        .968       1.139       1.140       1.140
                  (AC-FT)           53.         62.         62.         62.

                    CUMULATIVE AREA =    1.02 SQ MI

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

                    HYDROGRAPH AT STATION    C170A
                   TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     670.     12.08                 98.         29.         10.          4.
                  (INCHES)        .887       1.042       1.043       1.043
                  (AC-FT)           48.         57.         57.         57.

                    CUMULATIVE AREA =    1.02 SQ MI

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

                    HYDROGRAPH AT STATION    C170A
                   TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     637.     12.08                 92.         27.          9.          4.
                  (INCHES)        .839        .984        .984        .984
                  (AC-FT)           46.         54.         54.         54.

                    CUMULATIVE AREA =    1.02 SQ MI

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

                    HYDROGRAPH AT STATION    C170A
                   TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     617.     12.08                 89.         26.          9.          4.
                  (INCHES)        .809        .948        .949        .949
                  (AC-FT)           44.         52.         52.         52.

                    CUMULATIVE AREA =    1.02 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170A/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                    INTERPOLATED HYDROGRAPH AT    C170A

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     750.     12.08                111.         33.         11.          5.
                  (INCHES)       1.010       1.188       1.189       1.189
                  (AC-FT)           55.         65.         65.         65.

                    CUMULATIVE AREA =    1.02 SQ MI


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

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                *             *
80 KK           *    70A70B   *        ROUTE
                *             *
                **************
                          PROPOSED CHANNEL
                           ROUTE combined FLOW FROM C170A to C170B
                           Slope=(1563.0 - 1456.0) / 7426.0

                     HYDROGRAPH ROUTING DATA

84 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

85 RC                NORMAL DEPTH CHANNEL
                             ANL       .045  LEFT OVERBANK N-VALUE
                            ANCH       .045  MAIN CHANNEL N-VALUE
                             ANR       .045  RIGHT OVERBANK N-VALUE
                           RLNTH      7426.  REACH LENGTH
                             SEL      .0140  ENERGY SLOPE
                           ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                                --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
87 RY                ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
86 RX                DISTANCE        .00       .00       .00       .00     85.00     85.00     85.00     85.00

                                                  ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                      STORAGE        .00      3.43      6.86     10.30     13.73     17.16     20.59     24.02     27.46     30.89
                      OUTFLOW        .00     30.14     95.50    187.36    302.07    437.34    591.56    763.46    952.02   1156.41
                    ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

                      STORAGE      34.32     37.75     41.18     44.62     48.05     51.48     54.91     58.34     61.77     65.21
                      OUTFLOW    1375.91   1609.88   1857.77   2119.09   2393.39   2680.26   2979.33   3290.25   3612.70   3946.39
                    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      952. TO     3946.
                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   70A70B
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     556.     12.42                111.         34.         11.          5.
                  (INCHES)       1.010       1.238       1.239       1.239
                  (AC-FT)           55.         68.         68.         68.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR       72-HR     166.58-HR
+ (AC-FT)       (HR)
                    4.        12.42                1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
                  101.37      12.42              100.48      100.17      100.06      100.02

                    CUMULATIVE AREA =    1.02 SQ MI

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

                    HYDROGRAPH AT STATION   70A70B
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     511.     12.42                102.         31.         10.          5.
                  (INCHES)        .928       1.139       1.140       1.140
                  (AC-FT)           51.         62.         62.         62.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR       72-HR     166.58-HR
+ (AC-FT)       (HR)
                    4.        12.42                1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
                  101.30      12.42              100.46      100.16      100.05      100.02

                    CUMULATIVE AREA =    1.02 SQ MI

     ***           ***           ***           ***           ***
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                              HYDROGRAPH AT STATION    70A70B
                            TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      464.     12.42                       93.          29.          10.            4.
                              (INCHES)      .847        1.042        1.043         1.043
                               (AC-FT)       46.          57.          57.           57.

   PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          4.     12.42                        1.           0.           0.            0.

   PEAK STAGE     TIME                                MAXIMUM AVERAGE STAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.23      12.42                    100.43       100.15       100.05        100.02

                               CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION    70A70B
                            TRANSPOSITION AREA     60.0 SQ MI

   PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      432.     12.42                       88.          27.           9.            4.
                              (INCHES)      .799         .984         .984          .984
                               (AC-FT)       44.          54.          54.           54.

   PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          3.     12.42                        1.           0.           0.            0.

   PEAK STAGE     TIME                                MAXIMUM AVERAGE STAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.18      12.42                    100.42       100.14       100.05        100.02

                               CUMULATIVE AREA =     1.02 SQ MI


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

                              HYDROGRAPH AT STATION    70A70B
                            TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      413.     12.42                       85.          26.           9.            4.
                              (INCHES)      .770         .948         .949          .949
                               (AC-FT)       42.          52.          52.           52.

   PEAK STORAGE   TIME                              MAXIMUM AVERAGE STORAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          3.     12.42                        1.           0.           0.            0.

   PEAK STAGE     TIME                                MAXIMUM AVERAGE STAGE
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.14      12.42                    100.41       100.14       100.05        100.02

                               CUMULATIVE AREA =     1.02 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   49:  //70A70B/FLOW/08JAN1999/5MIN//
          ***             ***             ***             ***             ***


                               INTERPOLATED HYDROGRAPH AT    70A70B

   PEAK FLOW      TIME                                MAXIMUM AVERAGE FLOW
                                            6-HR        24-HR        72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +      534.     12.42                      107.          33.          11.            5.
                              (INCHES)      .968        1.188        1.189         1.189
                               (AC-FT)       53.          65.          65.           65.

                               CUMULATIVE AREA =     1.02 SQ MI
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 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   89 KK      *    S170B   *        BASIN
              *            *
              **************
                                   Compute runoff from subbasin 170B

                SUBBASIN RUNOFF DATA

   91 BA          SUBBASIN CHARACTERISTICS
                        TAREA          .50  SUBBASIN AREA

   92 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

   90 UI          INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                      107.0      419.0      718.0      822.0      666.0      418.0      265.0      167.0      105.0       65.0
                       39.0       21.0       21.0       22.0
                                                                         ***

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

                           HYDROGRAPH AT STATION     S170B
                         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)
 +      751.     12.17                    61.         15.           5.           2.
                            (INCHES)    1.138       1.138        1.138        1.138
                             (AC-FT)      30.         30.          30.          30.

                           CUMULATIVE AREA =      .50 SQ MI


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

                           HYDROGRAPH AT STATION     S170B
                         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)
 +      696.     12.17                    56.         14.           5.           2.
                            (INCHES)    1.045       1.045        1.045        1.045
                             (AC-FT)      28.         28.          28.          28.

                           CUMULATIVE AREA =      .50 SQ MI


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

                           HYDROGRAPH AT STATION     S170B
                         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)
 +      641.     12.17                    51.         13.           4.           2.
                            (INCHES)     .949        .949         .949         .949
                             (AC-FT)      25.         25.          25.          25.

                           CUMULATIVE AREA =      .50 SQ MI


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

                           HYDROGRAPH AT STATION     S170B
                         TRANSPOSITION AREA      60.0 SQ MI

    TOTAL RAINFALL =     3.65, TOTAL LOSS =     2.76, TOTAL EXCESS =      .89

  PEAK FLOW      TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR       24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +      607.     12.17                    48.         12.           4.           2.
                            (INCHES)     .891        .891         .891         .891
                             (AC-FT)      24.         24.          24.          24.

                           CUMULATIVE AREA =      .50 SQ MI
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      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    S170B
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.72, TOTAL EXCESS =     .86

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     587.     12.17                 46.         11.          4.          2.
                (INCHES)            .856        .856        .856        .856
                 (AC-FT)             23.         23.         23.         23.

                       CUMULATIVE AREA =     .50 SQ MI

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

                       INTERPOLATED HYDROGRAPH AT    S170B

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     732.     12.17                 59.         15.          5.          2.
                (INCHES)           1.105       1.105       1.105       1.105
                 (AC-FT)             29.         29.         29.         29.

                       CUMULATIVE AREA =     .50 SQ MI

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

          **************
          *            *
 95 KK    *     C170B  *      COMBINE
          *            *
          **************
                        Combine runoff from S170B with routed flow from C170A
                        This is the total flow at Sun Valley Parkway on the Fan 16 corridor.

 98 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                        ***
      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+    1000.     12.33                169.         49.         16.          7.
                (INCHES)           1.035       1.205       1.206       1.206
                 (AC-FT)             84.         98.         98.         98.

                       CUMULATIVE AREA =    1.52 SQ MI

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

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     901.     12.33                155.         45.         15.          7.
                (INCHES)            .950       1.108       1.109       1.109
                 (AC-FT)             77.         90.         90.         90.

                       CUMULATIVE AREA =    1.52 SQ MI

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

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA     30.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     796.     12.33                142.         41.         14.          6.
                (INCHES)            .865       1.012       1.012       1.012
                 (AC-FT)             70.         82.         82.         82.

                       CUMULATIVE AREA =    1.52 SQ MI
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      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA     60.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     734.     12.33                133.         39.         13.          6.
                (INCHES)            .815        .953        .954        .954
                 (AC-FT)             66.         77.         77.         77.

                       CUMULATIVE AREA =    1.52 SQ MI

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

                        HYDROGRAPH AT STATION    C170B
                       TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     693.     12.33                128.         38.         13.          5.
                (INCHES)            .784        .918        .919        .919
                 (AC-FT)             64.         74.         75.         75.

                       CUMULATIVE AREA =    1.52 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   49:  //C170B/FLOW/08JAN1999/5MIN//
       ***            ***            ***            ***            ***

                       INTERPOLATED HYDROGRAPH AT    C170B

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+    (CFS)       (HR)
                  (CFS)
+     941.     12.33                161.         47.         16.          7.
                (INCHES)            .984       1.148       1.149       1.149
                 (AC-FT)             80.         93.         93.         93.

                       CUMULATIVE AREA =    1.52 SQ MI

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

          **************
          *            *
100 KK    *   70B90B   *       ROUTE
          *            *
          **************
                       PROPOSED CHANNEL
                        ROUTE combined FLOW FROM C170B to C190B
                        Slope=(1456.0 - 1410.0) / 3986.0

                  HYDROGRAPH ROUTING DATA

104 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

105 RC            NORMAL DEPTH CHANNEL
                         ANL        .045  LEFT OVERBANK N-VALUE
                        ANCH        .045  MAIN CHANNEL N-VALUE
                         ANR        .045  RIGHT OVERBANK N-VALUE
                       RLNTH       3986.  REACH LENGTH
                         SEL       .0120  ENERGY SLOPE
                       ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
107 RY          ELEVATION   104.50   100.00   100.00   100.00   100.00   100.00   100.00   104.50
106 RX          DISTANCE       .00      .00      .00      .00   120.00   120.00   120.00   120.00

                                                                        ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.60      5.20      7.80     10.40     13.00     15.60     18.20     20.81     23.41
          OUTFLOW        .00     39.41    124.95    245.28    395.66    573.16    775.67   1001.60   1249.63   1518.71
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13
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     STORAGE     26.01     28.61     31.21     33.81     36.41     39.01     41.61     44.21     46.81     49.41
     OUTFLOW   1807.91   2116.43   2443.58   2788.73   3151.30   3530.80   3926.75   4338.72   4766.31   5209.14
   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     1250. TO     5209.
                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    70B90B
                           TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     950.       12.42               166.          49.          16.          7.
                         (INCHES)    1.016        1.205        1.206       1.206
                          (AC-FT)      82.          98.          98.         98.

 PEAK STORAGE     TIME                     MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
          6.      12.42                 2.           1.           0.          0.

   PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.60      12.42             100.49       100.17       100.06      100.02

                            CUMULATIVE AREA =      1.52 SQ MI

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

                             HYDROGRAPH AT STATION    70B90B
                           TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     847.       12.42               152.          45.          15.          7.
                         (INCHES)     .931        1.108        1.109       1.109
                          (AC-FT)      76.          90.          90.         90.

 PEAK STORAGE     TIME                     MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
          5.      12.42                 2.           1.           0.          0.

   PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.50      12.42             100.47       100.16       100.05      100.02

                            CUMULATIVE AREA =      1.52 SQ MI

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

                             HYDROGRAPH AT STATION    70B90B
                           TRANSPOSITION AREA      30.0 SQ MI

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     738.       12.42               139.          41.          14.          6.
                         (INCHES)     .847        1.012        1.012       1.012
                          (AC-FT)      69.          82.          82.         82.

 PEAK STORAGE     TIME                     MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
          5.      12.42                 2.           1.           0.          0.

   PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.38      12.42             100.44       100.15       100.05      100.02

                            CUMULATIVE AREA =      1.52 SQ MI

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

                             HYDROGRAPH AT STATION    70B90B
                           TRANSPOSITION AREA      60.0 SQ MI

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     680.       12.50               130.          39.          13.          6.
                         (INCHES)     .796         .953         .954        .954
                          (AC-FT)      65.          77.          77.         77.
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 PEAK STORAGE     TIME                     MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
          5.      12.50                 2.           1.           0.          0.

   PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.31      12.50             100.43       100.15       100.05      100.02

                            CUMULATIVE AREA =      1.52 SQ MI

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

                             HYDROGRAPH AT STATION    70B90B
                           TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     647.       12.50               125.          38.          13.          5.
                         (INCHES)     .766         .918         .919        .919
                          (AC-FT)      62.          74.          75.         75.

 PEAK STORAGE     TIME                     MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (AC-FT)      (HR)
          5.      12.50                 2.           1.           0.          0.

   PEAK STAGE     TIME                      MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
      101.27      12.50             100.42       100.14       100.05      100.02

                            CUMULATIVE AREA =      1.52 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   47:  //70B90B/FLOW/08JAN1999/5MIN//
         ***               ***               ***               ***               ***

                            INTERPOLATED HYDROGRAPH AT    70B90B

   PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                            (CFS)
 +     889.       12.42               158.          47.          16.          7.
                         (INCHES)     .965        1.148        1.149       1.149
                          (AC-FT)      78.          93.          93.         93.

                            CUMULATIVE AREA =      1.52 SQ MI

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

               **************
               *            *
109 KK         *    S170C   *         BASIN
               *            *
               **************
                                  Compute runoff from subbasin 170C

                 SUBBASIN RUNOFF DATA

111 BA             SUBBASIN CHARACTERISTICS
                         TAREA          .56  SUBBASIN AREA

112 LG             GREEN AND AMPT LOSS RATE
                         STRTL          .35  STARTING LOSS
                           DTH          .35  MOISTURE DEFICIT
                          PSIF         4.10  WETTING FRONT SUCTION
                         XKSAT          .46  HYDRAULIC CONDUCTIVITY
                         RTIMP          .00  PERCENT IMPERVIOUS AREA

110 UI             INPUT UNITGRAPH,  12 ORDINATES,  VOLUME =  .99
                    147.0     563.0     944.0     971.0     677.0     406.0     246.0     150.0      89.0      53.0
                     27.0      25.0

