TECHNICAL DATA NOTEBOOK

Gila River Floodplain Redelineation Study

Maricopa County

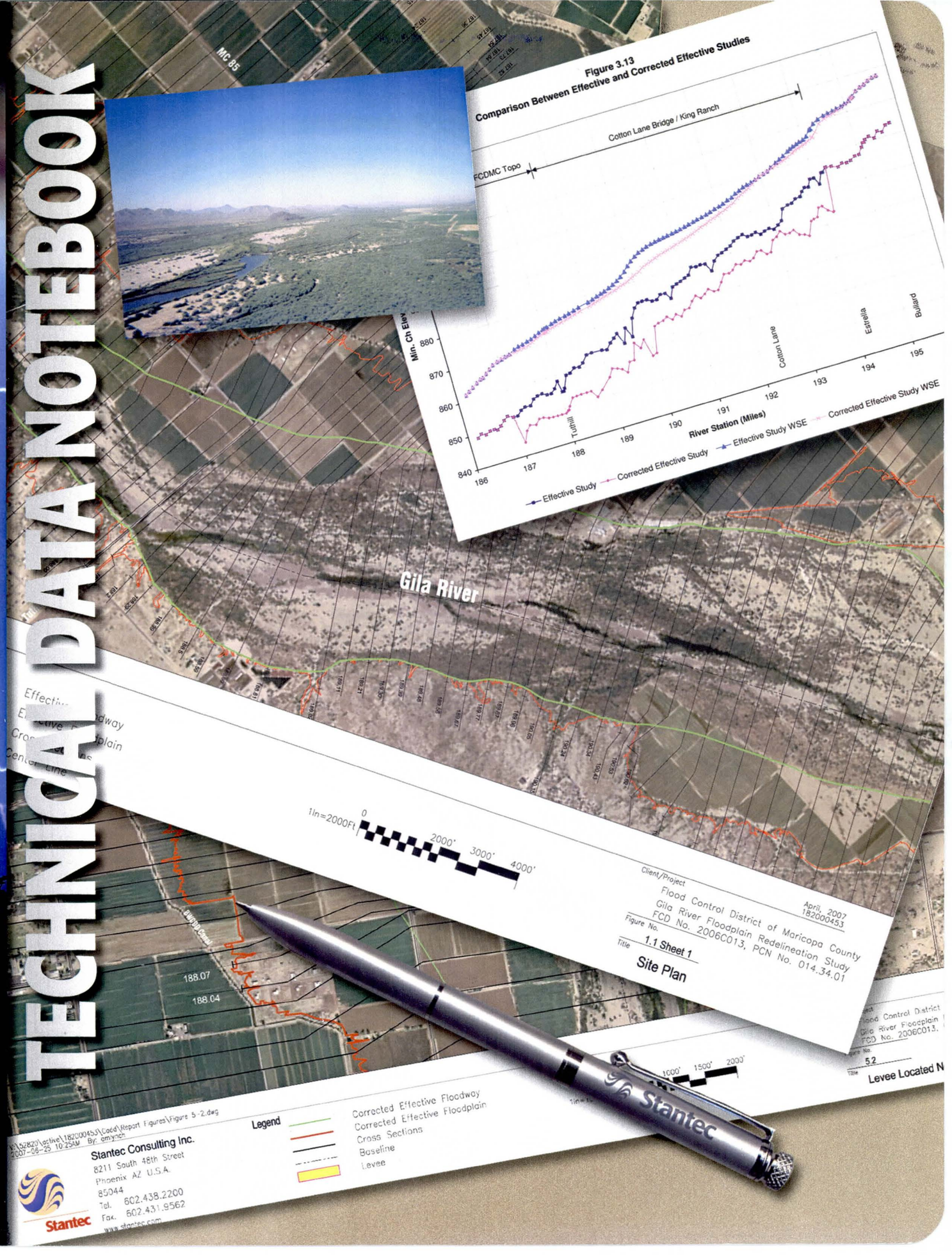
Prepared for the
Flood Control District of Maricopa County
by
Stantec Consulting

March 2008

STC Project No. 182000510

Contract FCD 2007C017

Stantec



Gila River Floodplain Redelineation Study
Maricopa County

Technical Data Notebook

PREPARED FOR:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, AZ 85009
(602) 506-1500
John Hathaway

PREPARED BY:

STANTEC CONSULTING INC.
8211 South 48th Street
Phoenix, Arizona 85044
(602) 438-2200

Registered Professional Engineer (Civil)
CERTIFICATE NO. 33989
STEPHANIE R. GERLACH
Date Signed 3/17/08
ARIZONA U.S.A.
Exp 09/30/2008

Registered Professional Engineer (Civil)
CERTIFICATE NO. 31680
PATRICK J. ELLISON
Date Signed 3/17/2008
ARIZONA U.S.A.
Expires 9/30/2008

March 2008

STANTEC CONSULTING Inc.
Project No.18200510

Contract FCD 2007C017

Flood Control District of Maricopa County

Stantec

Table of Contents

1.0 INTRODUCTION 1
1.1 PURPOSE 1
1.2 LOCATION 1
1.3 ANALYSIS METHODOLOGY 1
1.4 ORGANIZATION OF REPORT 2
1.5 AUTHORITY FOR STUDY 2
1.6 CORRESPONDENCE 2
2.0 ADWR/FEMA FORMS 5
2.1 STUDY DOCUMENTATION ABSTRACT FOR FEMA SUBMITTALS 5
2.2 FEMA FORMS 6
3.0 MAPPING AND SURVEY INFORMATION 13
3.1 FIELD SURVEY INFORMATION 13
3.2 MAPPING 27
3.2.1 Salt-Gila River Floodplain Delineation Restudy 27
3.2.2 Norte Vista / King Ranch Floodplain Redelineation 27
3.2.3 FCDMC Topography 27
3.2.4 Comparison of Topographic Mapping 28
4.0 HYDROLOGY 30
5.0 HYDRAULICS 31
5.1 METHOD DESCRIPTION 31
5.2 WORK STUDY MAPS 31
5.3 PARAMETER ESTIMATION 31
5.3.1 Roughness Coefficients 31
5.3.2 Expansion and Contraction Coefficients 36
5.4 CROSS SECTION DESCRIPTION 36
5.5 MODELING CONSIDERATIONS 37
5.5.1 Hydraulic Jump and Drop Analysis 37
5.5.2 Bridges and Culverts 37
5.5.3 Levees and Dikes 37
5.5.4 Islands and Flow Splits 38
5.5.5 Ineffective Flow Areas 38
5.5.6 Supercritical Flow 38
5.6 FLOODWAY MODELING 38
5.7 PROBLEMS ENCOUNTERED DURING THE STUDY 42
5.7.1 Tie-In to Existing Floodplain Delineations 42
5.7.2 Effects of New Topography 42
5.7.3 HEC-RAS Warning and Error Messages 42
5.7.4 CHECKRAS Warning Messages 42
5.8 CALIBRATION 43
5.9 FINAL RESULTS 43
5.9.1 Verification of Results 43
6.0 EROSION AND SEDIMENT TRANSPORT 56
7.0 DRAFT FIS REPORT DATA 57
7.1 SUMMARY OF DISCHARGES 57

Table of Contents Continued

7.2 FLOODWAY DATA 13
7.3 ANNOTATED FLOOD INSURANCE RATE MAPS 13
7.4 FLOOD PROFILES 13

List of Tables

Table 3.1: Datum Adjustment
Table 5.1: FIS Range of Hydraulic Roughness Coefficients
Table 5.2: Revised Range of Hydraulic Roughness Coefficients
Table 5.3: Comparison of Manning's n-values
Table 5.4: Summary of Bridges
Table 5.5: Comparison at Tie-in Locations
Table 5.6: Summary of HEC-RAS Model Results for Corrected Effective Model – Without Levee
Table 5.7: Summary of HEC-RAS Model Results for Corrected Effective Model – With Levee
Table 5.8: Summary of Results for the Floodway Profile
Table 5.9: Summary of HEC-RAS Model Results for Bridges
Table 7.1: Floodway Data Table

List of Figures

Figure 1.1: Site Plan
Figure 3.1: Field Survey Location
Figure 3.2: Survey Data Compared to HEC-RAS Models – XS 187.24
Figure 3.3: Survey Data Compared to HEC-RAS Models – XS 188.10
Figure 3.4: Survey Data Compared to HEC-RAS Models – XS 189.21
Figure 3.5: Survey Line Between XS 189.21 and 189.30 Extracted Survey Line Data Compared to Survey Data
Figure 3.6: Survey Data Compared to HEC-RAS Models – XS 189.87
Figure 3.7: Survey Data Compared to HEC-RAS Models – XS 190.91
Figure 3.8: Survey Data Compared to HEC-RAS Models – XS 191.67
Figure 3.9: Survey Data Compared to HEC-RAS Models – XS 192.14
Figure 3.10: Survey Data Compared to HEC-RAS Models – XS 192.42
Figure 3.11: Survey Data Compared to HEC-RAS Models – XS 193.34
Figure 3.12: Survey Data Compared to HEC-RAS Models – XS 193.94
Figure 3.13: Comparison Between Effective and Corrected Effective Studies
Figure 5.1: Manning's n-Value Distribution Map
Figure 5.2: Levee Located Near Tuthill Bridge
Figure 5.3: Islands

Table of Contents Continued

Appendices

Appendix A: References
Appendix B: General Documentation & Correspondence
Appendix C: Survey Field Notes
Appendix D: Hydrologic Analysis Supporting Documentation
Appendix E: Hydraulic Analysis Supporting Documentation
Appendix F: Erosion/Sediment Transport Analysis Supporting Documentation
Exhibit Maps
    Work Study Maps

1.0 Introduction

1.1 PURPOSE

This document contains the results and supporting computations for a hydraulic analyses and floodplain delineation conducted for a reach of the Gila River located in Maricopa County, Arizona. The overall study reach, approximately 8.2 miles in length, commences at the Airport Road crossing of the Gila River (approximately cross section 186.97) and extends up stream to the Bullard Avenue crossing of the Gila River (approximately cross section 195.13). For the subject reach the extent of the floodplain and associated base flood elevations were mapped as part of the *Salt-Gila River Floodplain Delineation Restudy* (Effective study), prepared by Michael Baker Jr. (1999). Revised hydraulic models through the subject reach of the Gila River were developed as part of two studies:

- The *El Rio Watercourse Master Plan*, (*ERWMP)* prepared by Stantec (2006) for the Flood Control District of Maricopa County (FCDMC)
- The *Norte Vista / King Ranch Floodplain Redelineation, Gila River* (Norte Vista / King Ranch) prepared by River Research & Design, Inc. for developers Spencer Management, Inc. and SD Construction, L.L.C. (2007)

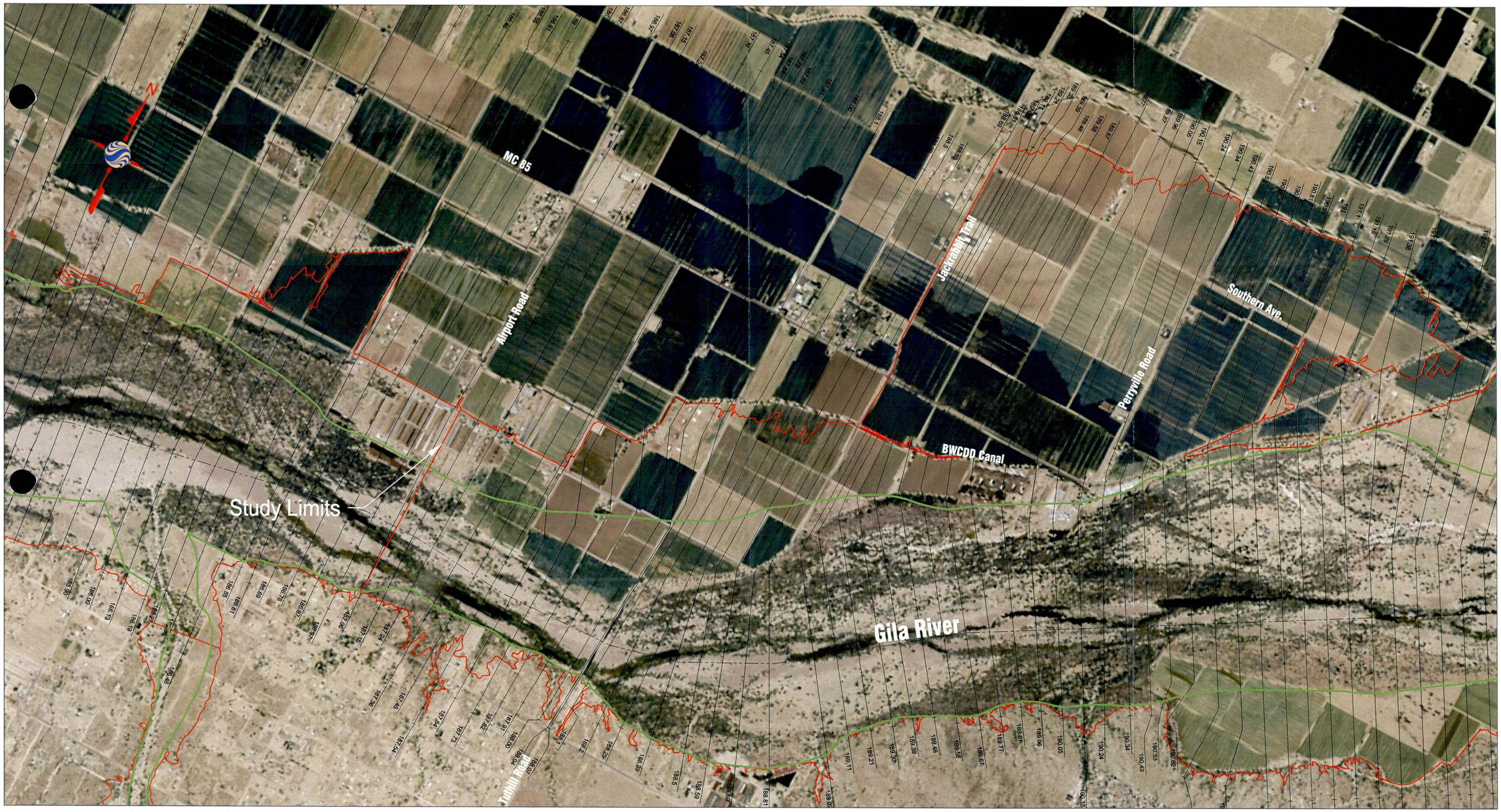
In the preparation of the models developed for the Norte Vista / King Ranch projects it was discovered that there were differences between recent topographic data and the topographic data used to develop the Effective model. Results of hydraulic models developed for the Norte Vista / King Ranch projects and the *ERWMP* (which uses topographic data from the Norte Vista / King Ranch projects) indicate that the water surface elevations in the vicinity of the levee area are lower. The Flood Control District of Maricopa County (FCDMC) obtained new topographic data through and downstream of the levee reach. The new topographic data combined with topographic data from the Norte Vista / King Ranch is used to evaluate the hydraulic conditions of the study reach.

1.2 LOCATION

The overall reach of the Gila River Floodplain Redelineation Study extends from approximately Airport Road (Township 1 South, Range 2 West, Section 7) to the Bullard Avenue Bridge (Township 1 North, Range 1 West, Sections 29 and 32). It includes the communities of Goodyear and Buckeye and unincorporated Maricopa County. Figure 1.1 depicts the Effective floodplain and floodway boundaries, study reach and hydraulic cross sections.

1.3 ANALYSIS METHODOLOGY

The hydraulics of the study is executed using the methodology contained in the Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics (1995). The hydraulic



V:\52820\active\182000510\cadd\Report Figures\Figure 1-1.dwg
2008-03-13 08:44AM By: sgerlach

January, 2008
182000510

ORIGINAL SHEET - ANSI B

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

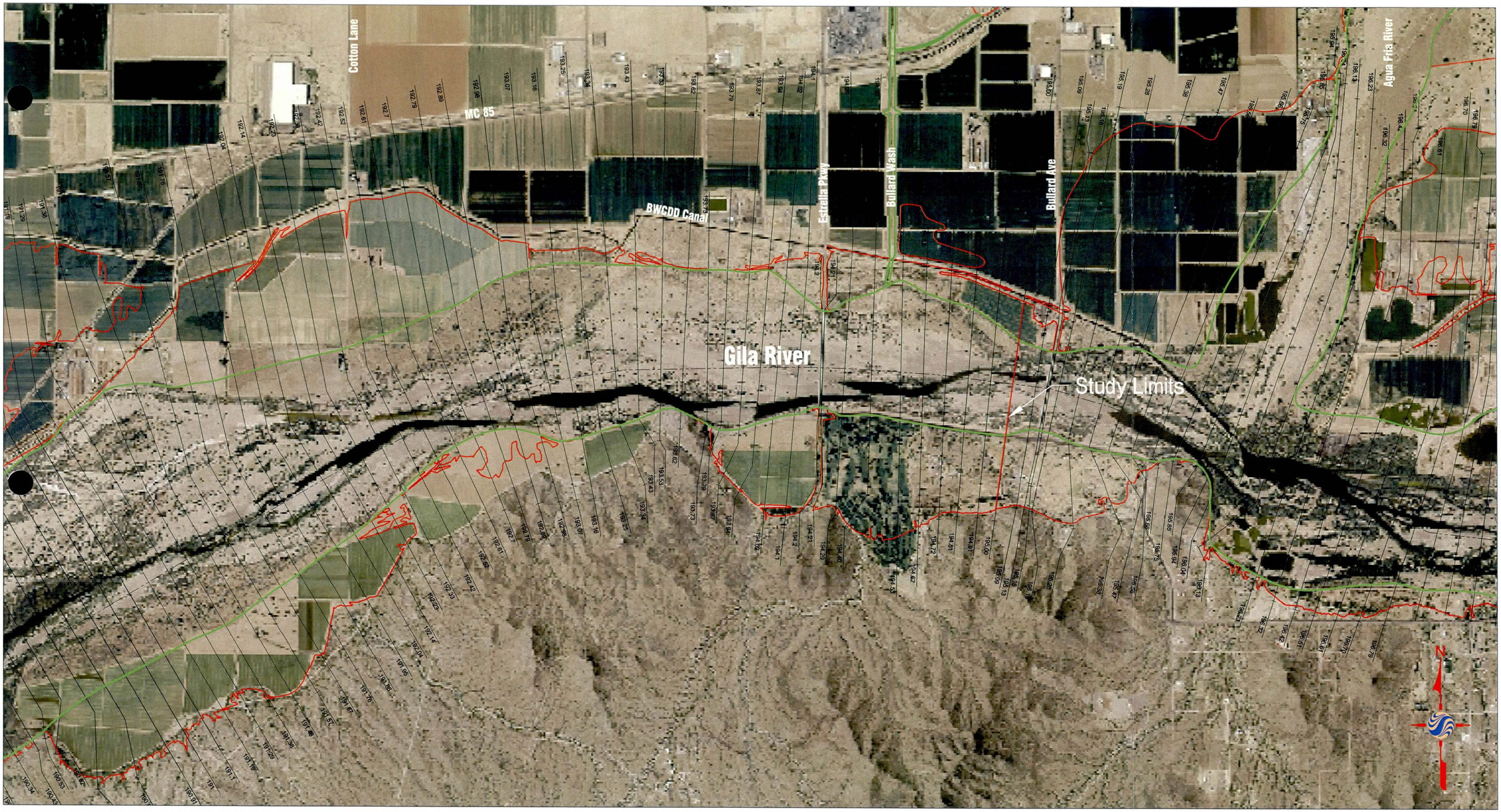
- Effective Floodway
- Effective Floodplain
- Cross Sections
- Center Line

1In=2000Ft 0 2000' 3000' 4000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
1.1 Sheet 1

Title
Site Plan



V:\52820\active\182000510\cadd\Report Figures\Figure 1-1.dwg
2008-03-13 08:45AM By: sgerlach

January, 2008
182000510

ORIGINAL SHEET - ANSI B

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Effective Floodway
- Effective Floodplain
- Cross Sections
- Center Line

1in=2000ft 0 2000' 3000' 4000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
1.1 Sheet 2

Title
Site Plan

modeling is accomplished using the US Army Corps of Engineers (COE) computer program HEC-RAS, version 3.1.3 (COE 2005).

1.4 ORGANIZATION OF REPORT

This report is generally structured in a Technical Data Notebook format in accordance with Arizona Department of Water Resources requirements of State Standard SS1-97 and State Standard Attachment SSA1-97.

1.5 AUTHORITY FOR STUDY

Pursuant to Arizona revised Statues 48-3609.01 the FCDMC is authorized to conduct watercourse master plans for river reaches within Maricopa County. Stantec Consulting Inc. was awarded the contract (FCD 2007C017).

1.6 CORRESPONDENCE

Correspondence that transpired during the course of this study that relates to the analysis documented in this report, such as scope, notice to proceed and review comments, are provided in Appendix B.

2.0 ADWR/FEMA FORMS

2.1 STUDY DOCUMENTATION ABSTRACT FOR FEMA SUBMITTALS

Study Documentation Abstract for FEMA Submittals	Initial Study		Restudy		CLOMR		LOMR	x	Other	

Section 2.1: Study Documentation Abstract for FEMA Submittals		
2.1.1	Date Study Accepted	
2.1.2	Study Contractor Contact(s) Address Phone Internal Reference Number	Stantec Consulting Inc. Pat Ellison, PE 8211 South 48th Street Phoenix, Arizona 85044 (602) 438-2200 FAX: (602) 431-9562 182000510
2.1.3	FEMA Technical Review Contractor Contact(s) Address Phone Internal Reference Number	
2.1.4	FEMA Regional Review Phone	
2.1.5	State Technical Reviewer Phone	
2.1.6	Local Technical Reviewer Phone	Flood Control District of Maricopa County John Hathaway, (602) 506-0503
2.1.7	Reach Description	The study will result in a redelineation of the 100-year floodplain and floodway along the Gila River between Airport Road and Bullard Avenue.
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	Avondale SW Topo dated 7/1/1979, aerial dated 4/18/1979 Perryville Topo dated 7/1/1979, aerial dated 9/6/1992
2.19	Unique Conditions and Problems	All unique conditions and problems are listed in Section 5.7.
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	Not applicable.

2.2 FEMA FORMS

See proceeding pages.

On MT-2 Form 1 page 2, regarding the review fee: the study is exempt because map changes are based on flood hazard information meant to improve upon that shown on the flood map. The study does not include any manmade modifications.

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires: August 31, 2007

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, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). 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 DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-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 DHS-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 480287	City of Katy Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
040046 040039 040037	Goodyear, City of Buckeye, Town of Maricopa County	AZ	04013C2550G 04013C2530G 04013C2510G 04013C2070H 04013C2065H	2550 2550 2510 2070 2065	09/30/2005

2. Flooding Source: Gila River

3. Project Name/Identifier: Gila River Redelineation Study

4. FEMA zone designations affected: AE, (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: $0

☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **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:	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address:	
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: Jeanine Guy, Interim Town Manager		Telephone No.: (623) 349-6000
Community Name: Town of Buckeye	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: Patrick J. Ellison, PE	License No.: State of Arizona - 31680	Expiration Date: 09/30/2009
Company Name: Stantec Consulting Inc.	Telephone No.: (602) 438-2200	Fax No.: (602) 431-9562
Signature:		Date:

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

Registered Professional Engineer (Civil) CERTIFICATE NO. 31680 PATRICK J. ELLISON Date Signed 3/27/2009 ARIZONA U.S.A.

Seal (Optional)

Expires 9/30/2009

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $0

☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **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:	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address:	
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: Timothy S. Phillips, Chief Engineer and General Manager		Telephone No.: (602) 506-1501
Community Name: Maricopa County	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: Patrick J. Ellison, PE	License No.: State of Arizona - 31680	Expiration Date: 09/30/2009
Company Name: Stantec Consulting Inc.	Telephone No.: (602) 438-2200	Fax No.: (602) 431-9562
Signature:		Date:

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

Registered Professional Engineer (Civil) CERTIFICATE NO. 31680 PATRICK J. ELLISON Date Signed 3/17/2008 ARIZONA, U.S.A. Seal (Optional)

Expires 9/30/2009

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $0

☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm **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:	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address:	
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: Keith Brown, PE, Assistant City Engineer		Telephone No.: 623-932-3910
Community Name: City of Goodyear	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: Patrick J. Ellison, PE	License No.: State of Arizona - 31680	Expiration Date: 09/30/2009
Company Name: Stantec Consulting Inc.	Telephone No.: (602) 438-2200	Fax No.: (602) 431-9562
Signature:		Date:

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

Registered Professional Engineer (Civil) CERTIFICATE NO. 31680 PATRICK J. ELLISON Date Signed 3/17/2008 ARIZONA U.S.A. Seal (Optional)

Expires 9/30/2008

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: August 31, 2007

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3.25 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, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). 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: Gila River
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)

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 DHS-FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

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	Airport Road	187.06	869.09	869.25
Upstream Limit	Bullard Avenue	195.00	912.50	912.05

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

DHS-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/fhm/frm_soft.shtm. 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 ☒ Diskette Submitted

	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:R2wlevee & Reach2	Plan Name:Main Run w/ Method 1 Floodway	File Name:same	Plan Name:same	NAD83
Corrected Effective Model*	File Name: gilarvr.prj	Plan Name: Redelineation w/ & w/o levee	File Name: same	Plan Name: same	NAD83
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	_____
Revised or Post-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	_____
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan 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 DHS-FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

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.

☒ Annotated FIRM and/or FBFM Included ☐ Digital Mapping (GIS/CADD) Data Submitted (Recommended)

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 or without 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/CLOMR 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/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

If Yes, please submit documentation from the community to show that they have complied with Sections 9 and 10 of the Endangered Species Act (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10 of the ESA.

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA.

5. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

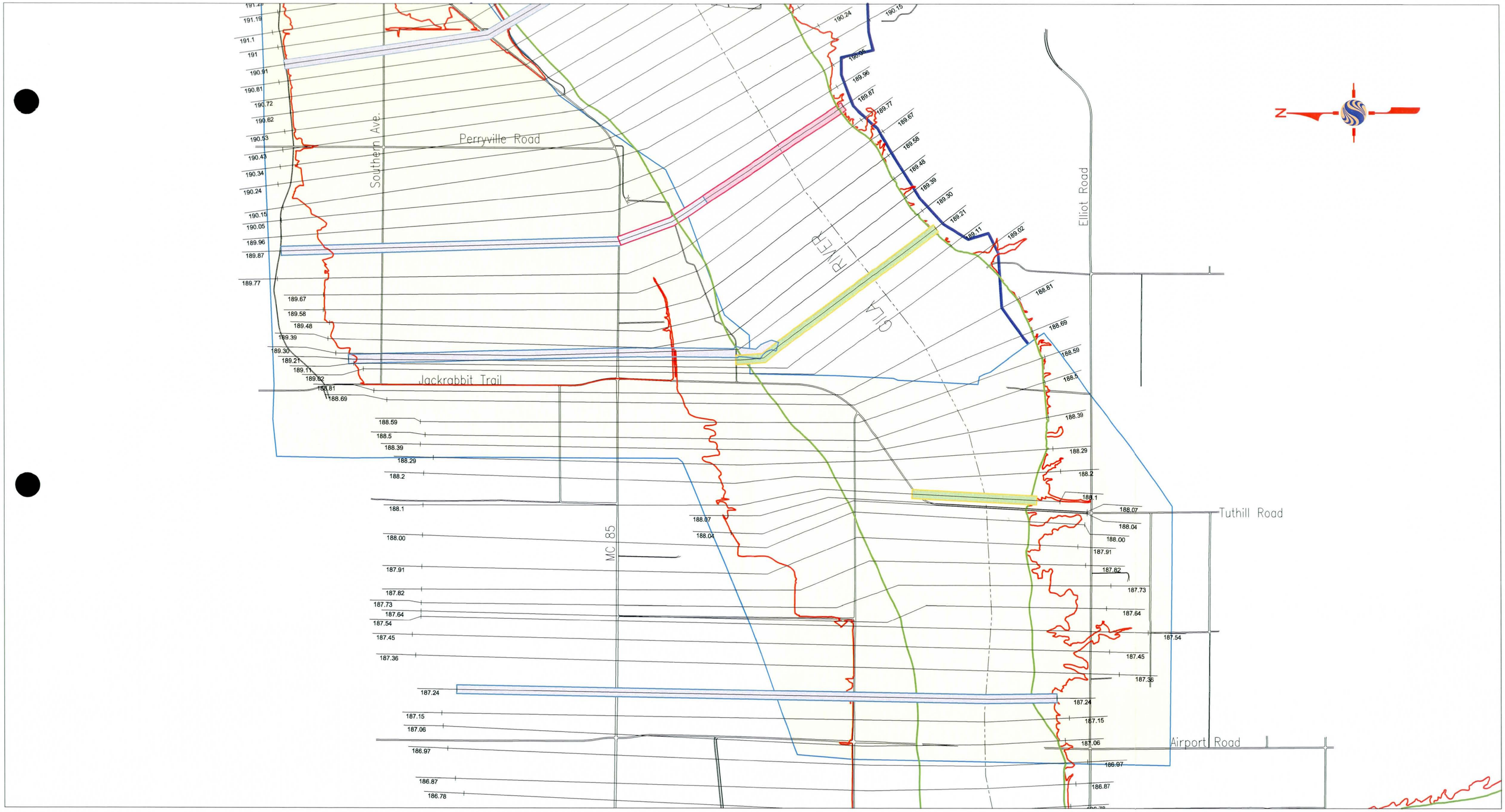
If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

3.0 MAPPING AND SURVEY INFORMATION

3.1 FIELD SURVEY INFORMATION

Field surveys were conducted by various consultants for the FCDMC during May 2005, June 2005, August 2005 and March 2007 to compare previous mapping and new topography in the area. The surveyed cross sections, 187.24, 188.10 189.21, 189.87, 190.91, 191.67, 192.14, 192.42, 193.34 and 193.94 are shown on Figure 3.1. Graphs comparing the Effective HEC-RAS model cross sections, Corrected Effective HEC-RAS model cross sections and survey data are shown on Figures 3.2 through 3.12. Data to create the graphs is included on a CD in Appendix C. The graphs show a reasonable correlation, within mapping limits, between the Corrected Effective topography and the survey data. There are significant differences, up to eight feet in some areas, between the Effective model and the Corrected Effective model. This difference is further discussed in Section 3.2 Mapping.



V:\52820\active\182000510\cadd\Report Figures\Figure 3-1.dwg
2008-03-13 08:25AM By: sgerlach

January, 2008
182000510

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Baseline
- Effective Floodway
- Effective Floodplain
- Existing Conditions Cross Sections
- King Ranch Topography Boundary
- FCDMC Topography Boundary
- May 2005 Survey Location by FCDMC Survey
- June 2005 Survey Location by Stantec Survey
- August 2005 Survey Location by Stantec Survey
- March 2007 Survey Location by FCDMC Survey

1in=2000ft 0 2000' 3000' 4000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
3.1 Sheet 1

Title
Field Survey Location

ORIGINAL SHEET - 22

V:\52820\active\182000510\cadd\Report Figures\Figure 3-1.dwg
2008-03-13 08:22AM By: sgerlach

March, 2008
182000510

ORIGINAL SHEET -

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Baseline
- Effective Floodway
- Effective Floodplain
- Existing Conditions Cross Sections
- King Ranch Topography Boundary
- FCDMC Topography Boundary
- May 2005 Survey Location by FCDMC Survey
- June 2005 Survey Location by Stantec Survey
- August 2005 Survey Location by Stantec Survey
- March 2007 Survey Location by FCDMC Survey

1in=2000ft 0 2000' 3000' 4000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
3.1 Sheet 2

Title
Field Survey Location

Figure 3.2
Survey Data Compared to HEC-RAS Models - XS 187.24

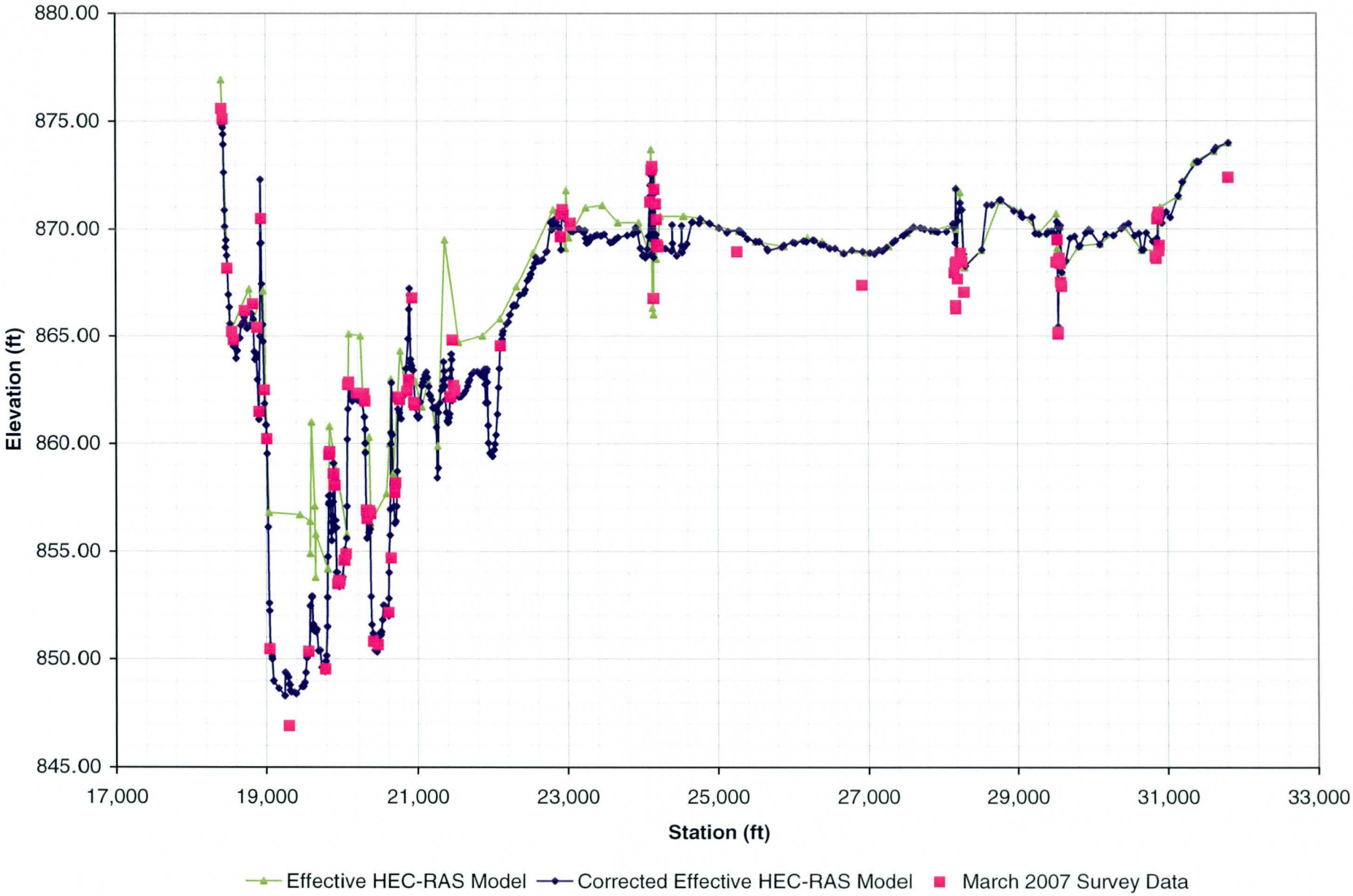


Figure 3.3
Survey Data Compared to HEC-RAS Models - XS 188.10

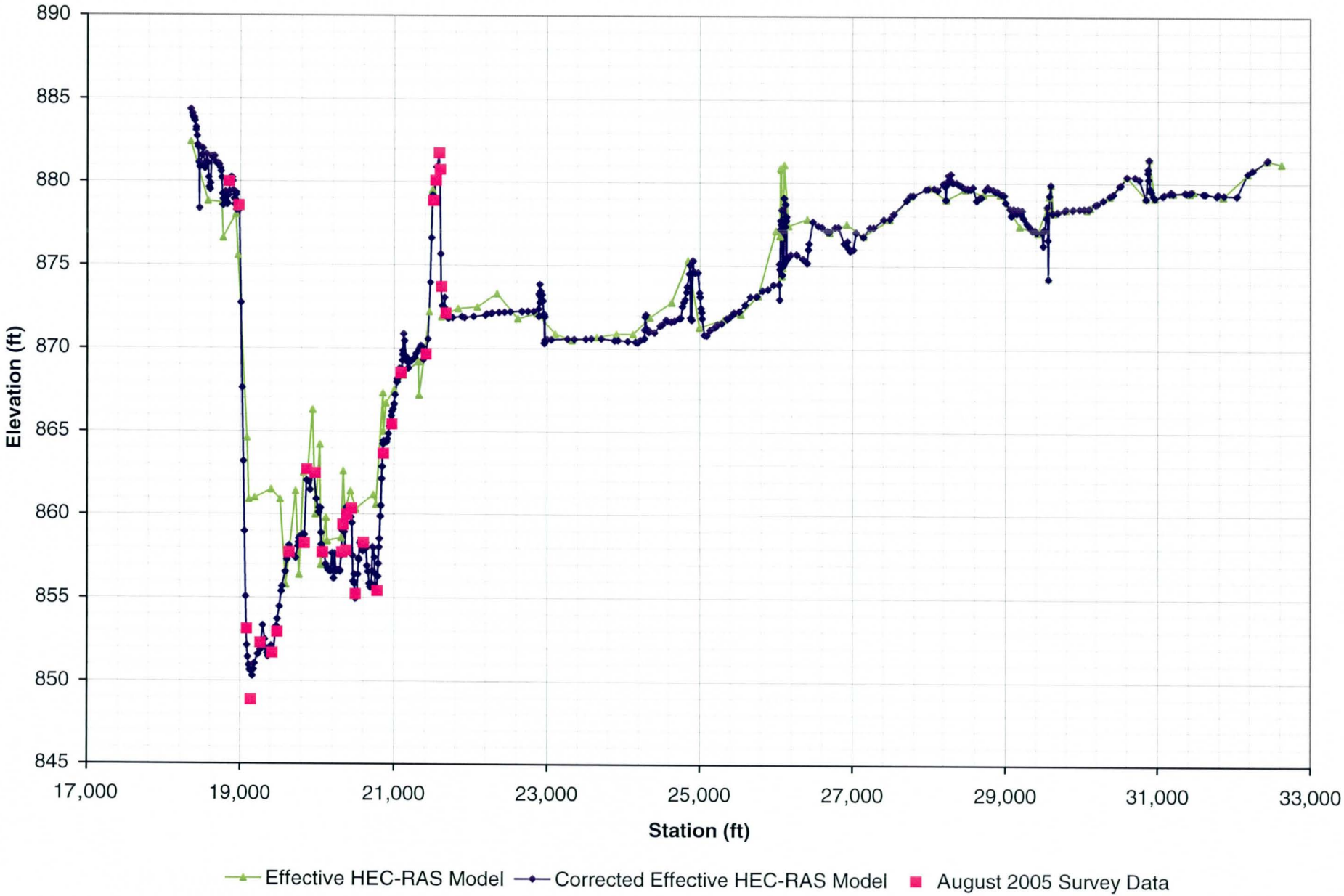


Figure 3.4
Survey Data Compared to HEC-RAS Models - XS 189.21

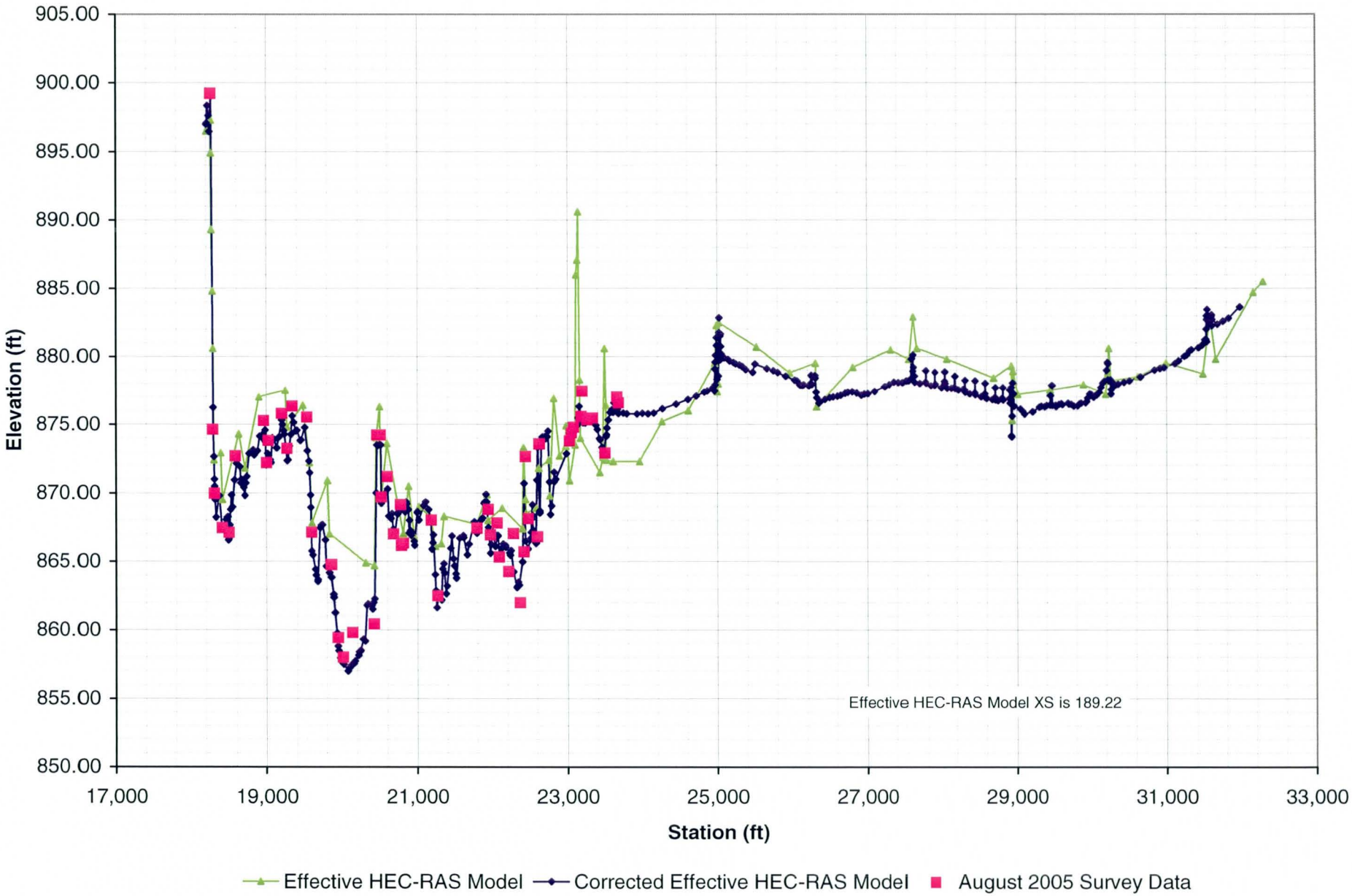


Figure 3.5
Survey Line between XS 189.21 and 189.30
Extracted Survey Line Data compared to Survey Data

