QUEEN CREEK WASH CHANNELIZATION
SOSSAMAN ROAD TO HAWES ROAD
Contract No.: 2000D-03

CLOMR
TECHNICAL DATA NOTEBOOK

Prepared for:

TOWN OF QUEEN CREEK

Registered Professional Engineer (Civil)
CERTIFICATE NO.
21684
BRIAN J.
FRY
Date Signed 1-21-04
ARIZONA, U.S.A.

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Prepared by:

DIBBLE & ASSOCIATES, CONSULTING ENGINEERS
2633 East Indian School Road, #401
Phoenix, Arizona 85016
(602) 957-1155

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

April 2003
Revised January 2004

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TABLE OF CONTENTS

Section 1.0: Introduction
1.1 Purpose of Study
1.2 Authority for Study
1.3 Location of Study
1.4 Summary of Methodology
1.5 Coordination and Acknowledgments
1.6 Study Results

Section 2.0: FEMA Forms and ADWR Abstracts

Section 3.0: Survey and Mapping Information
3.1 Field Survey Information
3.2 Mapping

Section 4.0: Hydrology
4.1 Method Description
4.2 Parameter Estimation
4.2.1 Drainage Area Boundaries
4.2.2 Watershed Work Maps
4.2.3 Gage Data
4.2.4 Statistical Parameters
4.2.5 Precipitation
4.2.6 Physical Parameters
4.3 Problems Encountered During the Study
4.3.1 Special Problems and Solutions
4.3.2 Modeling Warning and Error Messages
4.4 Calibration
4.5 Final Results
4.5.1 Hydrologic Analysis Results
4.5.2 Verification of Results

Section 5.0: Hydraulics
5.1 Method Description
5.2 Work Study Maps
5.3 Parameter Estimation
5.3.1 Roughness Coefficients
5.3.2 Expansion and Contraction Coefficients
5.4 Cross Section Description
5.5 Modeling Considerations
5.5.1 Hydraulic Jump and Drop Analysis
5.5.2 Bridges and Culverts
5.5.3 Levees and Dikes
5.5.4 Islands and Flow Splits

QUEEN CREEK WASH CHANNELIZATION
SOSSAMAN ROAD TO HAWES ROAD

TABLE OF CONTENTS (continued)

5.5.5 Ineffective Flow Areas
5.5.6 Supercritical Flow
5.6 Floodway Modeling
5.7 Problems Encountered During the Study
5.7.1 Special Problems and Solutions
5.7.2 Modeling Warning and Error Messages
5.8 Calibration
5.9 Final Results
5.9.1 Hydraulic Analysis Results
5.9.2 Verification of Results

Section 6.0: Erosion and Sediment Transport

Section 7.0: Draft FIS Report Data
7.1 Summary of Discharges
7.2 Floodway Data
7.3 Annotated Flood Insurance Rate Maps
7.4 Flood Profiles

List of Tables
5.3.1 Manning's "n" Value
6.0 Table of Channel Armoring Calculations for Dibble Reach
7.1.1 Summary of Discharges

List of Figures
1. Vicinity Map
2. Bed Gradations for Queen Creek from Ellsworth Road to Power Road.
3. Bank Gradations for Queen Creek from above Ocotillo Road to Power Road.
4. Thalweg Elevation Change for 2, 25 and 100 Year Flood for Existing Conditions.
5. Yang vs. Acker-White Sediment Transport Equations for Dibble Design Reach with the Preliminary Ryland Design Below Sossaman Road.
6. Sediment Load for Queen Creek for SPRR to Recker Road for Original Design Conditions.
7. Sediment Load for Design Conditions Hawes Road to Power Road Design Reaches.
8. Thalweg Elevation Change for 2, 25, and 100 Year Flood Hydrographs
9. Average Bed Elevation for Yang Equation for 2, 25 and 100 Year Flood Hydrographs.
10. Bed Elevation for One and Two 100 Year Flood Hydrographs for Queen Creek from SPRR to Recker Road.
11. Bed Elevations for Study Reach with Redesigned Ryland Reach.
12. Sediment Load for Study Reach with Revised Ryland Design.

QUEEN CREEK WASH CHANNELIZATION
SOSSAMAN ROAD TO HAWES ROAD

TABLE OF CONTENTS (continued)

Appendix A: References
- A.1 Data Collection Summary (none)
- A.2 Reference Documents

Appendix B: General Documentation and Correspondence
- B.1 Special Problem Reports (none)
- B.2 Contact (telephone) Reports (none)
- B.3 Meeting Minutes or Reports
- B.4 General Correspondence
- B.5 Contract Documents (Scope of Work)

Appendix C: Survey Field Notes
- C.1 Project Survey Report

Appendix D: Hydrologic Analysis Supporting Documentation

Appendix E: Hydraulic Analysis Supporting Documentation
- E.1 Roughness Coefficient Estimation
  - E.1.1 Existing Channel Photographs
  - E.1.2 Improved Channel, Sample Photographs of Landscape Treatment
- E.2 Post Project Conditions HEC-RAS Cross Section Plots
- E.3 Post Project Conditions HEC-RAS Output
- E.4 Pre Project Conditions Model HEC-RAS Cross Section Plots
- E.5 Pre Project Conditions Model HEC-RAS Output

Appendix F: Erosion and Sediment Transport Analysis Supporting Documentation
- F.1 Scour Analysis (HEC-6T Input and Output Files Contained on CD-ROM)
- F.2 Soil Sample Analysis

Appendix G: HEC-RAS Analysis Supporting Documentation
Queen Creek Wash Flood Profile Drawings (HEC-RAS)

Appendix H: FEMA Documents
MT-2 Forms
Current Effective FIRM Panel
HEC-RAS Files on CD-ROM

Exhibit Map (in map pocket) Floodplain Work Map, 1 in. = 200 ft.
Firm Panels (in map pocket) 3060G & 2695G, with Proposed Floodplain.

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QUEEN CREEK WASH CHANNELIZATION
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Section 1.0: Introduction

1.1 Purpose of Study

The existing Queen Creek Wash through the project reach cannot fully contain the 100-year runoff. The existing wash consists of constructed berms on both sides of the wash, and a thick, sandy bed. Existing vegetation in the wash includes mature and seedling Palo Verde and Mesquite trees, as well as other species. Most of this vegetation is concentrated along the toes of slopes. The wash will be channelized from Sossaman Road to Hawes Road, and tie into existing wash channelization at the project's downstream end (Ryland Reach) and tie into the existing wash at the upstream end. Four grade control structures will be constructed. Sediment transport and scour was considered for the project.

The planned improvements will provide 100-year flow capacity in the wash, as well as enhance the community with recreational opportunities. The project will assure 100-year level flood protection for future developments adjacent to Queen Creek Wash. The improvements include channelization, a bridge at Sossaman Road, a paved pathway system, and equestrian access. The new bridge at Sossaman Road is designed to pass the 100-year flood, and to be stable under 500-year flood scour. This report presents the results of the floodplain delineation and requests a Conditional Letter of Map Revision (CLOMR) for the project. The project location is shown on **Figure 1**.

1.2 Authority for Study

Dibble & Associates performed the hydrologic and hydraulic analyses for this study in association with their subcontractors, Cannon and Associates (structural engineering), McCloskey-Peltz (landscape architecture) and WEST Consultants (sediment transport engineers), for the Town of Queen Creek, Arizona. The Project Managers for the Queen Creek Wash Channelization were Tom Narva for The Town of Queen Creek and Brian Fry, P.E. for Dibble & Associates. The project was coordinated with Paul Stears, P.E., Don Rerick, P.E. and Tim Murphy, P.E. with the Flood Control District of Maricopa County (FCDMC). The FCDMC performs the floodplain administration for the Town of Queen Creek. This study was completed in April 2003.

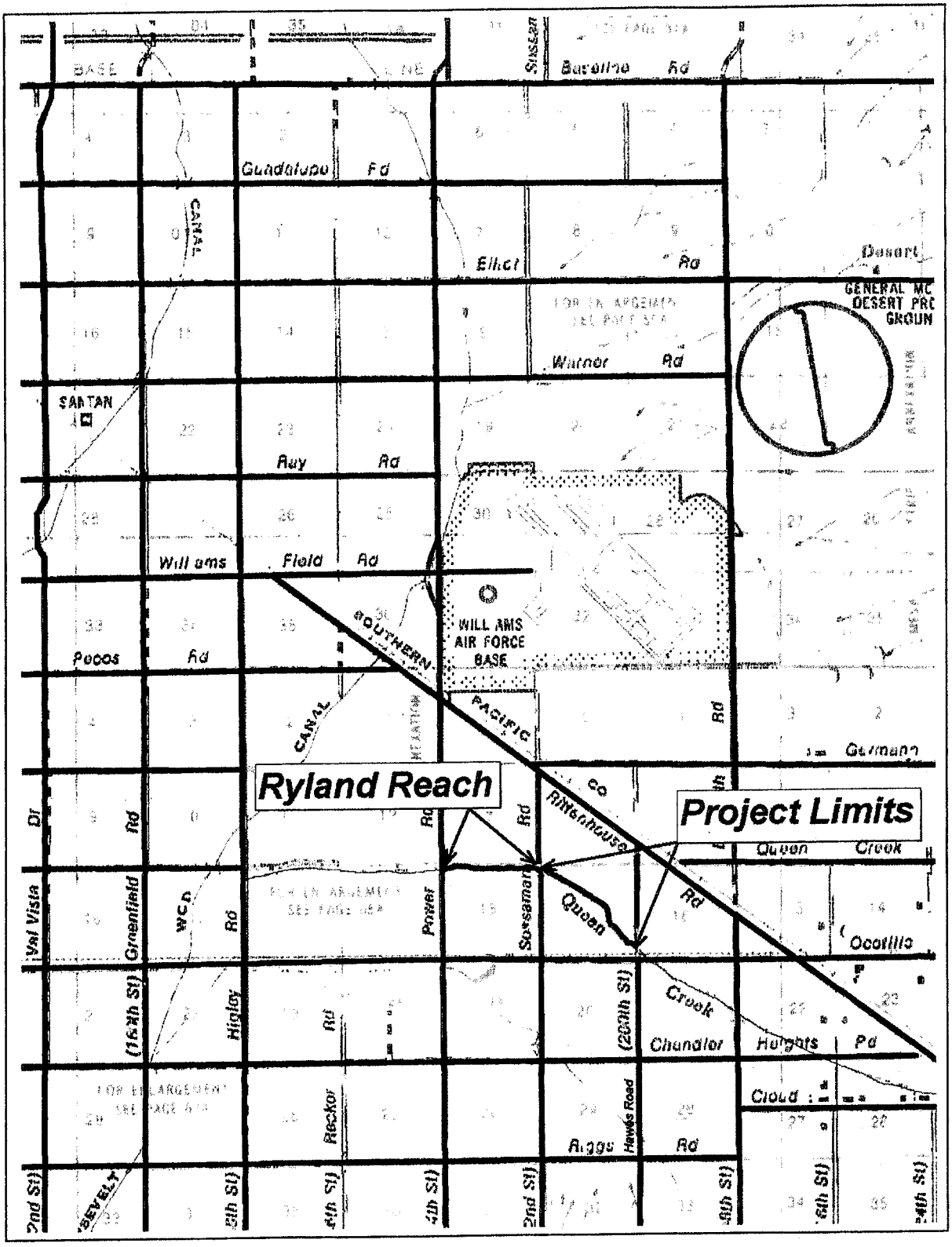

Figure 1 - Project Location

1.3 Location of Study

The Queen Creek Wash study area is located within portions of the Town of Queen Creek and unincorporated Maricopa County. The wash channelization project is located in Section 17, Township 2 South, Range 7 East (Sec17, T2S, R7E). This land section is bounded by Queen Creek Road (extension) on the north, Hawes Road on the east, Ocotillo Road on the south and Sossaman Road on the west. The downstream tie-in occurs in portions of Sections 7 and 18 of Township 2 North, Range 7 East and the upstream tie-in occurs in portions of Section 16 of Township 2 North, Range 7 East. Queen Creek Wash flows from the southeast to the northwest, and is depicted on Flood Insurance Rate Maps (FIRM) 04013C2695G and 04013C3060G. Queen Creek Wash is a tributary to the East Maricopa Floodway (EMF), a constructed channel parallel to the Roosevelt Water Conservation District Canal. The EMF is tributary to the Gila River.

1.4 Summary of Methodology

Floodplain areas are delineated using the HEC-RAS Version 2.2 computer model. The starting water surface was taken from the downstream channelization project, and the upstream water surface ties into the upstream floodplain delineation study. Rainfall-runoff methodology (HEC-1) was utilized for the project hydrology, as explained in Section 4. Using HEC-RAS, water surface elevations are calculated for the proposed channel and the resulting floodplain is delineated. No floodway is delineated, and the 100-year flood is completely contained within the channel banks. The HEC-6T computer program is used for sediment transport and scour computations.

1.5 Coordination and Acknowledgments

The channelization project was coordinated with the following agencies during the study:

- The Town of Queen Creek
- Federal Emergency Management Agency (FEMA)
- The Flood Control District of Maricopa County (FCDMC)

The project was also coordinated with the CLOMR for the downstream channelization project, known as Ryland Reach. The title of this CLOMR is *Queen Creek Wash CLOMR, Power Road to Sossaman Road.* Until that project receives a CLOMR, the current effective hydraulic model used for the current FIRM panel should be used for downstream areas. However, photographs contained in **Appendix E.1.1** depict the nearly complete channel grading. Therefore, the downstream tie-in is made to the CLOMR model for the Ryland Reach. Pre-Project Conditions Model, submitted here with the Post-Project Conditions Model, represents the completed condition of the downstream Ryland Reach.

Initially, the upstream tie-in was the Arroyo de la Reina channelization project. That channelization occurred from Hawes Road to approximately 1,700 feet downstream of Hawes Road. The FIRM panels were revised to reflect the Letter of Map Revision

(LOMR) for the Arroyo de la Reina project on June 21, 2000 (Case Number 00-09-145P). The Arroyo de la Reina LOMR is superseded by this channelization project from Hawes Road to Sossaman Road, because it was decided to modify one bank in the Arroyo de la Reina section to accommodate the paved pathway system. The upstream tie-in point then was coordinated with a previous floodplain delineation study performed for the FCDMC (FCD NO. 95-43) and revised to reflect a LOMR on April 16, 1998 (FEMA Case Number 97-09-1116P). The title of this LOMR is *Technical Data Notebook, Application for Letter of Map Revision, Queen Creek LOMR (Hawes Road to SPRR)*

The public was notified of the project in two public meetings, held on January 14, 2002 and on November 19, 2002. Meeting announcements were mailed to all property owners in the area, and an informational brochure was presented at the first public meeting. The project was also publicized in the local newspaper and on the FCDMC website. Comments from the public were noted or discussed. Copies of the meeting announcements and informational brochure are found in **Appendix B.4.** Intermediate review meetings were conducted between the representatives from Dibble & Associates, the Town of Queen Creek, the Flood Control District of Maricopa County, and the Maricopa County Department of Transportation.

1.6 Study Results

This channelization project indicates that the flooding along Queen Creek Wash will be significantly reduced, with the associated reclamation of property from the 100-year floodplain. It is requested that the existing Zone A floodplain be revised to a Zone AE floodplain. Work Maps showing the 100-year floodplain are based on HEC-RAS modeling. The full-size floodplain work maps for Queen Creek Wash from Hawes Road to Sossaman Road are contained in the map pocket.

The hydraulic analyses for this study are based on the proposed channel construction and the approved flow rates. Water surface elevations would be affected by maintenance or modifications to crossing roadways. Routine maintenance is planned along this segment. The flood elevations shown on the floodplain maps and profile drawings are considered valid only if hydraulic structures remain unobstructed, operate properly and do not fail.

Section 2.0: FEMA Forms and ADWR Abstracts

The FEMA Revision Request MT-2 Forms are found in **Appendix H.** The FEMA and ADWR abstracts are included in this section.

Section 2.0: FEMA & ADWR Abstracts

STUDY DOCUMENTATION ABSTRACT										
INITIAL STUDY		RESTUDY		LOMR		CLOMR	x	OTHER		

Section 2.1. Study Documentation Abstract for FEMA Submittals		
2.1.1	Date Study Accepted	
2.1.2	Study Contractor: Contacts Address Phone Internal Reference No. Subconsultants	Dibble & Associates Brian Fry, P.E. 2633 East Indian School Rd., Suite 401 Phoenix, AZ 85016-6763 (602) 957-1155 Dibble Job No. 10-0078 West Consultants, Sediment Transport Cannon & Associates, Structural Engineers McCloskey Peltz, Inc., Landscape Architects Z&H Engineering, Survey Ricker Atkinson McBee & Associates, Inc., Geotechnical Engineers
2.1.3	FEMA Technical Review Contractor Address Phone Internal Reference Number	**Pending**
2.1.4	FEMA Regional Reviewer Phone	**Pending**
2.1.5	State Technical Reviewer Phone	**Pending** (ADWR nor ADEM no longer provide technical review)
2.1.6	Local Technical Reviewer Phone	Timothy Murphy, P.E. Flood Control District of Maricopa County (602) 506-1501
2.1.7	Reach Description	a. Queen Creek Hawes Road to Sossaman Road Approximately 1.4 miles *FIRM Panels*: 04013C2695 G; 04013C3060 G

		Photo Date: 1956 Latest Photo Revision: 1973
2.2.2	Mapping for Hydrologic Study 1. Type/Source: Scale: Date: 2. Type/Source: Scale: Date:	 FCDMC Aerial Photography - EMF to Hawes Road: Kenney Aerial Mapping, Inc 1" = 200', 2 ft. Contour interval 1998 (Flight Date) FCDMC Aerial Photography - Hawes Road to Maricopa County Line: Aerial Mapping Company 1" = 200', 2 ft. Contour interval 1991 (Flight Date)
2.2.3	Mapping for Hydraulic Study 1. Type/Source: Scale: Date: 2. Type/Source: Scale: Date: 3. Type/Source: Scale: Date 4. Type/Source: Date:	 FCDMC Aerial Photography - EMF to Hawes Road: Kenney Aerial Mapping, Inc 1" = 200', 2 ft. Contour interval 1998 (Flight Date) FCDMC Aerial Photography - Hawes Road to Maricopa County Line: DTM, Inc. 1" = 200', 2 ft. Contour interval 1991 (Flight Date) Project Mapping – Hawes Road to Ocotillo Road: Aerial Mapping Company, Inc. 1'=200', 2ft. Contour interval 2001 (Flight Date) Ground survey data along Queen Creek Z&H Engineering, Inc. October 2001

Section 3.0: Survey and Mapping Information

3.1 Field Survey Information

Z&H Engineering completed the mapping control survey for a 400' swath of new mapping along the project reach. This mapping was completed by Aerial Mapping Company and is described in more detail below. Survey was conducted in October of 2001 under the direct supervision of Dave Vander Linden, RLS. In addition to surveying for mapping control, Z&H Engineering also collected data for hydraulic structures. The topographic mapping and floodplain elevations are placed on the National Geodetic Vertical Datum of 1988. **Appendix C** contains the project survey report.

3.2 Mapping

At project startup, FCDMC supplied all of the aerial mapping that had been performed to date in the project area. This mapping was generated as part of other hydrologic or hydraulic studies performed in the area. The HEC-RAS and HEC-2 models that were pasted together to form the compilation HEC-RAS model supplied by FCDMC were created from this mapping. Two different sources generated this mapping- the reach from the EMF to Hawes Road was performed by Kenney Aerial Mapping (KAM), while the reach from Hawes Road to the Maricopa County line was generated by DTM, Inc. This mapping was reportedly based on National Geodetic Vertical Datum of 1929 (NGVD '29).

Evaluation of this mapping and comparison with the survey being performed as part of this project showed that the mapping provided by FCDMC was not on NGVD '29 as reported, and in fact, had vertical control errors that would render it useless until corrected. Certain elevation reference marks (ERM's) in the Queen Creek/Gilbert area appear to be stamped with erroneous elevations. Some of these ERM's were used for the vertical control for the FCDMC mapping. This introduced a "tilt" or a "vertical skew" in the mapping. Once this was discovered, the vertical control points that were used for the FCDMC mapping were resurveyed and a "correction factor" was calculated for each set of mapping. The original mapping companies then corrected the mapping based on the correction factors. It should be noted that a decision was made to use North American Vertical Datum of 1988 (NAVD '88) for this project.

Z&H Engineering employed Bob Phillips of GPS Services to investigate the errors in the mapping. A full report of the mapping errors and corrections, produced by Bob Phillips, can be found in **Appendix C**.

In addition to the FCDMC mapping, a 400' swath of new mapping was generated along Queen Creek Wash from Sossaman Rd. to Hawes Rd. to be used for construction document generation. This mapping was performed by Aerial Mapping Company, Inc. (AMC). This mapping was not used for hydraulic modeling, but was compared to the mapping obtained from FCDMC to ensure quality and duplicity. The new mapping was

also based on NAVD '88 datum. A digital photo was also generated, which can be overlain with the mapping CAD file.

Section 4.0: Hydrology

Existing conditions flows have previously been determined for the study reach and are published in the FEMA FIS for Maricopa County, "Queen Creek Wash at Hawes Road." Existing conditions FEMA-approved runoff values are higher than future land use runoff values and the revised existing conditions runoff values presented by the revised hydrology model. Therefore, the FEMA-approved existing conditions runoff values govern the design of the Queen Creek Wash improvements. In other words, the channel is designed for 3010 cfs, from the existing Flood Insurance Study, and this is expected to decrease to 2831 cfs in the future.

The primary purpose of the current, i.e. revised, hydrologic analysis is to reevaluate existing conditions runoff values and determine future land use runoff values; these values are compared to FEMA-approved existing conditions runoff values, the largest of the three to be used for the design of wash improvements from Hawes Road to Sossaman Road, as well as to review the design performed by Coe & Van Loo (CVL) for Ryland Homes for the reach from Sossaman Road to Power Road. The project builds from the *Queen Creek and Sanokai Wash Hydraulic Master Plan* (HMP), completed in September, 2000. The Flood Control District of Maricopa County (FCDMC), in cooperation with the towns of Gilbert and Queen Creek, conducted the HMP study as a means to assure 100-year level flood protection for future developments adjacent to Queen Creek and Sanokai Washes. The existing Queen Creek Wash through the project reach cannot fully contain the 100-year runoff. The recommended improvements will provide 100-year flow capacity in the wash, as well as enhance the community with recreational opportunities. The improvements include a bridge at Sossaman Road, a paved pathway system, and equestrian access. The revised hydrology is described in the publication *Queen Creek Wash, Power Road to Hawes Road, Revised Hydrology*, and is available upon request. The revised hydrology is not being submitted for review at this time.

4.1 Method Description

As described above, existing conditions runoff values for the study area have been published in FEMA FIS for Maricopa County. Revised, existing land use and future land use hydrology for the Queen Creek area is developed using the U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package* (HEC-1) computer program. Guidance is given in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (DDM1) for application of the HEC-1 program within Maricopa County. The application of these tools and the project hydrology are more specifically described in the publication *Queen Creek Wash, Power Road to Hawes Road, Revised Hydrology*, and will not be repeated here.

Section 5.0: Hydraulics

5.1 Method Description

The existing wash consists of constructed berms on both sides of the wash, and a thick, sandy bed. Existing vegetation in the wash includes mature and seedling Palo Verde and Mesquite trees, as well as other species. Most of this vegetation is concentrated along the toes of slopes.

The project design criteria set forth at project startup dictated that the proposed improved channel be stable with respect to sediment transport, that the design eliminate the existing berms on both sides of the wash, and that the proposed channel have capacity for the 100-year flow rate.

A spreadsheet program was developed, which allowed the wash to be analyzed based on sediment transport characteristics. The spreadsheet allows the geometric and roughness characteristics to be varied by the user, and then uses those values to calculate the sediment transport capacity of the cross section.

The initial design approach incorporated a "9-point" channel cross section. A "pilot channel" was designed at the center of the cross section, which would have capacity for approximately the 2-year storm runoff, with overbank areas designed to carry the balance of the 100-year storm runoff. When the first design iteration was completed based on sediment transport loads, the geometry of the pilot channel for most of the design reach closely resembled the geometry of the existing wash bottom.

This inspired the second and ultimate design approach- use the existing wash bottom as the pilot channel wherever possible, and design the wash "from the top, down". This allows the existing sandy bed of the wash to remain in place, and much of the existing vegetation to be preserved. The wash was redesigned with this approach using the new project aerial mapping and HEC-RAS computer program, v. 2.2. Using HEC-RAS, cross section data is entered for the full length of the study wash, including four cross sections at each bridge. The bottom 2 feet (approximately) of the existing wash is left as-is, and overbank areas were cut into the side slopes until the cross section had capacity for the 100-year storm. The existing berms are removed as the overbank areas are cut into the slopes.

The starting water surface value for the HEC-RAS computer model has been determined from the 100-year water surface elevation of the downstream reach. This model is the Queen Creek CLOMR prepared for Ryland Homes, Power Road to Sossaman Road. Cross sections from this model have been copied into the Pre-Project Conditions model for this project. A FEMA approved existing conditions flow rate has been applied the Pre-Project Conditions model to determine the starting water surface elevation for the current project. The use of the FEMA approved existing conditions flow rate is supported in **Section 4.0: Hydrology**.

5.2 Work Study Maps

Appendix G (reduced-size) contains the work study maps showing the improved floodplain limits. A full size set of work study maps are found in the map pocket.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Two roughness coefficient investigations have been performed as par of this project, existing channel conditions and improved channel conditions. **Appendix E.1** contains color photographs and supporting roughness coefficient calculations. Landscape plans, detailing the proposed landscape treatment for the improved channel are being included with the channel construction plans with this submittal.

Manning's roughness coefficients, or "n"-values, are determined using procedures adopted by the USGS. The following supporting materials are used in this analysis:

- Aerial Photographs: March 26, 2001 1:14,400 contact prints by Aerial Mapping Company, Inc. used for base mapping of study area.
- Ground Photographs: Color photographs taken during field reconnaissance trips.
- Field Data: Information gathered during field reconnaissance trips.
- Plant Data: From Mountain States Nursery Website.

The Manning's "n"-value is affected by many factors including bed material, cross section irregularities, depth of flow, vegetation, channel alignment, channel shape, obstructions, suspended material and bed-load. The typical USGS procedure consists of selection of a base "n"-value and the addition of several adjustment factors to determine a total roughness coefficient for each channel sub-section (main channel and overbanks).

The base "n"-value accounts for roughness due to the bed material (Thomsen, 1991, Table 1). Where bank armor is utilized, the Arizona Department of Water Resources Manual for Engineering Analysis of Fluvial Systems provides an equation for calculating a "n"-value based on the size of bed material.

$$n_b = 0.0395 \times D_{50}^{(1/6)}$$

Where D_{50} = Diameter, in feet, in which 50% of the particles (by weight) are smaller.

This equation yields a base Manning's n-value of 0.035 for the bank armor sections. However, as stated above, the actual "n"-value is affected by many factors. Further refinements to the n-value are made based on, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona.* From this publication, it is found that the primary factors affecting the n-value are surface irregularities, obstructions and vegetation with consideration also given for depth and

meander. And excerpt from this publication is included in **Appendix E.1**. Based on the primary factors, the n-value is estimated from the equation;

$$n = (n_b + n_1 + n_2 + n_3) f_m$$

Where;

nb = base Manning's value for a straight uniform channel
n1 = value for surface irregularities
n2 = value for obstructions
n3 = value for vegetation
fm = factor for meander

There are three typical "n"-values used in this analysis and are summarized in **Table 5.3.1**.

Condition	nb	n1	n2	n3	fm	n
Existing	.024	.001	.004	.010	1.0	**.039**
New Landscape	.024	.001	.004	.015	1.0	**.044**
New Landscape in Bank Armor	.035	.001	.004	.015	1.0	**.055**

Adjustment for surface irregularities (n1): While the channel is intended to be as smooth as possible, it is expected that since this is an earth channel, there will be a minor degree of irregularity. Hence, the value for n1 is 0.001.
Adjustment for obstructions (n2): Since the channel is expected to be regularly maintained, the channel will be mostly free of large rocks and debris during dry times. However, because this is a "natural" channel, it is expected that minor debris could be present during flood events. Therefore, the value for n2 is 0.004.
Adjustment for vegetation (n3): The existing landscape consists of un-maintained desert trees and native brush. This vegetation is mostly concentrated along the channel banks with the main part of the channel open and the depth of flow is one to two times the height of the vegetation. This relates to a value of n3, for existing conditions, of 0.010. Because of the proposed plant type and density of landscape for the design condition, the value for n3 is 0.015 (when the landscape is mature and well maintained). The higher value for the design condition is justified due to the overall average increase in plant density over existing conditions.
Meander factor (fm): While the channel does have some bends built into the design, the effect of this will be negligible due to the low anticipated velocities. Therefore, the factor for meander, fm, is 1.0.

5.3.2 Expansion and Contraction Coefficients

Expansion and contraction coefficients for use in modeling Queen Creek Wash in HEC-RAS are 0.3 and 0.5, respectively, for cross sections that model structures such as culverts. Expansion and contraction coefficients of 0.1 and 0.3, respectively, are used in locations of open channels, or areas not affected by drainage structures.

5.4 Cross Section Description

HEC-RAS cross sections are spaced at approximately 100-foot intervals, and are more tightly spaced where a more detailed modeling of the terrain is necessary. Additional cross sections are added at roadway or driveway culverts, as required for proper modeling in the RAS model. In general, cross sections are oriented southwesterly to northeasterly and perpendicular to the Queen Creek Wash. Cross section data are obtained from the project mapping and supplemented at culverts/bridges with survey data.

The pilot channel for the proposed wash will be the existing bed and will have capacity for approximately the 2-year storm runoff. The overbank areas are level. The slopes connecting the overbank areas to existing ground are generally 6:1 (h:v).

There are locations along the wash where constraints dictate that no overbank area be constructed. Attempts were made to keep impacts to these areas to a minimum; however, steep existing side slopes are flattened in the proposed design to be no steeper than 4:1.

No overbank is constructed along the south side of the wash, from approximately station 65+00 through station 80+00. The design constraint in this instance is the existence of residential properties along the south bank of the wash. These residences are in unincorporated Maricopa County. Some of these properties actually extend out into the wash. In lieu of taking right-of-way in order to construct the southern overbank through this reach, the proposed design simply flattens the side slopes from 1:1 or steeper in some locations, to a slope no steeper than 4:1, and no flatter than 6:1. The overbank area along the north side of this reach has been widened to make up for the lost conveyance area.

The paved maintenance road is parallel to the wash along the top of the south bank from station 50+00 (Sossaman Road) to station 63+00. As the maintenance road approaches the residences in the unincorporated county island, it will cross over from the south side to the north side. Due to limited right of way through this reach, the maintenance road transitions down to the north overbank area, where it remains until it reaches Hawes Road. Access will be provided to the maintenance road both above and below the bridge at Hawes Road and the proposed bridge at Sossaman Road.

At cross sections 121+00 and 122+00 a property wall is proposed at the right bank station of the channel, this wall has been modeled into the HEC-RAS model at these cross sections. The wall provides containment for the 100-year event; however, the water surface extends less than a tenth of a foot above the channel top of bank.

At cross sections 118+00 and 119+00 there exists an area of low lying ground just left of the channel section. It is the intention of the town of Queen Creek to fill in this area, removing any adjacent low lying ground. The HEC-RAS model and channel construction documents have been modified to show this area filled in.

At some cross sections, levees modeled do not represent physical levees to be constructed with the channel improvements. The modeling tool termed levee is used to

keep flood waters out of low lying ground, below the water surface elevation, on either side of actual physical containments of flow. There are a number cross sections where it is unreasonable to expect that flood waters will erode the substantial length of earth beside the channel; therefore, a levee is modeled.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

No hydraulic jumps are modeled in the study area. Four grade control structures exist along the improved channel; however, these structures are buried and do not affect channel hydraulics. Refer to Section 6.0 for information on erosion and sediment transport.

5.5.2 Bridges and Culverts

The Town of Queen Creek plans to build a new bridge to convey Sossaman Road traffic over Queen Creek Wash. The new bridge will replace existing pipe culverts that now carry the flow under the existing roadway. Bridge construction plans and channel construction plans are included with this submittal as a separate plan set. There are no other culverts or bridges within the limits of the improvements to Queen Creek Wash. A bridge exists at Hawes Road; this bridge was previously modeled and reviewed by FEMA as part of a previous project.

The bridge roadway section will accommodate 5 lanes of traffic. It consists of two lanes in each direction with 6-foot-wide shoulders and a 12-foot-wide left turn lane/median. The clear roadway width of the bridge will be 74 feet. There will be 6-foot-wide raised sidewalks on each side of the bridge with metal railing which conforms to AASHTO requirements.

The roadway design speed for the bridge is 50 mph. The bridge profile will be on a vertical curve and the bridge roadway will have a 2% cross slope in each direction.

The Sossaman Road Bridge will be designed for the following hydraulic requirements:

a) The bridge opening under the bridge is 115 feet based on requirements determined by hydraulic analysis using the HEC-RAS computer program.

b) The bridge is designed to pass flow from the 100-year flood event

Q100 =	2831 cfs
Velocity100 =	6.34 feet/second
Water Surface Elevation100 =	1359.31

c) The bridge is checked for scour to verify that it will be stable when subjected to the 500-year flood event.

Q500 =	4813 cfs

Velocity500 =	7.41 feet/second
Water Surface Elevation500 =	1360.55

d) Bridge piers and abutments are designed for scour forces.

5.5.3 Levees and Dikes

No levees or dikes are modeled in the study area. No levees or dikes exist in the areas mapped by detailed methods.

5.5.4 Islands and Flow Splits

No islands or flow splits are modeled in the study area. No islands or flow splits exist in the areas mapped by detailed methods.

5.5.5 Ineffective Flow Areas

Because the study reach is an improved channel, it has been designed to remove any significant areas of ineffective flow. No ineffective flow areas are modeled in the study area.

5.5.6 Supercritical Flow

Critical depth and supercritical flow occurs in limited areas, and not for any length longer than one cross section. The floodplain is mapped using the results from the subcritical flow regime results.

5.6 Floodway Modeling

A floodway is not modeled as part of this project.

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

One special problem exists for this study. A survey discrepancy was encountered when various mapping and survey products were compared. This problem and its solution are described in **Section 3.2**.

5.7.2 Modeling Warning and Error Messages

Messages printed in the HEC-RAS output file include:

- Critical Depth
    - During standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

- Velocity Head
    - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
- Energy Equation
    - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
    - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
- Conveyance Ratio
    - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

- Manning's n Values
    - Manning's n values were composited to a single value in the main channel.

The above warning messages are normal and expected for an improved channel such as Queen Creek Wash.

5.8 Calibration

No known water surface elevations, historical flood records, or previous detailed studies are available from which to calibrate the hydraulic model or 100-year floodplain limits. This floodplain delineation updates and revises the Zone A delineation (Panels 4013C2695 G and 04013C3060 G).

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The HEC-RAS summary tables in **Appendix E.3** summarize the results of the hydraulic analyses, for the areas modeled in the HEC-RAS computer program. The final water surface elevations are reported on the floodplain delineation map.

5.9.2 Verification of Results

The input parameters for the HEC-RAS model are applied in a manner consistent with standard engineering practices for floodplain delineation studies. The improved channel floodplain is completely contained within the channel banks. The effects of erosion and sediment transport were considered in the channel design. There is no reason to doubt the accuracy or validity of the floodplain delineated in this study.

Section 6: Erosion and Sediment Transport

The erosion and sediment transport analyses were completed under the direction of Gary Freeman, P.E. and were presented in the Queen Creek Wash, Power Road To Hawes Road, Contract No.: 2000d03, Pre-Design Report. The results of those analyses remain valid, and the recommendation for two drop structures (with a total drop of 4.2 feet) is modified to four 1.5-foot high drop structures (with a total drop of 6.0 feet) at the following locations: Stations 49 + 00, 52 + 10, 92 + 50, and 110 + 75. The following text is excerpted directly from Chapter V, Sediment Transport and Scour and from Chapter IX, Sossaman Road to Power Road Channel Review, without modification.

SEDIMENT TRANSPORT AND SCOUR

An inspection of Queen Creek Wash from Power Road to Hawes Road indicates the creek is relatively stable in its current configuration however the channel is constrained and filled with dense vegetation below Sossaman Road. A site inspection by a team of WEST and Dibble personnel indicated no apparent vertical instabilities in the reach. The team walked the reach from Hawes Road to Power Road inspecting the vegetation, channel and banks. The reach appeared to be stable with the exception of bank erosion along the south bank of the County Island in the western half of section 17 between Hawes and Sossaman Roads.

The existing channel from Sossaman Road to Hawes Road (Dibble Reach) is less constrained than the channel from Power Road to Sossaman Road (Ryland Reach). The existing base of the channel is wider and levee heights are, for the most part, lower. The channel contains a large amount of vegetation but less than the upstream portion of the Ryland section which is currently densely vegetated. The vegetation consists primarily of desert wash vegetation with large areas of bare sand bed. The vegetation has a significant impact on flow in the channel and may direct flows towards the banks and other areas where vegetation is less dense. Currently flow paths exist between the vegetated areas but over time some clearing or adjustment in levee heights may be necessary to insure channel capacity.

Bank protection has been previously installed along portions of the north and south bank of the wash and will likely be necessary in the current project to protect homes built adjacent to the wash and on bends where vegetation is absent or not sufficient for protection.

Sediment samples were obtained for the reach from Power Road to Ellsworth Road to assist in modeling the wash. This sediment data was used in both the WEST and CVL studies as the basis for sedimentation in the wash. Sediment samples obtained by WEST for an earlier study were also used in this study to reduce the number of sediment samples necessary to describe the bed and banks of the wash. The size distribution data for the various samples are shown in **Figure 2**.

The sediment gradations are very similar between the banks and the sub-bed of the wash in areas where the sand bed is relatively shallow. This can be noted by comparing the sub-bed material (1.5-3.0 samples) with that obtained from the banks in the same areas.

The bank gradations are shown in **Figure 3**. The bank and sub-bed samples obtained for this study were classed as CL, CL-ML, SC-SM or SC – all indicating the presence of clay in the samples. The banks in this area exhibit erosion features indicating that the sub-bed and banks are erodible regardless of the clay content in the soils.

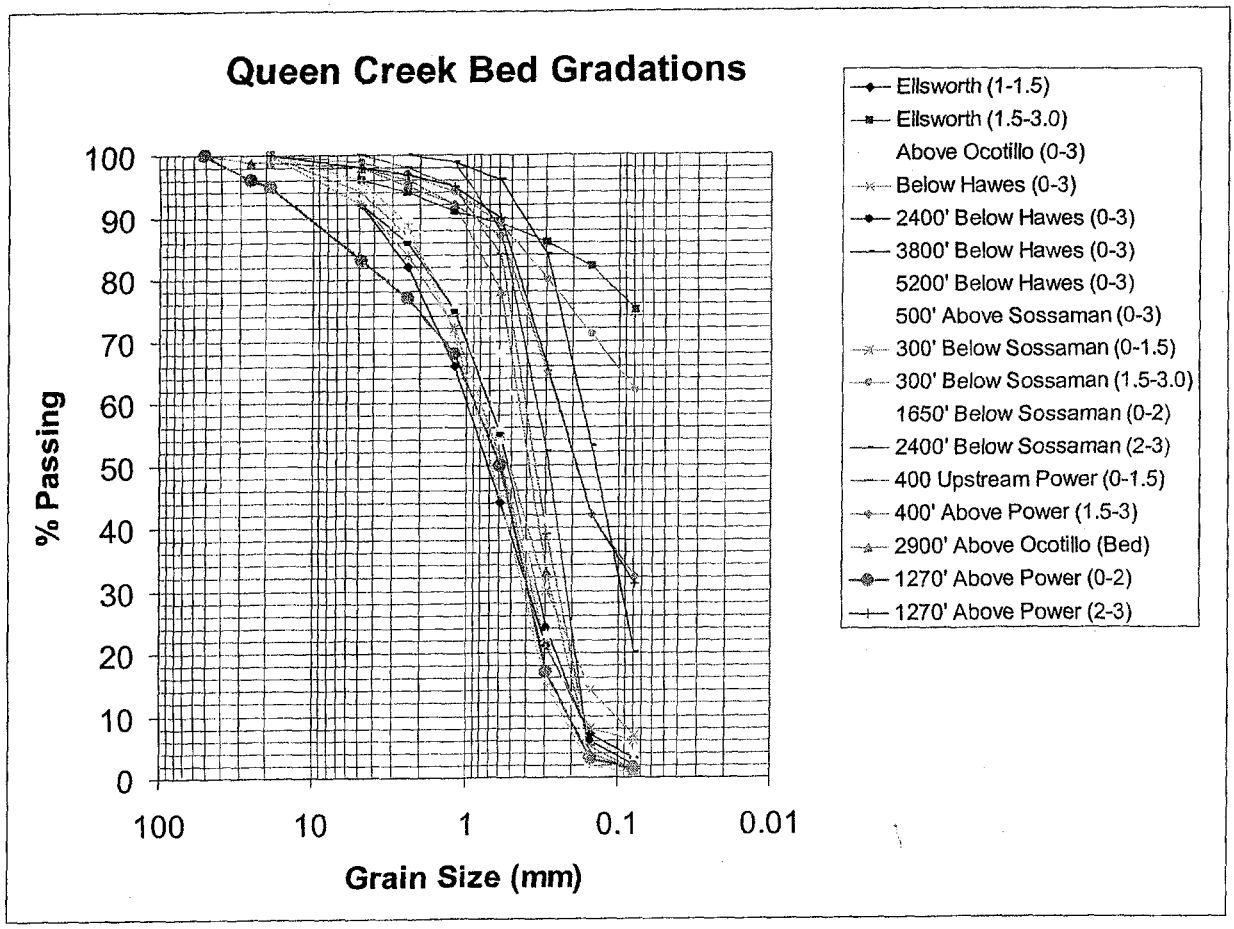

Figure 2 – Bed Gradations for Queen Creek from Ellsworth Road to Power Road. Numbers in parentheses indicate sample depth below bed in feet.

The bank and sub-bed materials are similar within a reach but vary significantly from reach. This can be shown by comparing sub-bed samples taken at Ellsworth Rd (1.5-3.0), 300' below Sossaman Rd (1.5-3.0) and 400' above Power Rd (1.5-3.0), (see **Figure 2**) which represent the parent material under the active bed of the channel. These samples can be compared with the bank gradation plots in **Figure 3**. The similarities between the sub-bed and bank material is obvious when comparing the two plots. Based on the soil samples and field observations, the sub-bed and banks appear to be less erodible than the sand bed of the channel due to the

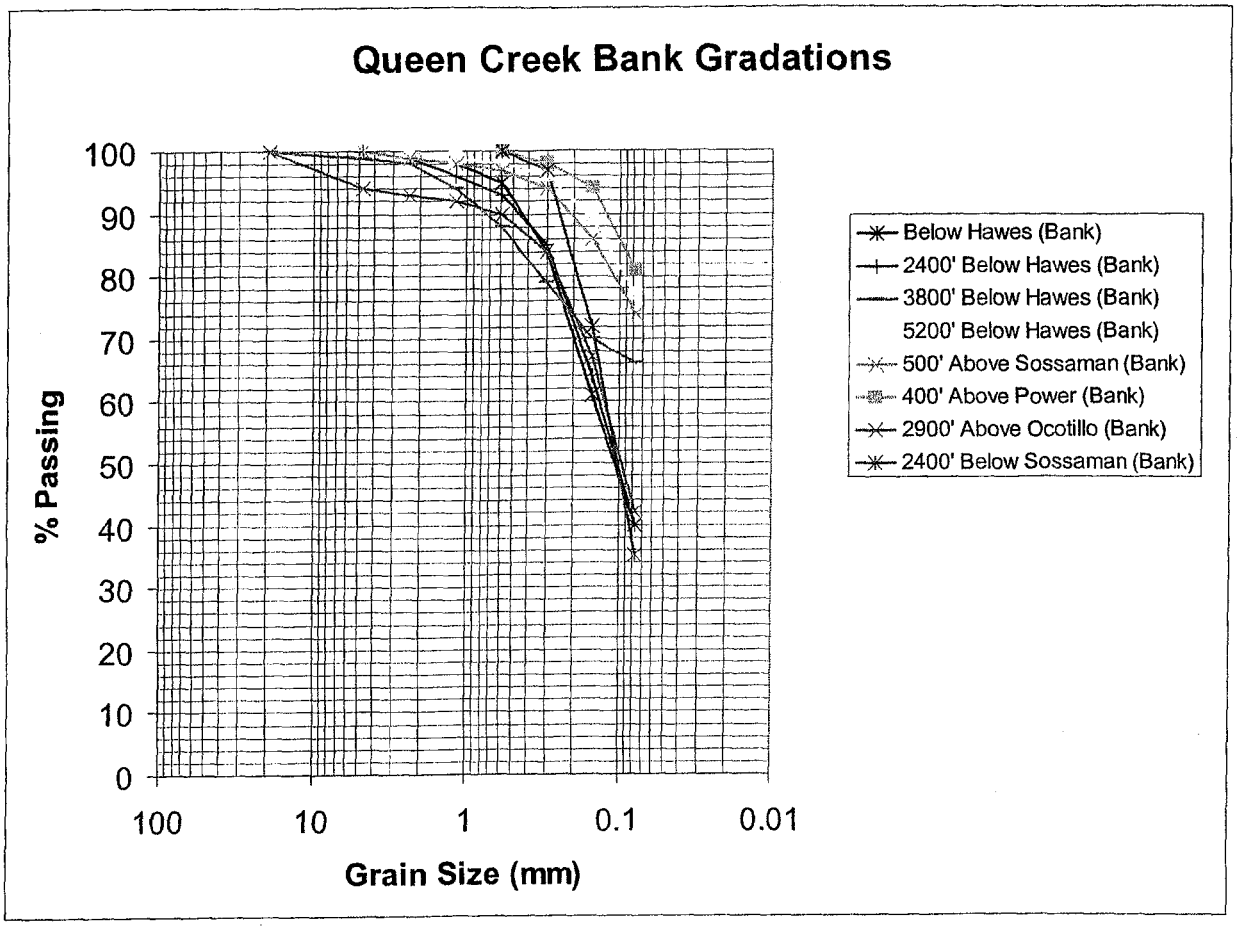

Figure 3 – Bank Gradations for Queen Creek from above Ocotillo Road to Power Road.

influence of the clay soil fractions. Based on the soil samples, erosion should be slower than that of the sand bed. Erosion of the banks during flood events could, however, be rapid and under direct attack the banks could recede at dramatic rates if not protected from erosion. In fact an eye witness account from one of the adjoining landowners indicated that just downstream of Haws road the bank retreated 40 feet or more during a single flood event. This was prior to the installation of the bank protection on the outer bank and illustrates the importance of protection for bends in the wash.

Currently there is sufficient sediment being transported into the design reach from upstream of Ellsworth and Hawes Roads to maintain a stable channel. As development continues in the area upstream from Hawes Road and sediment sources are reduced, the local sediment inflow will be reduced. This will combine with the impacts of the upstream Sanoki Flood Retention Structure (FRS) to cause a major reduction in the inflowing sediment load in the channel. At some future time, the sand in the system will likely be removed resulting in probable impacts to channel vegetation. This will result in the sub-bed being exposed to erosion unless armoring occurs within the active bed. While this condition does not appear to be imminent, it represents the probable future condition of the wash. The sand bed is important ecologically as it helps retain water for

vegetation and reduces evapotranspiration below what would occur from the bare native soil, aiding in both the establishment and growth of wash vegetation.

Development of the Sediment Transport Model

The HEC6T software version 5.13.15 was used to analyze the sediment transport characteristics of the designed channel for Queen Creek Wash for the 2, 5, 10, 25, 50 and 100 year events. An HEC-6T model was developed based on the HEC-RAS model provided to WEST by Dibble. The cross-section locations and the river-station numbering were converted from the HEC-RAS model and used as the geometry input for the sediment model. Since HEC-6T does not provide a straightforward method of inputting the cross-sections at the bridge and culverts, the cross-sections at these locations were modified so that they approximated the presence of the bridges and culverts. The other related data such as the reach-lengths, bank station locations and expansion/contraction coefficients were also based on the values used in the HEC-RAS model. The Manning's n values were based on those used in the HEC-RAS model. In order to analyze the sensitivity of the model to changes in roughness values the supplied Manning's n values were varied in the reach between Hawes Road and Power Road.

The HEC-6T model was developed using a supply reach rather than a equilibrium inflowing sediment load. This methodology gives an idea of the impact a clear water inflow has on existing bed elevations but features a sufficiently long model segment upstream of the design reach to allow the model to reach equilibrium transport conditions prior to flows reaching the area of interest. The impact of a clear water inflow on the design reach can be approximated by noting the lowering of the thalweg by about 3 feet at the far left side of **Figure 4** for the 100-year flood.

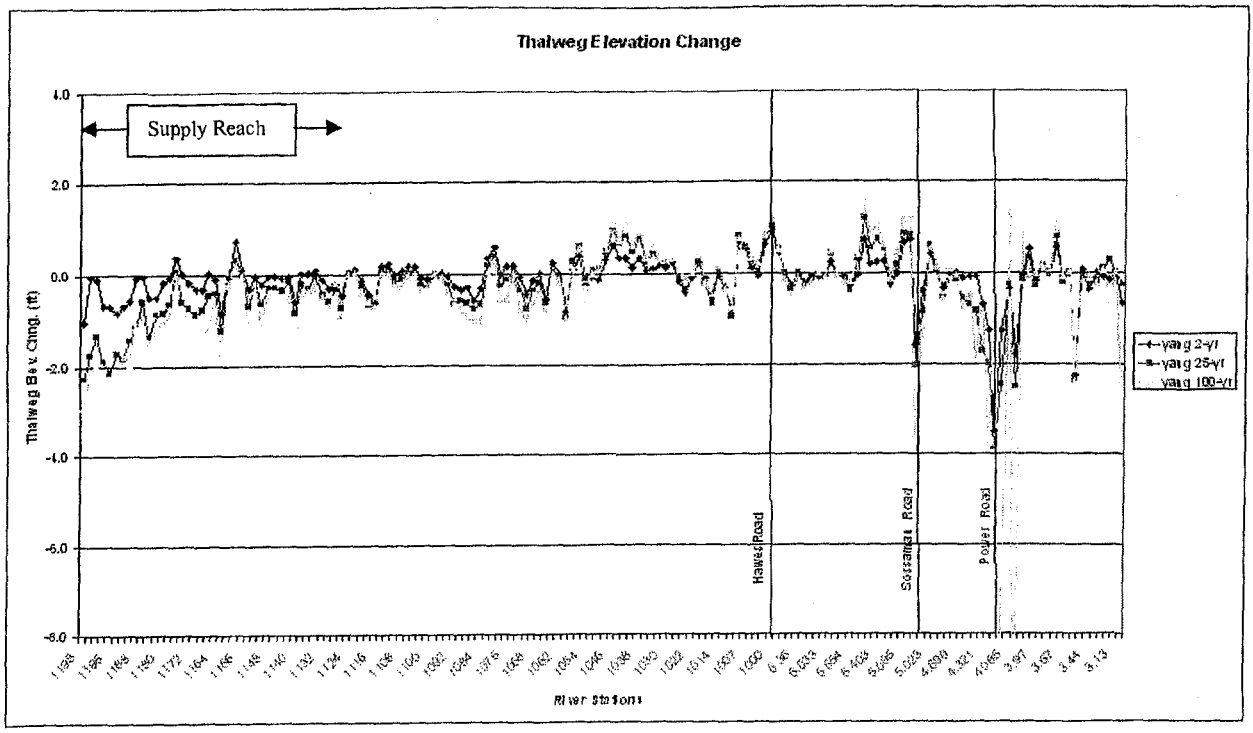

Figure 4- Thalweg Elevation Change for 2, 25 and 100 Year Flood for Existing Conditions.

The Manning's n value for a bare sand bed with gradations typical of those in the Dibble Reach is approximately 0.018. This very low n value yields a higher velocity and a lower slope for channel stability. The vegetation in the wash, however, increases the roughness significantly and it is estimated that the n value in the wash is currently 0.035 or higher. The vegetation is currently estimated to cover more than 50% of the wash in some areas. Since the current design anticipates leaving the current wash bed undisturbed with the existing vegetation, it can be anticipated that the Manning's n value for the wash will not be the 0.018 predicted for the bare sand bed. Only if all of the vegetation were to be removed from the channel would the n value fall to near the 0.018 range. Given the current plans for the wash it is anticipated that vegetation will be preserved in the wash and the Manning's n value kept significantly above the minimum. A minimum n value of 0.020 was used for design evaluations.

HEC-6T has the capability to use a number of different sediment transport equations to perform the modeling. The Corps of Engineers software SAMAID which is a part of the U.S. Army Corps of Engineers SAM software package was used to determine the appropriate equation for the Queen Creek Wash. The results from the SAMAID software indicated that the most appropriate equations were: 1) Van Rijn, 2) Yang and 3) Ackers-White equations. HEC-6T does not have the capability to use Van Rijn Equation and the Yang equation was therefore chosen as the best available equation with which to model sediment transport in this study. The Ackers-White equation was used for comparison.

For the model analysis it was assumed that an unlimited supply of bed sediment exists in the wash and the depth of the sediment available for erosion was set to 10 ft to view how far the bed would scour based on an erodible sand bed. Exceptions to the 10 ft depth

would include the cross-sections near culvert locations and grade control structures. In addition, it is also assumed that the entire bed cross-section was erodible from the left bank station to right bank station (left bank toe to right bank toe).

Existing Channel Stability

The HEC-6T model for existing conditions showed the reach to be relatively stable in its current configuration. This further substantiated what had been noted in the field by project personnel. The expected thalweg changes due to the 2, 25 and 100 year floods are shown in **Figure 4**. It can be noted that most erosion is less than ± 1 foot with the exception of the very upstream (left) end of the model (the supply reach) and the lower end of the model in the Power Ranch Reach where the channel has been extensively modified.

The large scour values at the right side of **Figure 4** are due to the existing bridge at Power Road which is scheduled for replacement. This area of erosion is due to the constriction at the existing bridge. The replacement of this bridge will reduce scour in this area and when the new bridge geometry was input into the HEC-6T model the erosion at Power Road was reduced to approximately two feet for the 100-year flood.

The scour depths reported above assume a continuing supply of bed material from upstream portions of the wash combined with low Manning's n values of at least 0.020. For higher n values that represent vegetated conditions scour depths are lower. Currently there is sufficient sediment being transported into the design reach from upstream of Ellsworth and Hawes Roads to maintain a stable channel. As development continues in the area upstream from Hawes Road and sediment sources are reduced, the local sediment inflow will be reduced. This will combine with the impacts of the upstream Sanoki Flood Retention Structure (FRS) to cause a major reduction in the inflowing sediment load in the channel. At some future time the sand in the system will likely be removed resulting in probable impacts to channel vegetation. This will result in the sub-bed being exposed to erosion unless armoring occurs within the active bed. While this condition does not appear to be imminent, it represents the probable future condition of the wash.

Design Channel Analysis (DIBBLE REACH)

The stability of the channel was evaluated not only by modeling of the 100, 50, 25, 10 and 2 year hydrographs in HEC-6T but also by using empirical relationships to determine stable slopes, armoring potential and long term scour. This process was completed for both the Sossaman to Hawes reach (Dibble Reach) and the Sossaman to Power reach (Ryland Reach).

The influence of sediment transport equations was evaluated for the "original" design conditions (final Dibble Reach plus the Preliminary Ryland Reach). In **Figure 5** a plot of the bed elevation changes computed using the Yang and Ackers-White Equations are presented. This plot provides a way to compare the influence of the two sediment transport equations on the results. The results show that the bed elevations calculated using the two equations are close to each other for most of the study reach. Both equations thus give similar results for this reach of Queen Creek. If the equations gave

significantly differing answers further investigation into sediment equations would be warranted.

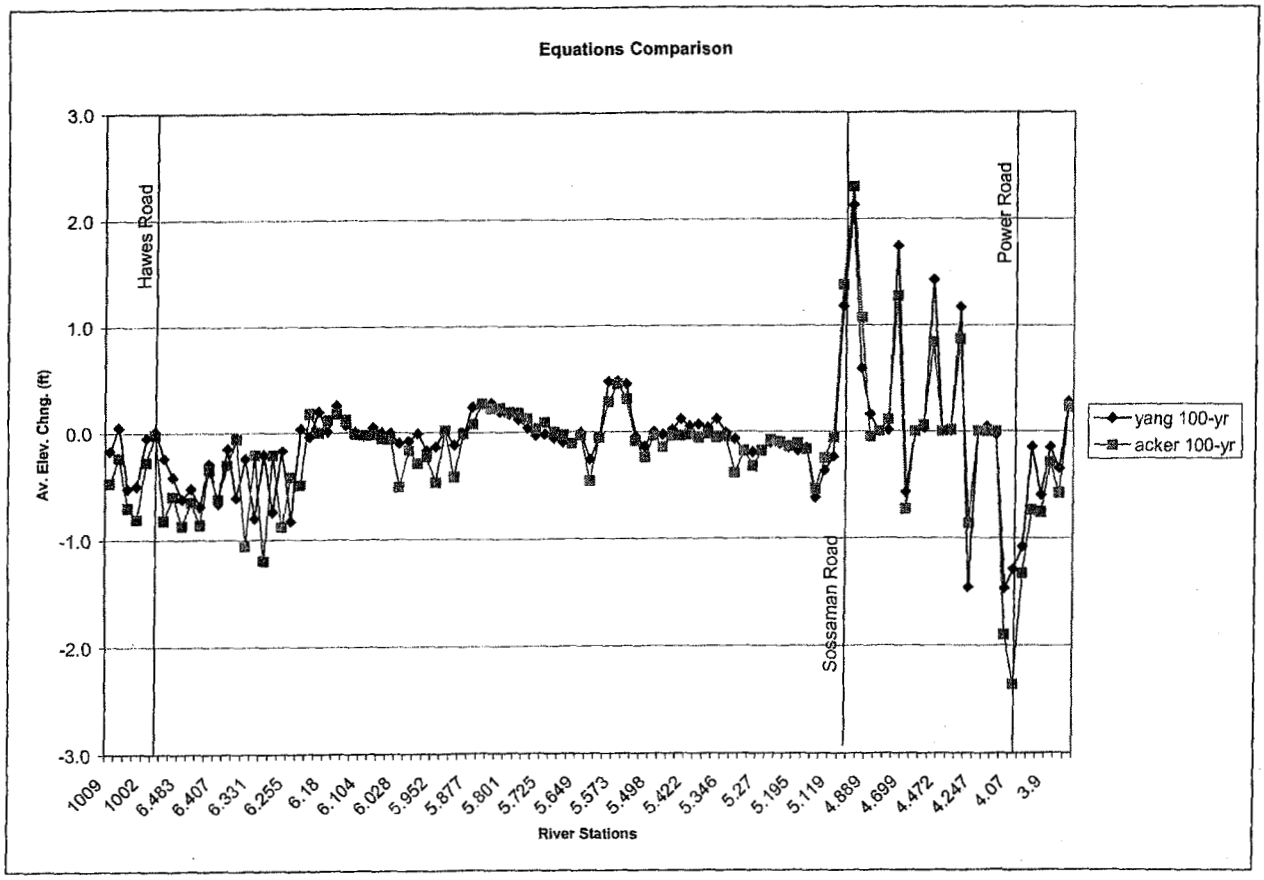

Figure 5. Yang vs. Acker-White Sediment Transport Equations for Dibble Design Reach with the Preliminary Ryland Design Below Sossaman Road.

Armoring calculations were performed using the methodology presented in Arizona Department of Water Resources State Standard 5-96. The details of the calculations are shown in **Table 6.0**. The calculations estimate Yd which is the scour depth at which armoring occurs. It can be noted that for low n values (0.020) the channel will armor at 4.2 ft of scour depth as shown in **Table 6.0** for the Dibble Reach. This is below the depth of the sand bed in some areas but not in all areas of the wash. It is expected that an armor layer sufficient to curtail erosion will form for at least the 2-25 year floods if not for all floods. The influence of Manning's n value can be seen in the comparison of the 100 year flood armor depths for varying Manning's n values in **Table 6.0**. In the higher n value cases the scour is significantly less and armor will develop under vegetated conditions. The maintenance of vegetation in the channel is thus important to wash stability. It should be noted that these calculations are based on channel averages and velocities between the vegetation will be somewhat higher than the average but should not be high enough to cause the system to unravel and fail.

Table 6.0- Table of Channel Armoring Calculations for Dibble Reach. (Hawes to Sossaman) Depth to Creation of Armor Layer is Yd.

Event	Mannings n	V (fps)	D90 (mm)	R (ft)	Grain n	f	Tau_p (lb/ft^2)	Dc (ft)	Dc (mm)	Ya (ft)	Ratio of sedimen t > Dc	Yd (ft)
2-yr	0.02	4.8	3	1.4	0.0146	0.022	0.122	0.025	7.7	0.08	0.04	1.8
5-yr	0.02	5.2	3	1.7	0.0146	0.021	0.139	0.029	8.8	0.09	0.035	2.4
10-yr	0.02	5.8	3	1.9	0.0146	0.020	0.164	0.034	10.3	0.10	0.037	2.6
25-yr	0.02	6.1	3	2.1	0.0146	0.019	0.176	0.036	11.1	0.11	0.033	3.2
50-yr	0.02	6.4	3	2.3	0.0146	0.019	0.189	0.039	11.9	0.12	0.03	3.8
100-yr	0.02	6.7	3	2.5	0.0146	0.018	0.197	0.041	12.4	0.12	0.028	4.2
100-yr	0.025	5.5	3	2.4	0.0146	0.019	0.137	0.028	8.7	0.09	0.043	1.9
100-yr	0.0375	4.9	3	3.1	0.0146	0.017	0.099	0.021	6.3	0.06	0.05	1.2

Figure 6 shows the sediment load in the designed channel for the 2- through 100 year flow events for the entire modeled reach. It can be seen that sediment load is near zero at the upstream end of the model. The load is set to zero at the upstream boundary to view the impacts of clear water inflow. Approximately five miles upstream from the inflow boundary of the model is the outlet of the Sonokai Flood Retarding Structure (FRS), which retards the incoming flood flows. Most of the sediment load in the wash from upstream will be deposited in the structure and not travel further down Queen Creek. The impact of the FRS and other upstream impacts are currently far enough from the upstream project limit that they will not impact the project in the immediate future. Any inaccuracy in boundary conditions in the HEC-6T model is also far enough upstream that it will not impact analysis in the Hawes to Sossaman reach of the wash. The use of this analysis does, however, give an indicator of future conditions in the wash. Degradation can be expected ultimately based on the reduction of bed material in the upper wash. For this analysis, the bed material gradations obtained from the Ellsworth Road channel sample were extended upstream to the SPRR bridge. A prior study by WEST indicates that the D84 for the channel upstream from Ellsworth coarsens significantly while the D50 and the D16 coarsen to a lesser extent as one moves up the wash towards the FRS.

The sediment load increases rapidly downstream from the clear water boundary and the curves remain approximately flat for the Dibble Reach as shown in **Figure 6**. The sudden increase and subsequent drop in sediment load at about cross section 5.0 (Sossaman Rd.) (Shown more clearly in **Figure 7**) is where the Ryland drop structures began to impact sediment transport under the preliminary Ryland design. This analysis implies that the

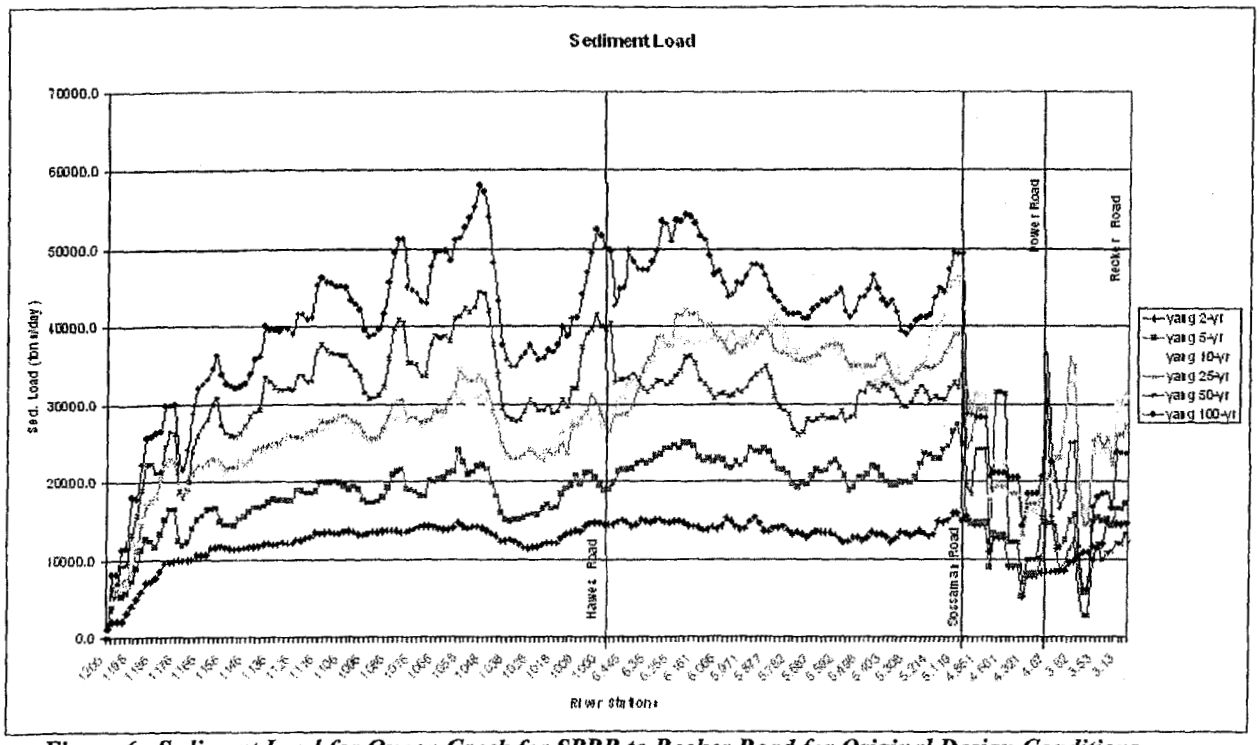

Figure 6. Sediment Load for Queen Creek for SPRR to Recker Road for Original Design Conditions.

equilibrium sediment transport capacity can be reached within a relatively short distance from the FRS or other point upstream from Hawes Road. The analysis from this HEC-6T model in the area from the SPRR to Ocotillo Road should not be relied on for design in that reach since the model is not adjusted for the farthest upstream reach as discussed above.

The change in the thalweg (minimum cross-section elevation) and average bed elevations for the design conditions are presented in **Figure 8** and **Figure 9** respectively. These figures show that the changes in the elevations between Hawes Road and Sossaman Road (Dibble Reach) are less than 2 ft for all the flow events for both the thalweg and average bed elevation. This indicates that the stream bed can be expected to be relatively stable during the various flood flows given the current inflowing sediment load.

An additional run was made with two 100 year flood hydrographs placed back to back in the HEC-6T model. This analysis showed little change in final bed elevations as shown in **Figure 10**. The depth of scour at the inflow boundary continues to increase slightly with the twin flood hydrograph but elsewhere the bed remains relatively constant throughout the reach. There are some minor variations but through the design reaches the model predicts the bed reaching an equilibrium condition after the first 100 year flow event. This indicates that after a large flood event the Ryland Reach as originally designed may have returned to a condition near the current equilibrium bed slope. Some additional scour was also noted below Power Road as the creek continues to scour in an attempt to regain equilibrium downstream of the preliminary Ryland drop structures and again below the new Power Road Bridge.

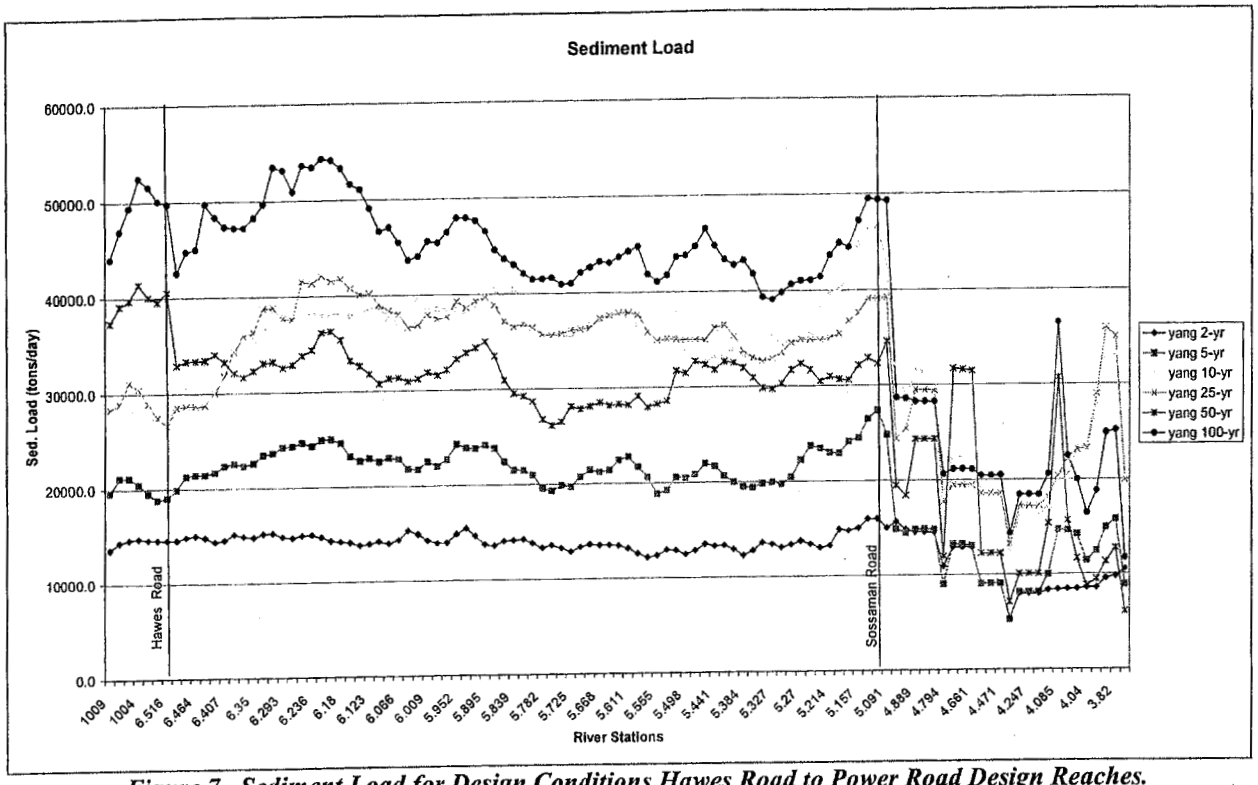

Figure 7. Sediment Load for Design Conditions Hawes Road to Power Road Design Reaches.

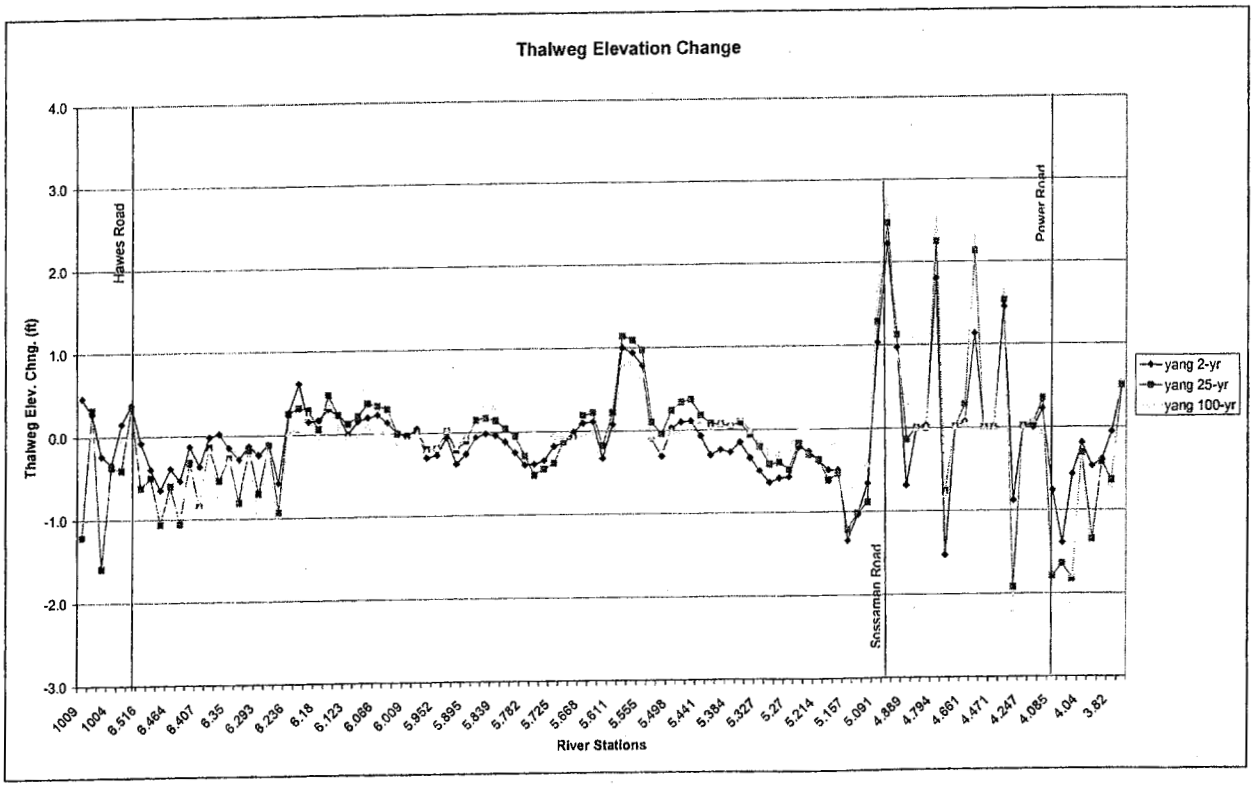

Figure 8. Thalweg Elevation Change for 2, 25, and 100 Year Flood Hydrographs.

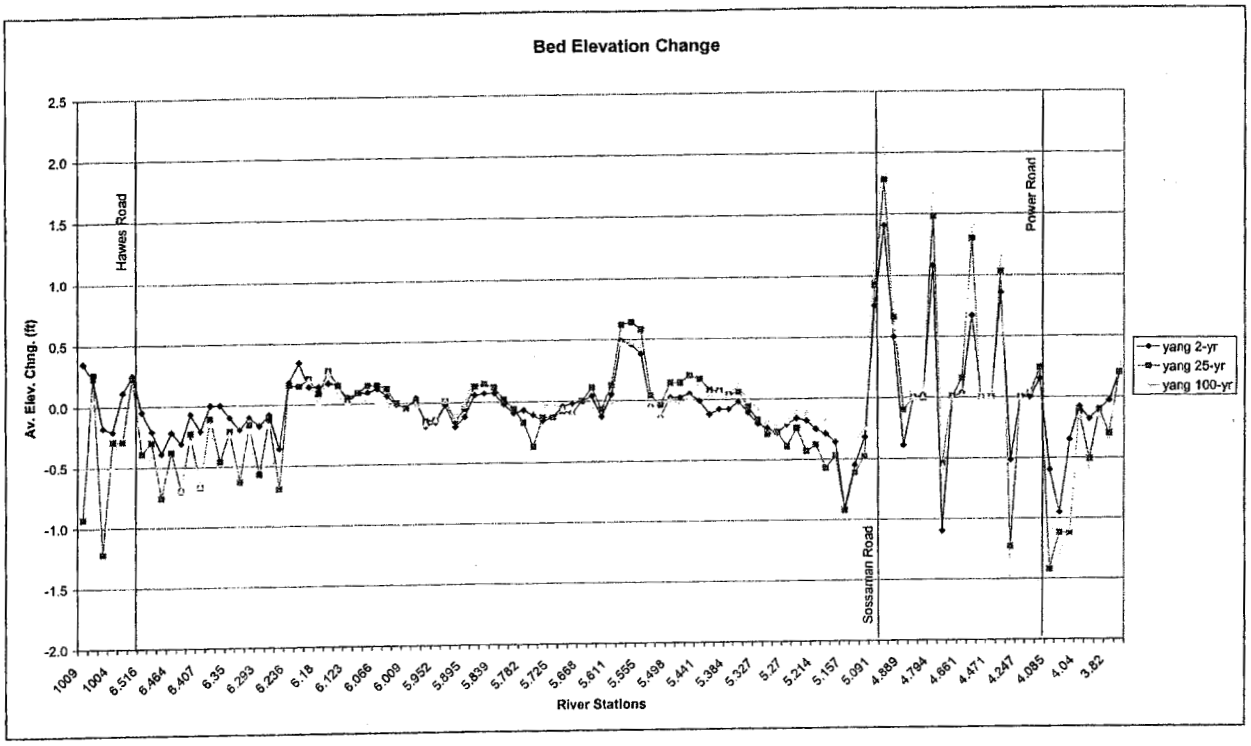

Figure 9. Average Bed Elevation for Yang Equation for 2, 25 and 100 Year Flood Hydrographs.

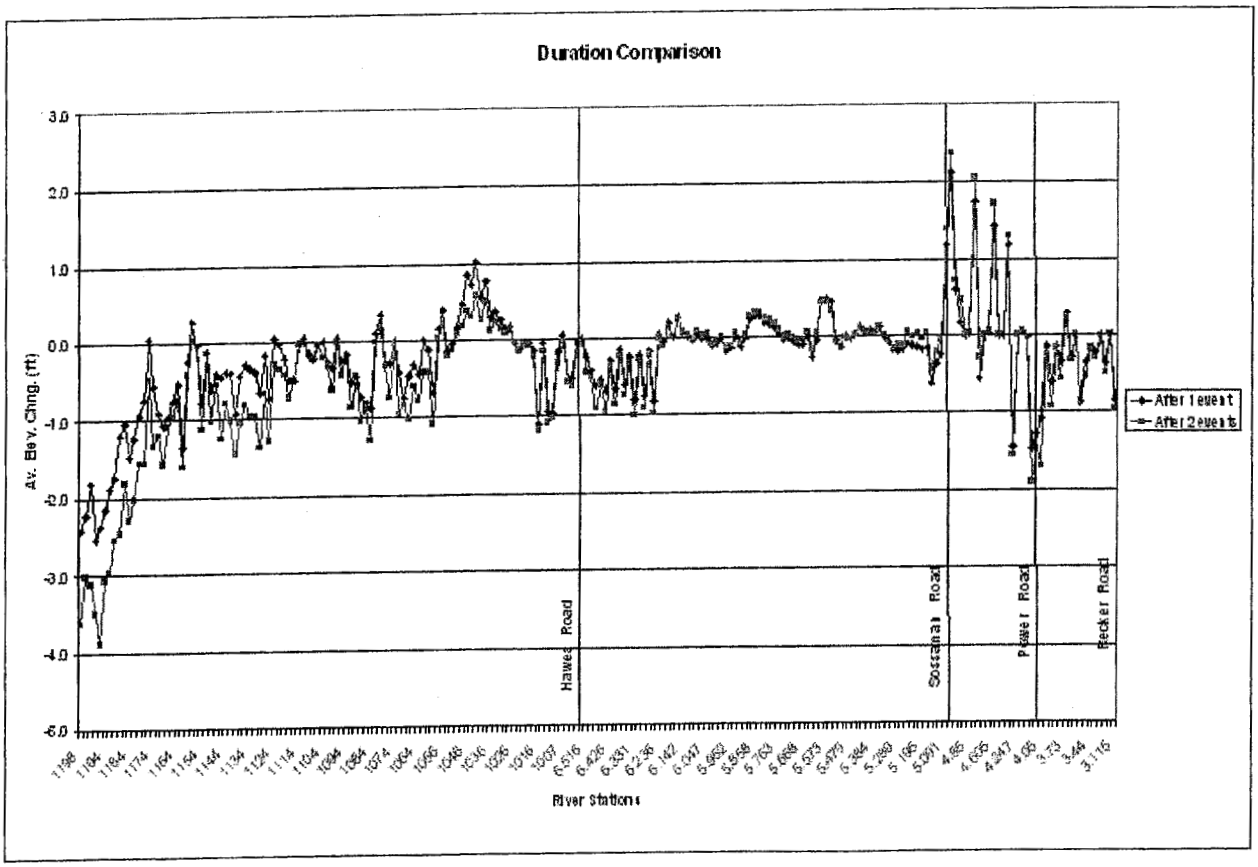

Figure 10. Bed Elevation for One and Two 100 Year Flood Hydrographs for Queen Creek from SPRR to Recker Road. Upper Portion Model Bed Gradation Based on Ellsworth Road Data.

Based on existing vegetation and expected future conditions it is not expected that grade control will be necessary in the short term for the Dibble Reach. If it is assumed that the vegetation is removed and only the sand bed provides roughness for the flow then grade control would be necessary in the long term. Also if the upstream sediment supply is cut off it may be necessary to provide some grade control to slow the flows in this reach. Based on the assumption of a Manning's n value of 0.021 the final slope would be 0.0006 (0.06%). This would require grade control to dissipate 15.2 feet of excess slope. When the armoring is considered, however, the grade control requirement would be reduced to approximately 4.2 ft. Necessary grade control could be accomplished by placing a 2.2 ft grade control structure some distance downstream from the Hawes Road Bridge, and an additional structure above the midpoint between Hawes Road and Sossaman Road.

It is recommendeded that the top of the grade control structures be placed approximately 1.0 ft below the existing grade and the channel slope allowed to adjust naturally to the existing processes in the wash.

Bank protection will be required on the outside of bends in the reach and a minimum of toe protection should be provided for reaches where homes will be built immediately adjacent to the wash and erosion can be reasonably expected. The toe protection can be at the base of the set-back banks and extend only sufficiently up the bank to prevent erosion of the bank toe and failure of the banks. It is recommended that toe protection be placed at the outside edge of the berms and toed down sufficiently to prevent failure due to the erosive actions of the stream. In areas with bends the outer bank should be protected to near the level of the 100 year flood.

Final Design Recommendations – Dibble Reach

Based on the revised/final Ryland design the need for additional grade control was noted near the downstream end of the Dibble Reach to insure long term stability. This was in accordance with discussions that involved Dibble, CVL, Ryland, the Town of Queen Creek, and FCDMC. A drop structure with a height of 2.0 feet is thus recommended just downstream of the Sossaman Road bridge. This will also provide the transition between the Dibble and Ryland channels.

Since grade control of 4.2 ft was determined to be necessary for a no sediment inflow future conditions in the Dibble Reach of the wash, two grade control structures are recommended with a total drop of 4.2 feet. Drop heights should be kept small to allow crossing of the structures by equestrians and others. It is recommended that these structures be covered to the extent possible and lowered to approximately 1.0 ft below the existing grade. Proposed locations of the structures are approximately 1250 ft above Sossaman Rd (station 62+50 or just west of the trail crossing) and approximately 1600 feet below Hawes Road (station 109+00 or where the channel begins to widen from its existing configuration). The two structures should have drops of 2.2 and 2.0 feet respectively. The weirs on both structures should be aligned to be perpendicular to a line drawn from the centerline of the downstream channel for the upstream drop and from the center of the bridge opening on Sossaman Road to the center of the lower drop structure. This alignment will insure that the flow is aligned in the channel to the best possible extent.

Bank and toe protection are also recommended for areas along the wash. Full bank protection (above the 100 year flood level) is recommended for the outside of bends and near the grade control structures. Toe protection is recommended where there is risk of erosion but where full bank protection is not required. The toe protection should be tied back to the top bank at intervals not to exceed every 200 feet.

The current designs should provide for a stable wash for flows up to the 100 year flow. Some minor erosion or sedimentation can be expected within the wash but this is normal for channels that are adjusting to changing conditions. Routine maintenance will be required along the wash to insure that local erosion points that may develop do not endanger property along the banks of the wash.

SOSSAMAN ROAD TO POWER ROAD CHANNEL REVIEW (RYLAND REACH)

The reach of the channel from Sossaman Road to Power Road was designed for Ryland Homes by Coe & Van Loo. The preliminary design for this reach (designated the Ryland Reach) included four drop structures in a channel that was widened and the slope reduced as compared with the existing channel. The design preserved large areas of existing vegetation in the existing channel and along the north side of the new channel.

The channel slope as originally designed by Coe & Van Loo was lowered to a slope of 0.0006 ft/ft with four drop structures yielding a combined drop of 9.42 feet. The existing slope in the channel is approximately 0.0026 ft/ft to 0.0028 ft/ft and appears to be stable in the current configuration based on HEC-6T analysis. The reduction in slope appeared to correspond with the value obtained by considering only the stable slope methodology for a Manning's n of approximately 0.021 however justification and methodology was not-provided in the CVL report. While the calculations for stable slope were in the range of 0.0006 when using a Manning's n value of 0.021, the stable slope increased when using a higher n value. Given the desire to have significant vegetation in the wash for a more natural channel it would appear that a higher n value could be used for slope stability calculations. The 0.0006 slope with the n value of 0.021 would be the worst case condition where a bare sand or native material bed exists with no vegetation in the channel. This reach of the wash will not armor based on observed sediment sizes.

Previous studies by WEST, based on less complete data, also indicated significantly less scour than that found by CVL and recommended a drop structure of 3.6 ft in height. These calculations were based on a channel n value of 0.035. Current channel vegetation in the upper portion of this reach probably results in an n value in excess of 0.10 based on research performed by the U.S. Army Corps of Engineers (See Freeman, et. al. 2000).

An additional problem was noted in the CVL reach in regards to sediment continuity. Sediment flow in a wash or channel should be uninterrupted or substantial scour and deposition will result. The preliminary design by CVL interrupted sediment continuity in Queen Creek from Sossaman to Power Road. All bed sediment was removed from Power to Recker Roads and the channel reshaped as a part of the Power Ranch

development project. The interception of sediment in the Ryland Reach would increased scour in the Power Ranch Development downstream of Power Road.

The installation of the originally proposed drop structures in conjunction with the lowering of the bed to reduce the slope would have caused a series of problems in the channel. First, the upstream drop structure was set below the existing channel grade and would have caused a headcut to move up the channel into the reach above Sossaman Road unless an additional grade control structure were placed at Sossaman Road. This head cut would have been on the order of three feet and would have caused a large amount of sediment to be transported down the channel and deposited. This could have placed upstream improvements at risk during low to intermediate flows.

Secondly the drop structures and low slope reaches between drop structures would tend to fill with sediment during larger floods until an equilibrium slope is reestablished through the reach possibly impacting water surface elevations in the wash. Until upstream sediment deposits are exhausted the equilibrium slope will be higher than the 0.0006 ft/ft slope. This impact can be seen in **Figures 6** through **9**.

The reaches of very low slope in the Ryland Reach would have intercepted sediment that is needed below Power Road to maintain channel bed elevations between Power and Recker Roads. Queen Creek would attempt to again reach sediment equilibrium and would scour until either a hard bed is reached or the sediment load is in equilibrium. If the sediment transport is not interrupted in the Ryland Reach the incoming sediment will continue down the channel and tend to keep the channel through Power Ranch stable. Some deposition may occur just downstream of the Power Road bridge depending on the relative flow conditions in the two sections of the wash (Ryland and Power Ranch).

Preliminary Recommendations

It was recommended that the initial design for the Ryland Reach of Queen Creek not be accepted without modification. While the grade control structures may be needed to insure future stability of the channel, if installed now it was recommended that they be installed as buried drop structures (i.e. with the top of the structure at or below current bed elevation) and the bed of the channel constructed close to the existing slope between the structures. If the bed were to be lowered to accommodate the design flows or if the current elevations of the drop structures were retained an additional drop control structure was recommended immediately downstream from the new Sossaman Road bridge to prevent a headcut from moving upstream into the Dibble Reach and beyond. With vegetation being planned for the channel a higher n value could be used (if allowed by FCD policies) which would result in fewer drop structures.

Bank protection should be planned for the outside of bends and toe protection should be designed for banks that are or will be immediately adjacent to homes along the wash where erosion is likely. This could consist of either riprap or some other type of permanent protection to insure the channel does not move beyond the lateral design limits.

Toe protection as well as full bank protection should be toed down in accordance with Flood Control District Guidelines. Riprap may be an attractive option depending on the distance and cost of transportation to the site. Riprap or other protection sizing should be such as to resist expected velocities in the channel.

In summary, it was recommended that the Ryland Reach be redesigned to keep near current slopes in their reach although the grade control structures could have been retained to protect against future lowered sediment conditions and bed adjustments in the wash.

Revised Ryland Design

Based on the above recommendations the Ryland design was modified to be more compatible with the Dibble Reach and less aggressive in terms of slope reduction. The number of drop structures was lowered from four to one and the slope modifications were eliminated to allow the wash to retain its natural character and to retain the sand bed. The need for a drop structure at Sossaman Road was discussed and the responsibility for the design of the structure was incorporated into the Dibble contract. The height of this drop is 2.0 feet (based on the revised Ryland design) and the structure is to be placed immediately downstream of the Sossaman bridge. This drop structure will be necessary to protect the upstream channel from degradation during low flows.

The updated Ryland design appears to be stable for existing conditions on the wash. This assumes vegetation will continue to be found in the wash after construction of homes along the wash and the elimination of irrigated farmland along the wash. Additionally the wash should be stable without extensive vegetation given the existing sediment load flowing into the reach from upstream. The average bed elevations for the various flows are shown in **Figure 11**.

The sediment load is shown in **Figure 12**. No evaluation of bank protection needs or lateral stability was performed for the Ryland Reach but protection is recommended as necessary. Stability, as discussed in this report, unless specified otherwise, refers to the stability of the channel bed elevation and not stability of the banks.

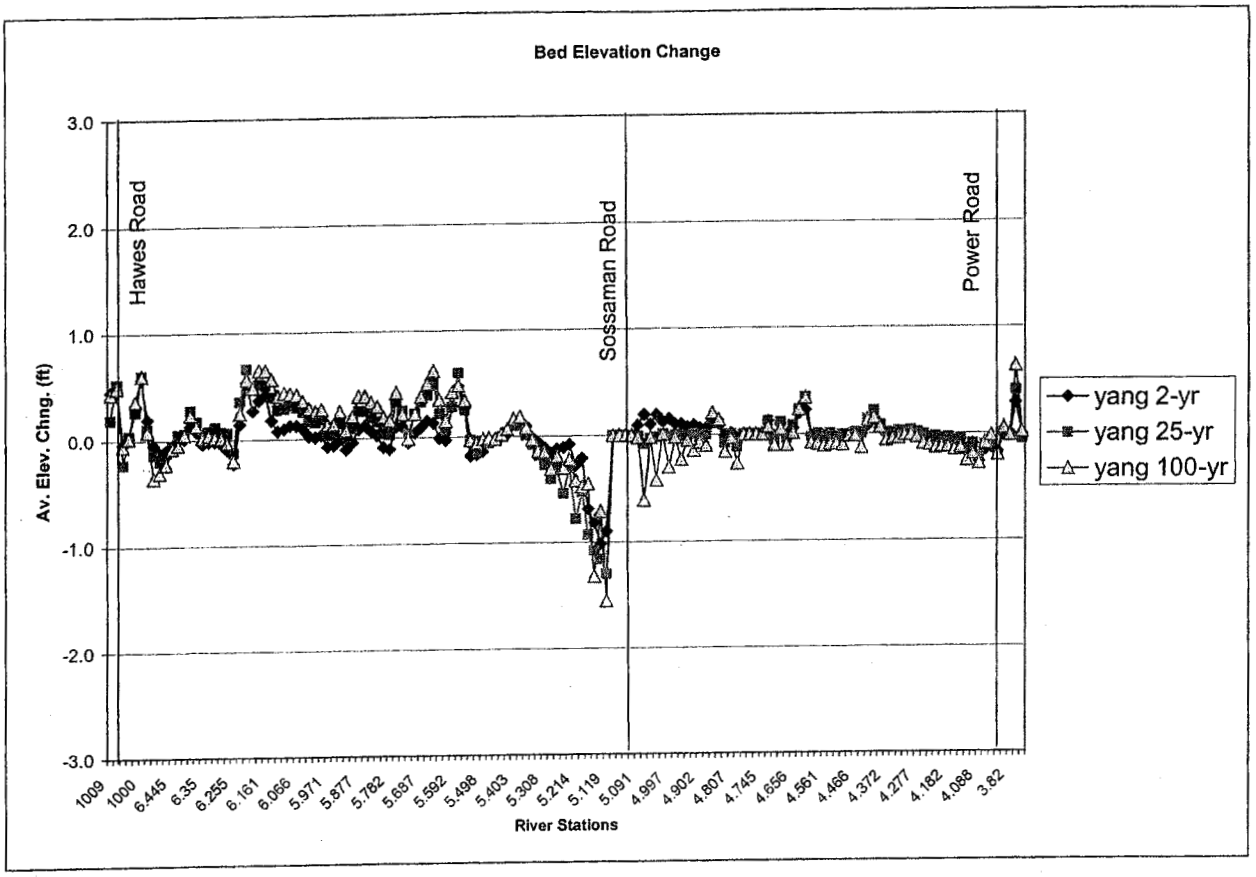

Figure 11. Average Bed Elevations for Study Reach with Redesigned Ryland Reach.

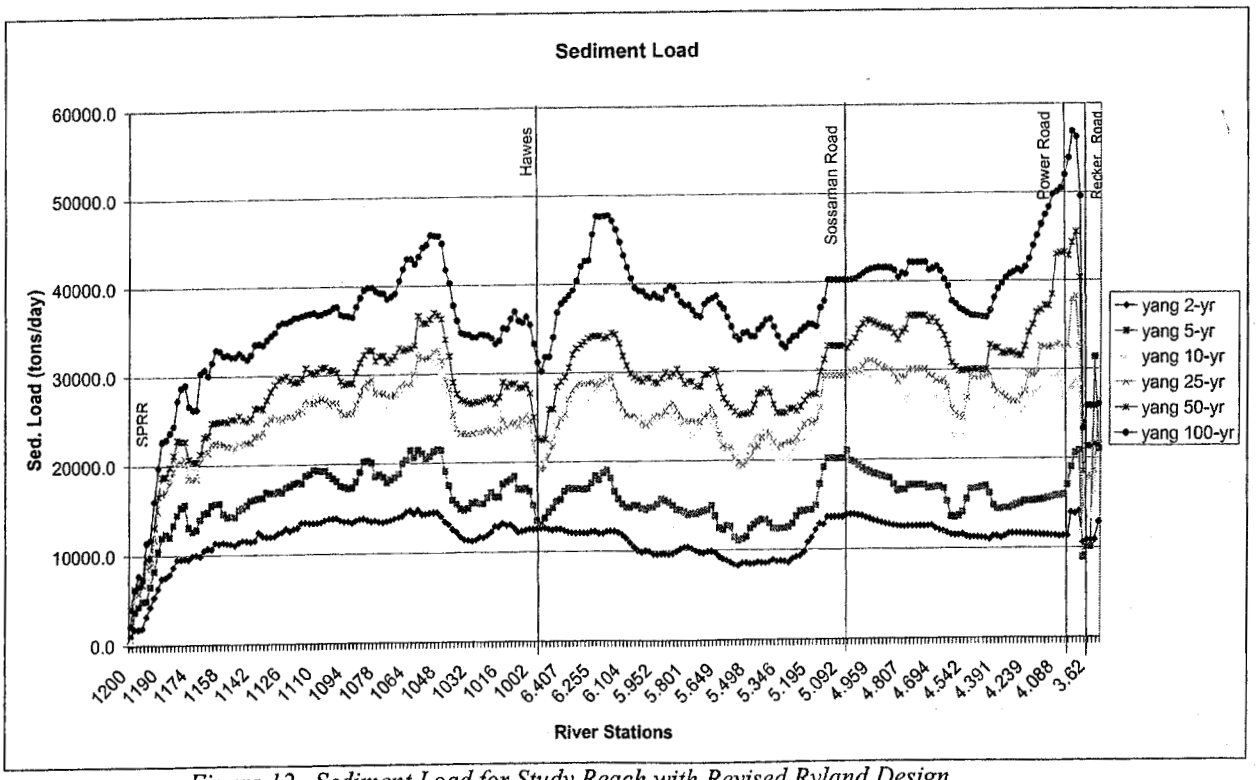

Figure 12. Sediment Load for Study Reach with Revised Ryland Design.

Section 7: Draft FIS Report Data

7.1 Summary of Discharges

Flow rates are per approved FEMA FIS for Maricopa County, Volume 1 of 16, July 19, 2001, Queen Creek Wash at Hawes Road.

7.2 Floodway Data

A floodway is not delineated, and the 100-year flood is completely contained within the channel banks.

7.3 Annotated Flood Insurance Rate Map

The reduced-scale floodplain delineation maps are presented in **Appendix G**. Full size maps are contained in the map pocket. Overlay maps showing the revised floodplain delineation maps (work maps) reduced to the scale of the current effective FIRM maps have been submitted to FEMA.

7.4 Flood Profiles

The flood profiles are included in **Appendix G**.

APPENDIX A

REFERENCES

APPENDIX A.1

DATA COLLECTION SUMMARY (NONE)

APPENDIX A.2

REFERENCED DOCUMENTS

Appendix A: References

A.2 Reference Documents

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A.2 Reference Documents (continued)

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Thomsen, B.W., United States Geological Survey, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*, April 1991.

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United States Geological Survey, *Chandler Heights, Arizona, 7.5-minute quadrangle*, 1:24000, 10-foot contour interval, 1956, photo revised 1973.

WEST Consultants, Inc., 2000, *Sediment Transport Analysis – Queen Creek & Sanokai Wash Hydraulic Master Plan East Maricopa Floodway Capacity Mitigation Study*, Project No. 05-0949-01, Prepared for Huitt~Zollars, Inc., September, 2000.

William A. Thomas, (2000). *Draft User's Manual, HEC-6T Sedimentation in Stream Networks*, Mobile Boundary Hydraulics, Clinton, Mississippi.

APPENDIX B

GENERAL DOCUMENTATION AND CORRESPONDENCE

APPENDIX B.1

SPECIAL PROBLEM REPORTS (NONE)

APPENDIX B.2

CONTACT (TELEPHONE) REPORTS

APPENDIX B.3

MEETING MINUTES OR REPORTS

QUEEN CREEK WASH - POWER ROAD TO HAWES ROAD

Project Kick-off Meeting
Town of Queen Creek
Wednesday, January 24, 2001

Attendees:

Dick Schaner	(Town of Queen Creek)
Tom Narva	(Town of Queen Creek)
Rich Perry	(Dibble)
Brian Fry	(Dibble)
Kevin Roberts	(Dibble)
Dennis Richards	(WEST Consultants)
Gary Freeman	(WEST Consultants)
Diane McCloskey	(McCloskey Peltz)
Dave Vanderlinden	(Z&H Engineering)
Ken Ricker	(Ricker, Atkinson, Mcbee)
A.J. Powell	(Cannon)
Paul Stears	(FCDMC)
David Degerness	(FCDMC)

Discussion of Scope Items:

- ***Survey / Mapping:***
  - Almost 100% of the survey work will be performed during the pre-design phase of the project, including providing the color aerial photo and utility locating.
  - Z&H will set panel for the project flight next week. The aerial mapping company will fly the job next week. The mapping will be complete and delivered to Dibble 4 weeks after the flight.
  - The vertical datum used for control will be NAD 88. David Degerness will verify that this is the same datum used in the existing hydraulic model.

- ***Geotechnical Investigation:***
  - All samples/borings required for the sediment transport analysis will be performed during the pre-design phase of the project. Samples/borings required for the Sossaman bridge design will be done during phase II.

- Locations of required test pits / borings will be identified by WEST Consultants on a map.

- Information regarding right-of-entry is needed before this work can begin. The Town of Queen Creek has agreements with all of the adjacent land developers. Letters have been mailed to all adjacent residences and properties that do not have an existing agreement with the Town. Tom Narva will delineate rights-of-entry on either a map or an aerial photo and provide it to Dibble by 1/25/01. Dibble will share this information with RAM and WEST.

➢ ***Hydrology & Hydraulics:***

- The existing hydrology model (HEC-1) will be reviewed and updated/modified if necessary. The model will be run for several different return periods, thus generating a hydrograph for each frequency storm.

- The existing hydraulics model will also be reviewed and updated/modified if necessary. In particular, the n-values used in the existing model will be evaluated to determine their appropriateness.

- Dibble will provide the results from both the hydrology model and the hydraulics model to WEST Consultants for use in the sediment transport and scour analyses.

➢ ***Sediment Transport / Scour Analyses:***

- The sediment transport analysis will be performed during the pre-design phase of the project. The HEC-6 model will be run for several different return periods from information provided by Dibble.

- The bridge scour analysis will be performed during the 30% design phase. The Hydraulic model developed by Dibble will be used for this scour analysis.

- After the HEC-6 analysis has been reviewed and approved by the Town and by FCDMC, this information should be shared with Coe & Van Loo, who is the engineer designing Queen Creek Wash from Sossaman to Power.

➢ ***Sossaman Road Bridge:***

- No work will be performed during the pre-design phase of the project.

- The structure selection report will be done during the 30% design phase. Cannon needs to know what the Sossaman Road profile will be in order to proceed with the design of the bridge.

➢ ***Landscape & Irrigation Design:***

- The work performed during the pre-design phase of the project will consist of reviewing the native plant inventory, coordinating with SWCA regarding 404 mitigation requirements, and developing a landscape concept which incorporates the mitigation requirements, the multi-use pathway, and the equestrian trail. The Town made it clear that a trail "benched" in a side slope is NOT a town-mandated design. It can be wherever it needs to be.

➢ ***Design Review for Sossaman Estates Channelization:***

- Dibble is acting as reviewer on behalf of the Town. The developer submittals must be made formally to the Town. Dibble is to review the *design* of the channel as it relates to hydraulics and sediment transport. Dibble is not to review the *plans* for clarity, completeness or constructability.

➢ ***FEMA CLOMR Submittal:***

- No work will be performed for this task during pre-design. This will happen at the end of the project.

➢ ***Public Involvement:***

- The first public meeting will be held after pre-design. The second public meeting will be held following either the 60% submittal or the 90% submittal.

- The Stakeholders' meeting will be held after the 90% submittal.

Discussion of Project Schedule:

➢ ***Contract & Notice to Proceed:***

- Funding is in place for the pre-design phase of the project. The only remaining hold-up is the Town attorney's review of the contract. Formal notice-to-proceed will be given as soon as signatures are on the contract.

- Survey and Geotechnical tasks are on the critical path for this project. Both should begin work next week.

- The project schedule is a total of 52 weeks long. The pre-design phase spans the first 12 weeks.

Discussion of Pre-Design Coordination:

- ***Critical Path Tasks:***
  - Survey, Mapping & Geotechnical Investigation.

- ***Existing Data Needs:***
  - Dibble needs a set of plans, and a copy of the report for the Sossaman Estates Development as soon as they become available. Dick Schaner will coordinate with Ryland Homes.

  - Dibble also needs to know the alignment of Queen Creek Road at Sossaman Road. Tom Narva reports that this intersection is shown on the plans of 2 different developers, and the 2 plans do not agree. The Town sewer line was installed on 'centerline' of Queen Creek Road. A comparison between a dimension shown on one of the plan sets and a field measurement from that point to the sewer manhole shows a bust of approximately 35' somewhere. The sewer manhole scales about 8' from the Queen Creek Road centerline on the plan, but the manhole was installed on the centerline. As soon as this bust is resolved, and the alignment of Queen Creek Road is known, the Town will provide this information to Dibble.

QUEEN CREEK WASH - POWER ROAD TO HAWES ROAD

Project Datum Resolution Meeting
Dibble & Associates
Monday, February 26, 2001

ATTENDEES:

Tom Narva	(Town of Queen Creek)
Paul Stears	(FCDMC)
David Degerness	(FCDMC)
Marta Dent	(FCDMC)
John Stocks	(FCDMC)
Brian Fry	(Dibble)
Kevin Roberts	(Dibble)
Myron Jasmann	(Dibble)
Burke Lokey	(Coe & Van Loo)
Rick Lozano	(Coe & Van Loo)
Bob Phillips	(GPS Services)

PURPOSE OF MEETING:
To attempt to determine the vertical datum used for the various projects that have been/are being done in the area of Queen Creek Wash between the Central Arizona Project (CAP) canal and the East Maricopa Floodway (EMF), in order to determine what datum should be used for the new mapping that Dibble & Associates will be acquiring for the project. This will also facilitate the "marrying" of the Dibble design with the CVL design.

DISCUSSION:
Several studies have been conducted by several consultants along Queen Creek Wash between the CAP and the EMF. These projects include both aerial mapping and hydraulic models (HEC-2 or HEC-RAS). Marta Dent is fairly confident that all of these projects west of the County line used a vertical datum of NGVD '29, as stated in the FCDMC consultant manual as a requirement. Dibble & Associates suspected that the mapping provided by the District (covering the area between Power Rd and Ellsworth Rd) is not based on NGVD '29. Marta Dent said that there was a project done by Huitt-Zollars that used a vertical datum of NAVD '88 for the area east of the County line, but everything else is based on NGVD '29.

FEMA requires (for the time being) that all projects submitted to them be based on NGVD '29. Since this project will eventually be submitted to FEMA for a LOMR, the datum for this project must be NGVD '29.

The county will soon be changing their datum requirement from NGVD '29 to "GDACS", which is based on NAVD '88. The FCDMC has the ability to convert digital aerial mapping quickly

and easily from one vertical datum to another. If all mapping panel points for each of the completed projects in the area are surveyed and provided to the District, Marta can convert all of the existing mapping to be on the same datum (NGVD '29).

John Stock pointed out that only 3 or 4 mapping control points on either side of a "seam" (where one project mapping overlaps another) would have to be surveyed for this conversion to occur. We are not concerned with all of the panel points within the limits of a given project. Bob Phillips agreed and stated the existing scope would cover this work.

ACTION ITEMS:

- **Marta Dent** will provide all of the control points used for each of the mapping projects that the District has to Dibble. **Marta** will also inform Dibble what HEC-RAS models are based on what mapping.

- **Burke Lokey** will provide all of the control points used for the mapping for both of the CVL projects (Power Ranch & Queen Creek Channel) in the area to Dibble. **Burke** will also provide to Dibble the LOMR package submitted to FEMA for the Power Ranch project.

- **Dibble** will gather all of the control points, decide which control points are near the seams of the various mapping reaches, and provide a list of control points to Bob Phillips.

- **Bob Phillips** will survey all of the control points provided to him by Dibble, and provide Dibble with a list of northings, eastings, and elevations for those points.

- **Dibble** will provide the list of coordinates and elevations to **Marta Dent** at the District for conversion to (or verification of) NGVD '29 datum.

- The new mapping that Dibble will obtain for the project will be done on NGVD '29 at Grid elevations. A factor for conversion to NAVD '88 will be provided.

- **Dave Degerness** will provide to Dibble the original HEC-2 existing conditions models for use in the existing conditions sediment transport analysis.

QUEEN CREEK WASH - POWER ROAD TO HAWES ROAD

Project Kick-off Meeting (#2)
Dibble & Associates Conference Room
Wednesday, September 12, 2001

Attendees:

Dick Schaner	(Town of Queen Creek)	dschaner@queencreek.org
Tom Narva	(Town of Queen Creek)	tnarva@queencreek.org
Brian Fry	(Dibble)	bfry@dibblecorp.com
Kevin Roberts	(Dibble)	kroberts@dibblecorp.com
Susan Detwiler	(Dibble)	sdetwiler@dibblecorp.com
Dennis Richards	(WEST Consultants)	drichards@westconsultants.com
Gary Freeman	(WEST Consultants)	gfreeman@westconsultants.com
Diane McCloskey	(McCloskey Peltz)	rundmc@mindspring.com
Noelle Sanders	(SWCA)	nsanders@swca.com
Ken Houser	(SWCA)	khouser@swca.com
Paul Stears	(FCDMC)	pjs@mail.maricopa.gov
David Degerness	(FCDMC)	djd@mail.maricopa.gov
Burke Lokey	(Coe & Van Loo)	blokey@cvlci.com

Discussion of Scope Items:

- ***Public Involvement:***
  - The first of 2 public meetings will be held following the pre-design phase of the project. According to the current schedule, this would fall during the week of Thanksgiving. Everyone in attendance agreed that the public meeting should be held the week after Thanksgiving (week of November 26).
  - Dick Schaner commented that all right-of-way issues should be evaluated prior to the public meeting. Any required right-of-way acquisitions should be clearly shown on some sort of exhibit at the public meeting.

- ***404 permit:***
  - The 404-permit application was originally submitted for the "full reach" (Power to Hawes) in March of 2000. The project was then broken into 2 pieces (Power to Sossaman, and Sossaman to Hawes). The permit application for the reach from Power to Sossaman was submitted in March of 2001. The corps has not responded to this application, as they believe the 2 reaches still constitute 1 project, not 2.

- The 404-permit process is likely on hold until the design for the reach from Sossaman to Hawes (this project) is complete. The 404-permit application submittal to the Corps will occur after the pre-design phase of this project is complete.

➢ ***Geotechnical Investigation:***

- All geotechnical work that is to be conducted for the pre-design phase of the project has been completed.

- The only remaining geotechnical work yet to be completed is borings for the Sossaman Road Bridge piers and abutments. This work will be completed after the pre-design phase of the project is complete.

➢ ***Hydrology & Hydraulics:***

- The Revised Hydrology Technical Memorandum has been completed and reviewed by the Flood Control District. The initial review generated a few comments regarding suggested revisions to the report. These comments have been addressed, and the report is now ready to be reviewed once again by the FCD. Dibble & Associates gave a copy of the revised report to Dave Degerness at this meeting. The lower flow rates, which were developed as a result of this revised hydrology study, will be the flow rates used for design of Queen Creek Wash, contingent on FCD approval of the report.

- The existing conditions hydraulic model (HEC-RAS) has been supplied to Dibble & Associates by the FCD. This model was created from aerial mapping which not on NAVD '88 datum. The mapping behind the existing model is the same mapping that this project is "correcting". Dibble has the cross section locations from this model in digital format. The original plan was to re-cut these cross sections once the corrected mapping was complete, thus "moving" the existing conditions model to the same datum as this project. Dibble has performed an investigation to compare the "shape" of the cross sections in the model to that of the same cross sections cut from the corrected mapping. Copies of plots of these cross sections were distributed at this meeting. The geometry of the cross sections appears to be relatively consistent between the existing model and the corrected mapping. Rather than "re-cutting" the same cross sections from the corrected mapping, it was decided that Dibble would simply adjust the elevations of the cross sections in the existing model by the adjustment factors recommended by Z&H and Bob Phillips as a result of their survey investigation. This will save the project money, as less time and effort is required to simply adjust the cross section elevations, and the resulting model will be no different than it would have been with "re-cut" cross sections.

- From the date of this meeting, Coe & Van Loo will require approximately 3 weeks before their work is ready to be reviewed by the Dibble team. Their current plans call for a slight re-alignment of the Queen Creek Wash just downstream from Sossaman Road. Per Dick Schaner, the Town of Queen Creek will most likely not allow the re-alignment of the wash as shown on the CVL plans. If this indeed is the case, and CVL is required to modify their plans to eliminate the wash re-alignment, then the time before their work is ready to be reviewed by the Dibble team could be substantially longer than 3 weeks.

- The Dibble reach of the wash (Sossaman to Hawes) should attempt to maintain a consistent "feel" when compared to the CVL reach (Power to Sossaman). The flattest side slope currently shown on the CVL plans is 8:1 (h:v).

QUEEN CREEK WASH - POWER ROAD TO HAWES ROAD

Project Datum Resolution Meeting
Dibble & Associates
Monday, July 16, 2001

ATTENDEES:

Tom Narva	(Town of Queen Creek)
Paul Stears	(FCDMC)
John Stock	(FCDMC)
Blair Haines	(Z&H Engineering)
Bob Phillips	(GPS Services)
Brian Fry	(Dibble)

PURPOSE OF MEETING:

To identify the course of action to correct the FCDMC mapping for use on the Queen Creek Wash project. The datum issue impacts three sets of mapping. FCDMC mapping from Hawes Road west to the EMF was completed by Kenney Aerial Mapping, Inc. (KAM), FCDMC mapping from Hawes Road east to the Maricopa County line was completed by Lee Harbers of DTM, Inc., and project design mapping was prepared from Sossaman Road to Ocotillo Road by Aerial Mapping Company, Inc. (AMCI). All three sets of mapping will be corrected based on the results of the field control surveys.

DECISIONS:

The mapping will be adjusted to NAVD 88 vertical datum. Per John Stock, since all the mapping is being updated it is better to go to the 88 datum instead of NGVD 1929.

Bob Phillips will provide equations for conversion to NGVD 1929 and Town of Gilbert datums.

Bob Phillips will provide results of surveys and the required mapping adjustments for each set of mapping to Dave VanderLinden of Z&H Engineers. Upon review and approval of the data, Dave will forward the mapping adjustments to KAM, DTM, and AMCI.

Lee Harbers of DTM, Inc. will submit a proposal for mapping adjustments to Brian Fry at Dibble and Associates. Brian will incorporate DTM's cost into a new work assignment under Dibble's on-call contract with FCDMC.

DTM, Inc. and KAM were instructed to coordinate edge matching of the corrected mapping at the common mapping boundary at Hawes Road.

Upon completion of the mapping corrections, the Flood Insurance Study (FIS) hydraulic model will need to be updated using the corrected mapping to produce a "corrected effective" model. The corrected effective model will then form the basis of the hydraulic modeling for the Queen Creek Channel sediment transport and design analysis. Paul Stears and Brian Fry will meet with Tim Phillips and other FCDMC staff to determine the extent of HEC-RAS modeling to be completed under the on-call contract.

HEC-RAS modeling to produce a "corrected effective" model will be included in the proposal for the on-call work assignment. The preparation of a Conditional Letter of Map Revision (CLOMR) for the Queen Creek Wash improvements from Sossaman Road to Hawes Road is included in the Queen Creek Wash contract.

QUEEN CREEK WASH - POWER ROAD TO HAWES ROAD

Project Datum Resolution Meeting
Dibble & Associates
Thursday, April 26, 2001

ATTENDEES:

Dick Schaner	(Town of Queen Creek)
Tom Narva	(Town of Queen Creek)
Paul Stears	(FCDMC)
Tim Phillips	(FCDMC)
John Stock	(FCDMC)
Dave VanderLinden	(Z&H Engineering)
Bob Phillips	(GPS Services)
Brian Fry	(Dibble)
Kevin Roberts	(Dibble)

PURPOSE OF MEETING:
To attempt to determine the extent of the problems which exist with the County's mapping and HEC-RAS models discovered during the survey for the Queen Creek Wash project.

DISCUSSION:

Per Bob Phillips, the existing mapping owned by the Flood Control District (FCD) was performed during 2 separate projects. Collins-Pina performed the survey control for both projects. The "east" project was contract no. 9503, and runs from the County line to Hawes Rd. The "west" project was contract no. 9703, and runs from Hawes Rd to a point near the East Maricopa Floodway.

It appears that for the east project, Collins Pina began the survey at a benchmark with an erroneous elevation. This can be easily corrected by determining a correction factor to be applied to the elevations. Once this is done, the vertical difference between the Collins Pina corrected control and our survey is plus/minus 0.2'. This difference is within the realm of normal GPS error. The horizontal aspect of the Collins Pina survey appears to be O.K.

The west project has a much more complicated error. The vertical difference between our survey and the Collins Pina survey for this area is 3.57'. That is, the survey performed for this project is 3:57' higher than mapping provided by the FCD.

Part of this difference is possibly due to the difference between Town of Queen Creek datum, and Town of Gilbert datum. In addition to this difference, at least 2 elevation reference marks

(ERM's), which were used for mapping control in the area, are labeled with incorrect elevations. This translates into a "tilt" error in the new mapping acquired for this project, and possible any other mapping performed in the area. Since the alignment of the wash within the limits of this project parallels the axis of the mapping control, a constant can be applied to the elevations in the mapping to generate an accurate representation of the ground. Aerial Mapping Company has indicated this can be done for $1000.00 or less.

CONCLUSIONS:

It was agreed by all that a problem exists that must be corrected. This is in the best interest of both the Town of Queen Creek and the FCD. The following plan of action was generated:

1) Check Wood & Associates mapping to determine if same error exists.

2) Correct the mapping performed by Collins Pina (both the east and the west).

3) Regenerate the HEC-RAS model for Queen Creek Wash.

   i. From ½ mile west of Power to Ellsworth Road.
   ii. Remainder – EMF to County Line.

3a) Perform Additional Ground Surveys.

   i. Will Rogers Equestrian Ranch
   ii. Power Ranch entrance bridge

4) Correct ERM's (if directed to do so by John Stock).

ACTION ITEMS:

Dibble & Associates will prepare a fee proposal for FCD to accomplish the above action plan in 2 different steps. The first fee proposal will include items 1 & 2 from the action plan. The second fee proposal will include items 3 & 3a from the action plan. Item 4 will not be included unless Dibble is approached by John Stock and specifically instructed to do so.

The FCD will provide Dibble & Associates with a CAD file containing the linework representing locations where all cross sections were cut for the RAS model. This is critical to regenerating the RAS model.

Fry, Brian

To: Timothy S Phillips (E-mail); Paul J. Stears (E-mail)
Cc: Roberts, Kevin
Subject: Queen Creek Mapping

Tim & Paul,

Upon review of the corrected mapping received from Kenney and DTM I believe I now understand the situation. I will summarize as best I can.

1. Although the Collins-Pina mapping prepared by Kenney and DTM was reported to be on NGVD 29 vertical datum, it appears that it was actually mapped to the Town of Gilbert Datum. The Town of Gilbert datum appears to be approximately 3.7 feet lower than NGVD 29.

2. Although the Collins-Pina mapping extends all the way to the EMF, the HEC-RAS model that everyone is using only contains Collins-Pina cross-sections from Recker Road upstream. The 1992 Wood mapping is used from Recker Road downstream to the EMF.

3. The Wood mapping is on NGVD 29 datum, as it should be.

4. The 3.7 foot vertical bust resulting from the datum difference between Gilbert and NGVD 29 is clearly visible in the HEC-RAS profile at Recker Road. The flowline elevation rises about 3.7 vertically in the downstream direction at Recker Road. Raising the profile from Recker Road upstream by the 3.7 feet would result in a smooth continuous flowline as would be expected in this area.

5. At our last meeting to discuss the findings of all the field survey, it was recommended by the surveyor that we correct the mapping to NAVD 88 vertical datum instead of NGVD 29 because there was better agreement when a constant adjustment factor was applied to the mapping. It was agreed by all in attendance that this was the best approach to use and was subsequently done.

6. Since the mapping adjustment was a constant, Dibble recommended that the HEC-RAS cross-sections simply be adjusted by the constant rather than re-cutting the cross-sections as originally envisioned. Comparison of about 10 representative cross-sections from the HEC-RAS model and the corrected mapping confirmed that this was a reasonable approach. The adjustment factor was to raise the Collins-Pina cross-sections by approximately 2.6 feet.

7. Keeping the Wood cross-sections as presented in the HEC-RAS and adjusting the Collins-Pina cross-sections by the 2.6 feet now results in a datum difference between NGVD 29 in the Wood mapping section and NAVD 88 in the corrected mapping sections. This results in a discrepancy of 1.1 feet, which is better than the 3.7 but still not as we would like.

8. Reviewing the survey data it appears that the difference between the NAVD 88 and NGVD 29 datums is about the 1.1 feet.

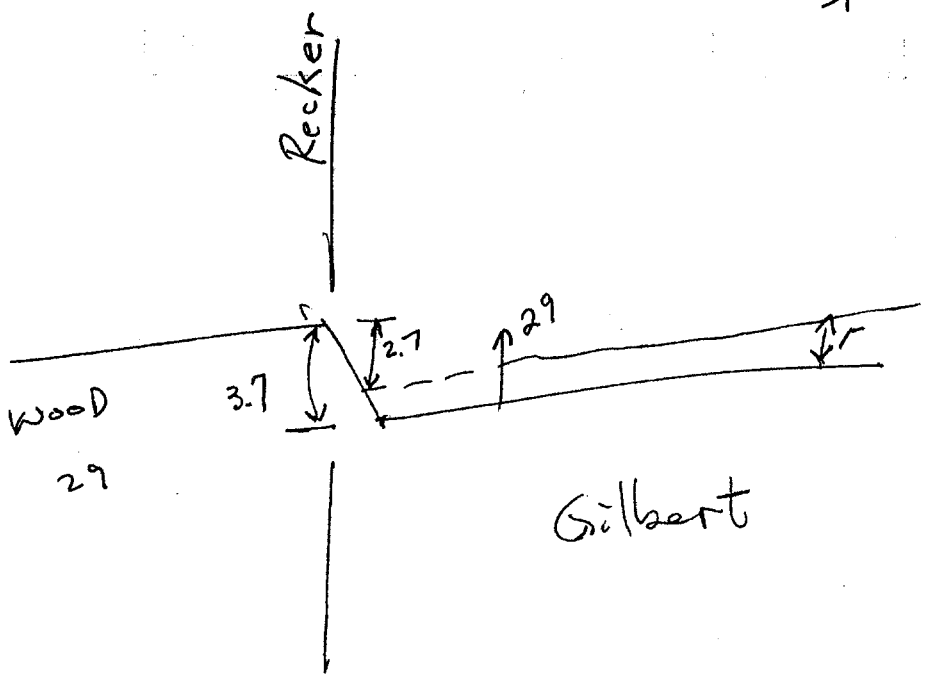
9. We can use the NAVD 88 cross-sections for the Queen Creek project, however, there is still the 1.1 foot discrepancy that somehow needs to be resolved to complete the model from Recker Road to the EMF.

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

CALC _____ DATE _____ JOB _____
CHKD _____ DATE _____ SHT ____ OF ____

TITLE _____

2.6
+ 1.1
3.7



APPENDIX B.4

GENERAL CORRESPONDENCE

QUEEN CREEK WASH SOSSAMAN ROAD TO HAWES ROAD
CHANNEL IMPROVEMENT PROJECT
CLOMR
Town of Queen Creek, Arizona
Contract No. 2000D03

Town of Queen Creek Arizona
****

State: Arizona
Community: Town of Queen Creek, Arizona
County: Maricopa

Consultant:
Dibble & Associates Consulting Engineers

Attn: Brian J. Fry, P.E.
2633 East Indian School Road, Suite 401
Phoenix, AZ 85016-6763
(602) 957-1155

****

Input File | Date
QC_Exist.PRJ | 11/26/03

Project Title: PRE-PROJECT CONDITIONS MODEL FOR FEMA SUBMITTAL - Queen Creek Wash, Sossaman Road to Hawes Road
Prepared By: Dibble and Associates Consulting Engineers
Model Created: April, 2003
Prepared For: Town of Queen Creek
Contact: Tom Narva, PH: 480-987-0109
Reviewing Agency: Flood Control District of Maricopa County
Contact: Tim Murphy, PH: 602-506-1501

Note: Crossections face downstream. River Miles increase in the upstream direction.

Note: This model is on NAVD 88 vertical datum.

This model is being used as the Pre Project Conditions Model for the Queen Creek Wash Improvement project, Town of Queen Creek Proj. No.2000D-03. The cross sections in this model were originally generated from erroneous mapping. The following correction factors have been applied to the elevations of the cross sections originating from the Coe & Van Loo, Flood Control District, and Collins Pina models in order to match the corrected aerial mapping:

West of Hawes Road: Correction = +2.683'
East of Hawes Road: Correction = +2.427'

The Bridge & Culvert routines were also adjusted by these correction factors.

This is a combined model of Queen Creek from East of Power Road to Hawes Road. It utilizes the following models from downstream to upstream.
1. Coe and Van Loo's Ryland Homes Model (Queen Creek Wash CLOMR, Power Road to Sossaman Road): x-sections 4.657 to 5.054.
3. The Flood Control Districts Power Road to Hawes Rd. Delineation: x-section 5.065 to 6.470.
3. Collins-Pina Delineation from Hawes Rd to the SPRR: x-section 1000.4

Model #1, the Coe and Van Loo CLOMR, was performed on different mapping than the erroneous mapping provided by FCDMC for this project. CVL mapping is on Town of Queen Creek datum, rather than NAVD 88 datum. Therefore, a correction factor of -2.00' was applied to Coe & Van Loo elevations to resolve the discrepancy.

Flow Rates:

At Cross Section 1000.40 - 3010 cfs obtained from FEMA FIS for Maricopa County, Queen Creek Wash at Hawes Road.

Input File
QC_Soss_Hawes.PRJ

Date
11/26/03

Project Title: Queen Creek Wash Sossaman Road to Hawes Road Channel Improvement Project - Town of Queen Creek Proj No. 2000D-03
Prepared By: Dibble and Associates Consulting Engineers
Model Created: April, 2003
Prepared For: Town of Queen Creek
Contact: Tom Narva, PH: 480-987-0109
Reviewing Agency: Flood Control District of Maricopa County
Contact: Tim Murphy, PH: 602-506-1501

Note: Crossections face downstream. River Miles increase in the upstream direction.

Note: This project is on NAVD 88 vertical datum.

Note: Levees modeled in this model do not represent physical levees to be constructed with the channel improvements. The modeling tool termed levee is used to keep flood waters out of low lying ground, below the water surface elevation, on either side of actual physical containments of flow. It would be unreasonable to expect that flood waters will erode the substantial length of earth beside the channel.

This model is the post project conditions model for the Queen Creek Wash Improvement project, Sossaman Road to Hawes Road. It will specifically be used for channel improvement design, and represents the final design of channel improvements. The cross sections in this model were originally generated from erroneous mapping, provided by the FCDMC. The following correction factors have been applied to the elevations of the cross sections originating from the Coe & Van Loo, Flood Control District, and Collins Pina models in order to match the corrected aerial mapping:

West of Hawes Road: Correction = +2.683'
East of Hawes Road: Correction = +2.427'

The Bridge & Culvert routines were also adjusted by these correction factors.

Hydraulic tie-ins with existing floodplain delineations, already accepted by FEMA as a map CLOMR or LOMR or currently in review, exist at the upstream and downstream limits of the model. Downstream, the floodplain ties into (0.5' tolerance) the delineation of Queen Creek Wash, Power Road to Sossaman Road, performed by Coe and Van Loo Consultants, Inc. This occurs at RM 5.054, CVL Station 61+00. The Coe and Van Loo CLOMR was performed on different mapping than the erroneous mapping provided by FCDMC for this project. CVL mapping is on Town of Queen Creek datum, rather than NAVD 88 datum. Therefore, a correction factor of -2.00' was applied to Coe & Van Loo elevations to resolve the discrepancy. Upstream, the floodplain ties into the delineation of Queen Creek Wash, Hawes Road to SPRR, performed by Collins/Pina Consulting Engineers, Inc. This occurs at RM 6.532, Collins/Pina Station 1000+40.

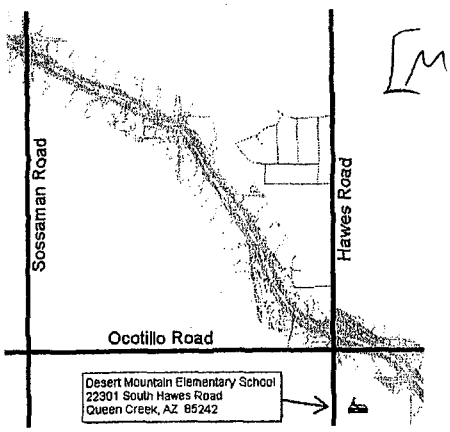
Flow Rates:

Existing hydrology approved by FEMA governs the design of the Queen Creek Channel improvements.

At Cross Section 6.532 - 3010 cfs obtained from FEMA FIS for Maricopa County, Queen Creek Wash at Hawes Road.

Starting WS Elevation:

The starting water surface value for the HEC-RAS computer model has been determined from the Pre Project Conditions Model, submitted to FEMA with this CLOMR model, 100-year water surface. FEMA approved existing conditions flow rate has been applied to this downstream reach to determine the starting water surface elevation for the current project at RM 5.054.



[Mailed to all property owners in the area.]

1/1

Queen Creek Wash Improvements

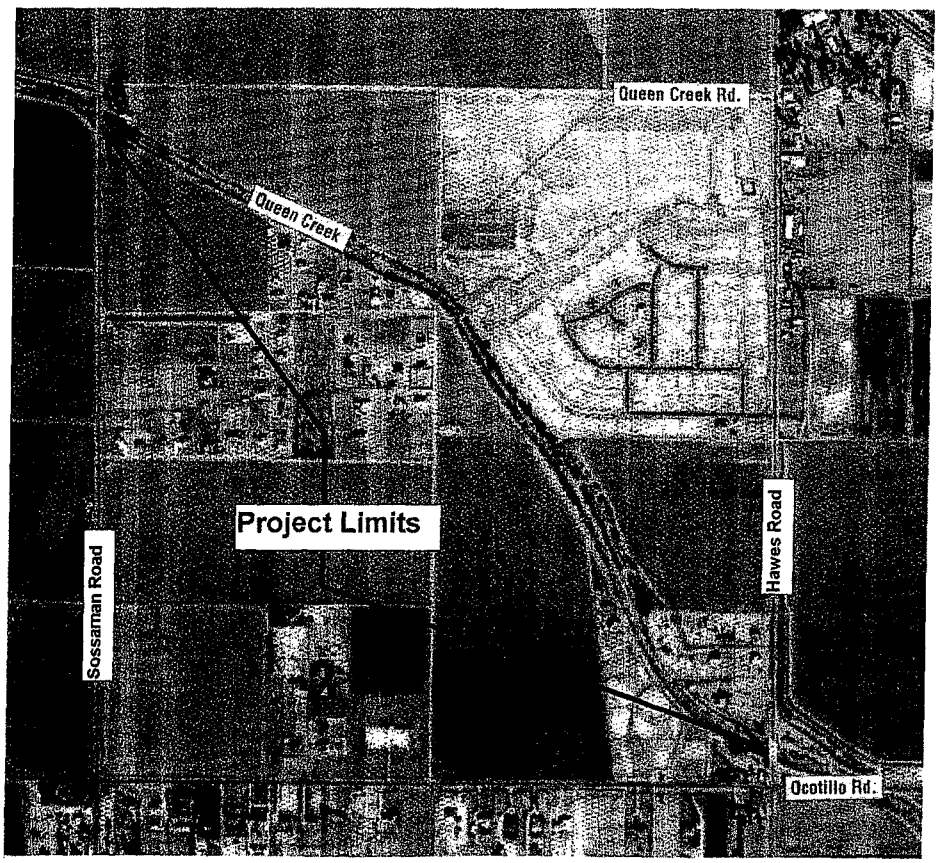
Monday, January 14, 2002
Desert Mountain Elementary School
22301 South Hawes Rd.
Queen Creek, AZ 85242
6 p.m. – 8 p.m.