                                                                      ***

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

                             HYDROGRAPH AT STATION     S170C
                           TRANSPOSITION AREA        .1 SQ MI

   TOTAL RAINFALL =     4.20, TOTAL LOSS =     3.13, TOTAL EXCESS =     1.06
```

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	830.	12.17		63.	16.	5.	2.
			(INCHES)	1.058	1.058	1.058	1.058
			(AC-FT)	31.	31.	31.	31.

CUMULATIVE AREA = .56 SQ MI

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

HYDROGRAPH AT STATION S170C
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)				
+	768.	12.17		58.	14.	5.	2.
			(INCHES)	.964	.964	.964	.964
			(AC-FT)	29.	29.	29.	29.

CUMULATIVE AREA = .56 SQ MI

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

HYDROGRAPH AT STATION S170C
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)				
+	705.	12.17		52.	13.	4.	2.
			(INCHES)	.869	.869	.869	.869
			(AC-FT)	26.	26.	26.	26.

CUMULATIVE AREA = .56 SQ MI

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

HYDROGRAPH AT STATION S170C
TRANSPOSITION AREA 60.0 SQ MI

TOTAL RAINFALL = 3.65, TOTAL LOSS = 2.84, TOTAL EXCESS = .81

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	666.	12.17		49.	12.	4.	2.
			(INCHES)	.810	.810	.810	.810
			(AC-FT)	24.	24.	24.	24.

CUMULATIVE AREA = .56 SQ MI

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

HYDROGRAPH AT STATION S170C
TRANSPOSITION AREA 90.0 SQ MI

TOTAL RAINFALL = 3.58, TOTAL LOSS = 2.80, TOTAL EXCESS = .78

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	643.	12.17		46.	12.	4.	2.
			(INCHES)	.775	.775	.775	.775
			(AC-FT)	23.	23.	23.	23.

CUMULATIVE AREA = .56 SQ MI

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

INTERPOLATED HYDROGRAPH AT S170C

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	807.	12.17		61.	15.	5.	2.
			(INCHES)	1.023	1.023	1.023	1.023
			(AC-FT)	30.	30.	30.	30.

CUMULATIVE AREA = .56 SQ MI

*** ***

115 KK — 70C90B — ROUTE

ROUTE runoff FROM S170C TO C190B
Slope=(1460 - 1410) / 4155

HYDROGRAPH ROUTING DATA

118 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

119 RC NORMAL DEPTH CHANNEL

ANL	.045	LEFT OVERBANK N-VALUE
ANCH	.045	MAIN CHANNEL N-VALUE
ANR	.045	RIGHT OVERBANK N-VALUE
RLNTH	4155.	REACH LENGTH
SEL	.0120	ENERGY SLOPE
ELMAX	104.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---	+	------ MAIN CHANNEL -------	+	--- RIGHT OVERBANK ---		
121 RY	ELEVATION	104.00	101.00	101.00	100.00	100.00	101.00	101.00	104.00
120 RX	DISTANCE	.00	20.00	80.00	84.00	99.00	103.00	163.00	183.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.32	.67	1.06	1.48	2.53	5.45	8.42	11.44	14.53
OUTFLOW	.00	4.13	13.37	26.88	44.44	70.00	142.78	254.61	398.90	572.49
ELEVATION	100.00	100.21	100.42	100.63	100.84	101.05	101.26	101.47	101.68	101.89
STORAGE	17.66	20.86	24.11	27.42	30.79	34.21	37.68	41.22	44.81	48.46
OUTFLOW	773.43	1000.36	1252.28	1528.44	1828.25	2151.24	2497.06	2865.40	3256.03	3668.77
ELEVATION	102.11	102.32	102.53	102.74	102.95	103.16	103.37	103.58	103.79	104.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 2151. TO 3669.
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 70C90B
TRANSPOSITION AREA .1 SQ MI

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	678.	12.33		63.	16.	5.	2.
			(INCHES)	1.058	1.058	1.058	1.058
			(AC-FT)	31.	31.	31.	31.

	PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
				6-HR	24-HR	72-HR	166.58-HR
+	(AC-FT)	(HR)					
	5.	12.33		1.	0.	0.	0.

	PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
				6-HR	24-HR	72-HR	166.58-HR
+	(FEET)	(HR)					
	102.01	12.33		100.38	100.10	100.03	100.01

CUMULATIVE AREA = .56 SQ MI

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

HYDROGRAPH AT STATION 70C90B
TRANSPOSITION AREA 10.0 SQ MI

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)					
			(CFS)				
+	608.	12.33		58.	14.	5.	2.
			(INCHES)	.964	.964	.964	.964
			(AC-FT)	29.	29.	29.	29.

	PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
				6-HR	24-HR	72-HR	166.58-HR
+	(AC-FT)	(HR)					
	5.	12.33		1.	0.	0.	0.

	PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
				6-HR	24-HR	72-HR	166.58-HR
+	(FEET)	(HR)					
	101.93	12.33		100.37	100.09	100.03	100.01

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                         CUMULATIVE AREA =      .56 SQ MI

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

                          HYDROGRAPH AT STATION    70C90B
                         TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      535.      12.33                    52.           13.           4.           2.
                         (INCHES)        .869          .869         .869         .869
                          (AC-FT)         26.           26.          26.          26.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         5.      12.33                     1.            0.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.85       12.33                 100.35        100.09       100.03       100.01

                         CUMULATIVE AREA =      .56 SQ MI

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

                          HYDROGRAPH AT STATION    70C90B
                         TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      490.      12.33                    49.           12.           4.           2.
                         (INCHES)        .810          .810         .810         .810
                          (AC-FT)         24.           24.          24.          24.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         4.      12.33                     1.            0.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.79       12.33                 100.34        100.09       100.03       100.01

                         CUMULATIVE AREA =      .56 SQ MI

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

                          HYDROGRAPH AT STATION    70C90B
                         TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      469.      12.42                    46.           12.           4.           2.
                         (INCHES)        .775          .775         .775         .775
                          (AC-FT)         23.           23.          23.          23.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
         4.      12.42                     0.            0.           0.           0.

  PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    101.77       12.42                 100.34        100.08       100.03       100.01

                         CUMULATIVE AREA =      .56 SQ MI

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


                         INTERPOLATED HYDROGRAPH AT    70C90B

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      652.      12.33                    61.           15.           5.           2.
                         (INCHES)       1.023         1.023        1.023        1.023
                          (AC-FT)         30.           30.          30.          30.

                         CUMULATIVE AREA =      .56 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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                   **************
                   *            *
 122 KK            *    S190B   *        BASIN
                   *            *
                   **************
                                        Compute runoff from subbasin 190B

                      SUBBASIN RUNOFF DATA

 124 BA               SUBBASIN CHARACTERISTICS
                             TAREA         .16  SUBBASIN AREA

 125 LG               GREEN AND AMPT LOSS RATE
                             STRTL         .35  STARTING LOSS
                               DTH         .35  MOISTURE DEFICIT
                              PSIF        3.55  WETTING FRONT SUCTION
                            XKSAT          .52  HYDRAULIC CONDUCTIVITY
                             RTIMP         .00  PERCENT IMPERVIOUS AREA

 123 UI               INPUT UNITGRAPH,    8 ORDINATES,   VOLUME = 1.00
                         118.0      405.0      395.0      194.0       88.0       41.0       14.0       12.0
                                                                         ***

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

                          HYDROGRAPH AT STATION     S190B
                         TRANSPOSITION AREA         .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.16, TOTAL EXCESS =    1.04

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      306.      12.08                    18.            5.           2.           1.
                         (INCHES)       1.040         1.040        1.040        1.040
                          (AC-FT)          9.            9.           9.           9.

                         CUMULATIVE AREA =      .16 SQ MI

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

                          HYDROGRAPH AT STATION     S190B
                         TRANSPOSITION AREA      10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =    3.04, TOTAL EXCESS =     .95

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      284.      12.08                    17.            4.           1.           1.
                         (INCHES)        .947          .947         .947         .947
                          (AC-FT)          8.            8.           8.           8.

                         CUMULATIVE AREA =      .16 SQ MI

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

                          HYDROGRAPH AT STATION     S190B
                         TRANSPOSITION AREA      30.0 SQ MI

   TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.93, TOTAL EXCESS =     .85

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      262.      12.08                    15.            4.           1.           1.
                         (INCHES)        .851          .851         .851         .851
                          (AC-FT)          7.            7.           7.           7.

                         CUMULATIVE AREA =      .16 SQ MI

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

                          HYDROGRAPH AT STATION     S190B
                         TRANSPOSITION AREA      60.0 SQ MI

   TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.86, TOTAL EXCESS =     .79

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR         24-HR         72-HR     166.58-HR
+    (CFS)       (HR)
                            (CFS)
+      248.      12.08                    14.            3.           1.           1.
                         (INCHES)        .793          .793         .793         .793
                          (AC-FT)          7.            7.           7.           7.

                         CUMULATIVE AREA =      .16 SQ MI

       ***          ***          ***          ***          ***
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                     HYDROGRAPH AT STATION     S190B
                    TRANSPOSITION AREA      90.0 SQ MI

   TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.82, TOTAL EXCESS =     .76

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+    240.      12.08                  13.          3.          1.          0.
                        (INCHES)     .757        .757        .757        .757
                         (AC-FT)       7.          7.          7.          7.

                       CUMULATIVE AREA =      .16 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT     S190B

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+    304.      12.08                  18.          5.          2.          1.
                        (INCHES)    1.030       1.030       1.030       1.030
                         (AC-FT)       9.          9.          9.          9.

                       CUMULATIVE AREA =      .16 SQ MI
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
127 KK        *    C190B   *     COMBINE
              *            *
              **************

                                 Combine runoff from S190B with routed flows from C170B & S170C
                                 This is the total flow at the downstream end of the Fan 16 corridor.

130 HC          HYDROGRAPH COMBINATION
                   ICOMP            3  NUMBER OF HYDROGRAPHS TO COMBINE

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

                     HYDROGRAPH AT STATION     C190B
                    TRANSPOSITION AREA       .1 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1591.      12.33                 246.         70.         23.         10.
                        (INCHES)    1.019       1.156       1.157       1.157
                         (AC-FT)     122.        138.        138.        138.

                       CUMULATIVE AREA =     2.24 SQ MI

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

                     HYDROGRAPH AT STATION     C190B
                    TRANSPOSITION AREA      10.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1436.      12.42                 225.         64.         21.          9.
                        (INCHES)     .932       1.061       1.061       1.061
                         (AC-FT)     112.        127.        127.        127.

                       CUMULATIVE AREA =     2.24 SQ MI

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

                     HYDROGRAPH AT STATION     C190B
                    TRANSPOSITION AREA      30.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1277.      12.42                 204.         58.         19.          8.
                        (INCHES)     .845        .964        .965        .965
                         (AC-FT)     101.        115.        115.        115.

                       CUMULATIVE AREA =     2.24 SQ MI

      ***         ***         ***         ***         ***
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                     HYDROGRAPH AT STATION     C190B
                    TRANSPOSITION AREA      60.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1185.      12.42                 191.         55.         18.          8.
                        (INCHES)     .793        .906        .906        .906
                         (AC-FT)      95.        108.        108.        108.

                       CUMULATIVE AREA =     2.24 SQ MI

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

                     HYDROGRAPH AT STATION     C190B
                    TRANSPOSITION AREA      90.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1127.      12.42                 184.         53.         18.          8.
                        (INCHES)     .762        .871        .871        .871
                         (AC-FT)      91.        104.        104.        104.

                       CUMULATIVE AREA =     2.24 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT     C190B

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+  (CFS)        (HR)
                           (CFS)
+   1486.      12.42                 232.         66.         22.          9.
                        (INCHES)     .961       1.092       1.092       1.092
                         (AC-FT)     115.        131.        131.        131.

                       CUMULATIVE AREA =     2.24 SQ MI

1
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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	S165	842.	12.17	78.	20.	7.	.62		
+	ROUTED TO	RR165	113.	12.75	66.	20.	7.	.62		
+	ROUTED TO	F1670A	111.	13.17	65.	20.	7.	.62		
+	HYDROGRAPH AT	S170A	757.	12.08	52.	13.	4.	.41		
+	2 COMBINED AT	C170A	750.	12.08	111.	33.	11.	1.02		
+	ROUTED TO	70A70B	534.	12.42	107.	33.	11.	1.02		
+	HYDROGRAPH AT	S170B	732.	12.17	59.	15.	5.	.50		
+	2 COMBINED AT	C170B	941.	12.33	161.	47.	16.	1.52		
+	ROUTED TO	70B90B	889.	12.42	158.	47.	16.	1.52		
+	HYDROGRAPH AT	S170C	807.	12.17	61.	15.	5.	.56		
+	ROUTED TO	70C90B	652.	12.33	61.	15.	5.	.56		
+	HYDROGRAPH AT	S190B	304.	12.08	18.	5.	2.	.16		
+	3 COMBINED AT	C190B	1486.	12.42	232.	66.	22.	2.24		

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

   -----DSS---ZCLOSE Unit:   71,    File: FAN1624.DSS
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Pointer Utilization:    .33
Number of Records:      64
File Size:     121.6  Kbytes
Percent Inactive:      .0
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CURRENT DATE: 10-09-2006
CURRENT TIME: 20:26:34

FILE DATE: 10-09-2006
FILE NAME: RR165

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	97.30	533.01	1 RCP	5.00	5.00	.012	IMPR SDT CIR
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: RR165 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
108.91	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
110.15	240.0	223.7	0.0	0.0	0.0	0.0	0.0	15.11	7
110.20	250.0	224.6	0.0	0.0	0.0	0.0	0.0	23.05	3
110.50	320.0	229.9	0.0	0.0	0.0	0.0	0.0	88.97	4
110.63	360.0	232.1	0.0	0.0	0.0	0.0	0.0	125.58	3
110.75	400.0	234.3	0.0	0.0	0.0	0.0	0.0	163.73	3
110.00	220.9	220.9	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: RR165 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
108.91	0.000	200.00	0.00	0.00
110.15	-0.004	240.00	1.23	0.51
110.20	-0.007	250.00	2.39	0.96
110.50	-0.003	320.00	1.16	0.36
110.63	-0.006	360.00	2.28	0.63
110.75	-0.005	400.00	2.01	0.50

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

CURRENT DATE: 10-09-2006
CURRENT TIME: 20:26:34

FILE DATE: 10-09-2006
FILE NAME: RR165

PERFORMANCE CURVE FOR CULVERT 1 - 1(5.00 (ft) BY 5.00 (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	102.45	2.45	2.45	1-S2n	1.51	1.75	1.45	0.35	8.46	2.29
80.00	103.88	3.88	3.88	1-S2n	2.18	2.53	2.13	0.53	10.03	3.01
120.00	105.74	5.74	5.74	5-S2n	2.77	3.12	2.72	0.67	10.99	3.53
160.00	107.12	7.12	7.12	5-S2n	3.36	3.62	3.32	0.80	11.59	3.94
200.00	108.91	8.91	6.62	2-M2c	4.07	4.03	4.03	0.91	11.79	4.30
223.66	110.15	10.15	5.77	2-M2c	5.00	4.21	4.21	1.02	12.73	4.62
224.57	110.20	10.20	5.96	2-M2c	5.00	4.21	4.21	1.04	12.76	4.69
229.87	110.50	10.50	6.84	2-M2c	5.00	4.25	4.25	1.21	12.96	5.16
232.14	110.63	10.63	7.10	2-M2c	5.00	4.27	4.27	1.30	13.05	5.40
234.26	110.75	10.75	7.33	2-M2c	5.00	4.28	4.28	1.38	13.12	5.62

El. inlet face invert 100.00 ft El. outlet invert 97.30 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	533.00 ft
OUTLET ELEVATION	97.30 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0051
CULVERT LENGTH ALONG SLOPE	533.01 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
CURRENT TIME: 20:26:34

FILE DATE: 10-09-2006
FILE NAME: RR165

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	50.00 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	97.30 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	97.30 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	97.30	0.000	0.00	0.00	0.00
40.00	97.65	0.684	0.35	2.29	0.43
80.00	97.83	0.730	0.53	3.01	0.66
120.00	97.97	0.758	0.67	3.53	0.84
160.00	98.10	0.778	0.80	3.94	1.00
200.00	98.21	0.793	0.91	4.30	1.14
240.00	98.32	0.806	1.02	4.62	1.27
250.00	98.34	0.809	1.04	4.69	1.30
320.00	98.51	0.826	1.21	5.16	1.51
360.00	98.60	0.834	1.30	5.40	1.62
400.00	98.68	0.842	1.38	5.62	1.73

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.50
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	110.00 ft

CURRENT DATE: 10-20-2006
CURRENT TIME: 17:14:55

FILE DATE: 10-20-2006
FILE NAME: NEW66502

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

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	51.90	50.70	134.01	5 RCB	10.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: NEW66502 DATE: 10-20-2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
51.90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
53.11	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
53.83	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
54.44	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
55.19	800.0	800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
55.90	960.0	960.0	0.0	0.0	0.0	0.0	0.0	0.00	1
57.02	1200.0	1200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
57.82	1400.0	1341.0	0.0	0.0	0.0	0.0	0.0	53.52	3
58.28	1600.0	1383.4	0.0	0.0	0.0	0.0	0.0	209.41	3
58.67	1800.0	1411.7	0.0	0.0	0.0	0.0	0.0	384.18	3
59.01	2000.0	1430.3	0.0	0.0	0.0	0.0	0.0	564.89	3
57.50	1295.7	1295.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: NEW66502 DATE: 10-20-2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
51.90	0.000	0.00	0.00	0.00
53.11	0.000	200.00	0.00	0.00
53.83	0.000	400.00	0.00	0.00
54.44	0.000	600.00	0.00	0.00
55.19	0.000	800.00	0.00	0.00
55.90	0.000	960.00	0.00	0.00
57.02	0.000	1200.00	0.00	0.00
57.82	-0.009	1400.00	5.49	0.39
58.28	-0.010	1600.00	7.21	0.45
58.67	-0.005	1800.00	4.17	0.23
59.01	-0.006	2000.00	4.82	0.24

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

CURRENT DATE: 10-20-2006 FILE DATE: 10-20-2006
CURRENT TIME: 17:14:55 FILE NAME: NEW66502

PERFORMANCE CURVE FOR CULVERT 1 - 5(10.00 (ft) BY 3.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	51.90	0.00	-1.20	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	53.11	1.21	0.75	1-S2n	0.54	0.79	0.55	1.81	7.29	4.96
400.00	53.83	1.93	1.61	1-S2n	0.84	1.26	0.76	2.60	10.53	6.05
600.00	54.44	2.54	2.54	1-S1f	1.09	1.65	1.80	3.19	6.67	6.77
800.00	55.19	3.12	3.29	4-FFt	1.32	2.00	3.00	3.68	5.33	7.32
960.00	55.90	3.61	4.00	4-FFt	1.49	2.26	3.00	4.02	6.40	7.69
1200.00	57.02	4.47	5.12	4-FFt	1.72	2.62	3.00	4.47	8.00	8.16
1340.99	57.82	5.06	5.92	4-FFt	1.86	2.82	3.00	4.81	8.94	8.49
1383.39	58.28	5.25	6.38	4-FFt	1.90	2.88	3.00	5.12	9.22	8.80
1411.65	58.67	5.38	6.77	4-FFt	1.92	2.92	3.00	5.41	9.41	9.07
1430.29	59.01	5.47	7.11	4-FFt	1.94	2.95	3.00	5.68	9.54	9.32

El. inlet face invert 51.90 ft El. outlet invert 50.70 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	51.90 ft
OUTLET STATION	134.00 ft
OUTLET ELEVATION	50.70 ft
NUMBER OF BARRELS	5
SLOPE (V/H)	0.0090
CULVERT LENGTH ALONG SLOPE	134.01 ft

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

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 10-20-2006 FILE DATE: 10-20-2006
CURRENT TIME: 17:14:55 FILE NAME: NEW66502

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

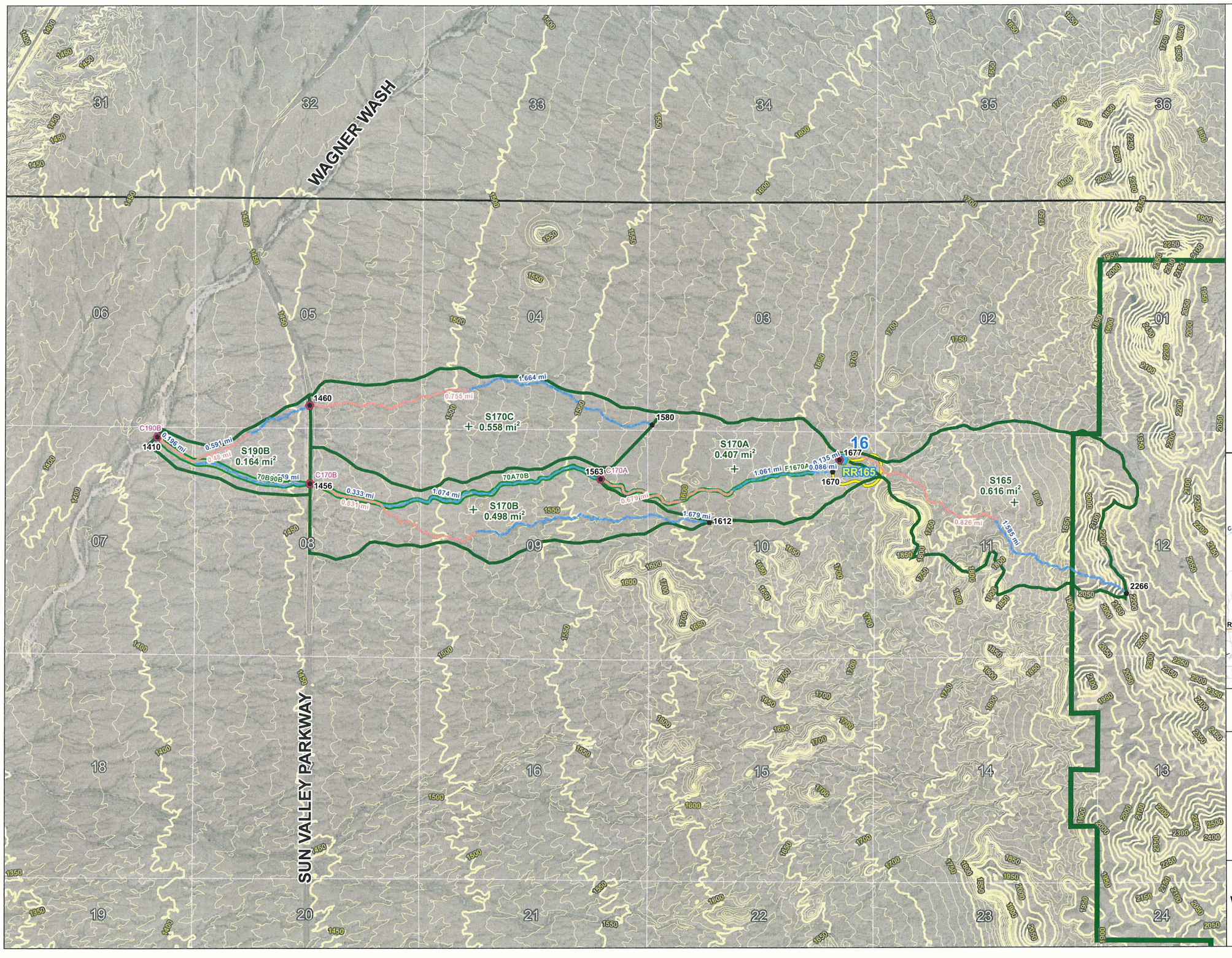
BOTTOM WIDTH	15.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.012
MANNING'S n (.01-0.1)	0.040
CHANNEL INVERT ELEVATION	50.70 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	50.70 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	50.70	0.000	0.00	0.00	0.00
200.00	52.51	0.650	1.81	4.96	1.36
400.00	53.30	0.661	2.60	6.05	1.95
600.00	53.89	0.667	3.19	6.77	2.39
800.00	54.38	0.673	3.68	7.32	2.75
960.00	54.72	0.676	4.02	7.69	3.01
1200.00	55.17	0.680	4.47	8.16	3.35
1400.00	55.51	0.682	4.81	8.49	3.60
1600.00	55.82	0.685	5.12	8.80	3.84
1800.00	56.11	0.687	5.41	9.07	4.05
2000.00	56.38	0.689	5.68	9.32	4.26

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	100.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	57.50 ft



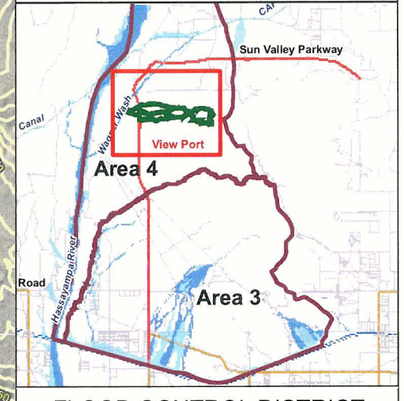
LEGEND

- Subbasin Boundaries
- Subbasin Centroids
- Lca Paths
- Lag & Routing Paths
- Elevation Points
- Concentration Points
- Step 3 Basins

Step 3 Corridors

- Floodwall
- Basin Outlet Pipe
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 16
SUBBASIN MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 900 1,800 2,700

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WAGNER WASH

SUN VALLEY PARKWAY

S190B
0.164 mi²

S170C
0.558 mi²

S170B
0.498 mi²

S170A
0.407 mi²

S165
0.616 mi²

RR165

10
0.94 in/hr

15
0.54 in/hr

110
0.13 in/hr

112
0.39 in/hr

98
0.37 in/hr

106
0.18 in/hr

47
0.11 in/hr

123
0.37 in/hr

100
0.40 in/hr

29
0.34 in/hr

14
1.04 in/hr

16

LEGEND

NRCS Soil Data

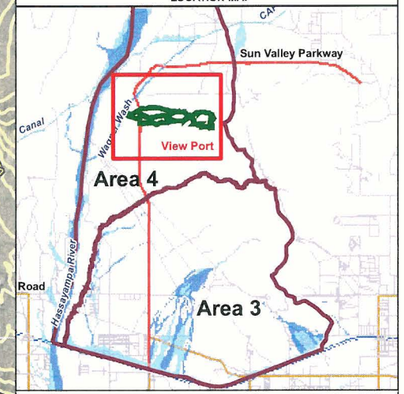
XKSAT (in/hr)

- 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
- Basin Outlet Pipe
- Step 3 Basins
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 16
SOIL MAP

FCD 2004C049
DECEMBER 2006

N
W E
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Feet
0 900 1,800 2,700

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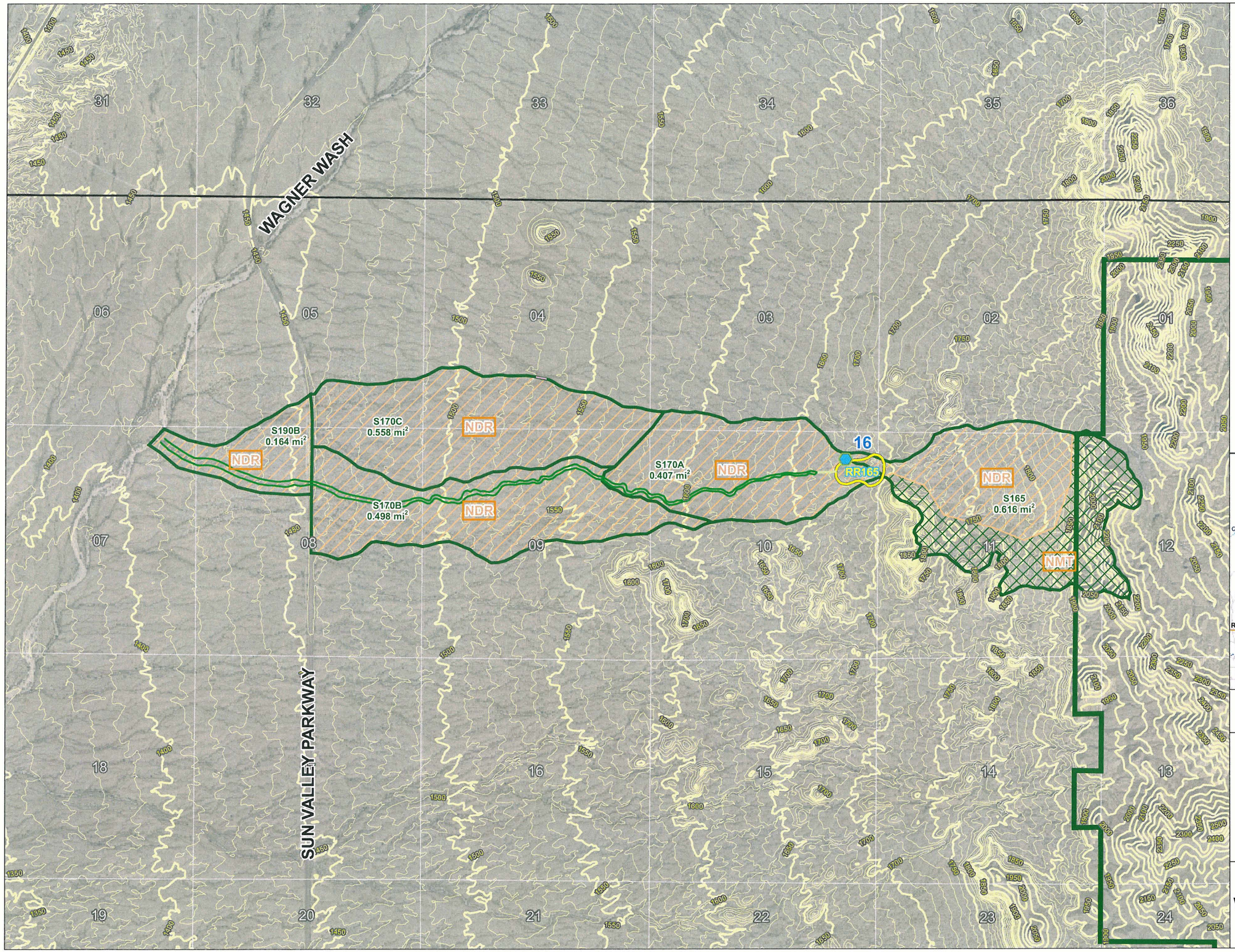


LEGEND

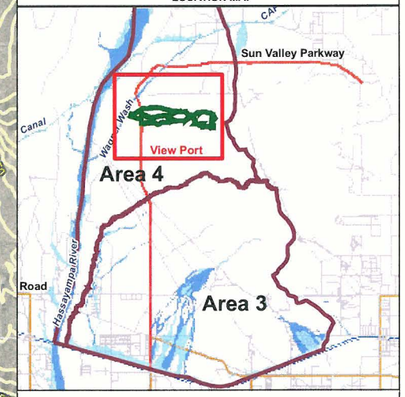
Existing Land Use

- Desert Rangeland (NDR), <5% Slopes
- Mountain Terrain (NMT), >10% Slopes
- Subbasin Boundaries
- Proposed Dikes

Step 3 Corridors

- 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
WAGNER SUB-AREA
FAN SYSTEM 16
LAND USE MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 900 1,800 2,700

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Appendix D

Design Analyses

Fan System 17/18

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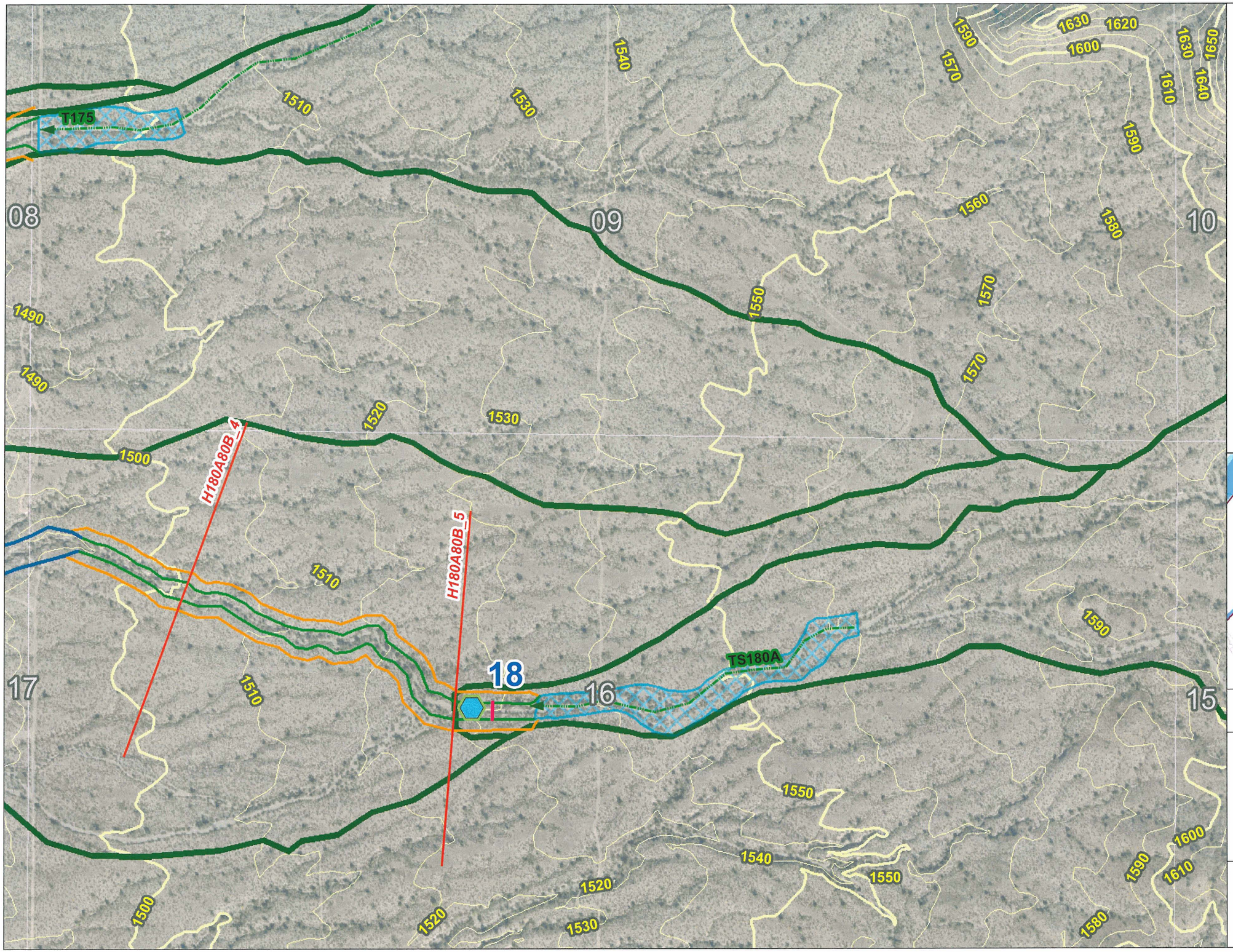


LEGEND

- Step 3 Basins
- 50' Basin Buffer

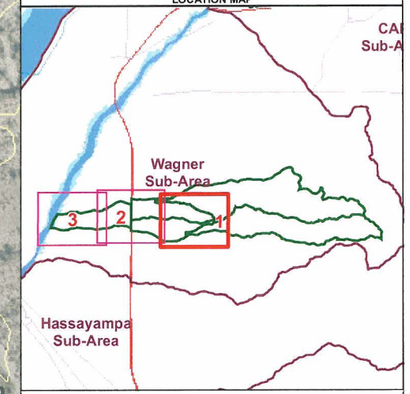
Step 3 Corridors

- Floodwall
- No Floodwall
- 50' Corridor Buffer
- Proposed Dikes
- 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 - WAGNER SUB-AREA
FAN SYSTEM 17 & 18
RECOMMENDED ALTERNATIVE

SHEET 1 OF 3

FCD 2004C049

DECEMBER 2006

N
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Feet
0 200 400 600

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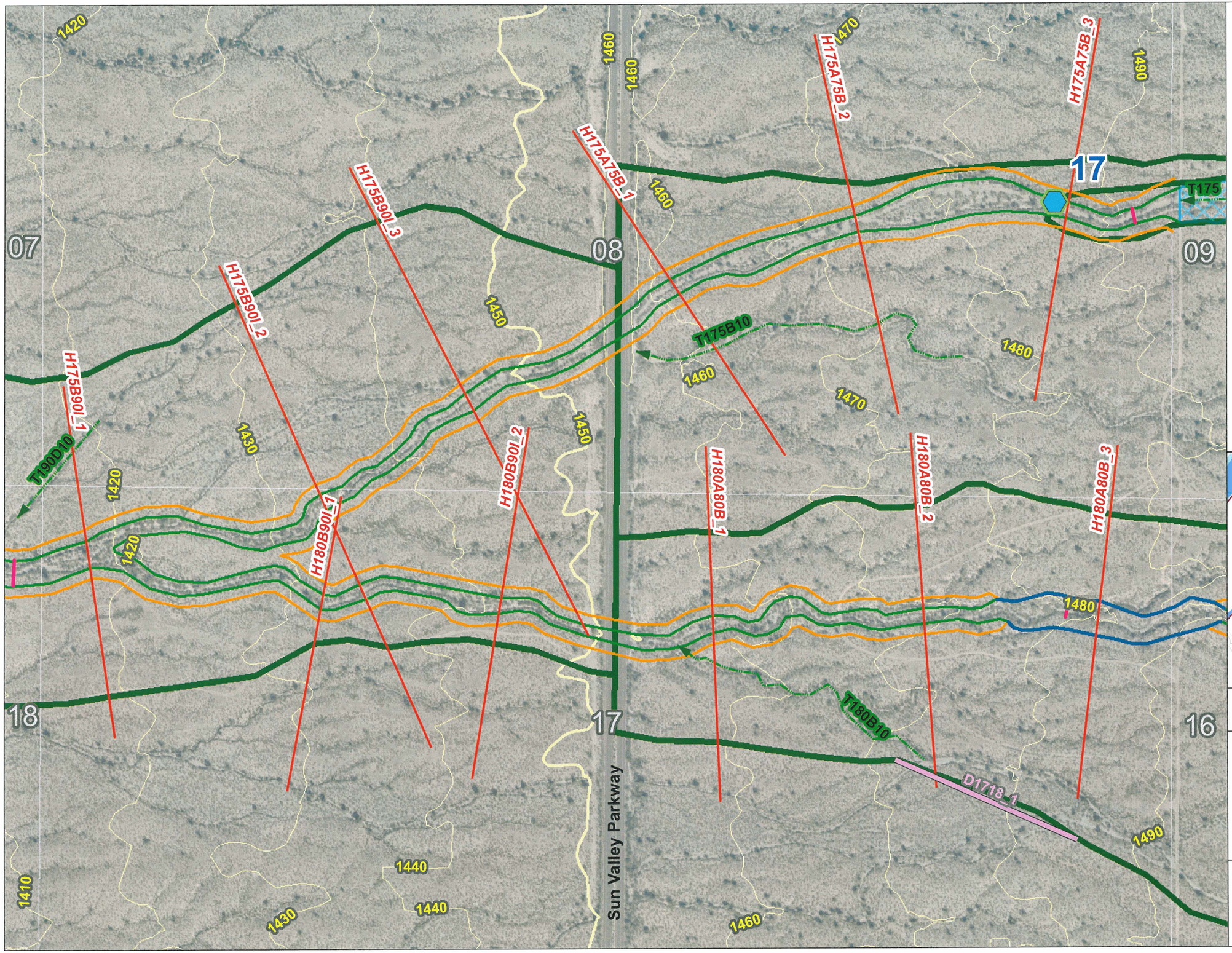


LEGEND

- Step 3 Basins
- 50' Basin Buffer

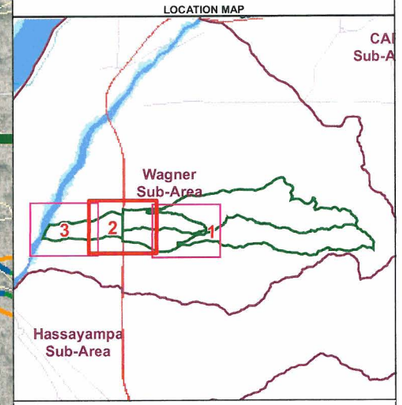
Step 3 Corridors

- Floodwall
- No Floodwall
- 50' Corridor Buffer
- Proposed Dikes
- 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 - WAGNER SUB-AREA
FAN SYSTEM 17 & 18
RECOMMENDED ALTERNATIVE

SHEET 2 OF 3

FCD 2004C049

DECEMBER 2006

N W E S

Feet
0 200 400 600

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WAGNER WASH
07
08
18
17
H190I90D_1
H190I90D_2
H190I90D_3
H175B90I_1
T190D10
1410
1390
1380
1420
1400
1370
1360
1350

LEGEND

- Step 3 Basins
- 50' Basin Buffer

Step 3 Corridors

- Floodwall
- No Floodwall
- 50' Corridor Buffer
- Proposed Dikes
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones

- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Countywide 10-ft Topo
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- White Tank Mtn Park
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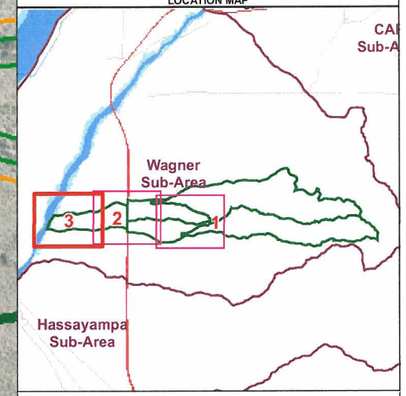
LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

SUN VALLEY
AREA DRAINAGE MASTER PLAN
STEP 3 - WAGNER SUB-AREA
FAN SYSTEM 17 & 18
RECOMMENDED ALTERNATIVE

SHEET 3 OF 3
FCD 2004C049
DECEMBER 2006

N
W
E
S

Feet
0 200 400 600

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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)
D1718_1	Dike	NA	0.9	0.0	3.6	1000	39	NA	$ 90	$ 280	$ 32	$ 147	$ 549	16%	51%	6%	27%	3%	18%	19%	100%	30%	26%
H175A75B_3	Walled-Levee Corridor	863	4.2	0.0	3.5	0.197	176	2.0	$ 420	$ 499	$ 52	$ 222	$ 1,193	35%	42%	4%	19%	6%	40%	23%	100%	61%	42%
H175A75B_2	Walled-Levee Corridor	862	3.8	0.0	4.0	0.18	176	2.1	$ 380	$ 461	$ 47	$ 202	$ 1,090	35%	42%	4%	19%	5%	39%	24%	100%	61%	43%
H175A75B_1	Walled-Levee Corridor	862	3.5	0.0	3.3	0.152	186	2.4	$ 350	$ 388	$ 40	$ 172	$ 950	37%	41%	4%	18%	5%	37%	24%	100%	61%	42%
H175B90I_3	Walled-Levee Corridor	862	5.1	0.0	4.1	0.221	191	1.7	$ 510	$ 550	$ 58	$ 243	$ 1,361	37%	40%	4%	18%	7%	37%	22%	100%	62%	41%
H175B90I_2	Walled-Levee Corridor	862	4.1	0.0	4.0	0.189	181	2.3	$ 410	$ 444	$ 50	$ 211	$ 1,115	37%	40%	4%	19%	6%	39%	26%	100%	61%	44%
H175B90I_1	Walled-Levee Corridor	1455	4.5	0.0	2.8	0.166	226	2.3	$ 450	$ 377	$ 44	$ 182	$ 1,053	43%	36%	4%	17%	5%	31%	24%	100%	62%	39%
H180A80B_5	Walled-Levee Corridor	764	4.6	0.0	2.7	0.207	181	2.0	$ 460	$ 469	$ 55	$ 224	$ 1,208	38%	39%	5%	19%	6%	39%	22%	100%	63%	42%
H180A80B_4	Walled-Levee Corridor	752	5.5	0.0	1.0	0.246	186	1.7	$ 550	$ 451	$ 60	$ 244	$ 1,305	42%	35%	5%	19%	7%	38%	19%	100%	64%	41%
H180A80B_3	Walled-Levee Corridor	742	3.6	0.0	0.0	0.187	160	2.5	$ 360	$ -	$ -	$ 1	$ 361	100%	0%	0%	0%	2%	0%	0%	0%	10%	0%
H180A80B_2	Walled-Levee Corridor	736	3.6	0.0	0.9	0.178	171	2.4	$ 360	$ 369	$ 24	$ 133	$ 885	41%	42%	3%	15%	4%	42%	19%	100%	47%	37%
H180A80B_1	Walled-Levee Corridor	727	4.3	0.0	0.9	0.2	181	3.7	$ 430	$ 386	$ 19	$ 122	$ 958	45%	40%	2%	13%	5%	40%	18%	100%	40%	35%
H180B90I_2	Walled-Levee Corridor	723	3.7	0.0	1.4	0.176	176	1.8	$ 370	$ 343	$ 41	$ 176	$ 931	40%	37%	4%	19%	5%	41%	22%	100%	61%	42%
H180B90I_1	Walled-Levee Corridor	723	7.3	0.0	7.0	0.352	171	2.1	$ 730	$ 888	$ 93	$ 396	$ 2,108	35%	42%	4%	19%	11%	41%	24%	100%	61%	43%
H190I90D_3	Walled-Levee Corridor	1450	6.3	0.0	5.2	0.231	226	2.1	$ 630	$ 590	$ 61	$ 260	$ 1,541	41%	38%	4%	17%	8%	32%	24%	100%	61%	39%
H190I90D_2	Walled-Levee Corridor	1448	5.3	0.0	3.5	0.189	231	2.3	$ 530	$ 472	$ 50	$ 213	$ 1,265	42%	37%	4%	17%	6%	30%	23%	100%	61%	38%
H190I90D_1	Walled-Levee Corridor	1434	8.5	0.0	7.9	0.306	231	3.0	$ 850	$ 873	$ 81	$ 360	$ 2,165	39%	40%	4%	17%	11%	31%	25%	100%	58%	38%
	TOTAL		78.8	0.0	55.8				$ 7,880	$ 7,840	$ 807	$ 3,509	**$ 20,036**	39%	39%	4%	18%	100%	35%	23%	100%	59%	39%
All Channels			77.9	0.0	52.2	3.4			$ 7,790	$ 7,560	$ 775	$ 3,362	$ 19,487	40%	39%	4%	17%	97%					
All Online Basins			0.0	0.0	0.0				$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Offline Basins			0.0	0.0	0.0				$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Dikes			0.9	0.0	3.6	1000			$ 90	$ 280	$ 32	$ 147	$ 549	16%	51%	6%	27%	3%					
Channel Cost per mile (in $1000)			$5,771		Basins Cost per ac. ft. (in $1000)				$0.00														

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
S175A	BASIN	863			4.58	1.34	175	44	15	6	1.216	1.218	1.218	1.218	87	87	87	87
75A75B	ROUTE	842	102	10.06	4.75	1.34	175	44	15	6	1.215	1.218	1.218	1.218	87	87	87	87
S175B	BASIN	692			4.08	0.32	53	13	4	2	1.514	1.514	1.514	1.514	26	26	26	26
C175B	COMBINE	862			4.67	1.66	214	54	18	8	1.199	1.201	1.201	1.201	106	106	106	106
75B90I	ROUTE	851	101.6	11.15	4.75	1.66	214	54	18	8	1.198	1.201	1.201	1.201	106	106	106	106
S180A	BASIN	767			4.5	0.94	131	33	11	5	1.297	1.299	1.299	1.299	65	65	65	65
80A80B	ROUTE	723	101.6	15.46	4.67	0.94	131	33	11	5	1.295	1.299	1.299	1.299	65	65	65	65
S180B	BASIN	628			4.08	0.29	43	11	4	2	1.351	1.351	1.351	1.351	21	21	21	21
C180B	COMBINE	723			4.58	1.24	164	41	14	6	1.235	1.238	1.238	1.238	81	82	82	82
80B90I	ROUTE	707	101.8	8.27	4.67	1.24	163	41	14	6	1.224	1.227	1.227	1.227	81	81	81	81
C190DI	COMBINE	1329			4.67	2.9	336	84	28	12	1.077	1.08	1.08	1.08	167	167	167	167
90I90D	ROUTE	1320	101.8	20.19	4.83	2.9	335	84	28	12	1.075	1.08	1.08	1.08	166	167	167	167
S190D	BASIN	731			4.08	0.36	50	13	4	2	1.289	1.289	1.289	1.289	25	25	25	25
C190D	COMBINE	1319			4.83	3.26	367	92	31	13	1.048	1.055	1.055	1.055	182	183	183	183

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
S175A	BASIN	844			12.58	1.34	161	41	14	6	1.12	1.131	1.132	1.132	80	81	81	81
75A75B	ROUTE	814	101.9	9.87	12.67	1.34	161	41	14	6	1.119	1.131	1.132	1.132	80	81	81	81
S175B	BASIN	562			12.08	0.32	44	11	4	2	1.252	1.252	1.252	1.252	22	22	22	22
C175B	COMBINE	840			12.67	1.66	203	51	17	7	1.134	1.144	1.144	1.144	101	101	101	101
75B90I	ROUTE	821	101.6	10.91	12.75	1.66	203	51	17	7	1.133	1.144	1.144	1.144	100	101	101	101
S180A	BASIN	691			12.5	0.94	115	29	10	4	1.134	1.158	1.158	1.158	57	58	58	58
80A80B	ROUTE	646	101.5	14.42	12.67	0.94	115	29	10	4	1.133	1.158	1.158	1.158	57	58	58	58
S180B	BASIN	502			12.08	0.29	35	9	3	1	1.114	1.114	1.114	1.114	18	18	18	18
C180B	COMBINE	661			12.67	1.24	149	38	13	5	1.118	1.136	1.137	1.137	74	75	75	75
80B90I	ROUTE	652	101.7	7.87	12.75	1.24	149	38	13	5	1.117	1.136	1.137	1.137	74	75	75	75
C190DI	COMBINE	1455			12.75	2.9	347	88	29	13	1.113	1.127	1.127	1.127	172	174	174	174
90I90D	ROUTE	1425	101.9	21.17	12.83	2.9	346	88	29	13	1.11	1.127	1.127	1.127	172	174	174	174
S190D	BASIN	580			12.08	0.36	41	10	3	1	1.064	1.064	1.064	1.064	20	20	20	20
C190D	COMBINE	1427			12.83	3.26	384	98	33	14	1.095	1.113	1.113	1.113	190	193	193	193

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)
H175A75B_3	Walled-Levee Corridor	0.0123	0.0049	0.20	75	2.0	0.045	863	79.1	152.0	1.9	2.0	2.0	75	5.7	0.70	No	0.3	1.1	5.4	406
H175A75B_2	Walled-Levee Corridor	0.0132	0.0124	0.18	75	2.1	0.045	862	79.0	148.7	1.9	2.0	2.1	75	5.8	0.73	No	1.1	1.2	5.5	3797
H175A75B_1	Walled-Levee Corridor	0.0096	0.0138	0.15	85	2.4	0.045	862	89.0	171.6	1.9	2.0	2.4	85	5.0	0.62	No	1.2	0.7	5.4	N/A
H175B90I_3	Walled-Levee Corridor	0.0183	0.0152	0.22	90	1.7	0.045	862	93.3	144.1	1.5	1.6	1.7	90	6.0	0.83	No	1.3	1.7	5.4	964
H175B90I_2	Walled-Levee Corridor	0.0139	0.0175	0.19	80	2.3	0.045	862	83.9	149.9	1.8	1.9	2.3	80	5.7	0.74	No	1.7	1.3	5.5	N/A
H175B90I_1	Walled-Levee Corridor	0.0137	0.0130	0.17	125	2.3	0.045	1455	128.5	244.5	1.9	2.0	2.3	125	6.0	0.75	No	2.1	2.2	5.5	4373
H180A80B_5	Walled-Levee Corridor	0.0180	0.0049	0.21	80	2.0	0.045	764	83.1	128.5	1.5	1.6	2.0	80	5.9	0.83	No	0.2	1.5	5.5	229
H180A80B_4	Walled-Levee Corridor	0.0189	0.0182	0.25	85	1.7	0.045	752	87.1	127.9	1.5	1.5	1.7	85	5.9	0.84	No	1.5	1.6	5.4	4333
H180A80B_3	Walled-Levee Corridor	0.0159	0.0176	0.19	159	2.5	0.045	742	83.6	131.4	1.6	1.6	2.5	83	5.6	0.79	No	1.6	1.4	5.5	N/A
H180A80B_2	Walled-Levee Corridor	0.0152	0.0167	0.18	70	2.4	0.045	736	73.1	125.6	1.7	1.8	2.4	70	5.9	0.77	No	1.4	1.2	5.5	N/A
H180A80B_1	Walled-Levee Corridor	0.0079	0.0131	0.20	80	3.7	0.045	727	82.5	159.3	1.9	2.0	3.7	80	4.6	0.57	No	1.2	0.6	5.5	N/A
H180B90I_2	Walled-Levee Corridor	0.0160	0.0120	0.18	75	1.8	0.045	723	77.9	125.6	1.6	1.7	1.8	75	5.8	0.78	No	0.8	1.2	5.4	750
H180B90I_1	Walled-Levee Corridor	0.0118	0.0159	0.35	70	2.1	0.045	723	73.9	134.7	1.8	1.9	2.1	70	5.4	0.68	No	1.2	0.8	5.4	N/A
H190I90D_3	Walled-Levee Corridor	0.0122	0.0147	0.23	125	2.1	0.045	1450	129.0	253.0	2.0	2.0	2.1	125	5.7	0.71	No	2.4	1.9	5.5	N/A
H190I90D_2	Walled-Levee Corridor	0.0117	0.0124	0.19	130	2.3	0.045	1448	134.0	259.9	1.9	2.0	2.3	130	5.6	0.69	No	1.9	1.7	5.4	N/A
H190I90D_1	Walled-Levee Corridor	0.0113	0.0111	0.31	130	3.0	0.045	1434	133.3	260.6	2.0	2.0	3.0	128	5.5	0.68	No	1.7	1.8	5.5	14675

Basins Summary

			Design Geometry				Hydraulics						Sedimentation	
Structure ID	Type	Adjacent Topo. Slope (ft/ft)	Top Area (acres)	Perimeter (ft)	Depth (ft)	Storage Volume Provided (ac. ft)	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)

Dike Cost Estimates

Structure ID	D1718_1

Dike Characteristics	Design	
Dike Length (ft)	1000	
Levee Top Width (ft)	15	
Levee Side Slope (ft/ft)	6	
Levee Height (ft)	4	
	Design	Aesthetic Trtmt.
Levee Surface Area (sq. Yd)	7111	1889
Levee Volume (cu. Yd)	5778	1334

Toe Protection		
Protection Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Protection Length	1000	ft
Thickness	1.5	ft
Protection Depth	6	ft
Tie-in Length/Depth	3.0	ft
Total Depth	9.0	ft
Area needed	333	sq. Yd
Volume	1000	cu. Yd

Levee Lining		
Lining Type	Riprap	
(Riprap, Gabions, Soil cement, Concrete,None)		
Levee Length (ft)	1000	
Levee Lining Width (ft)	24	
Levee Lining Thickness (ft)	1.5	
	Design	Aesthetic Trtmt.
Levee Lining Area (sq. Yd)	2667	835
Levee Lining Volume (cu. Yd)	1334	418

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	
Levee	Fill	5,778	cu. Yd	$ 7.00	$ 40,446	7,111	sq. Yd	$ 4.50	$ 32,000	7,111	sq. Yd	$ 11.67	$ 82,962	
Levee Lining	Riprap	1,334	cu. Yd	$ 75.00	$ 100,050	2,667	sq. Yd	$ -	$ -	2,667	sq. Yd	$ 20.83	$ 55,563	
Toe Protection	Riprap	1,000	cu. Yd	$ 75.00	$ 75,000	333	sq. Yd	$ -	$ -	333	sq. Yd	$ 25.00	$ 8,325	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 215,496			Total	$ 32,000			Total	$ 146,849	
		Contingency Cost (25% of Construction Cost)			$ 53,874									
		Engineering Design Cost (5% of Construction Cost)			$ 10,775									
		Total Construction Cost			$ 280,145									
Levee Aesthetic Treatment Cost	Fill	1,334	cu. Yd	$ 7.00	$ 9,338	7,111	sq. Yd	$ 4.50	$ 32,000	1,889	sq. Yd	$ 8.33	$ 15,742	
Levee Lining Aesthetic Trtmt. Cost	Riprap	418	cu. Yd	$ 75.00	$ 31,350	2,667	sq. Yd	$ -	$ -	835	sq. Yd	$ 33.33	$ 27,833	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 40,688			Total	$ 32,000			Total	$ 43,575	
		Contingency Cost (25% of Construction Cost)			$ 10,172									
		Engineering Design Cost (5% of Construction Cost)			$ 2,034									
		Total Construction Cost			$ 52,894									

Total Structure Aesthetic Trtmt Cost	$ 128,469

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way		0	$100,000	$ -
Adjacent Buffer Area	0	0	$100,000	$ -
Maintenance Access	0	0	$100,000	$ -
Levee	39	0.9	$100,000	$ 90,000
Other	0	0	$100,000	$ -
Total	39	0.9		$ 90,000

Total Land Related Aes. Trtmt Cost	$ 16,000

Total Cost	$ 548,993

Total Aesthetic Treatment Cost	$ 144,469

Total Right of Way Cost	$ 90,000

Walled-Levee Corridor

Structure ID	H175A75B

HEC1 ID	75A75B

Cutline ID	3

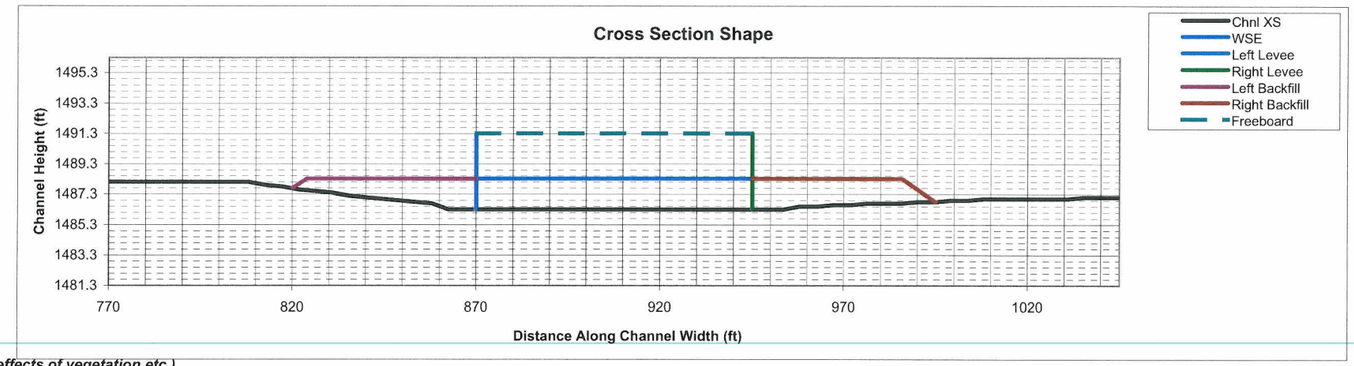
Longitudinal Geometry

Length	1039.7	ft
Initial Channel Slope	0.0123	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0049	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	870	Right Levee Station (ft)	945
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	870	Right Channel Limit Station (ft)	945

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	C175B	S175A								TOTAL
HEC1 Peak-Flow	862	863								
Weighting Factor	0.19	0.81								
Flow into Channel	166	697								863

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
86	76.0	37.6	1486.3	1486.8	2.3	0.5	75.0	0.5	0.5	0.57
259	76.9	73.0	1486.3	1487.3	3.5	1.0	75.0	0.9	1.0	0.63
647	78.4	127.5	1486.3	1488.0	5.1	1.7	75.0	1.6	1.7	0.69
863	79.1	152.0	1486.3	1488.3	5.7	2.0	75.0	1.9	2.0	0.70

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
86	76.3	49.6	1486.3	1487.0	1.7	0.7	75.0	0.7	0.7	0.38
259	77.6	96.5	1486.3	1487.6	2.7	1.3	75.0	1.2	1.3	0.42
647	79.5	169.0	1486.3	1488.6	3.8	2.3	75.0	2.1	2.3	0.45
863	80.4	201.7	1486.3	1489.0	4.3	2.7	75.0	2.5	2.7	0.46

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
	T175									
259	0.30									0.30

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
86	Stable
259	Stable
647	Erosive
863	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	259	cfs
Clear Water	No	
Total Incoming Sediment Load	0.299	cfs
Initial Chnl Sediment Capacity	1.098	cfs
Long-term Equilibrium Slope (ADWR)	0.0049	

Drop Structures

Design Slope	0.0049	ft/ft
Total Drop Needed	7.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.56	
Distance between Structures	406	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)
863	1.1	24.6	2.0	2.0	5.7	0.0123	-0.5	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1040
Channel Limit-Left Station (ft)	870
Channel Limit-Right Station (ft)	945
Channel Width (ft)	75

Levee

Left Levee Length (ft)	1040
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	1040
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	578
Left Levee Volume (cu. Yd)	96
Right Levee Surface Area (sq. Yd)	578
Right Levee Volume (cu. Yd)	96
Total Levee Surface Area (sq. Yd)	1156
Total Levee Volume (cu. Yd)	192

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)	52089
Left Levee Fill XS area (sq. ft)	66.6
Left Levee Fill Volume (cu. Yd)	2565
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)	52089
Right Levee Fill XS area (sq. ft)	80.7
Right Levee Fill Volume (cu. Yd)	3108
Total Levee Fill Surface Area (sq. ft)	104178
Total Levee Fill Volume (cu Yd)	5673

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	75	
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	2.56	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.90	2.89
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,457	$ 246
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	21	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	1,040	ft	$ 255	$ 264,889	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ 75.00	$ 86,700
Adjacent Levee Fill	Fill	5,673	cu. Yd	$ 7.00	$ 39,711	11,556	sq. Yd	$ 4.50	$ 52,000	11,556	sq. Yd	$ 11.67	$ 134,815
Wall Material Aesthetic Treatment Cost	Wall	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,156	sq. Yd	$ 63.00	$ 72,828	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -
Drop Structures	Gabions	3	EA	$ 2,456.50	$ 6,289	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 313
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 383,717			Total	$ 52,000			Total	$ 221,827
		Contingency Cost (25% of Construction Cost)			$ 95,929								
		Engineering Design Cost (5% of Construction Cost)			$ 19,186								
		Total Construction Cost			$ 498,832								
Wall Material Aesthetic Treatment Cost	Wall	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -	192	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,156	sq. Yd	$ 63.00	$ 72,828	1,156	sq. Yd	$ -	$ -	1,156	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	5,673	cu. Yd	$ 7.00	$ 39,711	11,556	sq. Yd	$ 4.50	$ 52,000	11,556	sq. Yd	$ 11.67	$ 134,815
Drop Structures Aesthetic Trtmt. Cost	Gabions	3	EA	$ 245.65	$ 629	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 31
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 113,168			Total	$ 52,000			Total	$ 134,846
		Contingency Cost (25% of Construction Cost)			$ 28,292								
		Engineering Design Cost (5% of Construction Cost)			$ 5,658								
		Total Construction Cost			$ 147,118								

Total Structure Aesthetic Trtmt Cost	$ 333,964

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	75	1.8	$100,000	$ 180,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	176	4.2		$ 420,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 1,192,660	Total Aesthetic Treatment Cost	$ 503,964	Total Right of Way Cost	$ 420,000

Walled-Levee Corridor

Structure ID	H175A75B	HEC1 ID	75A75B	Cutline ID	2

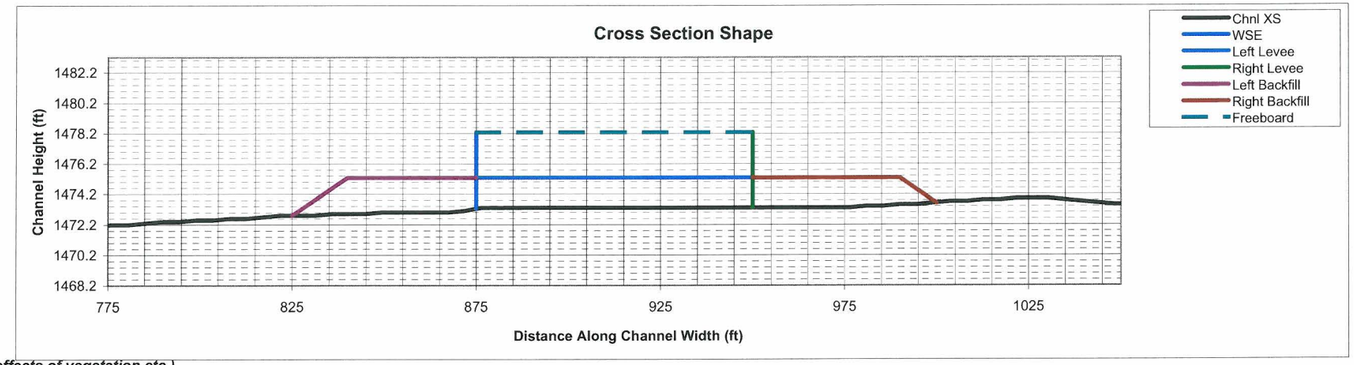
Longitudinal Geometry

Length	949.2	ft
Initial Channel Slope	0.0132	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0124	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	875	Right Levee Station (ft)	950
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	875	Right Channel Limit Station (ft)	950

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	C175B	S175A								TOTAL
HEC1 Peak-Flow	862	863								
Weighting Factor	0.56	0.44								
Flow into Channel	479	383								862

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
86	76.0	36.8	1473.2	1473.8	2.3	0.6	75.0	0.5	0.5	0.59
259	77.0	71.4	1473.2	1474.3	3.6	1.1	75.0	0.9	1.0	0.65
647	78.4	124.7	1473.2	1475.0	5.2	1.8	75.0	1.6	1.7	0.71
862	79.0	148.7	1473.2	1475.3	5.8	2.1	75.0	1.9	2.0	0.73

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
86	76.1	37.5	1473.2	1473.8	2.3	0.6	75.0	0.5	0.5	0.57
259	77.0	72.8	1473.2	1474.3	3.6	1.1	75.0	0.9	1.0	0.64
647	78.4	127.1	1473.2	1475.0	5.1	1.8	75.0	1.6	1.7	0.69
862	79.1	151.6	1473.2	1475.3	5.7	2.1	75.0	1.9	2.0	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
	H175A75B_3									
259	1.10									1.10

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
86	Stable
259	Stable
647	Erosive
862	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	259	cfs
Clear Water	No	
Total Incoming Sediment Load	1.098	cfs
Initial Chnl Sediment Capacity	1.209	cfs
Long-term Equilibrium Slope (ADWR)	0.0124	

Drop Structures

Design Slope	0.0124	ft/ft
Total Drop Needed	0.8	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.25	
Distance between Structures	3797	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)
862	1.1	24.6	2.1	2.0	5.8	0.0132	-0.5	0.9	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	949
Channel Limit-Left Station (ft)	875
Channel Limit-Right Station (ft)	950
Channel Width (ft)	75

Levee

Left Levee Length (ft)	949
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	949
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5

Left Levee Surface Area (sq. Yd)	527
Left Levee Volume (cu. Yd)	88
Right Levee Surface Area (sq. Yd)	527
Right Levee Volume (cu. Yd)	88
Total Levee Surface Area (sq. Yd)	1054
Total Levee Volume (cu. Yd)	176

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)	47647
Left Levee Fill XS area (sq. ft)	97.8
Left Levee Fill Volume (cu. Yd)	3437
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)	47552
Right Levee Fill XS area (sq. ft)	87.1
Right Levee Fill Volume (cu. Yd)	3061
Total Levee Fill Surface Area (sq. ft)	95199
Total Levee Fill Volume (cu Yd)	6498

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	75	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	8.1	
Structure Height (ft)	11.1	
Number of Structures	0.25	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	30.74	3.07
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,613	$ 261
Area per structure (sq. Yd)	8	1
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	949	ft	$ 255	$ 241,712	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,054	sq. Yd	$ -	$ -	1,054	sq. Yd	$ -	$ -	1,054	sq. Yd	$ 75.00	$ 79,050	
Adjacent Levee Fill	Fill	6,498	cu. Yd	$ 7.00	$ 45,486	10,544	sq. Yd	$ 4.50	$ 47,450	10,544	sq. Yd	$ 11.67	$ 123,019	
Wall Material Aesthetic Treatment Cost	Wall	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,054	sq. Yd	$ 63.00	$ 66,402	1,054	sq. Yd	$ -	$ -	1,054	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,612.90	$ 653	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 313	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 354,253			Total	$ 47,450			Total	$ 202,381	
		Contingency Cost (25% of Construction Cost)			$ 88,563									
		Engineering Design Cost (5% of Construction Cost)			$ 17,713									
		Total Construction Cost			$ 460,529									
Wall Material Aesthetic Treatment Cost	Wall	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	176	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,054	sq. Yd	$ 63.00	$ 66,402	1,054	sq. Yd	$ -	$ -	1,054	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,498	cu. Yd	$ 7.00	$ 45,486	10,544	sq. Yd	$ 4.50	$ 47,450	10,544	sq. Yd	$ 11.67	$ 123,019	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 260.95	$ 65	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 31	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 111,953			Total	$ 47,450			Total	$ 123,050	
		Contingency Cost (25% of Construction Cost)			$ 27,988									
		Engineering Design Cost (5% of Construction Cost)			$ 5,598									
		Total Construction Cost			$ 145,539									
Total Structure Aesthetic Trtmt Cost	$ 316,039													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	75	1.6	$100,000	$ 160,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	176	3.8		$ 380,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 1,090,360	Total Aesthetic Treatment Cost	$ 466,039
		Total Right of Way Cost	$ 380,000

Walled-Levee Corridor

Structure ID	H175A75B

HEC1 ID	75A75B

Cutline ID	1

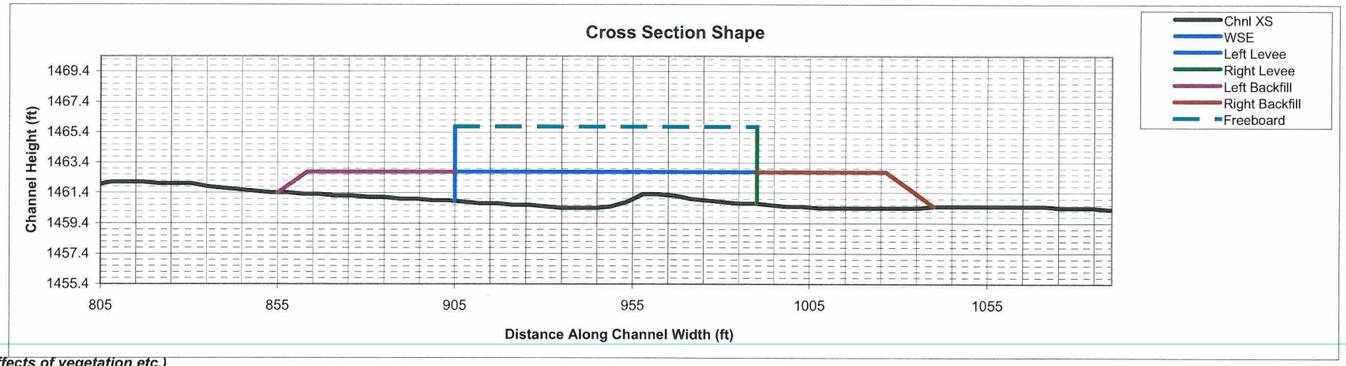
Longitudinal Geometry

Length	804.6	ft
Initial Channel Slope	0.0096	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0138	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	905	Right Levee Station (ft)	990
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	905	Right Channel Limit Station (ft)	990

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	C175B	S175A								TOTAL
HEC1 Peak-Flow	862	863								
Weighting Factor	0.88	0.12								
Flow into Channel	759	103								862

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
86	77.6	40.8	1460.4	1461.2	2.1	0.8	76.6	0.5	0.5	0.51
259	86.9	82.5	1460.4	1461.7	3.1	1.3	85.0	0.9	1.0	0.56
647	88.4	144.0	1460.4	1462.4	4.5	2.0	85.0	1.6	1.7	0.61
862	89.0	171.6	1460.4	1462.8	5.0	2.4	85.0	1.9	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
86	74.8	36.0	1460.4	1461.2	2.4	0.8	73.9	0.5	0.5	0.60
259	86.7	73.9	1460.4	1461.6	3.5	1.2	85.0	0.9	0.9	0.66
647	88.0	128.9	1460.4	1462.3	5.0	1.9	85.0	1.5	1.5	0.72
862	88.6	153.6	1460.4	1462.6	5.6	2.2	85.0	1.7	1.8	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
	H175A75B_2									
259	1.21									1.21

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
86	Stable
259	Stable
647	Stable
862	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	259	cfs
Clear Water	No	
Total Incoming Sediment Load	1.209	cfs
Initial Chnl Sediment Capacity	0.730	cfs
Long-term Equilibrium Slope (ADWR)	0.0138	

Drop Structures

Design Slope	0.0138	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)
862	1.1	24.6	2.4	2.0	5.0	0.0096	-0.6	0.7	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	805
Channel Limit-Left Station (ft)	905
Channel Limit-Right Station (ft)	990
Channel Width (ft)	85

Levee

Left Levee Length (ft)	805
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	805
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	438
Left Levee Volume (cu. Yd)	73
Right Levee Surface Area (sq. Yd)	456
Right Levee Volume (cu. Yd)	76
Total Levee Surface Area (sq. Yd)	894
Total Levee Volume (cu. Yd)	149

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)	40308
Left Levee Fill XS area (sq. ft)	76.3
Left Levee Fill Volume (cu. Yd)	2275
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)	40388
Right Levee Fill XS area (sq. ft)	100.5
Right Levee Fill Volume (cu. Yd)	2996
Total Levee Fill Surface Area (sq. ft)	80696
Total Levee Fill Volume (cu Yd)	5271

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)	7.6
Structure Height (ft)	10.6
Number of Structures	0.00

	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	33.33	3.33
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,833	$ 283
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	805	ft	$ 255	$ 205,035	149	cu. Yd	$ -	$ -	149	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	894	sq. Yd	$ -	$ -	894	sq. Yd	$ -	$ -	894	sq. Yd	$ 75.00	$ 67,050
Adjacent Levee Fill	Fill	5,271	cu. Yd	$ 7.00	$ 36,897	8,944	sq. Yd	$ 4.50	$ 40,250	8,944	sq. Yd	$ 11.67	$ 104,352
Wall Material Aesthetic Treatment Cost	Wall	149	cu. Yd	$ -	$ -	149	cu. Yd	$ -	$ -	149	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	894	sq. Yd	$ 63.00	$ 56,322	894	sq. Yd	$ -	$ -	894	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,833.05	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 354
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 298,254			Total	$ 40,250			Total	$ 171,756
		Contingency Cost (25% of Construction Cost)			$ 74,563								
		Engineering Design Cost (5% of Construction Cost)			$ 14,913								
		Total Construction Cost			$ 387,730								
Wall Material Aesthetic Treatment Cost	Wall	149	cu. Yd	$ -	$ -	149	cu. Yd	$ -	$ -	149	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	894	sq. Yd	$ 63.00	$ 56,322	894	sq. Yd	$ -	$ -	894	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,271	cu. Yd	$ 7.00	$ 36,897	8,944	sq. Yd	$ 4.50	$ 40,250	8,944	sq. Yd	$ 11.67	$ 104,352
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 283.05	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 35
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 93,219			Total	$ 40,250			Total	$ 104,387
		Contingency Cost (25% of Construction Cost)			$ 23,305								
		Engineering Design Cost (5% of Construction Cost)			$ 4,661								
		Total Construction Cost			$ 121,185								
Total Structure Aesthetic Trtmt Cost	$ 265,822												

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	0.6	$100,000	$ 60,000
Channel	85	1.6	$100,000	$ 160,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	186	3.5		$ 350,000

Total Land Related Aes. Trtmt Cost	$ 130,000

Total Cost	$ 949,736

Total Aesthetic Treatment Cost	$ 395,822

Total Right of Way Cost	$ 350,000

Walled-Levee Corridor

Structure ID	H175B90I	HEC1 ID	75B90I	Cutline ID	3

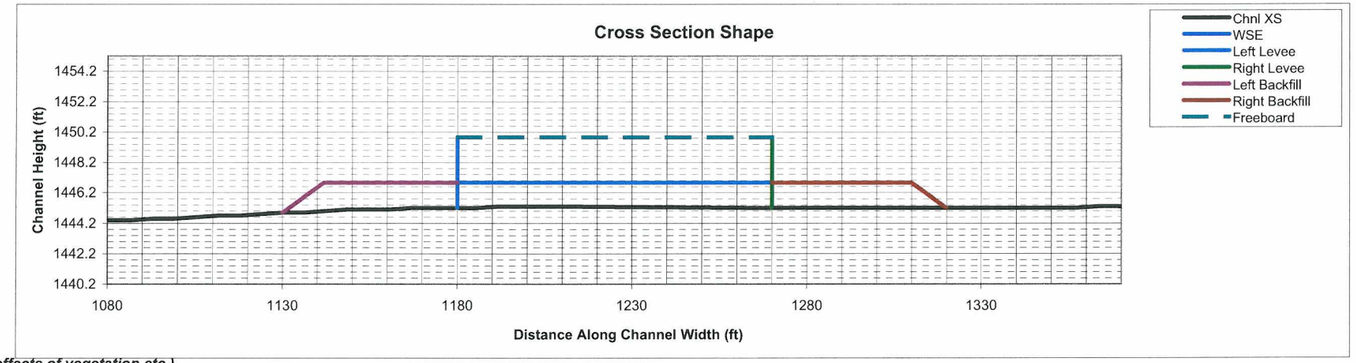
Longitudinal Geometry

Length	1166.4	ft
Initial Channel Slope	0.0183	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0152	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1180	Right Levee Station (ft)	1270
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1180	Right Channel Limit Station (ft)	1270

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	C175B									TOTAL
HEC1 Peak-Flow	862									
Weighting Factor	1.00									
Flow into Channel	862									862

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
86	90.9	35.8	1445.2	1445.7	2.4	0.5	90.0	0.4	0.4	0.67
259	91.7	69.5	1445.2	1446.0	3.7	0.8	90.0	0.8	0.8	0.75
647	92.8	121.0	1445.2	1446.6	5.3	1.4	90.0	1.3	1.3	0.81
862	93.3	144.1	1445.2	1446.9	6.0	1.7	90.0	1.5	1.6	0.83

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
86	91.0	37.9	1445.2	1445.7	2.3	0.5	90.0	0.4	0.4	0.62
259	91.8	73.5	1445.2	1446.1	3.5	0.9	90.0	0.8	0.8	0.69
647	93.0	128.0	1445.2	1446.7	5.1	1.5	90.0	1.4	1.4	0.75
862	93.5	152.4	1445.2	1447.0	5.7	1.8	90.0	1.6	1.7	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
	H175A75B_1	T175B10								
259	0.73	0.61								1.34

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
86	Stable
259	Stable
647	Erosive
862	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	259	cfs
Clear Water	No	
Total Incoming Sediment Load	1.343	cfs
Initial Chnl Sediment Capacity	1.744	cfs
Long-term Equilibrium Slope (ADWR)	0.0152	

Drop Structures

Design Slope	0.0152	ft/ft
Total Drop Needed	3.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.21	
Distance between Structures	964	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)
862	1.1	24.6	1.7	1.6	6.0	0.0183	-0.4	1.0	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1166
Channel Limit-Left Station (ft)	1180
Channel Limit-Right Station (ft)	1270
Channel Width (ft)	90

Levee

Left Levee Length (ft)	1166
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.7
Right Levee Length (ft)	1166
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	609
Left Levee Volume (cu. Yd)	101
Right Levee Surface Area (sq. Yd)	609
Right Levee Volume (cu. Yd)	101
Total Levee Surface Area (sq. Yd)	1218
Total Levee Volume (cu. Yd)	202

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)	58553
Left Levee Fill XS area (sq. ft)	77.3
Left Levee Fill Volume (cu. Yd)	3338
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)	58437
Right Levee Fill XS area (sq. ft)	74.8
Right Levee Fill Volume (cu. Yd)	3230
Total Levee Fill Surface Area (sq. ft)	116990
Total Levee Fill Volume (cu Yd)	6568

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)	7.4	
Structure Height (ft)	10.4	
Number of Structures	1.21	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	34.66	3.47
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,946	$ 295
Area per structure (sq. Yd)	10	1
Total Area (cu. Yd)	12	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	1,166	ft	$ 255	$ 296,982	202	cu. Yd	$ -	$ -	202	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,218	sq. Yd	$ -	$ -	1,218	sq. Yd	$ -	$ -	1,218	sq. Yd	$ 75.00	$ 91,350	
Adjacent Levee Fill	Fill	6,568	cu. Yd	$ 7.00	$ 45,976	12,956	sq. Yd	$ 4.50	$ 58,300	12,956	sq. Yd	$ 11.67	$ 151,148	
Wall Material Aesthetic Treatment Cost	Wall	202	cu. Yd	$ -	$ -	202	cu. Yd	$ -	$ -	202	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,218	sq. Yd	$ 63.00	$ 76,734	1,218	sq. Yd	$ -	$ -	1,218	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,946.10	$ 3,565	10	sq. Yd	$ -	$ -	10	sq. Yd	$ 37.50	$ 375	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 423,257			Total	$ 58,300			Total	$ 242,873	
		Contingency Cost (25% of Construction Cost)			$ 105,814									
		Engineering Design Cost (5% of Construction Cost)			$ 21,163									
		Total Construction Cost			$ 550,234									
Wall Material Aesthetic Treatment Cost	Wall	202	cu. Yd	$ -	$ -	202	cu. Yd	$ -	$ -	202	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,218	sq. Yd	$ 63.00	$ 76,734	1,218	sq. Yd	$ -	$ -	1,218	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,568	cu. Yd	$ 7.00	$ 45,976	12,956	sq. Yd	$ 4.50	$ 58,300	12,956	sq. Yd	$ 11.67	$ 151,148	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 294.95	$ 357	10	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 38	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 123,067			Total	$ 58,300			Total	$ 151,186	
		Contingency Cost (25% of Construction Cost)			$ 30,767									
		Engineering Design Cost (5% of Construction Cost)			$ 6,153									
		Total Construction Cost			$ 159,987									
Total Structure Aesthetic Trtmt Cost	$ 369,473													

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	90	2.4	$100,000	$ 240,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	191	5.1		$ 510,000

Total Land Related Aes. Trtmt Cost	$ 190,000

Total Cost	$ 1,361,407	Total Aesthetic Treatment Cost	$ 559,473	Total Right of Way Cost	$ 510,000

Walled-Levee Corridor

Structure ID	H175B90I

HEC1 ID	75B90I

Cutline ID	2

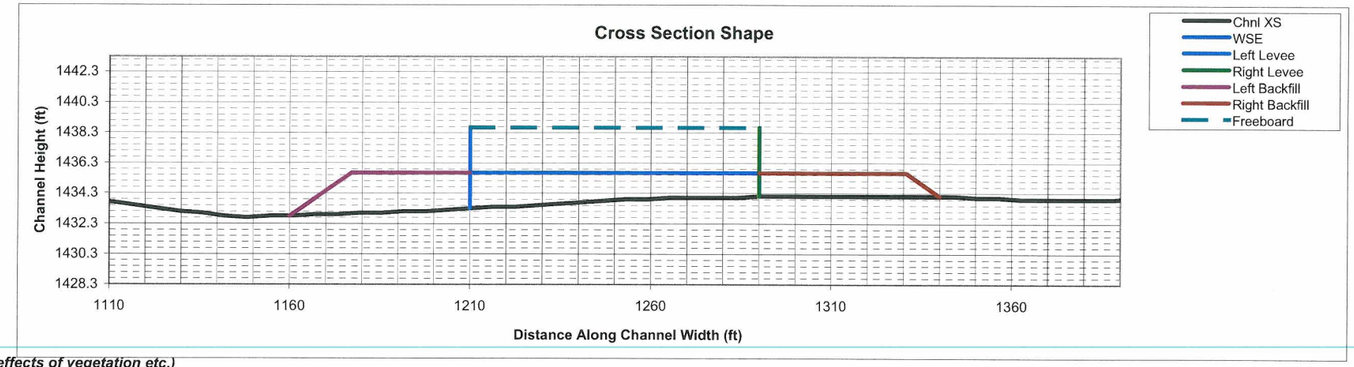
Longitudinal Geometry

Length	998.5	ft
Initial Channel Slope	0.0139	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0175	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1210	Right Levee Station (ft)	1290
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1210	Right Channel Limit Station (ft)	1290

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	C175B									TOTAL
HEC1 Peak-Flow	862									
Weighting Factor	1.00									
Flow into Channel	862									862

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
86	81.1	37.1	1433.3	1434.2	2.3	0.9	80.0	0.5	0.5	0.60
259	81.9	72.1	1433.3	1434.7	3.6	1.4	80.0	0.9	0.9	0.67
647	83.3	125.8	1433.3	1435.3	5.1	2.0	80.0	1.5	1.6	0.72
862	83.9	149.9	1433.3	1435.6	5.7	2.3	80.0	1.8	1.9	0.74

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
86	81.0	34.7	1433.3	1434.2	2.5	0.9	80.0	0.4	0.4	0.67
259	81.8	67.3	1433.3	1434.6	3.8	1.3	80.0	0.8	0.8	0.74
647	83.1	117.3	1433.3	1435.2	5.5	1.9	80.0	1.4	1.5	0.80
862	83.6	139.7	1433.3	1435.5	6.2	2.2	80.0	1.7	1.7	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
	H175B90I_3									
259	1.74									1.74

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
86	Stable
259	Stable
647	Erosive
862	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	259	cfs
Clear Water	No	
Total Incoming Sediment Load	1.744	cfs
Initial Chnl Sediment Capacity	1.258	cfs
Long-term Equilibrium Slope (ADWR)	0.0175	

Drop Structures

Design Slope	0.0175	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)
862	1.1	24.6	2.3	1.9	5.7	0.0139	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	998
Channel Limit-Left Station (ft)	1210
Channel Limit-Right Station (ft)	1290
Channel Width (ft)	80

Levee

Left Levee Length (ft)	998
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.3
Right Levee Length (ft)	998