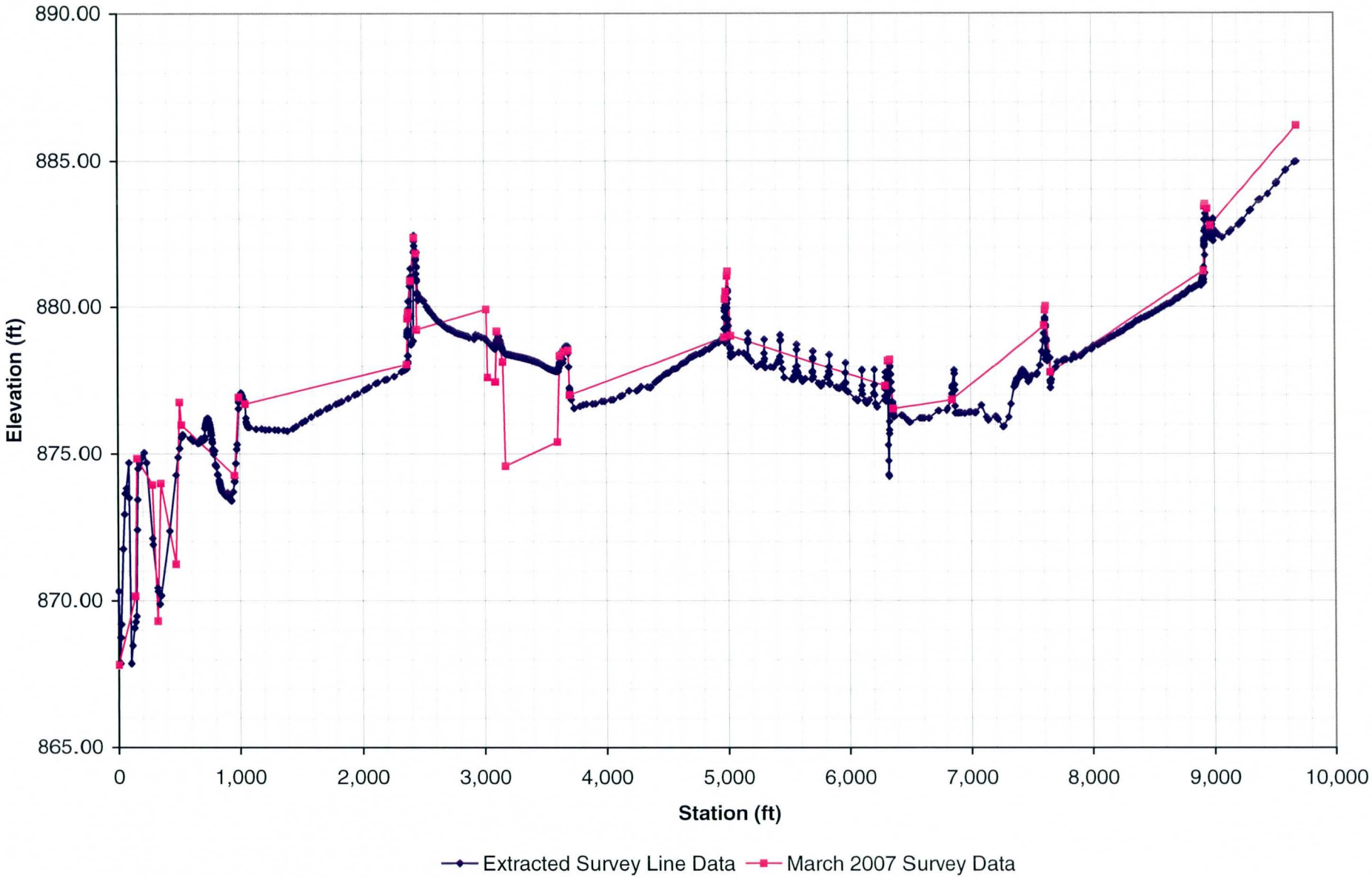


Figure 3.6
Survey Data Compared to HEC-RAS Models - XS 189.87

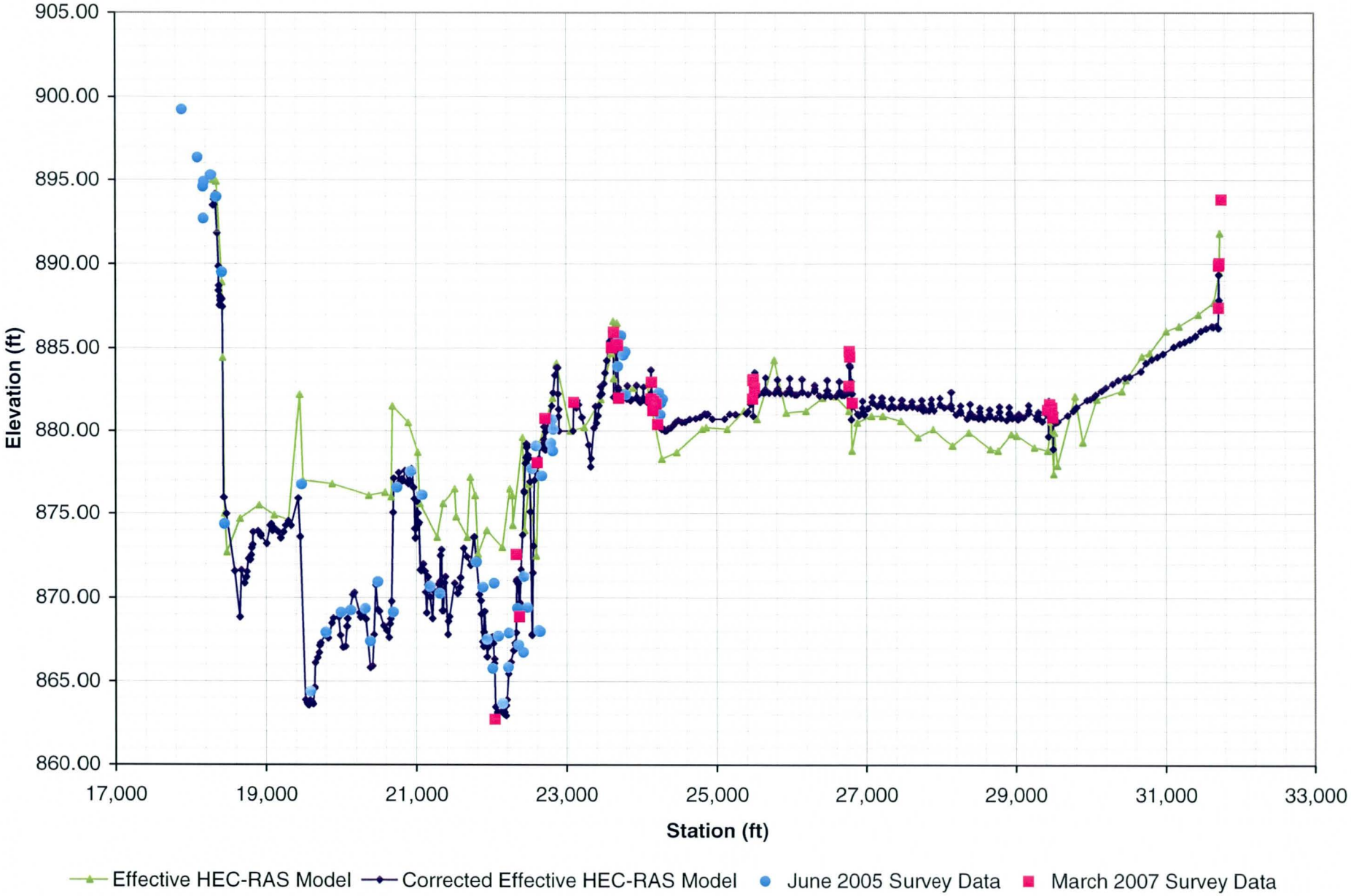


Figure 3.7
Survey Data Compared to HEC-RAS Models - XS 190.91

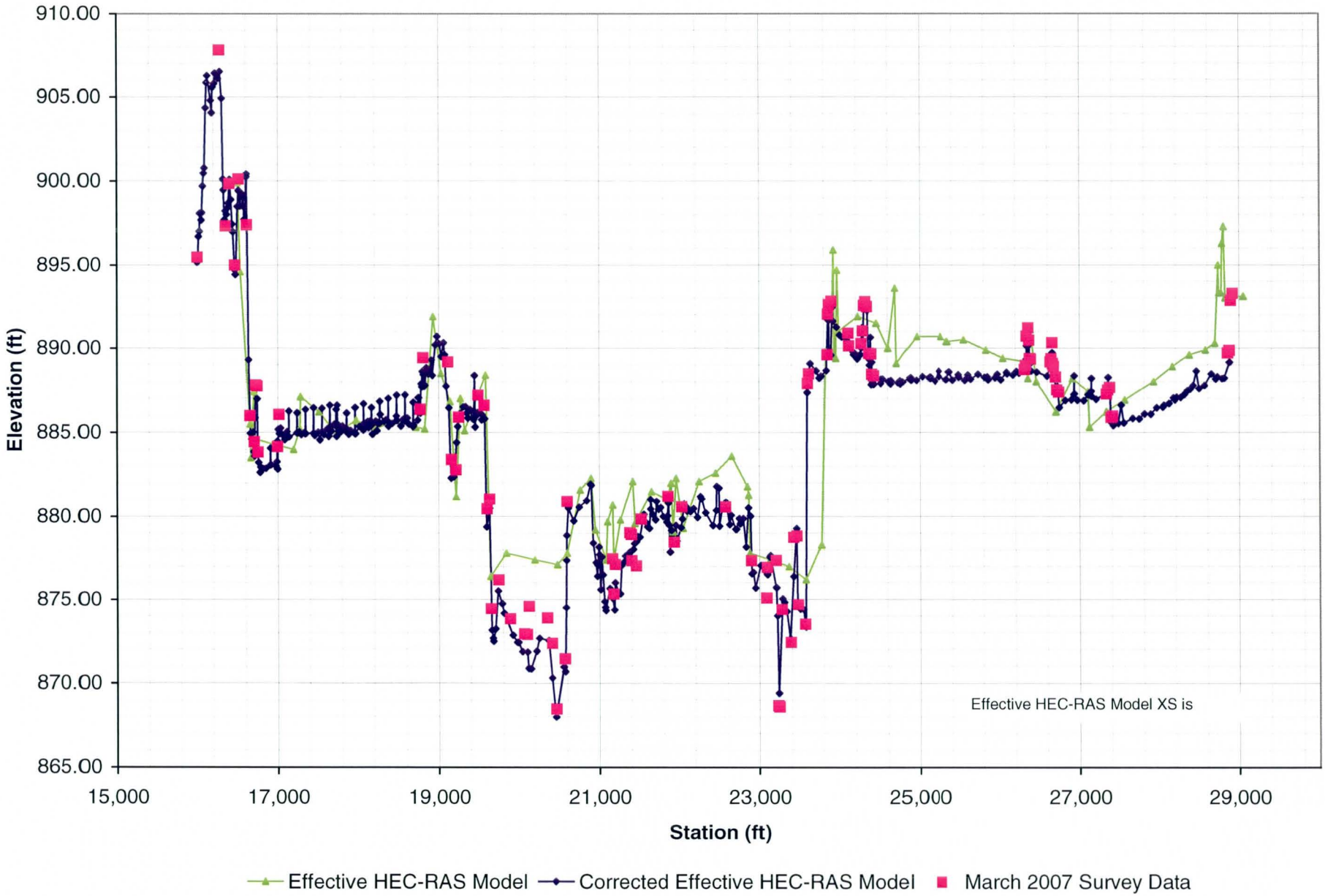


Figure 3.8
Survey Data Compared to HEC-RAS Models - XS 191.67

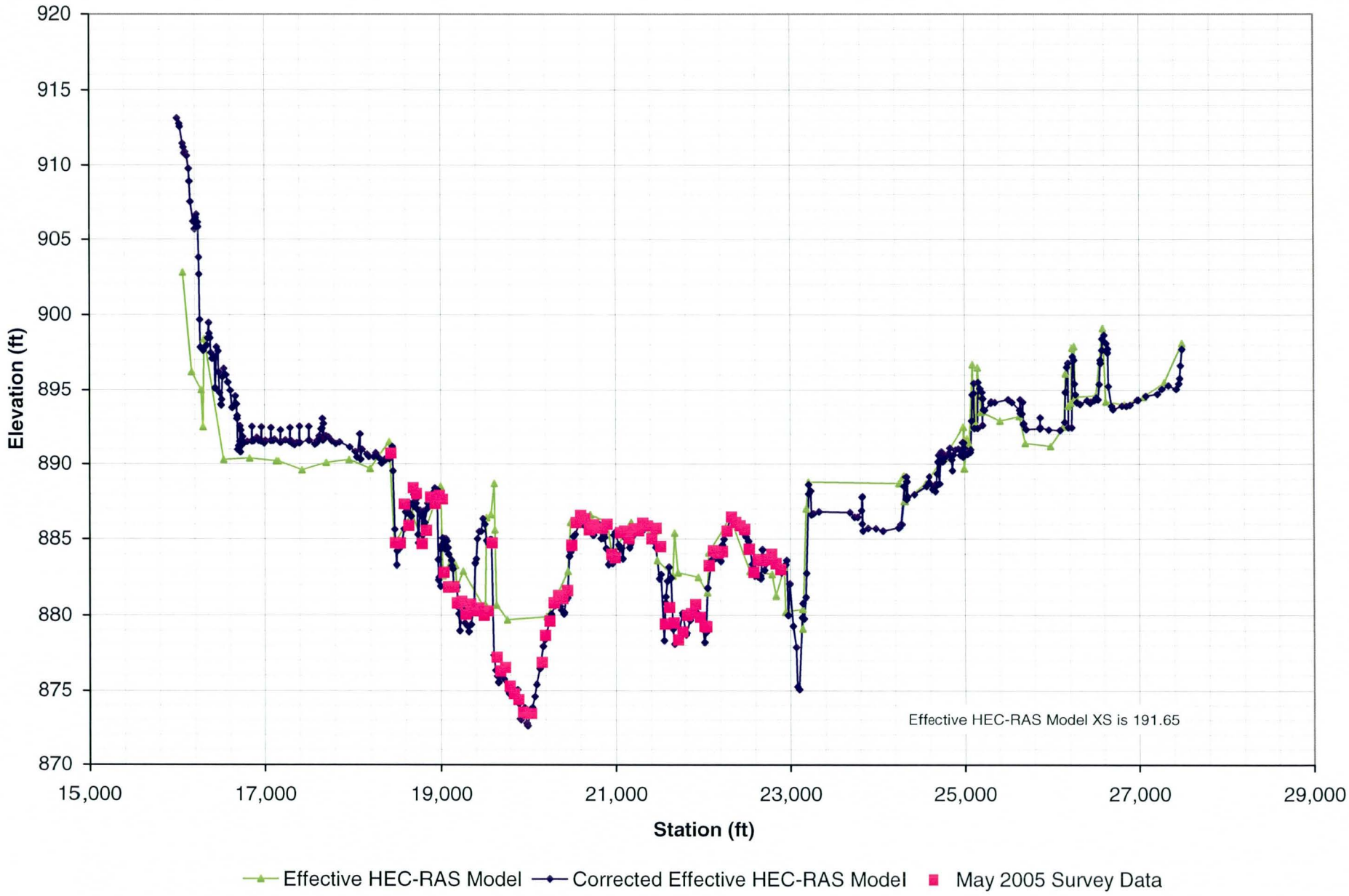
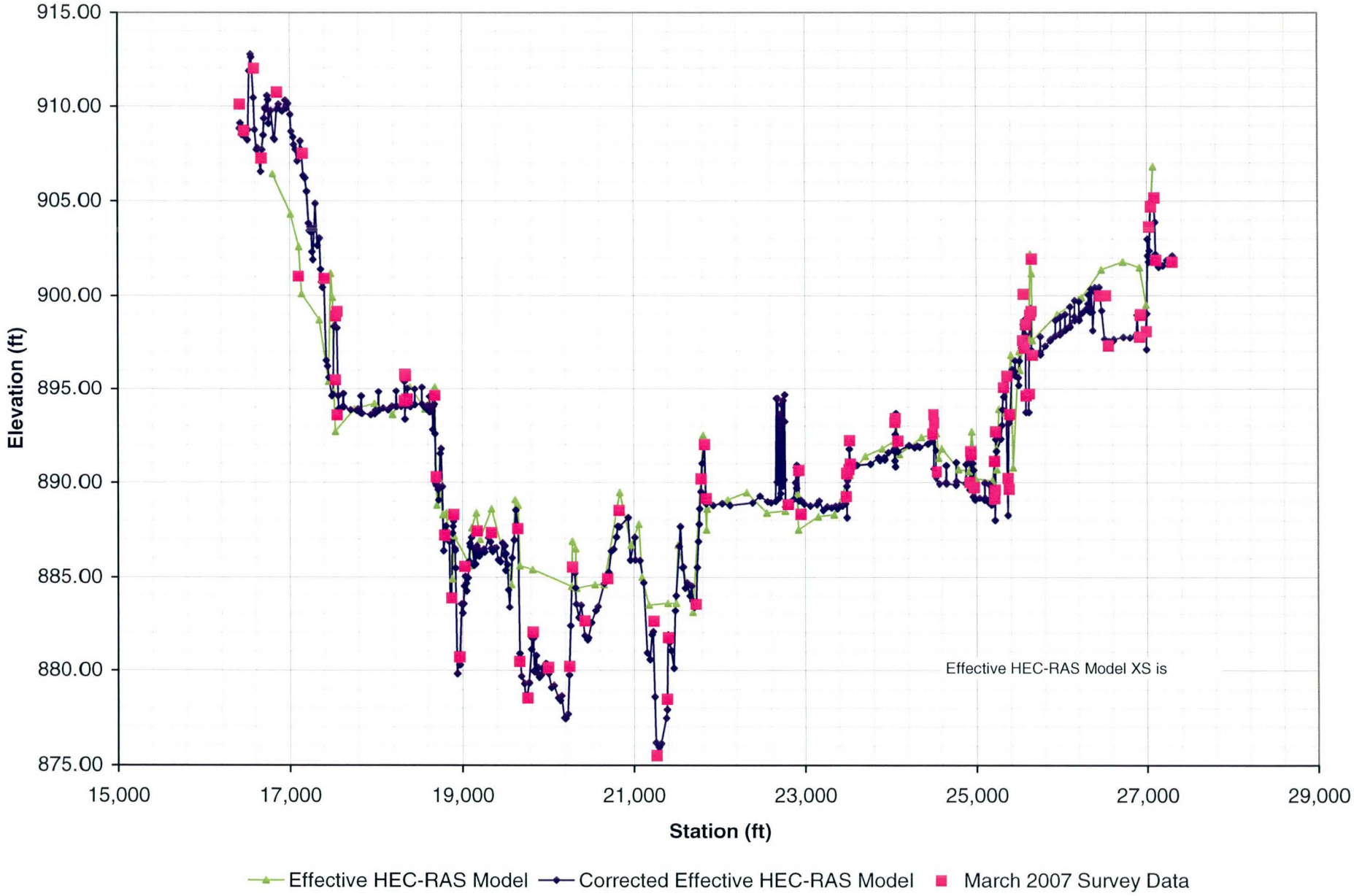


Figure 3.9
Survey Data Compared to HEC-RAS Models - XS 192.14



Firgure 3.10
Survey Data Compared to HEC-RAS Models - XS 192.42

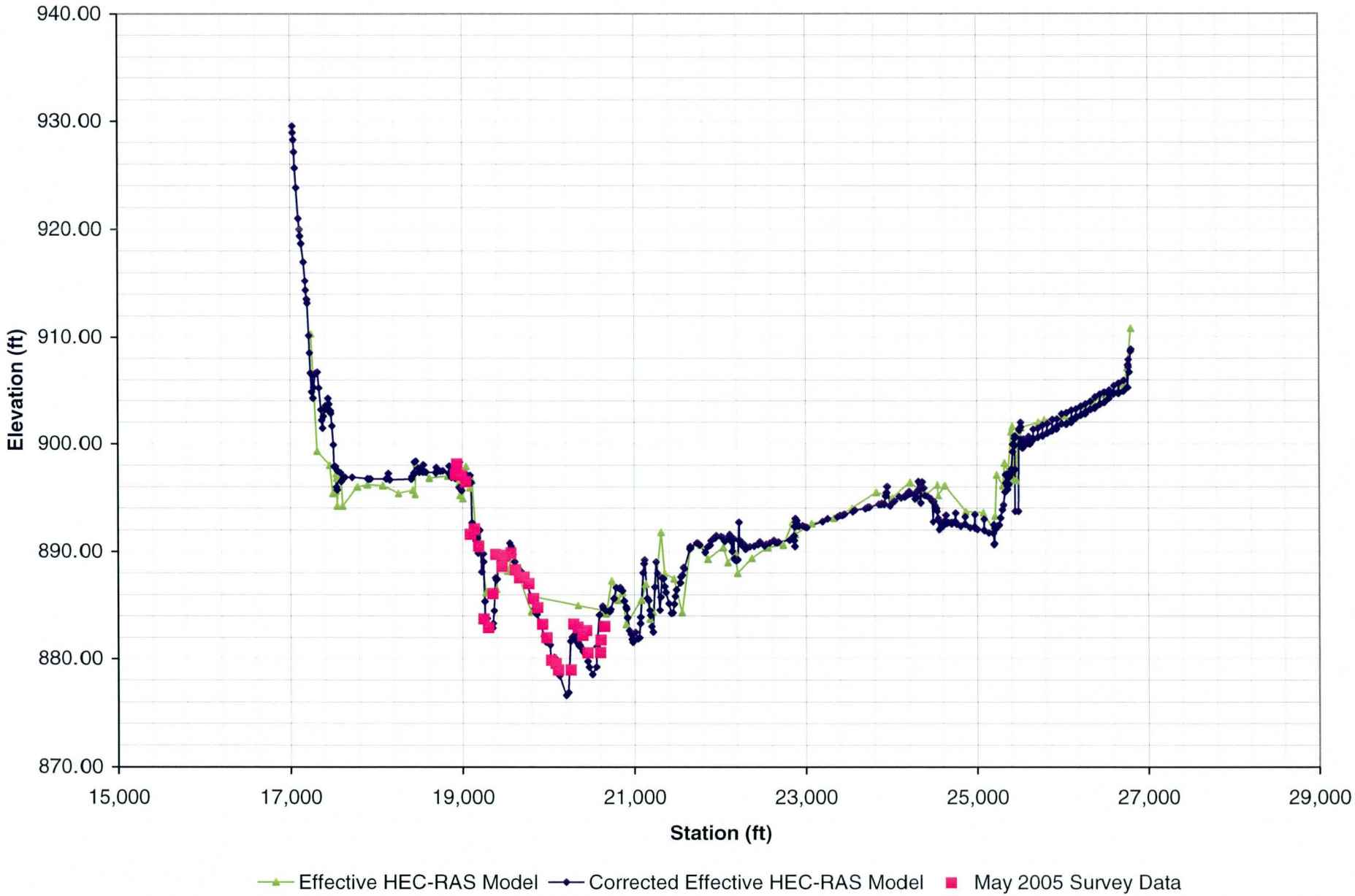


Figure 3.11
Survey Data Compared to HEC-RAS Models - XS 193.34

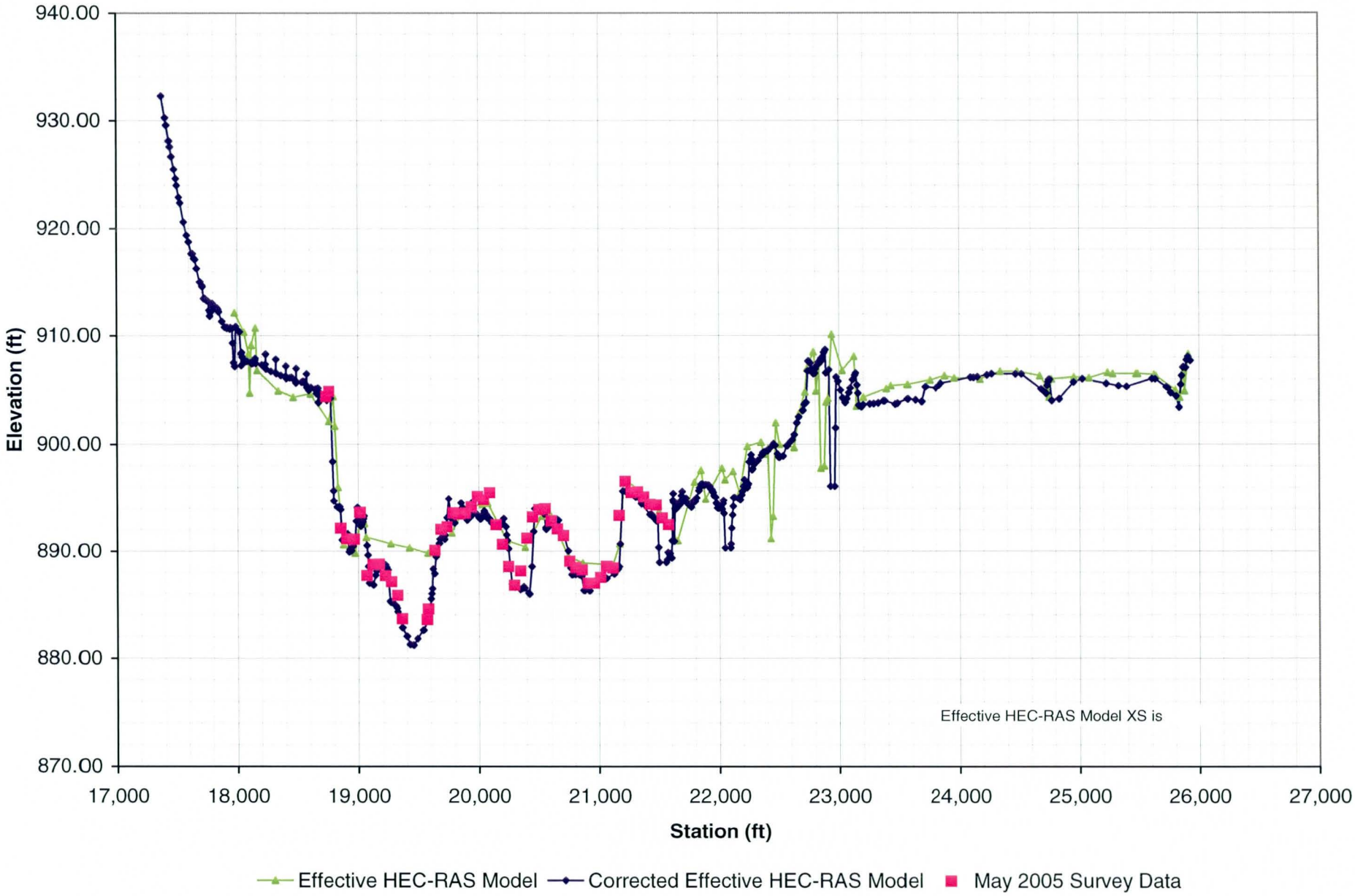
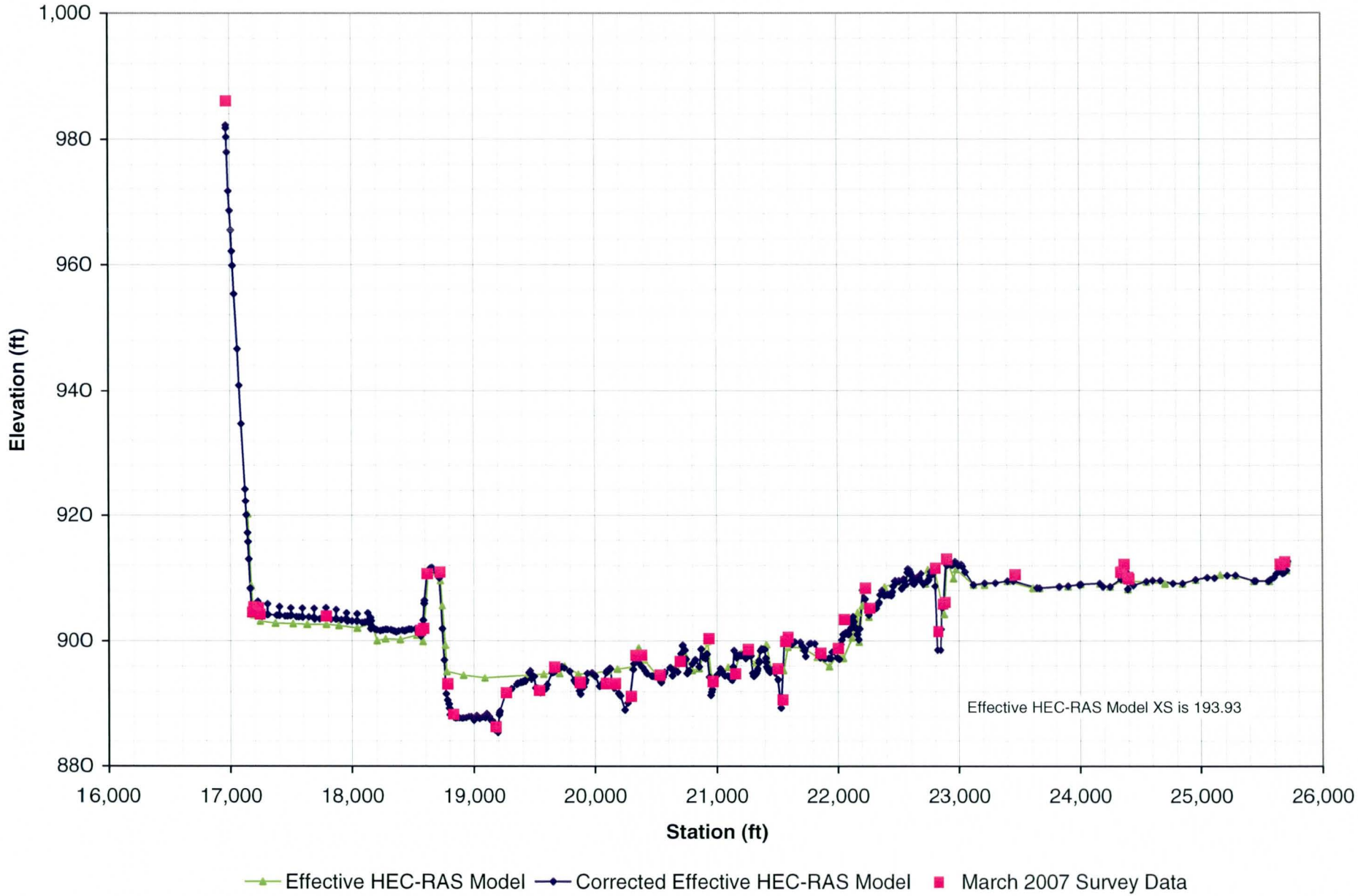


Figure 3.12
Survey Data Compared to HEC-RAS Models - XS 193.94



3.2 MAPPING

Mapping for this project consists of the following sources.

- Effective Model (Michael Baker, Jr. 1999)
- Norte Vista / King Ranch Floodplain Redelineation by River Research & Design, Inc. (2007)
- Mapping prepared for this project (2006)

Figure 3.1 shows the location of the three sources. The following section provides a description of each of the sources and map control used for the study.

3.2.1 Salt-Gila River Floodplain Delineation Restudy

The mapping, covering the study area, was developed for the Effective study and was completed by Michael Baker, Jr. and McLain Harbers Co., Inc. (Michael Baker, Jr., 1999). The study area was first flown on 14 November 1991. During the end of 1992 and early 1993 a flood with a peak discharge 130,000 cfs occurred with the largest runoff volume recorded on the Gila River. The channel and part of the adjacent overbanks were reflown on 6 February 1993. The contour interval was four feet. The horizontal datum is NAD83 State Plane Coordinate System (AZ Central Zone, International Feet) and the vertical datum is NGVD 29. The topography was provided by the FCDMC.

3.2.2 Norte Vista / King Ranch Floodplain Redelineation

The mapping, covering the area between cross sections 188.69 and 194.29, was developed for the Norte Vista / King Ranch project (River Research & Design, Inc., 2007). The area was flown by Kenney Aerial Mapping, Inc during 2003 and 2004. Ground control survey was provided by Coe & Van Loo Consultants, Inc. The contour interval varied between one foot in the overbanks and two feet in the channel. The horizontal datum was based on the Norte Vista / King Ranch project and the vertical datum was NGVD 29. The project was projected to the same horizontal coordinate system as the Effective study using ArcView v3.2.

3.2.3 FCDMC Topography

The mapping, covering the study area between cross sections 187.06 and 191.38, was developed for this project. The area was flown by Vertical Mapping Resources, Inc. during 13 March 2006. Ground control survey was provided by RBF Consulting, Inc. The contour interval is two feet. The horizontal datum NAD83 State Plane Coordinate System (AZ Central Zone, International Feet) and the vertical datum is NGVD 88. To adjust NAVD 88 data to NGVD 29 a vertical adjustment factor was determined using the National Geodetic Survey program VERTCON accessed at http://www.ngs.noaa.gov/cgi-bin/VERTCON/vert_con.prl (August, 2001). Four latitude/longitude pairs were selected from within the re-mapped area, and the results are summarized in the table below. A vertical datum shift of 2.1 feet was used to adjust NAVD 88 data to NGVD 29.