The Town of Queen Creek invites you to attend a public meeting to discuss the upcoming improvements to Queen Creek Wash, between Hawes Road and Sossaman Road. As a resident, with property near or adjacent to the wash, your opinion and insight is valued by the Town. We would like to hear your views.

Exhibits showing the proposed improvements, including aerial photographs will be on display at the meeting for all to view and comment on. Opportunity will be provided for you to write your comments down, and submit them to the Town.

A brief description of the project follows:
The existing Queen Creek Wash does not contain the flows produced by the 100-year storm. The improvements made as part of this project will provide 100-year flow capacity in the wash, while removing the existing berms along both banks. The project will also enhance the community with recreational opportunities. The improvements include a bridge at Sossaman Road, a paved pathway system, and equestrian access.

Please stop in on January 14, 2002 between 6 p.m. and 8 p.m. to see what is planned, and how it will benefit your area.

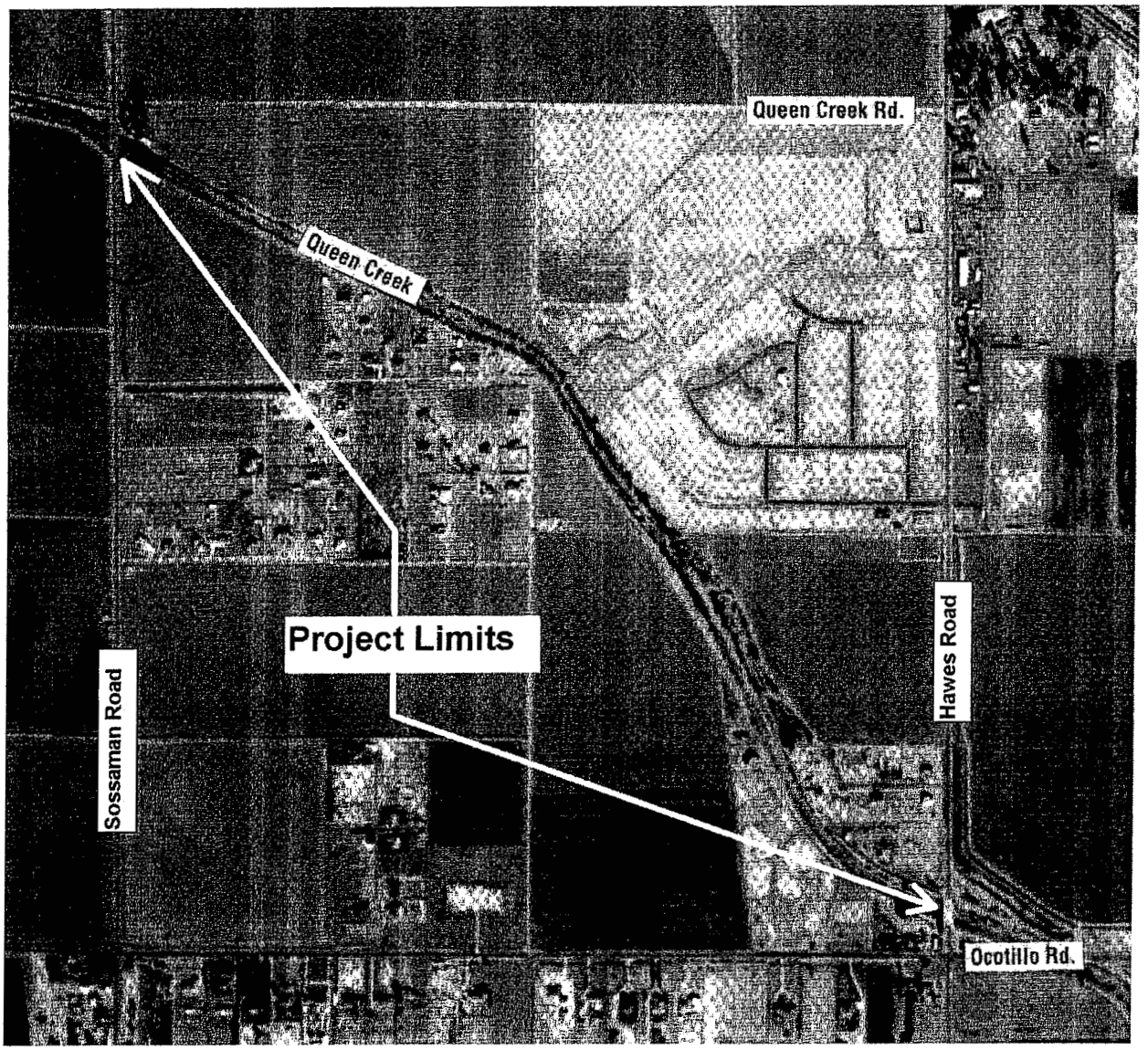


[Distributed at January 14, 2002 public meeting] 1/2

QUEEN CREEK WASH IMPROVEMENT PROJECT

Hawes Road to Sossaman Road

Project Information

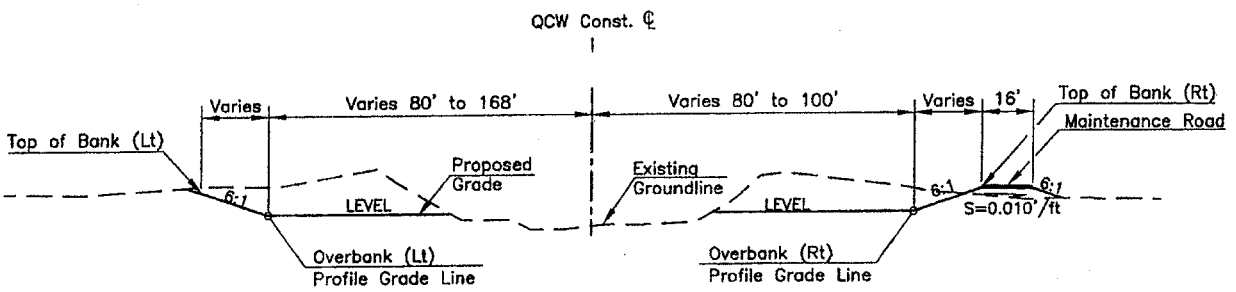


In order to ensure flood protection for the current and future residents of the Town of Queen Creek who live in the vicinity of Queen Creek Wash between Hawes Road and Sossaman Road, Queen Creek Wash must be improved. This project will improve Queen Creek Wash, increase the capacity of the wash, and remove the existing berms along the banks of the wash. After construction of the improvements is complete, residents will have flood protection from the 100-year storm. The project will also enhance the community with recreational opportunities. The

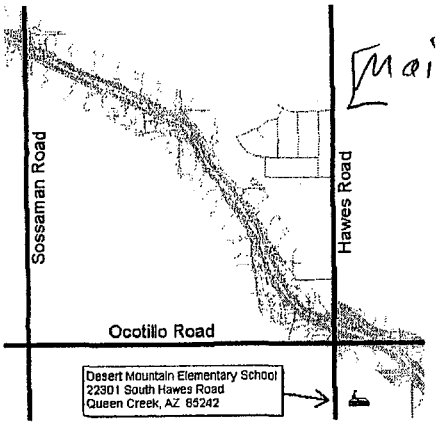
improvements include a bridge at Sossaman Road, a paved pathway system, and equestrian access.

The current concept is to preserve the sandy bottom of the existing wash along with much of the vegetation along the wash bottom. Additional capacity will be created by cutting into the sides of the wash starting at a point approximately 2' above the sandy bottom, and carving out an area that will convey flood waters down the wash. The design shows these cuts occurring on both sides of the wash for the majority of the length of the project.

At 2 different locations within the project, the existing side slopes of the wash on the south side are extremely steep. Several locations have begun to show undercutting of the slope. The improvements associated with this project include "flattening" these steep slopes to a slope not steeper than 4 to 1 (horizontal to vertical).



Typical Wash Cross Section



[Mailed to all property owners in the area]

1/1

Queen Creek Wash Improvements

Tuesday, November 19, 2002
Desert Mountain Elementary School, Room #214
22301 South Hawes Rd.
Queen Creek, AZ 85242
5:30 p.m. – 7:30 p.m.

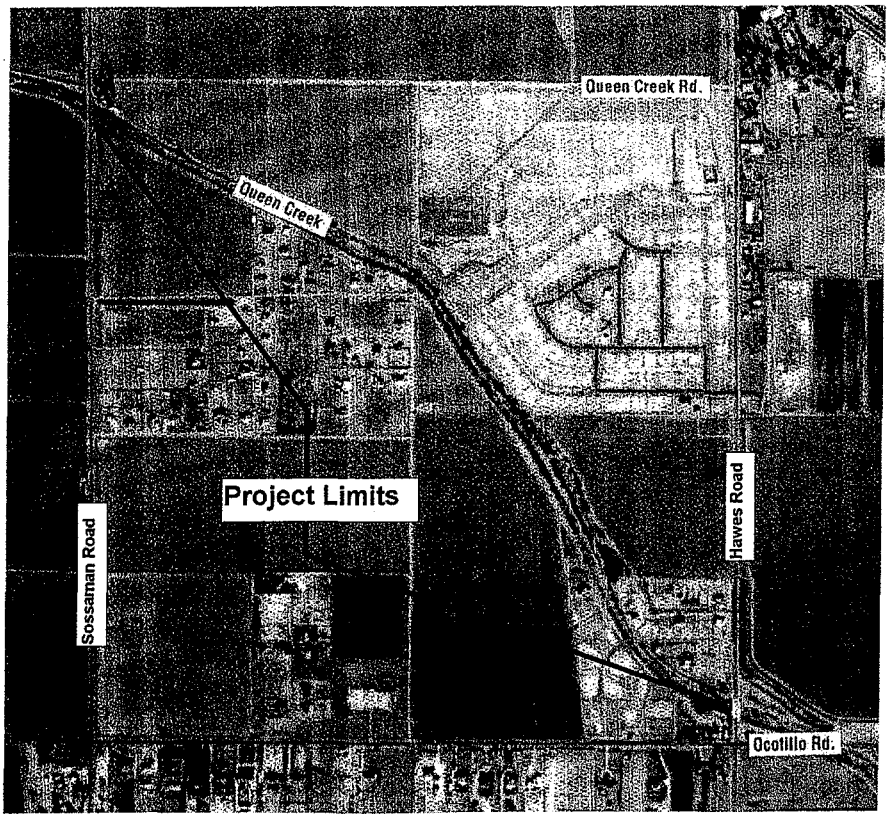
The Town of Queen Creek and the Flood Control District of Maricopa County invite you to attend a public meeting to discuss the upcoming improvements to Queen Creek Wash, between Hawes Road and Sossaman Road. As an owner of property near or adjacent to the wash, your opinion and insight is valued by the Town and by the Flood Control District. We would like to hear your views.

Exhibits showing the proposed improvements, including aerial photographs will be on display at the meeting for all to view and comment on. Opportunity will be provided for you to write your comments down, and submit them to the Town and the Flood Control District.

A brief description of the project follows:
The existing Queen Creek Wash does not contain the flows produced by the 100-year storm. The improvements made as part of this project will provide 100-year flow and flood control capacity in the wash, while removing the existing berms along both banks. The project will also enhance the community with recreational opportunities. The improvements include a bridge at Sossaman Road, a paved pathway system, and equestrian access.

Please stop in on November 19, 2002 between 5:30 p.m. and 7:30 p.m. to see what is planned, and how it will benefit your area.

For information, please contact Kevin Roberts by phone at 602-957-1155, or by email at kroberts@dibblecorp.com.



APPENDIX B.5

CONTRACT DOCUMENTS (SCOPE OF WORK)

TOWN OF QUEEN CREEK

QUEEN CREEK WASH
POWER ROAD TO HAWES ROAD

SCOPE OF WORK
January 16, 2001

INTRODUCTION

The purpose of this project is to reconstruct approximately 1.4 miles of Queen Creek Wash from Sossaman Road to Hawes Road within the Town of Queen Creek including construction of a bridge and approaches at Sossaman Road. The project will include technical review of reconstruction design by others for approximately one mile of Queen Creek Wash from Power Road to Sossaman Road. The Flood Control District of Maricopa County (District) is a project partner with the Town of Queen Creek (Town) and will provide input and review of the project during design development. The terms of the District's project involvement are described in Intergovernmental Agreement IGA FCD 2000A004. The improvements will provide 100-year flood protection, preserve and re-establish native vegetation and habitat, and provide recreational and open space benefits to the community. Project tasks include public involvement and coordination with stakeholders, survey & mapping, utility locating and relocation design, 404 permit, geotechnical investigation, hydrology and hydraulic analysis, sediment transport & bridge scour analysis, channelization design, Sossaman Road bridge design, landscape and environmental mitigation design, preparation of construction documents, FEMA CLOMR submittal, and engineering assistance during construction. The scope of work is described more fully as follows:

SCOPE OF WORK

I. PROJECT COORDINATION

A. Project Management

The Consultant's Project Manager will be knowledgeable of the progress and have responsible charge of the progress of each phase of the project. The Project Manager will be the point of contact for the Town and will keep the Town informed of all coordination with outside agencies and other affected parties. The Project Manager will be responsible for all administrative issues, technical direction of the work, scheduling, and budgetary oversight for the project as well as coordination and reporting with the Town's project manager.

Project coordination will be required with the following entities during development of the channel plans:

- Flood Control District of Maricopa County (District)
- Maricopa County Department of Transportation (MCDOT)
- U.S. Army Corps of Engineers, Regulatory Branch (COE)
- Sossaman Estates, LLC

Project coordination will include preparation, attendance, and follow-up minutes for project coordination meetings in addition to the continuous coordination through telephone conversations and written correspondence.

B. Meetings

In addition to meetings identified elsewhere, attendance at the following milestone meetings will be required:

- Project Kick-off Meeting
- Pre-Design Report Review Meeting
- 30% Review Meeting
- 60% Review Meeting
- 90% Review Meeting
- Final Design Review Meeting.

C. Utility Coordination

The following utility providers have facilities within the project vicinity. Coordination will be required to identify existing and planned utilities, conflicts, and relocation.

Utility Co		Contact	Phone no.
Queen Creek Water Co		Paul Gardner	480-987-3240
Queen Creek Irrigation District		Dean Griffith	480-987-3002
SRP	Design Engineer	Larry Neil	602-236-6233
Qwest	Design Consultant	Herb Cox	480-831-4465
	Working on new lines in this area		
	Const coordinator	John Aker	602-630-0496
CableAmerica		Jerry Blount	480-558-7260
Queen Creek Sewer		Tom Narva	480-987-9887

There are no conflicts with sewer at this time.

II. DATA COLLECTION

A. Site Visits

An initial site visit will be conducted with representatives from the Town, the District and the consultant project team to identify existing conditions along the channel reach and to identify key project issues. A representative from Sossaman Estates, LLC will be invited to attend. A more detailed site reconnaissance will be undertaken as part of the sediment transport analysis to observe channel development, hydraulic roughness, hydraulic structures, and sediment characteristics. Additional site visits will be made during the course of project development to verify site conditions and observe changes that may take place over time.

B. Existing Data and Reports

Existing data and reports will be obtained from the Town, the District and other sources pertaining to previous and existing studies and plans for Queen Creek Wash. Data to be collected includes the following:

- Queen Creek/Sanokai Wash Hydraulic Master Plan, FCD 98-26, September 2000 prepared by Huitt-Zollars.
- Sediment Transport Analysis – Queen Creek and Sanokai Wash Hydraulic Master Plan, East Maricopa Floodway Capacity Mitigation Study, September 5, 2000 prepared by WEST Consultants, Inc.
- Town of Queen Creek Open Space and Trails Plan, October 1994 prepared by Conoyer-Hedrick Inc., which describes trail concepts and standards.

- Native Plant Inventory for Queen Creek Wash 404 prepared by Desierto Verde dated February 2, 2000.
- Landscape, Irrigation, Salvage and Mitigation Plans for the 1 mile section of Queen Creek Wash between Power Road and Sossaman Road prepared by others. (Technical review required)
- 404 permit application and Corp. of Engineers mitigation requirements.
- Developer plans for adjacent properties (to be provided by the Town)
- Existing mapping
- Existing utility information

III. SURVEY, PHOTOGRAMMETRY, & MAPPING

All survey, photogrammetry, and mapping shall conform to Section 3 of the FCDMC *Consultant Guidelines*, Second Edition, August 1, 2000, except that data submittals will not be required to be in the GIS form prescribed in the FCDMC *Data Delivery Specifications*.

A. Field Surveys

The Consultant will establish horizontal and vertical control for aerial mapping along the design reach from Hawes Road to Sossaman Road. The mapping will be based on NAD 88 vertical control datum and the state plane coordinate system. Existing monuments and section corners will be surveyed within the project vicinity to establish project control. Surface features, including existing culverts, surface utilities, and other structures will be included. Cross-sections will be surveyed along Sossaman Road at 50 foot spacing extending 600 feet north and south of the Queen Creek Wash centerline.

B. Aerial Mapping

Aerial mapping will be prepared for a 500-foot wide strip along the Queen Creek Channel centerline from the upstream side of the Ocotillo Road Bridge east of Hawes Road to 500 feet downstream of the Sossaman Road crossing. Mapping will be prepared at 1"=40' scale with a 1-foot contour interval.

A color aerial photo digital image in TIFF format will be provided, rectified to match the aerial mapping.

C. Utilities

Surface and underground utilities within the project limits will be identified in the field survey. An ALLOWANCE will be established for potholing where critical underground utility conflicts may exist.

IV. PUBLIC INVOLVEMENT

A. Stakeholders

Project stakeholders include the equestrian community that will use the trail system and the adjacent landowners. Adjacent landowners include:

- Queen Creek 46 Partnership
- Lawther Family Ltd Partnership
- Emperor Estates Development Inc.
- Healy Investments Ltd Partnership
- Hankin LLC

A meeting will be conducted with the stakeholders at the 90% or final plans completion level to discuss project implementation issues.

B. Public Meetings

Two public meetings will be held. One public meeting will be held at completion of the pre-design phase to inform the public of the project and to receive input and comments from the public. The second meeting will be held following the 60% or 90% design to receive comments and input on the design. The Town will determine the timing of the second meeting. The Consultant will be responsible for meeting preparation and scheduling. The Town will assist the Consultant in identifying the meeting location. Meetings will be in an open house format with display boards showing the proposed project elements. Information brochures will be provided by the Consultant to be distributed at the meetings.

V. RIGHTS-OF-WAY AND EASEMENTS

Existing ROW will be shown on the base drawings. Preliminary ROW requirements will be shown on the 30% plans. Legal descriptions with exhibits will be prepared for required new ROW, easements, and temporary construction easements (TCE's) following the 60% submittal. Legal descriptions and exhibits will be updated as necessary during the 90% and final plans completion to incorporate required changes. The Town will acquire all ROW and easements. The Town will obtain rights-of-entry for access to the Wash during design and data collection.

VI. 404 PERMIT

An individual 404 permit has already been submitted to the COE with the Town designated as the permittee. The COE has requested additional information and has not distributed the application package for public comment. On-going coordination will be required with the COE to obtain the final 404 permit for this project. The permit will cover all construction activities between Power Road and Hawes Road, including the Power Road Bridge and Sossaman Road Bridge. The following tasks will be required to complete the 404 permit process.

A. Mitigation Plan

The Consultant will prepare a Habitat Mitigation and Monitoring Plan (HMMP) for submittal to the COE and the Arizona Game and Fish Department. The HMMP will be coordinated with the channel and landscape design to incorporate the proposed channel cross-section configuration and landscape plant species to be integrated within and around the mitigation areas. The limits of the HMMP will be from Power Road to Hawes Road. Coordination will be required with Sossaman Estates, LLC for the reach from Power Road to Sossaman Road.

B. Arizona State 401 Water Quality Certification

The Consultant will complete the Arizona State Water Quality certification for this project as required by the Arizona Department of Environmental Quality (ADEQ). The application form will be submitted to ADEQ on behalf of the Town. Specifically, the certification will state that construction will not occur while Queen Creek Wash is flowing, thus eliminating the potential for surface water contamination.

C. Environmental Assessment

The Consultant will assist the COE in completing the Environmental Assessment for this project. Specifically, the Consultant will provide a summary of the potential direct, indirect, and cumulative impacts to jurisdictional waters of the U.S. as a result of this project. In addition, the Consultant will provide an analysis of the contextual relationship between the Proposed Action and other activities that may occur within the foreseeable future.

VII. GEOTECHNICAL INVESTIGATION

A. Sediment Transport Sampling

Specific requirements for channel sampling and testing of channel bed and bank materials will be defined during the field reconnaissance. It is assumed that a total of 15 bed and bank material samples will be required to define sediment size distribution characteristics for sediment transport, erosion control, and scour evaluations. Bed and bank samples taken along Queen Creek will be excavated to a depth of 3 feet using a rubber-tire backhoe.

B. Bridge Foundation Sampling

Bridge and road test borings will be performed. Materials encountered will be sampled at 5-foot intervals. Borings at the bridge abutment and pier locations will be advanced to a depth of 80 feet. Samples for pavement design along Sossaman Road will be advanced to a depth of 5 feet.

C. Geotechnical Testing and Reports

Representative samples of the materials encountered will be tested for:

Test	No. of Tests
Moisture Content/Dry Density (rings)	50
Direct Shear	5
Consolidation	5
pH/ Resistivity, Salts, Chlorides, Sulfates	2
Sieve Analysis/Atterberg Limits	25
Standard Proctors	1
R-Value	1

The results of all field exploration and laboratory tests will be used in the engineering analysis and evaluation for foundation support and roadway design. The Geotechnical/Foundation Report for the bridge/road project will include recommendations for bridge foundations, earthwork factors, pavement design, site grading and preparation, and corrosion. The Geotechnical Report for the bed and bank sampling along Queen Creek will include the results of the laboratory testing.

VIII. HYDROLOGY

A. Review and Update Existing Model

The District will provide the Queen Creek watershed HEC-1 hydrology model and DDMS files for the Consultant's use. Per the recommendation in the Queen Creek / Sanokai Wash Hydraulic Master Plan (HMP), the outflow hydrograph from the Sonoqui Detention Dike will be reviewed with the District to determine if modifications are required. This task does not include generating hydrology for the Queen Creek watershed tributary to the Dike.

B. Design Flood Hydrographs

The rainfall values within the HEC-1 model will be modified to develop flood hydrographs for the 2-, 5-, 10-, 25-, 50- and 100-year return period events. Simplified methods were used to accomplish this task for the development of the HMP. The results of the hydrologic analysis will be reviewed with the Town and the District. The developed flood hydrographs will be used to evaluate flood conditions for individual flood events and for long-term conditions.

IX. HYDRAULICS

A. HEC-RAS Modeling

The District will provide the Queen Creek Wash HEC-RAS hydraulic model for the Consultant's use. The hydraulic model will be updated between the Meadowbrook Road wash crossing in the Trilogy at Power Ranch Development and Ellsworth Road, to reflect current topographic and development conditions along the channel using the best available existing data. Additional cross-sections may be added to the existing model, if necessary. New existing conditions cross-sections will be generated from the mapping being generated for this project between Sossaman Road and Hawes Road.

B. Channel Design

The channel design will develop an earth channel with mild sideslopes, landscaped with native vegetation species. The cross-section will include a meandering low flow channel designed to protect existing mature trees, where possible. Equestrian passage shall be accommodated in the drop structure design. Design features must minimize erosion and maintenance requirements.

The hydraulic design will define the channel geometry necessary for flood control, identify the location and dimension of required structures, and determine the location and specifications for erosion control revetments. The location and dimensions of required grade control structures will be defined. Preservation of existing mature trees will be considered in placement of drop structures. Hydraulic design will be conducted in accordance with Maricopa County design criteria. The results of the hydraulic design will define conditions that will influence the future elements of Queen Creek Wash.

X. SEDIMENT TRANSPORT AND SCOUR

A. HEC-6 Modeling

The Consultant will develop a HEC-6 sediment transport model for Queen Creek Wash between the Meadowbrook Road wash crossing in the Trilogy at Power Ranch Development and Ellsworth Road. The model will be used to evaluate hydraulic design elements and define requirements for erosion and sedimentation control.

The HEC-6 model will be used in conjunction with other appropriate methods to define general degradation, and scour potential characteristics in the vicinity of all hydraulic structures, including bridges, drop structures, levees, and revetments.

B. Bridge Scour Analysis

The Consultant will conduct a detailed assessment of scour potential for all proposed and existing bridge structures influenced by the design project. Hydraulic analysis will be conducted to establish existing and proposed hydraulic conditions at each bridge crossing. Hydraulic analyses will consider both the 100-year flood and a "superflood" event. The discharge of both the 100-year

flood and the superflood event will be coordinated with the Town of Queen Creek. Hydraulic characteristics will be analyzed and evaluated for each bridge. Hydraulic impacts due to debris build-up on piers will be analyzed. Scour analyses of bridges will be conducted according to the procedures outlined in the Federal Highway Administration's publication HEC-18. Results of the HEC-6 sediment transport analysis will be used to define the long-term degradation potential component of the total scour potential at each bridge site. Requirements for abutment erosion protection will also be defined.

XI. SOSSAMAN ROAD BRIDGE DESIGN

The Consultant shall design a bridge and approach roadway modifications for the Sossaman Road crossing of Queen Creek Wash. The bridge length will be approximately 150' to 250' long and the bridge width will accommodate 4 driving lanes plus a center left turn lane, curb and gutter, barriers, and a sidewalk. The bridge design shall provide a minimum of 10 feet of clearance under the bridge for equestrian passage. In addition to structural design and bridge construction plans a Bridge Structure Selection Report will be prepared for the 30% submittal.

A. Bridge Structure Selection Report

The Consultant will submit a Bridge Structure Selection Report for the new bridge prior to preparation of preliminary design and construction documents. The report will include concept sketches and studies of the type, size, and location of the bridge; aesthetic treatments; preliminary foundation investigation; preliminary cost estimate; analysis of constructability, traffic control, and environmental consequences for each alternative. Town, MCDOT, and District approval will be obtained before beginning preliminary bridge design. An initial and final Bridge Structure Selection Report will be submitted.

B. Approach Roadway Design

Approach roadway modifications will be designed for the new bridge. The bridge deck will accommodate a standard MCDOT roadway section, unless directed otherwise. Strategies for access to adjacent properties and maintenance roads at the approaches to the bridge will be considered in design.

Approach Roadway Geometry:
The horizontal alignment and final grade lines for the approach roadway will be established in conjunction with the bridge plans and required clearances at Queen Creek Wash. The horizontal alignment and bridge footprint will be presented at the first public meeting.

Temporary Construction Detour (Allowance):
A traffic detour is not anticipated to be required during bridge construction. Design of a traffic detour is included as an ALLOWANCE in this Scope of Work.

Traffic Signing and Striping:
Roadway signing and striping plans will comply with Maricopa County and ADOT practices and with the *Manual on Uniform Traffic Control Devices.* Signing plans will include location layouts for ground-mounted signs; sign layout formats; and details for regulatory, warning, and information signs. Pavement marking plans will include details for striping centerlines, shoulders, and "no-passing" zones.

XII. LANDSCAPE DESIGN

The Town has adopted Queen Creek Wash as part of its Open Space and Trails Plan. The landscape design intent is to preserve and enhance the "natural" character of the wash, preserve the rural character of the Town, and provide a corridor for a bike/pedestrian multi-use trail and a separate equestrian trail.

A. Native Plant Inventory & Salvage

Desierto Verde has completed a native plant inventory of Queen Creek Wash as part of the 404 permit requirements. The Native Plant Survey consists of an in field survey of native plant material within the project limits. A database has been developed listing each individual specimen along with information regarding species, height, width, caliper, condition, aesthetic rating, and salvageability. This information will be used for evaluation of existing material for preservation, reuse potential and to estimate salvage costs. Supplemental Native Plant Inventory (fieldwork) will be conducted as required to review and verify the information previously gathered by Desierto Verde for this area.

Based on the information gathered in the field and preliminary engineering plans and details, a native plant inventory / salvage plan will be prepared designating protected native plants impacted by the proposed construction. Each individual specimen will be located on the plan, identified by tag number, and keyed to a legend indicating whether that plant is "to be salvaged", "to be demolished", or "to be preserved in place."

An aerial photograph at a minimum scale of 1"=50' will be utilized for preparation of the Native Plant Inventory and Salvage Plans. Existing and proposed grading will be shown on the aerial photograph to determine the extent and impact on existing vegetation.

B. Preliminary Landscape Architectural Concept / Pre-design

Based on the preliminary engineering plans, native plant survey and on other pertinent data and information gathered and evaluated, a preliminary landscape concept plan will be developed. The landscape concept package will consist of the following:

- An overall plan and/or typical plan sections graphically depicting the proposed landscape design for Queen Creek Wash. The landscape concept will include the typical trail system landscape concept and incorporation of the required 404 permit landscape mitigation areas. The landscape concept plan will also include a preliminary plant list and notes.

- Cross sections or elevations as required illustrating the proposed landscape design (if necessary)

- A preliminary opinion of probable construction cost

- Narrative text will be prepared describing the proposed landscape concept.

- Text and graphics will be incorporated in the overall project Pre-Design Study Report and will be submitted to the Town, FCD, and other Project Stakeholders for review and comment.

- The landscape concept design package will be rendered in color and mounted, suitable for presentation at public meetings.

C. Landscape Construction Documents

The final landscape construction documents shall provide for rock groundcover, plantings and a complete automated irrigation system design for designated landscape areas within the project limits including the required 404 permit landscape mitigation and the trail system. Plans will include: native plant salvage, planting & irrigation along with associated details and special provisions.

XIII. CONDITIONAL LETTER OF MAP REVISION (CLOMR)

The District will provide the currently effective FEMA HEC-RAS hydraulic model, to be used as the base hydraulic model for the CLOMR submittal. Per FEMA requirements, the water surface must tie into the currently effective FEMA study water surface at the upstream and downstream end of the modified reach. The CLOMR submittal will include the following:

A. ADWR Requirements

The Arizona Department of Water Resources (ADWR) requires submittal of a *Technical Data Notebook* (TDN) along with each FEMA submittal. Requirements for TDN submittals are presented in *Instructions for Organizing and Submitting Technical Documentation for Flood Studies*, SSA 1-97, November 1997.

B. FEMA Requirements

FEMA submittal requirements are described in 44 CFR 65.6, *Revision of base flood elevation determinations*, & 65.8, *Review of Proposed Projects*. The following items will be included in the FEMA submittal:

FEMA Forms
Construction plans
Revised hydraulic analysis
Revised floodplain delineation

C. LOMR Submittal

The CLOMR submittal will be made at the conclusion of the design and will include final, sealed construction plans. Construction can proceed without the CLOMR during the FEMA review. Upon FEMA approval and completion of construction, a LOMR submittal will be prepared consisting of certified as-built channel and bridge construction plans. The Contractor will be required to prepare and certify the as-built plans

XIV. PRE-DESIGN

The pre-design phase will further develop the design concept identified in the Hydraulic Master Plan to a level of detail that can be used for the 30% design.

A. Sossaman Estates Channel Design Review

The Consultant will review the channel modifications proposed by Sossaman Estates, LLC between Power Road and Sossaman Road. Review comments on the proposed hydraulic design elements for the proposed improvements and recommendations for coordination of the proposed development with the current project will be developed and provided to the Town during the Pre-design. Subsequent plan submittals will be reviewed until final plan approval.

B. Pre-Design Study Report

The Pre-Design will include the following tasks:

- Data Collection
- Aerial mapping and topographic surveys
- Habitat mitigation and monitoring plan
- Geotechnical investigation
- Preliminary hydraulic analysis & HEC-RAS modeling
- Preliminary profile design
- Sediment transport analysis
- Native plant inventory
- Preliminary landscape concept
- Ryland channel design review

A *Pre-Design Study Report* will be submitted presenting the results of all the pre-design tasks.

XV. FINAL DESIGN AND CONSTRUCTION DOCUMENTS

Construction documents will generally be prepared according to District *Consultant Guidelines* and *Drafting Guides* using AutoCAD software. Design review submittals will be made at the 30%, 60%, 90%, and Final completion levels. A three-week review period will be included in the schedule for each submittal.

A. 30% Design

Base map preparation will begin during the pre-design, however, the 30% design will be developed after approval of the pre-design submittal. The 30% plans will show all existing features including utilities and existing ROW. The channel alignment, profile, and cross-section will be shown along with anticipated required new ROW and easements. Conflicting utilities will be identified for relocation. The preliminary planting plan will depict a landscape concept indicating proposed materials. Preliminary quantities and cost estimates final Bridge Structure Selection Report, and preliminary design calculations will also be included with the submittal.

B. 60% Design

The 60% plans will incorporate comments from the 30% review and will refine the design and hydraulic analysis. Preliminary construction details will be developed to show the size, configuration, materials, and section of the proposed improvements. Preliminary planting and native plant salvage plans will be included along with a "skeleton" irrigation design. The first draft construction special provisions (SP) and supplementary general conditions (SGC) and an updated quantity and cost estimate will be included.

C. 90% Design

The 90% plans will include all final details with reinforcing steel for concrete structures. The plans will be complete and ready for final agency review. Updated SP's, SGC's, quantity and cost estimates, and the bid form will be included as well as the final design report.

D. Final Design

The final design plans will incorporate any comments from the 90% review. The plans, SP's, and SGC's will be ready for contractor advertisement and bidding.

E. Special Provisions & Bid Documents

Special Provisions will be based on MAG Standard Specifications. All Special Provision items will be organized and numbered according to the MAG Specifications with each provision identifying whether it modifies, adds to, or replaces the applicable MAG provision. The front-end boilerplate provisions will be provided by the Town.

F. Engineer's Construction Cost Estimate

An Engineer's estimate will be provided with each plan submittal. The 60%, 90%, and Final estimates will be numbered according to the MAG specifications.

G. Bidding Assistance

The Town will provide copies of plans for bidding. The Consultant will attend the pre-bid meeting, respond to contractor questions, and issue necessary addenda during the bidding process.

XVI. ENGINEERING SERVICES DURING CONSTRUCTION (Allowance)

An ALLOWANCE will be established for the Consultant to respond to questions and design issues during construction. The allowance will be used on a time and materials basis as needed.

APPENDIX C

SURVEY FIELD NOTES

APPENDIX C.1

PROJECT SURVEY REPORT

QUEEN CREEK

GPS DATA

Prepared By:
Z & H ENGINEERING, INC.

For:
DIBBLE & ASSOCIATES

717 West Dunlap Avenue, Suite 100
Phoenix, Arizona 85021

QUEEN CREEK

GPS CONTROL DATA

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
29277
DAVID L.
VANDER-LINDEN
Date Signed 1-19-0
ARIZONA, U.S.A.

1007	812033.484	794185.293	1431.300	[illegible]	[illegible]	[illegible]								
1008	811565.270	794286.710	1430.775	1428.510	1431.5[illegible]	[illegible]								
1009	812071.076	792869.294	1417.270	1415.010	1417.840	1417.270								
1010	812801.314	791534.509	1421.330	1419.050	1421.900	1421.008		1420.954	tbm1010	1010 RB N-side of wash	[illegible]	[illegible]	[illegible]	[illegible]
1011	812329.747	791584.550	1421.940	1419.670	1422.510	1421.940						-0.570	0.000	2.270
1012	813488.917	789770.027	1405.270	1403.050	1405.860	1405.270						-0.590	0.000	2.220
1013	814025.073	788990.155	1409.820	1407.490	1410.420	1409.820						-0.600	0.000	2.330
1014	813718.877	789006.558	1412.190	1409.880	1412.760	1412.190						-0.570	0.000	2.310
1015	814366.805	787648.422	1397.170	1394.790	1397.770	1397.170						-0.600	0.000	2.380
1016	815513.336	786266.798	1403.655	1401.260	1404.255	1403.655						-0.600	0.000	2.395
1017	814915.643	786270.956	1404.265	1401.860	1404.865	1404.394		1404.337	tbm1017	PK Nail Ellsworth S. of Qwncrk Bridge	-0.057	-0.471	0.129	2.534
1018	816130.750	785017.190	1387.270	1384.870	1387.870	1387.270						-0.600	0.000	2.400
1019	816333.149	783821.997	1390.060	1387.630	1390.660	1390.208						-0.452	0.148	2.578
1020	816953.517	783735.732	1389.720	1387.300	1390.320	1389.720						-0.600	0.000	2.420
1021	817311.904	782684.779	1380.190	1377.800	1380.790	1380.190						-0.600	0.000	2.390
1022	818110.957	781589.730	1388.510	1386.070	1389.110	1389.102						-0.008	0.592	3.032
1023	818428.750	780288.056	1378.580	1376.110	1379.180	1378.580						-0.600	0.000	2.470
1024	818729.624	780427.755	1384.420	1381.960	1385.020	1384.420						-0.600	0.000	2.460
										Average Correction to DTM Data				2.427

QUEEN CREEK

GPS CONTROL DATA

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
29277
DAVID L.
VANDER-LINDEN
Date Signed 1-19-0K
ARIZONA, U.S.A.

		Final mapping data for Queen Creek Wash Panel points in East area from County Line to Hawes Rd.												
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			lev-gps	88-29	gps-cp	gps-dtm
1	819434.552	780562.032			1381.448	1380.558		1380.558	tbm5	1/2"RB Base1	0.000	-0.890		
6	815117.146	794086.092	1426.920		1427.507	1426.919	1426.919	1426.919	bm1	G 68 BC NGS	0.000	-0.588	-0.001	
7	811778.000	798622.000			1445.906	1445.597	1445.597	1445.597	bm2	Q 364 BC NGS	0.000	-0.309		
4	817323.000	791109.000			1414.524	1413.901	1413.901	1413.901	bm3	R 364 BC NGS	0.000	-0.623		
500	820883.000	786269.000			1400.728	1399.916	1399.813	1399.813	bm5	S 364 BC NGS	-0.103	-0.812		
			1401.415		1402.015	1401.415		1401.386	bm4	BCHH Ocotillo & Ellsworth	-0.029	-0.600	0.000	
1000	812656.061	799375.037	1447.825		1448.395	1447.825						-0.570	0.000	
1001	811343.494	800028.607		1422.340										
1002	811841.410	798614.897	1441.560	1439.450	1442.130	1441.517		1441.497	tbm1002	1/2"RB E of RR N of Wash	-0.020	-0.613	-0.043	2.067
1003	811365.561	797705.646	1441.620	1439.480	1442.190	1441.620						-0.570	0.000	2.140
1004	810908.853	796925.392	1439.805	1437.560	1440.241	1439.805						-0.436	0.000	2.245
1005	811432.260	796814.312	1439.920	1437.760	1440.490	1439.920						-0.570	0.000	2.160
1006	811523.220	795394.016	1435.110	1432.960	1435.680	1434.994		1435.014	tbm1006	RB 1006 N-side of wash	0.020	-0.686	-0.116	2.034
1007	812033.484	794185.393	1431.380	1429.200	1431.950	1431.380						-0.570	0.000	2.180
1008	811565.270	794286.710	1430.775	1428.610	1431.345	1430.775						-0.570	0.000	2.165
1009	812071.076	792869.294	1417.270	1415.010	1417.840	1417.270						-0.570	0.000	2.260
1010	812801.314	791534.509	1421.330	1419.050	1421.900	1421.008		1420.954	tbm1010	1010 RB N-side of wash	-0.054	-0.892	-0.322	1.958
1011	812329.747	791584.550	1421.940	1419.670	1422.510	1421.940						-0.570	0.000	2.270
1012	813488.917	789770.027	1405.270	1403.050	1405.860	1405.270						-0.590	0.000	2.220
1013	814025.073	788990.155	1409.820	1407.490	1410.420	1409.820						-0.600	0.000	2.330
1014	813718.877	789006.558	1412.190	1409.880	1412.760	1412.190						-0.570	0.000	2.310
1015	814366.805	787648.422	1397.170	1394.790	1397.770	1397.170						-0.600	0.000	2.380
1016	815513.336	786266.798	1403.655	1401.260	1404.255	1403.655						-0.600	0.000	2.395
1017	814915.643	786270.956	1404.265	1401.860	1404.865	1404.394		1404.337	tbm1017	PK Nail Ellsworth S. of Qwncrk Bridge	-0.057	-0.471	0.129	2.534
1018	816130.750	785017.190	1387.270	1384.870	1387.870	1387.270						-0.600	0.000	2.400
1019	816333.149	783821.997	1390.060	1387.630	1390.660	1390.208						-0.452	0.148	2.578
1020	816953.517	783735.732	1389.720	1387.300	1390.320	1389.720						-0.600	0.000	2.420
1021	817311.904	782684.779	1380.190	1377.800	1380.790	1380.190						-0.600	0.000	2.390
1022	818110.957	781589.730	1388.510	1386.070	1389.110	1389.102						-0.008	0.592	3.032
1023	818428.750	780288.056	1378.580	1376.110	1379.180	1378.580						-0.600	0.000	2.470
1024	818729.624	780427.755	1384.420	1381.960	1385.020	1384.420						-0.600	0.000	2.460
										Average Correction to DTM Data				2.427

		Final mapping data for Queen Creek Wash Old Panel points in West area from Hawes Rd.to Confluence											
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation					
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88					
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29	gps-cp
1023a	819250.245	780272.991	1375.020			1377.370							2.350
1024a	818942.882	779836.097	1375.380			1377.730							2.350
1025	819741.053	779672.211	1369.470		1372.732	1371.816		1371.710	tbm1025	Rock near old panel 1025	-0.106	-0.916	2.346
1026			1370.750			1373.100							2.350
1027	820870.798	779290.274											0.000
1028	821584.961	778591.949	1364.590		1368.243	1367.245						-0.998	2.655
1029	821657.249	777893.022	1365.210			1367.810							2.600
1030	822207.799	777867.981	1366.720			1369.320							2.600
1031	822596.133	776927.690	1356.210		1359.823	1358.762						-1.061	2.552
1032	822951.573	775649.932	1359.850		1363.402	1362.308						-1.094	2.458
1033	823434.178	775640.650	1359.920			1362.430							2.510
1034	823463.446	775649.932	1355.270			1357.780							2.510
1035	823311.066	773033.122	1350.430			1352.940							2.510
1036	823850.522	773000.465	1349.830			1352.340							2.510
1037	823641.753	771685.378	1347.290		1351.031	1349.846		1349.613	tbm1037	1/2" RB on North side of Queen Creek	-0.233	-1.185	2.556
1038	823397.533	770507.590	1349.020			1351.670							2.650
1039	824053.288	770494.328	1347.030		1350.992	1349.772		1349.373	tbm1039	pk nail Power Rd. N of Queen Creek	-0.399	-1.220	2.742
1040	823546.188	769210.798	1338.690			1341.400							2.710
1042	823738.274	767872.291	1335.650			1338.380							2.730
1043	823414.078	766545.908	1334.570			1337.300							2.730
1044	823135.749	765178.934	1329.420			1332.150							2.730
1045	823593.212	765201.885	1327.850			1330.570							2.720
1046	823348.593	763985.930	1327.880			1330.600							2.720
1047	823136.292	762599.659	1324.430			1327.150							2.720
1048	823661.919	762527.362	1320.730			1323.440							2.710
1049	822795.678	761320.750	1322.050		1326.084	1324.755		1324.323	tbm1049	tbm1049 rebar in old panel	-0.432	-1.329	2.705
1050	822243.682	760377.060	1321.450			1324.160							2.710
1051	822644.812	760280.758	1317.020			1319.730							2.710
1052	821592.029	759789.655	1315.430			1318.160							2.730
1053	820203.689	759670.781	1315.620			1318.370							2.750
1054	820236.781	760200.515	1318.310			1321.080							2.770
1055	819133.263	759665.711	1311.450			1314.250							2.800
1056	818238.604	758720.955	1313.440			1316.260							2.820
1057	817892.383	759044.465	1313.580			1316.420							2.840
1058	817091.107	758188.310	1311.510			1314.360							2.850
1059	816117.076	757151.906	1307.660		1311.689	1310.523		1309.923	tbm1059	nail West side canal	-0.600	-1.166	2.863
1060	815841.662	757429.294	1309.970			1312.820							2.850
1061	815244.485	756794.924	1308.400		1312.396	1311.254		1310.683	tbm1061	nail west side canal	-0.571	-1.142	2.854
1062	814689.606	755499.731	1307.080			1309.940							2.860
1063	814553.857	756257.103	1308.560			1311.430							2.870
1064	813728.037	755341.759	1296.520			1299.400							2.880
1065	812646.717	754597.779	1307.720			1310.610							2.890
1066	812337.071	755087.546	1304.230		1308.202	1307.133		1306.478	tbm1066	tbm1066 nail in old panel	-0.655	-1.069	2.903
										Average Correction to Kenney Data			2.683

	Final mapping data for Queen Creek Wash points in Culvert Crossing Meadowbrook Rd.& Other areas													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
472	818064.412	785600.127				1398.936	1398.881	1398.862	2DN1	GDACS Point 2DN1 Rod Driven Refusal	-0.074			
1381	818117.241	780979.932			1381.080	1383.429		1383.309	tbm3	BC Hole Hawes & Ocotillo	-0.120	2.349		
						1378.923		1378.823	tbm6	BC FL in Culdesac	-0.100			
						1363.123		1363.013	tp111	Pan 32	-0.110			
								1344.333	tp141	E6 SW				
								1332.978	tbm70	nail				
								1331.808	tp148	FL North pipe East End				
								1331.838	tp149	FL Center pipe East end North				
								1331.818	tp150	FL Center pipe East end South				
								1333.438	tp151	FL South pipe East end				
								1332.916	tp153	FL South pipe West end				
								1332.746	tp154	FL Center pipe West end South				
								1331.356	tp155	FL Center pipe West end North				
								1331.404	tp156	FL North pipe West end				
								1340.632	tp157	BSW NW Cor Bridge				
								1342.062	tp158	CLS West side pipe to N on West side				
								1342.722	tp159	CLS West side center pipe West end North				
								1343.252	tp160	CLS West side center pipe West end South				
								1343.612	tp161	CLS West side South end pipe West side				
								1344.162	tp162	CLS East side center pipe West end South				
								1336.888	tp167	NE Cor Bridge nail				
								1340.618	tbm17	NW Cor Bridge BSW				
						1335.030		1334.803	bm7	bchh SW Cor Bridge Recker & Queen Creek R	-0.227			
						1334.310		1334.158	bm8	1/2"RB 1/2 mile West Recker & Queen Creek F	-0.152			
						1335.540		1335.353	bm9	BCF Top Wall on Bridge Queen Creek & Higle	-0.187			
1326	820669.357	759938.356			1326.010	1328.648		1328.143	bm1326	BCHH Southbound Lane Higley Rd.	-0.505	2.638		
						1325.960		1325.748	bm10	1/2"RB 1/2 mile S on Higley Rd	-0.212			
						1315.310		1315.083	bm11	1/2"RB East side of Canal	-0.227			
						1312.830		1312.568	bm12	rock in cc East side canal	-0.262			
						1331.620		1331.393	bm13	1/2"RB N side of wash 200' E bridge	-0.227			

	Final mapping data for Queen Creek Wash New Panel points in Center area from Hawes Rd.to Power Rd.													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
11	823594.378	770504.624			1354.028	1352.825		1352.633	bm6	bc fl Power Rd & Queen Creek	-0.192	-1.203		
20	823425.703	780889.819			1378.358	1377.334		1377.228	tbm7	BCHH Hawes & Queen Creek	-0.106	-1.024		
21	820771.116	780934.889			1379.849	1378.919				BCHH		-0.930		
23	818117.187	783624.381			1393.899	1393.106				BC FL		-0.793		
24	815460.578	780992.652			1385.591	1384.846				BCHH		-0.745		
25	818109.586	778355.830			1377.336	1376.455				CPS		-0.881		
26	818101.829	775730.982			1371.254	1370.330				PK		-0.924		
27	820587.212	775689.146			1366.142	1365.130				CPS		-1.012		
28	823433.544	775641.007			1363.232	1362.121		1362.023	tbm8	RB Queen Creek & Sossmann	-0.098	-1.111		
30	823986.466	775635.089			1360.965	1359.835				PNL		-1.130		
31	823235.611	775645.866			1362.395	1361.291				PNL		-1.104		
32	823319.584	775317.167			1366.252	1365.139				PNL		-1.113		
33	822258.056	775660.905			1363.336	1362.266				PNL		-1.070		
34	822175.175	778340.255			1369.221	1368.198				PNL		-1.023		
35	823052.562	776090.265			1365.102	1364.011				PNL		-1.091		
36	822576.322	777095.203			1369.312	1368.254				PNL		-1.058		
37	821755.557	778301.691			1372.334	1371.326				PNL		-1.008		
38	821704.553	777905.384			1368.118	1367.104				PNL		-1.014		
39	821418.023	778551.088			1373.624	1372.632				PNL		-0.992		
40	820739.858	779262.283			1373.751	1372.794				PNL		-0.957		
41	818496.284	780974.011			1385.814	1384.964		1384.836	tbm4	PK Nail Hawes Rd. N. Queen Creek	-0.128	-0.850		
42	818524.085	780860.181			1390.448	1389.594				PNL		-0.854		
43	817531.288	782254.940			1386.835	1386.040				PNL		-0.795		
44	818287.423	782691.525			1389.932	1389.117				PNL		-0.815		
45	818117.397	781854.390			1390.044	1389.221		1389.119	tbm2	PK Nail Ocotillo E. of Bridge	-0.102	-0.823		
46	819881.462	779572.178			1379.572	1378.650				PNL		-0.922		
47	819279.965	779836.789			1378.737	1377.840				PNL		-0.897		
48	818903.720	780047.057			1379.871	1378.991				PNL		-0.880		
49	818304.576	779735.879			1380.998	1380.134				PNL		-0.864		
103	823235.944	775666.393			1362.435	1361.331				ZH3		-1.104		
										Average Correction to Aerial Data		-1.000		

	Final mapping data for Misc. Points, ERMs													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
473	804890.688	786304.644			1419.197	1418.909				erm 1416 mcbchh		-0.288		
474	818117.657	786260.328			1402.166	1401.417				erm 2126 mcbchh		-0.749		
475	826095.760	775601.968			1359.859	1358.655				5007 1 1/2" AC		-1.204		
476	820767.897	775686.133			1365.351	1364.333				5002 1 1/2"AC		-1.018		
477	820868.800	773055.694			1357.066	1356.001				5005 1"IP		-1.065		
478	818333.238	770587.137			1355.694	1354.675				7002 bchh dea108		-1.019		
479	820964.782	770546.089			1349.408	1348.298				7003 bchh dea107		-1.110		
480	824533.981	770490.628			1346.644	1345.409				7050 bchh dea122		-1.235		
481	826224.738	770465.656			1344.293	1342.998				7007 bchh dea107		-1.295		

Pt#	Northing (ft) NAD83(92) GRID	Easting (ft) NAD83(92) GRID	Elevation (ft) NGVD 29	Description
1	819434.552	780562.032	1382.843	Base PNL
2	828701.969	786118.009	1392.000	T2SR7ES10NW
3	818117.579	786260.325	1403.000	T2SR7ES15
4	817323.000	791109.000	1414.520	R364 1967
5	843940.971	785927.070	1384.711	BILLY 1975
6	815117.146	794086.093	1427.507	G 68 1980
7	811778.000	798622.000	1445.906	Q 364 1967
8	802184.150	781039.045	1426.000	T2SR7ES33SW
9	802246.129	786320.889	1438.000	T2SR7ES34SW
10	823713.289	771621.312	1350.750	MCDOT Cap Given
11	823594.378	770504.624	1356.228	MCDOT Cap GPS
20	823425.703	780889.819	1378.710	BCHH
21	820771.116	780934.889	1380.847	BCHH
22	818116.636	780979.987	1385.910	BC .05
23	818117.187	783624.381	1395.062	BC FL
24	815460.578	780992.652	1387.887	BCHH
25	818109.586	778355.830	1379.459	CPS
26	818101.829	775730.982	1373.857	PK
27	820587.212	775689.146	1368.140	CPS
28	823433.544	775641.007	1364.538	1/2"RB
29	823429.622	778265.413	1378.710	TP
30	823986.466	775635.089	1362.136	PNL
31	823235.611	775645.866	1363.748	PNL
32	823319.584	775317.167	1367.644	PNL
33	822258.056	775660.905	1364.928	PNL
34	822175.175	778340.255	1370.345	PNL
35	823052.562	776090.265	1366.420	PNL
36	822576.322	777095.203	1370.564	PNL
37	821755.557	778301.691	1373.569	PNL
38	821704.553	777905.384	1369.437	PNL
39	821418.023	778551.088	1374.897	PNL
40	820739.858	779262.283	1375.062	PNL
41	818496.284	780974.011	1387.366	PNL
42	818524.085	780860.181	1392.013	PNL
43	817531.288	782254.940	1388.391	PNL
44	818287.423	782691.525	1391.223	PNL
45	818117.397	781854.390	1391.529	PNL
46	819881.462	779572.178	1381.038	PNL
47	819279.965	779836.789	1380.302	PNL
48	818903.720	780047.057	1381.491	PNL
49	818304.576	779735.879	1382.822	PNL
103	823235.944	775666.393	1363.785	ZH3

Pt#	Northing (ft)	Easting (ft)	Elevation (ft)	Description
	NAD83(92) GROUND	NAD83(92) GROUND	NGVD 29	
1	819513.121	780636.873	1382.843	Base Panel
2	828781.425	786193.382	1392.000	T2SR7ES10NW
3	818196.021	786335.712	1403.000	T2SR7ES15
4	817401.366	791184.852	1414.520	R364 1967
5	844021.889	786002.426	1384.711	BILLY 1975
6	815195.300	794162.230	1427.507	G 68 1980
7	811855.834	798698.573	1445.906	Q 364 1967
8	802261.065	781113.932	1426.000	T2SR7ES33SW
9	802323.049	786396.282	1438.000	T2SR7ES34SW
10	823713.289	771621.312	1350.750	MCDOT Cap Given
11	823673.345	770578.500	1356.228	MCDOT Cap GPS
20	823504.654	780964.692	1378.710	BCHH
21	820849.813	781009.766	1380.847	BCHH
22	818195.078	781054.868	1385.910	BC .05
23	818195.629	783699.516	1395.062	BC FL
24	815538.765	781067.535	1387.887	BCHH
25	818188.027	778430.460	1379.459	CPS
26	818180.269	775805.360	1373.857	PK
27	820665.891	775763.520	1368.140	CPS
28	823512.496	775715.376	1364.538	1/2"RB
29	823508.573	778340.034	1378.710	TP
30	824065.471	775709.457	1362.136	PNL
31	823314.544	775720.235	1363.748	PNL
32	823398.525	775391.505	1367.644	PNL
33	822336.895	775735.276	1364.928	PNL
34	822254.006	778414.883	1370.345	PNL
35	823131.477	776164.677	1366.420	PNL
36	822655.191	777169.712	1370.564	PNL
37	821834.348	778376.315	1373.569	PNL
38	821783.339	777979.970	1369.437	PNL
39	821496.781	778625.736	1374.897	PNL
40	820818.552	779336.999	1375.062	PNL
41	818574.762	781048.892	1387.366	PNL
42	818602.566	780935.050	1392.013	PNL
43	817609.673	782329.943	1388.391	PNL
44	818365.881	782766.570	1391.223	PNL
45	818195.839	781929.355	1391.529	PNL
46	819960.073	779646.924	1381.038	PNL
47	819358.519	779911.560	1380.302	PNL
48	818982.237	780121.848	1381.491	PNL
49	818383.036	779810.641	1382.822	PNL
103	823314.876	775740.764	1363.785	ZH3

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PROJECT REPORT
Queen Creek Wash
26 April 2001

Section 1: Project Overview

Introduction

This is the report for Z&H Engineering of the survey of the Queen Creek Wash between Hawes Road and Sossaman Road. This report contains a project overview and then details the observations, problems encountered, reduction and adjustments performed to provide Horizontal and Vertical control for mapping a 400 foot wide strip along Queen Creek.

Method

The geodetic control survey was completed using ASHTECH- Z12 dual channel GPS receivers and a WILD N-3 Level with a Philly rod. The receivers collected data from the GPS, a constellation of satellites developed for the Department of Defense using RTK methods. The level was used for verification of elevation data from NSRS bench mark stations using 3rd Order procedures.

Control Selection

Horizontal Control

The following National Geodetic Survey (NGS) stations were used as the basis for the horizontal control:

G 68 1980 "B" Order station NGS
T2SR7ES15
T2SR7ES34SW

Vertical Control

The following stations were used as the basis for the vertical control:

R 364 1967 NGS
G 68 1980 NGS
Q 364 1967 NGS
ERM 1416 Maricopa County Brass Cap
ERM 1381 Maricopa County Brass Cap

The two ERM's were used as an effort to stabilize the vertical plane. However, they actually created a tilt.

Sequence of Events

1. After completing the original tasking we tied to the Bench mark on Power Road and the Queen Creek Bridge. The difference in elevation was slightly less than 5 feet. The position was off 125 feet by 115 feet, indicating to me that this coordinate might be a Ground coordinate instead of a Grid coordinate. After applying the Grid/Ground factor for this area the coordinate checked within a few hundredth of a foot horizontally. The vertical was still a problem that could not be explained without further investigation.

2. Next, I was invited to attend a meeting at Dibble to discuss the vertical problem we had found. (Ref Attachment A).

3. I was assigned to survey the additional points provided by Dibble (See Action Items, Attachment A). I was given two additional days of GPS to complete the Action Items. Upon completion of the two days, I found that the data provided was on different datums in the vertical and some of the points were on Grid while others were on Ground. I also found that the points selected were not the points used to create the primary models of the Queen Creek Wash. The points were instead, other projects that had been done near the wash. I discovered that there were two main studies for the Queen Creek Wash. One done in 1995 from the County line to just past Hawes Road and the other in 1997 from Hawes Road to Greenfield Road. In order for me to evaluate the elevation problem, I needed some of both projects points or the stations and data used to establish them.

4. I spoke with Dave Vanderlinden of Z & H Engineering to get approval to go to the Flood Control office and get the data on the points I needed. He spoke with Dibble and got the okay to gather the correct information from Marta Dent at Flood Control.

5. I contacted Marta Dent and arranged for a time to come in to do research on the points I needed. I took my research person, Trent Moody, with me to Flood Control. Marta gave us the folders containing the original survey data for both projects as well as a third one that was in the area. We looked through the folders and found the level and the horizontal survey data collected for each of the points in the two studies. I found an error in the starting elevation for one of the projects level loops. That changed all of the elevations in the East project by about 0.6 feet. I also found several other problems with the data, such as Grid/Ground errors. I was running out of time for the day so we asked Marta if we could copy the pertinent data and take it with us for further investigation. She said that would be fine and to let her know what we found out. This process took one full day of office time for both Trent and myself including the time with Marta.

6. Errors were found in the data which required additional observations to prove the corrections and the GPS data, as well as tie down the apparent differences in datums from the East study to the West study.

7. Our research and additional observations led to another meeting at Queen Creek to discuss the findings and make a Plan of Action to proceed. Approval was given at that meeting for 2 additional GPS observation days and four days of levels to verify the datum differences and the originally assigned GPS data from Hawes Road to Sossaman Road.

8. The levels were run by Z & H Engineering, processed and compared with the GPS solution. This resulted in a correction to the GPS data of about 1.5 feet, reducing the differences in the datums to about 3.5 feet. The GPS files were adjusted to account for the errors found in the ERMs and the adjusted data was then compared to the level loops run by Z & H Engineering resulting in a check on the level loops of less than 0.1 foot. This is within the expected error of GPS Vertical observations. At this point we had two sources that agreed on the vertical datum differences. The average difference in the West study from the corrected Level loop data of the East study is 3.56 feet. It should be noted that the errors in the ERMs caused a tilt in the GPS vertical plane. Which results in the need to readjust the aerial mapping by about 1.5 feet.

9. This information was presented at the last meeting at Dibble where we were assigned to continue to check to the West study to see if the datum differences were still 3.56 feet and to bring together all of Queen Creek Wash in the same Datum.

To be continued after additional data collection.....

Bob Phillips

The remaining observations and levels were obtained in the 29 vertical datum and check sections were run to verify the final solution in the 29 datum. The check sections reveled that the NGS control points did not agree within the allowable tolerances. Additional levels were run to attempt to find two NGS Control points that fall within the tolerance. Stations G 68, and S 364 resulted in the best solution and just within the tolerances of third order leveling. These points and the other points not meeting the allowable error are all part of a NGS First Order level line and should all be within the allowable tolerances. The same level data was processed using the NAVD 88 control values and all control points fell within the allowable tolerances.

I contacted NGS to discuss the history of this particular level line and was sent the complete history of the line and others within the area. I was told that there is documented subsidence issues in the area of the Queen Creek Wash. This explained the problems originally encountered in the earlier observations addressed in this report. It was the recommendation of the NGS that we not use NGVD 29 for our study. This along with the data problems led me to the decision that we should be using NAVD 88 to complete the study.

Project Datum Resolution Meeting
Dibble & Associates
Monday, July 16, 2001

ATTENDEES:

Tom Narva	(Town of Queen Creek)
Paul Stears	(FCDMC)
John Stock	(FCDMC)
Blair Haines	(Z&H Engineering)
Bob Phillips	(GPS Services)
Brian Fry	(Dibble)

PURPOSE OF MEETING:
To identify the course of action to correct the FCDMC mapping for use on the Queen Creek Wash project. The datum issue impacts three sets of mapping. FCDMC mapping from Hawes Road west to the EMF was completed by Kenney Aerial Mapping, Inc. (KAM), FCDMC mapping from Hawes Road east to the Maricopa County line was completed by Lee Harbers of DTM, Inc., and project design mapping was prepared from Hawes Road to Ocotillo Road by Aerial Mapping Company, Inc. (AMCI). All three sets of mapping will be corrected based on the results of the field control surveys.

DECISIONS:

The mapping will be adjusted to NAVD 88 vertical datum. Per John Stock, since all the mapping is being updated it is better to go to the 88 datum instead of NGVD 1929.

Bob Phillips will provide equations for conversion to NGVD 1929 and Town of Gilbert datums.

Bob Phillips will provide results of surveys and the required mapping adjustments for each set of mapping to Dave VanderLinden of Z&H Engineers. Upon review and approval of the data, Dave will forward the mapping adjustments to KAM, DTM, and AMCI.

The GPS data collected for this project was readjusted using NAVD 88 vertical data and the results are found at the end of this report. The level data was adjusted using Starnet and NAVD 88 and the results are found at the end of this report.

Queen Creek Wash Panel Points in East Area From the County Line to Hawes Rd. Study 95-03 DTM Inc.

The data originally provided by Collins Pina for the East portion of the Queen Creek Wash, County line to Hawes Rd., proved to be NAVD 88 values not NGVD 29 as reported. However, DTM Inc. used a modified version of these values as shown on the spreadsheet provided at the end of the report. This results in the need for readjustment of the mapping provided by DTM Inc. The average correction to the data used by DTM is +2.427 feet, the range of the correction is +1.958 to +3.032 feet with most of the corrections around +2.35 feet. The Conversion for the observed points to NGVD 29 are given in the spreadsheet at the end of the report.

Queen Creek Wash Panel Points in West Area From the Hawes Rd. to the EMF. Study 97-11 Kenney Aerial Mapping Inc.

The data provided by Collins Pina for the West portion of the Queen Creek Wash, Hawes Rd. to the EMF, was established using points included in the town of Gilbert. The town of Gilbert apparently has it's own datum and is different than the NGS points used in the East area. The difference appears to be on the magnitude of +2.5 feet. That is to say that Gilbert's data is 2.5 feet lower than NGS at least in the area of Queen Creek Wash. The mapping data done by Kenney Aerial Mapping, Inc. should be corrected using the data provided at the end of the study. The average correction to Kenney mapping is +2.683 feet. The range is from +2.350 to 2.903 feet with most of the corrections around +2.7 feet. The Conversion for the observed points to NGVD 29 are given in the spreadsheet at the end of the report.

Queen Creek Wash Panel Points in the middle Area From the Hawes Rd. to Ocotillo Rd. Aerial Mapping Inc.

The mapping provided by Aerial Mapping Inc. needs to be corrected because of the tilt introduced into the data from the use of bad ERM's . The average correction is –1.000 feet. The range is -.745 to -1.203 feet, with most of the corrections around -1.0 feet. The Conversion for the observed points to NGVD 29 are given in the spreadsheet at the end of the report. In the future, it is not recommended to use NGVD 29 data for survey control.

We are converting and combining all of the Queen Creek Wash studies into one datum. I believe this will result in the least amount of cost and will result in a database of common datum throughout the Queen Creek Wash.

Robert A. Phillips II
Geodesist,
GPS Services L.L.C.

1. Reference Email from Dave VanderLinden, Z& H Engineering, dated 16 May 2001, Subject: Queen Creek Additional GPS & Survey Level Requirements:
2. Reference Email from Brian Fry, Dibble, dated 17 May 2001, Subject: Queen Creek Survey Proposal.
3. Paragraph 2 of Ref 2 above, the additional survey work to the West of Meadowbrook Road to include the EMF and Paragraph 4 of Ref 2 above, culvert crossings at Meadowbrook Road, would require at a minimum the following:
    a. One day of Static GPS Observations to extend control @ $950/ Day (GPS Services)
    b. Three days of Office Research on known Queen Creek Data & Wood data @ $700/Day (GPS Services)
    c. Two days of RTK GPS Observations to find and tag points researched in office @ $950/Day (GPS Services)
    d. Five days of levels to maintain and check existing vertical datum and survey the culvert crossings at Meadowbrook Road @ $950/Day (Z&H)
    e. One day of Office data processing to combine and evaluate all data in the West area @ $700/Day (GPS Services)
4. Paragraph 2 of Ref 2 above, the additional survey work to the East to the County Line and Paragraph 4 of Ref 2 above, the crossing at Will Rogers, would require at a minimum the following:
    a. One day of Office Research to extend to the county line @ $700/Day (GPS Services)
    b. One day of RTK GPS Observations to find and tag researched points @ $950/Day (GPS Services)
    c. Two days of levels to maintain and check existing vertical datum and survey a crossing at Will Rogers @ $950/Day (Z&H)
    d. One day of Office data processing to combine and evaluate all data in the East area @ $700/Day (GPS Services)

Bob Phillips

DTM Mapping Company

Final mapping data for Queen Creek Wash from County Line to Hawes Rd. DTM						
Pt #	Northing	Easting	Elevation	Elevation		
	NAD83(92)	NAD83(92)	Old Coords	NGVD 88		
	GPS	GPS	DTM	GPS		gps-dtm
1000	812656.061	799375.037		1447.825		
1001	811343.494	800028.607	1422.340			
1002	811841.410	798614.897	1439.450	1441.517	1/2"RB E of RR N of Wash	2.067
1003	811365.561	797705.646	1439.480	1441.620		2.140
1004	810908.853	796925.392	1437.560	1439.805		2.245
1005	811432.260	796814.312	1437.760	1439.920		2.160
1006	811523.220	795394.016	1432.960	1434.994	RB 1006 N-side of wash	2.034
1007	812033.484	794185.393	1429.200	1431.380		2.180
1008	811565.270	794286.710	1428.610	1430.775		2.165
1009	812071.076	792869.294	1415.010	1417.270		2.260
1010	812801.314	791534.509	1419.050	1421.008	1010 RB N-side of wash	1.958
1011	812329.747	791584.550	1419.670	1421.940		2.270
1012	813488.917	789770.027	1403.050	1405.270		2.220
1013	814025.073	788990.155	1407.490	1409.820		2.330
1014	813718.877	789006.558	1409.880	1412.190		2.310
1015	814366.805	787648.422	1394.790	1397.170		2.380
1016	815513.336	786266.798	1401.260	1403.655		2.395
1017	814915.643	786270.956	1401.860	1404.394	PK Nail Ellsworth S. of Qwncrk Bridge	2.534
1018	816130.750	785017.190	1384.870	1387.270		2.400
1019	816333.149	783821.997	1387.630	1390.208		2.578
1020	816953.517	783735.732	1387.300	1389.720		2.420
1021	817311.904	782684.779	1377.800	1380.190		2.390
1022	818110.957	781589.730	1386.070	1389.102		3.032
1023	818428.750	780288.056	1376.110	1378.580		2.470
1024	818729.624	780427.755	1381.960	1384.420		2.460
						2.427

Kenney Aerial Mapping

	Final mapping data for Queen Creek Wash from Hawes Rd.to EMF.					
Pt #	Northing	Easting	Elevation	Elevation		
	NAD83(92)	NAD83(92)		NGVD 88		
	GPS	GPS	Collins Pina	GPS		gps-cp
1023a	819250.245	780272.991	1375.020	1377.370		2.350
1024a	818942.882	779836.097	1375.380	1377.730		2.350
1025	819741.053	779672.211	1369.470	1371.816	Rock near old panel 1025	2.346
1026			1370.750	1373.100		2.350
1027	820870.798	779290.274				0.000
1028	821584.961	778591.949	1364.590	1367.245		2.655
1029	821657.249	777893.022	1365.210	1367.810		2.600
1030	822207.799	777867.981	1366.720	1369.320		2.600
1031	822596.133	776927.690	1356.210	1358.762		2.552
1032	822951.573	775649.932	1359.850	1362.308		2.458
1033	823434.178	775640.650	1359.920	1362.430		2.510
1034	823463.446	775649.932	1355.270	1357.780		2.510
1035	823311.066	773033.122	1350.430	1352.940		2.510
1036	823850.522	773000.465	1349.830	1352.340		2.510
1037	823641.753	771685.378	1347.290	1349.846	1/2" RB on North side of Queen Creek	2.556
1038	823397.533	770507.590	1349.020	1351.670		2.650
1039	824053.268	770494.328	1347.030	1349.772	pk nail Power Rd. N of Queen Creek	2.742
1040	823546.188	769210.798	1338.690	1341.400		2.710
1042	823738.274	767872.291	1335.650	1338.380		2.730
1043	823414.078	766545.908	1334.570	1337.300		2.730
1044	823135.749	765178.934	1329.420	1332.150		2.730
1045	823593.212	765201.885	1327.850	1330.570		2.720
1046	823348.593	763985.930	1327.880	1330.600		2.720
1047	823136.292	762599.659	1324.430	1327.150		2.720
1048	823661.919	762527.362	1320.730	1323.440		2.710
1049	822795.678	761320.750	1322.050	1324.755	tbm1049 rebar in old panel	2.705
1050	822243.682	760377.060	1321.450	1324.160		2.710
1051	822644.812	760280.758	1317.020	1319.730		2.710
1052	821592.029	759789.655	1315.430	1318.160		2.730
1053	820203.689	759670.781	1315.620	1318.370		2.750
1054	820236.781	760200.515	1318.310	1321.080		2.770
1055	819133.263	759665.711	1311.450	1314.250		2.800
1056	818238.604	758720.955	1313.440	1316.260		2.820
1057	817892.383	759044.465	1313.580	1316.420		2.840
1058	817091.107	758188.310	1311.510	1314.360		2.850
1059	816117.076	757151.906	1307.660	1310.523	nail West side canal	2.863
1060	815841.662	757429.294	1309.970	1312.820		2.850
1061	815244.485	756794.924	1308.400	1311.254	nail west side canal	2.854
1062	814689.606	755499.731	1307.080	1309.940		2.860
1063	814553.857	756257.103	1308.560	1311.430		2.870
1064	813728.037	755341.759	1296.520	1299.400		2.880
1065	812646.717	754597.779	1307.720	1310.610		2.890
1066	812337.071	755087.546	1304.230	1307.133	tbm1066 nail in old panel	2.903
						2.683

Aerial Mapping Company

Final mapping data for Queen Creek Wash from Hawes Rd.to Ocotillo Rd. AMC						
Pt #	Northing	Easting	Elevation	Elevation		
	NAD83(92)	NAD83(92)	NAVD 29	NGVD 88		
	GPS	GPS	GPS	GPS		88-29
11	823594.378	770504.624	1354.028	1352.825	bc fl Power Rd & Queen Creek	-1.203
20	823425.703	780889.819	1378.358	1377.334	BCHH Hawes & Queen Creek	-1.024
21	820771.116	780934.889	1379.849	1378.919	BCHH	-0.930
23	818117.187	783624.381	1393.899	1393.106	BC FL	-0.793
24	815460.578	780992.652	1385.591	1384.846	BCHH	-0.745
25	818109.586	778355.830	1377.336	1376.455	CPS	-0.881
26	818101.829	775730.982	1371.254	1370.330	PK	-0.924
27	820587.212	775689.146	1366.142	1365.130	CPS	-1.012
28	823433.544	775641.007	1363.232	1362.121	RB Queen Creek & Sossmann	-1.111
30	823986.466	775635.089	1360.965	1359.835	PNL	-1.130
31	823235.611	775645.866	1362.395	1361.291	PNL	-1.104
32	823319.584	775317.167	1366.252	1365.139	PNL	-1.113
33	822258.056	775660.905	1363.336	1362.266	PNL	-1.070
34	822175.175	778340.255	1369.221	1368.198	PNL	-1.023
35	823052.562	776090.265	1365.102	1364.011	PNL	-1.091
36	822576.322	777095.203	1369.312	1368.254	PNL	-1.058
37	821755.557	778301.691	1372.334	1371.326	PNL	-1.008
38	821704.553	777905.384	1368.118	1367.104	PNL	-1.014
39	821418.023	778551.088	1373.624	1372.632	PNL	-0.992
40	820739.858	779262.283	1373.751	1372.794	PNL	-0.957
41	818496.284	780974.011	1385.814	1384.964	PK Nail Hawes Rd. N. Queen Creek	-0.850
42	818524.085	780860.181	1390.448	1389.594	PNL	-0.854
43	817531.288	782254.940	1386.835	1386.040	PNL	-0.795
44	818287.423	782691.525	1389.932	1389.117	PNL	-0.815
45	818117.397	781854.390	1390.044	1389.221	PK Nail Ocotillo E. of Bridge	-0.823
46	819881.462	779572.178	1379.572	1378.650	PNL	-0.922
47	819279.965	779836.789	1378.737	1377.840	PNL	-0.897
48	818903.720	780047.057	1379.871	1378.991	PNL	-0.880
49	818304.576	779735.879	1380.998	1380.134	PNL	-0.864
103	823235.944	775666.393	1362.435	1361.331	ZH3	-1.104
						-1.000

		Final mapping data for Queen Creek Wash Old Panel points in West area from Hawes Rd.to Confluence												
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29	gps-cp	
1023a	819250.245	780272.991	1375.020			1377.370							2.350	
1024a	818942.882	779836.097	1375.380			1377.730							2.350	
1025	819741.053	779672.211	1369.470		1372.732	1371.816		1371.710	tbm1025	Rock near old panel 1025	-0.106	-0.916	2.346	
1026			1370.750			1373.100							2.350	
1027	820870.798	779290.274											0.000	
1028	821584.961	778591.949	1364.590		1368.243	1367.245						-0.998	2.655	
1029	821657.249	777893.022	1365.210			1367.810							2.600	
1030	822207.799	777867.981	1366.720			1369.320							2.600	
1031	822596.133	776927.690	1356.210		1359.823	1358.762						-1.061	2.552	
1032	822951.573	775649.932	1359.850		1363.402	1362.308						-1.094	2.458	
1033	823434.178	775640.650	1359.920			1362.430							2.510	
1034	823463.446	775649.932	1355.270			1357.780							2.510	
1035	823311.066	773033.122	1350.430			1352.940							2.510	
1036	823850.522	773000.465	1349.830			1352.340							2.510	
1037	823641.753	771685.378	1347.290		1351.031	1349.846		1349.613	tbm1037	1/2" RB on North side of Queen Creek	-0.233	-1.185	2.556	
1038	823397.533	770507.590	1349.020			1351.670							2.650	
1039	824053.288	770494.328	1347.030		1350.992	1349.772		1349.373	tbm1039	pk nail Power Rd. N of Queen Creek	-0.399	-1.220	2.742	
1040	823546.188	769210.798	1338.690			1341.400							2.710	
1042	823738.274	767872.291	1335.650			1338.380							2.730	
1043	823414.078	766545.908	1334.570			1337.300							2.730	
1044	823135.749	765178.934	1329.420			1332.150							2.730	
1045	823593.212	765201.885	1327.850			1330.570							2.720	
1046	823348.593	763985.930	1327.880			1330.600							2.720	
1047	823136.292	762599.659	1324.430			1327.150							2.720	
1048	823661.919	762527.362	1320.730			1323.440							2.710	
1049	822795.678	761320.750	1322.050		1326.084	1324.755		1324.323	tbm1049	tbm1049 rebar in old panel	-0.432	-1.329	2.705	
1050	822243.682	760377.060	1321.450			1324.160							2.710	
1051	822644.812	760280.758	1317.020			1319.730							2.710	
1052	821592.029	759789.655	1315.430			1318.160							2.730	
1053	820203.689	759670.781	1315.620			1318.370							2.750	
1054	820236.781	760200.515	1318.310			1321.080							2.770	
1055	819133.263	759665.711	1311.450			1314.250							2.800	
1056	818238.604	758720.955	1313.440			1316.260							2.820	
1057	817892.383	759044.465	1313.580			1316.420							2.840	
1058	817091.107	758188.310	1311.510			1314.360							2.850	
1059	816117.076	757151.906	1307.660		1311.689	1310.523		1309.923	tbm1059	nail West side canal	-0.600	-1.166	2.863	
1060	815841.662	757429.294	1309.970			1312.820							2.850	
1061	815244.485	756794.924	1308.400		1312.396	1311.254		1310.683	tbm1061	nail west side canal	-0.571	-1.142	2.854	
1062	814689.606	755499.731	1307.080			1309.940							2.860	

1063	814553.857	756257.103	1308.560			1311.430							2.870	
1064	813728.037	755341.759	1296.520			1299.400							2.880	
1065	812646.717	754597.779	1307.720			1310.610							2.890	
1066	812337.071	755087.546	1304.230		1308.202	1307.133		1306.478	tbm1066	tbm1066 nail in old panel	-0.655	-1.069	2.903	
										Average Correction to Kenney Data			2.683	

(3)
Ocotillo

	Final mapping data for Queen Creek Wash New Panel points in Center area from Hawes Rd.to ~~Power~~ Rd.													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
11	823594.378	770504.624			1354.028	1352.825		1352.633	bm6	bc fl Power Rd & Queen Creek	-0.192	-1.203		
20	823425.703	780889.819			1378.358	1377.334		1377.228	tbm7	BCHH Hawes & Queen Creek	-0.106	-1.024		
21	820771.116	780934.889			1379.849	1378.919				BCHH		-0.930		
23	818117.187	783624.381			1393.899	1393.106				BC FL		-0.793		
24	815460.578	780992.652			1385.591	1384.846				BCHH		-0.745		
25	818109.586	778355.830			1377.336	1376.455				CPS		-0.881		
26	818101.829	775730.982			1371.254	1370.330				PK		-0.924		
27	820587.212	775689.146			1366.142	1365.130				CPS		-1.012		
28	823433.544	775641.007			1363.232	1362.121		1362.023	tbm8	RB Queen Creek & Sossmann	-0.098	-1.111		
30	823986.466	775635.089			1360.965	1359.835				PNL		-1.130		
31	823235.611	775645.866			1362.395	1361.291				PNL		-1.104		
32	823319.584	775317.167			1366.252	1365.139				PNL		-1.113		
33	822258.056	775660.905			1363.336	1362.266				PNL		-1.070		
34	822175.175	778340.255			1369.221	1368.198				PNL		-1.023		
35	823052.562	776090.265			1365.102	1364.011				PNL		-1.091		
36	822576.322	777095.203			1369.312	1368.254				PNL		-1.058		
37	821755.557	778301.691			1372.334	1371.326				PNL		-1.008		
38	821704.553	777905.384			1368.118	1367.104				PNL		-1.014		
39	821418.023	778551.088			1373.624	1372.632				PNL		-0.992		
40	820739.858	779262.283			1373.751	1372.794				PNL		-0.957		
41	818496.284	780974.011			1385.814	1384.964		1384.836	tbm4	PK Nail Hawes Rd. N. Queen Creek	-0.128	-0.850		
42	818524.085	780860.181			1390.448	1389.594				PNL		-0.854		
43	817531.288	782254.940			1386.835	1386.040				PNL		-0.795		
44	818287.423	782691.525			1389.932	1389.117				PNL		-0.815		
45	818117.397	781854.390			1390.044	1389.221		1389.119	tbm2	PK Nail Ocotillo E. of Bridge	-0.102	-0.823		
46	819881.462	779572.178			1379.572	1378.650				PNL		-0.922		
47	819279.965	779836.789			1378.737	1377.840				PNL		-0.897		
48	818903.720	780047.057			1379.871	1378.991				PNL		-0.880		
49	818304.576	779735.879			1380.998	1380.134				PNL		-0.864		
103	823235.944	775666.393			1362.435	1361.331				ZH3		-1.104		
										Average Correction to Aerial Data		-1.000		

		Final mapping data for Queen Creek Wash Panel points in East area from County Line to Hawes Rd.												
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			lev-gps	88-29	gps-cp	gps-dtm
1	819434.552	780562.032			1381.448	1380.558		1380.558	tbm5	1/2"RB Base1	0.000	-0.890		
6	815117.146	794086.092	1426.920		1427.507	1426.919	1426.919	1426.919	bm1	G 68 BC NGS	0.000	-0.588	-0.001	
7	811778.000	798622.000			1445.906	1445.597	1445.597	1445.597	bm2	Q 364 BC NGS	0.000	-0.309		
4	817323.000	791109.000			1414.524	1413.901	1413.901	1413.901	bm3	R 364 BC NGS	0.000	-0.623		
500	820883.000	786269.000			1400.728	1399.916	1399.813	1399.813	bm5	S 364 BC NGS	-0.103	-0.812		
			1401.415		1402.015	1401.415		1401.386	bm4	BCHH Ocotillo & Ellsworth	-0.029	-0.600	0.000	
1000	812656.061	799375.037	1447.825		1448.395	1447.825						-0.570	0.000	
1001	811343.494	800028.607		1422.340										
1002	811841.410	798614.897	1441.560	1439.450	1442.130	1441.517		1441.497	tbm1002	1/2"RB E of RR N of Wash	-0.020	-0.613	-0.043	2.067
1003	811365.561	797705.646	1441.620	1439.480	1442.190	1441.620						-0.570	0.000	2.140
1004	810908.853	796925.392	1439.805	1437.560	1440.241	1439.805						-0.436	0.000	2.245
1005	811432.260	796814.312	1439.920	1437.760	1440.490	1439.920						-0.570	0.000	2.160
1006	811523.220	795394.016	1435.110	1432.960	1435.680	1434.994		1435.014	tbm1006	RB 1006 N-side of wash	0.020	-0.686	-0.116	2.034
1007	812033.484	794185.393	1431.380	1429.200	1431.950	1431.380						-0.570	0.000	2.180
1008	811565.270	794286.710	1430.775	1428.610	1431.345	1430.775						-0.570	0.000	2.165
1009	812071.076	792869.294	1417.270	1415.010	1417.840	1417.270						-0.570	0.000	2.260
1010	812801.314	791534.509	1421.330	1419.050	1421.900	1421.008		1420.954	tbm1010	1010 RB N-side of wash	-0.054	-0.892	-0.322	1.958
1011	812329.747	791584.550	1421.940	1419.670	1422.510	1421.940						-0.570	0.000	2.270
1012	813488.917	789770.027	1405.270	1403.050	1405.860	1405.270						-0.590	0.000	2.220
1013	814025.073	788990.155	1409.820	1407.490	1410.420	1409.820						-0.600	0.000	2.330
1014	813718.877	789006.558	1412.190	1409.880	1412.760	1412.190						-0.570	0.000	2.310
1015	814366.805	787648.422	1397.170	1394.790	1397.770	1397.170						-0.600	0.000	2.380
1016	815513.336	786266.798	1403.655	1401.260	1404.255	1403.655						-0.600	0.000	2.395
1017	814915.643	786270.956	1404.265	1401.860	1404.865	1404.394		1404.337	tbm1017	PK Nail Ellsworth S. of Qwncrk Bridge	-0.057	-0.471	0.129	2.534
1018	816130.750	785017.190	1387.270	1384.870	1387.870	1387.270						-0.600	0.000	2.400
1019	816333.149	783821.997	1390.060	1387.630	1390.660	1390.208						-0.452	0.148	2.578
1020	816953.517	783735.732	1389.720	1387.300	1390.320	1389.720						-0.600	0.000	2.420
1021	817311.904	782684.779	1380.190	1377.800	1380.790	1380.190						-0.600	0.000	2.390
1022	818110.957	781589.730	1388.510	1386.070	1389.110	1389.102						-0.008	0.592	3.032
1023	818428.750	780288.056	1378.580	1376.110	1379.180	1378.580						-0.600	0.000	2.470
1024	818729.624	780427.755	1384.420	1381.960	1385.020	1384.420						-0.600	0.000	2.460
										Average Correction to DTM Data				2.427

	Final mapping data for Queen Creek Wash points in Culvert Crossing Meadowbrook Rd.& Other areas													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
472	818064.412	785600.127				1398.936	1398.881	1398.862	2DN1	GDACS Point 2DN1 Rod Driven Refusal	-0.074			
1381	818117.241	780979.932			1381.080	1383.429		1383.309	tbm3	BC Hole Hawes & Ocotillo	-0.120	2.349		
						1378.923		1378.823	tbm6	BC FL in Culdesac	-0.100			
						1363.123		1363.013	tp111	Pan 32	-0.110			
								1344.333	tp141	E6 SW				
								1332.978	tbm70	nail				
								1331.808	tp148	FL North pipe East End				
								1331.838	tp149	FL Center pipe East end North				
								1331.818	tp150	FL Center pipe East end South				
								1333.438	tp151	FL South pipe East end				
								1332.916	tp153	FL South pipe West end				
								1332.746	tp154	FL Center pipe West end South				
								1331.356	tp155	FL Center pipe West end North				
								1331.404	tp156	FL North pipe West end				
								1340.632	tp157	BSW NW Cor Bridge				
								1342.062	tp158	CLS West side pipe to N on West side				
								1342.722	tp159	CLS West side center pipe West end North				
								1343.252	tp160	CLS West side center pipe West end South				
								1343.612	tp161	CLS West side South end pipe West side				
								1344.162	tp162	CLS East side center pipe West end South				
								1336.888	tp167	NE Cor Bridge nail				
								1340.618	tbm17	NW Cor Bridge BSW				
						1335.030		1334.803	bm7	bchh SW Cor Bridge Recker & Queen Creek Rd	-0.227			
						1334.310		1334.158	bm8	1/2"RB 1/2 mile West Recker & Queen Creek Rc	-0.152			
						1335.540		1335.353	bm9	BCF Top Wall on Bridge Queen Creek & Higley	-0.187			
1326	820669.357	759938.356			1326.010	1328.648		1328.143	bm1326	BCHH Southbound Lane Higley Rd.	-0.505	2.638		
						1325.960		1325.748	bm10	1/2"RB 1/2 mile S on Higley Rd	-0.212			
						1315.310		1315.083	bm11	1/2"RB East side of Canal	-0.227			
						1312.830		1312.568	bm12	rock in cc East side canal	-0.262			
						1331.620		1331.393	bm13	1/2"RB N side of wash 200' E bridge	-0.227			

	Final mapping data for Misc. Points, ERMs													
Pt #	Northing	Easting	Elevation	Elevation	Elevation	Elevation	Elevation	Elevation						
	NAD83(92)	NAD83(92)			NAVD 29	NGVD 88	NGVD 88	NGVD 88						
	GPS	GPS	Collins Pina	DTM	GPS	GPS	PUB	Z&H Levels			88-GPS	88-29		
473	804890.688	786304.644			1419.197	1418.909				erm 1416 mcbchh		-0.288		
474	818117.657	786260.328			1402.166	1401.417				erm 2126 mcbchh		-0.749		
475	826095.760	775601.968			1359.859	1358.655				5007 1 1/2" AC		-1.204		
476	820767.897	775686.133			1365.351	1364.333				5002 1 1/2"AC		-1.018		
477	820868.800	773055.694			1357.066	1356.001				5005 1"IP		-1.065		
478	818333.238	770587.137			1355.694	1354.675				7002 bchh dea108		-1.019		
479	820964.782	770546.089			1349.408	1348.298				7003 bchh dea107		-1.110		
480	824533.981	770490.628			1346.644	1345.409				7050 bchh dea122		-1.235		
481	826224.738	770465.656			1344.293	1342.998				7007 bchh dea107		-1.295		

APPENDIX D

HYDROLOGIC ANALYSIS SUPPORTING DOCUMENTATION

FLOOD INSURANCE STUDY

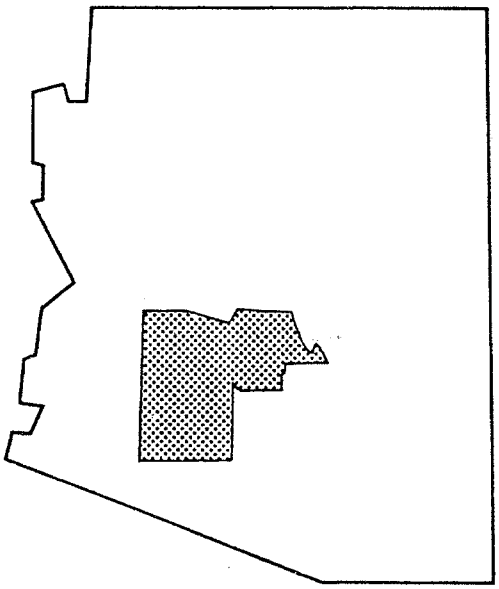
MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

VOLUME 1 OF 16

04013CV001

COMMUNITY NAME	COMMUNITY NUMBER
AVONDALE, CITY OF	040038
BUCKEYE, TOWN OF	040039
CAREFREE, TOWN OF	040126
CAVE CREEK, TOWN OF	040129
CHANDLER, CITY OF	040040
EL MIRAGE, CITY OF	040041
FOUNTAIN HILLS, TOWN OF	040135
GILA BEND, TOWN OF	040043
GILBERT, TOWN OF	040044
GLENDALE, CITY OF	040045
GOODYEAR, CITY OF	040046
GUADALUPE, TOWN OF	040111
LITCHFIELD PARK, CITY OF	040128
MARICOPA COUNTY UNINCORPORATED AREAS	040037
MESA, CITY OF	040048
PARADISE VALLEY, TOWN OF	040049
PEORIA, CITY OF	040050
PHOENIX, CITY OF	040051
QUEEN CREEK, TOWN OF	040132
SCOTTS DALE, CITY OF	045012
SURPRISE, CITY OF	045053
TEMPE, CITY OF	040054
TOLLESON, CITY OF	040055
WICKENBURG, TOWN OF	040056
YOUNGTOWN, TOWN OF	040057



REVISED: JULY 19, 2001

Federal Emergency Management Agency

Table 3. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Wash P					
At Hassayampa River	0.87	--[1]	--[1]	898	--[1]
Wash Q					
At Hassayampa River	0.37	--[1]	--[1]	584	--[1]
Wash S2					
At Little San Domingo Wash	0.32	--[1]	--[1]	420	--[1]
Yucca Flat Wash					
At LDS	1.90	--[1]	--[1]	2,085	--[1]
At Twin Peaks Wash	6.48	--[1]	--[1]	5,152	--[1]
White Tanks Wash					
Just downstream of White Tanks Wash Tributary No. 1	13.83	--[1]	--[1]	6,208	--[1]
Just upstream of White Tanks Wash Tributary No. 2	17.10	--[1]	--[1]	6,256	--[1]
At Buckeye Flood Retarding Structure	29.50	--[1]	--[1]	7,209	--[1]
White Tanks Wash Tributary No. 1					
At Sun Valley Parkway	1.06	--[1]	--[1]	603	--[1]
At White Tanks Wash	1.42	--[1]	--[1]	818	--[1]
Skunk Tank Wash					
At Desert Hills Drive	1.0	--[1]	--[1]	1,420	--[1]
At Irvine Road	1.4	--[1]	--[1]	1,880	--[1]
At confluence with Skunk Creek	4.8	--[1]	--[1]	5,260	--[1]
Valley Wash					
Approximately 600 feet downstream of 11th Avenue	0.7	--[1]	--[1]	820	--[1]
At confluence with Skunk Tank Wash	1.5	--[1]	--[1]	1,580	--[1]
Queen Creek					
At Hawes Road	26.50	--[1]	--[1]	3,010	--[1]

[1]Not Computed

Revised (Future Conditions) Hydrology

Future conditions hydrology for Queen Creek Wash has been developed and is presented in the publication Queen Creek Wash, Power Road to Hawes Road, Revised Hydrology, and is available upon request. The future conditions hydrology is not being submitted for review at this time.

APPENDIX E

HYDRAULIC ANALYSIS SUPPORTING DOCUMENTATION

APPENDIX E.1

ROUGHNESS COEFFICIENT ESTIMATION

Queen Creek Wash

n-value calculation at select cross sections

	Surface	nb	n1	n2	n3	n	fm	**n**
117+00	New Landscape	0.024	0.001	0.004	0.015	0.044	1.0	0.044
	Existing	0.024	0.001	0.004	0.010	0.039	1.0	0.039
104+00	New Landscape	0.024	0.001	0.004	0.015	0.044	1.0	0.044
	Existing	0.024	0.001	0.004	0.010	0.039	1.0	0.039
84+00	New Landscape	0.024	0.001	0.004	0.015	0.044	1.0	0.044
	Existing	0.024	0.001	0.004	0.012	0.041	1.0	0.041
	New Landscape in Rock	0.035	0.001	0.004	0.015	0.055	1.0	0.055
72+00	New Landscape	0.024	0.001	0.004	0.010	0.039	1.0	0.039
	Existing	0.024	0.001	0.004	0.010	0.039	1.0	0.039

n=(nb+n1+n2+n3)*fm
nb=base value for a straight uniform channel
n1=value for surface irregularities
n2=value for obstructions
n3=value for vegetation
fm=meandering factor

Excerpts from:

Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona

By B.W. Thomsen and H.W. Hjalmarson

Prepared by the
U.S. GEOLOGICAL SURVEY
Water Resources Division
375 South Euclid Avenue
Tucson, Arizona 85719

Prepared for the
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

April 1991

and, for convenience in the absence of a more suitable method, the coefficient is assumed to be unity (Chow, 1959). A detailed study of the velocity-head coefficient, alpha, in natural channels showed a significant correlation between alpha and channel roughness for channels without overbank flow. Variation in the horizontal distribution of velocity had a greater effect on the value of alpha than variation in the vertical. Computed values of alpha at 894 sites in a variety of settings ranged from 1.03 to 4.70, and the median value for trapezoidal channels was 1.40 (Hulsing and others, 1966). In the computation of water-surface profiles in open channels, the value of alpha is assumed to be 1.0 if the section is not subdivided (Davidian, 1984). In subdivided channel cross sections, the value of alpha is computed as

$$\alpha = \frac{\Sigma(k_i^3/a_i^2)}{K_T^3/A_T^2}, \tag{6}$$

where

k_i = conveyance of individual subsections,

a_i = area of individual subsections,

K_T = conveyance of entire cross section, and

A_T = area of entire cross section.

Channel n Values

The Manning roughness coefficient, *n*, is a measure of the flow resistance or relative roughness of a channel or overflow area. The flow resistance is affected by many factors including bed material, cross-section irregularities, depth of flow, vegetation, channel alignment, channel shape, obstructions, suspended material, and bedload. In general, all factors that cause turbulence and retard flow tend to increase the roughness coefficient (Jarrett, 1984). Channel roughness also is directly related to channel slope (Riggs, 1976; Jarrett, 1984). The relation of roughness to slope results partly from the interrelation between channel slope and bed-material particle size. For similar bed material, however, channels with low gradients have lower roughness coefficients than channels with high gradients (Jarrett, 1984). The direct relation between channel roughness and channel slope is not evident in low-gradient channels where high roughness coefficients result from vegetation. Roughness coefficients as great as 0.20 have been verified for channels with low gradients and dense vegetation (Arcement and Schneider, 1984). For vegetation that will bend under the force of flowing water, the relation between roughness and gradient can be inversely related. Steep slopes cause greater velocities that bend and flatten vegetation if depths of flow are sufficient, resulting in lower *n* values. Because of the relation between channel slope and size of bed material, the effect of slope on *n* values is considered in the selection of base *n* values.

A common method of selecting the roughness coefficient, *n*, is to first select a base value of *n* for the bed material (table 1). The base values of *n* are for a straight uniform channel of a given bed material. Cross-section irregularities, channel alignment, obstructions, vegetation, and other factors that increase roughness are accounted for by adding increments of roughness to the base value of *n*. Ranges of adjustments for the factors that may add to channel roughness are shown in table 2.

Many alluvial channels in Maricopa County have bed material that moves during floodflow. In addition to the changing channel geometry of these channels, the roughness coefficient may change during floodflow because of the changing form of the channel bed in parts of the channel cross section (Davidian, 1984). Bedforms, such as dunes, antidunes, and plane bed have been observed during large floods. Within a few minutes, dunes can appear, disappear, and reappear at different locations across a large stream channel. The Manning roughness coefficient can double or triple when the bedform changes from plane to dunes. A method of defining reliable values of Manning's *n* for unstable alluvial channels is not available. A plane bedform is common during large floods, and for this report, plane-bed conditions are assumed where the roughness coefficient is related to the size of the channel material and not the form of the channel bed. Plane-bed conditions were assumed for nearly all indirect measurements of peak discharge where the slope-area method was used.

Table 1.--*Base values of Manning's n for stable channels*

[Modified from Aldridge and Garrett, 1973, table 1]

n_b	Size of bed material		Base *n* values	
Channel material	Millimeters	Inches	Benson and Dalrymple (1967)[1]	Chow (1959)[2]
Concrete.....	-------	--------	0.012-0.018	0.011
Rock cut.....	-------	--------	----------	.025
Firm soil.....	-------	--------	.025- .032	.020
Coarse sand.....	1-2	--------	.026- .035	-----
Fine gravel.....	-------	--------	----------	.024
Gravel.....	2-64	0.08-2.5	.028- .035	-----
Coarse gravel.....	-------	--------	----------	.028
Cobble.....	64-256	2.5-10.0	.030- .050	-----
Boulder.....	>256	>10.0	.040- .070	-----

[1]Straight uniform channel.
[2]Smoothest channel attainable in indicated material.

Table 2.--*Adjustment factors for the determination of overall Manning's n values*

[Modified from Chow, 1959]

Channel conditions	Manning's n adjustment[1]	Example
Degree of irregularity: n_1		
Smooth	0.000	Smoothest channel attainable in given bed material.
Minor	.001 → .001- .005	Channels with slightly eroded or scoured side slopes.
Moderate	.006- .010	Channels with moderately sloughed or eroded side slopes.
Severe	.011- .020	Channels with badly sloughed banks; unshaped, jagged, and irregular surfaces of channels in rock.
Effects of obstruction[2]: n_2		
Negligible	.000- .004 (.004)	A few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, piers, or isolated boulders, that occupy less than 5 percent of the cross-sectional area.
Minor	.005- .015	Obstructions occupy 5 to 15 percent of the cross-sectional area and the spacing between obstructions is such that the sphere of influence around one obstruction does not extend to the sphere of influence around another obstruction. Smaller adjustments are used for curved smooth-surfaced objects than are used for sharp-edged angular objects.
Appreciable	.020- .030	Obstructions occupy from 15 to 50 percent of the cross-sectional area or the space between obstructions is small enough to cause the effects of several obstructions to be additive, thereby blocking an equivalent part of a cross section.
Severe	.040- .060	Obstructions occupy more than 50 percent of the cross-sectional area or the space between obstructions is small enough to cause turbulence across most of the cross section.
Vegetation: n_3		
Small	.002- .010	Dense growths of flexible turf grass, such as Bermuda, or weeds where the average depth of flow is at least two times the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrow weed, or saltcedar where the average depth of flow is at least three times the height of the vegetation.
Medium	.010- .025 (.015 FUTURE; .010 EXISTING)	Grass or weeds where the average depth of flow is from one to two times the height of the vegetation; moderately dense stemmy grass, weeds, or tree seedlings where the average depth of flow is from two to three times the height of the vegetation; moderately dense brush, similar to 1- to 2-year-old saltcedar in the dormant season, along the banks and no significant vegetation along the channel bottoms where the hydraulic radius exceeds 2 feet. (FUTURE CON .015; EXIST. CON .010)
Large	.025- .050	Turf grass or weeds where the average depth to flow is about equal to the height of vegetation; small trees intergrown with some weeds and brush where the hydraulic radius exceeds 2 feet.

See footnotes at end of table.

Table 2.--*Adjustment factors for the determination of overall Manning's n values*--Continued

Channel conditions	Manning's n adjustment[1]	Example
Vegetation—Continued:		
Very large	.050- .100	Turf grass or weeds where the average depth of flow is less than half the height of vegetation; small bushy trees intergrown with weeds along side slopes of dense cattails growing along channel bottom; trees intergrown with weeds and brush.
Variations in channel cross section: n_4		
Gradual	.000	Size and shape of cross sections change gradually.
Alternating	.001- .005	Large and small cross sections alternate occasionally, or the main flow occasionally shifts from side to side owing to changes in cross-sectional shape.
Alternating	.010- .015	Large and small cross sections alternate frequently, or the main flow frequently shifts from side to side owing to changes in cross-sectional shape.
Degree of meadering[3]: m		
Minor	1.00	Ratio of the meander length to the straight length of the channel reach is 1.0 to 1.2.
Appreciable	1.15	Ratio of the meader length to the straight length of channel is 1.2 to 1.5.
Severe	1.30	Ratio of the meander length to the straight length of channel is greater than 1.5.

[1]Adjustments for degree of irregularity, variations in cross section, effect of obstructions, and vegetation are added to the base n value (table 1) before multiplying by the adjustment for meander.

[2]Conditions considered in other steps must not be reevaluated or duplicated in this section.

[3]Adjustment values apply to flow confined in the channel and do not apply where downvalley flow crosses meanders. The adjustment is a multiplier.

For floodflows in sand channels with moveable beds, roughness mainly is a function of the size of the bed material as shown in the following table (Benson and Dalrymple, 1967, p. 22).

Median grain size, in millimeters	Manning's *n*	Median grain size, in millimeters	Manning's *n*
0.2	0.012	0.6	.023
.3	.017	.8	.025
.4	.020	1.0	.026
.5	.022		

The above *n* values are for upper-regime flow that is common during floods. Where these *n* values are used, the assumed flow regime should be confirmed (Benson and Dalrymple, 1967, p. 24). Stream channels in Maricopa County commonly are sandy in the low-flow part of the channel where flows are common. Higher parts of the channel beds and the channel banks commonly are stabilized by gravel, cobbles, and boulders, and (or) to some extent by vegetation.

Depth of flow must be considered in selection of *n* values. The effects of roughness elements on and near the channel bottom tend to diminish as the depth of flow increases. The effect of vegetation on *n* values depends greatly on the depth of flow and to some extent on the flexibility of the vegetation. If the flow is of sufficient depth to submerge and (or) flatten the vegetation, *n* values will be lowered. Density of vegetation below the high-water level and the alignment of vegetation in relation to direction of flow also affect *n* values. If the vegetation is aligned in rows along the direction of flow, less vegetation is in contact with higher velocity flow. The roughness of aligned vegetation tends to be less than the roughness of nonaligned vegetation.

Generally an *n* value is selected for a cross section that is representative of a reach of channel. If two or more cross sections are being considered, the reach that applies to a given section extends halfway to the next section. In this study, channel data including maps showing cross-section locations were furnished by Maricopa County Flood Control District. A cross section for each of the 16 sites was selected on the basis of the following criteria: (1) cross section should be located so that visual inspection is reasonably convenient; (2) cross section should be within a reach that is minimally affected by roads, bridges, and other structures that may obstruct floodflow; and (3) cross section should contain roughness elements typical of the reach. Widths of the cross sections range from a few hundred feet to a few thousand feet. Some sections have a distinct main channel and overflow areas; others are one large trapezoidal section.

Components of Manning's n

The general procedure for determining *n* values was to first select a base value of *n* for the bed material (table 1) followed by selection of *n*-value adjustments for channel irregularities and alignment, obstructions, vegetation, and other factors (table 2). In this procedure, the value of *n* was computed by

$$n = n_b + n_1 + n_2 + n_3, \tag{7}$$

where

n_b = base value of *n* for a straight uniform channel,

n_1 = value for surface irregularities,

n_2 = value for obstruction, and

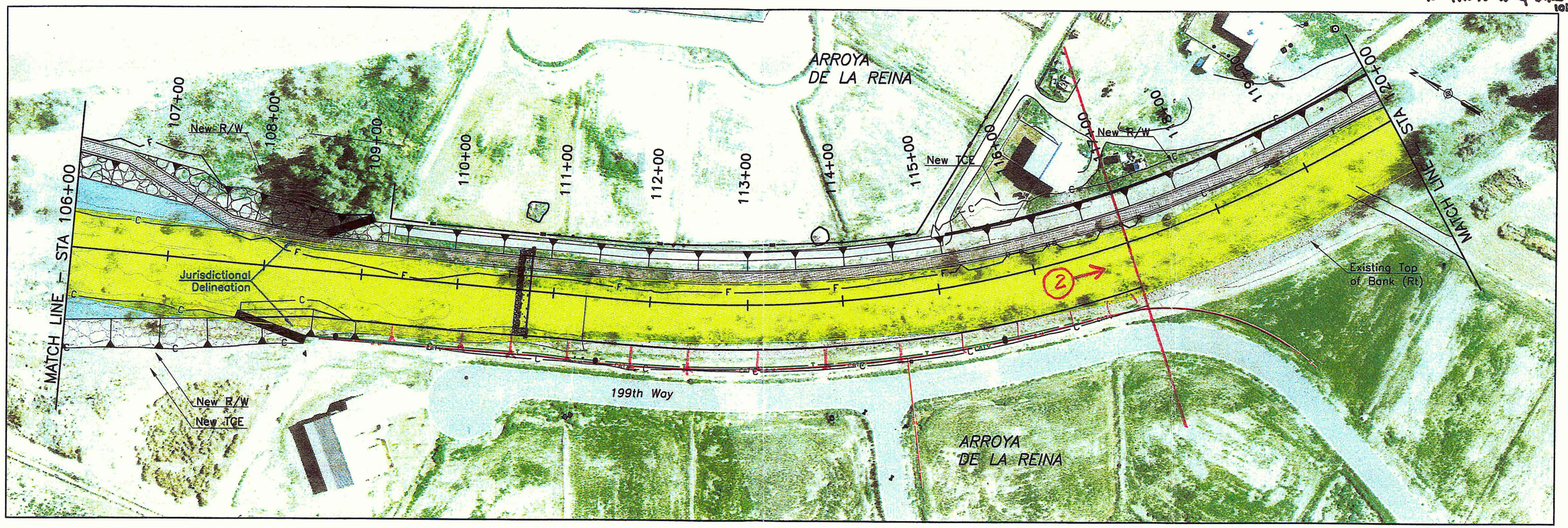
n_3 = value for vegetation.

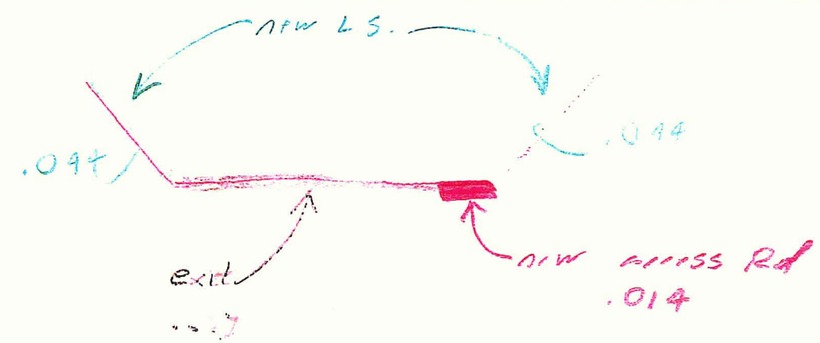
APPENDIX E.1.1

EXISTING CHANNEL PHOTOGRAPHS

MATCH LINE – STA 120+00
121+00
New R/W
122+00
New TCE
123+00
124+00
Match Existing Wash
125+00
HAWES ROAD
Jurisdictional Delineation

NOTE: ② → REFERS TO PHOTO # & DIREC

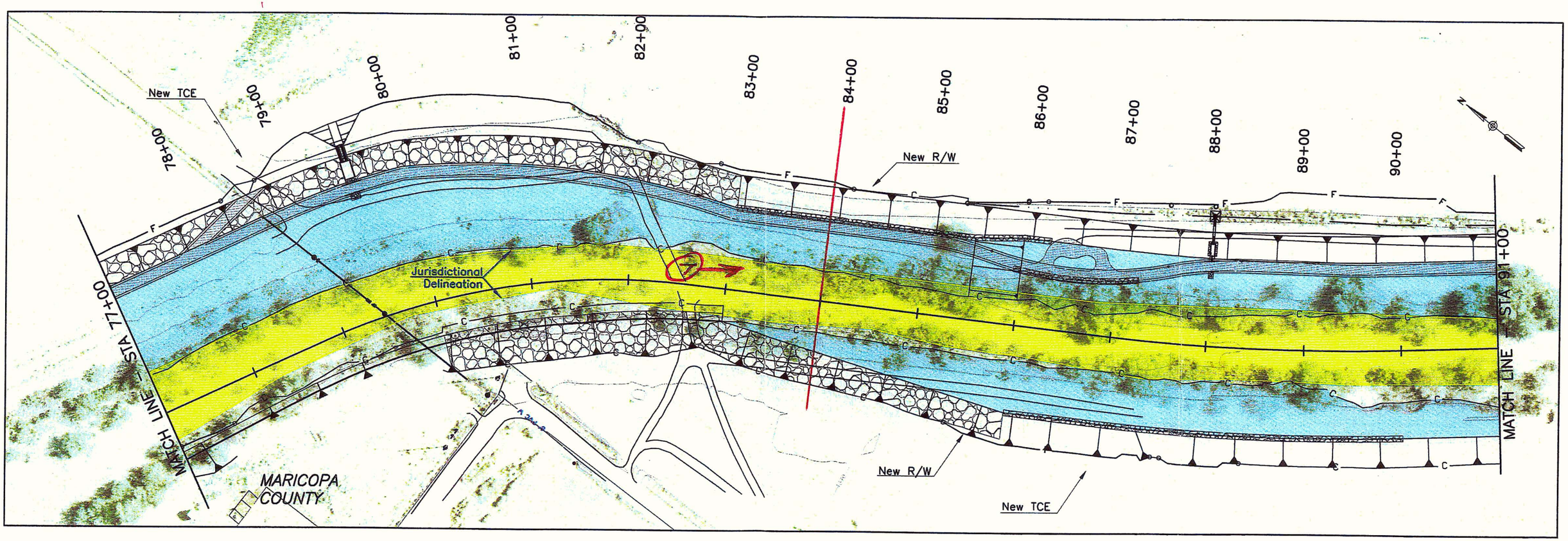


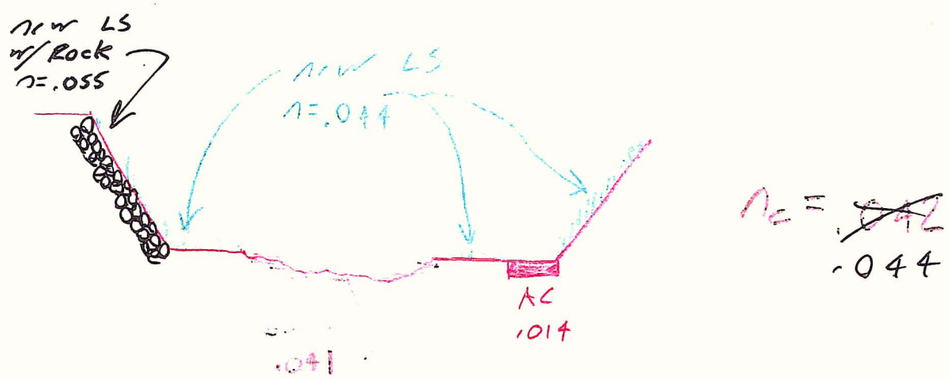


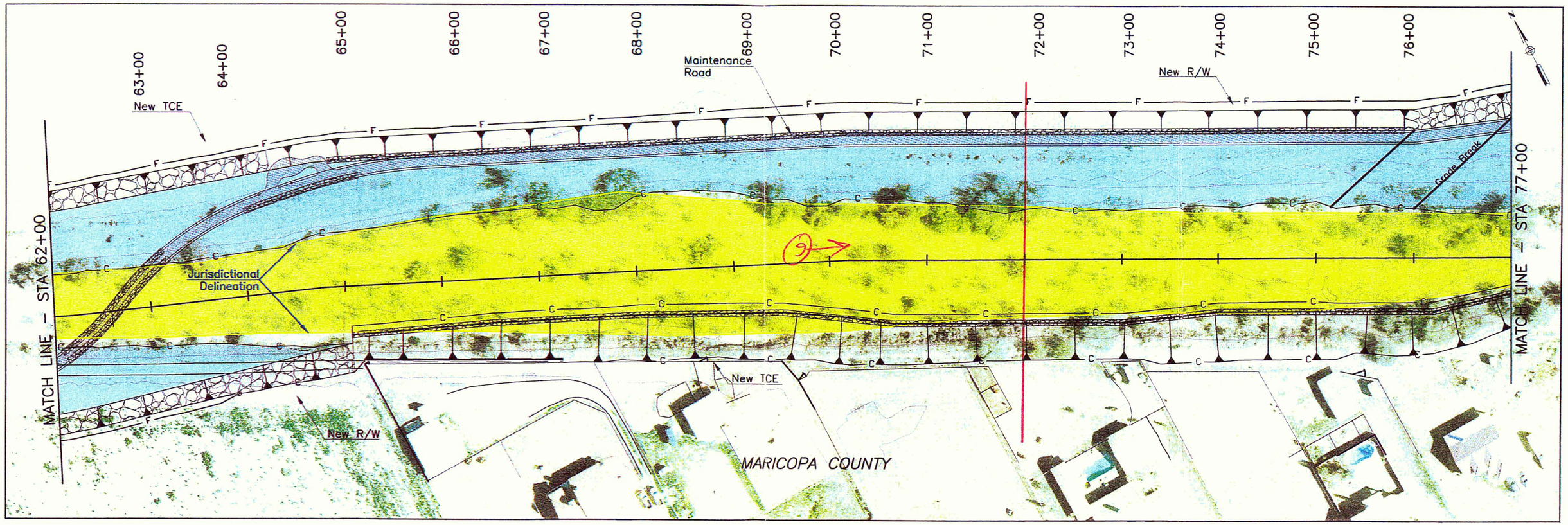
$n_c = .039$

92+00
93+00
94+00
95+00
96+00
97+00
98+00
99+00
100+00
101+00
102+00
103+00
104+00
105+00
Maintenance Road
New R/W
Jurisdictional Delineation
New R/W
New TCE
MATCH LINE – STA 91+00
MATCH LINE – STA 106+00

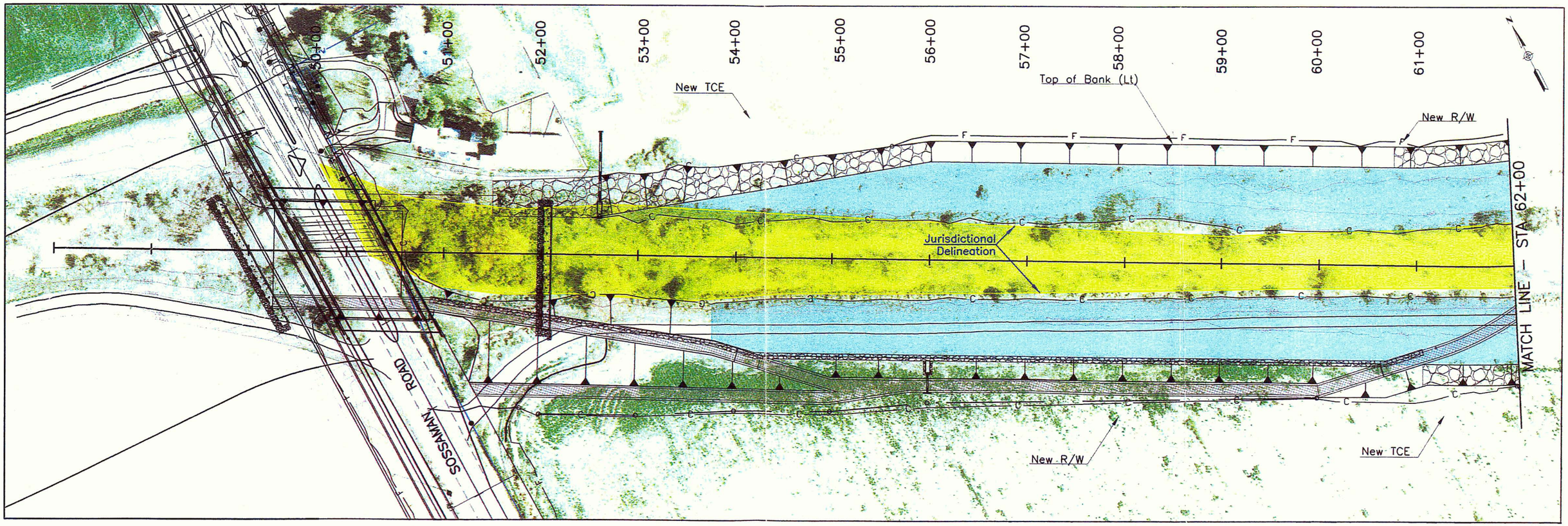
n_c = .042


New TCE
78+00
79+00
80+00
81+00
82+00
83+00
84+00
85+00
86+00
87+00
88+00
89+00
90+00
New R/W
Jurisdictional Delineation
MATCH LINE STA 77+00
MATCH LINE STA 91+00
MARICOPA COUNTY
New R/W
New TCE


new LS w/Rock n=.055
new LS n=.044
AC .014
.041
nc = ~~.041~~ .044


MATCH LINE – STA 62+00
63+00
64+00
65+00
66+00
67+00
68+00
69+00
70+00
71+00
72+00
73+00
74+00
75+00
76+00
MATCH LINE – STA 77+00
New TCE
Maintenance Road
New R/W
Grade Break
Jurisdictional Delineation
New TCE
New R/W
MARICOPA COUNTY

Riprap
AC
.014



$n_b = 0.0395 \times D_{50}^{(1/6)}$ (D in feet) $D = .5 \Rightarrow n = .035$

ADWR

PHOTO # 2

PHOTO # 4

RYLAND REACH - CURRENT CHANNEL CONSTRUCTION

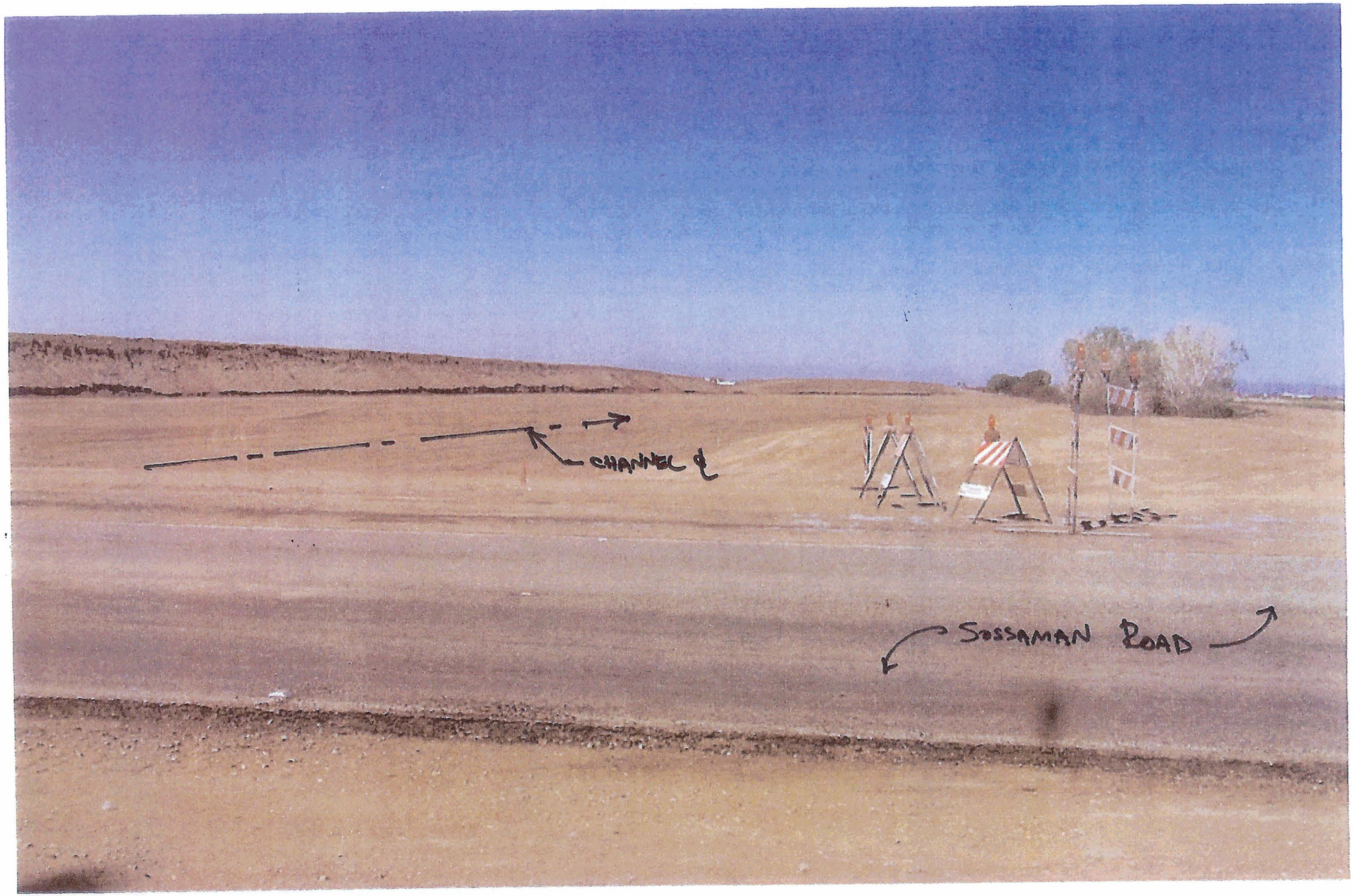
RYLAND REACH - CURRENT CHANNEL CONSTRUCTION

RYLAND REACH - CURRENT CHANNEL CONSTRUCTION

PHOTO # 7

PHOTO # 9

RYLAND REACH - CURRENT CHANNEL CONSTRUCTION



RYLAND RERRA - CURRENT CHANNEL CONSTRUCTION

RYLAND REACH - CURRENT CHANNEL CONSTRUCTION

APPENDIX E.1.2

IMPROVED CHANNEL, SAMPLE PHOTOGRAPHS OF LANDSCAPE TREATMENT

Acacia Greggii Mature Height = 15'
Catclaw Acacia

* See Landscape Plans for Locations

http://www.mswn.com/images/1333b.jpg

4/10/2003

Atriplex Canescens
Four Winged Saltbush

Mature Height = 3'→6'

Dodonea Viscosa Mature Height = 12'
Hopbush

* See Landscape Plans for Locations

Larrea Tridentata Mature Height = 6'→8'
Creosote

* See Landscape Plans for Locations

Simmondsia Chinensis
Jadoba

Mature Height = 8' → 10'+

*See Landscape Plans For Locations

Celtis Pallida
Desert Hackberry

Mature Height = 10' → 15'

* See Landscape Plans for Locations

Celtis Reticulata Mature Size is 30'x30'
Netleaf Hackberry

*See Landscape Plans for Locations

CERCIDIUM FLORIDUM
BLUE PALO VERDE

TREE

OUTSTANDING FEATURES: Blue Palo Verde is highly valued for its fantastic mid-spring flower display. This tree also has a picturesque, multiple trunk form and distinctive blue-green branches and foliage.

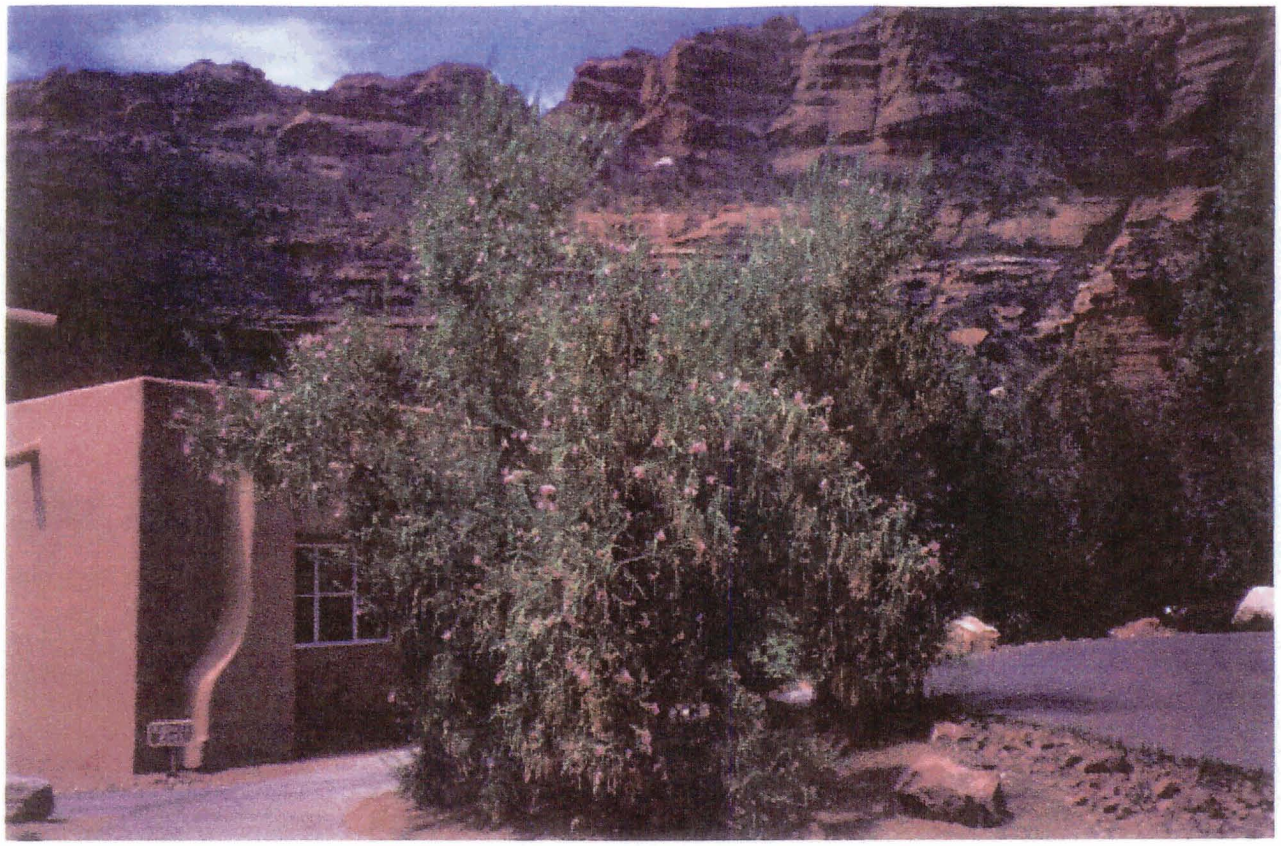
DESCRIPTION: This durable native tree is easily distinguished by its blue-green bark and brilliant spring flower display. It can grow to 25 feet tall, with a 25 foot spread. The tiny leaves are cold and drought deciduous, but because of the blue-green stems, the plants look "evergreen" from a distance. This tree typically has many trunks at the base, and requires pruning to develop a "walk under" canopy. In mid-spring, Blue Palo Verde produces masses of yellow flowers.

CULTURE/MAINTENANCE: *Cercidium* floridum is cold hardy to 15° F. This species grows native in areas with less than 10 inches of annual rainfall, and is extremely drought tolerant once established. It has a moderate to slow growth rate depending upon the amount of water applied. Blue Palo Verde should be planted in full sun or reflected heat, and in a soil with good drainage. It does require substantial pruning in the early stages to develop a "walk under" canopy. Also remove any growth affected with mistletoe or witches-broom. Preventative treatments for Palo Verde Root Borer should be applied in the spring and summer.

IDENTIFICATION: *Cercidium floridum* is easily distinguished from the other species of *Cercidium* by its bark, leaves, and flowers.

LANDSCAPE APPLICATION: Blue Palo Verde is a very versatile tree. It can be used as a focal point in the spring during its bloom season. In commercial landscapes, Blue Palo Verde makes a durable parking lot or street median tree. In a large, open area, try grouping several plants to create a grove. The tree casts moderately dense shade and can be used to cool a patio or front entry. *Cercidium floridum* is also a good choice for shading the south or west sides of buildings.

PRECAUTIONS: The thin trunks and small stems of young plants will need to be protected from rabbits and other wildlife. This protection can be removed as the plant ages, and the trunks and stems get larger. Watch out for the Palo Verde Root Borer which destroys the roots. Some people recommend treating with a systemic insecticide in the spring and summer. A healthy tree is usually less susceptible to the Palo Verde Root Borer. Mistletoe can infect Blue Palo Verde and weaken or even kill the tree, so this should be pruned out whenever it appears. Also, a mite causes the distorted growth called witches-broom, and this should be cut out as well.