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	588
Left Levee Volume (cu. Yd)	98
Right Levee Surface Area (sq. Yd)	499
Right Levee Volume (cu. Yd)	83
Total Levee Surface Area (sq. Yd)	1087
Total Levee Volume (cu. Yd)	181

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)	50122
Left Levee Fill XS area (sq. ft)	106.3
Left Levee Fill Volume (cu. Yd)	3929
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)	50022
Right Levee Fill XS area (sq. ft)	69.9
Right Levee Fill Volume (cu. Yd)	2584
Total Levee Fill Surface Area (sq. ft)	100144
Total Levee Fill Volume (cu Yd)	6513

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)	8.0	
Structure Height (ft)	11.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.52	3.25
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,764	$ 276
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	998	ft	$ 228	$ 227,375	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,087	sq. Yd	$ -	$ -	1,087	sq. Yd	$ -	$ -	1,087	sq. Yd	$ 75.00	$ 81,525	
Adjacent Levee Fill	Fill	6,513	cu. Yd	$ 7.00	$ 45,591	11,089	sq. Yd	$ 4.50	$ 49,900	11,089	sq. Yd	$ 11.67	$ 129,370	
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,087	sq. Yd	$ 63.00	$ 68,481	1,087	sq. Yd	$ -	$ -	1,087	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,764.20	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 341,447			Total	$ 49,900			Total	$ 211,229	
		Contingency Cost (25% of Construction Cost)			$ 85,362									
		Engineering Design Cost (5% of Construction Cost)			$ 17,072									
		Total Construction Cost			$ 443,881									
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,087	sq. Yd	$ 63.00	$ 68,481	1,087	sq. Yd	$ -	$ -	1,087	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,513	cu. Yd	$ 7.00	$ 45,591	11,089	sq. Yd	$ 4.50	$ 49,900	11,089	sq. Yd	$ 11.67	$ 129,370	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 276.25	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 114,072			Total	$ 49,900			Total	$ 129,404	
		Contingency Cost (25% of Construction Cost)			$ 28,518									
		Engineering Design Cost (5% of Construction Cost)			$ 5,704									
		Total Construction Cost			$ 148,294									
Total Structure Aesthetic Trtmt Cost	$ 327,597													

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	80	1.8	$100,000	$ 180,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	4.1		$ 410,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,115,010	Total Aesthetic Treatment Cost	$ 487,597	Total Right of Way Cost	$ 410,000

Walled-Levee Corridor

Structure ID	H175B90I

HEC1 ID	75B90I

Cutline ID	1

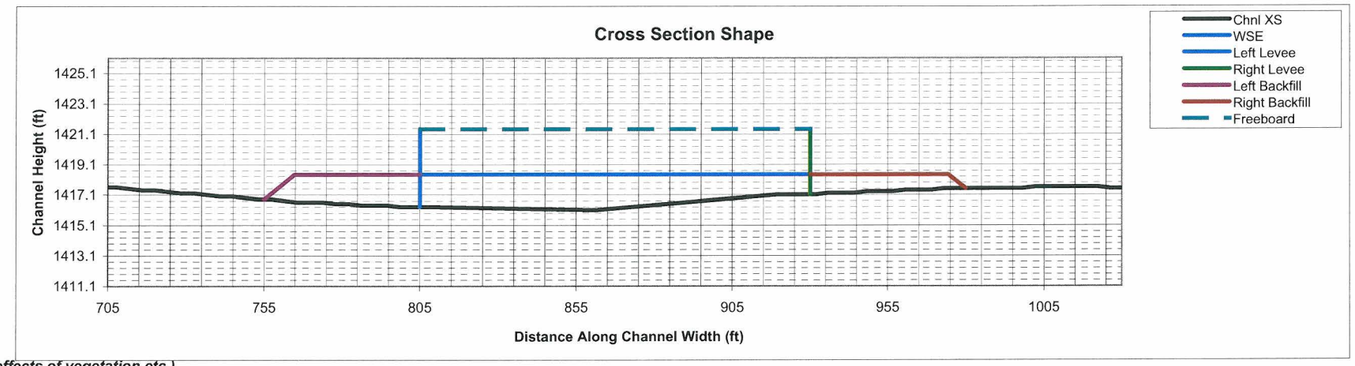
Longitudal Geometry

Length	874.6	ft
Initial Channel Slope	0.0137	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0130	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	805	Right Levee Station (ft)	930
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	805	Right Channel Limit Station (ft)	930

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	C190DI									TOTAL
HEC1 Peak-Flow	1455									
Weighting Factor	1.00									
Flow into Channel	1455									1455

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	102.5	56.1	1416.1	1416.9	2.6	0.8	101.9	0.5	0.6	0.62
437	126.4	118.0	1416.1	1417.4	3.7	1.3	125.0	0.9	0.9	0.67
1091	127.8	205.3	1416.1	1418.1	5.3	2.0	125.0	1.6	1.6	0.73
1455	128.5	244.5	1416.1	1418.4	6.0	2.3	125.0	1.9	2.0	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
146	103.1	57.1	1416.1	1416.9	2.5	0.8	102.5	0.6	0.6	0.60
437	126.5	119.8	1416.1	1417.4	3.6	1.3	125.0	0.9	1.0	0.66
1091	127.9	208.6	1416.1	1418.1	5.2	2.0	125.0	1.6	1.7	0.71
1455	128.5	248.4	1416.1	1418.5	5.9	2.4	125.0	1.9	2.0	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
	H175B90I_2	H180B90I_1								
437	1.26	0.82								2.07

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
146	Stable
437	Stable
1091	Erosive
1455	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	437	cfs
Clear Water	No	
Total Incoming Sediment Load	2.074	cfs
Initial Chnl Sediment Capacity	2.221	cfs
Long-term Equilibrium Slope (ADWR)	0.0130	

Drop Structures

Design Slope	0.0130	ft/ft
Total Drop Needed	0.6	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.20	
Distance between Structures	4373	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)
1455	1.1	24.6	2.3	2.0	6.0	0.0137	-0.5	1.0	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	875
Channel Limit-Left Station (ft)	805
Channel Limit-Right Station (ft)	930
Channel Width (ft)	125

Levee

Left Levee Length (ft)	875
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	875
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	496
Left Levee Volume (cu. Yd)	83
Right Levee Surface Area (sq. Yd)	418
Right Levee Volume (cu. Yd)	70
Total Levee Surface Area (sq. Yd)	914
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)	43815
Left Levee Fill XS area (sq. ft)	87.7
Left Levee Fill Volume (cu. Yd)	2842
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)	43815
Right Levee Fill XS area (sq. ft)	52.6
Right Levee Fill Volume (cu. Yd)	1705
Total Levee Fill Surface Area (sq. ft)	87630
Total Levee Fill Volume (cu Yd)	4547

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)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.20	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	51.73	5.17
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,397	$ 439
Area per structure (sq. Yd)	14	1
Total Area (cu. Yd)	3	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	875	ft	$ 228	$ 199,352	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	914	sq. Yd	$ -	$ -	914	sq. Yd	$ -	$ -	914	sq. Yd	$ 75.00	$ 68,550	
Adjacent Levee Fill	Fill	4,547	cu. Yd	$ 7.00	$ 31,829	9,722	sq. Yd	$ 4.50	$ 43,750	9,722	sq. Yd	$ 11.67	$ 113,426	
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	914	sq. Yd	$ 63.00	$ 57,582	914	sq. Yd	$ -	$ -	914	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 4,397.05	$ 879	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 521	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 289,642			Total	$ 43,750			Total	$ 182,497	
		Contingency Cost (25% of Construction Cost)			$ 72,411									
		Engineering Design Cost (5% of Construction Cost)			$ 14,482									
		Total Construction Cost			$ 376,535									
Wall Material Aesthetic Treatment Cost	Wall	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	153	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	914	sq. Yd	$ 63.00	$ 57,582	914	sq. Yd	$ -	$ -	914	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,547	cu. Yd	$ 7.00	$ 31,829	9,722	sq. Yd	$ 4.50	$ 43,750	9,722	sq. Yd	$ 11.67	$ 113,426	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 439.45	$ 88	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 52	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 89,499			Total	$ 43,750			Total	$ 113,478	
		Contingency Cost (25% of Construction Cost)			$ 22,375									
		Engineering Design Cost (5% of Construction Cost)			$ 4,475									
		Total Construction Cost			$ 116,349									
Total Structure Aesthetic Trtmt Cost	$ 273,577													

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.4	$100,000	$ 140,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	125	2.5	$100,000	$ 250,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	226	4.5		$ 450,000

Total Land Related Aes. Trtmt Cost	$ 140,000

Total Cost	$ 1,052,782	Total Aesthetic Treatment Cost	$ 413,577
		Total Right of Way Cost	$ 450,000

Walled-Levee Corridor

Structure ID	H180A80B

HEC1 ID	80A80B

Cutline ID	5

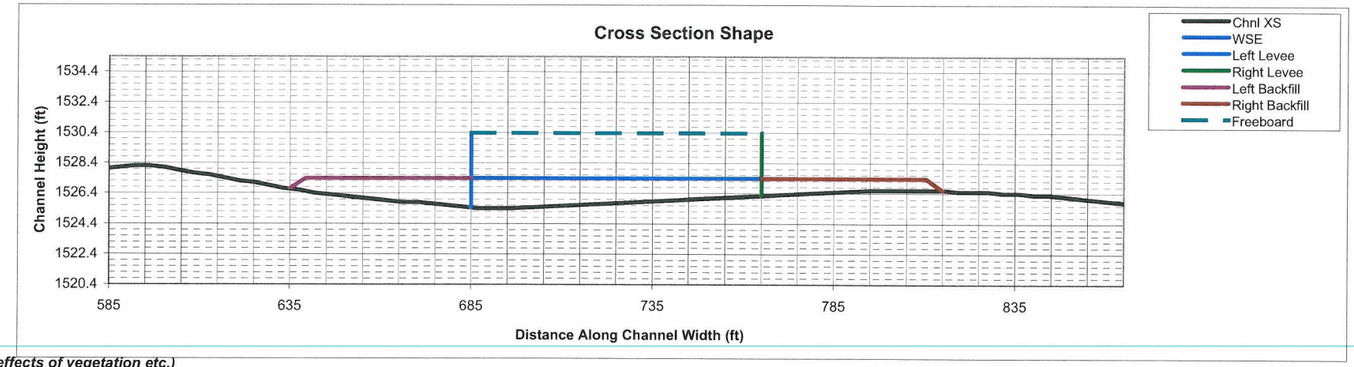
Longitudinal Geometry

Length	1094.2	ft
Initial Channel Slope	0.0180	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0049	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	685	Right Levee Station (ft)	765
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	685	Right Channel Limit Station (ft)	765

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	C180B	S180A								TOTAL
HEC1 Peak-Flow	723	767								
Weighting Factor	0.07	0.93								
Flow into Channel	50	714								764

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
76	72.8	30.6	1525.4	1526.1	2.5	0.7	72.1	0.4	0.4	0.67
229	81.4	61.9	1525.4	1526.5	3.7	1.1	80.0	0.8	0.8	0.74
573	82.5	107.9	1525.4	1527.1	5.3	1.7	80.0	1.3	1.3	0.81
764	83.1	128.5	1525.4	1527.4	5.9	2.0	80.0	1.5	1.6	0.83

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
76	81.0	47.2	1525.4	1526.4	1.6	1.0	80.0	0.6	0.6	0.37
229	82.1	91.8	1525.4	1526.9	2.5	1.5	80.0	1.1	1.1	0.41
573	83.9	160.4	1525.4	1527.8	3.6	2.4	80.0	1.9	2.0	0.44
764	84.6	191.3	1525.4	1528.2	4.0	2.8	80.0	2.3	2.4	0.45

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
	TS180A									
229	0.25									0.25

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
76	Stable
229	Stable
573	Erosive
764	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	229	cfs
Clear Water	No	
Total Incoming Sediment Load	0.245	cfs
Initial Chnl Sediment Capacity	1.511	cfs
Long-term Equilibrium Slope (ADWR)	0.0049	

Drop Structures

Design Slope	0.0049	ft/ft
Total Drop Needed	14.3	ft
Height of Drop Structure	3	ft
No. of Drop Structures	4.78	
Distance between Structures	229	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)
764	1.1	24.6	2.0	1.6	5.9	0.0180	-0.4	1.0	1.5	0.2	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1094
Channel Limit-Left Station (ft)	685
Channel Limit-Right Station (ft)	765
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1094
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1094
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.1

Left Levee Surface Area (sq. Yd)	596
Left Levee Volume (cu. Yd)	99
Right Levee Surface Area (sq. Yd)	498
Right Levee Volume (cu. Yd)	83
Total Levee Surface Area (sq. Yd)	1094
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)	54819
Left Levee Fill XS area (sq. ft)	67.1
Left Levee Fill Volume (cu. Yd)	2719
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)	54819
Right Levee Fill XS area (sq. ft)	42.2
Right Levee Fill Volume (cu. Yd)	1710
Total Levee Fill Surface Area (sq. ft)	109638
Total Levee Fill Volume (cu Yd)	4429

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)	6.7	
Structure Height (ft)	9.7	
Number of Structures	4.78	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.70	2.87
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,440	$ 244
Area per structure (sq. Yd)	9	1
Total Area (cu. Yd)	42	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	1,094	ft	$ 228	$ 249,247	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,094	sq. Yd	$ -	$ -	1,094	sq. Yd	$ -	$ -	1,094	sq. Yd	$ 75.00	$ 82,050
Adjacent Levee Fill	Fill	4,429	cu. Yd	$ 7.00	$ 31,003	12,156	sq. Yd	$ 4.50	$ 54,700	12,156	sq. Yd	$ 11.67	$ 141,815
Wall Material Aesthetic Treatment Cost	Wall	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,094	sq. Yd	$ 63.00	$ 68,922	1,094	sq. Yd	$ -	$ -	1,094	sq. Yd	$ -	$ -
Drop Structures	Gabions	5	EA	$ 2,439.50	$ 11,661	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 360,832			Total	$ 54,700			Total	$ 224,198
		Contingency Cost (25% of Construction Cost)			$ 90,208								
		Engineering Design Cost (5% of Construction Cost)			$ 18,042								
		Total Construction Cost			$ 469,082								
Wall Material Aesthetic Treatment Cost	Wall	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -	182	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,094	sq. Yd	$ 63.00	$ 68,922	1,094	sq. Yd	$ -	$ -	1,094	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trtmt. Cost	Fill	4,429	cu. Yd	$ 7.00	$ 31,003	12,156	sq. Yd	$ 4.50	$ 54,700	12,156	sq. Yd	$ 11.67	$ 141,815
Drop Structures Aesthetic Trtmt. Cost	Gabions	5	EA	$ 243.95	$ 1,166	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 101,091			Total	$ 54,700			Total	$ 141,848
		Contingency Cost (25% of Construction Cost)			$ 25,273								
		Engineering Design Cost (5% of Construction Cost)			$ 5,055								
		Total Construction Cost			$ 131,418								
Total Structure Aesthetic Trtmt Cost	$ 327,967												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.8	$100,000	$ 180,000
Maintenance Access	30	0.8	$100,000	$ 80,000
Channel	80	2	$100,000	$ 200,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	4.6		$ 460,000

Total Land Related Aes. Trtmt Cost	$ 180,000

Total Cost	$ 1,207,980	Total Aesthetic Treatment Cost	$ 507,967	Total Right of Way Cost	$ 460,000

Walled-Levee Corridor

Structure ID	H180A80B

HEC1 ID	80A80B

Cutline ID	4

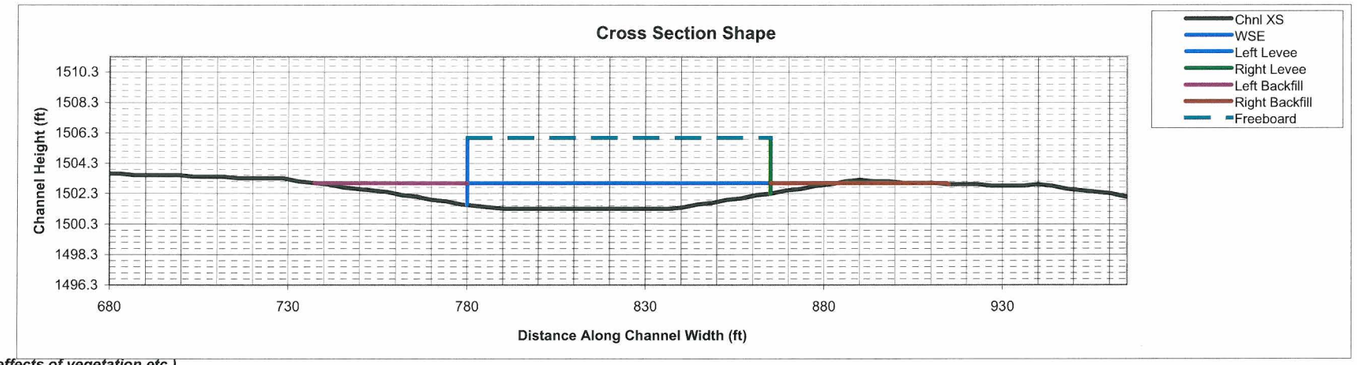
Longitundal Geometry

Length	1299.9	ft
Initial Channel Slope	0.0189	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0182	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	780	Right Levee Station (ft)	865
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	780	Right Channel Limit Station (ft)	865

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	C180B	S180A								TOTAL
HEC1 Peak-Flow	723	767								
Weighting Factor	0.34	0.66								
Flow into Channel	249	503								752

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
75	70.7	29.5	1501.3	1501.8	2.5	0.5	70.5	0.4	0.4	0.69
226	81.6	60.5	1501.3	1502.2	3.7	0.9	81.0	0.7	0.7	0.76
564	86.7	107.4	1501.3	1502.7	5.3	1.4	85.0	1.2	1.3	0.82
752	87.1	127.9	1501.3	1503.0	5.9	1.7	85.0	1.5	1.5	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
75	70.8	29.9	1501.3	1501.8	2.5	0.5	70.6	0.4	0.4	0.68
226	81.9	61.3	1501.3	1502.2	3.7	0.9	81.2	0.7	0.8	0.75
564	86.7	108.6	1501.3	1502.8	5.2	1.5	85.0	1.3	1.3	0.81
752	87.2	129.4	1501.3	1503.0	5.8	1.7	85.0	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
	H180A80B_5									
226	1.51									1.51

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
75	Stable
226	Stable
564	Erosive
752	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	226	cfs
Clear Water	No	
Total Incoming Sediment Load	1.511	cfs
Initial Chnl Sediment Capacity	1.594	cfs
Long-term Equilibrium Slope (ADWR)	0.0182	

Drop Structures

Design Slope	0.0182	ft/ft
Total Drop Needed	0.9	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.30	
Distance between Structures	4333	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)
752	1.1	24.6	1.7	1.5	5.9	0.0189	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1300
Channel Limit-Left Station (ft)	780
Channel Limit-Right Station (ft)	865
Channel Width (ft)	85

Levee

Left Levee Length (ft)	1300
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.4
Right Levee Length (ft)	1300
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.7

Left Levee Surface Area (sq. Yd)	636
Left Levee Volume (cu. Yd)	106
Right Levee Surface Area (sq. Yd)	534
Right Levee Volume (cu. Yd)	89
Total Levee Surface Area (sq. Yd)	1170
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)	42.6
Left Levee Fill Surface Area (sq. ft)	55374
Left Levee Fill XS area (sq. ft)	29.2
Left Levee Fill Volume (cu. Yd)	1406
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)	64993
Right Levee Fill XS area (sq. ft)	4.2
Right Levee Fill Volume (cu. Yd)	202
Total Levee Fill Surface Area (sq. ft)	120367
Total Levee Fill Volume (cu Yd)	1608

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)	7.2	
Structure Height (ft)	10.2	
Number of Structures	0.30	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.01	3.20
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,721	$ 272
Area per structure (sq. Yd)	9	1
Total Area (cu. Yd)	3	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	1,300	ft	$ 201	$ 261,248	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,170	sq. Yd	$ -	$ -	1,170	sq. Yd	$ -	$ -	1,170	sq. Yd	$ 75.00	$ 87,750	
Adjacent Levee Fill	Fill	1,608	cu. Yd	$ 7.00	$ 11,256	13,376	sq. Yd	$ 4.50	$ 60,190	13,376	sq. Yd	$ 11.67	$ 156,048	
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,170	sq. Yd	$ 63.00	$ 73,710	1,170	sq. Yd	$ -	$ -	1,170	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,720.85	$ 816	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 354	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 347,030			Total	$ 60,190			Total	$ 244,152	
		Contingency Cost (25% of Construction Cost)			$ 86,757									
		Engineering Design Cost (5% of Construction Cost)			$ 17,351									
		Total Construction Cost			$ 451,139									
Wall Material Aesthetic Treatment Cost	Wall	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	195	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,170	sq. Yd	$ 63.00	$ 73,710	1,170	sq. Yd	$ -	$ -	1,170	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	1,608	cu. Yd	$ 7.00	$ 11,256	13,376	sq. Yd	$ 4.50	$ 60,190	13,376	sq. Yd	$ 11.67	$ 156,048	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 272.00	$ 82	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 35	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 85,048			Total	$ 60,190			Total	$ 156,084	
		Contingency Cost (25% of Construction Cost)			$ 21,262									
		Engineering Design Cost (5% of Construction Cost)			$ 4,252									
		Total Construction Cost			$ 110,562									
Total Structure Aesthetic Trtmt Cost	$ 326,835													

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	85	2.5	$100,000	$ 250,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	186	5.5		$ 550,000

Total Land Related Aes. Trtmt Cost	$ 210,000

Total Cost	$ 1,305,481	Total Aesthetic Treatment Cost	$ 536,835	Total Right of Way Cost	$ 550,000

Walled-Levee Corridor

Structure ID	H180A80B

HEC1 ID	80A80B

Cutline ID	3

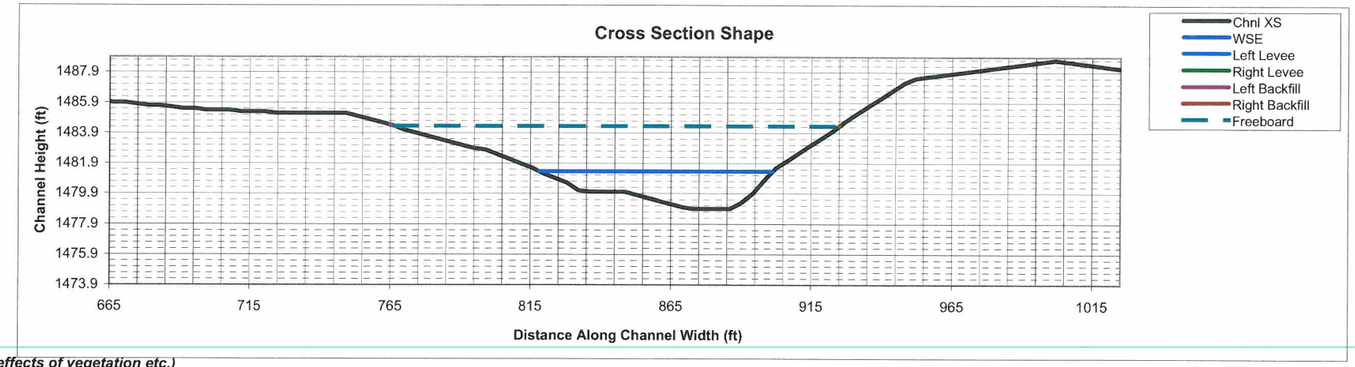
Longitudinal Geometry

Length	985.0	ft
Initial Channel Slope	0.0159	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0176	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	765	Right Levee Station (ft)	925
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	0
Left Channel Limit Station (ft)	766	Right Channel Limit Station (ft)	925

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	C180B	S180A								TOTAL
HEC1 Peak-Flow	723	767								
Weighting Factor	0.56	0.44								
Flow into Channel	405	337								742

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
74	40.5	24.7	1478.9	1479.8	3.0	0.9	40.5	0.6	0.6	0.68
223	66.9	58.4	1478.9	1480.4	3.8	1.5	66.7	0.9	0.9	0.72
557	78.6	107.9	1478.9	1481.1	5.2	2.2	78.3	1.4	1.4	0.77
742	83.6	131.4	1478.9	1481.4	5.6	2.5	83.3	1.6	1.6	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
74	39.9	23.8	1478.9	1479.8	3.1	0.9	39.9	0.6	0.6	0.71
223	66.5	56.5	1478.9	1480.4	3.9	1.5	66.3	0.8	0.9	0.75
557	77.7	104.2	1478.9	1481.0	5.3	2.1	77.4	1.3	1.3	0.81
742	82.7	127.0	1478.9	1481.3	5.8	2.4	82.4	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
	H180A80B_4									
223	1.59									1.59

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
74	Stable
223	Stable
557	Erosive
742	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	223	cfs
Clear Water	No	
Total Incoming Sediment Load	1.594	cfs
Initial Chnl Sediment Capacity	1.381	cfs
Long-term Equilibrium Slope (ADWR)	0.0176	

Drop Structures

Design Slope	0.0176	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)
742	1.1	24.6	2.5	1.6	5.6	0.0159	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	985
Channel Limit-Left Station (ft)	766
Channel Limit-Right Station (ft)	925
Channel Width (ft)	159

Levee

Left Levee Length (ft)	985
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	985
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)	159	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.2	
Structure Height (ft)	10.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	60.27	6.03
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,123	$ 513
Area per structure (sq. Yd)	18	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	985	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	$ 5,122.95	$ -	18	sq. Yd	$ -	$ -	18	sq. Yd	$ 37.50	$ 663
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ -			Total	$ -			Total	$ 663
		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	$ 512.55	$ -	18	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 66
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ -			Total	$ -			Total	$ 66
		Contingency Cost (25% of Construction Cost)			$ -								
		Engineering Design Cost (5% of Construction Cost)			$ -								
		Total Construction Cost			$ -								

Total Structure Aesthetic Trtmt Cost	$ 66

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	159	3.6	$100,000	$ 360,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	160	3.6		$ 360,000

Total Land Related Aes. Trtmt Cost	$ -

Total Cost	$ 360,663	Total Aesthetic Treatment Cost	$ 66	Total Right of Way Cost	$ 360,000

Walled-Levee Corridor

Structure ID	H180A80B	HEC1 ID	80A80B	Cutline ID	2

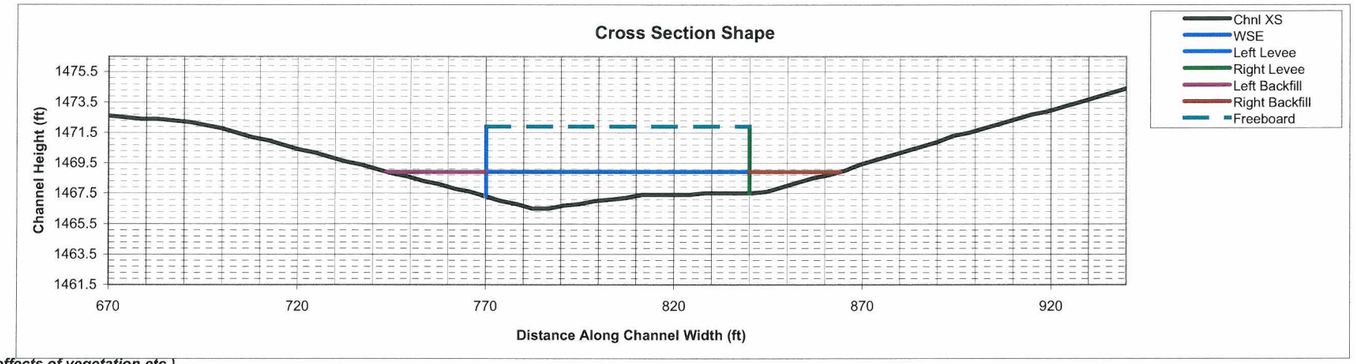
Longitudinal Geometry

Length	942.0	ft
Initial Channel Slope	0.0152	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0167	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	770	Right Levee Station (ft)	840
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	770	Right Channel Limit Station (ft)	840

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	C180B	S180A								TOTAL
HEC1 Peak-Flow	723	767								
Weighting Factor	0.72	0.28								
Flow into Channel	520	216								736

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
74	70.4	31.1	1466.5	1467.6	2.4	1.1	70.0	0.4	0.4	0.63
221	71.2	60.4	1466.5	1468.0	3.7	1.5	70.0	0.8	0.9	0.69
552	72.5	105.4	1466.5	1468.6	5.2	2.1	70.0	1.5	1.5	0.75
736	73.1	125.6	1466.5	1468.9	5.9	2.4	70.0	1.7	1.8	0.77

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
74	70.4	30.2	1466.5	1467.6	2.4	1.1	70.0	0.4	0.4	0.65
221	71.2	58.7	1466.5	1468.0	3.8	1.5	70.0	0.8	0.8	0.72
552	72.4	102.4	1466.5	1468.6	5.4	2.1	70.0	1.4	1.5	0.79
736	73.0	122.1	1466.5	1468.9	6.0	2.4	70.0	1.7	1.7	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
	H180A80B_3									
221	1.38									1.38

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
74	Stable
221	Stable
552	Erosive
736	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	221	cfs
Clear Water	No	
Total Incoming Sediment Load	1.381	cfs
Initial Chnl Sediment Capacity	1.214	cfs
Long-term Equilibrium Slope (ADWR)	0.0167	

Drop Structures

Design Slope	0.0167	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)
736	1.1	24.6	2.4	1.8	5.9	0.0152	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	942
Channel Limit-Left Station (ft)	770
Channel Limit-Right Station (ft)	840
Channel Width (ft)	70

Levee

Left Levee Length (ft)	942
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.6
Right Levee Length (ft)	942
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.4

Left Levee Surface Area (sq. Yd)	481
Left Levee Volume (cu. Yd)	80
Right Levee Surface Area (sq. Yd)	461
Right Levee Volume (cu. Yd)	77
Total Levee Surface Area (sq. Yd)	942
Total Levee Volume (cu. Yd)	157

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	26.4
Left Levee Fill Surface Area (sq. ft)	24869
Left Levee Fill XS area (sq. ft)	20.9
Left Levee Fill Volume (cu. Yd)	729
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	24.1
Right Levee Fill Surface Area (sq. ft)	22702
Right Levee Fill XS area (sq. ft)	18.6
Right Levee Fill Volume (cu. Yd)	649
Total Levee Fill Surface Area (sq. ft)	47571
Total Levee Fill Volume (cu Yd)	1378

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)	7.8	
Structure Height (ft)	10.8	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.11	2.81
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,389	$ 239
Area per structure (sq. Yd)	8	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	942	ft	$ 228	$ 214,616	157	cu. Yd	$ -	$ -	157	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	942	sq. Yd	$ -	$ -	942	sq. Yd	$ -	$ -	942	sq. Yd	$ 75.00	$ 70,650
Adjacent Levee Fill	Fill	1,378	cu. Yd	$ 7.00	$ 9,646	5,286	sq. Yd	$ 4.50	$ 23,786	5,286	sq. Yd	$ 11.67	$ 61,666
Wall Material Aesthetic Treatment Cost	Wall	157	cu. Yd	$ -	$ -	157	cu. Yd	$ -	$ -	157	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	942	sq. Yd	$ 63.00	$ 59,346	942	sq. Yd	$ -	$ -	942	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,389.35	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 283,608			Total	$ 23,786			Total	$ 132,608
		Contingency Cost (25% of Construction Cost)			$ 70,902								
		Engineering Design Cost (5% of Construction Cost)			$ 14,180								
		Total Construction Cost			$ 368,691								
Wall Material Aesthetic Treatment Cost	Wall	157	cu. Yd	$ -	$ -	157	cu. Yd	$ -	$ -	157	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	942	sq. Yd	$ 63.00	$ 59,346	942	sq. Yd	$ -	$ -	942	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	1,378	cu. Yd	$ 7.00	$ 9,646	5,286	sq. Yd	$ 4.50	$ 23,786	5,286	sq. Yd	$ 11.67	$ 61,666
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 238.85	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 68,992			Total	$ 23,786			Total	$ 61,695
		Contingency Cost (25% of Construction Cost)			$ 17,248								
		Engineering Design Cost (5% of Construction Cost)			$ 3,450								
		Total Construction Cost			$ 89,690								

Total Structure Aesthetic Trtmt Cost	$ 175,170

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	70	1.5	$100,000	$ 150,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	3.6		$ 360,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 885,084	Total Aesthetic Treatment Cost	$ 325,170	Total Right of Way Cost	$ 360,000

Walled-Levee Corridor

Structure ID	H180A80B

HEC1 ID	80A80B

Cutline ID	1

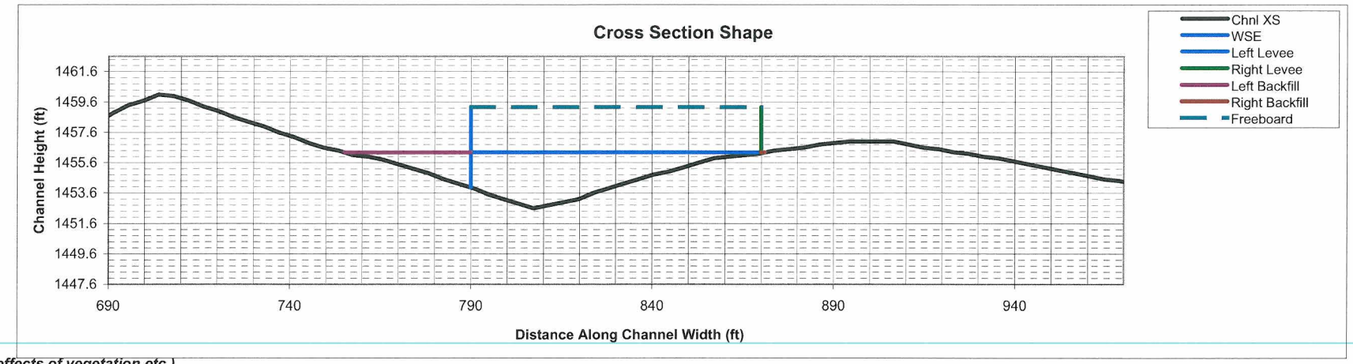
Longitundal Geometry

Length	1057.9	ft
Initial Channel Slope	0.0079	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0131	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	790	Right Levee Station (ft)	870
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	790	Right Channel Limit Station (ft)	870

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	C180B	S180A								TOTAL
HEC1 Peak-Flow	723	767								
Weighting Factor	0.91	0.09								
Flow into Channel	660	67								727

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
73	39.3	29.7	1452.6	1454.0	2.4	1.4	39.2	0.8	0.8	0.49
218	50.6	63.6	1452.6	1454.7	3.4	2.1	49.7	1.3	1.3	0.53
545	67.3	123.6	1452.6	1455.8	4.4	3.2	65.3	1.8	1.9	0.57
727	82.5	159.3	1452.6	1456.3	4.6	3.7	80.0	1.9	2.0	0.57

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
73	36.2	24.7	1452.6	1453.9	2.9	1.3	36.1	0.7	0.7	0.63
218	47.4	53.3	1452.6	1454.5	4.1	1.9	46.7	1.1	1.1	0.68
545	62.5	103.1	1452.6	1455.5	5.3	2.9	60.8	1.6	1.7	0.72
727	68.1	126.7	1452.6	1455.8	5.7	3.2	66.0	1.9	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
	H180A80B_2									
218	1.21									1.21

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
73	Stable
218	Stable
545	Stable
727	Stable

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	218	cfs
Clear Water	No	
Total Incoming Sediment Load	1.214	cfs
Initial Chnl Sediment Capacity	0.579	cfs
Long-term Equilibrium Slope (ADWR)	0.0131	

Drop Structures

Design Slope	0.0131	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)
727	1.1	24.6	3.7	2.0	4.6	0.0079	-0.9	0.6	1.5	0.4	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1058
Channel Limit-Left Station (ft)	790
Channel Limit-Right Station (ft)	870
Channel Width (ft)	80

Levee

Left Levee Length (ft)	1058
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.3
Right Levee Length (ft)	1058
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3

Left Levee Surface Area (sq. Yd)	623
Left Levee Volume (cu. Yd)	104
Right Levee Surface Area (sq. Yd)	353
Right Levee Volume (cu. Yd)	59
Total Levee Surface Area (sq. Yd)	976
Total Levee Volume (cu. Yd)	163

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	34.8
Left Levee Fill Surface Area (sq. ft)	36815
Left Levee Fill XS area (sq. ft)	36.1
Left Levee Fill Volume (cu. Yd)	1415
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	0.9
Right Levee Fill Surface Area (sq. ft)	952
Right Levee Fill XS area (sq. ft)	0
Right Levee Fill Volume (cu. Yd)	0
Total Levee Fill Surface Area (sq. ft)	37767
Total Levee Fill Volume (cu Yd)	1415

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)	7.9	
Structure Height (ft)	10.9	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	32.37	3.24
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,751	$ 275
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	1,058	ft	$ 213	$ 225,762	163	cu. Yd	$ -	$ -	163	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	976	sq. Yd	$ -	$ -	976	sq. Yd	$ -	$ -	976	sq. Yd	$ 75.00	$ 73,200	
Adjacent Levee Fill	Fill	1,415	cu. Yd	$ 7.00	$ 9,905	4,197	sq. Yd	$ 4.50	$ 18,885	4,197	sq. Yd	$ 11.67	$ 48,962	
Wall Material Aesthetic Treatment Cost	Wall	163	cu. Yd	$ -	$ -	163	cu. Yd	$ -	$ -	163	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	976	sq. Yd	$ 63.00	$ 61,488	976	sq. Yd	$ -	$ -	976	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 2,751.45	$ -	9	sq. Yd	$ -	$ -	9	sq. Yd	$ 37.50	$ 333	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 297,155			Total	$ 18,885			Total	$ 122,495	
		Contingency Cost (25% of Construction Cost)			$ 74,289									
		Engineering Design Cost (5% of Construction Cost)			$ 14,858									
		Total Construction Cost			$ 386,302									
Wall Material Aesthetic Treatment Cost	Wall	163	cu. Yd	$ -	$ -	163	cu. Yd	$ -	$ -	163	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	976	sq. Yd	$ 63.00	$ 61,488	976	sq. Yd	$ -	$ -	976	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	1,415	cu. Yd	$ 7.00	$ 9,905	4,197	sq. Yd	$ 4.50	$ 18,885	4,197	sq. Yd	$ 11.67	$ 48,962	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 275.40	$ -	9	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 33	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 71,393			Total	$ 18,885			Total	$ 48,995	
		Contingency Cost (25% of Construction Cost)			$ 17,848									
		Engineering Design Cost (5% of Construction Cost)			$ 3,570									
		Total Construction Cost			$ 92,811									
Total Structure Aesthetic Trtmt Cost	$ 160,691													

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	80	1.9	$100,000	$ 190,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	181	4.3		$ 430,000

Total Land Related Aes. Trtmt Cost	$ 170,000

Total Cost	$ 957,683	Total Aesthetic Treatment Cost	$ 330,691	Total Right of Way Cost	$ 430,000

Walled-Levee Corridor

Structure ID	H180B90I

HEC1 ID	80B90I

Cutline ID	2

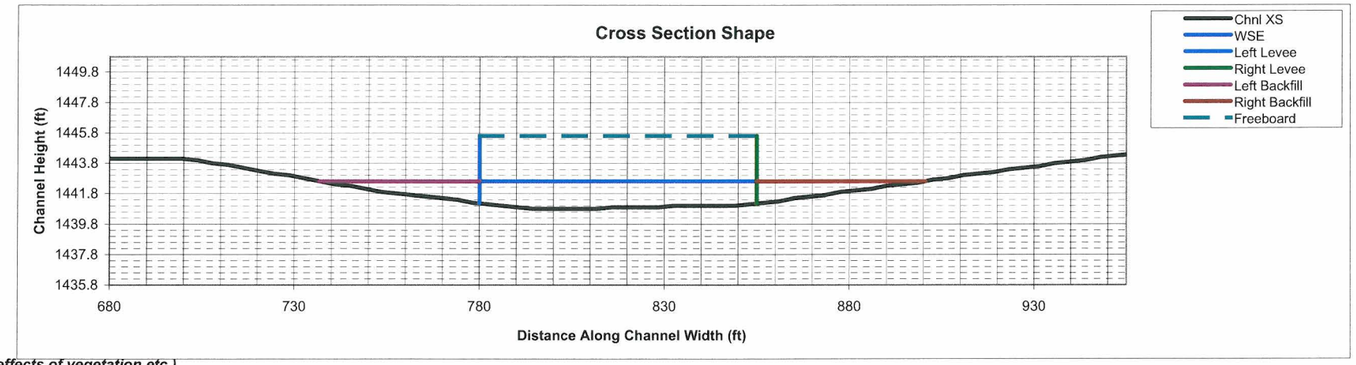
Longitudinal Geometry

Length	929.9	ft
Initial Channel Slope	0.0160	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0120	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	780	Right Levee Station (ft)	855
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	780	Right Channel Limit Station (ft)	855

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	C180B									TOTAL
HEC1 Peak-Flow	723									
Weighting Factor	1.00									
Flow into Channel	723									723

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
72	75.4	31.1	1440.8	1441.3	2.3	0.5	75.0	0.4	0.4	0.64
217	76.2	60.4	1440.8	1441.7	3.6	0.9	75.0	0.8	0.8	0.70
542	77.4	105.4	1440.8	1442.3	5.1	1.5	75.0	1.4	1.4	0.77
723	77.9	125.6	1440.8	1442.6	5.8	1.8	75.0	1.6	1.7	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
72	75.5	34.0	1440.8	1441.4	2.1	0.6	75.0	0.4	0.5	0.56
217	76.3	65.9	1440.8	1441.8	3.3	1.0	75.0	0.9	0.9	0.62
542	77.6	115.0	1440.8	1442.5	4.7	1.7	75.0	1.5	1.5	0.67
723	78.2	137.1	1440.8	1442.8	5.3	2.0	75.0	1.8	1.8	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
	H180A80B_1	T180B10								
217	0.58	0.24								0.82

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
72	Stable
217	Stable
542	Erosive
723	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	217	cfs
Clear Water	No	
Total Incoming Sediment Load	0.821	cfs
Initial Chnl Sediment Capacity	1.225	cfs
Long-term Equilibrium Slope (ADWR)	0.0120	

Drop Structures

Design Slope	0.0120	ft/ft
Total Drop Needed	3.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	1.24	
Distance between Structures	750	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)
723	1.1	24.6	1.8	1.7	5.8	0.0160	-0.4	0.9	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	930
Channel Limit-Left Station (ft)	780
Channel Limit-Right Station (ft)	855
Channel Width (ft)	75

Levee

Left Levee Length (ft)	930
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.4
Right Levee Length (ft)	930
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.5

Left Levee Surface Area (sq. Yd)	455
Left Levee Volume (cu. Yd)	76
Right Levee Surface Area (sq. Yd)	465
Right Levee Volume (cu. Yd)	78
Total Levee Surface Area (sq. Yd)	920
Total Levee Volume (cu. Yd)	154

Levee Fill

Left Levee Fill Buffer Width (ft)	50
Left Levee Fill Slope (ft/ft)	6
Left Levee Fill ROW Width (ft)	43.2
Left Levee Fill Surface Area (sq. ft)	40172
Left Levee Fill XS area (sq. ft)	33.2
Left Levee Fill Volume (cu. Yd)	1144
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	45.6
Right Levee Fill Surface Area (sq. ft)	42403
Right Levee Fill XS area (sq. ft)	33.6
Right Levee Fill Volume (cu. Yd)	1157
Total Levee Fill Surface Area (sq. ft)	82575
Total Levee Fill Volume (cu Yd)	2301

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	75	
Aesthetic Treatment Ratio	1.1	
Structure Thickness (ft)	1	
Drop Height (ft)	3	
Scour Depth (ft)	7.3	
Structure Height (ft)	10.3	
Number of Structures	1.24	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	28.60	2.86
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,431	$ 243
Area per structure (sq. Yd)	8	1
Total Area (cu. Yd)	10	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	930	ft	$ 201	$ 186,893	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	920	sq. Yd	$ -	$ -	920	sq. Yd	$ -	$ -	920	sq. Yd	$ 75.00	$ 69,000	
Adjacent Levee Fill	Fill	2,301	cu. Yd	$ 7.00	$ 16,107	9,176	sq. Yd	$ 4.50	$ 41,292	9,176	sq. Yd	$ 11.67	$ 107,053	
Wall Material Aesthetic Treatment Cost	Wall	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	920	sq. Yd	$ 63.00	$ 57,960	920	sq. Yd	$ -	$ -	920	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 2,431.00	$ 3,014	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 313	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 263,974			Total	$ 41,292			Total	$ 176,366	
		Contingency Cost (25% of Construction Cost)			$ 65,993									
		Engineering Design Cost (5% of Construction Cost)			$ 13,199									
		Total Construction Cost			$ 343,166									
Wall Material Aesthetic Treatment Cost	Wall	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	920	sq. Yd	$ 63.00	$ 57,960	920	sq. Yd	$ -	$ -	920	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,301	cu. Yd	$ 7.00	$ 16,107	9,176	sq. Yd	$ 4.50	$ 41,292	9,176	sq. Yd	$ 11.67	$ 107,053	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 243.10	$ 301	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 31	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 74,368			Total	$ 41,292			Total	$ 107,085	
		Contingency Cost (25% of Construction Cost)			$ 18,592									
		Engineering Design Cost (5% of Construction Cost)			$ 3,718									
		Total Construction Cost			$ 96,679									

Total Structure Aesthetic Trtmt Cost	$ 245,056

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	75	1.6	$100,000	$ 160,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	176	3.7		$ 370,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 930,824	Total Aesthetic Treatment Cost	$ 395,056	Total Right of Way Cost	$ 370,000

Walled-Levee Corridor

Structure ID	H180B90I

HEC1 ID	80B90I

Cutline ID	1

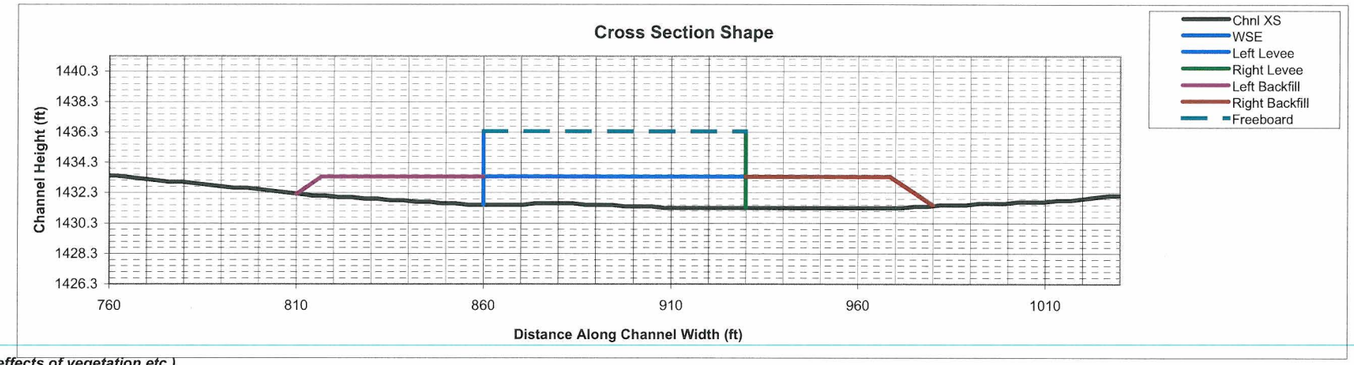
Longitudal Geometry

Length	1859.6	ft
Initial Channel Slope	0.0118	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0159	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	860	Right Levee Station (ft)	930
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	860	Right Channel Limit Station (ft)	930

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	C180B									TOTAL
HEC1 Peak-Flow	723									
Weighting Factor	1.00									
Flow into Channel	723									723

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
72	71.0	33.3	1431.3	1431.9	2.2	0.6	70.0	0.5	0.5	0.55
217	71.9	64.7	1431.3	1432.4	3.4	1.1	70.0	0.9	0.9	0.61
542	73.3	113.0	1431.3	1433.1	4.8	1.8	70.0	1.5	1.6	0.67
723	73.9	134.7	1431.3	1433.4	5.4	2.1	70.0	1.8	1.9	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
72	71.0	30.4	1431.3	1431.9	2.4	0.6	70.0	0.4	0.4	0.63
217	71.8	59.1	1431.3	1432.3	3.7	1.0	70.0	0.8	0.8	0.70
542	73.0	103.2	1431.3	1432.9	5.3	1.6	70.0	1.4	1.5	0.76
723	73.6	123.0	1431.3	1433.2	5.9	1.9	70.0	1.7	1.8	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
	H180B90I_2									
217	1.23									1.23

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
72	Stable
217	Stable
542	Stable
723	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	217	cfs
Clear Water	No	
Total Incoming Sediment Load	1.225	cfs
Initial Chnl Sediment Capacity	0.816	cfs
Long-term Equilibrium Slope (ADWR)	0.0159	

Drop Structures

Design Slope	0.0159	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)
723	1.1	24.6	2.1	1.9	5.4	0.0118	-0.5	0.8	1.5	0.2	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1860
Channel Limit-Left Station (ft)	860
Channel Limit-Right Station (ft)	930
Channel Width (ft)	70

Levee

Left Levee Length (ft)	1860
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1860
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	1013
Left Levee Volume (cu. Yd)	169
Right Levee Surface Area (sq. Yd)	1054
Right Levee Volume (cu. Yd)	176
Total Levee Surface Area (sq. Yd)	2067
Total Levee Volume (cu. Yd)	345

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)	93166
Left Levee Fill XS area (sq. ft)	72.7
Left Levee Fill Volume (cu. Yd)	5008
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)	93352
Right Levee Fill XS area (sq. ft)	91.5
Right Levee Fill Volume (cu. Yd)	6303
Total Levee Fill Surface Area (sq. ft)	186518
Total Levee Fill Volume (cu Yd)	11311

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)	7.7	
Structure Height (ft)	10.7	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	27.83	2.78
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 2,366	$ 236
Area per structure (sq. Yd)	8	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	1,860	ft	$ 255	$ 473,745	345	cu. Yd	$ -	$ -	345	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	2,067	sq. Yd	$ -	$ -	2,067	sq. Yd	$ -	$ -	2,067	sq. Yd	$ 75.00	$ 155,025
Adjacent Levee Fill	Fill	11,311	cu. Yd	$ 7.00	$ 79,177	20,667	sq. Yd	$ 4.50	$ 93,000	20,667	sq. Yd	$ 11.67	$ 241,111
Wall Material Aesthetic Treatment Cost	Wall	345	cu. Yd	$ -	$ -	345	cu. Yd	$ -	$ -	345	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	2,067	sq. Yd	$ 63.00	$ 130,221	2,067	sq. Yd	$ -	$ -	2,067	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 2,365.55	$ -	8	sq. Yd	$ -	$ -	8	sq. Yd	$ 37.50	$ 292
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 683,143			Total	$ 93,000			Total	$ 396,428
		Contingency Cost (25% of Construction Cost)			$ 170,786								
		Engineering Design Cost (5% of Construction Cost)			$ 34,157								
		Total Construction Cost			$ 888,085								
Wall Material Aesthetic Treatment Cost	Wall	345	cu. Yd	$ -	$ -	345	cu. Yd	$ -	$ -	345	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	2,067	sq. Yd	$ 63.00	$ 130,221	2,067	sq. Yd	$ -	$ -	2,067	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	11,311	cu. Yd	$ 7.00	$ 79,177	20,667	sq. Yd	$ 4.50	$ 93,000	20,667	sq. Yd	$ 11.67	$ 241,111
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 236.30	$ -	8	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 29
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 209,398			Total	$ 93,000			Total	$ 241,140
		Contingency Cost (25% of Construction Cost)			$ 52,350								
		Engineering Design Cost (5% of Construction Cost)			$ 10,470								
		Total Construction Cost			$ 272,217								
Total Structure Aesthetic Trtmt Cost	$ 606,358												

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	3	$100,000	$ 300,000
Maintenance Access	30	1.3	$100,000	$ 130,000
Channel	70	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	171	7.3		$ 730,000

Total Land Related Aes. Trtmt Cost	$ 300,000

Total Cost	$ 2,107,513	Total Aesthetic Treatment Cost	$ 906,358
		Total Right of Way Cost	$ 730,000

Walled-Levee Corridor

Structure ID	H190I90D	HEC1 ID	90I90D	Cutline ID	3

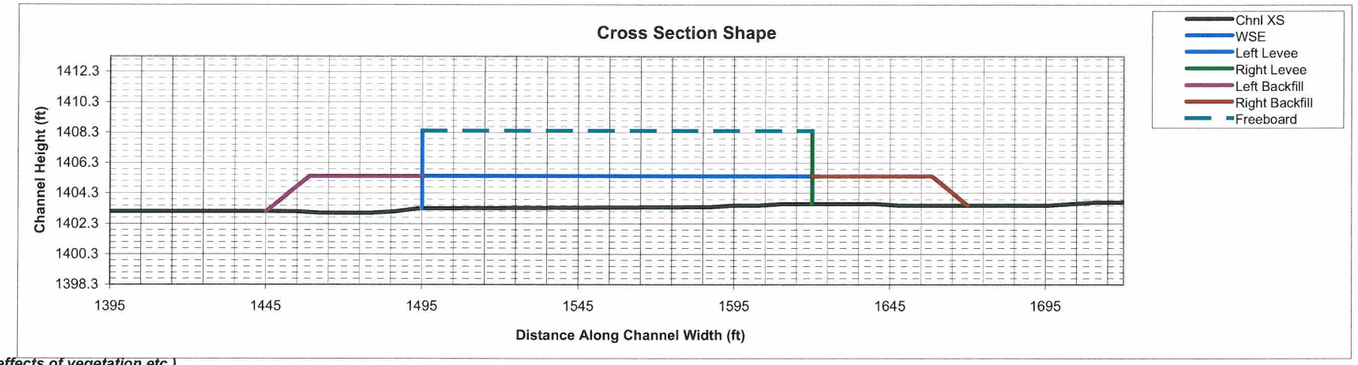
Longitudinal Geometry

Length	1220.6	ft
Initial Channel Slope	0.0122	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0147	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1495	Right Levee Station (ft)	1620
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1495	Right Channel Limit Station (ft)	1620

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	C190D	C190DI								TOTAL
HEC1 Peak-Flow	1427	1455								
Weighting Factor	0.19	0.81								
Flow into Channel	275	1175								1450

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
145	125.9	62.9	1403.3	1403.9	2.3	0.6	125.0	0.5	0.5	0.57
435	126.9	122.0	1403.3	1404.4	3.6	1.1	125.0	1.0	1.0	0.64
1088	128.3	212.5	1403.3	1405.1	5.1	1.8	125.0	1.7	1.7	0.69
1450	129.0	253.0	1403.3	1405.4	5.7	2.1	125.0	2.0	2.0	0.71

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
145	125.9	59.5	1403.3	1403.9	2.4	0.6	125.0	0.5	0.5	0.62
435	126.7	115.4	1403.3	1404.3	3.8	1.0	125.0	0.9	0.9	0.69
1088	128.1	200.8	1403.3	1405.0	5.4	1.7	125.0	1.6	1.6	0.75
1450	128.7	239.1	1403.3	1405.3	6.1	2.0	125.0	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
	H175B90I_1	T190D10								
435	2.22	0.22								2.44

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
145	Stable
435	Stable
1088	Erosive
1450	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	435	cfs
Clear Water	No	
Total Incoming Sediment Load	2.438	cfs
Initial Chnl Sediment Capacity	1.870	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)
1450	1.1	24.6	2.1	2.0	5.7	0.0122	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1221
Channel Limit-Left Station (ft)	1495
Channel Limit-Right Station (ft)	1620
Channel Width (ft)	125

Levee

Left Levee Length (ft)	1221
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	1221
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.8

Left Levee Surface Area (sq. Yd)	692
Left Levee Volume (cu. Yd)	115
Right Levee Surface Area (sq. Yd)	651
Right Levee Volume (cu. Yd)	109
Total Levee Surface Area (sq. Yd)	1343
Total Levee Volume (cu. Yd)	224

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)	61274
Left Levee Fill XS area (sq. ft)	101.4
Left Levee Fill Volume (cu. Yd)	4586
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)	61274
Right Levee Fill XS area (sq. ft)	82.7
Right Levee Fill Volume (cu. Yd)	3740
Total Levee Fill Surface Area (sq. ft)	122548
Total Levee Fill Volume (cu Yd)	8326

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)	8.2	
Structure Height (ft)	11.2	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	51.98	5.20
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,418	$ 442
Area per structure (sq. Yd)	14	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	1,221	ft	$ 255	$ 310,990	224	cu. Yd	$ -	$ -	224	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,343	sq. Yd	$ -	$ -	1,343	sq. Yd	$ -	$ -	1,343	sq. Yd	$ 75.00	$ 100,725
Adjacent Levee Fill	Fill	8,326	cu. Yd	$ 7.00	$ 58,282	13,567	sq. Yd	$ 4.50	$ 61,050	13,567	sq. Yd	$ 11.67	$ 158,278
Wall Material Aesthetic Treatment Cost	Wall	224	cu. Yd	$ -	$ -	224	cu. Yd	$ -	$ -	224	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,343	sq. Yd	$ 63.00	$ 84,609	1,343	sq. Yd	$ -	$ -	1,343	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,418.30	$ -	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 521
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 453,881			Total	$ 61,050			Total	$ 259,524
		Contingency Cost (25% of Construction Cost)			$ 113,470								
		Engineering Design Cost (5% of Construction Cost)			$ 22,694								
		Total Construction Cost			$ 590,046								
Wall Material Aesthetic Treatment Cost	Wall	224	cu. Yd	$ -	$ -	224	cu. Yd	$ -	$ -	224	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,343	sq. Yd	$ 63.00	$ 84,609	1,343	sq. Yd	$ -	$ -	1,343	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	8,326	cu. Yd	$ 7.00	$ 58,282	13,567	sq. Yd	$ 4.50	$ 61,050	13,567	sq. Yd	$ 11.67	$ 158,278
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 442.00	$ -	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 52
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 142,891			Total	$ 61,050			Total	$ 158,330
		Contingency Cost (25% of Construction Cost)			$ 35,723								
		Engineering Design Cost (5% of Construction Cost)			$ 7,145								
		Total Construction Cost			$ 185,758								

Total Structure Aesthetic Trtmt Cost	$ 405,138

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	0.8	$100,000	$ 80,000
Channel	125	3.5	$100,000	$ 350,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	226	6.3		$ 630,000

Total Land Related Aes. Trtmt Cost	$ 200,000

Total Cost	$ 1,540,619	Total Aesthetic Treatment Cost	$ 605,138	Total Right of Way Cost	$ 630,000

Walled-Levee Corridor

Structure ID	H190I90D

HEC1 ID	90I90D

Cutline ID	2

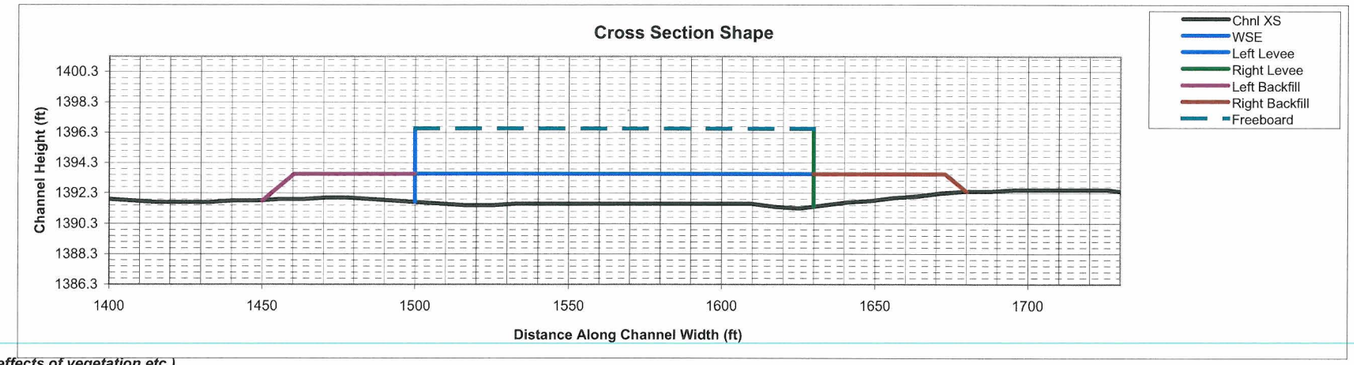
Longitudinal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0117	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0124	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1500	Right Levee Station (ft)	1630
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1500	Right Channel Limit Station (ft)	1630

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	C190D	C190DI								TOTAL
HEC1 Peak-Flow	1427	1455								
Weighting Factor	0.27	0.73								
Flow into Channel	383	1065								1448

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
145	131.0	64.7	1391.3	1392.1	2.2	0.8	130.0	0.5	0.5	0.56
434	131.9	125.4	1391.3	1392.5	3.5	1.2	130.0	1.0	1.0	0.62
1086	133.4	218.3	1391.3	1393.2	5.0	1.9	130.0	1.6	1.7	0.68
1448	134.0	259.9	1391.3	1393.6	5.6	2.3	130.0	1.9	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
145	131.0	63.6	1391.3	1392.1	2.3	0.8	130.0	0.5	0.5	0.57
434	131.9	123.3	1391.3	1392.5	3.5	1.2	130.0	0.9	0.9	0.64
1086	133.3	214.5	1391.3	1393.2	5.1	1.9	130.0	1.6	1.6	0.69
1448	133.9	255.4	1391.3	1393.5	5.7	2.2	130.0	1.9	2.0	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
	H190I90D_3									
434	1.87									1.87

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
145	Stable
434	Stable
1086	Stable
1448	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	434	cfs
Clear Water	No	
Total Incoming Sediment Load	1.870	cfs
Initial Chnl Sediment Capacity	1.723	cfs
Long-term Equilibrium Slope (ADWR)	0.0124	

Drop Structures

Design Slope	0.0124	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)
1448	1.1	24.6	2.3	2.0	5.6	0.0117	-0.5	0.8	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1500
Channel Limit-Right Station (ft)	1630
Channel Width (ft)	130

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.1

Left Levee Surface Area (sq. Yd)	533
Left Levee Volume (cu. Yd)	89
Right Levee Surface Area (sq. Yd)	567
Right Levee Volume (cu. Yd)	94
Total Levee Surface Area (sq. Yd)	1100
Total Levee Volume (cu. Yd)	183

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)	74
Left Levee Fill Volume (cu. Yd)	2741
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)	76.8
Right Levee Fill Volume (cu. Yd)	2844
Total Levee Fill Surface Area (sq. ft)	100200
Total Levee Fill Volume (cu Yd)	5585

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	130	
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)	52.69	5.27
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,479	$ 448
Area per structure (sq. Yd)	14	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	1,000	ft	$ 255	$ 254,701	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,100	sq. Yd	$ -	$ -	1,100	sq. Yd	$ -	$ -	1,100	sq. Yd	$ 75.00	$ 82,500
Adjacent Levee Fill	Fill	5,585	cu. Yd	$ 7.00	$ 39,095	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Wall Material Aesthetic Treatment Cost	Wall	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,100	sq. Yd	$ 63.00	$ 69,300	1,100	sq. Yd	$ -	$ -	1,100	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,478.65	$ -	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 542
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 363,096			Total	$ 50,000			Total	$ 212,671
		Contingency Cost (25% of Construction Cost)			$ 90,774								
		Engineering Design Cost (5% of Construction Cost)			$ 18,155								
		Total Construction Cost			$ 472,025								
Wall Material Aesthetic Treatment Cost	Wall	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -	183	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,100	sq. Yd	$ 63.00	$ 69,300	1,100	sq. Yd	$ -	$ -	1,100	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	5,585	cu. Yd	$ 7.00	$ 39,095	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 447.95	$ -	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 54
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 108,395			Total	$ 50,000			Total	$ 129,684
		Contingency Cost (25% of Construction Cost)			$ 27,099								
		Engineering Design Cost (5% of Construction Cost)			$ 5,420								
		Total Construction Cost			$ 140,914								
Total Structure Aesthetic Trtmt Cost	$ 320,597												

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	130	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	231	5.3		$ 530,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,264,697	Total Aesthetic Treatment Cost	$ 480,597	Total Right of Way Cost	$ 530,000

Walled-Levee Corridor

Structure ID	H190I90D

HEC1 ID	90I90D

Cutline ID	1

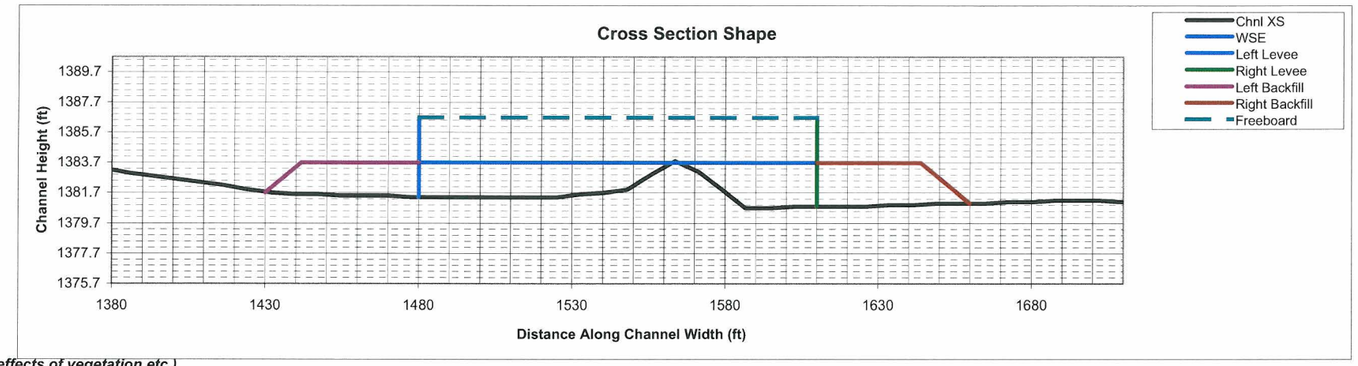
Longitundal Geometry

Length	1614.3	ft
Initial Channel Slope	0.0113	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0111	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1480	Right Levee Station (ft)	1610
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1480	Right Channel Limit Station (ft)	1610

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	C190D	C190DI								TOTAL
HEC1 Peak-Flow	1427	1455								
Weighting Factor	0.73	0.27								
Flow into Channel	1039	395								1434

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
143	100.1	58.4	1380.7	1381.9	2.5	1.2	98.4	0.6	0.6	0.56
430	109.8	117.1	1380.7	1382.5	3.7	1.8	106.9	1.1	1.1	0.62
1076	125.1	213.8	1380.7	1383.3	5.0	2.6	120.4	1.7	1.8	0.67
1434	133.3	260.6	1380.7	1383.7	5.5	3.0	127.8	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
143	100.3	58.7	1380.7	1381.9	2.4	1.2	98.6	0.6	0.6	0.56
430	109.9	117.8	1380.7	1382.5	3.7	1.8	107.0	1.1	1.1	0.61
1076	125.4	215.1	1380.7	1383.3	5.0	2.6	120.6	1.7	1.8	0.66
1434	133.6	262.2	1380.7	1383.7	5.5	3.0	128.1	2.0	2.0	0.67

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
	H190I90D_2									
430	1.72									1.72

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
143	Stable
430	Stable
1076	Erosive
1434	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	430	cfs
Clear Water	No	
Total Incoming Sediment Load	1.723	cfs
Initial Chnl Sediment Capacity	1.761	cfs
Long-term Equilibrium Slope (ADWR)	0.0111	

Drop Structures

Design Slope	0.0111	ft/ft
Total Drop Needed	0.3	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.11	
Distance between Structures	14675	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)
1434	1.1	24.6	3.0	2.0	5.5	0.0113	-0.7	0.8	1.5	0.4	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1614
Channel Limit-Left Station (ft)	1480
Channel Limit-Right Station (ft)	1610
Channel Width (ft)	130

Levee

Left Levee Length (ft)	1614
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.3
Right Levee Length (ft)	1614
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.9

Left Levee Surface Area (sq. Yd)	950
Left Levee Volume (cu. Yd)	158
Right Levee Surface Area (sq. Yd)	1058
Right Levee Volume (cu. Yd)	176
Total Levee Surface Area (sq. Yd)	2008
Total Levee Volume (cu. Yd)	334

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)	81038
Left Levee Fill XS area (sq. ft)	96
Left Levee Fill Volume (cu. Yd)	5739
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)	81038
Right Levee Fill XS area (sq. ft)	118.2
Right Levee Fill Volume (cu. Yd)	7066
Total Levee Fill Surface Area (sq. ft)	162076
Total Levee Fill Volume (cu Yd)	12805

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	130	
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	0.11	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	52.43	5.24
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,457	$ 445
Area per structure (sq. Yd)	14	1
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	1,614	ft	$ 282	$ 455,280	334	cu. Yd	$ -	$ -	334	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	2,008	sq. Yd	$ -	$ -	2,008	sq. Yd	$ -	$ -	2,008	sq. Yd	$ 75.00	$ 150,600
Adjacent Levee Fill	Fill	12,805	cu. Yd	$ 7.00	$ 89,635	17,933	sq. Yd	$ 4.50	$ 80,700	17,933	sq. Yd	$ 11.67	$ 209,222
Wall Material Aesthetic Treatment Cost	Wall	334	cu. Yd	$ -	$ -	334	cu. Yd	$ -	$ -	334	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	2,008	sq. Yd	$ 63.00	$ 126,504	2,008	sq. Yd	$ -	$ -	2,008	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,456.55	$ 490	14	sq. Yd	$ -	$ -	14	sq. Yd	$ 37.50	$ 542
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 671,909			Total	$ 80,700			Total	$ 360,364
		Contingency Cost (25% of Construction Cost)			$ 167,977								
		Engineering Design Cost (5% of Construction Cost)			$ 33,595								
		Total Construction Cost			$ 873,482								
Wall Material Aesthetic Treatment Cost	Wall	334	cu. Yd	$ -	$ -	334	cu. Yd	$ -	$ -	334	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	2,008	sq. Yd	$ 63.00	$ 126,504	2,008	sq. Yd	$ -	$ -	2,008	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	12,805	cu. Yd	$ 7.00	$ 89,635	17,933	sq. Yd	$ 4.50	$ 80,700	17,933	sq. Yd	$ 11.67	$ 209,222
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 445.40	$ 49	14	sq. Yd	$ -	$ -	1	sq. Yd	$ 37.50	$ 54
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 216,188			Total	$ 80,700			Total	$ 209,276
		Contingency Cost (25% of Construction Cost)			$ 54,047								
		Engineering Design Cost (5% of Construction Cost)			$ 10,809								
		Total Construction Cost			$ 281,044								

Total Structure Aesthetic Trtmt Cost	$ 571,021

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.6	$100,000	$ 260,000
Maintenance Access	30	1.1	$100,000	$ 110,000
Channel	130	4.8	$100,000	$ 480,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	231	8.5		$ 850,000

Total Land Related Aes. Trtmt Cost	$ 260,000

Total Cost	$ 2,164,546	Total Aesthetic Treatment Cost	$ 831,021	Total Right of Way Cost	$ 850,000

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*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104              *
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X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

1 HEC-1 INPUT PAGE 1

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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 17 & 18
    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: F17186.DAT
    8         ID
    9         ID   100-YEAR 6-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID            MODELED AREA = 3.3 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
              *
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1 HEC-1 INPUT PAGE 2

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   50         KK   S175A   BASIN
   51         KM      Compute runoff from subbasin 175A
   52         BA   1.338
   53         LG    0.27    0.35    4.45    0.37       1
   54         UI      81      81     149     277     398     505     574     655     792     958
```

```
   55         UI     656     528     479     442     405     364     338     297     261     223
   56         UI     200     190     176     151     132     108     104      90      90      72
   57         UI      62      63      56      39      40      40      39      40      15      16
   58         UI      15      16      15      16      15      16      15      16      15      16
   59         ZW                 C=FLOW
              *
   60         KK  75A75B   ROUTE
   61         KM   PROPOSED CHANNEL
   62         KM        Route runoff from S175A to Sun Valley Parkway at C175B.
   63         KM    Slope=(1486.0 - 1456.0) / 2793.0
   64         RS       2    FLOW      -1
   65         RC   0.045   0.045   0.045  2793.0   0.011   104.5
   66         RX     0.0     0.0     0.0     0.0    80.0    80.0    80.0    80.0
   67         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   68         ZW                 C=FLOW
              *
   69         KK   S175B   BASIN
   70         KM        Compute runoff from subbasin 175B
   71         BA   0.324
   72         LG    0.35    0.38    5.40    0.23       0
   73         UI      95     376     597     571     364     212     124      74      45      17
   74         UI      16      16       0       0       0       0       0       0       0       0
              *
   75         KK   C175B COMBINE
   76         KM        Combine runoff from S175B with routed flow from S175A at Sun Valley Prky
   77         HC       2
   78         ZW                 C=FLOW
              *
   79         KK  75B90I   ROUTE
   80         KM   PROPOSED CHANNEL
   81         KM        Route runoff from C175B to intermediate point in S190 (C190DI).
   82         KM    Slope=(1456.0 - 1413.0) / 3035.0
   83         RS       2    FLOW      -1
   84         RC   0.045   0.045   0.045  3035.0   0.014   104.5
   85         RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
   86         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   87         ZW                 C=FLOW
              *
   88         KK   S180A   BASIN
   89         KM        Compute runoff from subbasin 180A
   90         BA   0.941
   91         LG    0.20    0.35    4.35    0.40       2
   92         UI      69      70     194     308     430     500     591     792     611     451
   93         UI     406     358     325     290     252     212     179     164     150     127
```