Table 3.1 Datum Adjustments

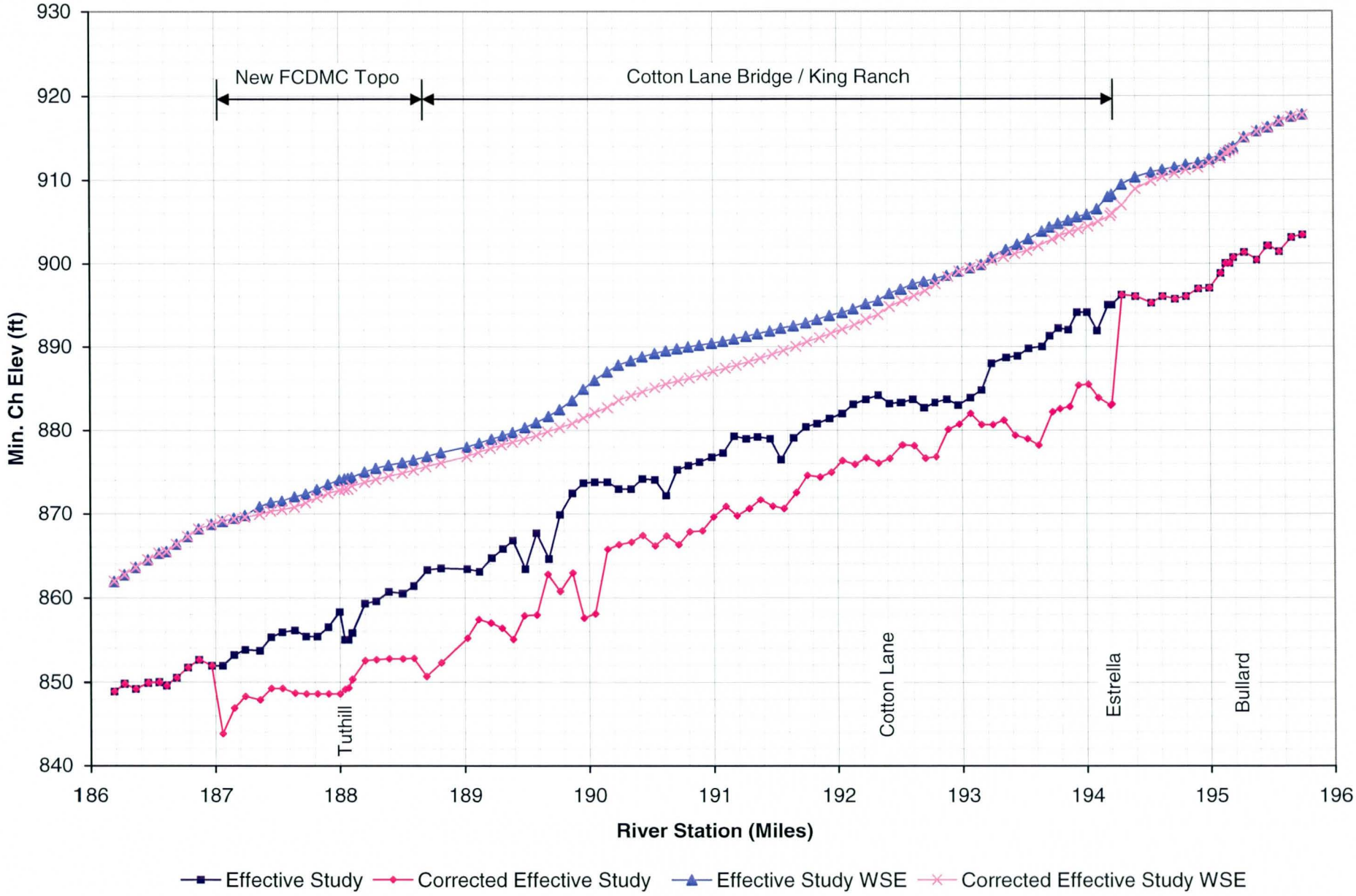
Latitude 1 (N)	Longitude 2 (W)	Datum shift (NAVD 88 minus NGVD 29) 3 (ft)
33.35	112.49	2.096
33.36	112.50	2.100
33.38	112.48	2.106
33.39	112.45	2.103
	Average	**2.101**

3.2.4 Comparison of Topographic Mapping

Figures 3.2 through 3.12 show a comparison of the Effective study and Corrected Effective study. In some locations the Corrected Effective study channel invert is as much as eight feet deeper. When the area was reflown for the Effective study 6 February 1993 there was still water in the channel from the flood event. The USGS gage data shows a discharge of 13,200 cfs on 6 February 1993 and 13,300 cfs for 7 February 1993. The water surface elevation in the main channel was mapped rather than the channel invert.

Figure 3.13 shows a comparison of the Effective study and Corrected Effective study thalweg. There are two locations where there is a sudden change in the thalweg near cross sections 194.12 and 186.97. This is due to the transition between new topography and the topography used for the Effective study. Also, the water elevations for the Effective and Corrected Effective models are shown.

Figure 3.13
Comparison Between Effective and Corrected Effective Studies



4.0 HYDROLOGY

This study does not include changes to the hydrology nor is documentation provided in Appendix D. The peak discharges from the Effective model were used in the Corrected Effective model.

5.0 HYDRAULICS

5.1 METHOD DESCRIPTION

Baseline hydraulic data for the Corrected Effective study was obtained from the Effective model and the Norte Vista / King Ranch Projects. The Effective study was authorized in 1992 by the FCDMC and extends from 3.4 miles downstream of State Route 85 on the Gila River to the Granite Reef Dam on the Salt River. The Effective HEC-RAS model was broken into multiple segments with one segment covering the Corrected Effective study area. The Effective HEC-RAS model includes cross sections between RM 178.61 (approximately 1.4 miles downstream of State Route 85) and RM 199.82 (approximately 4.6 miles upstream of Bullard Avenue), for a total reach length of approximately 21.21 miles. The Corrected Effective model includes cross sections between RM 178.61 and 199.07 (approximately four miles upstream of Bullard Avenue) for a total reach length of 20.46 miles. This study uses HEC-RAS version 3.1.3.

5.2 WORK STUDY MAPS

Floodplain delineation maps prepared for this study depict Corrected Effective floodplain and floodway boundaries, hydraulic cross section locations and alignments (see Exhibit Maps). Copies of the Work Maps reduced to 11" x 17" sheets are provided in the Exhibit Map Section. Work Maps at 24" x 36" sheets size, with a 1" = 400' scale are provided under separate cover. Work Maps depict where this study matches the Effective study mapping. Work maps for this study match the same sheet layout and page numbering so that sheets from the Effective study could be replaced with this study. The cover sheet shows the sheets effected by this study.

5.3 PARAMETER ESTIMATION

5.3.1 Roughness Coefficients

Roughness coefficients for the Gila River Floodplain Redelineation study were obtained from three sources. For cross sections upstream of 195.75 and downstream of 186.87 values from the Effective study were used (Michael Baker, Jr., 1994). Manning's n-values were estimated using circa 1991 and 1993 aerial photography, ground photographs and video and the 1 inch = 400 foot, 4 foot contour interval mapping. Ground photographs and videos were taken during field reconnaissance trips on 9 April and 18 November 1992 and 6 May and 16 June 1993.

For cross sections between 190.05 and 195.75 the n-values were obtained from the Norte Vista/ King Ranch project. For information regarding the method used to estimate the roughness coefficient see the report prepared by River Research & Design, Inc included on a CD in Appendix E. A figure showing the overview of the selected Manning's roughness coefficients is also included in Appendix E.

For cross sections between 187.06 and 190.05 n-values were developed as part of this study for the channel. The n-values from the Effective model were used for the overbank areas. The

Manning's roughness coefficients developed for the Effective Study were reviewed and, if necessary, were revised to reflect existing conditions of the Gila River. The following sections present the methodology and results of the investigation.

5.3.1.1 Methodology

In order to estimate Manning's n-values for portions of the study reach of the Gila River, physical characteristics were identified through field observations and examination of ground and aerial photographs as well as examination of topographic mapping. The discerning characteristics recorded were channel size and shape, bed material, vegetation density; the presence of meanders or channel bends and the presence or absence of channel obstructions. Physical characteristics of the channel reach were viewed on foot during field reconnaissance and each sub-reach was photographed at representative locations.

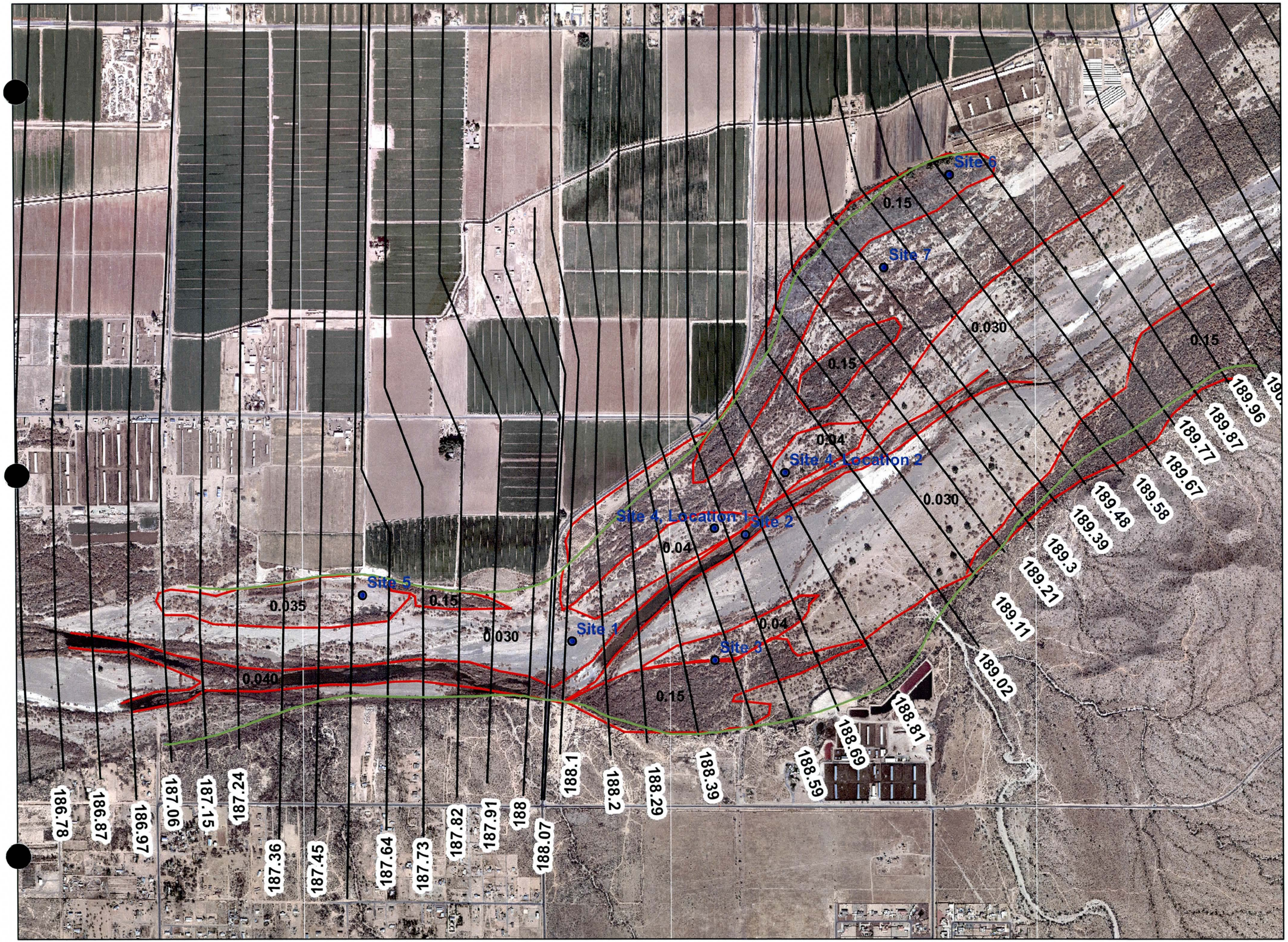
Manning's n-values were estimated using the methods set forth in the US Geological Survey (USGS) publication *Estimated Manning's n-Values for Stream Channels and Flood Plains in Maricopa County Arizona (USGS, 1991).* The method cited in the USGS publication and the method used for this study involved the selection of an initial Manning's n-value based upon the channel bed material and then the adjustment of that value for channel irregularities, effects of obstructions, vegetation and channel cross sectional variations. If the channel has sufficient meander to increase roughness, then the sum of the base n-value plus subsequent adjustments is multiplied by a meander value, *m*.

The main flow conveyance area (the area between the bank stations) of the Gila River is characterized with multiple channels (see Figure 5.1). Vegetation occurs adjacent to the channels generally along the side slopes of each of the channels. A composite n-value is estimated for vegetated channel segments that is representative of the vegetated side slopes and the non-vegetated bottom width. The difference between the composite n-value and the base n-value is then coded as the channel vegetation adjustment in the calculation sheets. Composite n-values are estimated for a typical channel section using Equation 6-17 from *Open Channel Hydraulics, Chow (1959).* That equation is:

$$nc = \left[\frac{\left(P_1 n_1^{1.5} + P_2 n_2^{1.5} + P_3 n_3^{1.5}\right)}{P} \right]^{2/3}$$

where:

P = total wetted perimeter of the channel;
P_1 = wetted perimeter of the channel bottom;
$P_{2,3}$ = wetted perimeter of the channel side slopes;
n_1 = Manning's n-value of the channel bottom; and
$n_{2,3}$ = Manning's n-value of the channel side slopes.
nc = composite n-value



Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Consultants:

Stantec Consulting Inc.
8211 S. 48th St.
Phoenix, AZ 85044

Legend

- Data Collection Points
- Cross-Section Location
- Manning's n-Value Boundary
- Main Flow Conveyance Area

Manning's n-Value Distribution Map

Figure 5.1

N

0 410 820 1,230 1,640 Feet

1 inch = 1200 feet

Title:

GILA RIVER FLOODPLAIN REDELINEATION STUDY

Produced by: RKJ

Date: February 2008

W:\active\182000453\GIS\Project\river_bound.mxd

The typical channel section estimated for a channel is based on inspection of the cross section plots, aerial photographs and field visits. The typical section is determined to be trapezoidal with 1:1 (horizontal to vertical) side slopes with channel bottom widths of up to 200 feet. Average depths of flow for the estimation of the wetted perimeter are approximately 21 feet. A channel side slope n-value of 0.050 is used along with the base n-value estimated for each watercourse reach to determine a composite n-value.

5.3.1.2 Summary of Manning's Roughness Coefficients

Calculation sheets developed to estimate Manning's n-values are provided in Appendix E. Manning's n-value estimated for the river reach from cross sections 187.06 to 190.05 are:

- Areas of dense vegetation (minor open areas no localized channels) = 0.15
- Areas of medium-dense vegetation (some open areas with localized channels) = 0.065
- Areas where the open area is at least 50 percent of the defined n-value area = 0.040
- Channels with dense vegetation adjacent and along side slopes = 0.040
- Areas of light vegetation coverage = 0.035
- Clear areas with minor vegetation = 0.030

Manning's n-values estimated in this study for the river reach between cross sections 187.06 to 190.05 are consistent with Manning's n-values estimated for the Effective Study. The range of hydraulic roughness coefficients reported in the Flood Insurance Study (FEMA, 2005) for the Gila River is summarized in Table 5.1 and the revised values are summarized in Table 5.2. Figure 5.1 shows the n-value distribution between cross sections 187.06 and 190.05. Table 5.3 includes a comparison of the Manning's n-values between 187.06 and 190.05 for the Effective and Corrected Effective models.

Table 5.1 FIS Range of Hydraulic Roughness Coefficients

Flooding Source	Channel	Overbanks
Gila River	0.030 - 0.120	0.035 – 1.000

Table 5.2 Revised Range of Hydraulic Roughness Coefficients

Flooding Source	Channel	Overbanks
Gila River	0.025 - 0.150	0.025 – 1.000

Table 5.3 Comparison of Manning's n-values

Cross Section	Effective HEC-RAS Model							Corrected Effective HEC-RAS Model												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
190.05	0.15	0.15	0.026	0.043	0.025			0.15	0.03	0.065	0.05									
189.96	0.15	0.15	0.026	0.043	0.025			0.05	0.15	0.03	0.065	0.05								
189.87	0.15	0.15	0.026	0.043	0.025			0.05	0.15	0.03	0.065	0.05								
189.77	0.15	0.15	0.027	0.065	0.025			0.15	0.03	0.04	0.03	0.065	0.15	0.05						
189.68	0.15	0.15	0.032	0.027	0.065	0.025		0.05	0.15	0.03	0.04	0.03	0.04	0.03	0.065	0.15	0.05			
189.58	0.15	0.15	0.032	0.027	0.065	0.025		0.05	0.15	0.03	0.04	0.03	0.04	0.03	0.04	0.065	0.15	0.05		
189.49	0.15	0.15	0.032	0.027	0.065	0.025		0.15	0.03	0.04	0.03	0.065	0.15	0.05						
189.39	0.032	0.032	0.027	0.065	0.025			0.15	0.03	0.04	0.03	0.065	0.15	0.05						
189.31	0.15	0.15	0.032	0.027	0.065	0.05	0.025	0.15	0.03	0.04	0.03	0.15	0.065	0.15	0.05					
189.22	0.15	0.15	0.032	0.027	0.065	0.051	0.025	0.15	0.2	0.03	0.06	0.04	0.03	0.15	0.065	0.15	0.05			
189.12	0.15	0.15	0.032	0.027	0.065	0.052	0.025	0.03	0.04	0.04	0.15	0.065	0.15	0.05						
189.02	0.15	0.15	0.032	0.027	0.065	0.065	0.025	0.05	0.03	0.04	0.15	0.04	0.065	0.15	0.05					
188.81	0.15	0.15	0.032	0.028	0.065	0.025		0.05	0.03	0.15	0.03	0.04	0.03	0.04	0.04	0.065	0.15	0.065	0.15	0.05
188.7	0.15	0.15	0.043	0.028	0.065	0.025		0.05	0.06	0.15	0.04	0.03	0.04	0.065	0.15	0.025				
188.59	0.065	0.065	0.028	0.065	0.025			0.15	0.065	0.15	0.04	0.03	0.04	0.04	0.065	0.15	0.065	0.025		
188.5	0.065	0.028	0.065	0.025				0.15	0.04	0.03	0.04	0.04	0.065	0.065	0.025					
188.39	0.15	0.15	0.026	0.065	0.025			0.15	0.04	0.03	0.04	0.04	0.065	0.065	0.025					
188.29	0.15	0.15	0.026	0.065	0.025			0.15	0.03	0.04	0.04	0.065	0.065	0.025						
188.2	0.043	0.15	0.03	0.065	0.025			0.043	0.015	0.04	0.03	0.065	0.025							
188.1	0.065	0.065	0.03	0.043	0.025			0.065	0.04	0.03	0.065	0.025								
188.07	0.065	0.032	0.025					0.065	0.04	0.03	0.025									
188.055	Bridge																			
188.04	0.065	0.032	0.025					0.065	0.04	0.03	0.035									
188	0.065	0.03	0.032	0.025				0.065	0.04	0.03	0.032	0.025								
187.91	0.065	0.03	0.032	0.025				0.065	0.03	0.04	0.03	0.15	0.032	0.025						
187.82	0.065	0.03	0.032	0.025				0.065	0.04	0.03	0.15	0.032	0.025							
187.73	0.065	0.03	0.032	0.025				0.065	0.04	0.03	0.15	0.032	0.025							
187.64	0.065	0.03	0.032	0.025				0.065	0.04	0.03	0.03	0.035	0.15	0.032	0.025					
187.54	0.065	0.03	0.025	0.025				0.065	0.03	0.04	0.03	0.035	0.025							
187.45	0.065	0.03	0.025	0.025				0.065	0.03	0.04	0.03	0.035	0.025							
187.36	0.065	0.03	0.025	0.025				0.065	0.04	0.03	0.035	0.025								
187.24	0.065	0.065	0.03	0.065	0.065	0.025		0.065	0.03	0.04	0.03	0.035	0.15	0.025						
187.15	0.065	0.03	0.065	0.025				0.065	0.03	0.04	0.03	0.035	0.15	0.065	0.025					
187.06	0.065	0.065	0.028	0.065	0.025	0.025		0.065	0.03	0.04	0.03	0.035	0.15	0.025	0.025					

5.3.2 Expansion and Contraction Coefficients

The contraction and expansion coefficients for the study area were obtained from two sources. For cross sections between 186.87 and 195.75 the coefficients were obtain from the Norte Vista/ King Ranch Project, except between 193.94 and 1943.53. These cross sections are located upstream and downstream of the Estrella Parkway Bridge. The expansion coefficients were changed to 0.5 from 0.3. The contraction and expansion coefficients for the main channel and the Tuthill Bridge were set to 0.1 and 0.3, respectively, which is consistent with the Effective study. For cross sections upstream of 195.75 and downstream of 186.87 coefficients were obtained from the Effective study.

5.4 CROSS SECTION DESCRIPTION

A HEC-RAS model was used to develop the Corrected Effective floodplain and floodway boundaries. Three sources were used to develop the cross sections for the HEC-RAS model. The sources are shown on Figure 3.1. The Effective study HEC-RAS model cross sections, obtained from the FCDMC, are used for the cross sections located downstream of RM 187.06 and upstream RM 194.29. Norte Vista / King Ranch Project HEC-RAS model, obtained from River Research & Design, Inc., replaced the Effective study cross sections between RM 194.29 and 191.48 and between 191.38 and 188.69 in the channel only. Between RM 187.06 and 188.59 and between 188.69 and 191.38 in the right overbank only cross sections were obtained from new topography developed for this study. Cross sectional geometry was developed from the new topography using a triangulated irregular network (TIN).

A TIN was developed from digital terrain models using the 3D Analyst extension of ArcView GIS v3.2 from the following sources.

- Effective mapping obtained from the FCDMC
- Norte Vista / King Ranch Project obtained from River Research & Design, Inc.
- New Topography obtained from the FCDMC

Contours, shown on the work maps, were developed from the TIN. The cross sectional alignments were provided by River Research & Design, Inc. The cross section numbering is expressed in river miles above Painted Rock Dam. Cross section stationing is from left to right looking downstream with the location of the hydraulic baseline set to station 20,000. The cross sectional alignments were adjusted slightly from the Effective study to better represent existing conditions. The following is a summary of differences between the Norte Vista / King Ranch and Effective study cross sectional data for the area between 194.29 and 188.69.

- Cross sections were modified slightly to better represent flows in the proposed channel between cross sections 193.73 and 190.24. See the figure located in Appendix E.

- The hydraulic baseline was modified slightly to stay within the channel. This resulted in a cross sectional station difference of 0.01 miles for the realigned cross sections.

Further information regarding the cross section modifications can be found in the TDN by River Research & Design, Inc. Cross section plots of RM 187.06 through 194.29 are included in Appendix E.

5.5 MODELING CONSIDERATIONS

5.5.1 Hydraulic Jump and Drop Analysis

There are no drop structures or physical conditions that would develop a hydraulic jump within the study reach.

5.5.2 Bridges and Culverts

There are four bridges in the reach of the Gila River between RM 178.91 to 199.07 and are summarized in Table 5.4. Bridge data needed to code HEC-RAS models was obtained from the Effective HEC-RAS model.

Table 5.4 Summary of Bridges

Location 1	Cross Section 2	Type of Structure 3	Modeling Method 4	Source of Data 5
State Route 85	180.025	Bridge	Energy (Standard Step) in HEC-RAS	Effective Study
Tuthill Road	188.055	Bridge	Energy (Standard Step) in HEC-RAS	Effective Study
Estrella Road	194.205	Bridge	Energy (Standard Step) in HEC-RAS	Effective Study
Bullard Avenue	195.15	Bridge	Energy (Standard Step) in HEC-RAS	Effective Study

One future bridge, Cotton Lane Bridge, is in the construction stages and will be submitted as a separate study.

5.5.3 Levees and Dikes

There are no engineered levees in the project but the area upstream of Tuthill bridge may function as a levee as shown on Figure 5.2. Two HEC-RAS models were built to investigate the effects of the levee, "with levee" and "without levee". The "with levee" model includes using the levee option in HEC-RAS between cross sections 188.81 and 188.07 at the location of the roadway. This model investigates the effects if the roadway embankment does not fail during the 100-year event resulting in a higher water surface elevation in the main channel of the Gila River. The "without levee" assumes the roadway embankment would fail and water could enter the area on the west side of the roadway. This model shows a lower water surface elevation in the main channel but a wider floodplain. Base Flood Elevation (BFE) lines on the work study maps for the "with levee" model were drawn between the roadway embankment and the south

bank. BFE lines for the "without levee" model were drawn between the north bank and the roadway embankment.

5.5.4 Islands and Flow Splits

No flow splits were identified through the restudy reach. Islands extend through out the study area and were included within the 100-year floodplain. An example of the islands on the south side of the Gila River on a farm field is shown on Figure 5.3 between cross sections 190.53 and 191.38. Additional islands are also located on farm fields on the north bank of the Gila River.

5.5.5 Ineffective Flow Areas

The ineffective flow area option of the HEC-RAS computer program is used to model ineffective flow areas. Typical ineffective flow areas are located upstream and downstream of bridges, such as Tuthill Bridge and Estrella Bridge. Other typical areas include backwater areas in the floodplain and within topographic depressions in which runoff is ponded and there is no apparent conveyance from one cross-section to another. These areas usually occur next to or on farm fields that are within the floodplain. One such area is shown on Figure 5.4 between cross sections 192.14 and 192.61. Ineffective flow areas were also utilized in the Effective HEC-RAS model to define non-conveyance areas behind canals and roadways that function as levees.

5.5.6 Supercritical Flow

There are no areas of supercritical flow within the study reach.

5.6 FLOODWAY MODELING

Floodway encroachments were obtained from two sources. The Effective study encroachments were used upstream of cross section 195.75 and downstream of cross section 186.87. Between cross sections 195.75 and 186.87 encroachment stations from the Norte Vista / King Ranch HEC-RAS model were used, except at cross sections 194.2 and 194.21. At these cross sections the encroachment was moved to the end of the cross section. The model was checked to make sure the rise in water surface elevation between the floodplain and the floodway model was less than foot.