Chilopsis Linearis
Desert Willow

Mature Height = 25'

* See Landscape Plans for Locations

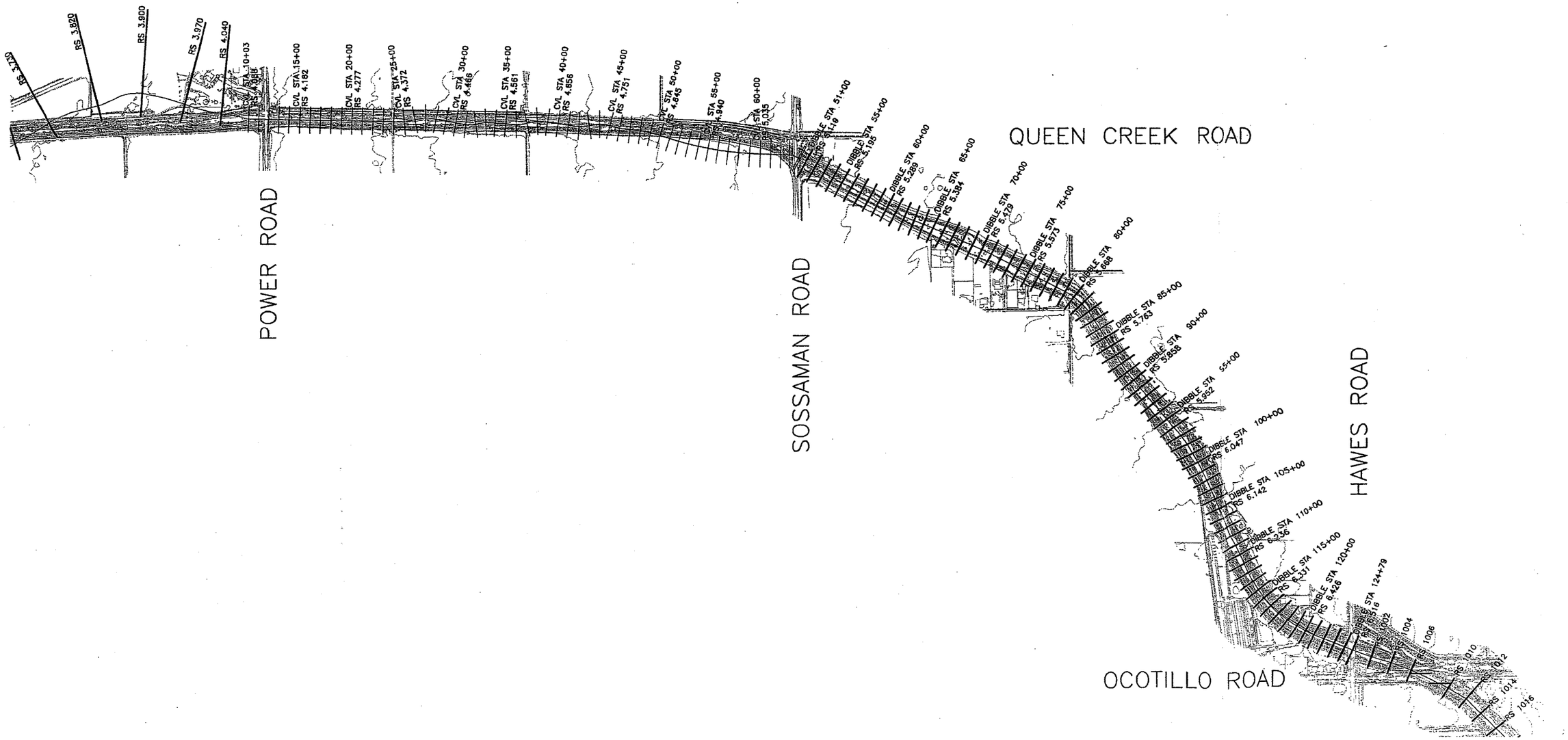
Prosopis Velutina
Velvet Mesquite

Mature Height is 30'

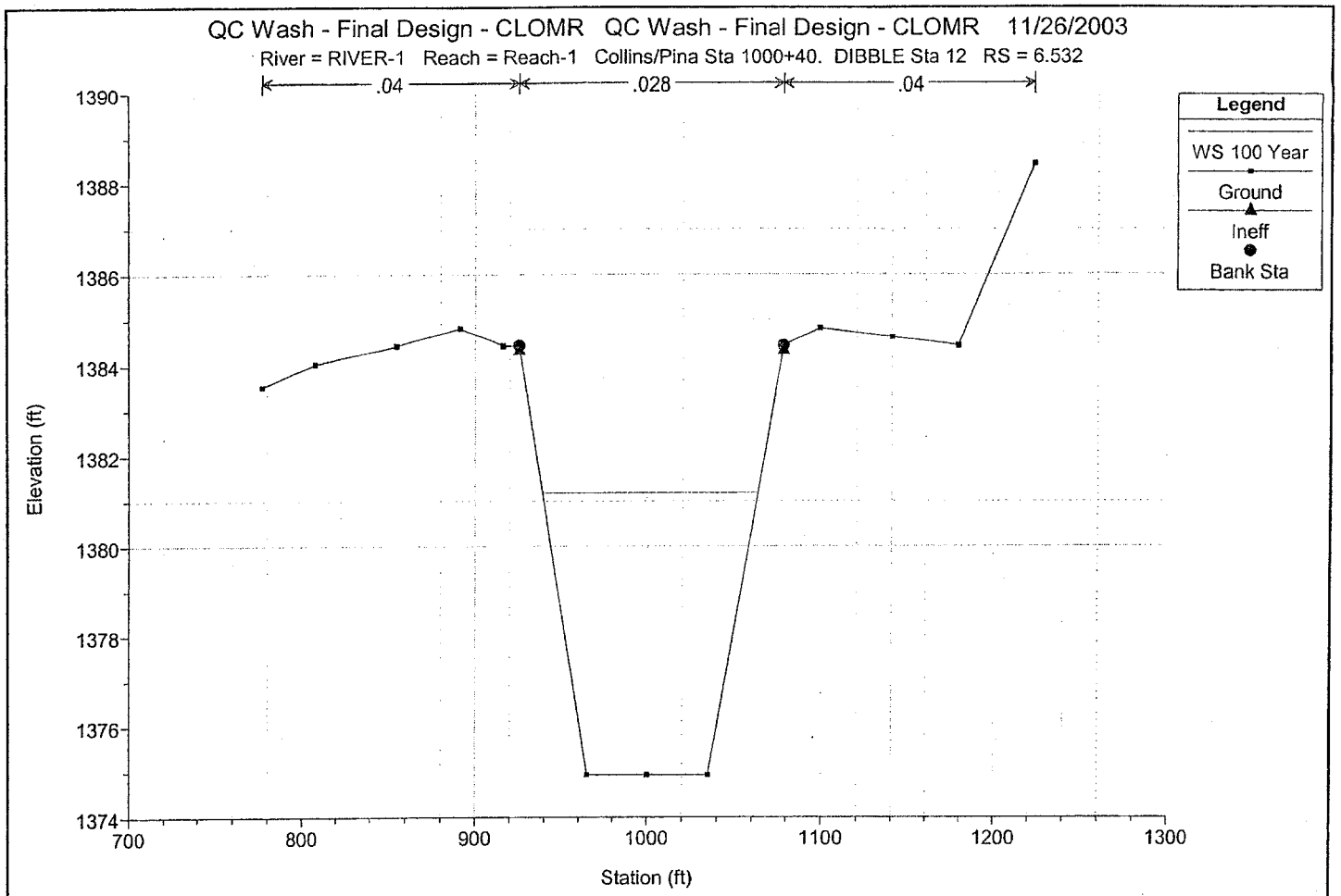
* See Landscape Plans for Locations

APPENDIX E.2

POST PROJECT CONDITION HECRAS CROSS SECTION PLOTS



COUNTY PROJECT NO. 2000D03	QUEEN CREEK WASH IMPROVEMENTS	
PROJECT DESCRIPTION: PROPOSED CONDITIONS HEC-RAS CROSS SECTION LAYOUT		
ENGINEER/CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	DRN. PAF DATE: 12/10/01	SCALE
	DES. SHD DATE: 12/10/01	1"=1000' HORIZONTAL
	CKD. KWR DATE: 12/10/01	n/a VERTICAL
		SHEETS NO. 1 OF 1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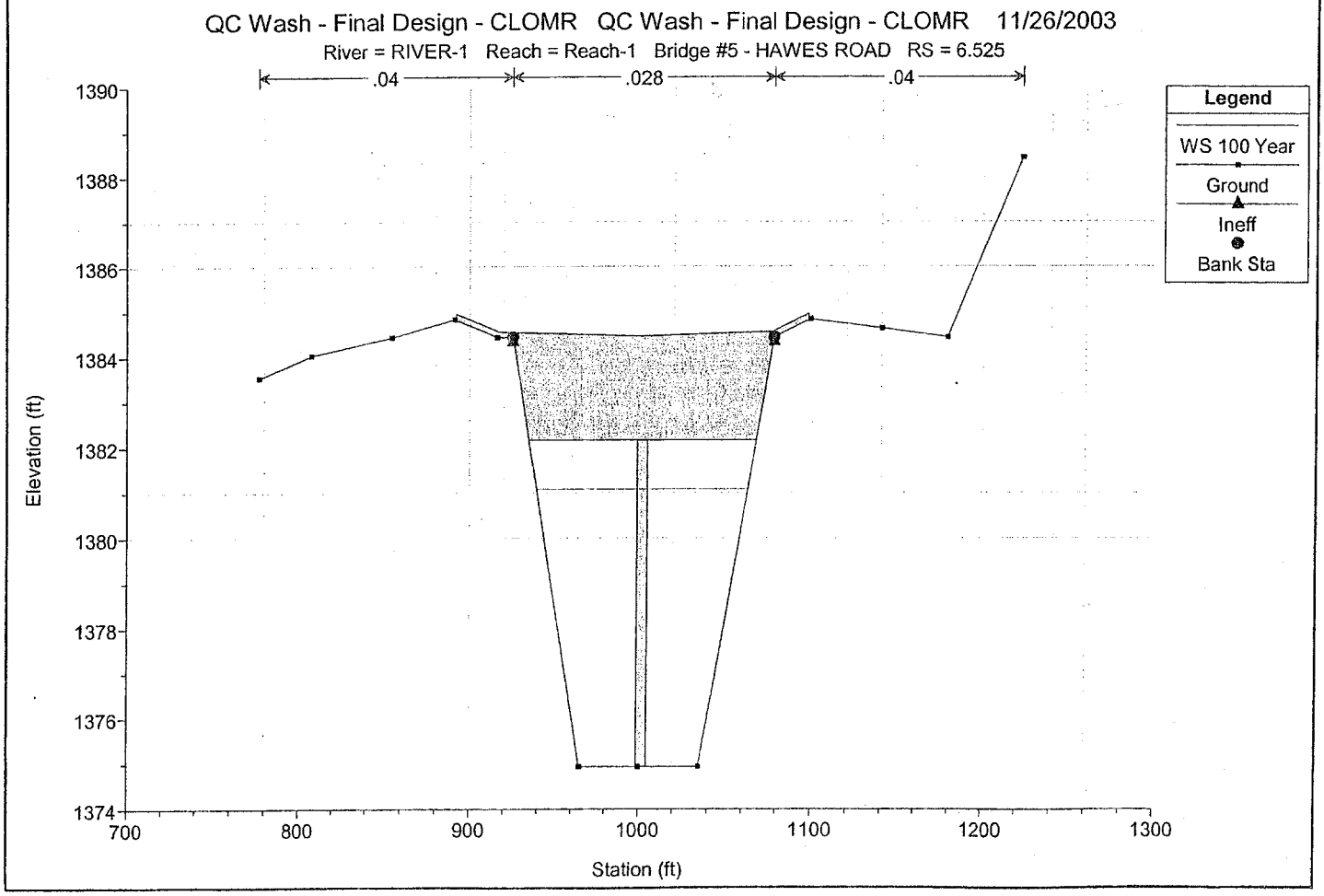
.028
.04
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)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WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1390
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1386
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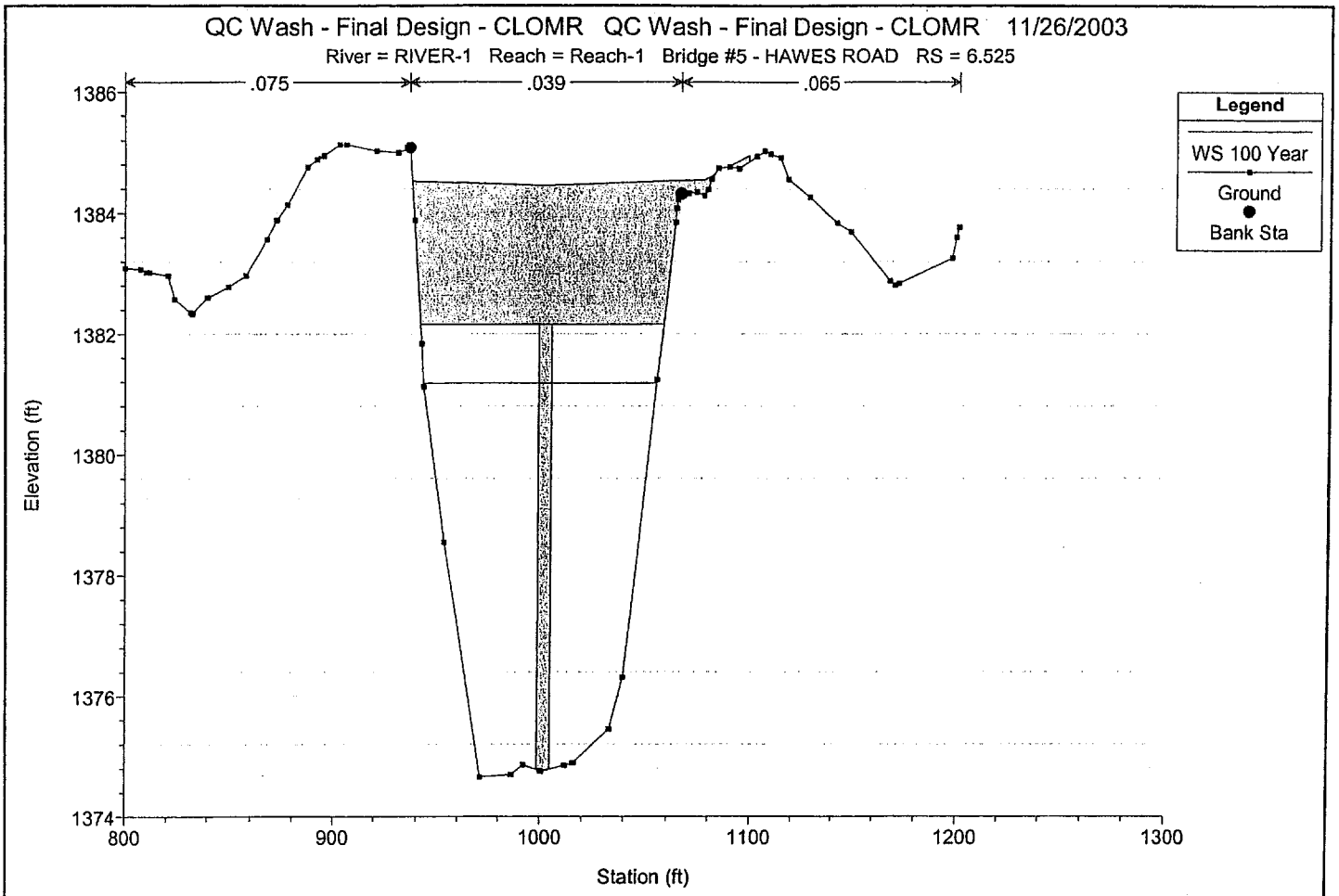
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)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.039
.065
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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1380
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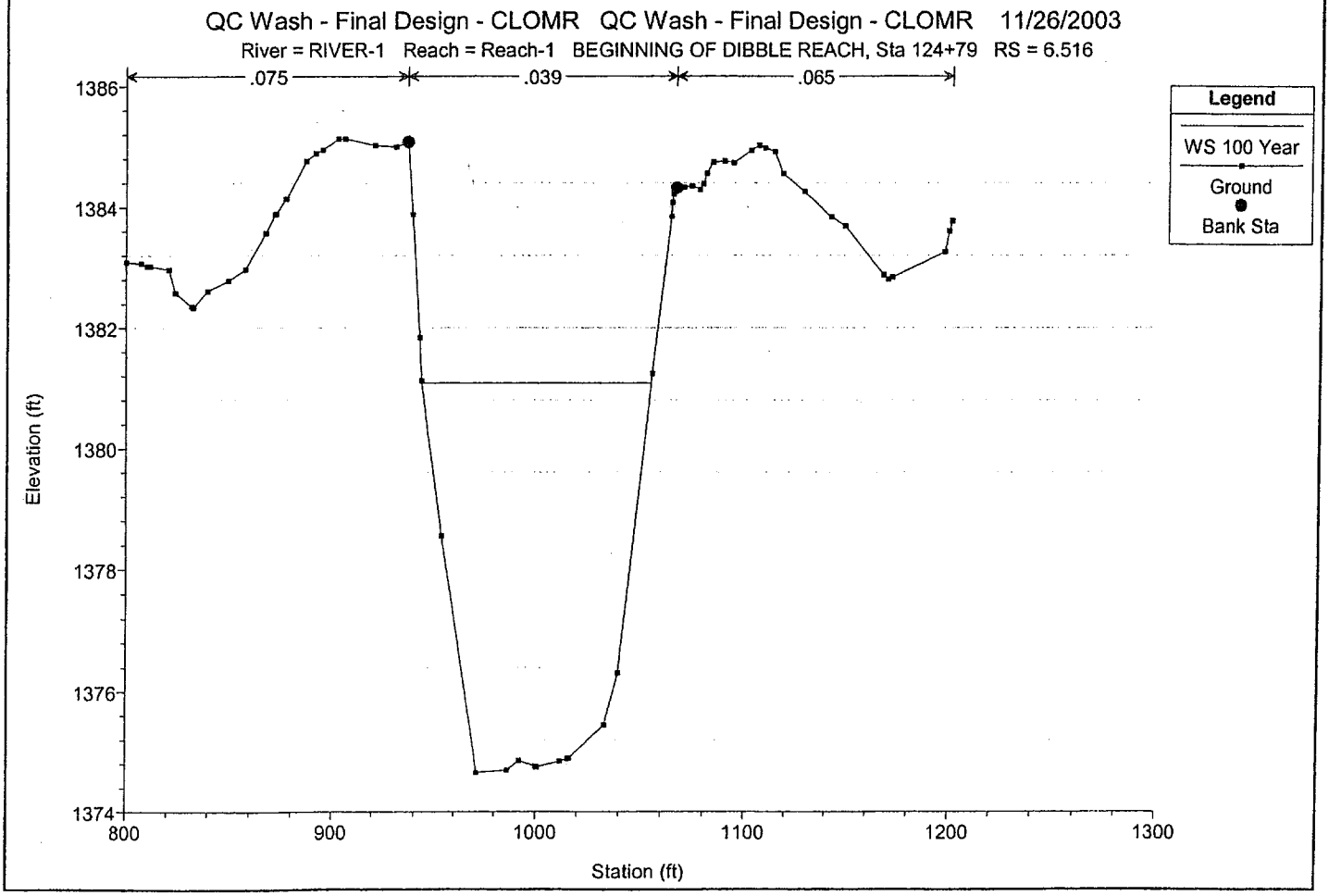
1200
1300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Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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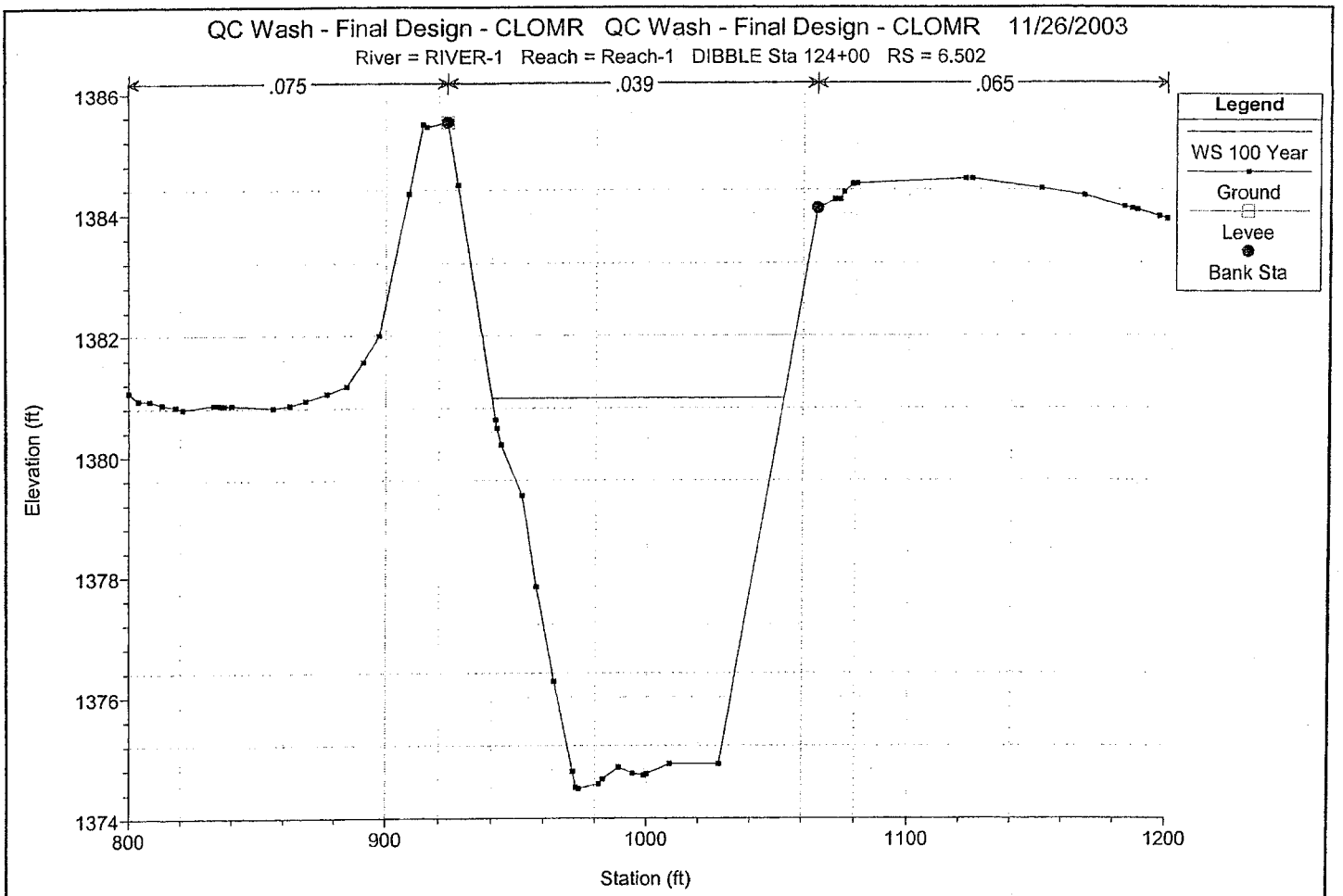
1100
1200
1300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WS 100 Year
Ground
Levee
Bank Sta
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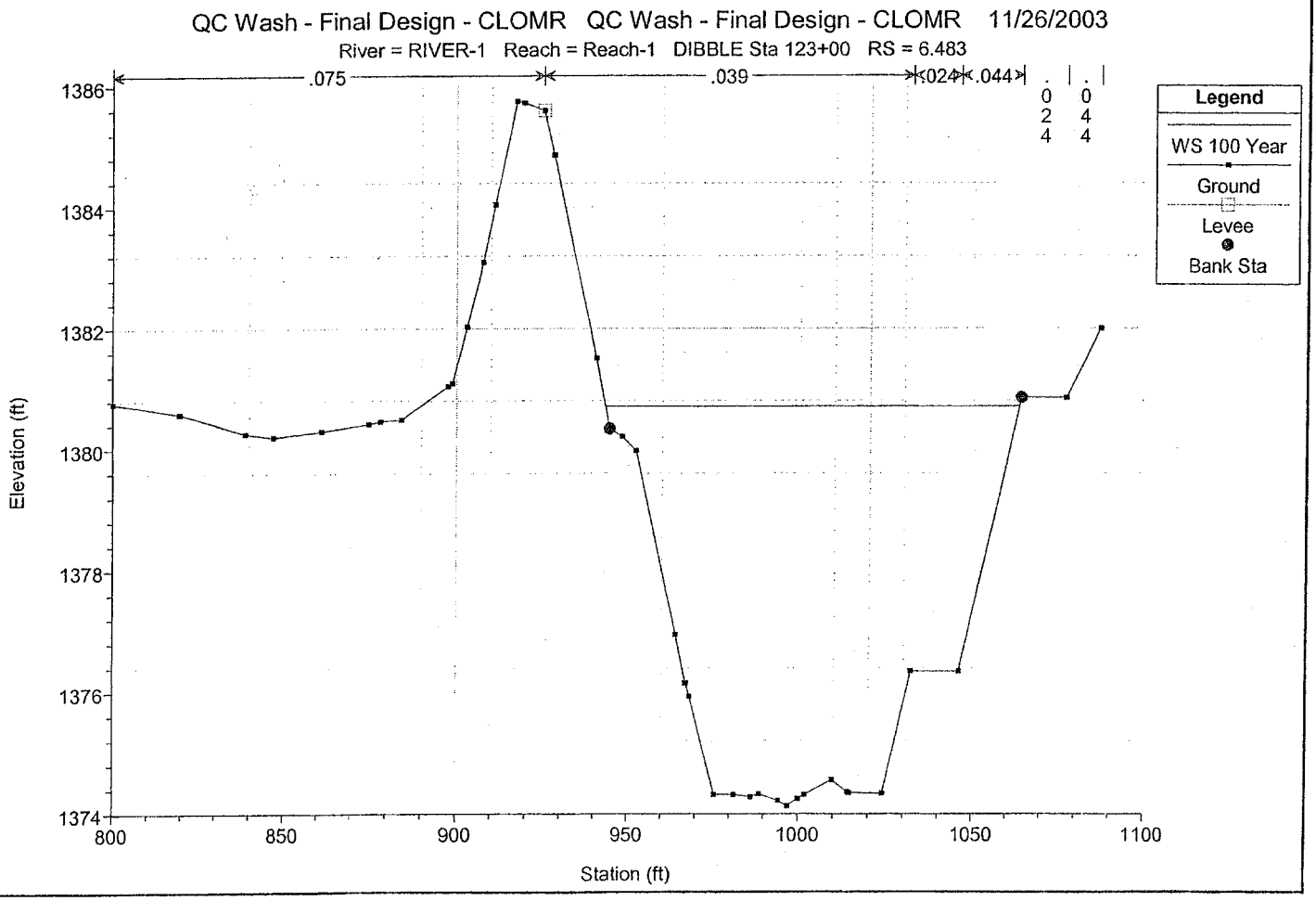
1200
Station (ft)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Ground
Levee
Bank Sta
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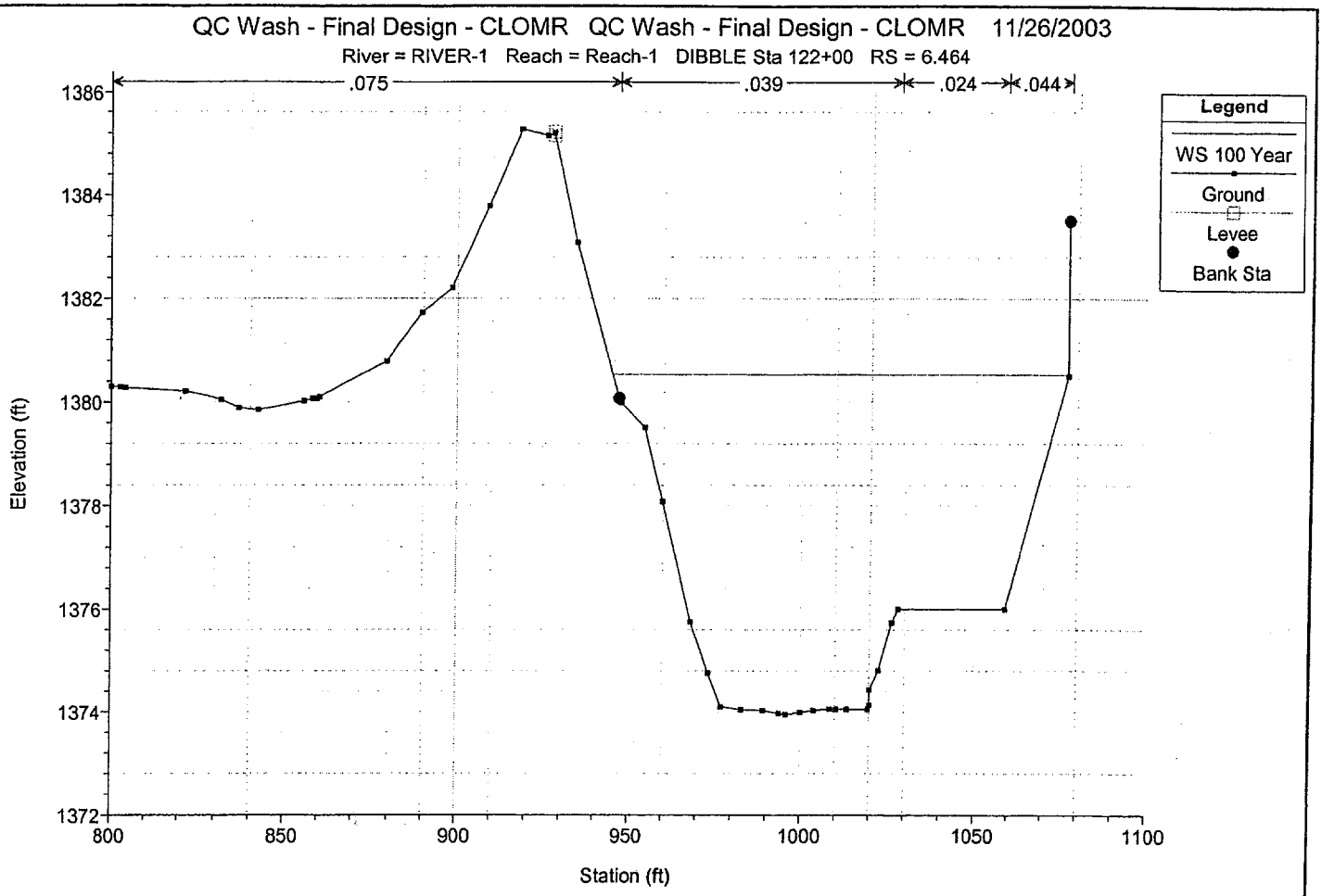
1050
1100
Station (ft)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Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
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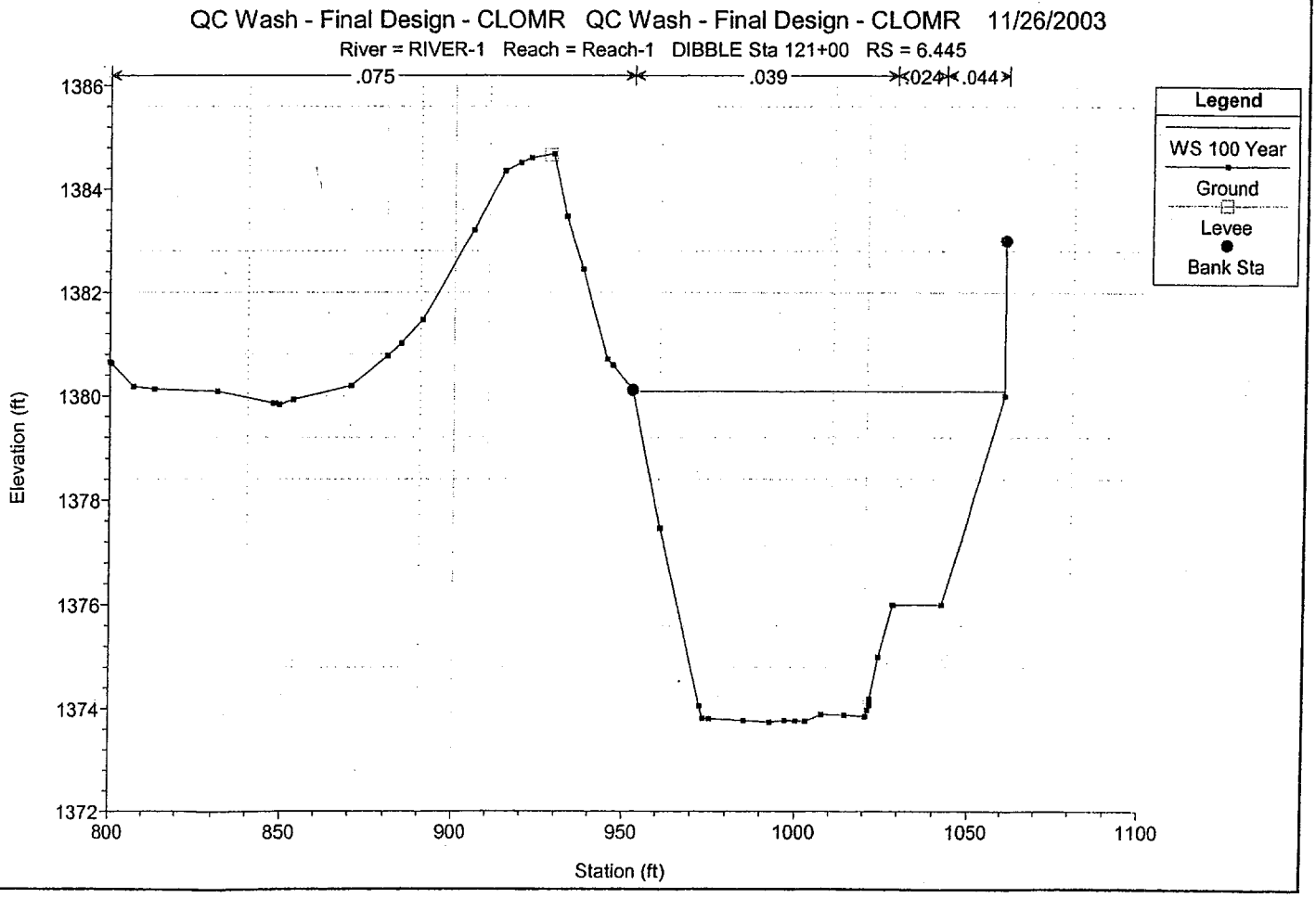
Station (ft)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Legend
WS 100 Year
Ground
Levee
Bank Sta
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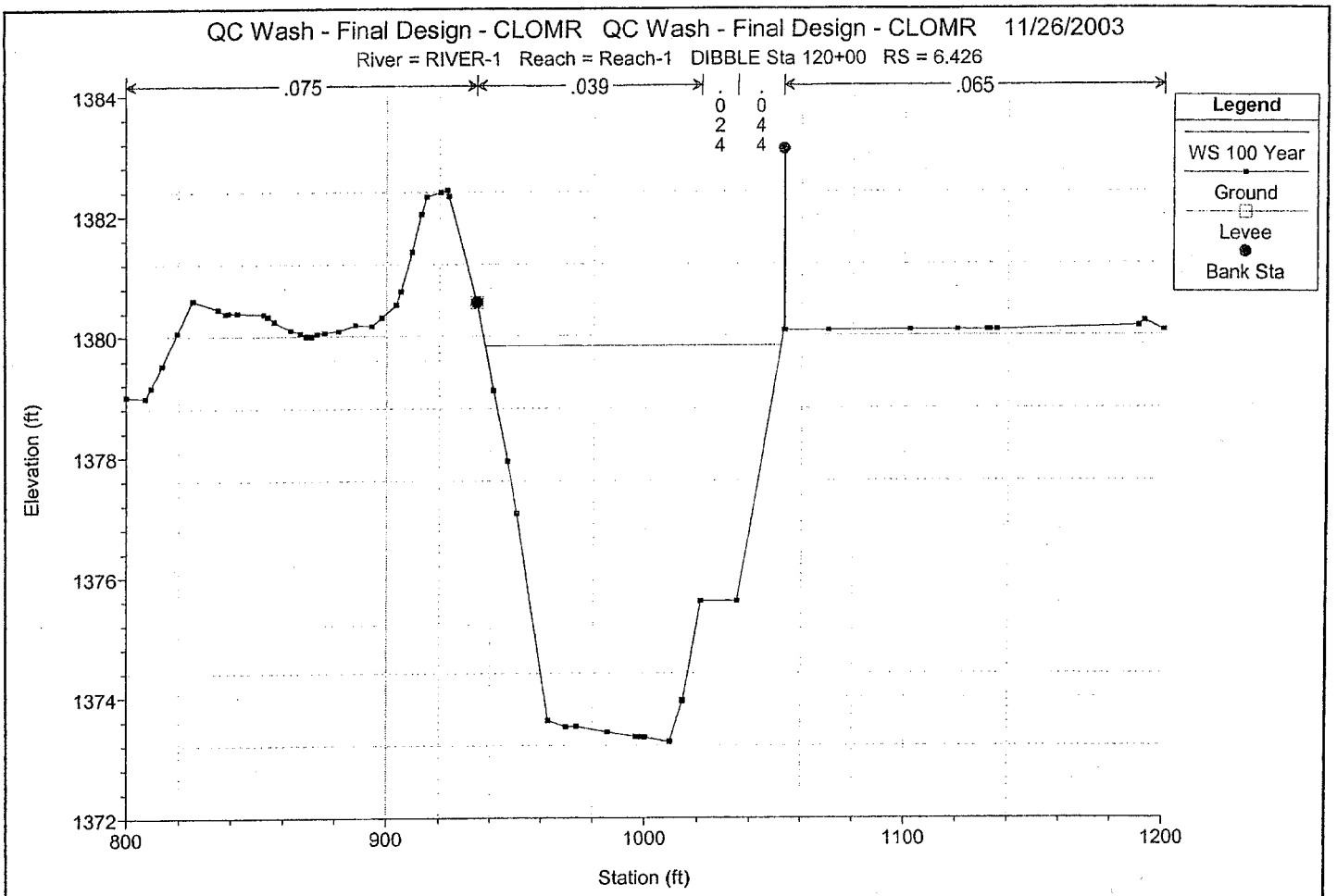
Station (ft)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Legend
WS 100 Year
Ground
Levee
Bank Sta
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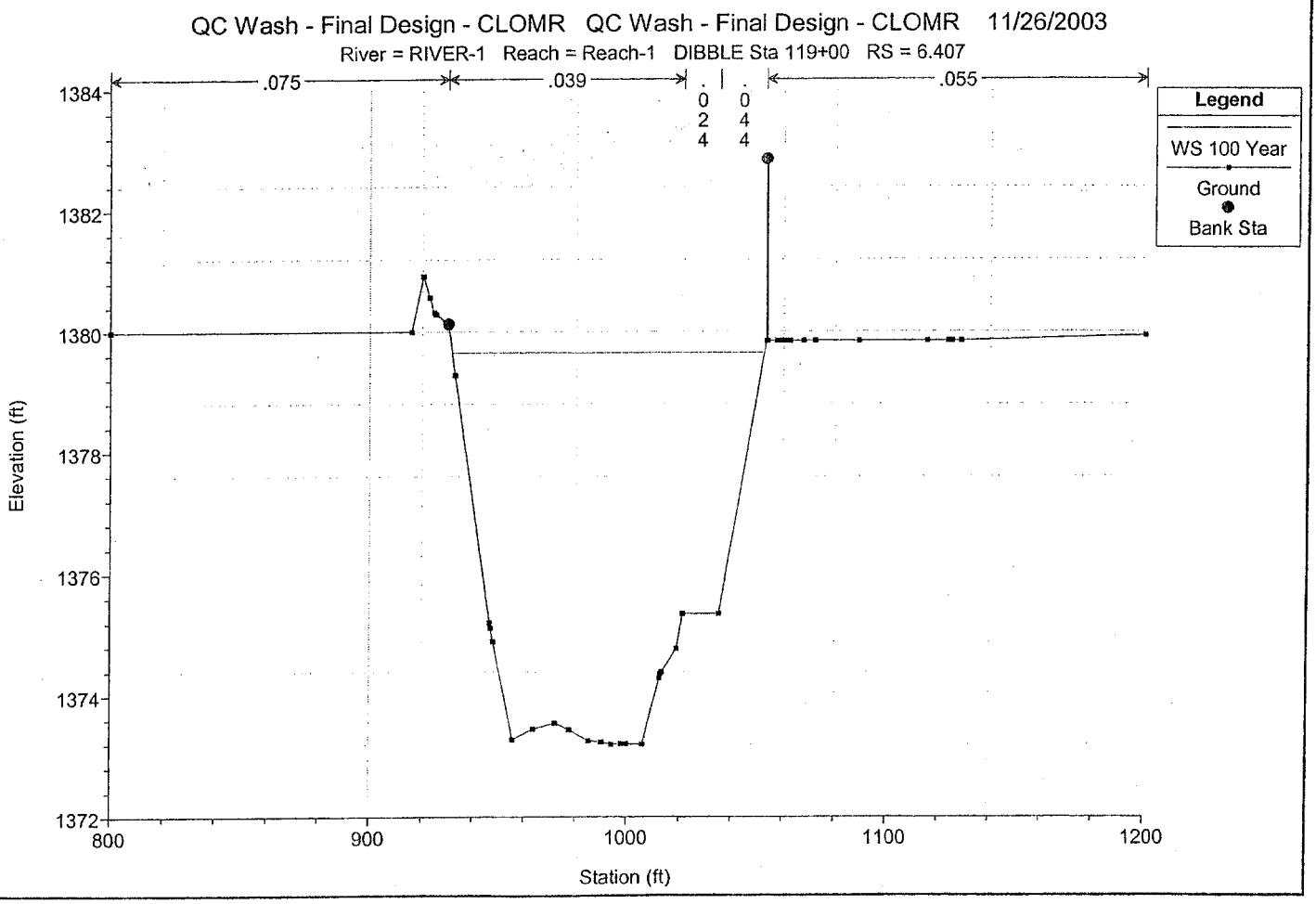
Station (ft)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Legend
WS 100 Year
Ground
Bank Sta
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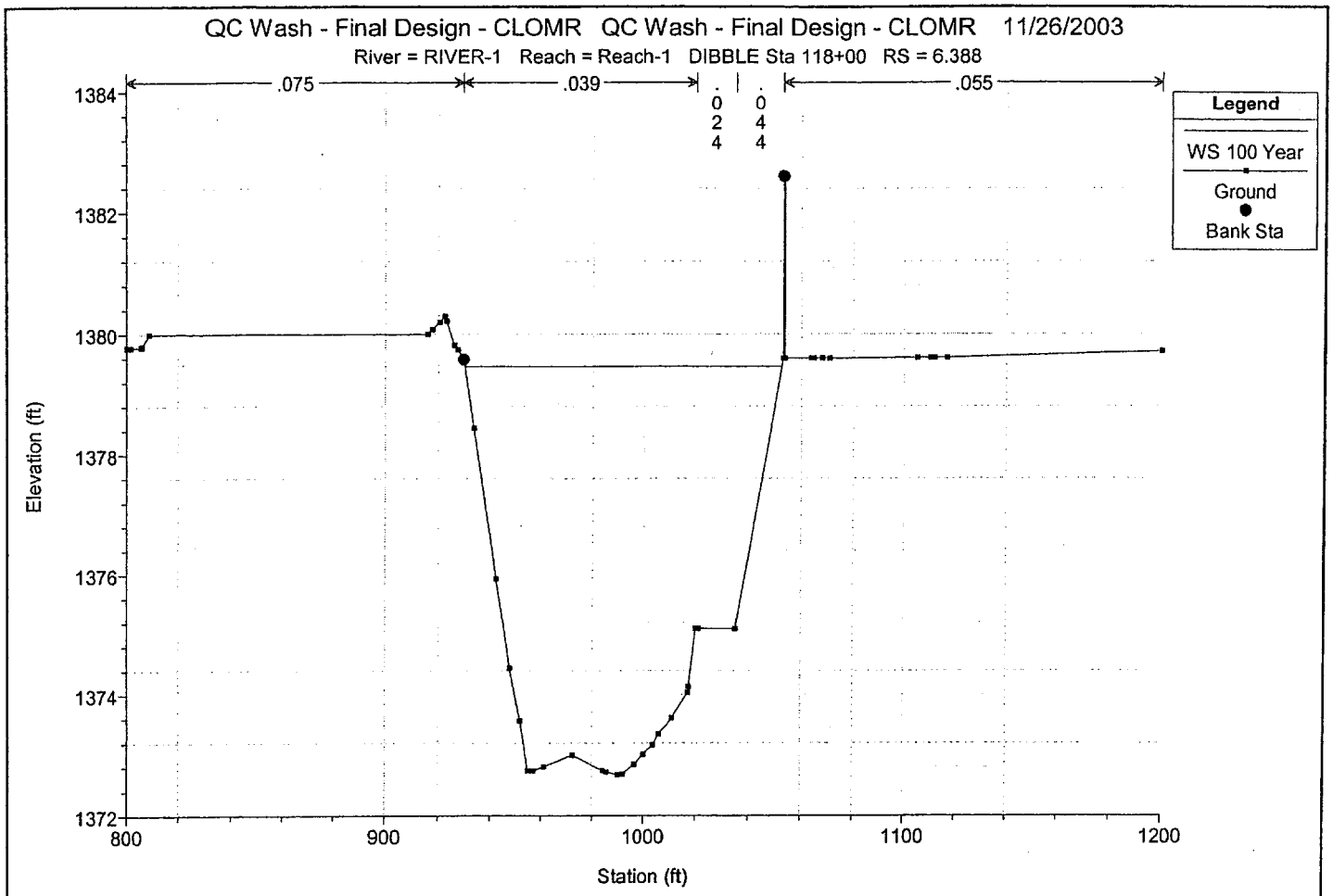
Station (ft)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.024
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Legend
WS 100 Year
Ground
Bank Sta
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Station (ft)
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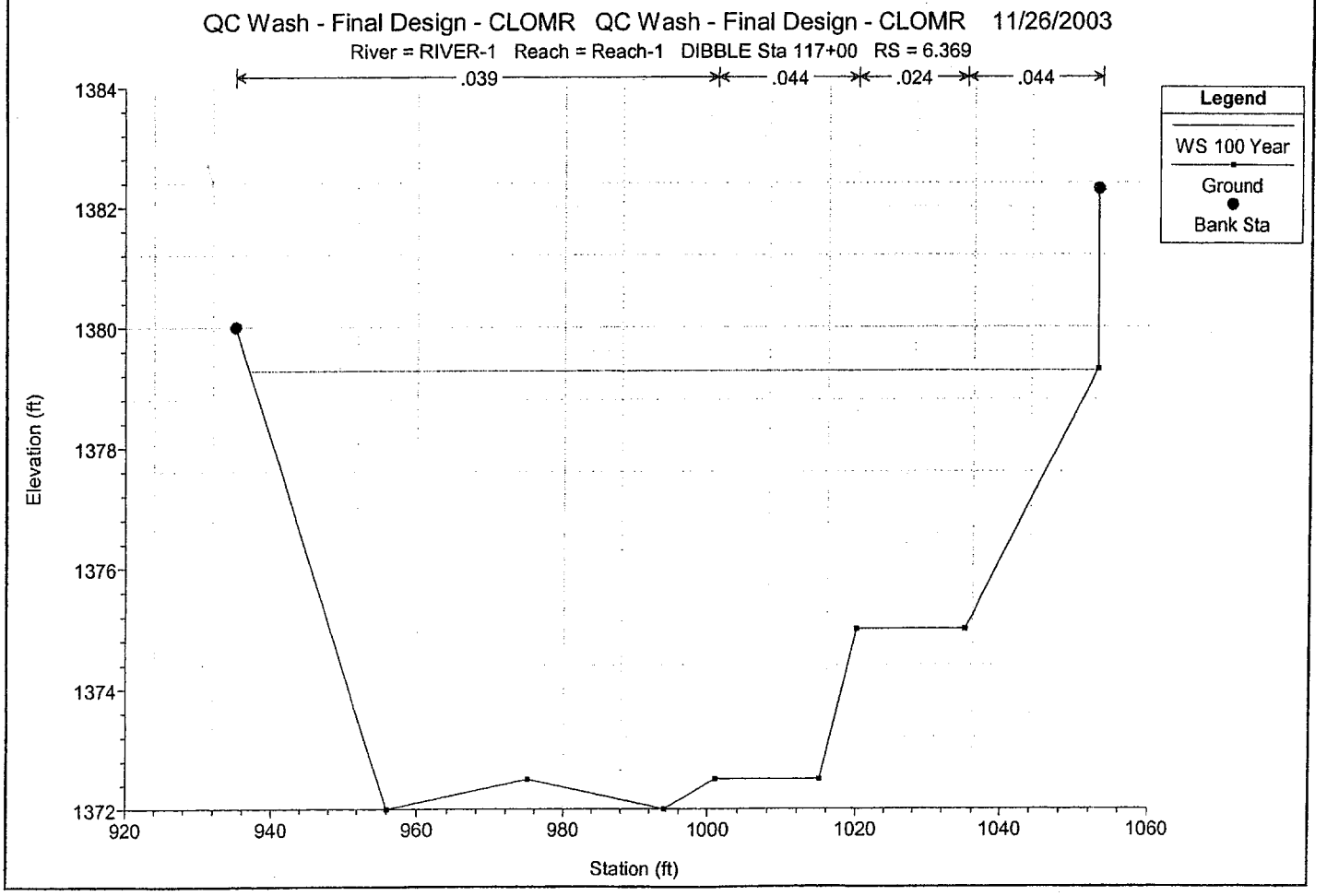
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.024
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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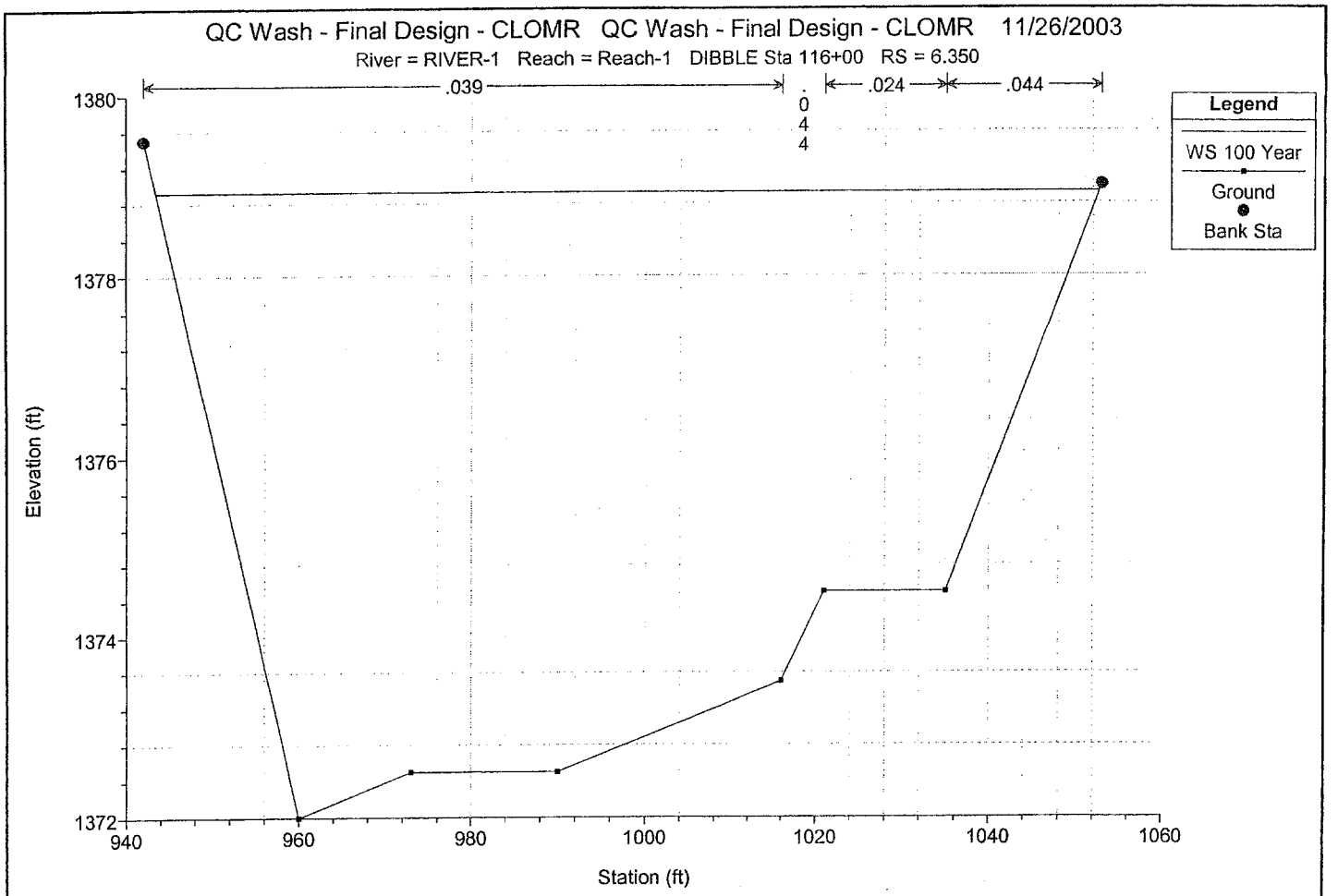
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WS 100 Year
Ground
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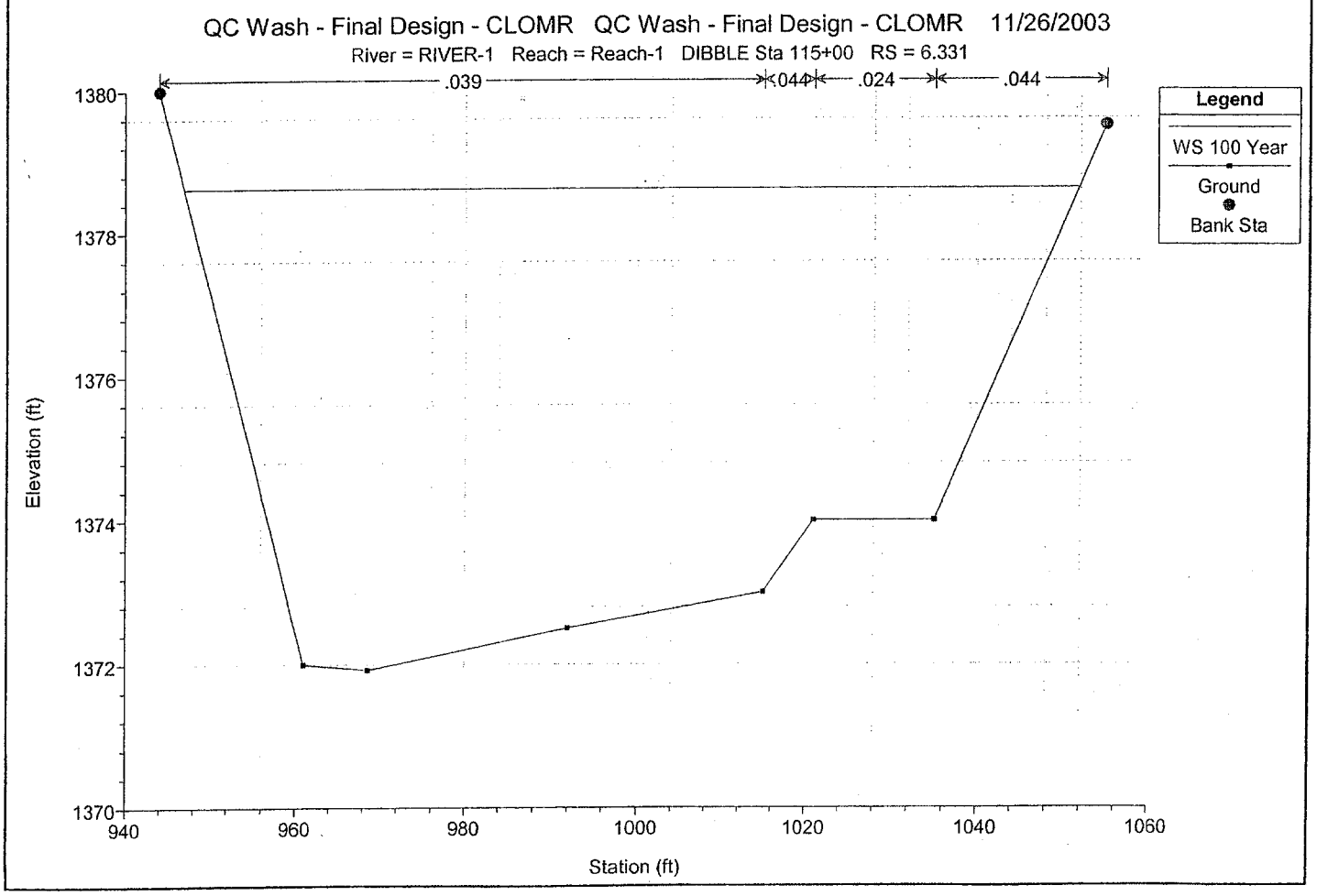
Station (ft)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Legend
WS 100 Year
Ground
Bank Sta
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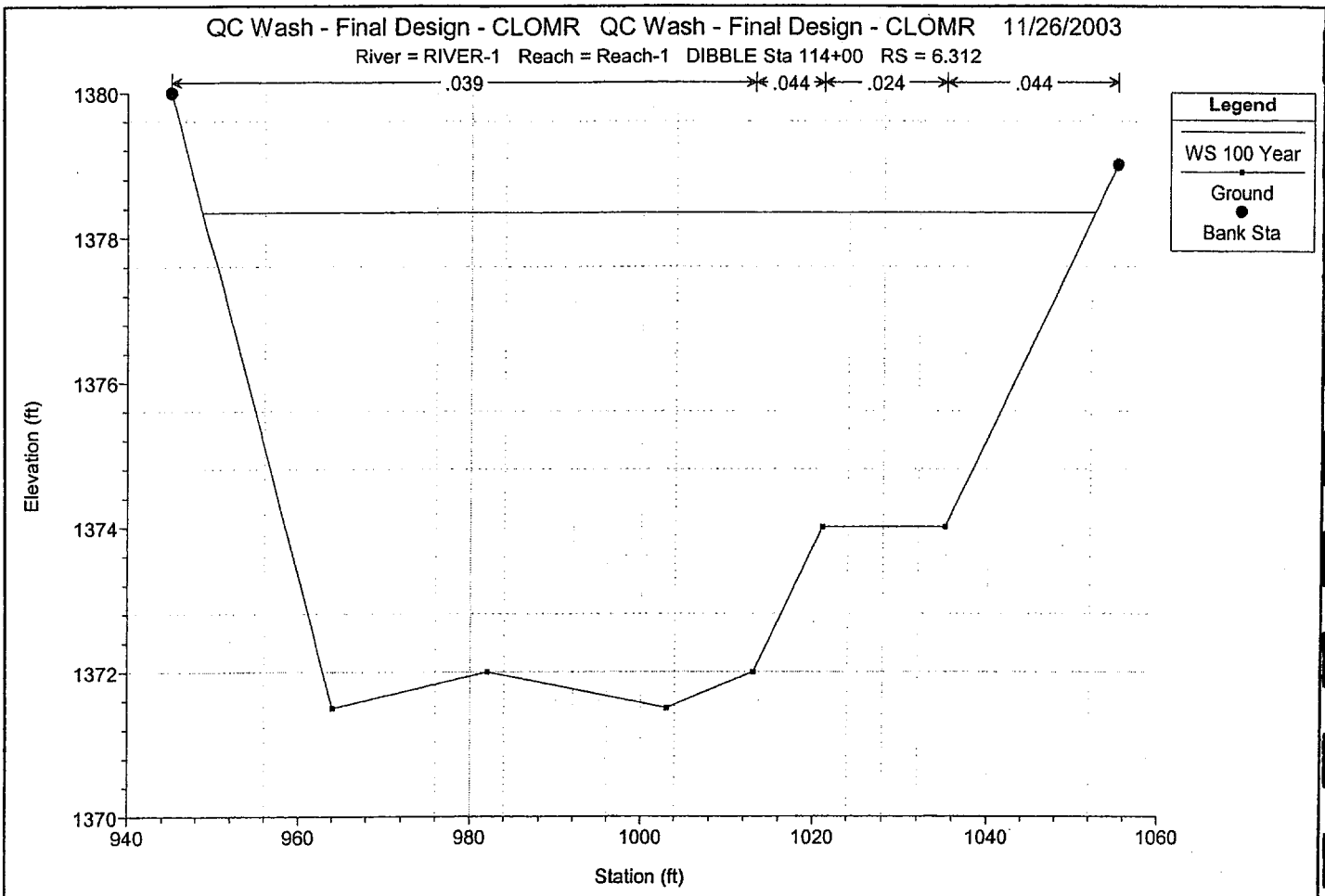
Station (ft)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Legend
WS 100 Year
Ground
Bank Sta
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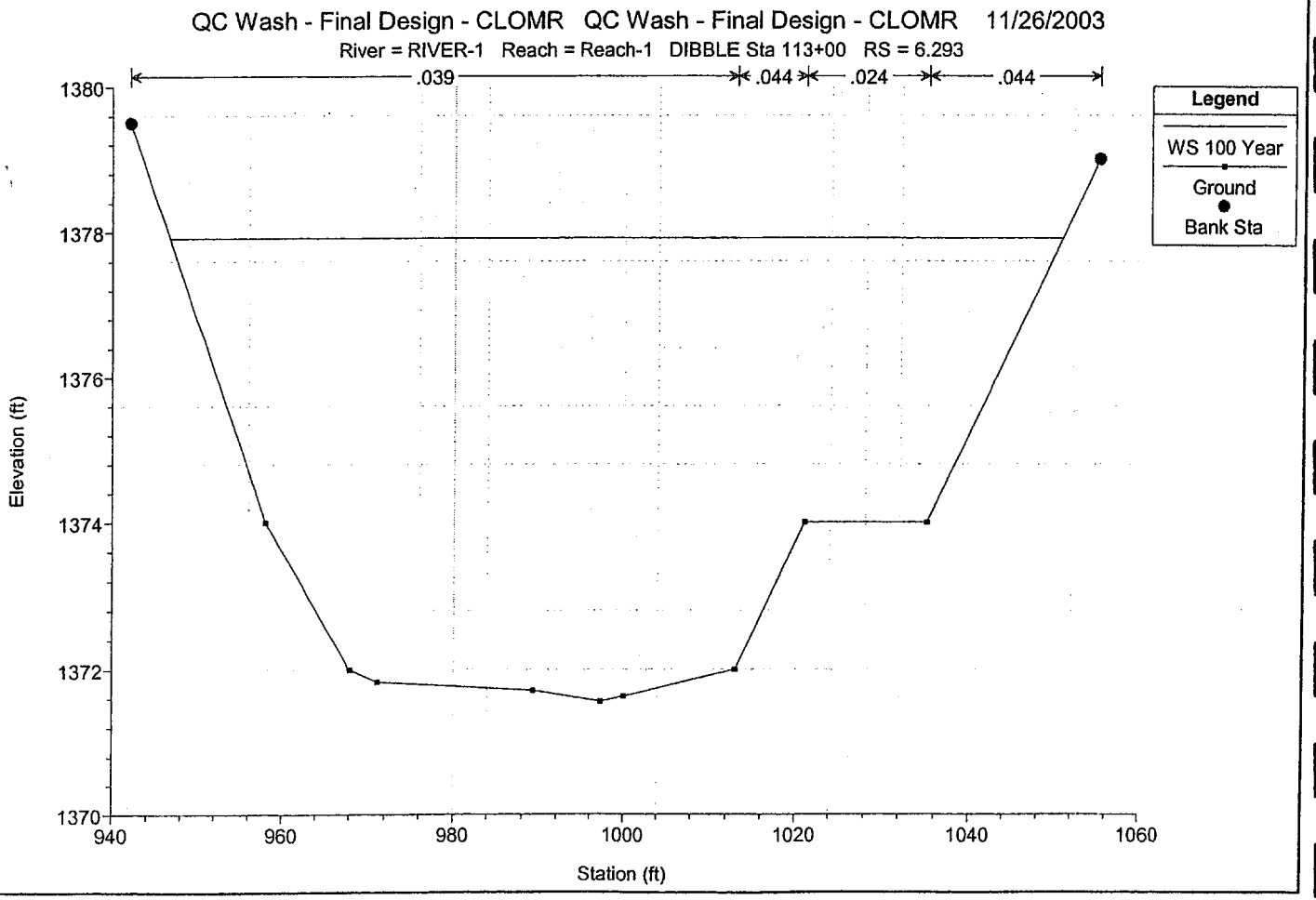
Station (ft)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.044
.024
.044
Legend
WS 100 Year
Ground
Bank Sta
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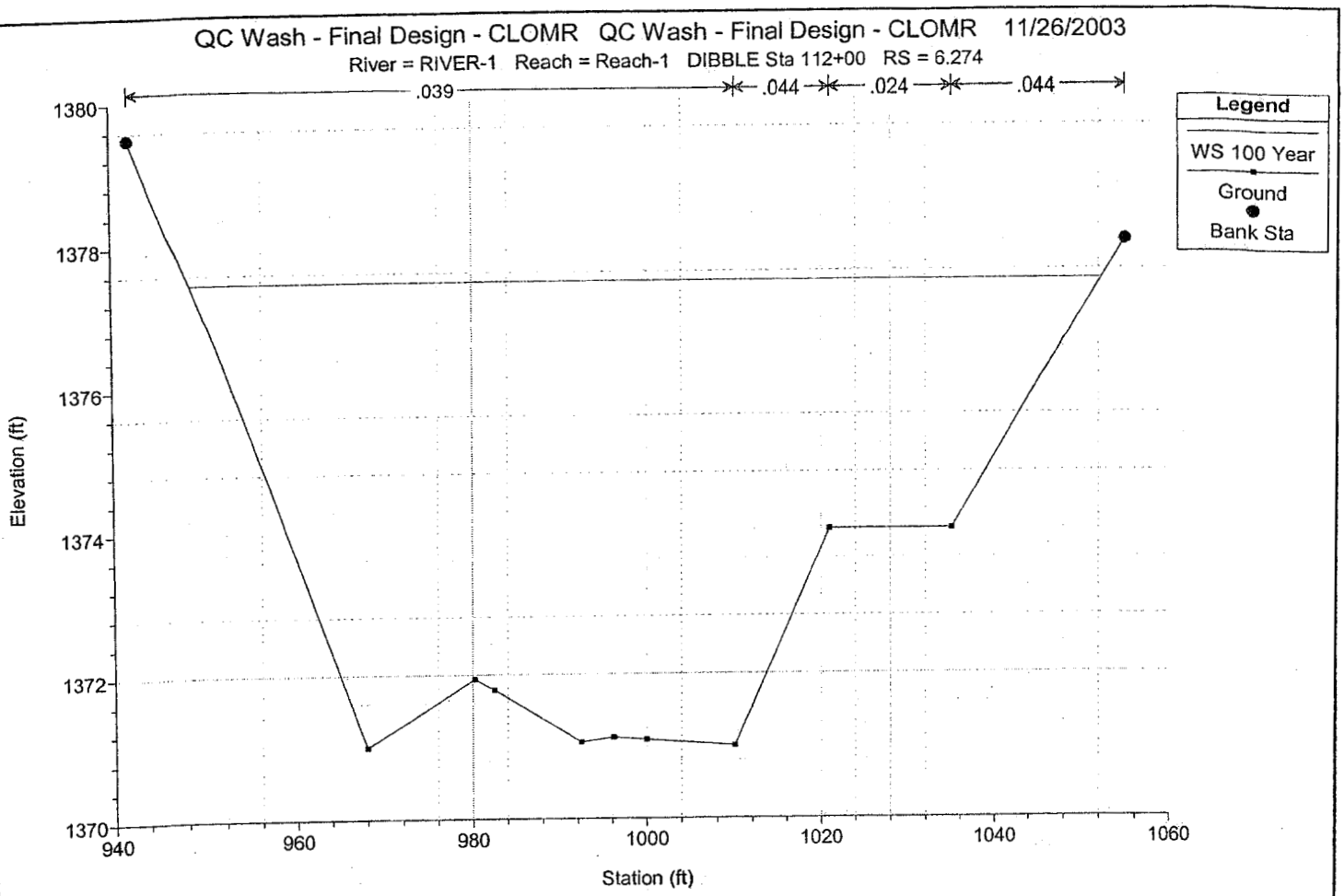
Station (ft)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.024
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Legend
WS 100 Year
Ground
Bank Sta
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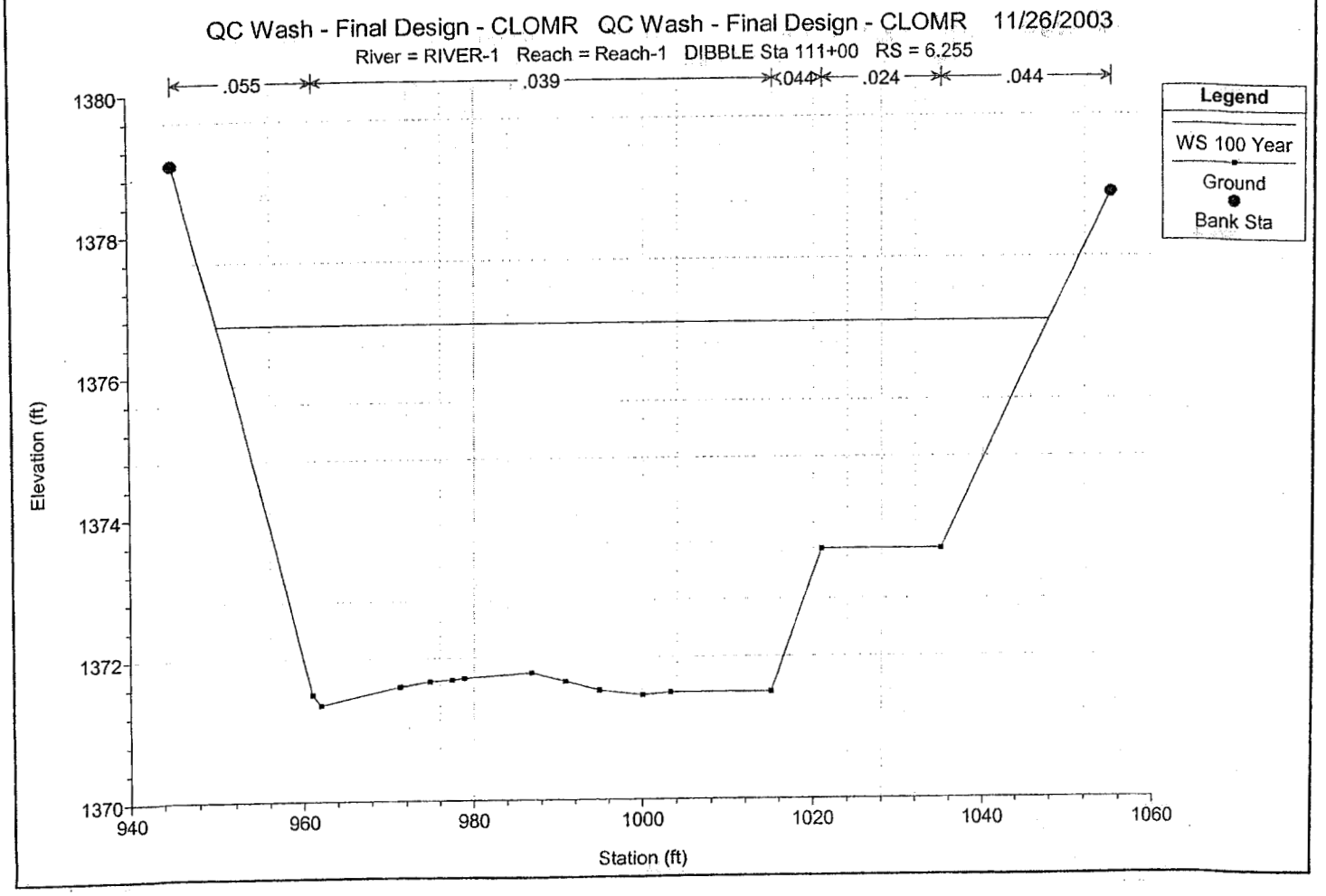
Station (ft)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.044
.024
.044
Legend
WS 100 Year
Ground
Bank Sta
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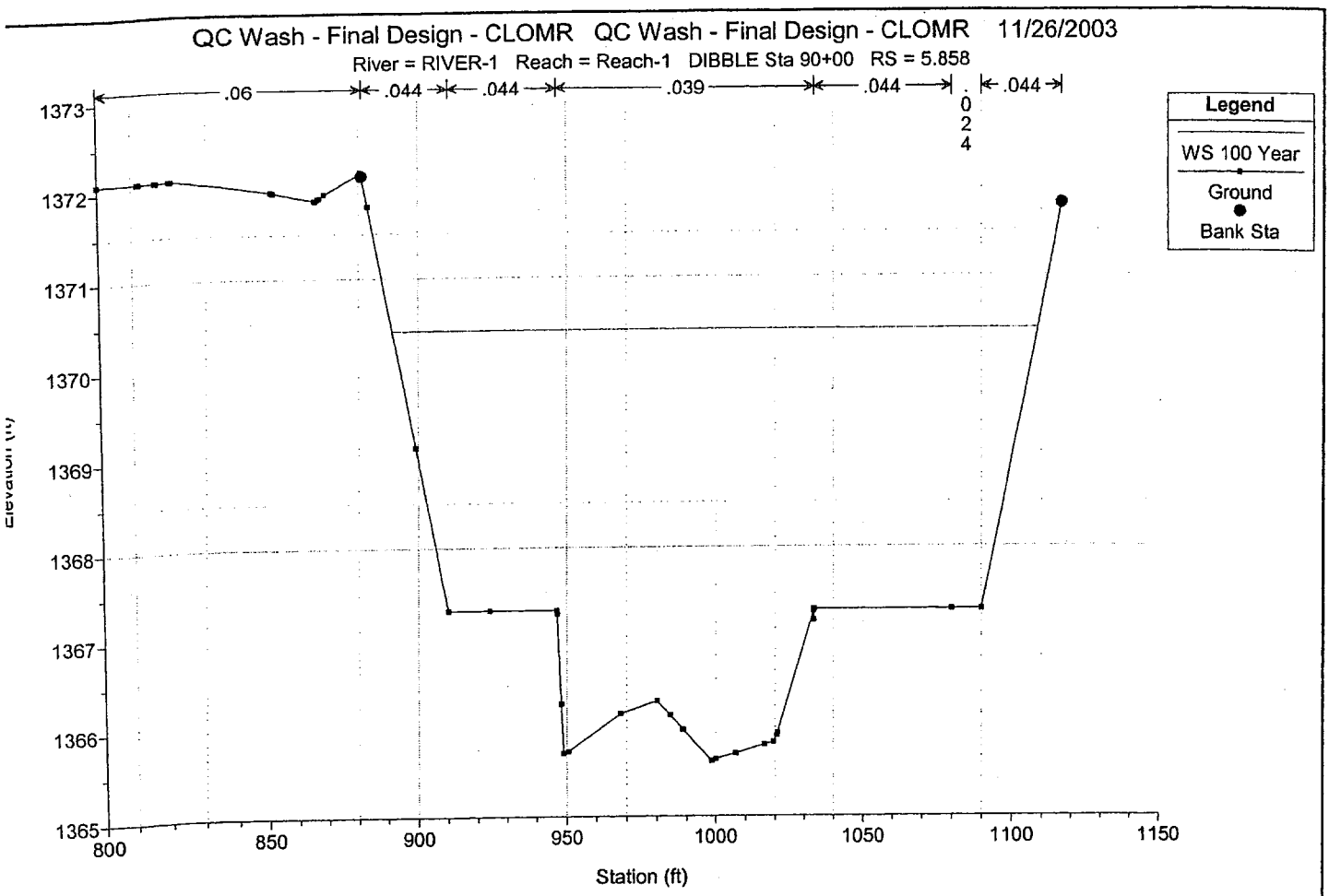
Station (ft)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.024
.044
Legend
WS 100 Year
Ground
Bank Sta
1373
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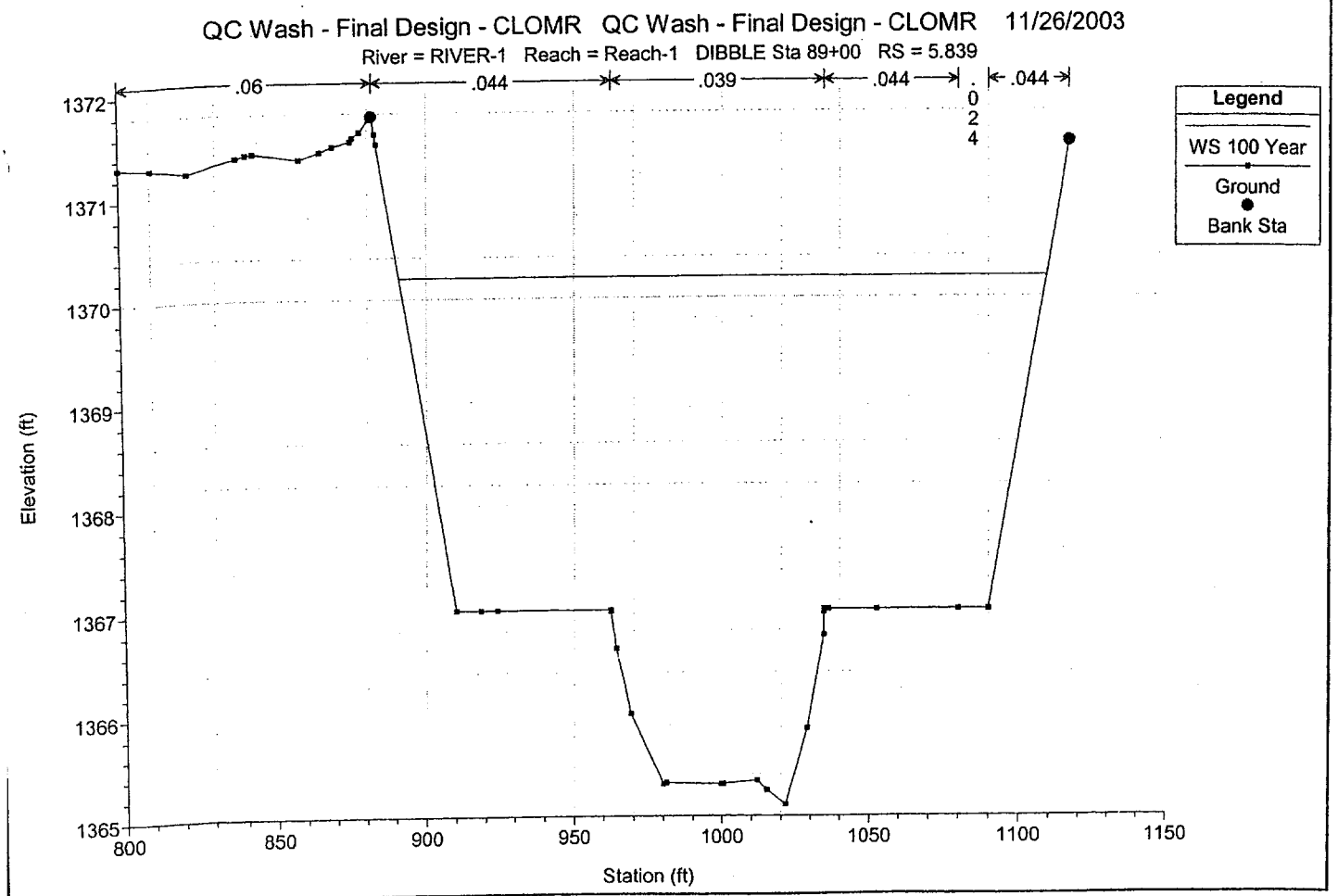
Station (ft)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.039
.044
.024
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
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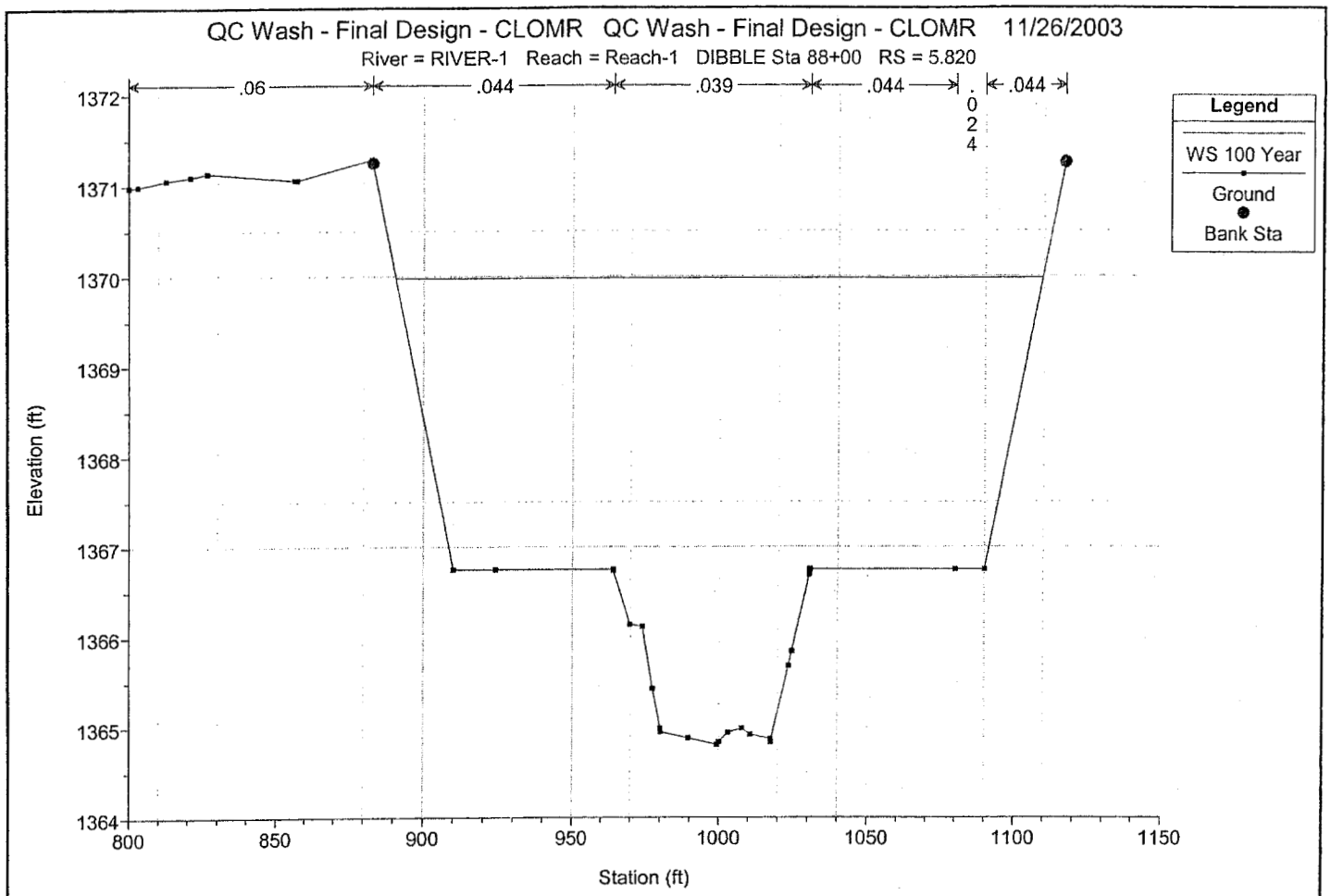
Station (ft)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WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
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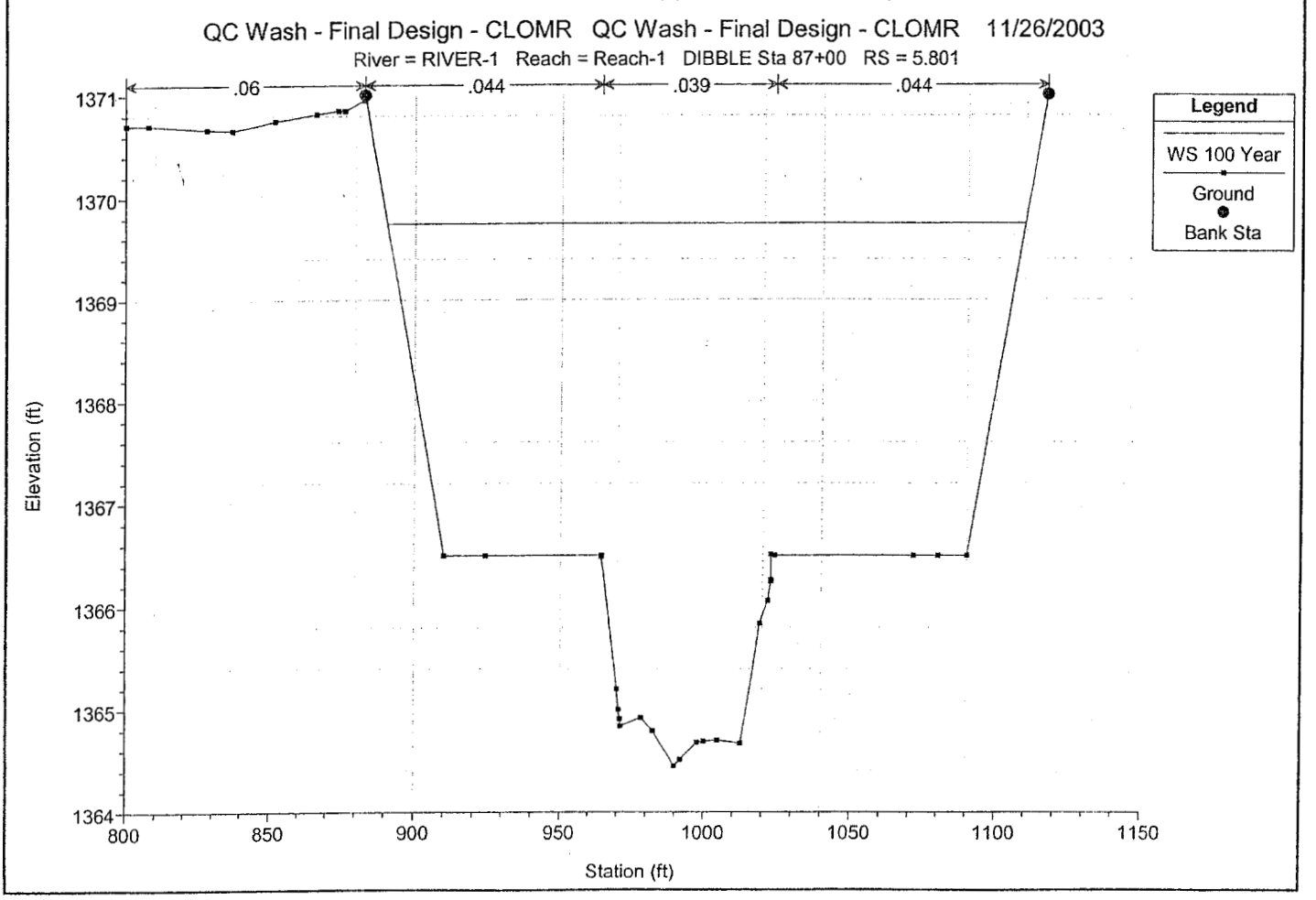
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.039
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Legend
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Ground
Bank Sta
Elevation (ft)
Station (ft)
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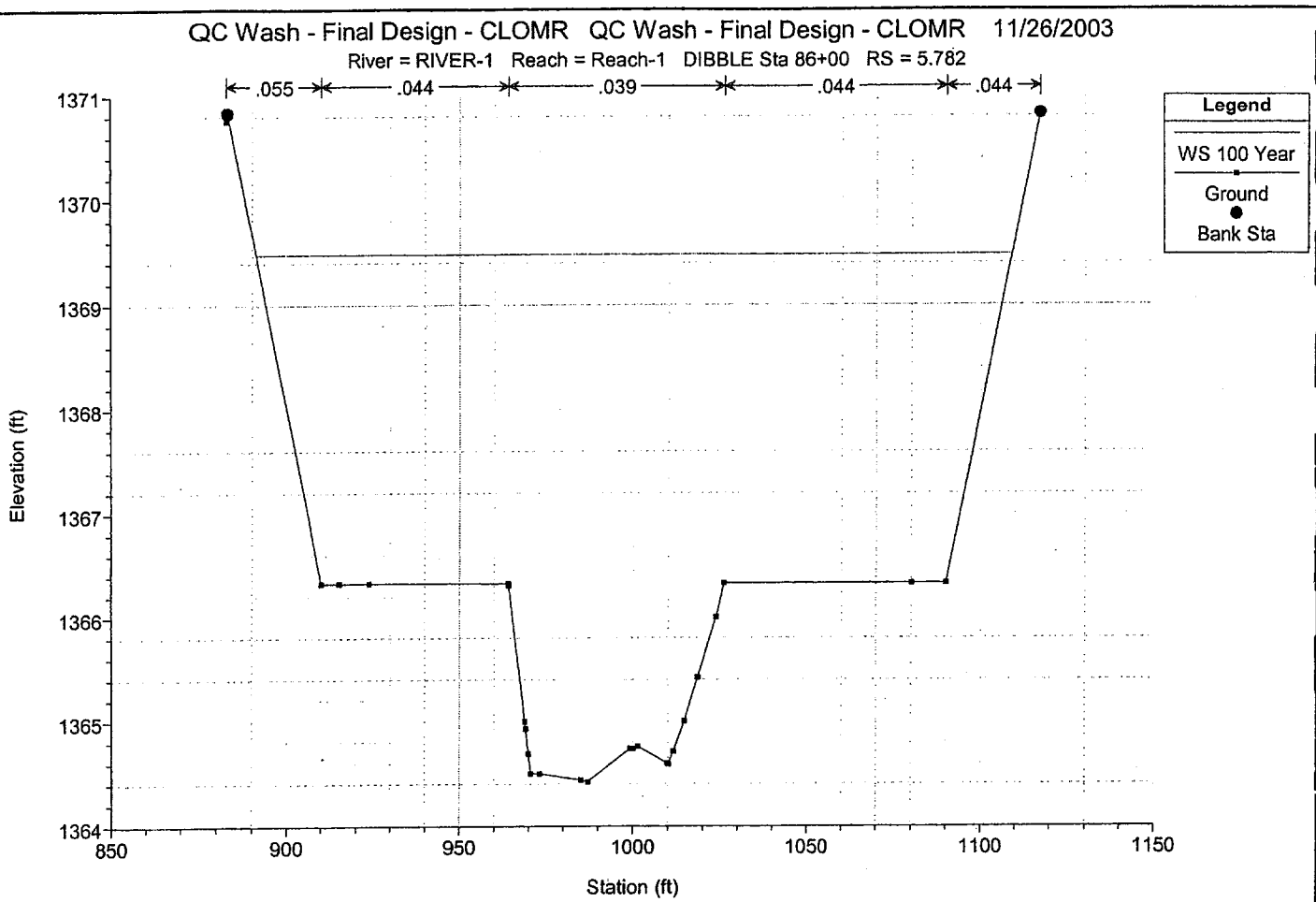
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.044
.039
.044
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
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900
950
1000
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1100
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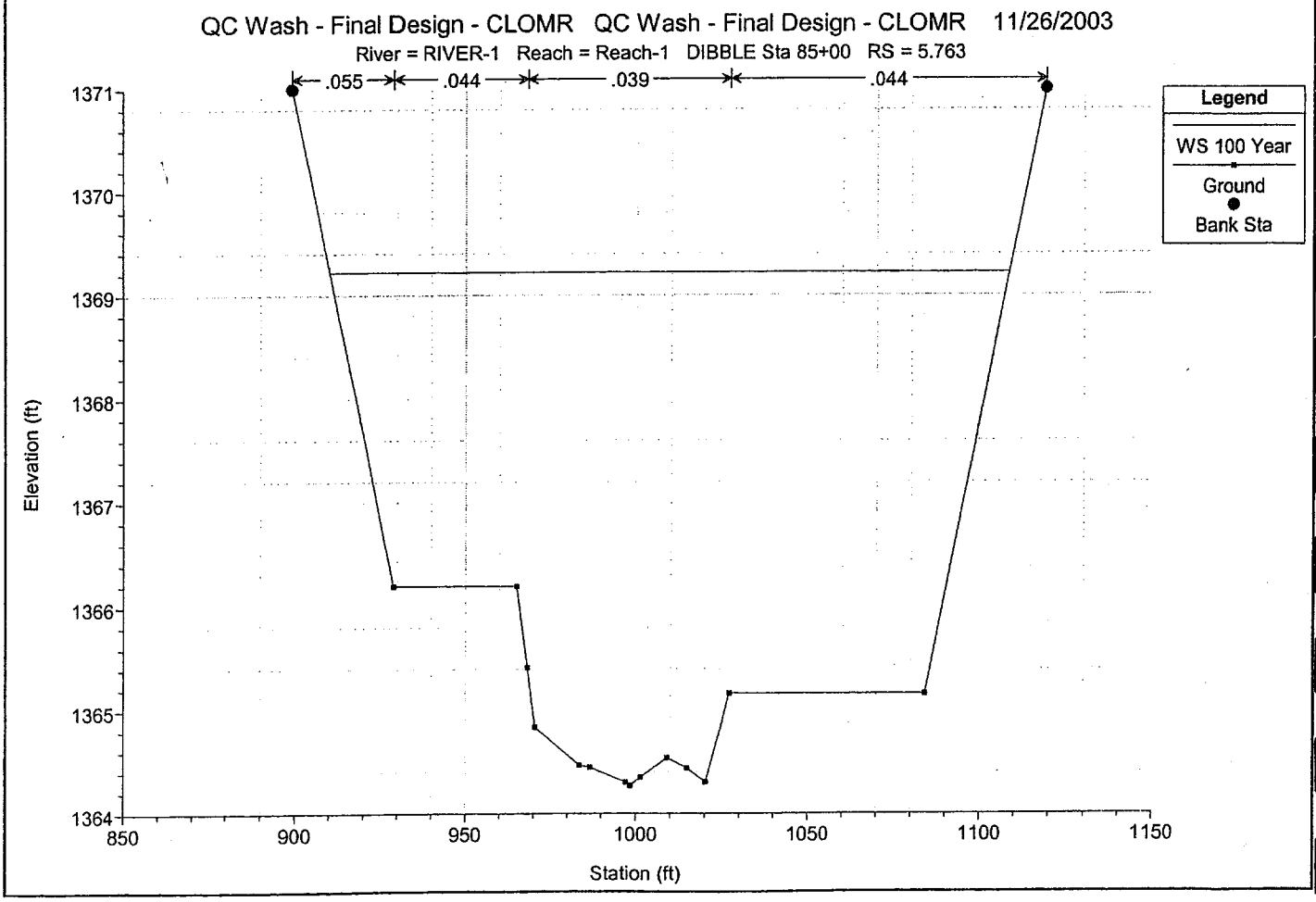
Station (ft)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.044
.039
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
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950
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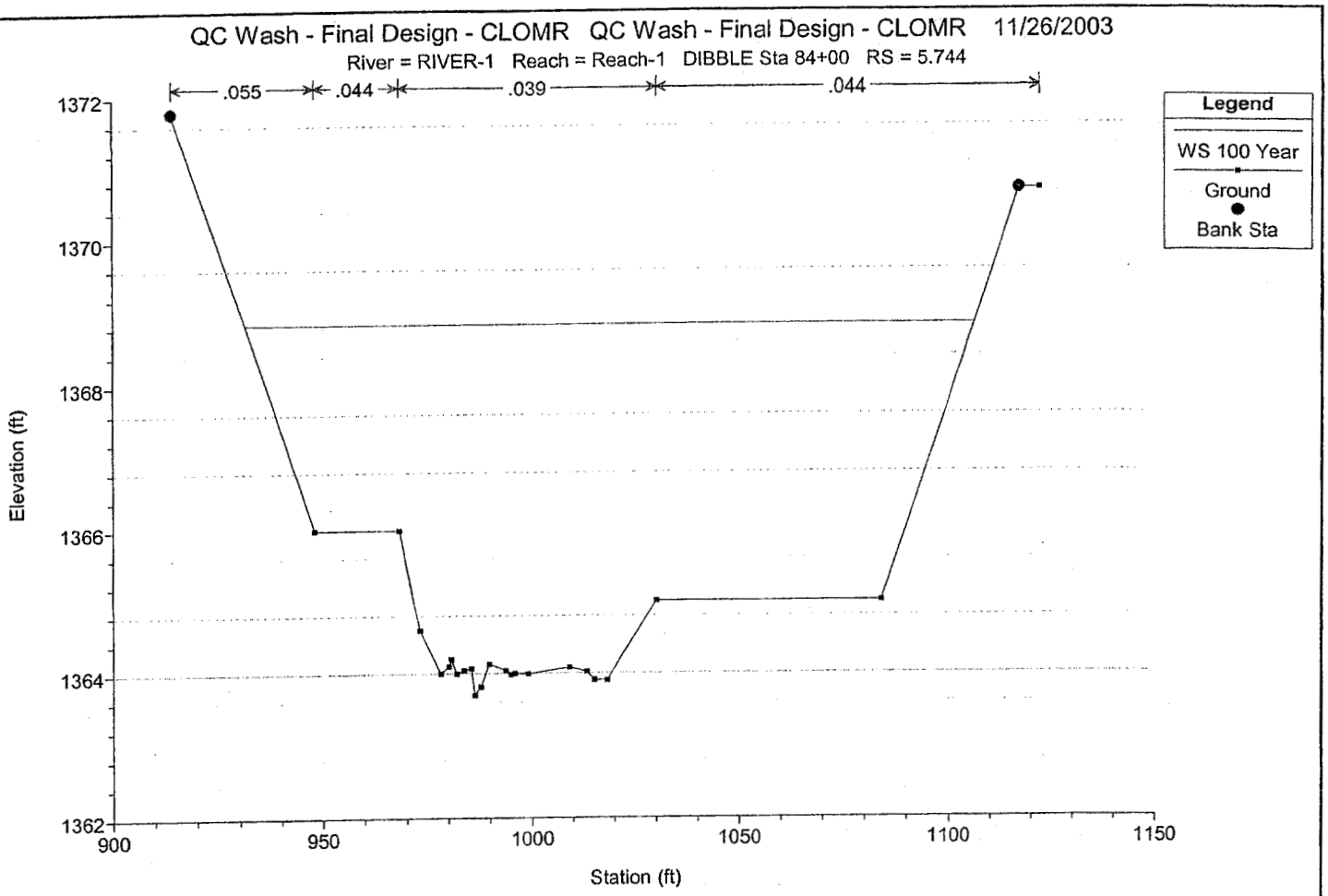
1050
1100
1150
Station (ft)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.039
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
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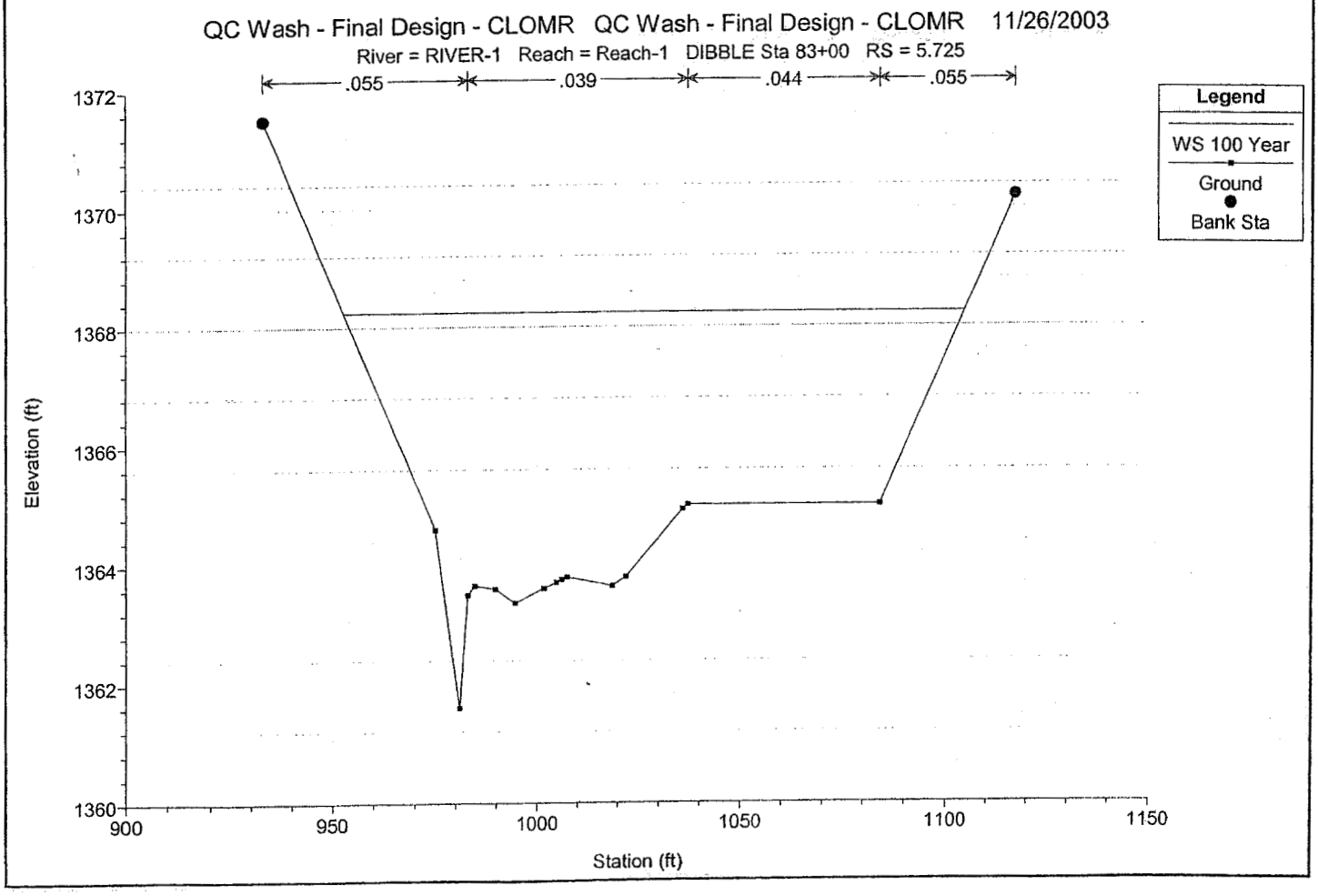
Station (ft)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Legend
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Ground
Bank Sta
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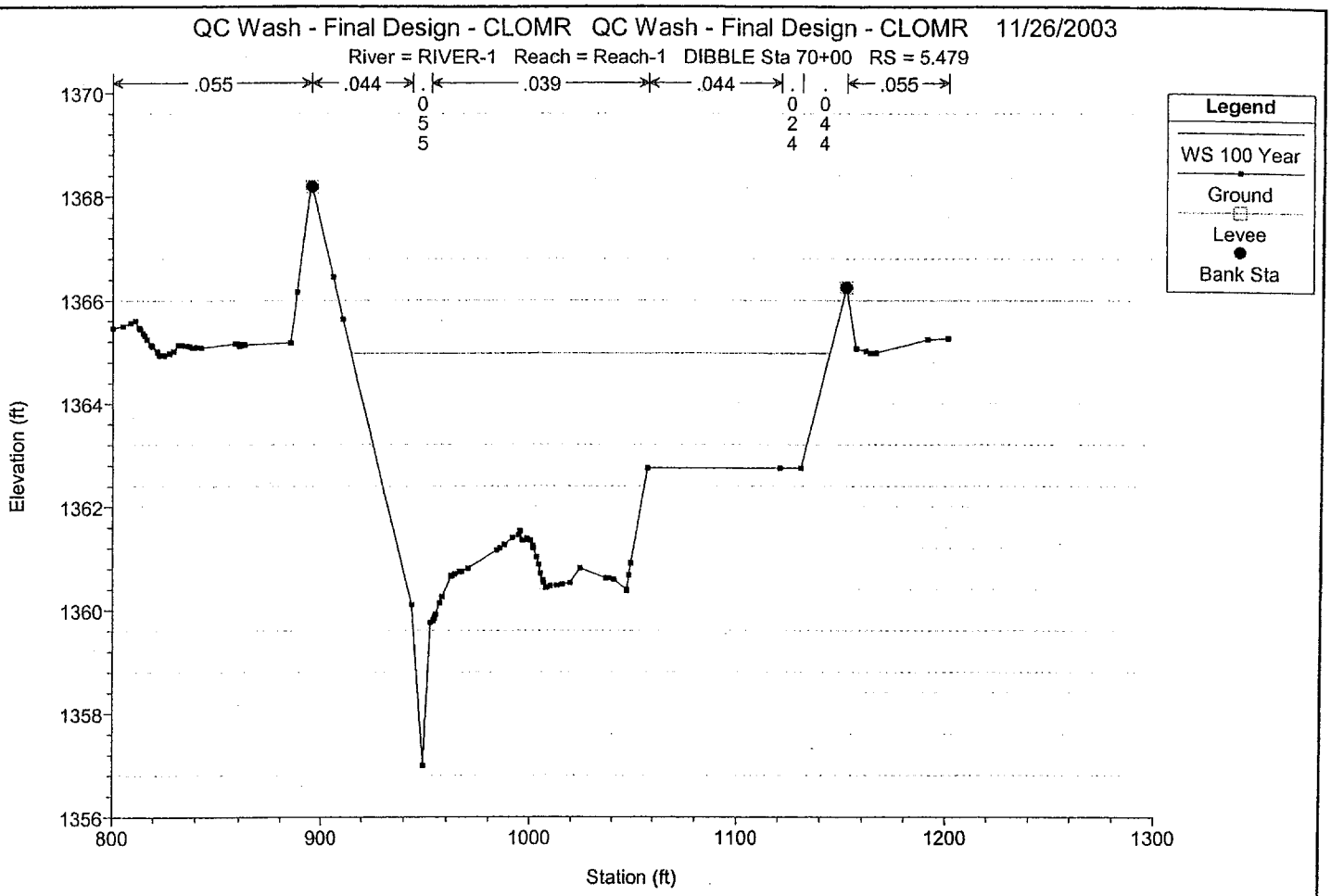
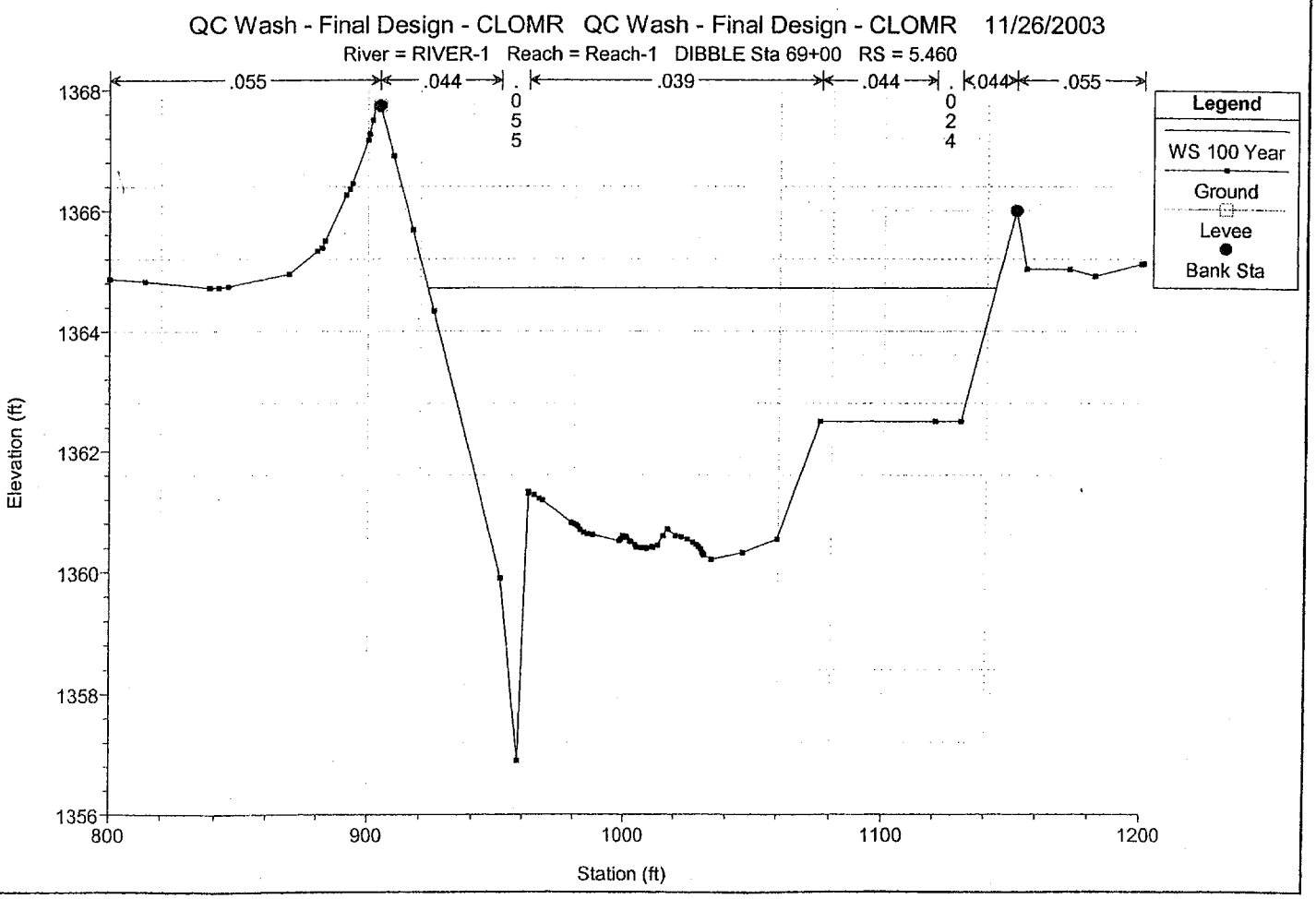
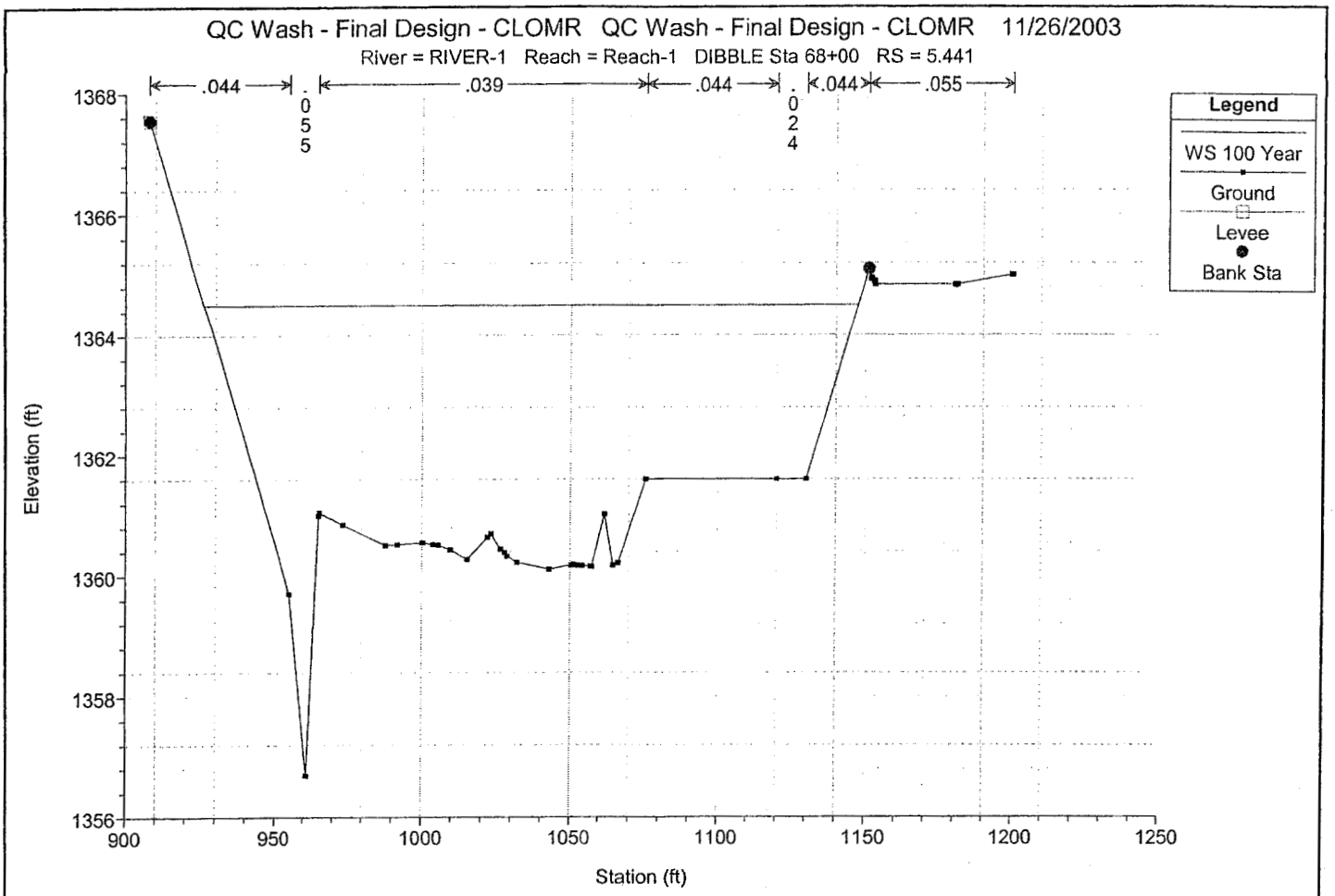
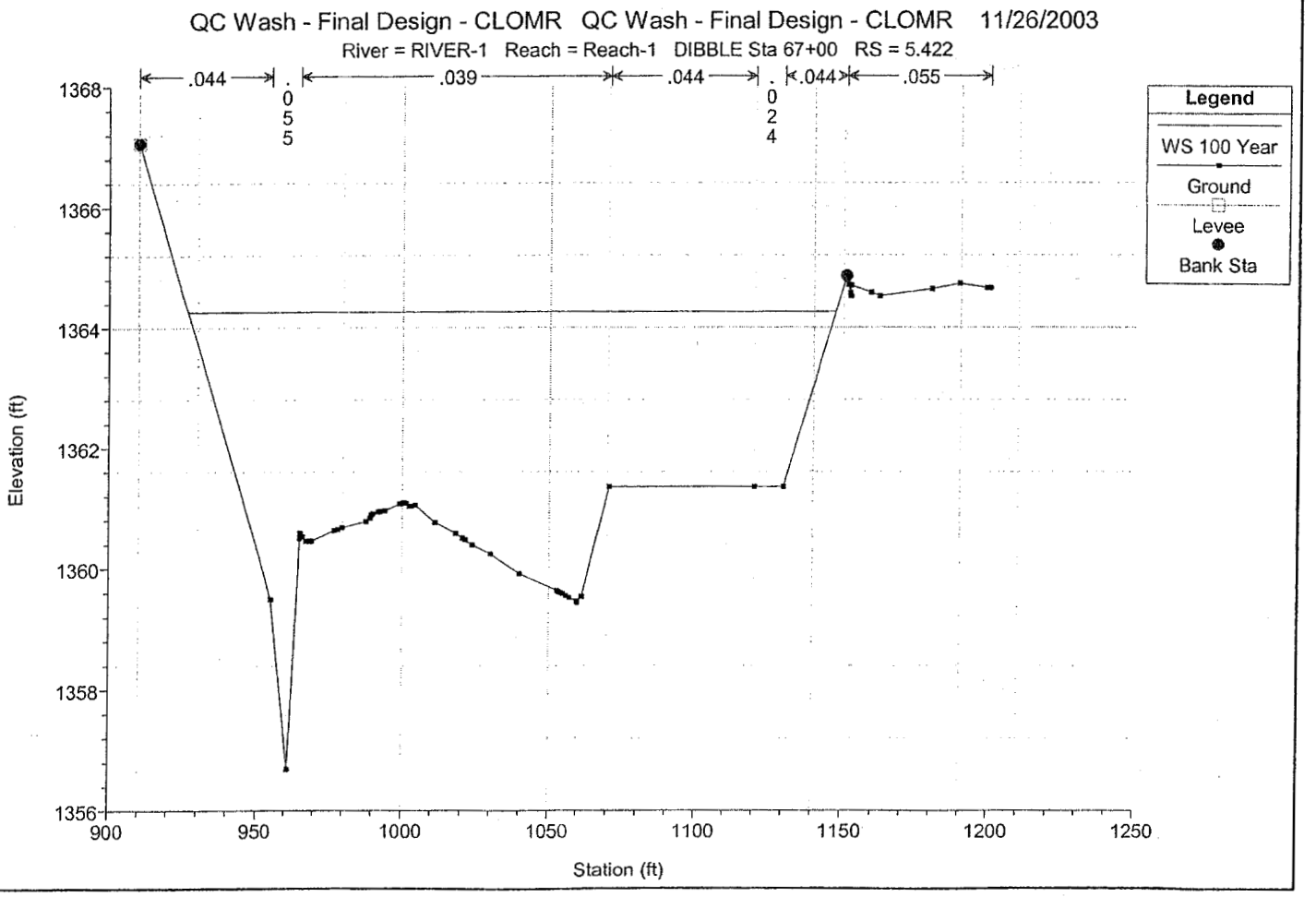
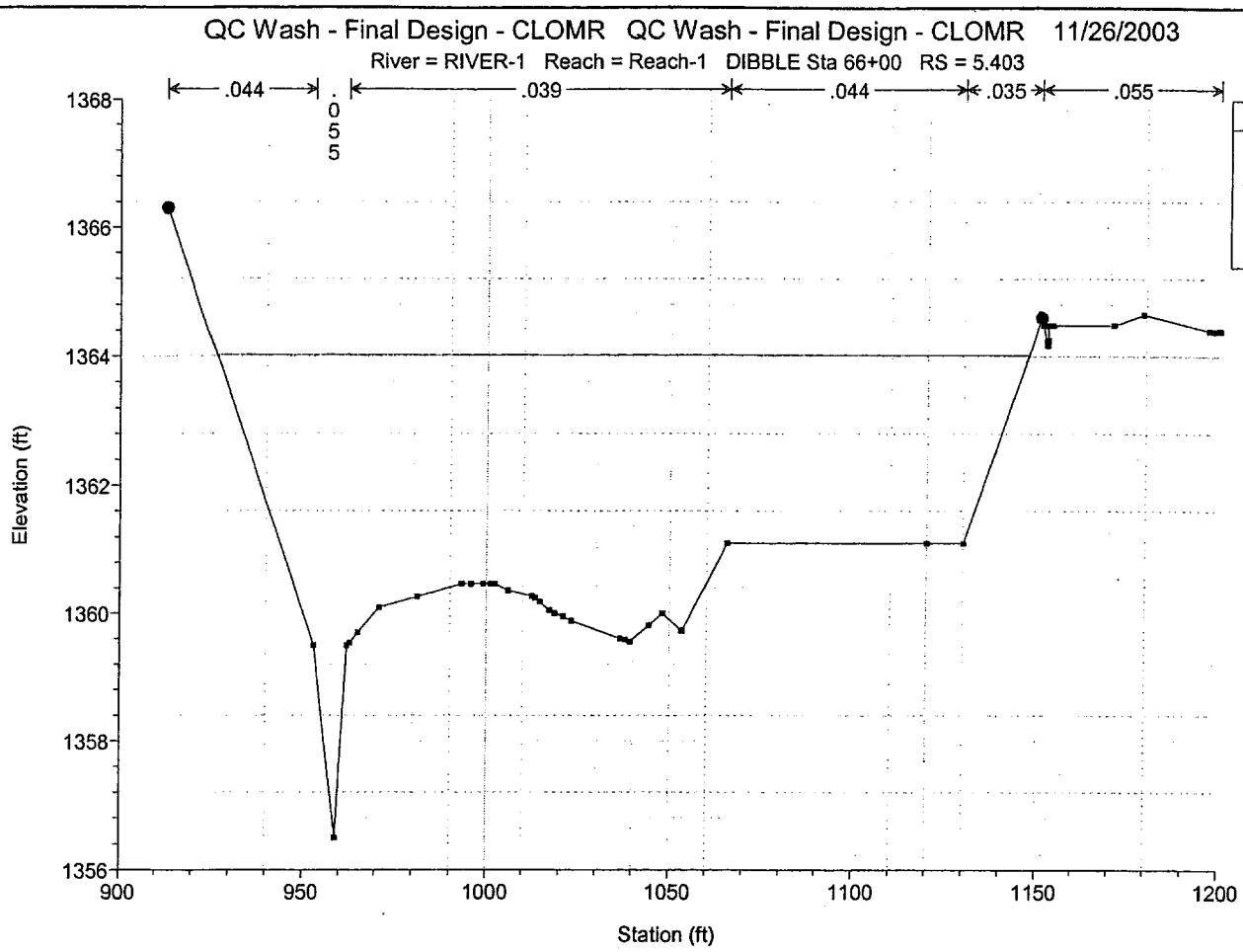
1366
1364
1362
1360
900
950
1000
1050
1100
1150
Station (ft)

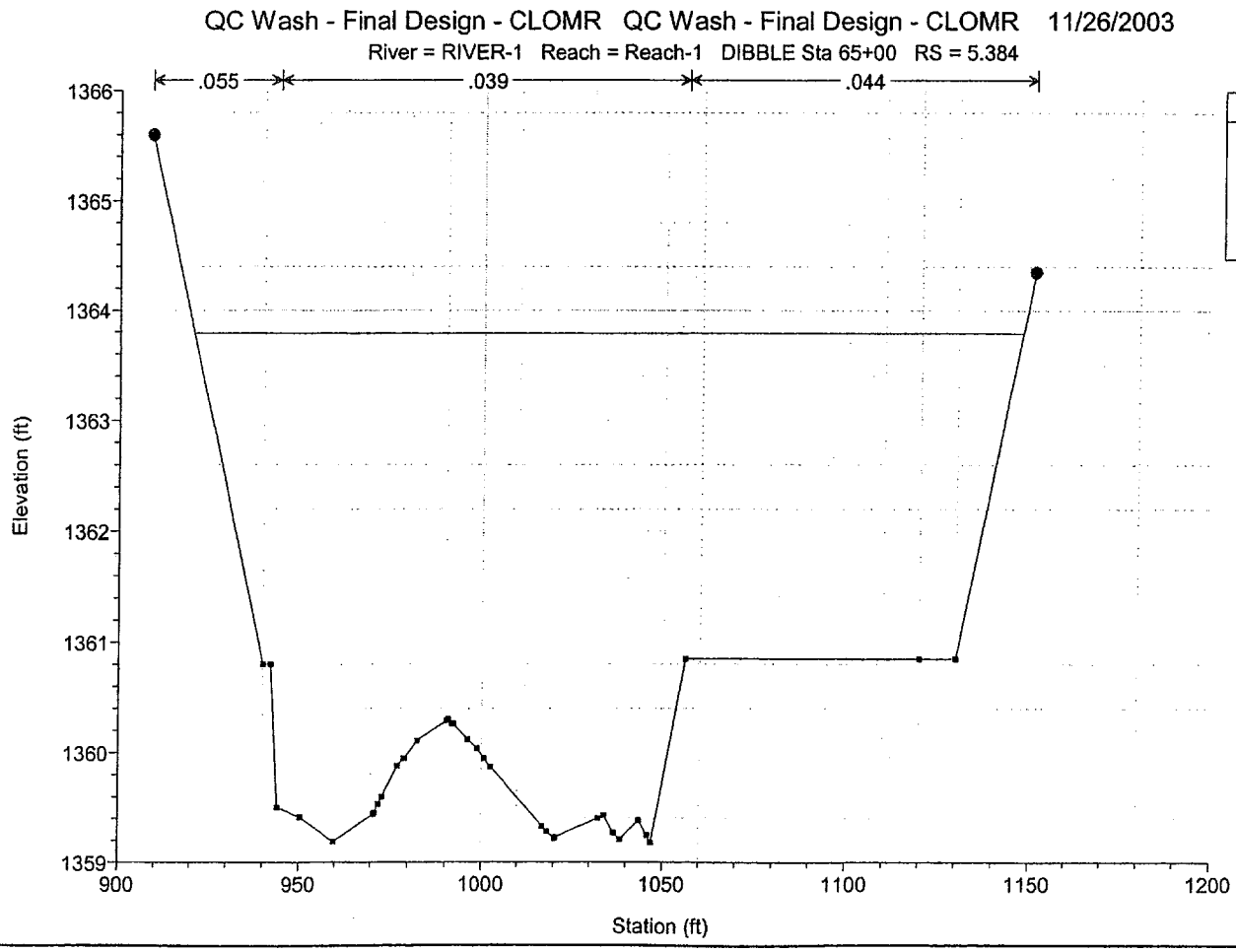

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 70+00 RS = 5.479
.055
.044
.055
.039
.024
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1356
1358
1360
1362
1364
1366
1368
1370
800
900
1000
1100
1200
1300

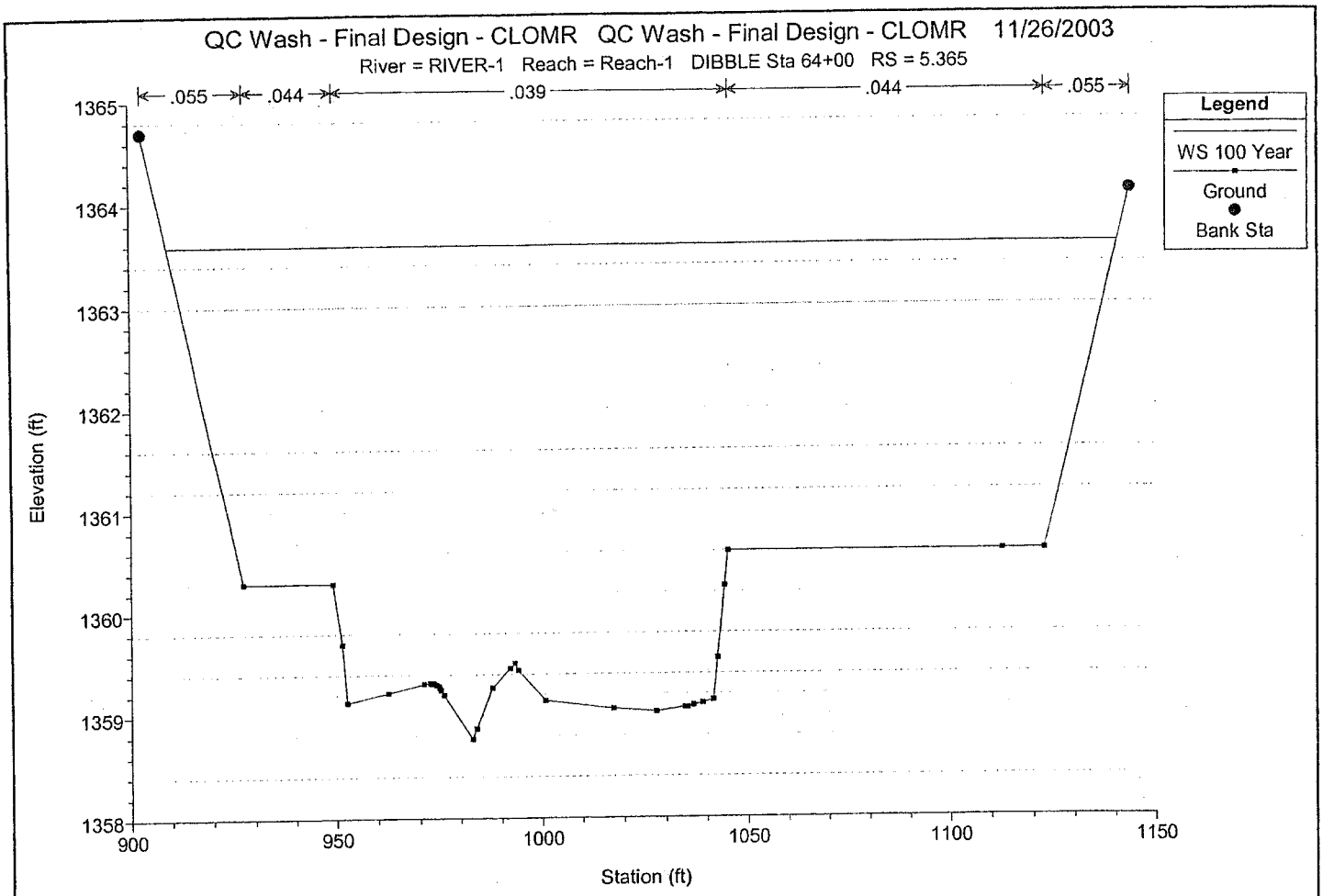

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 69+00 RS = 5.460
.055
.044
.055
.039
.024
.044
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1356
1358
1360
1362
1364
1366
1368
800
900
1000
1100
1200