1 HEC-1 INPUT PAGE 3

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   94         UI     105      88      81      76      59      54      53      34      34      33
   95         UI      34      20      13      13      14      13      13      14      13      13
   96         UI      13      14       0       0       0       0       0       0       0       0
   97         ZW                 C=FLOW
              *
   98         KK  80A80B   ROUTE
   99         KM   PROPOSED CHANNEL
  100         KM        Route runoff from S180A to Sun Valley Parkway at C180B.
  101         KM    Slope=(1528.0 - 1451.0) / 5165.0
  102         RS       3    FLOW      -1
  103         RC   0.045   0.045   0.045  5165.0   0.015   104.5
  104         RX     0.0     0.0     0.0     0.0    80.0    80.0    80.0    80.0
  105         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  106         ZW                 C=FLOW
              *
  107         KK   S180B   BASIN
  108         KM        Compute runoff from subbasin 180B
  109         BA   0.295
  110         LG    0.35    0.35    4.45    0.37       0
  111         UI     100     397     600     507     301     167      95      54      27      15
  112         UI      16       0       0       0       0       0       0       0       0       0
              *
  113         KK   C180B COMBINE
  114         KM        Combine runoff from S180B with routed flow from S180A at SVP
  115         HC       2
  116         ZW                 C=FLOW
              *
  117         KK  80B90I   ROUTE
  118         KM   PROPOSED CHANNEL
  119         KM        Route runoff from S180B to intermediate point in S190 (C190DI).
  120         KM    Slope=(1451.0 - 1413.0) / 2825.0
  121         RS       3    FLOW      -1
  122         RC   0.045   0.045   0.045  2825.0   0.013   104.5
  123         RX     0.0     0.0     0.0     0.0    70.0    70.0    70.0    70.0
  124         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  125         ZW                 C=FLOW
              *
  126         KK   C190DI COMBINE
  127         KM        Combine routed flows from C175B and C180B at intermediate point
  128         HC       2
  129         ZW                 C=FLOW
              *
```

```
          130          KK  90I90D   ROUTE
          131          KM   PROPOSED CHANNEL
          132          KM    Slope=(1413.0 - 1366.0) / 3721.0
          133          RS        3    FLOW      -1
          134          RC  0.045   0.045   0.045  3721.0   0.013   104.5
          135          RX    0.0     0.0     0.0     0.0   130.0   130.0   130.0   130.0
          136          RY  104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
1                                                HEC-1 INPUT                                                   PAGE  4

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

          137          ZW                C=FLOW
                       *

          138          KK   S190D   BASIN
          139          KM        Compute runoff from subbasin 190D
          140          BA  0.361
          141          LG   0.35    0.35    3.78    0.45       0
          142          UI    116     451     700     634     384     221     128      70      42      18
          143          UI     19       0       0       0       0       0       0       0       0       0
                       *

          144          KK   C190D COMBINE
          145          KM        Combine runoff from S190D with routed flows from C190I
          146          KM        This is the total flow at the downstream end of the Fan 17/18 corridor.
          147          HC      2
          148          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   50       S175A
                V
                V
   60      75A75B
                .
                .
   69           .      S175B
                .          .
                .          .
   75       C175B...........
                V
                V
   79      75B90I
                .
                .
   88           .      S180A
                .          V
                .          V
   98           .     80A80B
                .          .
                .          .
  107           .          .      S180B
                .          .          .
                .          .          .
  113           .      C180B...........
                .          V
                .          V
  117           .     80B90I
                .          .
                .          .
  126      C190DI...........
                V
                V
  130      90I90D
                .
                .
  138           .      S190D
                .          .
                .          .
  144       C190D...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*              JUN   1998                 *
*            VERSION 4.1                  *
*                                         *
* RUN DATE   20DEC06  TIME  18:36:53      *
*                                         *
*******************************************

                                       ***************************************
                                       *                                     *
                                       *   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 17 & 18

                         SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                         JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                         MODELER: TED LEHMAN
                         FILENAME: F17186.DAT

                         100-YEAR 6-HOUR MODEL
                         EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                                  MODELED AREA = 3.3 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    *    S175A   *        BASIN
           *            *
           **************
                               Compute runoff from subbasin 175A

              SUBBASIN RUNOFF DATA

  52 BA         SUBBASIN CHARACTERISTICS
                   TAREA        1.34  SUBBASIN AREA

  53 LG         GREEN AND AMPT LOSS RATE
                   STRTL         .27  STARTING LOSS
                     DTH         .35  MOISTURE DEFICIT
                    PSIF        4.45  WETTING FRONT SUCTION
                   XKSAT         .37  HYDRAULIC CONDUCTIVITY
                   RTIMP        1.00  PERCENT IMPERVIOUS AREA

  51 UI         INPUT UNITGRAPH,  50 ORDINATES,  VOLUME = 1.00
                  81.0      81.0     149.0     277.0     398.0     505.0     574.0     655.0     792.0     958.0
                 656.0     528.0     479.0     442.0     405.0     364.0     338.0     297.0     261.0     223.0
                 200.0     190.0     176.0     151.0     132.0     108.0     104.0      90.0      90.0      72.0
                  62.0      63.0      56.0      39.0      40.0      40.0      39.0      40.0      15.0      16.0
                  15.0      16.0      15.0      16.0      15.0      16.0      15.0      16.0      15.0      16.0

                                                                  ***

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

                         HYDROGRAPH AT STATION    S175A
                        TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =     1.77, TOTAL EXCESS =     1.42

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +    1083.       4.58                 204.          51.         17.          7.
                            (INCHES)   1.420        1.421       1.421       1.421
                            (AC-FT)     101.         101.        101.        101.

                             CUMULATIVE AREA =    1.34 SQ MI


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

                         HYDROGRAPH AT STATION    S175A
                        TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =     1.77, TOTAL EXCESS =     1.41

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +    1075.       4.58                 203.          51.         17.          7.
                            (INCHES)   1.408        1.409       1.409       1.409
                            (AC-FT)     100.         101.        101.        101.

                             CUMULATIVE AREA =    1.34 SQ MI


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

                         HYDROGRAPH AT STATION    S175A
                        TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =     2.04, TOTAL EXCESS =     1.08

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +     703.       4.58                 154.          39.         13.          6.
```



```
                            (INCHES)   1.073        1.074       1.074       1.074
                            (AC-FT)      77.          77.         77.         77.

                             CUMULATIVE AREA =    1.34 SQ MI


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

                         HYDROGRAPH AT STATION    S175A
                        TRANSPOSITION AREA     16.0 SQ MI

     TOTAL RAINFALL =    2.95, TOTAL LOSS =     2.18, TOTAL EXCESS =      .77

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +     492.       4.67                 110.          28.          9.          4.
                            (INCHES)    .767         .769        .769        .769
                            (AC-FT)      55.          55.         55.         55.

                             CUMULATIVE AREA =    1.34 SQ MI


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

                         HYDROGRAPH AT STATION    S175A
                        TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =     2.21, TOTAL EXCESS =      .38

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +     245.       4.67                  54.          14.          5.          2.
                            (INCHES)    .374         .376        .376        .376
                            (AC-FT)      27.          27.         27.         27.

                             CUMULATIVE AREA =    1.34 SQ MI


   -----DSS---ZOPEN:  Existing File Opened,  File: F17186.DSS
                      Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/08JAN1999/5MIN//
       ***          ***          ***          ***          ***



                         INTERPOLATED HYDROGRAPH AT    S175A

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                             (CFS)
 +     863.       4.58                 175.          44.         15.          6.
                            (INCHES)   1.216        1.218       1.218       1.218
                            (AC-FT)      87.          87.         87.         87.

                             CUMULATIVE AREA =    1.34 SQ MI


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

           **************
           *            *
  60 KK    *   75A75B   *        ROUTE
           *            *
           **************
                  PROPOSED CHANNEL
                         Route runoff from S175A to Sun Valley Parkway at C175B.
                   Slope=(1486.0 - 1456.0) / 2793.0

              HYDROGRAPH ROUTING DATA

  64 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

  65 RC         NORMAL DEPTH CHANNEL
                     ANL        .045  LEFT OVERBANK N-VALUE
                    ANCH        .045  MAIN CHANNEL N-VALUE
                     ANR        .045  RIGHT OVERBANK N-VALUE
                   RLNTH       2793.  REACH LENGTH
                     SEL       .0110  ENERGY SLOPE
                   ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                  --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
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 67 RY        ELEVATION   104.50     100.00     100.00     100.00     100.00     100.00     100.00     104.50
 66 RX        DISTANCE       .00        .00        .00        .00      80.00      80.00      80.00      80.00

                                                         ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE        .00      1.21      2.43      3.64      4.86      6.07      7.29      8.50      9.72     10.93
           OUTFLOW        .00     25.14     79.65    156.25    251.89    364.65    493.18    636.42    793.52    963.77
         ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

           STORAGE      12.15     13.36     14.58     15.79     17.01     18.22     19.44     20.65     21.87     23.08
           OUTFLOW    1146.58   1341.40   1547.79   1765.31   1993.60   2232.31   2481.13   2739.77   3007.96   3285.45
         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      964. TO      3285.
                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    75A75B
                     TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    1052.       4.67                 204.           51.            17.             7.
                            (INCHES)  1.419         1.421          1.421          1.421
                             (AC-FT)   101.          101.           101.           101.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +  (AC-FT)       (HR)
          6.      4.67                   2.            0.             0.             0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (FEET)       (HR)
     102.25       4.67               100.64        100.16         100.05         100.02

                       CUMULATIVE AREA =     1.34 SQ MI

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

                       HYDROGRAPH AT STATION    75A75B
                     TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +    1043.       4.67                 202.           51.            17.             7.
                            (INCHES)  1.407         1.409          1.409          1.409
                             (AC-FT)   100.          101.           101.           101.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +  (AC-FT)       (HR)
          6.      4.67                   2.            0.             0.             0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (FEET)       (HR)
     102.23       4.67               100.64        100.16         100.05         100.02

                       CUMULATIVE AREA =     1.34 SQ MI

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

                       HYDROGRAPH AT STATION    75A75B
                     TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     694.       4.75                 154.           39.            13.             6.
                            (INCHES)  1.072         1.074          1.074          1.074
                             (AC-FT)    76.           77.            77.            77.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +  (AC-FT)       (HR)
          4.      4.75                   1.            0.             0.             0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (FEET)       (HR)
     101.74       4.75               100.55        100.14         100.05         100.02

                       CUMULATIVE AREA =     1.34 SQ MI

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                       HYDROGRAPH AT STATION    75A75B
                     TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     483.       4.75                 110.           28.             9.             4.
                            (INCHES)   .766          .769           .769           .769
                             (AC-FT)    55.           55.            55.            55.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +  (AC-FT)       (HR)
          4.      4.75                   1.            0.             0.             0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (FEET)       (HR)
     101.40       4.75               100.45        100.11         100.04         100.02

                       CUMULATIVE AREA =     1.34 SQ MI

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

                       HYDROGRAPH AT STATION    75A75B
                     TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     234.       4.83                  54.           14.             5.             2.
                            (INCHES)   .373          .376           .376           .376
                             (AC-FT)    27.           27.            27.            27.

  PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +  (AC-FT)       (HR)
          2.      4.83                   1.            0.             0.             0.

   PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (FEET)       (HR)
     100.90       4.83               100.28        100.07         100.02         100.01

                       CUMULATIVE AREA =     1.34 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***

                       INTERPOLATED HYDROGRAPH AT    75A75B

   PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR          24-HR          72-HR      166.58-HR
 +   (CFS)        (HR)
                              (CFS)
 +     842.       4.75                 175.           44.            15.             6.
                            (INCHES)  1.215         1.218          1.218          1.218
                             (AC-FT)    87.           87.            87.            87.

                       CUMULATIVE AREA =     1.34 SQ MI

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

              **************
              *            *
 69 KK        *   S175B    *        BASIN
              *            *
              **************
                                  Compute runoff from subbasin 175B

                SUBBASIN RUNOFF DATA

 71 BA            SUBBASIN CHARACTERISTICS
                        TAREA          .32  SUBBASIN AREA

 72 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

 70 UI            INPUT UNITGRAPH,  12 ORDINATES,  VOLUME = 1.00
                       95.0     376.0     597.0     571.0     364.0     212.0     124.0      74.0      45.0      17.0
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16.0 16.0

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

HYDROGRAPH AT STATION S175B
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)			
+ 696.	4.08	53.	13.	4.	2.
		(INCHES) 1.522	1.522	1.522	1.522
		(AC-FT) 26.	26.	26.	26.

CUMULATIVE AREA = .32 SQ MI

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

HYDROGRAPH AT STATION S175B
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)			
+ 691.	4.08	53.	13.	4.	2.
		(INCHES) 1.510	1.510	1.510	1.510
		(AC-FT) 26.	26.	26.	26.

CUMULATIVE AREA = .32 SQ MI

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

HYDROGRAPH AT STATION S175B
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)			
+ 378.	4.08	42.	11.	4.	2.
		(INCHES) 1.214	1.214	1.214	1.214
		(AC-FT) 21.	21.	21.	21.

CUMULATIVE AREA = .32 SQ MI

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

HYDROGRAPH AT STATION S175B
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)			
+ 270.	4.08	32.	8.	3.	1.
		(INCHES) .912	.912	.912	.912
		(AC-FT) 16.	16.	16.	16.

CUMULATIVE AREA = .32 SQ MI

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

HYDROGRAPH AT STATION S175B
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)			
+ 153.	4.17	18.	4.	1.	1.
		(INCHES) .506	.506	.506	.506
		(AC-FT) 9.	9.	9.	9.

CUMULATIVE AREA = .32 SQ MI

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

INTERPOLATED HYDROGRAPH AT S175B

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 692.	4.08	53.	13.	4.	2.
		(INCHES) 1.514	1.514	1.514	1.514
		(AC-FT) 26.	26.	26.	26.

CUMULATIVE AREA = .32 SQ MI

*** ***

75 KK C175B COMBINE

Combine runoff from S175B with routed flow from S175A at Sun Valley Prky

77 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

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

HYDROGRAPH AT STATION C175B
TRANSPOSITION AREA .1 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 1095.	4.67	257.	64.	21.	9.
		(INCHES) 1.439	1.441	1.441	1.441
		(AC-FT) 128.	128.	128.	128.

CUMULATIVE AREA = 1.66 SQ MI

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

HYDROGRAPH AT STATION C175B
TRANSPOSITION AREA .5 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 1086.	4.67	255.	64.	21.	9.
		(INCHES) 1.427	1.429	1.429	1.429
		(AC-FT) 127.	127.	127.	127.

CUMULATIVE AREA = 1.66 SQ MI

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

HYDROGRAPH AT STATION C175B
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 764.	4.58	197.	49.	16.	7.
		(INCHES) 1.100	1.101	1.101	1.101
		(AC-FT) 97.	98.	98.	98.

CUMULATIVE AREA = 1.66 SQ MI

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

HYDROGRAPH AT STATION C175B
TRANSPOSITION AREA 16.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 544.	4.67	142.	36.	12.	5.
		(INCHES) .795	.797	.797	.797
		(AC-FT) 70.	71.	71.	71.

CUMULATIVE AREA = 1.66 SQ MI

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

HYDROGRAPH AT STATION C175B
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			

```
+     257.      4.67                  71.         18.          6.          3.
                          (INCHES)     .399        .402        .402        .402
                          (AC-FT)       35.         36.         36.         36.

                          CUMULATIVE AREA =    1.66 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT    C175B

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     862.      4.67                  214.         54.         18.          8.
                          (INCHES)    1.199       1.201       1.201       1.201
                          (AC-FT)      106.        106.        106.        106.

                          CUMULATIVE AREA =    1.66 SQ MI


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

             **************
             *            *
  79 KK      *    75B90I  *        ROUTE
             *            *
             **************
                          PROPOSED CHANNEL
                              Route runoff from C175B to intermediate point in S190 (C190DI).
                           Slope=(1456.0 - 1413.0) / 3035.0

                     HYDROGRAPH ROUTING DATA

  83 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

  84 RC                NORMAL DEPTH CHANNEL
                             ANL         .045  LEFT OVERBANK N-VALUE
                            ANCH         .045  MAIN CHANNEL N-VALUE
                             ANR         .045  RIGHT OVERBANK N-VALUE
                           RLNTH        3035.  REACH LENGTH
                             SEL        .0140  ENERGY SLOPE
                           ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                               --- LEFT OVERBANK --- + ------- MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  86 RY        ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
  85 RX        DISTANCE        .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                                  ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      1.65      3.30      4.95      6.60      8.25      9.90     11.55     13.20     14.85
          OUTFLOW        .00     35.46    112.41    220.60    355.77    515.23    697.10    899.91   1122.47   1363.82
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE      16.50     18.15     19.80     21.45     23.10     24.75     26.40     28.05     29.70     31.35
          OUTFLOW    1623.12   1899.63   2192.72   2501.80   2826.37   3165.96   3520.13   3888.48   4270.65   4666.30
        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     1122. TO     4666.
                 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   75B90I
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1072.      4.75                  257.         64.         21.          9.
                          (INCHES)    1.438       1.441       1.441       1.441
                          (AC-FT)      127.        128.        128.        128.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
        6.      4.75                    2.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
    101.84      4.75                100.62      100.16      100.05      100.02

                          CUMULATIVE AREA =    1.66 SQ MI

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


                          HYDROGRAPH AT STATION   75B90I
                        TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1063.      4.75                  255.         64.         21.          9.
                          (INCHES)    1.426       1.429       1.429       1.429
                          (AC-FT)      126.        127.        127.        127.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
        6.      4.75                    2.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
    101.83      4.75                100.62      100.16      100.05      100.02

                          CUMULATIVE AREA =    1.66 SQ MI

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


                          HYDROGRAPH AT STATION   75B90I
                        TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     760.      4.67                  196.         49.         16.          7.
                          (INCHES)    1.099       1.101       1.101       1.101
                          (AC-FT)       97.         98.         98.         98.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
        5.      4.67                    2.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
    101.49      4.67                100.53      100.13      100.04      100.02

                          CUMULATIVE AREA =    1.66 SQ MI

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


                          HYDROGRAPH AT STATION   75B90I
                        TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     538.      4.75                  142.         36.         12.          5.
                          (INCHES)     .794        .797        .797        .797
                          (AC-FT)       70.         71.         71.         71.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
        4.      4.75                    2.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
    101.21      4.75                100.44      100.11      100.04      100.02

                          CUMULATIVE AREA =    1.66 SQ MI

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


                          HYDROGRAPH AT STATION   75B90I
                        TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     252.      4.83                   71.         18.          6.          3.
                          (INCHES)     .399        .402        .402        .402
                          (AC-FT)       35.         36.         36.         36.
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 PEAK STORAGE    TIME                    MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR     166.58-HR
+  (AC-FT)       (HR)
         3.       4.83                1.          0.          0.          0.

   PEAK STAGE    TIME                     MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR     166.58-HR
+    (FEET)      (HR)
     100.77       4.83              100.29      100.07      100.02      100.01

                          CUMULATIVE AREA =    1.66 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***

                          INTERPOLATED HYDROGRAPH AT   75B90I

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      851.       4.75                214.         54.         18.          8.
                 (INCHES)           1.198       1.201       1.201       1.201
                  (AC-FT)             106.        106.        106.        106.

                          CUMULATIVE AREA =    1.66 SQ MI

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

            **************
            *            *
   88 KK    *     S180A  *        BASIN
            *            *
            **************
                          Compute runoff from subbasin 180A

      SUBBASIN RUNOFF DATA
   90 BA    SUBBASIN CHARACTERISTICS
                 TAREA         .94  SUBBASIN AREA

   91 LG    GREEN AND AMPT LOSS RATE
                 STRTL         .20  STARTING LOSS
                   DTH         .35  MOISTURE DEFICIT
                  PSIF        4.35  WETTING FRONT SUCTION
                 XKSAT         .40  HYDRAULIC CONDUCTIVITY
                 RTIMP        2.00  PERCENT IMPERVIOUS AREA

   89 UI    INPUT UNITGRAPH,  42 ORDINATES,  VOLUME = 1.00
                 69.0      70.0     194.0     308.0     430.0     500.0     591.0     792.0     611.0     451.0
                406.0     358.0     325.0     290.0     252.0     212.0     179.0     164.0     150.0     127.0
                105.0      88.0      81.0      76.0      59.0      54.0      53.0      34.0      34.0      33.0
                 34.0      20.0      13.0      13.0      14.0      13.0      13.0      14.0      13.0      13.0
                 13.0      14.0
                                                                                                       ***

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

                          HYDROGRAPH AT STATION    S180A
                         TRANSPOSITION AREA       .1 SQ MI

      TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.44

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      890.       4.50                145.         36.         12.          5.
                 (INCHES)           1.434       1.436       1.436       1.436
                  (AC-FT)             72.         72.         72.         72.

                          CUMULATIVE AREA =     .94 SQ MI

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

                          HYDROGRAPH AT STATION    S180A
                         TRANSPOSITION AREA       .5 SQ MI

      TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.42

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      883.       4.50                144.         36.         12.          5.
                 (INCHES)           1.422       1.424       1.424       1.424
                  (AC-FT)             71.         71.         71.         71.

                          CUMULATIVE AREA =     .94 SQ MI

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

                          HYDROGRAPH AT STATION    S180A
                         TRANSPOSITION AREA      2.8 SQ MI

      TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.04, TOTAL EXCESS =    1.08

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      567.       4.50                109.         27.          9.          4.
                 (INCHES)           1.081       1.083       1.083       1.083
                  (AC-FT)             54.         54.         54.         54.

                          CUMULATIVE AREA =     .94 SQ MI

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

                          HYDROGRAPH AT STATION    S180A
                         TRANSPOSITION AREA     16.0 SQ MI

      TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.18, TOTAL EXCESS =     .77

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      392.       4.50                 78.         20.          7.          3.
                 (INCHES)            .770        .772        .772        .772
                  (AC-FT)             39.         39.         39.         39.

                          CUMULATIVE AREA =     .94 SQ MI

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

                          HYDROGRAPH AT STATION    S180A
                         TRANSPOSITION AREA     90.0 SQ MI

      TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.21, TOTAL EXCESS =     .39

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      194.       4.50                 39.         10.          3.          1.
                 (INCHES)            .382        .385        .385        .385
                  (AC-FT)             19.         19.         19.         19.

                          CUMULATIVE AREA =     .94 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***

                          INTERPOLATED HYDROGRAPH AT    S180A

   PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                    (CFS)
+      767.       4.50                131.         33.         11.          5.
                 (INCHES)           1.297       1.299       1.299       1.299
                  (AC-FT)             65.         65.         65.         65.

                          CUMULATIVE AREA =     .94 SQ MI

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

            **************
            *            *
   98 KK    *   80A80B   *        ROUTE
            *            *
            **************
                          PROPOSED CHANNEL
                             Route runoff from S180A to Sun Valley Parkway at C180B.
                           Slope=(1528.0 - 1451.0) / 5165.0

      HYDROGRAPH ROUTING DATA
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 102 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

 103 RC          NORMAL DEPTH CHANNEL
                         ANL        .045  LEFT OVERBANK N-VALUE
                        ANCH        .045  MAIN CHANNEL N-VALUE
                         ANR        .045  RIGHT OVERBANK N-VALUE
                       RLNTH       5165.  REACH LENGTH
                         SEL       .0150  ENERGY SLOPE
                       ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                               CROSS-SECTION DATA
                                --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 105 RY        ELEVATION    104.50     100.00     100.00     100.00     100.00     100.00     100.00     104.50
 104 RX        DISTANCE        .00        .00        .00        .00      80.00      80.00      80.00      80.00

                                                         ***

                                             COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

             STORAGE       .00      2.25      4.49      6.74      8.99     11.23     13.48     15.73     17.97     20.22
             OUTFLOW       .00     29.35     93.01    182.46    294.14    425.82    575.91    743.17    926.63   1125.44
           ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

             STORAGE     22.47     24.71     26.96     29.21     31.45     33.70     35.95     38.19     40.44     42.69
             OUTFLOW   1338.91   1566.42   1807.43   2061.44   2328.02   2606.78   2897.34   3199.36   3512.54   3836.58
           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      1339. TO      3837.
                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    80A80B
                   TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     835.       4.67                    145.          36.          12.           5.
                              (INCHES)   1.432        1.436        1.436        1.436
                               (AC-FT)     72.          72.          72.          72.

  PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          6.      4.67                      1.           0.           0.           0.

   PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.78       4.67                  100.46       100.11       100.04       100.02

                       CUMULATIVE AREA =       .94 SQ MI

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

                    HYDROGRAPH AT STATION    80A80B
                   TRANSPOSITION AREA       .5 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     829.       4.67                    144.          36.          12.           5.
                              (INCHES)   1.420        1.424        1.424        1.424
                               (AC-FT)     71.          71.          71.          71.

  PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          6.      4.67                      1.           0.           0.           0.

   PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.77       4.67                  100.45       100.11       100.04       100.02

                       CUMULATIVE AREA =       .94 SQ MI

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

                    HYDROGRAPH AT STATION    80A80B
                   TRANSPOSITION AREA      2.8 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     542.       4.67                    109.          27.           9.           4.
                              (INCHES)   1.079        1.083        1.083        1.083
                               (AC-FT)     54.          54.          54.          54.

  PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          4.      4.67                      1.           0.           0.           0.

   PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.37       4.67                  100.39       100.10       100.03       100.01

                       CUMULATIVE AREA =       .94 SQ MI

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

                    HYDROGRAPH AT STATION    80A80B
                   TRANSPOSITION AREA     16.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     369.       4.75                     78.          20.           7.           3.
                              (INCHES)    .768         .772         .772         .772
                               (AC-FT)     39.          39.          39.          39.

  PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          3.      4.75                      1.           0.           0.           0.

   PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     101.08       4.75                  100.32       100.08       100.03       100.01

                       CUMULATIVE AREA =       .94 SQ MI

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

                    HYDROGRAPH AT STATION    80A80B
                   TRANSPOSITION AREA     90.0 SQ MI

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     171.       4.83                     38.          10.           3.           1.
                              (INCHES)    .380         .385         .385         .385
                               (AC-FT)     19.          19.          19.          19.

  PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +  (AC-FT)       (HR)
          2.      4.83                      1.           0.           0.           0.

   PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR        24-HR        72-HR     166.58-HR
 +   (FEET)       (HR)
     100.68       4.83                  100.21       100.05       100.02       100.01

                       CUMULATIVE AREA =       .94 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT    80A80B

   PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)       (HR)
                                (CFS)
 +     723.       4.67                    131.          33.          11.           5.
                              (INCHES)   1.295        1.299        1.299        1.299
                               (AC-FT)     65.          65.          65.          65.

                       CUMULATIVE AREA =       .94 SQ MI


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


             **************
             *            *
 107 KK      *    S180B   *      BASIN
             *            *
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                        Compute runoff from subbasin 180B

          SUBBASIN RUNOFF DATA

 109 BA     SUBBASIN CHARACTERISTICS
               TAREA        .29  SUBBASIN AREA

 110 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

 108 UI     INPUT UNITGRAPH,  11 ORDINATES,  VOLUME = 1.00
              100.0     397.0     600.0     507.0     301.0     167.0      95.0      54.0      27.0      15.0
               16.0

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

              HYDROGRAPH AT STATION    S180B
             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)
+     631.     4.08                  43.          11.           4.          2.
                        (INCHES)    1.359        1.359        1.359       1.359
                         (AC-FT)      21.          21.          21.         21.

                         CUMULATIVE AREA =     .29 SQ MI

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

              HYDROGRAPH AT STATION    S180B
             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)
+     627.     4.08                  43.          11.           4.          2.
                        (INCHES)    1.347        1.347        1.347       1.347
                         (AC-FT)      21.          21.          21.         21.

                         CUMULATIVE AREA =     .29 SQ MI

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

              HYDROGRAPH AT STATION    S180B
             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)
+     316.     4.08                  32.           8.           3.          1.
                        (INCHES)    1.013        1.013        1.013       1.013
                         (AC-FT)      16.          16.          16.         16.

                         CUMULATIVE AREA =     .29 SQ MI

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

              HYDROGRAPH AT STATION    S180B
             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)
+     215.     4.08                  23.           6.           2.          1.
                        (INCHES)     .712         .712         .712        .712
                         (AC-FT)      11.          11.          11.         11.

                         CUMULATIVE AREA =     .29 SQ MI

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

              HYDROGRAPH AT STATION    S180B
             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)
+     104.     4.17                  10.           3.           1.          0.
                        (INCHES)     .324         .324         .324        .324
                         (AC-FT)       5.           5.           5.          5.

                         CUMULATIVE AREA =     .29 SQ MI

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

                         INTERPOLATED HYDROGRAPH AT    S180B

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+   (CFS)      (HR)
                          (CFS)
+     628.     4.08                  43.          11.           4.          2.
                        (INCHES)    1.351        1.351        1.351       1.351
                         (AC-FT)      21.          21.          21.         21.

                         CUMULATIVE AREA =     .29 SQ MI

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

              **************
              *            *
 113 KK       *    C180B   *     COMBINE
              *            *
              **************
                                 Combine runoff from S180B with routed flow from S180A at SVP

 115 HC          HYDROGRAPH COMBINATION
                    ICOMP         2  NUMBER OF HYDROGRAPHS TO COMBINE

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

              HYDROGRAPH AT STATION    C180B
             TRANSPOSITION AREA       .1 SQ MI

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+   (CFS)      (HR)
                          (CFS)
+     869.     4.58                 188.          47.          16.          7.
                        (INCHES)    1.414        1.417        1.417       1.417
                         (AC-FT)      93.          93.          93.         93.

                         CUMULATIVE AREA =    1.24 SQ MI

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

              HYDROGRAPH AT STATION    C180B
             TRANSPOSITION AREA       .5 SQ MI

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+   (CFS)      (HR)
                          (CFS)
+     861.     4.58                 186.          47.          16.          7.
                        (INCHES)    1.402        1.405        1.405       1.405
                         (AC-FT)      92.          93.          93.         93.

                         CUMULATIVE AREA =    1.24 SQ MI

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

              HYDROGRAPH AT STATION    C180B
             TRANSPOSITION AREA      2.8 SQ MI

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+   (CFS)      (HR)
                          (CFS)
+     582.     4.58                 141.          35.          12.          5.
                        (INCHES)    1.064        1.067        1.067       1.067
                         (AC-FT)      70.          70.          70.         70.

                         CUMULATIVE AREA =    1.24 SQ MI

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

              HYDROGRAPH AT STATION    C180B
             TRANSPOSITION AREA     16.0 SQ MI

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR    166.58-HR
+   (CFS)      (HR)
                          (CFS)
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+    399.      4.67                100.          25.           8.            4.
                        (INCHES)   .754          .758          .758          .758
                        (AC-FT)     50.           50.           50.           50.

                        CUMULATIVE AREA =     1.24 SQ MI


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

                         HYDROGRAPH AT STATION      C180B
                       TRANSPOSITION AREA      90.0 SQ MI

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     175.        4.83               49.           12.            4.            2.
                        (INCHES)   .367          .370          .370          .370
                        (AC-FT)     24.           24.           24.           24.

                        CUMULATIVE AREA =     1.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/08JAN1999/5MIN//
        ***            ***            ***            ***            ***


                        INTERPOLATED HYDROGRAPH AT     C180B

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     723.        4.58              164.           41.           14.            6.
                        (INCHES)  1.235         1.238         1.238         1.238
                        (AC-FT)     81.           82.           82.           82.

                        CUMULATIVE AREA =     1.24 SQ MI


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


             **************
             *            *
117 KK       *   80B90I   *         ROUTE
             *            *
             **************
                        PROPOSED CHANNEL
                              Route runoff from S180B to intermediate point in S190 (C190DI).
                         Slope=(1451.0 - 1413.0) / 2825.0

              HYDROGRAPH ROUTING DATA

121 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

122 RC          NORMAL DEPTH CHANNEL
                      ANL         .045  LEFT OVERBANK N-VALUE
                     ANCH         .045  MAIN CHANNEL N-VALUE
                      ANR         .045  RIGHT OVERBANK N-VALUE
                    RLNTH        2825.  REACH LENGTH
                      SEL        .0130  ENERGY SLOPE
                    ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                         CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
124 RY         ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
123 RX          DISTANCE       .00       .00       .00       .00     70.00     70.00     70.00     70.00

                                                          ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

           STORAGE        .00       1.08       2.15       3.23       4.30       5.38       6.45       7.53       8.60       9.68
           OUTFLOW        .00      23.90      75.72     148.51     239.34     346.39     468.35     604.21     753.15     914.50
         ELEVATION     100.00     100.24     100.47     100.71     100.95     101.18     101.42     101.66     101.89     102.13

           STORAGE      10.75      11.83      12.90      13.98      15.05      16.13      17.20      18.28      19.35      20.43
           OUTFLOW    1087.67    1272.16    1467.50    1673.31    1889.21    2114.88    2350.01    2594.31    2847.54    3109.45
         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        239. TO       3109.
                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     80B90I
                       TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     858.        4.67              188.           47.           16.            7.
                        (INCHES)  1.414         1.417         1.417         1.417
                        (AC-FT)     93.           93.           93.           93.

  PEAK STORAGE    TIME                  MAXIMUM AVERAGE STORAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (AC-FT)       (HR)
        3.        4.67                1.            0.            0.            0.

   PEAK STAGE     TIME                   MAXIMUM AVERAGE STAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (FEET)        (HR)
     102.05       4.67             100.64        100.16        100.05        100.02

                        CUMULATIVE AREA =     1.24 SQ MI


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

                         HYDROGRAPH AT STATION     80B90I
                       TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     850.        4.67              186.           47.           16.            7.
                        (INCHES)  1.402         1.405         1.405         1.405
                        (AC-FT)     92.           93.           93.           93.

  PEAK STORAGE    TIME                  MAXIMUM AVERAGE STORAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (AC-FT)       (HR)
        3.        4.67                1.            0.            0.            0.

   PEAK STAGE     TIME                   MAXIMUM AVERAGE STAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (FEET)        (HR)
     102.04       4.67             100.64        100.16        100.05        100.02

                        CUMULATIVE AREA =     1.24 SQ MI


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

                         HYDROGRAPH AT STATION     80B90I
                       TRANSPOSITION AREA       2.8 SQ MI

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     578.        4.67              141.           35.           12.            5.
                        (INCHES)  1.063         1.067         1.067         1.067
                        (AC-FT)     70.           70.           70.           70.

  PEAK STORAGE    TIME                  MAXIMUM AVERAGE STORAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (AC-FT)       (HR)
        2.        4.67                1.            0.            0.            0.

   PEAK STAGE     TIME                   MAXIMUM AVERAGE STAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (FEET)        (HR)
     101.61       4.67             100.55        100.14        100.05        100.02

                        CUMULATIVE AREA =     1.24 SQ MI


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

                         HYDROGRAPH AT STATION     80B90I
                       TRANSPOSITION AREA      16.0 SQ MI

   PEAK FLOW      TIME                    MAXIMUM AVERAGE FLOW
                                  6-HR          24-HR          72-HR      166.58-HR
+    (CFS)        (HR)
                         (CFS)
+     394.        4.75              100.           25.            8.            4.
                        (INCHES)   .754          .758          .758          .758
                        (AC-FT)     50.           50.           50.           50.

  PEAK STORAGE    TIME                  MAXIMUM AVERAGE STORAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (AC-FT)       (HR)
        2.        4.75                1.            0.            0.            0.

   PEAK STAGE     TIME                   MAXIMUM AVERAGE STAGE
                                  6-HR          24-HR          72-HR      166.58-HR
+   (FEET)        (HR)
     101.28       4.75             100.45        100.11        100.04        100.02
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                    CUMULATIVE AREA =     1.24 SQ MI

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

                  HYDROGRAPH AT STATION   80B90I
                 TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     171.      5.00                49.          12.         4.           2.
                (INCHES)          .366         .370        .370         .370
                 (AC-FT)           24.          24.         24.          24.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
        1.      5.00                 0.           0.          0.           0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
    100.77      5.00              100.29       100.07      100.02       100.01

                    CUMULATIVE AREA =     1.24 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                  INTERPOLATED HYDROGRAPH AT   80B90I

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     707.      4.67                163.          41.         14.           6.
                (INCHES)          1.224        1.227       1.227        1.227
                 (AC-FT)           81.          81.         81.          81.

                    CUMULATIVE AREA =     1.24 SQ MI


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


           **************
           *            *
 126 KK    *    C190DI  *      COMBINE
           *            *
           **************
                        Combine routed flows from C175B and C180B at intermediate point

 128 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                        ***

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

                  HYDROGRAPH AT STATION   C190DI
                 TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1920.      4.75                445.         112.         37.          16.
                (INCHES)          1.428        1.431       1.431        1.431
                 (AC-FT)          221.         221.        221.         221.

                    CUMULATIVE AREA =     2.90 SQ MI

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

                  HYDROGRAPH AT STATION   C190DI
                 TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1904.      4.75                441.         111.         37.          16.
                (INCHES)          1.416        1.419       1.419        1.419
                 (AC-FT)          219.         219.        219.         219.

                    CUMULATIVE AREA =     2.90 SQ MI
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      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION   C190DI
                 TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1338.      4.67                338.          85.         28.          12.
                (INCHES)          1.083        1.086       1.086        1.086
                 (AC-FT)          167.         168.        168.         168.

                    CUMULATIVE AREA =     2.90 SQ MI

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

                  HYDROGRAPH AT STATION   C190DI
                 TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     932.      4.75                242.          61.         20.           9.
                (INCHES)          .777         .780        .780         .780
                 (AC-FT)          120.         121.        121.         121.

                    CUMULATIVE AREA =     2.90 SQ MI

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

                  HYDROGRAPH AT STATION   C190DI
                 TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     420.      4.92                120.          30.         10.           4.
                (INCHES)          .385         .388        .388         .388
                 (AC-FT)           59.          60.         60.          60.

                    CUMULATIVE AREA =     2.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                  INTERPOLATED HYDROGRAPH AT   C190DI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1329.      4.67                336.          84.         28.          12.
                (INCHES)          1.077        1.080       1.080        1.080
                 (AC-FT)          167.         167.        167.         167.

                    CUMULATIVE AREA =     2.90 SQ MI


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


           **************
           *            *
 130 KK    *   90I90D   *       ROUTE
           *            *
           **************
                        PROPOSED CHANNEL
                         Slope=(1413.0 - 1366.0) / 3721.0

                HYDROGRAPH ROUTING DATA

 133 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

 134 RC          NORMAL DEPTH CHANNEL
                       ANL        .045  LEFT OVERBANK N-VALUE
                      ANCH        .045  MAIN CHANNEL N-VALUE
                       ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH      3721.  REACH LENGTH
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                   SEL        .0130  ENERGY SLOPE
                 ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                     CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 136 RY        ELEVATION  104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 135 RX        DISTANCE      .00       .00       .00       .00    130.00    130.00    130.00    130.00

                                                             ***

                                 COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.63      5.26      7.89     10.52     13.15     15.78     18.41     21.04     23.67
          OUTFLOW        .00     44.44    140.92    276.65    446.32    646.60    875.15   1130.16   1410.17   1713.99
        ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

          STORAGE      26.30     28.93     31.56     34.19     36.82     39.45     42.08     44.71     47.34     49.97
          OUTFLOW    2040.57   2389.03   2758.58   3148.52   3558.22   3987.11   4434.65   4900.37   5383.82   5884.58
        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      875. TO      5885.
                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    90I90D
                  TRANSPOSITION AREA       .1 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +    1894.     4.83                444.        112.          37.          16.
                        (INCHES)   1.425       1.431        1.431        1.431
                         (AC-FT)    220.        221.         221.         221.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (AC-FT)     (HR)
        8.      4.83                  3.          1.           0.           0.

 PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (FEET)      (HR)
    102.26      4.83              100.77      100.19       100.06       100.03

                    CUMULATIVE AREA =     2.90 SQ MI

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

                    HYDROGRAPH AT STATION    90I90D
                  TRANSPOSITION AREA       .5 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +    1878.     4.83                440.        111.          37.          16.
                        (INCHES)   1.413       1.419        1.419        1.419
                         (AC-FT)    218.        219.         219.         219.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (AC-FT)     (HR)
        8.      4.83                  3.          1.           0.           0.

 PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (FEET)      (HR)
    102.25      4.83              100.76      100.19       100.06       100.03

                    CUMULATIVE AREA =     2.90 SQ MI

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

                    HYDROGRAPH AT STATION    90I90D
                  TRANSPOSITION AREA      2.8 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +    1328.     4.83                337.         85.          28.          12.
                        (INCHES)   1.081       1.086        1.086        1.086
                         (AC-FT)    167.        168.         168.         168.

 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.

 PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (FEET)      (HR)
    101.83      4.83              100.66      100.17       100.06       100.02
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                    CUMULATIVE AREA =     2.90 SQ MI

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

                    HYDROGRAPH AT STATION    90I90D
                  TRANSPOSITION AREA     16.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +     917.     4.92                242.         61.          20.           9.
                        (INCHES)    .775        .780         .780         .780
                         (AC-FT)    120.        121.         121.         121.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (AC-FT)     (HR)
        5.      4.92                  2.          1.           0.           0.

 PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (FEET)      (HR)
    101.46      4.92              100.54      100.14       100.05       100.02

                    CUMULATIVE AREA =     2.90 SQ MI

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

                    HYDROGRAPH AT STATION    90I90D
                  TRANSPOSITION AREA     90.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +     408.     5.08                120.         30.          10.           4.
                        (INCHES)    .384        .388         .388         .388
                         (AC-FT)     59.         60.          60.          60.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (AC-FT)     (HR)
        3.      5.08                  1.          0.           0.           0.

 PEAK STAGE     TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR         72-HR     166.58-HR
 +  (FEET)      (HR)
    100.89      5.08              100.36      100.09       100.03       100.01

                    CUMULATIVE AREA =     2.90 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***

                    INTERPOLATED HYDROGRAPH AT    90I90D

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR         72-HR     166.58-HR
 +   (CFS)      (HR)
                          (CFS)
 +    1320.     4.83                335.         84.          28.          12.
                        (INCHES)   1.075       1.080        1.080        1.080
                         (AC-FT)    166.        167.         167.         167.

                    CUMULATIVE AREA =     2.90 SQ MI

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

             **************
             *            *
 138 KK      *    S190D   *       BASIN
             *            *
             **************
                             Compute runoff from subbasin 190D

               SUBBASIN RUNOFF DATA

 140 BA          SUBBASIN CHARACTERISTICS
                       TAREA         .36  SUBBASIN AREA

 141 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

 139 UI          INPUT UNITGRAPH,  11 ORDINATES,  VOLUME = 1.00
                     116.0     451.0     700.0     634.0     384.0     221.0     128.0      70.0      42.0      18.0
                      19.0

                                                            ***

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

                       HYDROGRAPH AT STATION    S190D
                     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)
+     735.       4.08                 50.          13.          4.           2.
                      (INCHES)      1.298        1.298       1.298        1.298
                       (AC-FT)        25.          25.         25.          25.

                       CUMULATIVE AREA =      .36 SQ MI

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

                       HYDROGRAPH AT STATION    S190D
                     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)
+     730.       4.08                 50.          12.          4.           2.
                      (INCHES)      1.287        1.287       1.287        1.287
                       (AC-FT)        25.          25.         25.          25.

                       CUMULATIVE AREA =      .36 SQ MI

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

                       HYDROGRAPH AT STATION    S190D
                     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)
+     363.       4.08                 37.           9.          3.           1.
                      (INCHES)       .948         .948        .948         .948
                       (AC-FT)        18.          18.         18.          18.

                       CUMULATIVE AREA =      .36 SQ MI

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

                       HYDROGRAPH AT STATION    S190D
                     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)
+     241.       4.08                 25.           6.          2.           1.
                      (INCHES)       .632         .632        .632         .632
                       (AC-FT)        12.          12.         12.          12.

                       CUMULATIVE AREA =      .36 SQ MI

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

                       HYDROGRAPH AT STATION    S190D
                     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.       4.17                 10.           3.          1.           0.
                      (INCHES)       .261         .261        .261         .261
                       (AC-FT)         5.           5.          5.           5.

                       CUMULATIVE AREA =      .36 SQ MI

        ***           ***           ***           ***           ***
```

```
                       INTERPOLATED HYDROGRAPH AT    S190D

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      166.58-HR
+   (CFS)        (HR)
                         (CFS)
+     731.       4.08                 50.          13.          4.           2.
                      (INCHES)      1.289        1.289       1.289        1.289
                       (AC-FT)        25.          25.         25.          25.

                       CUMULATIVE AREA =      .36 SQ MI


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

              **************
              *            *
 144 KK       *    C190D   *        COMBINE
              *            *
              **************

                                    Combine runoff from S190D with routed flows from C190I
                                    This is the total flow at the downstream end of the Fan 17/18 corridor.

 147 HC            HYDROGRAPH COMBINATION
                       ICOMP             2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                            ***

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

                       HYDROGRAPH AT STATION    C190D
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    1902.       4.83                494.         124.         41.          18.
                      (INCHES)      1.408        1.416       1.416        1.416
                       (AC-FT)       245.         246.        246.         246.

                       CUMULATIVE AREA =     3.26 SQ MI

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

                       HYDROGRAPH AT STATION    C190D
                     TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    1886.       4.83                489.         123.         41.          18.
                      (INCHES)      1.396        1.404       1.404        1.404
                       (AC-FT)       243.         244.        244.         244.

                       CUMULATIVE AREA =     3.26 SQ MI

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

                       HYDROGRAPH AT STATION    C190D
                     TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      166.58-HR
+   (CFS)        (HR)
                         (CFS)
+    1341.       4.75                373.          94.         31.          14.
                      (INCHES)      1.063        1.071       1.071        1.071
                       (AC-FT)       185.         186.        186.         186.

                       CUMULATIVE AREA =     3.26 SQ MI

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

                       HYDROGRAPH AT STATION    C190D
                     TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      166.58-HR
+   (CFS)        (HR)
                         (CFS)
+     921.       4.92                265.          67.         22.          10.
                      (INCHES)       .757         .764        .764         .764
                       (AC-FT)       132.         133.        133.         133.

                       CUMULATIVE AREA =     3.26 SQ MI

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

                       HYDROGRAPH AT STATION    C190D
```