V:\52820\active\182000510\cadd\Report Figures\Figure 5-2.dwg
2008-03-13 03:10PM By: sgerlach

January, 2008
182000510

ORIGINAL SHEET - 36

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

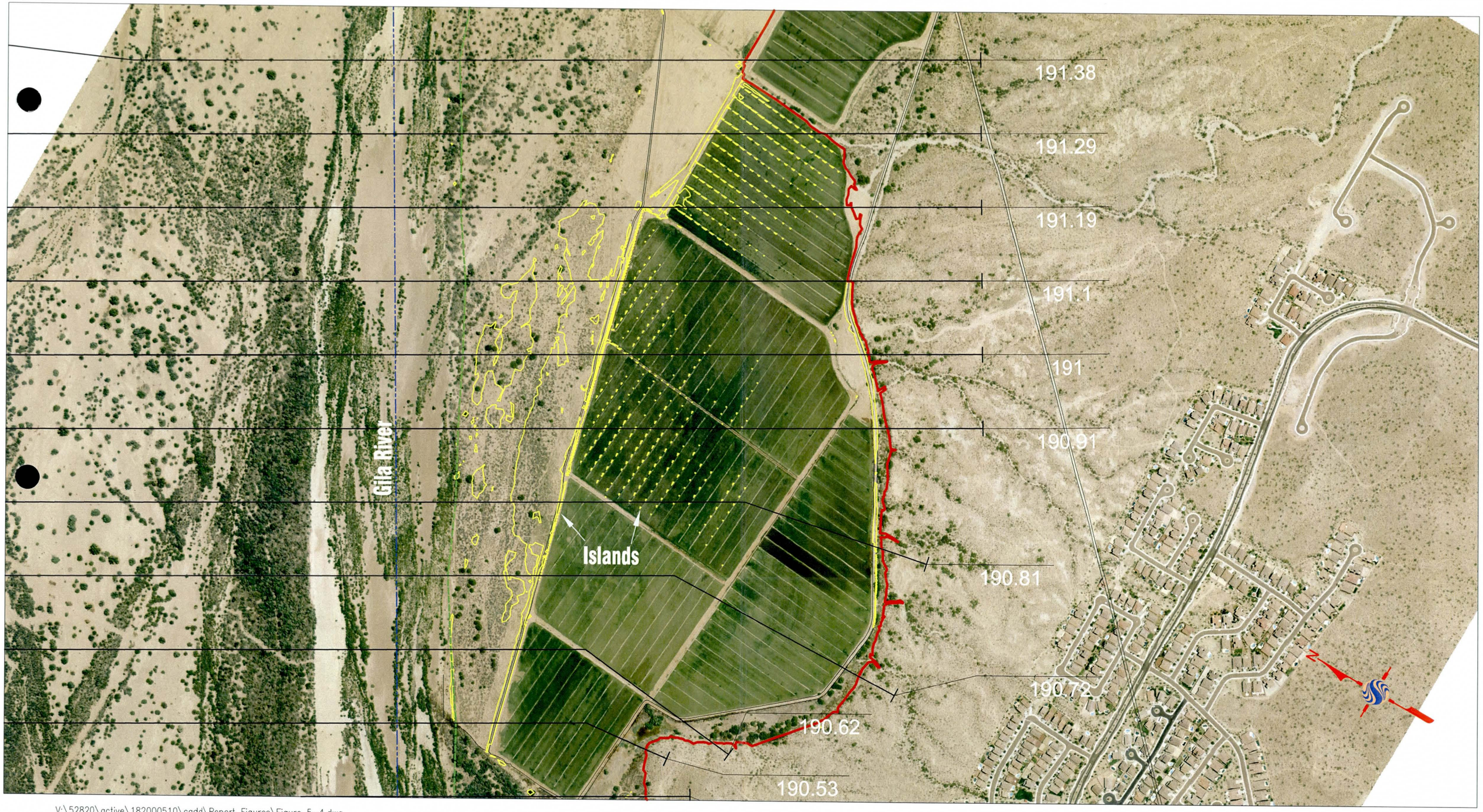
- Corrected Effective Floodway
- Corrected Effective Floodplain
- Cross Sections
- Baseline
- Levee

1in=1000ft 0 1000' 1500' 2000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
5.2

Title
Levee Located Near Tuthill Bridge



V:\52820\active\182000510\cadd\Report Figures\Figure 5-4.dwg
2008-03-12 05:10PM By: amlynch

March, 2008
182000510

ORIGINAL SHEET - A

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Corrected Effective Floodway
- Corrected Effective Floodplain
- Cross Sections
- Baseline
- Islands

1in=600ft 0 600' 900' 1200'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
5.3

Title
Islands

V:\52820\active\182000510\cadd\Report Figures\Figure 5-4.dwg
2008-03-12 05:09PM By: amlynch

March, 2008
182000510

ORIGINAL SHEET - 22

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Corrected Effective Floodway
- Corrected Effective Floodplain
- Cross Sections
- Baseline
- Ineffective Flow Area

0 500' 750' 1000'
1in=500ft

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2007C017, PCN No. 014.34.01

Figure No.
5.4

Title
Ineffective Flow Area

5.7 PROBLEMS ENCOUNTERED DURING THE STUDY

5.7.1 Tie-In to Existing Floodplain Delineations

This study ties into the Effective study at upstream and downstream ends at cross sections 195.00 and 187.06 (Baker, 1999). Table 5.5 shows a comparison between the water surface elevation and top width for the Effective and Corrected Effective study. It also ties into the Bullard Wash between cross sections 194.91 and 194.40.

Table 5.5 Comparison at Tie-in Locations

River Sta (miles)	Water Surface Elevation Effective (ft)	Water Surface Elevation Corrected Effective (ft)	Top Width Effective (ft)	Top Width Corrected Effective (ft)
1	2	3	4	5
195.00	912.50	912.06	4,603.60	4,370.28
187.06	869.09	869.25	4621.00	4624.59

5.7.2 Effects of New Topography

As stated in previous sections new topography was obtained for the area between Airport Road (cross section 187.06) and Bullard Avenue (cross section 195.00). The new topography was used to update the HEC-RAS model. Water surface elevations decreased in some area as much as four feet. At the tie-ins between the new and existing topography there is a sudden change in the thalweg.

5.7.3 HEC-RAS Warning and Error Messages

The HEC-RAS models ("with levee" and "without levee") execute with out errors for both the floodplain and floodway profiles. However, the model does report several different warning messages. In general, the majority of these messages are to be expected given the hydraulic characteristic of the Gila River.

5.7.4 CHECKRAS Warning Messages

Warning messages from CHECKRAS in the Corrected Effective study area (187.06 and 195.00) were reviewed. The areas upstream of cross section 195.00 and downstream of cross section 187.06 are in Effective Study area. The reports from CHECKRAS are included in Appendix E.

NT Check – Several warnings were noted for the Manning's roughness values that were less than 0.035 in the overbank area. This warning is not applicable for this situation since a majority of the overbank area is farm fields. For an explanation of the Manning's roughness determination see the report by River Research & Design, Inc. Several warnings were noted for contraction/expansion coefficients. Except for cross sections between RM 193.94 and 194.53

the contraction/expansion coefficients were not changed from the Effective model. The expansion coefficient for cross sections between 193.94 and 194.53 were changed from 0.3 to 0.5 to model the expansion at the Estrella Bridge.

Cross Section Check – Several warnings were noted for overbank distances longer than channel distances. This warning is not applicable because the cross section locations were not changed from the Effective study. Another warning was concerning the decrease in discharge in the downstream direction. This warning is not applicable for this situation since the values were obtained from the Effective study.

Structure Check – Warnings were noted for the Estrella and Tuthill Bridges within the study area. The bridge data including cross section spacing and alignments, ineffective flow and encroachment stations were provided as part of the Effective Model.

Floodway Check – Several warnings were noted regarding the location of the floodway encroachment station. The encroachment station was determined by the rise of the water surface elevation and smoothing the location of the floodway alignment.

5.8 CALIBRATION

No calibration procedures were attempted in this study. The mapped floodplain limits were inspected for reasonableness and found to be appropriate.

5.9 FINAL RESULTS

Print outs from the HEC-RAS models for each of the Corrected Effective models ("with levee" and "without levee") are provided in Appendix E on the CD as a Portable Document Format (PDF). Also included is a copy of the HIS submittal. Summary output for the floodplain profiles are provided in Tables 5.6 through 5.9. Results are reported for the reach of the Gila River commencing at cross section 187.06 to 195.00. The HEC-RAS model data files, both input and output, are provided digitally on CD in Appendix E.

5.9.1 Verification of Results

The results seem reasonable. In the areas with the Effective topography the Effective and Corrected Effective floodplains correspond closely.

Table 5.6 Summary of HEC-RAS Model Results for Corrected Effective Model – Without Levee

River Sta (miles) 1	Peak Discharge (cfs) 2	Min. Channel Elev (ft) 3	Water Surface Elevation (ft) 4	Critical Water Surface (ft) 5	Energy Gradeline Elevation (ft) 6	Energy Gradeline Slope (ft/ft) 7	Average Velocity (ft/s) 8	Flow Area (ft^2) 9	Top Width (ft) 10	Froude # Channel 11	Station where Water Surface meets Existing Ground Left (ft) 12	Station where Water Surface meets Existing Ground Right (ft) 13
195.00	227,000	897.00	912.06	908.48	913.29	0.00154	8.50	26,708.27	4,370.28	0.49	17,212.88	21,979.17
194.91	227,000	896.90	911.44	907.63	912.52	0.00144	7.90	28,732.25	4,974.02	0.47	17,089.17	22,135.57
194.81	227,000	896.00	911.17	905.84	911.89	0.00081	6.45	35,180.13	5,169.68	0.37	17,036.10	22,281.87
194.72	227,000	895.70	910.74	905.79	911.47	0.00092	6.62	34,294.99	4,708.56	0.38	16,913.82	22,396.20
194.62	227,000	896.00	910.35	905.58	911.00	0.00085	6.35	35,733.46	5,283.09	0.36	16,691.75	22,404.29
194.53	227,000	895.20	909.85	905.21	910.55	0.00096	6.55	34,658.68	5,328.08	0.38	16,349.65	22,503.40
194.40	227,000	896.00	908.88	904.77	909.79	0.00121	7.30	31,084.47	5,853.53	0.43	16,361.02	22,731.81
194.29	227,000	896.20	906.93	904.97	908.51	0.00279	9.88	22,984.82	5,112.60	0.63	16,823.77	22,220.18
194.21	227,000	883.10	905.98	902.06	907.46	0.00159	9.76	23,258.21	2,988.54	0.52	17,414.00	21,242.65
194.21	Bridge											
194.20	227,000	882.97	905.66	901.99	907.21	0.00172	9.98	22,734.70	2,491.01	0.54	18,396.21	21,242.27
194.10	227,000	883.87	904.98	901.14	906.26	0.00150	9.08	25,013.46	4,412.61	0.50	16,687.75	22,709.69
194.02	227,000	885.49	904.41	900.33	905.51	0.00135	8.40	27,030.96	4,291.92	0.46	16,820.13	22,783.13
193.94	227,000	885.38	904.05	899.39	904.95	0.00112	7.56	30,028.25	4,697.20	0.41	17,244.09	22,857.79
193.87	227,000	882.80	903.69	898.76	904.49	0.00101	7.04	32,261.63	4,427.12	0.39	17,628.36	22,935.67
193.79	227,000	882.55	903.27	898.23	904.02	0.00112	6.69	33,924.73	4,083.97	0.38	18,117.93	23,032.46
193.73	227,000	882.18	902.83	898.08	903.65	0.00098	6.98	32,508.52	3,422.12	0.40	18,740.59	22,162.71
193.62	227,000	878.21	902.05	897.98	903.03	0.00122	7.60	29,853.90	3,219.12	0.45	19,051.18	23,203.45
193.53	227,000	878.96	901.51	897.32	902.43	0.00114	7.39	30,700.48	3,344.24	0.43	19,072.85	23,317.95
193.43	227,000	879.37	901.10	896.46	901.88	0.00097	6.88	32,986.82	3,715.24	0.40	18,888.26	23,165.00
193.34	227,000	881.18	900.75	895.90	901.42	0.00084	6.51	34,855.86	3,883.47	0.37	18,786.64	22,969.17
193.25	227,000	880.67	900.33	895.48	900.97	0.00104	6.33	35,885.75	4,130.89	0.37	18,721.88	23,214.23
193.16	227,000	880.66	899.82	895.44	900.50	0.00092	6.51	34,872.23	4,280.54	0.40	18,634.95	23,229.60
193.07	227,000	881.99	899.45	894.72	900.07	0.00081	6.16	36,858.77	4,504.27	0.37	18,643.94	23,273.04
192.98	227,000	880.71	899.02	894.32	899.66	0.00087	6.16	36,825.77	4,501.06	0.37	18,928.62	24,878.79

Table 5.6 Summary of HEC-RAS Model Results for Corrected Effective Model – Without Levee - Continued

River Sta (miles)	Peak Discharge (cfs)	Min. Channel Elev (ft)	Water Surface Elevation (ft)	Critical Water Surface (ft)	Energy Gradeline Elevation (ft)	Energy Gradeline Slope (ft/ft)	Average Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)	Froude # Channel	Station where Water Surface meets Existing Ground Left (ft)	Station where Water Surface meets Existing Ground Right (ft)
1	2	3	4	5	6	7	8	9	10	11	12	13
192.89	227,000	880.09	898.37	894.01	899.12	0.00135	6.41	35,398.90	5,078.22	0.40	19,110.77	24,350.98
192.79	227,000	876.81	897.48	893.64	898.35	0.00174	6.68	33,968.24	5,344.69	0.44	19,297.37	24,708.11
192.70	227,000	876.64	896.65	892.33	897.59	0.00135	6.55	34,645.14	5,675.95	0.43	19,297.85	25,035.07
192.61	227,000	878.15	896.06	891.72	896.98	0.00116	6.48	35,045.62	5,866.10	0.43	19,101.63	25,156.22
192.52	227,000	878.23	895.44	890.81	896.39	0.00115	6.72	33,791.54	6,069.18	0.42	19,204.41	25,385.54
192.42	227,000	876.63	894.76	891.45	895.76	0.00135	7.11	31,931.56	5,803.19	0.46	19,106.62	25,487.06
192.33	227,000	876.06	893.82	890.83	895.00	0.00163	7.54	30,105.49	5,961.39	0.50	18,871.87	25,520.50
192.23	227,000	876.72	893.24	889.65	894.16	0.00143	6.77	33,551.08	5,881.42	0.44	18,795.27	25,321.64
192.14	227,000	875.94	892.61	889.42	893.46	0.00138	6.45	35,167.20	6,569.82	0.44	18,684.52	25,373.48
192.04	227,000	876.36	892.06	888.54	892.78	0.00120	5.96	38,113.39	6,331.97	0.41	18,631.19	25,016.22
191.95	227,000	874.98	891.56	887.60	892.20	0.00104	5.70	39,814.73	6,278.79	0.39	18,577.09	24,885.23
191.86	227,000	874.43	891.08	886.73	891.68	0.00101	5.61	40,498.52	6,173.49	0.38	17,438.33	24,831.86
191.76	227,000	874.62	890.60	886.58	891.15	0.00105	5.33	42,620.77	6,548.10	0.37	18,475.93	25,024.03
191.67	227,000	872.60	890.03	886.43	890.59	0.00117	5.50	41,272.22	6,270.14	0.39	18,453.49	24,865.66
191.57	227,000	870.63	889.55	885.66	890.02	0.00100	5.15	44,050.98	6,246.39	0.36	17,004.08	24,645.39
191.48	227,000	870.93	889.10	884.98	889.55	0.00086	5.03	45,106.36	7,075.78	0.34	17,321.50	26,352.44
191.38	227,000	871.69	888.62	884.78	889.09	0.00096	5.13	44,213.48	6,621.80	0.35	17,595.16	24,224.36
191.29	227,000	870.63	888.20	883.87	888.62	0.00086	4.94	45,929.80	6,934.29	0.33	17,006.23	24,046.05
191.19	227,000	869.78	887.79	882.93	888.21	0.00080	4.97	45,668.52	7,259.78	0.31	16,883.95	27,498.49
191.10	227,000	870.88	887.44	882.08	887.85	0.00064	4.89	46,420.29	7,374.02	0.30	16,881.09	27,953.45
191.00	227,000	869.64	887.05	881.88	887.51	0.00070	5.15	44,116.21	7,043.55	0.31	16,775.67	27,827.01
190.91	227,000	867.98	886.63	881.54	887.13	0.00080	5.30	42,809.86	7,269.76	0.32	16,652.40	28,081.31
190.81	227,000	867.86	886.27	881.12	886.75	0.00069	5.22	43,515.63	7,494.50	0.32	16,638.51	28,250.70
190.72	227,000	866.30	885.93	880.48	886.40	0.00069	5.07	44,744.39	7,567.59	0.31	16,683.06	28,421.51
190.62	227,000	867.37	885.56	880.08	886.04	0.00077	5.15	44,095.21	6,953.89	0.31	17,649.36	28,443.75
190.53	227,000	866.16	885.10	879.61	885.61	0.00092	5.41	41,990.17	5,568.45	0.32	18,270.27	28,203.83
190.43	227,000	867.42	884.58	878.92	885.15	0.00092	5.48	41,389.80	5,370.74	0.33	18,311.10	28,498.54

Table 5.6 Summary of HEC-RAS Model Results for Corrected Effective Model – Without Levee - Continued

River Sta (miles)	Peak Discharge (cfs)	Min. Channel Elev (ft)	Water Surface Elevation (ft)	Critical Water Surface (ft)	Energy Gradeline Elevation (ft)	Energy Gradeline Slope (ft/ft)	Average Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)	Froude # Channel	Station where Water Surface meets Existing Ground Left (ft)	Station where Water Surface meets Existing Ground Right (ft)
1	2	3	4	5	6	7	8	9	10	11	12	13
190.34	227,000	866.61	884.11	878.36	884.67	0.00099	5.37	42,309.69	5,453.74	0.33	18,344.86	28,948.38
190.24	227,000	866.29	883.58	877.78	884.13	0.00112	5.28	42,974.58	5,162.69	0.33	18,253.82	28,926.73
190.15	227,000	865.74	882.72	878.04	883.49	0.00146	6.14	36,946.05	4,887.60	0.40	17,970.61	28,963.16
190.05	227,000	858.06	882.10	875.75	882.72	0.00139	5.36	42,321.89	5,183.88	0.35	18,286.64	29,166.69
189.96	227,000	857.56	881.46	875.66	882.06	0.00132	5.45	41,646.34	5,994.58	0.34	18,389.61	29,395.48
189.87	227,000	862.94	880.80	874.83	881.37	0.00151	5.34	42,478.85	5,961.75	0.34	18,431.87	29,647.96
189.77	227,000	860.75	880.30	873.42	880.71	0.00091	4.58	49,580.35	9,166.13	0.28	18,347.91	29,847.25
189.67	227,000	862.77	879.81	873.14	880.24	0.00090	4.64	48,887.17	9,148.01	0.28	18,141.59	29,581.68
189.58	227,000	857.92	879.34	872.76	879.76	0.00100	4.60	49,366.23	9,112.92	0.28	18,149.62	29,598.80
189.48	227,000	857.85	878.93	871.94	879.31	0.00078	4.47	50,748.71	9,789.47	0.26	18,302.26	29,726.47
189.39	227,000	855.02	878.58	871.32	878.95	0.00064	4.36	52,034.00	10,236.19	0.26	18,355.89	30,031.79
189.30	227,000	856.36	878.25	871.53	878.63	0.00084	4.48	50,633.75	10,089.01	0.27	18,348.35	30,114.57
189.21	227,000	856.97	877.83	870.89	878.18	0.00097	4.46	50,889.97	9,761.26	0.26	18,287.88	30,317.45
189.11	227,000	857.40	877.35	869.73	877.68	0.00096	4.35	52,170.65	9,434.89	0.25	18,185.10	30,515.60
189.02	227,000	855.16	876.85	868.98	877.19	0.00096	4.35	52,162.66	9,211.87	0.26	17,733.98	30,025.99
188.81	227,000	852.25	876.09	866.91	876.42	0.00053	4.34	52,309.21	8,415.25	0.23	17,691.77	30,189.43
188.69	227,000	850.62	875.64	868.19	876.02	0.00086	4.76	47,656.55	8,476.33	0.26	17,710.53	30,337.22
188.59	227,000	852.76	875.22	868.14	875.55	0.00084	4.51	50,356.12	9,087.30	0.26	17,774.44	30,541.09
188.50	227,000	852.73	874.87	867.21	875.19	0.00066	4.34	52,281.70	9,430.57	0.24	17,981.43	30,715.02
188.39	227,000	852.73	874.50	866.13	874.83	0.00063	4.41	51,428.02	8,574.63	0.24	18,228.35	31,750.69
188.29	227,000	852.62	874.12	866.08	874.49	0.00068	4.60	49,349.50	7,572.93	0.25	18,374.89	26,275.88
188.20	227,000	852.50	873.79	864.43	874.24	0.00038	4.90	46,344.16	6,831.61	0.25	18,525.04	25,469.41
188.10	227,000	850.29	873.35	864.63	873.92	0.00104	5.60	40,505.92	6,471.46	0.28	19,005.20	26,045.80
188.07	227,000	849.32	872.98	864.69	873.74	0.00064	6.33	35,837.88	5,491.49	0.32	19,114.55	25,797.52
188.06	Bridge											
188.04	227,000	849.15	872.95	864.98	873.71	0.00069	6.03	37,619.47	5,982.72	0.33	19,126.97	25,838.95
188.00	227,000	848.62	872.83	866.60	873.50	0.00068	5.90	38,490.64	6,770.00	0.35	18,047.96	29,716.11

Table 5.6 Summary of HEC-RAS Model Results for Corrected Effective Model – Without Levee - Continued

River Sta (miles)	Peak Discharge (cfs)	Min. Channel Elev (ft)	Water Surface Elevation (ft)	Critical Water Surface (ft)	Energy Gradeline Elevation (ft)	Energy Gradeline Slope (ft/ft)	Average Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)	Froude # Channel	Station where Water Surface meets Existing Ground Left (ft)	Station where Water Surface meets Existing Ground Right (ft)
1	2	3	4	5	6	7	8	9	10	11	12	13
187.91	227,000	848.62	872.48	864.99	873.12	0.00075	5.97	38,024.59	5,679.51	0.35	18,929.22	29,753.96
187.82	227,000	848.62	871.94	864.07	872.55	0.00219	6.26	36,263.21	5,264.33	0.34	19,023.81	29,750.95
187.73	227,000	848.62	871.30	863.24	871.87	0.00102	5.99	37,870.85	5,318.44	0.33	18,832.24	29,766.35
187.64	227,000	848.72	870.79	864.00	871.47	0.00075	6.30	36,027.09	4,660.03	0.36	18,625.62	29,757.80
187.54	227,000	849.28	870.51	863.69	871.11	0.00072	6.11	37,172.73	4,371.64	0.34	17,528.92	29,667.42
187.45	227,000	849.28	870.30	863.05	870.78	0.00061	5.40	42,067.82	5,807.81	0.30	18,013.67	29,633.99
187.36	227,000	847.91	869.92	862.03	870.47	0.00061	5.63	40,288.91	7,305.65	0.31	17,949.61	29,602.65
187.24	227,000	848.31	869.57	861.17	870.07	0.00063	5.41	41,963.89	7,928.73	0.28	18,458.62	30,880.54
187.15	227,000	846.94	869.37	860.15	869.78	0.00048	4.88	46,493.34	9,772.17	0.26	18,374.07	30,854.71
187.06	227,000	843.81	869.25	861.34	869.54	0.00033	4.29	52,930.32	9,541.90	0.22	18,362.26	29,718.70

Table 5.7 Summary of HEC-RAS model results for Corrected Effective Model – With Levee

River Sta (miles) 1	Peak Discharge (cfs) 2	Min. Channel Elev (ft) 3	Water Surface Elevation (ft) 4	Critical Water Surface (ft) 5	Energy Elevation (ft) 6	Gradeline Slope (ft/ft) 7	Average Velocity (ft/s) 8	Flow Area (ft^2) 9	Top Width (ft) 10	Froude # Channel 11	Station where Water Surface meets Existing Ground Left (ft) 12	Station where Water Surface meets Existing Ground Right (ft) 13
195.00	227,000	897.00	912.06	908.48	913.29	0.00154	8.50	26,708.27	4,370.28	0.49	17,212.88	21,979.17
194.91	227,000	896.90	911.44	907.63	912.52	0.00144	7.90	28,732.25	4,974.02	0.47	17,089.17	22,135.57
194.81	227,000	896.00	911.17	905.84	911.89	0.00081	6.45	35,180.13	5,169.68	0.37	17,036.10	22,281.87
194.72	227,000	895.70	910.74	905.79	911.47	0.00092	6.62	34,294.99	4,708.56	0.38	16,913.82	22,396.20
194.62	227,000	896.00	910.35	905.58	911.00	0.00085	6.35	35,733.46	5,283.09	0.36	16,691.75	22,404.29
194.53	227,000	895.20	909.85	905.21	910.55	0.00096	6.55	34,658.68	5,328.08	0.38	16,349.65	22,503.40
194.40	227,000	896.00	908.88	904.77	909.79	0.00121	7.30	31,084.47	5,853.53	0.43	16,361.02	22,731.81
194.29	227,000	896.20	906.93	904.97	908.51	0.00279	9.88	22,984.82	5,112.60	0.63	16,823.77	22,220.18
194.21	227,000	883.10	905.98	902.06	907.46	0.00159	9.76	23,258.21	2,988.54	0.52	17,414.00	21,242.65
194.21	Bridge											
194.20	227,000	882.97	905.66	901.99	907.21	0.00172	9.98	22,734.70	2,491.01	0.54	18,396.21	21,242.27
194.10	227,000	883.87	904.98	901.14	906.26	0.00150	9.08	25,013.46	4,412.61	0.50	16,687.75	22,709.69
194.02	227,000	885.49	904.41	900.33	905.51	0.00135	8.40	27,030.96	4,291.92	0.46	16,820.13	22,783.13
193.94	227,000	885.38	904.05	899.39	904.95	0.00112	7.56	30,028.25	4,697.20	0.41	17,244.09	22,857.79
193.87	227,000	882.80	903.69	898.76	904.49	0.00101	7.04	32,261.63	4,427.12	0.39	17,628.36	22,935.67
193.79	227,000	882.55	903.27	898.23	904.02	0.00112	6.69	33,924.73	4,083.97	0.38	18,117.93	23,032.46
193.73	227,000	882.18	902.83	898.08	903.65	0.00098	6.98	32,508.52	3,422.12	0.40	18,740.59	22,162.71
193.62	227,000	878.21	902.05	897.98	903.03	0.00122	7.60	29,853.90	3,219.12	0.45	19,051.18	23,203.45
193.53	227,000	878.96	901.51	897.32	902.43	0.00114	7.39	30,700.48	3,344.24	0.43	19,072.85	23,317.95
193.43	227,000	879.37	901.10	896.46	901.88	0.00097	6.88	32,986.82	3,715.24	0.40	18,888.26	23,165.00
193.34	227,000	881.18	900.75	895.90	901.42	0.00084	6.51	34,855.86	3,883.47	0.37	18,786.64	22,969.17
193.25	227,000	880.67	900.33	895.48	900.97	0.00104	6.33	35,885.75	4,130.89	0.37	18,721.88	23,214.23
193.16	227,000	880.66	899.82	895.44	900.50	0.00092	6.51	34,872.23	4,280.54	0.40	18,634.95	23,229.60
193.07	227,000	881.99	899.45	894.72	900.07	0.00081	6.16	36,858.77	4,504.27	0.37	18,643.94	23,273.04
192.98	227,000	880.71	899.02	894.32	899.66	0.00087	6.16	36,825.77	4,501.06	0.37	18,928.62	24,878.79
192.89	227,000	880.09	898.37	894.01	899.12	0.00135	6.41	35,399.20	5,078.24	0.40	19,110.76	24,351.00
192.79	227,000	876.81	897.48	893.64	898.35	0.00174	6.68	33,969.19	5,344.71	0.44	19,297.37	24,708.11