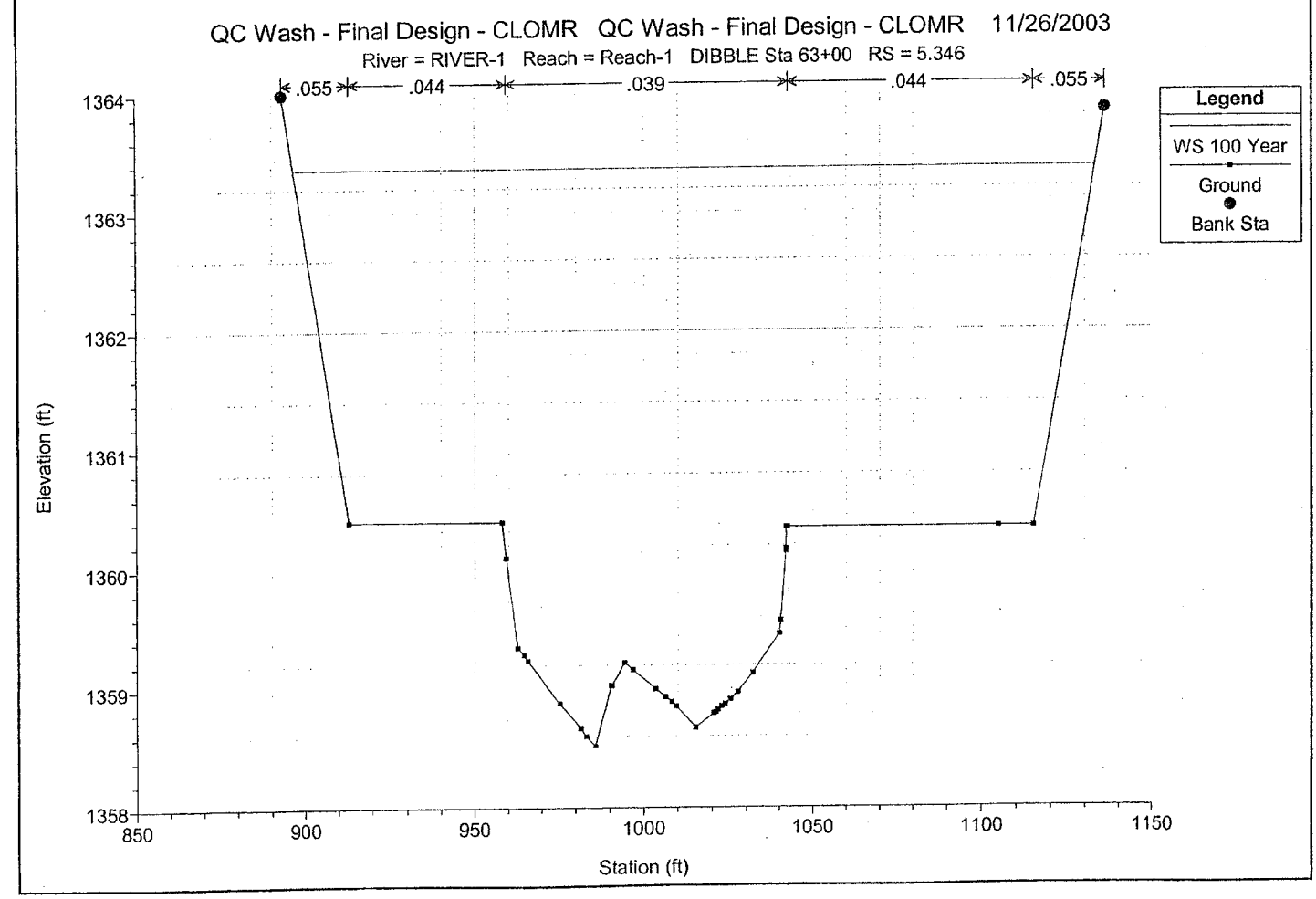

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 68+00 RS = 5.441
.044
.055
.039
.044
.024
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1368
1366
1364
1362
1360
1358
1356
900
950
1000
1050
1100
1150
1200
1250

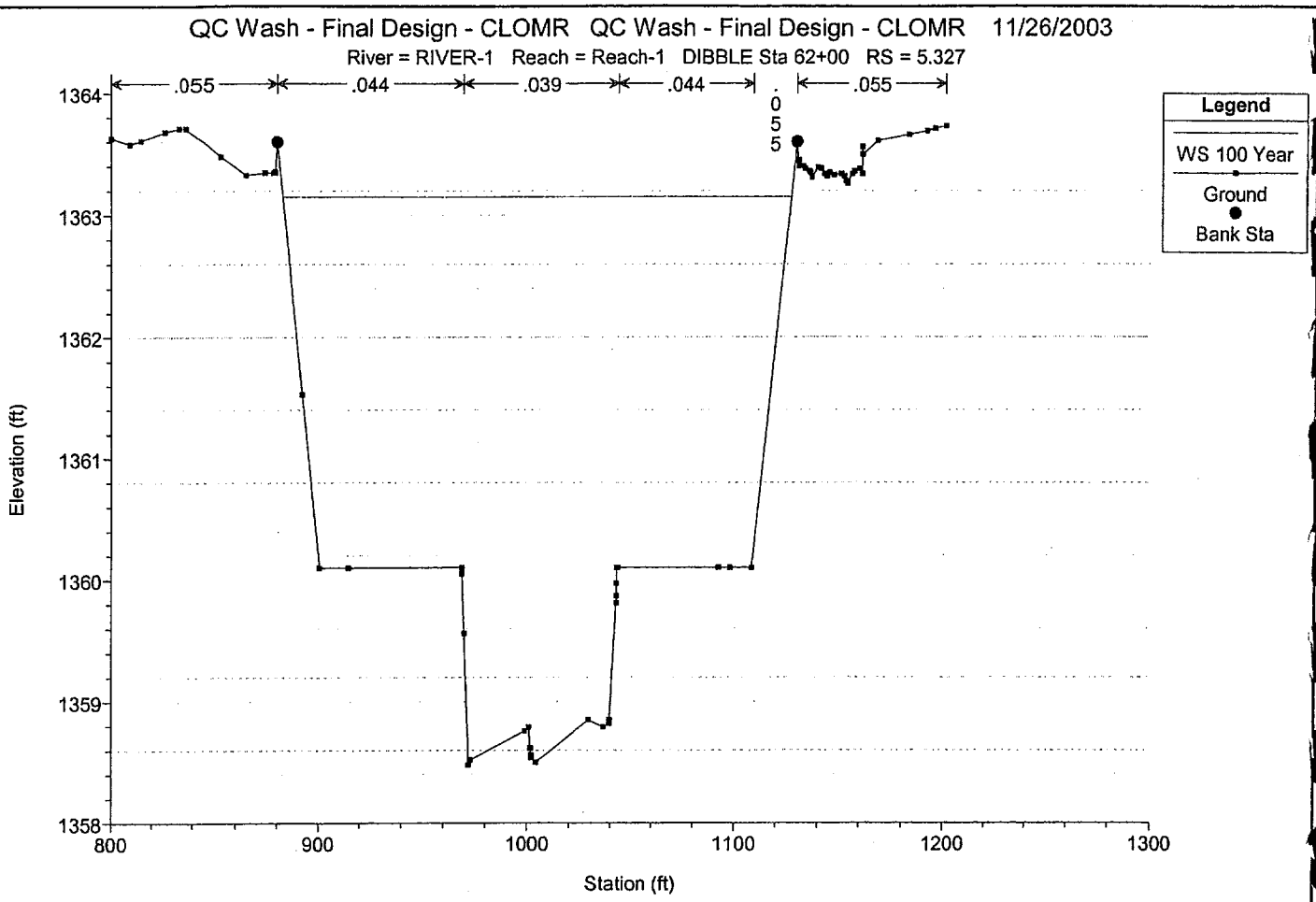

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 67+00 RS = 5.422
.044
.055
.039
.044
.024
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1368
1366
1364
1362
1360
1358
1356
900
950
1000
1050
1100
1150
1200
1250

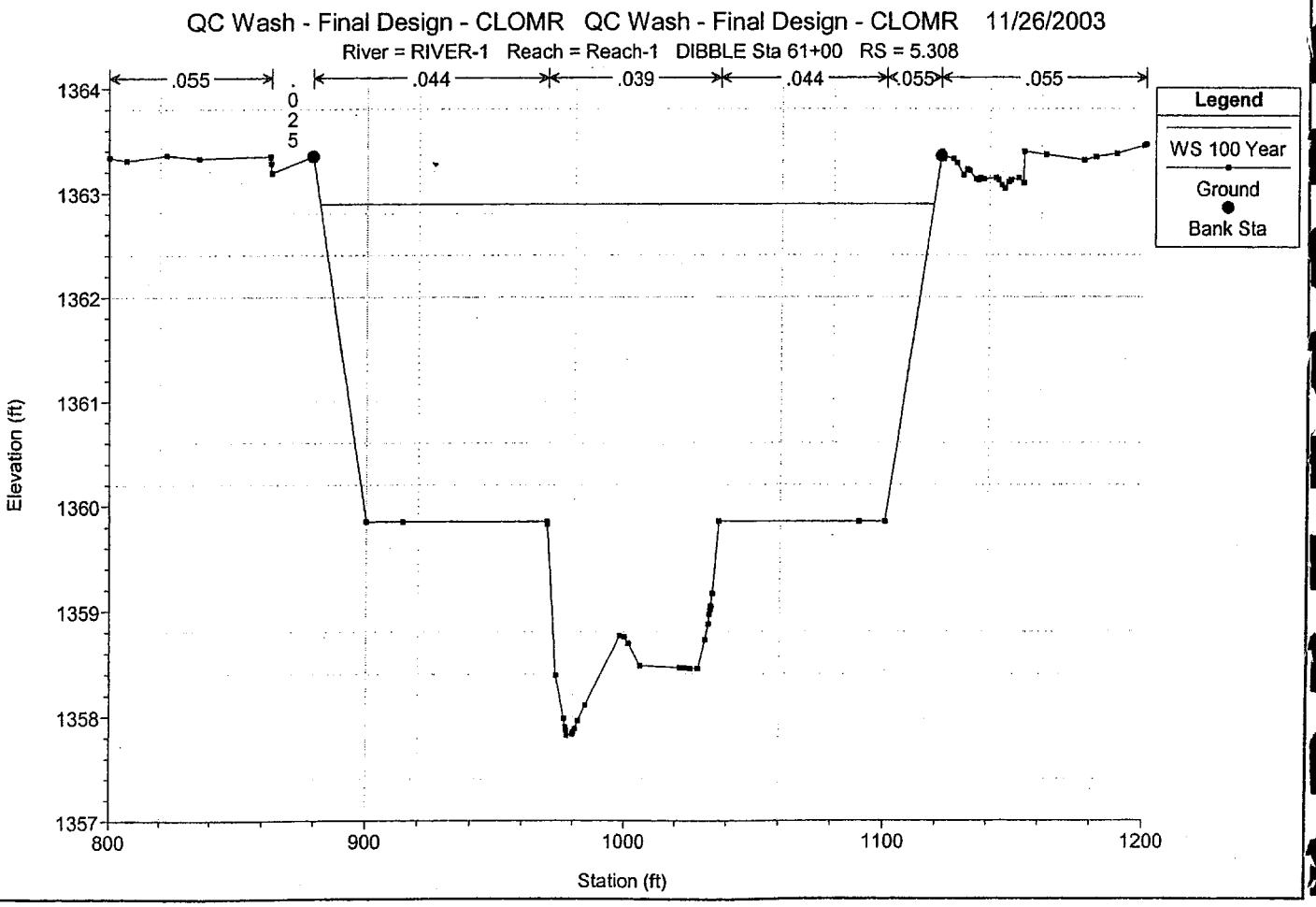

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 66+00 RS = 5.403
.044
.055
.039
.044
.035
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1368
1366
1364
1362
1360
1358
1356
900
950
1000
1050
1100
1150
1200

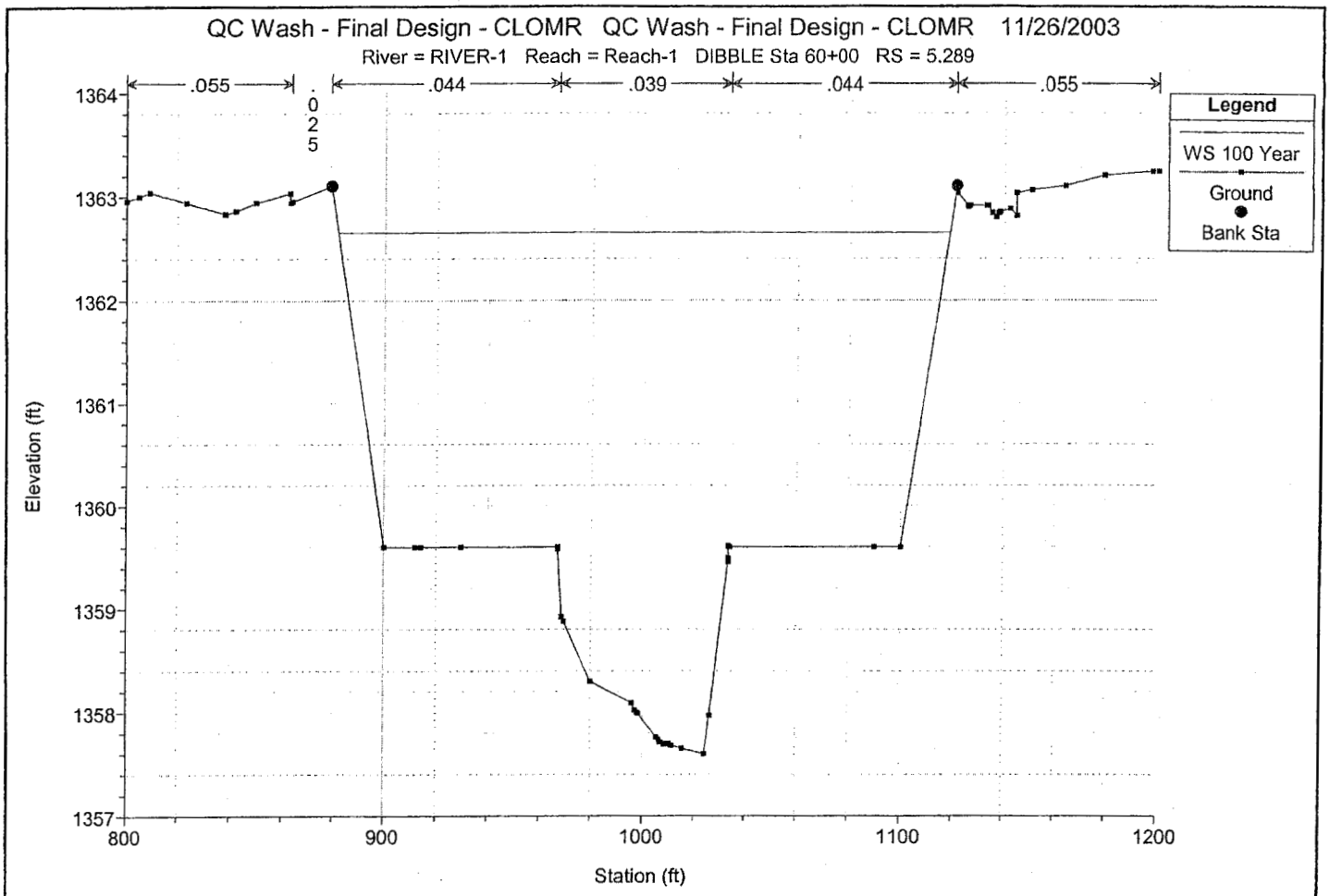

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 65+00 RS = 5.384
.055
.039
.044
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
1366
1365
1364
1363
1362
1361
1360
1359
900
950
1000
1050
1100
1150
1200

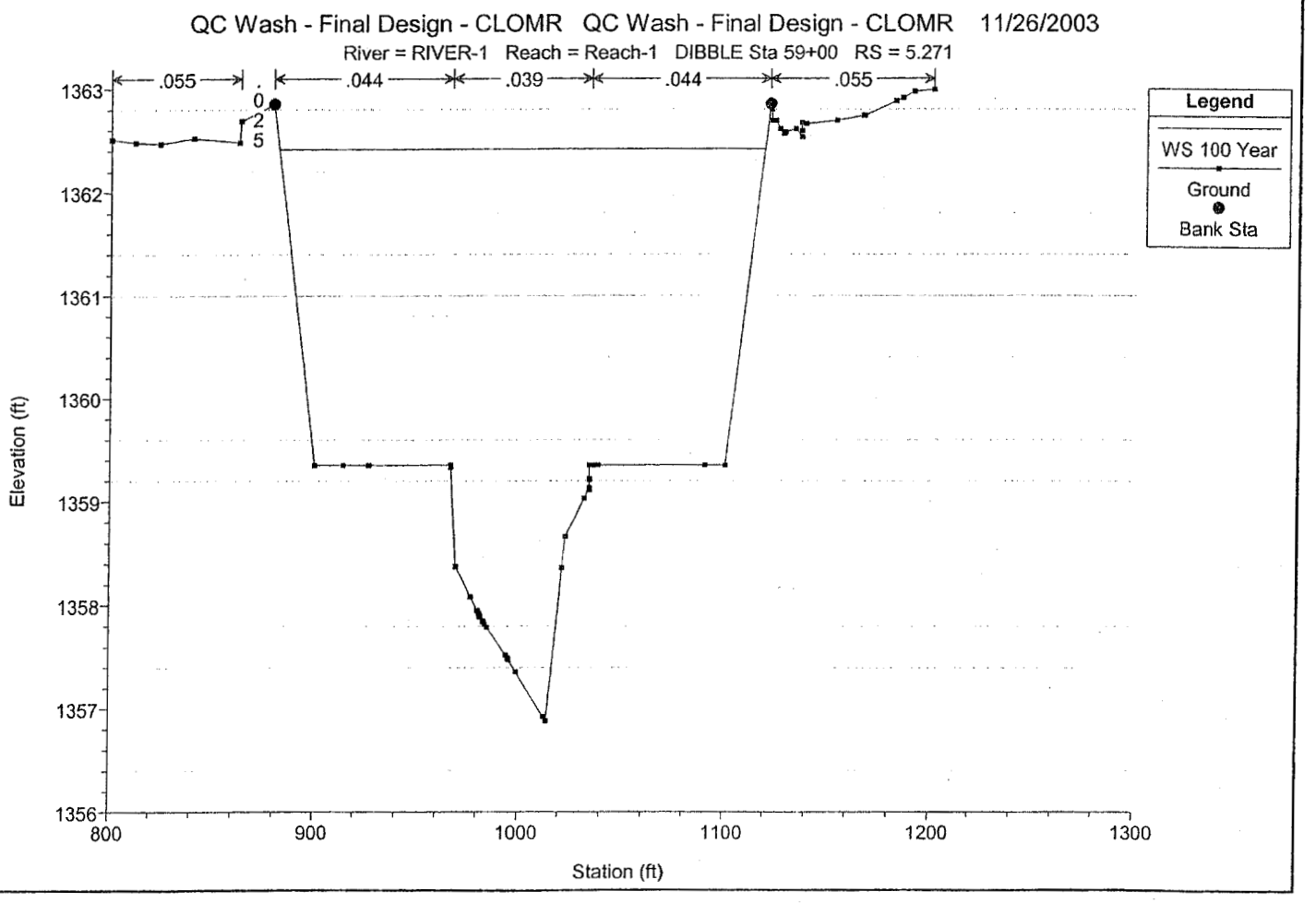

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 64+00 RS = 5.365
.055
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1365
1364
1363
1362
1361
1360
1359
1358
900
950
1000
1050
1100
1150
Station (ft)

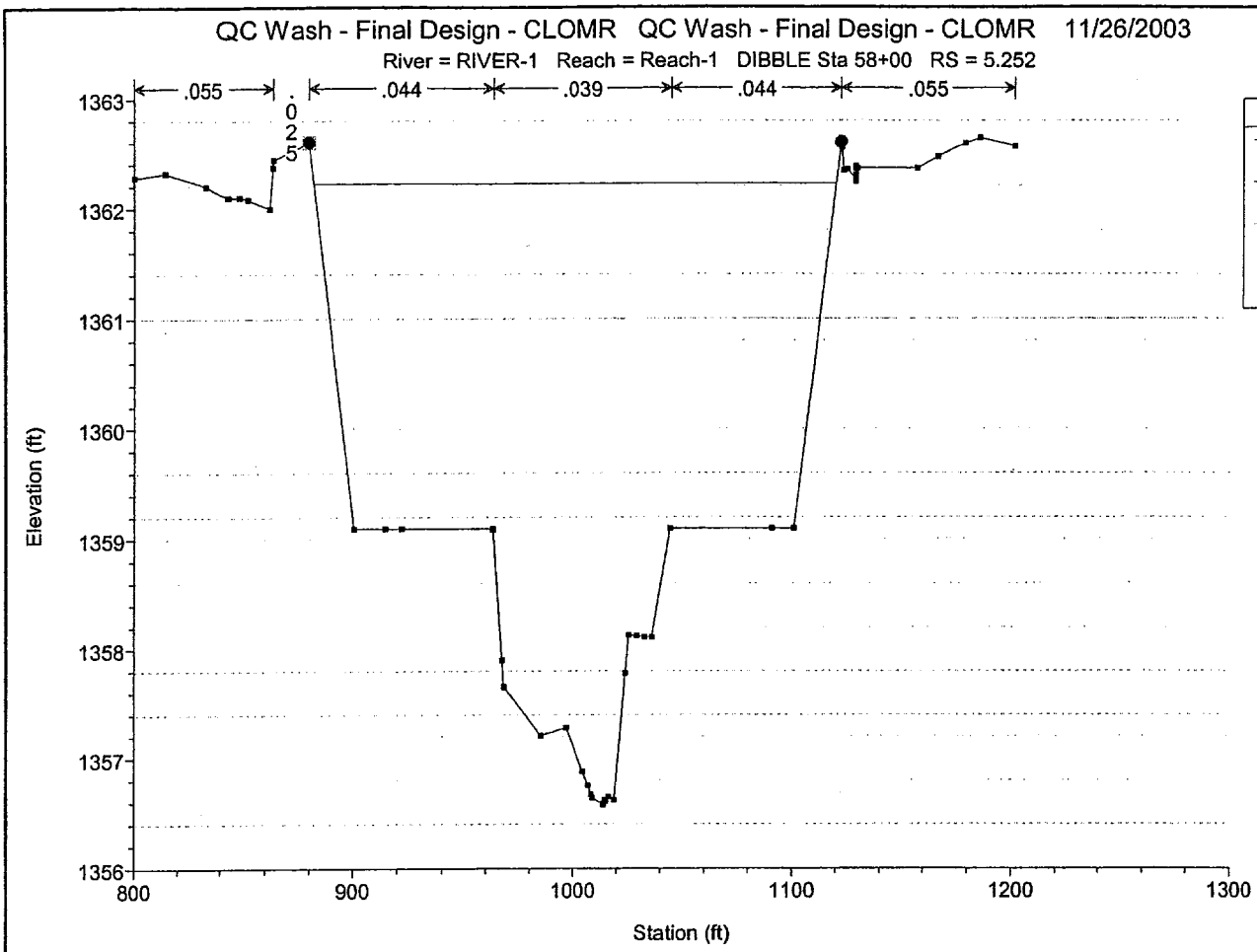

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 63+00 RS = 5.346
.055
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1364
1363
1362
1361
1360
1359
1358
850
900
950
1000
1050
1100
1150
Station (ft)

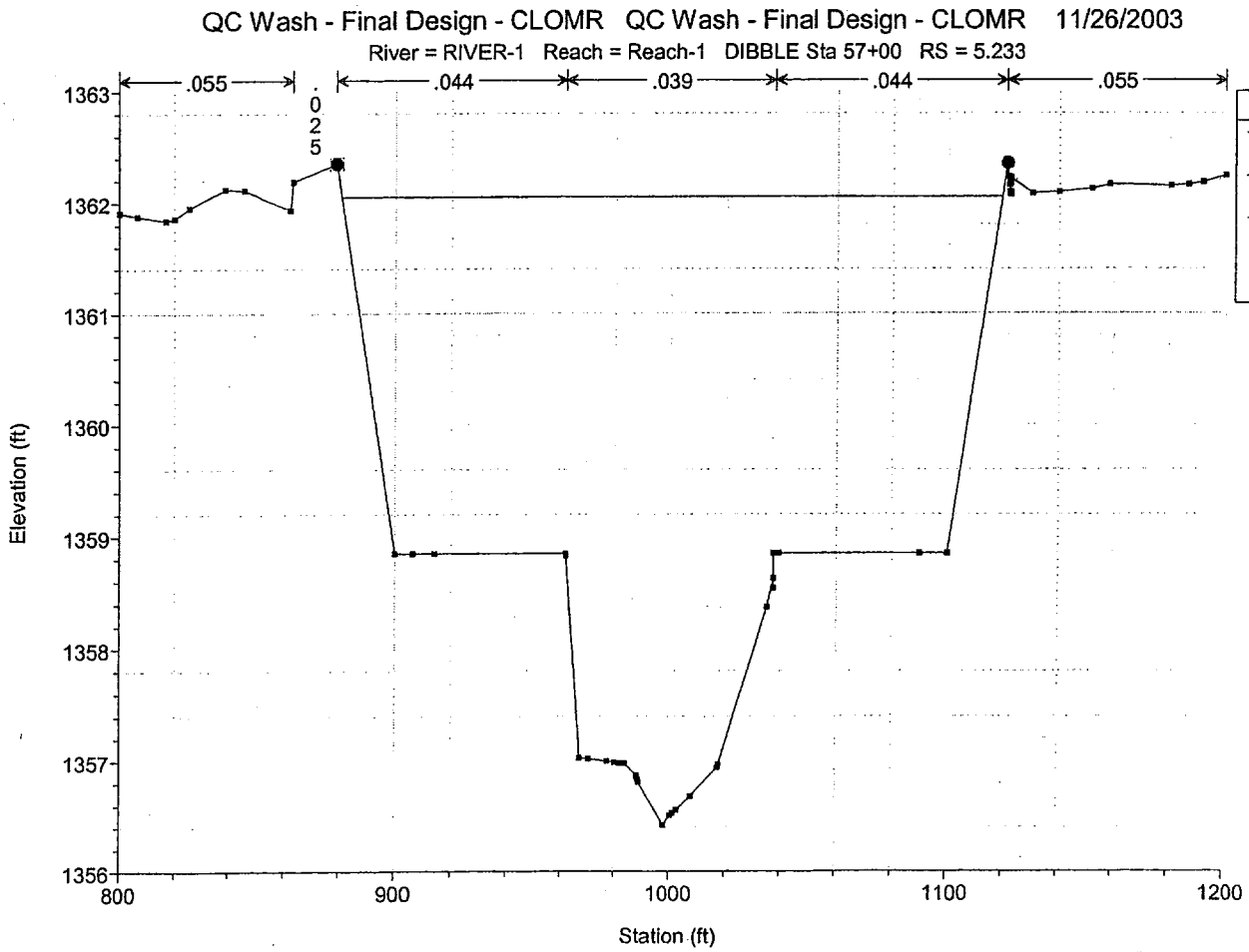

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 62+00 RS = 5.327
.055
.044
.039
.044
.055
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1364
1363
1362
1361
1360
1359
1358
800
900
1000
1100
1200
1300
Station (ft)

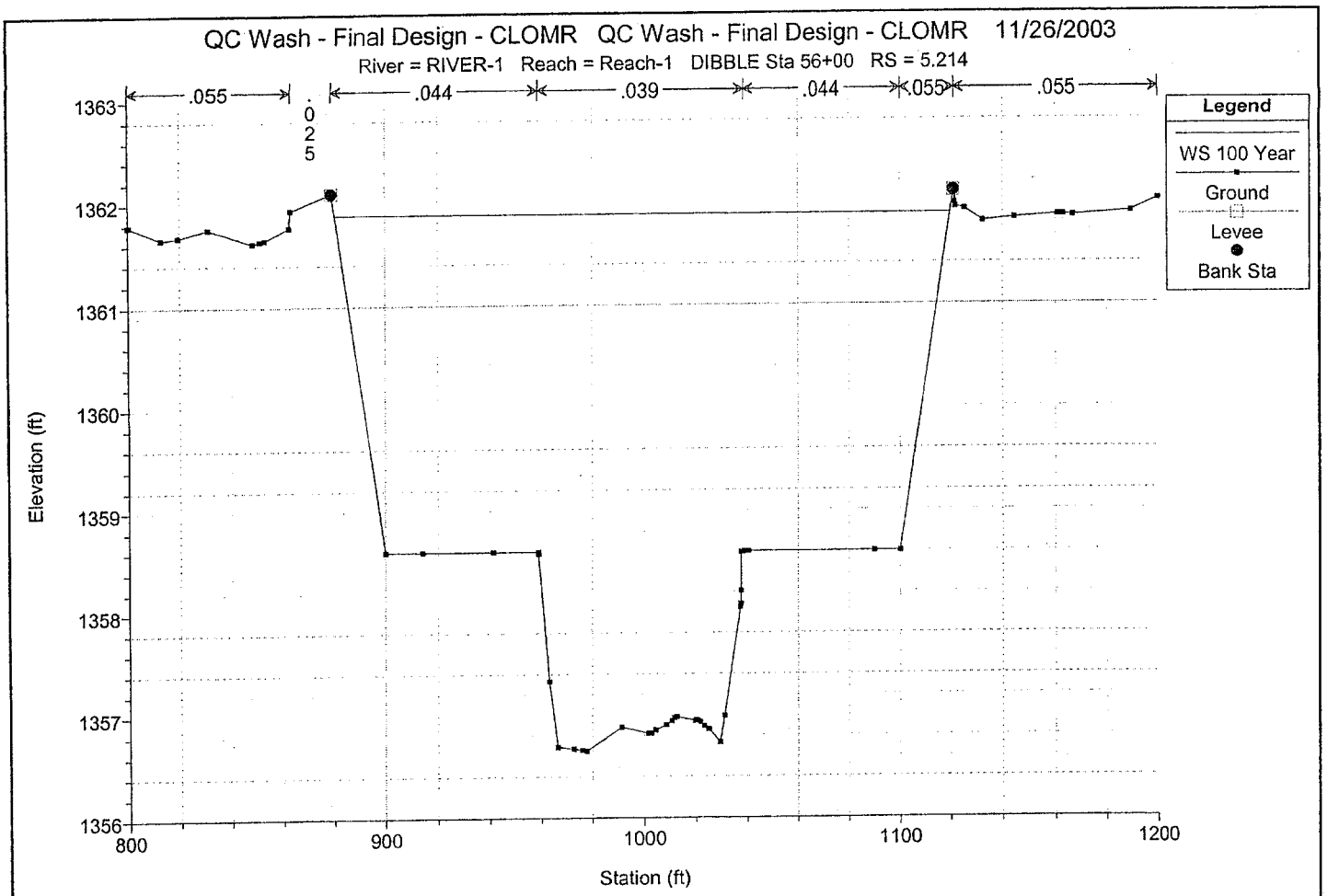

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 61+00 RS = 5.308
.055
.025
.044
.039
.044
.055
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1364
1363
1362
1361
1360
1359
1358
1357
800
900
1000
1100
1200
Station (ft)

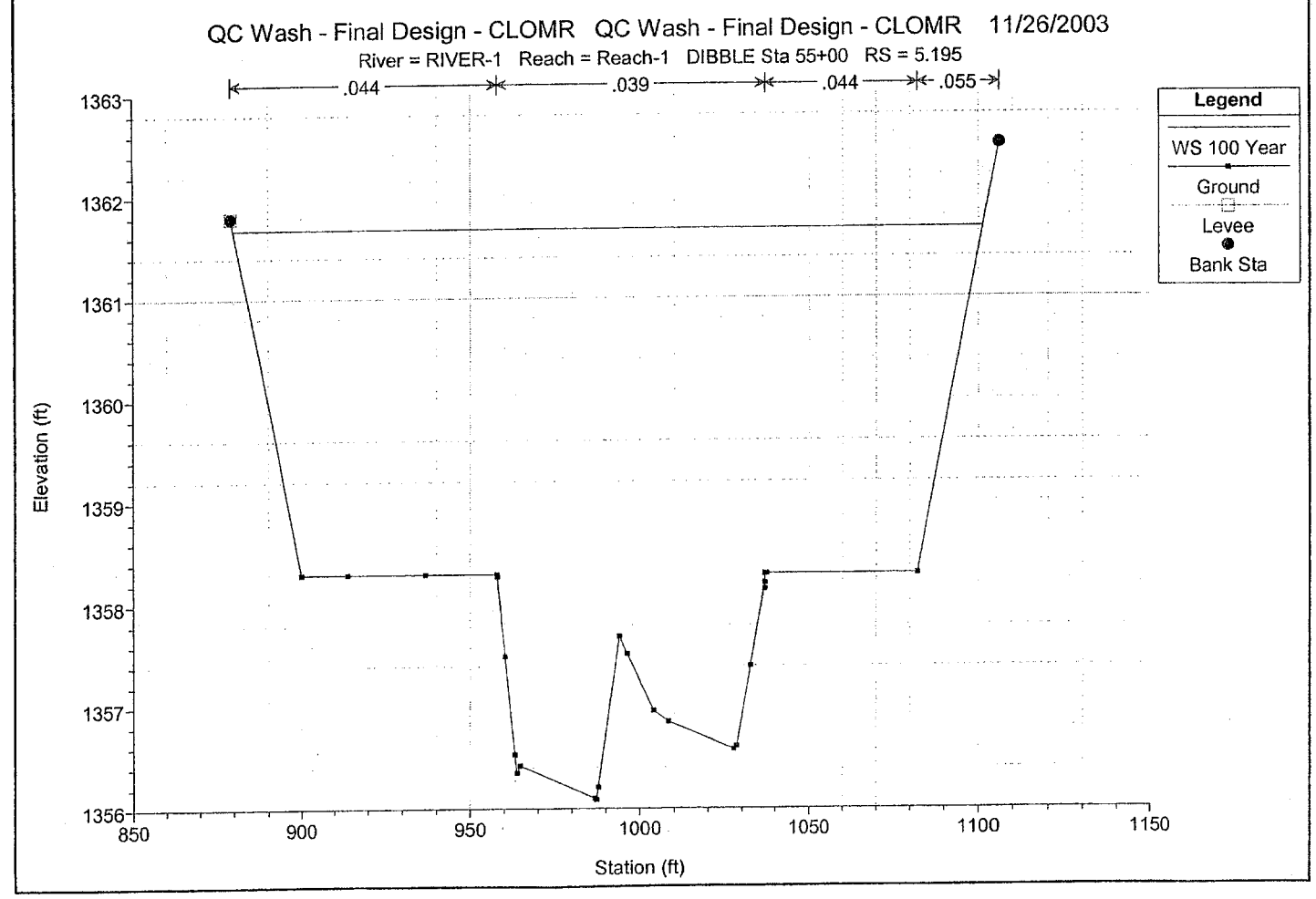

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 60+00 RS = 5.289
.055
.025
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1364
1363
1362
1361
1360
1359
1358
1357
800
900
1000
1100
1200
Station (ft)

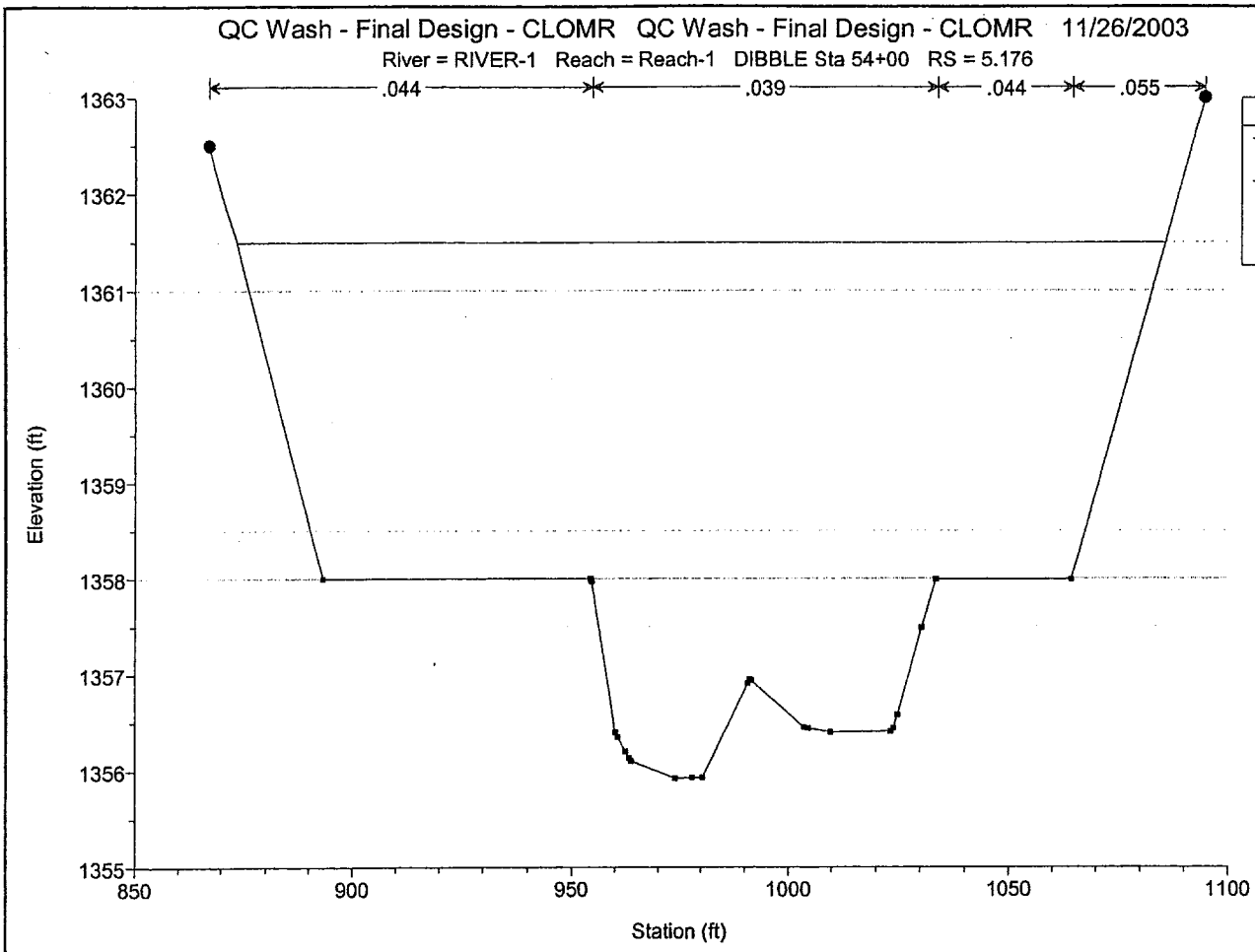

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 59+00 RS = 5.271
.055
.025
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
800
900
1000
1100
1200
1300
Station (ft)

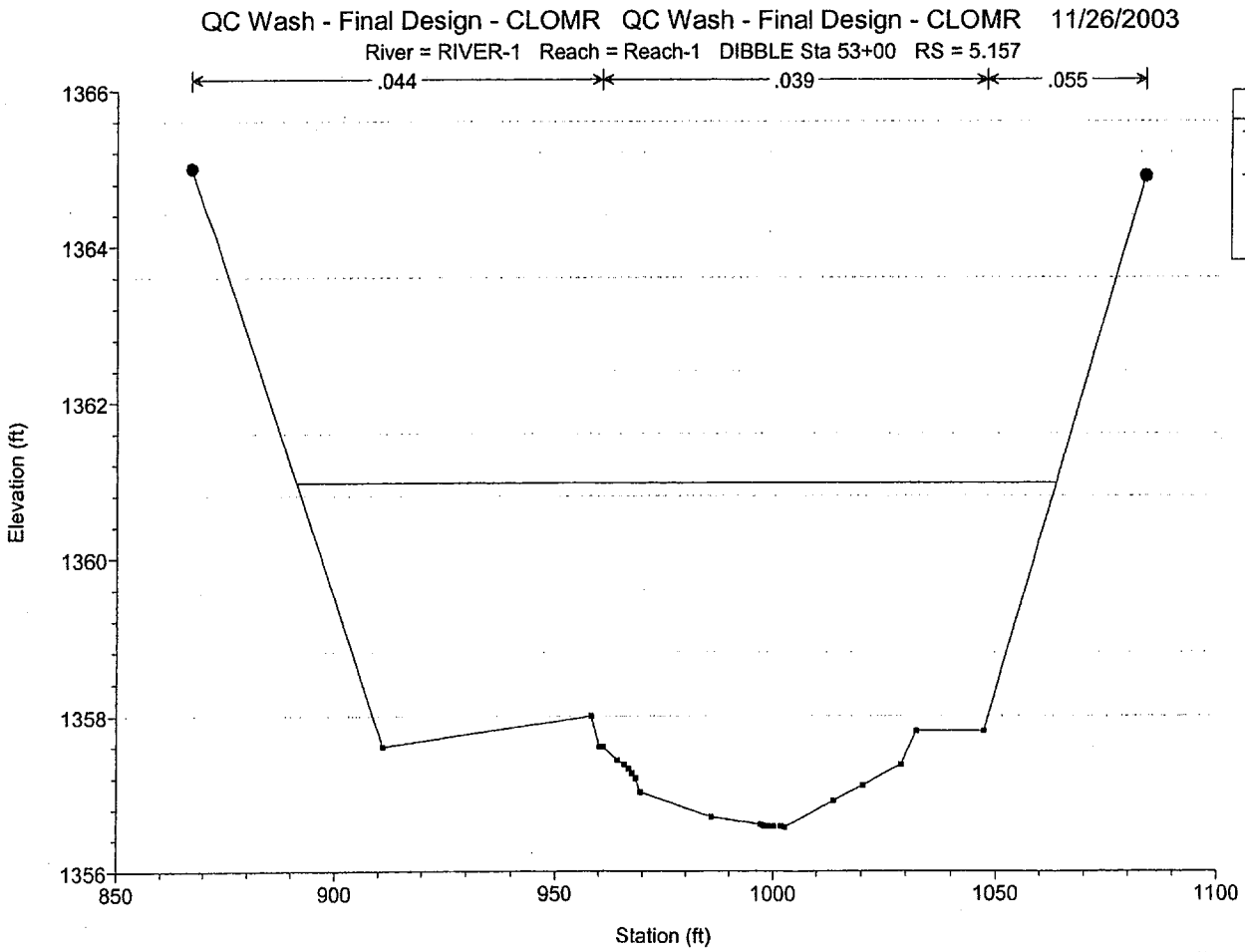

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 58+00 RS = 5.252
.055
.025
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
800
900
1000
1100
1200
1300
Station (ft)

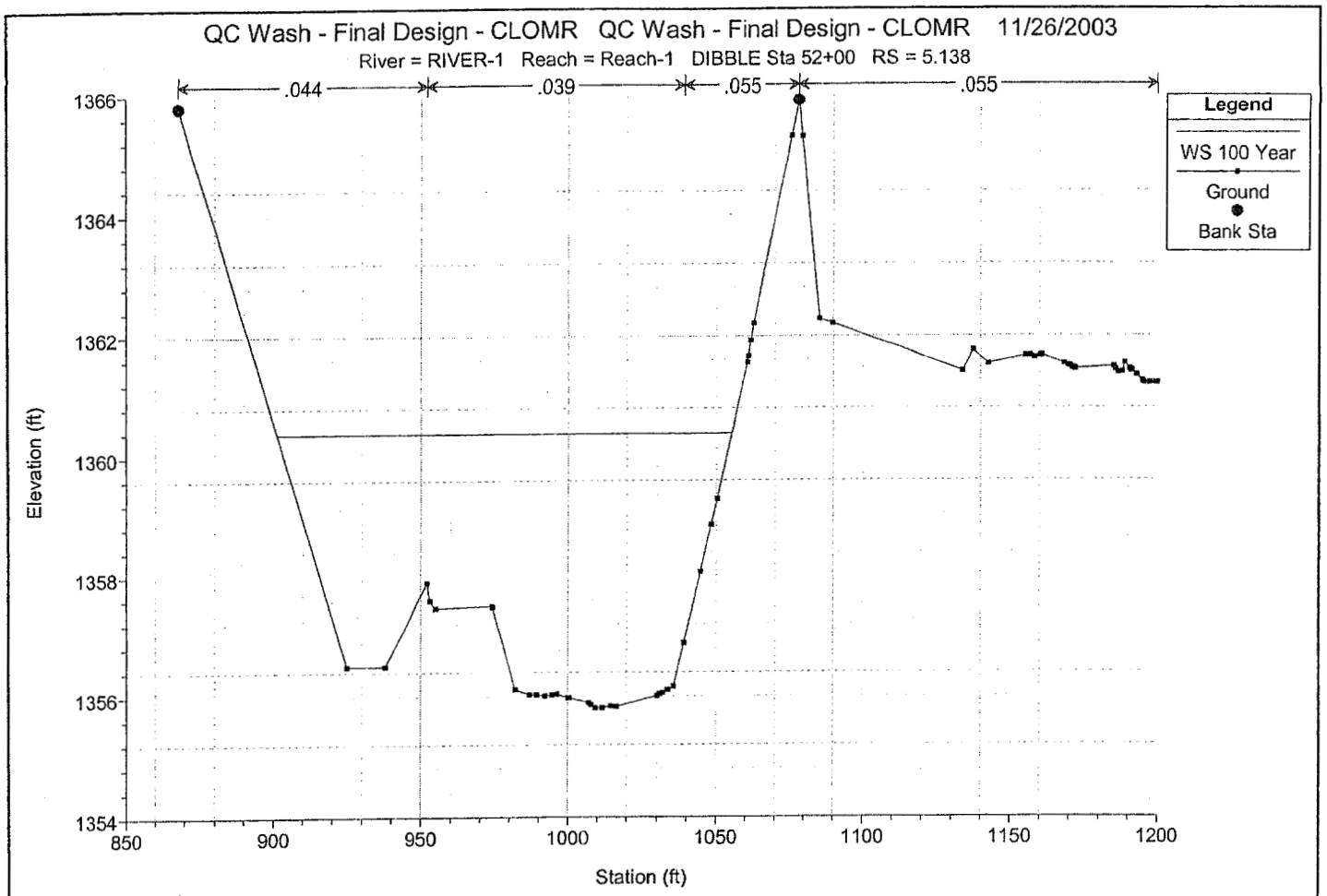

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 57+00 RS = 5.233
.055
.025
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
800
900
1000
1100
1200
Station (ft)

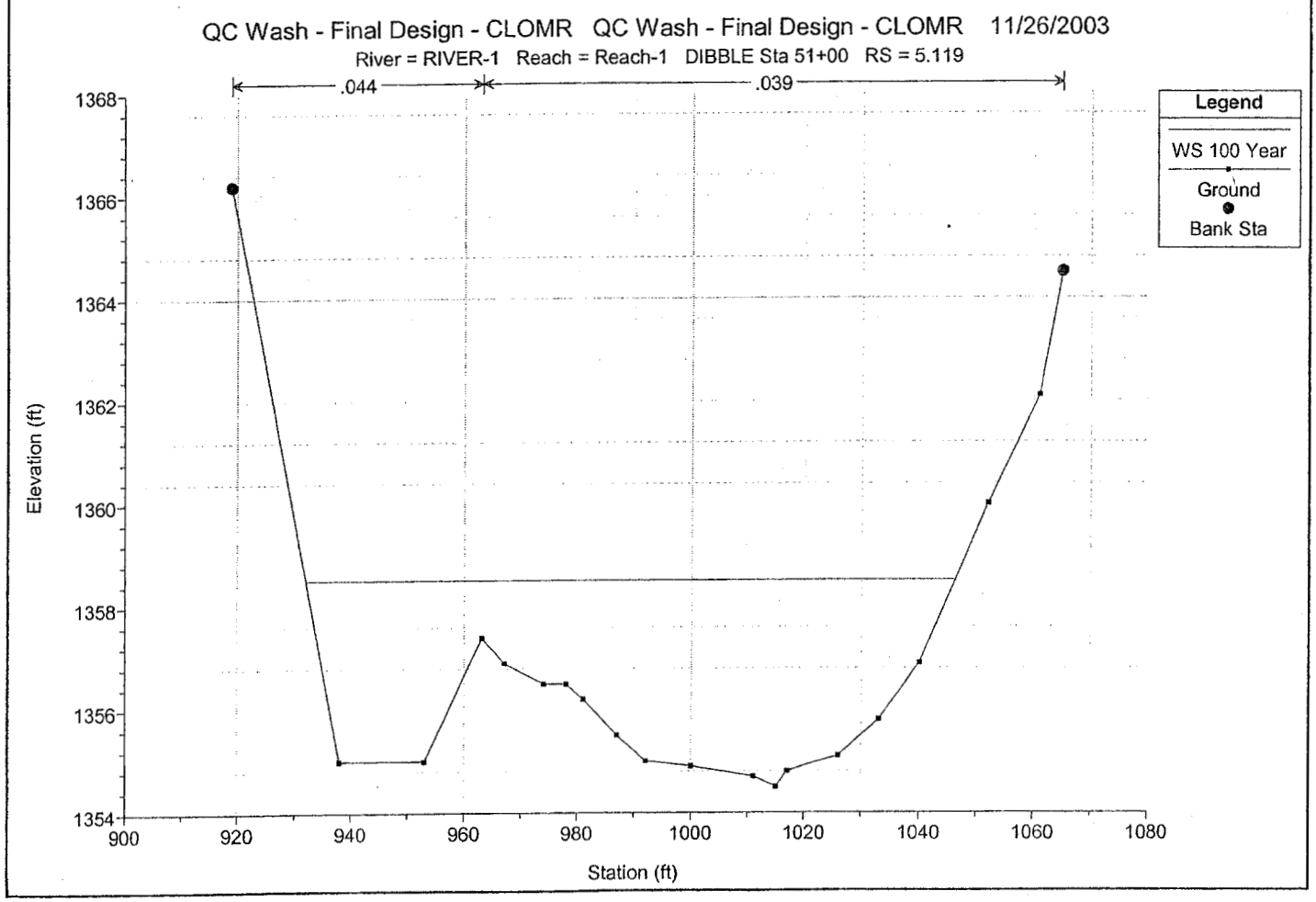

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 56+00 RS = 5.214
.055
.025
.044
.039
.044
.055
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
800
900
1000
1100
1200
Station (ft)

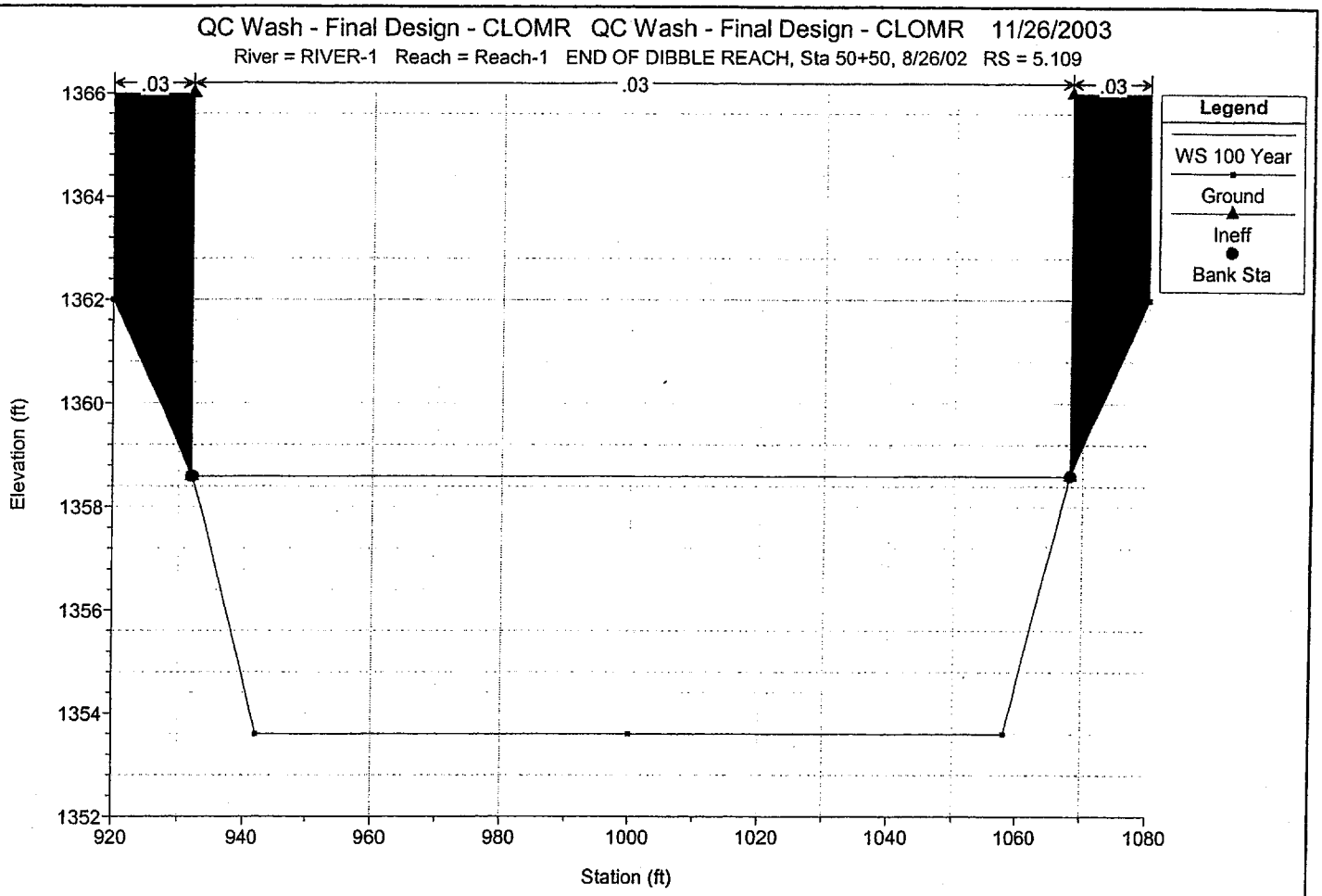

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 55+00 RS = 5.195
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Levee
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
850
900
950
1000
1050
1100
1150
Station (ft)

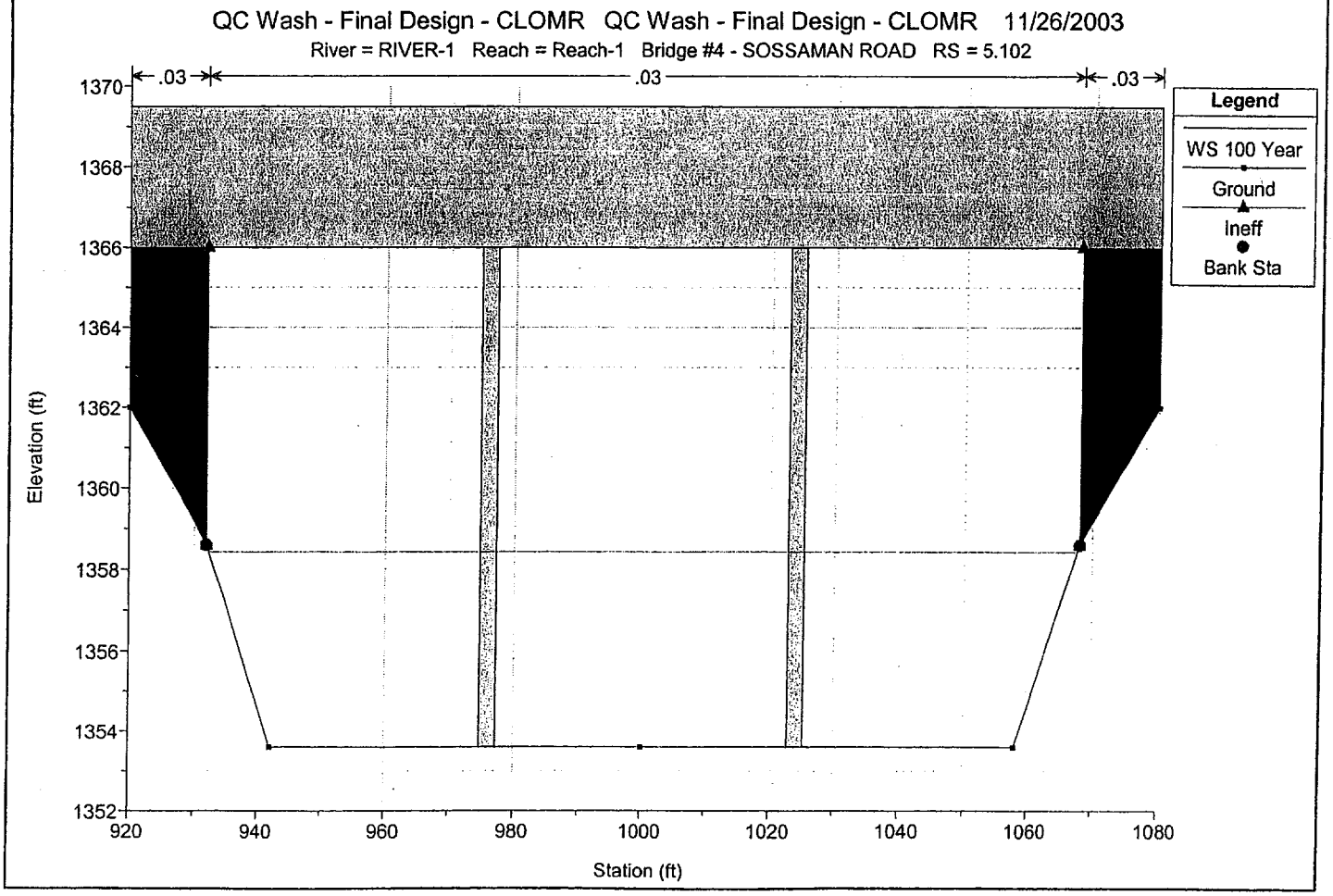

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 54+00 RS = 5.176
.044
.039
.044
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1363
1362
1361
1360
1359
1358
1357
1356
1355
850
900
950
1000
1050
1100
Station (ft)

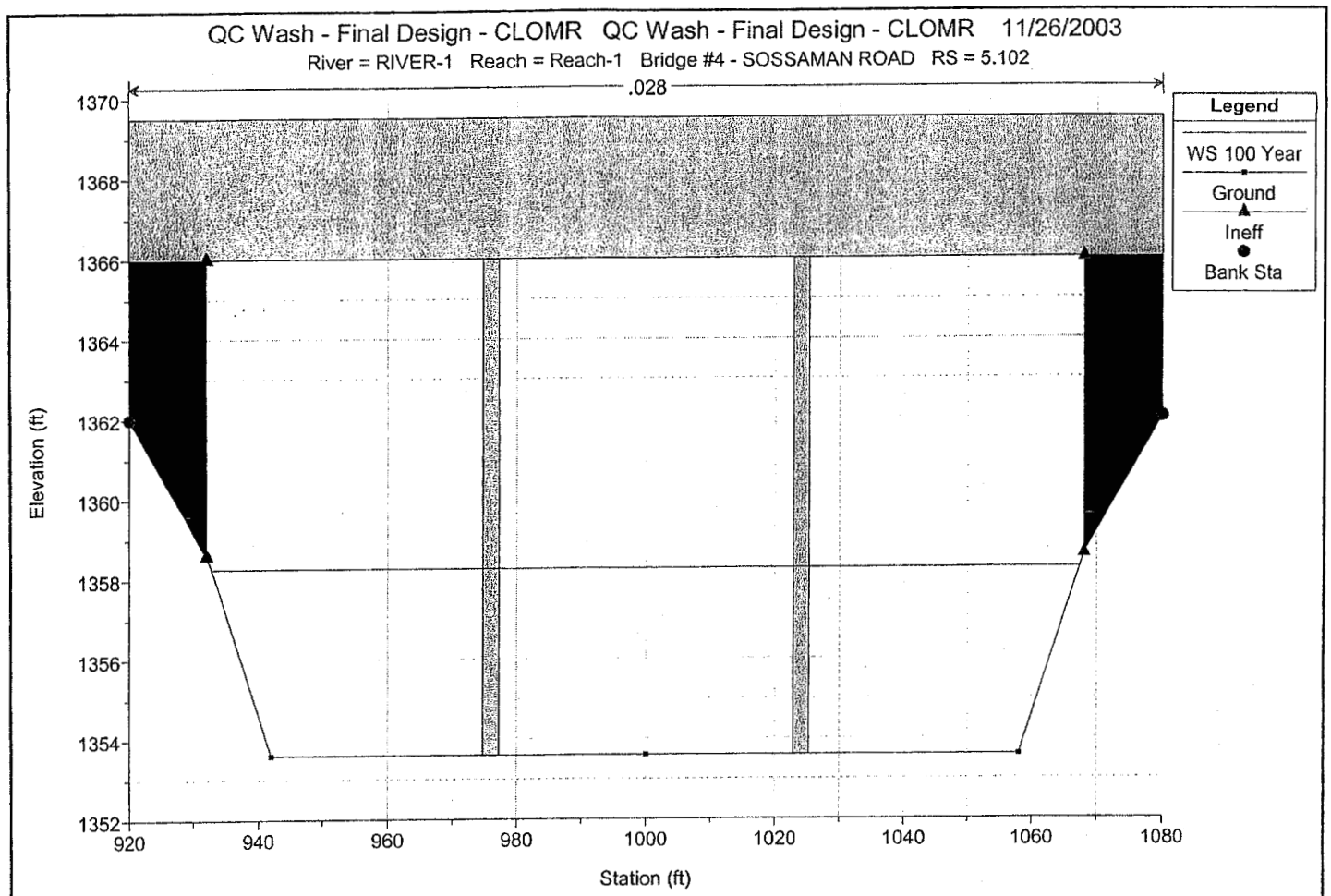

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 53+00 RS = 5.157
.044
.039
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
850
900
950
1000
1050
1100
Station (ft)

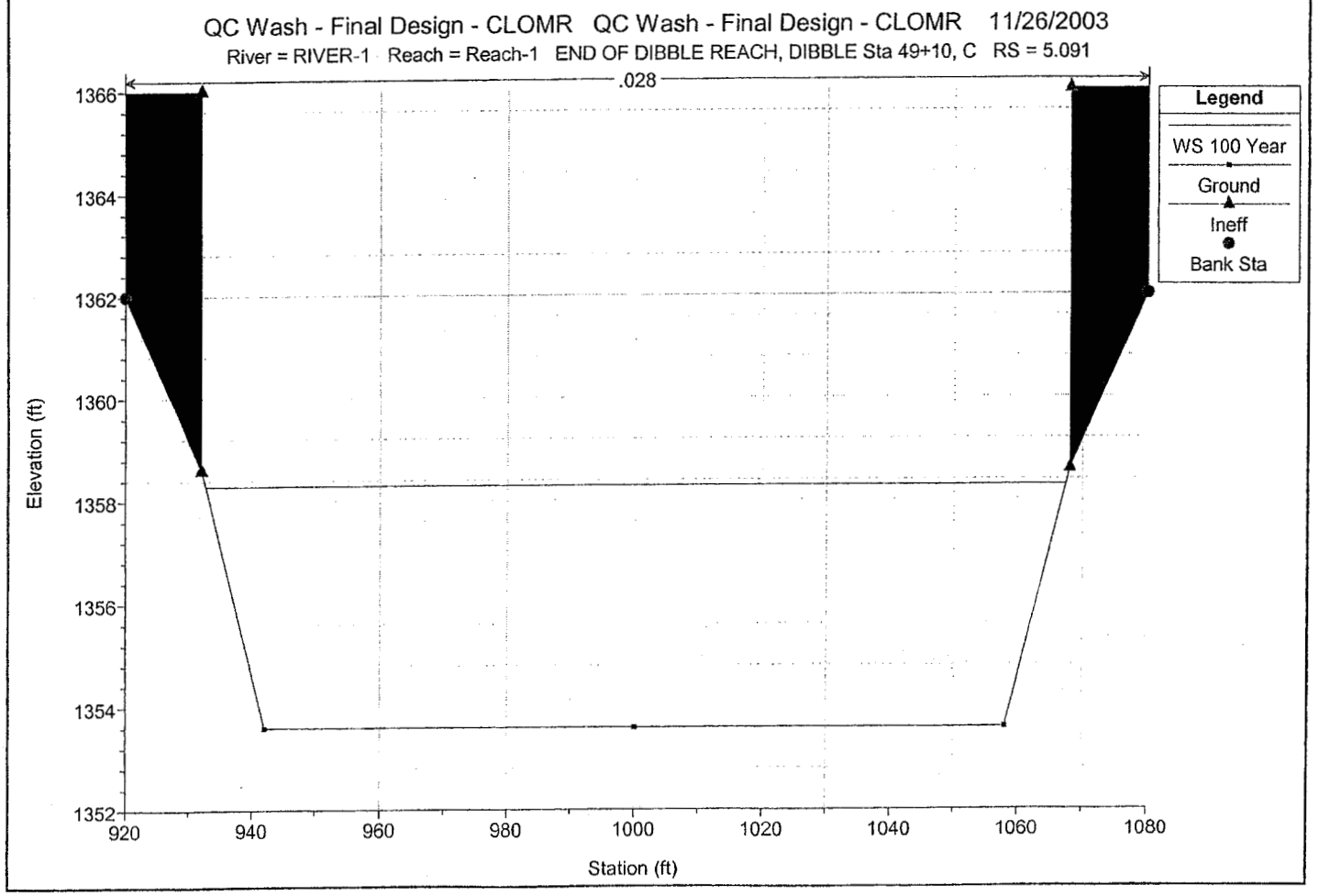

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 52+00 RS = 5.138
.044
.039
.055
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
850
900
950
1000
1050
1100
1150
1200
Station (ft)

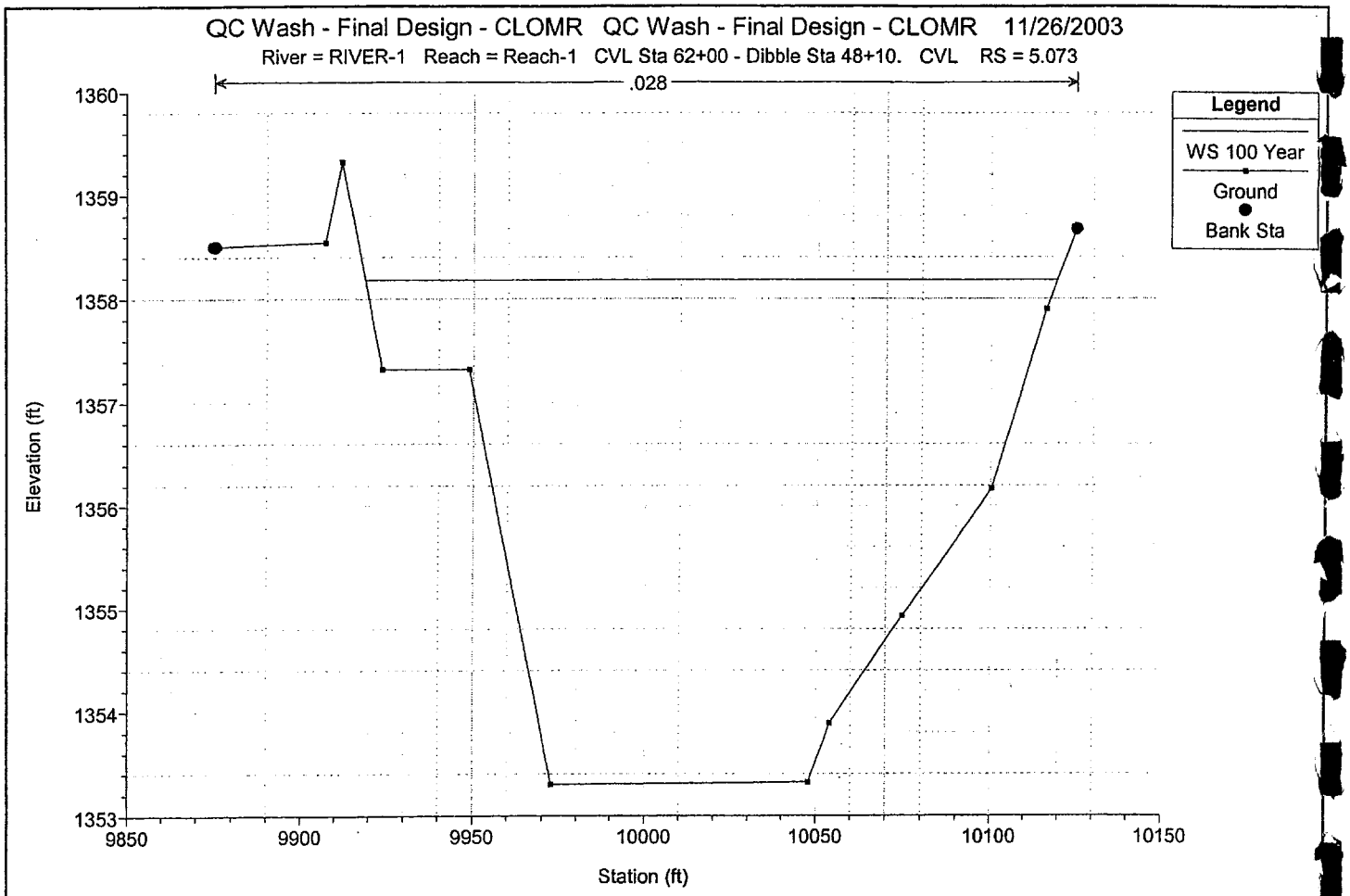

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 DIBBLE Sta 51+00 RS = 5.119
.044
.039
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1368
1366
1364
1362
1360
1358
1356
1354
900
920
940
960
980
1000
1020
1040
1060
1080
Station (ft)

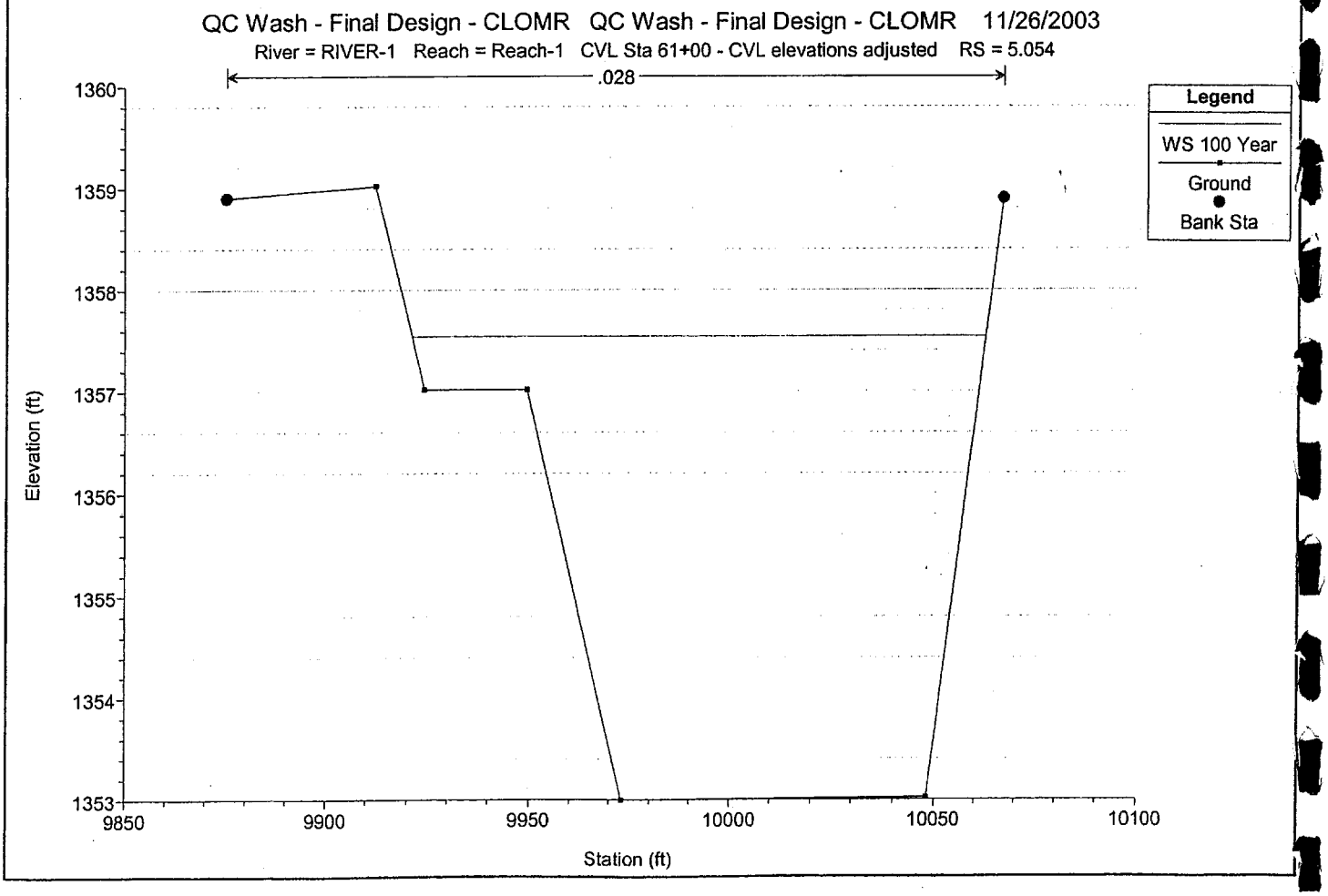

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 END OF DIBBLE REACH, Sta 50+50, 8/26/02 RS = 5.109
.03
.03
.03
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
1352
920
940
960
980
1000
1020
1040
1060
1080
Station (ft)


QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Bridge #4 - SOSSAMAN ROAD RS = 5.102
.03
.03
.03
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1370
1368
1366
1364
1362
1360
1358
1356
1354
1352
920
940
960
980
1000
1020
1040
1060
1080
Station (ft)


QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Bridge #4 - SOSSAMAN ROAD RS = 5.102
.028
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1370
1368
1366
1364
1362
1360
1358
1356
1354
1352
920
940
960
980
1000
1020
1040
1060
1080
Station (ft)


QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 END OF DIBBLE REACH, DIBBLE Sta 49+10, C RS = 5.091
.028
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
1352
920
940
960
980
1000
1020
1040
1060
1080
Station (ft)


QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 62+00 - Dibble Sta 48+10. CVL RS = 5.073
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1360
1359
1358
1357
1356
1355
1354
1353
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 61+00 - CVL elevations adjusted RS = 5.054
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1360
1359
1358
1357
1356
1355
1354
1353
9850
9900
9950
10000
10050
10100
Station (ft)

APPENDIX E.3

POST PROJECT CONDITION HEC-RAS OUTPUT

HEC-RAS Plan: CLOMR River: RIVER-1 Reach: Reach-1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6.532	3010.00	1374.93	1381.18	1378.48	1381.56	0.001066	4.95	608.35	124.62	0.39
Reach-1	6.525	Bridge									
Reach-1	6.516	3010.00	1374.66	1381.08		1381.55	0.002574	5.53	544.23	110.89	0.44
Reach-1	6.502	3010.00	1374.49	1380.97	1378.75	1381.49	0.003109	5.82	517.06	112.55	0.48
Reach-1	6.483	3010.00	1374.13	1380.71	1378.45	1381.19	0.002769	5.57	540.87	120.29	0.46
Reach-1	6.464	3010.00	1373.95	1380.53	1378.10	1380.93	0.002029	5.02	599.47	132.12	0.41
Reach-1	6.445	3010.00	1373.74	1380.09	1378.08	1380.66	0.003207	6.05	497.85	107.90	0.50
Reach-1	6.426	3010.00	1373.26	1379.84	1377.58	1380.34	0.002733	5.65	533.21	113.98	0.46
Reach-1	6.407	3010.00	1373.20	1379.65		1380.07	0.002263	5.21	577.71	120.71	0.42
Reach-1	6.388	3010.00	1372.68	1379.46		1379.85	0.001965	4.97	605.47	122.47	0.39
Reach-1	6.369	3010.00	1372.00	1379.28		1379.65	0.001877	4.93	610.46	115.99	0.38
Reach-1	6.350	3010.00	1372.00	1378.93		1379.42	0.002633	5.64	533.41	109.32	0.45
Reach-1	6.331	3010.00	1371.92	1378.62		1379.15	0.002783	5.83	516.24	104.86	0.46
Reach-1	6.312	3010.00	1371.50	1378.34		1378.87	0.002755	5.83	516.59	103.66	0.46
Reach-1	6.293	3010.00	1371.56	1377.92		1378.54	0.003658	6.36	473.31	104.05	0.53
Reach-1	6.274	3010.00	1371.00	1377.47		1378.15	0.004209	6.60	456.03	104.14	0.56
Reach-1	6.255	3010.00	1371.35	1376.71		1377.60	0.006720	7.59	396.66	97.93	0.66
Reach-1	6.236	3010.00	1370.00	1376.37		1377.00	0.004153	6.38	472.04	103.06	0.53
Reach-1	6.217	3010.00	1369.00	1376.02		1376.57	0.004010	5.93	508.02	111.31	0.49
Reach-1	6.199	3010.00	1368.00	1375.55		1376.11	0.005087	6.01	500.97	125.88	0.53
Reach-1	6.180	3010.00	1369.49	1375.13		1375.59	0.004801	5.43	554.15	165.25	0.52
Reach-1	6.161	3010.00	1368.90	1374.91		1375.22	0.002311	4.45	676.17	187.67	0.41
Reach-1	6.142	3010.00	1369.26	1374.68		1374.99	0.002383	4.43	679.34	193.99	0.42
Reach-1	6.123	3010.00	1368.96	1374.39		1374.72	0.002876	4.65	647.65	193.44	0.45
Reach-1	6.104	3010.00	1368.76	1374.12		1374.44	0.002633	4.57	658.95	193.24	0.44
Reach-1	6.085	3010.00	1368.52	1373.86		1374.18	0.002542	4.52	665.54	193.20	0.43
Reach-1	6.066	3010.00	1368.21	1373.62		1373.93	0.002449	4.46	674.52	193.86	0.42
Reach-1	6.047	3010.00	1368.09	1373.36		1373.68	0.002562	4.50	668.36	194.38	0.43
Reach-1	6.028	3010.00	1367.84	1373.09		1373.42	0.002706	4.56	660.19	194.72	0.44
Reach-1	6.009	3010.00	1367.66	1372.81		1373.14	0.002846	4.61	652.51	194.89	0.44
Reach-1	5.990	3010.00	1367.80	1372.55		1372.86	0.002596	4.49	670.37	195.54	0.43
Reach-1	5.971	3010.00	1367.85	1372.20		1372.56	0.003343	4.81	625.67	194.86	0.47
Reach-1	5.952	3010.00	1367.61	1371.87		1372.24	0.003207	4.85	621.14	194.46	0.48
Reach-1	5.933	3010.00	1366.83	1371.58		1371.93	0.002889	4.71	639.05	194.57	0.46
Reach-1	5.914	3010.00	1366.87	1371.20		1371.60	0.003640	5.05	596.48	193.64	0.51
Reach-1	5.896	3010.00	1366.40	1370.84		1371.24	0.003589	5.07	593.85	192.84	0.51
Reach-1	5.877	3010.00	1366.17	1370.63		1370.91	0.002382	4.22	713.10	216.37	0.41
Reach-1	5.858	3010.00	1365.61	1370.41		1370.68	0.002217	4.13	728.37	217.35	0.40
Reach-1	5.839	3010.00	1365.11	1370.20		1370.46	0.002146	4.06	741.72	218.40	0.39
Reach-1	5.820	3010.00	1364.81	1369.98		1370.24	0.002214	4.08	737.61	218.74	0.39
Reach-1	5.801	3010.00	1364.45	1369.75		1370.01	0.002425	4.08	737.71	218.97	0.39
Reach-1	5.782	3010.00	1364.42	1369.48		1369.76	0.002558	4.19	717.56	217.82	0.41

HEC-RAS Plan: CLOMR River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5.763	3010.00	1364.27	1369.22		1369.50	0.002470	4.27	705.13	198.21	0.40
Reach-1	5.744	3010.00	1363.70	1368.85		1369.22	0.003164	4.87	618.09	174.97	0.46
Reach-1	5.725	3010.00	1361.60	1368.24		1368.79	0.005418	5.96	505.20	151.71	0.58
Reach-1	5.706	3010.00	1361.40	1367.91		1368.30	0.003645	4.99	602.80	177.83	0.48
Reach-1	5.687	3010.00	1361.20	1367.65		1367.95	0.002912	4.43	679.07	199.81	0.42
Reach-1	5.668	3010.00	1361.00	1367.42		1367.67	0.002434	4.06	742.01	218.15	0.39
Reach-1	5.649	3010.00	1362.30	1367.12		1367.40	0.003094	4.25	708.67	212.56	0.41
Reach-1	5.630	3010.00	1362.36	1366.75		1367.06	0.003598	4.46	674.14	210.62	0.44
Reach-1	5.611	3010.00	1359.00	1366.51		1366.76	0.002267	3.99	755.17	224.37	0.38
Reach-1	5.592	3010.00	1358.40	1366.35		1366.55	0.001693	3.61	833.51	227.95	0.33
Reach-1	5.574	3010.00	1357.90	1366.16		1366.38	0.001695	3.74	805.14	229.56	0.35
Reach-1	5.555	3010.00	1357.80	1366.00		1366.21	0.001647	3.71	810.24	229.36	0.35
Reach-1	5.536	3010.00	1357.80	1365.73	1364.28	1366.00	0.002739	4.17	721.42	237.93	0.42
Reach-1	5.517	3010.00	1357.70	1365.45		1365.72	0.002729	4.19	719.09	236.43	0.42
Reach-1	5.498	3010.00	1357.50	1365.21	1363.66	1365.46	0.002363	4.03	747.64	236.73	0.40
Reach-1	5.479	3010.00	1357.00	1364.96	1363.37	1365.23	0.002379	4.10	733.90	229.03	0.40
Reach-1	5.460	3010.00	1356.90	1364.72	1363.08	1364.99	0.002400	4.15	724.66	220.49	0.40
Reach-1	5.441	3010.00	1356.70	1364.51	1362.71	1364.75	0.002151	3.98	755.96	221.19	0.38
Reach-1	5.422	3010.00	1356.70	1364.26	1362.58	1364.52	0.002415	4.11	731.52	220.81	0.40
Reach-1	5.403	3010.00	1356.50	1364.02	1362.35	1364.28	0.002482	4.10	733.38	221.08	0.40
Reach-1	5.384	3010.00	1359.18	1363.79		1364.04	0.002240	3.99	753.64	226.97	0.39
Reach-1	5.365	3010.00	1358.77	1363.59		1363.82	0.002044	3.85	781.88	231.36	0.37
Reach-1	5.346	3010.00	1358.52	1363.37		1363.60	0.002260	3.91	769.16	236.58	0.38
Reach-1	5.327	3010.00	1358.48	1363.15		1363.38	0.002225	3.81	789.57	244.12	0.37
Reach-1	5.308	3010.00	1357.82	1362.89		1363.14	0.002481	3.99	755.01	236.51	0.39
Reach-1	5.289	3010.00	1357.60	1362.65		1362.89	0.002409	3.95	762.23	236.61	0.39
Reach-1	5.271	3010.00	1356.88	1362.42		1362.65	0.002355	3.92	767.76	236.79	0.38
Reach-1	5.252	3010.00	1356.58	1362.22	1360.36	1362.44	0.001879	3.70	813.45	237.48	0.35
Reach-1	5.233	3010.00	1356.42	1362.05	1360.11	1362.25	0.001773	3.62	830.35	238.36	0.34
Reach-1	5.214	3010.00	1356.65	1361.88	1359.86	1362.08	0.001637	3.54	851.07	239.40	0.33
Reach-1	5.195	3010.00	1356.09	1361.68	1359.68	1361.90	0.001807	3.76	801.45	221.63	0.35
Reach-1	5.176	3010.00	1355.92	1361.50		1361.72	0.001792	3.82	787.38	212.19	0.35
Reach-1	5.157	3010.00	1356.57	1360.97		1361.43	0.004474	5.46	551.24	172.08	0.54
Reach-1	5.138	3010.00	1355.81	1360.38		1360.92	0.005764	5.89	511.45	153.94	0.57
Reach-1	5.119	3010.00	1354.50	1358.51	1358.51	1359.91	0.017169	9.48	317.57	114.20	1.00
Reach-1	5.109	3010.00	1353.60	1358.59	1356.30	1358.95	0.001240	4.79	628.77	135.96	0.39
Reach-1	5.102	Bridge									
Reach-1	5.091	3010.00	1353.60	1358.29	1356.30	1358.69	0.001337	5.12	587.60	134.75	0.43
Reach-1	5.073	3010.00	1353.30	1358.18		1358.51	0.001595	4.63	650.12	200.78	0.45
Reach-1	5.054	3010.00	1353.00	1357.54	1356.42	1358.25	0.003518	6.74	446.48	141.36	0.67

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X     X    X  X
XXXXXXX  XXXX     X       XXX XXXX      XXXXXX   XXXX
X     X  X        X           X  X      X    X       X
X     X  X        X    X      X   X     X    X       X
X     X  XXXXXX    XXXX       X    X    X    X  XXXXX
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PROJECT DATA
Project Title: QC Wash - Final Design - CLOMR
Project File : QC_Soss_Hawes.prj
Run Date and Time: 11/26/2003 4:37:45 PM

Project in English units

Project Description:
Project Title: Queen Creek Wash Sossaman Road to Hawes Road Channel
Improvement Project - Town of Queen Creek Proj No. 2000D-03
Prepared By:
Dibble and Associates Consulting Engineers
Model Created: April,
2003
Prepared For: Town of Queen Creek
Contact: Tom Narva, PH: 480-987-0109
Reviewing Agency: Flood Control District of Maricopa County

Contact: Tim Murphy, PH: 602-506-1501

Note: Crossections face downstream. River Miles increase in the upstream direction.

Note: This project is on NAVD 88 vertical datum.

Note: Levees modeled in this
model do not represent physical levees to be constructed with the channel improvements. The modeling tool termed levee is used to keep flood waters out of low lying ground, below the water surface elevation, on either side of actual physical containments of flow. It would be unreasonable to expect that flood waters will erode the substantial length of earth beside the channel.

This model is the post project conditions model for the Queen Creek Wash Improvement project, Sossaman Road to Hawes Road. It will specifically be used for channel improvement design, and represents the final design of channel improvements. The cross sections in this model were originally generated from erroneous mapping, provided by the FCDMC. The following correction factors have been applied to the elevations of the cross sections originating from the Coe & Van Loo, Flood Control District, and Collins Pina models in order to match the corrected aerial mapping:

West of Hawes Road: Correction = +2.683'
East of Hawes Road: Correction = +2.427'

The Bridge & Culvert routines were also adjusted by these correction factors.

Hydraulic tie-ins with existing floodplain delineations, already accepted by FEMA as a map CLOMR or LOMR or currently in review, exist at the upstream and downstream limits of the model. Downstream, the floodplain ties into (0.5' tolerance) the delineation of Queen Creek Wash, Power Road to Sossaman Road, performed by Coe and Van Loo Consultants, Inc. This occurs at RM 5.054, CVL Station 61+00. The Coe and Van Loo CLOMR was performed on different mapping than the erroneous mapping provided by FCDMC for this project. CVL mapping is on Town of Queen Creek datum, rather than NAVD 88 datum. Therefore, a correction factor of -2.00' was applied to Coe & Van Loo elevations to resolve the discrepancy. Upstream, the floodplain ties into the delineation of Queen Creek Wash, Hawes Road to SPRR, performed by Collins/Pina Consulting Engineers, Inc. This occurs at RM 6.532, Collins/Pina Station 1000+40.

REACH: Reach-1 RS: 6.532

INPUT
Description: Collins/Pina Sta 1000+40. DIBBLE Sta 125+60. Just Upstream from Hawes Road. Collins Pina cross sections raised 2.683 feet to match NAV88 vertical datum.

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
777	1383.53	808	1384.03	855	1384.43	891	1384.83	916	1384.43
925	1384.43	965	1374.93	1000	1374.93	1035	1374.93	1078	1384.43
1099	1384.83	1140	1384.63	1179	1384.43	1223	1388.43		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
777	.04	925	.028	1078	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
925	1078		86	86	86	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
777	925	1384.33	1078	1223	1384.33

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1381.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.028	
W.S. Elev (ft)	1381.18	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	1378.48	Flow Area (sq ft)		608.35	
E.G. Slope (ft/ft)	0.001066	Area (sq ft)		608.35	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	124.62	Top Width (ft)		124.62	
Vel Total (ft/s)	4.95	Avg. Vel. (ft/s)		4.95	
Max Chl Dpth (ft)	6.25	Hydr. Depth (ft)		4.88	
Conv. Total (cfs)	92208.6	Conv. (cfs)		92208.6	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		126.03	
Min Ch El (ft)	1374.93	Shear (lb/sq ft)		0.32	
Alpha	1.00	Stream Power (lb/ft s)		1.59	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.00	117.17	
C & E Loss (ft)		Cum SA (acres)	0.01	33.04	

BRIDGE RIVER: RIVER-1
REACH: Reach-1 RS: 6.525

INPUT
Description: Bridge #5 - HAWES ROAD

Distance from Upstream XS = 1
Deck/Roadway Width = 84
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew = 0
Upstream Deck/Roadway Coordinates
num= 9

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
892	1384.955	1375.055	917	1384.555	1375.055
925	1384.545	1382.155	1000	1384.455	1382.155
1078	1384.574	1382.155	1078	1384.574	1375.055
1098	1384.955	1375.055			

Upstream Bridge Cross Section Data
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
777	1383.53	808	1384.03	855	1384.43	891	1384.83	916	1384.43
925	1384.43	965	1374.93	1000	1374.93	1035	1374.93	1078	1384.43
1099	1384.83	1140	1384.63	1179	1384.43	1223	1388.43		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
777	.04	925	.028	1078	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
925	1078	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
777	925	1384.33	1078	1223	1384.33

Downstream Deck/Roadway Coordinates
num= 9

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
892	1384.955	1375.055	917	1384.555	1375.055
925	1384.545	1382.155	1000	1384.455	1382.155
1078	1384.574	1382.155	1078	1384.574	1375.055
1098	1384.955	1375.055			

```
     800    .075  923.15    .039  1065.3    .065

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        923.15  1065.3              100     100     100            .1        .3
Left Levee      Station=  923.15      Elevation= 1385.52

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1381.49   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.53   Wt. n-Val.                            0.039
  W.S. Elev (ft)            1380.97   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)            1378.75   Flow Area (sq ft)                    517.06
  E.G. Slope (ft/ft)       0.003109   Area (sq ft)                         517.06
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             112.55   Top Width (ft)                       112.55
  Vel Total (ft/s)             5.82   Avg. Vel. (ft/s)                       5.82
  Max Chl Dpth (ft)            6.48   Hydr. Depth (ft)                       4.59
  Conv. Total (cfs)         53983.9   Conv. (cfs)                         53983.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     113.98
  Min Ch El (ft)            1374.49   Shear (lb/sq ft)                       0.88
  Alpha                        1.00   Stream Power (lb/ft s)                 5.13
  Frctn Loss (ft)              0.29   Cum Volume (acre-ft)         0.00     115.87
  C & E Loss (ft)              0.01   Cum SA (acres)               0.01      32.77


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6.483

INPUT
Description: DIBBLE Sta 123+00

Even foot station data is scaled from 1"=20'
             Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
             truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data     num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     800 1380.76  819.49 1380.59  819.87 1380.59  838.79 1380.26  847.07  1380.2
  861.27  1380.3  875.04 1380.42  878.36 1380.46  884.26 1380.49  897.57 1381.04
  898.75 1381.09  902.92 1382.03  907.57  1383.1  911.01 1384.05  917.13 1385.75
  919.07 1385.72  925.06 1385.59  927.92 1384.86   940.4 1381.51  944.39 1380.34
  948.08 1380.21  952.14 1379.98  963.97 1376.95  967.02 1376.15  968.15 1375.93
  975.48 1374.32  981.29 1374.32   986.3 1374.28  988.65 1374.33  994.29 1374.22
  996.94 1374.13    1000 1374.25 1001.95 1374.32 1009.69 1374.56 1014.11 1374.37
 1014.65 1374.35 1023.97 1374.34    1032 1376.35 1046.01 1376.35    1064 1380.85
    1077 1380.85    1087    1382

Manning's n Values         num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     800    .075  925.06    .039    1032    .024 1046.01    .044    1064    .024
    1077    .044

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        944.39    1064              100     100     100            .1        .3
Left Levee      Station=  925.06      Elevation= 1385.59

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1381.19   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.48   Wt. n-Val.                  0.039      0.038
  W.S. Elev (ft)            1380.71   Reach Len. (ft)            100.00     100.00     100.00
  Crit W.S. (ft)            1378.45   Flow Area (sq ft)            0.23     540.64
  E.G. Slope (ft/ft)       0.002769   Area (sq ft)                 0.23     540.64
  Q Total (cfs)             3010.00   Flow (cfs)                   0.14    3009.86
  Top Width (ft)             120.29   Top Width (ft)               1.25     119.04
  Vel Total (ft/s)             5.57   Avg. Vel. (ft/s)             0.63       5.57
  Max Chl Dpth (ft)            6.58   Hydr. Depth (ft)             0.18       4.54
  Conv. Total (cfs)         57200.5   Conv. (cfs)                   2.8    57197.8
  Length Wtd. (ft)           100.00   Wetted Per. (ft)             1.30     120.53
  Min Ch El (ft)            1374.13   Shear (lb/sq ft)             0.03       0.78
  Alpha                        1.00   Stream Power (lb/ft s)       0.02       4.32
  Frctn Loss (ft)              0.24   Cum Volume (acre-ft)         0.00     114.66
  C & E Loss (ft)              0.03   Cum SA (acres)               0.01      32.50


Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6.464
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INPUT
Description: DIBBLE Sta 122+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within
Channel.

A Property Wall has modeled at Right Bank Station 1077.
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1380.3	802.61	1380.29	804.18	1380.28	821.66	1380.21	831.39	1380.05
836.62	1379.89	842.3	1379.85	855.67	1380.02	858.13	1380.07	859.4	1380.07
860.07	1380.1	879.11	1380.79	889.56	1381.73	898.25	1382.21	908.81	1383.79
918.2	1385.27	925.52	1385.15	927.41	1385.2	934.3	1383.08	946.8	1380.07
947.12	1380	947.3	1379.99	954.51	1379.51	959.71	1378.08	968.21	1375.75
973.35	1374.76	977.02	1374.1	982.86	1374.04	989.13	1374.03	993.73	1373.97
995.63	1373.95	1000.01	1373.99	1003.82	1374.03	1008.49	1374.06	1010.33	1374.05
1013.45	1374.05	1019.59	1374.05	1019.96	1374.13	1020	1374.43	1022.55	1374.81
1026.13	1375.74	1028	1376	1059	1376	1077	1380.5	1077	1383.5
1077.5	1383.5								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.075	946.8	.039	1028	.024	1059	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
946.8	1077	100	100	100	.1	.3

Left Levee Station= 927.59 Elevation= 1385.22

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1380.93	Element			
Vel Head (ft)	0.39	Wt. n-Val.	0.075	0.037	
W.S. Elev (ft)	1380.53	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1378.10	Flow Area (sq ft)	0.45	599.03	
E.G. Slope (ft/ft)	0.002029	Area (sq ft)	0.45	599.03	
Q Total (cfs)	3010.00	Flow (cfs)	0.15	3009.85	
Top Width (ft)	132.12	Top Width (ft)	1.92	130.20	
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	0.33	5.02	
Max Chl Dpth (ft)	6.58	Hydr. Depth (ft)	0.23	4.60	
Conv. Total (cfs)	66829.6	Conv. (cfs)	3.3	66826.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)	1.98	131.91	
Min Ch El (ft)	1373.95	Shear (lb/sq ft)	0.03	0.58	
Alpha	1.00	Stream Power (lb/ft s)	0.01	2.89	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	0.00	113.35	
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	32.22	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.445

INPUT
Description: DIBBLE Sta 121+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within
Channel.

A Property Wall has been modeled at Right Bank Station
1060.
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1380.65	800.4	1380.63	806.99	1380.18	813.07	1380.13	831.27	1380.09
847.38	1379.86	848	1379.86	849.16	1379.83	853.31	1379.93	870.13	1380.2
880.3	1380.77	884.36	1381.01	890.67	1381.47	905.35	1383.2	914.27	1384.35
918.92	1384.51	921.88	1384.6	928.36	1384.68	932.26	1383.47	937.17	1382.45
944.43	1380.71	946.07	1380.6	952	1380.12	960.42	1377.47	972.37	1374.06
973.34	1373.82	975.11	1373.81	985.11	1373.77	992.49	1373.74	996.94	1373.78
1000.01	1373.77	1003	1373.76	1007.67	1373.89	1014.35	1373.88	1020.33	1373.85
1021.02	1373.98	1021.57	1374.09	1021.59	1374.07	1021.63	1374.19	1024	1375
1028	1376	1042	1376	1060	1380	1060	1383	1060.5	1383

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.075	952	.039	1028	.024	1042	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
952	1060	100	100	100	.1	.3

Left Levee Station= 927.56 Elevation= 1384.66

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1380.66	Element			
Vel Head (ft)	0.57	Wt. n-Val.		0.038	
W.S. Elev (ft)	1380.09	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1378.08	Flow Area (sq ft)		497.85	
E.G. Slope (ft/ft)	0.003207	Area (sq ft)		497.85	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	107.90	Top Width (ft)		107.90	
Vel Total (ft/s)	6.05	Avg. Vel. (ft/s)		6.05	
Max Chl Dpth (ft)	6.35	Hydr. Depth (ft)		4.61	
Conv. Total (cfs)	53148.5	Conv. (cfs)		53148.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		109.71	
Min Ch El (ft)	1373.74	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		5.49	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)		112.09	
C & E Loss (ft)	0.02	Cum SA (acres)		31.94	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.426

INPUT
Description: DIBBLE Sta 120+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 64

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1379.01	807.14	1378.99	809.41	1379.15	813.58	1379.52	819.32	1380.06
825.57	1380.6	834.76	1380.46	837.54	1380.39	838.71	1380.4	842.29	1380.4
852.32	1380.38	853.91	1380.34	856.3	1380.26	862.74	1380.11	866.47	1380.05
868.71	1380	870.93	1380	872.97	1380.04	875.87	1380.06	881.27	1380.09
887.91	1380.2	894.18	1380.18	898.03	1380.32	903.45	1380.53	905.24	1380.75
909.38	1381.41	913.07	1382.03	915.1	1382.32	920.51	1382.4	923.06	1382.43
923.6	1382.33	934.73	1380.57	941.33	1379.1	946.75	1377.93	950.1	1377.06
962.7	1373.61	969.54	1373.51	973.55	1373.52	985.5	1373.42	985.52	1373.42
985.66	1373.42	996.41	1373.34	998.38	1373.34	1000	1373.33	1009.56	1373.26
1009.63	1373.27	1014.27	1373.93	1014.37	1373.95	1014.42	1373.95	1021	1375.6
1035	1375.6	1053	1380.1	1053	1383.1	1053.5	1383.1	1053.5	1380.1
1070.28	1380.1	1102.13	1380.11	1120.34	1380.11	1131.85	1380.11	1132.8	1380.11
1135.54	1380.11	1190.3	1380.17	1192.62	1380.25	1200	1380.1		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.075	934.73	.039	1021	.024	1035	.044	1053	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
934.73	1053	100	100	100	.1	.3

Left Levee Station= 934.73 Elevation= 1380.57

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1380.34	Element			
Vel Head (ft)	0.49	Wt. n-Val.		0.038	
W.S. Elev (ft)	1379.84	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1377.58	Flow Area (sq ft)		533.21	
E.G. Slope (ft/ft)	0.002733	Area (sq ft)		533.21	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	113.98	Top Width (ft)		113.98	
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)		5.65	
Max Chl Dpth (ft)	6.58	Hydr. Depth (ft)		4.68	
Conv. Total (cfs)	57571.5	Conv. (cfs)		57571.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		115.54	
Min Ch El (ft)	1373.26	Shear (lb/sq ft)		0.79	
Alpha	1.00	Stream Power (lb/ft s)		4.45	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		110.91	
C & E Loss (ft)	0.02	Cum SA (acres)		31.69	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.407

INPUT
Description: DIBBLE Sta 119+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

A low area shown on
existing mapping, but since filled in, has been removed from the
Left Overbank of this cross section.

Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1380	915.75	1380	920.34	1380.92	922.68	1380.57	924.45	1380.32
925.21	1380.29	930	1380.13	932.61	1379.28	946.62	1375.21	947.02	1375.12
947.99	1374.9	955.64	1373.28	963.72	1373.45	972.31	1373.55	977.57	1373.44
985.24	1373.26	990.3	1373.24	994.08	1373.2	997.81	1373.21	997.84	1373.21
1000	1373.21	1005.91	1373.2	1012.39	1374.3	1012.77	1374.37	1013.37	1374.4
1018.73	1374.78	1021.01	1375.35	1035	1375.35	1053.01	1379.85	1053.01	1382.85
1053.51	1382.85	1053.51	1379.85	1057.26	1379.85	1057.67	1379.85	1057.83	1379.85
1058.1	1379.85	1058.7	1379.85	1058.8	1379.85	1059.25	1379.85	1059.38	1379.85
1059.45	1379.85	1061.35	1379.85	1062.25	1379.85	1067.35	1379.85	1071.92	1379.85
1089.04	1379.85	1115.29	1379.85	1123.57	1379.85	1124.86	1379.85	1128.54	1379.85
1200	1379.93								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.075	930	.039	1021.01	.024	1035	.044	1053.01	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
930	1053.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1380.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.		0.038	
W.S. Elev (ft)	1379.65	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		577.71	
E.G. Slope (ft/ft)	0.002263	Area (sq ft)		577.71	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	120.71	Top Width (ft)		120.71	
Vel Total (ft/s)	5.21	Avg. Vel. (ft/s)		5.21	
Max Chl Dpth (ft)	6.45	Hydr. Depth (ft)		4.79	
Conv. Total (cfs)	63267.4	Conv. (cfs)		63267.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		122.27	
Min Ch El (ft)	1373.20	Shear (lb/sq ft)		0.67	
Alpha	1.00	Stream Power (lb/ft s)		3.48	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)		109.63	
C & E Loss (ft)	0.01	Cum SA (acres)		31.42	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.388

INPUT
Description: DIBBLE Sta 118+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

A low area shown on
existing mapping, but since filled in, has been removed from the
Left Overbank of this cross section.

Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1379.78	801.73	1379.78	805.68	1379.79	806.17	1379.8	808.89	1380
916	1380	917.64	1380.08	920.36	1380.2	922.28	1380.3	923	1380.22
925.97	1379.82	927.28	1379.75	929.55	1379.58	933.69	1378.44	942.41	1375.93
947.61	1374.44	951.57	1373.57	954.95	1372.74	956.87	1372.74	961.18	1372.81
972.17	1373	984.24	1372.74	985.55	1372.72	989.94	1372.68	991.77	1372.69
996.32	1372.85	1000	1373.01	1003.59	1373.17	1005.99	1373.34	1010.98	1373.61
1017.05	1374.04	1017.32	1374.14	1019.89	1375.1	1021	1375.1	1035	1375.1
1053	1379.6	1053	1382.6	1053.5	1382.6	1053.5	1379.6	1063.86	1379.6
1064.28	1379.6	1064.56	1379.6	1064.73	1379.6	1067.91	1379.6	1070.82	1379.6
1105.09	1379.61	1110.38	1379.61	1111.99	1379.61	1116.62	1379.61	1200	1379.72

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

800	.075	929.55	.039	1019.89	.024	1035	.044	1053	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
929.55	1053	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1379.85	Element			
Vel Head (ft)	0.38	Wt. n-Val.		0.038	
W.S. Elev (ft)	1379.46	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		605.47	
E.G. Slope (ft/ft)	0.001965	Area (sq ft)		605.47	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	122.47	Top Width (ft)		122.47	
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)		4.97	
Max Chl Dpth (ft)	6.78	Hydr. Depth (ft)		4.94	
Conv. Total (cfs)	67901.9	Conv. (cfs)		67901.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		124.14	
Min Ch El (ft)	1372.68	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.97	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		108.27	
C & E Loss (ft)	0.00	Cum SA (acres)		31.14	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.369

INPUT
Description: DIBBLE Sta 117+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
935	1380	956	1372	975	1372.5	994	1372	1001	1372.5
1015	1372.5	1020	1375	1035	1375	1053	1379.3	1053	1382.3
1053.5	1382.3								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
935	.039	1001	.044	1020	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
935	1053	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1379.65	Element			
Vel Head (ft)	0.38	Wt. n-Val.		0.039	
W.S. Elev (ft)	1379.28	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		610.46	
E.G. Slope (ft/ft)	0.001877	Area (sq ft)		610.46	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	115.99	Top Width (ft)		115.99	
Vel Total (ft/s)	4.93	Avg. Vel. (ft/s)		4.93	
Max Chl Dpth (ft)	7.28	Hydr. Depth (ft)		5.26	
Conv. Total (cfs)	69480.8	Conv. (cfs)		69480.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		118.46	
Min Ch El (ft)	1372.00	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.98	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		106.88	
C & E Loss (ft)	0.01	Cum SA (acres)		30.87	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.350

INPUT
Description: DIBBLE Sta 116+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is

truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
942	1379.5	960	1372	973	1372.5	990	1372.5	1016	1373.5
1021	1374.5	1035	1374.5	1053	1379				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
942	.039	1016	.044	1021	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
942	1053	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1379.42	Element			
Vel Head (ft)	0.49	Wt. n-Val.		0.038	
W.S. Elev (ft)	1378.93	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		533.41	
E.G. Slope (ft/ft)	0.002633	Area (sq ft)		533.41	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	109.32	Top Width (ft)		109.32	
Vel Total (ft/s)	5.64	Avg. Vel. (ft/s)		5.64	
Max Chl Dpth (ft)	6.93	Hydr. Depth (ft)		4.88	
Conv. Total (cfs)	58661.1	Conv. (cfs)		58661.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		111.38	
Min Ch El (ft)	1372.00	Shear (lb/sq ft)		0.79	
Alpha	1.00	Stream Power (lb/ft s)		4.44	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)		105.57	
C & E Loss (ft)	0.00	Cum SA (acres)		30.61	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.331

INPUT
Description: DIBBLE Sta 115+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
944	1380	961	1372	968.57	1371.92	992	1372.5	1015	1373
1021	1374	1035	1374	1055	1379.5				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
944	.039	1015	.044	1021	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
944	1055	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1379.15	Element			
Vel Head (ft)	0.53	Wt. n-Val.		0.038	
W.S. Elev (ft)	1378.62	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		516.24	
E.G. Slope (ft/ft)	0.002783	Area (sq ft)		516.24	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	104.86	Top Width (ft)		104.86	
Vel Total (ft/s)	5.83	Avg. Vel. (ft/s)		5.83	
Max Chl Dpth (ft)	6.70	Hydr. Depth (ft)		4.92	
Conv. Total (cfs)	57060.4	Conv. (cfs)		57060.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		107.06	
Min Ch El (ft)	1371.92	Shear (lb/sq ft)		0.84	
Alpha	1.00	Stream Power (lb/ft s)		4.88	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		104.36	
C & E Loss (ft)	0.00	Cum SA (acres)		30.36	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.312

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INPUT
Description: DIBBLE Sta 114+00

Even foot station data is scaled from 1"=20'
            Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
            truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     945    1380     964   1371.5    982    1372    1003   1371.5    1013    1372
    1021    1374    1035    1374    1055    1379

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     945    .039    1013    .044    1021    .024    1035    .044

Bank Sta: Left    Right    Lengths: Left Channel    Right     Coeff Contr.    Expan.
           945    1055               100     100     100              .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1378.87   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.53   Wt. n-Val.                            0.038
  W.S. Elev (ft)            1378.34   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     516.59
  E.G. Slope (ft/ft)       0.002755   Area (sq ft)                          516.59
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             103.66   Top Width (ft)                        103.66
  Vel Total (ft/s)             5.83   Avg. Vel. (ft/s)                        5.83
  Max Chl Dpth (ft)            6.84   Hydr. Depth (ft)                        4.98
  Conv. Total (cfs)         57344.9   Conv. (cfs)                          57344.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      105.93
  Min Ch El (ft)            1371.50   Shear (lb/sq ft)                        0.84
  Alpha                        1.00   Stream Power (lb/ft s)                  4.89
  Frctn Loss (ft)              0.32   Cum Volume (acre-ft)                  103.18
  C & E Loss (ft)              0.01   Cum SA (acres)                         30.12


Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6.293

INPUT
Description: DIBBLE Sta 113+00

Even foot station data is scaled from 1"=20'
            Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
            truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data     num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     942  1379.5     958    1374     968    1372  971.18 1371.83  989.24 1371.71
  997.21 1371.56    1000 1371.63    1013    1372    1021    1374    1035    1374
    1055    1379

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     942    .039    1013    .044    1021    .024    1035    .044

Bank Sta: Left    Right    Lengths: Left Channel    Right     Coeff Contr.    Expan.
           942    1055               100     100     100              .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1378.54   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.63   Wt. n-Val.                            0.038
  W.S. Elev (ft)            1377.92   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     473.31
  E.G. Slope (ft/ft)       0.003658   Area (sq ft)                          473.31
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             104.05   Top Width (ft)                        104.05
  Vel Total (ft/s)             6.36   Avg. Vel. (ft/s)                        6.36
  Max Chl Dpth (ft)            6.36   Hydr. Depth (ft)                        4.55
  Conv. Total (cfs)         49767.5   Conv. (cfs)                          49767.5
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      105.64
  Min Ch El (ft)            1371.56   Shear (lb/sq ft)                        1.02
  Alpha                        1.00   Stream Power (lb/ft s)                  6.51
  Frctn Loss (ft)              0.39   Cum Volume (acre-ft)                  102.04
```

C & E Loss (ft) 0.00 Cum SA (acres) 29.89

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.274

INPUT
Description: DIBBLE Sta 112+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
942	1379.5	968	1371	980.22	1371.94	982.46	1371.79	992.4	1371.06
996.16	1371.12	1000	1371.09	1010	1371	1021	1374	1035	1374
1055	1378								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
942	.039	1010	.044	1021	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
942	1055	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1378.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.		0.039	
W.S. Elev (ft)	1377.47	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		456.03	
E.G. Slope (ft/ft)	0.004209	Area (sq ft)		456.03	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	104.14	Top Width (ft)		104.14	
Vel Total (ft/s)	6.60	Avg. Vel. (ft/s)		6.60	
Max Chl Dpth (ft)	6.47	Hydr. Depth (ft)		4.38	
Conv. Total (cfs)	46393.9	Conv. (cfs)		46393.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		105.99	
Min Ch El (ft)	1371.00	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		7.46	
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)		100.97	
C & E Loss (ft)	0.02	Cum SA (acres)		29.65	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.255

INPUT
Description: DIBBLE Sta 111+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
945	1379	961	1371.5	962	1371.35	971.24	1371.6	974.76	1371.67
977.41	1371.69	978.82	1371.71	986.77	1371.78	990.75	1371.66	994.82	1371.53
1000	1371.46	1003.24	1371.5	1015	1371.5	1021	1373.5	1035	1373.5
1055	1378.5								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
945	.055	961	.039	1015	.044	1021	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
945	1055	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1377.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.		0.040	
W.S. Elev (ft)	1376.71	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		396.66	

E.G. Slope (ft/ft)	0.006720	Area (sq ft)	396.66
Q Total (cfs)	3010.00	Flow (cfs)	3010.00
Top Width (ft)	97.93	Top Width (ft)	97.93
Vel Total (ft/s)	7.59	Avg. Vel. (ft/s)	7.59
Max Chl Dpth (ft)	5.36	Hydr. Depth (ft)	4.05
Conv. Total (cfs)	36718.1	Conv. (cfs)	36718.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)	99.83
Min Ch El (ft)	1371.35	Shear (lb/sq ft)	1.67
Alpha	1.00	Stream Power (lb/ft s)	12.65
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	99.99
C & E Loss (ft)	0.08	Cum SA (acres)	29.41

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.236

INPUT
Description: DIBBLE Sta 110+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
940	1378	958	1371	962	1370	968.07	1370.16	971.88	1370.14
972.83	1370.16	974.27	1370.15	985.16	1370.16	995.14	1370.74	996.83	1370.84
1009	1370	1021	1373	1035	1373	1055	1378.5		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
940	.055	958	.039	1009	.044	1021	.024	1035	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
940	1055	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1377.00	Element			
Vel Head (ft)	0.63	Wt. n-Val.		0.041	
W.S. Elev (ft)	1376.37	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		472.04	
E.G. Slope (ft/ft)	0.004153	Area (sq ft)		472.04	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	103.06	Top Width (ft)		103.06	
Vel Total (ft/s)	6.38	Avg. Vel. (ft/s)		6.38	
Max Chl Dpth (ft)	6.37	Hydr. Depth (ft)		4.58	
Conv. Total (cfs)	46707.6	Conv. (cfs)		46707.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		105.06	
Min Ch El (ft)	1370.00	Shear (lb/sq ft)		1.16	
Alpha	1.00	Stream Power (lb/ft s)		7.43	
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)		99.00	
C & E Loss (ft)	0.03	Cum SA (acres)		29.18	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.217

INPUT
Description: DIBBLE Sta 109+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
937	1377	948	1371	955	1370.5	969	1371	975	1370
988	1369	1009	1370	1021	1373	1035	1373	1055	1377

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
937	.055	948	.039	1009	.055	1021	.024	1035	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

937	1055	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1376.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.043	
W.S. Elev (ft)	1376.02	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		508.02	
E.G. Slope (ft/ft)	0.004010	Area (sq ft)		508.02	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	111.31	Top Width (ft)		111.31	
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)		5.93	
Max Chl Dpth (ft)	7.02	Hydr. Depth (ft)		4.56	
Conv. Total (cfs)	47533.3	Conv. (cfs)		47533.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		113.43	
Min Ch El (ft)	1369.00	Shear (lb/sq ft)		1.12	
Alpha	1.00	Stream Power (lb/ft s)		6.64	
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)		97.87	
C & E Loss (ft)	0.00	Cum SA (acres)		28.94	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.199

INPUT
Description: DIBBLE Sta 108+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
921	1377.5	954	1371	960	1368	962	1370	970	1370
978.72	1370.62	978.76	1370.62	978.83	1370.62	986.14	1370.99	991.84	1370.59
1000	1370.18	1000.41	1370.16	1005.1	1370.24	1010.26	1370.48	1022	1370.5
1029	1372.5	1042	1372.5	1071	1378.5				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
921	.055	960	.039	1029	.024	1042	.055	1071	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
921	1071	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1376.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.		0.044	
W.S. Elev (ft)	1375.55	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		500.97	
E.G. Slope (ft/ft)	0.005087	Area (sq ft)		500.97	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	125.88	Top Width (ft)		125.88	
Vel Total (ft/s)	6.01	Avg. Vel. (ft/s)		6.01	
Max Chl Dpth (ft)	7.55	Hydr. Depth (ft)		3.98	
Conv. Total (cfs)	42200.9	Conv. (cfs)		42200.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		128.51	
Min Ch El (ft)	1368.00	Shear (lb/sq ft)		1.24	
Alpha	1.00	Stream Power (lb/ft s)		7.44	
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)		96.71	
C & E Loss (ft)	0.03	Cum SA (acres)		28.67	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.180

INPUT
Description: DIBBLE Sta 107+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
904	1377.5	936	1372.5	950	1372.5	956.95	1369.49	959.97	1369.6
968.53	1369.82	970.28	1370.04	973.89	1370.04	977.11	1370.02	980.28	1370.07
989.99	1370.46	991.83	1370.53	991.96	1370.52	992.8	1370.5	1000	1370.27
1010.65	1369.94	1012.23	1370.08	1014.36	1370.17	1016.73	1370.05	1021.8	1370.13
1023	1370	1031	1372.5	1058	1372.5	1064	1374	1066	1374
1076	1374	1078	1374	1095	1377				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
904	.055	936	.044	950	.039	1031	.044	1058	.055
1064	.024	1078	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
904	1095	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1375.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.		0.042	
W.S. Elev (ft)	1375.13	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		554.15	
E.G. Slope (ft/ft)	0.004801	Area (sq ft)		554.15	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	165.25	Top Width (ft)		165.25	
Vel Total (ft/s)	5.43	Avg. Vel. (ft/s)		5.43	
Max Chl Dpth (ft)	5.64	Hydr. Depth (ft)		3.35	
Conv. Total (cfs)	43442.0	Conv. (cfs)		43442.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		166.80	
Min Ch El (ft)	1369.49	Shear (lb/sq ft)		1.00	
Alpha	1.00	Stream Power (lb/ft s)		5.41	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)		95.50	
C & E Loss (ft)	0.04	Cum SA (acres)		28.33	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.161

INPUT
Description: DIBBLE Sta 106+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 83

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1376.12	801.53	1376.06	807.1	1376.04	812.5	1376.07	815.16	1376.11
816.42	1376.29	817.96	1376.31	821.57	1376.31	825.38	1376.38	833.77	1376.49
838.69	1376.53	841.16	1377.45	845.47	1378.99	847.28	1378.67	854.09	1377.56
860.34	1377.39	863.06	1377.34	864.08	1377.16	867.34	1376.74	867.7	1376.72
875.42	1376.69	876.15	1376.7	878.08	1376.73	878.65	1376.74	879.71	1376.76
890.87	1376.95	890.92	1376.95	896.77	1377.13	899.51	1376.67	900.77	1376.44
926.67	1371.77	938.34	1371.77	952.96	1371.77	962.01	1368.9	962.14	1368.91
962.19	1368.91	964.7	1369.04	969.01	1369.25	969.03	1369.25	974.32	1369.54
978.92	1369.45	986.67	1369.63	994.1	1370.04	998.78	1369.68	1000.01	1369.62
1002.11	1369.51	1004.19	1369.48	1008.85	1369.48	1014.28	1370.04	1015.29	1370.12
1017.49	1370.12	1026.76	1370.02	1032.87	1371.23	1033.76	1371.41	1033.77	1371.63
1033.8	1371.7	1036.64	1372.1	1070.01	1372.1	1080.01	1372.1	1107.02	1376.6
1123.01	1376.44	1123.43	1376.55	1124.07	1376.06	1129.99	1376.8	1130	1376.47
1130.01	1376.63	1130.03	1376.67	1130.05	1376.97	1131.71	1377.03	1134.42	1377.14
1139.98	1377.06	1149.95	1377.1	1151.22	1377.12	1156.14	1377.14	1161.77	1377.02
1164.03	1376.92	1170.48	1376.26	1172.74	1376.04	1176.81	1375.91	1176.89	1375.92
1187.65	1375.72	1191.1	1375.69	1200.02	1375.75				

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.07	896.77	.055	926.67	.044	952.96	.039	1036.64	.044
1080.01	.055	1107.02	.024	1123.01	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
896.77	1107.02	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1375.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.041	
W.S. Elev (ft)	1374.91	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		676.17	

E.G. Slope (ft/ft)	0.002311	Area (sq ft)	676.17
Q Total (cfs)	3010.00	Flow (cfs)	3010.00
Top Width (ft)	187.67	Top Width (ft)	187.67
Vel Total (ft/s)	4.45	Avg. Vel. (ft/s)	4.45
Max Chl Dpth (ft)	6.01	Hydr. Depth (ft)	3.60
Conv. Total (cfs)	62608.2	Conv. (cfs)	62608.2
Length Wtd. (ft)	100.00	Wetted Per. (ft)	189.13
Min Ch El (ft)	1368.90	Shear (lb/sq ft)	0.52
Alpha	1.00	Stream Power (lb/ft s)	2.30
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	94.09
C & E Loss (ft)	0.00	Cum SA (acres)	27.93

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.142

INPUT
Description: DIBBLE Sta 105+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 82

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1377.3	800.55	1376.85	800.74	1376.72	800.86	1376.64	800.98	1376.55
801.4	1376.25	803.68	1377.64	804.07	1377.86	804.66	1377.74	804.97	1377.68
805.21	1377.64	809.09	1376.9	816.45	1376.65	821.02	1376.48	823.66	1376.75
824.82	1376.85	826.66	1376.55	831.02	1375.99	834.43	1376.24	838.35	1376.35
838.71	1376.32	839.77	1376.12	841.61	1376.13	853.74	1376.47	860.81	1376.38
867.91	1376.62	871.83	1376.68	876.23	1377.12	876.91	1377.18	877.66	1377.24
879.25	1377.22	887.08	1377.33	887.12	1377.33	892.44	1376.44	893.01	1376.35
910.74	1373.39	920.01	1371.85	934	1371.85	937.35	1371.85	954.97	1371.85
955.02	1371.84	962.33	1370.45	964.32	1369.75	965.28	1369.54	968.48	1369.46
973.43	1369.58	977.58	1369.57	993.01	1369.55	994.91	1369.51	998.76	1369.43
1000.01	1369.39	1003.39	1369.26	1004.72	1369.37	1016.06	1369.44	1016.6	1369.44
1017.74	1369.47	1033.64	1369.7	1034.57	1369.89	1040.08	1371.85	1070.01	1371.85
1080.01	1371.85	1107	1376.35	1123.01	1376.19	1125.48	1376.81	1126.81	1377.14
1126.84	1376.94	1126.86	1376.88	1127.19	1376.91	1132.27	1377.29	1134.37	1376.95
1139.07	1376.5	1146.43	1376.09	1148.03	1376.02	1155.82	1375.98	1156.93	1375.9
1165.54	1375.77	1174.08	1375.71	1192.11	1375.75	1192.84	1375.75	1193.2	1375.75
1194.16	1375.75	1200.01	1375.76						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.07	887.12	.044	954.97	.039	1040.08	.044	1107	.025
1123.01	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
887.12	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1374.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.		0.040	
W.S. Elev (ft)	1374.68	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		679.34	
E.G. Slope (ft/ft)	0.002383	Area (sq ft)		679.34	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	193.99	Top Width (ft)		193.99	
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43	
Max Chl Dpth (ft)	5.42	Hydr. Depth (ft)		3.50	
Conv. Total (cfs)	61657.6	Conv. (cfs)		61657.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		195.10	
Min Ch El (ft)	1369.26	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.30	
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)		92.53	
C & E Loss (ft)	0.00	Cum SA (acres)		27.49	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.123

INPUT
Description: DIBBLE Sta 104+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 70

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1375.96	805.31	1375.98	807.73	1375.96	808.65	1376.02	809.05	1375.94
821.55	1375.85	823.3	1375.91	825.21	1376.25	826.6	1376.84	829.27	1377.56
830.24	1377.04	830.78	1376.84	830.82	1376.83	833.03	1376.03	835.06	1377.16

835.82	1377.61	839.57	1376.96	841.72	1376.57	851.45	1376.41	852.5	1376.4
857.11	1376.32	868.49	1376.7	877.12	1376.95	879.06	1376.96	882.77	1376.99
883.18	1376.99	883.67	1376.96	888.36	1376.6	889.76	1376.63	889.8	1376.63
893	1376.1	920	1371.6	934	1371.6	940.2	1371.6	958.48	1371.6
958.53	1371.58	964.07	1369.77	965.37	1369.41	967.69	1368.96	974.94	1369.05
988.01	1369.21	993	1369.46	994.88	1369.6	1000	1369.54	1004.74	1369.49
1015.06	1369.45	1016.83	1369.39	1018.11	1369.44	1025.05	1369.64	1032.7	1370.78
1035.36	1371.18	1035.38	1371.39	1035.4	1371.26	1035.41	1371.37	1036.6	1371.6
1037.08	1371.6	1038.23	1371.6	1070.01	1371.6	1080.01	1371.6	1107	1376.1
1123.01	1375.94	1133.76	1376.06	1135.93	1375.9	1147.2	1375.64	1147.87	1375.72
1157.07	1375.68	1157.53	1375.68	1175.84	1375.61	1185.18	1375.58	1200.01	1375.73

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.075	882.77	.044	965.37	.039	1036.6	.044	1107	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
889.8	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1374.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.		0.041	
W.S. Elev (ft)	1374.39	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		647.65	
E.G. Slope (ft/ft)	0.002876	Area (sq ft)		647.65	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	193.44	Top Width (ft)		193.44	
Vel Total (ft/s)	4.65	Avg. Vel. (ft/s)		4.65	
Max Chl Dpth (ft)	5.43	Hydr. Depth (ft)		3.35	
Conv. Total (cfs)	56130.2	Conv. (cfs)		56130.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		194.84	
Min Ch El (ft)	1368.96	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.77	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		91.01	
C & E Loss (ft)	0.00	Cum SA (acres)		27.04	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.104

INPUT
Description: DIBBLE Sta 103+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 74

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1375.37	805.99	1375.37	817.35	1375.37	821.87	1375.4	829.7	1375.33
840.09	1375.32	845.06	1375.33	857.75	1376.9	864.09	1376.04	864.41	1375.85
865.04	1376.16	865.66	1376.46	867.56	1377.39	870.87	1377	874.12	1376.57
881.03	1376.56	882.8	1376.42	884.38	1376.5	885.13	1376.54	888.58	1376.58
888.61	1376.58	888.64	1376.58	890.66	1376.24	893	1375.85	915.96	1372.02
920	1371.35	934	1371.35	955.89	1371.35	955.94	1371.33	958.15	1370.24
959.27	1370.03	959.63	1369.96	962.76	1369.93	963.57	1369.93	965.12	1369.69
968.08	1369.25	976.16	1369.38	976.9	1369.42	977.41	1369.37	979.76	1369.21
986.13	1368.78	987	1368.77	989.33	1368.82	990.14	1368.8	993.99	1368.76
1000	1368.79	1003.71	1368.81	1006.72	1368.83	1010.31	1368.87	1010.99	1368.88
1021.57	1369	1023.51	1369.08	1030.17	1369.63	1033.48	1370.24	1036.04	1370.72
1036.05	1370.75	1039.38	1371.35	1070	1371.35	1080	1371.35	1107	1375.85
1123	1375.69	1126.79	1375.74	1135.5	1375.58	1143.06	1375.59	1145.83	1375.6
1145.85	1375.59	1147.57	1375.55	1156.83	1375.28	1158.46	1375.3	1159.35	1375.28
1177.39	1375.36	1177.71	1375.36	1178.63	1375.36	1200	1375.44		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.07	888.64	.044	955.89	.039	1039.38	.044	1107	.025
1123	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
888.64	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1374.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.040	
W.S. Elev (ft)	1374.12	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		658.95	
E.G. Slope (ft/ft)	0.002633	Area (sq ft)		658.95	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	193.24	Top Width (ft)		193.24	

Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	4.57
Max Chl Dpth (ft)	5.36	Hydr. Depth (ft)	3.41
Conv. Total (cfs)	58659.0	Conv. (cfs)	58659.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	194.26
Min Ch El (ft)	1368.76	Shear (lb/sq ft)	0.56
Alpha	1.00	Stream Power (lb/ft s)	2.55
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	89.51
C & E Loss (ft)	0.00	Cum SA (acres)	26.60

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.085

INPUT
Description: DIBBLE Sta 102+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 69

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1375.03	805.12	1375.03	815.69	1375.02	833.62	1374.95	855.37	1375.05
862.11	1375.06	863.83	1375.07	865.91	1375.21	869.29	1375.32	880.05	1375.54
884.89	1376.72	885.49	1376.89	885.93	1377.04	886.22	1376.87	886.38	1376.76
888.22	1375.55	888.41	1375.62	888.91	1375.82	889.41	1376.01	889.71	1376.12
889.76	1376.14	893.01	1375.6	905.7	1373.48	920	1371.1	934	1371.1
940.16	1371.1	950.31	1371.1	950.33	1371.09	950.35	1371.08	952.93	1370.18
955.27	1370.04	958.21	1369.92	961.49	1369.4	962.35	1369.27	973.33	1368.79
979.05	1368.97	979.68	1369.01	979.9	1369	980.94	1368.99	994.96	1368.82
998.8	1368.74	1000	1368.7	1005.42	1368.52	1022.45	1368.56	1024.74	1368.53
1032.6	1369.69	1032.89	1369.73	1032.91	1370.03	1038.96	1371.1	1070	1371.1
1080	1371.1	1107.01	1375.6	1123	1375.44	1123.15	1375.4	1125.28	1375.4
1126.06	1375.4	1130.13	1375.48	1137.08	1375.62	1141.69	1375.72	1146.96	1375.41
1156.95	1375.05	1160.14	1374.94	1160.66	1374.93	1168.67	1374.86	1169.23	1374.83
1175.97	1374.83	1177.16	1374.84	1180.03	1374.85	1200	1374.95		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.07	889.76	.044	950.31	.039	1038.96	.044	1107.01	.025
1123	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
889.76	1107.01	100	100	100	.1	.3

CROSS SECTION OUTPUT *Profile #100 Year*

E.G. Elev (ft)	1374.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.040	
W.S. Elev (ft)	1373.86	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		665.54	
E.G. Slope (ft/ft)	0.002542	Area (sq ft)		665.54	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	193.20	Top Width (ft)		193.20	
Vel Total (ft/s)	4.52	Avg. Vel. (ft/s)		4.52	
Max Chl Dpth (ft)	5.34	Hydr. Depth (ft)		3.44	
Conv. Total (cfs)	59704.8	Conv. (cfs)		59704.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		194.35	
Min Ch El (ft)	1368.52	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		2.46	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		87.99	
C & E Loss (ft)	0.00	Cum SA (acres)		26.16	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.066

INPUT
Description: DIBBLE Sta 101+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, *flow is contained within Channel.*
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1374.94	802.86	1374.94	819.49	1374.94	831.36	1374.93	834.83	1374.93
841.16	1374.97	860.91	1375.02	862.86	1375.02	863.05	1375.02	863.2	1375.03
865.01	1375.08	874	1375.34	875.25	1375.39	876.64	1375.6	882.24	1376.43
883.37	1375.67	884.42	1375.22	886.68	1376.32	886.73	1376.35	888.4	1376.07
893	1375.3	920.01	1370.8	924.86	1370.8	934.01	1370.8	951.46	1370.8
951.5	1370.78	953.87	1369.66	958.53	1369.65	958.55	1369.65	964.62	1368.94

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1372.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.		0.039	
W.S. Elev (ft)	1371.87	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		621.14	
E.G. Slope (ft/ft)	0.003207	Area (sq ft)		621.14	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	194.46	Top Width (ft)		194.46	
Vel Total (ft/s)	4.85	Avg. Vel. (ft/s)		4.85	
Max Chl Dpth (ft)	4.26	Hydr. Depth (ft)		3.19	
Conv. Total (cfs)	53150.0	Conv. (cfs)		53150.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		195.19	
Min Ch El (ft)	1367.61	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		3.09	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)		77.44	
C & E Loss (ft)	0.01	Cum SA (acres)		23.03	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.933

INPUT
Description: DIBBLE Sta 94+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1373.38	800.74	1373.37	816.66	1373.42	820.88	1373.45	848.68	1373.65
857.93	1373.58	858.26	1373.57	858.36	1373.57	858.54	1373.57	874.19	1373.57
877.58	1374.2	879.6	1374.64	880.42	1374	882	1373.13	885.05	1374.49
885.1	1374.52	888.61	1373.93	893	1373.2	920	1368.7	934	1368.7
938.63	1368.7	940.73	1368.7	940.81	1368.61	941.41	1367.75	943.3	1367.67
945.21	1367.6	945.61	1367.59	946.18	1367.57	946.25	1367.57	946.31	1367.57
946.58	1367.55	947.38	1367.52	970	1367.19	972.91	1367.29	976.22	1367.02
978.35	1366.83	982.67	1367.28	984.07	1367.45	986.07	1367.41	995.34	1367.52
1000	1367.54	1009.61	1367.57	1011.74	1367.64	1014.31	1367.66	1019.26	1367.52
1023.78	1367.28	1025.51	1367.31	1027.85	1367.23	1032.72	1367.19	1044.83	1368.7
1070	1368.7	1080	1368.7	1107	1373.2				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	885.1	.044	938.63	.039	1044.83	.044	1070	.024
1080	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
885.1	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1371.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.		0.039	
W.S. Elev (ft)	1371.58	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		639.05	
E.G. Slope (ft/ft)	0.002889	Area (sq ft)		639.05	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	194.57	Top Width (ft)		194.57	
Vel Total (ft/s)	4.71	Avg. Vel. (ft/s)		4.71	
Max Chl Dpth (ft)	4.75	Hydr. Depth (ft)		3.28	
Conv. Total (cfs)	56004.9	Conv. (cfs)		56004.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		195.71	
Min Ch El (ft)	1366.83	Shear (lb/sq ft)		0.59	
Alpha	1.00	Stream Power (lb/ft s)		2.77	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)		76.00	
C & E Loss (ft)	0.00	Cum SA (acres)		22.58	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.914

INPUT
Description: DIBBLE Sta 93+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is

truncated at Right Bank Station, flow is contained within Channel.

Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1373.04	808.09	1373.02	820.57	1372.96	827.74	1372.92	830.24	1372.92
841.42	1372.97	854.14	1373.01	860.15	1372.98	862.04	1372.95	863.13	1373
876.79	1373.16	876.95	1373.17	877.36	1373.2	881.52	1373.67	881.99	1373.7
888.61	1374.26	890.72	1373.21	891.8	1372.66	892.44	1372.96	892.5	1372.98
893	1372.9	919.99	1368.4	933.43	1368.4	934	1368.4	939.14	1368.4
939.19	1368.39	940.39	1368.06	948.97	1367.92	949.56	1367.9	949.72	1367.9
949.76	1367.89	949.8	1367.89	950.07	1367.89	950.29	1367.88	965.22	1367.09
971.48	1367.11	972.45	1367.08	974.91	1366.94	975.86	1366.87	982.46	1367.03
984.43	1367.07	985.04	1367.05	992.76	1366.9	999.99	1367.03	1007.41	1367.16
1010.68	1367.19	1012.9	1367.24	1019.58	1367.37	1025.99	1367.61	1032.96	1367.91
1033.58	1368.05	1033.59	1368.04	1033.61	1368.15	1033.63	1368.39	1034.26	1368.4
1035.12	1368.4	1070	1368.4	1080.01	1368.4	1107	1372.9		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	892.5	.044	939.14	.039	1033.58	.044	1070	.024
1080.01	.044	1107	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
892.5	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1371.60	Element			
Vel Head (ft)	0.40	Wt. n-Val.		0.039	
W.S. Elev (ft)	1371.20	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		596.48	
E.G. Slope (ft/ft)	0.003640	Area (sq ft)		596.48	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	193.64	Top Width (ft)		193.64	
Vel Total (ft/s)	5.05	Avg. Vel. (ft/s)		5.05	
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)		3.08	
Conv. Total (cfs)	49887.2	Conv. (cfs)		49887.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		194.53	
Min Ch El (ft)	1366.87	Shear (lb/sq ft)		0.70	
Alpha	1.00	Stream Power (lb/ft s)		3.52	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)		74.58	
C & E Loss (ft)	0.00	Cum SA (acres)		22.14	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.896

INPUT
Description: DIBBLE Sta 92+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.

Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1372.43	815.84	1372.67	816.86	1372.69	817.61	1372.69	834.38	1372.51
848.35	1372.63	852.21	1372.63	856.69	1372.65	880.85	1372.76	890.97	1372.85
891.42	1372.85	891.47	1372.86	891.68	1372.82	893	1372.6	920	1368.1
928.22	1368.1	934	1368.1	942.29	1368.1	942.34	1368.06	942.81	1367.64
943.81	1367.63	958.79	1367.16	974.07	1366.75	978.05	1366.71	984.85	1366.71
1000	1366.56	1004.91	1366.52	1006.48	1366.51	1007.12	1366.5	1007.75	1366.49
1014.69	1366.42	1017.36	1366.4	1017.48	1366.4	1029.59	1367.31	1034.25	1368.1
1070	1368.1	1079.99	1368.1	1107	1372.6				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	891.47	.044	920	.039	1034.25	.044	1070	.024
1079.99	.044	1107	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
891.47	1107	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1371.24	Element			
Vel Head (ft)	0.40	Wt. n-Val.		0.039	
W.S. Elev (ft)	1370.84	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		593.85	
E.G. Slope (ft/ft)	0.003589	Area (sq ft)		593.85	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	

Top Width (ft)	192.84	Top Width (ft)	192.84
Vel Total (ft/s)	5.07	Avg. Vel. (ft/s)	5.07
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)	3.08
Conv. Total (cfs)	50244.3	Conv. (cfs)	50244.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	193.58
Min Ch El (ft)	1366.40	Shear (lb/sq ft)	0.69
Alpha	1.00	Stream Power (lb/ft s)	3.48
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	73.21
C & E Loss (ft)	0.04	Cum SA (acres)	21.69

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.877

INPUT
Description: DIBBLE Sta 91+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1372.05	801.34	1372.06	814.61	1372.06	825.17	1372.05	833.96	1372.07
853.71	1372.16	861.85	1372.14	881.97	1372.26	882.02	1372.26	883	1372.1
883.52	1372.02	910.01	1367.6	924.01	1367.6	939.62	1367.6	939.67	1367.55
940.5	1366.76	953.84	1366.49	961.44	1366.3	967.75	1366.35	971.05	1366.31
974.53	1366.27	981.78	1366.21	995.52	1366.19	998.25	1366.23	1000.01	1366.23
1010.89	1366.26	1021.07	1366.2	1024.17	1366.17	1030.14	1367.59	1030.19	1367.6
1080.01	1367.6	1090.01	1367.6	1117.01	1372.1				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	882.02	.044	939.67	.039	1030.19	.044	1080.01	.024
1090.01	.044	1117.01	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
882.02	1117.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1370.91	Element			
Vel Head (ft)	0.28	Wt. n-Val.		0.040	
W.S. Elev (ft)	1370.63	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		713.10	
E.G. Slope (ft/ft)	0.002382	Area (sq ft)		713.10	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	216.37	Top Width (ft)		216.37	
Vel Total (ft/s)	4.22	Avg. Vel. (ft/s)		4.22	
Max Chl Dpth (ft)	4.46	Hydr. Depth (ft)		3.30	
Conv. Total (cfs)	61669.9	Conv. (cfs)		61669.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		217.39	
Min Ch El (ft)	1366.17	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		2.06	
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)		71.71	
C & E Loss (ft)	0.00	Cum SA (acres)		21.22	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.858

INPUT
Description: DIBBLE Sta 90+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1372.1	811.61	1372.11	815.94	1372.11	819.55	1372.12	850.69	1371.97
851.43	1371.96	865.02	1371.87	865.24	1371.87	865.27	1371.87	865.3	1371.87
866.12	1371.89	866.79	1371.9	868.5	1371.94	880.7	1372.17	880.73	1372.17
880.75	1372.18	880.78	1372.17	880.98	1372.14	883	1371.8	899.05	1369.12
910	1367.3	924	1367.3	946.67	1367.3	946.72	1367.26	948.12	1366.25
948.89	1365.7	950.57	1365.72	968.04	1366.14	980.16	1366.28	984.62	1366.12
988.85	1365.96	998.59	1365.61	1000	1365.63	1006.61	1365.69	1016.28	1365.79
1019.37	1365.82	1020.54	1365.89	1020.84	1365.92	1033.11	1367.28	1033.16	1367.18
1033.32	1367.3	1080	1367.3	1090	1367.3	1117	1371.8		

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	880.98	.044	910	.044	946.67	.039	1033.32	.044
1080	.024	1090	.044	1117	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
880.98	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1370.68	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.040	
W.S. Elev (ft)	1370.41	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		728.37	
E.G. Slope (ft/ft)	0.002217	Area (sq ft)		728.37	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	217.35	Top Width (ft)		217.35	
Vel Total (ft/s)	4.13	Avg. Vel. (ft/s)		4.13	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		3.35	
Conv. Total (cfs)	63927.1	Conv. (cfs)		63927.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		218.58	
Min Ch El (ft)	1365.61	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		1.91	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		70.06	
C & E Loss (ft)	0.00	Cum SA (acres)		20.73	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.839

INPUT
Description: DIBBLE Sta 89+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1371.32	810.16	1371.3	821.19	1371.25	835.82	1371.38	839.05	1371.41
841.46	1371.42	856.88	1371.36	863.73	1371.43	868.12	1371.48	874.15	1371.53
874.99	1371.56	877.36	1371.62	880.57	1371.74	881.36	1371.76	881.41	1371.77
882.41	1371.6	883	1371.5	910	1367	918.35	1367	924	1367
962.35	1367	962.4	1366.99	964.25	1366.63	969.01	1366	980.05	1365.31
981.09	1365.32	999.73	1365.31	1000	1365.31	1000.04	1365.31	1000.48	1365.31
1012	1365.34	1015.02	1365.25	1021.56	1365.11	1028.89	1365.85	1034.51	1366.75
1034.53	1366.75	1034.55	1366.97	1034.57	1367	1034.72	1367	1034.76	1367
1036.08	1367	1052.54	1367	1080	1367	1090	1367	1117	1371.5

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	881.41	.044	962.35	.039	1034.57	.044	1080	.024
1090	.044	1117	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
881.41	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1370.46	Element			
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	1370.20	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		741.72	
E.G. Slope (ft/ft)	0.002146	Area (sq ft)		741.72	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	218.40	Top Width (ft)		218.40	
Vel Total (ft/s)	4.06	Avg. Vel. (ft/s)		4.06	
Max Chl Dpth (ft)	5.09	Hydr. Depth (ft)		3.40	
Conv. Total (cfs)	64974.6	Conv. (cfs)		64974.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		219.36	
Min Ch El (ft)	1365.11	Shear (lb/sq ft)		0.45	
Alpha	1.00	Stream Power (lb/ft s)		1.84	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		68.37	
C & E Loss (ft)	0.00	Cum SA (acres)		20.23	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.820

INPUT
Description: DIBBLE Sta 88+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1370.98	802.97	1370.99	812.58	1371.06	820.97	1371.1	826.67	1371.14
856.28	1371.06	856.86	1371.06	856.97	1371.06	857.14	1371.06	882.72	1371.29
882.77	1371.29	883	1371.25	910	1366.75	924	1366.75	964	1366.75
964.04	1366.74	969.71	1366.14	974.06	1366.12	977.44	1365.43	979.97	1364.99
980.16	1364.95	989.44	1364.88	999.3	1364.81	1000	1364.84	1002.93	1364.94
1007.65	1364.99	1010.45	1364.92	1017.42	1364.87	1017.57	1364.84	1023.42	1365.68
1024.51	1365.84	1030.39	1366.69	1030.41	1366.7	1030.44	1366.75	1030.78	1366.75
1080	1366.75	1090	1366.75	1117	1371.25				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	883	.044	964.04	.039	1030.44	.044	1080	.024
1090	.044	1117	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
883	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1370.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	1369.98	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		737.61	
E.G. Slope (ft/ft)	0.002214	Area (sq ft)		737.61	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	218.74	Top Width (ft)		218.74	
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)		4.08	
Max Chl Dpth (ft)	5.17	Hydr. Depth (ft)		3.37	
Conv. Total (cfs)	63976.9	Conv. (cfs)		63976.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		219.59	
Min Ch El (ft)	1364.81	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		1.89	
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)		66.67	
C & E Loss (ft)	0.00	Cum SA (acres)		19.72	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.801

INPUT
Description: DIBBLE Sta 87+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Right Bank Station, flow is contained within Channel.
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1370.71	807.6	1370.71	827.92	1370.67	836.86	1370.66	851.67	1370.75
866.09	1370.82	873.73	1370.85	876.09	1370.85	882.75	1370.95	882.8	1370.95
882.83	1370.96	883.01	1371	909.99	1366.5	924	1366.5	924.02	1366.5
964.19	1366.5	964.21	1366.5	964.25	1366.49	969.77	1365.2	970.61	1365
971.01	1364.91	971.29	1364.84	978.22	1364.92	982.38	1364.79	989.76	1364.45
991.9	1364.51	997.7	1364.68	1000	1364.69	1004.63	1364.7	1012.55	1364.67
1019.06	1365.84	1021.6	1366.06	1022.6	1366.25	1022.63	1366.26	1022.65	1366.51
1023.8	1366.5	1023.91	1366.5	1071.44	1366.5	1080	1366.5	1090.01	1366.5
1117.01	1371								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.06	883.01	.044	964.25	.039	1023.8	.044	1117.01	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
883.01	1117.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1370.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.042	
W.S. Elev (ft)	1369.75	Reach Len. (ft)	100.00	100.00	100.00

Crit W.S. (ft)		Flow Area (sq ft)	737.71
E.G. Slope (ft/ft)	0.002425	Area (sq ft)	737.71
Q Total (cfs)	3010.00	Flow (cfs)	3010.00
Top Width (ft)	218.97	Top Width (ft)	218.97
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)	4.08
Max Chl Dpth (ft)	5.30	Hydr. Depth (ft)	3.37
Conv. Total (cfs)	61122.4	Conv. (cfs)	61122.4
Length Wtd. (ft)	100.00	Wetted Per. (ft)	220.08
Min Ch El (ft)	1364.45	Shear (lb/sq ft)	0.51
Alpha	1.00	Stream Power (lb/ft s)	2.07
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	64.98
C & E Loss (ft)	0.00	Cum SA (acres)	19.22

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.782

INPUT
Description: DIBBLE Sta 86+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
882.64	1370.76	882.66	1370.76	882.72	1370.76	882.88	1370.8	882.97	1370.82
883.01	1370.83	910.01	1366.33	915.18	1366.33	924.01	1366.33	963.99	1366.33
964.05	1366.31	968.78	1365	969.04	1364.93	969.9	1364.69	970.6	1364.5
973.17	1364.5	985.06	1364.44	987.06	1364.42	999.13	1364.74	1000.01	1364.74
1001.4	1364.76	1009.77	1364.6	1010.19	1364.59	1011.48	1364.71	1014.59	1365
1018.41	1365.42	1023.58	1366	1026	1366.33	1080.01	1366.33	1090.01	1366.33
1117	1370.83								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
882.64	.055	910.01	.044	963.99	.039	1026	.044	1090.01	.044
1117	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
883.01	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1369.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.		0.042	
W.S. Elev (ft)	1369.48	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		717.56	
E.G. Slope (ft/ft)	0.002558	Area (sq ft)		717.56	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	217.82	Top Width (ft)		217.82	
Vel Total (ft/s)	4.19	Avg. Vel. (ft/s)		4.19	
Max Chl Dpth (ft)	5.06	Hydr. Depth (ft)		3.29	
Conv. Total (cfs)	59518.7	Conv. (cfs)		59518.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		218.69	
Min Ch El (ft)	1364.42	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.20	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		63.31	
C & E Loss (ft)	0.00	Cum SA (acres)		18.72	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.763

INPUT
Description: DIBBLE Sta 85+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
899	1371	929	1366.2	965	1366.2	968.01	1365.42	970.41	1364.84
983.54	1364.47	986.61	1364.45	997.05	1364.3	998.34	1364.27	1001.35	1364.35
1008.96	1364.54	1014.78	1364.44	1020.22	1364.3	1027	1365.16	1084	1365.16
1119	1371								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
899	.055	929	.044	968.01	.039	1027	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
899	1119	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1369.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.042	
W.S. Elev (ft)	1369.22	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		705.13	
E.G. Slope (ft/ft)	0.002470	Area (sq ft)		705.13	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	198.21	Top Width (ft)		198.21	
Vel Total (ft/s)	4.27	Avg. Vel. (ft/s)		4.27	
Max Chl Dpth (ft)	4.95	Hydr. Depth (ft)		3.56	
Conv. Total (cfs)	60562.4	Conv. (cfs)		60562.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		199.02	
Min Ch El (ft)	1364.27	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.33	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		61.67	
C & E Loss (ft)	0.01	Cum SA (acres)		18.24	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.744

INPUT
Description: DIBBLE Sta 84+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
914	1371.8	948	1366	968	1366	973	1364.6	978	1364
980	1364.1	980.56	1364.2	981.84	1364	983.61	1364.04	985.4	1364.07
986.24	1363.7	987.65	1363.82	989.66	1364.13	993.65	1364.04	994.85	1363.98
995.73	1364	998.93	1363.99	1008.94	1364.08	1013.2	1364.02	1015.03	1363.91
1018.08	1363.9	1030	1365	1084	1365	1117	1370.7	1122	1370.7

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
914	.055	948	.044	968	.039	1030	.044

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
914	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1369.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.		0.041	
W.S. Elev (ft)	1368.85	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		618.09	
E.G. Slope (ft/ft)	0.003164	Area (sq ft)		618.09	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	174.97	Top Width (ft)		174.97	
Vel Total (ft/s)	4.87	Avg. Vel. (ft/s)		4.87	
Max Chl Dpth (ft)	5.15	Hydr. Depth (ft)		3.53	
Conv. Total (cfs)	53509.6	Conv. (cfs)		53509.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		175.96	
Min Ch El (ft)	1363.70	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		3.38	
Frctn Loss (ft)	0.40	Cum Volume (acre-ft)		60.16	
C & E Loss (ft)	0.02	Cum SA (acres)		17.81	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.725

INPUT
Description: DIBBLE Sta 83+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
933	1371.5	975	1364.6	981	1361.6	983	1363.5	984.78	1363.66
989.75	1363.6	994.53	1363.37	1001.63	1363.61	1004.76	1363.71	1006.12	1363.76
1007.36	1363.8	1018.55	1363.65	1021.9	1363.8	1035.85	1364.93	1037	1365
1084	1365	1117	1370.2						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
933	.055	983	.039	1037	.044	1084	.055	1117	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
933	1117	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1368.79	Element			
Vel Head (ft)	0.55	Wt. n-Val.		0.043	
W.S. Elev (ft)	1368.24	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		505.20	
E.G. Slope (ft/ft)	0.005418	Area (sq ft)		505.20	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	151.71	Top Width (ft)		151.71	
Vel Total (ft/s)	5.96	Avg. Vel. (ft/s)		5.96	
Max Chl Dpth (ft)	6.64	Hydr. Depth (ft)		3.33	
Conv. Total (cfs)	40891.0	Conv. (cfs)		40891.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		153.80	
Min Ch El (ft)	1361.60	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)		6.62	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)		58.87	
C & E Loss (ft)	0.05	Cum SA (acres)		17.44	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.706

INPUT
Description: DIBBLE Sta 82+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
924	1371.5	968	1364.4	974	1361.4	976	1363.7	985.1	1363.06
986.78	1362.98	990.4	1363.23	992.08	1363.24	995.34	1363.01	997.65	1363
1000.35	1362.95	1010.29	1363.14	1020.15	1363.4	1023.99	1363.48	1029.65	1363.9
1041	1364.75	1105	1364.75	1136	1369.9	1141	1369.9		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
924	.055	976	.039	1041	.044	1105	.055	1136	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
924	1136	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1368.30	Element			
Vel Head (ft)	0.39	Wt. n-Val.		0.042	
W.S. Elev (ft)	1367.91	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		602.80	
E.G. Slope (ft/ft)	0.003645	Area (sq ft)		602.80	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	177.83	Top Width (ft)		177.83	
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)		4.99	
Max Chl Dpth (ft)	6.51	Hydr. Depth (ft)		3.39	
Conv. Total (cfs)	49856.0	Conv. (cfs)		49856.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		180.22	
Min Ch El (ft)	1361.40	Shear (lb/sq ft)		0.76	
Alpha	1.00	Stream Power (lb/ft s)		3.80	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)		57.59	
C & E Loss (ft)	0.02	Cum SA (acres)		17.06	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.687

INPUT

Description: DIBBLE Sta 81+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel. The left bank of this cross section is shared by an incised retention basin.

Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
920	1371.5	964	1364	970	1361.2	973	1363.5	980	1363.69
980.78	1363.7	981.4	1363.7	982.6	1363.64	991.74	1362.84	991.84	1362.8
998.97	1362.74	1012.47	1362.88	1015.79	1362.9	1028.56	1362.78	1031.21	1362.8
1037	1364.5	1123	1364.5	1152	1369.2	1162	1369.2		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
920	.055	973	.039	1037	.044	1123	.055	1152	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
920	1152	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1367.95	Element			
Vel Head (ft)	0.31	Wt. n-Val.		0.042	
W.S. Elev (ft)	1367.65	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		679.07	
E.G. Slope (ft/ft)	0.002912	Area (sq ft)		679.07	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	199.81	Top Width (ft)		199.81	
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43	
Max Chl Dpth (ft)	6.45	Hydr. Depth (ft)		3.40	
Conv. Total (cfs)	55777.3	Conv. (cfs)		55777.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		202.07	
Min Ch El (ft)	1361.20	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		2.71	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)		56.12	
C & E Loss (ft)	0.02	Cum SA (acres)		16.63	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.668

INPUT
Description: DIBBLE Sta 80+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel. The left bank of this cross section is shared by an incised retention basin.

Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
926	1370.2	964	1364	970	1361	973	1363.5	979.95	1363.7
982.75	1363.8	983.21	1363.76	983.55	1363.71	993.99	1362.7	1000.43	1362.49
1001.36	1362.5	1017.84	1362.67	1020.39	1362.7	1027.09	1362.63	1037.78	1362.52
1038.66	1362.5	1040.75	1363.15	1044	1364.25	1142	1364.25	1169	1368.7
1179	1368.7								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
926	.055	973	.039	1044	.044	1142	.055	1169	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
926	1169	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1367.67	Element			
Vel Head (ft)	0.26	Wt. n-Val.		0.042	
W.S. Elev (ft)	1367.42	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		742.01	
E.G. Slope (ft/ft)	0.002434	Area (sq ft)		742.01	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	218.15	Top Width (ft)		218.15	
Vel Total (ft/s)	4.06	Avg. Vel. (ft/s)		4.06	
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)		3.40	

Conv. Total (cfs)	61014.3	Conv. (cfs)	61014.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	220.64
Min Ch El (ft)	1361.00	Shear (lb/sq ft)	0.51
Alpha	1.00	Stream Power (lb/ft s)	2.07
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	54.49
C & E Loss (ft)	0.00	Cum SA (acres)	16.15

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.649

INPUT
Description: DIBBLE Sta 79+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel. The left bank of this cross section is shared by an incised retention basin.

Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
947.9	1368.4	948	1368.3	948	1369	949	1369	949	1366
964	1363.7	967	1363.7	967.04	1363.67	968.84	1363.05	970.42	1362.8
981.79	1363	983.17	1363.14	985.09	1363.13	986.34	1363.13	989.82	1363.1
991.15	1363.04	993.16	1363	995.41	1362.94	1000.95	1362.82	1005.76	1362.7
1008.93	1362.64	1012.06	1362.57	1018.05	1362.44	1022.87	1362.3	1025.51	1362.3
1027.67	1362.46	1030.09	1362.66	1033.74	1362.97	1040.22	1363.45	1042.26	1363.6
1042.73	1363.64	1043.48	1363.68	1044.1	1363.7	1045.56	1363.7	1047	1364
1142	1364	1169	1368.3	1179	1368.3				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
947.9	.044	964	.039	1047	.044	1142	.055	1169	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
949	1169	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1367.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.043	
W.S. Elev (ft)	1367.12	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		708.67	
E.G. Slope (ft/ft)	0.003094	Area (sq ft)		708.67	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	212.56	Top Width (ft)		212.56	
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)		4.25	
Max Chl Dpth (ft)	4.82	Hydr. Depth (ft)		3.33	
Conv. Total (cfs)	54113.2	Conv. (cfs)		54113.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		214.34	
Min Ch El (ft)	1362.30	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		2.71	
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)		52.83	
C & E Loss (ft)	0.00	Cum SA (acres)		15.65	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.630

INPUT
Description: DIBBLE Sta 78+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
948.9	1367.4	949	1367.3	949	1368.5	950	1368.5	950	1365.1
962	1363.3	972	1363.3	982.16	1362.8	990.56	1362.58	1001.88	1362.97
1002.42	1363	1014.5	1362.61	1018.09	1362.5	1018.74	1362.48	1019.4	1362.46
1019.58	1362.5	1023.54	1362.4	1026.43	1362.36	1032.12	1362.85	1033.55	1362.97
1037.49	1363	1045.65	1363.16	1048	1363.75	1142	1363.75	1169	1368.1
1174	1368.1	1176	1367.5						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
948.9	.044	962	.039	1048	.044	1142	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
950	1169	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1367.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.043	
W.S. Elev (ft)	1366.75	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		674.14	
E.G. Slope (ft/ft)	0.003598	Area (sq ft)		674.14	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	210.62	Top Width (ft)		210.62	
Vel Total (ft/s)	4.46	Avg. Vel. (ft/s)		4.46	
Max Chl Dpth (ft)	4.39	Hydr. Depth (ft)		3.20	
Conv. Total (cfs)	50178.3	Conv. (cfs)		50178.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		212.78	
Min Ch El (ft)	1362.36	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		3.18	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		51.24	
C & E Loss (ft)	0.02	Cum SA (acres)		15.17	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.611

INPUT
Description: DIBBLE Sta 77+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
928.23	1367.79	963	1362	969	1359	972.24	1362.24	982.56	1362.15
984.41	1362.13	984.48	1362.13	985.23	1362.13	988.13	1362.1	990.73	1362.08
990.89	1362.08	991.96	1362.07	992.76	1362.07	992.81	1362.07	994.01	1362.06
994.74	1362.05	999.99	1362.02	1003.06	1362	1004.29	1362	1004.34	1362
1004.38	1362	1004.43	1362	1004.49	1362	1004.6	1362	1004.68	1362
1004.81	1362	1005.45	1362	1005.55	1362	1005.77	1362	1005.97	1362
1018.33	1362	1018.73	1362	1022.41	1362	1022.45	1362	1023.16	1362.05
1023.65	1362.08	1025.42	1362.2	1026.65	1362.29	1027.54	1362.35	1028.19	1362.39
1038.28	1363	1038.4	1363	1038.56	1363	1038.7	1363	1038.82	1363
1040.69	1363.2	1045	1363.4	1132	1363.4	1142	1363.4	1169	1368

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
928.23	.044	963	.055	972.24	.039	1045	.044	1132	.024
1142	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
928.23	1169	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1366.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.041	
W.S. Elev (ft)	1366.51	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		755.17	
E.G. Slope (ft/ft)	0.002267	Area (sq ft)		755.17	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	224.37	Top Width (ft)		224.37	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	7.51	Hydr. Depth (ft)		3.37	
Conv. Total (cfs)	63218.3	Conv. (cfs)		63218.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		227.10	
Min Ch El (ft)	1359.00	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.88	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		49.60	
C & E Loss (ft)	0.01	Cum SA (acres)		14.67	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.592

INPUT
Description: DIBBLE Sta 76+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 92

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900.5	1368.75	911.99	1366.85	913.42	1366.61	917.74	1365.89	945	1361.35
951	1358.4	954.33	1361.68	959.45	1361.66	959.85	1361.62	966.03	1361
966.07	1361	966.33	1361	966.38	1361	966.82	1361	966.87	1361
966.96	1361	967.3	1361.01	967.36	1361.01	967.4	1361	967.54	1361
967.6	1361	967.73	1360.99	969.09	1360.96	970.16	1360.92	970.57	1360.91
970.73	1360.9	970.78	1360.9	970.8	1360.9	970.86	1360.9	970.89	1360.89
971.14	1360.9	971.21	1360.9	971.33	1360.89	979.87	1360.91	980.84	1360.85
982.53	1360.76	982.6	1360.76	982.67	1360.76	982.81	1360.75	982.93	1360.76
983.36	1360.76	984.7	1360.81	985.01	1360.83	985.97	1360.77	986.26	1360.77
987.52	1360.72	989.15	1360.64	994.62	1360.48	996.43	1360.4	997.52	1360.36
1000	1360.28	1000.39	1360.27	1003.76	1360.49	1004.57	1360.55	1004.8	1360.56
1005.04	1360.58	1006.51	1360.69	1007.1	1360.74	1007.79	1360.79	1008.6	1360.86
1009.63	1360.94	1010.44	1361	1010.77	1361.04	1011.95	1361.18	1014.18	1361.45
1018.3	1361.95	1018.73	1362	1028.58	1362.53	1029.3	1362.56	1030.06	1362.6
1033.63	1362.78	1033.89	1362.8	1034.55	1362.83	1034.69	1362.84	1035.58	1362.88
1037.89	1363	1037.91	1363	1037.93	1363	1037.98	1363	1038.22	1363
1040.5	1363	1040.68	1363	1040.92	1363	1041.25	1363	1041.71	1363
1041.96	1363	1042.09	1363	1042.86	1363	1044.1	1363	1047	1363
1130	1364.1	1151	1367.75						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
900.5	.044	945	.055	954.33	.039	1151	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900.5	1151	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1366.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.040	
W.S. Elev (ft)	1366.35	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		833.51	
E.G. Slope (ft/ft)	0.001693	Area (sq ft)		833.51	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	227.95	Top Width (ft)		227.95	
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)		3.61	
Max Chl Dpth (ft)	7.95	Hydr. Depth (ft)		3.66	
Conv. Total (cfs)	73163.0	Conv. (cfs)		73163.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		230.76	
Min Ch El (ft)	1358.40	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.38	
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)		47.78	
C & E Loss (ft)	0.00	Cum SA (acres)		14.15	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.574

INPUT
Description: DIBBLE Sta 75+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1367.13	806.63	1367.24	808.06	1367.27	812.01	1367.28	815.23	1366.82
818.37	1366.45	818.76	1366.45	834.24	1366.48	838.54	1366.5	862.66	1366.62
863.34	1366.63	868.85	1366.65	869.89	1366.66	871.44	1366.67	873.45	1366.68
875.79	1366.72	878.42	1366.76	883.17	1366.92	885.81	1366.98	888.99	1368.01
891.35	1368.76	891.78	1368.87	892.32	1369.03	895.7	1369.12	903	1367.9
907.22	1367.2	914.81	1365.93	945	1360.9	949	1357.9	955.28	1362.18
958.15	1362.24	962.15	1361.43	965.08	1360.83	968.49	1360.13	984.89	1360.31
988.11	1360.32	990.42	1360.25	996.05	1360.04	999.1	1359.97	1000.01	1360.03
1001.04	1360.11	1002.14	1360.19	1002.74	1360.2	1004.41	1360.52	1008.31	1361.24
1009.87	1361.33	1012.11	1361.46	1012.41	1361.52	1013.56	1361.5	1013.9	1361.43
1015.43	1361.42	1015.86	1361.41	1017.19	1361.41	1017.56	1361.51	1019.16	1361.53
1020.79	1361.61	1021.15	1361.71	1022.6	1361.63	1024.53	1361.83	1024.69	1361.83
1028.97	1361.97	1038.63	1362.55	1046.14	1363	1057.55	1364	1120.01	1364
1130.01	1364	1151	1367.5	1154.68	1366.58	1157.77	1366.56	1160.2	1366.49
1160.23	1366.6	1160.25	1366.56	1163.11	1366.58	1168.14	1366.62	1172.5	1366.65

1187.81 1366.75 1200.01 1366.78

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	895.7	.044	945	.055	955.28	.039	1057.55	.044
1120.01	.024	1130.01	.044	1151	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
895.7	1151	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1366.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.041	
W.S. Elev (ft)	1366.16	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		805.14	
E.G. Slope (ft/ft)	0.001695	Area (sq ft)		805.14	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	229.56	Top Width (ft)		229.56	
Vel Total (ft/s)	3.74	Avg. Vel. (ft/s)		3.74	
Max Chl Dpth (ft)	8.26	Hydr. Depth (ft)		3.51	
Conv. Total (cfs)	73116.9	Conv. (cfs)		73116.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		232.96	
Min Ch El (ft)	1357.90	Shear (lb/sq ft)		0.37	
Alpha	1.00	Stream Power (lb/ft s)		1.37	
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)		45.89	
C & E Loss (ft)	0.00	Cum SA (acres)		13.62	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.555

INPUT
Description: DIBBLE Sta 74+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 62

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1366.37	808.96	1366.45	809.16	1366.45	809.42	1366.45	809.59	1366.46
810.33	1366.45	810.8	1366.46	810.89	1366.46	811	1366.46	814.06	1366.51
830.14	1366.58	838.52	1366.54	865.11	1366.49	866.7	1366.47	867.64	1366.48
867.78	1366.48	867.94	1366.48	868.17	1366.48	868.63	1366.48	869.49	1366.48
872.94	1366.49	884.95	1366.53	892.18	1368.77	894.02	1369.35	902.99	1367.85
906.67	1367.24	913.64	1366.08	945	1360.85	951	1357.8	954.48	1361.33
962.92	1361.48	970.26	1361.71	973.3	1361.79	978.09	1361.91	978.18	1361.91
981.62	1361.34	984.8	1360.75	992.01	1359.63	992.85	1359.49	994.21	1359.47
1000	1359.38	1003.95	1359.32	1010.24	1359.3	1017.13	1360.37	1028.7	1362.09
1029.67	1362.18	1033.09	1362.31	1035.15	1362.41	1035.2	1362.42	1037.07	1362.38
1045.73	1362.23	1047.78	1362.67	1049.75	1363.07	1053.36	1363.75	1120	1363.75
1130.01	1363.75	1151.01	1367.25	1154.94	1366.27	1154.99	1366.27	1176.77	1366.42
1192.75	1366.46	1200.01	1366.52						

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	894.02	.044	945	.055	954.48	.039	1053.36	.044
1120	.024	1130.01	.044	1151.01	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
894.02	1151.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1366.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.041	
W.S. Elev (ft)	1366.00	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		810.24	
E.G. Slope (ft/ft)	0.001647	Area (sq ft)		810.24	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	229.36	Top Width (ft)		229.36	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	8.20	Hydr. Depth (ft)		3.53	
Conv. Total (cfs)	74159.0	Conv. (cfs)		74159.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		232.76	
Min Ch El (ft)	1357.80	Shear (lb/sq ft)		0.36	
Alpha	1.00	Stream Power (lb/ft s)		1.33	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)		44.04	
C & E Loss (ft)	0.01	Cum SA (acres)		13.10	

CROSS SECTION RIVER: RIVER-1

REACH: Reach-1 RS: 5.536

INPUT
Description: DIBBLE Sta 73+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1366.64	826.61	1365.77	829.25	1365.72	840.34	1365.61	841.69	1365.6
842.11	1365.59	842.78	1365.59	843.69	1365.58	861.63	1365.47	870.97	1365.79
889.29	1366.11	891.56	1366.12	894.13	1366.13	895.31	1366.36	897.92	1366.87
898.21	1366.93	902	1366.3	935.01	1360.8	941	1357.8	944.29	1361.08
945.45	1361.1	948.28	1361.07	954.5	1360.94	954.79	1360.95	955.34	1360.95
956.84	1360.93	957.63	1360.91	961.12	1361.31	964.08	1361.68	965.08	1361.79
965.89	1361.91	970.42	1361.85	973.19	1361.84	975.2	1361.82	977.65	1361.81
985.95	1362.16	989.54	1362.31	995.6	1362.35	1000.01	1362.39	1001.52	1362.4
1003.9	1362.42	1005.32	1362.44	1006.2	1362.44	1006.89	1362.45	1007.43	1362.45
1007.84	1362.45	1011.91	1362.44	1020.74	1362.19	1024.97	1362.08	1031.51	1361.92
1041.37	1361.77	1049.07	1363.5	1049.14	1363.5	1120.01	1363.5	1130.01	1363.5
1151.01	1367	1155.12	1365.97	1155.18	1365.98	1168.28	1366.04	1176.67	1366.13
1181.03	1366.15	1194.93	1366.3	1200	1366.35				

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	898.21	.044	935.01	.055	944.29	.039	1049.07	.044
1120.01	.024	1130.01	.044	1151.01	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
898.21	1151.01	100	100	100	.1	.3

Left Levee Station= 898.21 Elevation= 1366.93

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1366.00	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.041	
W.S. Elev (ft)	1365.73	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1364.28	Flow Area (sq ft)		721.42	
E.G. Slope (ft/ft)	0.002739	Area (sq ft)		721.42	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	237.93	Top Width (ft)		237.93	
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)		4.17	
Max Chl Dpth (ft)	7.93	Hydr. Depth (ft)		3.03	
Conv. Total (cfs)	57517.0	Conv. (cfs)		57517.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		240.86	
Min Ch El (ft)	1357.80	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		2.14	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)		42.28	
C & E Loss (ft)	0.00	Cum SA (acres)		12.56	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.517

INPUT
Description: DIBBLE Sta 72+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1365.88	818.58	1365.91	818.65	1365.91	818.71	1365.91	818.75	1365.91
818.78	1365.91	818.81	1365.91	818.85	1365.91	818.87	1365.91	818.88	1365.91
818.9	1365.91	818.91	1365.91	818.94	1365.91	818.98	1365.91	819	1365.91
819.04	1365.91	819.07	1365.92	819.13	1365.92	819.24	1365.92	819.44	1365.93
819.81	1365.92	830.53	1366.06	833.55	1366.03	847.06	1365.82	856.06	1365.77
873.32	1365.8	874.58	1365.81	875.24	1365.81	876.05	1365.82	876.35	1365.83
876.66	1365.83	877.45	1365.83	879.14	1365.85	885.83	1365.89	892.3	1365.94
894.86	1366.55	897.01	1367.08	902	1366.25	935.01	1360.75	941	1357.7
944.85	1361.59	948.64	1361.31	956.39	1360.75	959.18	1360.78	973	1361.42
981.51	1361.88	987.35	1362.21	987.66	1362.27	988.18	1362.38	988.82	1362.46
990.25	1362.45	1000.01	1362.14	1016.18	1361.63	1026.62	1361.5	1027.39	1361.5
1028.69	1361.47	1030.57	1361.43	1033.1	1361.38	1036.42	1361.3	1039.75	1361.25
1041.78	1361.49	1044.46	1361.79	1046.6	1362.11	1051.14	1363.25	1120.01	1363.25
1130	1363.25	1151.01	1366.75	1154.92	1365.78	1155.16	1365.72	1155.19	1365.86
1155.2	1365.77	1157.12	1365.73	1168.76	1365.89	1185.3	1366.05	1189.62	1366.13
1197.91	1366.15	1200	1366.16						

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	897.01	.044	935.01	.055	944.85	.039	1051.14	.044

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 1120.01    .024    1130    .044 1151.01    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        897.01 1151.01              100     100     100            .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1365.72   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.27   Wt. n-Val.                           0.041
  W.S. Elev (ft)            1365.45   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    719.09
  E.G. Slope (ft/ft)       0.002729   Area (sq ft)                         719.09
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             236.43   Top Width (ft)                       236.43
  Vel Total (ft/s)             4.19   Avg. Vel. (ft/s)                       4.19
  Max Chl Dpth (ft)            7.75   Hydr. Depth (ft)                       3.04
  Conv. Total (cfs)         57619.4   Conv. (cfs)                         57619.4
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     239.65
  Min Ch El (ft)            1357.70   Shear (lb/sq ft)                       0.51
  Alpha                        1.00   Stream Power (lb/ft s)                 2.14
  Frctn Loss (ft)              0.25   Cum Volume (acre-ft)                  40.63
  C & E Loss (ft)              0.01   Cum SA (acres)                        12.02


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.498

INPUT
Description: DIBBLE Sta 71+00

Even foot station data is scaled from 1"=20'
             Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data     num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     800 1365.31  823.14  1365.1  848.83 1365.01  851.32 1365.01     869 1365.23
   879.5 1365.24  886.79 1365.47  887.51 1365.48  893.87 1367.32     902 1365.97
     935 1360.47     941  1357.5   944.5 1360.97  949.09 1360.83   953.7 1360.69
  957.04 1360.59  961.66 1360.38  964.07 1360.46  974.22  1360.8  979.27 1361.03
  990.47  1361.5  990.52  1361.5  991.55 1361.53  992.44 1361.52  999.99 1361.48
 1011.12 1361.42 1017.24 1361.39 1020.44 1361.46 1027.95 1361.43 1029.94 1361.41
 1035.41 1361.39 1042.86 1361.38 1046.63  1361.6  1049.5 1361.77 1050.15 1361.81
 1058.44    1363    1120    1363 1129.99    1363    1151  1366.5 1155.16 1365.46
 1155.72 1365.32 1155.76 1365.49 1161.39 1365.45 1173.43 1365.46 1184.04 1365.53
 1189.57  1365.6    1200  1365.7

Manning's n Values         num=       8
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     800    .055  893.87    .044     935    .055   944.5    .039 1058.44    .044
    1120    .024 1129.99    .044    1151    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        893.87    1151              100     100     100            .1       .3
Left Levee       Station=  893.87      Elevation= 1367.32
Right Levee      Station=    1151      Elevation=  1366.5

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1365.46   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.25   Wt. n-Val.                           0.041
  W.S. Elev (ft)            1365.21   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)            1363.66   Flow Area (sq ft)                    747.64
  E.G. Slope (ft/ft)       0.002363   Area (sq ft)                         747.64
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             236.73   Top Width (ft)                       236.73
  Vel Total (ft/s)             4.03   Avg. Vel. (ft/s)                       4.03
  Max Chl Dpth (ft)            7.71   Hydr. Depth (ft)                       3.16
  Conv. Total (cfs)         61916.7   Conv. (cfs)                         61916.7
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     239.56
  Min Ch El (ft)            1357.50   Shear (lb/sq ft)                       0.46
  Alpha                        1.00   Stream Power (lb/ft s)                 1.85
  Frctn Loss (ft)              0.24   Cum Volume (acre-ft)                  38.94
  C & E Loss (ft)              0.00   Cum SA (acres)                        11.47


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.479

INPUT
Description: DIBBLE Sta 70+00

Even foot station data is scaled from 1"=20'
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Horiz, 1"=10' Vert Construction Drawings.

Station Elevation Data num= 108

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1365.46	804.8	1365.5	808.52	1365.57	810.83	1365.61	812.57	1365.47
813.15	1365.45	814.53	1365.36	815.46	1365.32	816.63	1365.25	818.47	1365.14
819.16	1365.11	821.38	1365.01	821.64	1364.99	822.6	1364.94	824.75	1364.94
827.19	1364.97	829.24	1365.01	831.37	1365.14	833.21	1365.13	834.38	1365.12
835.58	1365.12	836.95	1365.11	837.95	1365.08	839.06	1365.08	840	1365.09
842.24	1365.08	857.76	1365.16	858.42	1365.16	858.86	1365.16	859.3	1365.15
859.93	1365.11	860.19	1365.12	860.53	1365.12	860.87	1365.12	861.13	1365.13
861.45	1365.14	861.78	1365.14	862.08	1365.15	862.4	1365.15	862.56	1365.14
884.36	1365.18	884.56	1365.18	887.72	1366.16	894.39	1368.25	894.85	1368.19
894.91	1368.19	905.39	1366.45	910.22	1365.64	943.47	1360.1	949	1357
952.14	1359.76	953.45	1359.8	953.48	1359.79	953.73	1359.83	954.06	1359.86
954.66	1359.92	956.48	1360.14	957.74	1360.26	962.04	1360.67	962.27	1360.66
963.71	1360.7	965.95	1360.74	966.89	1360.75	969.97	1360.81	983.72	1361.16
985.06	1361.2	987.26	1361.27	991.03	1361.4	994.33	1361.46	994.84	1361.53
996.19	1361.35	996.2	1361.35	998.15	1361.39	998.73	1361.36	999.96	1361.35
1000.01	1361.35	1001.08	1361.25	1001.44	1361.2	1003.06	1361.02	1004.06	1360.88
1004.95	1360.71	1006.23	1360.58	1006.52	1360.53	1007.64	1360.43	1008.52	1360.45
1009.87	1360.47	1012.93	1360.48	1015.31	1360.5	1019.14	1360.53	1024.01	1360.81
1036.56	1360.62	1037.92	1360.62	1040.21	1360.6	1046.47	1360.4	1046.6	1360.37
1047.71	1360.67	1048.6	1360.91	1056.56	1362.75	1120.01	1362.75	1130.01	1362.75
1151.01	1366.25	1155.77	1365.07	1155.82	1365.06	1160.46	1365.01	1162.69	1364.97
1165.29	1364.98	1190.21	1365.24	1200.01	1365.26				

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	894.91	.044	943.47	.055	952.14	.039	1056.56	.044
1120.01	.024	1130.01	.044	1151.01	.055				

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
894.91	1151.01	100	100	100	.1	.3

Left Levee Station= 894.91 Elevation= 1368.19

Right Levee Station= 1151.01 Elevation= 1366.25

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1365.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.041	
W.S. Elev (ft)	1364.96	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1363.37	Flow Area (sq ft)		733.90	
E.G. Slope (ft/ft)	0.002379	Area (sq ft)		733.90	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	229.03	Top Width (ft)		229.03	
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)		4.10	
Max Chl Dpth (ft)	7.96	Hydr. Depth (ft)		3.20	
Conv. Total (cfs)	61717.2	Conv. (cfs)		61717.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		231.90	
Min Ch El (ft)	1357.00	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.93	
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)		37.24	
C & E Loss (ft)	0.00	Cum SA (acres)		10.94	

CROSS SECTION RIVER: RIVER-1

REACH: Reach-1 RS: 5.460

INPUT

Description: DIBBLE Sta 69+00

Even foot station data is scaled from 1"=20'

Horiz, 1"=10' Vert Construction Drawings.

Station Elevation Data num= 83

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1364.87	813.73	1364.83	838.11	1364.72	841.26	1364.72	844.93	1364.74
868.78	1364.95	879.84	1365.33	881.85	1365.38	883.08	1365.5	891.42	1366.26
892.87	1366.36	893.8	1366.45	899.81	1367.17	900.39	1367.27	901.63	1367.5
903.08	1367.73	904.73	1367.74	909.67	1366.91	917.06	1365.68	925.1	1364.34
951	1359.9	958	1356.9	962	1361.3	962.08	1361.33	964.36	1361.28
966.39	1361.22	967.66	1361.19	978.74	1360.82	979.17	1360.81	979.77	1360.8
980.71	1360.78	981.61	1360.75	982.51	1360.7	983.81	1360.66	985.37	1360.63
987.51	1360.62	997.62	1360.51	998.18	1360.53	998.62	1360.55	999.3	1360.6
999.58	1360.59	1000	1360.59	1000.41	1360.59	1000.54	1360.59	1000.86	1360.57
1002.03	1360.51	1002.39	1360.5	1004.18	1360.45	1004.64	1360.42	1004.81	1360.41
1006.81	1360.4	1006.93	1360.4	1008.89	1360.4	1008.96	1360.39	1011.1	1360.42
1011.13	1360.41	1011.25	1360.41	1013.12	1360.44	1015.3	1360.6	1017.01	1360.71
1020.19	1360.6	1022.43	1360.58	1024.63	1360.54	1026.88	1360.49	1028.15	1360.45
1029.03	1360.42	1029.93	1360.38	1030.52	1360.33	1030.89	1360.3	1031.18	1360.28
1033.96	1360.21	1046.04	1360.32	1059.37	1360.54	1075.67	1362.5	1120.01	1362.5
1130.01	1362.5	1151	1366	1154.89	1365.03	1154.94	1365.03	1171.61	1365.03

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 1181.53 1364.92 1199.14 1365.12    1200 1365.13

Manning's n Values        num=       8
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     800    .055  904.73    .044     951    .055     962    .039 1075.67    .044
 1120.01    .024 1130.01    .044    1151    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        904.73    1151              100     100     100             .1       .3
Left Levee       Station=  904.73      Elevation= 1367.74

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1364.99   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.27   Wt. n-Val.                            0.041
  W.S. Elev (ft)            1364.72   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)            1363.08   Flow Area (sq ft)                     724.66
  E.G. Slope (ft/ft)       0.002400   Area (sq ft)                          724.66
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             220.49   Top Width (ft)                        220.49
  Vel Total (ft/s)             4.15   Avg. Vel. (ft/s)                        4.15
  Max Chl Dpth (ft)            7.82   Hydr. Depth (ft)                        3.29
  Conv. Total (cfs)         61439.6   Conv. (cfs)                          61439.6
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      223.81
  Min Ch El (ft)            1356.90   Shear (lb/sq ft)                        0.49
  Alpha                        1.00   Stream Power (lb/ft s)                  2.02
  Frctn Loss (ft)              0.23   Cum Volume (acre-ft)                   35.57
  C & E Loss (ft)              0.01   Cum SA (acres)                         10.42


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.441

INPUT
Description: DIBBLE Sta 68+00

Even foot station data is scaled from 1"=20'
             Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
             truncated at Left Bank Station, flow is contained within Channel.
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  908.07 1367.55     955  1359.7     961  1356.7     965    1361  965.32 1361.05
   973.5 1360.85  987.85 1360.51  991.88 1360.52    1000 1360.55 1000.26 1360.55
 1003.68 1360.52 1005.56 1360.51 1009.63 1360.43 1015.26 1360.27 1022.16 1360.64
 1023.34  1360.7 1026.52 1360.44  1027.9 1360.39 1028.73 1360.33 1032.03 1360.22
 1042.91 1360.11 1050.32 1360.17 1051.14 1360.18 1052.41 1360.17 1054.22 1360.16
 1057.06 1360.15 1057.39 1360.15 1061.75 1361.02  1064.7 1360.17 1066.41 1360.21
 1075.58  1361.6 1120.01  1361.6 1130.01  1361.6 1151.01  1365.1 1151.71 1364.93
 1151.83 1364.96 1152.04 1364.94 1152.64 1364.89 1153.01 1364.85 1153.04  1364.9
 1153.07 1364.84 1180.05 1364.84 1180.54 1364.83 1181.11 1364.84 1199.56    1365
 1200.01    1365

Manning's n Values        num=       7
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  908.07    .044     955    .055     965    .039 1075.58    .044 1120.01    .024
 1130.01    .044 1151.01    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        908.07 1151.01              100     100     100             .1       .3
Left Levee       Station=  908.07      Elevation= 1367.55

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1364.75   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.25   Wt. n-Val.                            0.040
  W.S. Elev (ft)            1364.51   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)            1362.71   Flow Area (sq ft)                     755.96
  E.G. Slope (ft/ft)       0.002151   Area (sq ft)                          755.96
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             221.19   Top Width (ft)                        221.19
  Vel Total (ft/s)             3.98   Avg. Vel. (ft/s)                        3.98
  Max Chl Dpth (ft)            7.81   Hydr. Depth (ft)                        3.42
  Conv. Total (cfs)         64897.6   Conv. (cfs)                          64897.6
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      224.76
  Min Ch El (ft)            1356.70   Shear (lb/sq ft)                        0.45
  Alpha                        1.00   Stream Power (lb/ft s)                  1.80
  Frctn Loss (ft)              0.23   Cum Volume (acre-ft)                   33.87
  C & E Loss (ft)              0.00   Cum SA (acres)                          9.92
```

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.422

INPUT
Description: DIBBLE Sta 67+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Left Bank Station, flow is contained within Channel.
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
910	1367.06	955	1359.5	961	1356.7	965	1360.5	965.02	1360.58
965.29	1360.59	966.06	1360.53	967.33	1360.46	968.49	1360.45	969.12	1360.46
977.04	1360.63	978.29	1360.65	979.77	1360.68	987.83	1360.78	989.14	1360.84
989.61	1360.89	990.18	1360.91	991.92	1360.94	992.4	1360.95	993.93	1360.96
999.08	1361.07	999.94	1361.08	1000.62	1361.09	1001.17	1361.08	1002.33	1361.03
1002.94	1361.03	1004.36	1361.05	1011.13	1360.76	1018.15	1360.58	1020.45	1360.5
1021.38	1360.47	1023.85	1360.39	1029.89	1360.24	1039.81	1359.91	1052.89	1359.63
1053.39	1359.61	1054.05	1359.6	1054.79	1359.58	1055.9	1359.55	1056.94	1359.52
1059.6	1359.46	1059.75	1359.44	1061.33	1359.54	1070.47	1361.35	1120.01	1361.35
1130	1361.35	1151	1364.85	1151.58	1364.71	1152.16	1364.57	1152.35	1364.52
1152.39	1364.7	1159.17	1364.58	1161.95	1364.52	1179.91	1364.64	1189.48	1364.73
1198.75	1364.66	1200.01	1364.66						

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
910	.044	955	.055	965	.039	1070.47	.044	1120.01	.024
1130	.044	1151	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
910	1151	100	100	100	.1	.3

Left Levee Station= 910 Elevation= 1367.06

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1364.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.041	
W.S. Elev (ft)	1364.26	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1362.58	Flow Area (sq ft)		731.52	
E.G. Slope (ft/ft)	0.002415	Area (sq ft)		731.52	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	220.81	Top Width (ft)		220.81	
Vel Total (ft/s)	4.11	Avg. Vel. (ft/s)		4.11	
Max Chl Dpth (ft)	7.56	Hydr. Depth (ft)		3.31	
Conv. Total (cfs)	61254.4	Conv. (cfs)		61254.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		223.87	
Min Ch El (ft)	1356.70	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		2.03	
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)		32.16	
C & E Loss (ft)	0.00	Cum SA (acres)		9.41	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.403

INPUT
Description: DIBBLE Sta 66+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Left Bank Station, flow is contained within Channel.
Station Elevation Data num= 44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
913	1366.3	953	1359.5	959	1356.5	962	1359.5	962.8	1359.54
965.12	1359.7	970.87	1360.09	981.18	1360.26	993.13	1360.46	995.67	1360.46
998.95	1360.46	1001	1360.46	1002.05	1360.46	1005.71	1360.36	1012.39	1360.27
1013.24	1360.24	1014.58	1360.18	1017.15	1360.05	1018.66	1360	1021.04	1359.95
1023.3	1359.88	1036.61	1359.6	1038.03	1359.58	1039.36	1359.56	1044.34	1359.81
1048.04	1360	1053.21	1359.73	1053.34	1359.72	1065.46	1361.1	1120	1361.1
1130	1361.1	1151	1364.6	1151.51	1364.48	1152.5	1364.23	1152.72	1364.17
1152.76	1364.25	1152.77	1364.48	1154.1	1364.48	1170.88	1364.48	1179.11	1364.65
1196.94	1364.4	1198.4	1364.39	1199.67	1364.4	1200	1364.4		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
913	.044	953	.055	962	.039	1065.46	.044	1130	.035

```
    1151     .055

 Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
            913     1151               100     100     100              .1        .3

 CROSS SECTION OUTPUT     Profile #100 Year

   E.G. Elev (ft)            1364.28   Element                    Left OB    Channel    Right OB
   Vel Head (ft)                0.26   Wt. n-Val.                            0.041
   W.S. Elev (ft)            1364.02   Reach Len. (ft)            100.00     100.00     100.00
   Crit W.S. (ft)            1362.35   Flow Area (sq ft)                     733.38
   E.G. Slope (ft/ft)       0.002482   Area (sq ft)                          733.38
   Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
   Top Width (ft)             221.08   Top Width (ft)                        221.08
   Vel Total (ft/s)             4.10   Avg. Vel. (ft/s)                        4.10
   Max Chl Dpth (ft)            7.52   Hydr. Depth (ft)                        3.32
   Conv. Total (cfs)         60422.7   Conv. (cfs)                         60422.7
   Length Wtd. (ft)           100.00   Wetted Per. (ft)                      223.78
   Min Ch El (ft)            1356.50   Shear (lb/sq ft)                        0.51
   Alpha                        1.00   Stream Power (lb/ft s)                  2.08
   Frctn Loss (ft)              0.24   Cum Volume (acre-ft)                   30.48
   C & E Loss (ft)              0.00   Cum SA (acres)                          8.90


 CROSS SECTION           RIVER: RIVER-1
 REACH: Reach-1             RS: 5.384

 INPUT
 Description: DIBBLE Sta 65+00

 Even foot station data is scaled from 1"=20'
              Horiz, 1"=10' Vert Construction Drawings.

 Cross Section is
              truncated at Bank Stations, flow is contained within Channel.
 Station Elevation Data     num=       36
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      909   1365.6      940   1360.8      942   1360.8      944   1359.5   950.37   1359.41
   959.58  1359.19   970.65  1359.44   970.88  1359.45    971.9  1359.53   972.97    1359.6
   977.11  1359.88   978.89  1359.95    982.5  1360.11   990.28  1360.29   990.82    1360.3
   991.78  1360.26    992.2  1360.26    996.1  1360.12   998.69  1360.04  1000.65   1359.95
  1002.45  1359.87   1016.9  1359.33  1018.28  1359.28  1020.24  1359.22  1020.57   1359.23
   1032.4   1359.4  1034.06  1359.43  1036.72  1359.27  1038.45  1359.21  1043.59   1359.38
  1045.86  1359.25  1046.93  1359.18   1055.9  1360.85     1120  1360.85     1130   1360.85
     1151  1364.35

 Manning's n Values         num=        4
      Sta    n Val      Sta    n Val      Sta    n Val      Sta    n Val
      909     .055      944     .039   1055.9     .044     1151     .055

 Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
            909     1151               100     100     100              .1        .3

 CROSS SECTION OUTPUT     Profile #100 Year

   E.G. Elev (ft)            1364.04   Element                    Left OB    Channel    Right OB
   Vel Head (ft)                0.25   Wt. n-Val.                            0.041
   W.S. Elev (ft)            1363.79   Reach Len. (ft)            100.00     100.00     100.00
   Crit W.S. (ft)                      Flow Area (sq ft)                     753.64
   E.G. Slope (ft/ft)       0.002240   Area (sq ft)                          753.64
   Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
   Top Width (ft)             226.97   Top Width (ft)                        226.97
   Vel Total (ft/s)             3.99   Avg. Vel. (ft/s)                        3.99
   Max Chl Dpth (ft)            4.61   Hydr. Depth (ft)                        3.32
   Conv. Total (cfs)         63596.1   Conv. (cfs)                         63596.1
   Length Wtd. (ft)           100.00   Wetted Per. (ft)                      228.04
   Min Ch El (ft)            1359.18   Shear (lb/sq ft)                        0.46
   Alpha                        1.00   Stream Power (lb/ft s)                  1.85
   Frctn Loss (ft)              0.21   Cum Volume (acre-ft)                   28.77
   C & E Loss (ft)              0.01   Cum SA (acres)                          8.39


 CROSS SECTION           RIVER: RIVER-1
 REACH: Reach-1             RS: 5.365

 INPUT
 Description: DIBBLE Sta 64+00

 Even foot station data is scaled from 1"=20'
              Horiz, 1"=10' Vert Construction Drawings.
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Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
903	1364.7	927	1360.3	949	1360.3	951.19	1359.7	952.4	1359.13
962.44	1359.22	970.82	1359.31	972.43	1359.32	972.81	1359.31	973.05	1359.31
973.19	1359.32	973.37	1359.31	973.85	1359.3	974.44	1359.29	974.54	1359.28
974.69	1359.27	974.97	1359.25	975.73	1359.2	982.78	1358.77	983.77	1358.87
987.58	1359.27	991.93	1359.46	993.08	1359.51	993.9	1359.44	1000.7	1359.14
1017.19	1359.06	1027.55	1359.03	1034.44	1359.07	1035.09	1359.07	1036.55	1359.09
1038.72	1359.11	1041.38	1359.14	1042.34	1359.55	1043.97	1360.26	1044.77	1360.6
1112.5	1360.6	1122.5	1360.6	1143.48	1364.1	1143.5	1364.1		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
903	.055	927	.044	949	.039	1044.77	.044	1122.5	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
903	1143.5	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1363.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.041	
W.S. Elev (ft)	1363.59	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		781.88	
E.G. Slope (ft/ft)	0.002044	Area (sq ft)		781.88	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	231.36	Top Width (ft)		231.36	
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)		3.85	
Max Chl Dpth (ft)	4.82	Hydr. Depth (ft)		3.38	
Conv. Total (cfs)	66573.9	Conv. (cfs)		66573.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		232.48	
Min Ch El (ft)	1358.77	Shear (lb/sq ft)		0.43	
Alpha	1.00	Stream Power (lb/ft s)		1.65	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)		27.01	
C & E Loss (ft)	0.00	Cum SA (acres)		7.86	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.346

INPUT
Description: DIBBLE Sta 63+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
893	1364	913	1360.4	958	1360.4	959.15	1360.1	962.68	1359.35
964.53	1359.29	965.74	1359.24	975.28	1358.88	981.61	1358.67	983.17	1358.6
985.8	1358.52	990.43	1359.03	990.44	1359.03	990.48	1359.03	994.45	1359.22
996.8	1359.16	1003.35	1359	1006.28	1358.93	1008.16	1358.89	1009.51	1358.85
1015.19	1358.67	1020.43	1358.79	1020.95	1358.8	1021.67	1358.82	1022.68	1358.85
1023.79	1358.87	1025.28	1358.91	1027.56	1358.97	1031.93	1359.13	1039.98	1359.46
1040.27	1359.57	1041.83	1360.15	1041.84	1360.17	1041.88	1360.35	1042.38	1360.35
1105.01	1360.35	1115.01	1360.35	1136.01	1363.85				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
893	.055	913	.044	959.15	.039	1042.38	.044	1115.01	.055
1136.01	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
893	1136.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1363.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.041	
W.S. Elev (ft)	1363.37	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		769.16	
E.G. Slope (ft/ft)	0.002260	Area (sq ft)		769.16	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	236.58	Top Width (ft)		236.58	
Vel Total (ft/s)	3.91	Avg. Vel. (ft/s)		3.91	
Max Chl Dpth (ft)	4.85	Hydr. Depth (ft)		3.25	
Conv. Total (cfs)	63320.8	Conv. (cfs)		63320.8	

Length Wtd. (ft)	100.00	Wetted Per. (ft)	237.56
Min Ch El (ft)	1358.52	Shear (lb/sq ft)	0.46
Alpha	1.00	Stream Power (lb/ft s)	1.79
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	25.23
C & E Loss (ft)	0.00	Cum SA (acres)	7.32

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.327

INPUT
Description: DIBBLE Sta 62+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 83

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1363.63	808.85	1363.58	814.29	1363.61	825.99	1363.68	833.11	1363.71
836.41	1363.71	851.93	1363.48	863.97	1363.33	872.85	1363.35	877.09	1363.35
877.89	1363.36	877.94	1363.36	878	1363.35	878.99	1363.6	891.4	1361.53
900	1360.1	914.01	1360.1	968.36	1360.1	968.46	1360.1	968.51	1360.1
968.52	1360.1	968.53	1360.09	968.55	1360.07	968.58	1360.05	969.68	1359.56
972.07	1358.48	972.78	1358.52	998.67	1358.76	1000.77	1358.79	1001.58	1358.62
1001.87	1358.56	1001.96	1358.54	1004.08	1358.5	1029.34	1358.85	1036.61	1358.79
1039.27	1358.82	1039.35	1358.82	1039.45	1358.85	1042.32	1359.87	1042.34	1359.97
1042.35	1359.81	1042.38	1360.1	1042.42	1360.1	1042.64	1360.1	1042.72	1360.1
1042.79	1360.1	1042.94	1360.1	1042.97	1360.1	1091.9	1360.1	1097.5	1360.1
1107.5	1360.1	1128.51	1363.6	1128.53	1363.6	1129.12	1363.45	1129.16	1363.45
1129.19	1363.44	1129.53	1363.4	1131.59	1363.4	1132.31	1363.38	1134.35	1363.36
1134.85	1363.35	1135.63	1363.31	1138.79	1363.39	1140.16	1363.38	1141.65	1363.34
1143.12	1363.32	1144.26	1363.35	1146.47	1363.33	1149.81	1363.34	1151.14	1363.32
1152.04	1363.28	1152.81	1363.26	1155.06	1363.34	1156.05	1363.36	1158.37	1363.38
1159.88	1363.34	1159.92	1363.56	1159.93	1363.5	1167.14	1363.61	1182.13	1363.66
1190.71	1363.69	1194.7	1363.71	1200.01	1363.73				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	878.99	.044	968.52	.039	1042.38	.044	1107.5	.055
1128.51	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
878.99	1128.51	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1363.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.042	
W.S. Elev (ft)	1363.15	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		789.57	
E.G. Slope (ft/ft)	0.002225	Area (sq ft)		789.57	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	244.12	Top Width (ft)		244.12	
Vel Total (ft/s)	3.81	Avg. Vel. (ft/s)		3.81	
Max Chl Dpth (ft)	4.67	Hydr. Depth (ft)		3.23	
Conv. Total (cfs)	63811.4	Conv. (cfs)		63811.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		245.69	
Min Ch El (ft)	1358.48	Shear (lb/sq ft)		0.45	
Alpha	1.00	Stream Power (lb/ft s)		1.70	
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)		23.44	
C & E Loss (ft)	0.00	Cum SA (acres)		6.77	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.308

INPUT
Description: DIBBLE Sta 61+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 71

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1363.34	806.67	1363.31	822.45	1363.36	835.11	1363.33	862.31	1363.35
862.33	1363.34	862.38	1363.35	862.65	1363.28	863	1363.19	879.01	1363.35
900	1359.85	914	1359.85	969.22	1359.85	969.28	1359.83	972.89	1358.39
976.18	1357.98	976.76	1357.9	977.01	1357.87	977.22	1357.84	977.33	1357.82
979.65	1357.83	979.98	1357.85	980.53	1357.88	981.78	1357.96	984.61	1358.11
997.77	1358.76	999.63	1358.75	1001.2	1358.69	1005.8	1358.48	1021.66	1358.46
1023.41	1358.46	1025.6	1358.45	1028.46	1358.45	1028.73	1358.45	1031.37	1358.72
1032.7	1358.87	1033.02	1358.96	1033.29	1359.01	1033.55	1359.04	1034.11	1359.16
1036.29	1359.85	1090.01	1359.85	1100	1359.85	1121.01	1363.35	1121.27	1363.39

1121.9	1363.32	1122.19	1363.35	1125.62	1363.32	1127.06	1363.28	1129.39	1363.17
1131.04	1363.22	1131.75	1363.21	1134.48	1363.13	1135.38	1363.12	1136.07	1363.14
1137.42	1363.13	1142.36	1363.14	1143.32	1363.12	1144.6	1363.07	1145.71	1363.04
1147.38	1363.1	1148.12	1363.12	1151.24	1363.14	1153.26	1363.09	1153.32	1363.39
1161.67	1363.36	1176.5	1363.31	1180.89	1363.34	1188.96	1363.37	1199.32	1363.45
1200	1363.46								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	863	.025	879.01	.044	969.22	.039	1036.29	.044
1100	.055	1121.01	.055						

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
879.01	1121.01	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1363.14	Element			
Vel Head (ft)	0.25	Wt. n-Val.		0.042	
W.S. Elev (ft)	1362.89	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		755.01	
E.G. Slope (ft/ft)	0.002481	Area (sq ft)		755.01	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	236.51	Top Width (ft)		236.51	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	5.07	Hydr. Depth (ft)		3.19	
Conv. Total (cfs)	60434.7	Conv. (cfs)		60434.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		237.52	
Min Ch El (ft)	1357.82	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		1.96	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		21.67	
C & E Loss (ft)	0.00	Cum SA (acres)		6.22	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.289

INPUT
Description: DIBBLE Sta 60+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Station Elevation Data num= 70

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1362.96	804.93	1363	809.21	1363.04	823.37	1362.94	837.66	1362.83
841.8	1362.86	849.42	1362.94	862.6	1363.03	862.64	1363.03	862.66	1363.03
862.98	1362.94	863	1362.94	863.52	1362.95	879	1363.1	900	1359.6
911.72	1359.6	914	1359.6	929.63	1359.6	966.88	1359.6	966.93	1359.58
968.62	1358.92	969.57	1358.88	979.91	1358.3	995.82	1358.09	997.14	1358.02
997.91	1358	998.26	1357.99	1005.34	1357.76	1006.26	1357.74	1006.67	1357.72
1007.03	1357.71	1007.17	1357.71	1007.28	1357.71	1008.35	1357.69	1009.36	1357.69
1009.68	1357.7	1010.27	1357.7	1011.27	1357.68	1015.43	1357.65	1024.14	1357.6
1026.02	1357.97	1033.21	1359.49	1033.22	1359.45	1033.24	1359.61	1033.26	1359.6
1033.58	1359.6	1033.73	1359.6	1090	1359.6	1100	1359.6	1121	1363.1
1121.32	1363.03	1125.38	1362.91	1125.65	1362.9	1125.84	1362.91	1126.22	1362.91
1132.93	1362.91	1133.45	1362.91	1135.16	1362.84	1136.64	1362.8	1137.68	1362.84
1138.13	1362.85	1142.11	1362.88	1144.71	1362.81	1144.74	1363.03	1144.76	1363.03
1150.62	1363.06	1163.57	1363.1	1179.06	1363.2	1197.52	1363.24	1200	1363.24

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	863.52	.025	879	.044	966.88	.039	1033.26	.044
1121	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
879	1121	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1362.89	Element			
Vel Head (ft)	0.24	Wt. n-Val.		0.041	
W.S. Elev (ft)	1362.65	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		762.23	
E.G. Slope (ft/ft)	0.002409	Area (sq ft)		762.23	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	236.61	Top Width (ft)		236.61	
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)		3.95	
Max Chl Dpth (ft)	5.05	Hydr. Depth (ft)		3.22	
Conv. Total (cfs)	61324.8	Conv. (cfs)		61324.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		237.64	
Min Ch El (ft)	1357.60	Shear (lb/sq ft)		0.48	

Alpha	1.00	Stream Power (lb/ft s)	1.91
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	19.93
C & E Loss (ft)	0.00	Cum SA (acres)	5.68

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.271

INPUT
Description: DIBBLE Sta 59+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 69

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1362.51	811.78	1362.48	824.02	1362.47	840.22	1362.52	862.11	1362.48
862.17	1362.48	863	1362.69	878.99	1362.85	900	1359.35	914	1359.35
926.55	1359.35	966.37	1359.35	966.42	1359.33	969.18	1358.37	976.63	1358.08
980	1357.95	980.76	1357.92	981.17	1357.9	981.33	1357.89	981.47	1357.89
982.69	1357.85	982.78	1357.85	982.91	1357.85	983.02	1357.84	983.23	1357.84
983.71	1357.82	984.68	1357.79	994.09	1357.52	995.01	1357.49	995.35	1357.48
998.92	1357.36	1012.58	1356.92	1013.86	1356.88	1020.97	1358.36	1022.43	1358.66
1031.31	1359.03	1033.71	1359.13	1033.72	1359.22	1033.73	1359.21	1033.74	1359.11
1033.76	1359.35	1034.18	1359.35	1034.41	1359.35	1036.76	1359.35	1037.91	1359.35
1090	1359.35	1100	1359.35	1121	1362.85	1121.08	1362.83	1121.46	1362.8
1121.65	1362.69	1123.51	1362.69	1123.59	1362.69	1125.73	1362.61	1127.58	1362.56
1127.97	1362.58	1128.14	1362.58	1133	1362.61	1136.15	1362.53	1136.17	1362.67
1136.18	1362.59	1136.21	1362.67	1138.17	1362.66	1153.17	1362.69	1166.32	1362.74
1181.63	1362.88	1184.77	1362.91	1190.53	1362.97	1200.01	1362.99		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	863	.025	878.99	.044	966.37	.039	1033.76	.044
1121	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
878.99	1121	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1362.65	Element			
Vel Head (ft)	0.24	Wt. n-Val.		0.041	
W.S. Elev (ft)	1362.42	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		767.76	
E.G. Slope (ft/ft)	0.002355	Area (sq ft)		767.76	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	236.79	Top Width (ft)		236.79	
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)		3.92	
Max Chl Dpth (ft)	5.54	Hydr. Depth (ft)		3.24	
Conv. Total (cfs)	62026.9	Conv. (cfs)		62026.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		238.08	
Min Ch El (ft)	1356.88	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.86	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)		18.17	
C & E Loss (ft)	0.01	Cum SA (acres)		5.13	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.252

INPUT
Description: DIBBLE Sta 58+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 56

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1362.28	814.34	1362.32	833.02	1362.2	842.79	1362.1	847.34	1362.1
851	1362.08	861.18	1362	861.23	1362	862.74	1362.37	863	1362.44
879.01	1362.6	900	1359.1	914	1359.1	921.59	1359.1	962.45	1359.1
962.46	1359.1	962.5	1359.09	966.81	1357.9	967.67	1357.66	968.04	1357.65
985.04	1357.21	996.61	1357.28	996.66	1357.28	1004.37	1356.88	1006.77	1356.75
1008.17	1356.67	1008.95	1356.64	1013.83	1356.58	1014.12	1356.59	1014.66	1356.62
1015.2	1356.61	1016.35	1356.65	1018.8	1356.62	1023.69	1357.78	1025.28	1358.13
1028.79	1358.12	1032.49	1358.11	1035.7	1358.11	1043.52	1359.1	1090.01	1359.1
1100	1359.1	1121.01	1362.6	1121.24	1362.55	1122.08	1362.34	1123.87	1362.35
1127.6	1362.26	1127.61	1362.3	1127.63	1362.24	1127.64	1362.38	1127.65	1362.36
1128.48	1362.36	1155.74	1362.36	1165.14	1362.47	1177.48	1362.59	1184.19	1362.64
1200.01	1362.56								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	863	.025	879.01	.044	962.46	.039	1043.52	.044
1121.01	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
879.01	1121.01	100	100	100	.1	.3

Left Levee Station= 879.01 Elevation= 1362.6

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1362.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.041	
W.S. Elev (ft)	1362.22	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1360.36	Flow Area (sq ft)		813.45	
E.G. Slope (ft/ft)	0.001879	Area (sq ft)		813.45	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	237.48	Top Width (ft)		237.48	
Vel Total (ft/s)	3.70	Avg. Vel. (ft/s)		3.70	
Max Chl Dpth (ft)	5.64	Hydr. Depth (ft)		3.43	
Conv. Total (cfs)	69446.7	Conv. (cfs)		69446.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		238.46	
Min Ch El (ft)	1356.58	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.48	
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		16.36	
C & E Loss (ft)	0.00	Cum SA (acres)		4.59	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.233

INPUT
Description: DIBBLE Sta 57+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
800	1361.91	806.56	1361.88	816.9	1361.84	819.96	1361.86	825.6	1361.95
838.4	1362.12	845.36	1362.11	861.89	1361.93	861.93	1361.93	861.95	1361.93
863	1362.19	879	1362.35	900	1358.85	906.21	1358.85	914	1358.85
961.7	1358.85	961.76	1358.83	961.77	1358.83	967.22	1357.03	970.52	1357.02
977.38	1357	980.13	1356.99	981.97	1356.98	982.99	1356.98	983.58	1356.98
988.07	1356.87	988.3	1356.85	988.54	1356.83	988.87	1356.81	997.77	1356.42
1000.44	1356.51	1001.14	1356.53	1002.54	1356.56	1007.51	1356.68	1017.32	1356.94
1017.68	1356.97	1035.03	1358.37	1037.28	1358.63	1037.31	1358.54	1037.33	1358.85
1037.59	1358.85	1039.24	1358.85	1090	1358.85	1100	1358.85	1121	1362.35
1121.49	1362.23	1121.78	1362.16	1122.05	1362.09	1122.15	1362.07	1122.18	1362.17
1122.2	1362.22	1129.84	1362.08	1139.73	1362.09	1151.77	1362.12	1158.29	1362.16
1180.36	1362.15	1186.75	1362.16	1192.11	1362.18	1200	1362.24		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
800	.055	863	.025	879	.044	961.7	.039	1037.33	.044
1121	.055								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
879	1121	100	100	100	.1	.3

Left Levee Station= 879 Elevation= 1362.35

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1362.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.041	
W.S. Elev (ft)	1362.05	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1360.11	Flow Area (sq ft)		830.35	
E.G. Slope (ft/ft)	0.001773	Area (sq ft)		830.35	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	238.36	Top Width (ft)		238.36	
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)		3.62	
Max Chl Dpth (ft)	5.63	Hydr. Depth (ft)		3.48	
Conv. Total (cfs)	71490.4	Conv. (cfs)		71490.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		239.63	
Min Ch El (ft)	1356.42	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.39	
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)		14.47	
C & E Loss (ft)	0.00	Cum SA (acres)		4.04	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.214

```
INPUT
Description: DIBBLE Sta 56+00

Even foot station data is scaled from 1"=20'
            Horiz, 1"=10' Vert Construction Drawings.
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     800 1361.79   800.2 1361.79  812.68 1361.66  819.46 1361.68  831.11 1361.76
  847.91 1361.62  850.77 1361.64  852.56 1361.65  862.27 1361.77   862.3 1361.77
  862.33 1361.77     863 1361.94     879  1362.1     900  1358.6     914  1358.6
  941.35  1358.6  958.83  1358.6  958.88 1358.58  958.89 1358.58  963.12 1357.33
  966.29 1356.69  972.56 1356.67  975.95 1356.66  977.55 1356.65  991.07 1356.88
 1001.54 1356.82 1002.65 1356.82 1004.31 1356.85 1008.34  1356.9 1010.49 1356.94
 1011.66 1356.97 1012.38 1356.98 1019.52 1356.94 1019.98 1356.95 1020.66 1356.94
 1021.62 1356.93 1023.18 1356.89 1024.96 1356.86 1029.39 1356.73 1031.01 1356.99
 1037.18 1358.05 1037.31 1358.08 1037.34 1358.08 1037.35 1358.08 1037.37 1358.21
  1037.4 1358.59 1037.92 1358.59 1038.53  1358.6 1040.46  1358.6    1090  1358.6
    1100  1358.6    1121  1362.1 1121.51 1361.98 1121.79 1362.08 1121.83 1361.94
 1125.32 1361.92 1132.41  1361.8 1144.49 1361.83 1160.86 1361.86 1162.93 1361.86
 1166.72 1361.85  1189.3 1361.89    1200 1362.01

Manning's n Values        num=       7
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     800    .055     863    .025     879    .044  958.83    .039 1038.53    .044
    1100    .055    1121    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           879    1121             100     100     100             .1       .3
Left Levee       Station=     879      Elevation=  1362.1
Right Levee      Station=    1121      Elevation=  1362.1

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1362.08   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.19   Wt. n-Val.                            0.041
  W.S. Elev (ft)            1361.88   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)            1359.86   Flow Area (sq ft)                     851.07
  E.G. Slope (ft/ft)       0.001637   Area (sq ft)                          851.07
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             239.40   Top Width (ft)                        239.40
  Vel Total (ft/s)             3.54   Avg. Vel. (ft/s)                        3.54
  Max Chl Dpth (ft)            5.23   Hydr. Depth (ft)                        3.55
  Conv. Total (cfs)         74396.9   Conv. (cfs)                         74396.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      240.78
  Min Ch El (ft)            1356.65   Shear (lb/sq ft)                        0.36
  Alpha                        1.00   Stream Power (lb/ft s)                  1.28
  Frctn Loss (ft)              0.17   Cum Volume (acre-ft)                   12.54
  C & E Loss (ft)              0.00   Cum SA (acres)                          3.49


CROSS SECTION        RIVER: RIVER-1
REACH: Reach-1          RS: 5.195

INPUT
Description: DIBBLE Sta 55+00

Even foot station data is scaled from 1"=20'
            Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
            truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  879.01  1361.8     900  1358.3  914.01  1358.3  936.78  1358.3  957.77  1358.3
  957.82 1358.28  960.23  1357.5  963.23 1356.53  963.76 1356.35  964.72 1356.42
  986.89  1356.1  987.25 1356.09  987.75 1356.21  993.85 1357.69   996.2 1357.52
 1003.87 1356.96 1008.23 1356.85  1027.6 1356.58 1028.36 1356.61 1028.49 1356.61
 1032.58  1357.4 1036.78 1358.21  1036.8 1358.15 1036.84  1358.3  1037.3  1358.3
    1082  1358.3    1106  1362.5

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  879.01    .044  957.77    .039 1036.84    .044    1082    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        879.01    1106             100     100     100             .1       .3
Left Levee       Station=  879.01      Elevation=  1361.8

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1361.90   Element                    Left OB    Channel   Right OB
```

Vel Head (ft)	0.22	Wt. n-Val.		0.041	
W.S. Elev (ft)	1361.68	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1359.68	Flow Area (sq ft)		801.45	
E.G. Slope (ft/ft)	0.001807	Area (sq ft)		801.45	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	221.63	Top Width (ft)		221.63	
Vel Total (ft/s)	3.76	Avg. Vel. (ft/s)		3.76	
Max Chl Dpth (ft)	5.59	Hydr. Depth (ft)		3.62	
Conv. Total (cfs)	70815.1	Conv. (cfs)		70815.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		223.06	
Min Ch El (ft)	1356.09	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		1.52	
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		10.64	
C & E Loss (ft)	0.00	Cum SA (acres)		2.97	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.176

INPUT
Description: DIBBLE Sta 54+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
867	1362.5	893	1358	954	1358	954.21	1358	954.26	1357.98
954.32	1357.97	959.96	1356.4	960.47	1356.35	962.27	1356.2	963.14	1356.13
963.64	1356.1	973.75	1355.92	977.66	1355.93	980.18	1355.93	990.49	1356.91
990.94	1356.95	991.31	1356.94	1003.35	1356.45	1004.31	1356.44	1009.5	1356.4
1023.18	1356.41	1023.83	1356.44	1024.72	1356.58	1030.01	1357.49	1033.04	1357.99
1064	1357.99	1094	1363						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
867	.044	954.21	.039	1033.04	.044	1064	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
867	1094	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1361.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.041	
W.S. Elev (ft)	1361.50	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		787.38	
E.G. Slope (ft/ft)	0.001792	Area (sq ft)		787.38	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	212.19	Top Width (ft)		212.19	
Vel Total (ft/s)	3.82	Avg. Vel. (ft/s)		3.82	
Max Chl Dpth (ft)	5.58	Hydr. Depth (ft)		3.71	
Conv. Total (cfs)	71095.8	Conv. (cfs)		71095.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		213.21	
Min Ch El (ft)	1355.92	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		1.58	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)		8.82	
C & E Loss (ft)	0.02	Cum SA (acres)		2.47	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.157

INPUT
Description: DIBBLE Sta 53+00

Even foot station data is scaled from 1"=20'
Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
truncated at Bank Stations, flow is contained within Channel.
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
867	1365	911	1357.6	958	1358	960	1357.6	960.78	1357.6
964.09	1357.43	965.69	1357.37	966.68	1357.32	967.48	1357.26	968.23	1357.2
969.4	1357.02	985.81	1356.7	997.17	1356.6	997.65	1356.59	998.09	1356.58

```
  998.94 1356.58 1000.07 1356.58 1001.68 1356.58 1002.55 1356.57  1013.7 1356.91
  1020.2 1357.11 1028.75 1357.37    1032  1357.8    1047  1357.8    1083  1364.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     867    .044     960    .039    1047    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           867    1083              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1361.43   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.46   Wt. n-Val.                            0.041
  W.S. Elev (ft)            1360.97   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    551.24
  E.G. Slope (ft/ft)       0.004474   Area (sq ft)                         551.24
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             172.08   Top Width (ft)                       172.08
  Vel Total (ft/s)             5.46   Avg. Vel. (ft/s)                       5.46
  Max Chl Dpth (ft)            4.40   Hydr. Depth (ft)                       3.20
  Conv. Total (cfs)         45000.6   Conv. (cfs)                         45000.6
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     172.78
  Min Ch El (ft)            1356.57   Shear (lb/sq ft)                       0.89
  Alpha                        1.00   Stream Power (lb/ft s)                 4.87
  Frctn Loss (ft)              0.51   Cum Volume (acre-ft)                   7.28
  C & E Loss (ft)              0.01   Cum SA (acres)                         2.03


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 5.138

INPUT
Description: DIBBLE Sta 52+00

Even foot station data is scaled from 1"=20'
             Horiz, 1"=10' Vert Construction Drawings.

Cross Section is
             truncated at Left Bank Station, flow is contained within Channel.
Station Elevation Data    num=      77
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     868  1365.8     925  1356.5     938  1356.5     952  1357.9     953  1357.6
  954.96 1357.47  973.99 1357.51  974.06  1357.5  974.08 1357.49  981.93 1356.12
   986.9 1356.03  989.35 1356.03  992.22 1356.01  994.57 1356.03  996.17 1356.04
 1000.01 1355.98 1000.42 1355.98 1007.07 1355.89 1007.84 1355.86 1009.23 1355.81
 1011.55 1355.81 1011.64 1355.81 1014.48 1355.84 1016.42 1355.83 1030.07 1356.01
 1030.97 1356.04 1031.99 1356.06 1033.68 1356.11 1035.72 1356.16 1039.05 1356.88
 1044.63 1358.07 1048.31 1358.86  1050.3 1359.29 1060.44 1361.56 1060.78 1361.66
 1061.63 1361.92 1062.62 1362.21 1075.56 1365.31 1078.08 1365.91 1079.27  1365.3
 1085.19 1362.29 1089.55 1362.21  1133.8 1361.41 1137.48 1361.75 1142.65 1361.53
 1155.05 1361.66 1156.67 1361.66 1158.15 1361.63 1160.07 1361.66 1160.68 1361.67
 1168.21 1361.53 1169.61  1361.5 1170.05 1361.49 1170.26 1361.49 1170.98 1361.46
 1171.05 1361.46 1171.14 1361.46 1171.24 1361.46 1171.36 1361.45 1171.51 1361.45
 1171.71 1361.45 1171.99 1361.44 1185.12 1361.48 1185.71 1361.43 1186.64 1361.38
 1188.01 1361.39 1188.79 1361.54 1190.59 1361.44 1190.95 1361.42 1191.23 1361.41
 1192.89 1361.34 1194.86 1361.24 1194.92 1361.23 1195.33 1361.21 1197.36 1361.21
  1199.3 1361.21    1200 1361.21

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
     868    .044     952    .039 1039.05    .055 1078.08    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           868 1078.08              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1360.92   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.54   Wt. n-Val.                            0.042
  W.S. Elev (ft)            1360.38   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    511.45
  E.G. Slope (ft/ft)       0.005764   Area (sq ft)                         511.45
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             153.94   Top Width (ft)                       153.94
  Vel Total (ft/s)             5.89   Avg. Vel. (ft/s)                       5.89
  Max Chl Dpth (ft)            4.57   Hydr. Depth (ft)                       3.32
  Conv. Total (cfs)         39647.3   Conv. (cfs)                         39647.3
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     154.95
  Min Ch El (ft)            1355.81   Shear (lb/sq ft)                       1.19
  Alpha                        1.00   Stream Power (lb/ft s)                 6.99
```

Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	6.06
C & E Loss (ft)	0.09	Cum SA (acres)	1.65

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.119

INPUT
Description: DIBBLE Sta 51+00
just upstream from Sossaman Road

Even foot
station data is scaled from 1"=20' Horiz, 1"=10' Vert Construction Drawings.

Cross Section is truncated at Bank Stations, flow is contained within Channel.

Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
919	1366.2	938	1355	953	1355	963	1357.4	967	1356.9
974	1356.5	978	1356.5	981	1356.2	987	1355.5	992	1355
1000	1354.9	1011	1354.7	1015	1354.5	1017	1354.8	1026	1355.1
1033	1355.8	1040	1356.9	1052	1360	1061	1362.1	1065	1364.5

Manning's n Values num= 2

Sta	n Val	Sta	n Val
919	.044	963	.039

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
919	1065	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1359.91	Element			
Vel Head (ft)	1.39	Wt. n-Val.		0.040	
W.S. Elev (ft)	1358.51	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	1358.51	Flow Area (sq ft)		317.57	
E.G. Slope (ft/ft)	0.017169	Area (sq ft)		317.57	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	114.20	Top Width (ft)		114.20	
Vel Total (ft/s)	9.48	Avg. Vel. (ft/s)		9.48	
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)		2.78	
Conv. Total (cfs)	22971.6	Conv. (cfs)		22971.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		115.92	
Min Ch El (ft)	1354.50	Shear (lb/sq ft)		2.94	
Alpha	1.00	Stream Power (lb/ft s)		27.83	
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)		5.11	
C & E Loss (ft)	0.31	Cum SA (acres)		1.34	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.109

INPUT
Description: END OF DIBBLE REACH, Sta 50+50, 8/26/02
Added to model the bridge transition. Downstream reach (CVL design) was previously "undefined". This cross section models how the transition will occur between designs.

Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
920	1362	932	1358.6	942	1353.6	1000	1353.6	1058	1353.6
1068	1358.6	1080	1362						

```
Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     920     .03     932     .03    1068     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           932    1068              140     140     140              .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1358.95   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.36   Wt. n-Val.                            0.030
  W.S. Elev (ft)            1358.59   Reach Len. (ft)             67.00     67.00      67.00
  Crit W.S. (ft)            1356.30   Flow Area (sq ft)                    628.77
  E.G. Slope (ft/ft)       0.001240   Area (sq ft)                         628.77
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             135.96   Top Width (ft)                       135.96
  Vel Total (ft/s)             4.79   Avg. Vel. (ft/s)                       4.79
  Max Chl Dpth (ft)            4.99   Hydr. Depth (ft)                       4.62
  Conv. Total (cfs)         85461.7   Conv. (cfs)                         85461.7
  Length Wtd. (ft)            67.00   Wetted Per. (ft)                     138.32
  Min Ch El (ft)            1353.60   Shear (lb/sq ft)                       0.35
  Alpha                        1.00   Stream Power (lb/ft s)                 1.69
  Frctn Loss (ft)              0.10   Cum Volume (acre-ft)                   4.57
  C & E Loss (ft)              0.01   Cum SA (acres)                         1.20


BRIDGE                    RIVER: RIVER-1
REACH: Reach-1               RS: 5.102

INPUT
Description: Bridge #4 - SOSSAMAN ROAD

Distance from Upstream XS =       67
Deck/Roadway Width        =       72
Weir Coefficient          =      2.6
Bridge Deck/Roadway Skew  =        0
Upstream  Deck/Roadway Coordinates
    num=        6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   903.5  1369.5  1353.5     932  1369.5  1353.5     932  1369.5    1366
    1068  1369.5    1366    1068  1369.5  1353.5  1096.5  1369.5  1353.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     920    1362     932  1358.6     942  1353.6    1000  1353.6    1058  1353.6
    1068  1358.6    1080    1362

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     920     .03     932     .03    1068     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
           932    1068              .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366

Downstream  Deck/Roadway Coordinates
    num=        6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   903.5  1369.5  1353.5     932  1369.5  1353.5     932  1369.5    1366
    1078  1369.5    1366    1078  1369.5  1353.5  1096.5  1369.5  1353.5

Downstream Bridge Cross Section Data
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     920    1362     932  1358.6     942  1353.6    1000  1353.6    1058  1353.6
    1068  1358.6    1080    1362

Manning's n Values          num=       3
```

```
     Sta    n Val     Sta    n Val     Sta    n Val
     920     .028     920     .028    1080     .028

Bank Sta: Left   Right    Coeff Contr.   Expan.
          920    1080            .3        .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =  1370.5
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=     976    Downstream=     976
Upstream     num=       2
    Width   Elev    Width   Elev
     2.5  1353.5     2.5  1366.5
Downstream     num=       2
    Width   Elev    Width   Elev
     2.5  1353.5     2.5  1366.5

Pier Data
Pier Station     Upstream=    1024    Downstream=    1024
Upstream     num=       2
    Width   Elev    Width   Elev
     2.5  1353.5     2.5  1366.5
Downstream     num=       2
    Width   Elev    Width   Elev
     2.5  1353.5     2.5  1366.5

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
      Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8006408
           Max Low Cord                =1360.083

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT    Profile #100 Year
Opening : Bridge #1

  E.G. US. (ft)                 1358.95   Element                 Inside BR US  Inside BR DS
  W.S. US. (ft)                 1358.59   E.G. Elev (ft)               1358.84       1358.71
  Q Total (cfs)                 3010.00   W.S. Elev (ft)               1358.43       1358.26
  Q Bridge (cfs)                3010.00   Crit W.S. (ft)               1356.38       1356.38
  Q Weir (cfs)                            Max Chl Dpth (ft)               4.83          4.66
  Weir Sta Lft (ft)                       Vel Total (ft/s)                5.17          5.37
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             582.30        560.92
  Weir Submerg                            Froude # Chl                    0.43          0.45
  Weir Max Depth (ft)                     Specif Force (cu ft)         1850.91       1775.28
  Min Top Rd (ft)               1370.50   Hydr Depth (ft)                 4.47          4.33
  Min El Prs (ft)               1360.08   W.P. Total (ft)               151.89        150.49
  Delta EG (ft)                    0.25   Conv. Total (cfs)            70649.2       71557.3
  Delta WS (ft)                    0.30   Top Width (ft)                130.31        129.65
  BR Open Area (sq ft)          1574.40   Frctn Loss (ft)                 0.13          0.00
  BR Open Vel (ft/s)               5.37   C & E Loss (ft)                 0.00          0.01
  Coef of Q                               Shear Total (lb/sq ft)          0.43          0.41
  Br Sel Method            Energy only    Power Total (lb/ft s)           2.25          2.21
```

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.091

INPUT
Description: END OF DIBBLE REACH, DIBBLE Sta 49+10, Copy of Dibble cross
             section 5.109 placed immediately downstream of Sossaman Road in
             order to model a consistent cross section through the
             bridge.

Cross section stations adjusted so thalweg falls at
             station 1000 instead of 10000.  This was done for purposes of
             bridge modeling.
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     920    1362     932   1358.6    942  1353.6    1000  1353.6    1058  1353.6
    1068  1358.6    1080    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     920    .028     920    .028    1080    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          920    1080               100     100     100              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
     920     932    1366    1068    1080    1366

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1358.69   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.41   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1358.29   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)            1356.30   Flow Area (sq ft)                    587.60
  E.G. Slope (ft/ft)       0.001337   Area (sq ft)                         587.60
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             134.75   Top Width (ft)                       134.75
  Vel Total (ft/s)             5.12   Avg. Vel. (ft/s)                       5.12
  Max Chl Dpth (ft)            4.69   Hydr. Depth (ft)                       4.36
  Conv. Total (cfs)         82333.0   Conv. (cfs)                         82333.0
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     136.96
  Min Ch El (ft)            1353.60   Shear (lb/sq ft)                       0.36
  Alpha                        1.00   Stream Power (lb/ft s)                 1.83
  Frctn Loss (ft)              0.15   Cum Volume (acre-ft)                   2.68
  C & E Loss (ft)              0.04   Cum SA (acres)                         0.78