TRANSPOSITION AREA 90.0 SQ MI

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	409.	5.08	130.	33.	11.	5.
			(INCHES) .370	.374	.374	.374
			(AC-FT) 64.	65.	65.	65.

CUMULATIVE AREA = 3.26 SQ MI

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

INTERPOLATED HYDROGRAPH AT C190D

	PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
+	(CFS)	(HR)				
			(CFS)			
+	1319.	4.83	367.	92.	31.	13.
			(INCHES) 1.048	1.055	1.055	1.055
			(AC-FT) 182.	183.	183.	183.

CUMULATIVE AREA = 3.26 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									
+		S175A	863.	4.58	175.	44.	15.	1.34		
	ROUTED TO									
+		75A75B	842.	4.75	175.	44.	15.	1.34		
	HYDROGRAPH AT									
+		S175B	692.	4.08	53.	13.	4.	.32		
	2 COMBINED AT									
+		C175B	862.	4.67	214.	54.	18.	1.66		
	ROUTED TO									
+		75B90I	851.	4.75	214.	54.	18.	1.66		
	HYDROGRAPH AT									
+		S180A	767.	4.50	131.	33.	11.	.94		
	ROUTED TO									
+		80A80B	723.	4.67	131.	33.	11.	.94		
	HYDROGRAPH AT									
+		S180B	628.	4.08	43.	11.	4.	.29		
	2 COMBINED AT									
+		C180B	723.	4.58	164.	41.	14.	1.24		
	ROUTED TO									
+		80B90I	707.	4.67	163.	41.	14.	1.24		
	2 COMBINED AT									
+		C190DI	1329.	4.67	336.	84.	28.	2.90		
	ROUTED TO									
+		90I90D	1320.	4.83	335.	84.	28.	2.90		
	HYDROGRAPH AT									
+		S190D	731.	4.08	50.	13.	4.	.36		
	2 COMBINED AT									
+		C190D	1319.	4.83	367.	92.	31.	3.26		

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

-----DSS---ZCLOSE Unit: 71, File: F17186.DSS
Pointer Utilization: .30
Number of Records: 80
File Size: 151.2 Kbytes
Percent Inactive: .0

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   20DEC06  TIME  18:36:54   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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 17 & 18
    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: F171824.DAT
    8         ID
    9         ID   100-YEAR 24-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID             MODELED AREA = 3.3 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         KK   S175A   BASIN
   43         KM       Compute runoff from subbasin 175A
   44         BA   1.338
   45         LG    0.27    0.35    4.45    0.37       1
   46         UI      81      81     149     277     398     505     574     655     792     958
   47         UI     656     528     479     442     405     364     338     297     261     223
   48         UI     200     190     176     151     132     108     104      90      90      72
   49         UI      62      63      56      39      40      40      39      40      15      16
   50         UI      15      16      15      16      15      16      15      16      15      16
   51         ZW                  C=FLOW
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   52         KK  75A75B   ROUTE
   53         KM   PROPOSED CHANNEL
   54         KM        Route runoff from S175A to Sun Valley Parkway at C175B.
   55         KM    Slope=(1486.0 - 1456.0) / 2793.0
   56         RS       2    FLOW      -1
   57         RC   0.045   0.045   0.045  2793.0   0.011   104.5
   58         RX     0.0     0.0     0.0     0.0    80.0    80.0    80.0    80.0
   59         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   60         ZW                  C=FLOW
              *
   61         KK   S175B   BASIN
   62         KM        Compute runoff from subbasin 175B
   63         BA   0.324
   64         LG    0.35    0.38    5.40    0.23       0
   65         UI      95     376     597     571     364     212     124      74      45      17
   66         UI      16      16       0       0       0       0       0       0       0       0
              *
   67         KK   C175B COMBINE
   68         KM        Combine runoff from S175B with routed flow from S175A at Sun Valley Prky
   69         HC       2
   70         ZW                  C=FLOW
              *
   71         KK  75B90I   ROUTE
   72         KM   PROPOSED CHANNEL
   73         KM        Route runoff from C175B to intermediate point in S190 (C190DI).
   74         KM    Slope=(1456.0 - 1413.0) / 3035.0
   75         RS       2    FLOW      -1
   76         RC   0.045   0.045   0.045  3035.0   0.014   104.5
   77         RX     0.0     0.0     0.0     0.0   100.0   100.0   100.0   100.0
   78         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   79         ZW                  C=FLOW
              *
   80         KK   S180A   BASIN
   81         KM        Compute runoff from subbasin 180A
   82         BA   0.941
   83         LG    0.20    0.35    4.35    0.40       2
   84         UI      69      70     194     308     430     500     591     792     611     451
   85         UI     406     358     325     290     252     212     179     164     150     127
   86         UI     105      88      81      76      59      54      53      34      34      33
   87         UI      34      20      13      13      14      13      13      14      13      13
   88         UI      13      14       0       0       0       0       0       0       0       0
   89         ZW                  C=FLOW
              *
   90         KK  80A80B   ROUTE
   91         KM   PROPOSED CHANNEL
   92         KM        Route runoff from S180A to Sun Valley Parkway at C180B.
   93         KM    Slope=(1528.0 - 1451.0) / 5165.0
   94         RS       3    FLOW      -1
   95         RC   0.045   0.045   0.045  5165.0   0.015   104.5
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   96         RX     0.0     0.0     0.0     0.0    80.0    80.0    80.0    80.0
   97         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
   98         ZW                  C=FLOW
              *
   99         KK   S180B   BASIN
  100         KM        Compute runoff from subbasin 180B
  101         BA   0.295
  102         LG    0.35    0.35    4.45    0.37       0
  103         UI     100     397     600     507     301     167      95      54      27      15
  104         UI      16       0       0       0       0       0       0       0       0       0
              *
  105         KK   C180B COMBINE
  106         KM        Combine runoff from S180B with routed flow from S180A at SVP
  107         HC       2
  108         ZW                  C=FLOW
              *
  109         KK  80B90I   ROUTE
  110         KM   PROPOSED CHANNEL
  111         KM        Route runoff from S180B to intermediate point in S190 (C190DI).
  112         KM    Slope=(1451.0 - 1413.0) / 2825.0
  113         RS       3    FLOW      -1
  114         RC   0.045   0.045   0.045  2825.0   0.013   104.5
  115         RX     0.0     0.0     0.0     0.0    70.0    70.0    70.0    70.0
  116         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
  117         ZW                  C=FLOW
              *
  118         KK  C190DI COMBINE
  119         KM        Combine routed flows from C175B and C180B at intermediate point
  120         HC       2
  121         ZW                  C=FLOW
              *
  122         KK  90I90D   ROUTE
  123         KM   PROPOSED CHANNEL
  124         KM    Slope=(1413.0 - 1366.0) / 3721.0
  125         RS       3    FLOW      -1
  126         RC   0.045   0.045   0.045  3721.0   0.013   104.5
  127         RX     0.0     0.0     0.0     0.0   130.0   130.0   130.0   130.0
  128         RY   104.5   100.0   100.0   100.0   100.0   100.0   100.0   104.5
```

```
           129          ZW               C=FLOW
                        *

           130          KK   S190D   BASIN
           131          KM        Compute runoff from subbasin 190D
           132          BA   0.361
           133          LG    0.35    0.35    3.78    0.45       0
           134          UI    116     451     700     634     384     221     128      70      42      18
           135          UI     19       0       0       0       0       0       0       0       0       0
                        *
1                                            HEC-1 INPUT                                          PAGE  4

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


           136          KK   C190D COMBINE
           137          KM        Combine runoff from S190D with routed flows from C190I
           138          KM        This is the total flow at the downstream end of the Fan 17/18 corridor.
           139          HC        2
           140          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE        (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   42         S175A
                V
                V
   52        75A75B
                .
                .
   61           .      S175B
                .          .
                .          .
   67         C175B...........
                V
                V
   71        75B90I
                .
                .
   80           .      S180A
                .          V
                .          V
   90           .      80A80B
                .          .
                .          .
   99           .          .      S180B
                .          .          .
                .          .          .
  105           .      C180B...........
                .          V
                .          V
  109           .      80B90I
                .          .
                .          .
  118        C190DI...........
                V
                V
  122        90I90D
                .
                .
  130           .      S190D
                .          .
                .          .
  136         C190D...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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   20DEC06  TIME  18:36:54   *                                   *          (916) 756-1104             *
 *                                       *                                   *                                     *
 *****************************************                                   ***************************************



                           HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
                               - FAN SYSTEM 17 & 18

                           SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                           JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                           MODELER: TED LEHMAN
                           FILENAME: F171824.DAT

                           100-YEAR 24-HOUR MODEL
                           EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                                    MODELED AREA = 3.3 SQ. MILES

                           GREEN-AMPT LOSS METHOD

                           S-GRAPH UNIT HYDROGRAPHS
                             - MOUNTAIN
                             - DESERT/RANGELAND
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                           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
                      .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      .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      .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      .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
                      .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      .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      .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      .00
                      .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
                      .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      .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      .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      .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
                      .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       .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
          .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       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00


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

              **************
              *            *
  42 KK       *    S175A   *       BASIN
              *            *
              **************
                                  Compute runoff from subbasin 175A

                 SUBBASIN RUNOFF DATA

  44 BA            SUBBASIN CHARACTERISTICS
                        TAREA        1.34  SUBBASIN AREA

  45 LG            GREEN AND AMPT LOSS RATE
                        STRTL         .27  STARTING LOSS
                          DTH         .35  MOISTURE DEFICIT
                         PSIF        4.45  WETTING FRONT SUCTION
                        XKSAT         .37  HYDRAULIC CONDUCTIVITY
                        RTIMP        1.00  PERCENT IMPERVIOUS AREA

  43 UI            INPUT UNITGRAPH,  50 ORDINATES,  VOLUME = 1.00
                        81.0       81.0      149.0      277.0      398.0      505.0      574.0      655.0      792.0      958.0
                       656.0      528.0      479.0      442.0      405.0      364.0      338.0      297.0      261.0      223.0
                       200.0      190.0      176.0      151.0      132.0      108.0      104.0       90.0       90.0       72.0
                        62.0       63.0       56.0       39.0       40.0       40.0       39.0       40.0       15.0       16.0
                        15.0       16.0       15.0       16.0       15.0       16.0       15.0       16.0       15.0       16.0

                                                                              ***

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

                          HYDROGRAPH AT STATION     S175A
                        TRANSPOSITION AREA         .1 SQ MI

    TOTAL RAINFALL =     4.20, TOTAL LOSS =     3.01, TOTAL EXCESS =     1.19

   PEAK FLOW       TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (CFS)         (HR)
                                 (CFS)
 +       881.      12.58                   169.           43.           14.            6.
                              (INCHES)    1.171         1.184         1.184         1.184
                               (AC-FT)      84.           84.           84.           84.

                               CUMULATIVE AREA =     1.34 SQ MI


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

                          HYDROGRAPH AT STATION     S175A
                        TRANSPOSITION AREA       10.0 SQ MI

    TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.90, TOTAL EXCESS =     1.09

   PEAK FLOW       TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (CFS)         (HR)
                                 (CFS)
 +       815.      12.58                   155.           39.           13.            6.
                              (INCHES)    1.079         1.091         1.091         1.091
                               (AC-FT)      77.           78.           78.           78.

                               CUMULATIVE AREA =     1.34 SQ MI

   -----DSS---ZOPEN:  Existing File Opened,  File: F171824.DSS
                      Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //S175A/FLOW/08JAN1999/5MIN//
     ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT     S175A

   PEAK FLOW       TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (CFS)         (HR)
                                 (CFS)
 +       844.      12.58                   161.           41.           14.            6.
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                              (INCHES)    1.120         1.131         1.132         1.132
                               (AC-FT)      80.           81.           81.           81.

                               CUMULATIVE AREA =     1.34 SQ MI


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

              **************
              *            *
  52 KK       *   75A75B   *       ROUTE
              *            *
              **************
                                  PROPOSED CHANNEL
                                       Route runoff from S175A to Sun Valley Parkway at C175B.
                                   Slope=(1486.0 - 1456.0) / 2793.0

                 HYDROGRAPH ROUTING DATA

  56 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

  57 RC            NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH       2793.  REACH LENGTH
                          SEL       .0110  ENERGY SLOPE
                        ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                              CROSS-SECTION DATA
                               --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  59 RY          ELEVATION     104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
  58 RX           DISTANCE        .00       .00       .00       .00     80.00     80.00     80.00     80.00

                                                                     ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE         .00      1.21      2.43      3.64      4.86      6.07      7.29      8.50      9.72     10.93
              OUTFLOW         .00     25.14     79.65    156.25    251.89    364.65    493.18    636.42    793.52    963.77
            ELEVATION      100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

              STORAGE       12.15     13.36     14.58     15.79     17.01     18.22     19.44     20.65     21.87     23.08
              OUTFLOW     1146.58   1341.40   1547.79   1765.31   1993.60   2232.31   2481.13   2739.77   3007.96   3285.45
            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       964. TO      3285.
                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    75A75B
                        TRANSPOSITION AREA         .1 SQ MI

   PEAK FLOW       TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (CFS)         (HR)
                                 (CFS)
 +       852.      12.67                   168.           43.           14.            6.
                              (INCHES)    1.171         1.183         1.184         1.184
                               (AC-FT)      84.           84.           84.           84.

  PEAK STORAGE     TIME                          MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR      166.58-HR
 +  (AC-FT)        (HR)
          5.       12.67                     1.            0.            0.            0.

   PEAK STAGE      TIME                           MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (FEET)        (HR)
      101.98       12.67                 100.57        100.15        100.05        100.02

                               CUMULATIVE AREA =     1.34 SQ MI


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

                          HYDROGRAPH AT STATION    75A75B
                        TRANSPOSITION AREA       10.0 SQ MI

   PEAK FLOW       TIME                            MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR      166.58-HR
 +   (CFS)         (HR)
                                 (CFS)
 +       785.      12.75                   155.           39.           13.            6.
                              (INCHES)    1.079         1.091         1.091         1.091
                               (AC-FT)      77.           78.           78.           78.

  PEAK STORAGE     TIME                          MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR      166.58-HR
 +  (AC-FT)        (HR)
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        5.     12.75                   1.          0.          0.          0.

   PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (FEET)      (HR)
    101.88     12.75                 100.54      100.14      100.05       100.02

                         CUMULATIVE AREA =    1.34 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //75A75B/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                         INTERPOLATED HYDROGRAPH AT   75A75B

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     814.     12.67                   161.         41.         14.          6.
                           (INCHES)    1.119       1.131       1.132       1.132
                            (AC-FT)      80.         81.         81.         81.

                         CUMULATIVE AREA =    1.34 SQ MI


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


              **************
              *            *
   61 KK      *    S175B   *       BASIN
              *            *
              **************
                              Compute runoff from subbasin 175B

             SUBBASIN RUNOFF DATA

   63 BA       SUBBASIN CHARACTERISTICS
                     TAREA          .32  SUBBASIN AREA

   64 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

   62 UI       INPUT UNITGRAPH,  12 ORDINATES,  VOLUME = 1.00
                   95.0     376.0     597.0     571.0     364.0     212.0     124.0      74.0      45.0      17.0
                   16.0      16.0
                                                                    ***

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

                         HYDROGRAPH AT STATION    S175B
                       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)
 +     572.     12.08                    45.         11.          4.          2.
                           (INCHES)    1.279       1.279       1.279       1.279
                            (AC-FT)      22.         22.         22.         22.

                         CUMULATIVE AREA =     .32 SQ MI


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

                         HYDROGRAPH AT STATION    S175B
                       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)
 +     533.     12.08                    41.         10.          3.          1.
                           (INCHES)    1.175       1.175       1.175       1.175
                            (AC-FT)      20.         20.         20.         20.

                         CUMULATIVE AREA =     .32 SQ MI

       ***           ***           ***           ***           ***
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                         INTERPOLATED HYDROGRAPH AT    S175B

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     562.     12.08                    44.         11.          4.          2.
                           (INCHES)    1.252       1.252       1.252       1.252
                            (AC-FT)      22.         22.         22.         22.

                         CUMULATIVE AREA =     .32 SQ MI


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


              **************
              *            *
   67 KK      *    C175B   *       COMBINE
              *            *
              **************

                              Combine runoff from S175B with routed flow from S175A at Sun Valley Prky

   69 HC       HYDROGRAPH COMBINATION
                     ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

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

                         HYDROGRAPH AT STATION    C175B
                       TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     884.     12.67                   213.         54.         18.          8.
                           (INCHES)    1.192       1.202       1.202       1.202
                            (AC-FT)     106.        107.        107.        107.

                         CUMULATIVE AREA =    1.66 SQ MI


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

                         HYDROGRAPH AT STATION    C175B
                       TRANSPOSITION AREA     10.0 SQ MI

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     812.     12.67                   196.         49.         16.          7.
                           (INCHES)    1.098       1.107       1.107       1.107
                            (AC-FT)      97.         98.         98.         98.

                         CUMULATIVE AREA =    1.66 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   17:  //C175B/FLOW/08JAN1999/5MIN//
       ***           ***           ***           ***           ***


                         INTERPOLATED HYDROGRAPH AT    C175B

   PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)       (HR)
                             (CFS)
 +     840.     12.67                   203.         51.         17.          7.
                           (INCHES)    1.134       1.144       1.144       1.144
                            (AC-FT)     101.        101.        101.        101.

                         CUMULATIVE AREA =    1.66 SQ MI


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


              **************
              *            *
   71 KK      *   75B90I   *       ROUTE
              *            *
              **************
                        PROPOSED CHANNEL
```

```
                     Route runoff from C175B to intermediate point in S190 (C190DI).
                   Slope=(1456.0 - 1413.0) / 3035.0

             HYDROGRAPH ROUTING DATA

 75 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

 76 RC          NORMAL DEPTH CHANNEL
                       ANL       .045  LEFT OVERBANK N-VALUE
                      ANCH       .045  MAIN CHANNEL N-VALUE
                       ANR       .045  RIGHT OVERBANK N-VALUE
                     RLNTH      3035.  REACH LENGTH
                       SEL      .0140  ENERGY SLOPE
                     ELMAX      104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 78 RY          ELEVATION   104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 77 RX          DISTANCE       .00       .00       .00       .00    100.00    100.00    100.00    100.00

                                                     ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

               STORAGE       .00      1.65      3.30      4.95      6.60      8.25      9.90     11.55     13.20     14.85
               OUTFLOW       .00     35.46    112.41    220.60    355.77    515.23    697.10    899.91   1122.47   1363.82
             ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

               STORAGE     16.50     18.15     19.80     21.45     23.10     24.75     26.40     28.05     29.70     31.35
               OUTFLOW   1623.12   1899.63   2192.72   2501.80   2826.37   3165.96   3520.13   3888.48   4270.65   4666.30
             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      1122. TO      4666.
                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    75B90I
                    TRANSPOSITION AREA       .1 SQ MI

 PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
+    (CFS)      (HR)
                               (CFS)
+     864.     12.75                     213.           54.           18.            8.
                            (INCHES)     1.191         1.202         1.202         1.202
                             (AC-FT)      106.          107.          107.          107.

 PEAK STORAGE   TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        6.     12.75                        2.            0.            0.            0.

 PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
    101.62     12.75                    100.56        100.14        100.05        100.02

                         CUMULATIVE AREA =     1.66 SQ MI

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

                      HYDROGRAPH AT STATION    75B90I
                    TRANSPOSITION AREA      10.0 SQ MI

 PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
+    (CFS)      (HR)
                               (CFS)
+     794.     12.75                     196.           49.           16.            7.
                            (INCHES)     1.097         1.107         1.107         1.107
                             (AC-FT)       97.           98.           98.           98.

 PEAK STORAGE   TIME                           MAXIMUM AVERAGE STORAGE
                                         6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)      (HR)
        5.     12.75                        2.            0.            0.            0.

 PEAK STAGE     TIME                             MAXIMUM AVERAGE STAGE
                                         6-HR         24-HR         72-HR     166.58-HR
+   (FEET)      (HR)
    101.53     12.75                    100.53        100.14        100.05        100.02

                         CUMULATIVE AREA =     1.66 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //75B90I/FLOW/08JAN1999/5MIN//
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    ***             ***             ***             ***             ***

                       INTERPOLATED HYDROGRAPH AT    75B90I

 PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
+    (CFS)      (HR)
                               (CFS)
+     821.     12.75                     203.           51.           17.            7.
                            (INCHES)     1.133         1.144         1.144         1.144
                             (AC-FT)      100.          101.          101.          101.

                         CUMULATIVE AREA =     1.66 SQ MI

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

             **************
             *            *
 80 KK       *    S180A   *       BASIN
             *            *
             **************
                              Compute runoff from subbasin 180A

               SUBBASIN RUNOFF DATA

 82 BA            SUBBASIN CHARACTERISTICS
                        TAREA          .94  SUBBASIN AREA

 83 LG            GREEN AND AMPT LOSS RATE
                        STRTL          .20  STARTING LOSS
                          DTH          .35  MOISTURE DEFICIT
                         PSIF         4.35  WETTING FRONT SUCTION
                        XKSAT          .40  HYDRAULIC CONDUCTIVITY
                        RTIMP         2.00  PERCENT IMPERVIOUS AREA

 81 UI            INPUT UNITGRAPH,  42 ORDINATES,  VOLUME = 1.00
                      69.0      70.0     194.0     308.0     430.0     500.0     591.0     792.0     611.0     451.0
                     406.0     358.0     325.0     290.0     252.0     212.0     179.0     164.0     150.0     127.0
                     105.0      88.0      81.0      76.0      59.0      54.0      53.0      34.0      34.0      33.0
                      34.0      20.0      13.0      13.0      14.0      13.0      13.0      14.0      13.0      13.0
                      13.0      14.0

                                                     ***

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

                      HYDROGRAPH AT STATION     S180A
                    TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.99, TOTAL EXCESS =     1.20

 PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
+    (CFS)      (HR)
                               (CFS)
+     716.     12.50                     119.           30.           10.            4.
                            (INCHES)     1.179         1.203         1.204         1.204
                             (AC-FT)       59.           60.           60.           60.

                         CUMULATIVE AREA =      .94 SQ MI

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

                      HYDROGRAPH AT STATION     S180A
                    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)
+     664.     12.50                     110.           28.            9.            4.
                            (INCHES)     1.087         1.110         1.111         1.111
                             (AC-FT)       55.           56.           56.           56.

                         CUMULATIVE AREA =      .94 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //S180A/FLOW/08JAN1999/5MIN//
    ***             ***             ***             ***             ***

                       INTERPOLATED HYDROGRAPH AT     S180A

 PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
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                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                        (CFS)
+     691.     12.50                    115.         29.         10.          4.
                      (INCHES)       1.134       1.158       1.158       1.158
                       (AC-FT)          57.         58.         58.         58.

                     CUMULATIVE AREA =     .94 SQ MI
```

*** ***

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          **************
          *            *
 90 KK    *    80A80B  *        ROUTE
          *            *
          **************
                    PROPOSED CHANNEL
                        Route runoff from S180A to Sun Valley Parkway at C180B.
                     Slope=(1528.0 - 1451.0) / 5165.0

               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        5165.  REACH LENGTH
                       SEL        .0150  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     80.00     80.00     80.00     80.00

                                              ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.25      4.49      6.74      8.99     11.23     13.48     15.73     17.97     20.22
          OUTFLOW        .00     29.35     93.01    182.46    294.14    425.82    575.91    743.17    926.63   1125.44
          ELEVATION    100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

            STORAGE     22.47     24.71     26.96     29.21     31.45     33.70     35.95     38.19     40.44     42.69
            OUTFLOW   1338.91   1566.42   1807.43   2061.44   2328.02   2606.78   2897.34   3199.36   3512.54   3836.58
          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 1339. TO 3837.
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 80A80B
TRANSPOSITION AREA .1 SQ MI

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                        (CFS)
+     671.     12.67                    119.         30.         10.          4.
                      (INCHES)       1.178       1.203       1.204       1.204
                       (AC-FT)          59.         60.         60.         60.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       5.     12.67                      1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.56     12.67                  100.41      100.11      100.04      100.02

                     CUMULATIVE AREA =     .94 SQ MI
```

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

HYDROGRAPH AT STATION 80A80B
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.     12.67                    110.         28.          9.          4.
                      (INCHES)       1.086       1.110       1.111       1.111
                       (AC-FT)          55.         56.         56.         56.
```



```
  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       5.     12.67                      1.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.48     12.67                  100.39      100.10      100.03      100.01

                     CUMULATIVE AREA =     .94 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80A80B/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***
```

INTERPOLATED HYDROGRAPH AT 80A80B

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                        (CFS)
+     646.     12.67                    115.         29.         10.          4.
                      (INCHES)       1.133       1.158       1.158       1.158
                       (AC-FT)          57.         58.         58.         58.

                     CUMULATIVE AREA =     .94 SQ MI
```

*** ***

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          **************
          *            *
 99 KK    *     S180B  *        BASIN
          *            *
          **************
                    Compute runoff from subbasin 180B

               SUBBASIN RUNOFF DATA

101 BA           SUBBASIN CHARACTERISTICS
                      TAREA          .29  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,  11 ORDINATES,  VOLUME = 1.00
                    100.0     397.0     600.0     507.0     301.0     167.0      95.0      54.0      27.0      15.0
                     16.0
                                                                                  ***

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

                     HYDROGRAPH AT STATION    S180B
                     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)
+     511.     12.08                     36.          9.          3.          1.
                      (INCHES)       1.136       1.136       1.136       1.136
                       (AC-FT)          18.         18.         18.         18.

                     CUMULATIVE AREA =     .29 SQ MI

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

                     HYDROGRAPH AT STATION    S180B
                     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)
+     474.     12.08                     33.          8.          3.          1.
                      (INCHES)       1.043       1.043       1.043       1.043
                       (AC-FT)          16.         16.         16.         16.
```

```
                       CUMULATIVE AREA =      .29 SQ MI

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


                       INTERPOLATED HYDROGRAPH AT     S180B

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    502.       12.08                   35.          9.          3.          1.
                              (INCHES)  1.114       1.114       1.114       1.114
                               (AC-FT)    18.         18.         18.         18.

                       CUMULATIVE AREA =      .29 SQ MI


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


              **************
              *            *
   105 KK     *    C180B   *      COMBINE
              *            *
              **************
                         Combine runoff from S180B with routed flow from S180A at SVP

   107 HC          HYDROGRAPH COMBINATION
                         ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                       ***

      ***           ***           ***           ***           ***
                        HYDROGRAPH AT STATION     C180B
                       TRANSPOSITION AREA       .1 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    691.       12.58                  155.         39.         13.          6.
                              (INCHES)  1.168       1.187       1.187       1.187
                               (AC-FT)    77.         78.         78.         78.

                       CUMULATIVE AREA =     1.24 SQ MI

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

                        HYDROGRAPH AT STATION     C180B
                       TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    637.       12.67                  143.         36.         12.          5.
                              (INCHES)  1.076       1.094       1.094       1.094
                               (AC-FT)    71.         72.         72.         72.

                       CUMULATIVE AREA =     1.24 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //C180B/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                       INTERPOLATED HYDROGRAPH AT     C180B

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    661.       12.67                  149.         38.         13.          5.
                              (INCHES)  1.118       1.136       1.137       1.137
                               (AC-FT)    74.         75.         75.         75.

                       CUMULATIVE AREA =     1.24 SQ MI


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

              **************
              *            *
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```
   109 KK     *    80B90I  *        ROUTE
              *            *
              **************
                          PROPOSED CHANNEL
                               Route runoff from S180B to intermediate point in S190 (C190DI).
                           Slope=(1451.0 - 1413.0) / 2825.0

              HYDROGRAPH ROUTING DATA

   113 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

   114 RC          NORMAL DEPTH CHANNEL
                           ANL         .045  LEFT OVERBANK N-VALUE
                          ANCH         .045  MAIN CHANNEL N-VALUE
                           ANR         .045  RIGHT OVERBANK N-VALUE
                         RLNTH        2825.  REACH LENGTH
                           SEL        .0130  ENERGY SLOPE
                         ELMAX        104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   116 RY         ELEVATION   104.50     100.00     100.00     100.00     100.00     100.00     100.00     104.50
   115 RX         DISTANCE       .00        .00        .00        .00      70.00      70.00      70.00      70.00

                                                                  ***

                                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                  STORAGE      .00      1.08      2.15      3.23      4.30      5.38      6.45      7.53      8.60      9.68
                  OUTFLOW      .00     23.90     75.72    148.51    239.34    346.39    468.35    604.21    753.15    914.50
                ELEVATION   100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

                  STORAGE    10.75     11.83     12.90     13.98     15.05     16.13     17.20     18.28     19.35     20.43
                  OUTFLOW  1087.67   1272.16   1467.50   1673.31   1889.21   2114.88   2350.01   2594.31   2847.54   3109.45
                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       239. TO      3109.
                 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    80B90I
                      TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    681.       12.75                  155.         39.         13.          6.
                              (INCHES)  1.167       1.187       1.187       1.187
                               (AC-FT)    77.         78.         78.         78.

 PEAK STORAGE     TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR       72-HR    166.58-HR
 +  (AC-FT)       (HR)
        3.       12.75                    1.          0.          0.          0.

  PEAK STAGE      TIME                         MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (FEET)       (HR)
     101.78      12.75                100.58      100.15      100.05      100.02

                       CUMULATIVE AREA =     1.24 SQ MI


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

                        HYDROGRAPH AT STATION    80B90I
                      TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                         MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    627.       12.75                  143.         36.         12.          5.
                              (INCHES)  1.075       1.094       1.094       1.094
                               (AC-FT)    71.         72.         72.         72.

 PEAK STORAGE     TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR       72-HR    166.58-HR
 +  (AC-FT)       (HR)
        3.       12.75                    1.          0.          0.          0.

  PEAK STAGE      TIME                         MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR       72-HR    166.58-HR
 +   (FEET)       (HR)
     101.69      12.75                100.55      100.14      100.05      100.02

                       CUMULATIVE AREA =     1.24 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/04JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //80B90I/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT   80B90I

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     652.     12.75                149.         38.         13.          5.
                         (INCHES)    1.117       1.136       1.137       1.137
                         (AC-FT)      74.         75.         75.         75.

                        CUMULATIVE AREA =    1.24 SQ MI



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


             **************
             *            *
 118 KK      *    C190DI  *      COMBINE
             *            *
             **************
                        Combine routed flows from C175B and C180B at intermediate point

 120 HC           HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                          HYDROGRAPH AT STATION   C190DI
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1545.     12.75                368.         93.         31.         13.
                         (INCHES)    1.181       1.196       1.196       1.196
                         (AC-FT)      183.        185.        185.        185.

                        CUMULATIVE AREA =    2.90 SQ MI

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

                          HYDROGRAPH AT STATION   C190DI
                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1422.     12.75                339.         86.         29.         12.
                         (INCHES)    1.088       1.102       1.102       1.102
                         (AC-FT)      168.        170.        170.        170.

                        CUMULATIVE AREA =    2.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //C190DI/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT   C190DI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1455.     12.75                347.         88.         29.         13.
                         (INCHES)    1.113       1.127       1.127       1.127
                         (AC-FT)      172.        174.        174.        174.

                        CUMULATIVE AREA =    2.90 SQ MI



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

             **************
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```
             *            *
             *    90I90D  *       ROUTE
             *            *
             **************
                          PROPOSED CHANNEL
                           Slope=(1413.0 - 1366.0) / 3721.0

                      HYDROGRAPH ROUTING DATA

 125 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

 126 RC           NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH       3721.  REACH LENGTH
                          SEL       .0130  ENERGY SLOPE
                        ELMAX       104.5  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                            --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 128 RY          ELEVATION    104.50    100.00    100.00    100.00    100.00    100.00    100.00    104.50
 127 RX          DISTANCE        .00       .00       .00       .00    130.00    130.00    130.00    130.00

                                                    ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

             STORAGE        .00      2.63      5.26      7.89     10.52     13.15     15.78     18.41     21.04     23.67
             OUTFLOW        .00     44.44    140.92    276.65    446.32    646.60    875.15   1130.16   1410.17   1713.99
           ELEVATION     100.00    100.24    100.47    100.71    100.95    101.18    101.42    101.66    101.89    102.13

             STORAGE      26.30     28.93     31.56     34.19     36.82     39.45     42.08     44.71     47.34     49.97
             OUTFLOW    2040.57   2389.03   2758.58   3148.52   3558.22   3987.11   4434.65   4900.37   5383.82   5884.58
           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      875. TO     5885.
                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   90I90D
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1521.     12.83                367.         93.         31.         13.
                         (INCHES)    1.178       1.196       1.196       1.196
                         (AC-FT)      182.        185.        185.        185.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)     (HR)
                7.     12.83                3.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
              101.98     12.83           100.69      100.18      100.06      100.03

                        CUMULATIVE AREA =    2.90 SQ MI

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

                          HYDROGRAPH AT STATION   90I90D
                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1389.     12.83                338.         86.         29.         12.
                         (INCHES)    1.085       1.102       1.102       1.102
                         (AC-FT)      168.        170.        170.        170.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (AC-FT)     (HR)
                7.     12.83                2.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
              101.88     12.83           100.66      100.17      100.06      100.02

                        CUMULATIVE AREA =    2.90 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/04JAN1999/5MIN//
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 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   17:  //90I90D/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                               INTERPOLATED HYDROGRAPH AT   90I90D

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1425.      12.83                    346.          88.           29.           13.
                              (INCHES)   1.110         1.127         1.127         1.127
                              (AC-FT)     172.          174.          174.          174.

                               CUMULATIVE AREA =    2.90 SQ MI


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

              **************
              *            *
 130 KK       *    S190D   *        BASIN
              *            *
              **************
                                  Compute runoff from subbasin 190D

          SUBBASIN RUNOFF DATA

 132 BA     SUBBASIN CHARACTERISTICS
                  TAREA          .36  SUBBASIN AREA

 133 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

 131 UI     INPUT UNITGRAPH,  11 ORDINATES,  VOLUME = 1.00
               116.0     451.0     700.0     634.0     384.0     221.0     128.0      70.0      42.0      18.0
                19.0
                                                                    ***
       ***             ***             ***             ***             ***

                               HYDROGRAPH AT STATION    S190D
                              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)
 +     592.      12.08                     42.           11.            4.            2.
                              (INCHES)   1.090         1.090         1.090         1.090
                              (AC-FT)      21.           21.           21.           21.

                               CUMULATIVE AREA =     .36 SQ MI

       ***             ***             ***             ***             ***
                               HYDROGRAPH AT STATION    S190D
                              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)
 +     548.      12.08                     39.           10.            3.            1.
                              (INCHES)    .997          .997          .997          .997
                              (AC-FT)      19.           19.           19.           19.

                               CUMULATIVE AREA =     .36 SQ MI

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


                               INTERPOLATED HYDROGRAPH AT    S190D

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +     580.      12.08                     41.           10.            3.            1.
                              (INCHES)   1.064         1.064         1.064         1.064
                              (AC-FT)      20.           20.           20.           20.

                               CUMULATIVE AREA =     .36 SQ MI


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

              **************
              *            *
 136 KK       *    C190D   *        COMBINE
              *            *
              **************
                                  Combine runoff from S190D with routed flows from C190I
                                  This is the total flow at the downstream end of the Fan 17/18 corridor.

 139 HC        HYDROGRAPH COMBINATION
                  ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***
       ***             ***             ***             ***             ***

                               HYDROGRAPH AT STATION    C190D
                              TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1527.      12.83                    408.          104.           35.           15.
                              (INCHES)   1.165         1.184         1.184         1.184
                              (AC-FT)     203.          206.          206.          206.

                               CUMULATIVE AREA =    3.26 SQ MI

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

                               HYDROGRAPH AT STATION    C190D
                              TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1395.      12.83                    376.           96.           32.           14.
                              (INCHES)   1.072         1.090         1.090         1.090
                              (AC-FT)     186.          189.          190.          190.

                               CUMULATIVE AREA =    3.26 SQ MI

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


                               INTERPOLATED HYDROGRAPH AT    C190D

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                         6-HR         24-HR         72-HR     166.58-HR
 +   (CFS)        (HR)
                                (CFS)
 +    1427.      12.83                    384.           98.           33.           14.
                              (INCHES)   1.095         1.113         1.113         1.113
                              (AC-FT)     190.          193.          193.          193.