Table 5.7 Summary of HEC-RAS model results for Corrected Effective Model – With Levee - Continued

River Sta (miles) 1	Peak Discharge (cfs) 2	Min. Channel Elev (ft) 3	Water Surface Elevation (ft) 4	Critical Water Surface (ft) 5	Energy Gradeline Elevation (ft) 6	Energy Gradeline Slope (ft/ft) 7	Average Velocity (ft/s) 8	Flow Area (ft^2) 9	Top Width (ft) 10	Froude # Channel 11	Station where Water Surface meets Existing Ground Left (ft) 12	Station where Water Surface meets Existing Ground Right (ft) 13
192.70	227,000	876.64	896.65	892.33	897.59	0.00135	6.55	34,646.51	5,675.97	0.43	19,297.85	25,035.07
192.61	227,000	878.15	896.06	891.72	896.98	0.00116	6.48	35,047.27	5,866.16	0.43	19,101.63	25,156.22
192.52	227,000	878.23	895.44	890.81	896.39	0.00115	6.72	33,793.74	6,069.23	0.42	19,204.40	25,385.54
192.42	227,000	876.63	894.76	891.45	895.76	0.00135	7.11	31,934.25	5,803.33	0.46	19,106.62	25,487.06
192.33	227,000	876.06	893.82	890.83	895.00	0.00163	7.54	30,110.13	5,961.69	0.50	18,871.87	25,520.50
192.23	227,000	876.72	893.24	889.65	894.16	0.00142	6.76	33,557.55	5,881.84	0.44	18,795.27	25,321.65
192.14	227,000	875.94	892.61	889.42	893.46	0.00138	6.45	35,177.02	6,569.96	0.44	18,684.51	25,373.48
192.04	227,000	876.36	892.06	888.54	892.78	0.00120	5.95	38,126.83	6,332.16	0.41	18,631.17	25,016.22
191.95	227,000	874.98	891.56	887.60	892.21	0.00104	5.70	39,831.59	6,278.96	0.39	18,577.08	24,885.26
191.86	227,000	874.43	891.08	886.73	891.68	0.00101	5.60	40,519.24	6,174.46	0.38	17,438.32	24,832.74
191.76	227,000	874.62	890.61	886.58	891.15	0.00105	5.32	42,648.16	6,548.31	0.37	18,475.91	25,024.22
191.67	227,000	872.60	890.04	886.43	890.60	0.00116	5.50	41,308.19	6,270.43	0.39	18,453.46	24,865.72
191.57	227,000	870.63	889.56	885.66	890.03	0.00100	5.15	44,096.36	6,247.54	0.36	17,004.03	24,645.43
191.48	227,000	870.93	889.11	884.98	889.56	0.00086	5.03	45,168.46	7,088.51	0.34	17,320.95	26,352.49
191.38	227,000	871.69	888.64	884.78	889.10	0.00096	5.13	44,289.06	6,622.50	0.35	17,595.07	24,224.82
191.29	227,000	870.63	888.21	883.87	888.64	0.00086	4.93	46,025.03	6,936.09	0.33	17,006.03	26,807.35
191.19	227,000	869.78	887.80	882.93	888.22	0.00079	4.96	45,778.77	7,292.31	0.31	16,883.06	27,499.34
191.10	227,000	870.88	887.46	882.08	887.87	0.00064	4.88	46,540.07	7,402.90	0.29	16,879.63	27,955.23
191.00	227,000	869.64	887.07	881.88	887.53	0.00070	5.13	44,253.62	7,097.35	0.31	16,775.61	27,833.17
190.91	227,000	867.98	886.66	881.54	887.15	0.00080	5.28	42,977.24	7,291.96	0.32	16,652.28	28,095.35
190.81	227,000	867.86	886.30	881.12	886.78	0.00069	5.19	43,707.86	7,510.08	0.32	16,638.07	28,256.91
190.72	227,000	866.30	885.97	880.48	886.43	0.00068	5.05	44,956.09	7,589.96	0.31	16,682.89	28,432.96
190.62	227,000	867.37	885.60	880.08	886.07	0.00076	5.12	44,320.05	6,974.84	0.31	17,649.24	28,458.45
190.53	227,000	866.16	885.15	879.61	885.65	0.00091	5.38	42,215.24	5,579.55	0.32	18,270.10	28,213.25
190.43	227,000	867.42	884.63	878.92	885.20	0.00090	5.45	41,642.74	5,389.77	0.33	18,310.12	28,511.09
190.34	227,000	866.61	884.17	878.36	884.72	0.00097	5.33	42,593.79	5,482.69	0.33	18,340.61	28,971.48
190.24	227,000	866.29	883.65	877.78	884.20	0.00110	5.24	43,305.52	5,204.14	0.32	18,251.52	28,952.74

Table 5.7 Summary of HEC-RAS model results for Corrected Effective Model – With Levee - Continued

River Sta (miles) 1	Peak Discharge (cfs) 2	Min. Channel Elev (ft) 3	Water Surface Elevation (ft) 4	Critical Water Surface (ft) 5	Energy Gradeline Elevation (ft) 6	Energy Gradeline Slope (ft/ft) 7	Average Velocity (ft/s) 8	Flow Area (ft^2) 9	Top Width (ft) 10	Froude # Channel 11	Station where Water Surface meets Existing Ground Left (ft) 12	Station where Water Surface meets Existing Ground Right (ft) 13
190.15	227,000	865.74	882.82	878.04	883.57	0.00142	6.07	37,382.63	4,963.93	0.40	17,968.27	29,004.73
190.05	227,000	858.06	882.22	875.75	882.82	0.00134	5.30	42,837.54	5,274.17	0.34	18,286.30	29,207.82
189.96	227,000	857.56	881.61	875.66	882.20	0.00126	5.37	42,301.07	6,602.23	0.34	18,389.06	29,445.67
189.87	227,000	862.94	880.99	874.83	881.54	0.00142	5.23	43,379.57	6,841.86	0.33	18,431.62	29,709.39
189.77	227,000	860.75	880.53	873.42	880.92	0.00085	4.47	50,729.54	9,322.28	0.27	18,347.25	29,847.58
189.67	227,000	862.77	880.08	873.14	880.48	0.00083	4.51	50,344.70	9,877.84	0.27	18,140.35	29,644.53
189.58	227,000	857.92	879.65	872.76	880.04	0.00091	4.44	51,146.96	9,782.88	0.27	18,146.63	29,677.64
189.48	227,000	857.85	879.28	871.94	879.63	0.00071	4.30	52,779.89	10,661.14	0.25	18,301.31	29,797.88
189.39	227,000	855.02	878.97	871.32	879.31	0.00057	4.17	54,421.47	10,833.23	0.24	18,354.80	30,133.55
189.30	227,000	856.36	878.68	871.53	879.02	0.00073	4.25	53,416.89	11,003.12	0.25	18,346.68	30,460.13
189.21	227,000	856.97	878.33	870.89	878.64	0.00081	4.18	54,252.33	11,071.77	0.24	18,287.34	30,577.09
189.11	227,000	857.40	877.94	869.73	878.23	0.00078	4.03	56,307.33	10,817.13	0.23	18,184.34	30,636.29
189.02	227,000	855.16	877.55	868.98	877.84	0.00074	3.95	57,441.31	10,614.34	0.23	17,730.74	30,758.84
188.81	227,000	852.25	876.90	866.93	877.21	0.00046	4.45	51,024.43	4,506.70	0.22	17,686.73	22,193.43
188.69	227,000	850.62	876.45	868.19	876.84	0.00080	5.00	45,366.09	4,323.07	0.25	17,708.79	22,031.87
188.59	227,000	852.76	876.05	868.11	876.39	0.00078	4.73	47,946.88	4,163.01	0.25	17,772.26	21,935.28
188.50	227,000	852.73	875.69	867.21	876.04	0.00065	4.73	47,954.80	3,902.98	0.24	17,979.97	21,882.95
188.39	227,000	852.73	875.31	866.13	875.67	0.00062	4.85	46,831.10	3,654.71	0.24	18,227.28	21,881.98
188.29	227,000	852.62	874.92	866.08	875.32	0.00067	5.08	44,715.69	3,438.00	0.24	18,372.05	21,810.05
188.20	227,000	852.50	874.60	864.43	875.08	0.00036	5.45	41,663.12	3,093.59	0.25	18,521.50	21,615.09
188.10	227,000	850.29	874.06	864.63	874.75	0.00110	6.45	35,180.98	2,473.78	0.29	19,002.64	21,476.43
188.07	227,000	849.32	873.57	864.69	874.55	0.00072	7.96	28,525.15	1,737.63	0.35	19,113.40	20,851.03
188.06	Bridge											
188.04	227,000	849.15	873.42	864.98	874.48	0.00081	8.25	27,524.33	1,727.66	0.36	19,126.04	20,853.69
188.00	227,000	848.62	873.14	866.60	874.25	0.00095	8.31	27,328.50	6,874.35	0.41	18,043.14	29,717.00
187.91	227,000	848.62	872.76	864.99	873.69	0.00096	7.67	29,612.00	5,733.81	0.39	18,916.84	29,754.63
187.82	227,000	848.62	872.00	864.08	872.94	0.00343	7.77	29,209.60	5,287.84	0.42	19,023.50	29,751.13

Table 5.7 Summary of HEC-RAS model results for Corrected Effective Model – With Levee - Continued

River Sta (miles) 1	Peak Discharge (cfs) 2	Min. Channel Elev (ft) 3	Water Surface Elevation (ft) 4	Critical Water Surface (ft) 5	Energy Gradeline Elevation (ft) 6	Energy Gradeline Slope (ft/ft) 7	Average Velocity (ft/s) 8	Flow Area (ft^2) 9	Top Width (ft) 10	Froude # Channel 11	Station where Water Surface meets Existing Ground Left (ft) 12	Station where Water Surface meets Existing Ground Right (ft) 13
187.73	227,000	848.62	871.20	863.24	871.92	0.00128	6.78	33,465.38	5,173.14	0.37	18,832.48	29,764.31
187.64	227,000	848.72	870.79	863.98	871.47	0.00076	6.31	35,975.89	4,658.79	0.36	18,625.69	29,757.80
187.54	227,000	849.28	870.51	863.69	871.11	0.00072	6.11	37,172.73	4,371.64	0.34	17,528.92	29,667.42
187.45	227,000	849.28	870.30	863.05	870.78	0.00061	5.40	42,067.82	5,807.81	0.30	18,013.67	29,633.99
187.36	227,000	847.91	869.92	862.03	870.47	0.00061	5.63	40,288.91	7,305.65	0.31	17,949.61	29,602.65
187.24	227,000	848.31	869.57	861.17	870.07	0.00063	5.41	41,963.89	7,928.73	0.28	18,458.62	30,880.54
187.15	227,000	846.94	869.37	860.15	869.78	0.00048	4.88	46,493.34	9,772.17	0.26	18,374.07	30,854.71
187.06	227,000	843.81	869.25	861.34	869.54	0.00033	4.29	52,930.32	9,541.90	0.22	18,362.26	29,718.70

Table 5.8 Summary of Results for the Floodway Profile

River Station (miles)	Water Surface Elevation (WSE) Floodplain (ft)	Water Surface Elevation (WSE) Floodway (ft)	Energy Grade Line (EGL) Floodplain (ft)	Energy Grade Line (EGL) Floodway (ft)	Surcharge WSE (ft)	Surcharge EGL (ft)	Floodway Encroachment Station Left (ft)	Floodway Encroachment Station Right (ft)
1	2	3	4	5	6	7	8	9
195.00	912.06	912.32	913.29	913.76	0.26	0.47	18,846.60	20,978.00
194.91	911.44	911.72	912.52	912.93	0.28	0.41	18,830.00	21,286.90
194.81	911.17	911.46	911.89	912.27	0.29	0.38	18,830.90	21,544.50
194.72	910.74	910.98	911.47	911.83	0.24	0.36	18,832.60	21,653.16
194.62	910.35	910.47	911.00	911.32	0.12	0.32	18,871.40	21,793.50
194.53	909.85	909.95	910.55	910.78	0.10	0.23	18,928.90	22,150.00
194.40	908.88	908.97	909.79	909.96	0.09	0.17	19,006.60	22,130.00
194.29	906.93	907.06	908.51	908.67	0.13	0.16	18,945.40	21,792.00
194.21	905.98	906.19	907.46	907.62	0.21	0.16	19,100.00	21,300.00
194.20	905.66	905.85	907.21	907.34	0.19	0.13	19,120.00	21,300.00
194.10	904.98	905.21	906.26	906.45	0.23	0.19	18,875.00	21,370.00
194.02	904.41	904.71	905.51	905.74	0.30	0.23	18,835.00	21,520.00
193.94	904.05	904.38	904.95	905.23	0.33	0.28	18,720.00	21,560.00
193.87	903.69	904.04	904.49	904.83	0.35	0.34	18,620.00	21,522.00
193.79	903.27	903.62	904.02	904.39	0.35	0.37	18,600.00	21,530.00
193.73	902.83	903.22	903.65	904.05	0.39	0.40	18,730.00	21,605.00
193.62	902.05	902.48	903.03	903.46	0.43	0.43	19,045.00	21,760.00
193.53	901.51	901.93	902.43	902.91	0.42	0.48	19,161.00	21,870.00
193.43	901.10	901.60	901.88	902.38	0.50	0.50	18,971.00	21,960.00
193.34	900.75	901.32	901.42	901.95	0.57	0.53	18,870.00	22,270.00
193.25	900.33	900.95	900.97	901.56	0.62	0.59	18,810.00	22,440.00
193.16	899.82	900.53	900.50	901.16	0.71	0.66	18,737.81	22,520.00
193.07	899.45	900.23	900.07	900.80	0.78	0.73	18,740.00	22,520.00
192.98	899.02	899.83	899.66	900.45	0.81	0.79	19,085.00	22,510.34
192.89	898.37	899.27	899.12	899.99	0.90	0.87	19,205.00	22,328.00
192.79	897.48	898.46	898.35	899.36	0.98	1.01	19,300.00	22,200.00
192.70	896.65	897.65	897.59	898.69	1.00	1.10	19,419.00	21,870.00
192.61	896.06	897.06	896.98	898.12	1.00	1.14	19,525.90	22,020.00
192.52	895.44	896.45	896.39	897.55	1.01	1.16	19,575.00	21,975.00
192.42	894.76	895.76	895.76	896.94	1.00	1.18	19,525.00	22,075.00
192.33	893.82	894.82	895.00	896.20	1.00	1.20	19,395.00	22,025.00

Table 5.8 Summary of Results for the Floodway Profile - Continued

River Station (miles)	Water Surface Elevation (WSE) Floodplain (ft)	Water Surface Elevation (WSE) Floodway (ft)	Energy Grade Line (EGL) Floodplain (ft)	Energy Grade Line (EGL) Floodway (ft)	Surcharge WSE (ft)	Surcharge EGL (ft)	Floodway Encroachment Station Left (ft)	Floodway Encroachment Station Right (ft)
1	2	3	4	5	6	7	8	9
192.23	893.24	894.16	894.16	895.37	0.92	1.21	19,430.00	22,075.00
192.14	892.61	893.35	893.46	894.58	0.74	1.12	19,430.00	22,180.00
192.04	892.06	892.68	892.78	893.76	0.62	0.98	19,380.00	22,300.00
191.95	891.56	892.15	892.20	893.04	0.59	0.84	19,360.00	22,403.38
191.86	891.08	891.68	891.68	892.44	0.60	0.76	19,355.00	22,645.22
191.76	890.60	891.10	891.15	891.87	0.50	0.72	19,470.00	22,931.35
191.67	890.03	890.42	890.59	891.21	0.39	0.62	19,580.00	23,282.85
191.57	889.55	889.84	890.02	890.52	0.29	0.50	19,580.00	23,590.00
191.48	889.10	889.39	889.55	889.94	0.29	0.39	19,450.00	23,900.00
191.38	888.62	888.90	889.09	889.45	0.28	0.36	19,550.00	24,139.79
191.29	888.20	888.41	888.62	888.95	0.21	0.33	19,539.60	23,940.60
191.19	887.79	887.98	888.21	888.47	0.19	0.26	19,550.00	23,839.95
191.10	887.44	887.63	887.85	888.08	0.19	0.23	19,520.00	23,771.65
191.00	887.05	887.27	887.51	887.74	0.22	0.23	19,540.83	23,708.25
190.91	886.63	886.87	887.13	887.37	0.24	0.24	19,576.00	23,601.15
190.81	886.27	886.50	886.75	887.01	0.23	0.26	19,595.59	23,581.48
190.72	885.93	886.14	886.40	886.65	0.21	0.25	19,650.00	23,478.12
190.62	885.56	885.75	886.04	886.27	0.19	0.23	19,632.00	23,374.73
190.53	885.10	885.26	885.61	885.83	0.16	0.22	19,600.00	23,238.24
190.43	884.58	884.74	885.15	885.34	0.16	0.19	19,615.00	23,044.14
190.34	884.11	884.25	884.67	884.85	0.14	0.18	19,347.00	22,888.90
190.24	883.58	883.70	884.13	884.30	0.12	0.17	19,147.00	22,712.72
190.15	882.72	882.88	883.49	883.65	0.16	0.16	19,000.00	22,595.26
190.05	882.10	882.24	882.72	882.89	0.14	0.17	18,789.00	22,512.15
189.96	881.46	881.63	882.06	882.23	0.17	0.17	18,618.00	22,534.77
189.87	880.80	881.00	881.37	881.56	0.20	0.19	18,525.00	22,773.88
189.77	880.30	880.50	880.71	880.93	0.20	0.22	18,395.73	22,855.00
189.67	879.81	880.05	880.24	880.47	0.24	0.23	18,198.71	22,740.00
189.58	879.34	879.61	879.76	880.01	0.27	0.25	18,273.51	22,960.00
189.48	878.93	879.22	879.31	879.59	0.29	0.28	18,383.43	23,180.00
189.39	878.58	878.90	878.95	879.25	0.32	0.30	18,428.59	23,275.00
189.30	878.25	878.59	878.63	878.95	0.34	0.32	18,393.23	23,380.00
189.21	877.83	878.21	878.18	878.54	0.38	0.36	18,313.06	23,475.00

Table 5.8 Summary of Results for the Floodway Profile - Continued

River Station	Water Surface Elevation (WSE)		Energy Grade Line (EGL)		Surcharge		Floodway Encroachment Station	
	Floodplain	Floodway	Floodplain	Floodway	WSE	EGL	Left	Right
(miles)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	2	3	4	5	6	7	8	9
189.11	877.35	877.79	877.68	878.10	0.44	0.42	18,196.96	23,600.00
189.02	876.85	877.37	877.19	877.67	0.52	0.48	17,826.77	23,700.00
188.81	876.09	876.73	876.42	877.03	0.64	0.61	17,654.80	23,780.00
188.69	875.64	876.36	876.02	876.69	0.72	0.67	17,705.12	23,720.00
188.59	875.22	876.02	875.55	876.31	0.80	0.76	17,764.80	23,640.00
188.50	874.87	875.72	875.19	876.01	0.85	0.82	17,985.99	23,450.00
188.39	874.50	875.40	874.83	875.71	0.90	0.88	18,219.99	23,400.00
188.29	874.12	875.08	874.49	875.42	0.96	0.93	18,370.74	23,300.00
188.20	873.79	874.79	874.24	875.21	1.00	0.97	18,700.00	23,250.00
188.10	873.35	874.35	873.92	874.93	1.00	1.01	18,969.12	23,100.00
188.07	872.98	873.92	873.74	874.75	0.94	1.01	19,107.54	23,150.00
188.04	872.95	873.81	873.71	874.70	0.86	0.99	19,107.51	23,100.00
188.00	872.83	873.69	873.50	874.49	0.86	0.99	19,064.73	23,010.00
187.91	872.48	873.34	873.12	874.09	0.86	0.97	19,105.10	22,800.00
187.82	871.94	872.80	872.55	873.50	0.86	0.95	19,134.40	22,580.00
187.73	871.30	872.10	871.87	872.76	0.80	0.89	19,064.30	22,350.00
187.64	870.79	871.57	871.47	872.33	0.78	0.86	19,149.80	22,110.00
187.54	870.51	871.26	871.11	871.94	0.75	0.83	19,070.00	22,000.00
187.45	870.30	870.94	870.78	871.62	0.64	0.84	19,030.10	21,860.00
187.36	869.92	870.64	870.47	871.27	0.72	0.80	18,951.60	21,674.60
187.24	869.57	870.22	870.07	870.86	0.65	0.79	18,963.00	21,500.00
187.15	869.37	869.99	869.78	870.52	0.62	0.74	18,686.60	21,500.00
187.06	869.25	869.81	869.54	870.24	0.56	0.70	18,358.98	21,542.00

Table 5.9 Summary of HEC-RAS Model Results for Bridges

River Station (miles) 1	Road Name	Water Surface Elevation (ft) 2	Energy Grade Line Elevation (ft) 3	Peak Discharge (cfs) 4	Discharge Through Structure (cfs) 5	Discharge Over Weir (cfs) 6	Velocity (ft/s) 7	Friction Loss (ft) 8	Contraction Coefficients 9	Expansion Coefficients 10
188.055	Tuthill	872.97	873.74	227,000	227,000	0	6.51	0.03	0.1	0.3
194.205	Estrella	905.70	907.39	227,000	227,000	0	10.44	0.08	0.3	0.5

6.0 EROSION AND SEDIMENT TRANSPORT

Erosion and sediment transport was not conducted as part of this study. This LOMR is based on topographic changes and no new structures are part of the revision.

7.0 DRAFT FIS REPORT DATA

7.1 SUMMARY OF DISCHARGES

Peak discharges used in the hydraulic analysis were obtained from the Effective Study.

7.2 FLOODWAY DATA

Table 7.2 shows the floodplain and floodway elevation for each cross section.

Table 7.1 Floodway Data Table

Floodway Cross Section	Source FEMA Cross Section	Floodway Distance[1] (miles)	Floodway Width (ft)	Floodway Area (sq ft)	Floodway Mean Velocity (fps)	Base Flood Elevations Regulatory[2] (ft)	Base Flood Elevations Without Floodway (ft)	Base Flood Elevations With Floodway (ft)	Base Flood Elevations Increase (ft)
1	2	3	4	5	6	7	8	9	10
187.06		20.727	3,180.85	43,137.12	5.26	869.25	869.25	869.81	0.6
187.15		20.817	2,813.40	38,719.92	5.86	869.37	869.37	869.99	0.6
187.24		20.907	2,537.00	35,499.68	6.39	869.57	869.57	870.22	0.6
187.36	AO	21.027	2,723.00	35,571.88	6.38	869.92	869.92	870.64	0.7
187.45		21.117	2,829.90	34,262.61	6.63	870.30	870.30	870.94	0.6
187.54		21.207	2,930.00	34,356.64	6.61	870.51	870.51	871.26	0.8
187.64		21.307	2,960.20	32,746.32	6.93	870.79	870.79	871.57	0.8
187.73		21.397	3,285.70	34,997.05	6.49	871.30	871.30	872.10	0.8
187.82	AP	21.487	3,445.60	33,798.66	6.72	871.94	871.94	872.80	0.9
187.91		21.577	3,694.90	33,942.63	6.69	872.48	872.48	873.34	0.9
188		21.667	3,938.15	34,135.01	6.65	872.83	872.83	873.69	0.9
188.04		21.707	3,576.03	32,702.59	6.94	873.42/872.95	872.95	873.81	0.9
188.07		21.737	3,514.82	32,874.23	6.91	873.57/872.98	872.98	873.92	0.9
188.1	AQ	21.767	3,968.97	39,382.12	5.76	874.06/873.35	873.35	874.35	1.0
188.2		21.867	4,463.38	46,564.61	4.87	874.60/873.79	873.79	874.79	1.0
188.29		21.957	4,848.57	49,740.31	4.56	874.92/874.12	874.12	875.08	1.0
188.39		22.057	5,096.99	51,993.57	4.37	875.31/874.5	874.50	875.40	0.9
188.5		22.167	5,396.09	53,422.39	4.25	875.69/874.87	874.87	875.72	0.9
188.59	AR	22.257	5,795.56	52,784.22	4.3	876.05/875.22	875.22	876.02	0.8
188.69		22.357	5,894.45	54,934.63	4.55	876.45/875.64	875.64	876.36	0.7
188.81		22.477	5,934.24	58,152.82	4.16	876.90/876.09	876.09	876.73	0.6
189.02		22.687	5,873.23	53,727.31	4.23	877.55/876.85	876.85	877.37	0.5
189.11	AS	22.777	5,403.04	52,593.88	4.32	877.94/877.35	877.35	877.79	0.4
189.21		22.877	5,161.94	50,407.28	4.5	877.83	877.83	878.21	0.4
189.3		22.967	4,986.77	49,959.48	4.54	878.25	878.25	878.59	0.3
189.39		23.057	4,846.41	51,292.96	4.43	878.58	878.58	878.90	0.3