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.073

INPUT
Description: CVL Sta 62+00 - Dibble Sta 48+10.   CVL elevations adjusted -2.0'
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1358.5 9907.04 1358.54 9911.75 1359.32 9923.75 1357.32 9948.75 1357.32
 9972.75  1353.310047.75 1353.3210054.04 1353.8910074.65 1354.9310100.31 1356.17
 10116.2  1357.9   10125 1358.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .028   10125    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9875   10125              100     100     100              .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1358.51   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.33   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1358.18   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    650.12
  E.G. Slope (ft/ft)       0.001595   Area (sq ft)                         650.12
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             200.78   Top Width (ft)                       200.78
  Vel Total (ft/s)             4.63   Avg. Vel. (ft/s)                       4.63
  Max Chl Dpth (ft)            4.88   Hydr. Depth (ft)                       3.24
  Conv. Total (cfs)         75362.7   Conv. (cfs)                         75362.7
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     201.37
  Min Ch El (ft)            1353.30   Shear (lb/sq ft)                       0.32
```

Alpha	1.00	Stream Power (lb/ft s)	1.49
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	1.26
C & E Loss (ft)	0.04	Cum SA (acres)	0.39

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.054

INPUT
Description: CVL Sta 61+00 - CVL elevations adjusted -2.0'
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9875	1358.9	9912.06	1359.02	9924.06	1357.02	9949.06	1357.02	9973.06	1353
10048.06	1353.02	10066.59	1358.9						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9875	.028	9875	.028	10066.59	.028

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9875	10066.59	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1358.25	Element			
Vel Head (ft)	0.71	Wt. n-Val.		0.028	
W.S. Elev (ft)	1357.54	Reach Len. (ft)			
Crit W.S. (ft)	1356.42	Flow Area (sq ft)		446.48	
E.G. Slope (ft/ft)	0.003518	Area (sq ft)		446.48	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	141.36	Top Width (ft)		141.36	
Vel Total (ft/s)	6.74	Avg. Vel. (ft/s)		6.74	
Max Chl Dpth (ft)	4.54	Hydr. Depth (ft)		3.16	
Conv. Total (cfs)	50747.2	Conv. (cfs)		50747.2	
Length Wtd. (ft)		Wetted Per. (ft)		142.44	
Min Ch El (ft)	1353.00	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		4.64	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8
Reach-1	6.532	.04	.028	.04					
Reach-1	6.525	Bridge							
Reach-1	6.516	.075	.039	.065					
Reach-1	6.502	.075	.039	.065					
Reach-1	6.483	.075	.039	.024	.044	.024	.044		
Reach-1	6.464	.075	.039	.024	.044				
Reach-1	6.445	.075	.039	.024	.044				
Reach-1	6.426	.075	.039	.024	.044	.065			
Reach-1	6.407	.075	.039	.024	.044	.055			
Reach-1	6.388	.075	.039	.024	.044	.055			
Reach-1	6.369	.039	.044	.024	.044				
Reach-1	6.350	.039	.044	.024	.044				
Reach-1	6.331	.039	.044	.024	.044				
Reach-1	6.312	.039	.044	.024	.044				
Reach-1	6.293	.039	.044	.024	.044				
Reach-1	6.274	.039	.044	.024	.044				
Reach-1	6.255	.055	.039	.044	.024	.044			
Reach-1	6.236	.055	.039	.044	.024	.044			
Reach-1	6.217	.055	.039	.055	.024	.055			
Reach-1	6.199	.055	.039	.024	.055	.055			
Reach-1	6.180	.055	.044	.039	.044	.055	.024	.055	
Reach-1	6.161	.07	.055	.044	.039	.044	.055	.024	.055
Reach-1	6.142	.07	.044	.039	.044	.025	.055		
Reach-1	6.123	.075	.044	.039	.044	.055			
Reach-1	6.104	.07	.044	.039	.044	.025	.055		
Reach-1	6.085	.07	.044	.039	.044	.025	.055		
Reach-1	6.066	.06	.044	.039	.044	.025	.055		
Reach-1	6.047	.06	.044	.039	.044	.055	.025	.055	
Reach-1	6.028	.06	.044	.039	.044	.055	.025	.055	

Reach-1	6.009	.06	.044	.039	.044	.055	.025	.055	
Reach-1	5.990	.044	.039	.044	.055	.025	.055		
Reach-1	5.971	.06	.044	.039	.044	.055	.025	.055	
Reach-1	5.952	.06	.044	.039	.044	.024	.055	.055	
Reach-1	5.933	.06	.044	.039	.044	.024	.055		
Reach-1	5.914	.06	.044	.039	.044	.024	.044	.055	
Reach-1	5.896	.06	.044	.039	.044	.024	.044	.055	
Reach-1	5.877	.06	.044	.039	.044	.024	.044	.055	
Reach-1	5.858	.06	.044	.044	.039	.044	.024	.044	.055
Reach-1	5.839	.06	.044	.039	.044	.024	.044	.055	
Reach-1	5.820	.06	.044	.039	.044	.024	.044	.055	
Reach-1	5.801	.06	.044	.039	.044	.055			
Reach-1	5.782	.055	.044	.039	.044	.044	.055		
Reach-1	5.763	.055	.044	.039	.044				
Reach-1	5.744	.055	.044	.039	.044				
Reach-1	5.725	.055	.039	.044	.055	.055			
Reach-1	5.706	.055	.039	.044	.055	.055			
Reach-1	5.687	.055	.039	.044	.055	.055			
Reach-1	5.668	.055	.039	.044	.055	.055			
Reach-1	5.649	.044	.039	.044	.055	.055			
Reach-1	5.630	.044	.039	.044	.055				
Reach-1	5.611	.044	.055	.039	.044	.024	.055		
Reach-1	5.592	.044	.055	.039	.055				
Reach-1	5.574	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.555	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.536	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.517	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.498	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.479	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.460	.055	.044	.055	.039	.044	.024	.044	.055
Reach-1	5.441	.044	.055	.039	.044	.024	.044	.055	
Reach-1	5.422	.044	.055	.039	.044	.024	.044	.055	
Reach-1	5.403	.044	.055	.039	.044	.035	.055		
Reach-1	5.384	.055	.039	.044	.055				
Reach-1	5.365	.055	.044	.039	.044	.055			
Reach-1	5.346	.055	.044	.039	.044	.055	.055		
Reach-1	5.327	.055	.044	.039	.044	.055	.055		
Reach-1	5.308	.055	.025	.044	.039	.044	.055	.055	
Reach-1	5.289	.055	.025	.044	.039	.044	.055		
Reach-1	5.271	.055	.025	.044	.039	.044	.055		
Reach-1	5.252	.055	.025	.044	.039	.044	.055		
Reach-1	5.233	.055	.025	.044	.039	.044	.055		
Reach-1	5.214	.055	.025	.044	.039	.044	.055	.055	
Reach-1	5.195	.044	.039	.044	.055				
Reach-1	5.176	.044	.039	.044	.055				
Reach-1	5.157	.044	.039	.055					
Reach-1	5.138	.044	.039	.055	.055				
Reach-1	5.119	.044	.039						
Reach-1	5.109	.03	.03	.03					
Reach-1	5.102	Bridge							
Reach-1	5.091	.028	.028	.028					
Reach-1	5.073	.028	.028	.028					
Reach-1	5.054	.028	.028	.028					

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	6.532	86	86	86
Reach-1	6.525	Bridge		
Reach-1	6.516	19	19	19
Reach-1	6.502	100	100	100
Reach-1	6.483	100	100	100
Reach-1	6.464	100	100	100
Reach-1	6.445	100	100	100
Reach-1	6.426	100	100	100
Reach-1	6.407	100	100	100
Reach-1	6.388	100	100	100
Reach-1	6.369	100	100	100
Reach-1	6.350	100	100	100
Reach-1	6.331	100	100	100
Reach-1	6.312	100	100	100
Reach-1	6.293	100	100	100
Reach-1	6.274	100	100	100
Reach-1	6.255	100	100	100
Reach-1	6.236	100	100	100

Reach-1	6.217	100	100	100
Reach-1	6.199	100	100	100
Reach-1	6.180	100	100	100
Reach-1	6.161	100	100	100
Reach-1	6.142	100	100	100
Reach-1	6.123	100	100	100
Reach-1	6.104	100	100	100
Reach-1	6.085	100	100	100
Reach-1	6.066	100	100	100
Reach-1	6.047	100	100	100
Reach-1	6.028	100	100	100
Reach-1	6.009	100	100	100
Reach-1	5.990	100	100	100
Reach-1	5.971	100	100	100
Reach-1	5.952	100	100	100
Reach-1	5.933	100	100	100
Reach-1	5.914	100	100	100
Reach-1	5.896	100	100	100
Reach-1	5.877	100	100	100
Reach-1	5.858	100	100	100
Reach-1	5.839	100	100	100
Reach-1	5.820	100	100	100
Reach-1	5.801	100	100	100
Reach-1	5.782	100	100	100
Reach-1	5.763	100	100	100
Reach-1	5.744	100	100	100
Reach-1	5.725	100	100	100
Reach-1	5.706	100	100	100
Reach-1	5.687	100	100	100
Reach-1	5.668	100	100	100
Reach-1	5.649	100	100	100
Reach-1	5.630	100	100	100
Reach-1	5.611	100	100	100
Reach-1	5.592	100	100	100
Reach-1	5.574	100	100	100
Reach-1	5.555	100	100	100
Reach-1	5.536	100	100	100
Reach-1	5.517	100	100	100
Reach-1	5.498	100	100	100
Reach-1	5.479	100	100	100
Reach-1	5.460	100	100	100
Reach-1	5.441	100	100	100
Reach-1	5.422	100	100	100
Reach-1	5.403	100	100	100
Reach-1	5.384	100	100	100
Reach-1	5.365	100	100	100
Reach-1	5.346	100	100	100
Reach-1	5.327	100	100	100
Reach-1	5.308	100	100	100
Reach-1	5.289	100	100	100
Reach-1	5.271	100	100	100
Reach-1	5.252	100	100	100
Reach-1	5.233	100	100	100
Reach-1	5.214	100	100	100
Reach-1	5.195	100	100	100
Reach-1	5.176	100	100	100
Reach-1	5.157	100	100	100
Reach-1	5.138	100	100	100
Reach-1	5.119	50	50	50
Reach-1	5.109	140	140	140
Reach-1	5.102	Bridge		
Reach-1	5.091	100	100	100
Reach-1	5.073	100	100	100
Reach-1	5.054	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	6.532	.3	.5
Reach-1	6.525	Bridge	
Reach-1	6.516	.1	.3
Reach-1	6.502	.1	.3
Reach-1	6.483	.1	.3
Reach-1	6.464	.1	.3
Reach-1	6.445	.1	.3

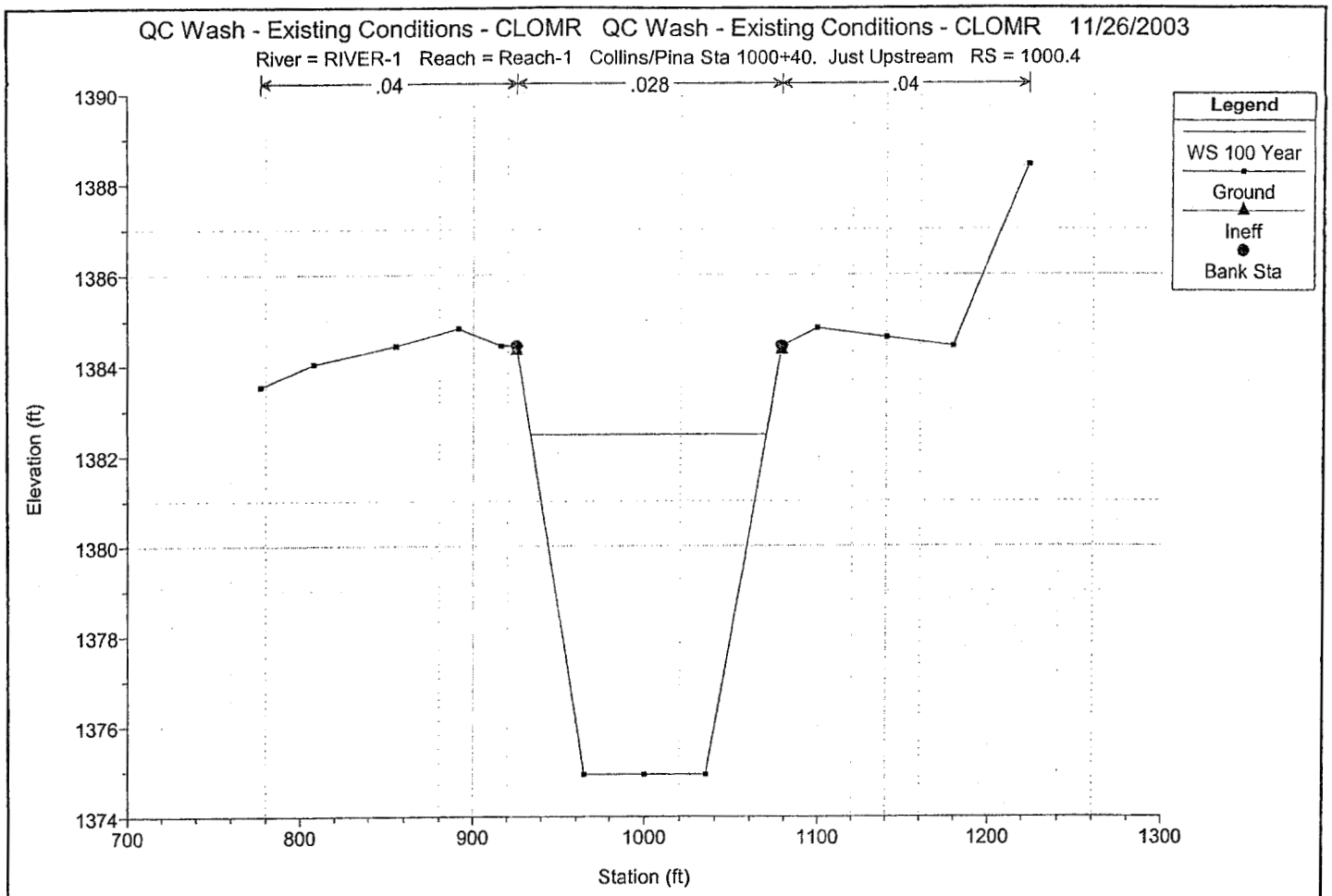
Reach-1	6.426		.1	.3
Reach-1	6.407		.1	.3
Reach-1	6.388		.1	.3
Reach-1	6.369		.1	.3
Reach-1	6.350		.1	.3
Reach-1	6.331		.1	.3
Reach-1	6.312		.1	.3
Reach-1	6.293		.1	.3
Reach-1	6.274		.1	.3
Reach-1	6.255		.1	.3
Reach-1	6.236		.1	.3
Reach-1	6.217		.1	.3
Reach-1	6.199		.1	.3
Reach-1	6.180		.1	.3
Reach-1	6.161		.1	.3
Reach-1	6.142		.1	.3
Reach-1	6.123		.1	.3
Reach-1	6.104		.1	.3
Reach-1	6.085		.1	.3
Reach-1	6.066		.1	.3
Reach-1	6.047		.1	.3
Reach-1	6.028		.1	.3
Reach-1	6.009		.1	.3
Reach-1	5.990		.1	.3
Reach-1	5.971		.1	.3
Reach-1	5.952		.1	.3
Reach-1	5.933		.1	.3
Reach-1	5.914		.1	.3
Reach-1	5.896		.1	.3
Reach-1	5.877		.1	.3
Reach-1	5.858		.1	.3
Reach-1	5.839		.1	.3
Reach-1	5.820		.1	.3
Reach-1	5.801		.1	.3
Reach-1	5.782		.1	.3
Reach-1	5.763		.1	.3
Reach-1	5.744		.1	.3
Reach-1	5.725		.1	.3
Reach-1	5.706		.1	.3
Reach-1	5.687		.1	.3
Reach-1	5.668		.1	.3
Reach-1	5.649		.1	.3
Reach-1	5.630		.1	.3
Reach-1	5.611		.1	.3
Reach-1	5.592		.1	.3
Reach-1	5.574		.1	.3
Reach-1	5.555		.1	.3
Reach-1	5.536		.1	.3
Reach-1	5.517		.1	.3
Reach-1	5.498		.1	.3
Reach-1	5.479		.1	.3
Reach-1	5.460		.1	.3
Reach-1	5.441		.1	.3
Reach-1	5.422		.1	.3
Reach-1	5.403		.1	.3
Reach-1	5.384		.1	.3
Reach-1	5.365		.1	.3
Reach-1	5.346		.1	.3
Reach-1	5.327		.1	.3
Reach-1	5.308		.1	.3
Reach-1	5.289		.1	.3
Reach-1	5.271		.1	.3
Reach-1	5.252		.1	.3
Reach-1	5.233		.1	.3
Reach-1	5.214		.1	.3
Reach-1	5.195		.1	.3
Reach-1	5.176		.1	.3
Reach-1	5.157		.1	.3
Reach-1	5.138		.1	.3
Reach-1	5.119		.1	.3
Reach-1	5.109		.1	.3
Reach-1	5.102	Bridge		
Reach-1	5.091		.3	.5
Reach-1	5.073		.1	.3
Reach-1	5.054		.1	.3

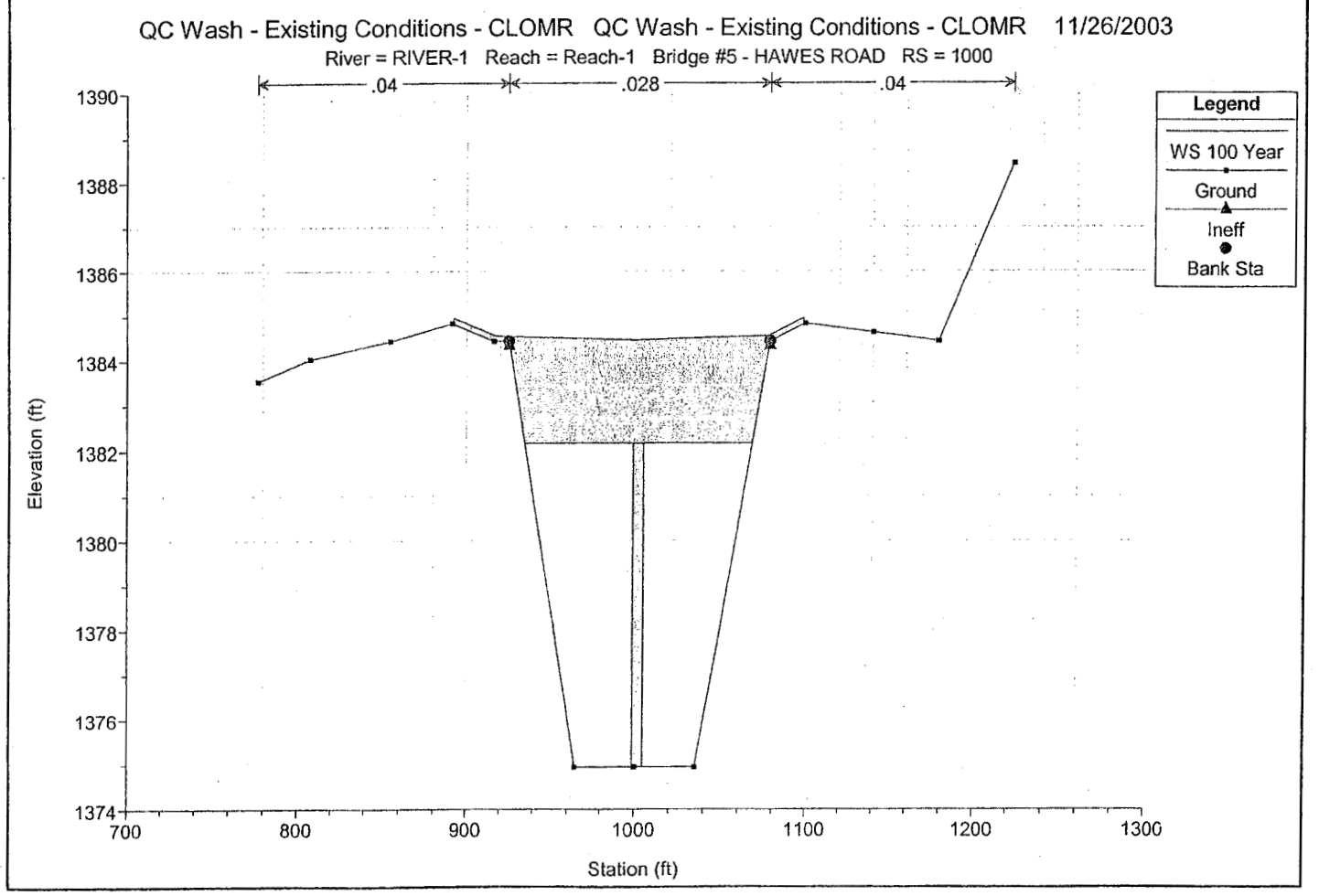
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : CLOMR

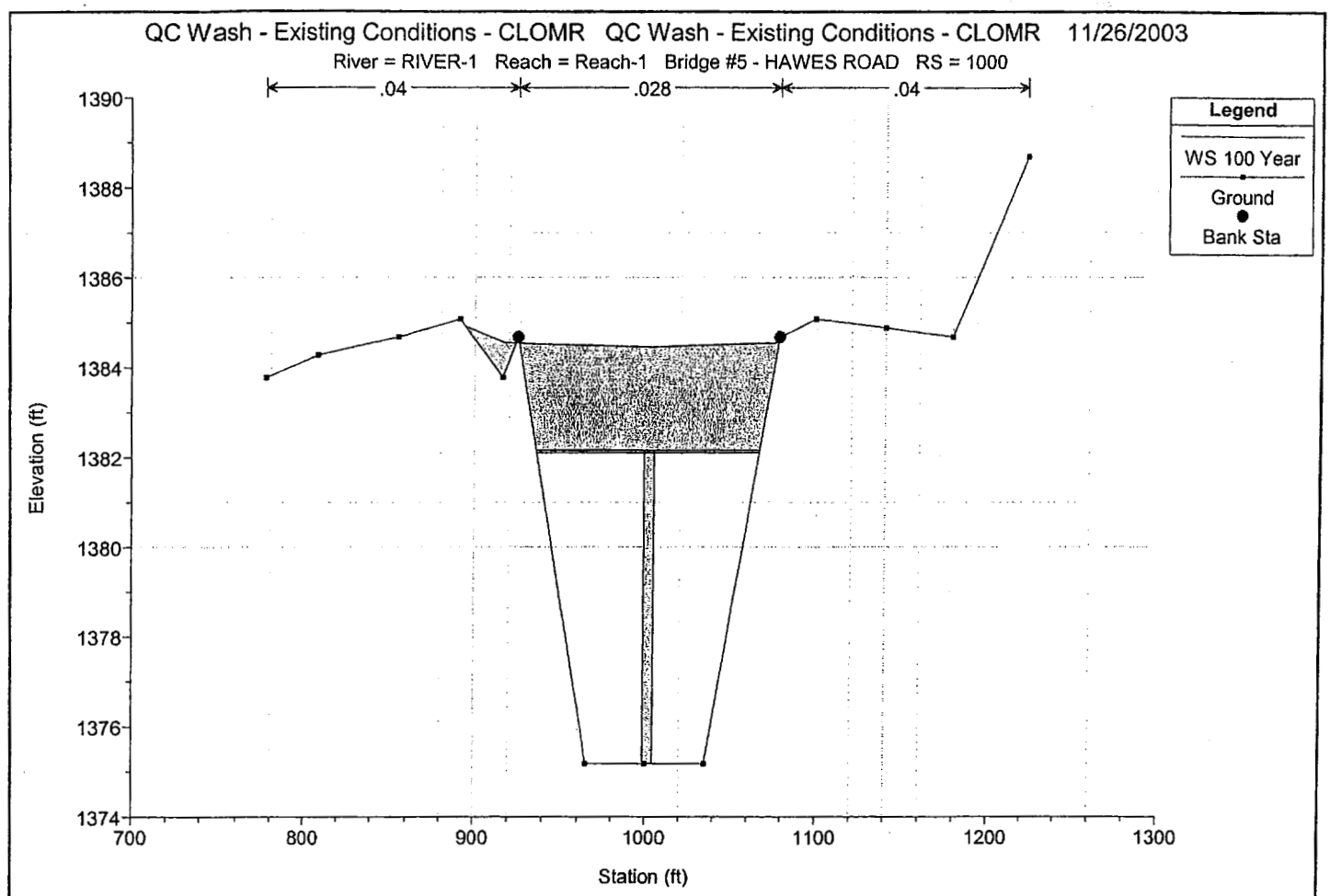
```
River: RIVER-1  Reach: Reach-1     RS: 6.483     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.464     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.445     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.426     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.407     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.388     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.369     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.350     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.331     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.312     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.293     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.274     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.255     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.236     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.217     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.199     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 6.180     Profile: 100 Year
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 5.649     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 5.630     Profile: 100 Year
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 5.176     Profile: 100 Year
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.138     Profile: 100 Year
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
     Note:   Manning's n values were composited to a single value in the main channel.
River: RIVER-1  Reach: Reach-1     RS: 5.119     Profile: 100 Year
     Warning:The energy equation could not be balanced within the specified number of iterations.  The program used
critical depth
             for the water surface and continued on with the calculations.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the
calculated
             water surface came back below critical depth.  This indicates that there is not a valid subcritical
answer.  The
             program defaulted to critical depth.
River: RIVER-1  Reach: Reach-1     RS: 5.073     Profile: 100 Year
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
```

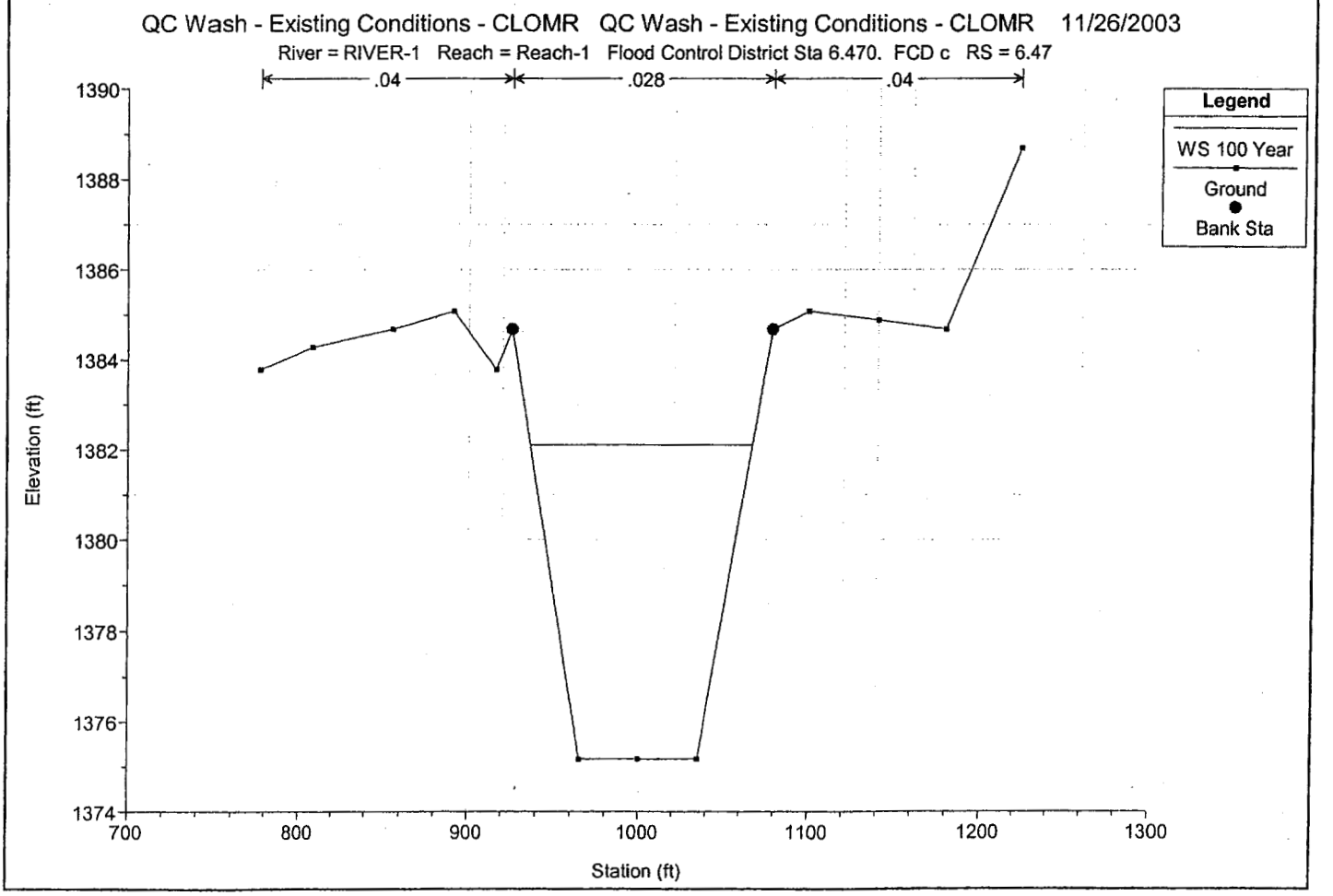
APPENDIX E.4

PRE PROJECT CONDITION HECRAS CROSS SECTION PLOTS


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Collins/Pina Sta 1000+40. Just Upstream RS = 1000.4
.04
.028
.04
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Bridge #5 - HAWES ROAD RS = 1000
.04
.028
.04
Legend
WS 100 Year
Ground
Ineff
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Bridge #5 - HAWES ROAD RS = 1000
.04
.028
.04
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)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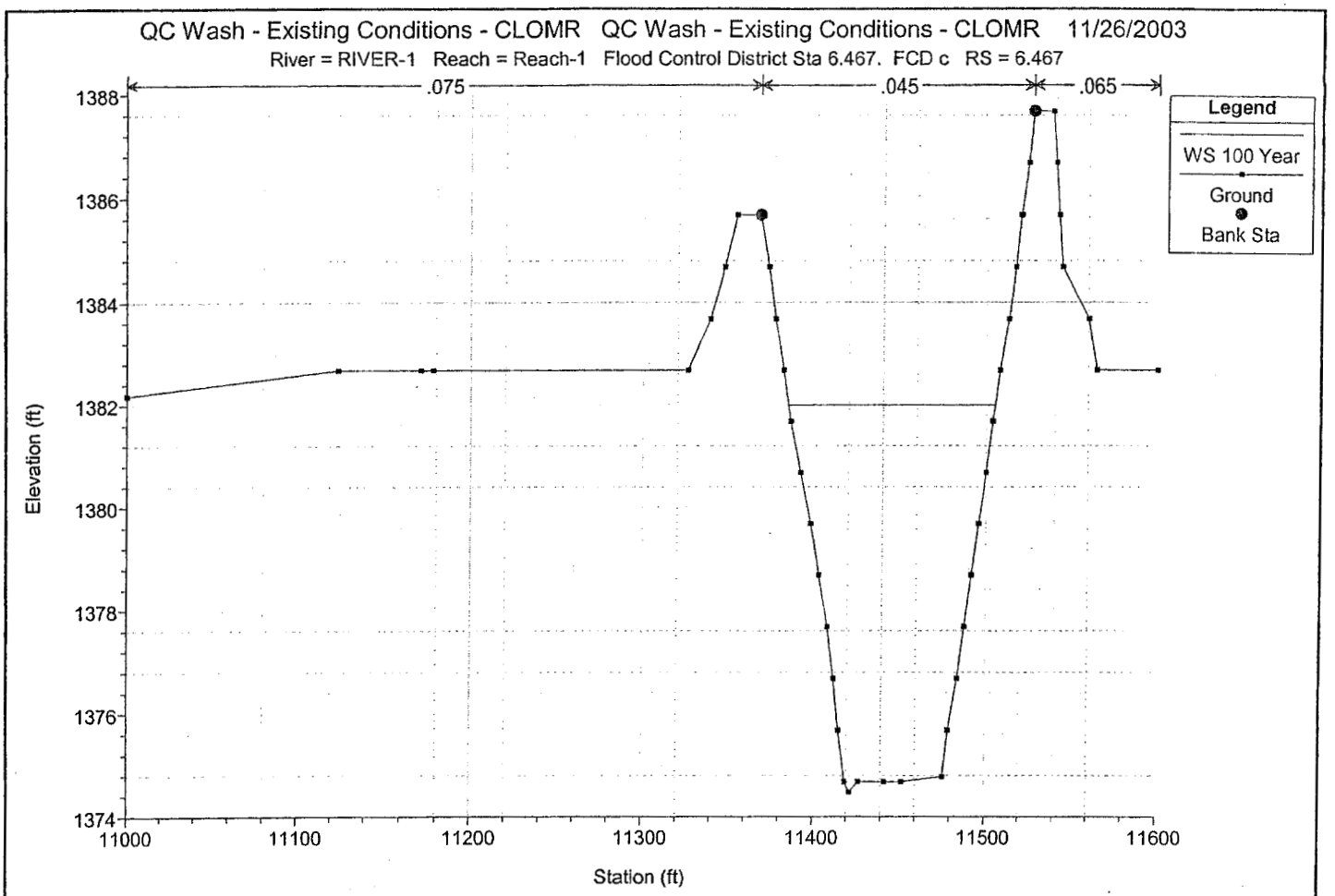
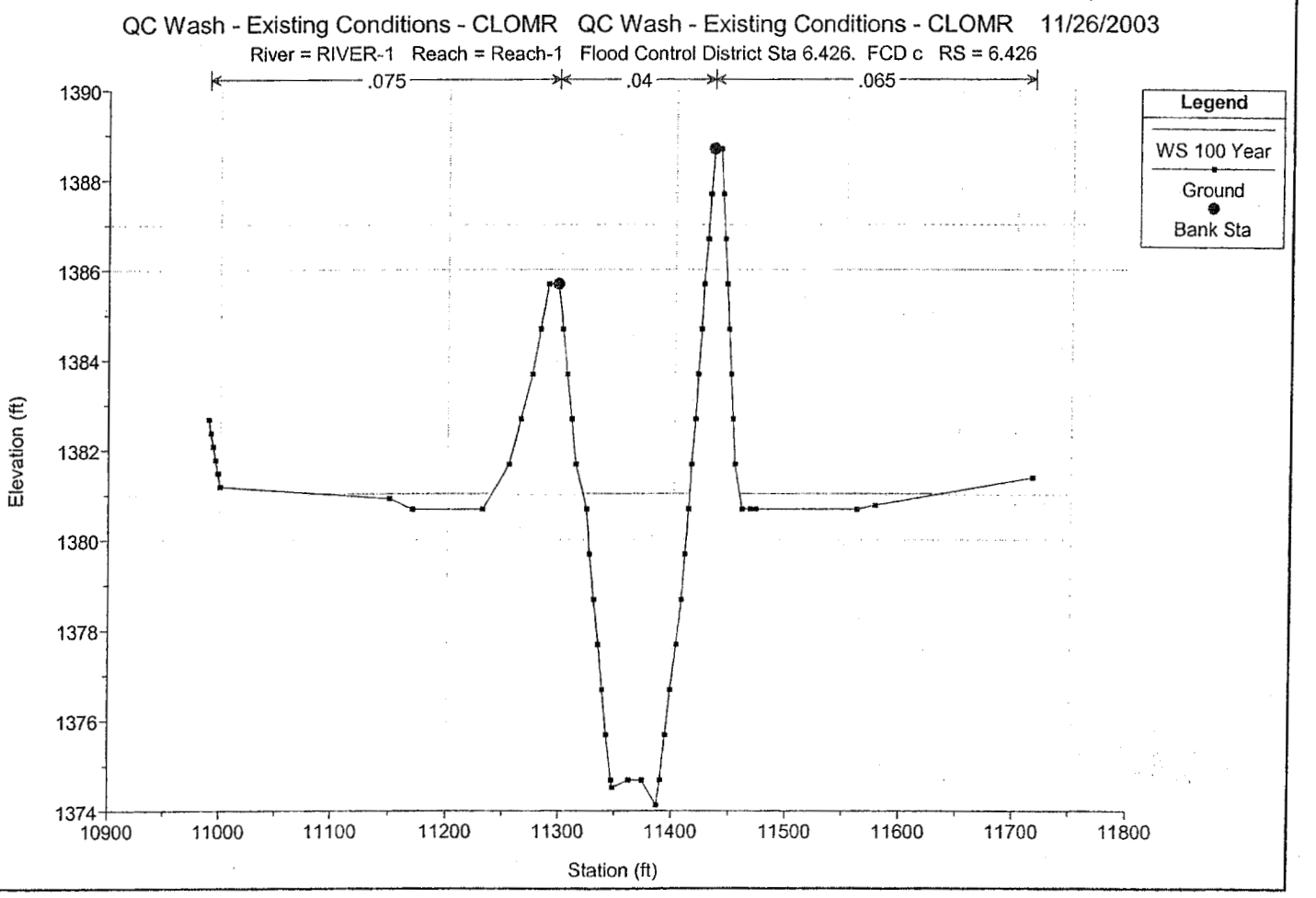
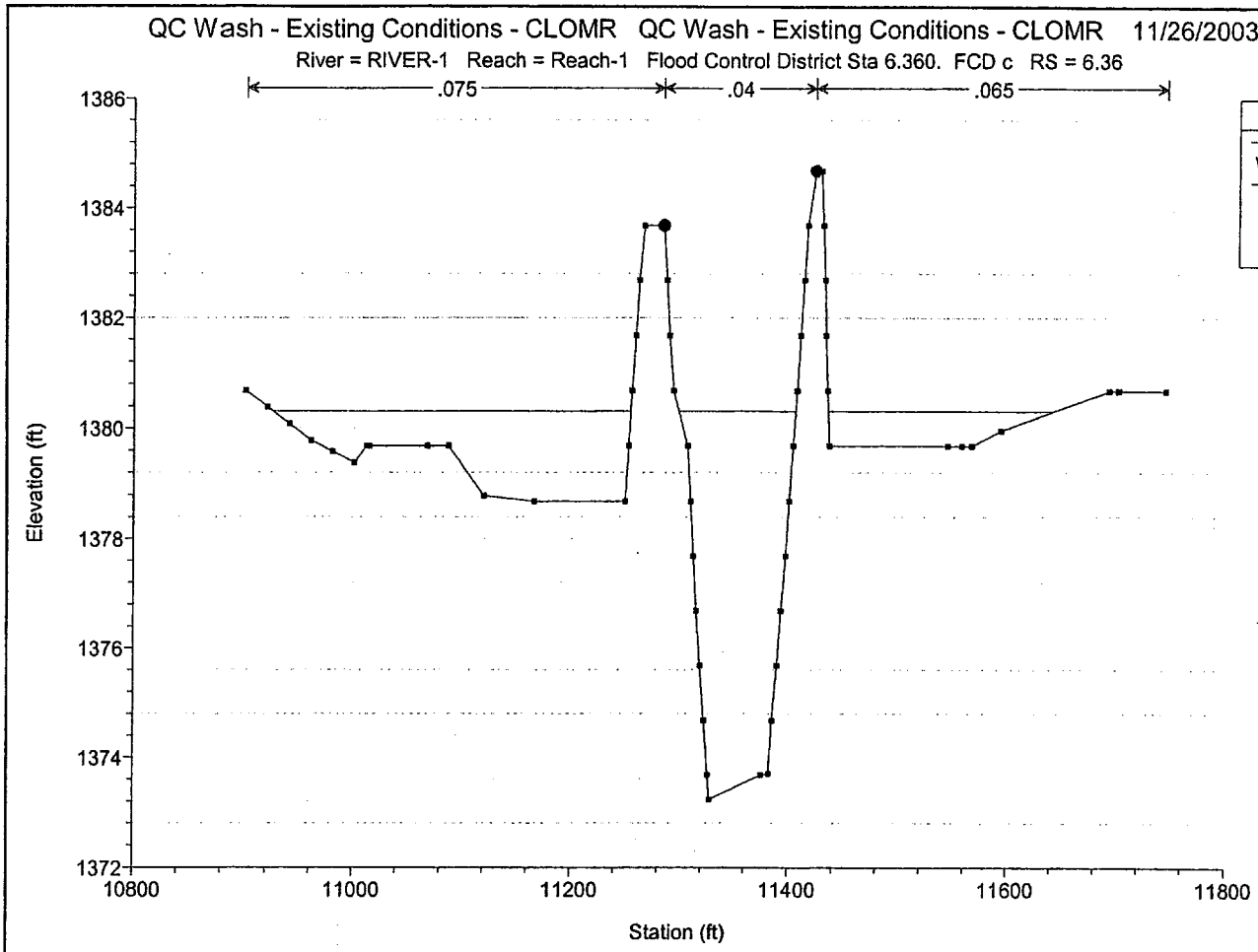
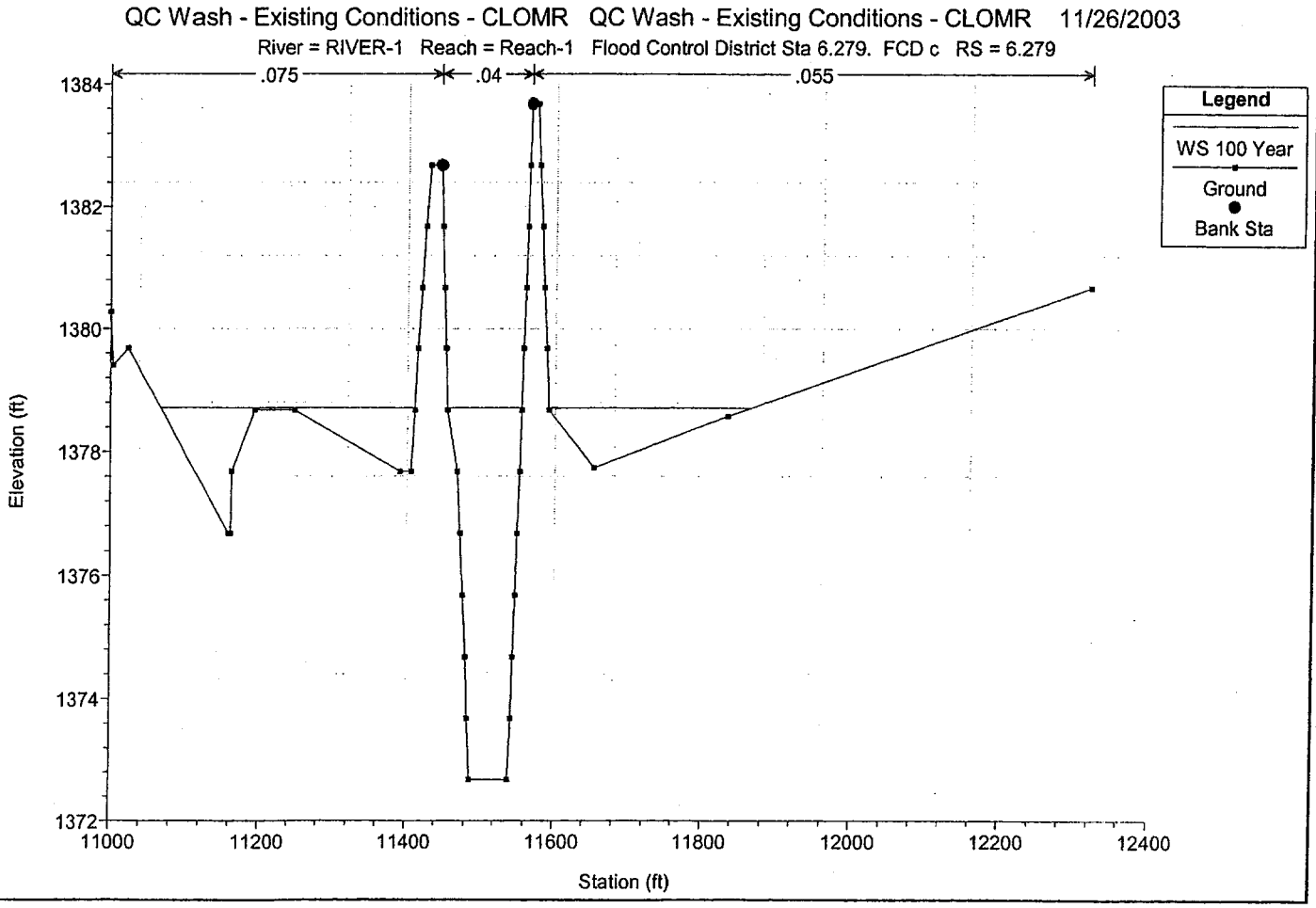
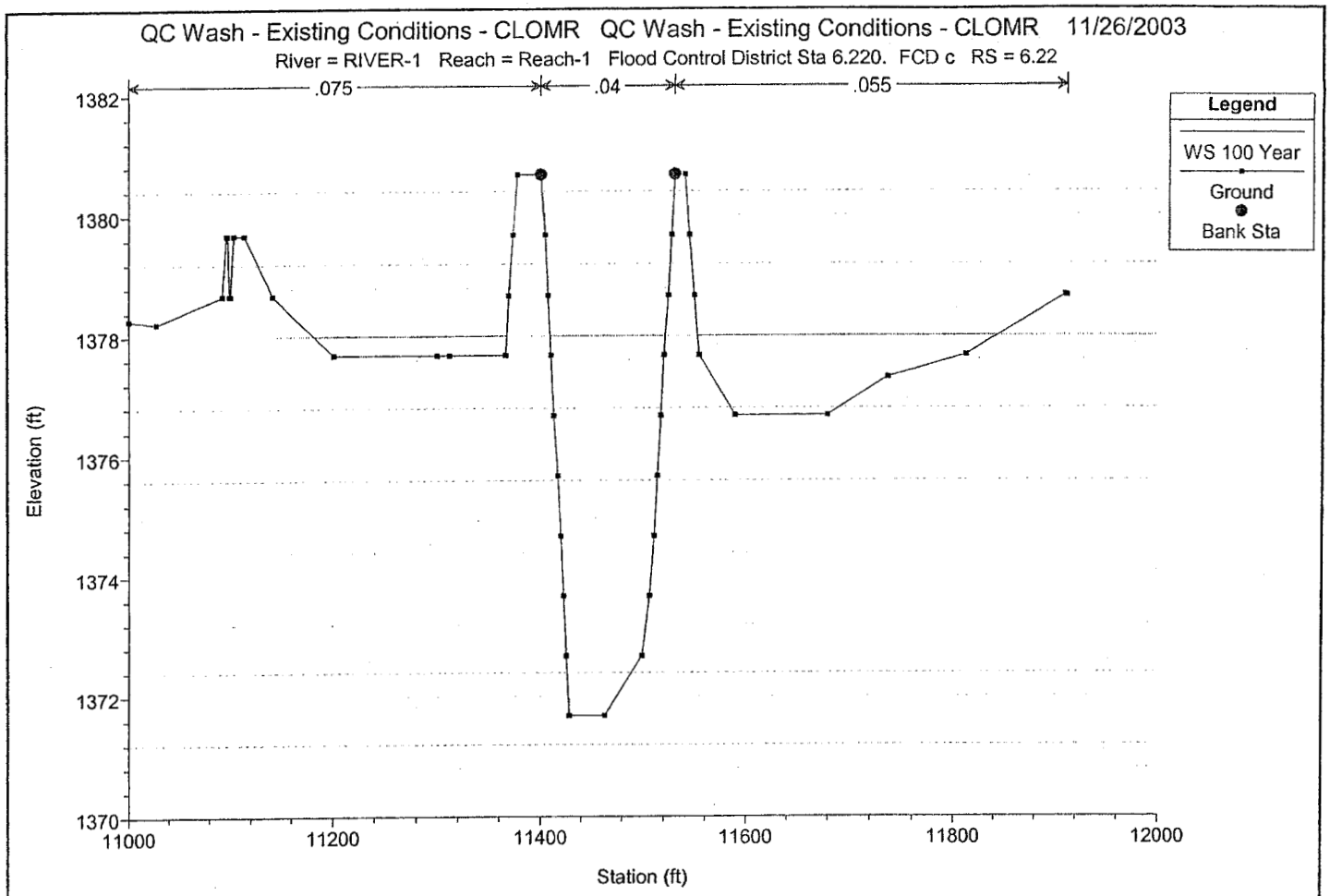
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.470. FCD c RS = 6.47
.04
.028
.04
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
700
800
900
1000
1100
1200
1300
Station (ft)

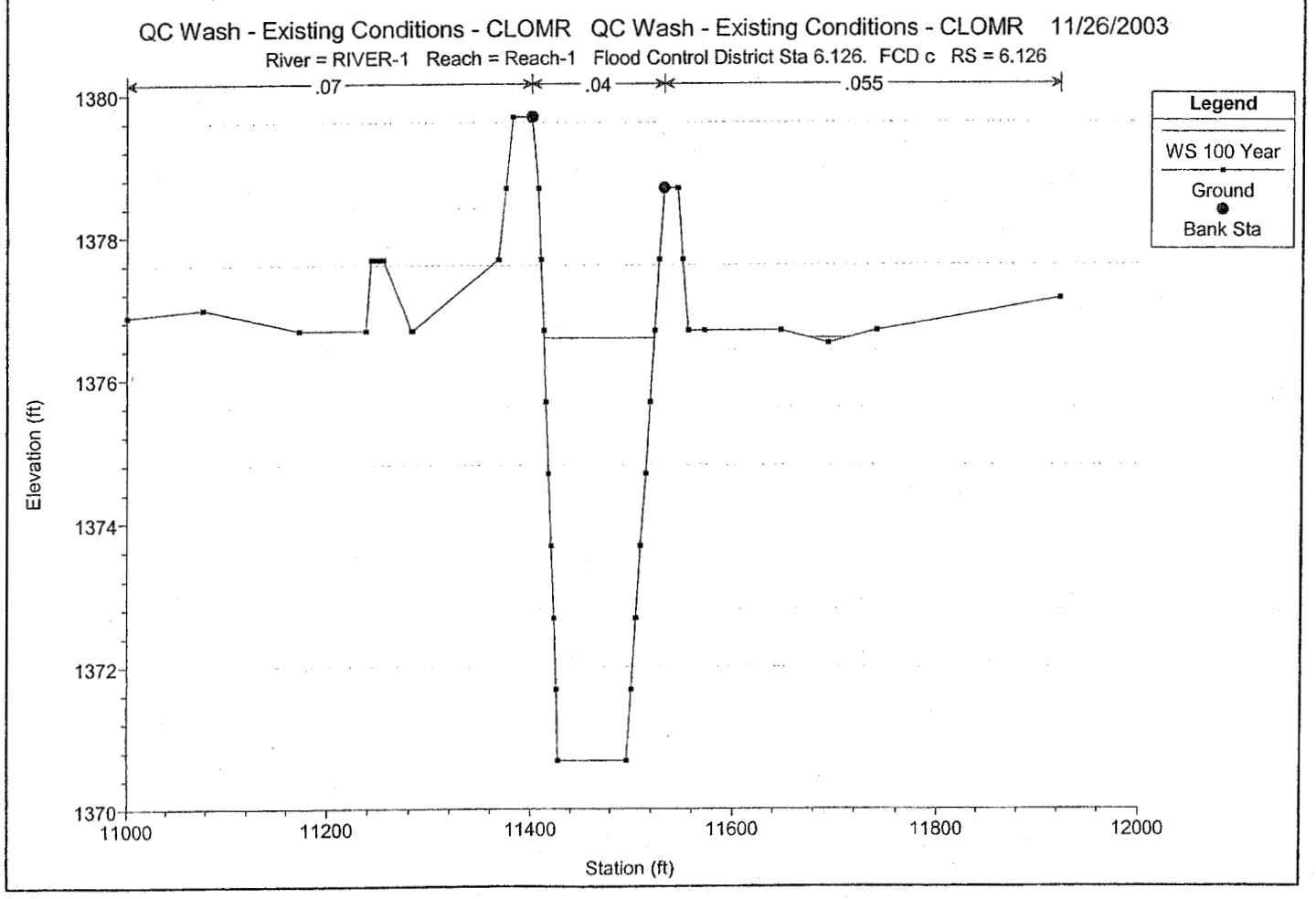

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.467. FCD c RS = 6.467
.075
.045
.065
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1388
1386
1384
1382
1380
1378
1376
1374
11000
11100
11200
11300
11400
11500
11600
Station (ft)

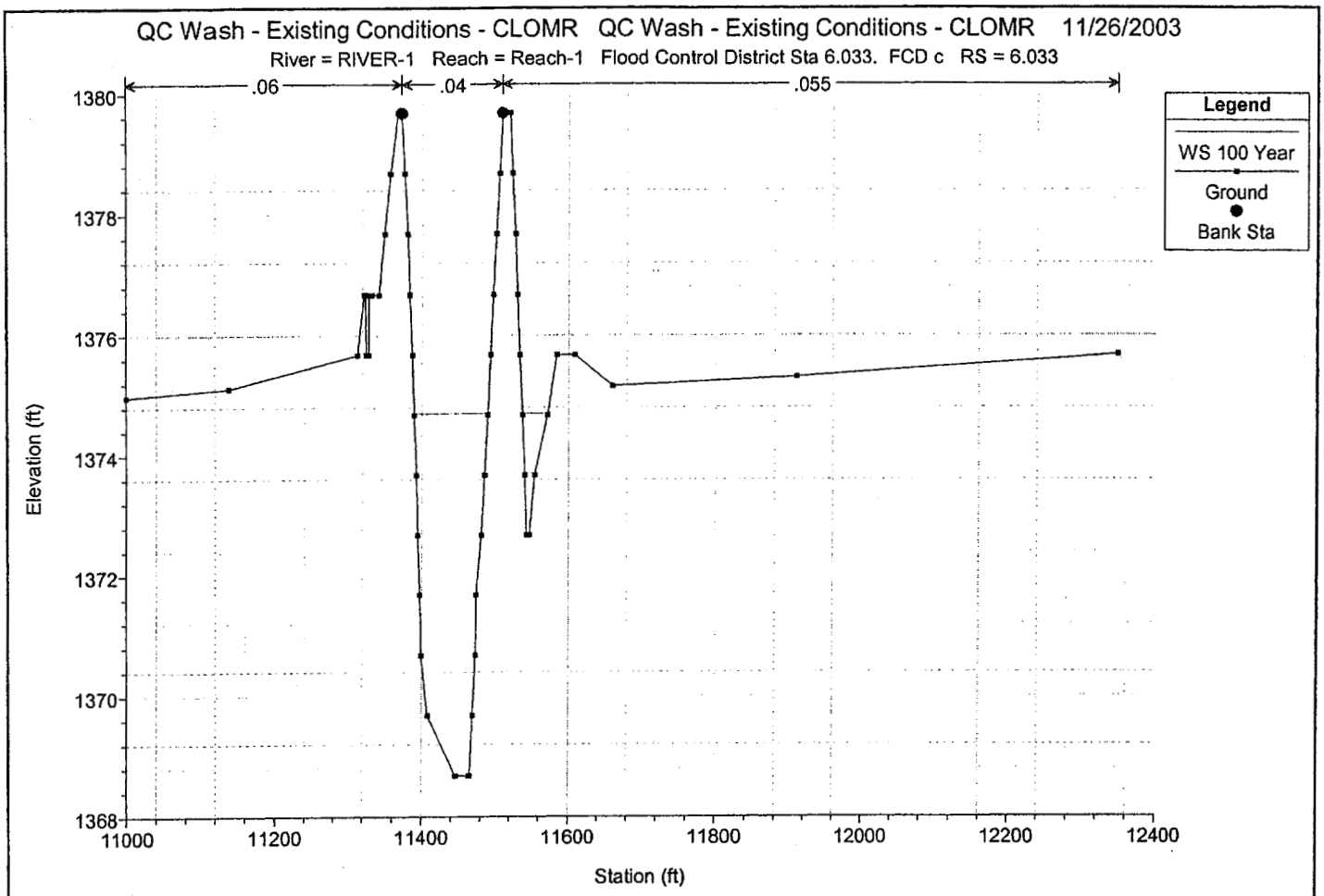

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.426. FCD c RS = 6.426
.075
.04
.065
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1390
1388
1386
1384
1382
1380
1378
1376
1374
10900
11000
11100
11200
11300
11400
11500
11600
11700
11800
Station (ft)

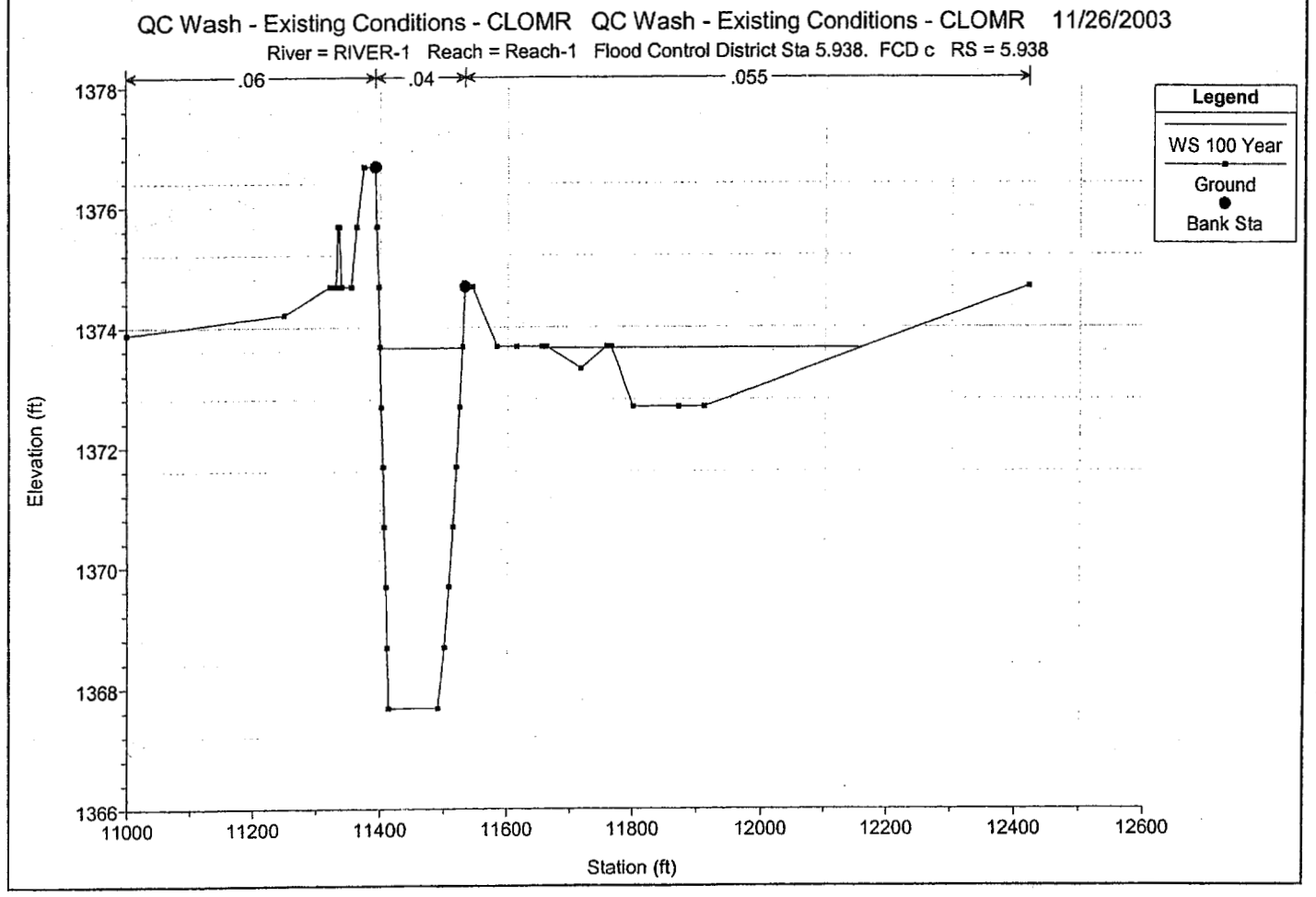

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.360. FCD c RS = 6.36
.075
.04
.065
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1386
1384
1382
1380
1378
1376
1374
1372
10800
11000
11200
11400
11600
11800
Station (ft)

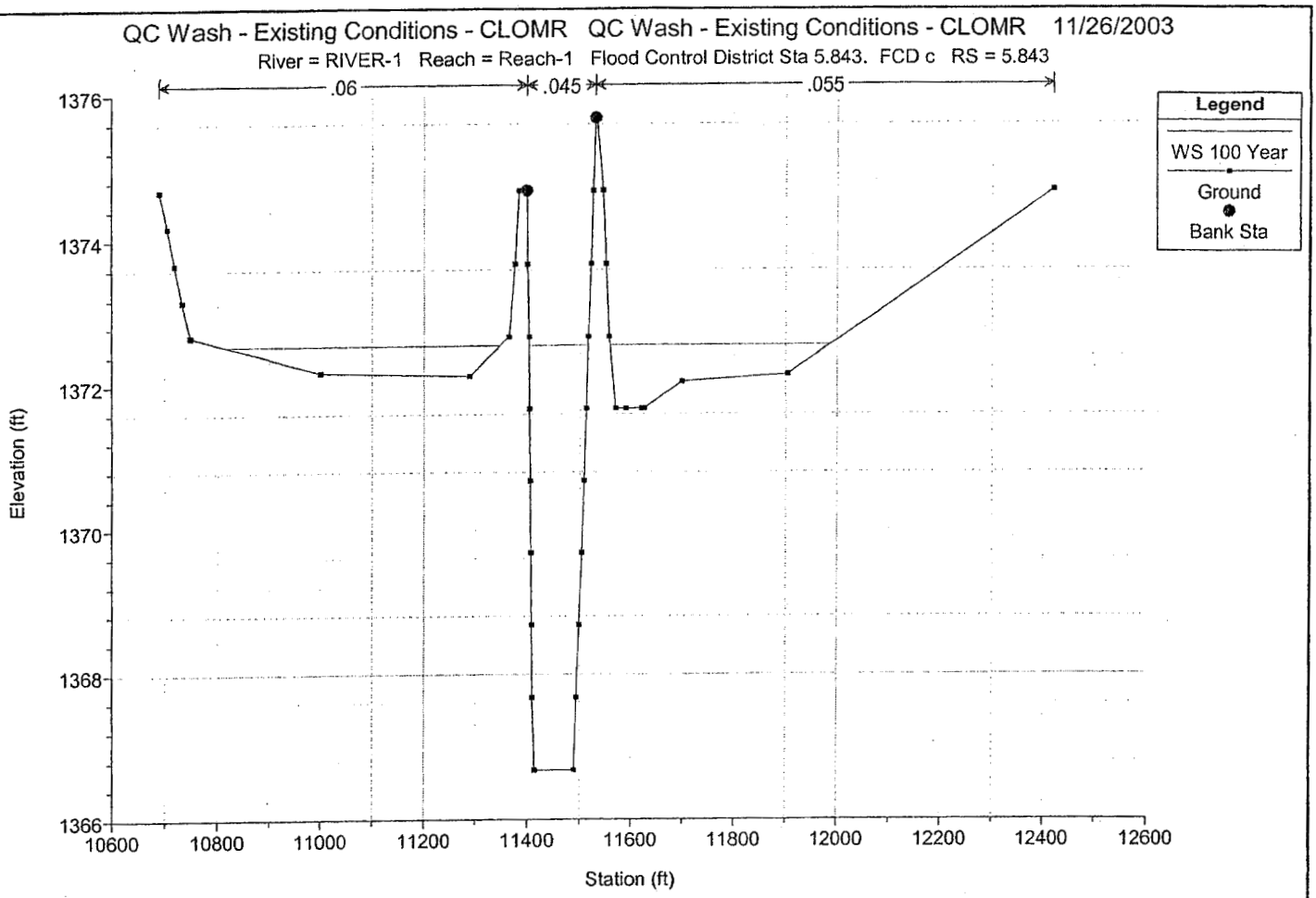

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.279. FCD c RS = 6.279
.075
.04
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1384
1382
1380
1378
1376
1374
1372
11000
11200
11400
11600
11800
12000
12200
12400
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.220. FCD c RS = 6.22
.075
.04
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1382
1380
1378
1376
1374
1372
1370
11000
11200
11400
11600
11800
12000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.126. FCD c RS = 6.126
.07
.04
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1380
1378
1376
1374
1372
1370
11000
11200
11400
11600
11800
12000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 6.033. FCD c RS = 6.033
.06
.04
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1380
1378
1376
1374
1372
1370
1368
11000
11200
11400
11600
11800
12000
12200
12400
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.938. FCD c RS = 5.938
.06
.04
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1378
1376
1374
1372
1370
1368
1366
11000
11200
11400
11600
11800
12000
12200
12400
12600
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.843. FCD c RS = 5.843
.06
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1376
1374
1372
1370
1368
1366
10600
10800
11000
11200
11400
11600
11800
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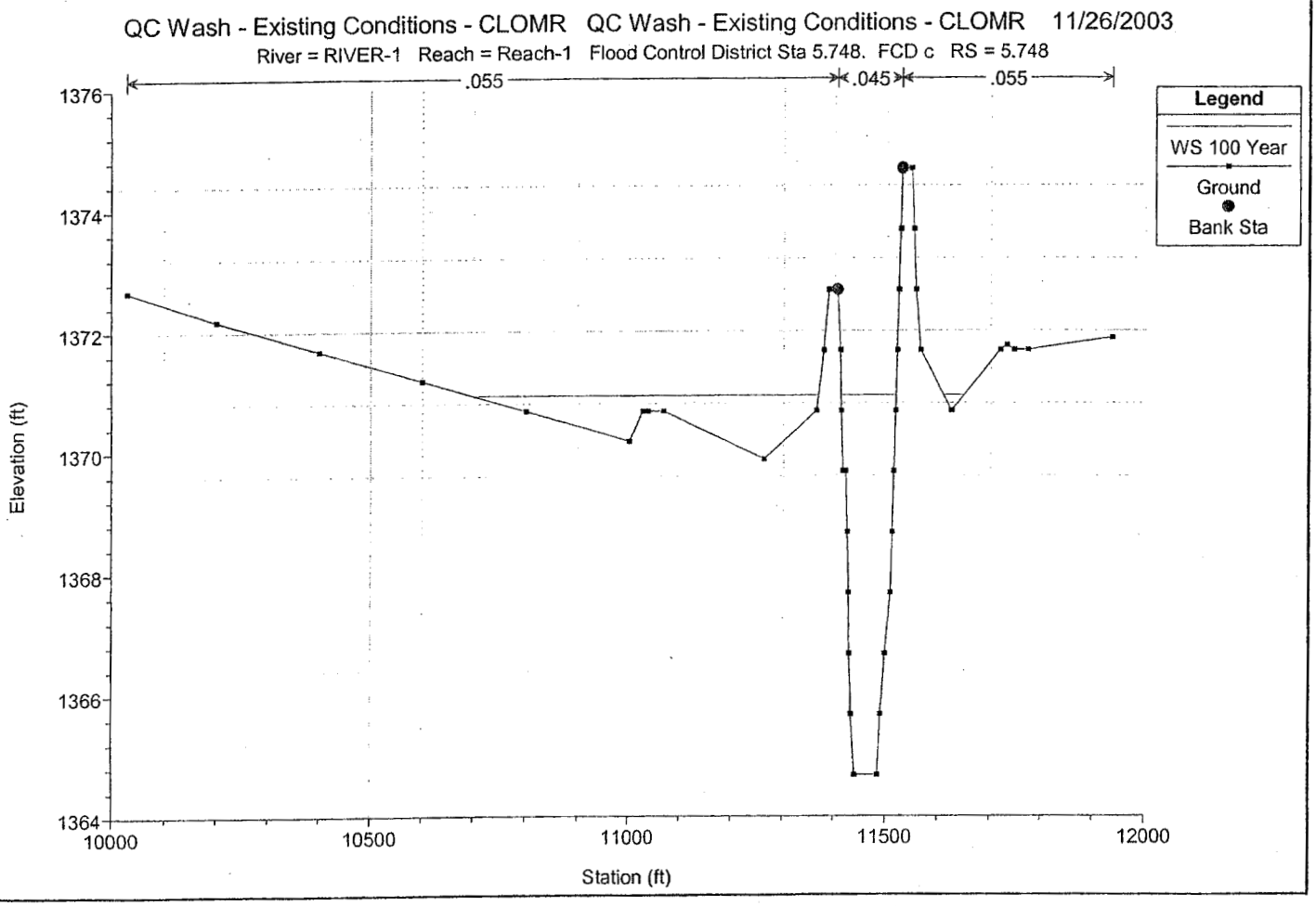
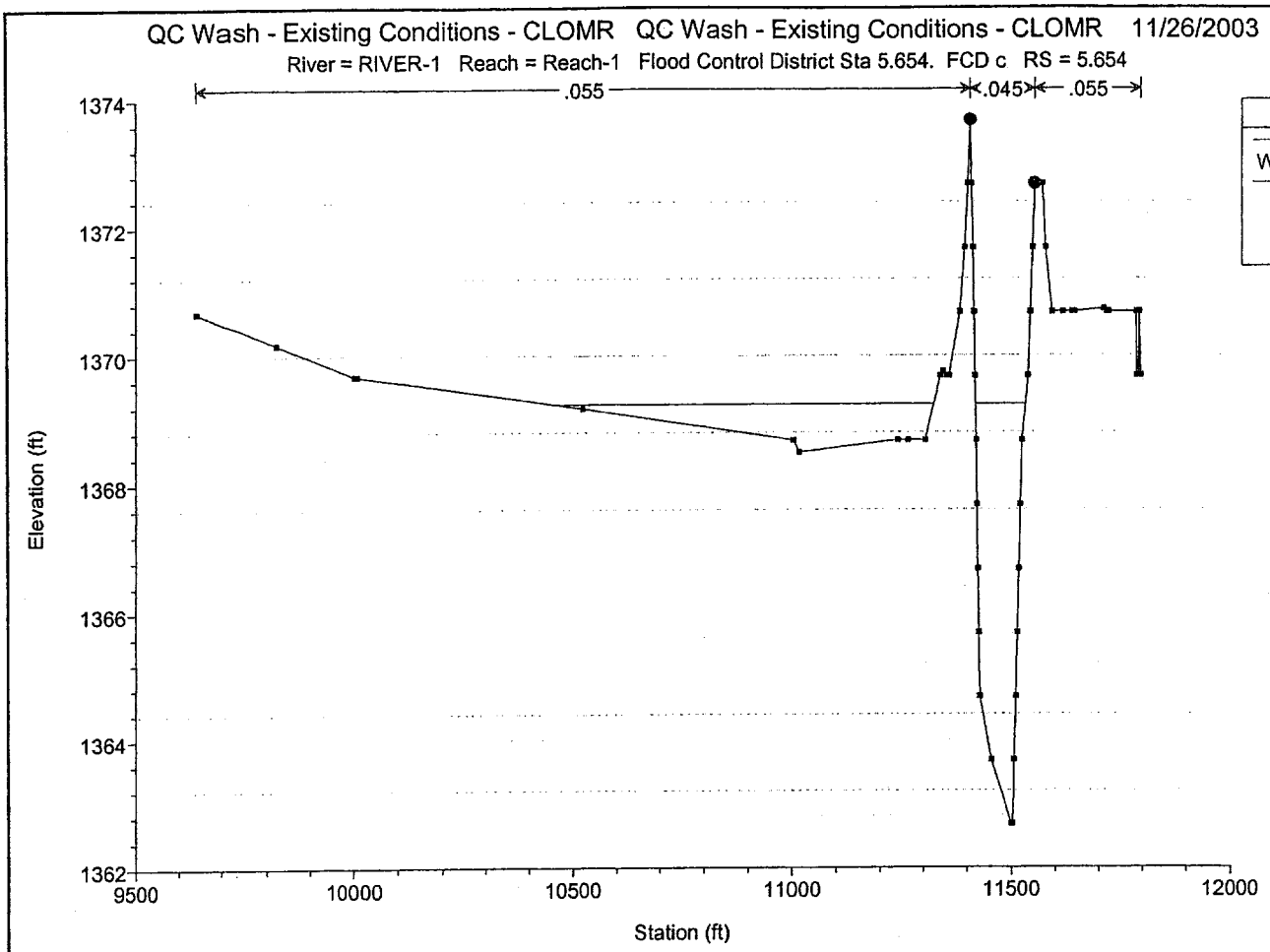
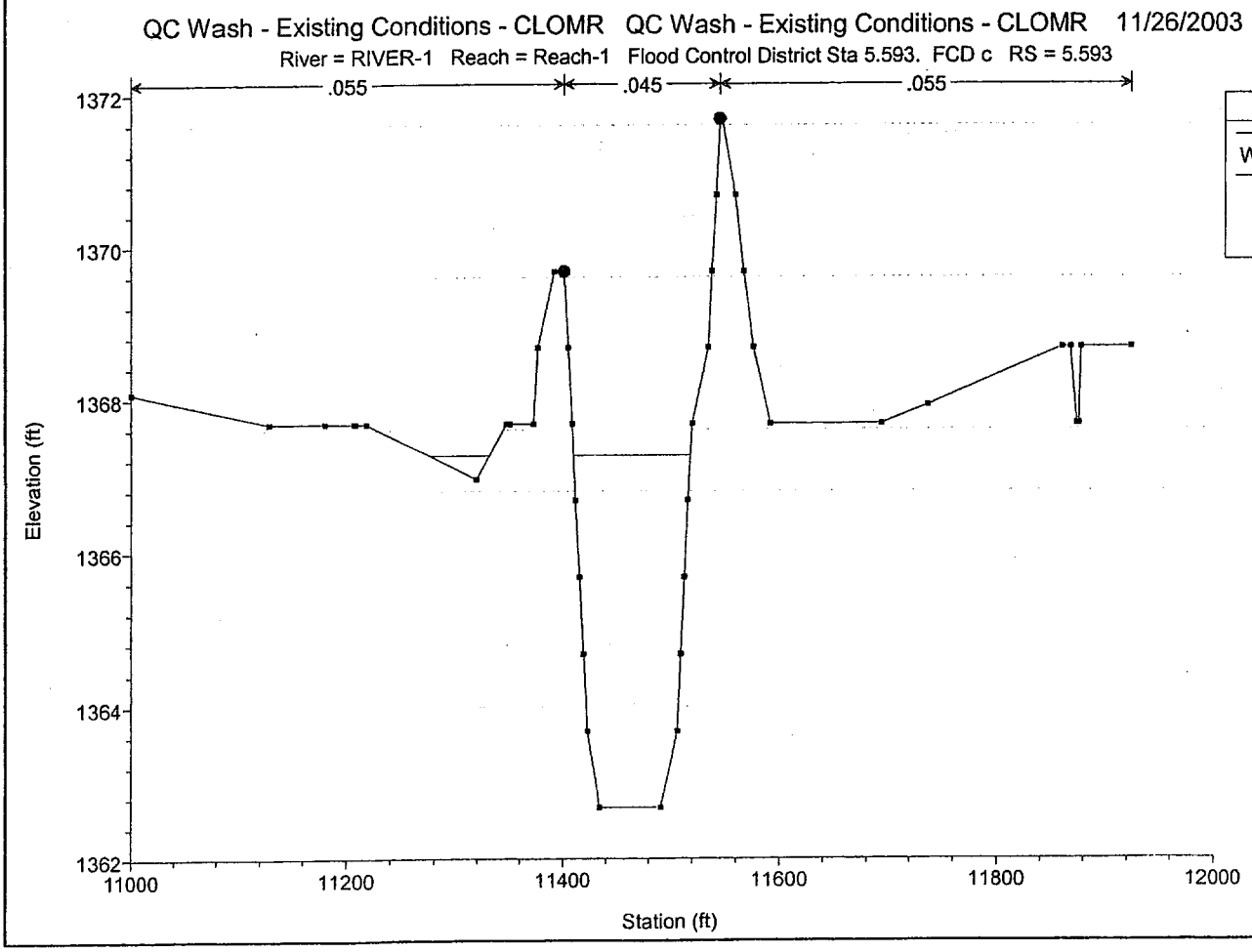
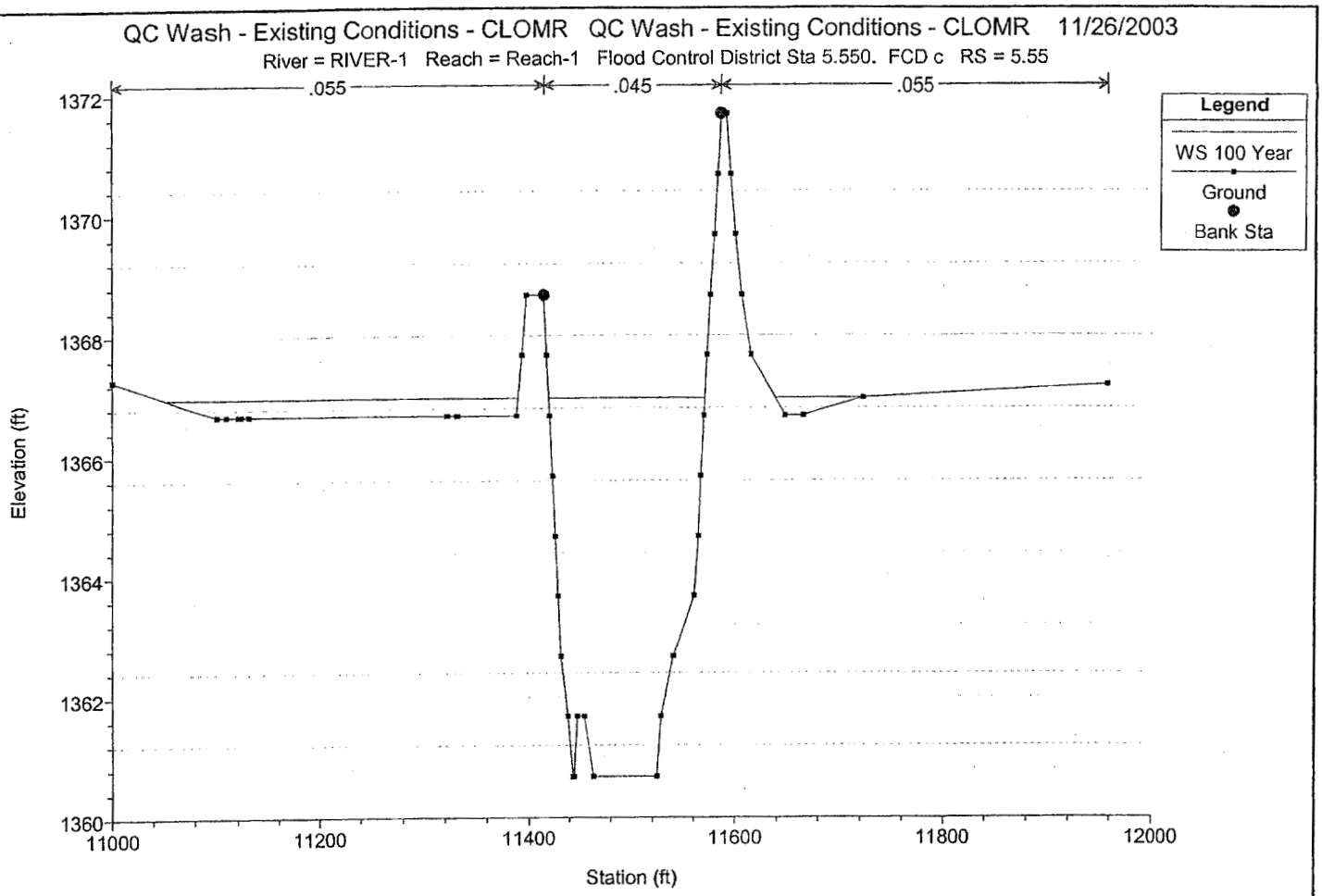
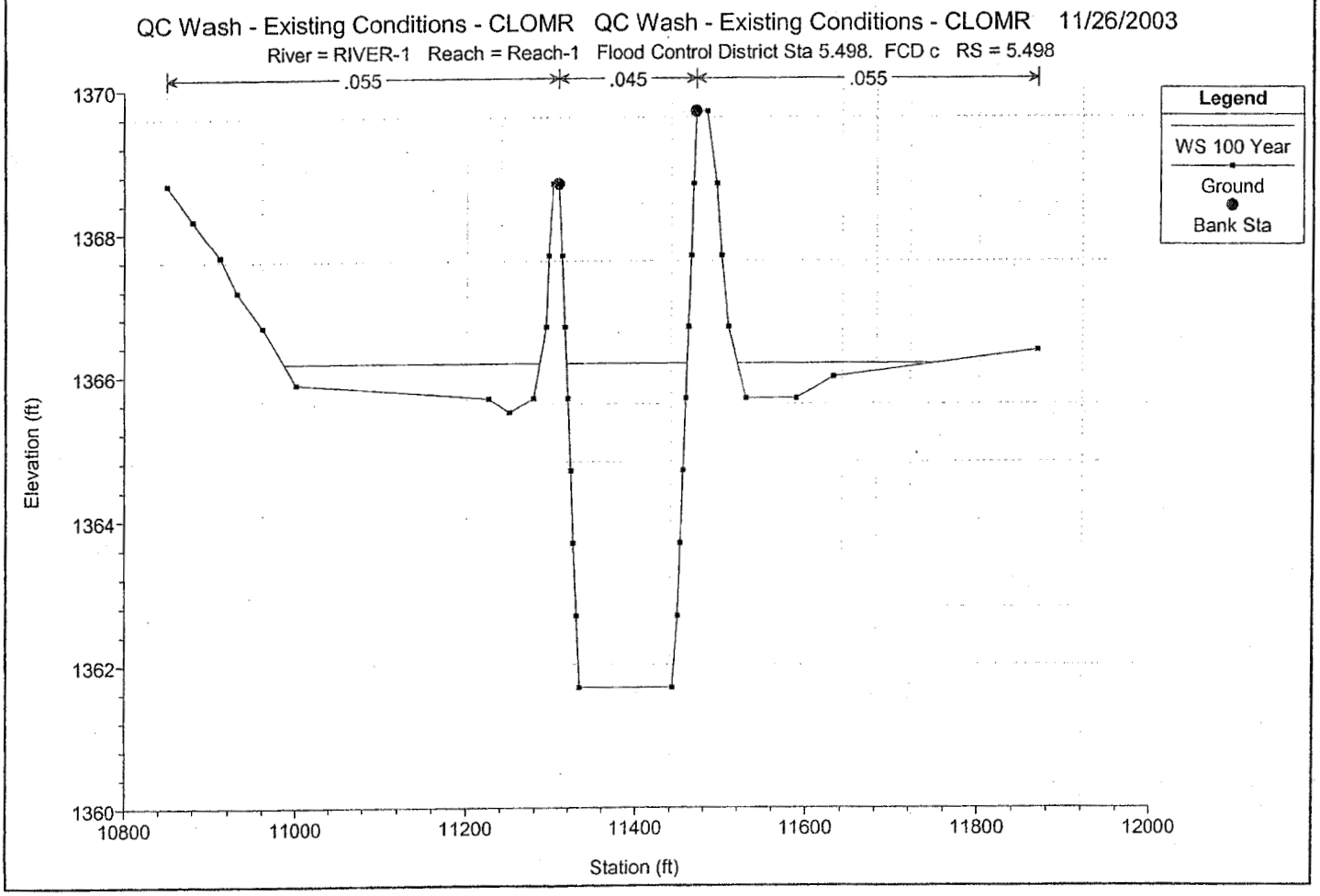
12200
12400
12600
Station (ft)

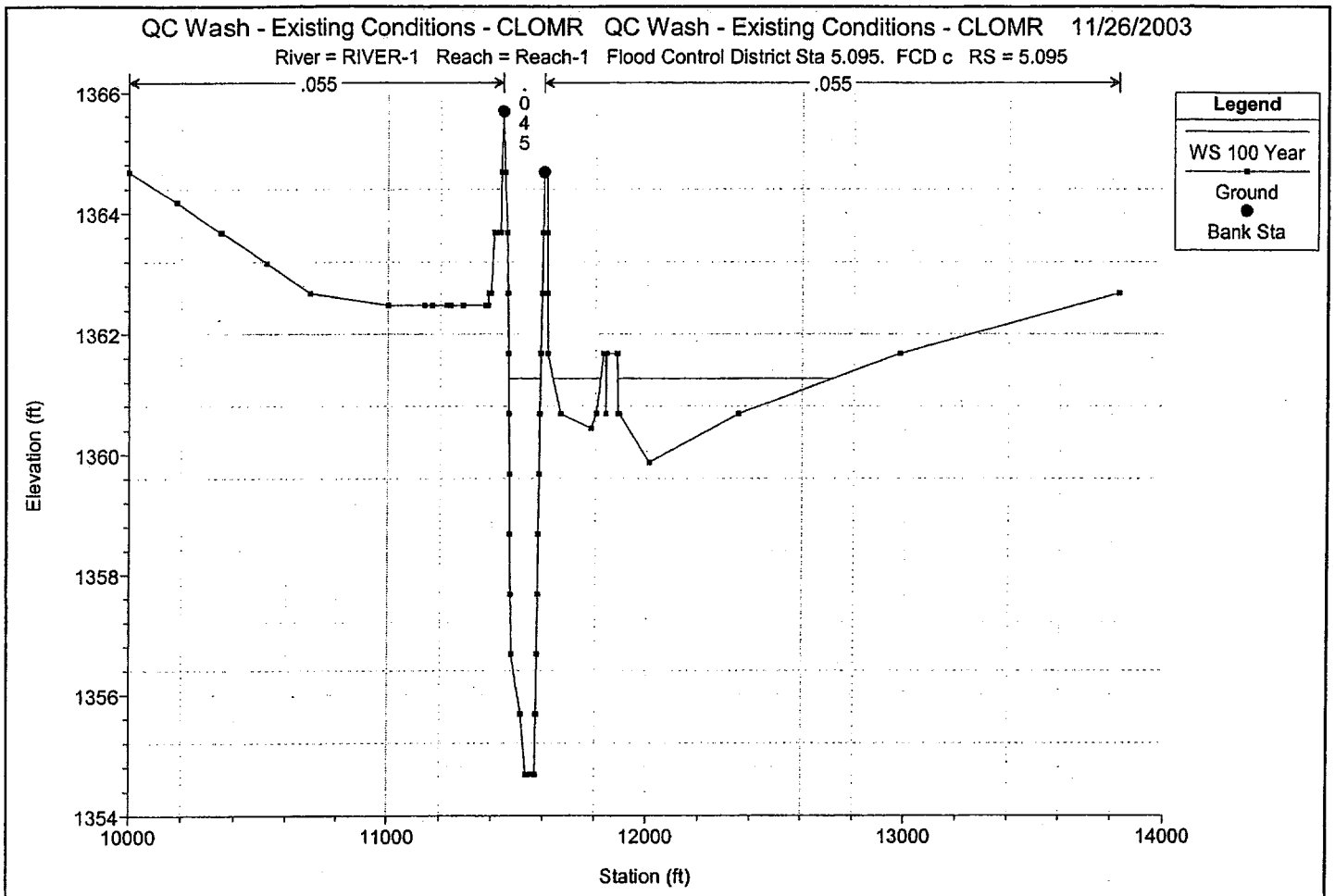

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.748. FCD c RS = 5.748
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1376
1374
1372
1370
1368
1366
1364
10000
10500
11000
11500
12000
Station (ft)

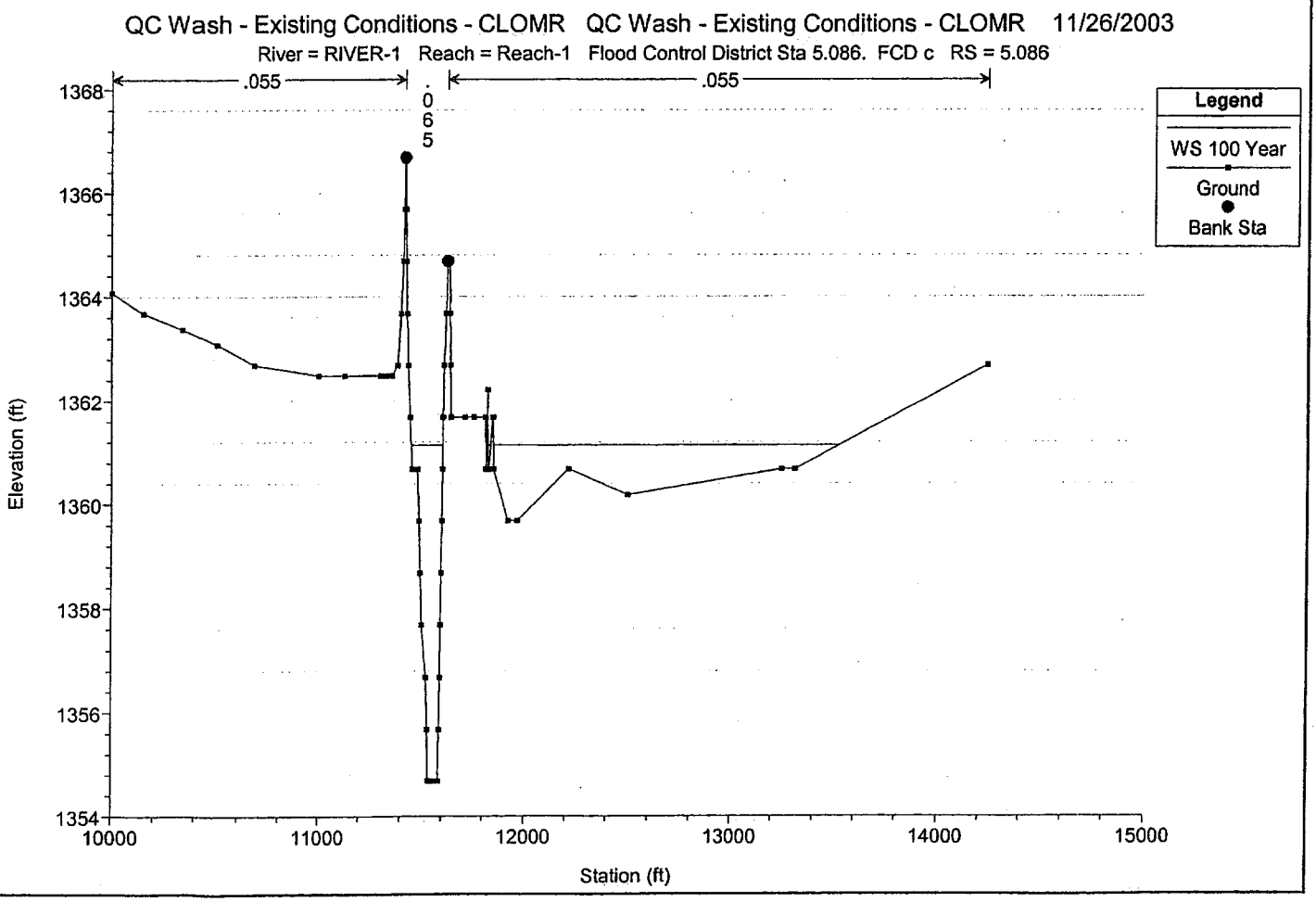

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.654. FCD c RS = 5.654
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1374
1372
1370
1368
1366
1364
1362
9500
10000
10500
11000
11500
12000
Station (ft)

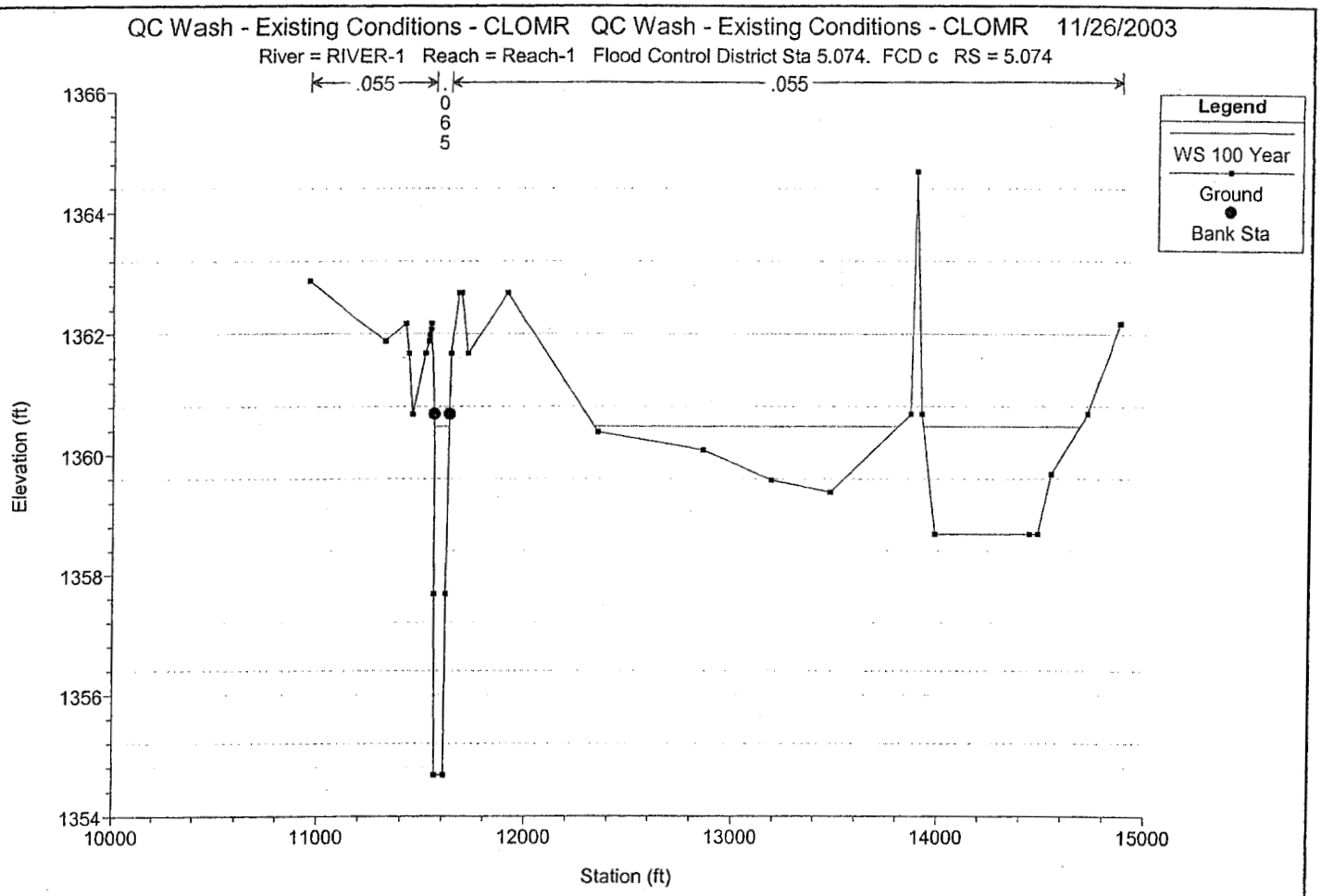

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.593. FCD c RS = 5.593
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1372
1370
1368
1366
1364
1362
11000
11200
11400
11600
11800
12000
Station (ft)

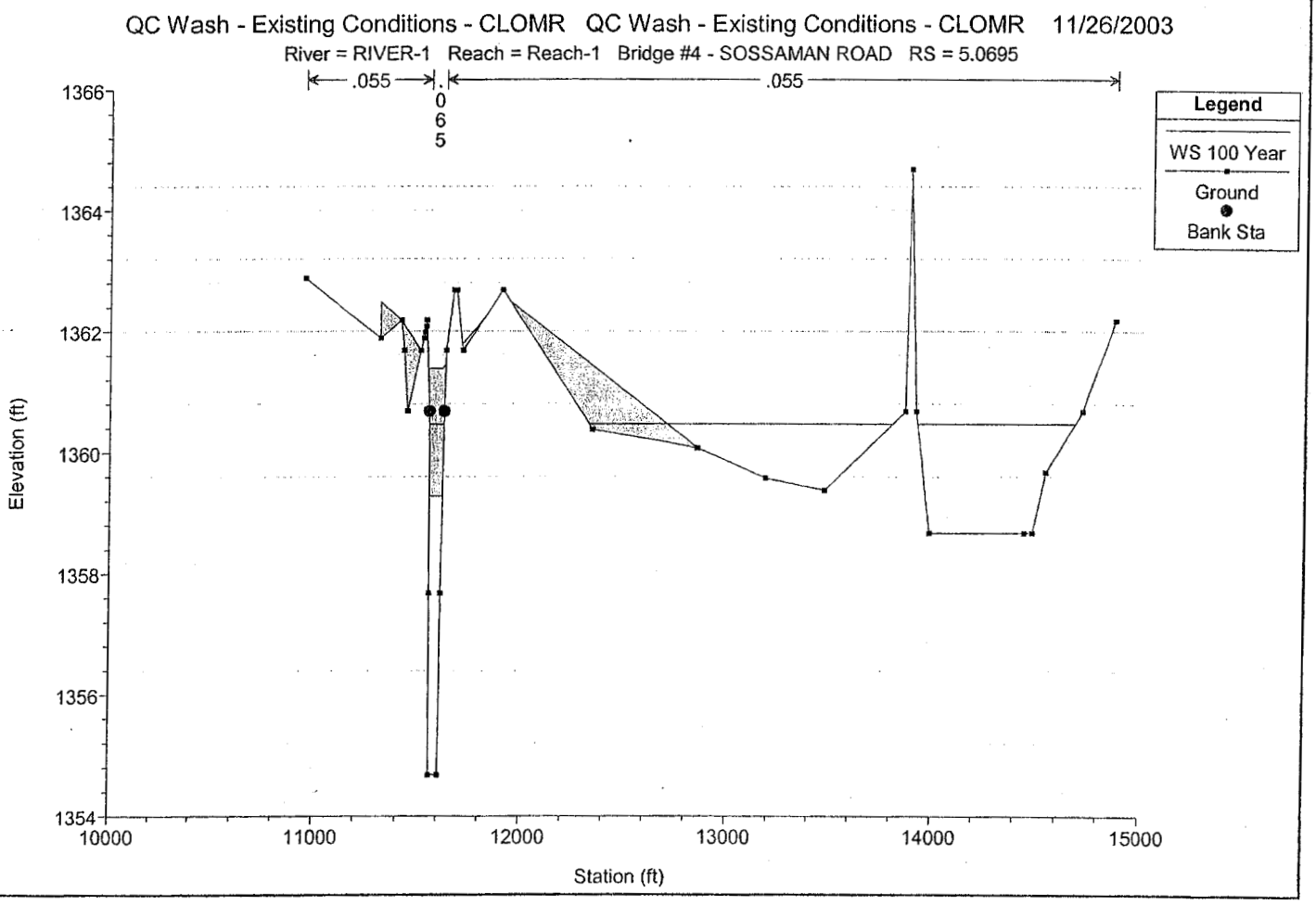

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.550. FCD c RS = 5.55
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1372
1370
1368
1366
1364
1362
1360
11000
11200
11400
11600
11800
12000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.498. FCD c RS = 5.498
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1370
1368
1366
1364
1362
1360
10800
11000
11200
11400
11600
11800
12000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.095. FCD c RS = 5.095
.055
.045
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
10000
11000
12000
13000
14000
Station (ft)

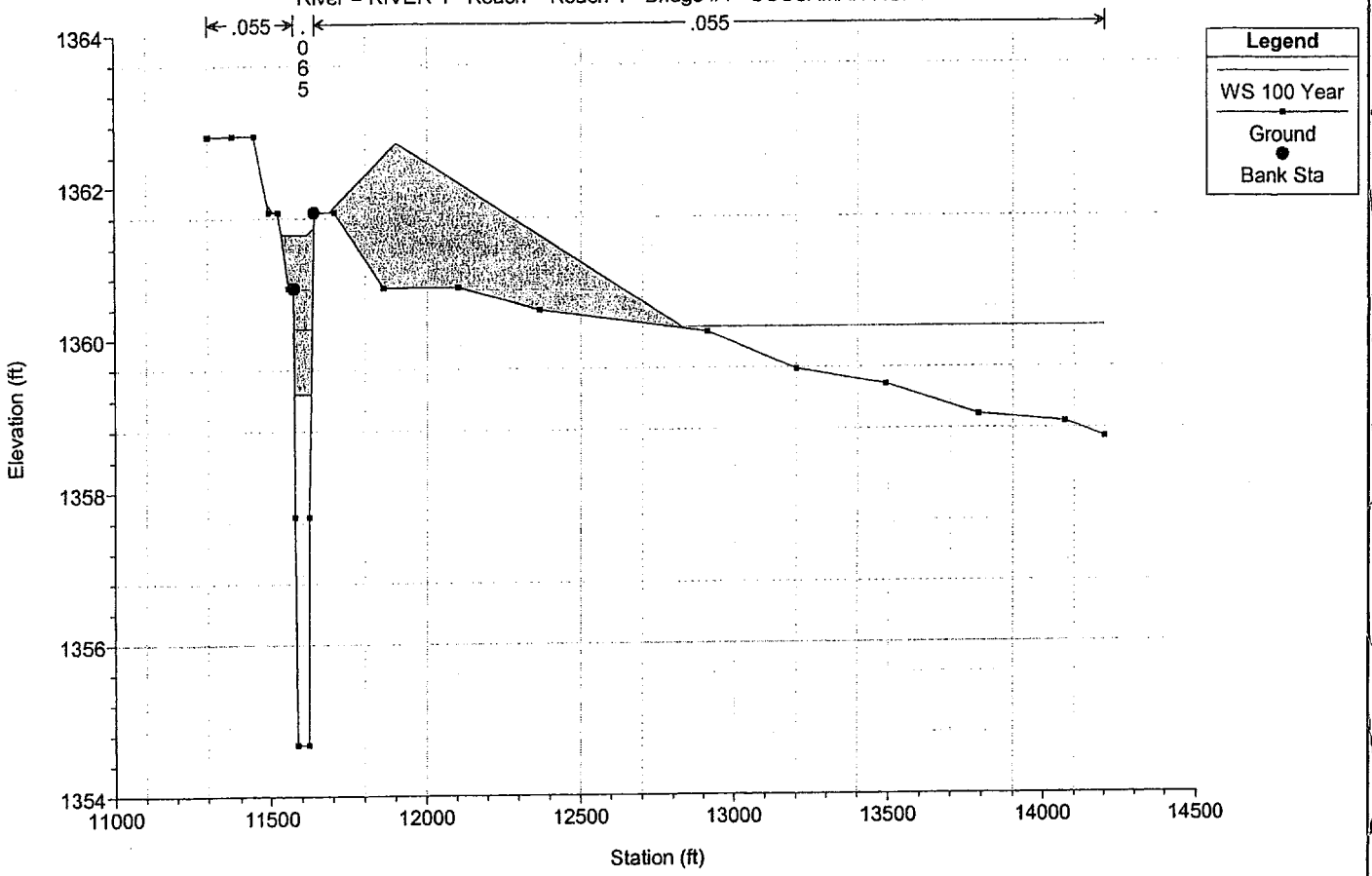

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.086. FCD c RS = 5.086
.055
.065
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1368
1366
1364
1362
1360
1358
1356
1354
10000
11000
12000
13000
14000
15000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.074. FCD c RS = 5.074
.055
.065
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
10000
11000
12000
13000
14000
15000
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 Bridge #4 - SOSSAMAN ROAD RS = 5.0695
.055
.065
.055
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1366
1364
1362
1360
1358
1356
1354
10000
11000
12000
13000
14000
15000
Station (ft)

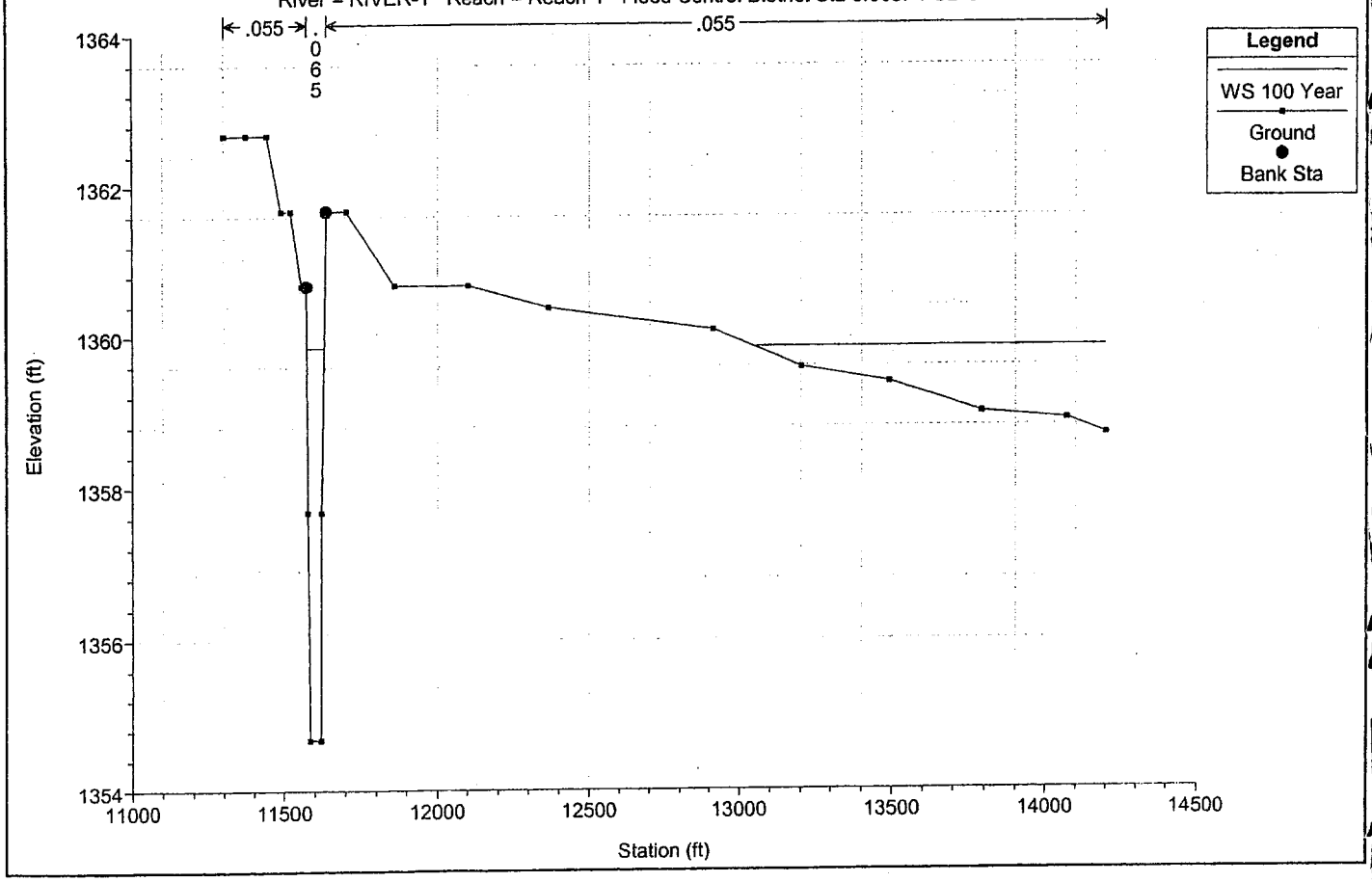
QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003

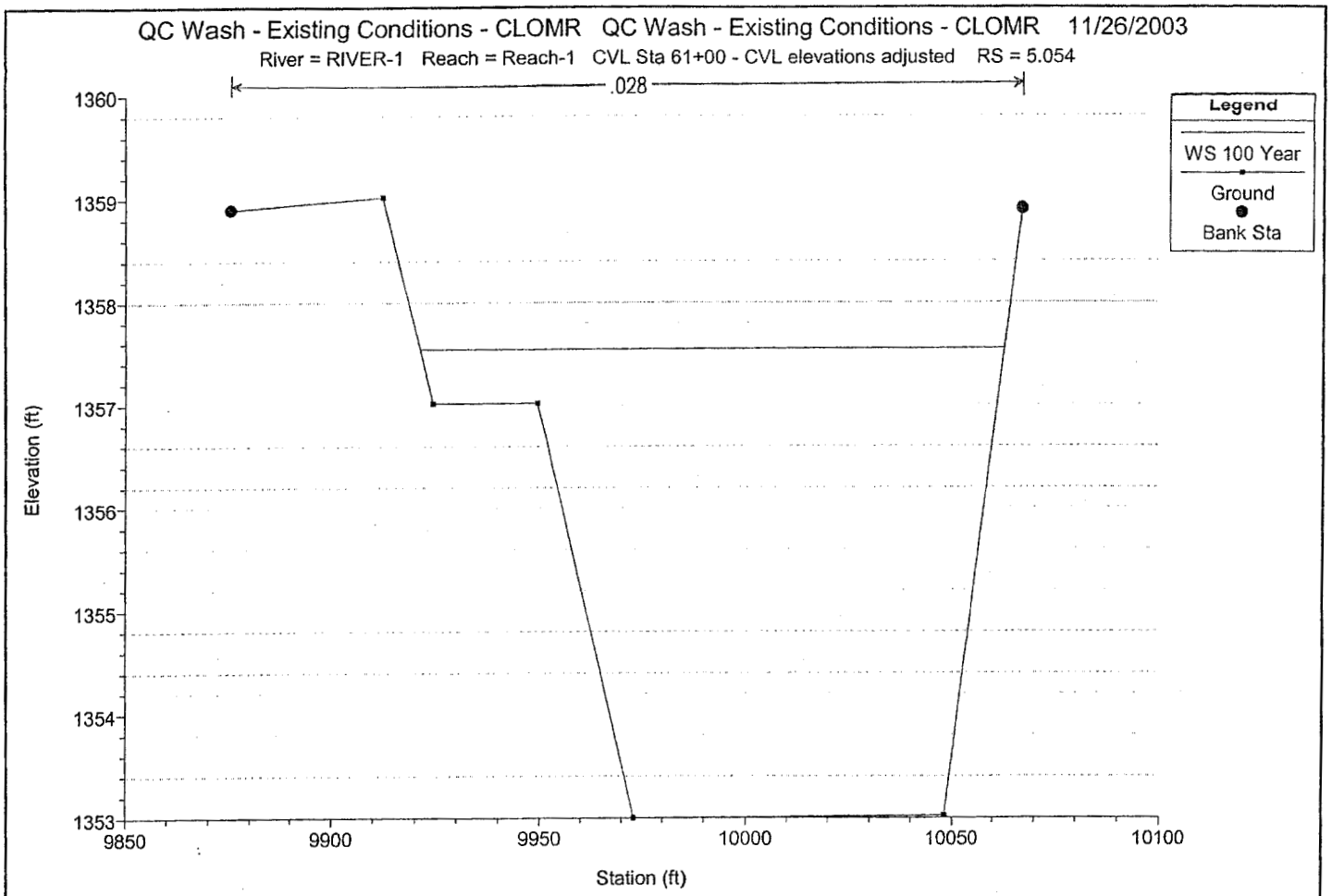
River = RIVER-1 Reach = Reach-1 Bridge #4 - SOSSAMAN ROAD RS = 5.0695

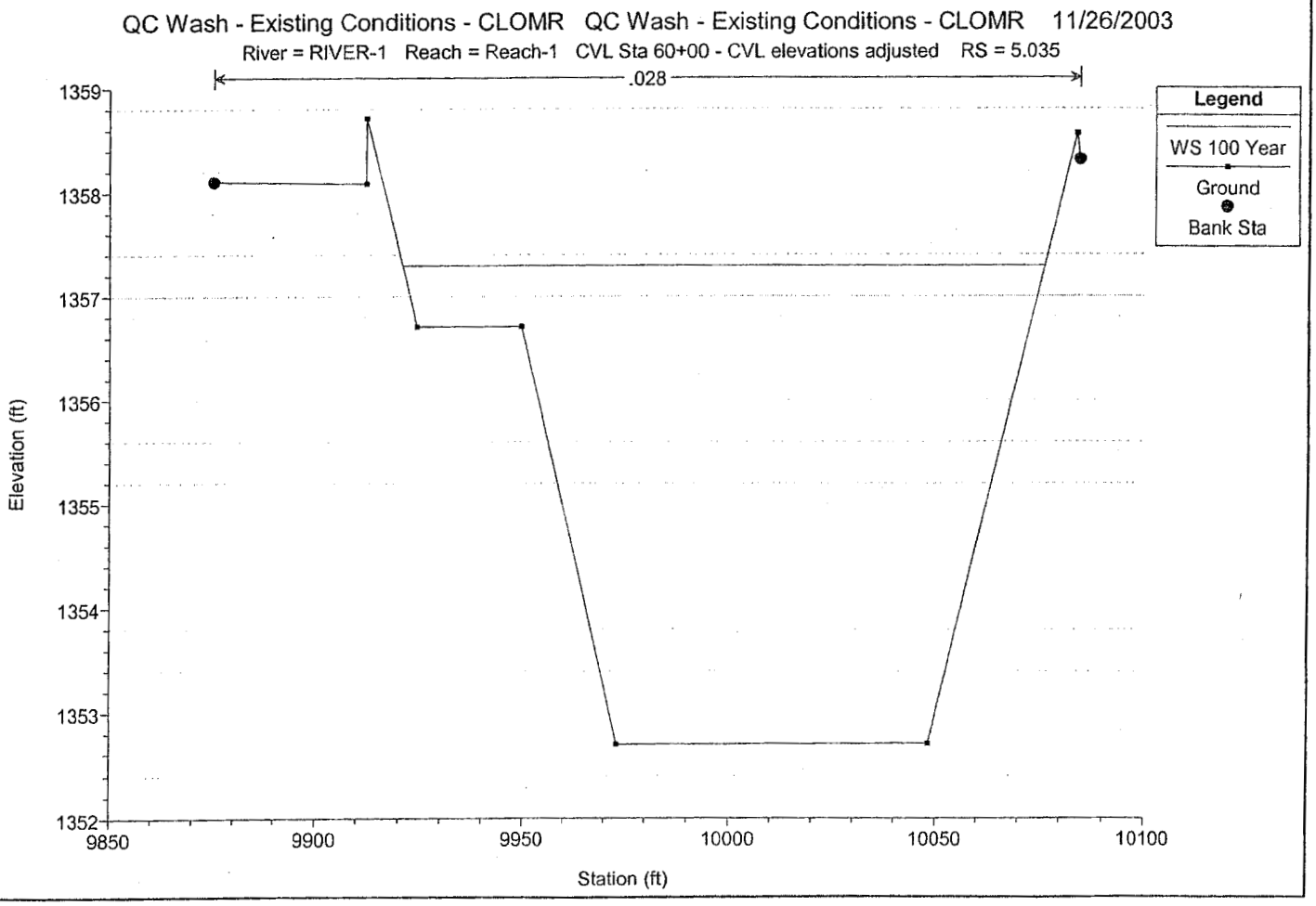


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003

River = RIVER-1 Reach = Reach-1 Flood Control District Sta 5.065. FCD c RS = 5.065




QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 61+00 - CVL elevations adjusted RS = 5.054
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1360
1359
1358
1357
1356
1355
1354
1353
9850
9900
9950
10000
10050
10100
Station (ft)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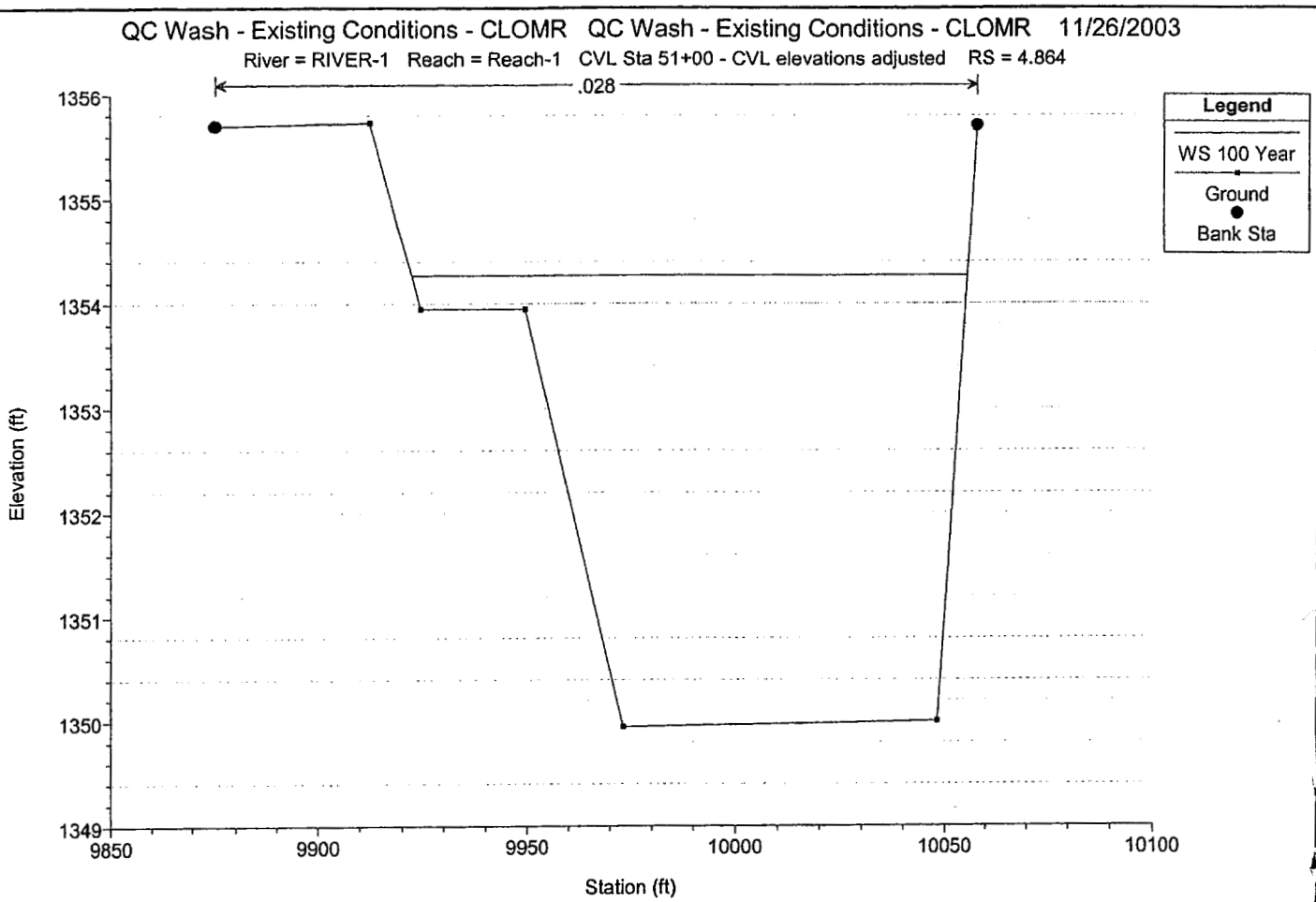
River = RIVER-1 Reach = Reach-1 CVL Sta 60+00 - CVL elevations adjusted RS = 5.035
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1359
1358
1357
1356
1355
1354
1353
1352
9850
9900
9950
10000
10050
10100
Station (ft)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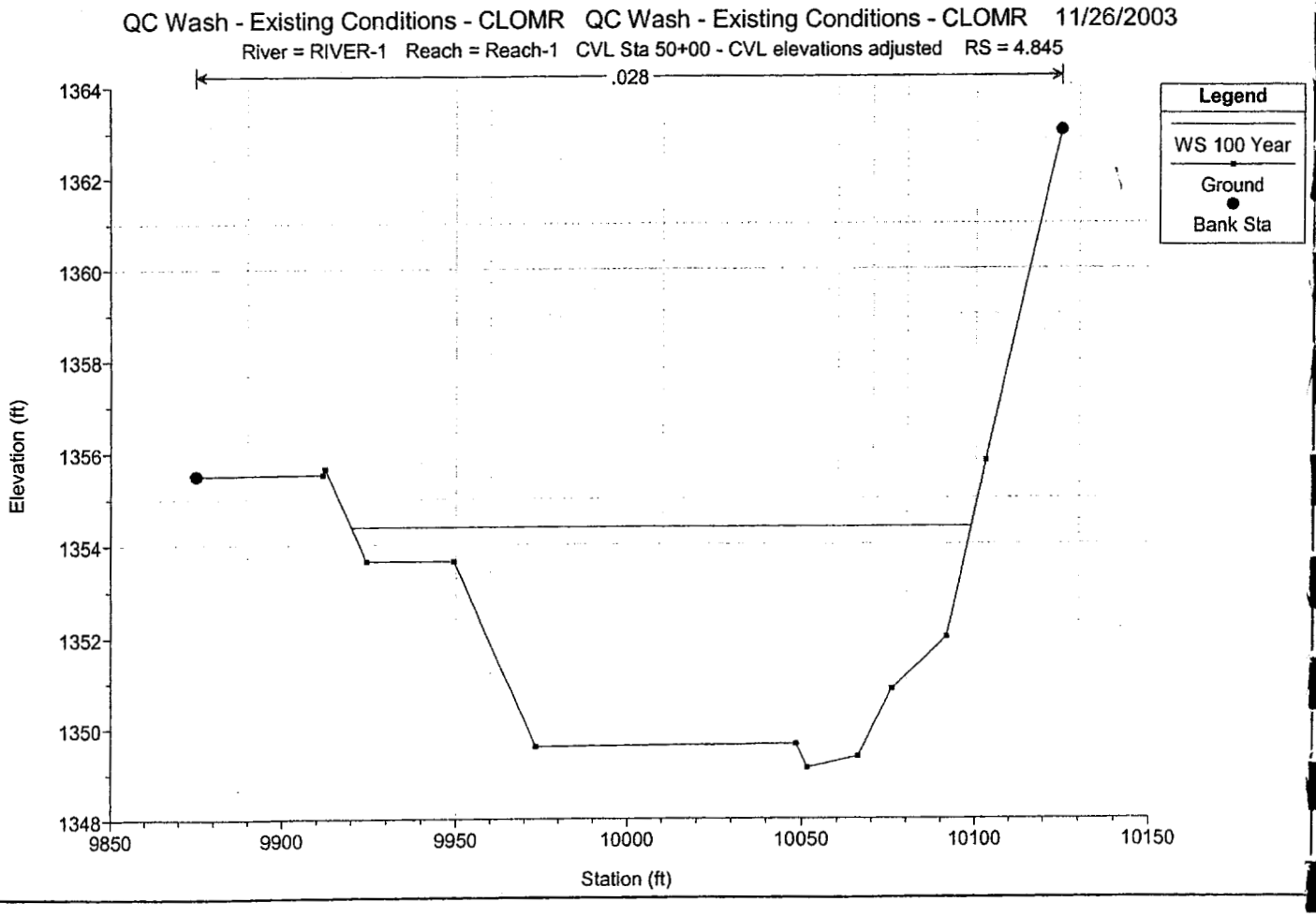
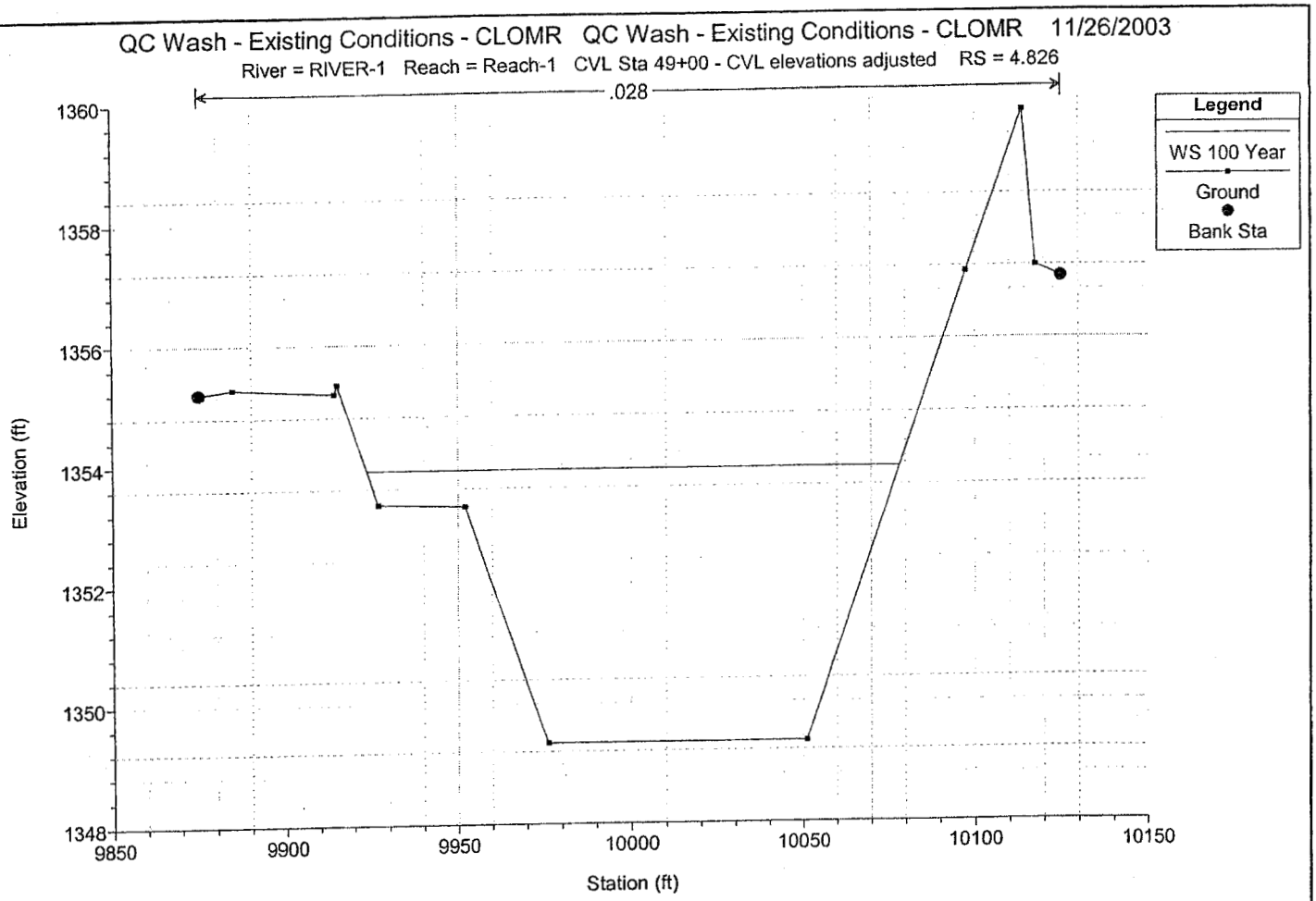
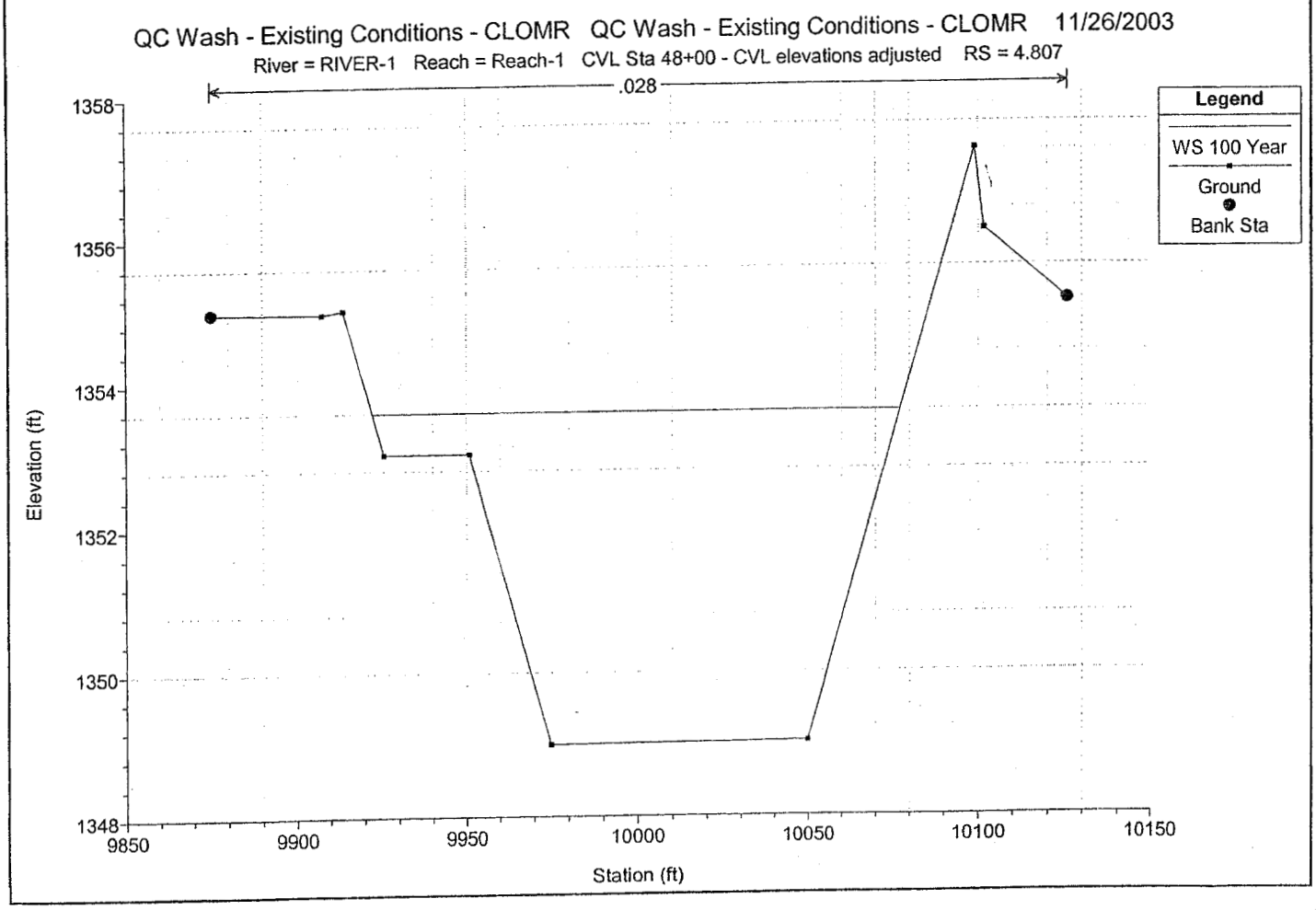
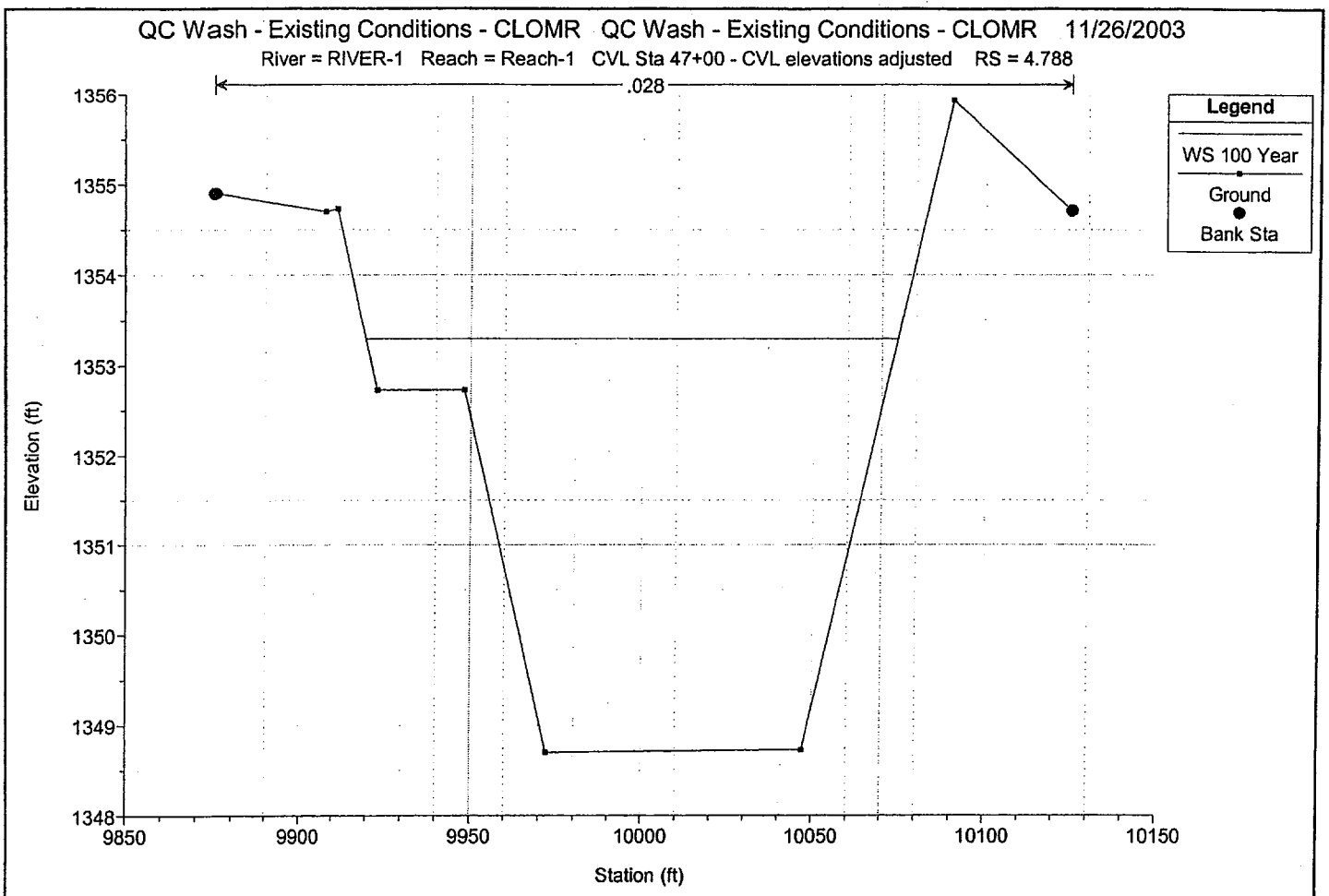
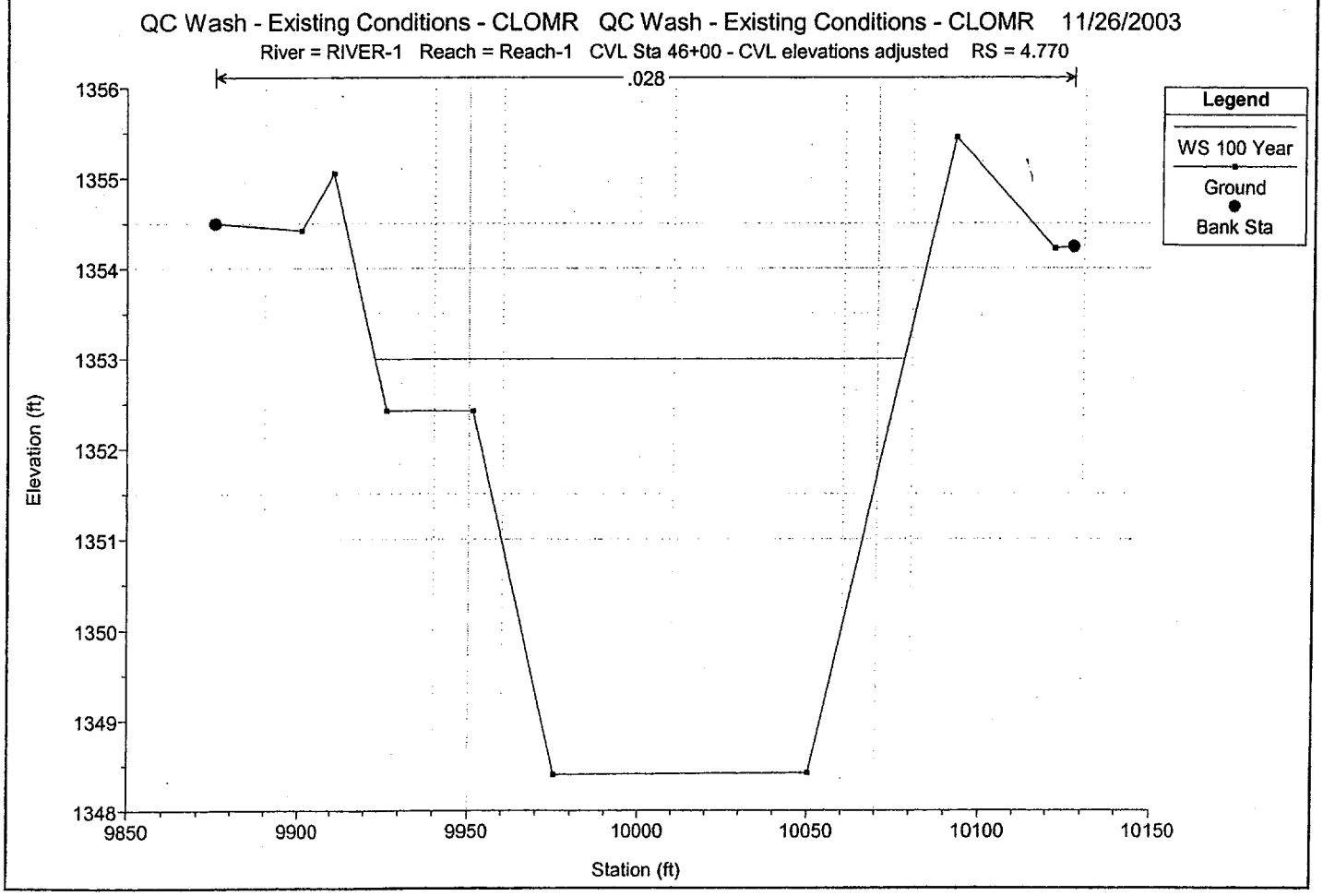
River = RIVER-1 Reach = Reach-1 CVL Sta 51+00 - CVL elevations adjusted RS = 4.864
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1356
1355
1354
1353
1352
1351
1350
1349
9850
9900
9950
10000
10050
10100
Station (ft)

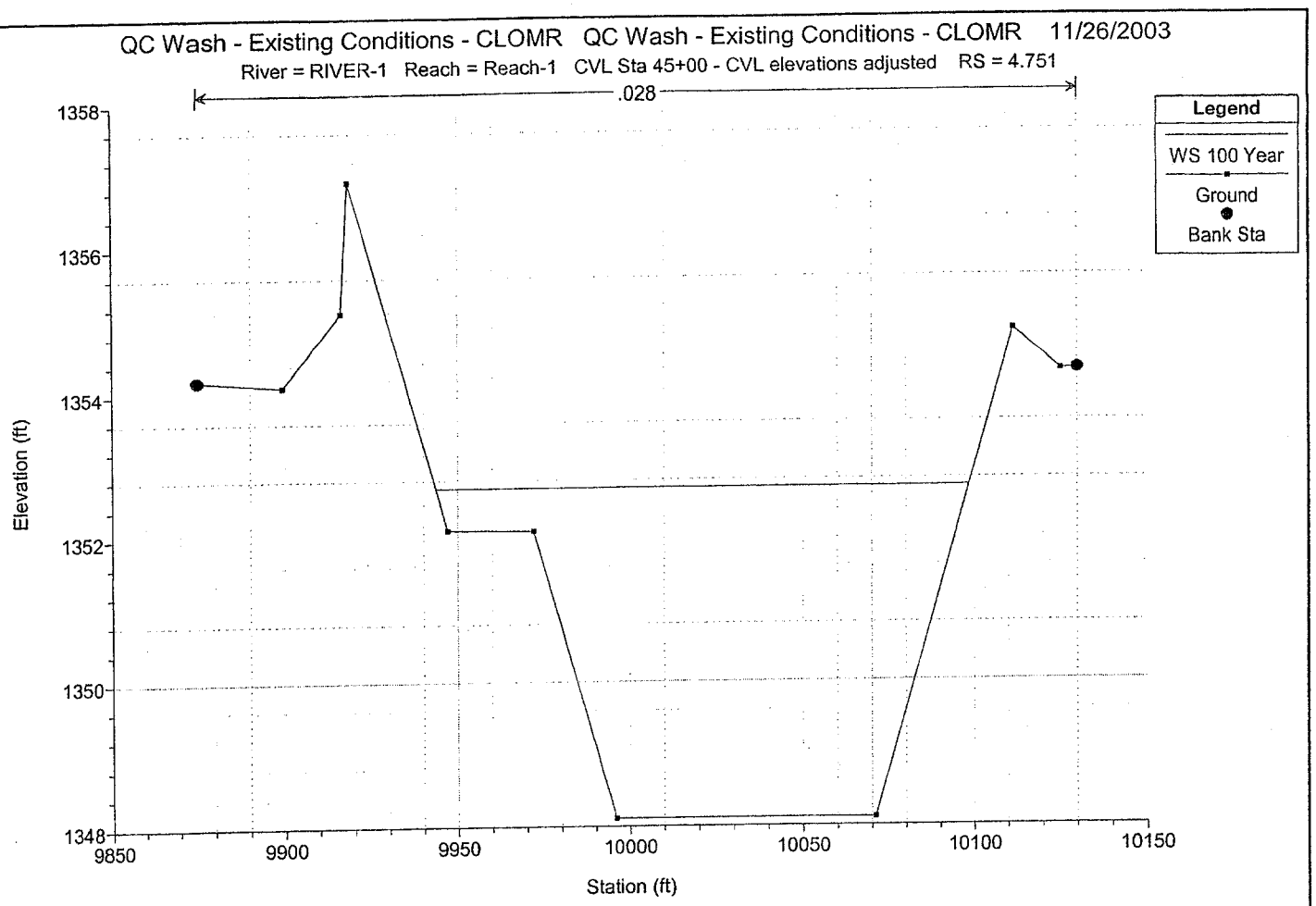

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 50+00 - CVL elevations adjusted RS = 4.845
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1364
1362
1360
1358
1356
1354
1352
1350
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)

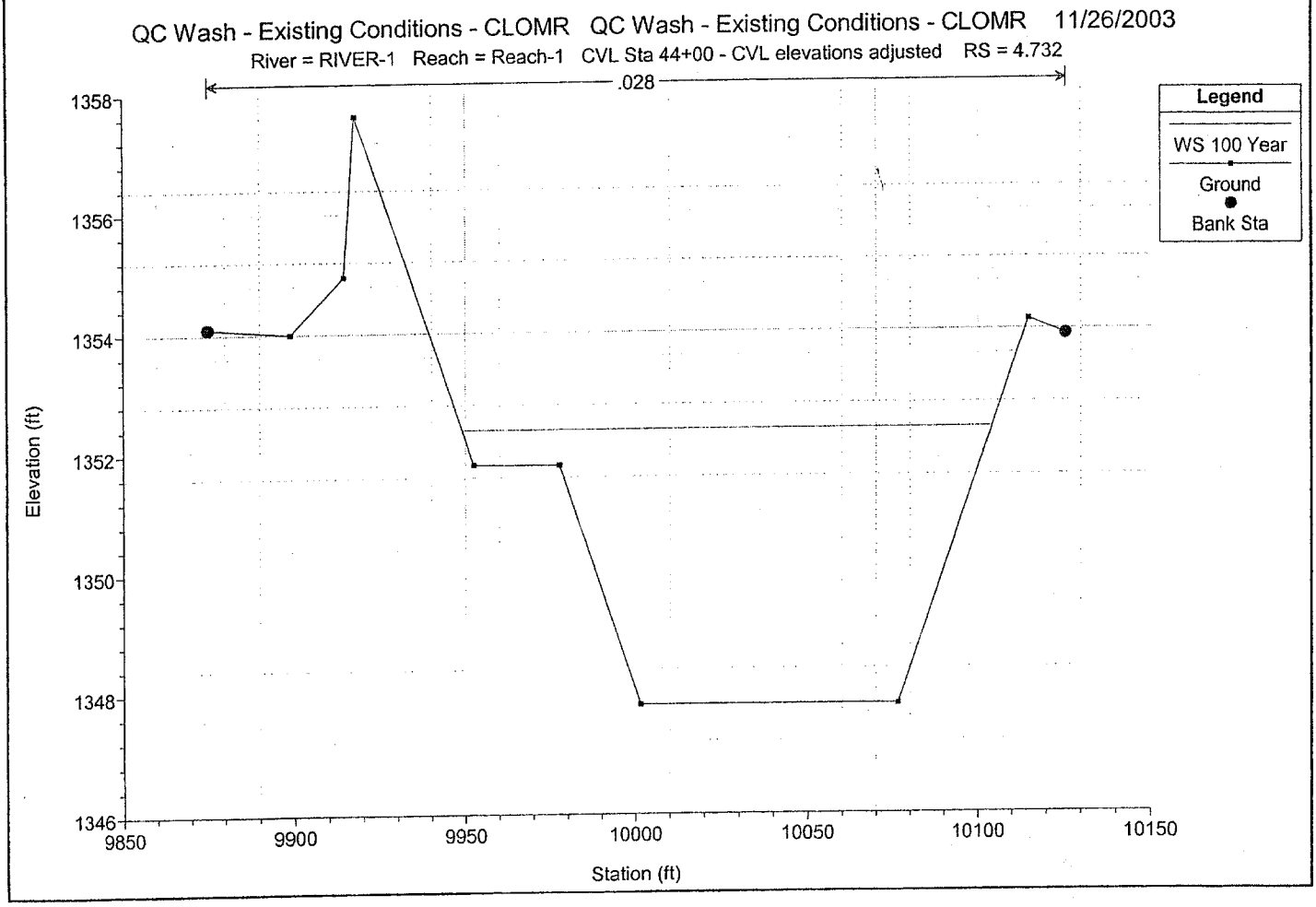

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 49+00 - CVL elevations adjusted RS = 4.826
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1360
1358
1356
1354
1352
1350
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)

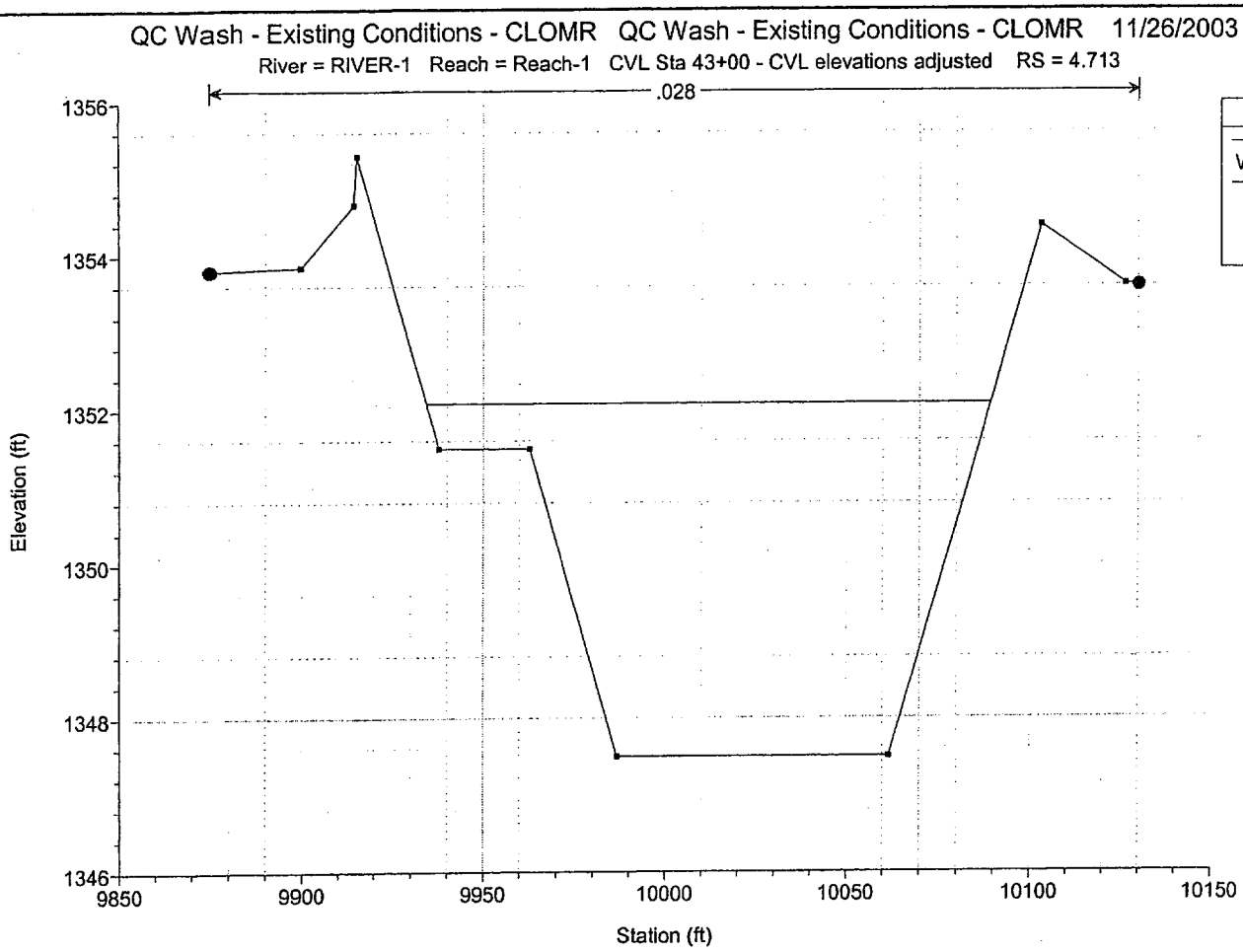

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 48+00 - CVL elevations adjusted RS = 4.807
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1358
1356
1354
1352
1350
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)

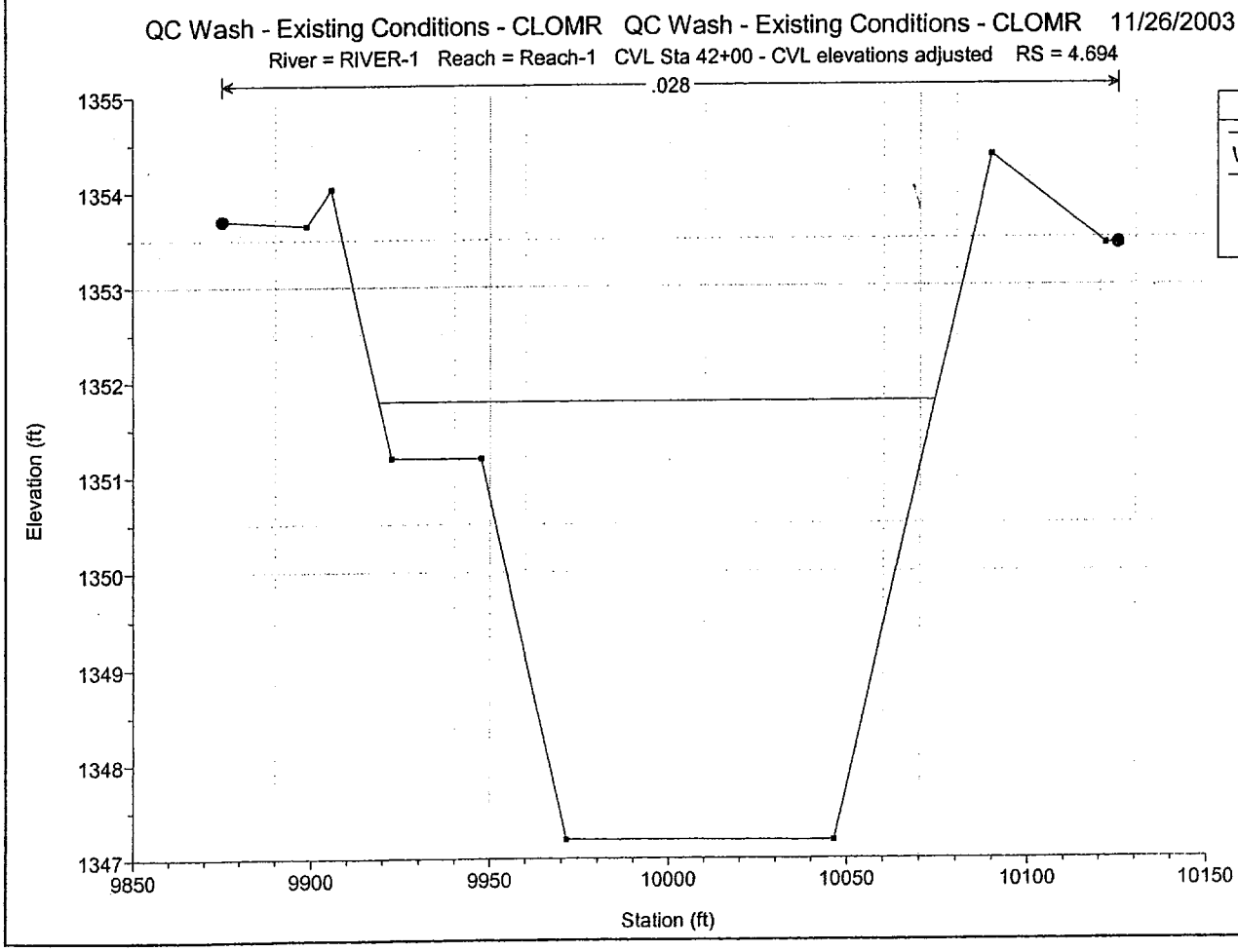

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 47+00 - CVL elevations adjusted RS = 4.788
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1356
1355
1354
1353
1352
1351
1350
1349
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)

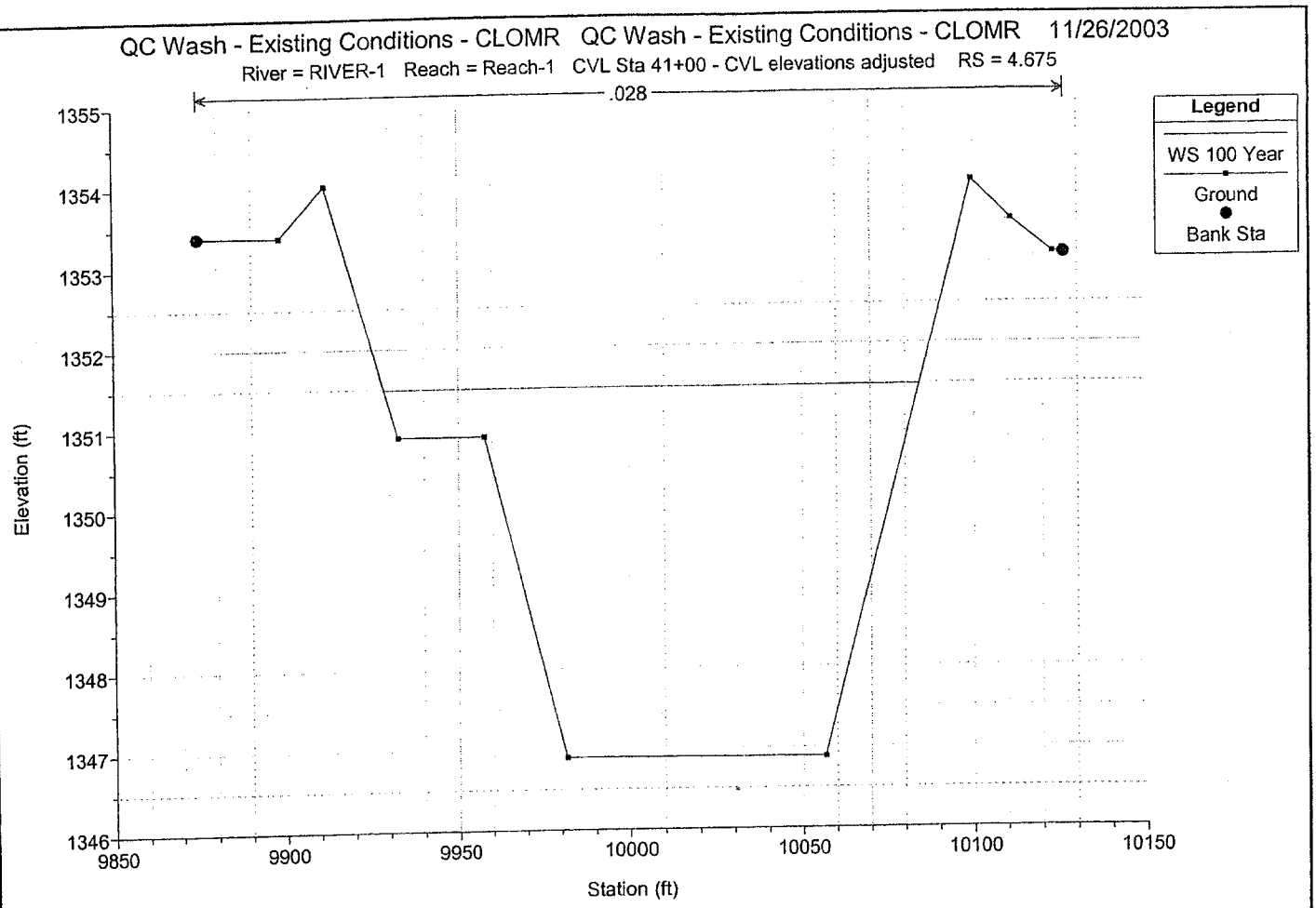

QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 46+00 - CVL elevations adjusted RS = 4.770
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1356
1355
1354
1353
1352
1351
1350
1349
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 45+00 - CVL elevations adjusted RS = 4.751
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1358
1356
1354
1352
1350
1348
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 44+00 - CVL elevations adjusted RS = 4.732
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1358
1356
1354
1352
1350
1348
1346
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 43+00 - CVL elevations adjusted RS = 4.713
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1356
1354
1352
1350
1348
1346
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 42+00 - CVL elevations adjusted RS = 4.694
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1355
1354
1353
1352
1351
1350
1349
1348
1347
9850
9900
9950
10000
10050
10100
10150
Station (ft)


QC Wash - Existing Conditions - CLOMR QC Wash - Existing Conditions - CLOMR 11/26/2003
River = RIVER-1 Reach = Reach-1 CVL Sta 41+00 - CVL elevations adjusted RS = 4.675
.028
Legend
WS 100 Year
Ground
Bank Sta
Elevation (ft)
1355
1354
1353
1352
1351
1350
1349
1348
1347
1346
9850
9900
9950
10000
10050
10100
10150
Station (ft)

APPENDIX E.5

PRE PROJECT CONDITIONS HEC-RAS OUTPUT

HEC-RAS Plan: ExistingCond River: RIVER-1 Reach: Reach-1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	1000.4	3010.00	1374.93	1382.47	1378.49	1382.70	0.000532	3.88	776.21	135.88	0.29
Reach-1	1000	Bridge									
Reach-1	6.47	3010.00	1375.18	1382.11		1382.40	0.000730	4.33	694.44	130.52	0.33
Reach-1	6.467	3010.00	1374.48	1382.00		1382.35	0.002281	4.73	635.76	120.54	0.36
Reach-1	6.426	3010.00	1374.13	1381.02		1381.70	0.004146	6.66	522.10	418.16	0.54
Reach-1	6.36	3010.00	1373.23	1380.31		1380.63	0.002038	4.87	985.04	641.48	0.38
Reach-1	6.279	3010.00	1372.68	1378.71		1379.24	0.003984	6.16	780.77	716.23	0.52
Reach-1	6.22	3010.00	1371.68	1378.00		1378.33	0.002056	4.86	863.73	588.26	0.38
Reach-1	6.126	3010.00	1370.68	1376.57		1377.08	0.003009	5.74	526.20	147.66	0.46
Reach-1	6.033	3010.00	1368.68	1374.70		1375.35	0.004188	6.50	487.75	134.58	0.54
Reach-1	5.938	3010.00	1367.68	1373.66		1373.94	0.001758	4.45	891.47	611.20	0.35
Reach-1	5.843	3010.00	1366.68	1372.55		1372.88	0.002643	4.87	934.20	1071.67	0.39
Reach-1	5.748	3010.00	1364.68	1370.93		1371.35	0.003683	5.49	822.46	813.96	0.45
Reach-1	5.654	3010.00	1362.68	1369.24		1369.62	0.003212	5.15	877.35	978.99	0.42
Reach-1	5.593	3010.00	1362.68	1367.27		1368.09	0.008225	7.27	421.87	163.88	0.66
Reach-1	5.55	3010.00	1360.68	1366.97		1367.20	0.001652	3.90	865.61	573.50	0.31
Reach-1	5.498	3010.00	1361.68	1366.17		1366.54	0.003689	5.03	748.87	674.93	0.44
Reach-1	5.403	3010.00	1359.68	1365.10		1365.29	0.001688	3.67	1082.93	728.09	0.31
Reach-1	5.308	3010.00	1357.68	1364.24		1364.41	0.001811	4.08	1434.09	1206.14	0.32
Reach-1	5.214	3010.00	1357.68	1363.32		1363.49	0.001874	3.97	1809.12	2579.95	0.32
Reach-1	5.156	3010.00	1356.68	1361.80	1360.34	1362.49	0.006137	6.68	464.87	350.23	0.57
Reach-1	5.095	3010.00	1354.68	1361.26		1361.46	0.001616	3.92	1300.20	1138.62	0.30
Reach-1	5.086	3010.00	1354.68	1361.14		1361.22	0.002728	2.91	1766.27	1843.83	0.26
Reach-1	5.074	3010.00	1354.68	1360.47	1359.58	1360.51	0.001787	2.58	2205.73	2306.12	0.21
Reach-1	5.0695	Bridge									
Reach-1	5.065	3010.00	1354.68	1359.85	1359.85	1360.17	0.012257	6.13	958.15	1214.15	0.54
Reach-1	5.054	3010.00	1353.00	1357.54		1358.25	0.003507	6.73	446.94	141.39	0.67
Reach-1	5.035	3010.00	1352.70	1357.29		1357.89	0.003007	6.20	485.20	155.12	0.62
Reach-1	5.016	3010.00	1352.40	1357.00		1357.59	0.002985	6.19	486.28	155.14	0.62
Reach-1	4.997	3010.00	1352.10	1356.70		1357.29	0.002979	6.19	486.60	155.17	0.62
Reach-1	4.978	3010.00	1351.79	1356.40		1356.99	0.002942	6.16	488.69	155.37	0.61
Reach-1	4.959	3010.00	1351.48	1356.12		1356.70	0.002915	6.12	491.63	156.65	0.61
Reach-1	4.940	3010.00	1351.18	1355.83		1356.41	0.002878	6.10	493.72	156.82	0.61
Reach-1	4.921	3010.00	1350.87	1355.55		1356.12	0.002797	6.04	498.35	157.08	0.60
Reach-1	4.902	3010.00	1350.56	1355.29		1355.84	0.002684	5.96	505.17	157.56	0.59
Reach-1	4.883	3010.00	1350.26	1354.91		1355.54	0.003090	6.39	471.40	147.08	0.63
Reach-1	4.864	3010.00	1349.95	1354.27		1355.14	0.004672	7.51	401.00	133.14	0.76
Reach-1	4.845	3010.00	1349.13	1354.39		1354.74	0.001517	4.77	630.68	178.76	0.45
Reach-1	4.826	3010.00	1349.34	1353.90		1354.51	0.003070	6.25	481.57	154.65	0.62
Reach-1	4.807	3010.00	1349.00	1353.60		1354.20	0.003034	6.23	483.49	154.80	0.62
Reach-1	4.788	3010.00	1348.70	1353.29		1353.90	0.003044	6.23	483.09	154.85	0.62
Reach-1	4.770	3010.00	1348.40	1352.99		1353.59	0.003034	6.22	483.60	154.89	0.62

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4.751	3010.00	1348.11	1352.69		1353.29	0.003023	6.21	484.32	155.02	0.62
Reach-1	4.732	3010.00	1347.81	1352.39		1352.99	0.003030	6.22	483.94	155.02	0.62
Reach-1	4.713	3010.00	1347.50	1352.09		1352.68	0.003013	6.21	484.87	155.07	0.62
Reach-1	4.694	3010.00	1347.19	1351.79		1352.38	0.002997	6.20	485.72	155.15	0.62
Reach-1	4.675	3010.00	1346.89	1351.49	1350.23	1352.08	0.003003	6.19	486.04	155.64	0.62

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX   XXXX        XXXX     XX     XXXX
X     X  X       X    X       X   X   X  X   X
X     X  X       X            X   X  X    X  X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX   XXXX
X     X  X       X            X X    X    X       X
X     X  X       X    X       X  X   X    X       X
X     X  XXXXXX   XXXX        X   X  X    X  XXXXX
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PROJECT DATA
Project Title: QC Wash - Existing Conditions - CLOMR
Project File : QC_Exist.prj
Run Date and Time: 11/26/2003 1:49:46 PM

Project in English units

Project Description:
Project Title: PRE-PROJECT CONDITIONS MODEL FOR FEMA SUBMITTAL - Queen Creek Wash, Sossaman Road to Hawes Road
Prepared By: Dibble and Associates
Consulting Engineers
Model Created: April, 2003
Prepared For: Town of Queen Creek
Contact: Tom Narva, PH: 480-987-0109
Reviewing Agency:
Flood Control District of Maricopa County
Contact: Tim Murphy, PH: 602-506-1501

Note: Crossections face downstream. River Miles increase in the upstream direction.

Note: This model is on NAVD 88 vertical datum.

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This model is being used as the Pre Project Conditions Model for the Queen Creek Wash Improvement project, Town of Queen Creek Proj. No. 2000D-03. The cross sections in this model were originally generated from erroneous mapping. The following correction factors have been applied to the elevations of the cross sections originating from the Coe & Van Loo, Flood Control District, and Collins Pina models in order to match the corrected aerial mapping:

West of Hawes Road: Correction = +2.683'
East of Hawes Road: Correction = +2.427'

The Bridge & Culvert routines were also adjusted by these correction factors.

This is a combined model of Queen Creek from East of Power Road to Hawes Road. It utilizes the following models from downstream to upstream.
1.
Coe and Van Loo's Ryland Homes Model (Queen Creek Wash CLOMR, Power Road to Sossaman Road): x-sections 4.657 to 5.054.
3. The Flood Control Districts
Power Road to Hawes Rd. Delineation: x-section 5.065 to 6.470.
3. Collins-Pina
Delineation from Hawes Rd to the SPRR: x-section 1000.4

Model #1, the Coe and Van Loo CLOMR, was performed on different mapping than the erroneous mapping provided by FCDMC for this project. CVL mapping is on Town of Queen Creek datum, rather than NAVD 88 datum. Therefore, a correction factor of -2.00' was applied to Coe & Van Loo elevations to resolve the discrepancy.

Flow Rates:

At Cross Section 1000.40 - 3010 cfs obtained from FEMA FIS

for Maricopa County, Queen Creek Wash at Hawes Road.

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PLAN DATA

```
Plan Title: QC Wash - Existing Conditions - CLOMR
Plan File : j:\10-0078\CLOMR data\Fin_RAS\QC_Exist.p01

           Geometry Title: QC Wash - Existing Conditions - CLOMR
           Geometry File : j:\10-0078\CLOMR data\Fin_RAS\QC_Exist.g01

           Flow Title     : QC Wash - Existing Conditions - CLOMR
           Flow File      : j:\10-0078\CLOMR data\Fin_RAS\QC_Exist.f01

Plan Summary Information:
Number of:  Cross Sections =   45    Mulitple Openings =    0
            Culverts       =    0    Inline Weirs      =    0
            Bridges        =    2

Computational Information
    Water surface calculation tolerance =  0.01
    Critical depth calculaton tolerance =  0.01
    Maximum number of interations       =  20
    Maximum difference tolerance        =  0.3
    Flow tolerance factor               =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow
```

FLOW DATA

```
Flow Title: QC Wash - Existing Conditions - CLOMR
Flow File : j:\10-0078\CLOMR data\Fin_RAS\QC_Exist.f01

Flow Data (cfs)
```

River	Reach	RS	100 Year
RIVER-1	Reach-1	1000.4	3010

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	100 Year		Normal S = .003

GEOMETRY DATA

```
Geometry Title: QC Wash - Existing Conditions - CLOMR
Geometry File : j:\10-0078\CLOMR data\Fin_RAS\QC_Exist.g01

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1             RS: 1000.4

INPUT
Description: Collins/Pina Sta 1000+40.  Just Upstream from Hawes Road. Collins
             Pina cross sections raised 2.683 feet to match NAV88 vertical
             datum.
Station Elevation Data     num=      14
```

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
777	1383.53	808	1384.03	855	1384.43	891	1384.83	916	1384.43
925	1384.43	965	1374.93	1000	1374.93	1035	1374.93	1078	1384.43
1099	1384.83	1140	1384.63	1179	1384.43	1223	1388.43		

```
Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
     777     .04     925    .028    1078     .04

 Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           925    1078                 84      84      84              .3       .5
 Ineffective Flow     num=        2
    Sta L   Sta R    Elev   Sta L   Sta R    Elev
      777     925 1384.33    1078    1223 1384.33

 CROSS SECTION OUTPUT    Profile #100 Year

   E.G. Elev (ft)            1382.70   Element                    Left OB    Channel   Right OB
   Vel Head (ft)                0.23   Wt. n-Val.                            0.028
   W.S. Elev (ft)            1382.47   Reach Len. (ft)              0.00       0.00       0.00
   Crit W.S. (ft)            1378.49   Flow Area (sq ft)                    776.21
   E.G. Slope (ft/ft)       0.000532   Area (sq ft)                         776.21
   Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
   Top Width (ft)             135.88   Top Width (ft)                       135.88
   Vel Total (ft/s)             3.88   Avg. Vel. (ft/s)                       3.88
   Max Chl Dpth (ft)            7.54   Hydr. Depth (ft)                       5.71
   Conv. Total (cfs)        130542.3   Conv. (cfs)                        130542.3
   Length Wtd. (ft)             0.00   Wetted Per. (ft)                     137.59
   Min Ch El (ft)            1374.93   Shear (lb/sq ft)                       0.19
   Alpha                        1.00   Stream Power (lb/ft s)                 0.73
   Frctn Loss (ft)                     Cum Volume (acre-ft)        32.89     116.36      47.43
   C & E Loss (ft)                     Cum SA (acres)              55.75      27.04      78.38


 BRIDGE                    RIVER: RIVER-1
 REACH: Reach-1               RS: 1000

 INPUT
 Description: Bridge #5 - HAWES ROAD

 Distance from Upstream XS =        0
 Deck/Roadway Width        =       84
 Weir Coefficient          =      2.6
 Bridge Deck/Roadway Skew  =        0
 Upstream  Deck/Roadway Coordinates
     num=        9
      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
      8921384.9551375.055      9171384.5551375.055      9251384.5451375.055
      9251384.5451382.155     10001384.4551382.155     10771384.5551382.155
     10781384.5741382.155     10781384.5741375.055     10981384.9551375.055

 Upstream Bridge Cross Section Data
 Station Elevation Data     num=       14
      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
      777 1383.53      808 1384.03      855 1384.43      891 1384.83      916 1384.43
      925 1384.43      965 1374.93     1000 1374.93     1035 1374.93     1078 1384.43
     1099 1384.83     1140 1384.63     1179 1384.43     1223 1388.43

 Manning's n Values         num=        3
      Sta   n Val      Sta   n Val      Sta   n Val
      777     .04      925    .028     1078     .04

 Bank Sta: Left   Right    Coeff Contr.   Expan.
           925    1078              .3       .5
 Ineffective Flow     num=        2
    Sta L   Sta R    Elev   Sta L   Sta R    Elev
      777     925 1384.33    1078    1223 1384.33

 Downstream  Deck/Roadway Coordinates
     num=        9
      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
      8921384.9551375.055      9171384.5551375.055      9251384.5451375.055
      9251384.5451382.155     10001384.4551382.155     10771384.5551382.155
     10781384.5741382.155     10781384.5741375.055     10981384.9551375.055

 Downstream Bridge Cross Section Data
 Station Elevation Data     num=       14
      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
      777 1383.78      808 1384.28      855 1384.68      891 1385.08      916 1383.78
      925 1384.68      965 1375.18     1000 1375.18     1035 1375.18     1078 1384.68
     1099 1385.08     1140 1384.88     1179 1384.68     1223 1388.68

 Manning's n Values         num=        3
      Sta   n Val      Sta   n Val      Sta   n Val
      777     .04      925    .028     1078     .04

 Bank Sta: Left   Right    Coeff Contr.   Expan.
```

```
          925     1078              .3        .5

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =      .95
Elevation at which weir flow begins         =1384.455
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station      Upstream=  1001.5    Downstream=  1001.5
Upstream      num=        2
    Width   Elev     Width   Elev
       6  1372.5       61382.155
Downstream      num=        2
    Width   Elev     Width   Elev
       6  1372.5       61382.155

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                 KVal =    1.15
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.7905694
           Max Low Cord                =1382.155

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT     Profile #100 Year
Opening : Bridge #1

  E.G. US. (ft)                 1382.70   Element                  Inside BR US  Inside BR DS
  W.S. US. (ft)                 1382.47   E.G. Elev (ft)               1382.70       1382.40
  Q Total (cfs)                 3010.00   W.S. Elev (ft)               1382.16       1382.11
  Q Bridge (cfs)                3010.00   Crit W.S. (ft)               1378.67       1378.91
  Q Weir (cfs)                            Max Chl Dpth (ft)               7.22          6.93
  Weir Sta Lft (ft)                       Vel Total (ft/s)                4.36          4.61
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             690.43        652.88
  Weir Submerg                            Froude # Chl                    0.33          0.35
  Weir Max Depth (ft)                     Specif Force (cu ft)         2627.12       2450.11
  Min Top Rd (ft)               1384.45   Hydr Depth (ft)                               5.24
  Min El Prs (ft)               1382.16   W.P. Total (ft)               270.33        139.94
  Delta EG (ft)                    0.31   Conv. Total (cfs)            68460.6       96739.8
  Delta WS (ft)                    0.36   Top Width (ft)                              124.52
  BR Open Area (sq ft)           690.43   Frctn Loss (ft)
  BR Open Vel (ft/s)               4.36   C & E Loss (ft)
  Coef of Q                               Shear Total (lb/sq ft)          0.31          0.28
  Br Sel Method              Press Only   Power Total (lb/ft s)           1.34          1.30


Note:     Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow.
          The Yarnell answer has been disregarded.
Note:     The downstream water surface is below the minimum elevation for pressure flow.  The sluice
          gate equations were used for pressure flow.

CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 6.47

INPUT
Description: Flood Control District Sta 6.470.  FCD cross sections raised 2.427
             feet to match NAV88 vertical datum.
Station Elevation Data     num=       14
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
     777 1383.78      808 1384.28      855 1384.68      891 1385.08      916 1383.78
     925 1384.68      965 1375.18     1000 1375.18     1035 1375.18     1078 1384.68
    1099 1385.08     1140 1384.88     1179 1384.68     1223 1388.68

Manning's n Values         num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
```

777	.04	925	.028	1078	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
925	1078		30	30	30	.3	.5

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1382.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.028	
W.S. Elev (ft)	1382.11	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)		Flow Area (sq ft)		694.44	
E.G. Slope (ft/ft)	0.000730	Area (sq ft)		694.44	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	130.52	Top Width (ft)		130.52	
Vel Total (ft/s)	4.33	Avg. Vel. (ft/s)		4.33	
Max Chl Dpth (ft)	6.93	Hydr. Depth (ft)		5.32	
Conv. Total (cfs)	111428.0	Conv. (cfs)		111428.0	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		132.08	
Min Ch El (ft)	1375.18	Shear (lb/sq ft)		0.24	
Alpha	1.00	Stream Power (lb/ft s)		1.04	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	32.89	115.07	47.43
C & E Loss (ft)	0.02	Cum SA (acres)	55.75	26.92	78.38

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.467

INPUT
Description: Flood Control District Sta 6.467. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1382.18	11124	1382.68	11171	1382.68	11178	1382.68	11326	1382.68
11339	1383.68	11347	1384.68	11354	1385.68	11368	1385.68	11373	1384.68
11377	1383.68	11382	1382.68	11386	1381.68	11392	1380.68	11398	1379.68
11403	1378.68	11408	1377.68	11412	1376.68	11415	1375.68	11419	1374.68
11422	1374.48	11427	1374.68	11442	1374.68	11452	1374.68	11476	1374.78
11479	1375.68	11484	1376.68	11488	1377.68	11492	1378.68	11496	1379.68
11500	1380.68	11504	1381.68	11508	1382.68	11513	1383.68	11517	1384.68
11520	1385.68	11524	1386.68	11527	1387.68	11538	1387.68	11540	1386.68
11542	1385.68	11544	1384.68	11560	1383.68	11565	1382.68	11600	1382.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.075	11368	.045	11527	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11368	11527		300	203	175	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1382.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.045	
W.S. Elev (ft)	1382.00	Reach Len. (ft)	300.00	203.00	175.00
Crit W.S. (ft)		Flow Area (sq ft)		635.76	
E.G. Slope (ft/ft)	0.002281	Area (sq ft)		635.76	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	120.54	Top Width (ft)		120.54	
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)		4.73	
Max Chl Dpth (ft)	7.52	Hydr. Depth (ft)		5.27	
Conv. Total (cfs)	63016.8	Conv. (cfs)		63016.8	
Length Wtd. (ft)	203.08	Wetted Per. (ft)		122.24	
Min Ch El (ft)	1374.48	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		3.51	
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	32.89	114.61	47.43
C & E Loss (ft)	0.03	Cum SA (acres)	55.75	26.83	78.38

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.426

INPUT
Description: Flood Control District Sta 6.426. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10990	1382.68	10992	1382.38	10994	1382.08	10996	1381.78	10998	1381.48
11000	1381.18	11149	1380.92	11169	1380.68	11231	1380.68	11254	1381.68

11264	1382.68	11274	1383.68	11281	1384.68	11288	1385.68	11297	1385.68
11301	1384.68	11305	1383.68	11309	1382.68	11313	1381.68	11323	1380.68
11326	1379.68	11330	1378.68	11334	1377.68	11338	1376.68	11342	1375.68
11347	1374.68	11348	1374.52	11362	1374.68	11374	1374.68	11387	1374.13
11390	1374.68	11394	1375.68	11398	1376.68	11403	1377.68	11407	1378.68
11410	1379.68	11413	1380.68	11415	1381.68	11418	1382.68	11420	1383.68
11423	1384.68	11425	1385.68	11428	1386.68	11430	1387.68	11433	1388.68
11439	1388.68	11441	1387.68	11443	1386.68	11445	1385.68	11447	1384.68
11449	1383.68	11451	1382.68	11453	1381.68	11460	1380.68	11467	1380.68
11472	1380.68	11561	1380.68	11577	1380.77	11715	1381.38		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10990	.075	11297	.04	11433	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11297	11433	380	340	295	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1381.70	Element			
Vel Head (ft)	0.68	Wt. n-Val.	0.075	0.040	0.065
W.S. Elev (ft)	1381.02	Reach Len. (ft)	380.00	340.00	295.00
Crit W.S. (ft)		Flow Area (sq ft)	29.85	445.51	46.75
E.G. Slope (ft/ft)	0.004146	Area (sq ft)	29.85	445.51	46.75
Q Total (cfs)	3010.00	Flow (cfs)	13.11	2968.49	28.40
Top Width (ft)	418.16	Top Width (ft)	147.84	94.09	176.22
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)	0.44	6.66	0.61
Max Chl Dpth (ft)	6.89	Hydr. Depth (ft)	0.20	4.73	0.27
Conv. Total (cfs)	46748.6	Conv. (cfs)	203.5	46103.9	441.1
Length Wtd. (ft)	341.45	Wetted Per. (ft)	147.85	95.81	176.25
Min Ch El (ft)	1374.13	Shear (lb/sq ft)	0.05	1.20	0.07
Alpha	1.32	Stream Power (lb/ft s)	0.02	8.02	0.04
Frctn Loss (ft)	0.96	Cum Volume (acre-ft)	32.79	112.09	47.34
C & E Loss (ft)	0.11	Cum SA (acres)	55.24	26.33	78.02

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.36

INPUT
Description: Flood Control District Sta 6.360. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 56

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10900	1380.68	10920	1380.38	10940	1380.08	10960	1379.78	10980	1379.58
11000	1379.38	11011	1379.68	11014	1379.68	11066	1379.68	11086	1379.68
11119	1378.78	11165	1378.68	11248	1378.68	11251	1379.68	11254	1380.68
11257	1381.68	11260	1382.68	11264	1383.68	11282	1383.68	11285	1382.68
11288	1381.68	11292	1380.68	11305	1379.68	11308	1378.68	11311	1377.68
11314	1376.68	11318	1375.68	11322	1374.68	11326	1373.68	11328	1373.23
11375	1373.68	11382	1373.7	11385	1374.68	11389	1375.68	11392	1376.68
11396	1377.68	11399	1378.68	11402	1379.68	11405	1380.68	11408	1381.68
11411	1382.68	11414	1383.68	11421	1384.68	11426	1384.68	11428	1383.68
11430	1382.68	11431	1381.68	11433	1380.68	11435	1379.68	11543	1379.68
11556	1379.68	11565	1379.68	11592	1379.96	11691	1380.68	11700	1380.68
11743	1380.68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10900	.075	11282	.04	11421	.065

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11282	11421	600	490	380	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1380.63	Element			
Vel Head (ft)	0.32	Wt. n-Val.	0.075	0.040	0.065
W.S. Elev (ft)	1380.31	Reach Len. (ft)	600.00	490.00	380.00
Crit W.S. (ft)		Flow Area (sq ft)	341.68	539.61	103.75
E.G. Slope (ft/ft)	0.002038	Area (sq ft)	341.68	539.61	103.75
Q Total (cfs)	3010.00	Flow (cfs)	313.73	2628.58	67.69
Top Width (ft)	641.48	Top Width (ft)	328.16	107.06	206.26
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)	0.92	4.87	0.65
Max Chl Dpth (ft)	7.08	Hydr. Depth (ft)	1.04	5.04	0.50
Conv. Total (cfs)	66679.5	Conv. (cfs)	6950.0	58230.1	1499.5

Length Wtd. (ft)	495.48	Wetted Per. (ft)	328.45	108.99	206.41
Min Ch El (ft)	1373.23	Shear (lb/sq ft)	0.13	0.63	0.06
Alpha	2.23	Stream Power (lb/ft s)	0.12	3.07	0.04
Frctn Loss (ft)	1.37	Cum Volume (acre-ft)	31.17	108.24	46.83
C & E Loss (ft)	0.02	Cum SA (acres)	53.16	25.55	76.73

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.279

INPUT
Description: Flood Control District Sta 6.279. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1380.28	11003	1379.4	11024	1379.68	11158	1376.68	11161	1376.68
11162	1377.68	11194	1378.68	11247	1378.68	11390	1377.68	11405	1377.68
11410	1378.68	11414	1379.68	11419	1380.68	11424	1381.68	11430	1382.68
11445	1382.68	11447	1381.68	11449	1380.68	11452	1379.68	11454	1378.68
11468	1377.68	11472	1376.68	11476	1375.68	11480	1374.68	11483	1373.68
11487	1372.68	11539	1372.68	11542	1373.68	11544	1374.68	11547	1375.68
11549	1376.68	11552	1377.68	11554	1378.68	11556	1379.68	11559	1380.68
11561	1381.68	11563	1382.68	11566	1383.68	11574	1383.68	11577	1382.68
11581	1381.68	11584	1380.68	11588	1379.68	11591	1378.68	11652	1377.74
11833	1378.58	12320	1380.68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.075	11445	.04	11566	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11445	11566	325	305	285	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1379.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.075	0.040	0.055
W.S. Elev (ft)	1378.71	Reach Len. (ft)	325.00	305.00	285.00
Crit W.S. (ft)		Flow Area (sq ft)	213.36	434.37	133.04
E.G. Slope (ft/ft)	0.003984	Area (sq ft)	213.36	434.37	133.04
Q Total (cfs)	3010.00	Flow (cfs)	194.23	2675.32	140.44
Top Width (ft)	716.23	Top Width (ft)	342.97	100.13	273.13
Vel Total (ft/s)	3.86	Avg. Vel. (ft/s)	0.91	6.16	1.06
Max Chl Dpth (ft)	6.03	Hydr. Depth (ft)	0.62	4.34	0.49
Conv. Total (cfs)	47686.1	Conv. (cfs)	3077.1	42383.9	2225.0
Length Wtd. (ft)	304.34	Wetted Per. (ft)	343.53	102.04	273.14
Min Ch El (ft)	1372.68	Shear (lb/sq ft)	0.15	1.06	0.12
Alpha	2.28	Stream Power (lb/ft s)	0.14	6.52	0.13
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	27.35	102.77	45.80
C & E Loss (ft)	0.06	Cum SA (acres)	48.54	24.38	74.64

Warning: Divided flow computed for this cross-section.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.22

INPUT
Description: Flood Control District Sta 6.220. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1378.28	11027	1378.22	11092	1378.68	11096	1379.68	11097	1379.68
11099	1378.68	11100	1378.68	11103	1379.68	11113	1379.68	11141	1378.68
11200	1377.68	11299	1377.68	11311	1377.68	11365	1377.68	11368	1378.68
11372	1379.68	11376	1380.68	11399	1380.68	11403	1379.68	11406	1378.68
11409	1377.68	11412	1376.68	11416	1375.68	11419	1374.68	11422	1373.68
11425	1372.68	11428	1371.68	11463	1371.68	11499	1372.68	11506	1373.68
11510	1374.68	11513	1375.68	11516	1376.68	11519	1377.68	11523	1378.68
11526	1379.68	11529	1380.68	11539	1380.68	11543	1379.68	11548	1378.68
11553	1377.68	11588	1376.68	11678	1376.68	11736	1377.31	11811	1377.68
11909	1378.68	11910	1378.67						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.075	11399	.04	11529	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11399	11529	510	500	490	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1378.33	Element			
Vel Head (ft)	0.33	Wt. n-Val.	0.075	0.040	0.055
W.S. Elev (ft)	1378.00	Reach Len. (ft)	510.00	500.00	490.00
Crit W.S. (ft)		Flow Area (sq ft)	56.21	558.20	249.31
E.G. Slope (ft/ft)	0.002056	Area (sq ft)	56.21	558.20	249.31
Q Total (cfs)	3010.00	Flow (cfs)	22.83	2711.76	275.42
Top Width (ft)	588.26	Top Width (ft)	184.92	112.25	291.09
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	0.41	4.86	1.10
Max Chl Dpth (ft)	6.32	Hydr. Depth (ft)	0.30	4.97	0.86
Conv. Total (cfs)	66381.1	Conv. (cfs)	503.4	59803.7	6073.9
Length Wtd. (ft)	499.58	Wetted Per. (ft)	184.97	113.97	291.14
Min Ch El (ft)	1371.68	Shear (lb/sq ft)	0.04	0.63	0.11
Alpha	1.76	Stream Power (lb/ft s)	0.02	3.05	0.12
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	26.34	99.29	44.55
C & E Loss (ft)	0.02	Cum SA (acres)	46.57	23.64	72.79

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.126

INPUT
Description: Flood Control District Sta 6.126. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1376.88	11077	1376.98	11172	1376.68	11237	1376.68	11242	1377.68
11246	1377.68	11250	1377.68	11254	1377.68	11281	1376.68	11282	1376.68
11366	1377.68	11373	1378.68	11380	1379.68	11399	1379.68	11405	1378.68
11408	1377.68	11411	1376.68	11413	1375.68	11416	1374.68	11419	1373.68
11422	1372.68	11425	1371.68	11427	1370.68	11496	1370.68	11500	1371.68
11504	1372.68	11508	1373.68	11513	1374.68	11517	1375.68	11521	1376.68
11525	1377.68	11530	1378.68	11543	1378.68	11548	1377.68	11554	1376.68
11570	1376.68	11645	1376.68	11692	1376.5	11739	1376.68	11920	1377.13

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.07	11399	.04	11530	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11399	11530	470	488	505	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1377.08	Element			
Vel Head (ft)	0.51	Wt. n-Val.		0.040	0.055
W.S. Elev (ft)	1376.57	Reach Len. (ft)	470.00	488.00	505.00
Crit W.S. (ft)		Flow Area (sq ft)		524.80	1.40
E.G. Slope (ft/ft)	0.003009	Area (sq ft)		524.80	1.40
Q Total (cfs)	3010.00	Flow (cfs)		3009.77	0.23
Top Width (ft)	147.66	Top Width (ft)		109.36	38.30
Vel Total (ft/s)	5.72	Avg. Vel. (ft/s)		5.74	0.16
Max Chl Dpth (ft)	5.89	Hydr. Depth (ft)		4.80	0.04
Conv. Total (cfs)	54869.3	Conv. (cfs)		54865.1	4.2
Length Wtd. (ft)	488.16	Wetted Per. (ft)		111.16	38.30
Min Ch El (ft)	1370.68	Shear (lb/sq ft)		0.89	0.01
Alpha	1.01	Stream Power (lb/ft s)		5.09	0.00
Frctn Loss (ft)	1.72	Cum Volume (acre-ft)	26.01	93.08	43.14
C & E Loss (ft)	0.01	Cum SA (acres)	45.49	22.37	70.94

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 6.033

INPUT
Description: Flood Control District Sta 6.033. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

11000	1374.98	11137	1375.12	11313	1375.68	11322	1376.68	11324	1376.68
11325	1375.68	11328	1375.68	11329	1376.68	11332	1376.68	11342	1376.68
11350	1377.68	11357	1378.68	11367	1379.68	11372	1379.68	11376	1378.68
11380	1377.68	11383	1376.68	11386	1375.68	11389	1374.68	11392	1373.68
11394	1372.68	11397	1371.68	11399	1370.68	11408	1369.68	11446	1368.68
11464	1368.68	11465	1368.68	11469	1369.68	11473	1370.68	11474	1371.68
11481	1372.68	11485	1373.68	11489	1374.68	11493	1375.68	11497	1376.68
11501	1377.68	11505	1378.68	11509	1379.68	11520	1379.68	11523	1378.68
11527	1377.68	11530	1376.68	11533	1375.68	11537	1374.68	11540	1373.68
11543	1372.68	11547	1372.68	11554	1373.68	11571	1374.68	11584	1375.68
11608	1375.68	11660	1375.16	11910	1375.31	12350	1375.68		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.06	11372	.04	11509	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11372	11509	445	500	540	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1375.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.		0.040	0.055
W.S. Elev (ft)	1374.70	Reach Len. (ft)	445.00	500.00	540.00
Crit W.S. (ft)		Flow Area (sq ft)		453.92	33.83
E.G. Slope (ft/ft)	0.004188	Area (sq ft)		453.92	33.83
Q Total (cfs)	3010.00	Flow (cfs)		2952.01	57.99
Top Width (ft)	134.58	Top Width (ft)		100.17	34.41
Vel Total (ft/s)	6.17	Avg. Vel. (ft/s)		6.50	1.71
Max Chl Dpth (ft)	6.02	Hydr. Depth (ft)		4.53	0.98
Conv. Total (cfs)	46511.6	Conv. (cfs)		45615.5	896.1
Length Wtd. (ft)	501.78	Wetted Per. (ft)		102.02	34.84
Min Ch El (ft)	1368.68	Shear (lb/sq ft)		1.16	0.25
Alpha	1.09	Stream Power (lb/ft s)		7.57	0.44
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	26.01	87.59	42.93
C & E Loss (ft)	0.11	Cum SA (acres)	45.49	21.19	70.52

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.938

INPUT
Description: Flood Control District Sta 5.938. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 42

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1373.88	11248	1374.21	11320	1374.68	11328	1374.68	11331	1374.68
11333	1375.68	11335	1375.68	11339	1374.68	11355	1374.68	11363	1375.68
11374	1376.68	11392	1376.68	11394	1375.68	11397	1374.68	11399	1373.68
11401	1372.68	11404	1371.68	11406	1370.68	11409	1369.68	11411	1368.68
11413	1367.68	11490	1367.68	11500	1368.68	11507	1369.68	11513	1370.68
11518	1371.68	11523	1372.68	11528	1373.68	11532	1374.68	11544	1374.68
11583	1373.68	11614	1373.68	11654	1373.68	11661	1373.68	11716	1373.31
11756	1373.68	11762	1373.68	11764	1373.68	11798	1372.68	11869	1372.68
11909	1372.68	12420	1374.68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.06	11392	.04	11532	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11392	11532	500	495	470	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1373.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.040	0.055
W.S. Elev (ft)	1373.66	Reach Len. (ft)	500.00	495.00	470.00
Crit W.S. (ft)		Flow Area (sq ft)		629.90	261.57
E.G. Slope (ft/ft)	0.001758	Area (sq ft)		629.90	261.57
Q Total (cfs)	3010.00	Flow (cfs)		2800.61	209.39
Top Width (ft)	611.20	Top Width (ft)		128.83	482.36
Vel Total (ft/s)	3.38	Avg. Vel. (ft/s)		4.45	0.80
Max Chl Dpth (ft)	5.98	Hydr. Depth (ft)		4.89	0.54
Conv. Total (cfs)	71793.8	Conv. (cfs)		66799.5	4994.2

Length Wtd. (ft)	493.44	Wetted Per. (ft)		130.59	482.38
Min Ch El (ft)	1367.68	Shear (lb/sq ft)		0.53	0.06
Alpha	1.62	Stream Power (lb/ft s)		2.35	0.05
Frctn Loss (ft)	1.05	Cum Volume (acre-ft)	26.01	81.37	41.10
C & E Loss (ft)	0.00	Cum SA (acres)	45.49	19.88	67.31

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.843

INPUT
Description: Flood Control District Sta 5.843. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10690	1374.68	10705	1374.18	10720	1373.68	10735	1373.18	10750	1372.68
11000	1372.18	11289	1372.13	11364	1372.68	11375	1373.68	11383	1374.68
11398	1374.68	11399	1373.68	11402	1372.68	11403	1371.68	11405	1370.68
11406	1369.68	11408	1368.68	11409	1367.68	11414	1366.68	11489	1366.68
11493	1367.68	11498	1368.68	11503	1369.68	11507	1370.68	11512	1371.68
11516	1372.68	11521	1373.68	11525	1374.68	11530	1375.68	11532	1375.68
11544	1374.68	11550	1373.68	11556	1372.68	11569	1371.68	11589	1371.68
11619	1371.68	11624	1371.68	11698	1372.05	11903	1372.15	12420	1374.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10690	.06	11398	.045	11530	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11398	11530	494	492	490	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1372.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.060	0.045	0.055
W.S. Elev (ft)	1372.55	Reach Len. (ft)	494.00	492.00	490.00
Crit W.S. (ft)		Flow Area (sq ft)	160.41	561.72	212.06
E.G. Slope (ft/ft)	0.002643	Area (sq ft)	160.41	561.72	212.06
Q Total (cfs)	3010.00	Flow (cfs)	91.93	2733.37	184.70
Top Width (ft)	1071.67	Top Width (ft)	531.27	113.35	427.05
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	0.57	4.87	0.87
Max Chl Dpth (ft)	5.87	Hydr. Depth (ft)	0.30	4.96	0.50
Conv. Total (cfs)	58543.5	Conv. (cfs)	1788.0	53163.1	3592.4
Length Wtd. (ft)	492.08	Wetted Per. (ft)	531.27	115.76	427.09
Min Ch El (ft)	1366.68	Shear (lb/sq ft)	0.05	0.80	0.08
Alpha	2.08	Stream Power (lb/ft s)	0.03	3.90	0.07
Frctn Loss (ft)	1.53	Cum Volume (acre-ft)	25.09	74.60	38.55
C & E Loss (ft)	0.01	Cum SA (acres)	42.44	18.50	62.41

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.748

INPUT
Description: Flood Control District Sta 5.748. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10030	1372.68	10200	1372.18	10400	1371.68	10600	1371.18	10800	1370.68
11000	1370.18	11027	1370.68	11036	1370.68	11037	1370.68	11067	1370.68
11262	1369.88	11364	1370.68	11378	1371.68	11388	1372.68	11405	1372.68
11411	1371.68	11413	1370.68	11416	1369.68	11417	1369.68	11422	1369.68
11425	1368.68	11428	1367.68	11430	1366.68	11434	1365.68	11441	1364.68
11485	1364.68	11490	1365.68	11498	1366.68	11508	1367.68	11511	1368.68
11514	1369.68	11517	1370.68	11520	1371.68	11523	1372.68	11526	1373.68
11529	1374.68	11547	1374.68	11551	1373.68	11555	1372.68	11564	1371.68
11624	1370.68	11625	1370.68	11718	1371.68	11731	1371.76	11746	1371.68
11773	1371.68	11935	1371.88						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10030	.055	11405	.045	11529	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11405	11529	430	510	570	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1371.35	Element			
Vel Head (ft)	0.42	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1370.93	Reach Len. (ft)	430.00	510.00	570.00
Crit W.S. (ft)		Flow Area (sq ft)	331.78	485.52	5.17
E.G. Slope (ft/ft)	0.003683	Area (sq ft)	331.78	485.52	5.17
Q Total (cfs)	3010.00	Flow (cfs)	340.85	2666.98	2.17
Top Width (ft)	813.96	Top Width (ft)	668.92	105.27	39.77
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)	1.03	5.49	0.42
Max Chl Dpth (ft)	6.25	Hydr. Depth (ft)	0.50	4.61	0.13
Conv. Total (cfs)	49597.6	Conv. (cfs)	5616.4	43945.4	35.8
Length Wtd. (ft)	501.56	Wetted Per. (ft)	668.93	106.98	39.78
Min Ch El (ft)	1364.68	Shear (lb/sq ft)	0.11	1.04	0.03
Alpha	2.01	Stream Power (lb/ft s)	0.12	5.73	0.01
Frctn Loss (ft)	1.72	Cum Volume (acre-ft)	22.30	68.69	37.32
C & E Loss (ft)	0.01	Cum SA (acres)	35.63	17.27	59.78

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.654

INPUT
Description: Flood Control District Sta 5.654. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 56

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9640	1370.68	9820	1370.18	10000	1369.68	10005	1369.68	10520	1369.18
11000	1368.68	11013	1368.49	11238	1368.68	11262	1368.68	11301	1368.68
11335	1369.68	11342	1369.75	11350	1369.68	11355	1369.68	11379	1370.68
11390	1371.68	11397	1372.68	11402	1373.68	11403	1373.68	11406	1372.68
11409	1371.68	11411	1370.68	11414	1369.68	11417	1368.68	11419	1367.68
11422	1366.68	11425	1365.68	11428	1364.68	11454	1363.68	11499	1362.68
11503	1362.68	11506	1363.68	11509	1364.68	11512	1365.68	11515	1366.68
11518	1367.68	11521	1368.68	11535	1369.68	11539	1370.68	11544	1371.68
11549	1372.68	11566	1372.68	11573	1371.68	11589	1370.68	11613	1370.68
11634	1370.68	11639	1370.68	11708	1370.72	11714	1370.68	11719	1370.68
11782	1370.68	11784	1369.68	11788	1369.68	11789	1370.68	11790	1370.68
11793	1369.68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9640	.055	11403	.045	11549	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11403	11549	190	310	425	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1369.62	Element			
Vel Head (ft)	0.37	Wt. n-Val.	0.055	0.045	
W.S. Elev (ft)	1369.24	Reach Len. (ft)	190.00	310.00	425.00
Crit W.S. (ft)		Flow Area (sq ft)	350.06	527.29	
E.G. Slope (ft/ft)	0.003212	Area (sq ft)	350.06	527.29	
Q Total (cfs)	3010.00	Flow (cfs)	293.16	2716.84	
Top Width (ft)	978.99	Top Width (ft)	865.41	113.58	
Vel Total (ft/s)	3.43	Avg. Vel. (ft/s)	0.84	5.15	
Max Chl Dpth (ft)	6.56	Hydr. Depth (ft)	0.40	4.64	
Conv. Total (cfs)	53111.2	Conv. (cfs)	5172.7	47938.5	
Length Wtd. (ft)	304.10	Wetted Per. (ft)	865.42	115.42	
Min Ch El (ft)	1362.68	Shear (lb/sq ft)	0.08	0.92	
Alpha	2.04	Stream Power (lb/ft s)	0.07	4.72	
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)	18.93	62.76	37.29
C & E Loss (ft)	0.04	Cum SA (acres)	28.06	15.99	59.52

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.593

INPUT
Description: Flood Control District Sta 5.593. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1368.08	11128	1367.68	11180	1367.68	11207	1367.68	11208	1367.68
11218	1367.68	11319	1366.96	11347	1367.68	11350	1367.68	11372	1367.68
11376	1368.68	11391	1369.68	11400	1369.68	11404	1368.68	11408	1367.68
11411	1366.68	11415	1365.68	11419	1364.68	11423	1363.68	11434	1362.68
11491	1362.68	11506	1363.68	11509	1364.68	11512	1365.68	11515	1366.68
11519	1367.68	11534	1368.68	11537	1369.68	11541	1370.68	11544	1371.68
11546	1371.68	11558	1370.68	11566	1369.68	11575	1368.68	11591	1367.68
11693	1367.68	11736	1367.92	11859	1368.68	11867	1368.68	11873	1367.68
11875	1367.68	11877	1368.68	11923	1368.68				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.055	11400	.045	11544	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11400	11544	216	226	236	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1368.09	Element			
Vel Head (ft)	0.82	Wt. n-Val.	0.055	0.045	
W.S. Elev (ft)	1367.27	Reach Len. (ft)	216.00	226.00	236.00
Crit W.S. (ft)		Flow Area (sq ft)	8.67	413.19	
E.G. Slope (ft/ft)	0.008225	Area (sq ft)	8.67	413.19	
Q Total (cfs)	3010.00	Flow (cfs)	6.15	3003.85	
Top Width (ft)	163.88	Top Width (ft)	55.74	108.14	
Vel Total (ft/s)	7.13	Avg. Vel. (ft/s)	0.71	7.27	
Max Chl Dpth (ft)	4.59	Hydr. Depth (ft)	0.16	3.82	
Conv. Total (cfs)	33189.6	Conv. (cfs)	67.8	33121.8	
Length Wtd. (ft)	225.93	Wetted Per. (ft)	55.75	109.24	
Min Ch El (ft)	1362.68	Shear (lb/sq ft)	0.08	1.94	
Alpha	1.04	Stream Power (lb/ft s)	0.06	14.12	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	18.15	59.41	37.29
C & E Loss (ft)	0.18	Cum SA (acres)	26.05	15.20	59.52

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.55

INPUT
Description: Flood Control District Sta 5.550. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11000	1367.28	11099	1366.68	11108	1366.68	11120	1366.68	11122	1366.68
11130	1366.68	11321	1366.68	11330	1366.68	11331	1366.68	11387	1366.68
11392	1367.68	11396	1368.68	11413	1368.68	11416	1367.68	11419	1366.68
11422	1365.68	11425	1364.68	11428	1363.68	11431	1362.68	11438	1361.68
11443	1360.68	11444	1360.68	11447	1361.68	11454	1361.68	11463	1360.68
11524	1360.68	11528	1361.68	11540	1362.68	11560	1363.68	11564	1364.68
11566	1365.68	11569	1366.68	11572	1367.68	11575	1368.68	11579	1369.68
11582	1370.68	11585	1371.68	11590	1371.68	11594	1370.68	11599	1369.68
11605	1368.68	11614	1367.68	11647	1366.68	11665	1366.68	11722	1366.97
11958	1367.18								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11000	.055	11413	.045	11585	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11413	11585	280	272	265	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1367.20	Element			
Vel Head (ft)	0.23	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1366.97	Reach Len. (ft)	280.00	272.00	265.00
Crit W.S. (ft)		Flow Area (sq ft)	90.56	760.20	14.85
E.G. Slope (ft/ft)	0.001652	Area (sq ft)	90.56	760.20	14.85

Q Total (cfs)	3010.00	Flow (cfs)	41.39	2963.50	5.11
Top Width (ft)	573.50	Top Width (ft)	337.25	151.74	84.51
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	0.46	3.90	0.34
Max Chl Dpth (ft)	6.29	Hydr. Depth (ft)	0.27	5.01	0.18
Conv. Total (cfs)	74052.0	Conv. (cfs)	1018.3	72907.9	125.8
Length Wtd. (ft)	272.15	Wetted Per. (ft)	337.28	153.58	84.52
Min Ch El (ft)	1360.68	Shear (lb/sq ft)	0.03	0.51	0.02
Alpha	1.24	Stream Power (lb/ft s)	0.01	1.99	0.01
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)	17.91	56.37	37.25
C & E Loss (ft)	0.01	Cum SA (acres)	25.08	14.52	59.29

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.498

INPUT
Description: Flood Control District Sta 5.498. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10850	1368.68	10880	1368.18	10910	1367.68	10930	1367.18	10960	1366.68
11000	1365.88	11225	1365.68	11249	1365.49	11277	1365.68	11292	1366.68
11295	1367.68	11300	1368.68	11307	1368.68	11311	1367.68	11314	1366.68
11318	1365.68	11322	1364.68	11325	1363.68	11329	1362.68	11333	1361.68
11442	1361.68	11448	1362.68	11451	1363.68	11454	1364.68	11457	1365.68
11460	1366.68	11463	1367.68	11466	1368.68	11469	1369.68	11482	1369.68
11493	1368.68	11499	1367.68	11507	1366.68	11528	1365.68	11587	1365.68
11630	1365.98	11868	1366.35						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10850	.055	11307	.045	11469	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11307	11469	490	498	499	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1366.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1366.17	Reach Len. (ft)	490.00	498.00	499.00
Crit W.S. (ft)		Flow Area (sq ft)	121.71	569.78	57.38
E.G. Slope (ft/ft)	0.003689	Area (sq ft)	121.71	569.78	57.38
Q Total (cfs)	3010.00	Flow (cfs)	109.76	2863.32	36.92
Top Width (ft)	674.93	Top Width (ft)	298.77	142.42	233.74
Vel Total (ft/s)	4.02	Avg. Vel. (ft/s)	0.90	5.03	0.64
Max Chl Dpth (ft)	4.49	Hydr. Depth (ft)	0.41	4.00	0.25
Conv. Total (cfs)	49555.1	Conv. (cfs)	1807.0	47140.3	607.8
Length Wtd. (ft)	497.49	Wetted Per. (ft)	298.79	143.66	233.75
Min Ch El (ft)	1361.68	Shear (lb/sq ft)	0.09	0.91	0.06
Alpha	1.49	Stream Power (lb/ft s)	0.08	4.59	0.04
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	17.22	52.22	37.03
C & E Loss (ft)	0.05	Cum SA (acres)	23.03	13.61	58.32

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.403

INPUT
Description: Flood Control District Sta 5.403. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10730	1366.68	10800	1366.18	10860	1365.68	10940	1365.18	10990	1364.68
11000	1364.58	11299	1364.02	11380	1364.68	11389	1365.68	11406	1366.68
11413	1366.68	11416	1365.68	11419	1364.68	11423	1363.68	11426	1362.68
11429	1361.68	11432	1360.68	11435	1359.68	11441	1359.68	11535	1359.68
11544	1359.68	11550	1360.68	11558	1361.68	11565	1362.68	11573	1363.68
11581	1364.68	11586	1365.68	11589	1366.68	11592	1367.68	11595	1368.68
11597	1368.68	11610	1367.68	11617	1366.68	11627	1365.68	11642	1364.68
11654	1364.68	11741	1365.07	11966	1365.42				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10730	.055	11413	.045	11595	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11413	11595	500	500	500	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1365.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1365.10	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)	315.58	740.74	26.61
E.G. Slope (ft/ft)	0.001688	Area (sq ft)	315.58	740.74	26.61
Q Total (cfs)	3010.00	Flow (cfs)	282.34	2717.22	10.44
Top Width (ft)	728.09	Top Width (ft)	436.10	165.38	126.61
Vel Total (ft/s)	2.78	Avg. Vel. (ft/s)	0.89	3.67	0.39
Max Chl Dpth (ft)	5.42	Hydr. Depth (ft)	0.72	4.48	0.21
Conv. Total (cfs)	73260.3	Conv. (cfs)	6871.8	66134.4	254.1
Length Wtd. (ft)	500.00	Wetted Per. (ft)	436.13	166.61	126.62
Min Ch El (ft)	1359.68	Shear (lb/sq ft)	0.08	0.47	0.02
Alpha	1.58	Stream Power (lb/ft s)	0.07	1.72	0.01
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	14.76	44.73	36.55
C & E Loss (ft)	0.00	Cum SA (acres)	18.90	11.85	56.26

Warning: Divided flow computed for this cross-section.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.308

INPUT
Description: Flood Control District Sta 5.308. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.

Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10480	1366.68	10500	1366.18	10515	1365.68	10530	1365.18	10550	1364.68
11000	1362.98	11176	1363.05	11356	1362.68	11360	1362.68	11362	1363.68
11363	1363.68	11364	1362.68	11376	1362.68	11390	1363.68	11401	1364.68
11411	1365.68	11420	1365.68	11427	1364.68	11429	1363.68	11432	1362.68
11434	1361.68	11436	1360.68	11438	1359.68	11440	1358.68	11443	1357.68
11448	1357.68	11507	1358.68	11511	1359.68	11514	1360.68	11518	1361.68
11521	1362.68	11524	1363.68	11527	1364.68	11529	1365.68	11535	1366.68
11543	1366.68	11550	1365.68	11559	1364.68	11575	1363.68	11709	1363.53
11912	1363.68	11950	1364.3	12355	1364.68				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10480	.055	11420	.045	11535	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11420	11535	502	502	502	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1364.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1364.24	Reach Len. (ft)	502.00	502.00	502.00
Crit W.S. (ft)		Flow Area (sq ft)	715.17	494.54	224.38
E.G. Slope (ft/ft)	0.001811	Area (sq ft)	715.17	494.54	224.38
Q Total (cfs)	3010.00	Flow (cfs)	811.62	2016.82	181.56
Top Width (ft)	1206.14	Top Width (ft)	728.43	97.78	379.93
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)	1.13	4.08	0.81
Max Chl Dpth (ft)	6.56	Hydr. Depth (ft)	0.98	5.06	0.59
Conv. Total (cfs)	70738.2	Conv. (cfs)	19073.9	47397.3	4266.9
Length Wtd. (ft)	502.00	Wetted Per. (ft)	729.15	100.01	379.95
Min Ch El (ft)	1357.68	Shear (lb/sq ft)	0.11	0.56	0.07
Alpha	2.62	Stream Power (lb/ft s)	0.13	2.28	0.05
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	8.85	37.64	35.11
C & E Loss (ft)	0.00	Cum SA (acres)	12.22	10.34	53.35

Warning: Divided flow computed for this cross-section.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.214

INPUT
Description: Flood Control District Sta 5.214. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.

Station Elevation Data num= 40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10210	1364.68	10230	1364.48	10255	1364.18	10280	1363.88	10300	1363.68
11000	1362.48	11182	1362.48	11334	1362.48	11337	1362.48	11340	1362.68
11341	1362.68	11361	1362.68	11376	1363.68	11388	1364.68	11404	1364.68
11408	1363.68	11411	1362.68	11413	1361.68	11416	1360.68	11418	1359.68
11421	1358.68	11424	1357.68	11486	1357.68	11499	1358.68	11505	1359.68
11508	1360.68	11512	1361.68	11515	1362.68	11518	1363.68	11521	1364.68
11540	1364.68	11551	1363.68	11564	1362.68	11567	1362.59	11699	1362.68
11932	1362.78	12100	1363.68	12180	1362.68	12720	1362.68	13570	1363.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10210	.055	11404	.045	11521	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11404	11521	310	303	294	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1363.49	Element			
Vel Head (ft)	0.17	Wt. n-Val.	0.055	0.045	0.055
W.S. Elev (ft)	1363.32	Reach Len. (ft)	310.00	303.00	294.00
Crit W.S. (ft)		Flow Area (sq ft)	507.25	506.74	795.13
E.G. Slope (ft/ft)	0.001874	Area (sq ft)	507.25	506.74	795.13
Q Total (cfs)	3010.00	Flow (cfs)	417.16	2010.78	582.07
Top Width (ft)	2579.95	Top Width (ft)	860.33	107.84	1611.79
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.82	3.97	0.73
Max Chl Dpth (ft)	5.64	Hydr. Depth (ft)	0.59	4.70	0.49
Conv. Total (cfs)	69527.1	Conv. (cfs)	9635.8	46446.4	13445.0
Length Wtd. (ft)	302.61	Wetted Per. (ft)	860.36	109.57	1611.82
Min Ch El (ft)	1357.68	Shear (lb/sq ft)	0.07	0.54	0.06
Alpha	3.87	Stream Power (lb/ft s)	0.06	2.15	0.04
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	1.80	31.87	29.23
C & E Loss (ft)	0.05	Cum SA (acres)	3.06	9.15	41.88

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.156

INPUT
Description: Flood Control District Sta 5.156. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.

Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10060	1364.68	10300	1364.18	10560	1363.68	10640	1363.18	10730	1362.68
11000	1362.48	11193	1362.48	11333	1362.48	11349	1362.48	11354	1362.48
11356	1362.68	11357	1362.68	11358	1362.48	11367	1362.48	11391	1362.68
11405	1363.68	11423	1363.68	11428	1362.68	11431	1361.68	11434	1360.68
11437	1359.68	11441	1358.68	11443	1357.68	11446	1356.68	11476	1356.68
11483	1356.68	11516	1356.68	11519	1357.68	11522	1358.68	11529	1359.68
11534	1360.68	11537	1361.68	11541	1362.68	11544	1363.68	11566	1363.68
11576	1362.68	11599	1361.68	11618	1361.68	11716	1361.76	11902	1361.87
11968	1362.68	11980	1362.68	12080	1361.68	12330	1362.38	13435	1362.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10060	.055	11423	.045	11544	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11423	11544	100	320	245	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1362.49	Element			
Vel Head (ft)	0.69	Wt. n-Val.		0.045	0.055
W.S. Elev (ft)	1361.80	Reach Len. (ft)	100.00	320.00	245.00
Crit W.S. (ft)	1360.34	Flow Area (sq ft)		449.82	15.05
E.G. Slope (ft/ft)	0.006137	Area (sq ft)		449.82	15.05
Q Total (cfs)	3010.00	Flow (cfs)		3005.02	4.98
Top Width (ft)	350.23	Top Width (ft)		106.84	243.39
Vel Total (ft/s)	6.47	Avg. Vel. (ft/s)		6.68	0.33
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)		4.21	0.06
Conv. Total (cfs)	38423.9	Conv. (cfs)		38360.3	63.6
Length Wtd. (ft)	312.98	Wetted Per. (ft)		108.38	243.39

Min Ch El (ft)	1356.68	Shear (lb/sq ft)	1.59	0.02
Alpha	1.06	Stream Power (lb/ft s)	10.62	0.01
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	28.54	26.50
C & E Loss (ft)	0.15	Cum SA (acres)	8.40	35.62

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.095

INPUT
Description: Flood Control District Sta 5.095. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 71

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10000	1364.68	10180	1364.18	10350	1363.68	10520	1363.18	10690	1362.68
11000	1362.48	11139	1362.48	11168	1362.48	11223	1362.48	11238	1362.48
11286	1362.48	11372	1362.48	11375	1362.48	11377	1362.48	11378	1362.48
11383	1362.48	11385	1362.68	11386	1362.68	11395	1362.68	11407	1363.68
11427	1363.68	11433	1363.68	11437	1364.68	11442	1365.68	11443	1365.68
11449	1364.68	11458	1363.68	11461	1362.68	11464	1361.68	11466	1360.68
11469	1359.68	11471	1358.68	11475	1357.68	11479	1356.68	11516	1355.68
11537	1354.68	11557	1354.68	11564	1354.68	11570	1354.68	11574	1355.68
11576	1356.68	11578	1357.68	11580	1358.68	11582	1359.68	11584	1360.68
11587	1361.68	11592	1362.68	11596	1363.68	11600	1364.68	11611	1364.68
11612	1363.68	11614	1362.68	11615	1361.68	11665	1360.68	11780	1360.43
11802	1360.68	11829	1361.68	11837	1361.68	11839	1360.68	11840	1360.68
11842	1361.68	11843	1361.68	11883	1361.68	11884	1361.68	11887	1360.68
11889	1360.68	11892	1360.68	12007	1359.87	12350	1360.68	12980	1361.68
13825	1362.68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10000	.055	11443	.045	11600	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11443	11600	42	48	210	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1361.46	Element			
Vel Head (ft)	0.20	Wt. n-Val.		0.045	0.055
W.S. Elev (ft)	1361.26	Reach Len. (ft)	42.00	48.00	210.00
Crit W.S. (ft)		Flow Area (sq ft)		625.22	674.98
E.G. Slope (ft/ft)	0.001616	Area (sq ft)		625.22	674.98
Q Total (cfs)	3010.00	Flow (cfs)		2451.81	558.19
Top Width (ft)	1138.62	Top Width (ft)		120.92	1017.70
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)		3.92	0.83
Max Chl Dpth (ft)	6.58	Hydr. Depth (ft)		5.17	0.66
Conv. Total (cfs)	74873.1	Conv. (cfs)		60988.3	13884.8
Length Wtd. (ft)	98.64	Wetted Per. (ft)		123.14	1018.10
Min Ch El (ft)	1354.68	Shear (lb/sq ft)		0.51	0.07
Alpha	2.36	Stream Power (lb/ft s)		2.01	0.06
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)		24.59	24.56
C & E Loss (ft)	0.03	Cum SA (acres)		7.57	32.07

Warning: Divided flow computed for this cross-section.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.086

INPUT
Description: Flood Control District Sta 5.086. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 71

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10000	1364.08	10150	1363.68	10340	1363.38	10500	1363.08	10680	1362.68
11000	1362.48	11126	1362.48	11302	1362.48	11311	1362.48	11323	1362.48
11326	1362.48	11344	1362.48	11347	1362.48	11354	1362.48	11355	1362.48
11381	1362.68	11398	1363.68	11410	1364.68	11415	1365.68	11418	1366.68
11420	1366.68	11423	1365.68	11426	1364.68	11428	1363.68	11435	1362.68
11444	1361.68	11455	1360.68	11463	1360.68	11480	1360.68	11486	1359.68
11493	1358.68	11501	1357.68	11523	1356.68	11530	1355.68	11536	1354.68
11557	1354.68	11572	1354.68	11584	1354.68	11587	1355.68	11590	1356.68
11592	1357.68	11595	1358.68	11597	1359.68	11600	1360.68	11602	1361.68

11605	1362.68	11615	1363.68	11622	1364.68	11632	1364.68	11634	1363.68
11637	1362.68	11640	1361.68	11706	1361.68	11752	1361.68	11809	1361.68
11810	1361.68	11812	1360.68	11813	1360.68	11820	1362.21	11821	1360.68
11825	1360.68	11846	1361.68	11848	1361.68	11850	1360.68	11919	1359.68
11961	1359.68	12210	1360.68	12500	1360.18	13245	1360.68	13310	1360.68
14240	1362.68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10000	.055	11420	.065	11622	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11420	11622	34	70	500	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1361.22	Element			
Vel Head (ft)	0.08	Wt. n-Val.		0.065	0.055
W.S. Elev (ft)	1361.14	Reach Len. (ft)	34.00	70.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)		580.09	1186.19
E.G. Slope (ft/ft)	0.002728	Area (sq ft)		580.09	1186.19
Q Total (cfs)	3010.00	Flow (cfs)		1686.81	1323.19
Top Width (ft)	1843.83	Top Width (ft)		150.98	1692.85
Vel Total (ft/s)	1.70	Avg. Vel. (ft/s)		2.91	1.12
Max Chl Dpth (ft)	6.46	Hydr. Depth (ft)		3.84	0.70
Conv. Total (cfs)	57631.2	Conv. (cfs)		32296.6	25334.6
Length Wtd. (ft)	319.38	Wetted Per. (ft)		152.62	1693.38
Min Ch El (ft)	1354.68	Shear (lb/sq ft)		0.65	0.12
Alpha	1.82	Stream Power (lb/ft s)		1.88	0.13
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)		23.93	20.07
C & E Loss (ft)	0.01	Cum SA (acres)		7.42	25.54

Warning: Divided flow computed for this cross-section.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.074

INPUT
Description: Flood Control District Sta 5.074. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.

Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
10950	1362.88	11310	1361.88	11410	1362.18	11425	1361.68	11446	1360.68
11505	1361.68	11520	1361.88	11525	1361.98	11530	1362.08	11532	1362.18
11533	1362.18	11550	1360.68	11555	1357.68	11561	1354.68	11605	1354.68
11610	1357.68	11623	1360.68	11628	1361.68	11665	1362.68	11678	1362.68
11710	1361.68	11900	1362.68	12340	1360.38	12850	1360.08	13180	1359.58
13470	1359.38	13860	1360.68	13880	1364.68	13910	1360.68	13980	1358.68
14440	1358.68	14480	1358.68	14540	1359.68	14715	1360.68	14870	1362.18

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
10950	.055	11550	.065	11623	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11550	11623	60	60	15	.3	.5

CROSS SECTION OUTPUT Profile #100 Year

			Left OB	Channel	Right OB
E.G. Elev (ft)	1360.51	Element			
Vel Head (ft)	0.04	Wt. n-Val.		0.065	0.055
W.S. Elev (ft)	1360.47	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)	1359.58	Flow Area (sq ft)		325.23	1880.50
E.G. Slope (ft/ft)	0.001787	Area (sq ft)		325.23	1880.50
Q Total (cfs)	3010.00	Flow (cfs)		840.57	2169.43
Top Width (ft)	2306.12	Top Width (ft)		71.73	2234.39
Vel Total (ft/s)	1.36	Avg. Vel. (ft/s)		2.58	1.15
Max Chl Dpth (ft)	5.79	Hydr. Depth (ft)		4.53	0.84
Conv. Total (cfs)	71199.9	Conv. (cfs)		19883.3	51316.5
Length Wtd. (ft)	0.00	Wetted Per. (ft)		74.36	2234.42
Min Ch El (ft)	1354.68	Shear (lb/sq ft)		0.49	0.09
Alpha	1.52	Stream Power (lb/ft s)		1.26	0.11
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		23.20	2.47
C & E Loss (ft)	0.00	Cum SA (acres)		7.24	3.00

Warning: Divided flow computed for this cross-section.

BRIDGE RIVER: RIVER-1
REACH: Reach-1 RS: 5.0695

```
INPUT
Description: Bridge #4 - SOSSAMAN ROAD

Distance from Upstream XS =       0
Deck/Roadway Width        =      60
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =       0
Upstream  Deck/Roadway Coordinates
    num=        8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   113101362.483       0   114101362.183       0   115051361.683       0
   115331361.3831359.283   115611361.3831359.283   116101361.3831359.283
   119001362.5831359.283   128501360.083       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   10950 1362.88   11310 1361.88   11410 1362.18   11425 1361.68   11446 1360.68
   11505 1361.68   11520 1361.88   11525 1361.98   11530 1362.08   11532 1362.18
   11533 1362.18   11550 1360.68   11555 1357.68   11561 1354.68   11605 1354.68
   11610 1357.68   11623 1360.68   11628 1361.68   11665 1362.68   11678 1362.68
   11710 1361.68   11900 1362.68   12340 1360.38   12850 1360.08   13180 1359.58
   13470 1359.38   13860 1360.68   13880 1364.68   13910 1360.68   13980 1358.68
   14440 1358.68   14480 1358.68   14540 1359.68   14715 1360.68   14870 1362.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   10950    .055   11550    .065   11623    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
         11550   11623             .3       .5

Downstream  Deck/Roadway Coordinates
    num=        8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   113101362.483       0   114101362.183       0   115051361.683       0
   115331361.3831359.283   115611361.3831359.283   116101361.3831359.283
   119001362.5831359.283   128501360.083       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   11300 1362.68   11370 1362.68   11440 1362.68   11490 1361.68   11520 1361.68
   11555 1360.68   11570 1360.68   11575 1357.68   11585 1354.68   11620 1354.68
   11620 1357.68   11635 1361.68   11700 1361.68   11860 1360.68   12100 1360.68
   12365 1360.38   12910 1360.08   13200 1359.58   13490 1359.38   13790 1358.98
   14070 1358.88   14200 1358.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   11300    .055   11570    .065   11635    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
         11570   11635             .3       .5

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =1360.083
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
      Energy
Selected Low Flow Methods = Energy

High Flow Method
      Pressure and Weir flow
          Submerged Inlet Cd          =
          Submerged Inlet + Outlet Cd =.8006408
          Max Low Cord                =1360.083

Additional Bridge Parameters
      Add Friction component to Momentum
      Do not add Weight component to Momentum
      Class B flow critical depth computations use critical depth
          inside the bridge at the upstream end
```

Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100 Year
Opening : Bridge #1

E.G. US. (ft)	1360.51	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	1360.47	E.G. Elev (ft)	1360.51	1360.23
Q Total (cfs)	3010.00	W.S. Elev (ft)	1360.47	1360.14
Q Bridge (cfs)	424.39	Crit W.S. (ft)	1359.43	1359.75
Q Weir (cfs)		Max Chl Dpth (ft)	5.79	5.46
Weir Sta Lft (ft)		Vel Total (ft/s)	1.48	2.33
Weir Sta Rgt (ft)		Flow Area (sq ft)	2038.91	1289.38
Weir Submerg		Froude # Chl	0.12	0.19
Weir Max Depth (ft)		Specif Force (cu ft)	2146.39	1369.00
Min Top Rd (ft)	1360.08	Hydr Depth (ft)	1.10	0.94
Min El Prs (ft)	1360.08	W.P. Total (ft)	1989.48	1485.21
Delta EG (ft)	0.35	Conv. Total (cfs)	59917.8	31950.4
Delta WS (ft)	0.62	Top Width (ft)	1858.03	1372.30
BR Open Area (sq ft)	199.09	Frctn Loss (ft)	0.26	0.00
BR Open Vel (ft/s)	2.13	C & E Loss (ft)	0.02	0.07
Coef of Q		Shear Total (lb/sq ft)	0.16	0.48
Br Sel Method	Energy only	Power Total (lb/ft s)	0.24	1.12

Warning: The pressure/weir method gave an invalid answer. The upstream energy was less than the downstream energy. The program defaulted to the energy based answer.
Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.
Note: The downstream water surface is above the minimum elevation for pressure flow. The orifice equations were used for pressure flow.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5.065

INPUT
Description: Flood Control District Sta 5.065. FCD cross sections raised 2.427 feet to match NAV88 vertical datum.
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11300	1362.68	11370	1362.68	11440	1362.68	11490	1361.68	11520	1361.68
11555	1360.68	11570	1360.68	11575	1357.68	11585	1354.68	11620	1354.68
11620	1357.68	11635	1361.68	11700	1361.68	11860	1360.68	12100	1360.68
12365	1360.38	12910	1360.08	13200	1359.58	13490	1359.38	13790	1358.98
14070	1358.88	14200	1358.68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11300	.055	11570	.065	11635	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
11570	11635	58.1	58.1	58.1	.3	.5

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1360.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.065	0.055
W.S. Elev (ft)	1359.85	Reach Len. (ft)	58.10	58.10	58.10
Crit W.S. (ft)	1359.85	Flow Area (sq ft)		230.48	727.68
E.G. Slope (ft/ft)	0.012257	Area (sq ft)		230.48	727.68
Q Total (cfs)	3010.00	Flow (cfs)		1413.68	1596.32
Top Width (ft)	1214.15	Top Width (ft)		56.76	1157.39
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)		6.13	2.19
Max Chl Dpth (ft)	5.17	Hydr. Depth (ft)		4.06	0.63
Conv. Total (cfs)	27187.3	Conv. (cfs)		12768.9	14418.5
Length Wtd. (ft)	58.10	Wetted Per. (ft)		61.09	1158.56
Min Ch El (ft)	1354.68	Shear (lb/sq ft)		2.89	0.48
Alpha	2.05	Stream Power (lb/ft s)		17.71	1.05
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)		22.89	0.49
C & E Loss (ft)	0.12	Cum SA (acres)		7.24	0.77

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

```
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
         section.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to
         critical depth, the calculated water surface came back below critical depth.  This indicates
         that there is not a valid subcritical answer.  The program defaulted to critical depth.

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.054

INPUT
Description: CVL Sta 61+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1358.9 9912.06 1359.02 9924.06 1357.02 9949.06 1357.02 9973.06    1353
10048.06 1353.0210066.59  1358.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810066.59    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510066.59              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1358.25   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.70   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1357.54   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     446.94
  E.G. Slope (ft/ft)       0.003507   Area (sq ft)                          446.94
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             141.39   Top Width (ft)                        141.39
  Vel Total (ft/s)             6.73   Avg. Vel. (ft/s)                        6.73
  Max Chl Dpth (ft)            4.54   Hydr. Depth (ft)                        3.16
  Conv. Total (cfs)         50828.0   Conv. (cfs)                         50828.0
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      142.47
  Min Ch El (ft)            1353.00   Shear (lb/sq ft)                        0.69
  Alpha                        1.00   Stream Power (lb/ft s)                  4.63
  Frctn Loss (ft)              0.32   Cum Volume (acre-ft)                   22.44
  C & E Loss (ft)              0.03   Cum SA (acres)                          7.11


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5.035

INPUT
Description: CVL Sta 60+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1358.1 9912.14 1358.08 9912.19 1358.71 9924.19 1356.71 9949.19 1356.71
 9973.19  1352.710048.19 1352.7110083.44 1358.5610084.17 1358.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810084.17    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510084.17              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1357.89   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.60   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1357.29   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     485.20
  E.G. Slope (ft/ft)       0.003007   Area (sq ft)                          485.20
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             155.12   Top Width (ft)                        155.12
  Vel Total (ft/s)             6.20   Avg. Vel. (ft/s)                        6.20
  Max Chl Dpth (ft)            4.59   Hydr. Depth (ft)                        3.13
  Conv. Total (cfs)         54892.7   Conv. (cfs)                         54892.7
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      155.88
  Min Ch El (ft)            1352.70   Shear (lb/sq ft)                        0.58
  Alpha                        1.00   Stream Power (lb/ft s)                  3.62
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                   21.37
  C & E Loss (ft)              0.00   Cum SA (acres)                          6.77


CROSS SECTION          RIVER: RIVER-1
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REACH: Reach-1            RS: 5.016

INPUT
Description: CVL Sta 59+00 - CVL elevations adjusted -2.0'
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1357.8  9911.8 1357.85 9911.85  1358.4 9923.85  1356.4 9948.85  1356.4
 9972.85  1352.410047.85  1352.410094.22 1360.13

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810094.22    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510094.22              100     100     100              .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1357.59   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.59   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1357.00   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     486.28
  E.G. Slope (ft/ft)       0.002985   Area (sq ft)                          486.28
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             155.14   Top Width (ft)                        155.14
  Vel Total (ft/s)             6.19   Avg. Vel. (ft/s)                        6.19
  Max Chl Dpth (ft)            4.60   Hydr. Depth (ft)                        3.13
  Conv. Total (cfs)         55090.5   Conv. (cfs)                          55090.5
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      155.90
  Min Ch El (ft)            1352.40   Shear (lb/sq ft)                        0.58
  Alpha                        1.00   Stream Power (lb/ft s)                  3.60
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                   20.26
  C & E Loss (ft)              0.00   Cum SA (acres)                          6.41


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4.997

INPUT
Description: CVL Sta 58+00 - CVL elevations adjusted -2.0'
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1357.5 9911.55 1357.51  9911.6  1358.1  9923.6  1356.1  9948.6  1356.1
  9972.6  1352.1 10047.6  1352.110102.19  1361.210110.75 1358.05

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810110.75    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510110.75              100     100     100              .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1357.29   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.59   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1356.70   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     486.60
  E.G. Slope (ft/ft)       0.002979   Area (sq ft)                          486.60
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             155.17   Top Width (ft)                        155.17
  Vel Total (ft/s)             6.19   Avg. Vel. (ft/s)                        6.19
  Max Chl Dpth (ft)            4.60   Hydr. Depth (ft)                        3.14
  Conv. Total (cfs)         55145.6   Conv. (cfs)                          55145.6
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      155.93
  Min Ch El (ft)            1352.10   Shear (lb/sq ft)                        0.58
  Alpha                        1.00   Stream Power (lb/ft s)                  3.59
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                   19.14
  C & E Loss (ft)              0.00   Cum SA (acres)                          6.05


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4.978

INPUT
Description: CVL Sta 57+00 - CVL elevations adjusted -2.0'
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1357.3 9911.37 1357.28 9911.42 1357.79 9923.42 1355.79 9948.42 1355.79
 9972.42  1351.810047.42 1351.7910107.23 1361.7610116.88 1357.42
```

```
Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810116.88    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510116.88              100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1356.99   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.59   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1356.40   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     488.69
  E.G. Slope (ft/ft)       0.002942   Area (sq ft)                          488.69
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             155.37   Top Width (ft)                        155.37
  Vel Total (ft/s)             6.16   Avg. Vel. (ft/s)                        6.16
  Max Chl Dpth (ft)            4.61   Hydr. Depth (ft)                        3.15
  Conv. Total (cfs)         55491.9   Conv. (cfs)                         55491.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      156.13
  Min Ch El (ft)            1351.79   Shear (lb/sq ft)                        0.57
  Alpha                        1.00   Stream Power (lb/ft s)                  3.54
  Frctn Loss (ft)              0.29   Cum Volume (acre-ft)                   18.02
  C & E Loss (ft)              0.00   Cum SA (acres)                          5.70


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.959

INPUT
Description: CVL Sta 56+00 - CVL elevations adjusted -2.0'
Station Elevation Data     num=        7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875    1357 9911.29 1357.04 9923.34 1355.48 9948.34 1355.48 9972.34 1351.48
10047.34  1351.510105.76 1361.22

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810105.76    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510105.76              100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1356.70   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.58   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1356.12   Reach Len. (ft)             100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     491.63
  E.G. Slope (ft/ft)       0.002915   Area (sq ft)                          491.63
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             156.65   Top Width (ft)                        156.65
  Vel Total (ft/s)             6.12   Avg. Vel. (ft/s)                        6.12
  Max Chl Dpth (ft)            4.64   Hydr. Depth (ft)                        3.14
  Conv. Total (cfs)         55747.4   Conv. (cfs)                         55747.4
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      157.40
  Min Ch El (ft)            1351.48   Shear (lb/sq ft)                        0.57
  Alpha                        1.00   Stream Power (lb/ft s)                  3.48
  Frctn Loss (ft)              0.29   Cum Volume (acre-ft)                   16.90
  C & E Loss (ft)              0.00   Cum SA (acres)                          5.34


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.940

INPUT
Description: CVL Sta 55+00 - CVL elevations adjusted -2.0'
Station Elevation Data     num=        7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1356.8 9911.27 1356.75 9923.32 1355.18 9948.32 1355.18 9972.32 1351.18
10047.32  1351.2 10103.5 1360.54

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .028 10103.5    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9875 10103.5              100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #100 Year
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E.G. Elev (ft)	1356.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.028	
W.S. Elev (ft)	1355.83	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		493.72	
E.G. Slope (ft/ft)	0.002878	Area (sq ft)		493.72	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	156.82	Top Width (ft)		156.82	
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10	
Max Chl Dpth (ft)	4.65	Hydr. Depth (ft)		3.15	
Conv. Total (cfs)	56102.8	Conv. (cfs)		56102.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		157.57	
Min Ch El (ft)	1351.18	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		3.43	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		15.76	
C & E Loss (ft)	0.00	Cum SA (acres)		4.98	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 4.921

INPUT
Description: CVL Sta 54+00 - CVL elevations adjusted -2.0'
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9875	1356.5	9911.35	1356.49	9923.4	1354.87	9948.4	1354.87	9972.4	1350.87
10047.4	1350.91	10093.68	1358.59						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9875	.028	9875	.028	10093.68	.028

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9875	10093.68	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1356.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.		0.028	
W.S. Elev (ft)	1355.55	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		498.35	
E.G. Slope (ft/ft)	0.002797	Area (sq ft)		498.35	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	157.08	Top Width (ft)		157.08	
Vel Total (ft/s)	6.04	Avg. Vel. (ft/s)		6.04	
Max Chl Dpth (ft)	4.68	Hydr. Depth (ft)		3.17	
Conv. Total (cfs)	56918.8	Conv. (cfs)		56918.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		157.84	
Min Ch El (ft)	1350.87	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		3.33	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)		14.63	
C & E Loss (ft)	0.00	Cum SA (acres)		4.62	

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 4.902

INPUT
Description: CVL Sta 53+00 - CVL elevations adjusted -2.0'
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9875	1356.2	9911.47	1356.23	9923.52	1354.56	9948.52	1354.56	9972.52	1350.56
10047.52	1350.61	10081.14	1356.17						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9875	.028	9875	.028	10081.14	.028

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9875	10081.14	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1355.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.028	
W.S. Elev (ft)	1355.29	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		505.17	
E.G. Slope (ft/ft)	0.002684	Area (sq ft)		505.17	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	157.56	Top Width (ft)		157.56	
Vel Total (ft/s)	5.96	Avg. Vel. (ft/s)		5.96	
Max Chl Dpth (ft)	4.73	Hydr. Depth (ft)		3.21	

Conv. Total (cfs)	58102.6	Conv. (cfs)	58102.6
Length Wtd. (ft)	100.00	Wetted Per. (ft)	158.33
Min Ch El (ft)	1350.56	Shear (lb/sq ft)	0.53
Alpha	1.00	Stream Power (lb/ft s)	3.19
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	13.47
C & E Loss (ft)	0.01	Cum SA (acres)	4.26

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.883

INPUT
Description: CVL Sta 52+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875    1356 9911.82 1355.97 9923.87 1354.26 9948.87 1354.26 9972.87 1350.26
10047.87  1350.310070.73    1356

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810070.73    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510070.73              100     100     100            .1       .3
```

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1355.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.028	
W.S. Elev (ft)	1354.91	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		471.40	
E.G. Slope (ft/ft)	0.003090	Area (sq ft)		471.40	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	147.08	Top Width (ft)		147.08	
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)		6.39	
Max Chl Dpth (ft)	4.65	Hydr. Depth (ft)		3.20	
Conv. Total (cfs)	54150.0	Conv. (cfs)		54150.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		148.03	
Min Ch El (ft)	1350.26	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		3.92	
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)		12.35	
C & E Loss (ft)	0.02	Cum SA (acres)		3.91	

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CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.864

INPUT
Description: CVL Sta 51+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1355.7 9912.01 1355.73 9924.06 1353.95 9949.06 1353.95 9973.06 1349.95
10048.06    135010057.38  1355.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810057.38    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510057.38              100     100     100            .1       .3
```

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	1355.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.		0.028	
W.S. Elev (ft)	1354.27	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		401.00	
E.G. Slope (ft/ft)	0.004672	Area (sq ft)		401.00	
Q Total (cfs)	3010.00	Flow (cfs)		3010.00	
Top Width (ft)	133.14	Top Width (ft)		133.14	
Vel Total (ft/s)	7.51	Avg. Vel. (ft/s)		7.51	
Max Chl Dpth (ft)	4.32	Hydr. Depth (ft)		3.01	
Conv. Total (cfs)	44038.4	Conv. (cfs)		44038.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		134.70	
Min Ch El (ft)	1349.95	Shear (lb/sq ft)		0.87	
Alpha	1.00	Stream Power (lb/ft s)		6.52	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		11.35	
C & E Loss (ft)	0.16	Cum SA (acres)		3.59	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for

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        additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.845

INPUT
Description: CVL Sta 50+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1355.5 9911.69 1355.53 9912.36 1355.65 9924.36 1353.65 9949.36 1353.65
 9973.36  1349.610048.36 1349.6510051.49 1349.1310065.94 1349.3710075.73 1350.86
10091.62    135210102.92 1355.8110124.91 1363.03

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810124.91    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510124.91              100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1354.74   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.35   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1354.39   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    630.68
  E.G. Slope (ft/ft)       0.001517   Area (sq ft)                         630.68
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             178.76   Top Width (ft)                       178.76
  Vel Total (ft/s)             4.77   Avg. Vel. (ft/s)                       4.77
  Max Chl Dpth (ft)            5.26   Hydr. Depth (ft)                       3.53
  Conv. Total (cfs)         77279.8   Conv. (cfs)                         77279.8
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     179.75
  Min Ch El (ft)            1349.13   Shear (lb/sq ft)                       0.33
  Alpha                        1.00   Stream Power (lb/ft s)                 1.59
  Frctn Loss (ft)              0.21   Cum Volume (acre-ft)                  10.17
  C & E Loss (ft)              0.03   Cum SA (acres)                         3.23


Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for additional cross sections.

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.826

INPUT
Description: CVL Sta 49+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1355.2 9884.63 1355.28 9914.16 1355.19 9915.03 1355.34 9927.03 1353.34
 9952.03  1353.3 9976.03 1349.3410051.03 1349.3410097.53 1357.1110113.87 1359.78
10117.66  1357.210124.93 1357.01

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810124.93    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510124.93              100     100     100            .1        .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1354.51   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.61   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1353.90   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    481.57
  E.G. Slope (ft/ft)       0.003070   Area (sq ft)                         481.57
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             154.65   Top Width (ft)                       154.65
  Vel Total (ft/s)             6.25   Avg. Vel. (ft/s)                       6.25
  Max Chl Dpth (ft)            4.56   Hydr. Depth (ft)                       3.11
  Conv. Total (cfs)         54321.4   Conv. (cfs)                         54321.4
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     155.40
  Min Ch El (ft)            1349.34   Shear (lb/sq ft)                       0.59
  Alpha                        1.00   Stream Power (lb/ft s)                 3.71
  Frctn Loss (ft)              0.31   Cum Volume (acre-ft)                   8.89
  C & E Loss (ft)              0.00   Cum SA (acres)                         2.85
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CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.807

INPUT
Description: CVL Sta 48+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875    1355 9907.57 1354.98 9913.86 1355.03 9925.86 1353.03 9950.86 1353.03
 9974.86    134910049.86 1349.0310099.02 1357.2310101.67 1356.1110125.83 1355.11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810125.83    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510125.83              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1354.20   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.60   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1353.60   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    483.49
  E.G. Slope (ft/ft)       0.003034   Area (sq ft)                         483.49
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             154.80   Top Width (ft)                       154.80
  Vel Total (ft/s)             6.23   Avg. Vel. (ft/s)                       6.23
  Max Chl Dpth (ft)            4.60   Hydr. Depth (ft)                       3.12
  Conv. Total (cfs)         54645.3   Conv. (cfs)                         54645.3
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     155.56
  Min Ch El (ft)            1349.00   Shear (lb/sq ft)                       0.59
  Alpha                        1.00   Stream Power (lb/ft s)                 3.67
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                   7.78
  C & E Loss (ft)              0.00   Cum SA (acres)                         2.49


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.788

INPUT
Description: CVL Sta 47+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1354.9  9907.6  1354.7 9911.12 1354.73 9923.12 1352.73 9948.12 1352.73
 9972.12  1348.710047.12 1348.7310090.44 1355.9310125.03 1354.71

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810125.03    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510125.03              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1353.90   Element                   Left OB    Channel   Right OB
  Vel Head (ft)                0.60   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1353.29   Reach Len. (ft)            100.00    100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    483.09
  E.G. Slope (ft/ft)       0.003044   Area (sq ft)                         483.09
  Q Total (cfs)             3010.00   Flow (cfs)                          3010.00
  Top Width (ft)             154.85   Top Width (ft)                       154.85
  Vel Total (ft/s)             6.23   Avg. Vel. (ft/s)                       6.23
  Max Chl Dpth (ft)            4.59   Hydr. Depth (ft)                       3.12
  Conv. Total (cfs)         54559.0   Conv. (cfs)                         54559.0
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                     155.61
  Min Ch El (ft)            1348.70   Shear (lb/sq ft)                       0.59
  Alpha                        1.00   Stream Power (lb/ft s)                 3.68
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                   6.67
  C & E Loss (ft)              0.00   Cum SA (acres)                         2.14


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.770

INPUT
Description: CVL Sta 46+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1354.5 9900.71 1354.42 9910.42 1355.05 9926.22 1352.42 9951.22 1352.42
 9975.22  1348.410050.22 1348.4210092.44 1355.4510121.45 1354.22 10126.9 1354.24
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Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .028 10126.9    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9875 10126.9              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1353.59   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.60   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1352.99   Reach Len. (ft)            100.00     100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     483.60
  E.G. Slope (ft/ft)       0.003034   Area (sq ft)                          483.60
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             154.89   Top Width (ft)                        154.89
  Vel Total (ft/s)             6.22   Avg. Vel. (ft/s)                        6.22
  Max Chl Dpth (ft)            4.59   Hydr. Depth (ft)                        3.12
  Conv. Total (cfs)         54645.0   Conv. (cfs)                         54645.0
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      155.65
  Min Ch El (ft)            1348.40   Shear (lb/sq ft)                        0.59
  Alpha                        1.00   Stream Power (lb/ft s)                  3.66
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                    5.56
  C & E Loss (ft)              0.00   Cum SA (acres)                          1.78


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.751

INPUT
Description: CVL Sta 45+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1354.2 9899.26 1354.11 9916.01 1355.13 9918.07 1356.93 9946.99 1352.11
 9971.99  1352.1 9995.99 1348.1110070.99 1348.1110111.57 1354.8610125.17 1354.29
10130.06  1354.3

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810130.06    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510130.06              100     100     100             .1       .3

CROSS SECTION OUTPUT    Profile #100 Year

  E.G. Elev (ft)            1353.29   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                0.60   Wt. n-Val.                            0.028
  W.S. Elev (ft)            1352.69   Reach Len. (ft)            100.00     100.00     100.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     484.32
  E.G. Slope (ft/ft)       0.003023   Area (sq ft)                          484.32
  Q Total (cfs)             3010.00   Flow (cfs)                           3010.00
  Top Width (ft)             155.02   Top Width (ft)                        155.02
  Vel Total (ft/s)             6.21   Avg. Vel. (ft/s)                        6.21
  Max Chl Dpth (ft)            4.58   Hydr. Depth (ft)                        3.12
  Conv. Total (cfs)         54749.9   Conv. (cfs)                         54749.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)                      155.78
  Min Ch El (ft)            1348.11   Shear (lb/sq ft)                        0.59
  Alpha                        1.00   Stream Power (lb/ft s)                  3.65
  Frctn Loss (ft)              0.30   Cum Volume (acre-ft)                    4.45
  C & E Loss (ft)              0.00   Cum SA (acres)                          1.42


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.732

INPUT
Description: CVL Sta 44+00 - CVL elevations adjusted -2.0'
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9875  1354.1 9898.94    1354 9914.42 1354.95 9917.55 1357.63 9952.51 1351.81
 9977.51  1351.810001.51 1347.8110076.51 1347.8110114.73 1354.1610125.56 1353.91

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9875    .028    9875    .02810125.56    .028

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          987510125.56              100     100     100             .1       .3
```

Reach-1	5.074	.055	.065	.055
Reach-1	5.0695	Bridge		
Reach-1	5.065	.055	.065	.055
Reach-1	5.054	.028	.028	.028
Reach-1	5.035	.028	.028	.028
Reach-1	5.016	.028	.028	.028
Reach-1	4.997	.028	.028	.028
Reach-1	4.978	.028	.028	.028
Reach-1	4.959	.028	.028	.028
Reach-1	4.940	.028	.028	.028
Reach-1	4.921	.028	.028	.028
Reach-1	4.902	.028	.028	.028
Reach-1	4.883	.028	.028	.028
Reach-1	4.864	.028	.028	.028
Reach-1	4.845	.028	.028	.028
Reach-1	4.826	.028	.028	.028
Reach-1	4.807	.028	.028	.028
Reach-1	4.788	.028	.028	.028
Reach-1	4.770	.028	.028	.028
Reach-1	4.751	.028	.028	.028
Reach-1	4.732	.028	.028	.028
Reach-1	4.713	.028	.028	.028
Reach-1	4.694	.028	.028	.028
Reach-1	4.675	.028	.028	.028

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	1000.4	84	84	84
Reach-1	1000	Bridge		
Reach-1	6.47	30	30	30
Reach-1	6.467	300	203	175
Reach-1	6.426	380	340	295
Reach-1	6.36	600	490	380
Reach-1	6.279	325	305	285
Reach-1	6.22	510	500	490
Reach-1	6.126	470	488	505
Reach-1	6.033	445	500	540
Reach-1	5.938	500	495	470
Reach-1	5.843	494	492	490
Reach-1	5.748	430	510	570
Reach-1	5.654	190	310	425
Reach-1	5.593	216	226	236
Reach-1	5.55	280	272	265
Reach-1	5.498	490	498	499
Reach-1	5.403	500	500	500
Reach-1	5.308	502	502	502
Reach-1	5.214	310	303	294
Reach-1	5.156	100	320	245
Reach-1	5.095	42	48	210
Reach-1	5.086	34	70	500
Reach-1	5.074	60	60	15
Reach-1	5.0695	Bridge		
Reach-1	5.065	58.1	58.1	58.1
Reach-1	5.054	100	100	100
Reach-1	5.035	100	100	100
Reach-1	5.016	100	100	100
Reach-1	4.997	100	100	100
Reach-1	4.978	100	100	100
Reach-1	4.959	100	100	100
Reach-1	4.940	100	100	100
Reach-1	4.921	100	100	100
Reach-1	4.902	100	100	100
Reach-1	4.883	100	100	100
Reach-1	4.864	100	100	100
Reach-1	4.845	100	100	100
Reach-1	4.826	100	100	100
Reach-1	4.807	100	100	100
Reach-1	4.788	100	100	100
Reach-1	4.770	100	100	100
Reach-1	4.751	100	100	100
Reach-1	4.732	100	100	100
Reach-1	4.713	100	100	100
Reach-1	4.694	100	100	100
Reach-1	4.675	100	100	100

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.		Contr.	Expan.
Reach-1	1000.4		.3	.5
Reach-1	1000	Bridge		
Reach-1	6.47		.3	.5
Reach-1	6.467		.1	.3
Reach-1	6.426		.1	.3
Reach-1	6.36		.1	.3
Reach-1	6.279		.1	.3
Reach-1	6.22		.1	.3
Reach-1	6.126		.1	.3
Reach-1	6.033		.1	.3
Reach-1	5.938		.1	.3
Reach-1	5.843		.1	.3
Reach-1	5.748		.1	.3
Reach-1	5.654		.1	.3
Reach-1	5.593		.1	.3
Reach-1	5.55		.1	.3
Reach-1	5.498		.1	.3
Reach-1	5.403		.1	.3
Reach-1	5.308		.1	.3
Reach-1	5.214		.1	.3
Reach-1	5.156		.1	.3
Reach-1	5.095		.1	.3
Reach-1	5.086		.1	.3
Reach-1	5.074		.3	.5
Reach-1	5.0695	Bridge		
Reach-1	5.065		.3	.5
Reach-1	5.054		.1	.3
Reach-1	5.035		.1	.3
Reach-1	5.016		.1	.3
Reach-1	4.997		.1	.3
Reach-1	4.978		.1	.3
Reach-1	4.959		.1	.3
Reach-1	4.940		.1	.3
Reach-1	4.921		.1	.3
Reach-1	4.902		.1	.3
Reach-1	4.883		.1	.3
Reach-1	4.864		.1	.3
Reach-1	4.845		.1	.3
Reach-1	4.826		.1	.3
Reach-1	4.807		.1	.3
Reach-1	4.788		.1	.3
Reach-1	4.770		.1	.3
Reach-1	4.751		.1	.3
Reach-1	4.732		.1	.3
Reach-1	4.713		.1	.3
Reach-1	4.694		.1	.3
Reach-1	4.675		.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : ExistingCond

River: RIVER-1 Reach: Reach-1 RS: 1000 Profile: 100 Year
Note: Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow. The Yarnell answer
has been disregarded.
Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used
for pressure flow.
River: RIVER-1 Reach: Reach-1 RS: 6.47 Profile: 100 Year
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: RIVER-1 Reach: Reach-1 RS: 6.426 Profile: 100 Year
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: RIVER-1 Reach: Reach-1 RS: 6.36 Profile: 100 Year