                               CUMULATIVE AREA =    3.26 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	S175A	844.	12.58	161.	41.	14.	1.34		
+	ROUTED TO	75A75B	814.	12.67	161.	41.	14.	1.34		
+	HYDROGRAPH AT	S175B	562.	12.08	44.	11.	4.	.32		
+	2 COMBINED AT	C175B	840.	12.67	203.	51.	17.	1.66		
+	ROUTED TO	75B90I	821.	12.75	203.	51.	17.	1.66		
+	HYDROGRAPH AT	S180A	691.	12.50	115.	29.	10.	.94		
+	ROUTED TO	80A80B	646.	12.67	115.	29.	10.	.94		
+	HYDROGRAPH AT	S180B	502.	12.08	35.	9.	3.	.29		

```
          2 COMBINED AT
+                       C180B       661.   12.67         149.         38.         13.       1.24

          ROUTED TO
+                      80B90I       652.   12.75         149.         38.         13.       1.24

          2 COMBINED AT
+                       C190DI      1455.   12.75         347.         88.         29.       2.90

          ROUTED TO
+                      90I90D       1425.   12.83         346.         88.         29.       2.90

          HYDROGRAPH AT
+                       S190D        580.   12.08          41.         10.          3.        .36

          2 COMBINED AT
+                       C190D       1427.   12.83         384.         98.         33.       3.26


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


    -----DSS---ZCLOSE Unit:  71,   File: F171824.DSS
               Pointer Utilization:    .30
               Number of Records:     80
               File Size:    151.2  Kbytes
               Percent Inactive:    .0
```

CURRENT DATE: 10-24-2005
CURRENT TIME: 14:21:03

FILE DATE: 10-24-2005
FILE NAME: SVP63208

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	49.54	49.27	135.00	3 RCB	12.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: SVP63208 DATE: 10-24-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
49.54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
51.19	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
52.17	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
52.98	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
53.71	800.0	800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
54.08	910.0	910.0	0.0	0.0	0.0	0.0	0.0	0.00	1
55.01	1200.0	1200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
55.60	1400.0	1400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
56.16	1600.0	1600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
56.64	1800.0	1770.2	0.0	0.0	0.0	0.0	0.0	30.22	2
57.12	2000.0	1885.9	0.0	0.0	0.0	0.0	0.0	113.51	3
56.30	1648.9	1648.9	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SVP63208 DATE: 10-24-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
49.54	0.000	0.00	0.00	0.00
51.19	0.000	200.00	0.00	0.00
52.17	0.000	400.00	0.00	0.00
52.98	0.000	600.00	0.00	0.00
53.71	0.000	800.00	0.00	0.00
54.08	0.000	910.00	0.00	0.00
55.01	0.000	1200.00	0.00	0.00
55.60	0.000	1400.00	0.00	0.00
56.16	0.000	1600.00	0.00	0.00
56.64	0.001	1800.00	-0.44	-0.02
57.12	-0.001	2000.00	0.55	0.03

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

CURRENT DATE: 10-24-2005
CURRENT TIME: 14:21:03

FILE DATE: 10-24-2005
FILE NAME: SVP63208

PERFORMANCE CURVE FOR CULVERT 1 - 3(12.00 (ft) BY 5.00 (ft)) RCB

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	49.54	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	51.19	1.51	1.65	3-M1t	1.06	0.99	1.28	1.28	4.35	5.69
400.00	52.17	2.40	2.63	3-M1t	1.67	1.57	1.92	1.92	5.80	7.24
600.00	52.98	3.16	3.44	3-M1t	2.19	2.06	2.42	2.42	6.88	8.30
800.00	53.71	3.84	4.17	3-M1t	2.66	2.49	2.86	2.86	7.78	9.12
910.00	54.08	4.19	4.54	3-M1t	2.91	2.71	3.07	3.07	8.23	9.51
1200.00	55.01	5.09	5.47	3-M1t	3.53	3.26	3.59	3.59	9.27	10.37
1400.00	55.60	5.74	6.06	3-M2t	3.93	3.62	3.92	3.92	9.93	10.88
1600.00	56.16	6.45	6.62	3-M2t	4.33	3.95	4.22	4.22	10.53	11.34
1770.22	56.64	7.10	7.09	3-M2t	5.00	4.23	4.51	4.51	10.92	11.75
1885.94	57.12	7.58	7.39	3-M2t	5.00	4.41	4.77	4.77	10.97	12.13

El. inlet face invert 49.54 ft El. outlet invert 49.27 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	49.54 ft
OUTLET STATION	135.00 ft
OUTLET ELEVATION	49.27 ft
NUMBER OF BARRELS	3
SLOPE (V/H)	0.0020
CULVERT LENGTH ALONG SLOPE	135.00 ft

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

BARREL SHAPE	BOX
BARREL SPAN	12.00 ft
BARREL RISE	5.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 10-24-2005
CURRENT TIME: 14:21:03

FILE DATE: 10-24-2005
FILE NAME: SVP63208

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	25.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.015
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	49.27 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	49.27 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	49.27	0.000	0.00	0.00	0.00
200.00	50.55	0.888	1.28	5.69	1.19
400.00	51.19	0.923	1.92	7.24	1.79
600.00	51.69	0.940	2.42	8.30	2.27
800.00	52.13	0.951	2.86	9.12	2.67
910.00	52.34	0.956	3.07	9.51	2.88
1200.00	52.86	0.964	3.59	10.37	3.36
1400.00	53.19	0.969	3.92	10.88	3.67
1600.00	53.49	0.972	4.22	11.34	3.95
1800.00	53.78	0.975	4.51	11.75	4.22
2000.00	54.04	0.978	4.77	12.13	4.47

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	100.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	56.30 ft

CURRENT DATE: 10-24-2005
CURRENT TIME: 14:52:12

FILE DATE: 10-24-2005
FILE NAME: SVP61824

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	44.20	42.86	135.01	4 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: SVP61824 DATE: 10-24-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
44.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
45.60	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
46.42	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
47.13	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
47.76	800.0	800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
48.33	1000.0	1000.0	0.0	0.0	0.0	0.0	0.0	0.00	1
48.89	1200.0	1200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
49.46	1400.0	1400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
49.95	1565.0	1565.0	0.0	0.0	0.0	0.0	0.0	0.00	1
50.70	1800.0	1800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
51.33	2000.0	1978.0	0.0	0.0	0.0	0.0	0.0	20.57	3
51.06	1902.0	1902.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SVP61824 DATE: 10-24-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
44.20	0.000	0.00	0.00	0.00
45.60	0.000	200.00	0.00	0.00
46.42	0.000	400.00	0.00	0.00
47.13	0.000	600.00	0.00	0.00
47.76	0.000	800.00	0.00	0.00
48.33	0.000	1000.00	0.00	0.00
48.89	0.000	1200.00	0.00	0.00
49.46	0.000	1400.00	0.00	0.00
49.95	0.000	1565.00	0.00	0.00
50.70	0.000	1800.00	0.00	0.00
51.33	-0.003	2000.00	1.45	0.07

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

CURRENT DATE: 10-24-2005 FILE DATE: 10-24-2005
CURRENT TIME: 14:52:12 FILE NAME: SVP61824

PERFORMANCE CURVE FOR CULVERT 1 - 4(10.00 (ft) BY 5.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	44.20	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	45.60	1.40	1.40	1-S2n	0.59	0.92	0.52	0.74	9.60	12.68
400.00	46.42	2.22	2.22	1-S2n	0.94	1.46	0.98	1.11	10.18	16.28
600.00	47.13	2.93	2.93	1-S2n	1.22	1.92	1.31	1.40	11.49	18.75
800.00	47.76	3.56	3.56	1-S2n	1.48	2.32	1.61	1.66	12.42	20.68
1000.00	48.33	4.13	4.13	1-S2n	1.71	2.69	1.89	1.89	13.21	22.28
1200.00	48.89	4.69	4.69	1-S2n	1.94	3.04	2.18	2.10	13.75	23.65
1400.00	49.46	5.26	5.26	5-S2n	2.15	3.37	2.44	2.29	14.34	24.88
1565.00	49.95	5.75	5.75	5-S2n	2.32	3.63	2.66	2.44	14.71	25.79
1800.00	50.70	6.50	6.50	5-S2n	2.56	3.99	2.96	2.64	15.23	26.96
1977.97	51.32	7.12	7.12	5-S2n	2.73	4.24	3.14	2.80	15.73	27.87

El. inlet face invert 44.20 ft El. outlet invert 42.86 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	44.20 ft
OUTLET STATION	135.00 ft
OUTLET ELEVATION	42.86 ft
NUMBER OF BARRELS	4
SLOPE (V/H)	0.0099
CULVERT LENGTH ALONG SLOPE	135.01 ft

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

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	5.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 10-24-2005 FILE DATE: 10-24-2005
CURRENT TIME: 14:52:12 FILE NAME: SVP61824

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

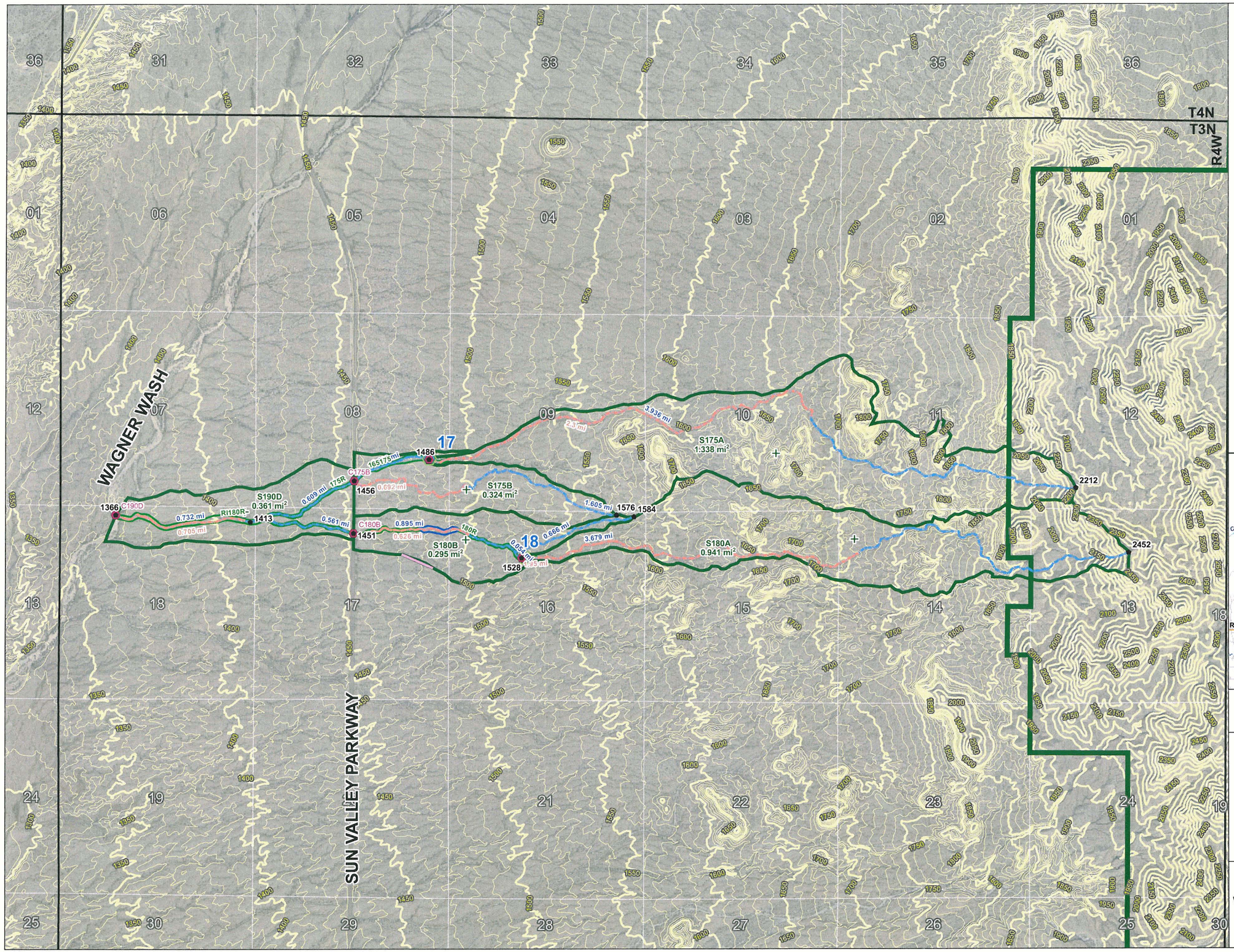
BOTTOM WIDTH	20.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.150
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	42.86 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	42.86 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	42.86	0.000	0.00	0.00	0.00
200.00	43.60	2.607	0.74	12.68	6.88
400.00	43.97	2.727	1.11	16.28	10.35
600.00	44.26	2.789	1.40	18.75	13.13
800.00	44.52	2.829	1.66	20.68	15.53
1000.00	44.75	2.857	1.89	22.28	17.67
1200.00	44.96	2.878	2.10	23.65	19.63
1400.00	45.15	2.898	2.29	24.88	21.43
1565.00	45.30	2.910	2.44	25.79	22.83
1800.00	45.50	2.924	2.64	26.96	24.72
2000.00	45.66	2.934	2.80	27.87	26.23

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	100.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	51.06 ft



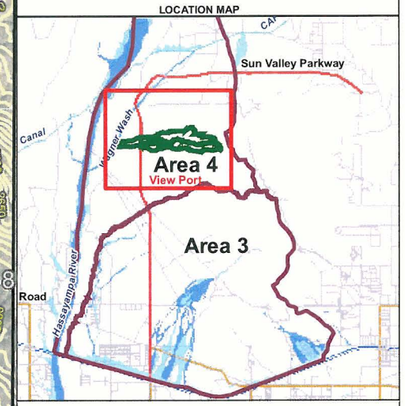
LEGEND

- Subbasin Boundaries
- Subbasin Centroids
- Lca Paths
- Lag & Routing Paths
- Elevation Points
- Concentration Points

Step 3 Corridors

- Floodwall
- No Floodwall
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 17 & 18
SUBBASIN MAP

FCD 2004C049
DECEMBER 2006

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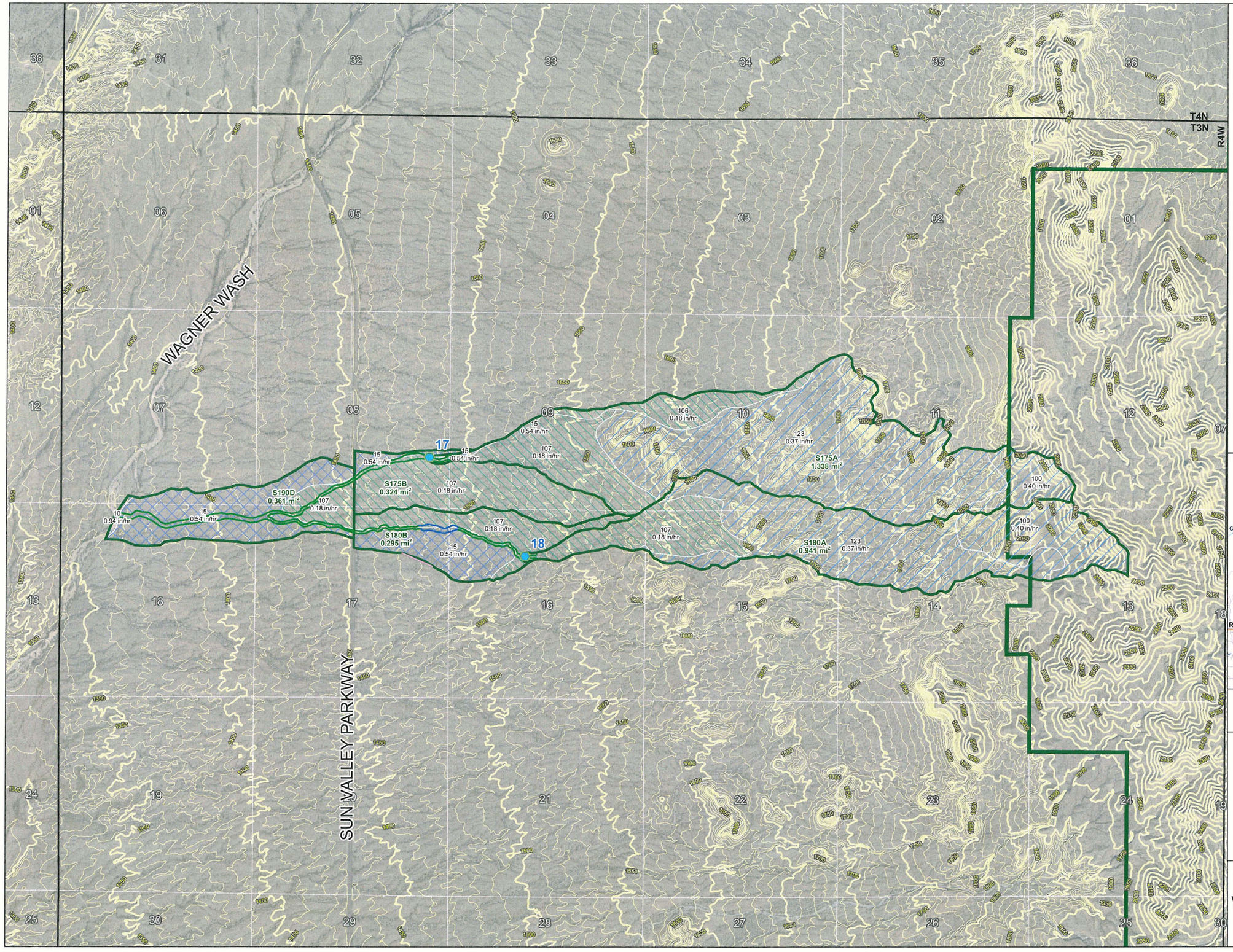


LEGEND

NRCS Soil Data

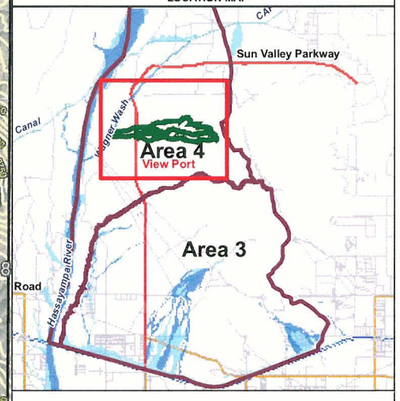
XKSAT (in/hr)

- 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
- Proposed Dikes
- 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
WAGNER SUB-AREA
FAN SYSTEM 17 & 18
SOIL MAP

FCD 2004C049

DECEMBER 2006

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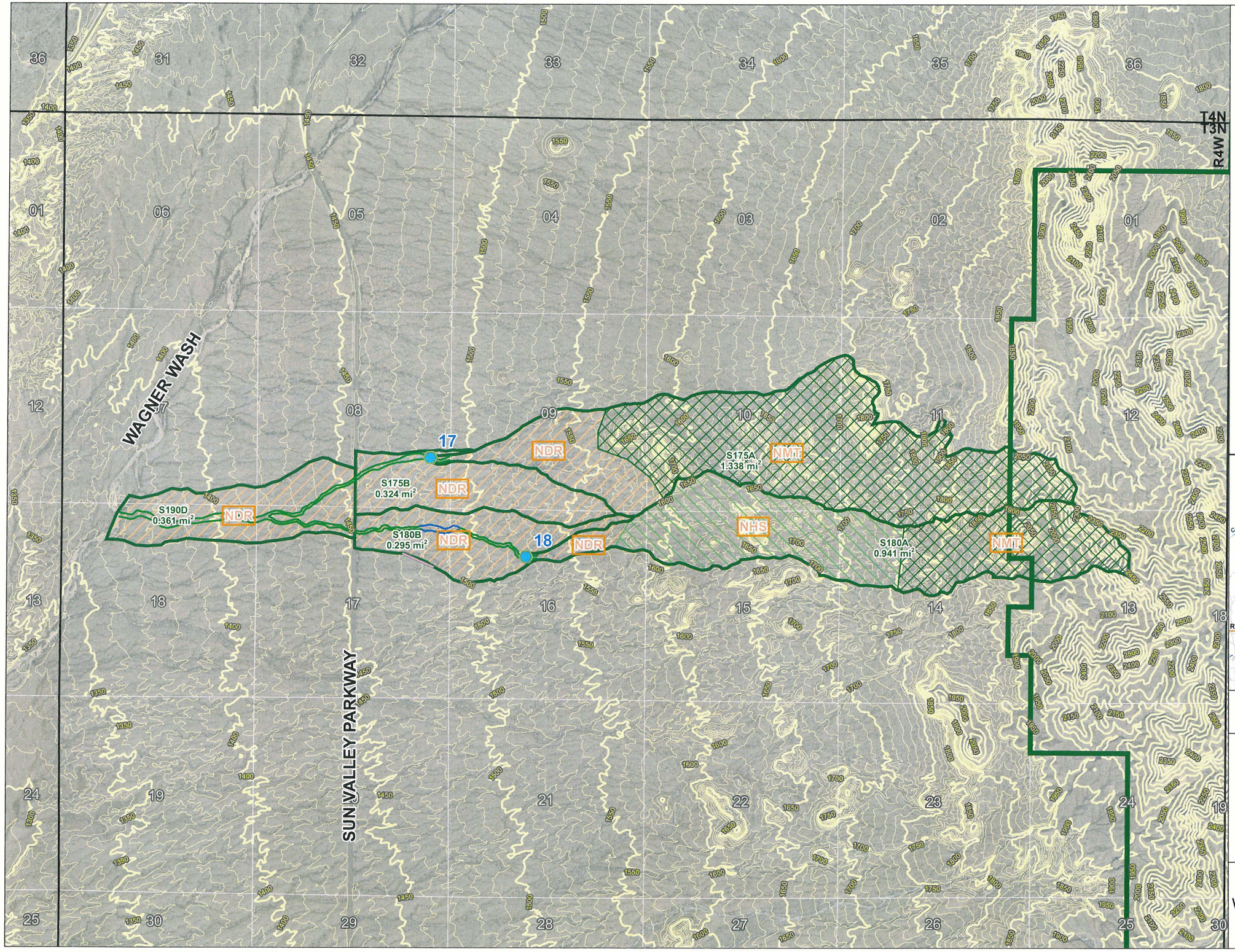


LEGEND

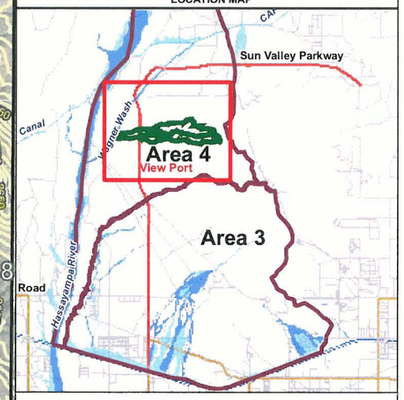
Existing Land Use

- Desert Rangeland (NDR), <5% Slopes
- Hillslopes (NHS), 5-10% slopes
- Mountain Terrain (NMT), >10% Slopes
- Subbasin Boundaries
- Proposed Dikes

Step 3 Corridors

- Floodwall
- No Floodwall
- 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
WAGNER SUB-AREA
FAN SYSTEM 17 & 18
LAND USE MAP

FCD 2004C049
DECEMBER 2006

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Appendix E

Design Analyses

Fan System 19

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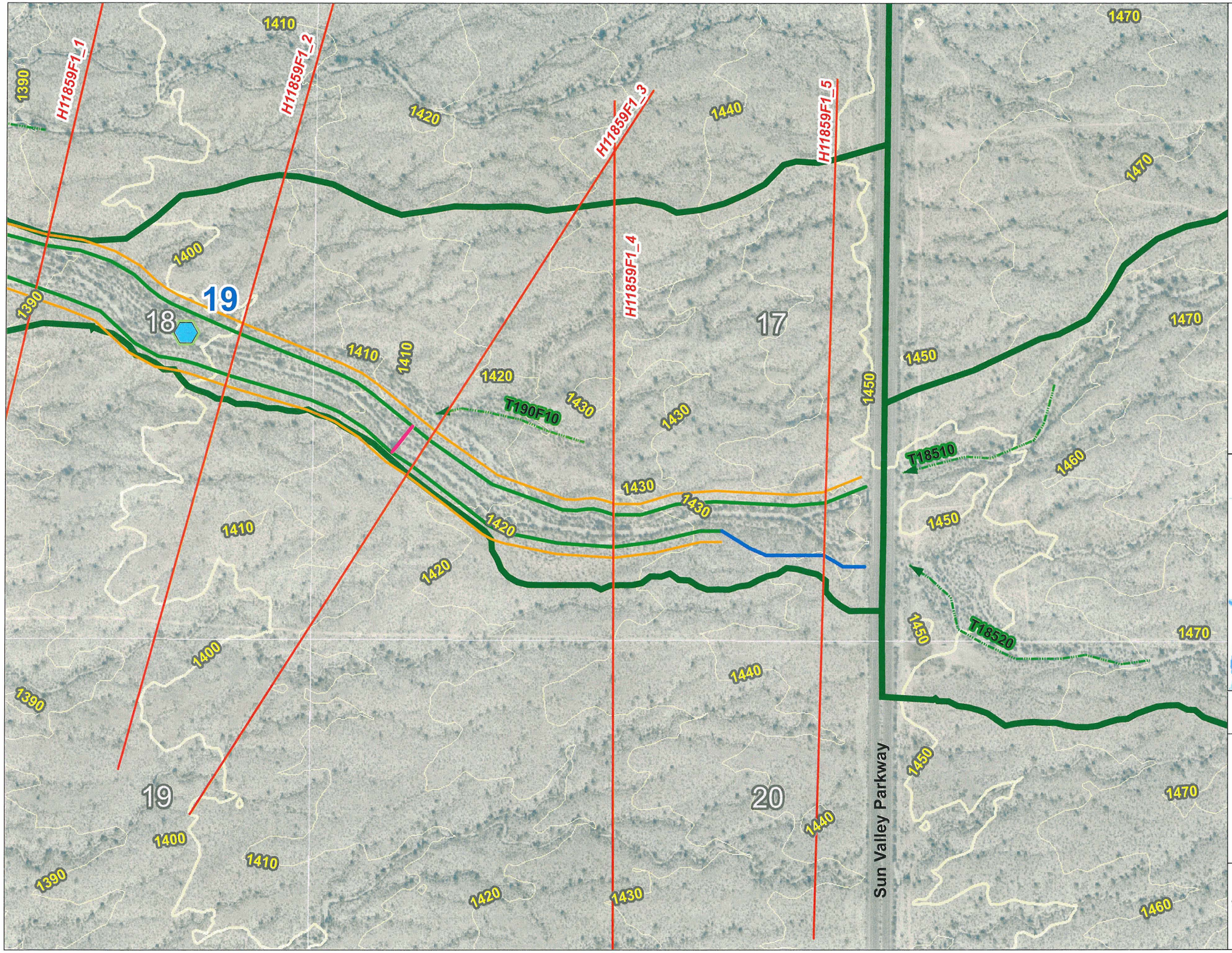
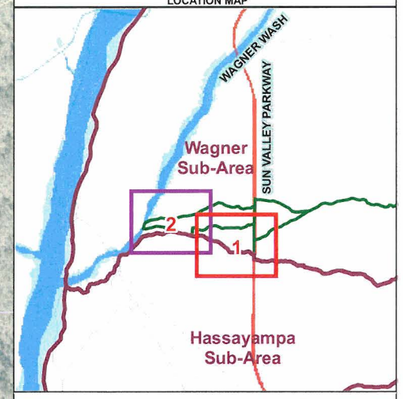


LEGEND

Step 3 Corridors
- No Floodwall
- Floodwall
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones
- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Trib. Sed. Supply Reaches
- 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 - WAGNER SUB-AREA
FAN SYSTEM 19
RECOMMENDED ALTERNATIVE
SHEET 1 OF 2

FCD 2004C049
DECEMBER 2006

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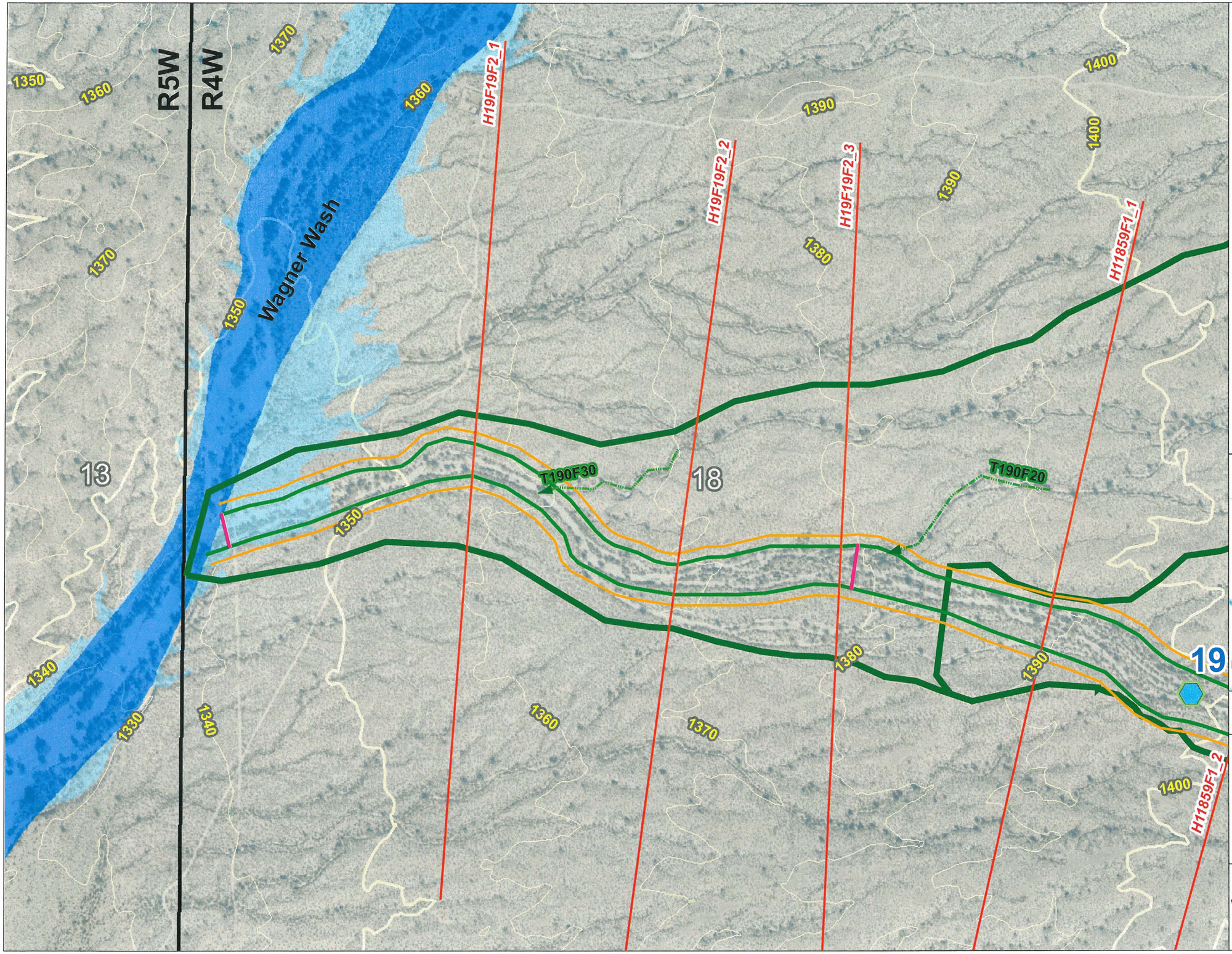
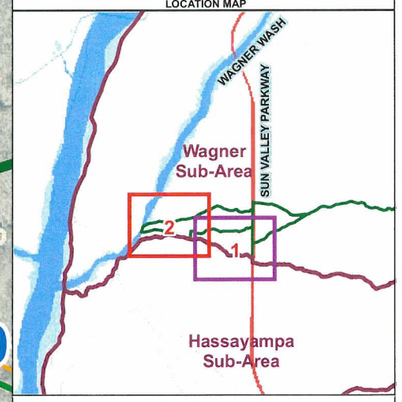


LEGEND

Step 3 Corridors
- No Floodwall
- Floodwall
- 50' Corridor Buffer
- Grade Control Structure
- Approximate Zone A

FEMA Flood Zones
- Floodway Fringe
- Floodway
- Subbasin Boundaries
- Cross Section
- Trib. Sed. Supply Reaches
- 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 - WAGNER SUB-AREA
FAN SYSTEM 19
RECOMMENDED ALTERNATIVE
SHEET 2 OF 2
FCD 2004C049
DECEMBER 2006

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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)
H11859F1_5	Walled-Levee Corridor	1651	4.8	0.0	0.0	0.135	296	2.5	$ 480	$ 124	$ 16	$ 62	$ 682	70%	18%	2%	9%	6%	13%	15%	100%	68%	21%
H11859F1_4	Walled-Levee Corridor	1634	5.7	0.0	2.9	0.189	253	2.6	$ 570	$ 462	$ 48	$ 205	$ 1,284	44%	36%	4%	16%	12%	28%	22%	100%	60%	36%
H11859F1_3	Walled-Levee Corridor	1616	5.6	0.0	4.4	0.189	248	2.5	$ 560	$ 490	$ 50	$ 216	$ 1,316	43%	37%	4%	16%	13%	29%	25%	100%	60%	38%
H11859F1_2	Walled-Levee Corridor	1599	6.9	0.0	4.1	0.189	303	2.1	$ 690	$ 481	$ 50	$ 212	$ 1,433	48%	34%	3%	15%	14%	23%	24%	100%	61%	34%
H11859F1_1	Walled-Levee Corridor	1582	6.8	0.0	1.5	0.187	303	2.7	$ 680	$ 351	$ 49	$ 194	$ 1,275	53%	28%	4%	15%	12%	24%	20%	100%	66%	34%
H19F19F2_3	Walled-Levee Corridor	1572	5.7	0.0	2.7	0.17	283	2.0	$ 570	$ 380	$ 45	$ 186	$ 1,181	48%	32%	4%	16%	11%	25%	23%	100%	62%	35%
H19F19F2_2	Walled-Levee Corridor	1574	5.2	0.0	1.8	0.179	243	3.0	$ 520	$ 382	$ 30	$ 144	$ 1,076	48%	35%	3%	13%	10%	29%	20%	100%	54%	33%
H19F19F2_1	Walled-Levee Corridor	1577	10.3	0.0	4.1	0.34	251	3.3	$ 1,030	$ 768	$ 90	$ 367	$ 2,255	46%	34%	4%	16%	21%	28%	21%	100%	64%	36%
	TOTAL	51.0	0.0	21.5					$ 5,100	$ 3,438	$ 377	$ 1,585	**$ 10,501**	49%	33%	4%	15%	100%	25%	22%	100%	62%	34%
All Channels		51.0	0.0	21.5	1.6				$ 5,100	$ 3,438	$ 377	$ 1,585	$ 10,501	49%	33%	4%	15%	100%					
All Online Basins		0.0	0.0	0.0					$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Offline Basins		0.0	0.0	0.0					$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
All Dikes		0.0	0.0	0.0	0				$ -	$ -	$ -	$ -	$ -	0%	0%	0%	0%	0%					
Channel Cost per mile (in $1000)		$6,655		Basins Cost per ac. ft. (in $1000)					$0.00														

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
S185	BASIN	1450			4.5	2.42	288	72	24	10	1.106	1.107	1.107	1.107	143	143	143	143
1859F1	ROUTE	1407	101.7	29.44	4.67	2.42	288	72	24	10	1.105	1.107	1.107	1.107	143	143	143	143
S190F1	BASIN	453			4.08	0.2	27	7	2	1	1.241	1.241	1.241	1.241	13	13	13	13
C190F1	COMBINE	1407			4.67	2.62	306	77	26	11	1.085	1.087	1.087	1.087	152	152	152	152
9F19F2	ROUTE	1345	101.5	21.89	4.83	2.62	303	76	25	11	1.073	1.076	1.076	1.076	150	151	151	151
S180C	BASIN	536			4	0.21	27	7	2	1	1.221	1.221	1.221	1.221	13	13	13	13
80C90F	ROUTE	290	102.4	11.4	4.5	0.21	27	7	2	1	1.221	1.221	1.221	1.221	13	13	13	13
S190F2	BASIN	568			4.17	0.33	43	11	4	2	1.221	1.221	1.221	1.221	21	21	21	21
C190F	COMBINE	1380			4.75	3.16	340	85	28	12	1.002	1.006	1.006	1.006	169	169	169	169

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
S185	BASIN	1655			12.5	2.42	288	73	24	10	1.105	1.117	1.117	1.117	143	144	144	144
1859F1	ROUTE	1571	101.8	31.51	12.67	2.42	288	73	24	10	1.104	1.117	1.117	1.117	143	144	144	144
S190F1	BASIN	356			12.08	0.2	22	6	2	1	1.029	1.029	1.029	1.029	11	11	11	11
C190F1	COMBINE	1572			12.67	2.62	308	78	26	11	1.093	1.104	1.105	1.105	153	155	155	155
9F19F2	ROUTE	1491	101.6	23.31	12.83	2.62	308	78	26	11	1.092	1.104	1.105	1.105	153	154	155	155
S180C	BASIN	418			12	0.21	22	6	2	1	1.009	1.009	1.009	1.009	11	11	11	11
80C90F	ROUTE	248	102.2	9.57	12.42	0.21	22	6	2	1	1.009	1.009	1.009	1.009	11	11	11	11
S190F2	BASIN	447			12.17	0.33	35	9	3	1	1.002	1.002	1.002	1.002	18	18	18	18
C190F	COMBINE	1579			12.75	3.16	362	91	30	13	1.065	1.076	1.076	1.076	179	181	181	181

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)
H11859F1_5	Walled-Levee Corridor	0.0183	0.0079	0.14	243	2.5	0.045	1651	199.4	288.3	1.4	1.4	2.5	199	5.7	0.84	No	1.1	3.4	5.5	288
H11859F1_4	Walled-Levee Corridor	0.0105	0.0177	0.19	150	2.6	0.045	1634	153.8	305.0	2.0	2.0	2.6	150	5.4	0.66	No	3.4	1.7	5.5	N/A
H11859F1_3	Walled-Levee Corridor	0.0113	0.0106	0.19	145	2.5	0.045	1616	149.3	293.0	2.0	2.0	2.5	145	5.5	0.68	No	1.7	1.8	5.5	4348
H11859F1_2	Walled-Levee Corridor	0.0135	0.0138	0.19	200	2.1	0.045	1599	203.9	312.6	1.5	1.6	2.1	200	5.1	0.72	No	2.0	1.9	5.3	N/A
H11859F1_1	Walled-Levee Corridor	0.0133	0.0133	0.19	200	2.7	0.045	1582	202.1	310.9	1.5	1.6	2.7	200	5.1	0.72	No	1.9	1.9	5.4	N/A
H19F19F2_3	Walled-Levee Corridor	0.0121	0.0144	0.17	180	2.0	0.045	1572	183.2	306.4	1.7	1.7	2.0	180	5.1	0.69	No	2.2	1.7	5.3	N/A
H19F19F2_2	Walled-Levee Corridor	0.0126	0.0107	0.18	140	3.0	0.045	1574	142.4	273.9	1.9	2.0	3.0	140	5.7	0.72	No	1.7	2.2	5.6	1575
H19F19F2_1	Walled-Levee Corridor	0.0121	0.0120	0.34	150	3.3	0.045	1577	152.9	285.5	1.9	1.9	3.3	150	5.5	0.71	No	2.4	2.5	5.6	29941

Basins Summary

			Design Geometry				Hydraulics						Sedimentation	
Structure ID	Type	Adjacent Topo. Slope (ft/ft)	Top Area (acres)	Perimeter (ft)	Depth (ft)	Storage Volume Provided (ac. ft)	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)

Walled-Levee Corridor

Structure ID	H11859F1	HEC1 ID	1859F1	Cutline ID	5

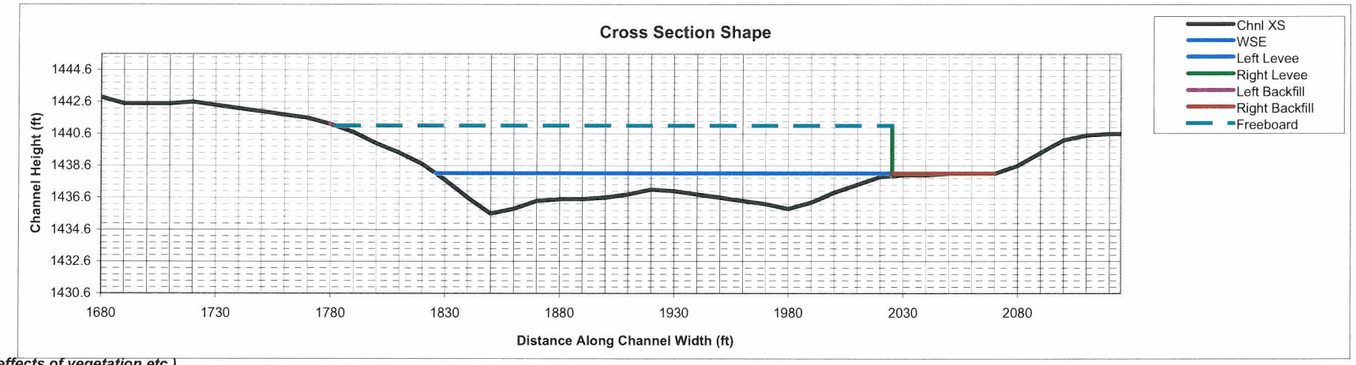
Longitudinal Geometry

Length	711.5	ft
Initial Channel Slope	0.0183	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0079	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1780	Right Levee Station (ft)	2025
Left Adjacent Buffer Width (ft)	0	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1782	Right Channel Limit Station (ft)	2025

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	C190F1	S185								TOTAL
HEC1 Peak-Flow	1572	1655								
Weighting Factor	0.05	0.95								
Flow into Channel	76	1575								1651

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
165	131.6	61.3	1435.6	1436.8	2.7	1.2	131.4	0.5	0.5	0.69
495	173.5	132.4	1435.6	1437.3	3.7	1.7	173.4	0.8	0.8	0.75
1238	190.6	238.3	1435.6	1437.8	5.2	2.2	190.4	1.2	1.3	0.82
1651	199.4	288.3	1435.6	1438.1	5.7	2.5	199.0	1.4	1.4	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
165	148.6	82.8	1435.6	1437.0	2.0	1.4	148.4	0.6	0.6	0.47
495	180.2	173.0	1435.6	1437.5	2.9	1.9	180.1	1.0	1.0	0.51
1238	200.8	313.0	1435.6	1438.2	4.0	2.6	200.3	1.6	1.6	0.56
1651	204.1	374.4	1435.6	1438.5	4.4	2.9	203.3	1.8	1.8	0.57

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
	T18510	T18520								
495	0.55	0.51								1.06

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
165	Stable
495	Stable
1238	Erosive
1651	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	495	cfs
Clear Water	No	
Total Incoming Sediment Load	1.057	cfs
Initial Chnl Sediment Capacity	3.438	cfs
Long-term Equilibrium Slope (ADWR)	0.0079	

Drop Structures

Design Slope	0.0079	ft/ft
Total Drop Needed	7.4	ft
Height of Drop Structure	3	ft
No. of Drop Structures	2.47	
Distance between Structures	288	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)
1651	1.1	24.6	2.5	1.4	5.7	0.0183	-0.5	0.9	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	712
Channel Limit-Left Station (ft)	1782
Channel Limit-Right Station (ft)	2025
Channel Width (ft)	243

Levee

Left Levee Length (ft)	712
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	0
Right Levee Length (ft)	712
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.2

Left Levee Surface Area (sq. Yd)	0
Left Levee Volume (cu. Yd)	0
Right Levee Surface Area (sq. Yd)	253
Right Levee Volume (cu. Yd)	42
Total Levee Surface Area (sq. Yd)	253
Total Levee Volume (cu. Yd)	42

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)	45.1
Right Levee Fill Surface Area (sq. ft)	32089
Right Levee Fill XS area (sq. ft)	2.3
Right Levee Fill Volume (cu. Yd)	61
Total Levee Fill Surface Area (sq. ft)	32089
Total Levee Fill Volume (cu Yd)	61

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	243	
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	2.47	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	84.90	8.49
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 7,217	$ 722
Area per structure (sq. Yd)	27	3
Total Area (cu. Yd)	67	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	712	ft	$ 86	$ 61,257	42	cu. Yd	$ -	$ -	42	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	253	sq. Yd	$ -	$ -	253	sq. Yd	$ -	$ -	253	sq. Yd	$ 75.00	$ 18,975
Adjacent Levee Fill	Fill	61	cu. Yd	$ 7.00	$ 427	3,568	sq. Yd	$ 4.50	$ 16,056	3,568	sq. Yd	$ 11.67	$ 41,626
Wall Material Aesthetic Treatment Cost	Wall	42	cu. Yd	$ -	$ -	42	cu. Yd	$ -	$ -	42	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	253	sq. Yd	$ 63.00	$ 15,939	253	sq. Yd	$ -	$ -	253	sq. Yd	$ -	$ -
Drop Structures	Gabions	2	EA	$ 7,216.50	$ 17,825	27	sq. Yd	$ -	$ -	27	sq. Yd	$ 37.50	$ 1,013
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 95,448			Total	$ 16,056			Total	$ 61,613
		Contingency Cost (25% of Construction Cost)			$ 23,862								
		Engineering Design Cost (5% of Construction Cost)			$ 4,772								
		Total Construction Cost			$ 124,082								
Wall Material Aesthetic Treatment Cost	Wall	42	cu. Yd	$ -	$ -	42	cu. Yd	$ -	$ -	42	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	253	sq. Yd	$ 63.00	$ 15,939	253	sq. Yd	$ -	$ -	253	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	61	cu. Yd	$ 7.00	$ 427	3,568	sq. Yd	$ 4.50	$ 16,056	3,568	sq. Yd	$ 11.67	$ 41,626
Drop Structures Aesthetic Trtmt. Cost	Gabions	2	EA	$ 721.65	$ 1,782	27	sq. Yd	$ -	$ -	3	sq. Yd	$ 37.50	$ 101
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 18,148			Total	$ 16,056			Total	$ 41,727
		Contingency Cost (25% of Construction Cost)			$ 4,537								
		Engineering Design Cost (5% of Construction Cost)			$ 907								
		Total Construction Cost			$ 23,593								
Total Structure Aesthetic Trtmt Cost	$ 81,375												

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	243	4	$100,000	$ 400,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	296	4.8		$ 480,000

Total Land Related Aes. Trtmt Cost	$ 60,000

Total Cost	$ 681,751	Total Aesthetic Treatment Cost	$ 141,375
		Total Right of Way Cost	$ 480,000

Walled-Levee Corridor

Structure ID	H11859F1

HEC1 ID	1859F1

Cutline ID	4

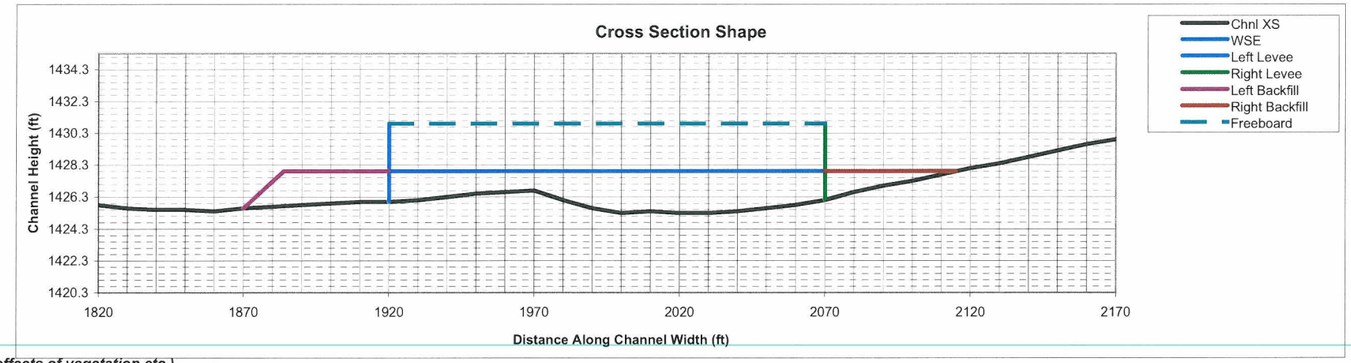
Longitundal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0105	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0177	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1920	Right Levee Station (ft)	2070
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1920	Right Channel Limit Station (ft)	2070

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	C190F1	S185								TOTAL
HEC1 Peak-Flow	1572	1655								
Weighting Factor	0.26	0.74								
Flow into Channel	404	1230								1634

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
163	110.3	67.1	1425.3	1426.2	2.4	0.9	109.9	0.6	0.6	0.55
490	151.7	147.3	1425.3	1426.9	3.3	1.6	150.0	1.0	1.0	0.59
1226	153.1	256.2	1425.3	1427.6	4.8	2.3	150.0	1.7	1.7	0.64
1634	153.8	305.0	1425.3	1427.9	5.4	2.6	150.0	2.0	2.0	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
163	103.1	55.8	1425.3	1426.1	2.9	0.8	102.8	0.5	0.5	0.70
490	151.4	125.9	1425.3	1426.7	3.9	1.4	150.0	0.8	0.8	0.75
1226	152.6	218.8	1425.3	1427.3	5.6	2.0	150.0	1.4	1.5	0.82
1634	153.2	260.4	1425.3	1427.6	6.3	2.3	150.0	1.7	1.7	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
	H11859F1_5									
490	3.44									3.44

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
163	Stable
490	Stable
1226	Stable
1634	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	490	cfs
Clear Water	No	
Total Incoming Sediment Load	3.438	cfs
Initial Chnl Sediment Capacity	1.665	cfs
Long-term Equilibrium Slope (ADWR)	0.0177	

Drop Structures

Design Slope	0.0177	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 + Zdeq + 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)	Zdeq (ft)	Zbs (ft)	Zi (ft)	Zt (ft)
1634	1.1	24.6	2.6	2.0	5.4	0.0105	-0.6	0.8	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1920
Channel Limit-Right Station (ft)	2070
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.8

Left Levee Surface Area (sq. Yd)	544
Left Levee Volume (cu. Yd)	91
Right Levee Surface Area (sq. Yd)	533
Right Levee Volume (cu. Yd)	89
Total Levee Surface Area (sq. Yd)	1077
Total Levee Volume (cu. Yd)	180

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)	50200
Left Levee Fill XS area (sq. ft)	87.3
Left Levee Fill Volume (cu. Yd)	3233
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	45.1
Right Levee Fill Surface Area (sq. ft)	45100
Right Levee Fill XS area (sq. ft)	38.7
Right Levee Fill Volume (cu. Yd)	1433
Total Levee Fill Surface Area (sq. ft)	95300
Total Levee Fill Volume (cu Yd)	4666

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)	8.0	
Structure Height (ft)	11.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	61.38	6.14
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,217	$ 522
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	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ 75.00	$ 80,775	
Adjacent Levee Fill	Fill	4,666	cu. Yd	$ 7.00	$ 32,662	10,567	sq. Yd	$ 4.50	$ 47,550	10,567	sq. Yd	$ 11.67	$ 123,278	
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,077	sq. Yd	$ 63.00	$ 67,851	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,217.30	$ -	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 355,214			Total	$ 47,550			Total	$ 204,678	
		Contingency Cost (25% of Construction Cost)			$ 88,804									
		Engineering Design Cost (5% of Construction Cost)			$ 17,761									
		Total Construction Cost			$ 461,779									
Wall Material Aesthetic Treatment Cost	Wall	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	180	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,077	sq. Yd	$ 63.00	$ 67,851	1,077	sq. Yd	$ -	$ -	1,077	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,666	cu. Yd	$ 7.00	$ 32,662	10,567	sq. Yd	$ 4.50	$ 47,550	10,567	sq. Yd	$ 11.67	$ 123,278	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 521.90	$ -	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 100,513			Total	$ 47,550			Total	$ 123,340	
		Contingency Cost (25% of Construction Cost)			$ 25,128									
		Engineering Design Cost (5% of Construction Cost)			$ 5,026									
		Total Construction Cost			$ 130,667									
Total Structure Aesthetic Trtmt Cost	$ 301,557													

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	2	0	$100,000	$ -
Total	253	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,284,007	Total Aesthetic Treatment Cost	$ 461,557	Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H11859F1

HEC1 ID	1859F1

Cutline ID	3

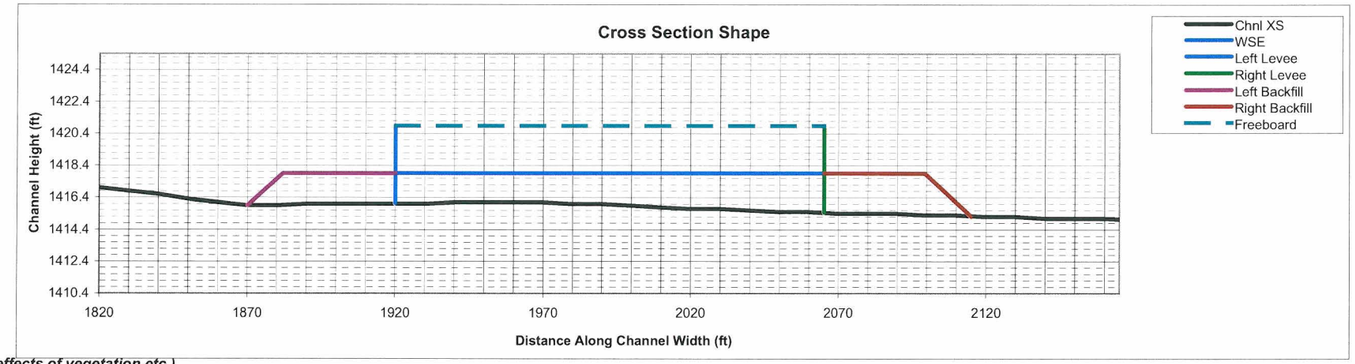
Longitudinal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0113	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0106	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1920	Right Levee Station (ft)	2065
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1920	Right Channel Limit Station (ft)	2065

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	C190F1	S185								TOTAL
HEC1 Peak-Flow	1572	1655								
Weighting Factor	0.47	0.53								
Flow into Channel	738	878								1616

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
162	146.3	73.0	1415.4	1416.4	2.2	1.0	145.0	0.5	0.5	0.55
485	147.2	141.5	1415.4	1416.8	3.4	1.4	145.0	1.0	1.0	0.61
1212	148.7	246.1	1415.4	1417.6	4.9	2.2	145.0	1.7	1.7	0.67
1616	149.3	293.0	1415.4	1417.9	5.5	2.5	145.0	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
162	146.3	74.4	1415.4	1416.4	2.2	1.0	145.0	0.5	0.5	0.53
485	147.3	144.2	1415.4	1416.9	3.4	1.5	145.0	1.0	1.0	0.59
1212	148.8	250.9	1415.4	1417.6	4.8	2.2	145.0	1.7	1.7	0.65
1616	149.4	298.7	1415.4	1417.9	5.4	2.5	145.0	2.0	2.1	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
	H11859F1_4									
485	1.67									1.67

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
162	Stable
485	Stable
1212	Stable
1616	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	485	cfs
Clear Water	No	
Total Incoming Sediment Load	1.665	cfs
Initial Chnl Sediment Capacity	1.831	cfs
Long-term Equilibrium Slope (ADWR)	0.0106	

Drop Structures

Design Slope	0.0106	ft/ft
Total Drop Needed	0.7	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.23	
Distance between Structures	4348	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)
1616	1.1	24.6	2.5	2.0	5.5	0.0113	-0.6	0.8	1.5	0.3	2.0	5.5

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1920
Channel Limit-Right Station (ft)	2065
Channel Width (ft)	145

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.9
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	5.4

Left Levee Surface Area (sq. Yd)	544
Left Levee Volume (cu. Yd)	91
Right Levee Surface Area (sq. Yd)	600
Right Levee Volume (cu. Yd)	100
Total Levee Surface Area (sq. Yd)	1144
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)	50200
Left Levee Fill XS area (sq. ft)	84.1
Left Levee Fill Volume (cu. Yd)	3115
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)	50200
Right Levee Fill XS area (sq. ft)	105.5
Right Levee Fill Volume (cu. Yd)	3907
Total Levee Fill Surface Area (sq. ft)	100400
Total Levee Fill Volume (cu Yd)	7022

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)	7.9	
Structure Height (ft)	10.9	
Number of Structures	0.23	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	58.28	5.83
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,954	$ 496
Area per structure (sq. Yd)	16	2
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	1,000	ft	$ 255	$ 254,701	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -
Wall Surface Cost	Wall	1,144	sq. Yd	$ -	$ -	1,144	sq. Yd	$ -	$ -	1,144	sq. Yd	$ 75.00	$ 85,800
Adjacent Levee Fill	Fill	7,022	cu. Yd	$ 7.00	$ 49,154	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,144	sq. Yd	$ 63.00	$ 72,072	1,144	sq. Yd	$ -	$ -	1,144	sq. Yd	$ -	$ -
Drop Structures	Gabions	0	EA	$ 4,953.80	$ 1,139	16	sq. Yd	$ -	$ -	16	sq. Yd	$ 37.50	$ 604
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 377,067			Total	$ 50,000			Total	$ 216,034
		Contingency Cost (25% of Construction Cost)			$ 94,267								
		Engineering Design Cost (5% of Construction Cost)			$ 18,853								
		Total Construction Cost			$ 490,187								
Wall Material Aesthetic Treatment Cost	Wall	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -	191	cu. Yd	$ -	$ -
Wall Surface Aesthetic Trtmt. Cost	Wall	1,144	sq. Yd	$ 63.00	$ 72,072	1,144	sq. Yd	$ -	$ -	1,144	sq. Yd	$ -	$ -
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	7,022	cu. Yd	$ 7.00	$ 49,154	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 495.55	$ 114	16	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 60
Other					$ -				$ -				$ -
		Total without Contingency & Engineering Design Cost			$ 121,340			Total	$ 50,000			Total	$ 129,690
		Contingency Cost (25% of Construction Cost)			$ 30,335								
		Engineering Design Cost (5% of Construction Cost)			$ 6,067								
		Total Construction Cost			$ 157,742								