[1] – Miles above Crest of Gillespie Dam

[2] – River Side / Land Side

Table 7.1 Floodway Data Table – Continued

Floodway Source		Floodway				Base Flood Elevations			
Cross Section	FEMA Cross Section	Distance[1] (miles)	Width (ft)	Area (sq ft)	Mean Velocity (fps)	Regulatory[2] (ft)	Without Floodway (ft)	With Floodway (ft)	Increase (ft)
1	2	3	4	5	6	7	8	9	10
189.48		23.147	4,796.57	49,969.90	4.54	878.93	878.93	879.22	0.3
189.58	AT	23.247	4,686.49	48,231.29	4.71	879.34	879.34	879.61	0.3
189.67		23.337	4,541.29	47,985.45	4.73	879.81	879.81	880.05	0.2
189.77		23.437	4,459.27	47,896.42	4.74	880.30	880.30	880.50	0.2
189.87		23.537	4,248.88	42,448.31	5.35	880.80	880.80	881.00	0.2
189.96		23.627	3,916.77	40,375.12	5.62	881.46	881.46	881.63	0.2
190.05	AU	23.717	3,723.15	38,941.23	5.83	882.10	882.10	882.24	0.1
190.15		23.817	3,595.10	34,508.23	6.58	882.72	882.72	882.88	0.2
190.24		23.907	3,565.72	38,228.94	5.94	883.58	883.58	883.70	0.1
190.34		24.007	3,541.90	37,179.54	6.11	884.11	884.11	884.25	0.1
190.43		24.097	3,429.14	36,385.74	6.24	884.58	884.58	884.74	0.2
190.53	AV	24.197	3,638.24	37,706.00	6.02	885.10	885.10	885.26	0.2
190.62		24.287	3,739.19	39,048.63	5.81	885.56	885.56	885.75	0.2
190.72		24.387	3,828.12	39,452.63	5.75	885.93	885.93	886.14	0.2
190.81		24.477	3,985.89	39,862.05	5.69	886.27	886.27	886.50	0.2
190.91	AW	24.577	4,021.61	39,872.31	5.69	886.63	886.63	886.87	0.2
191.00		24.667	4,167.42	41,047.50	5.53	887.05	887.05	887.27	0.2
191.10		24.767	4,251.65	42,399.11	5.35	887.44	887.44	887.63	0.2
191.19		24.857	4,289.95	40,355.13	5.63	887.79	887.79	887.98	0.2
191.29		24.957	4,401.00	39,080.00	5.81	888.20	888.20	888.41	0.2
191.38		25.047	4,589.79	38,823.75	5.85	888.62	888.62	888.90	0.3
191.48	AX	25.147	4,450.00	38,697.61	5.87	889.10	889.10	889.39	0.3
191.57		25.237	4,010.00	34,356.04	6.61	889.55	889.55	889.84	0.3
191.67		25.337	3,702.85	31,971.38	7.1	890.03	890.03	890.42	0.4

[1] – Miles above Crest of Gillespie Dam

[2] – River Side / Land Side

Table 7.1 Floodway Data Table – Continued

Floodway Cross Section	Source FEMA Cross Section	Floodway Distance[1] (miles)	Floodway Width (ft)	Floodway Area (sq ft)	Floodway Mean Velocity (fps)	Base Flood Elevations Regulatory[2] (ft)	Base Flood Elevations Without Floodway (ft)	Base Flood Elevations With Floodway (ft)	Base Flood Elevations Increase (ft)
1	2	3	4	5	6	7	8	9	10
191.76		25.427	3,461.35	32,569.02	6.97	890.60	890.60	891.10	0.5
191.86		25.527	3,290.22	32,506.23	6.98	891.08	891.08	891.68	0.6
191.95	AY	25.617	3,043.38	30,186.39	7.52	891.56	891.56	892.15	0.6
192.04		25.707	2,920.00	27,958.00	8.12	892.06	892.06	892.68	0.6
192.14		25.807	2,750.00	26,359.31	8.61	892.61	892.61	893.35	0.7
192.23		25.897	2,645.00	26,745.61	8.49	893.24	893.24	894.16	0.9
192.33		25.997	2,630.00	25,244.67	8.99	893.82	893.82	894.82	1.0
192.42	AZ	26.087	2,550.00	26,901.43	8.44	894.76	894.76	895.76	1.0
192.52		26.187	2,400.00	27,648.13	8.21	895.44	895.44	896.45	1.0
192.61		26.277	2,494.10	28,345.85	8.01	896.06	896.06	897.06	1.0
192.7		26.367	2,451.00	28,225.23	8.04	896.65	896.65	897.65	1.0
192.79		26.457	2,896.12	30,056.13	7.55	897.48	897.48	898.46	1.0
192.89	BA	26.557	3,123.00	33,348.75	6.81	898.37	898.37	899.27	0.9
192.98		26.647	3,425.34	35,905.89	6.32	899.02	899.02	899.83	0.8
193.07		26.737	3,780.00	37,664.82	6.03	899.45	899.45	900.23	0.8
193.16		26.827	3,782.19	35,774.67	6.35	899.82	899.82	900.53	0.7
193.25		26.917	3,630.00	36,289.44	6.26	900.33	900.33	900.95	0.6
193.34	BB	27.007	3,400.00	35,776.63	6.34	900.75	900.75	901.32	0.6
193.43		27.097	2,989.00	32,090.97	7.07	901.10	901.10	901.60	0.5
193.53		27.197	2,709.00	28,627.97	7.93	901.51	901.51	901.93	0.4
193.62		27.287	2,709.38	28,524.72	7.96	902.05	902.05	902.48	0.4
193.73		27.397	2,864.85	31,082.58	7.3	902.83	902.83	903.22	0.4
193.79	BC	27.457	2,924.53	32,351.12	7.02	903.27	903.27	903.62	0.4
193.87		27.537	2,897.87	31,849.28	7.13	903.69	903.69	904.04	0.3

[1] – Miles above Crest of Gillespie Dam

[2] – River Side / Land Side

Table 7.1 Floodway Data Table – Continued

Floodway Cross Section	Source FEMA Cross Section	Floodway Distance[1] (miles)	Floodway Width (ft)	Floodway Area (sq ft)	Floodway Mean Velocity (fps)	Base Flood Elevations Regulatory[2] (ft)	Base Flood Elevations Without Floodway (ft)	Base Flood Elevations With Floodway (ft)	Base Flood Elevations Increase (ft)
1	2	3	4	5	6	7	8	9	10
193.94		27.607	2,827.14	30,582.11	7.42	904.05	904.05	904.38	0.3
194.02		27.687	2,681.13	27,859.32	8.16	904.41	904.41	904.71	0.3
194.10		27.767	2,447.17	25,548.31	8.89	904.98	904.98	905.21	0.2
194.20	BD	27.867	2,119.11	23,127.52	9.82	905.66	905.66	905.85	0.2
194.21		27.877	2,123.30	23,713.35	9.57	905.98	905.98	906.19	0.2
194.29		27.957	2,846.60	22,727.02	9.99	906.93	906.93	907.06	0.1
194.4		28.067	3,077.52	29,057.57	7.81	908.88	908.88	908.97	0.1
194.53		28.197	3,089.46	31,060.40	7.31	909.85	909.85	909.95	0.1
194.62	BE	28.287	2,913.73	30,674.29	7.4	910.35	910.35	910.47	0.1
194.72		28.387	2,810.30	30,748.75	7.38	910.74	910.74	910.98	0.2
194.81		28.477	2,713.60	31,370.35	7.24	911.17	911.17	911.46	0.3
194.91		28.577	2,456.90	25,744.07	8.82	911.44	911.44	911.72	0.3
195		28.667	2,129.74	23,555.82	9.64	912.06	912.06	912.32	0.3

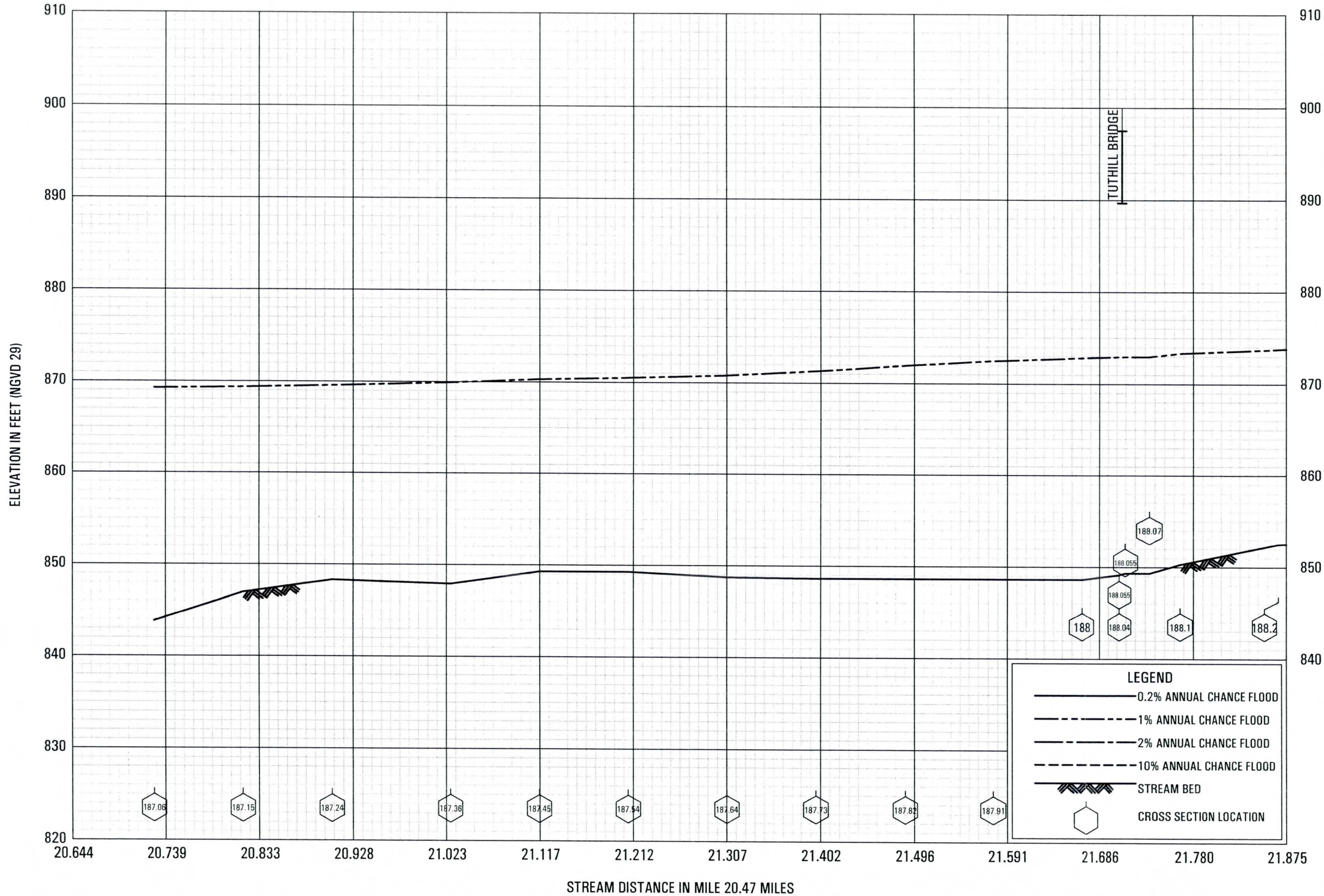
[1] – Miles above Crest of Gillespie Dam
[2] – River Side / Land Side

7.3 ANNOTATED FLOOD INSURANCE RATE MAPS

Annotated FIRM panels are included on the following pages.

7.4 FLOOD PROFILES

The flood profiles are included on the following pages.



FLOOD PROFILES WITHOUT LEVEE

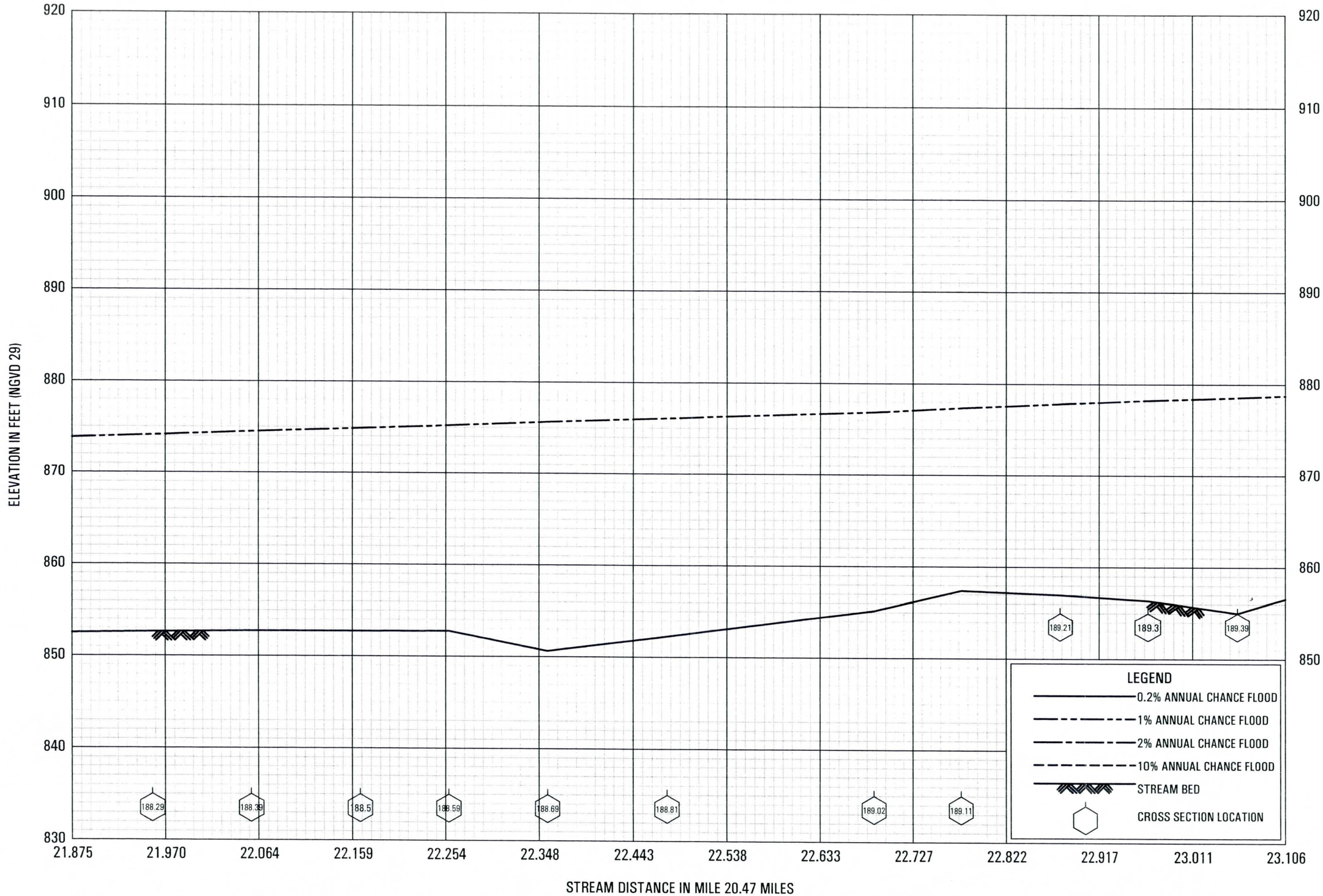
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

01P



FLOOD PROFILES WITHOUT LEVEE

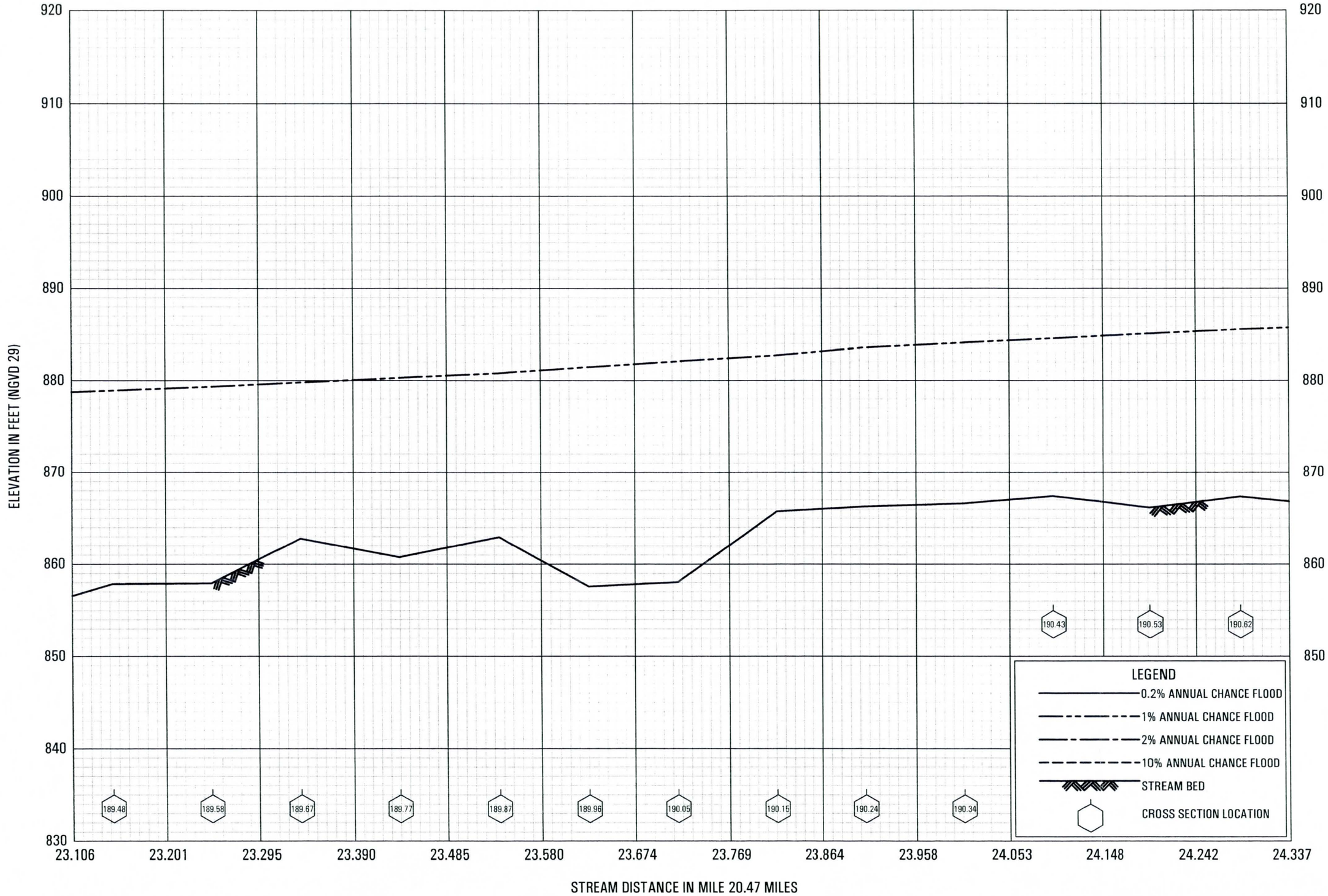
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

02P



FLOOD PROFILES WITHOUT LEVEE

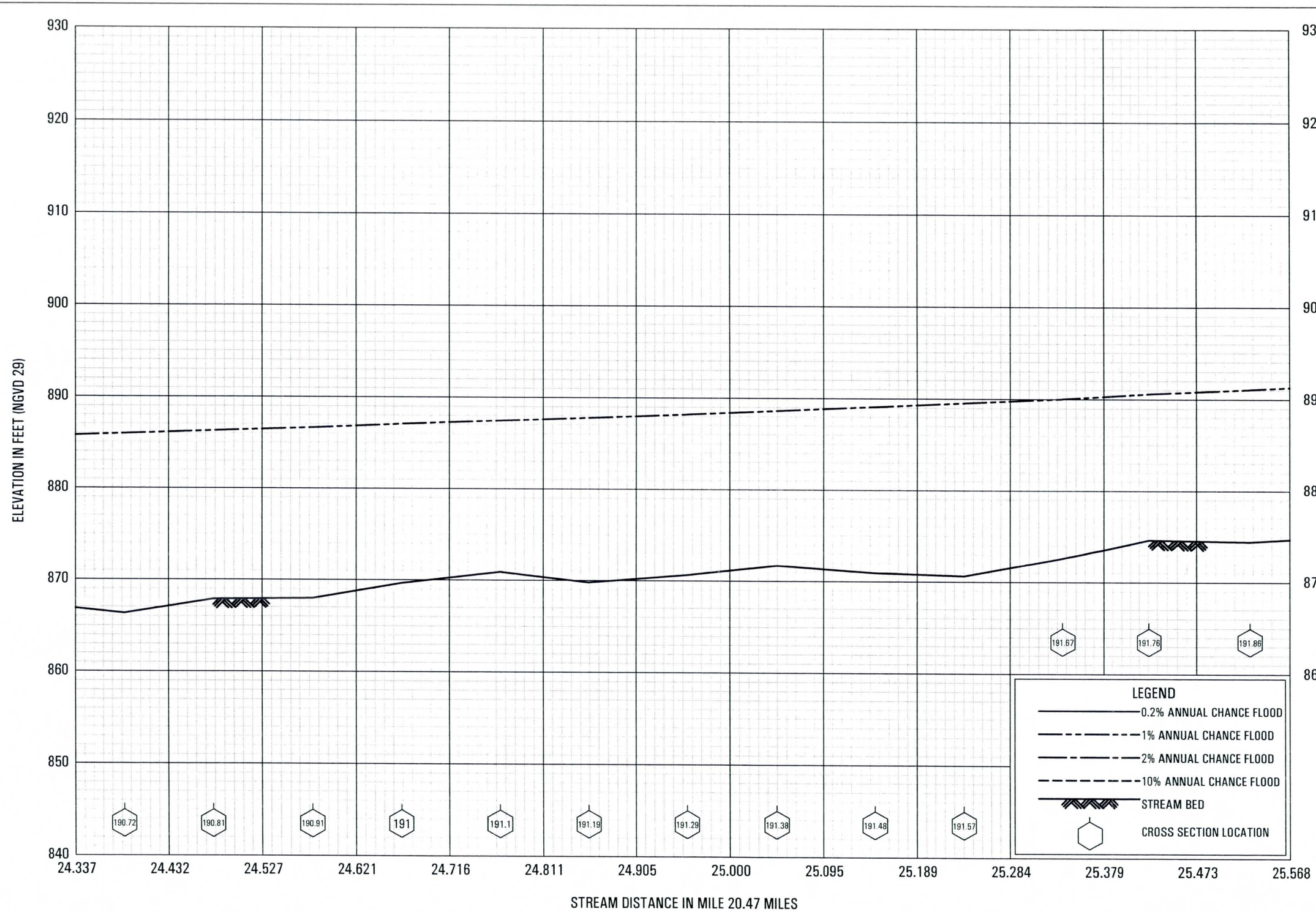
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

03P



FLOOD PROFILES WITHOUT LEVEE

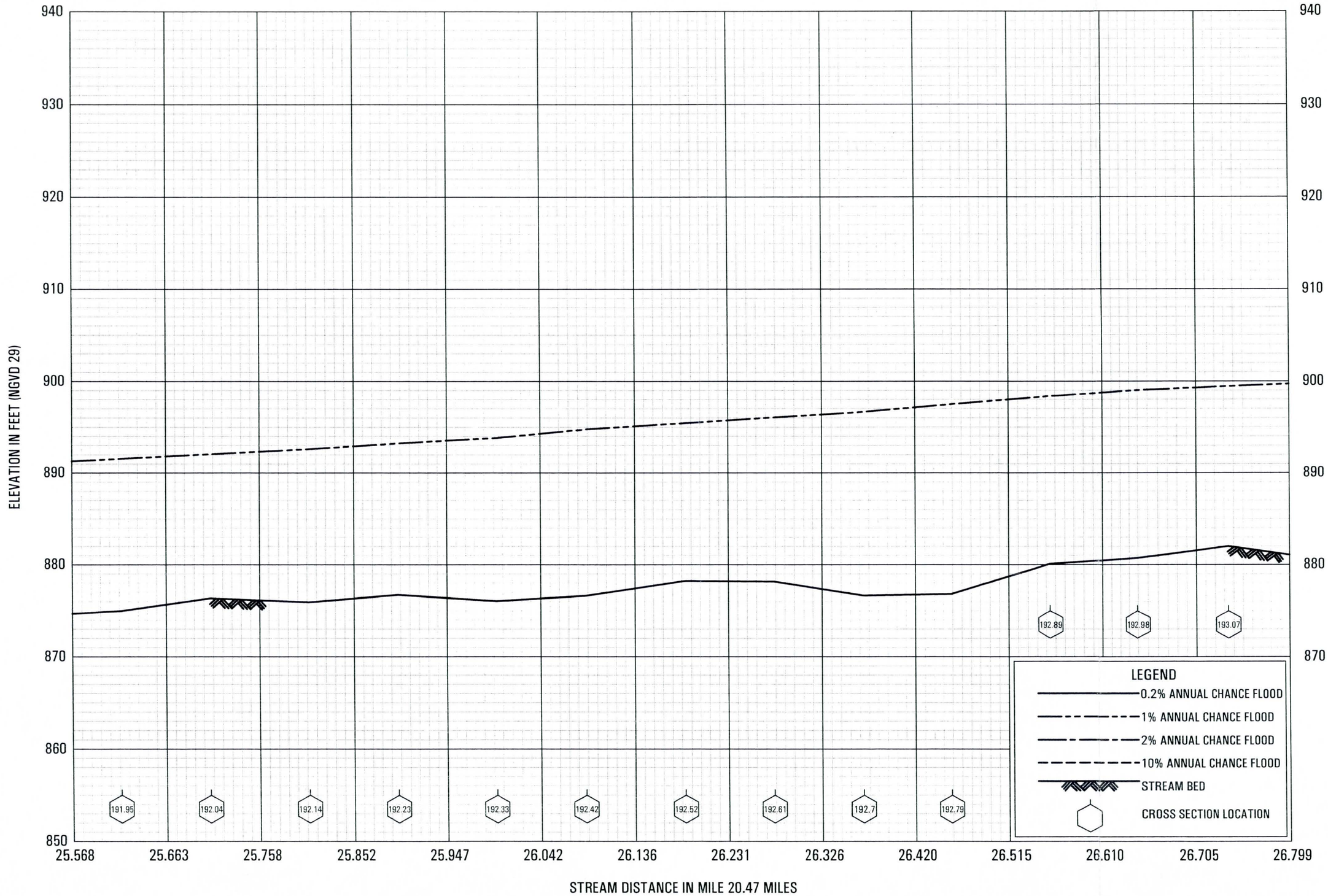
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