```
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 6.279     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
River: RIVER-1  Reach: Reach-1     RS: 6.22     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 6.126     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 6.033     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.938     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.843     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.748     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.654     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.593     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.55     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.498     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may
indicate
             the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.403     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
River: RIVER-1  Reach: Reach-1     RS: 5.308     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
River: RIVER-1  Reach: Reach-1     RS: 5.214     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
             This may indicate the need for additional cross sections.
River: RIVER-1  Reach: Reach-1     RS: 5.156     Profile: 100 Year
     Warning:Divided flow computed for this cross-section.
```

Warning:The conveyance ratio (upstream conveyance divided by downstream convèyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: RIVER-1 Reach: Reach-1 RS: 5.095 Profile: 100 Year
Warning:Divided flow computed for this cross-section.
River: RIVER-1 Reach: Reach-1 RS: 5.086 Profile: 100 Year
Warning:Divided flow computed for this cross-section.
River: RIVER-1 Reach: Reach-1 RS: 5.074 Profile: 100 Year
Warning:Divided flow computed for this cross-section.
River: RIVER-1 Reach: Reach-1 RS: 5.0695 Profile: 100 Year
Warning:The pressure/weir method gave an invalid answer. The upstream energy was less than the downstream energy. The
program defaulted to the energy based answer.
Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum
answer has been disregarded.
Note: The downstream water surface is above the minimum elevation for pressure flow. The orifice equations were used for
pressure flow.
River: RIVER-1 Reach: Reach-1 RS: 5.0695 Profile: 100 Year Upstream
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
River: RIVER-1 Reach: Reach-1 RS: 5.0695 Profile: 100 Year Downstream
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
River: RIVER-1 Reach: Reach-1 RS: 5.065 Profile: 100 Year
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
River: RIVER-1 Reach: Reach-1 RS: 4.864 Profile: 100 Year
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: RIVER-1 Reach: Reach-1 RS: 4.845 Profile: 100 Year
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

APPENDIX F

EROSION AND SEDIMENT TRANSPORT ANALYSES SUPPORTING DOCUMENTATION

APPENDIX F.1

SCOUR ANALYSIS (HEC-6T INPUT & OUTPUT FILES CONTAINED ON CD ROM)

WEST CONSULTANTS, INC.

California
11848 Bernardo Plaza Court,
Suite 140-B
San Diego, CA 92128-2417

858.487.9378
858.487.9448 Fax

Washington
12509 Bel-Red Road
Suite 100
Bellevue, WA 98005-2535

425-646-8806
425.646.0570 Fax

Arizona
2151 East Broadway
Suite 116
Tempe, AZ 85282-1705

480.345.2155
480.245.2156 Fax

www.westconsultants.com

Hydraulics

Hydrology

Sedimentation

Water Quality

Erosion Control

Environmental Services

12 November 2002

RECEIVED
DEC 4 2002
DIBBLE & ASSOC.

Brian Fry
Kevin Roberts
Dibble & Associates
2633 E. Indian School Rd, # 401
Phoenix, AZ 85016

Brian and Kevin:

After reviewing our calculations for toe down and riprap I thought it would be good to reiterate our recommendations for toe down for both bank protection and toe protection. According to our calculations toe down should be a minimum of 4.0 feet below the lower of the existing or future thalweg for the reach from Haws Road (cross section 6.516) to cross section 6.199 in the RAS model. Toe down from cross section 6.199 to Sossaman Road should be a minimum of 3.0 feet below the lower of the existing or future thalweg. Since the thalweg varies along the length of the river a design is usually specified as starting from an elevation and proceeding at a constant slope. Further since the future condition is lower than the existing condition the toe down depths can be calculated as starting at 3.0 feet below the elevation of the drop structure crest and moving upstream at a slope of 0.0021 until the next drop structure as illustrated in Figure 1. Toe down in the area just downstream of the drop structure may need to be increased to be lower than the anticipated depth of the scour hole from the drop. The area adjacent to the drop structures should also be protected with bank protection if additional structures are added.

Based on the recommended change in depth for toe down at 6.199 it would be advantageous to locate the upper drop structure either at or downstream from that location. I believe the location we selected yesterday is below that location and will minimize toe down in the reach where 4.0 ft are required.

In examining the number and location of drops it appears that we need approximately 2.0 feet of drop just upstream from Sossaman Road with an additional 2.0 feet in drop distributed farther up the wash. This can either be distributed as a series of 1 ft drops or two single higher drop structures. Figure 1 shows the two options with drops located at the points that Kevin and I discussed. The one change is an additional drop just upstream from Sossaman Road that we haven't discussed but which looks to be necessary if we are to avoid a higher drop structure at the lower path crossing.

We have checked the riprap sizing and determined that 9" riprap will be stable on the banks near the bridge as long as the velocity in the channel is less than 8.75 ft/sec. Pier and abutment scour calculations, however, may indicate that larger sizes are required at those locations. The statistics used in the calculations assume that the ratio of D_{85}/D_{15} is 1.7. This equates to a D_{30} of 0.37 ft, a D_{50} of 0.5 ft and a D_{100} of 0.75 ft. As long as the gradation used is similar to that used in the calculations the riprap should be stable.

Sincerely;

Gary E. Freeman, PhD, PE
Director, Water Resources Engineering

Queen Creek Wash
Sossaman Bridge Replacement

SCOUR ANALYSIS REPORT

Prepared for:

Dibble & Associates
2633 East Indian School Road
Phoenix, AZ 85016

Prepared by:

WEST CONSULTANTS, INC.

WEST Consultants, Inc.
2151 East Broadway Road, Suite 116
Tempe, AZ 85282-1705

August 2002

Registered Professional Engineer (Civil)
CERTIFICATE NO.
21560
DENNIS L.
RICHARDS
Date Signed 8-19-02
ARIZONA, U.S.A.

Appendix I

Queen Creek Scour Data

100-Year Event

General and Pier Scour Data			
Variable	**Description**	**Value**	**Unit**
Q	Discharge	2832	cfs
y_1	Upstream Main Channel Water Depth	3.58	ft
V_1	Upstream Approach Velocity	7.00	ft/s
w'	Fall Velocity	0.036	ft/s
W_1	Upstream Main Channel Bottom Width	112.00	ft
W_2	Bottom Width of Contracted Channel Less Pier Widths	98.40	ft
S	Channel Slope	0.0098	ft/ft
a	Pier Width (Included Debris Width)	6.50	ft
y_0	Existing Depth in the Contracted Section Before Scour	2.98	ft
Fr	Froude Number	0.65	-
D_{50}	Mean Diameter	0.09	mm
D_{90}	90% Finer Diameter	0.23	mm
Left Abutment (Looking Downstream) Scour Data			
Variable	**Description**	**Value**	**Unit**
A_e	Flow Area of the Approach Cross Section Obstructed by the Embankment	117.00	ft^2
L	Length of Embankment Projected Normal to the Flow	54.00	ft
L'	Length of Active Flow Obstructed by Embankment	54.00	ft
K_1	Coefficient for Abutment Shape	1	-
θ	Embankment Angle	60	degrees
K_2	$(\theta/90)^{0.13}$	0.95	-
Right Abutment (Looking Downstream) Scour Data			
N/A			

1.35*Q_{100} Event

General and Pier Scour Data			
Variable	**Description**	**Value**	**Unit**
Q	Discharge	3856	cfs
y_1	Upstream Main Channel Water Depth	4.10	ft
V_1	Upstream Approach Velocity	7.93	ft/s
w'	Fall Velocity	0.036	ft/s
W_1	Upstream Main Channel Bottom Width	112.00	ft
W_2	Bottom Width of Contracted Channel Less Pier Widths	98.40	ft
S	Channel Slope	0.0098	ft/ft
a	Pier Width (Included Debris Width)	6.50	ft
y_0	Existing Depth in the Contracted Section Before Scour	3.00	ft
Fr	Froude Number	0.69	-
D_{50}	Mean Diameter	0.09	mm
D_{90}	90% Finer Diameter	0.23	mm
Left Abutment (Looking Downstream) Scour Data			
Variable	**Description**	**Value**	**Unit**
A_e	Flow Area of the Approach Cross Section Obstructed by the Embankment	150.00	ft^2
L	Length of Embankment Projected Normal to the Flow	54.00	ft
L'	Length of Active Flow Obstructed by Embankment	54.00	ft
K_1	Coefficient for Abutment Shape	1.00	-
θ	Embankment Angle	60	degrees
K_2	$(\theta/90)^{0.13}$	0.95	-
Right Abutment (Looking Downstream) Scour Data			
N/A			

500-Year Event

General and Pier Scour Data			
Variable	**Description**	**Value**	**Unit**
Q	Discharge	4855	cfs
y_1	Upstream Main Channel Water Depth	7.28	ft
V_1	Upstream Approach Velocity	3.71	ft/s
w'	Fall Velocity	0.036	ft/s
W_1	Upstream Main Channel Bottom Width	112.00	ft
W_2	Bottom Width of Contracted Channel Less Pier Widths	98.40	ft
S	Channel Slope	0.0098	ft/ft
a	Pier Width (Included Debris Width)	6.50	ft
y_0	Existing Depth in the Contracted Section Before Scour	6.60	ft
Fr	Froude Number	0.24	-
D_{50}	Mean Diameter	0.09	mm
D_{90}	90% Finer Diameter	0.23	mm
Left Abutment (Looking Downstream) Scour Data			
Variable	**Description**	**Value**	**Unit**
A_e	Flow Area of the Approach Cross Section Obstructed by the Embankment	476.00	ft^2
L	Length of Embankment Projected Normal to the Flow	54.00	ft
L'	Length of Active Flow Obstructed by Embankment	54.00	ft
K_1	Coefficient for Abutment Shape	1	-
θ	Embankment Angle	60	degrees
K_2	$(\theta/90)^{0.13}$	0.95	-
Right Abutment (Looking Downstream) Scour Data			
A_e	Flow Area of the Approach Cross Section Obstructed by the Embankment	14.00	ft^2
L	Length of Embankment Projected Normal to the Flow	5.00	ft
L'	Length of Active Flow Obstructed by Embankment	5.00	ft
K_1	Coefficient for Abutment Shape	1.00	-
θ	Embankment Angle	120	degrees
K_2	$(\theta/90)^{0.13}$	1.04	-

GENERAL (CONTRACTION) SCOUR

EQUATION - 5.2 (HEC-18, 4th EDITION)

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{K_1}$$

EQUATION - 5.3 (HEC-18, 4th EDITION)

$y_s = y_2 - y_0$ = (AVERAGE CONTRACTION SCOUR DEPTH)

WHERE: y_1 = AVERAGE DEPTH IN THE UPSTREAM MAIN CHANNEL, ft. (HEC-RAS CROSS SECTION: 5-119)

y_2 = AVERAGE DEPTH IN CONTRACTED SECTION, ft.

y_0 = EXISTING DEPTH IN THE CONTRACTED SECTION BEFORE SCOUR, ft

Q_1 = FLOW IN UPSTREAM CHANNEL, ft^3/s

Q_2 = FLOW IN THE CONTRACTED CHANNEL, ft^3/s.

W_1 = BOTTOM WIDTH OF THE UPSTREAM MAIN CHANNEL, ft.

W_2 = BOTTOM WIDTH OF THE MAIN CHANNEL IN THE CONTRACTED SECTION LESS PIER WIDTH(S), ft.

K_1 = EXPONENT BASED ON V^*/ω

WHERE: $V^* = \sqrt{g y_1 S_1}$ = SHEAR VELOCITY

$g = 32.2$ ft/s

S_1 = CHANNEL SLOPE

ω = FALL VELOCITY BASED ON D_{50}.

100-YEAR EVENT CALCULATIONS:

$y_1 = 3.58$ ft

$y_0 = 2.98$ ft

$W_1 = 112$ ft

$W_2 = 98.4$ ft

$Q_1 = Q_2 = 2832$ cfs

$K_1 = 0.69$ (SEE HEC-18, 4th Ed., Pg # 5.11)

SINCE $V^* = \sqrt{g\, y_1\, S_1}$

$= \sqrt{32.2 \times 3.58 \times 0.0098}$

$\Rightarrow V^* = 1.06$ ft/s.

$\omega = 0.036$ ft/s

$V^*/\omega = 29.4 > 2 \Rightarrow K_1 = \underline{\underline{0.69}}$

$$y_2 = y_1 \left(\frac{W_1}{W_2}\right)^{K_1} = 3.58 \times \left(\frac{112}{98.4}\right)^{0.69}$$

$\Rightarrow y_2 = 3.91$ ft

y_s = GENERAL (CONTRACTION) SCOUR

$= y_2 - y_0 = 3.91 - 2.98$

$\Rightarrow \boxed{y_s = 0.9 \text{ ft}}$

PIER SCOUR: (CSU EQUATION, HEC-18)

EQUATION-6.1 (HEC-18, 4th EDITION)

$$\frac{y_s}{y_1} = 2.0\ K_1\ K_2\ K_3\ K_4 \left(\frac{a}{y_1}\right)^{0.65} Fr_1^{0.43}$$

WHERE: y_s = PIER SCOUR DEPTH, ft

y_1 = UPSTREAM FLOW DEPTH, ft

K_1 = CORRECTION FACTOR FOR PIER SHAPE

K_2 = CORRECTION FACTOR FOR FLOW ANGLE OF ATTACK

K_3 = CORRECTION FACTOR FOR BED CONDITION

K_4 = CORRECTION FACTOR FOR ARMORING BY BED MATERIAL SIZE

a = EFFECTIVE PIER WIDTH, ft

Fr = FROUDE NUMBER

100-YEAR EVENT CALCULATIONS:

$y_1 = 3.58$ ft $= 1.09$ m ; $V_1 = 7$ ft/s $= 2.13$ m/s

$K_1 = 1.1$ SQUARE NOSE SHAPE FACTOR CONSIDERING DEBRIS LOADING ON THE PIER COLUMN.

$K_2 = 1.0$ PIERS ARE ALIGNED WITH THE FLOW

$K_3 = 1.1$ (TABLE 6.3, HEC-18)

K_4 FACTOR CALCULATIONS: (BASED ON HEC-18, 3rd EDITION)

$$V_R = \left[\frac{V_1 - V_i}{V_{c90} - V_i}\right] \quad \text{- EQN 24a}$$

$$V_i = 0.645 \left[\frac{D_{50}}{a}\right]^{0.053} V_{c50} \quad \text{- EQN 24b}$$

WHERE: V_R = VELOCITY RATIO

V_1 = APPROACH VELOCITY, m/s

V_i = APPROACH VELOCITY WHEN PARTICLES AT A PIER BEGIN TO MOVE, m/s

V_{c90} = CRITICAL VELOCITY FOR D_{90} BED MATERIAL SIZE, m/s

V_{c50} = CRITICAL VELOCITY FOR D_{50} BED MATERIAL SIZE, m/s

a = EFFECTIVE PIER WIDTH, m

$$V_c = 6.19\, y^{1/6} D_c^{1/3}$$

WHERE: D_c = CRITICAL PARTICLE SIZE FOR THE CRITICAL VELOCITY V_c, m

$D_{50} = 0.09$ mm $= 0.00009$ m

$D_{90} = 0.23$ mm $= 0.00023$ m

$a = 6.5$ ft

$$V_{c50} = 6.19\,(1.09)^{1/6}\,(0.00009)^{1/3}$$

$$= 0.28 \text{ m/s}$$

$$V_{c90} = 6.19\,(1.09)^{1/6}\,(0.00023)^{1/3}$$

$$= 0.38 \text{ m/s}$$

$$V_i = 0.645\left[\frac{0.00009}{6.5}\right]^{0.053}(0.28)$$

$$= 0.10 \text{ m/s}$$

$$V_R = \left[\frac{V_1 - V_i}{V_{c90} - V_i}\right] = \frac{2.13 - 0.10}{0.38 - 0.10}$$

$$\Rightarrow V_R = \underline{\underline{7.25}}$$

BASED ON TABLE-5 (HEC-18, 3rd EDITION)

SINCE $V_R > 1.0 \Rightarrow \boxed{K_4 = 1.0}$

F_{r_1} = FROUDE NUMBER $= V_1 / \sqrt{g y_1}$

$$= \frac{7.0}{\sqrt{32.2 \times 3.58}} = \underline{\underline{0.65}}$$

FROM EQUATION-6.1 (HEC-18, 4th EDITION)

$$y_s = \left[2.0 \; K_1 K_2 K_3 K_4 \left(\frac{a}{y_1} \right)^{0.65} F_{r_1}^{0.43} \right] \times y_1$$

$$\Rightarrow y_s = \left[(2.0)(1.1)(1.0)(1.1)(1.0) \left(\frac{6.5}{3.58} \right)^{0.65} (0.65)^{0.43} \right. \times 3.58$$

$$\Rightarrow \boxed{y_s = 10.62 \text{ ft}}$$

ABUTMENT SCOUR (LIVE-BED):

FROEHLICK'S LIVE-BED ABUTMENT SCOUR EQUATION (HEC-18, 4th EDITION)

$$\frac{y_s}{y_a} = 2.27\ K_1 K_2 \left(\frac{L'}{y_a}\right)^{0.43} F_r^{0.61} + 1 \qquad \text{EQN. (7.1)}$$

WHERE:

K_1 = COEFFICIENT FOR ABUTMENT SHAPE

K_2 = COFFICIENT FOR ANGLE OF EMBANKMENT TO FLOW

$K_2 = (\theta/90)^{0.13}$ (SEE FIGURE 7.4, HEC-18)

$\theta < 90°$ IF EMBANKMENT POINTS DOWNSTREAM

$\theta > 90°$ IF EMBANKMENT POINTS UPSTREAM

L' = LENGTH OF ACTIVE FLOW OBSTRUCTED BY EMBANKMENT, ft.

A_e = FLOW AREA OF THE APPROACH CROSS SECTION OBSTRUCTED BY THE EMBANKMENT, ft^2

F_r = FROUDE NUMBER OF APPROACH FLOW UPSTREAM OF THE ABUTMENT

$= V_e/\sqrt{g y_a}$

$V_e = Q_e/A_e$ ft/s.

Q_e = FLOW cfs.

y_a = AVERAGE DEPTH OF FLOW (A_e/L), ft.

L = LENGTH OF EMBANKMENT PROJECTED NORMAL TO THE FLOW, ft.

y_s = SCOUR DEPTH, ft.

100-YEAR EVENT CALCULATIONS:

LEFT ABUTMENT:-

$A_e = 110 \ ft^2$

$L = 54 \ ft.$

$L' = 54 \ ft.$

$K(1) = 1.00$ (VERTICAL WALL ABUTMENT ASSUMED)

$\theta = 60°$ (ABUTMENT POINTING DOWNSTREAM)

$K(2) = (\theta/90)^{0.13} = (60/90)^{0.13} = 0.95$

$y_a = A_e/L = 110/54 = 2.04 \ ft$

$F_r = 0.65$

$y_s = 2.04 \times \left[(2.27)(1)(0.95)\left(\frac{54}{2.04}\right)^{0.43}(0.65)^{0.61} + 1\right]$

$\Rightarrow \boxed{y_s = 16.5 \ ft}$

RIGHT ABUTMENT:-

$A_e = 0 \ ft^2$

$L = 5 \ ft$

$L' = 0 \ ft$ (FLOW DOES NOT REACH ABUTMENT - DEPTH)

$\boxed{y_s = 0 \ ft}$

13-782 500 SHEETS, FILLER 5 SQUARE
42-381 50 SHEETS EYE-EASE® 5 SQUARE
42-382 100 SHEETS EYE-EASE® 5 SQUARE
42-389 200 SHEETS EYE-EASE® 5 SQUARE
42-392 100 RECYCLED WHITE 5 SQUARE
42-399 200 RECYCLED WHITE 5 SQUARE
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RICKER • ATKINSON • McBEE & ASSOCIATES, INC.

Geotechnical Engineering • Construction Materials Testing

Dibble & Associates
2633 East Indian School Road, Suite 401
Phoenix, Arizona 85016-6763

March 21, 2002

Attention: Brian Fry

Subject: Preliminary Drilled Shaft Capacities
Sossaman Road Bridge over Queen Creek Wash
Queen Creek, Arizona

R.A.M. Project No. G06046

Attached to this letter is a design chart providing preliminary capacities for straight, cast-in-place drilled shaft foundations for the above-referenced project. These capacities are for shafts with diameters of 3, 4 and 5 feet, extending to a depth of 60 feet below the scour depth. We anticipate that the site soils to depths of at least 60 feet will consist of stratified layers of sands, silts and clays, containing varying amounts of gravel and variably cemented. The site soils were generalized using an average unit weight of 120 pcf and an average blow count of 30 to determine these capacities, using the AASHTO method to determine the axial capacities of the drilled shafts in cohesionless soil. These capacities are net in that the weight of the concrete in the foundations do not need to be included in the overall weight of the structure when determining size and depth of the shafts. This chart will be revised as necessary once we have completed the field investigation for the new bridge, which will include test borings advanced to a depth of at least 80 feet below the anticipated depth of scour.

Please call if you have any questions or require any additional information.

Respectfully submitted,
RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.

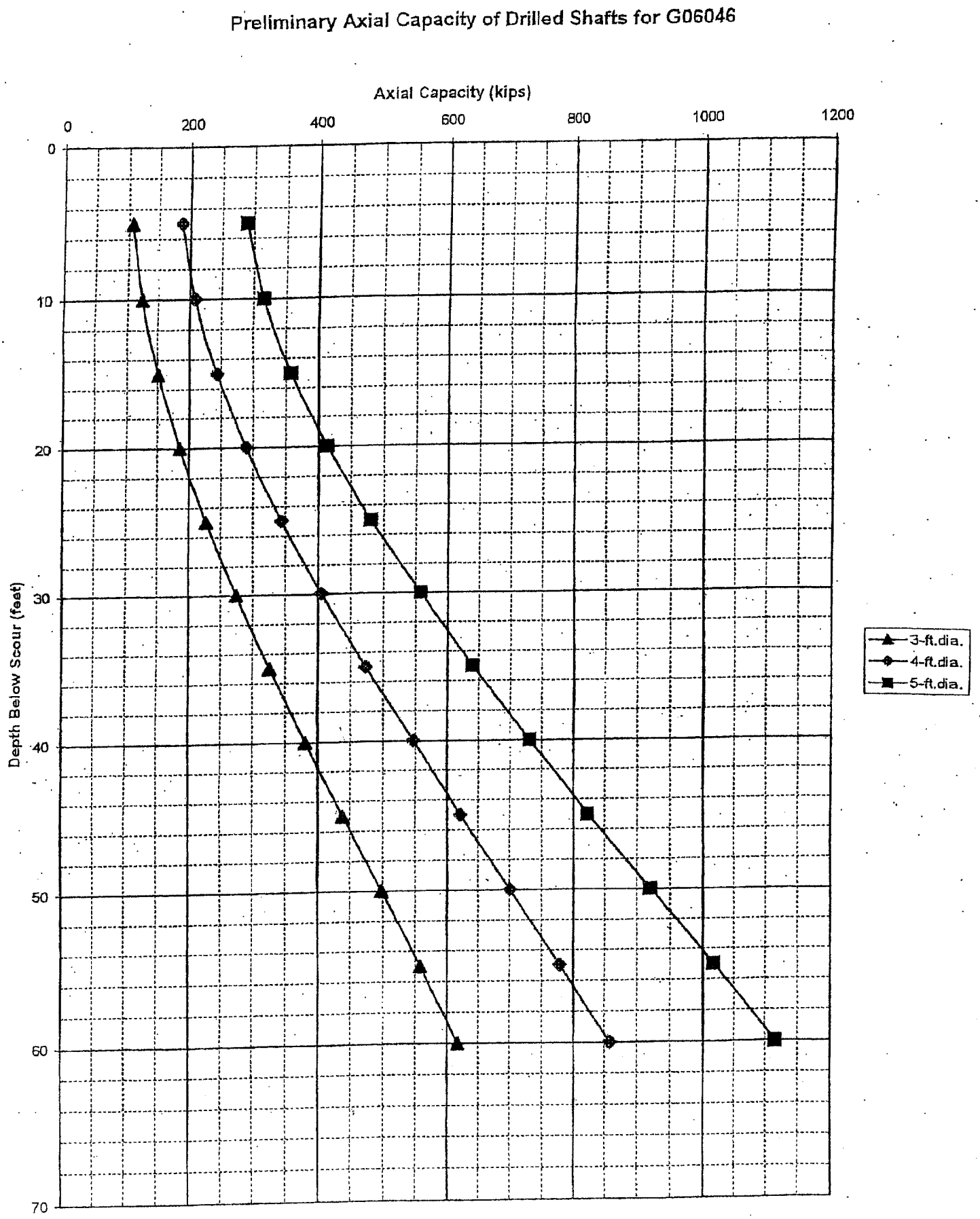
Registered Professional Engineer (Civil) CERTIFICATE NO. 28182 DAVID A. THOMAS Date Signed 3-21-02 ARIZONA U.S.A.

Registered Professional Engineer (Civil) CERTIFICATE NO. 10971 KENNETH L. RICKER Date Signed 3-21-02 ARIZONA U.S.A.

By: David A. Thomas, P.E.

Reviewed by: Kenneth L. Ricker, P.E.

/dat
Copies to: Addressee (3)
Cannon & Associates; Attn: Jerry A. Cannon, P.E. (1)


Preliminary Axial Capacity of Drilled Shafts for G06046
Axial Capacity (kips)
0
200
400
600
800
1000
1200
Depth Below Scour (feet)
0
10
20
30
40
50
60
70
3-ft.dia.
4-ft.dia.
5-ft.dia.

GENERAL NOTES:

Design Specifications

American Association of State Highway and Transportation Officials (AASHTO)Standard Specifications for Highway Bridges,16th Edition with 1997,1998,1999,2000 & 2002 Interim Revisions.

Construction Specifications

ADOT Standard Specifications for Road and Bridge Construction, 2000 edition.

Design Loadings

Dead Load:
Dead Load includes allowance of 25 psf for future wearing surface.
Live Load:
AASHTO HS20-44.

Seismic Performance Category A.

Hydraulic Design Criteria

Drainage Report provided by Dibble & Associates.

Q_{100} = 2831 cfs downstream of bridge.Q_{500} = 4813 cfs downstream of bridge.The flow that occurs through the bridge opening is as follows:

Q_{100} = 2831 cfs, H.W. Elevation = 1359.31 feet, Velocity = 6.34 ft/sec
Q_{500} = 4813 cfs, H.W. Elevation = 1360.55 feet, Velocity = 7.41 ft/sec

Maximum Q_{100} Abutment Scour = feet. Maximum Q_{500} Pier Scour = feet. The scour depths for the piers and abutments is to be determined.

Concrete and Reinforcement Stresses

f'c = 4500 psi-Superstructure except Barriers (Deck fc = 1400 psi)
f'c = 4000 psi-Abutments,Columns,Wingwalls and Drilled Shafts
f'c = 3000 psi-Approach Slabs and Barriers
fs = 24,000 psi-Grade 60 Reinforcing Steel

All concrete shall be Class 'S' unless noted otherwise.

Reinforcing steel shall conform to ASTM A615. All reinforcing shall be furnished as Grade 60.

Reinforcing steel to be welded, where approved by the Engineer, shall conform to ASTM A706.

All Mechanical splices of reinforcing steel shall develop 125% of the yield strength of the reinforcing bar and shall conform to the requirements for mechanical connections in Section 605-3.02 of the Standard Specifications.

All dimensions for reinforcing steel shall be to center of bars,unless noted otherwise.

Adjacent lap splices shall be staggered a minimum of 40 bar diameters.

All reinforcing shall have a 2" cover unless noted otherwise.

For concrete finish, see the Standard Specifications and Special Provisions.

Concrete Barriers

Concrete barriers shall be constructed after deck slab falsework has been removed. Barriers shall not be slip formed.

Dimensions

Dimensions shall not be scaled from drawings.

Forms

Forms for new construction shall be cambered for dead load deflection,vertical curvature and falsework settlement.

Foundations

Geotechnical Engineering Letter Report by Ricker, Atkinson,McBee & Associates dated March 21, 2002..Abutments and piers to be supported on drilled shaft foundations.

Construction Joints

Sandblast all construction joints in concrete prior to placement of concrete. See Standard Specifications.

Coordination

Contractor shall coordinate all existing conditions during construction of project.

Chamfer

All exposed corners shall be chamfered 3/4 " unless noted otherwise in accordance with Section 601-3.02 (C)1 of the Standard Specifications. This note applies to all bridge drawings.

Standard ADOT Drawing List

Inventory & Operating Rating

Ratings are in accordance with the AASHTO Manual for Condition Evaluation of Bridges, 1994,Second Edition,Load Factor Method.

Inventory Rating:
Operating Rating:

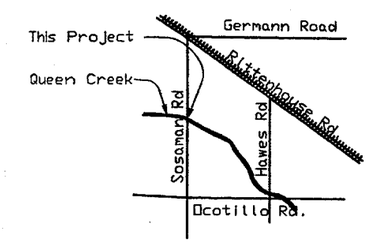
Construction of New Bridge

The road will be closed during construction of the new bridge.

The Contractor shall provide an opening between the falsework supports for the new bridge that is of adequate size to pass the flow of water.

Legend

3/5 — Detail Number / Sheet Number



Vicinity Map

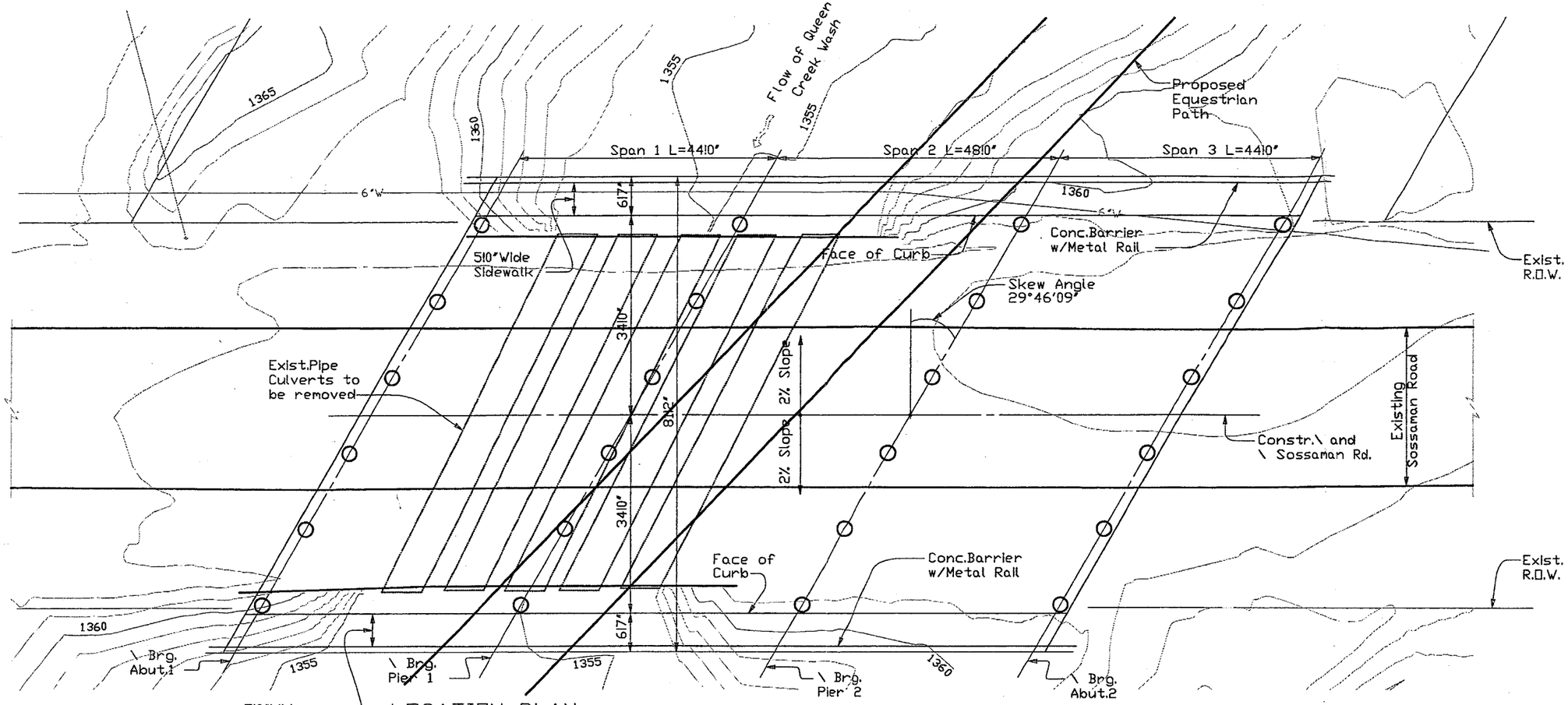
Abbreviations

Abut.	Abutment
b/b	Back-to-Back
Bm.	Beam
Bott.	Bottom
Brg.	Bearing
C.I.P.	Cast-in-Place
C.G.	Center of Gravity
C.S.P.	Corrugated Steel Pipe
\	Centerline
Clr.	Clear
Col.	Column
Conc.	Concrete
Constr.	Construction
Diam.	Diameter
Diaph.	Diaphragm
Dtl.	Detail
Dwgs.	Drawings
Ea.	Each
Elev.	Elevation
Embed.	Embedment
Eq.	Equal
Exist.	Existing
Ext.	Exterior
F	Fixed
Fin.	Finish
Ftg.	Footing
Ga.	Gauge
H.W.	High Water
Hk.	Hook
Horiz.	Horizontal
I.D.	Inner Diameter
Int.	Interior
Longit.	Longitudinal
Max.	Maximum
Min.	Minimum
Misc.	Miscellaneous
No.,#	Number
o.c.	On Center
PCDOT	Pima County Dept.of Transportation
psi	Pounds per Square Inch
R.	Radius
R/W	Right of Way
Rdwy.	Roadway
Reinf.	Reinforcement
Sched.	Schedule
Sec.	Second
Sect.	Section
Sht.	Sheet
Sim.	Similar
Sp.	Space
Sta.	Station
Std.	Standard
Stl.	Steel
Sym.	Symmetrical
Trans.	Transverse
Typ.	Typical
u.n.o.	Unless Noted Otherwise
w/	With
WP	Working Point

NO.	REVISION DESCRIPTION	DIV/SECT. ENGR.	DATE

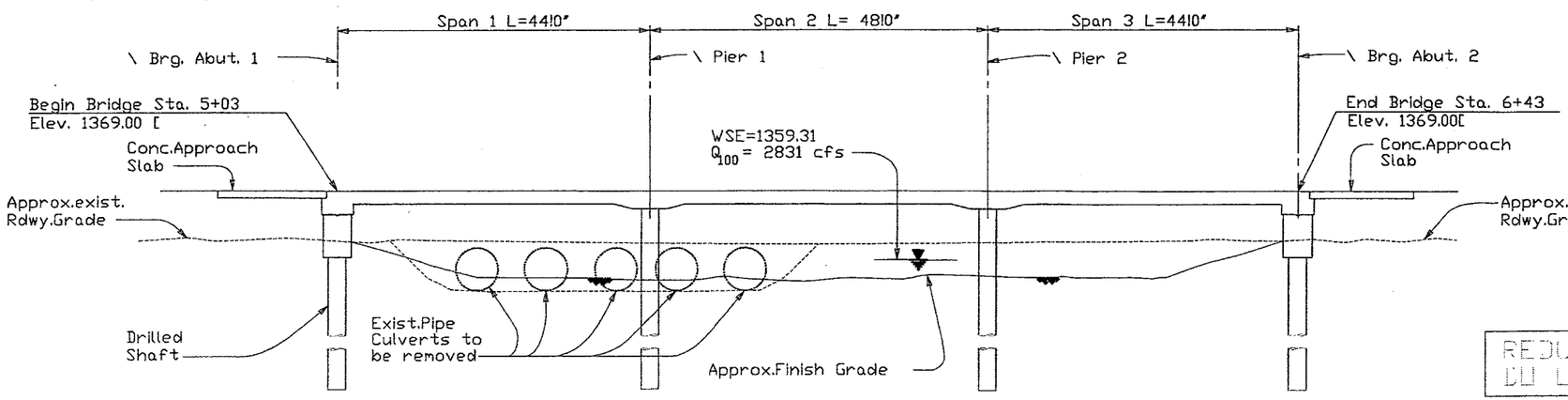
		DATE
DESIGNED	JAC	5/02
DRAWN	AL	5/02
CHECKED	JAC/AL	5/02
PROJ. ENG	JAC	

SOSAMAN ROAD BRIDGE AT QUEEN CREEK WASH



LOCATION PLAN

1"=10'0"
New Three Span Cast-in-Place Reinforced Concrete Slab Bridge
Skew 29°46'09"
Contour Interval = 1'0"



SECTION @ CONSTRUCTION \

1"=10'0"

REDUCED SIDE DO NOT SCALE

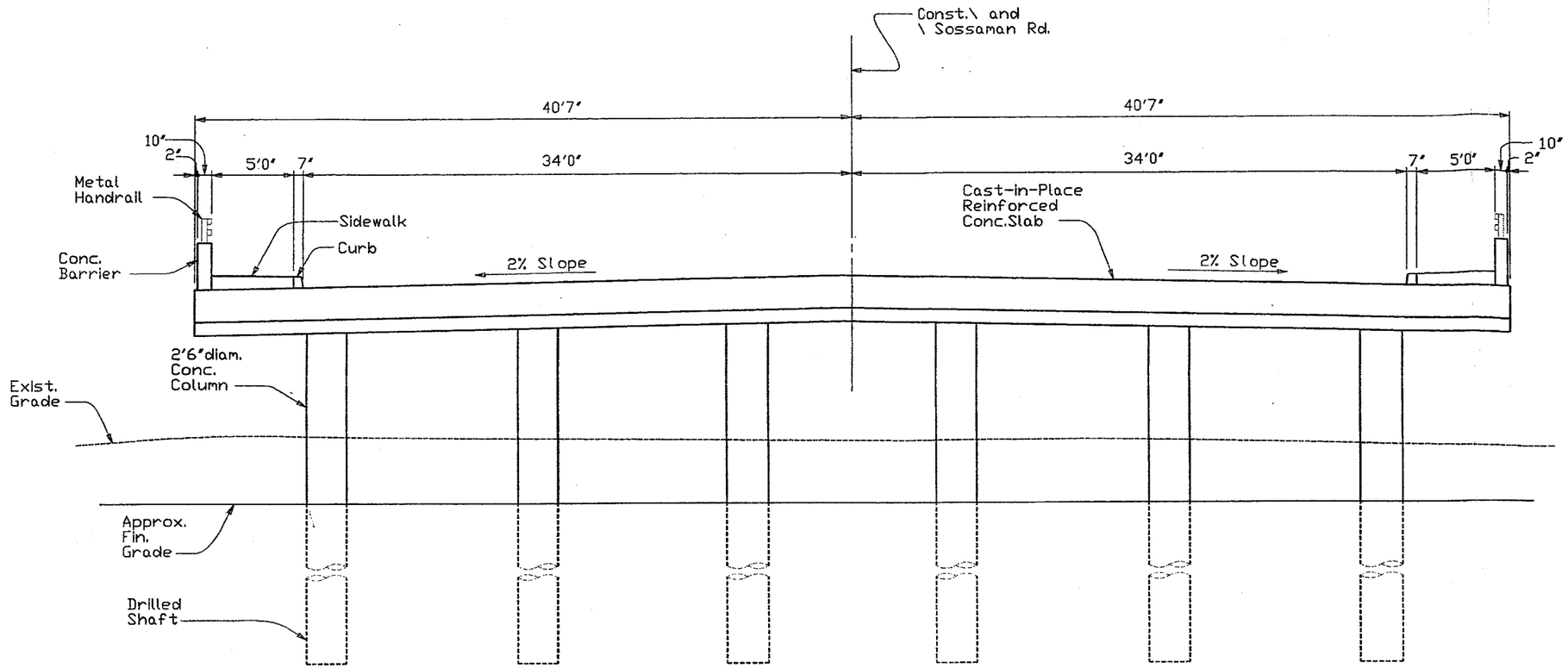
NO.	REVISION DESCRIPTION	DIV/SECT. ENGR.

		DATE
DESIGNED	JAC	5/02
DRAWN	AL	5/02
CHECKED	JAC/AL	5/02
PROJ. ENG	JAC	

DATE SOSSAMAN ROAD BRIDGE AT QUEEN CREEK WASH

Consulting Engineers 10050005001

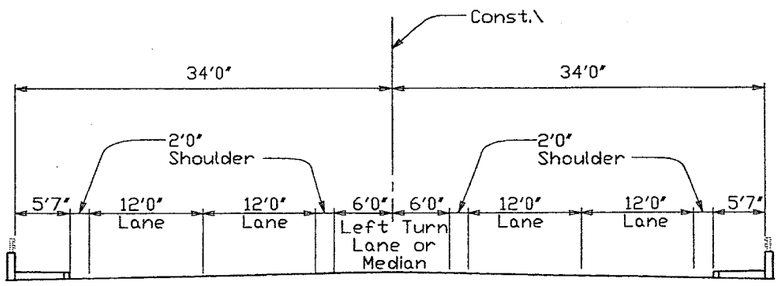
LOCATION PLAN & SECTION | SHEET 2 OF 3



TYPICAL BRIDGE SECTION

1/4 "=1'0"

1



PROPOSED BRIDGE LANES

No Scale

REDUCED SIZE
DO NOT SCALE

NO.	REVISION DESCRIPTION	DIV/SECT.	ENGR.	DATE

SOSSAMAN ROAD
BRIDGE AT
QUEEN CREEK
WASH

		DATE
DESIGNED	JAC	5/02
DRAWN	AL	5/02
CHECKED	JAC/AL	5/02
PROJ. ENG	JAC	

Consulting Engineers 0055101

TYP. SECTION	SHEET 3 OF 3

APPENDIX F.2

SOIL SAMPLE ANALYSIS

R·A·M

RICKER • ATKINSON • McBEE & ASSOCIATES, INC.

Geotechnical Engineering • Construction Materials Testing

Dibble & Associates
2633 East Indian School Road, Suite 401
Phoenix, Arizona 85016-6763

February 7, 2001

Attention: Brian Fry

Subject: Bank and Bed Sampling and Testing
Queen Creek Improvements
Ellsworth Road to Power Road
Queen Creek, Arizona

R.A.M. Project No. G06046

At your request this firm has sampled from the bank and bed area of Queen Creek between Ellsworth Road and Power Road. The samples were obtained by excavating 15 test pits at the locations selected by West Consultants and as described on the attached sheet. The test pits were 3 feet deep and representative samples were obtained and returned to our laboratory for testing. In Test Pits 1, 7, 9 and 10 two materials were encountered, both were sampled and both materials were tested. Bed samples were obtained from 10 locations (1 to 10) and bank samples were obtained from 5 locations (3B, 4B, 5B, 6B and 10B). The results of the laboratory tests are attached.

If you have any questions or need additional information please do not hesitate to call.

Respectfully submitted,
RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.

Kenneth L. Ricker, P.E.

/ces
Copies to: Addressee (4)
West Consultants, Inc. (1)

2105 South Hardy Drive, Suite 13, Tempe, AZ 85282 • Telephone (480) 921-8100 • Facsimile (480) 921-4081

Sample Locations for Queen Creek Channel Design
Sediment Transport Study

Location		Description	Bed	Bank
Ellsworth to Ocotillo				
	1.	200' downstream from Ellsworth Road	X	
	2.	500' upstream from Ocotillo Road	X	
Hawes to Sossaman				
	3.	500' downstream from Hawes Road	X	X
	4.	2400' downstream from Hawes Road	X	X
	5.	5200' downstream from Hawes Road	X	X
	6.	6900' downstream from Hawes Road (Approximately 500' upstream of Sossaman Road)	X	X
Sossaman to Power				
	7.	Approximately 300' below Sossaman Road	X	
	8.	1650' downstream from Sossaman Road	X	
	9.	1270' upstream from Power Road	X	
	10.	400' upstream from Power Road	X	X
		Total Samples	10	5

LABORATORY TEST RESULTS

Date: 6-Feb-01

SAMPLE SOURCE: As noted below

TESTING PERFORMED: Sieve Analysis, Percent Passing No. 200 Sieve, Atterberg Limits (ASTM C136, D1140, D4318)

SAMPLED BY: RAM/Miller

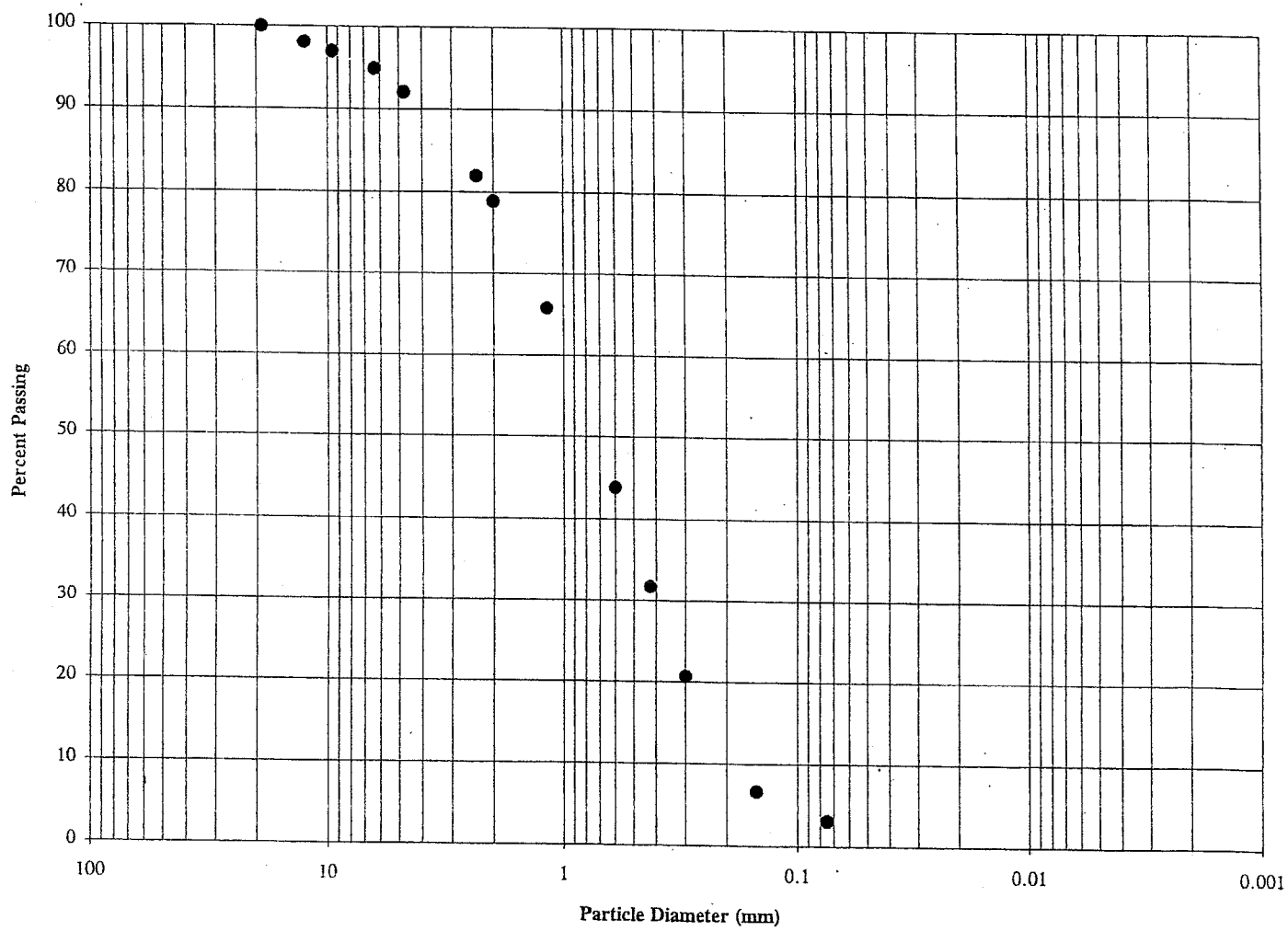
RESULTS:

Sample	Atterberg Limits		Sieve Size - Accumulative Percent Passing											Soil
Source	LL	PI	200	100	50	30	16	8	4	3/4"	1"	2"	3"	Class.*
1 @ 0'-1.5'	N/A	NP	3.1	7	21	44	66	82	92	100				SP
1 @ 1.5'-3'	26	5	75	82	86	89	91	94	96	100				CL-ML
2 @ 0'-3'	N/A	NP	3.0	6	23	54	75	88	95	100				SP
3 @ 0'-3'	N/A	NP	6.9	14	30	55	75	87	94	100				SW-SM
3B @ 0'-3'	N/A	NP	40	61	84	95	98	99	100					SM
4 @ 0'-3'	N/A	NP	2.0	6	24	55	75	86	92	100				SP
4B @ 0'-3'	N/A	NP	40	64	85	93	96	99	100					SM
5 @ 0'-3'	N/A	NP	3.8	13	41	68	82	90	95	100				SP
5B @ 0'-3'	27	9	77	89	96	98	99	100						CL
6 @ 0'-3'	N/A	NP	1.1	4	23	56	76	87	93	100				SP
6B @ 0'-3'	26	10	74	86	94	97	98	99	100					CL
7 @ 0'-1.5'	N/A	NP	5.9	8	21	51	72	84	92	100				SP-SM
7 @ 1.5'-3'	23	8	62	71	80	89	94	97	99	100				CL
8 @ 0'-3'	N/A	NP	0.7	2	15	45	71	89	96	100				SP
9 @ 0'-2'	N/A	NP	1.4	3	17	50	68	77	83	95	96	100		SP
9 @ 2'-3'	26	9	31	42	66	90	95	97	98	100				SC
10 @ 0'-1.5'	N/A	NP	1.2	5	39	84	95	98	100					SP
10 @ 1.5'-3'	22	7	32	42	65	87	92	95	98	100				SC-SM
10B @ 0'-3'	26	7	81	94	98	100								CL-ML

NP = Non-Plastic

* Unified Soil Classification System

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

1 @ 0'-1.5'

Percent Gravel: 8

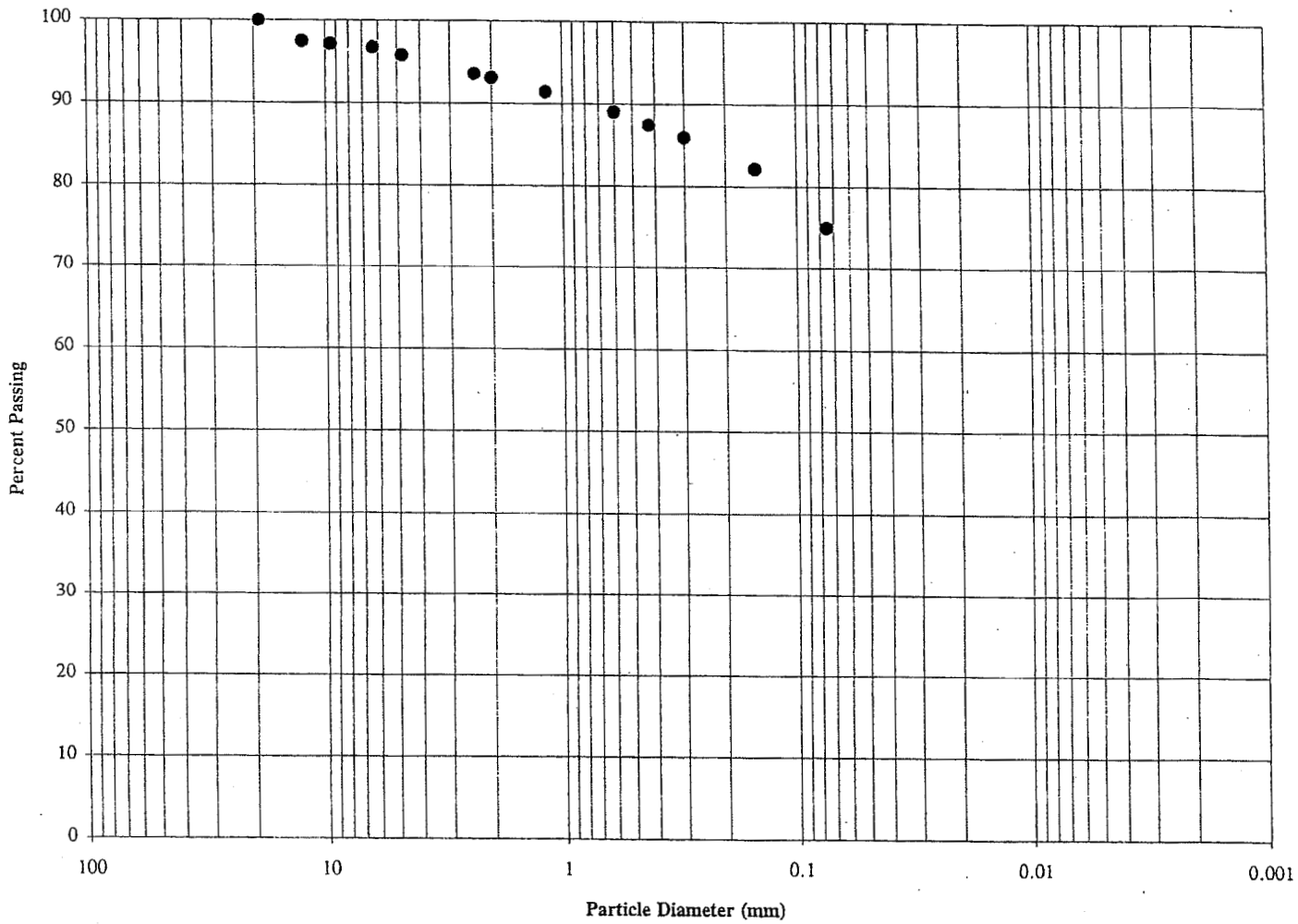
Percent Sand: 89

Percent Silt & Clay: 3

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

1 @ 1.5'-3'

Percent Gravel: 4

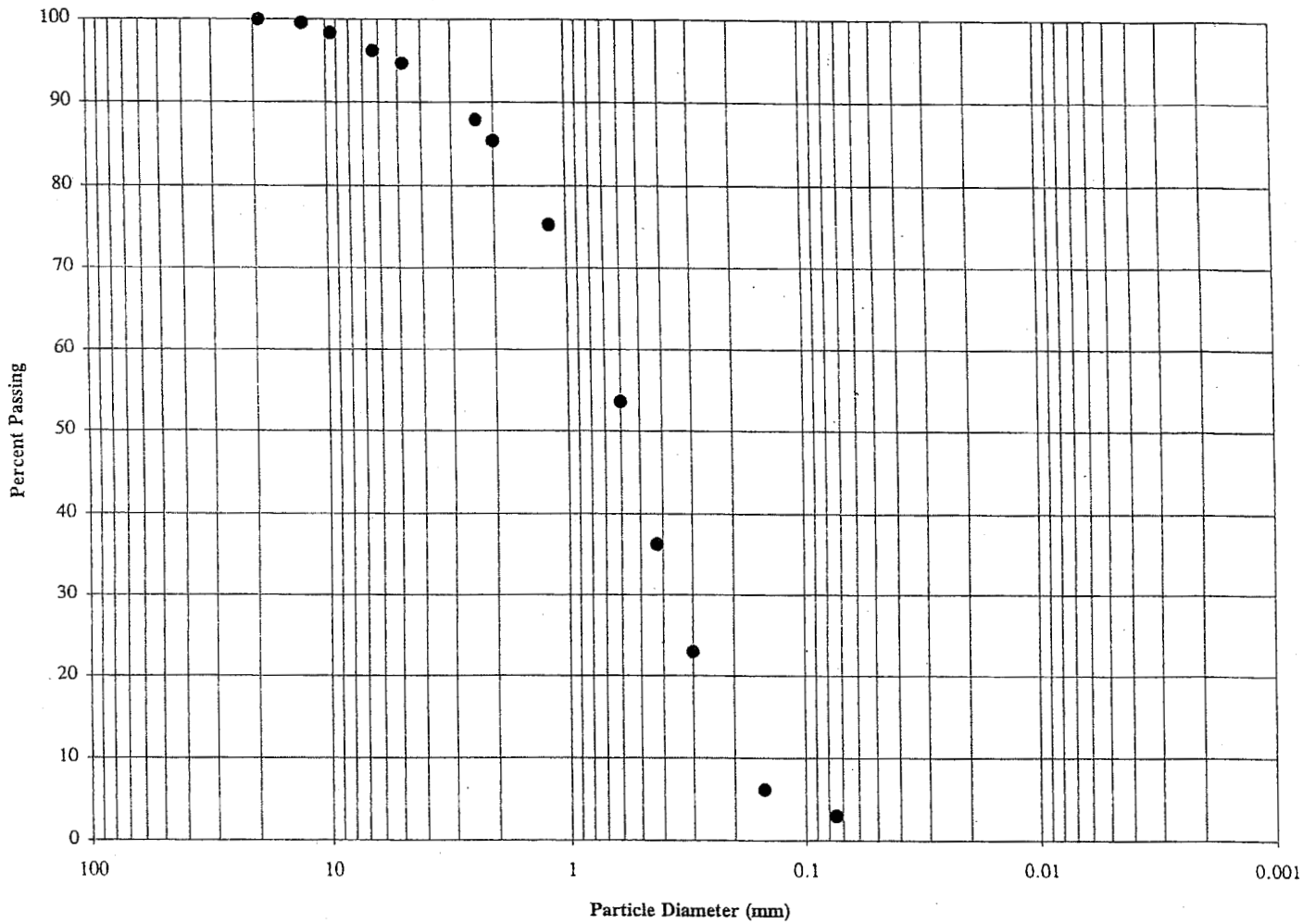
Percent Sand: 21

Percent Silt & Clay: 75

Liquid Limit: 26

Plastic Limit: 5

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

2 @ 0'-3'

Percent Gravel: 5

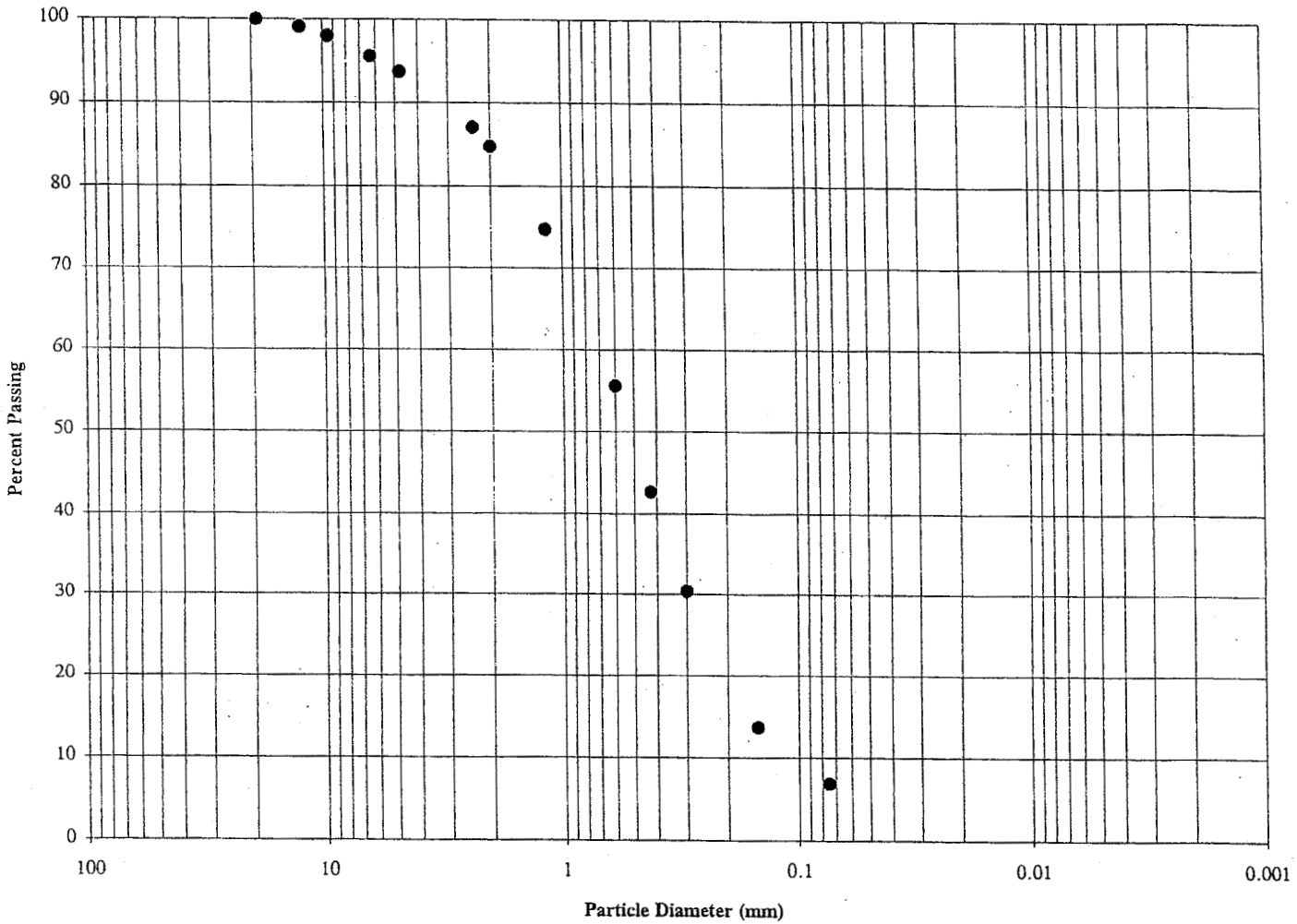
Percent Sand: 92

Percent Silt & Clay: 3

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

3 @ 0'-3'

Percent Gravel: 6

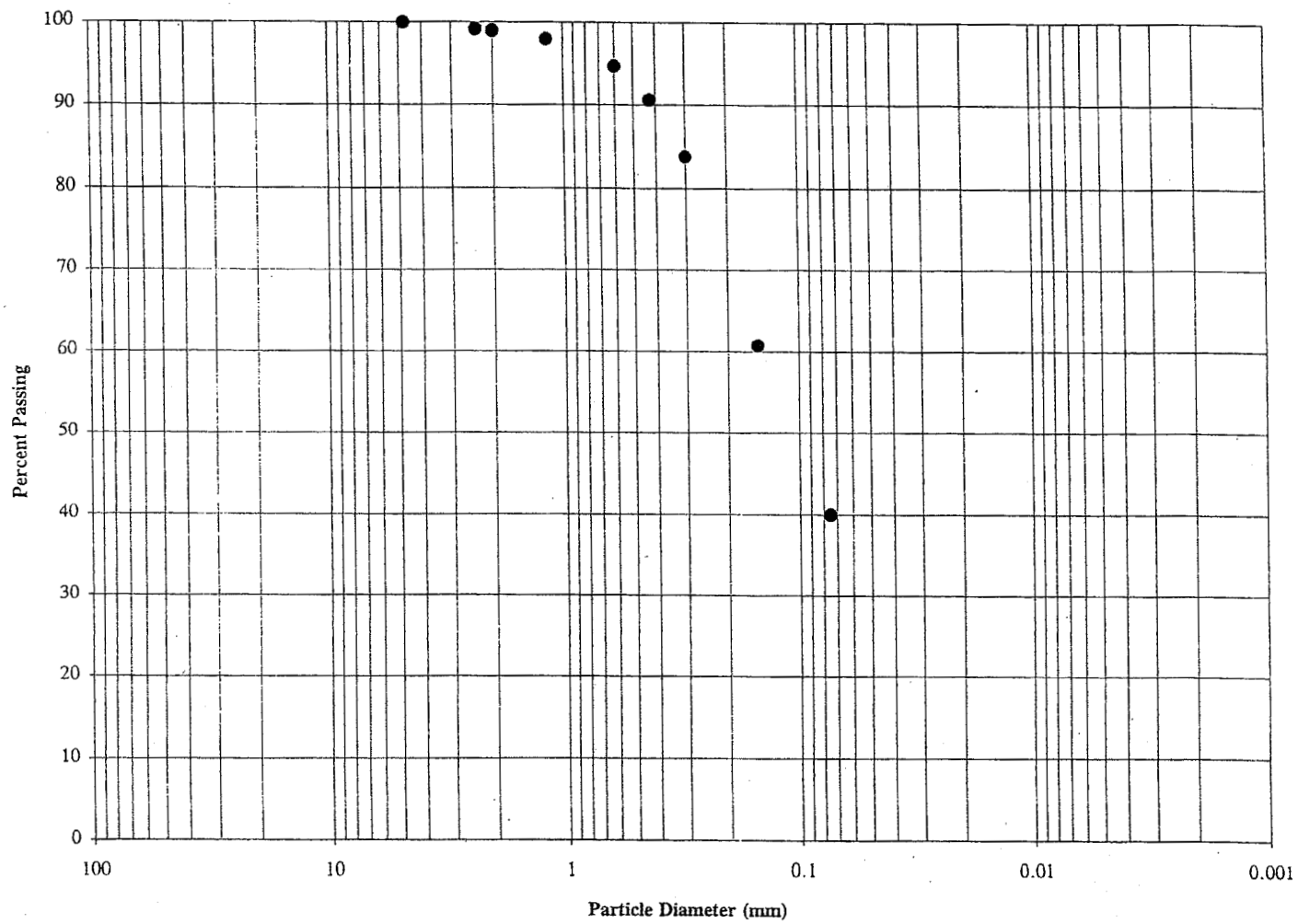
Percent Sand: 87

Percent Silt & Clay: 7

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

3B @ 0'-3'

Percent Gravel: 0

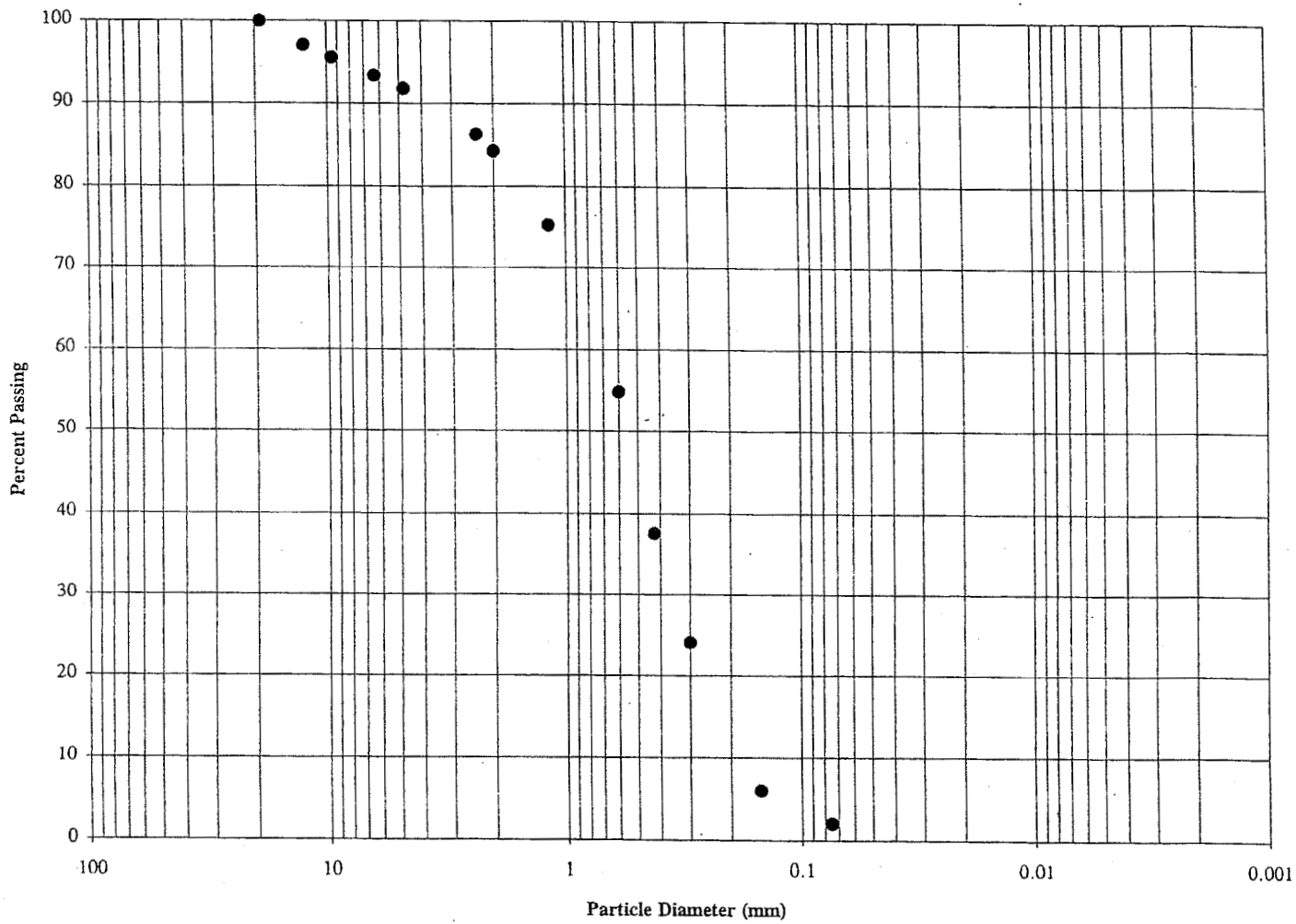
Percent Sand: 60

Percent Silt & Clay: 40

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

4 @ 0'-3'

Percent Gravel: 8

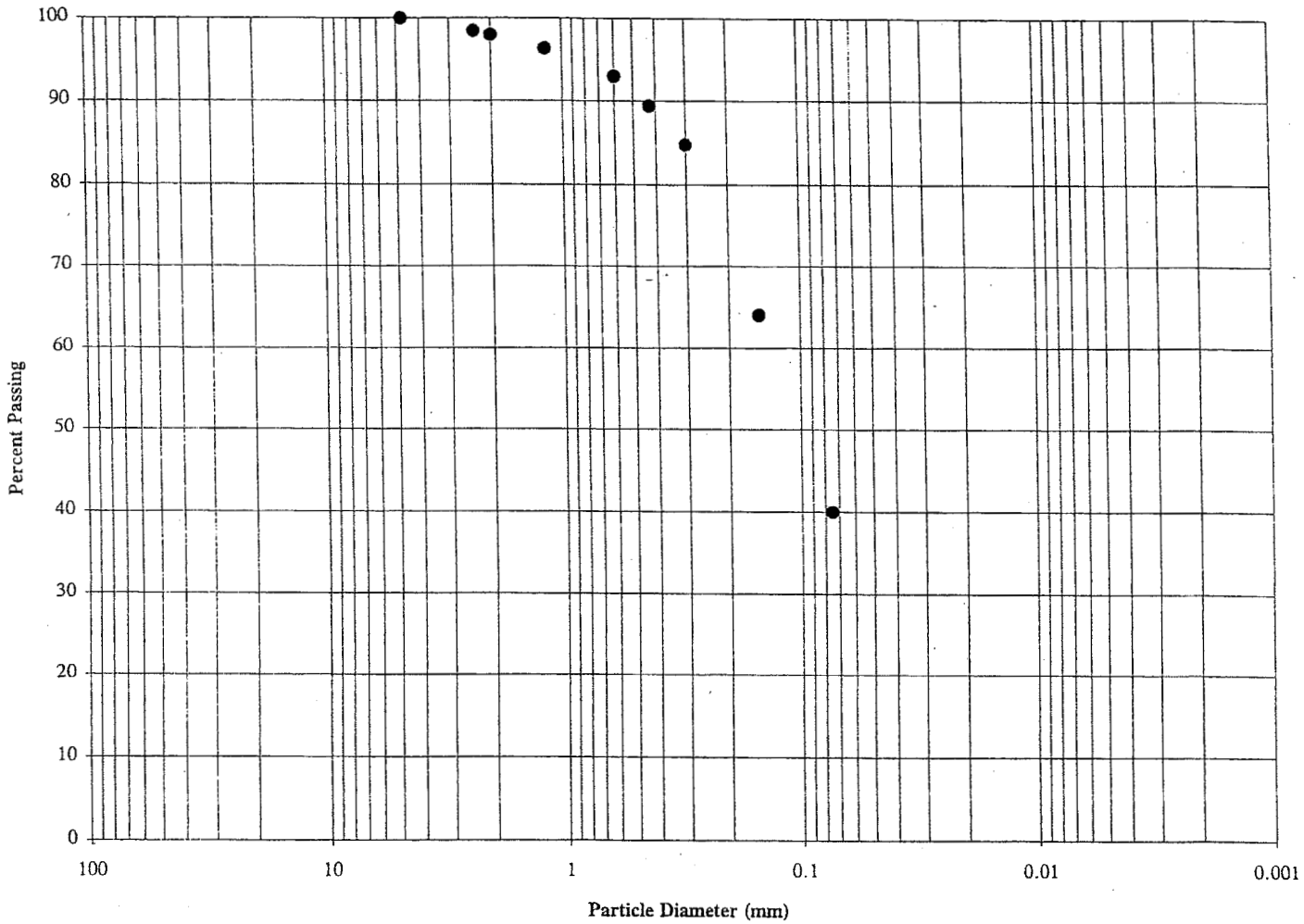
Percent Sand: 90

Percent Silt & Clay: 2

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

4B @ 0'-3'

Percent Gravel: 0

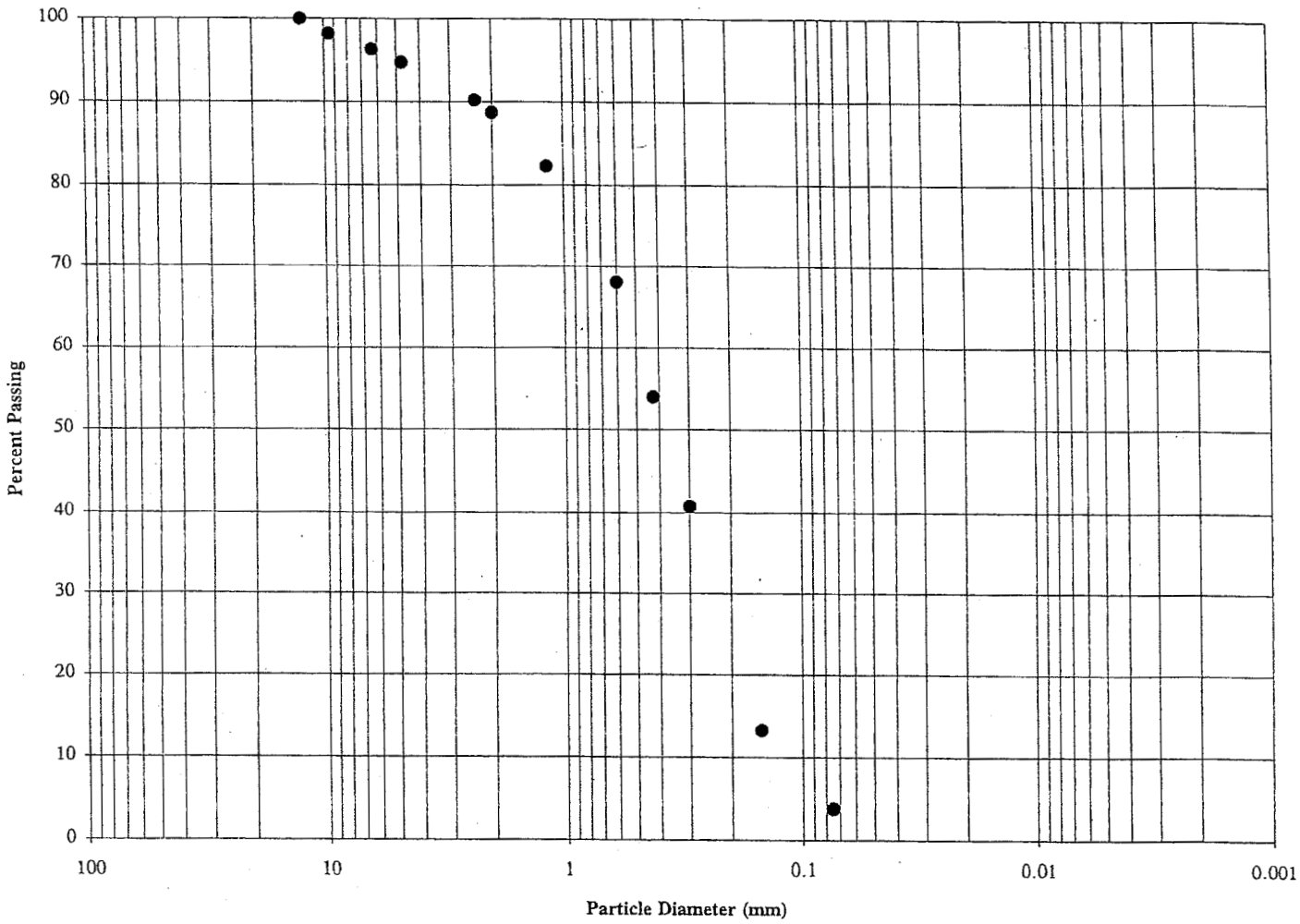
Percent Sand: 60

Percent Silt & Clay: 40

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

5 @ 0'-3'

Percent Gravel: 5

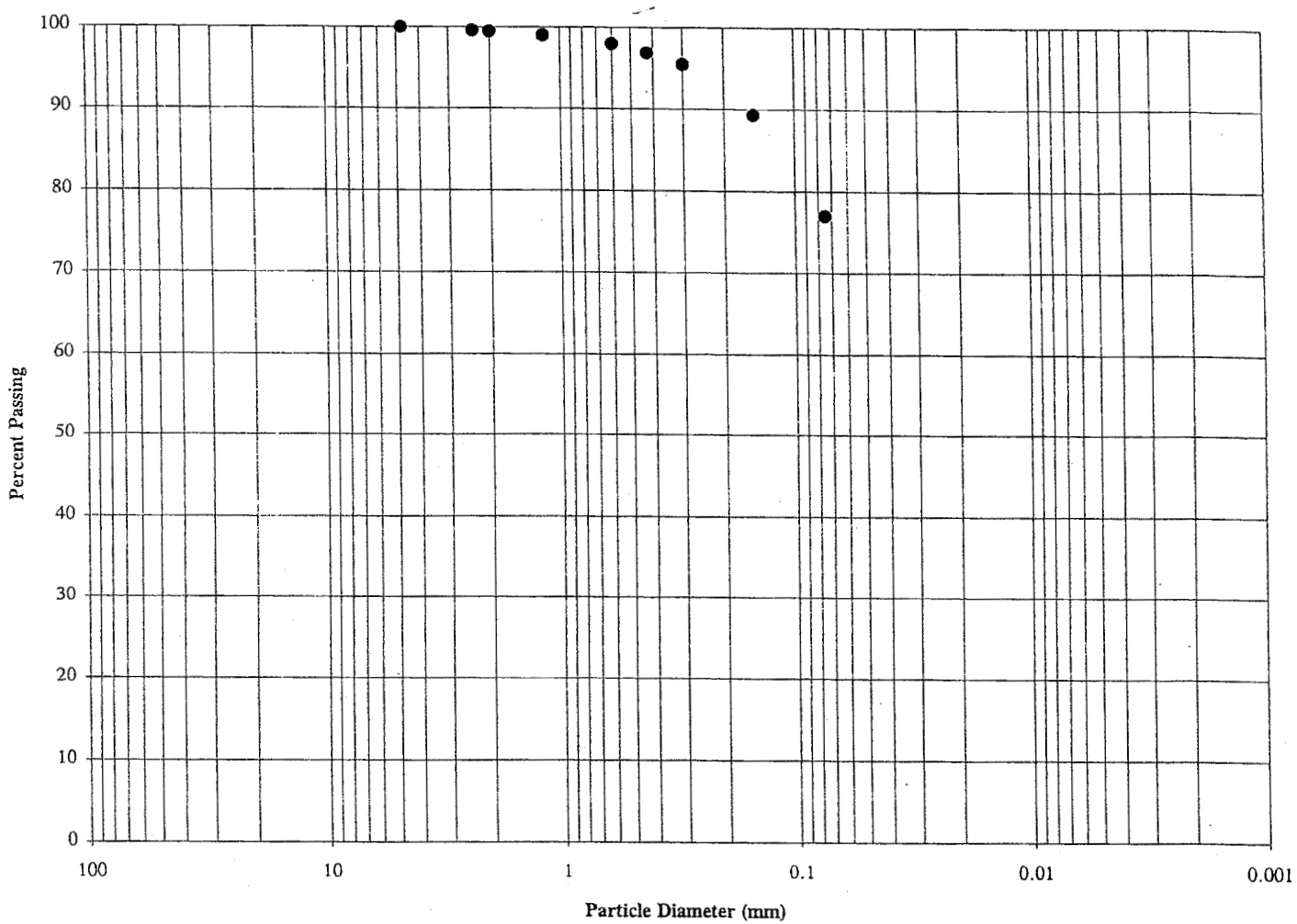
Percent Sand: 91

Percent Silt & Clay: 4

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

5B @ 0'-3'

Percent Gravel: 0

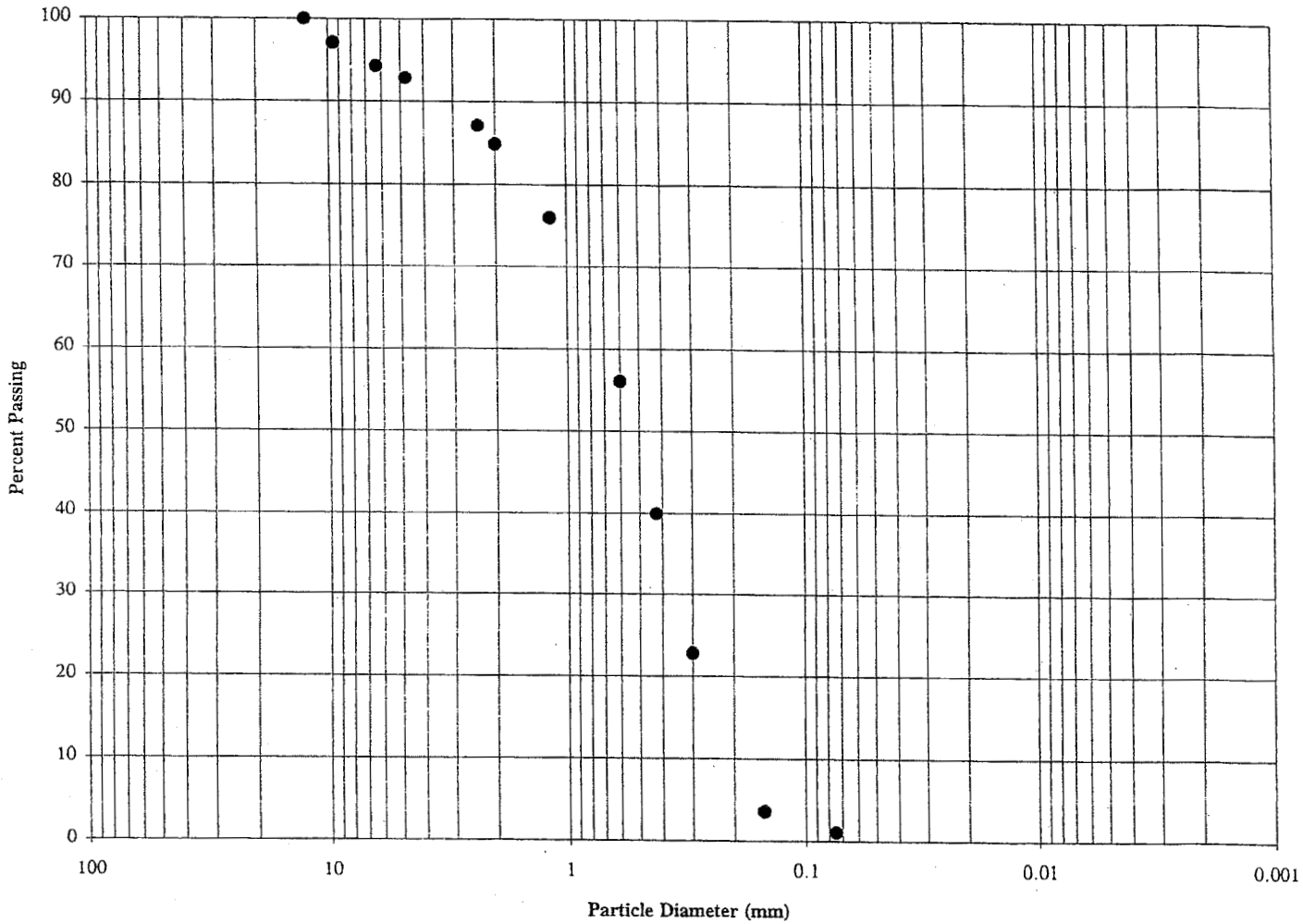
Percent Sand: 23

Percent Silt & Clay: 77

Liquid Limit: 27

Plastic Limit: 9

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

6 @ 0'-3'

Percent Gravel: 7

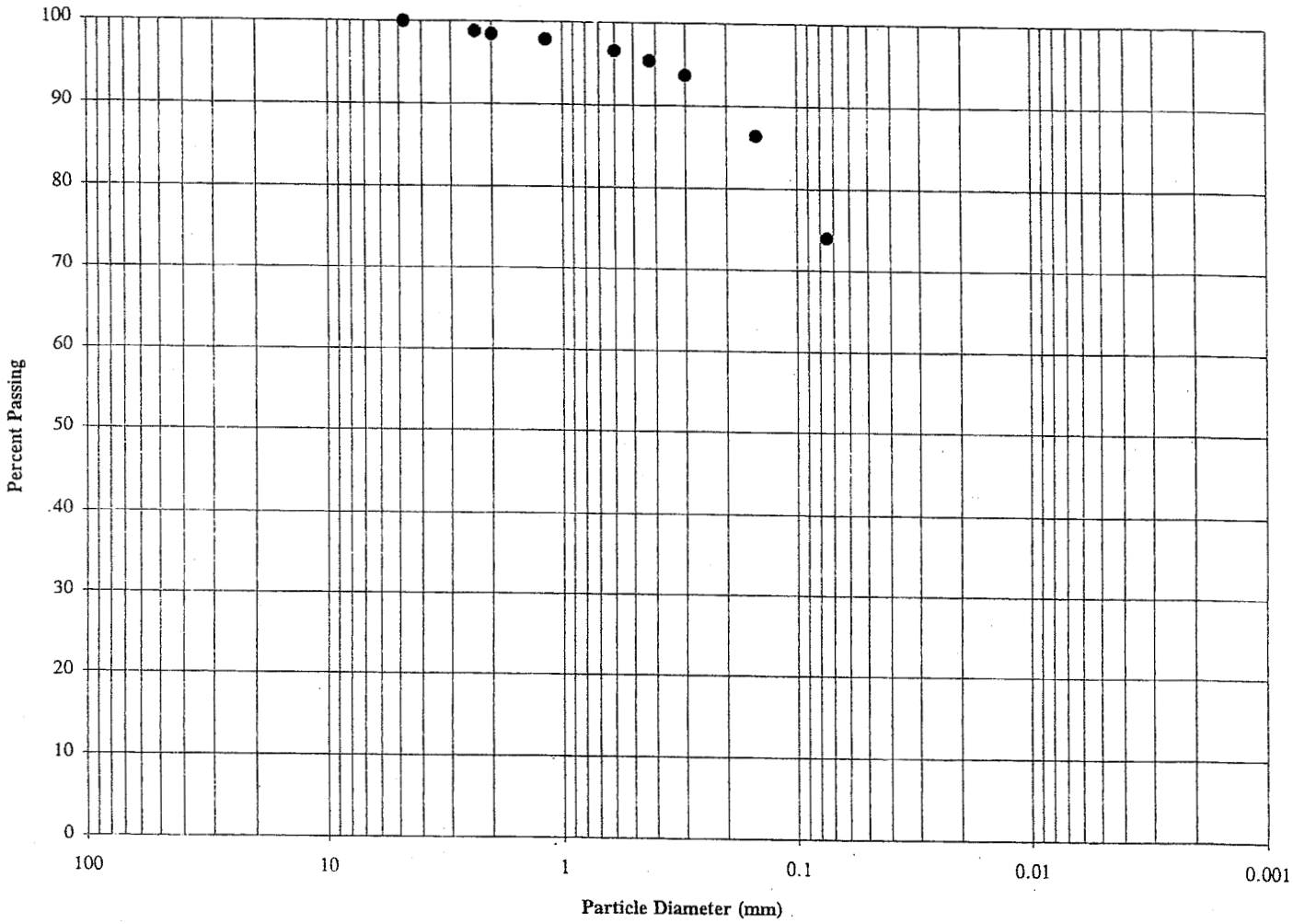
Percent Sand: 92

Percent Silt & Clay: 1

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

6B @ 0'-3'

Percent Gravel: 0

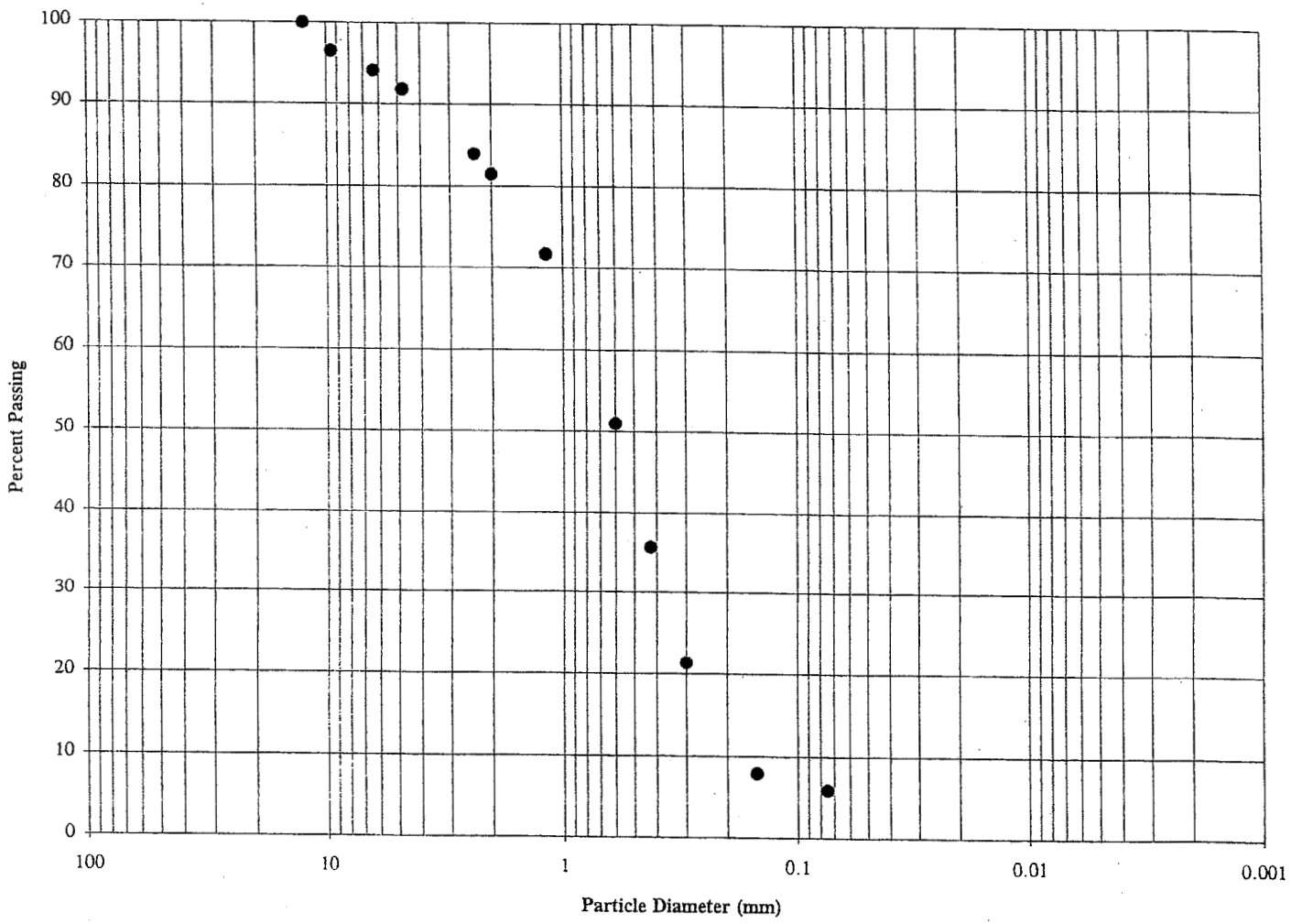
Percent Sand: 26

Percent Silt & Clay: 74

Liquid Limit: 26

Plastic Limit: 10

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

7 @ 0'-1.5'

Percent Gravel: 8

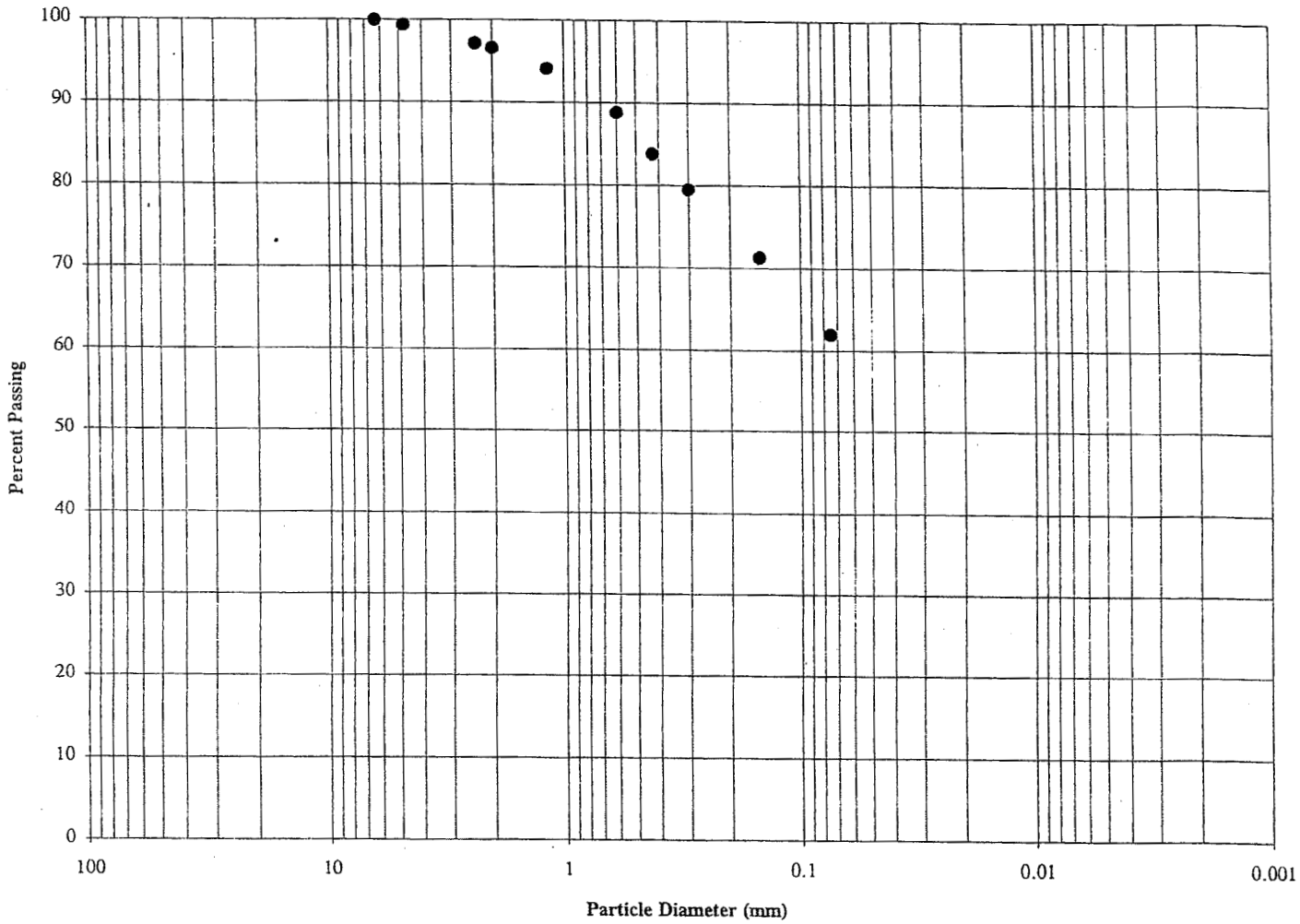
Percent Sand: 86

Percent Silt & Clay: 6

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

7 @ 1.5'-3'

Percent Gravel: 1

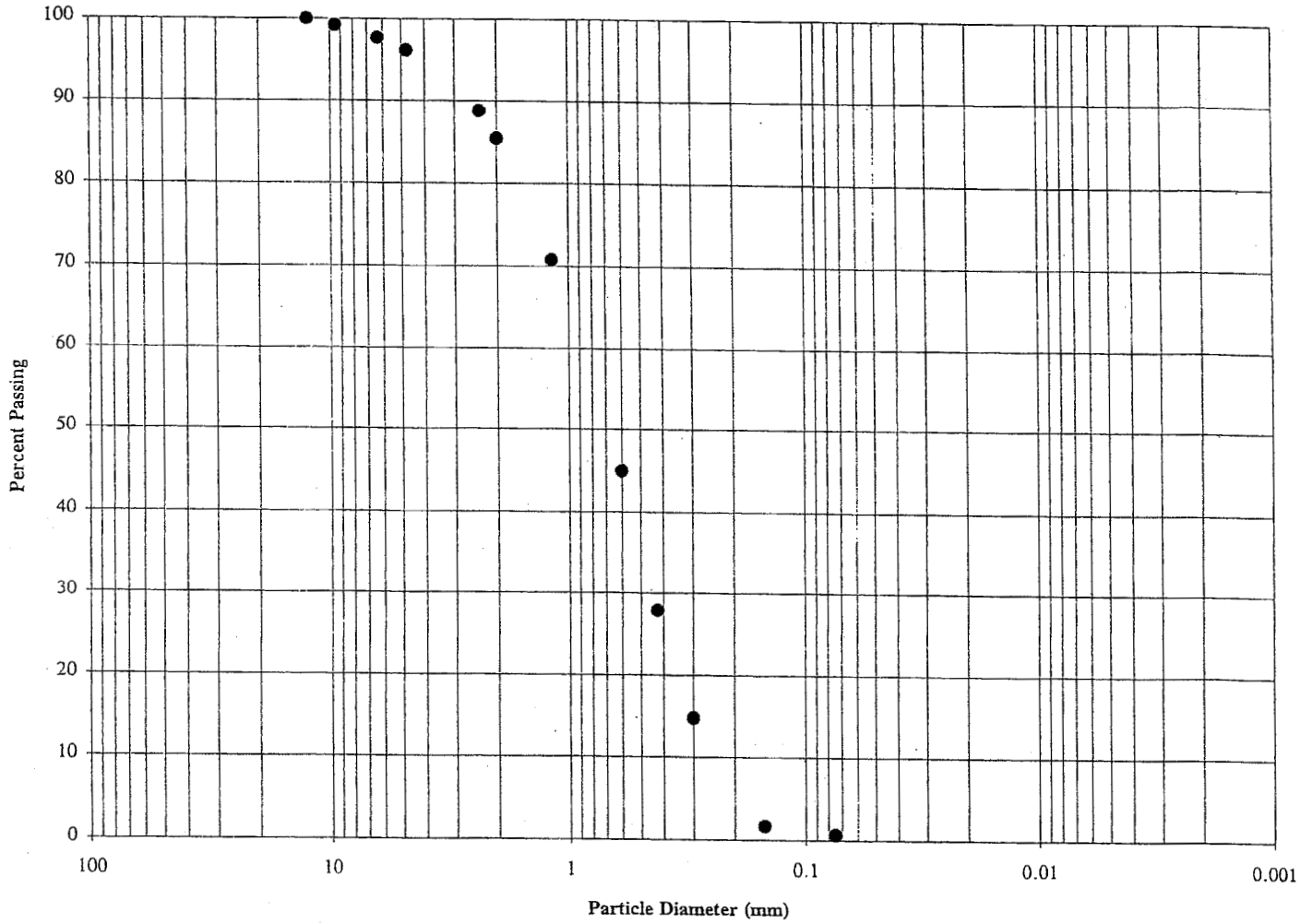
Percent Sand: 37

Percent Silt & Clay: 62

Liquid Limit: 23

Plastic Limit: 8

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

8 @ 0'-3'

Percent Gravel: 4

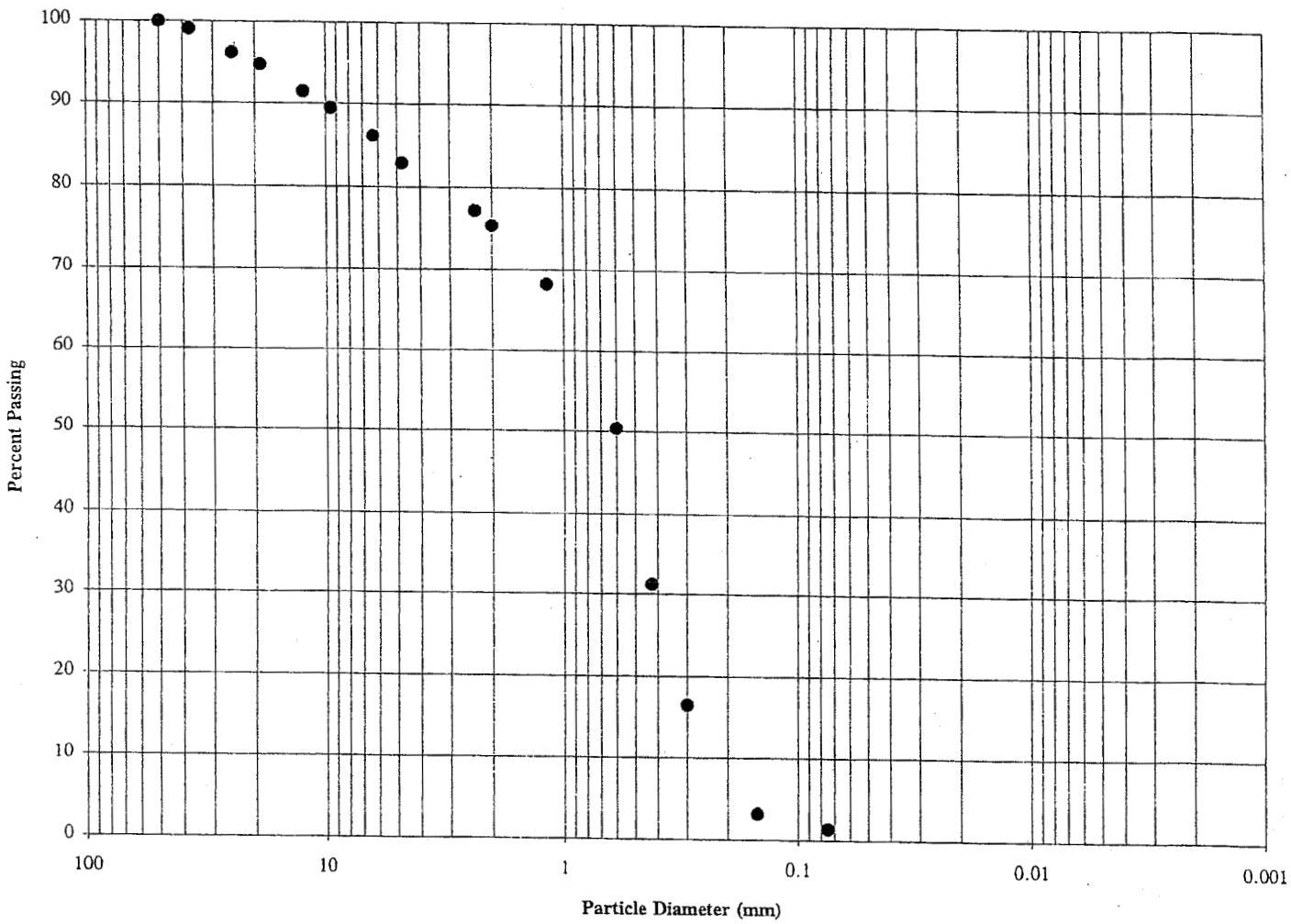
Percent Sand: 95

Percent Silt & Clay: 1

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

9 @ 0'-2'

Percent Gravel: 17

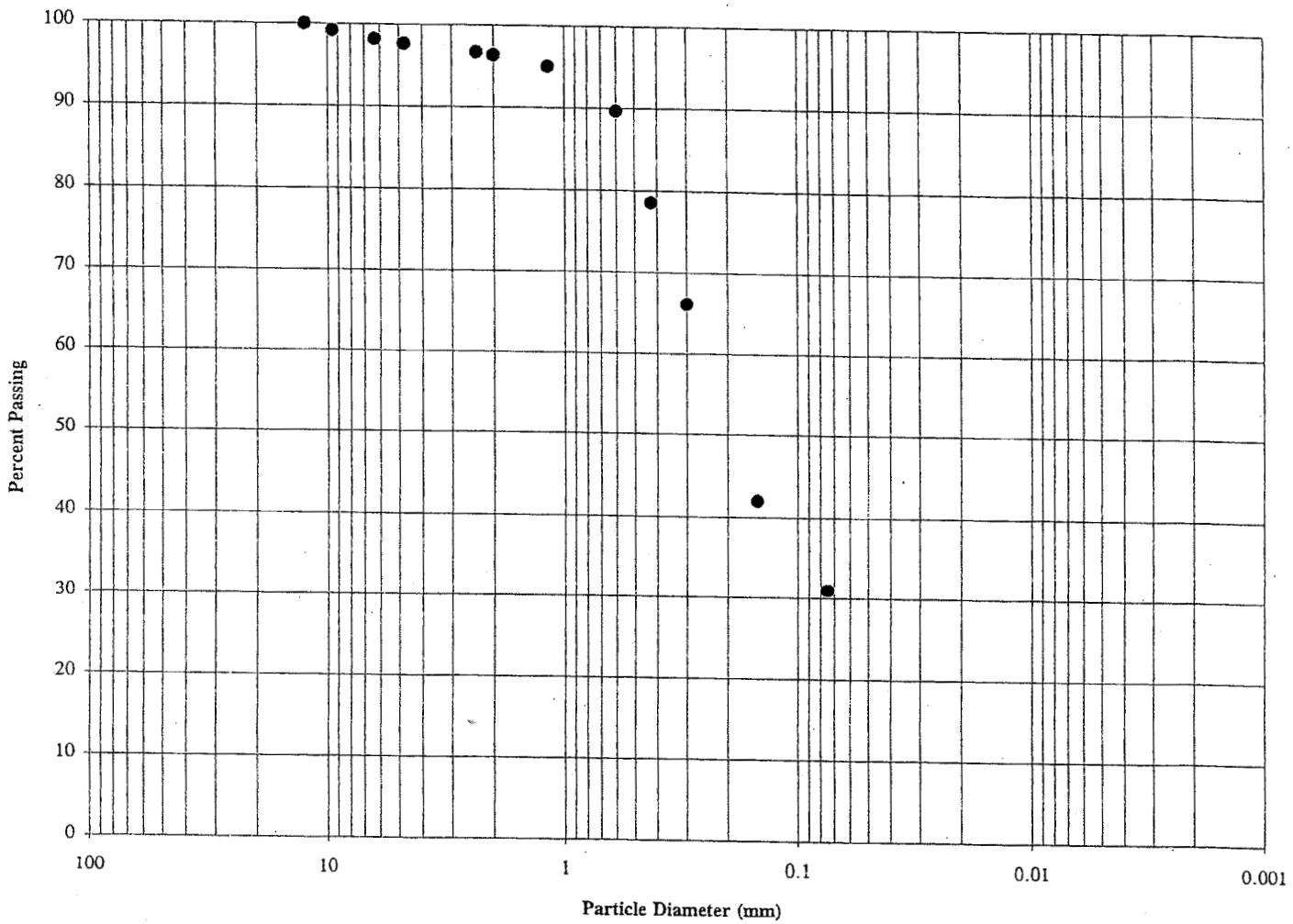
Percent Sand: 82

Percent Silt & Clay: 1

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

9 @ 2'-3'

Percent Gravel: 2

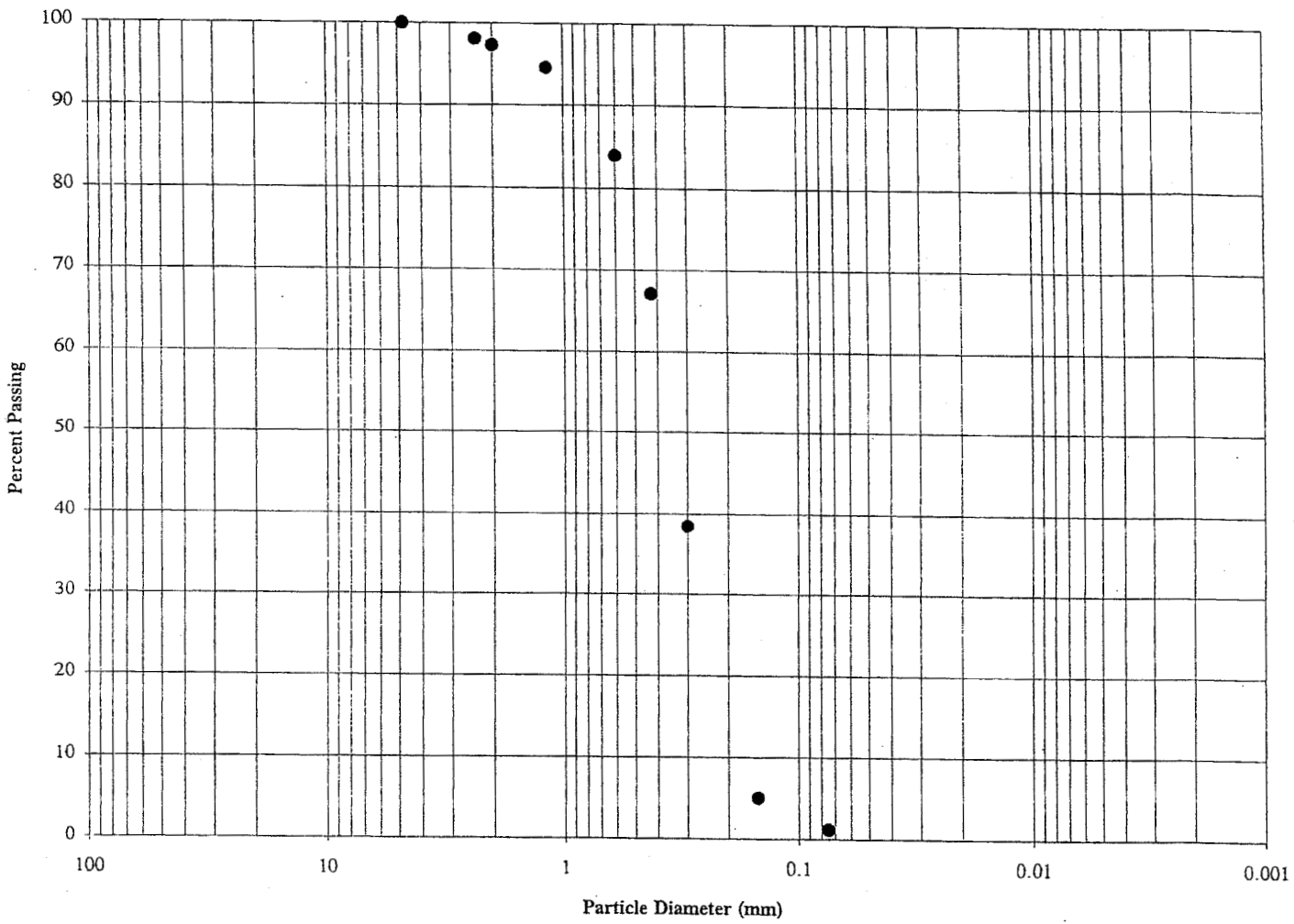
Percent Sand: 67

Percent Silt & Clay: 31

Liquid Limit: 26

Plastic Limit: 9

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

10 @ 0'-1.5'

Percent Gravel: 0

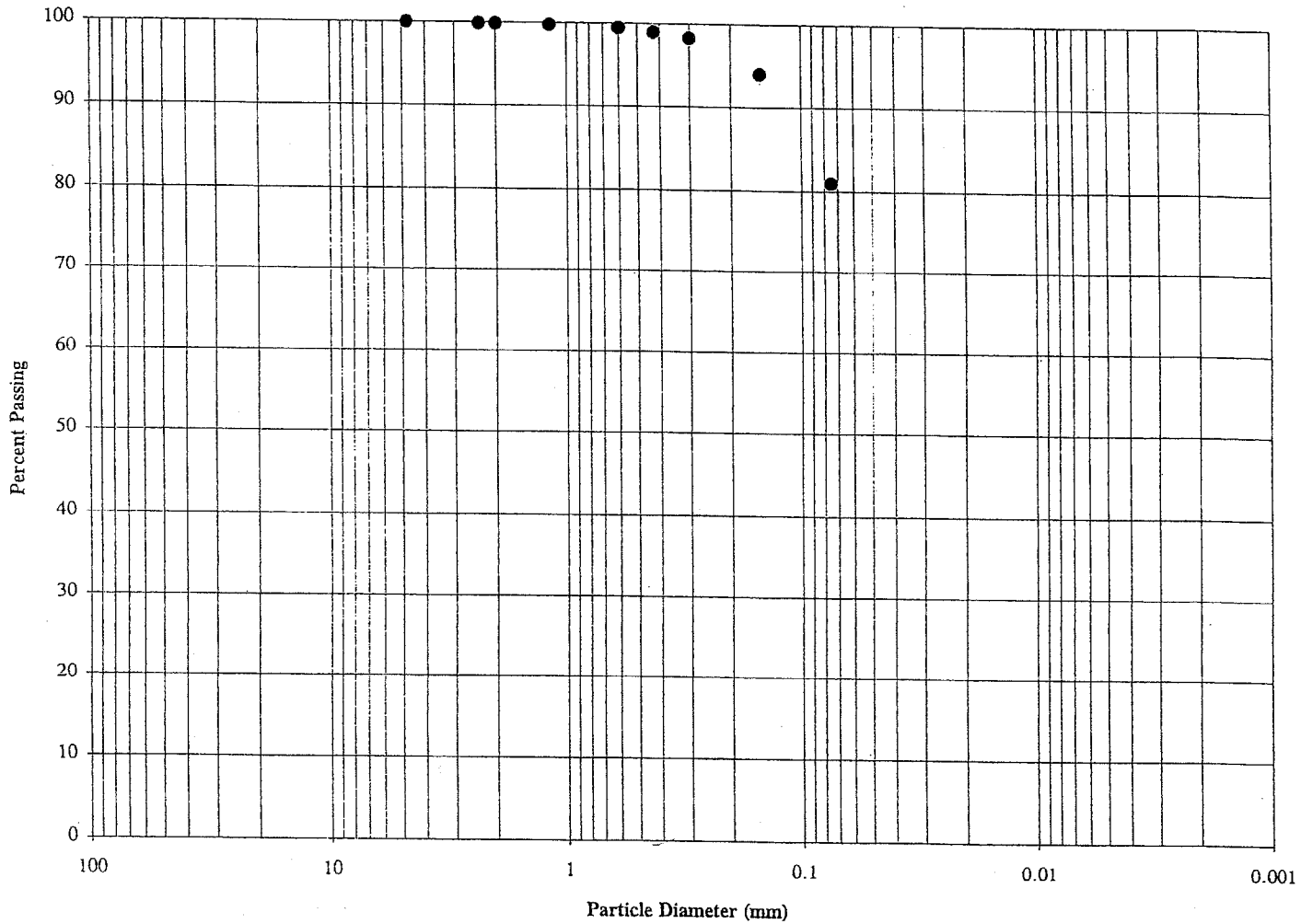
Percent Sand: 99

Percent Silt & Clay: 1

Liquid Limit: N/A

Plastic Limit: NP

PARTICLE-SIZE ANALYSIS TEST RESULTS
(ASTM D422)



Sample Source:

10B @ 0'-3'

Percent Gravel: 0

Percent Sand: 19

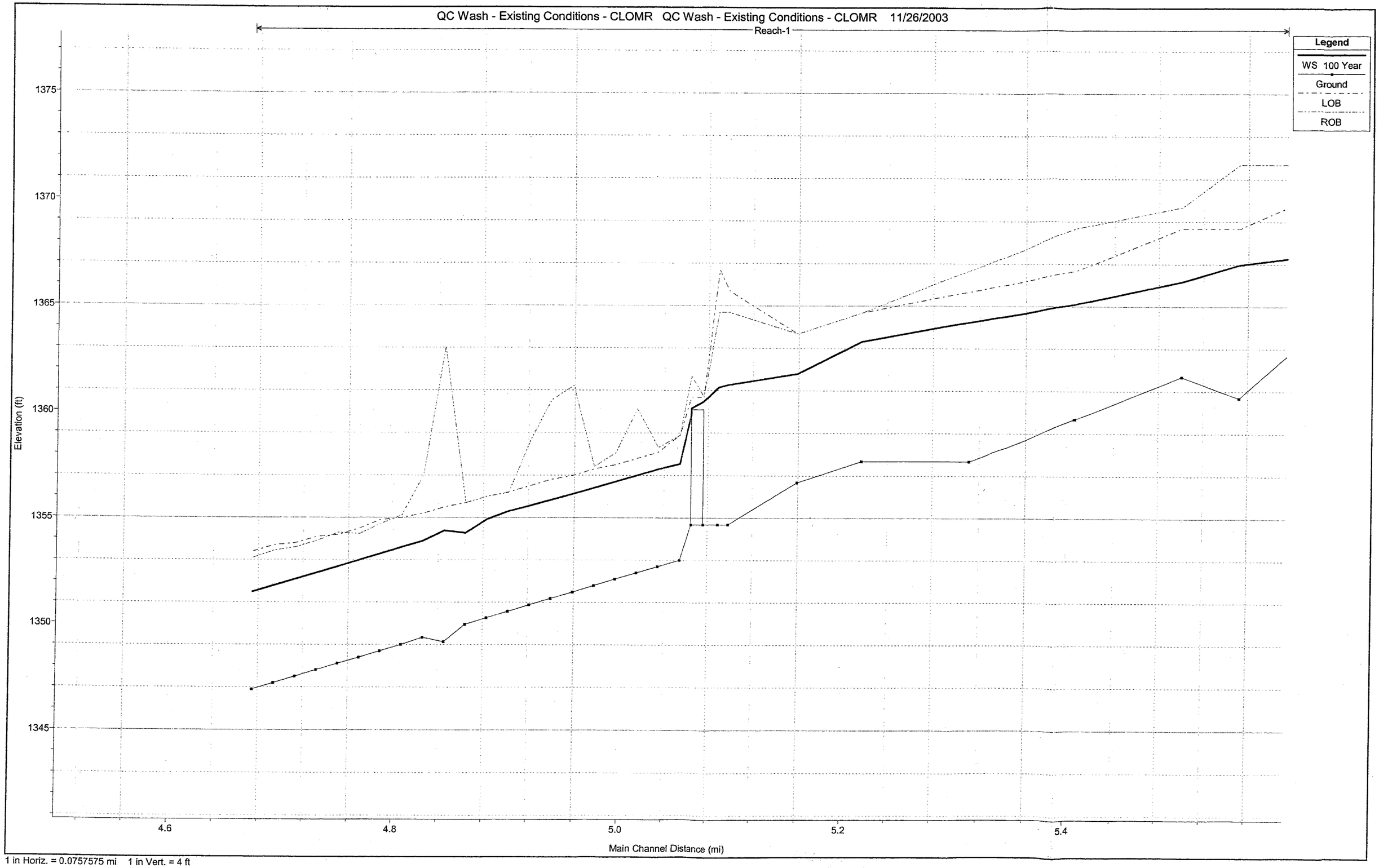
Percent Silt & Clay: 81

Liquid Limit: 26

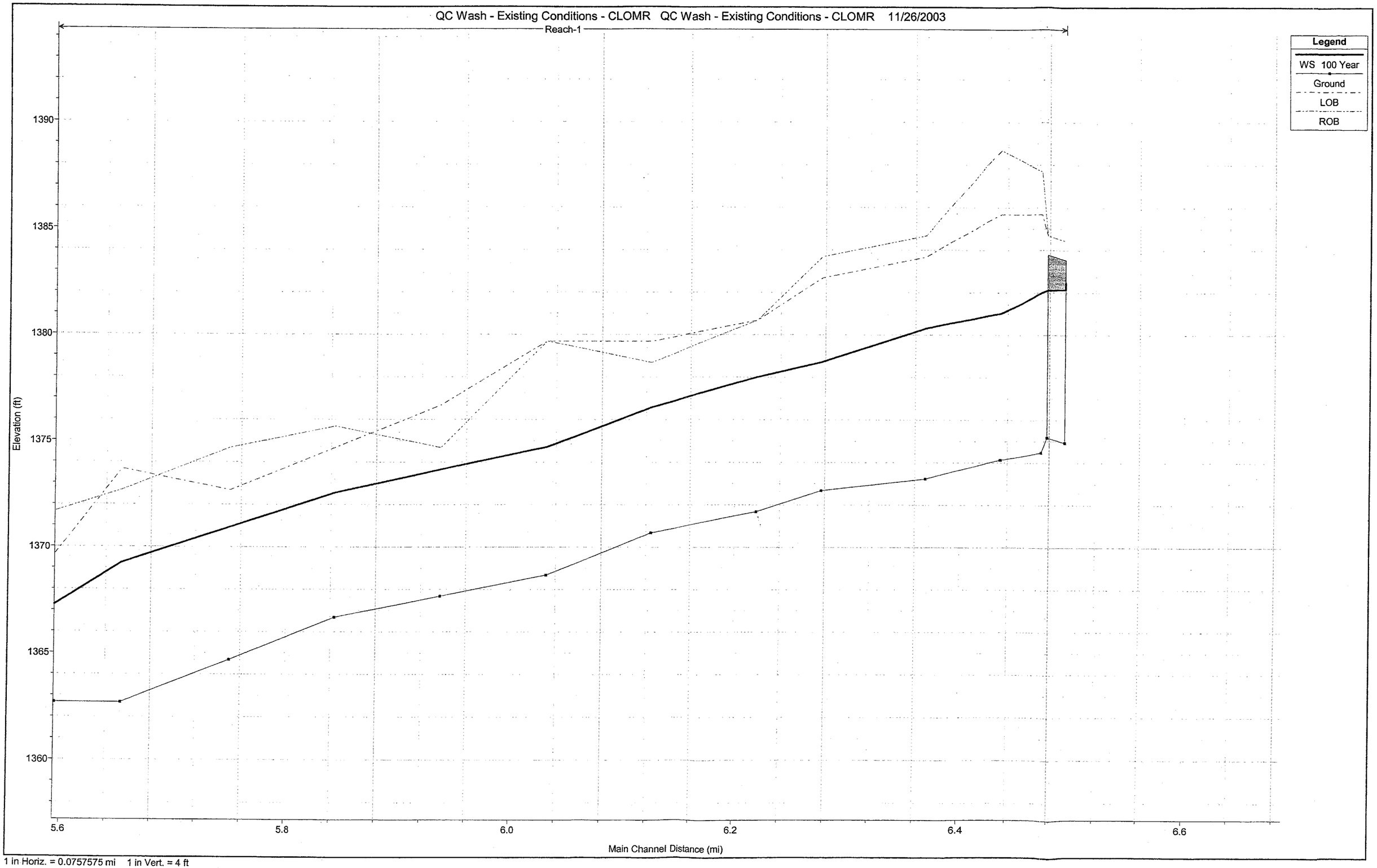
Plastic Limit: 7

APPENDIX G

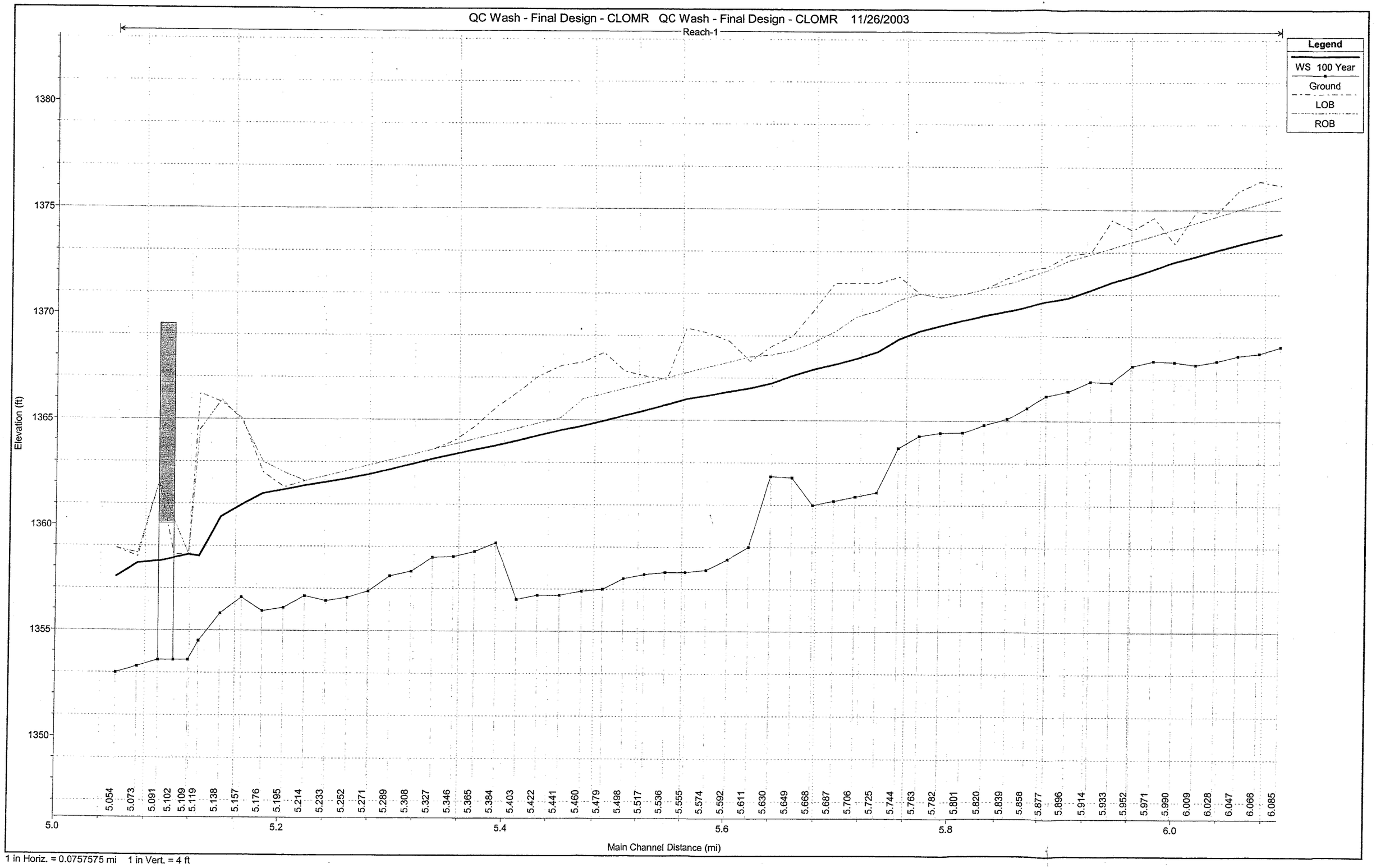
HEC-RAS ANALYSIS SUPPORTING DOCUMENTATION



1 in Horiz. = 0.0757575 mi 1 in Vert. = 4 ft

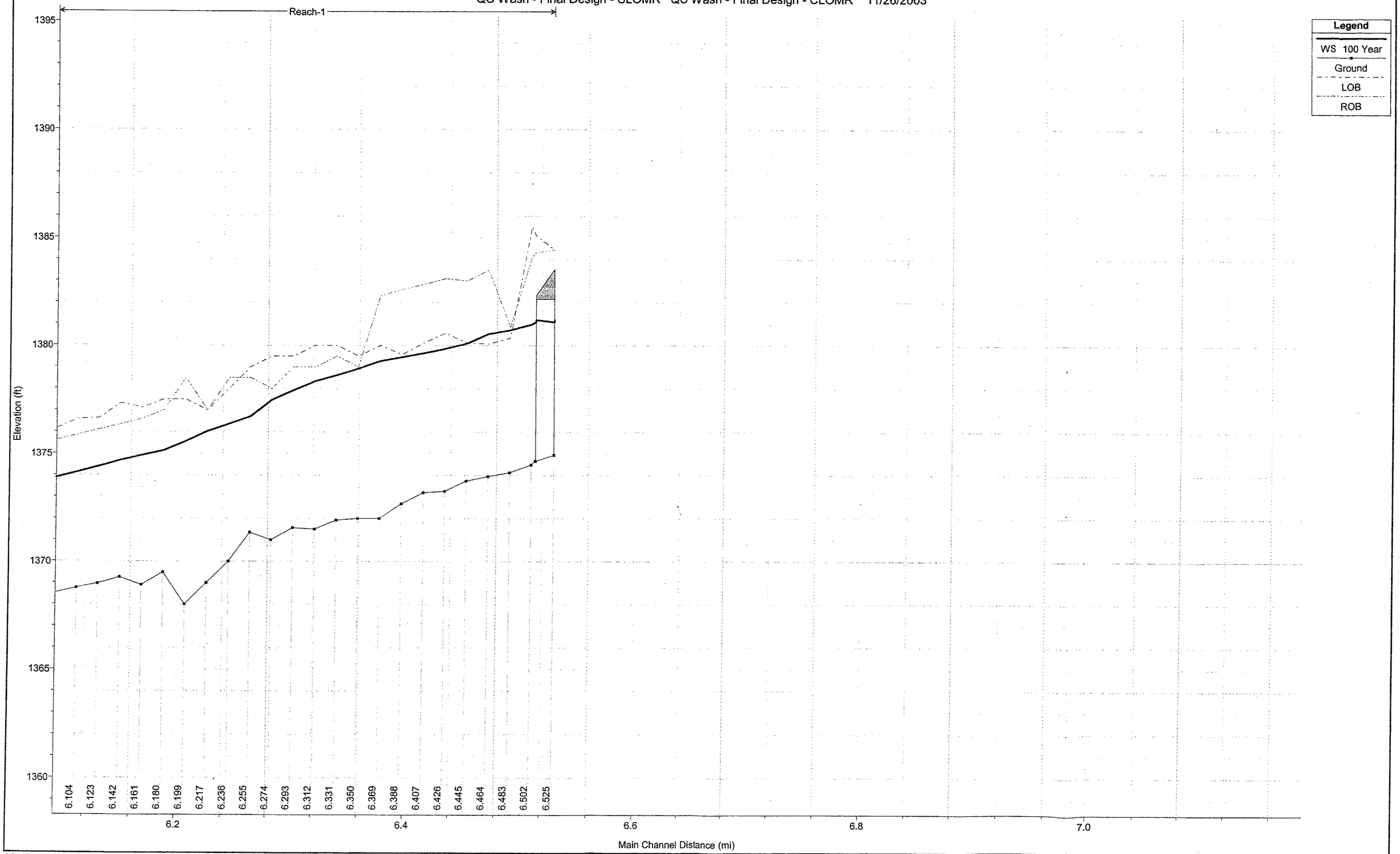


1 in Horiz. = 0.0757575 mi 1 in Vert. = 4 ft



1 in Horiz. = 0.0757575 mi 1 in Vert. = 4 ft

QC Wash - Final Design - CLOMR QC Wash - Final Design - CLOMR 11/26/2003



1 in Horiz. = 0.0757575 mi 1 in Vert. = 4 ft

APPENDIX H

FEMA DOCUMENTS

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☒ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
	See Attached List				

2. Flooding Source: Queen Creek Wash
3. Project Name/Identifier: Plans for the Construction of Queen Creek Wash, Sossaman Road to Hawes Road
4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)
5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☒ Physical Change ☒ Improved Methodology/Data

☐ Regulatory Floodway Revision ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following types of flooding and structures (check all that apply)

Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)

☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

Structures: ☒ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included?	☐ Yes Fee amount: $_____
	☒ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/mit/tsd/frm_fees.htm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Dick Schaner	Company: Town of Queen Creek	
Mailing Address: 22350 S. Ellsworth Road	Daytime Telephone No.: (480) 987-9887	Fax No.: (480) 987-0109
Queen Creek, AZ	E-Mail Address: dschaner@queencreek.org	
Signature of Requester (required):		Date:

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title:		Telephone No.:
Community Name:	Community Official's Signature (required):	Date:

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Brian Fry, P.E.	License No.: 21684	Expiration Date: 12/31/2005
Company Name: Dibble & Associates	Telephone No.: (602) 957 1155	Fax No.: (602) 957 2838
Signature: Brian J. Fry		Date: 1/21/04

NOTE: The above certification is for elevations resulting from hydrologic and hydraulic analysis only.
See Appendix C for survey elevation certification.

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

To Be Attached to MT-2 FORM 1 for Queen Creek Wash, Sossaman Road to Hawes Road

In response to Item B, Question 1. The NFIP map panels affected for all impacted communities are:

Community Number	Community Name	State	Map No.	Panel No.	Effective Date
040132 040037	Town of Queen Creek Maricopa County, unincorporated	AZ	04013C	2695G	07/19/01
040132 040037	Town of Queen Creek Maricopa County, unincorporated	AZ	04013C	3060G	07/19/01

In response to Item C, Reason Review Fee:

This project is exempt from fees because:

1. The topographic mapping in this vicinity is revised to correct previous elevation datum errors.
2. The detailed hydrologic and hydraulic study was conducted by a local agency to replace an approximate study conducted by FEMA and shown on the effective Flood Insurance Rate Map.
3. Queen Creek Wash will be channelized, improving upon the floodplain shown on the flood map and the effective FIRM will no longer be applicable.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Queen Creek Wash
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☒ Not revised (skip to section 2) ☐ No existing analysis ☐ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
Existing Zone A Discharge	*Not Available for*	*Comparison*	

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☒ Yes ☐ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	RM 5.064, D/S of Sossaman Rd	RM 5.054	1357.41-See Attach.	1357.54
Upstream Limit	RM 6.532, U/S of Hawes Rd	RM 6.532	1381.41-See Attach.	1381.18

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/mit/tsd/frm_soft.htm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☒ Yes ☐ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name: QC_Exist.prj	Floodway File Name: No Floodway
Revised or Post-Project Conditions Model	Natural File Name: QC_Soss_Hawes.prj	Floodway File Name: No Floodway
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: *http://www.fema.gov/mit/tsd/en_modl.htm.*

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☐ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☐ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

To Be Attached to MT-2 FORM 2 for Queen Creek Wash, Sossaman Road to Hawes Road

In response to Item B, Question 1. Explanation of Downstream and Upstream Limit Effective Water Surface Elevation:

The *downstream* tie-in effective model exists on a different datum than that of the proposed model. The proposed study is on NAVD88 datum. The downstream tie-in effective model (Queen Creek Wash CLOMR, Power Road to Sossaman Road, performed by Coe & Van Loo Consultants, Inc) is on Town of Queen Creek datum. A datum shift of -2.00', applied to Coe & Van Loo CLOMR results, is necessary to resolve the discrepancy; therefore, the effective water surface elevation at the downstream tie-in point (RM 5.054, Coe & Van Loo Sta 6100), once a datum shift has been performed, is 1359.41' - 2.00' = 1357.41'. This is within 0.5' of the proposed model water surface elevation equal to 1357.54'.

The *upstream* tie-in effective model exists on a different datum than that of the proposed model. The proposed study is on NAVD88 datum. The upstream tie-in effective model (Queen Creek LOMR (Hawes to SPRR) FCDMC 95-43, FEMA Case No. 97-09-1116P, performed by Collins/Pina Consulting Engineers, Inc.) was based on erroneous mapping, described in detail in **Section 3.2** and **Appendix C**. A datum shift of 2.683' is necessary to resolve the discrepancy for this section of mapping; therefore, the effective water surface elevation at the upstream tie-in point (RM 6.532, FCDMC 95-43 Station 1000.4), once a datum shift has been performed, is 1378.98' + 2.427' = 1381.41'. This is within 0.5' of the proposed model water surface elevation equal to 1381.18'.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Queen Creek Wash
Note: Fill out one form for each flooding source studied

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization .....complete Section B
Bridge/Culvert .....complete Section C
Dam .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: Queen Creek Wash Channelization from Sossaman Road to Hawes Road**

   Type (check one): ☒ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: From Sosaman Road to Hawes Road

   Downstream Limit/Cross Section: Approx. River Mile 5.082, Channel Construction Station 49+00

   Upstream Limit/Cross Section: Approx. River Mile 6.516, Channel Construction Station 124+00

2. **Name of Structure: Sossaman Road Bridge**

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: Sossaman Road

   Downstream Limit/Cross Section: River Mile 5.082, Channel Construction Station 49+10

   Upstream Limit/Cross Section: River Mile 5.109, Channel Construction Station 50+50

3. **Name of Structure:**

   Type (check one) ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure:

   Downstream Limit/Cross Section:

   Upstream Limit/Cross Section:

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source: Queen Creek Wash

Name of Structure: Queen Creek Wash Channelization from Sossaman Road to Hawes Road

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin
- ☐ Other (Describe):
- ☒ Drop structures
- ☒ Transitions in cross sectional geometry
- ☐ Energy dissipator

2. Drawing Checklist

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Hydraulic Considerations

The channel was designed to carry 2,831 (cfs) and/or the 100-year flood.

The design elevation in the channel is based on (check one):

☒ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
☐ Other locations (specify):

4. Sediment Transport Considerations

Was sediment transport considered? ☒ Yes ☐ No If Yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: Queen Creek Wash

Name of Structure: Sossaman Road Bridge

1. This revision reflects (check one):

- ☒ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☒ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☒ Skew Angle
- ☐ Distances Between Cross Sections
- ☒ Erosion Protection
- ☒ Low Chord Elevations – Upstream and Downstream
- ☒ Top of Road Elevations – Upstream and Downstream
- ☐ *Structure Invert Elevations – Upstream and Downstream*
- ☒ Stream Invert Elevations – Upstream and Downstream
- ☐ Cross-Section Locations

4. Sediment Transport Considerations

Was sediment transport considered? ☒ Yes ☐ No If yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

D. DAM

Flooding Source:

Name of Structure:

1. This request is for (check one): ☐ Existing dam ☐ New dam ☐ Modification of existing dam

2. The dam was designed by (check one): ☐ Federal agency ☐ State agency ☐ Local government agency

   ☐ *Private organization Name of the agency or organization:*

3. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

4. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If yes, then fill out Section F (Sediment Transport).
   If No, then attach your explanation for why debris/sediment analysis was not considered.

5. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

6. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

☐ upgrading of an existing levee/floodwall system
☐ a newly constructed levee/floodwall system
☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc.	Station	to
☐ structural floodwall	Station	to
☐ Other (describe):	Station	to

c. Structural Type (check one):

☐ monolithic cast-in place reinforced concrete
☐ reinforced concrete masonry block
☐ sheet piling
☐ Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency?

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout	☐ Yes	☐ No
3.5 feet or more at the upstream end	☐ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☐ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

2. Freeboard (continued)

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one): ☐ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope landside is:

b. The maximum levee slope floodside is:

c. The range of velocities along the levee during the base flood is: (min.) to (max.)

d. Embankment material is protected by (describe what kind):

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach		Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
						D_{100}	D_{50}	Thickness	
Sta	to								
Sta	to								
Sta	to								
Sta	to								
Sta	to								
Sta	to								

(Extend table on an added sheet as needed and reference each entry)

4. Embankment Protection (continued)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:

☐ Overall height: Sta. ; height ft.

☐ Limiting foundation soil strength:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

c. Summary of stability analysis results:

Case	*Loading Conditions*	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed? ☐ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Stability analysis submitted provides for:

☐ Overturning ☐ Sliding If not, explain:

c. Loading included in the analyses were:

☐ Lateral earth @ P_A = psf; P_p = psf

☐ Surcharge-Slope @ , ☐ surface psf

☐ Wind @ P_w = psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g

☐ 1%-annual-chance significant wave height: ft.

☐ 1%-annual-chance significant wave period: sec.

d. Summary of Stability Analysis Results: Factors of Safety.

Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No

b. The computed range of settlement is ft. to ft.

c. Settlement of the levee crest is determined to be primarily from :

☐ Foundation consolidation
☐ Embankment compression
☐ Other (Describe):

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: acres
Draining to ponding area: acres

b. Relationships Established

Ponding elevation vs. storage	☐ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☐ No
Differential head vs. gravity flow	☐ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☐ No
• Common storm (River Watershed)	☐ Yes	☐ No
• Historical ponding probability	☐ Yes	☐ No
• Coastal wave overtopping	☐ Yes	☐ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No

If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is cfs

h. The length of levee system used to drive this seepage rate in item g: ft.

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants:
For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem
Hydrocompaction ☐ is ☐ is not a problem
Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No

Attach supporting documentation

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☐ No If Yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

    b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations? ☐ Yes ☐ No

    c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations? ☐ Yes ☐ No

    If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
    If No, please attach supporting documentation.

12. Operations and Maintenance Plan

    Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

F. SEDIMENT TRANSPORT

Flooding Source: Queen Creek Wash

Name of Structure: Queen Creek Wash Channelization from Sossaman Road to Hawes Road

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume 46.6 acre-feet

Debris load associated with the base flood discharge: Volume 0.0 acre-feet

Sediment transport rate 0.65 (percent concentration by volume)

Method used to estimate sediment transport: Yang Equation / HEC-6T

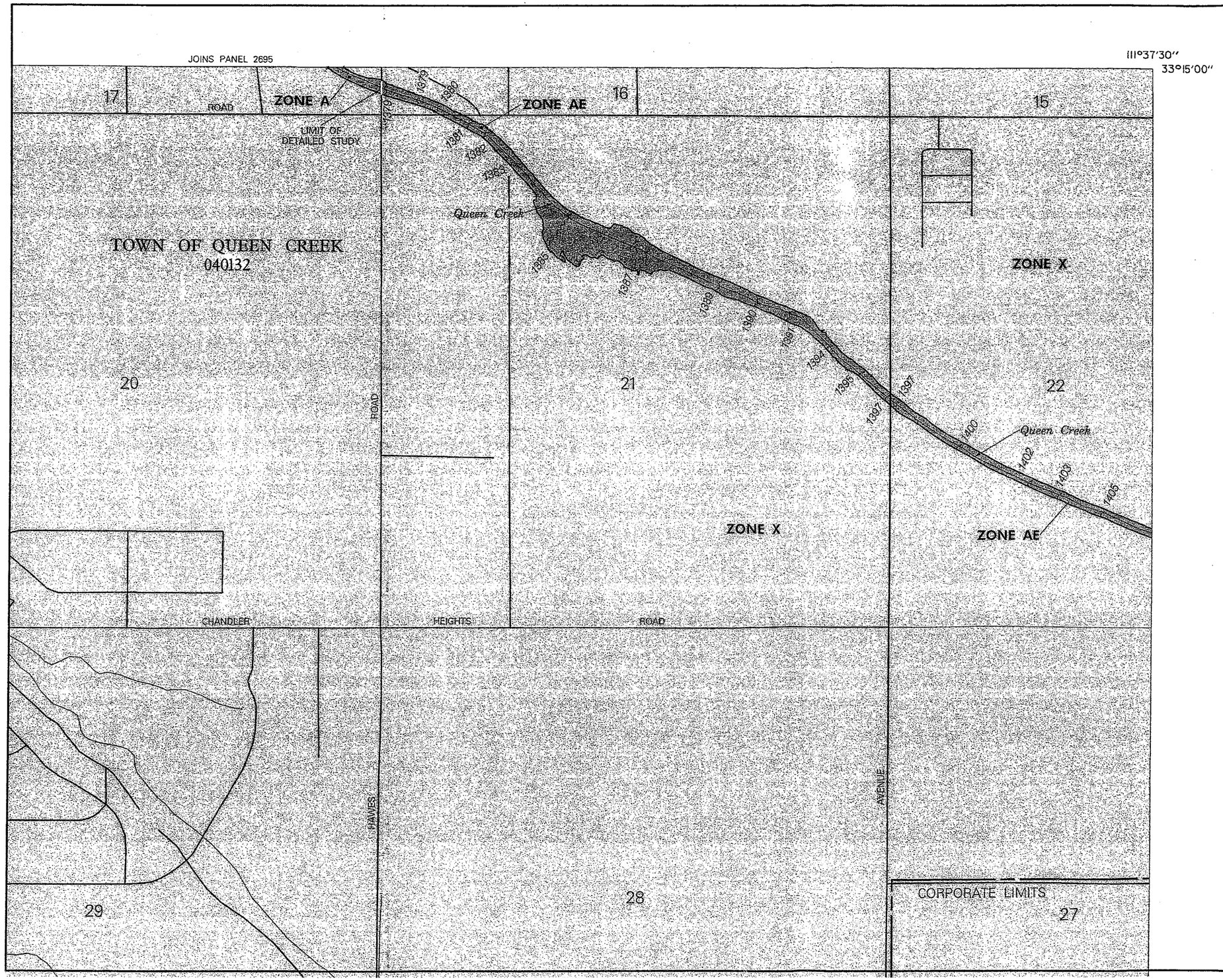
Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: HEC-6T Sediment Transport Model

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

HEC-6T and HEC-RAS. Significant bed changes were not observed in the models.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 3060 OF 4350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

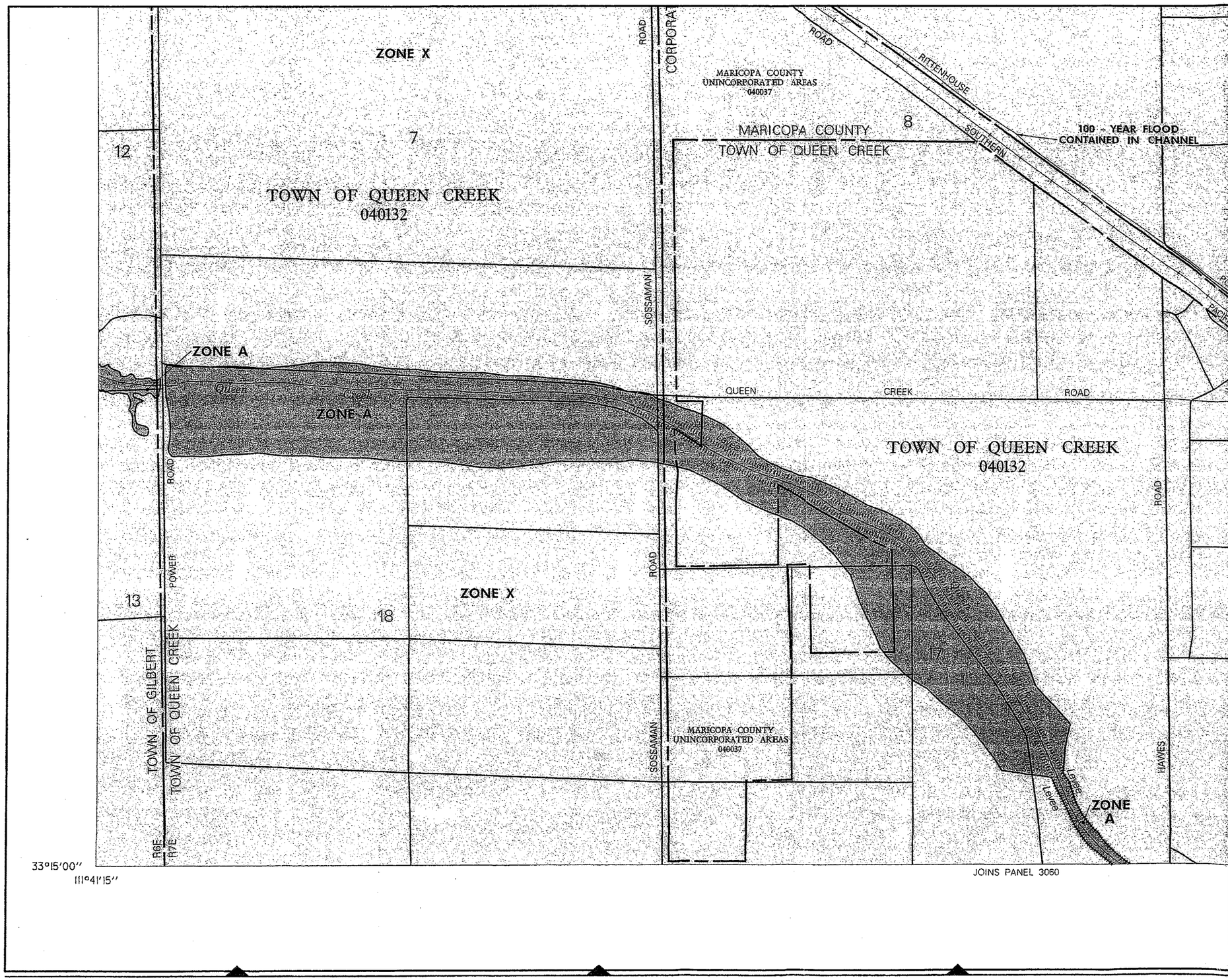
COMMUNITY	NUMBER	PANEL	SUFFIX
GILBERT, TOWN OF	040044	3060	G
QUEEN CREEK, TOWN OF	040132	3060	G
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	3060	G

MAP NUMBER
04013C3060 G

MAP REVISED:
JULY 19, 2001

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2695 OF 4350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
GILBERT, TOWN OF	040044	2695	G
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	2695	G
MESA, CITY OF	040048	2695	G
QUEEN CREEK, TOWN OF	040132	2695	G

MAP NUMBER
04013C2695 G

MAP REVISED:
JULY 19, 2001

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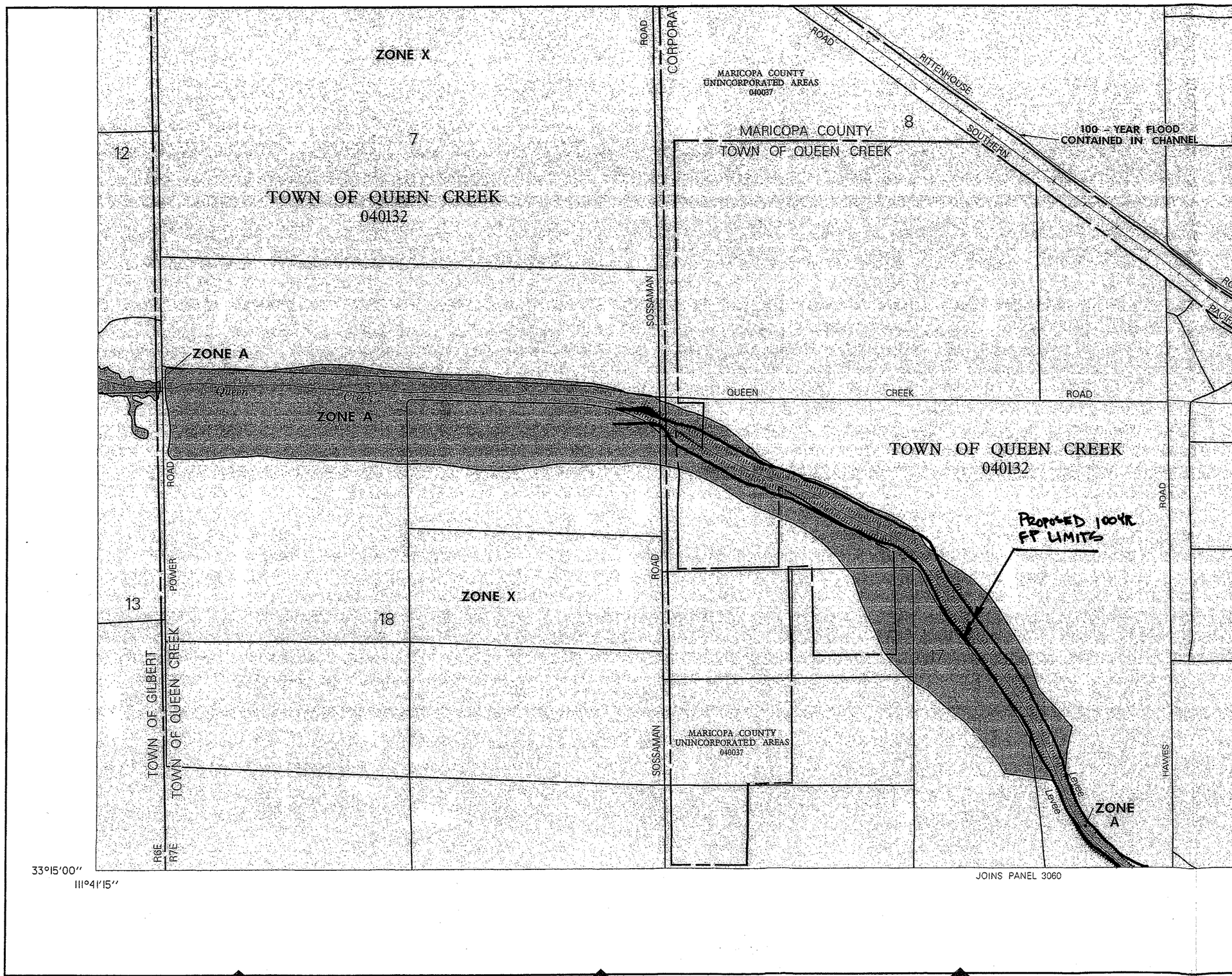

APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2695 OF 4350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

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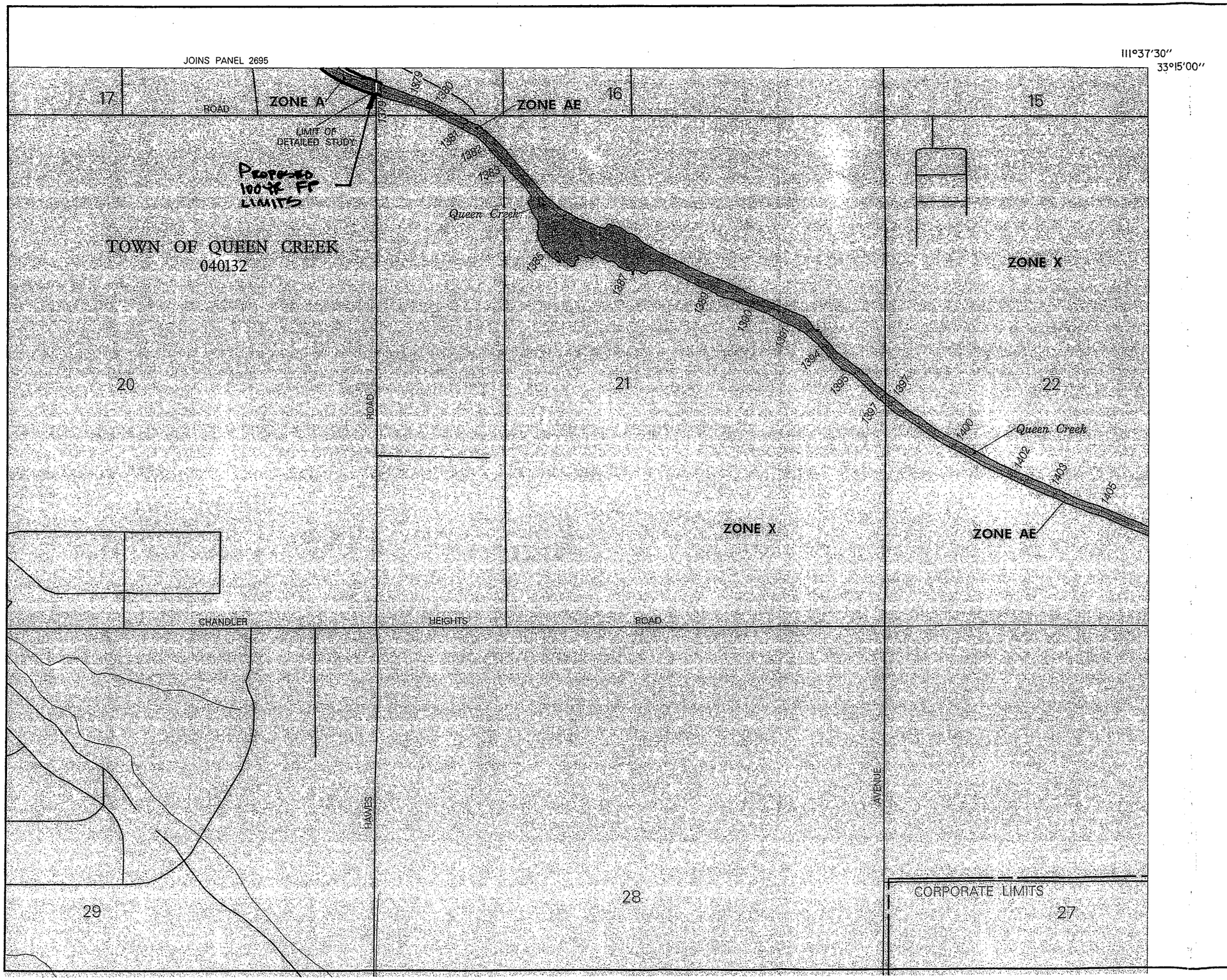

APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 3060 OF 4350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
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MAP NUMBER 04013C3060 G

MAP REVISED: JULY 19, 2001

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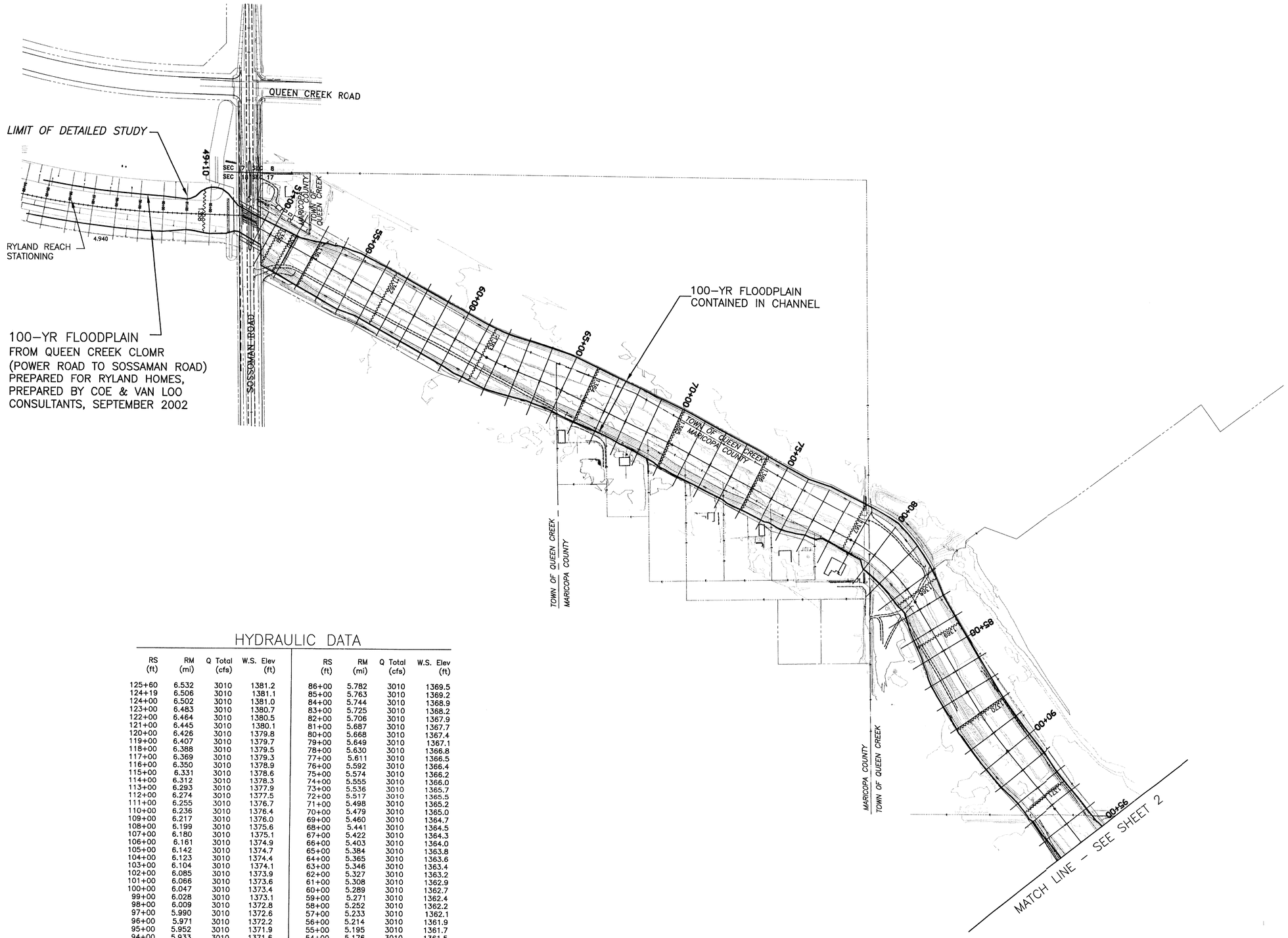
THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2'CONTOUR INTERVALS.

FCDMC AERIAL PHOTOGRAPHY – EMF TO HAWES ROAD:
KENNEY AERIAL MAPPING COMPANY
1"=200', 2 FT. CONTOUR INTERVAL, 1998 (FLIGHT DATE)

GROUND CONTROL SURVEY DATA
Z&H ENGINEERING, INC.
OCTOBER 2001



HYDRAULIC DATA

RS (ft)	RM (mi)	Q Total (cfs)	W.S. Elev (ft)	RS (ft)	RM (mi)	Q Total (cfs)	W.S. Elev (ft)
125+60	6.532	3010	1381.2	86+00	5.782	3010	1369.5
124+19	6.506	3010	1381.1	85+00	5.763	3010	1369.2
124+00	6.502	3010	1381.0	84+00	5.744	3010	1368.9
123+00	6.483	3010	1380.7	83+00	5.725	3010	1368.2
122+00	6.464	3010	1380.5	82+00	5.706	3010	1367.9
121+00	6.445	3010	1380.1	81+00	5.687	3010	1367.7
120+00	6.426	3010	1379.8	80+00	5.668	3010	1367.4
119+00	6.407	3010	1379.7	79+00	5.649	3010	1367.1
118+00	6.388	3010	1379.5	78+00	5.630	3010	1366.8
117+00	6.369	3010	1379.3	77+00	5.611	3010	1366.5
116+00	6.350	3010	1378.9	76+00	5.592	3010	1366.4
115+00	6.331	3010	1378.6	75+00	5.574	3010	1366.2
114+00	6.312	3010	1378.3	74+00	5.555	3010	1366.0
113+00	6.293	3010	1377.9	73+00	5.536	3010	1365.7
112+00	6.274	3010	1377.5	72+00	5.517	3010	1365.5
111+00	6.255	3010	1376.7	71+00	5.498	3010	1365.2
110+00	6.236	3010	1376.4	70+00	5.479	3010	1365.0
109+00	6.217	3010	1376.0	69+00	5.460	3010	1364.7
108+00	6.199	3010	1375.6	68+00	5.441	3010	1364.5
107+00	6.180	3010	1375.1	67+00	5.422	3010	1364.3
106+00	6.161	3010	1374.9	66+00	5.403	3010	1364.0
105+00	6.142	3010	1374.7	65+00	5.384	3010	1363.8
104+00	6.123	3010	1374.4	64+00	5.365	3010	1363.6
103+00	6.104	3010	1374.1	63+00	5.346	3010	1363.4
102+00	6.085	3010	1373.9	62+00	5.327	3010	1363.2
101+00	6.066	3010	1373.6	61+00	5.308	3010	1362.9
100+00	6.047	3010	1373.4	60+00	5.289	3010	1362.7
99+00	6.028	3010	1373.1	59+00	5.271	3010	1362.4
98+00	6.009	3010	1372.8	58+00	5.252	3010	1362.2
97+00	5.990	3010	1372.6	57+00	5.233	3010	1362.1
96+00	5.971	3010	1372.2	56+00	5.214	3010	1361.9
95+00	5.952	3010	1371.9	55+00	5.195	3010	1361.7
94+00	5.933	3010	1371.6	54+00	5.176	3010	1361.5
93+00	5.914	3010	1371.2	53+00	5.157	3010	1361.0
92+00	5.896	3010	1370.8	52+00	5.138	3010	1360.4
91+00	5.877	3010	1370.6	51+00	5.119	3010	1358.5
90+00	5.858	3010	1370.4	50+50	5.109	3010	1358.6
89+00	5.839	3010	1370.2	49+10	5.091	3010	1358.3
88+00	5.820	3010	1370.0	48+10	5.073	3010	1358.2
87+00	5.801	3010	1369.8	47+10	5.054	3010	1357.5

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE — M12.0 M13.0
- EROSION SETBACK (WHEN APPLICABLE)
- CROSS SECTION — 75+00 (CROSS SECTION STATION DESIGNATION)
- ELEVATION REFERENCE MARK — ERM XXX
- BASE FLOOD ELEVATIONS — 1221
- ZONE DESIGNATIONS — ZONE AE
- CORPORATE LIMITS — Corporate Limits
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY — County Boundary

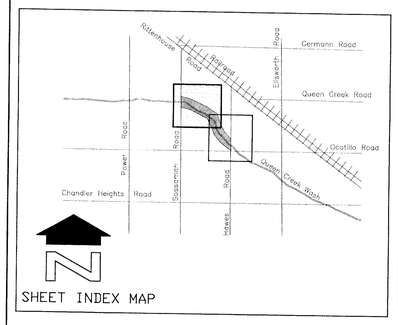
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). CONVERSION FACTOR 1988 NAVD +1.6 FEET = 1929 NGVD

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 1,000 UNLESS NOTED OTHERWISE
2. EAST OF HAWES ROAD: FCDMC CONTRACT NO. 95-43 (TOWN OF GILBERT DATUM) + 2.427 FEET = NAVD 88.
3. WEST OF SOSSAMAN ROAD: RYLAND REACH (TOWN OF QUEEN CREEK DATUM) – 2.0 FEET = NAVD 88

-200' 0' 200' 400'
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

TOWN OF QUEEN CREEK

QUEEN CREEK WASH
CHANNELIZATION CLOMR
SOSSAMAN ROAD TO HAWES ROAD

PROJECT NO. 2000D-03

Registered Professional Engineer (Civil) CERTIFICATE NO. 21664 BRIAN J. FRY Date Signed 11-26-03 ARIZONA, U.S.A.

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1982

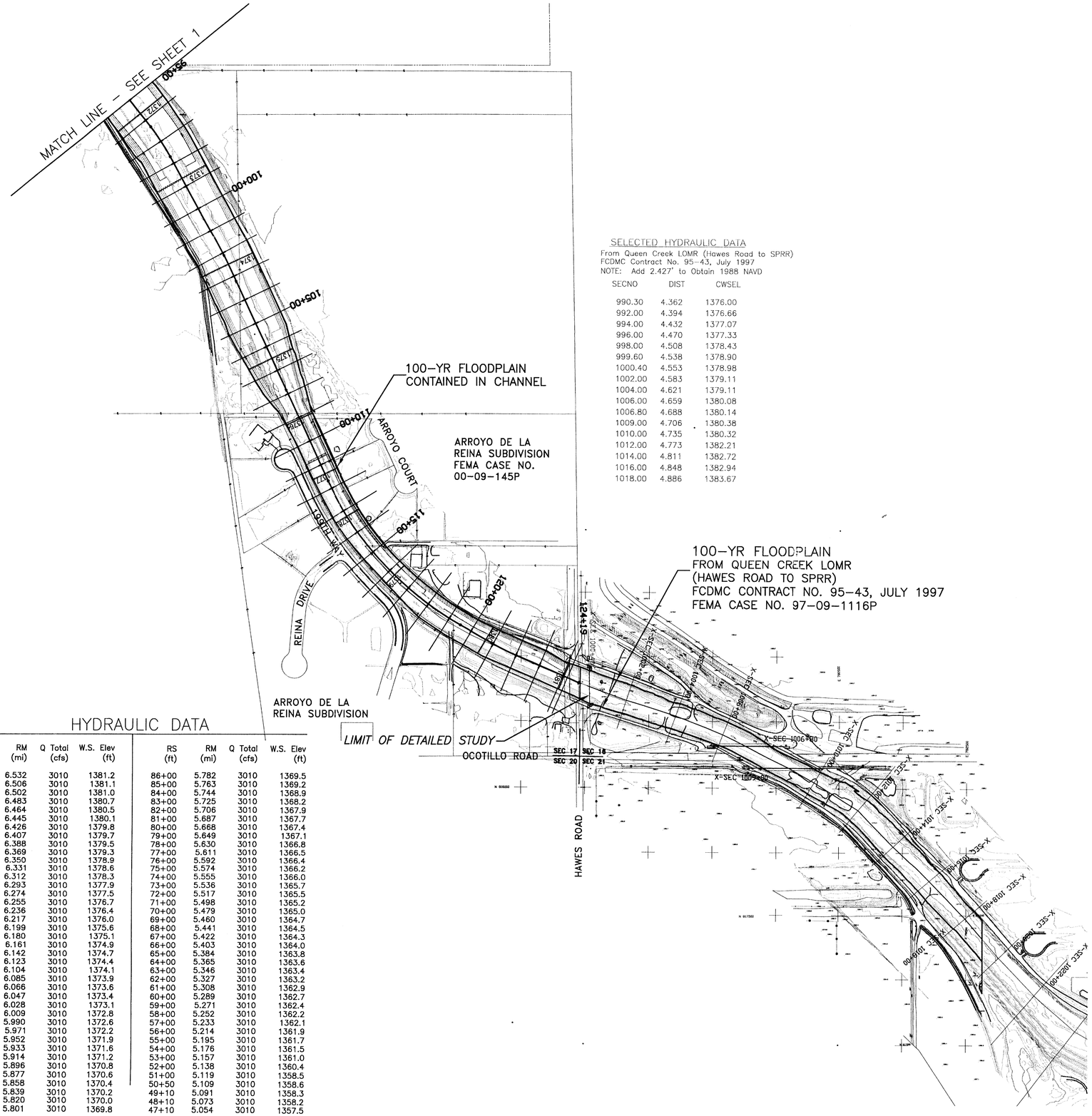
	BY	DATE
DESIGN	JEP	11/26/03
DESIGN CHK.	FEB	11/26/03
PLANS	JEP	11/26/03
PLANS CHK.	FEB	11/26/03

SHEET 1 OF 2

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2'CONTOUR INTERVALS.

FCDMC AERIAL PHOTOGRAPHY – EMF TO HAWES ROAD:
KENNEY AERIAL MAPPING COMPANY
1"=200', 2 FT. CONTOUR INTERVAL, 1998 (FLIGHT DATE)

GROUND CONTROL SURVEY DATA
Z&H ENGINEERING, INC.
OCTOBER 2001



SELECTED HYDRAULIC DATA

From Queen Creek LOMR (Hawes Road to SPRR)
FCDMC Contract No. 95-43, July 1997
NOTE: Add 2.427' to Obtain 1988 NAVD

SECNO	DIST	CWSEL
990.30	4.362	1376.00
992.00	4.394	1376.66
994.00	4.432	1377.07
996.00	4.470	1377.33
998.00	4.508	1378.43
999.60	4.538	1378.90
1000.40	4.553	1378.98
1002.00	4.583	1379.11
1004.00	4.621	1379.11
1006.00	4.659	1380.08
1006.80	4.688	1380.14
1009.00	4.706	1380.38
1010.00	4.735	1380.32
1012.00	4.773	1382.21
1014.00	4.811	1382.72
1016.00	4.848	1382.94
1018.00	4.886	1383.67

HYDRAULIC DATA

RS (ft)	RM (mi)	Q Total (cfs)	W.S. Elev (ft)	RS (ft)	RM (mi)	Q Total (cfs)	W.S. Elev (ft)
125+60	6.532	3010	1381.2	86+00	5.782	3010	1369.5
124+19	6.506	3010	1381.1	85+00	5.763	3010	1369.2
124+00	6.502	3010	1381.0	84+00	5.744	3010	1368.9
123+00	6.483	3010	1380.7	83+00	5.725	3010	1368.2
122+00	6.464	3010	1380.5	82+00	5.706	3010	1367.9
121+00	6.445	3010	1380.1	81+00	5.687	3010	1367.7
120+00	6.426	3010	1379.8	80+00	5.668	3010	1367.4
119+00	6.407	3010	1379.7	79+00	5.649	3010	1367.1
118+00	6.388	3010	1379.5	78+00	5.630	3010	1366.8
117+00	6.369	3010	1379.3	77+00	5.611	3010	1366.5
116+00	6.350	3010	1378.9	76+00	5.592	3010	1366.4
115+00	6.331	3010	1378.6	75+00	5.574	3010	1366.2
114+00	6.312	3010	1378.3	74+00	5.555	3010	1366.0
113+00	6.293	3010	1377.9	73+00	5.536	3010	1365.7
112+00	6.274	3010	1377.5	72+00	5.517	3010	1365.5
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LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	75+00 (CROSS SECTION STATION DESIGNATION)
ELEVATION REFERENCE MARK	ERM XXX
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

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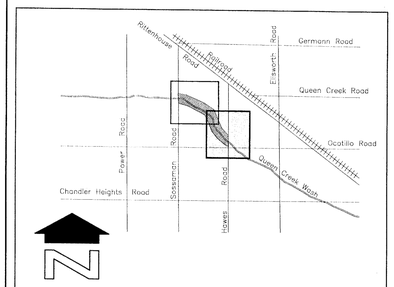

SHEET INDEX MAP

NO.	REVISION	BY	DATE

TOWN OF QUEEN CREEK

QUEEN CREEK WASH CHANNELIZATION CLOMR SOSSAMAN ROAD TO HAWES ROAD

PROJECT NO. 2000D-03

Registered Professional Engineer (Civil) CERTIFICATE NO. 21664 BRIAN J. FRY Date Signed 11-26-03 ARIZONA, U.S.A.

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

	BY	DATE
DESIGN	JEP	11/26/03
DESIGN CHK.	FEB	11/26/03
PLANS	JEP	11/26/03
PLANS CHK.	FEB	11/26/03

SHEET 2 OF 2