Total Structure Aesthetic Trtmt Cost	$ 337,432

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	3.3	$100,000	$ 330,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	248	5.6		$ 560,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,316,221	Total Aesthetic Treatment Cost	$ 497,432	Total Right of Way Cost	$ 560,000

Walled-Levee Corridor

Structure ID	H11859F1	HEC1 ID	1859F1	Cutline ID	2

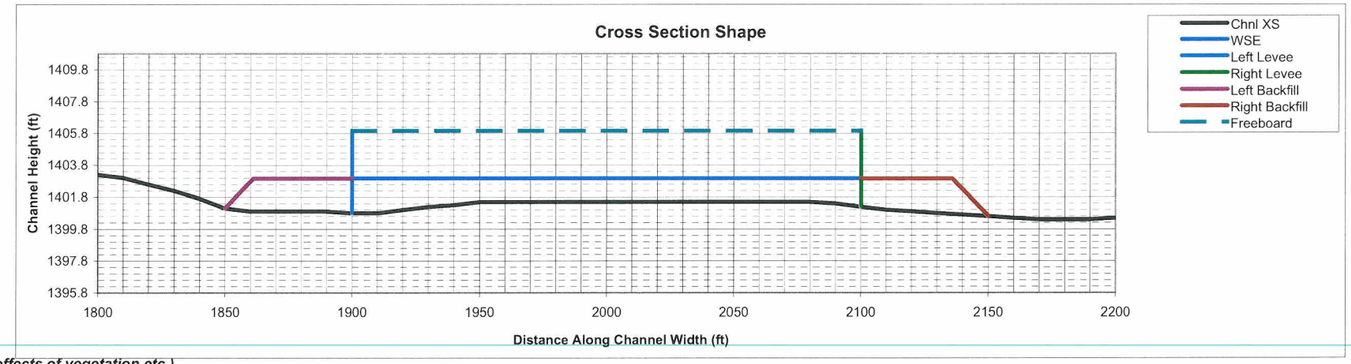
Longitundal Geometry

Length	1000.0	ft
Initial Channel Slope	0.0135	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0138	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1900	Right Levee Station (ft)	2100
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1900	Right Channel Limit Station (ft)	2100

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	C190F1	S185								TOTAL
HEC1 Peak-Flow	1572	1655								
Weighting Factor	0.68	0.32								
Flow into Channel	1065	534								1599

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
160	201.6	78.2	1400.8	1401.8	2.0	1.0	200.0	0.4	0.4	0.58
480	202.3	151.3	1400.8	1402.1	3.2	1.3	200.0	0.7	0.8	0.64
1199	203.4	262.8	1400.8	1402.7	4.6	1.9	200.0	1.3	1.3	0.70
1599	203.9	312.6	1400.8	1402.9	5.1	2.1	200.0	1.5	1.6	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
160	201.6	77.6	1400.8	1401.8	2.1	1.0	200.0	0.4	0.4	0.58
480	202.3	150.3	1400.8	1402.1	3.2	1.3	200.0	0.7	0.8	0.65
1199	203.4	261.1	1400.8	1402.7	4.6	1.9	200.0	1.3	1.3	0.71
1599	203.9	310.5	1400.8	1402.9	5.1	2.1	200.0	1.5	1.6	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
	H11859F1_3	T190F10								
480	1.83	0.18								2.01

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
160	Stable
480	Stable
1199	Stable
1599	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	480	cfs
Clear Water	No	
Total Incoming Sediment Load	2.014	cfs
Initial Chnl Sediment Capacity	1.947	cfs
Long-term Equilibrium Slope (ADWR)	0.0138	

Drop Structures

Design Slope	0.0138	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)
1599	1.1	24.6	2.1	1.6	5.1	0.0135	-0.5	0.7	1.5	0.3	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	1000
Channel Limit-Left Station (ft)	1900
Channel Limit-Right Station (ft)	2100
Channel Width (ft)	200

Levee

Left Levee Length (ft)	1000
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.1
Right Levee Length (ft)	1000
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.7

Left Levee Surface Area (sq. Yd)	567
Left Levee Volume (cu. Yd)	94
Right Levee Surface Area (sq. Yd)	522
Right Levee Volume (cu. Yd)	87
Total Levee Surface Area (sq. Yd)	1089
Total Levee Volume (cu. Yd)	181

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)	50200
Left Levee Fill XS area (sq. ft)	91.7
Left Levee Fill Volume (cu. Yd)	3396
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)	50200
Right Levee Fill XS area (sq. ft)	87.9
Right Levee Fill Volume (cu. Yd)	3256
Total Levee Fill Surface Area (sq. ft)	100400
Total Levee Fill Volume (cu Yd)	6652

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)	6.6	
Structure Height (ft)	9.6	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	71.48	7.15
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 6,076	$ 608
Area per structure (sq. Yd)	22	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	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,089	sq. Yd	$ -	$ -	1,089	sq. Yd	$ -	$ -	1,089	sq. Yd	$ 75.00	$ 81,675	
Adjacent Levee Fill	Fill	6,652	cu. Yd	$ 7.00	$ 46,564	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,089	sq. Yd	$ 63.00	$ 68,607	1,089	sq. Yd	$ -	$ -	1,089	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 6,075.80	$ -	22	sq. Yd	$ -	$ -	22	sq. Yd	$ 37.50	$ 833	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 369,872			Total	$ 50,000			Total	$ 212,138	
		Contingency Cost (25% of Construction Cost)			$ 92,468									
		Engineering Design Cost (5% of Construction Cost)			$ 18,494									
		Total Construction Cost			$ 480,834									
Wall Material Aesthetic Treatment Cost	Wall	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	181	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,089	sq. Yd	$ 63.00	$ 68,607	1,089	sq. Yd	$ -	$ -	1,089	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,652	cu. Yd	$ 7.00	$ 46,564	11,111	sq. Yd	$ 4.50	$ 50,000	11,111	sq. Yd	$ 11.67	$ 129,630	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 607.75	$ -	22	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 83	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 115,171			Total	$ 50,000			Total	$ 129,713	
		Contingency Cost (25% of Construction Cost)			$ 28,793									
		Engineering Design Cost (5% of Construction Cost)			$ 5,759									
		Total Construction Cost			$ 149,722									
Total Structure Aesthetic Trtmt Cost	$ 329,435													

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	200	4.6	$100,000	$ 460,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	303	6.9		$ 690,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,432,972	Total Aesthetic Treatment Cost	$ 489,435	Total Right of Way Cost	$ 690,000

Walled-Levee Corridor

Structure ID	H11859F1

HEC1 ID	1859F1

Cutline ID	1

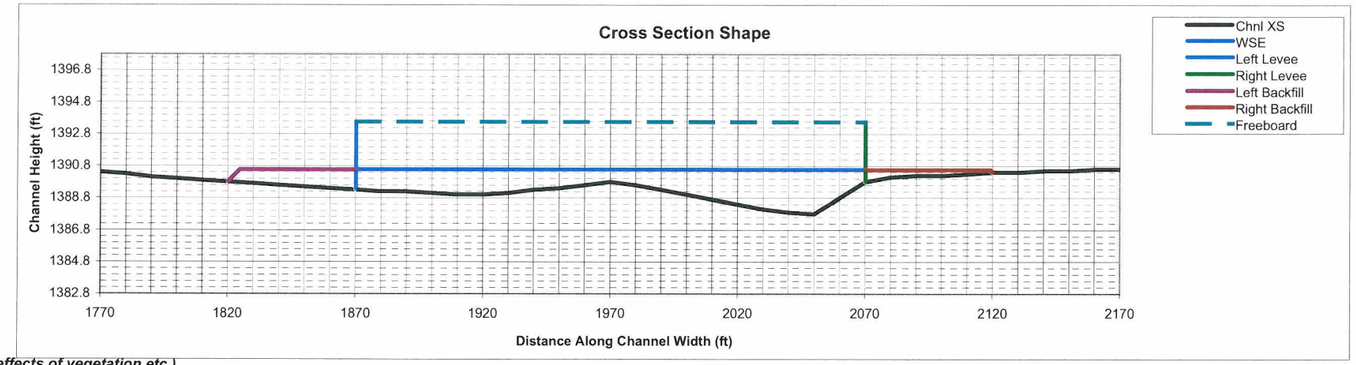
Longitudinal Geometry

Length	988.2	ft
Initial Channel Slope	0.0133	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0133	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1870	Right Levee Station (ft)	2070
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1870	Right Channel Limit Station (ft)	2070

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	C190F1	S185								TOTAL
HEC1 Peak-Flow	1572	1655								
Weighting Factor	0.89	0.11								
Flow into Channel	1397	185								1582

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
158	133.0	66.1	1387.8	1389.2	2.4	1.4	132.9	0.5	0.5	0.60
475	193.1	148.3	1387.8	1389.7	3.2	1.9	192.6	0.8	0.8	0.64
1187	201.6	261.4	1387.8	1390.3	4.5	2.5	200.0	1.3	1.3	0.70
1582	202.1	310.9	1387.8	1390.5	5.1	2.7	200.0	1.5	1.6	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
158	133.0	66.1	1387.8	1389.2	2.4	1.4	132.9	0.5	0.5	0.60
475	193.1	148.3	1387.8	1389.7	3.2	1.9	192.6	0.8	0.8	0.64
1187	201.6	261.4	1387.8	1390.3	4.5	2.5	200.0	1.3	1.3	0.70
1582	202.1	310.9	1387.8	1390.5	5.1	2.7	200.0	1.5	1.6	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
	H11859F1_2									
475	1.95									1.95

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
158	Stable
475	Stable
1187	Stable
1582	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	475	cfs
Clear Water	No	
Total Incoming Sediment Load	1.947	cfs
Initial Chnl Sediment Capacity	1.945	cfs
Long-term Equilibrium Slope (ADWR)	0.0133	

Drop Structures

Design Slope	0.0133	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)
1582	1.1	24.6	2.7	1.6	5.1	0.0133	-0.6	0.7	1.5	0.3	2.0	5.4

Cost Estimates

Channel Characteristics

Channel Length (ft)	988
Channel Limit-Left Station (ft)	1870
Channel Limit-Right Station (ft)	2070
Channel Width (ft)	200

Levee

Left Levee Length (ft)	988
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.2
Right Levee Length (ft)	988
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.7

Left Levee Surface Area (sq. Yd)	461
Left Levee Volume (cu. Yd)	77
Right Levee Surface Area (sq. Yd)	406
Right Levee Volume (cu. Yd)	68
Total Levee Surface Area (sq. Yd)	867
Total Levee Volume (cu. Yd)	145

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)	49509
Left Levee Fill XS area (sq. ft)	48.2
Left Levee Fill Volume (cu. Yd)	1764
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)	49410
Right Levee Fill XS area (sq. ft)	18.3
Right Levee Fill Volume (cu. Yd)	670
Total Levee Fill Surface Area (sq. ft)	98919
Total Levee Fill Volume (cu Yd)	2434

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)	6.6	
Structure Height (ft)	9.6	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	71.09	7.11
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 6,043	$ 604
Area per structure (sq. Yd)	22	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	988	ft	$ 201	$ 198,548	145	cu. Yd	$ -	$ -	145	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	867	sq. Yd	$ -	$ -	867	sq. Yd	$ -	$ -	867	sq. Yd	$ 75.00	$ 65,025	
Adjacent Levee Fill	Fill	2,434	cu. Yd	$ 7.00	$ 17,038	10,978	sq. Yd	$ 4.50	$ 49,400	10,978	sq. Yd	$ 11.67	$ 128,074	
Wall Material Aesthetic Treatment Cost	Wall	145	cu. Yd	$ -	$ -	145	cu. Yd	$ -	$ -	145	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	867	sq. Yd	$ 63.00	$ 54,621	867	sq. Yd	$ -	$ -	867	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 6,042.65	$ -	22	sq. Yd	$ -	$ -	22	sq. Yd	$ 37.50	$ 833	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 270,207			Total	$ 49,400			Total	$ 193,932	
		Contingency Cost (25% of Construction Cost)			$ 67,552									
		Engineering Design Cost (5% of Construction Cost)			$ 13,510									
		Total Construction Cost			$ 351,269									
Wall Material Aesthetic Treatment Cost	Wall	145	cu. Yd	$ -	$ -	145	cu. Yd	$ -	$ -	145	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	867	sq. Yd	$ 63.00	$ 54,621	867	sq. Yd	$ -	$ -	867	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,434	cu. Yd	$ 7.00	$ 17,038	10,978	sq. Yd	$ 4.50	$ 49,400	10,978	sq. Yd	$ 11.67	$ 128,074	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 604.35	$ -	22	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 83	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 71,659			Total	$ 49,400			Total	$ 128,157	
		Contingency Cost (25% of Construction Cost)			$ 17,915									
		Engineering Design Cost (5% of Construction Cost)			$ 3,583									
		Total Construction Cost			$ 93,157									

Total Structure Aesthetic Trtmt Cost	$ 270,714

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	200	4.5	$100,000	$ 450,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	303	6.8		$ 680,000

Total Land Related Aes. Trtmt Cost	$ 160,000

Total Cost	$ 1,274,602	Total Aesthetic Treatment Cost	$ 430,714	Total Right of Way Cost	$ 680,000

Walled-Levee Corridor

Structure ID	H19F19F2

HEC1 ID	9F19F2

Cutline ID	3

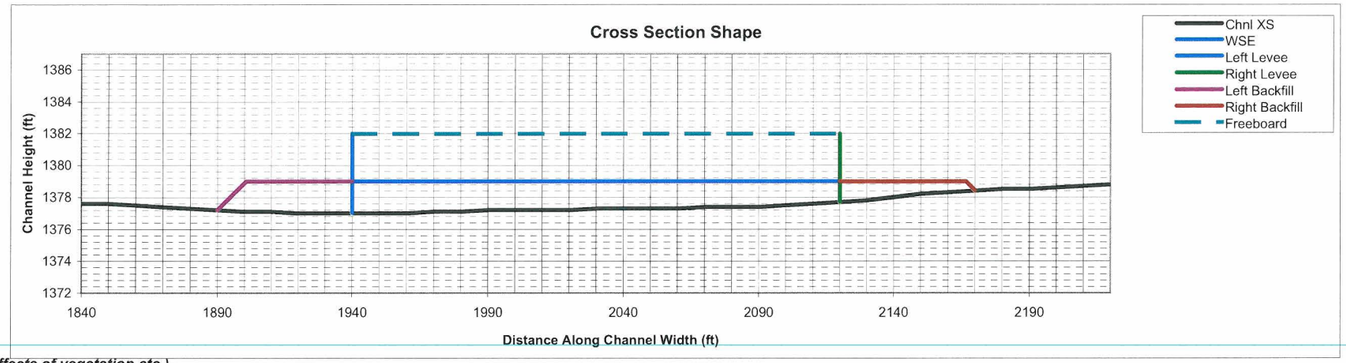
Longitudinal Geometry

Length	894.5	ft
Initial Channel Slope	0.0121	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0144	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1940	Right Levee Station (ft)	2120
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1940	Right Channel Limit Station (ft)	2120

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	C190F	C190F1								TOTAL
HEC1 Peak-Flow	1579	1572								
Weighting Factor	0.13	0.87								
Flow into Channel	210	1362								1572

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
157	180.1	76.4	1377.0	1377.7	2.1	0.7	179.4	0.4	0.4	0.56
472	181.5	148.2	1377.0	1378.1	3.2	1.1	180.0	0.8	0.8	0.62
1179	182.7	257.5	1377.0	1378.7	4.6	1.7	180.0	1.4	1.4	0.67
1572	183.2	306.4	1377.0	1379.0	5.1	2.0	180.0	1.7	1.7	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
157	177.7	72.1	1377.0	1377.7	2.2	0.7	177.0	0.4	0.4	0.60
472	181.4	140.6	1377.0	1378.1	3.4	1.1	180.0	0.8	0.8	0.67
1179	182.6	244.3	1377.0	1378.6	4.8	1.6	180.0	1.3	1.4	0.73
1572	183.1	290.7	1377.0	1378.9	5.4	1.9	180.0	1.6	1.6	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
	H11859F1_1	T190F20								
472	1.95	0.27								2.22

Maximum Permissible Velocity

Channel Lining	Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
157	Stable
472	Stable
1179	Stable
1572	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	472	cfs
Clear Water	No	
Total Incoming Sediment Load	2.218	cfs
Initial Chnl Sediment Capacity	1.736	cfs
Long-term Equilibrium Slope (ADWR)	0.0144	

Drop Structures

Design Slope	0.0144	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)
1572	1.1	24.6	2.0	1.7	5.1	0.0121	-0.5	0.7	1.5	0.2	2.0	5.3

Cost Estimates

Channel Characteristics

Channel Length (ft)	895
Channel Limit-Left Station (ft)	1940
Channel Limit-Right Station (ft)	2120
Channel Width (ft)	180

Levee

Left Levee Length (ft)	895
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5
Right Levee Length (ft)	895
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	4.3

Left Levee Surface Area (sq. Yd)	497
Left Levee Volume (cu. Yd)	83
Right Levee Surface Area (sq. Yd)	428
Right Levee Volume (cu. Yd)	71
Total Levee Surface Area (sq. Yd)	925
Total Levee Volume (cu. Yd)	154

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)	44814
Left Levee Fill XS area (sq. ft)	86.2
Left Levee Fill Volume (cu. Yd)	2857
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)	44725
Right Levee Fill XS area (sq. ft)	44.1
Right Levee Fill Volume (cu. Yd)	1462
Total Levee Fill Surface Area (sq. ft)	89539
Total Levee Fill Volume (cu Yd)	4319

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)	7.0	
Structure Height (ft)	10.0	
Number of Structures	0.00	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	66.74	6.67
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,673	$ 567
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	895	ft	$ 228	$ 203,908	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	925	sq. Yd	$ -	$ -	925	sq. Yd	$ -	$ -	925	sq. Yd	$ 75.00	$ 69,375	
Adjacent Levee Fill	Fill	4,319	cu. Yd	$ 7.00	$ 30,233	9,944	sq. Yd	$ 4.50	$ 44,750	9,944	sq. Yd	$ 11.67	$ 116,019	
Wall Material Aesthetic Treatment Cost	Wall	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	925	sq. Yd	$ 63.00	$ 58,275	925	sq. Yd	$ -	$ -	925	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,672.90	$ -	20	sq. Yd	$ -	$ -	20	sq. Yd	$ 37.50	$ 750	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 292,416			Total	$ 44,750			Total	$ 186,144	
		Contingency Cost (25% of Construction Cost)			$ 73,104									
		Engineering Design Cost (5% of Construction Cost)			$ 14,621									
		Total Construction Cost			$ 380,141									
Wall Material Aesthetic Treatment Cost	Wall	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	154	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	925	sq. Yd	$ 63.00	$ 58,275	925	sq. Yd	$ -	$ -	925	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	4,319	cu. Yd	$ 7.00	$ 30,233	9,944	sq. Yd	$ 4.50	$ 44,750	9,944	sq. Yd	$ 11.67	$ 116,019	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 566.95	$ -	20	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 75	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 88,508			Total	$ 44,750			Total	$ 116,094	
		Contingency Cost (25% of Construction Cost)			$ 22,127									
		Engineering Design Cost (5% of Construction Cost)			$ 4,425									
		Total Construction Cost			$ 115,060									

Total Structure Aesthetic Trtmt Cost	$ 275,904

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.4	$100,000	$ 140,000
Maintenance Access	30	0.6	$100,000	$ 60,000
Channel	180	3.7	$100,000	$ 370,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	283	5.7		$ 570,000

Total Land Related Aes. Trtmt Cost	$ 140,000

Total Cost	$ 1,181,035

Total Aesthetic Treatment Cost	$ 415,904

Total Right of Way Cost	$ 570,000

Walled-Levee Corridor

Structure ID	H19F19F2

HEC1 ID	9F19F2

Cutline ID	2

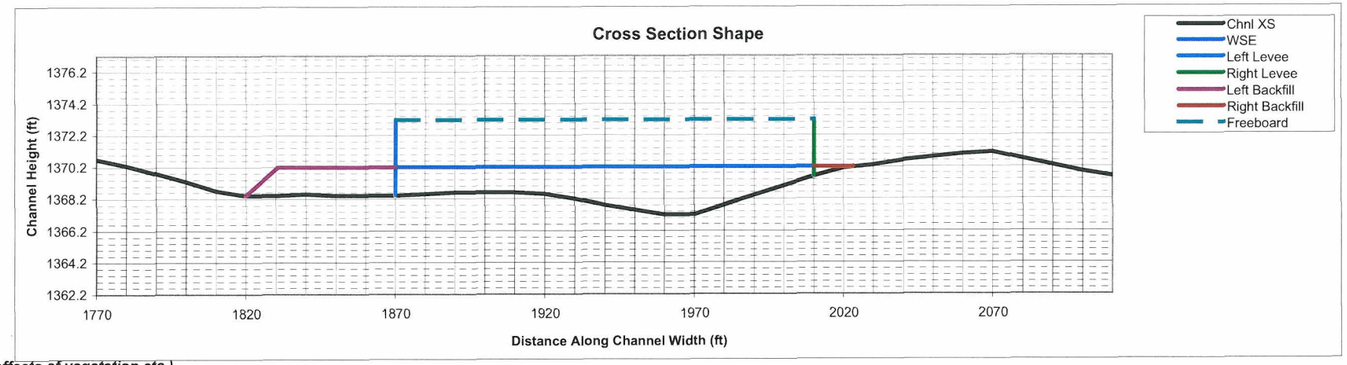
Longitudinal Geometry

Length	945.1	ft
Initial Channel Slope	0.0126	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0107	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1870	Right Levee Station (ft)	2010
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1870	Right Channel Limit Station (ft)	2010

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	C190F	C190F1								TOTAL
HEC1 Peak-Flow	1579	1572								
Weighting Factor	0.35	0.65								
Flow into Channel	557	1017								1574

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
157	123.8	65.1	1367.2	1368.6	2.4	1.4	123.6	0.5	0.5	0.59
472	132.7	129.3	1367.2	1369.1	3.7	1.9	131.9	1.0	1.0	0.65
1181	141.8	230.0	1367.2	1369.9	5.1	2.7	140.0	1.6	1.6	0.71
1574	142.4	273.9	1367.2	1370.2	5.7	3.0	140.0	1.9	2.0	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
157	124.3	68.4	1367.2	1368.6	2.3	1.4	124.0	0.6	0.6	0.55
472	133.7	136.2	1367.2	1369.2	3.5	2.0	132.8	1.0	1.0	0.60
1181	142.0	241.7	1367.2	1369.9	4.9	2.7	140.0	1.7	1.7	0.65
1574	142.6	287.8	1367.2	1370.3	5.5	3.1	140.0	2.0	2.1	0.67

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
	H19F19F2_3									
472	1.74									1.74

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
157	Stable
472	Stable
1181	Erosive
1574	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	472	cfs
Clear Water	No	
Total Incoming Sediment Load	1.736	cfs
Initial Chnl Sediment Capacity	2.190	cfs
Long-term Equilibrium Slope (ADWR)	0.0107	

Drop Structures

Design Slope	0.0107	ft/ft
Total Drop Needed	1.8	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.60	
Distance between Structures	1575	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)
1574	1.1	24.6	3.0	2.0	5.7	0.0126	-0.6	0.9	1.5	0.4	2.0	5.6

Cost Estimates

Channel Characteristics

Channel Length (ft)	945
Channel Limit-Left Station (ft)	1870
Channel Limit-Right Station (ft)	2010
Channel Width (ft)	140

Levee

Left Levee Length (ft)	945
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	4.8
Right Levee Length (ft)	945
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.6

Left Levee Surface Area (sq. Yd)	504
Left Levee Volume (cu. Yd)	84
Right Levee Surface Area (sq. Yd)	378
Right Levee Volume (cu. Yd)	63
Total Levee Surface Area (sq. Yd)	882
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)	47347
Left Levee Fill XS area (sq. ft)	77.8
Left Levee Fill Volume (cu. Yd)	2723
Right Levee Fill Buffer Width (ft)	50
Right Levee Fill Slope (ft/ft)	6
Right Levee Fill ROW Width (ft)	13.2
Right Levee Fill Surface Area (sq. ft)	12475
Right Levee Fill XS area (sq. ft)	3.2
Right Levee Fill Volume (cu. Yd)	112
Total Levee Fill Surface Area (sq. ft)	59822
Total Levee Fill Volume (cu Yd)	2835

Drop Structures

Structure Type	Gabions	
(Riprap, Gabions, Soil cement, Concrete,None)		
Structure Length (ft)	140	
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	0.60	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	56.55	5.65
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 4,807	$ 480
Area per structure (sq. Yd)	16	2
Total Area (cu. Yd)	9	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	945	ft	$ 228	$ 215,300	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	882	sq. Yd	$ -	$ -	882	sq. Yd	$ -	$ -	882	sq. Yd	$ 75.00	$ 66,150	
Adjacent Levee Fill	Fill	2,835	cu. Yd	$ 7.00	$ 19,845	6,636	sq. Yd	$ 4.50	$ 29,862	6,636	sq. Yd	$ 11.67	$ 77,420	
Wall Material Aesthetic Treatment Cost	Wall	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	882	sq. Yd	$ 63.00	$ 55,566	882	sq. Yd	$ -	$ -	882	sq. Yd	$ -	$ -	
Drop Structures	Gabions	1	EA	$ 4,806.75	$ 2,884	16	sq. Yd	$ -	$ -	16	sq. Yd	$ 37.50	$ 583	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 293,595			Total	$ 29,862			Total	$ 144,153	
		Contingency Cost (25% of Construction Cost)			$ 73,399									
		Engineering Design Cost (5% of Construction Cost)			$ 14,680									
		Total Construction Cost			$ 381,673									
Wall Material Aesthetic Treatment Cost	Wall	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	147	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	882	sq. Yd	$ 63.00	$ 55,566	882	sq. Yd	$ -	$ -	882	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	2,835	cu. Yd	$ 7.00	$ 19,845	6,636	sq. Yd	$ 4.50	$ 29,862	6,636	sq. Yd	$ 11.67	$ 77,420	
Drop Structures Aesthetic Trtmt. Cost	Gabions	1	EA	$ 480.25	$ 288	16	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 58	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 75,699			Total	$ 29,862			Total	$ 77,478	
		Contingency Cost (25% of Construction Cost)			$ 18,925									
		Engineering Design Cost (5% of Construction Cost)			$ 3,785									
		Total Construction Cost			$ 98,409									

Total Structure Aesthetic Trtmt Cost	$ 205,749

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	1.5	$100,000	$ 150,000
Maintenance Access	30	0.7	$100,000	$ 70,000
Channel	140	3	$100,000	$ 300,000
Levee	1	0	$100,000	$ -
Other	2	0	$100,000	$ -
Total	243	5.2		$ 520,000

Total Land Related Aes. Trtmt Cost	$ 150,000

Total Cost	$ 1,075,689	Total Aesthetic Treatment Cost	$ 355,749	Total Right of Way Cost	$ 520,000

Walled-Levee Corridor

Structure ID	H19F19F2

HEC1 ID	9F19F2

Cutline ID	1

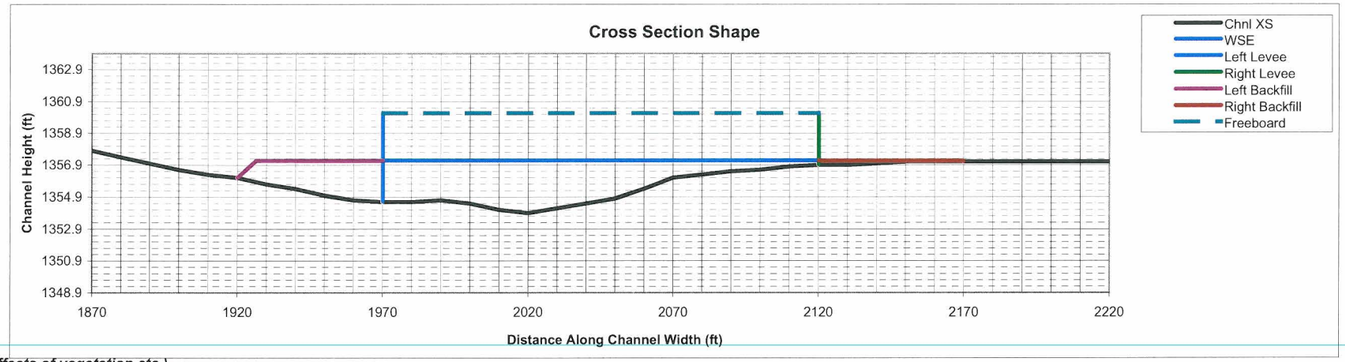
Longitudnal Geometry

Length	1796.5	ft
Initial Channel Slope	0.0121	ft/ft
Long-term (Equilibrium) Chnl Slope	0.0120	ft/ft

Levee

Left Levee Type	Wall	Right Levee Type	Wall
Left Levee Station (ft)	1970	Right Levee Station (ft)	2120
Left Adjacent Buffer Width (ft)	50	Right Adjacent Buffer Width (ft)	50
Left Channel Limit Station (ft)	1970	Right Channel Limit Station (ft)	2120

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	C190F	C190F1								TOTAL
HEC1 Peak-Flow	1579	1572								
Weighting Factor	0.68	0.32								
Flow into Channel	1066	511								1577

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
158	85.6	56.9	1353.9	1355.1	2.8	1.2	85.0	0.7	0.7	0.60
473	96.2	115.2	1353.9	1355.7	4.1	1.8	95.0	1.2	1.2	0.66
1183	142.9	233.8	1353.9	1356.8	5.1	2.9	140.6	1.6	1.7	0.69
1577	152.9	285.5	1353.9	1357.2	5.5	3.3	150.0	1.9	1.9	0.71

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
158	85.6	57.0	1353.9	1355.1	2.8	1.2	85.1	0.7	0.7	0.60
473	96.2	115.5	1353.9	1355.8	4.1	1.9	95.0	1.2	1.2	0.65
1183	143.7	234.9	1353.9	1356.8	5.0	2.9	141.4	1.6	1.7	0.69
1577	152.9	286.2	1353.9	1357.2	5.5	3.3	150.0	1.9	1.9	0.70

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
	H19F19F2_2	T190F30							
473	2.19	0.24							2.43

Maximum Permissible Velocity

Channel Lining: Natural - Fine Gravel

Discharge (cfs)	FHWA Max. Permissible Velocity Table
158	Stable
473	Stable
1183	Erosive
1577	Erosive

FHWA Max. Permissible Velocity (ft/s)	5

Equilibrium Slope Calculations

Dominant Discharge	473	cfs
Clear Water	No	
Total Incoming Sediment Load	2.434	cfs
Initial Chnl Sediment Capacity	2.457	cfs
Long-term Equilibrium Slope (ADWR)	0.0120	

Drop Structures

Design Slope	0.0120	ft/ft
Total Drop Needed	0.2	ft
Height of Drop Structure	3	ft
No. of Drop Structures	0.06	
Distance between Structures	29941	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)
1577	1.1	24.6	3.3	1.9	5.5	0.0121	-0.7	0.8	1.5	0.4	2.0	5.6

Cost Estimates

Channel Characteristics

Channel Length (ft)	1796
Channel Limit-Left Station (ft)	1970
Channel Limit-Right Station (ft)	2120
Channel Width (ft)	150

Levee

Left Levee Length (ft)	1796
Left Levee Top Width (ft)	0.5
Left Levee Height (ft)	5.6
Right Levee Length (ft)	1796
Right Levee Top Width (ft)	0.5
Right Levee Height (ft)	3.3

Left Levee Surface Area (sq. Yd)	1118
Left Levee Volume (cu. Yd)	186
Right Levee Surface Area (sq. Yd)	659
Right Levee Volume (cu. Yd)	110
Total Levee Surface Area (sq. Yd)	1777
Total Levee Volume (cu. Yd)	296

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)	90002
Left Levee Fill XS area (sq. ft)	92.8
Left Levee Fill Volume (cu. Yd)	6173
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)	89823
Right Levee Fill XS area (sq. ft)	6.7
Right Levee Fill Volume (cu. Yd)	446
Total Levee Fill Surface Area (sq. ft)	179825
Total Levee Fill Volume (cu Yd)	6619

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)	7.7	
Structure Height (ft)	10.7	
Number of Structures	0.06	
	Design	Aesthetic Trtmt.
Volume per structure (cu.Yd)	59.33	5.93
Unit Cost (per cu. Yd)	$ 85.00	$ 85.00
Other Cost	$ -	$ -
Cost per structure	$ 5,043	$ 504
Area per structure (sq. Yd)	17	2
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	1,796	ft	$ 241	$ 432,416	296	cu. Yd	$ -	$ -	296	cu. Yd	$ -	$ -	
Wall Surface Cost	Wall	1,777	sq. Yd	$ -	$ -	1,777	sq. Yd	$ -	$ -	1,777	sq. Yd	$ 75.00	$ 133,275	
Adjacent Levee Fill	Fill	6,619	cu. Yd	$ 7.00	$ 46,333	19,956	sq. Yd	$ 4.50	$ 89,800	19,956	sq. Yd	$ 11.67	$ 232,815	
Wall Material Aesthetic Treatment Cost	Wall	296	cu. Yd	$ -	$ -	296	cu. Yd	$ -	$ -	296	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,777	sq. Yd	$ 63.00	$ 111,951	1,777	sq. Yd	$ -	$ -	1,777	sq. Yd	$ -	$ -	
Drop Structures	Gabions	0	EA	$ 5,043.05	$ 303	17	sq. Yd	$ -	$ -	17	sq. Yd	$ 37.50	$ 625	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 591,003			Total	$ 89,800			Total	$ 366,715	
		Contingency Cost (25% of Construction Cost)			$ 147,751									
		Engineering Design Cost (5% of Construction Cost)			$ 29,550									
		Total Construction Cost			$ 768,304									
Wall Material Aesthetic Treatment Cost	Wall	296	cu. Yd	$ -	$ -	296	cu. Yd	$ -	$ -	296	cu. Yd	$ -	$ -	
Wall Surface Aesthetic Trtmt. Cost	Wall	1,777	sq. Yd	$ 63.00	$ 111,951	1,777	sq. Yd	$ -	$ -	1,777	sq. Yd	$ -	$ -	
Adj. Levee Fill Aesthetic Trmt. Cost	Fill	6,619	cu. Yd	$ 7.00	$ 46,333	19,956	sq. Yd	$ 4.50	$ 89,800	19,956	sq. Yd	$ 11.67	$ 232,815	
Drop Structures Aesthetic Trtmt. Cost	Gabions	0	EA	$ 504.05	$ 30	17	sq. Yd	$ -	$ -	2	sq. Yd	$ 37.50	$ 63	
Other					$ -				$ -				$ -	
		Total without Contingency & Engineering Design Cost			$ 158,314			Total	$ 89,800			Total	$ 232,877	
		Contingency Cost (25% of Construction Cost)			$ 39,579									
		Engineering Design Cost (5% of Construction Cost)			$ 7,916									
		Total Construction Cost			$ 205,809									

Total Structure Aesthetic Trtmt Cost	$ 528,486

Land Cost

Land Cost Component	Width (ft)	Area (acre)	Unit Cost	Cost
Misc. Right of Way	0	0	$100,000	$ -
Adjacent Buffer Area	70	2.9	$100,000	$ 290,000
Maintenance Access	30	1.2	$100,000	$ 120,000
Channel	150	6.2	$100,000	$ 620,000
Levee	1	0	$100,000	$ -
Other	0	0	$100,000	$ -
Total	251	10.3		$ 1,030,000

Total Land Related Aes. Trtmt Cost	$ 290,000

Total Cost	$ 2,254,818	Total Aesthetic Treatment Cost	$ 818,486	Total Right of Way Cost	$ 1,030,000

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN  1998                 *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   30NOV06  TIME  10:03:21   *
 *                                       *
 *****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X         XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

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

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

1 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 19
    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: FAN196.DAT
    8         ID
    9         ID   100-YEAR 6-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID            MODELED AREA = 3.2 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    S185   BASIN
   51         KM         Compute runoff from subbasin 185
   52         BA   2.421
   53         LG    0.16    0.35    4.35    0.40       1
   54         UI     165     166     391     668     960    1130    1281    1613    1908    1239
   55         UI    1060     936     847     785     677     614     534     438     399     375
   56         UI     338     271     230     210     183     183     133     126     127      85
   57         UI      80      82      81      67      32      31      32      32      31      32
   58         UI      32      31      32      32      32       0       0       0       0       0
   59         ZW                 C=FLOW
              *

   60         KK  1859F1   ROUTE
   61         KM   PROPOSED CHANNEL
   62         KM        Route runoff from S185 to C190F1.
   63         KM    Slope=(1442.0 - 1384.0) / 4700.0
   64         RS       3    FLOW      -1
   65         RC   0.045   0.045   0.045  4700.0   0.012   105.0
   66         RX     0.0     0.0     0.0     0.0   160.0   160.0   160.0   160.0
   67         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
   68         ZW                 C=FLOW
              *

   69         KK  S190F1   BASIN
   70         KM        Compute runoff from subbasin 190F1
   71         BA   0.202
   72         LG    0.35    0.35    3.58    0.51       0
   73         UI     100     369     475     302     158      80      41      18      12       0
              *

   74         KK  C190F1 COMBINE
   75         KM        Combine runoff from S190F1A w/ routed flow from S185
   76         HC       2
   77         ZW                 C=FLOW
              *

   78         KK  9F19F2   ROUTE
   79         KM   PROPOSED CHANNEL
   80         KM        Route runoff from C190F1 to C190F.
   81         KM    Slope=(1384.0 - 1340.0) / 3512.0
   82         RS       2    FLOW      -1
   83         RC   0.045   0.045   0.045  3512.0   0.013   105.0
   84         RX     0.0     0.0     0.0     0.0   180.0   180.0   180.0   180.0
   85         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
   86         ZW                 C=FLOW
              *

   87         KK   S180C   BASIN
   88         KM        Compute runoff from subbasin 180C
   89         BA   0.207
   90         LG    0.35    0.35    3.50    0.54       0
   91         UI      269     731     387     142      48      20       0       0       0       0
              *
```

1 HEC-1 INPUT PAGE 3

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

   92         KK  80C90F   ROUTE
   93         KM    ROUTE runoff FROM S180C TO C190F
   94         KM    Slope=(1451 - 1340) / 8818
   95         RS       6    FLOW      -1
   96         RC   0.045   0.045   0.045  8818   0.013     104
   97         RX     0.0      20      80      84      99     103     163     183
   98         RY     104     103     102     100     100     102     103     104
              *

   99         KK  S190F2   BASIN
  100         KM        Compute runoff from subbasin 190F2
  101         BA   0.328
  102         LG    0.35    0.35    3.50    0.54       0
  103         UI      69     264     461     538     442     279     182     113      72      45
  104         UI      30      14      13      14       0       0       0       0       0       0
              *

  105         KK   C190F COMBINE
  106         KM        Combine runoff from S190F2 with routed flows from C190F1 & S180C
  107         KM        This is the total flow at the downstream end of the Fan 19 corridor.
  108         HC       3
  109         ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   50        S185
               V
               V
   60      1859F1
               .
               .
   69            .      S190F1
                 .          .
                 .          .
   74      C190F1............
               V
               V
   78      9F19F2
               .
               .
   87            .      S180C
                 .          V
                 .          V
```

```
  92          .       80C90F
              .           .
              .           .
  99          .           .       S190F2
              .           .            .
              .           .            .
 105      C190F.......................

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   30NOV06  TIME  10:03:21   *
 *                                       *
 *****************************************

 ***************************************
 *                                     *
 *    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 19

                         SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                         JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                         MODELER: TED LEHMAN
                         FILENAME: FAN196.DAT

                         100-YEAR 6-HOUR MODEL
                         EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                                  MODELED AREA = 3.2 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    *    S185    *        BASIN
           *            *
           **************
                          Compute runoff from subbasin 185

              SUBBASIN RUNOFF DATA

  52 BA          SUBBASIN CHARACTERISTICS
                       TAREA        2.42  SUBBASIN AREA

  53 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .16  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.35  WETTING FRONT SUCTION
                       XKSAT         .40  HYDRAULIC CONDUCTIVITY
                       RTIMP        1.00  PERCENT IMPERVIOUS AREA

  51 UI          INPUT UNITGRAPH,  45 ORDINATES,  VOLUME = 1.00
                   165.0    166.0    391.0    668.0    960.0   1130.0   1281.0   1613.0   1908.0   1239.0
                  1060.0    936.0    847.0    785.0    677.0    614.0    534.0    438.0    399.0    375.0
                   338.0    271.0    230.0    210.0    183.0    183.0    133.0    126.0    127.0     85.0
                    80.0     82.0     81.0     67.0     32.0     31.0     32.0     32.0     31.0     32.0
                    32.0     31.0     32.0     32.0     32.0

                                                ***

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

                            HYDROGRAPH AT STATION     S185
                           TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.44

  PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR      72-HR    166.58-HR
+  (CFS)       (HR)
                           (CFS)
+   2168.      4.50                374.        93.        31.        13.
                         (INCHES)  1.434      1.435      1.435      1.435
                          (AC-FT)   185.       185.       185.       185.

                           CUMULATIVE AREA =    2.42 SQ MI
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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S185
                       TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.76, TOTAL EXCESS =    1.42

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    2152.      4.50                370.         93.         31.         13.
                (INCHES)          1.423       1.424       1.424       1.424
                 (AC-FT)            184.        184.        184.        184.

                       CUMULATIVE AREA =    2.42 SQ MI


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

                        HYDROGRAPH AT STATION     S185
                       TRANSPOSITION AREA       2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.04, TOTAL EXCESS =    1.08

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1385.      4.58                280.         70.         23.         10.
                (INCHES)          1.077       1.078       1.078       1.078
                 (AC-FT)            139.        139.        139.        139.

                       CUMULATIVE AREA =    2.42 SQ MI


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

                        HYDROGRAPH AT STATION     S185
                       TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.18, TOTAL EXCESS =     .77

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     962.      4.58                199.         50.         17.          7.
                (INCHES)          .763        .765        .765        .765
                 (AC-FT)             99.         99.         99.         99.

                       CUMULATIVE AREA =    2.42 SQ MI


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

                        HYDROGRAPH AT STATION     S185
                       TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.22, TOTAL EXCESS =     .38

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     478.      4.58                 97.         24.          8.          4.
                (INCHES)          .373        .375        .375        .375
                 (AC-FT)             48.         48.         48.         48.

                       CUMULATIVE AREA =    2.42 SQ MI

    -----DSS---ZOPEN:  Existing File Opened,  File: FAN196.DSS
                       Unit:  71;  DSS Version: 6-JG
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/01JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/02JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/03JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/04JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/05JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/06JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/07JAN1999/5MIN//
    -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/08JAN1999/5MIN//
      ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT     S185

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1450.      4.50                288.         72.         24.         10.
                (INCHES)          1.106       1.107       1.107       1.107
                 (AC-FT)            143.        143.        143.        143.

                       CUMULATIVE AREA =    2.42 SQ MI
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 60 KK    *    1859F1  *        ROUTE
          *            *
          **************
                      PROPOSED CHANNEL
                          Route runoff from S185 to C190F1.
                       Slope=(1442.0 - 1384.0) / 4700.0

                  HYDROGRAPH ROUTING DATA

 64 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

 65 RC              NORMAL DEPTH CHANNEL
                           ANL       .045  LEFT OVERBANK N-VALUE
                          ANCH       .045  MAIN CHANNEL N-VALUE
                           ANR       .045  RIGHT OVERBANK N-VALUE
                         RLNTH      4700.  REACH LENGTH
                           SEL      .0120  ENERGY SLOPE
                         ELMAX      105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 67 RY        ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 66 RX        DISTANCE        .00       .00       .00       .00    160.00    160.00    160.00    160.00

                                             ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      4.54      9.09     13.63     18.17     22.72     27.26     31.80     36.34     40.89
          OUTFLOW        .00     62.65    198.68    390.09    629.39    911.94   1234.42   1594.29   1989.53   2418.44
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      45.43     49.97     54.52     59.06     63.60     68.15     72.69     77.23     81.78     86.32
          OUTFLOW    2879.58   3371.70   3893.70   4444.60   5023.52   5629.66   6262.27   6920.70   7604.31   8312.52
        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     2418. TO     8313.
                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   1859F1
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    2082.      4.67                373.         93.         31.         13.
                (INCHES)          1.433       1.435       1.435       1.435
                 (AC-FT)            185.        185.        185.        185.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
                  12.      4.67                 3.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
                102.16     4.67              100.57      100.14      100.05      100.02

                       CUMULATIVE AREA =    2.42 SQ MI


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

                        HYDROGRAPH AT STATION   1859F1
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    2065.      4.67                370.         93.         31.         13.
                (INCHES)          1.421       1.424       1.424       1.424
                 (AC-FT)            184.        184.        184.        184.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+ (AC-FT)       (HR)
                  12.      4.67                 3.          1.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
                102.15     4.67              100.57      100.14      100.05      100.02
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                         CUMULATIVE AREA =     2.42 SQ MI

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

                           HYDROGRAPH AT STATION    1859F1
                         TRANSPOSITION AREA      2.8 SQ MI

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +     1347.        4.67                   280.          70.          23.           10.
                            (INCHES)      1.076        1.078        1.078         1.078
                             (AC-FT)       139.         139.         139.          139.

    PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (AC-FT)        (HR)
        10.         4.67                     3.           1.           0.            0.

     PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (FEET)        (HR)
      101.66        4.67                 100.49       100.12       100.04        100.02

                         CUMULATIVE AREA =     2.42 SQ MI

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

                           HYDROGRAPH AT STATION    1859F1
                         TRANSPOSITION AREA     16.0 SQ MI

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +      924.        4.75                   198.          50.          17.            7.
                            (INCHES)       .762         .765         .765          .765
                             (AC-FT)        98.          99.          99.           99.

    PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (AC-FT)        (HR)
         8.         4.75                     2.           1.           0.            0.

     PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (FEET)        (HR)
      101.33        4.75                 100.40       100.10       100.03        100.01

                         CUMULATIVE AREA =     2.42 SQ MI

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

                           HYDROGRAPH AT STATION    1859F1
                         TRANSPOSITION AREA     90.0 SQ MI

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +      438.        4.83                    97.          24.           8.            4.
                            (INCHES)       .372         .375         .375          .375
                             (AC-FT)        48.          48.          48.           48.

    PEAK STORAGE    TIME                           MAXIMUM AVERAGE STORAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +   (AC-FT)        (HR)
         5.         4.83                     1.           0.           0.            0.

     PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (FEET)        (HR)
      100.84        4.83                 100.25       100.06       100.02        100.01

                         CUMULATIVE AREA =     2.42 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/08JAN1999/5MIN//
        ***             ***             ***             ***             ***


                         INTERPOLATED HYDROGRAPH AT     1859F1

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +     1407.        4.67                   288.          72.          24.           10.
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                            (INCHES)      1.105        1.107        1.107         1.107
                             (AC-FT)       143.         143.         143.          143.

                             CUMULATIVE AREA =     2.42 SQ MI


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

              *************
              *           *
 69 KK        *   S190F1  *        BASIN
              *           *
              *************
                                    Compute runoff from subbasin 190F1

                  SUBBASIN RUNOFF DATA

 71 BA              SUBBASIN CHARACTERISTICS
                          TAREA         .20  SUBBASIN AREA

 72 LG              GREEN AND AMPT LOSS RATE
                          STRTL         .35  STARTING LOSS
                            DTH         .35  MOISTURE DEFICIT
                           PSIF        3.58  WETTING FRONT SUCTION
                          XKSAT         .51  HYDRAULIC CONDUCTIVITY
                          RTIMP         .00  PERCENT IMPERVIOUS AREA

 70 UI              INPUT UNITGRAPH,   9 ORDINATES,  VOLUME =  .99
                       100.0     369.0     475.0     302.0     158.0      80.0      41.0      18.0      12.0
                                                                ***

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

                             HYDROGRAPH AT STATION    S190F1
                           TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.94, TOTAL EXCESS =     1.25

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +      454.        4.08                    27.           7.           2.            1.
                            (INCHES)      1.246        1.246        1.246         1.246
                             (AC-FT)        13.          13.          13.           13.

                             CUMULATIVE AREA =      .20 SQ MI


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

                             HYDROGRAPH AT STATION    S190F1
                           TRANSPOSITION AREA       .5 SQ MI

   TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.94, TOTAL EXCESS =     1.24

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +      451.        4.08                    27.           7.           2.            1.
                            (INCHES)      1.235        1.235        1.235         1.235
                             (AC-FT)        13.          13.          13.           13.

                             CUMULATIVE AREA =      .20 SQ MI


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

                             HYDROGRAPH AT STATION    S190F1
                           TRANSPOSITION AREA      2.8 SQ MI

   TOTAL RAINFALL =     3.12, TOTAL LOSS =     2.23, TOTAL EXCESS =      .89

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
 +      208.        4.08                    19.           5.           2.            1.
                            (INCHES)       .881         .881         .881          .881
                             (AC-FT)         9.           9.           9.            9.

                             CUMULATIVE AREA =      .20 SQ MI


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

                             HYDROGRAPH AT STATION    S190F1
                           TRANSPOSITION AREA     16.0 SQ MI

   TOTAL RAINFALL =     2.95, TOTAL LOSS =     2.38, TOTAL EXCESS =      .57

     PEAK FLOW      TIME                             MAXIMUM AVERAGE FLOW
                                           6-HR        24-HR        72-HR     166.58-HR
 +    (CFS)         (HR)
                              (CFS)
```

```
+      134.      4.08                    12.          3.          1.          0.
                                (INCHES)      .566        .566        .566        .566
                                (AC-FT)         6.          6.          6.          6.

                                CUMULATIVE AREA =      .20 SQ MI


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

                                HYDROGRAPH AT STATION    S190F1
                               TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =     2.59, TOTAL LOSS =     2.39, TOTAL EXCESS =      .20

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+       55.      4.08                     4.          1.          0.          0.
                                (INCHES)      .200        .200        .200        .200
                                (AC-FT)         2.          2.          2.          2.

                                CUMULATIVE AREA =      .20 SQ MI

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


                                INTERPOLATED HYDROGRAPH AT    S190F1

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+      453.      4.08                    27.          7.          2.          1.
                                (INCHES)     1.241       1.241       1.241       1.241
                                (AC-FT)         13.         13.         13.         13.

                                CUMULATIVE AREA =      .20 SQ MI


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

            **************
            *            *
 74 KK      *    C190F1  *      COMBINE
            *            *
            **************
                Combine runoff from S190F1A w/ routed flow from S185

 76 HC          HYDROGRAPH COMBINATION
                     ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

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

                                HYDROGRAPH AT STATION    C190F1
                               TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+     2086.      4.67                   400.        100.         33.         14.
                                (INCHES)     1.419       1.421       1.421       1.421
                                (AC-FT)       198.        199.        199.        199.

                                CUMULATIVE AREA =     2.62 SQ MI

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

                                HYDROGRAPH AT STATION    C190F1
                               TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+     2069.      4.67                   397.         99.         33.         14.
                                (INCHES)     1.407       1.409       1.409       1.409
                                (AC-FT)       197.        197.        197.        197.

                                CUMULATIVE AREA =     2.62 SQ MI


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

                                HYDROGRAPH AT STATION    C190F1
                               TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+     1357.      4.67                   299.         75.         25.         11.
                                (INCHES)     1.061       1.063       1.063       1.063
                                (AC-FT)       148.        149.        149.        149.

                                CUMULATIVE AREA =     2.62 SQ MI


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

                                HYDROGRAPH AT STATION    C190F1
                               TRANSPOSITION AREA      16.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+      927.      4.75                   211.         53.         18.          8.
                                (INCHES)      .747        .750        .750        .750
                                (AC-FT)       105.        105.        105.        105.

                                CUMULATIVE AREA =     2.62 SQ MI


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

                                HYDROGRAPH AT STATION    C190F1
                               TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+      439.      4.83                   101.         25.          8.          4.
                                (INCHES)      .359        .361        .361        .361
                                (AC-FT)        50.         51.         51.         51.

                                CUMULATIVE AREA =     2.62 SQ MI

  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/01JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/02JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/03JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/04JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/05JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/06JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/07JAN1999/5MIN//
  -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                                INTERPOLATED HYDROGRAPH AT    C190F1

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR        24-HR       72-HR     166.58-HR
+    (CFS)       (HR)
                                (CFS)
+     1407.      4.67                   306.         77.         26.         11.
                                (INCHES)     1.085       1.087       1.087       1.087
                                (AC-FT)       152.        152.        152.        152.

                                CUMULATIVE AREA =     2.62 SQ MI


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

            **************
            *            *
 78 KK      *    9F19F2  *        ROUTE
            *            *
            **************
                                PROPOSED CHANNEL
                                    Route runoff from C190F1 to C190F.
                                  Slope=(1384.0 - 1340.0) / 3512.0

                            HYDROGRAPH ROUTING DATA

 82 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
 83 RC                        NORMAL DEPTH CHANNEL
                                     ANL        .045  LEFT OVERBANK N-VALUE
                                    ANCH        .045  MAIN CHANNEL N-VALUE
                                     ANR        .045  RIGHT OVERBANK N-VALUE
                                   RLNTH       3512.  REACH LENGTH
                                     SEL       .0130  ENERGY SLOPE
                                   ELMAX      105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                                CROSS-SECTION DATA
                                --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 85 RY        ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 84 RX        DISTANCE        .00       .00       .00       .00    180.00    180.00    180.00    180.00

                                                   ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
```

```
               STORAGE       .00      3.82      7.64     11.46     15.28     19.10     22.91     26.73     30.55     34.37
               OUTFLOW       .00     73.37    232.70    456.94    737.33   1068.47   1446.47   1868.39   2331.86   2834.91
             ELEVATION    100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

               STORAGE     38.19     42.01     45.83     49.65     53.47     57.29     61.11     64.92     68.74     72.56
               OUTFLOW   3375.86   3953.26   4565.83   5212.44   5892.05   6603.76   7346.69   8120.07   8923.18   9755.35
             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     3376. TO      9755.
                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    9F19F2
                  TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    2008.       4.75                   400.        100.         33.          14.
                           (INCHES)    1.417       1.421       1.421       1.421
                            (AC-FT)     198.        199.        199.        199.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       14.       4.75                     4.          1.          0.          0.

  PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.92       4.75                 100.57      100.14      100.05      100.02

                              CUMULATIVE AREA =     2.62 SQ MI

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

                    HYDROGRAPH AT STATION    9F19F2
                  TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    1990.       4.75                   397.         99.         33.          14.
                           (INCHES)    1.405       1.409       1.409       1.409
                            (AC-FT)     197.        197.        197.        197.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       14.       4.75                     4.          1.          0.          0.

  PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.91       4.75                 100.57      100.14      100.05      100.02

                              CUMULATIVE AREA =     2.62 SQ MI

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

                    HYDROGRAPH AT STATION    9F19F2
                  TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    1321.       4.83                   299.         75.         25.          11.
                           (INCHES)    1.059       1.063       1.063       1.063
                            (AC-FT)     148.        149.        149.        149.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
       11.       4.83                     4.          1.          0.          0.

  PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.49       4.83                 100.49      100.12      100.04      100.02

                              CUMULATIVE AREA =     2.62 SQ MI

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

                    HYDROGRAPH AT STATION    9F19F2
                  TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     893.       4.92                   210.         53.         18.           8.
                           (INCHES)     .746        .750        .750        .750
                            (AC-FT)     104.        105.        105.        105.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
        9.       4.92                     3.          1.          0.          0.

  PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    101.18       4.92                 100.39      100.10      100.03      100.01

                              CUMULATIVE AREA =     2.62 SQ MI

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

                    HYDROGRAPH AT STATION    9F19F2
                  TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+     402.       5.08                   101.         25.          8.           4.
                           (INCHES)     .358        .361        .361        .361
                            (AC-FT)      50.         51.         51.         51.

 PEAK STORAGE    TIME                        MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)       (HR)
        5.       5.08                     2.          0.          0.          0.

  PEAK STAGE     TIME                        MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    100.73       5.08                 100.25      100.06      100.02      100.01

                              CUMULATIVE AREA =     2.62 SQ MI

-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/01JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/02JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/03JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/04JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/05JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/06JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/07JAN1999/5MIN//
-----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/08JAN1999/5MIN//
      ***         ***         ***         ***         ***

                    INTERPOLATED HYDROGRAPH AT    9F19F2

  PEAK FLOW      TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                              (CFS)
+    1345.       4.83                   303.         76.         25.          11.
                           (INCHES)    1.073       1.076       1.076       1.076
                            (AC-FT)     150.        151.        151.        151.

                              CUMULATIVE AREA =     2.62 SQ MI

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

                **************
                *            *
   87 KK        *    S180C   *        BASIN
                *            *
                **************
                                         Compute runoff from subbasin 180C

                 SUBBASIN RUNOFF DATA

   89 BA          SUBBASIN CHARACTERISTICS
                        TAREA          .21   SUBBASIN AREA

   90 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .35   STARTING LOSS
                          DTH          .35   MOISTURE DEFICIT
                         PSIF         3.50   WETTING FRONT SUCTION
                        XKSAT          .54   HYDRAULIC CONDUCTIVITY
                        RTIMP          .00   PERCENT IMPERVIOUS AREA

   88 UI          INPUT UNITGRAPH,    6 ORDINATES,   VOLUME = 1.00
                      269.0      731.0      387.0      142.0       48.0       20.0
                                                                         ***

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

                    HYDROGRAPH AT STATION    S180C
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                         TRANSPOSITION AREA        .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.97, TOTAL EXCESS =    1.23

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     538.       4.00                    27.          7.           2.           1.
                             (INCHES)    1.226        1.226        1.226        1.226
                             (AC-FT)      14.          14.          14.          14.

                              CUMULATIVE AREA =      .21 SQ MI


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

                          HYDROGRAPH AT STATION    S180C
                         TRANSPOSITION AREA        .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.96, TOTAL EXCESS =    1.22

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     534.       4.00                    27.          7.           2.           1.
                             (INCHES)    1.216        1.216        1.216        1.216
                             (AC-FT)      13.          13.          13.          13.

                              CUMULATIVE AREA =      .21 SQ MI


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

                          HYDROGRAPH AT STATION    S180C
                         TRANSPOSITION AREA       2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    2.27, TOTAL EXCESS =     .85

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     228.       4.00                    19.          5.           2.           1.
                             (INCHES)     .850         .850         .850         .850
                             (AC-FT)       9.           9.           9.           9.

                              CUMULATIVE AREA =      .21 SQ MI


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

                          HYDROGRAPH AT STATION    S180C
                         TRANSPOSITION AREA      16.0 SQ MI

     TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.41, TOTAL EXCESS =     .54

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     145.       4.00                    12.          3.           1.           0.
                             (INCHES)     .534         .534         .534         .534
                             (AC-FT)       6.           6.           6.           6.

                              CUMULATIVE AREA =      .21 SQ MI


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

                          HYDROGRAPH AT STATION    S180C
                         TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.42, TOTAL EXCESS =     .17

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +      57.       4.00                     4.          1.           0.           0.
                             (INCHES)     .172         .172         .172         .172
                             (AC-FT)       2.           2.           2.           2.

                              CUMULATIVE AREA =      .21 SQ MI

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


                         INTERPOLATED HYDROGRAPH AT     S180C

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     536.       4.00                    27.          7.           2.           1.
                             (INCHES)    1.221        1.221        1.221        1.221
                             (AC-FT)      13.          13.          13.          13.
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                              CUMULATIVE AREA =      .21 SQ MI


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


               **************
               *            *
  92 KK        *   80C90F   *        ROUTE
               *            *
               **************
                              ROUTE runoff FROM S180C TO C190F
                              Slope=(1451 - 1340) / 8818

               HYDROGRAPH ROUTING DATA

  95 RS           STORAGE ROUTING
                      NSTPS           6  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC       -1.00  INITIAL CONDITION
                          X         .00  WORKING R AND D COEFFICIENT

  96 RC           NORMAL DEPTH CHANNEL
                        ANL        .045  LEFT OVERBANK N-VALUE
                       ANCH        .045  MAIN CHANNEL N-VALUE
                        ANR        .045  RIGHT OVERBANK N-VALUE
                      RLNTH       8818.  REACH LENGTH
                        SEL       .0130  ENERGY SLOPE
                      ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                              CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  98 RY         ELEVATION    104.00     103.00     102.00     100.00     100.00     102.00     103.00     104.00
  97 RX         DISTANCE        .00      20.00      80.00      84.00      99.00     103.00     163.00     183.00

                                                     ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

              STORAGE         .00        .66       1.35       2.08       2.84       3.64       4.48       5.35       6.26       7.21
              OUTFLOW         .00       4.24      13.56      26.85      43.73      64.00      87.55     114.32     144.27     177.42
            ELEVATION      100.00     100.21     100.42     100.63     100.84     101.05     101.26     101.47     101.68     101.89

              STORAGE        8.32      10.37      13.51      17.72      23.00      29.17      35.71      42.61      49.87      57.49
              OUTFLOW      216.70     267.84     335.23     424.09     538.97     693.16     879.49    1094.09    1336.89    1608.06
            ELEVATION      102.11     102.32     102.53     102.74     102.95     103.16     103.37     103.58     103.79     104.00


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

                          HYDROGRAPH AT STATION    80C90F
                         TRANSPOSITION AREA        .1 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     291.       4.50                    27.          7.           2.           1.
                             (INCHES)    1.226        1.226        1.226        1.226
                             (AC-FT)      14.          14.          14.          14.

 PEAK STORAGE     TIME                         MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         2.       4.50                     0.          0.           0.           0.

  PEAK STAGE      TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     102.39       4.50                  100.34       100.09       100.03       100.01

                              CUMULATIVE AREA =      .21 SQ MI


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

                          HYDROGRAPH AT STATION    80C90F
                         TRANSPOSITION AREA        .5 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (CFS)        (HR)
                               (CFS)
 +     289.       4.50                    27.          7.           2.           1.
                             (INCHES)    1.216        1.216        1.216        1.216
                             (AC-FT)      13.          13.          13.          13.

 PEAK STORAGE     TIME                         MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR    166.58-HR
 +  (AC-FT)       (HR)
         2.       4.50                     0.          0.           0.           0.

  PEAK STAGE      TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR    166.58-HR
 +   (FEET)       (HR)
     102.38       4.50                  100.34       100.09       100.03       100.01

                              CUMULATIVE AREA =      .21 SQ MI
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      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION   80C90F
                 TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     173.      4.42                19.           5.           2.           1.
                (INCHES)          .850         .850         .850         .850
                (AC-FT)             9.           9.           9.           9.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)     (HR)
        1.      4.42                 0.           0.           0.           0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.87      4.42              100.31       100.08       100.03       100.01

                CUMULATIVE AREA =     .21 SQ MI

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

                  HYDROGRAPH AT STATION   80C90F
                 TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     101.      4.42                12.           3.           1.           0.
                (INCHES)          .534         .534         .534         .534
                (AC-FT)             6.           6.           6.           6.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)     (HR)
        1.      4.42                 0.           0.           0.           0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.37      4.42              100.24       100.06       100.02       100.01

                CUMULATIVE AREA =     .21 SQ MI

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

                  HYDROGRAPH AT STATION   80C90F
                 TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+      24.      4.75                 4.           1.           0.           0.
                (INCHES)          .172         .172         .172         .172
                (AC-FT)             2.           2.           2.           2.

  PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)     (HR)
        0.      4.75                 0.           0.           0.           0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    100.59      4.75              100.13       100.03       100.01       100.00

                CUMULATIVE AREA =     .21 SQ MI

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


                INTERPOLATED HYDROGRAPH AT   80C90F

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     290.      4.50                27.           7.           2.           1.
                (INCHES)         1.221        1.221        1.221        1.221
                (AC-FT)            13.          13.          13.          13.

                CUMULATIVE AREA =     .21 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
                 **************
                 *            *
 99 KK           *   S190F2   *        BASIN
                 *            *
                 **************
                          Compute runoff from subbasin 190F2

                    SUBBASIN RUNOFF DATA

101 BA                 SUBBASIN CHARACTERISTICS
                            TAREA          .33  SUBBASIN AREA

102 LG                 GREEN AND AMPT LOSS RATE
                            STRTL          .35  STARTING LOSS
                              DTH          .35  MOISTURE DEFICIT
                             PSIF         3.50  WETTING FRONT SUCTION
                            XKSAT          .54  HYDRAULIC CONDUCTIVITY
                            RTIMP          .00  PERCENT IMPERVIOUS AREA

100 UI                 INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                          69.0      264.0      461.0      538.0      442.0      279.0      182.0      113.0       72.0       45.0
                          30.0       14.0       13.0       14.0
                                                                                  ***
      ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION   S190F2
                 TRANSPOSITION AREA      .1 SQ MI

   TOTAL RAINFALL =     3.20, TOTAL LOSS =     1.97, TOTAL EXCESS =     1.23

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     571.      4.17                43.          11.           4.           2.
                (INCHES)         1.229        1.229        1.229        1.229
                (AC-FT)            21.          21.          21.          21.

                CUMULATIVE AREA =     .33 SQ MI

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

                  HYDROGRAPH AT STATION   S190F2
                 TRANSPOSITION AREA      .5 SQ MI

   TOTAL RAINFALL =     3.18, TOTAL LOSS =     1.96, TOTAL EXCESS =     1.22

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     567.      4.17                43.          11.           4.           2.
                (INCHES)         1.218        1.218        1.218        1.218
                (AC-FT)            21.          21.          21.          21.

                CUMULATIVE AREA =     .33 SQ MI

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

                  HYDROGRAPH AT STATION   S190F2
                 TRANSPOSITION AREA      2.8 SQ MI

   TOTAL RAINFALL =     3.12, TOTAL LOSS =     2.27, TOTAL EXCESS =      .85

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     283.      4.17                30.           8.           3.           1.
                (INCHES)          .852         .852         .852         .852
                (AC-FT)            15.          15.          15.          15.

                CUMULATIVE AREA =     .33 SQ MI

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

                  HYDROGRAPH AT STATION   S190F2
                 TRANSPOSITION AREA     16.0 SQ MI

   TOTAL RAINFALL =     2.95, TOTAL LOSS =     2.41, TOTAL EXCESS =      .54

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     180.      4.17                19.           5.           2.           1.
                (INCHES)          .536         .536         .536         .536
                (AC-FT)             9.           9.           9.           9.

                CUMULATIVE AREA =     .33 SQ MI

      ***           ***           ***           ***           ***
```

```
                  HYDROGRAPH AT STATION    S190F2
                TRANSPOSITION AREA      90.0 SQ MI

   TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.42, TOTAL EXCESS =     .17

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+     65.       4.17                 6.           2.            1.            0.
                       (INCHES)    .173         .173          .173          .173
                        (AC-FT)      3.           3.            3.            3.

                         CUMULATIVE AREA =     .33 SQ MI

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


                 INTERPOLATED HYDROGRAPH AT    S190F2

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    568.       4.17                43.          11.            4.            2.
                       (INCHES)   1.221        1.221         1.221         1.221
                        (AC-FT)     21.          21.           21.           21.

                         CUMULATIVE AREA =     .33 SQ MI


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

              *************
              *           *
 105 KK       *   C190F   *      COMBINE
              *           *
              *************

                                 Combine runoff from S190F2 with routed flows from C190F1 & S180C
                                 This is the total flow at the downstream end of the Fan 19 corridor.

 108 HC          HYDROGRAPH COMBINATION
                    ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                   ***

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

                  HYDROGRAPH AT STATION     C190F
                TRANSPOSITION AREA        .1 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+   2140.       4.75               470.         118.           39.           17.
                       (INCHES)   1.385        1.388         1.388         1.388
                        (AC-FT)    233.         234.          234.          234.

                         CUMULATIVE AREA =    3.16 SQ MI

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

                  HYDROGRAPH AT STATION     C190F
                TRANSPOSITION AREA        .5 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+   2121.       4.75               466.         117.           39.           17.
                       (INCHES)   1.373        1.377         1.377         1.377
                        (AC-FT)    231.         232.          232.          232.

                         CUMULATIVE AREA =    3.16 SQ MI

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

                  HYDROGRAPH AT STATION     C190F
                TRANSPOSITION AREA       2.8 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+   1415.       4.75               348.          87.           29.           13.
                       (INCHES)   1.024        1.027         1.027         1.027
                        (AC-FT)    172.         173.          173.          173.

                         CUMULATIVE AREA =    3.16 SQ MI

       ***          ***          ***          ***          ***
```

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                  HYDROGRAPH AT STATION     C190F
                TRANSPOSITION AREA      16.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    948.       4.83               241.          61.           20.            9.
                       (INCHES)    .710         .713          .713          .713
                        (AC-FT)    120.         120.          120.          120.

                         CUMULATIVE AREA =    3.16 SQ MI

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

                  HYDROGRAPH AT STATION     C190F
                TRANSPOSITION AREA      90.0 SQ MI

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    419.       5.08               111.          28.            9.            4.
                       (INCHES)    .327         .329          .329          .329
                        (AC-FT)     55.          55.           55.           55.

                         CUMULATIVE AREA =    3.16 SQ MI

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


                 INTERPOLATED HYDROGRAPH AT    C190F

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR         24-HR         72-HR     166.58-HR
+   (CFS)       (HR)
                         (CFS)
+   1380.       4.75               340.          85.           28.           12.
                       (INCHES)   1.002        1.006         1.006         1.006
                        (AC-FT)    169.         169.          169.          169.

                         CUMULATIVE AREA =    3.16 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	S185	1450.	4.50	288.	72.	24.	2.42		
+	ROUTED TO	1859F1	1407.	4.67	288.	72.	24.	2.42		
+	HYDROGRAPH AT	S190F1	453.	4.08	27.	7.	2.	.20		
+	2 COMBINED AT	C190F1	1407.	4.67	306.	77.	26.	2.62		
+	ROUTED TO	9F19F2	1345.	4.83	303.	76.	25.	2.62		
+	HYDROGRAPH AT	S180C	536.	4.00	27.	7.	2.	.21		
+	ROUTED TO	80C90F	290.	4.50	27.	7.	2.	.21		
+	HYDROGRAPH AT	S190F2	568.	4.17	43.	11.	4.	.33		
+	3 COMBINED AT	C190F	1380.	4.75	340.	85.	28.	3.16		

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


   -----DSS---ZCLOSE Unit:  71,    File: FAN196.DSS
            Pointer Utilization:    .25
            Number of Records:     32
            File Size:      62.2  Kbytes
            Percent Inactive:     .0
```

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN  1998                 *
 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   30NOV06  TIME  10:03:22   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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 19
    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: FAN1924.DAT
    8         ID
    9         ID   100-YEAR 24-HOUR MODEL
   10         ID   EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
   11         ID            MODELED AREA = 3.2 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         KK    S185   BASIN
   43         KM        Compute runoff from subbasin 185
   44         BA   2.421
   45         LG    0.16    0.35    4.35    0.40       1
   46         UI     165     166     391     668     960    1130    1281    1613    1908    1239
   47         UI    1060     936     847     785     677     614     534     438     399     375
   48         UI     338     271     230     210     183     183     133     126     127      85
   49         UI      80      82      81      67      32      31      32      32      31      32
   50         UI      32      31      32      32      32       0       0       0       0       0
   51         ZW                 C=FLOW
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   52         KK  1859F1   ROUTE
   53         KM   PROPOSED CHANNEL
   54         KM        Route runoff from S185 to C190F1.
   55         KM    Slope=(1442.0 - 1384.0) / 4700.0
   56         RS       3    FLOW      -1
   57         RC   0.045   0.045   0.045  4700.0   0.012   105.0
   58         RX     0.0     0.0     0.0     0.0   160.0   160.0   160.0   160.0
   59         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
   60         ZW                 C=FLOW
              *
   61         KK  S190F1   BASIN
   62         KM        Compute runoff from subbasin 190F1
   63         BA   0.202
   64         LG    0.35    0.35    3.58    0.51       0
   65         UI     100     369     475     302     158      80      41      18      12       0
              *
   66         KK  C190F1 COMBINE
   67         KM        Combine runoff from S190F1A w/ routed flow from S185
   68         HC       2
   69         ZW                 C=FLOW
              *
   70         KK  9F19F2   ROUTE
   71         KM   PROPOSED CHANNEL
   72         KM        Route runoff from C190F1 to C190F.
   73         KM    Slope=(1384.0 - 1340.0) / 3512.0
   74         RS       2    FLOW      -1
   75         RC   0.045   0.045   0.045  3512.0   0.013   105.0
   76         RX     0.0     0.0     0.0     0.0   180.0   180.0   180.0   180.0
   77         RY   105.0   100.0   100.0   100.0   100.0   100.0   100.0   105.0
   78         ZW                 C=FLOW
              *
   79         KK   S180C   BASIN
   80         KM        Compute runoff from subbasin 180C
   81         BA   0.207
   82         LG    0.35    0.35    3.50    0.54       0
   83         UI     269     731     387     142      48      20       0       0       0       0
              *
   84         KK  80C90F   ROUTE
   85         KM    ROUTE runoff FROM S180C TO C190F
   86         KM    Slope=(1451 - 1340) / 8818
   87         RS       6    FLOW      -1
   88         RC   0.045   0.045   0.045    8818   0.013     104
   89         RX     0.0      20      80      84      99     103     163     183
   90         RY     104     103     102     100     100     102     103     104
              *
```

1 HEC-1 INPUT PAGE 3

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
   91         KK  S190F2   BASIN
   92         KM        Compute runoff from subbasin 190F2
   93         BA   0.328
   94         LG    0.35    0.35    3.50    0.54       0
   95         UI      69     264     461     538     442     279     182     113      72      45
   96         UI      30      14      13      14       0       0       0       0       0       0
              *
   97         KK   C190F COMBINE
   98         KM        Combine runoff from S190F2 with routed flows from C190F1 & S180C
   99         KM        This is the total flow at the downstream end of the Fan 19 corridor.
  100         HC       3
  101         ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   42       S185
              V
              V
   52      1859F1
              .
              .
   61         .      S190F1
              .          .
              .          .
   66      C190F1.........
              V
              V
   70      9F19F2
              .
              .
   79         .       S180C
              .         V
              .         V
   84         .      80C90F
              .          .
              .          .
   91         .          .      S190F2
              .          .          .
              .          .          .
   97       C190F.......................
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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   30NOV06  TIME  10:03:22   *                              *          (916) 756-1104             *
 *                                       *                              *                                     *
*****************************************                               ***************************************


                     HYDROLOGY FOR STEP 3 RECOMMENDED ALTERNATIVE FOR SUN VALLEY ADMP
                        - FAN SYSTEM 19

                     SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
                     JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
                     MODELER: TED LEHMAN
                     FILENAME: FAN1924.DAT

                     100-YEAR 24-HOUR MODEL
                     EXISTING CONDITIONS - WITH RECOMMENDED ALTERNATIVE ELEMENTS
                              MODELED AREA = 3.2 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
                      .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
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                      .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     .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
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                      .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

  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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                      .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     .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
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                      .00     .00     .00     .00     .00     .00     .00     .00     .00     .00
                      .00     .00     .00     .00     .00     .00     .00     .00

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

             **************
             *            *
  42 KK      *    S185    *     BASIN
             *            *
             **************
                                  Compute runoff from subbasin 185

               SUBBASIN RUNOFF DATA

  44 BA          SUBBASIN CHARACTERISTICS
                      TAREA        2.42  SUBBASIN AREA

  45 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .16  STARTING LOSS
                        DTH         .35  MOISTURE DEFICIT
                       PSIF        4.35  WETTING FRONT SUCTION
                      XKSAT         .40  HYDRAULIC CONDUCTIVITY
                      RTIMP        1.00  PERCENT IMPERVIOUS AREA

  43 UI          INPUT UNITGRAPH,  45 ORDINATES,  VOLUME = 1.00
                    165.0     166.0     391.0     668.0     960.0    1130.0    1281.0    1613.0    1908.0    1239.0
                   1060.0     936.0     847.0     785.0     677.0     614.0     534.0     438.0     399.0     375.0
                    338.0     271.0     230.0     210.0     183.0     183.0     133.0     126.0     127.0      85.0
                     80.0      82.0      81.0      67.0      32.0      31.0      32.0      32.0      31.0      32.0
                     32.0      31.0      32.0      32.0      32.0
                                                                        ***

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

                          HYDROGRAPH AT STATION      S185
                        TRANSPOSITION AREA       .1 SQ MI

   TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.02, TOTAL EXCESS =    1.18

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                           (CFS)
+    1745.     12.50                304.          77.         26.          11.
                         (INCHES)   1.168        1.180       1.180        1.180
                          (AC-FT)    151.         152.        152.         152.

                           CUMULATIVE AREA =    2.42 SQ MI


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

                          HYDROGRAPH AT STATION      S185
                        TRANSPOSITION AREA     10.0 SQ MI

   TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.90, TOTAL EXCESS =    1.09
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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1616.      12.50                280.         71.          24.          10.
                (INCHES)             1.077        1.089        1.089        1.089
                (AC-FT)              139.         141.         141.         141.

                CUMULATIVE AREA =     2.42 SQ MI

    -----DSS---ZOPEN:  Existing File Opened,  File: FAN1924.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //S185/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                INTERPOLATED HYDROGRAPH AT     S185

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1655.      12.50                288.         73.          24.          10.
                (INCHES)             1.105        1.117        1.117        1.117
                (AC-FT)              143.         144.         144.         144.

                CUMULATIVE AREA =     2.42 SQ MI



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


          **************
          *            *
 52 KK    *    1859F1  *        ROUTE
          *            *
          **************
                PROPOSED CHANNEL
                    Route runoff from S185 to C190F1.
                 Slope=(1442.0 - 1384.0) / 4700.0

          HYDROGRAPH ROUTING DATA

 56 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

 57 RC      NORMAL DEPTH CHANNEL
                   ANL       .045  LEFT OVERBANK N-VALUE
                  ANCH       .045  MAIN CHANNEL N-VALUE
                   ANR       .045  RIGHT OVERBANK N-VALUE
                 RLNTH      4700.  REACH LENGTH
                   SEL      .0120  ENERGY SLOPE
                 ELMAX      105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 59 RY      ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
 58 RX      DISTANCE        .00       .00       .00       .00    160.00    160.00    160.00    160.00

                                          ***

                                COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE         .00      4.54      9.09     13.63     18.17     22.72     27.26     31.80     36.34     40.89
          OUTFLOW         .00     62.65    198.68    390.09    629.39    911.94   1234.42   1594.29   1989.53   2418.44
        ELEVATION      100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE       45.43     49.97     54.52     59.06     63.60     68.15     72.69     77.23     81.78     86.32
          OUTFLOW     2879.58   3371.70   3893.70   4444.60   5023.52   5629.66   6262.27   6920.70   7604.31   8312.52
        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     2418. TO     8313.
                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   1859F1
               TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1662.      12.67                304.         77.          26.          11.
                (INCHES)             1.167        1.180        1.180        1.180
                (AC-FT)              151.         152.         152.         152.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
       11.      12.67                 3.           1.           0.           0.

   PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.89     12.67               100.51       100.13       100.04       100.02

                CUMULATIVE AREA =     2.42 SQ MI


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

                HYDROGRAPH AT STATION   1859F1
               TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1530.      12.67                280.         71.          24.          10.
                (INCHES)             1.076        1.089        1.089        1.089
                (AC-FT)              139.         141.         141.         141.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)        (HR)
       10.      12.67                 3.           1.           0.           0.

   PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)       (HR)
     101.80     12.67               100.48       100.12       100.04       100.02

                CUMULATIVE AREA =     2.42 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //1859F1/FLOW/08JAN1999/5MIN//
      ***           ***           ***           ***           ***


                INTERPOLATED HYDROGRAPH AT   1859F1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)        (HR)
                    (CFS)
+     1571.      12.67                288.         73.          24.          10.
                (INCHES)             1.104        1.117        1.117        1.117
                (AC-FT)              143.         144.         144.         144.

                CUMULATIVE AREA =     2.42 SQ MI



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


          **************
          *            *
 61 KK    *    S190F1  *        BASIN
          *            *
          **************
                    Compute runoff from subbasin 190F1

             SUBBASIN RUNOFF DATA

 63 BA        SUBBASIN CHARACTERISTICS
                    TAREA         .20  SUBBASIN AREA

 64 LG        GREEN AND AMPT LOSS RATE
                    STRTL         .35  STARTING LOSS
                      DTH         .35  MOISTURE DEFICIT
                     PSIF        3.58  WETTING FRONT SUCTION
                    XKSAT         .51  HYDRAULIC CONDUCTIVITY
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

 62 UI        INPUT UNITGRAPH,   9 ORDINATES,  VOLUME =  .99
                 100.0     369.0     475.0     302.0     158.0      80.0      41.0      18.0      12.0
                                                                        ***

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

                HYDROGRAPH AT STATION   S190F1
               TRANSPOSITION AREA       .1 SQ MI
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```
      TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.15, TOTAL EXCESS =    1.05

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     360.     12.08                23.           6.           2.           1.
                (INCHES)         1.044        1.044        1.044        1.044
                (AC-FT)             11.          11.          11.          11.

                CUMULATIVE AREA =     .20 SQ MI


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

                  HYDROGRAPH AT STATION   S190F1
                 TRANSPOSITION AREA     10.0 SQ MI

      TOTAL RAINFALL =    3.99, TOTAL LOSS =    3.03, TOTAL EXCESS =     .96

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     333.     12.08                21.           5.           2.           1.
                (INCHES)          .951         .951         .951         .951
                (AC-FT)             10.          10.          10.          10.

                CUMULATIVE AREA =     .20 SQ MI

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


                INTERPOLATED HYDROGRAPH AT   S190F1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     356.     12.08                22.           6.           2.           1.
                (INCHES)         1.029        1.029        1.029        1.029
                (AC-FT)             11.          11.          11.          11.

                CUMULATIVE AREA =     .20 SQ MI


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

              **************
              *            *
   66 KK      *    C190F1  *      COMBINE
              *            *
              **************
                          Combine runoff from S190F1A w/ routed flow from S185

   68 HC            HYDROGRAPH COMBINATION
                         ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                          ***

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

                    HYDROGRAPH AT STATION   C190F1
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1666.     12.67               327.          82.          27.          12.
                (INCHES)         1.157        1.169        1.169        1.169
                (AC-FT)            162.         164.         164.         164.

                CUMULATIVE AREA =    2.62 SQ MI


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

                    HYDROGRAPH AT STATION   C190F1
                   TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1534.     12.67               301.          76.          25.          11.
                (INCHES)         1.067        1.078        1.078        1.078
                (AC-FT)            149.         151.         151.         151.

                CUMULATIVE AREA =    2.62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //C190F1/FLOW/08JAN1999/5MIN//
       ***             ***             ***             ***             ***


                    INTERPOLATED HYDROGRAPH AT   C190F1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1572.     12.67               308.          78.          26.          11.
                (INCHES)         1.093        1.104        1.105        1.105
                (AC-FT)            153.         155.         155.         155.

                CUMULATIVE AREA =    2.62 SQ MI


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

              **************
              *            *
   70 KK      *    9F19F2  *      ROUTE
              *            *
              **************
                          PROPOSED CHANNEL
                              Route runoff from C190F1 to C190F.
                             Slope=(1384.0 - 1340.0) / 3512.0

                 HYDROGRAPH ROUTING DATA

   74 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

   75 RC           NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH        3512.  REACH LENGTH
                          SEL        .0130  ENERGY SLOPE
                        ELMAX        105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                     CROSS-SECTION DATA
                                  --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
   77 RY          ELEVATION    105.00    100.00    100.00    100.00    100.00    100.00    100.00    105.00
   76 RX          DISTANCE        .00       .00       .00       .00    180.00    180.00    180.00    180.00

                                                          ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                    STORAGE        .00      3.82      7.64     11.46     15.28     19.10     22.91     26.73     30.55     34.37
                    OUTFLOW        .00     73.37    232.70    456.94    737.33   1068.47   1446.47   1868.39   2331.86   2834.91
                  ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

                    STORAGE      38.19     42.01     45.83     49.65     53.47     57.29     61.11     64.92     68.74     72.56
                    OUTFLOW    3375.86   3953.26   4565.83   5212.44   5892.05   6603.76   7346.69   8120.07   8923.18   9755.35
                  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     3376. TO     9755.
                 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   9F19F2
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                  (CFS)
+    1590.     12.75               326.          82.          27.          12.
                (INCHES)         1.156        1.169        1.169        1.169
                (AC-FT)            162.         164.         164.         164.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
      12.     12.75                 4.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.67     12.75              100.51       100.13       100.04       100.02

                CUMULATIVE AREA =    2.62 SQ MI


       ***             ***             ***             ***             ***
```

```
                    HYDROGRAPH AT STATION    9F19F2
                  TRANSPOSITION AREA      10.0 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    1456.      12.83                 301.         76.         25.          11.
                         (INCHES)     1.065       1.078       1.078        1.078
                          (AC-FT)      149.        151.        151.         151.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
 +  (AC-FT)       (HR)
       12.       12.83                   4.          1.          0.           0.

   PEAK STAGE    TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (FEET)       (HR)
    101.59       12.83               100.49      100.12      100.04       100.02

                        CUMULATIVE AREA =     2.62 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/01JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/02JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/03JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/04JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/05JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/06JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/07JAN1999/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.   13:  //9F19F2/FLOW/08JAN1999/5MIN//
        ***           ***           ***           ***           ***


                   INTERPOLATED HYDROGRAPH AT    9F19F2

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +    1491.      12.83                 308.         78.         26.          11.
                         (INCHES)     1.092       1.104       1.105        1.105
                          (AC-FT)      153.        154.        155.         155.

                        CUMULATIVE AREA =     2.62 SQ MI


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


           **************
           *            *
  79 KK    *    S180C   *          BASIN
           *            *
           **************

                      Compute runoff from subbasin 180C

           SUBBASIN RUNOFF DATA

  81 BA        SUBBASIN CHARACTERISTICS
                     TAREA          .21  SUBBASIN AREA

  82 LG        GREEN AND AMPT LOSS RATE
                     STRTL          .35  STARTING LOSS
                       DTH          .35  MOISTURE DEFICIT
                      PSIF         3.50  WETTING FRONT SUCTION
                     XKSAT          .54  HYDRAULIC CONDUCTIVITY
                     RTIMP          .00  PERCENT IMPERVIOUS AREA

  80 UI        INPUT UNITGRAPH,   6 ORDINATES,  VOLUME = 1.00
                     269.0      731.0      387.0      142.0       48.0       20.0
                                                                       ***

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

                    HYDROGRAPH AT STATION     S180C
                  TRANSPOSITION AREA         .1 SQ MI

      TOTAL RAINFALL =     4.20, TOTAL LOSS =     3.17, TOTAL EXCESS =     1.03

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     423.      12.00                  23.          6.          2.           1.
                         (INCHES)     1.024       1.024       1.024        1.024
                          (AC-FT)       11.         11.         11.          11.

                        CUMULATIVE AREA =      .21 SQ MI

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

                    HYDROGRAPH AT STATION     S180C
                  TRANSPOSITION AREA       10.0 SQ MI
```

```
      TOTAL RAINFALL =     3.99, TOTAL LOSS =     3.06, TOTAL EXCESS =      .93

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     392.      12.00                  21.          5.          2.           1.
                         (INCHES)      .930        .930        .930         .930
                          (AC-FT)       10.         10.         10.          10.

                        CUMULATIVE AREA =      .21 SQ MI

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


                   INTERPOLATED HYDROGRAPH AT     S180C

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     418.      12.00                  22.          6.          2.           1.
                         (INCHES)     1.009       1.009       1.009        1.009
                          (AC-FT)       11.         11.         11.          11.

                        CUMULATIVE AREA =      .21 SQ MI


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

           **************
           *            *
  84 KK    *   80C90F   *          ROUTE
           *            *
           **************
                 ROUTE runoff FROM S180C TO C190F
                 Slope=(1451 - 1340) / 8818

           HYDROGRAPH ROUTING DATA

  87 RS         STORAGE ROUTING
                      NSTPS           6  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       8818.  REACH LENGTH
                        SEL       .0130  ENERGY SLOPE
                      ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                      --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  90 RY       ELEVATION    104.00    103.00    102.00    100.00    100.00    102.00    103.00    104.00
  89 RX        DISTANCE       .00     20.00     80.00     84.00     99.00    103.00    163.00    183.00
                                                                ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

     STORAGE        .00       .66      1.35      2.08      2.84      3.64      4.48      5.35      6.26      7.21
     OUTFLOW        .00      4.24     13.56     26.85     43.73     64.00     87.55    114.32    144.27    177.42
   ELEVATION     100.00    100.21    100.42    100.63    100.84    101.05    101.26    101.47    101.68    101.89

     STORAGE       8.32     10.37     13.51     17.72     23.00     29.17     35.71     42.61     49.87     57.49
     OUTFLOW     216.70    267.84    335.23    424.09    538.97    693.16    879.49   1094.09   1336.89   1608.06
   ELEVATION     102.11    102.32    102.53    102.74    102.95    103.16    103.37    103.58    103.79    104.00

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

                    HYDROGRAPH AT STATION    80C90F
                  TRANSPOSITION AREA         .1 SQ MI

   PEAK FLOW      TIME                           MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (CFS)        (HR)
                           (CFS)
 +     251.      12.42                  23.          6.          2.           1.
                         (INCHES)     1.024       1.024       1.024        1.024
                          (AC-FT)       11.         11.         11.          11.

  PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR     166.58-HR
 +  (AC-FT)       (HR)
        2.       12.42                   0.          0.          0.           0.

   PEAK STAGE    TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR     166.58-HR
 +   (FEET)       (HR)
    102.25       12.42               100.32      100.08      100.03       100.01

                        CUMULATIVE AREA =      .21 SQ MI
```

```
      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION   80C90F
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      234.     12.42                21.           5.           2.           1.
                          (INCHES)    .930         .930         .930         .930
                            (AC-FT)     10.          10.          10.          10.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (AC-FT)      (HR)
         2.     12.42                 0.           0.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+    (FEET)      (HR)
     102.18     12.42              100.30       100.08       100.03       100.01

                        CUMULATIVE AREA =     .21 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT   80C90F

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      248.     12.42                22.           6.           2.           1.
                          (INCHES)   1.009        1.009        1.009        1.009
                            (AC-FT)     11.          11.          11.          11.

                        CUMULATIVE AREA =     .21 SQ MI


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

           **************
           *            *
  91 KK    *    S190F2  *        BASIN
           *            *
           **************
                                Compute runoff from subbasin 190F2

              SUBBASIN RUNOFF DATA

  93 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .33  SUBBASIN AREA

  94 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .35  STARTING LOSS
                        DTH         .35  MOISTURE DEFICIT
                       PSIF        3.50  WETTING FRONT SUCTION
                      XKSAT         .54  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

  92 UI          INPUT UNITGRAPH,  14 ORDINATES,  VOLUME = 1.00
                      69.0      264.0      461.0      538.0      442.0      279.0      182.0      113.0       72.0       45.0
                      30.0       14.0       13.0       14.0
                                                                                                                        ***

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

                        HYDROGRAPH AT STATION   S190F2
                       TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    3.17, TOTAL EXCESS =    1.03

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      456.     12.17                36.           9.           3.           1.
                          (INCHES)   1.026        1.026        1.026        1.026
                            (AC-FT)     18.          18.          18.          18.

                        CUMULATIVE AREA =     .33 SQ MI


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

                        HYDROGRAPH AT STATION   S190F2
                       TRANSPOSITION AREA      10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    3.06, TOTAL EXCESS =     .93

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      420.     12.17                33.           8.           3.           1.
                          (INCHES)    .932         .932         .932         .932
                            (AC-FT)     16.          16.          16.          16.

                        CUMULATIVE AREA =     .33 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT   S190F2

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+      447.     12.17                35.           9.           3.           1.
                          (INCHES)   1.002        1.002        1.002        1.002
                            (AC-FT)     18.          18.          18.          18.

                        CUMULATIVE AREA =     .33 SQ MI


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

           **************
           *            *
  97 KK    *     C190F  *      COMBINE
           *            *
           **************
                                Combine runoff from S190F2 with routed flows from C190F1 & S180C
                                This is the total flow at the downstream end of the Fan 19 corridor.

 100 HC          HYDROGRAPH COMBINATION
                      ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                                                                        ***

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

                        HYDROGRAPH AT STATION    C190F
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+     1692.     12.75               385.          97.          32.          14.
                          (INCHES)   1.133        1.145        1.145        1.145
                            (AC-FT)    191.         193.         193.         193.

                        CUMULATIVE AREA =     3.16 SQ MI

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

                        HYDROGRAPH AT STATION    C190F
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+     1541.     12.75               354.          89.          30.          13.
                          (INCHES)   1.042        1.053        1.053        1.053
                            (AC-FT)    176.         177.         177.         177.

                        CUMULATIVE AREA =     3.16 SQ MI

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


                        INTERPOLATED HYDROGRAPH AT    C190F

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+    (CFS)       (HR)
                              (CFS)
+     1579.     12.75               362.          91.          30.          13.
                          (INCHES)   1.065        1.076        1.076        1.076
                            (AC-FT)    179.         181.         181.         181.

                        CUMULATIVE AREA =     3.16 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
+                        S185      1655.   12.50         288.         73.         24.       2.42

          ROUTED TO
+                      1859F1      1571.   12.67         288.         73.         24.       2.42

          HYDROGRAPH AT
+                      S190F1       356.   12.08          22.          6.          2.        .20

          2 COMBINED AT
+                      C190F1      1572.   12.67         308.         78.         26.       2.62

          ROUTED TO
+                      9F19F2      1491.   12.83         308.         78.         26.       2.62

          HYDROGRAPH AT
+                       S180C       418.   12.00          22.          6.          2.        .21

          ROUTED TO
+                      80C90F       248.   12.42          22.          6.          2.        .21

          HYDROGRAPH AT
+                      S190F2       447.   12.17          35.          9.          3.        .33

          3 COMBINED AT
+                       C190F      1579.   12.75         362.         91.         30.       3.16


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


    -----DSS---ZCLOSE Unit:  71,   File: FAN1924.DSS
               Pointer Utilization:   .25
               Number of Records:     32
               File Size:     62.2  Kbytes
               Percent Inactive:    .0
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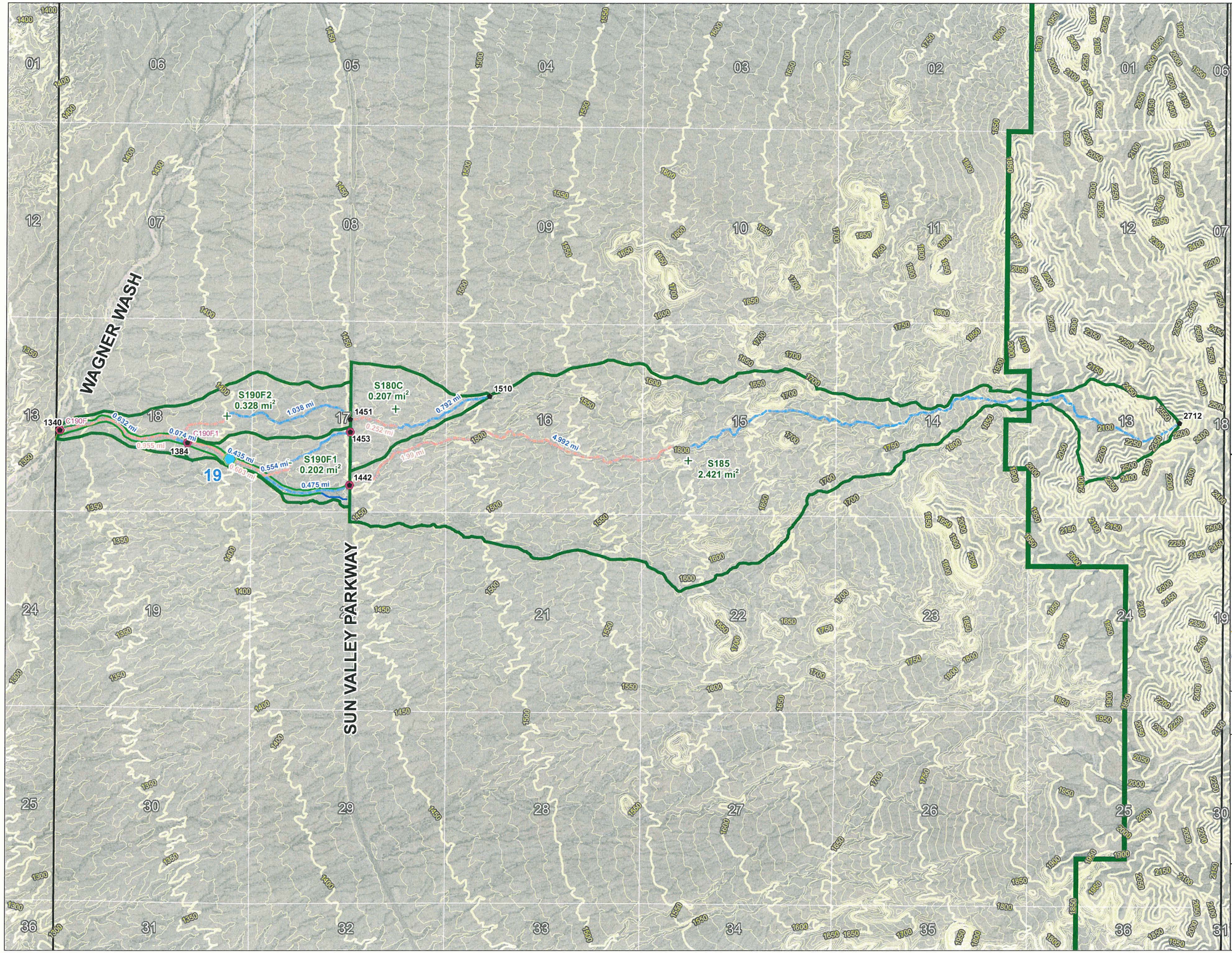


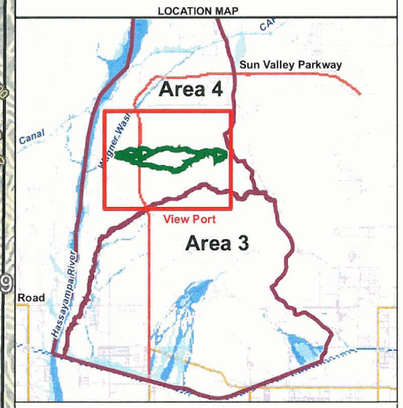
LEGEND

- Subbasin Boundaries
- Subbasin Centroids
- Lca Paths
- Lag & Routing Paths
- Elevation Points
- Concentration Points

Step 3 Corridors

- Floodwall
- No Floodwall
- 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
WAGNER SUB-AREA
FAN SYSTEM 19
SUBBASIN MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 1,000 2,000 3,000

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WAGNER WASH

SUN VALLEY PARKWAY

S190F2
0.328 mi²

S190F1
0.202 mi²

S180C
0.207 mi²

S185
2.421 mi²

10
0.94 in/hr

15
0.54 in/hr

15
0.54 in/hr

71
0.36 in/hr

71
0.36 in/hr

107
0.18 in/hr

107
0.18 in/hr

107
0.18 in/hr

123
0.37 in/hr

100
0.40 in/hr

19

LEGEND

NRCS Soil Data

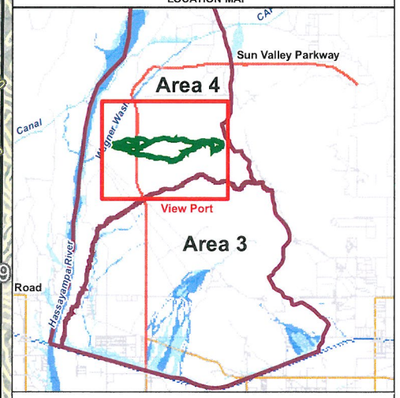
XKSAT (in/hr)

- 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
- 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
WAGNER SUB-AREA
FAN SYSTEM 19
SOIL MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 1,000 2,000 3,000

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WAGNER WASH

SUN VALLEY PARKWAY

S190F2
0.328 mi²

S190F1
0.202 mi²

S180C
0.207 mi²

S185
2.421 mi²

NDR

NHS

NMT

19

LEGEND

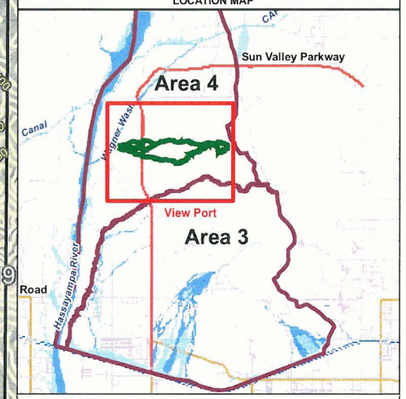
Existing Land Use

- Desert Rangeland (NDR), <5% Slopes
- Hillslopes (NHS), 5-10% slopes
- Mountain Terrain (NMT), >10% Slopes
- Subbasin Boundaries

Step 3 Corridors

- Floodwall
- No Floodwall
- 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
WAGNER SUB-AREA
FAN SYSTEM 19
LAND USE MAP

FCD 2004C049
DECEMBER 2006

N
W E
S

Feet
0 1,000 2,000 3,000

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Appendix F

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

Wagner-Wash

Wagner

CAP

Hassayampa

White Tank Wash

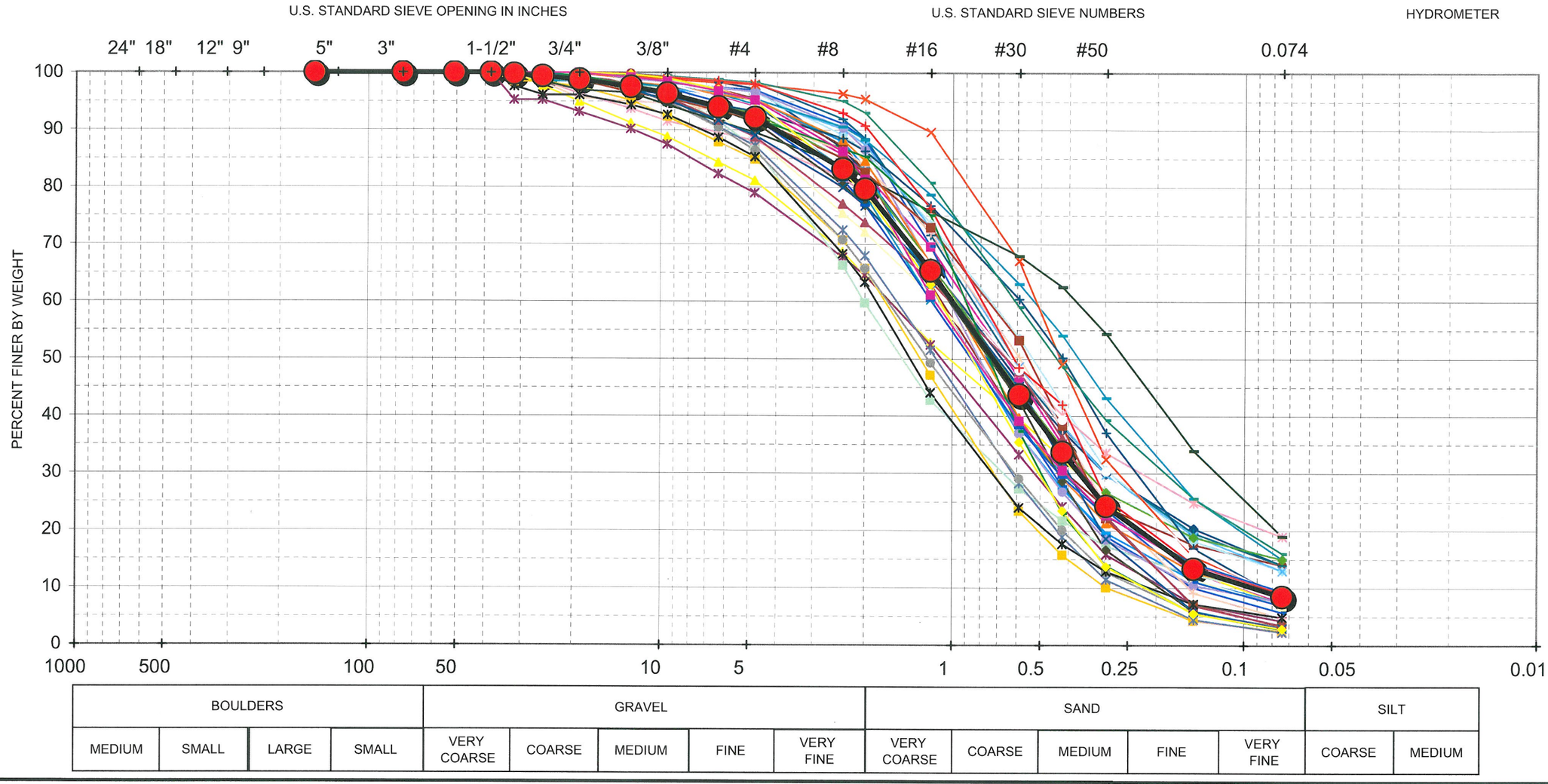
FRS No. 1

FRS No. 2 and 3

WHITE TANK MOUNTAIN REGIONAL PARK

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.