04P



FLOOD PROFILES WITHOUT LEVEE

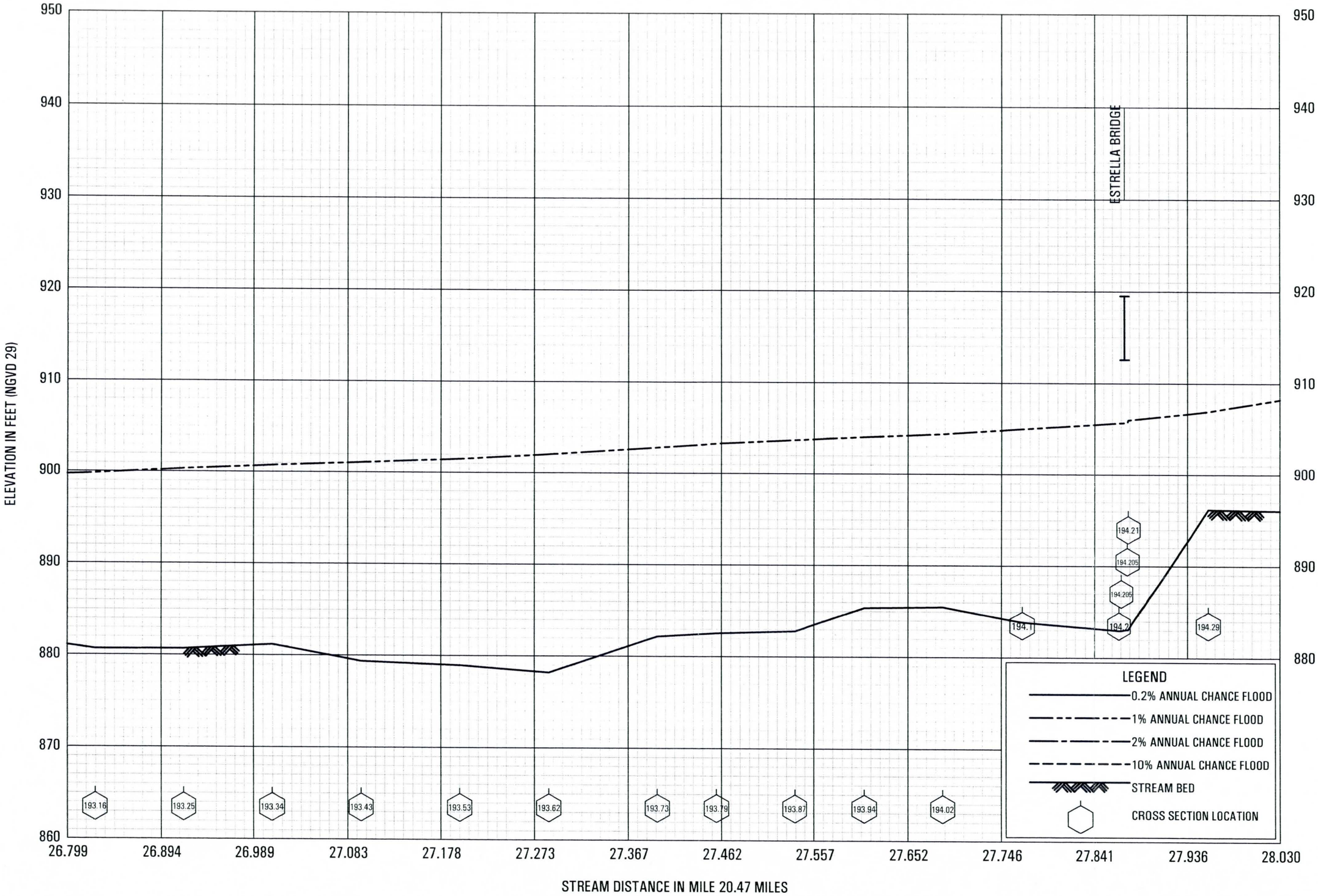
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

05P



FLOOD PROFILES WITHOUT LEVEE

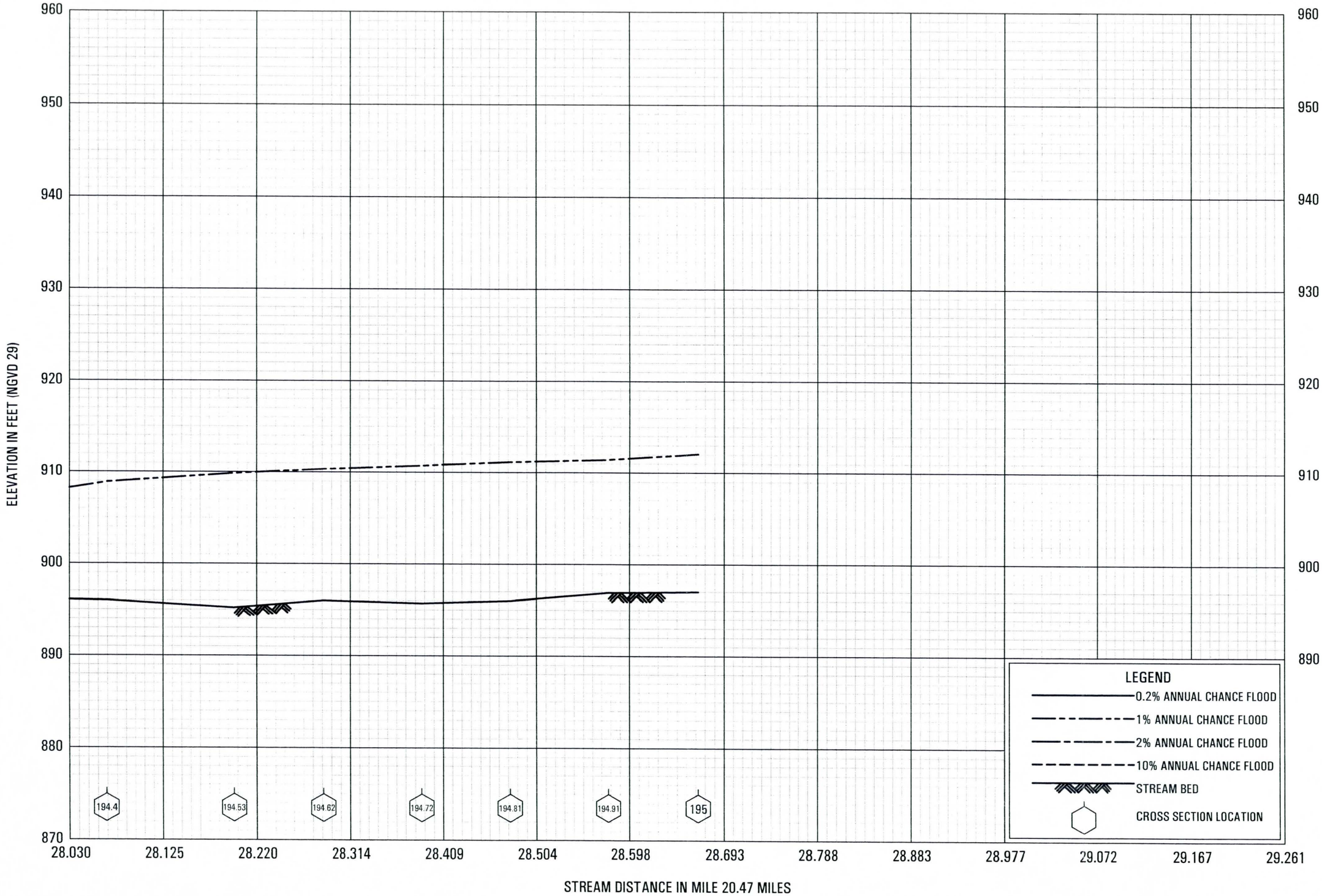
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

06P



FLOOD PROFILES WITHOUT LEVEE

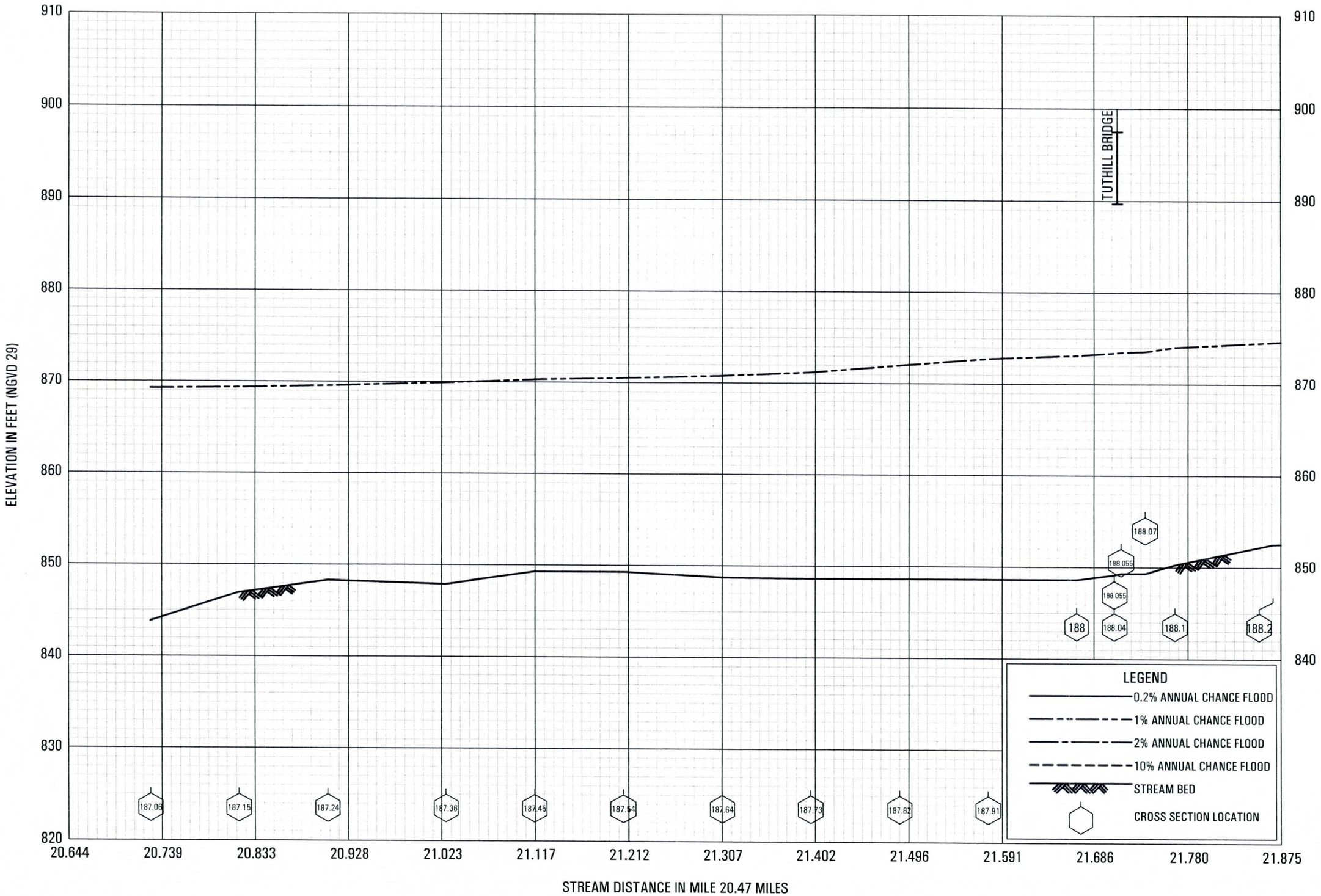
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

07P



FLOOD PROFILES WITH LEVEE

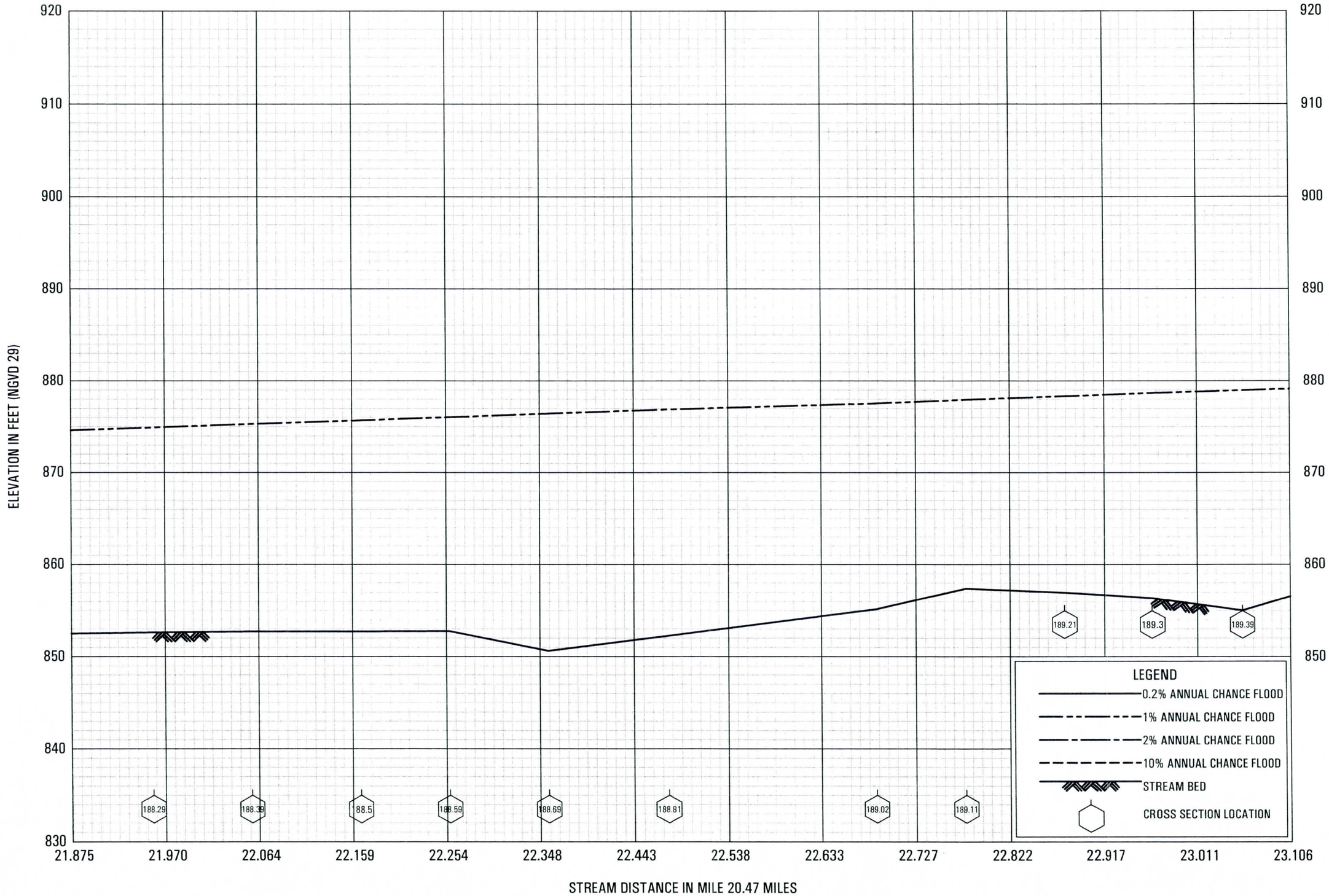
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

01P



FLOOD PROFILES WITH LEVEE

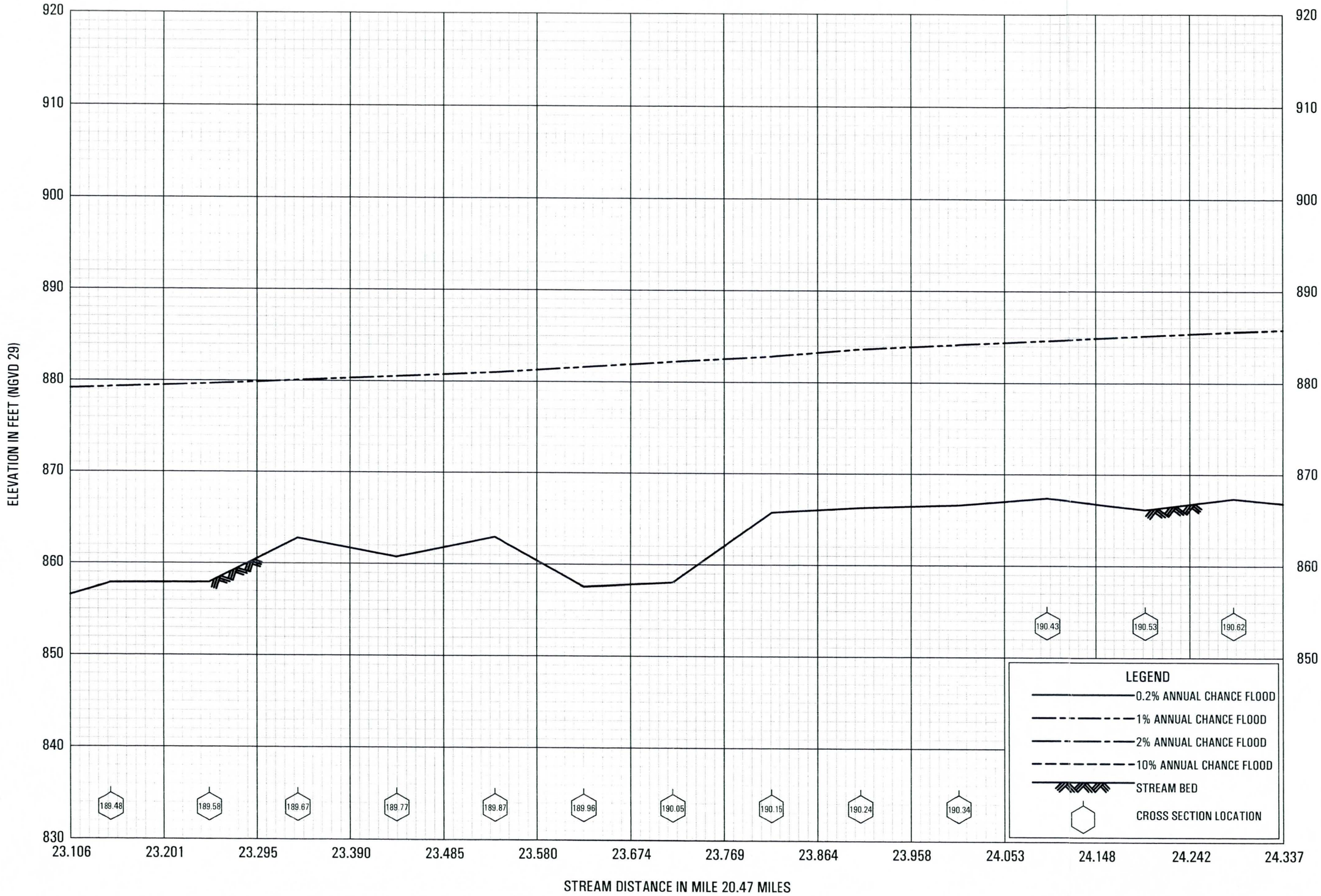
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

02P



FLOOD PROFILES WITH LEVEE

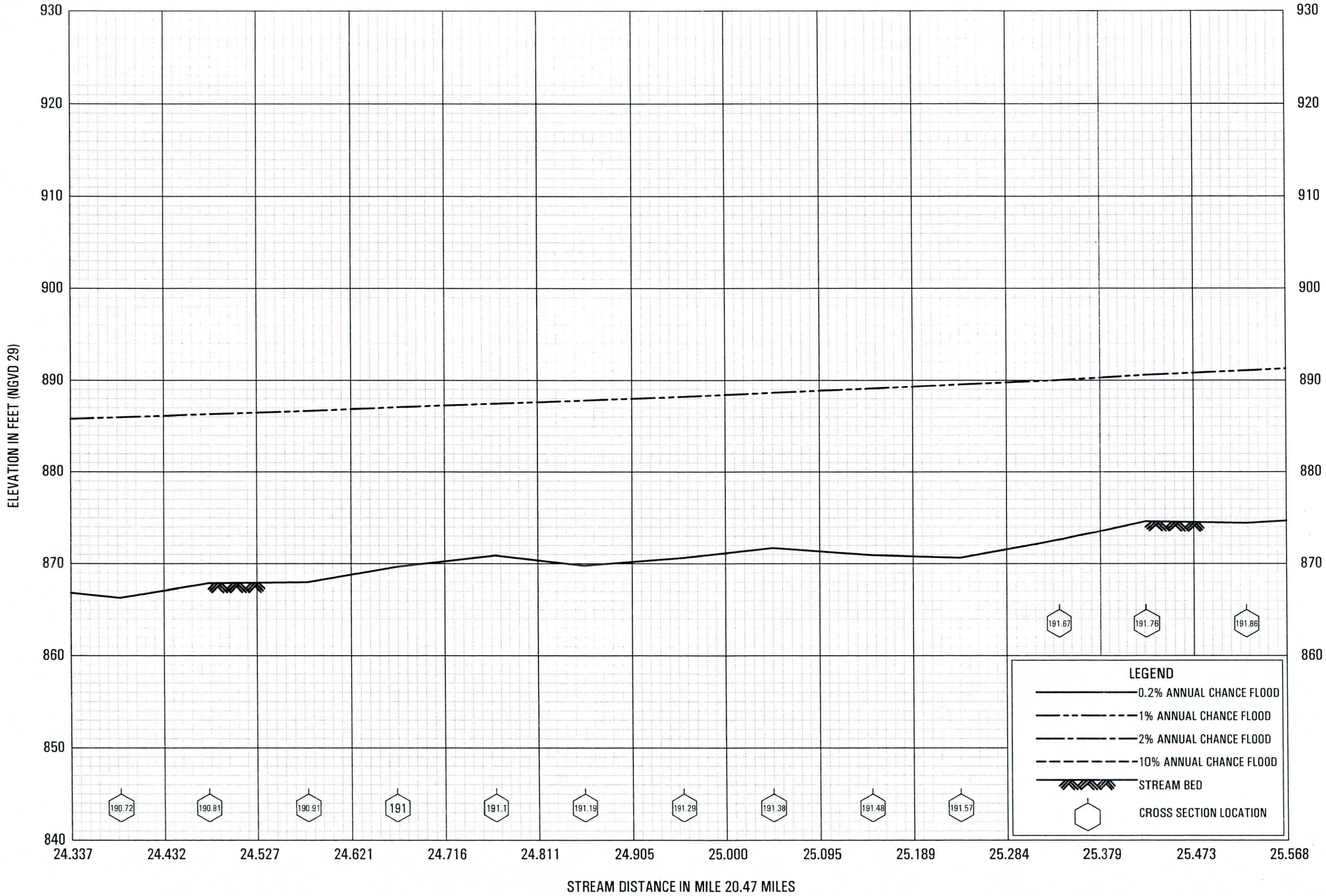
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

03P



FLOOD PROFILES WITH LEVEE

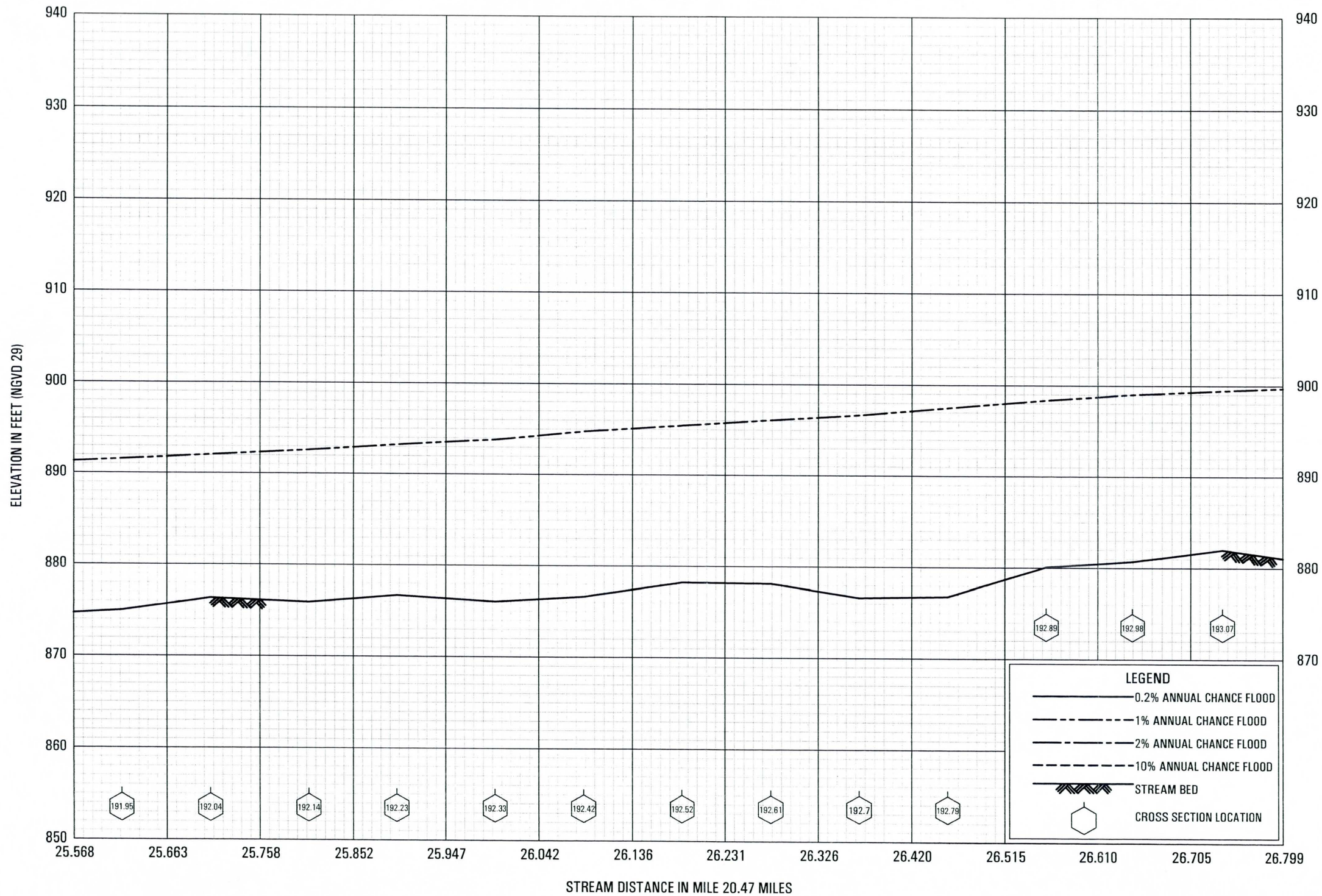
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

04P



FLOOD PROFILES WITH LEVEE

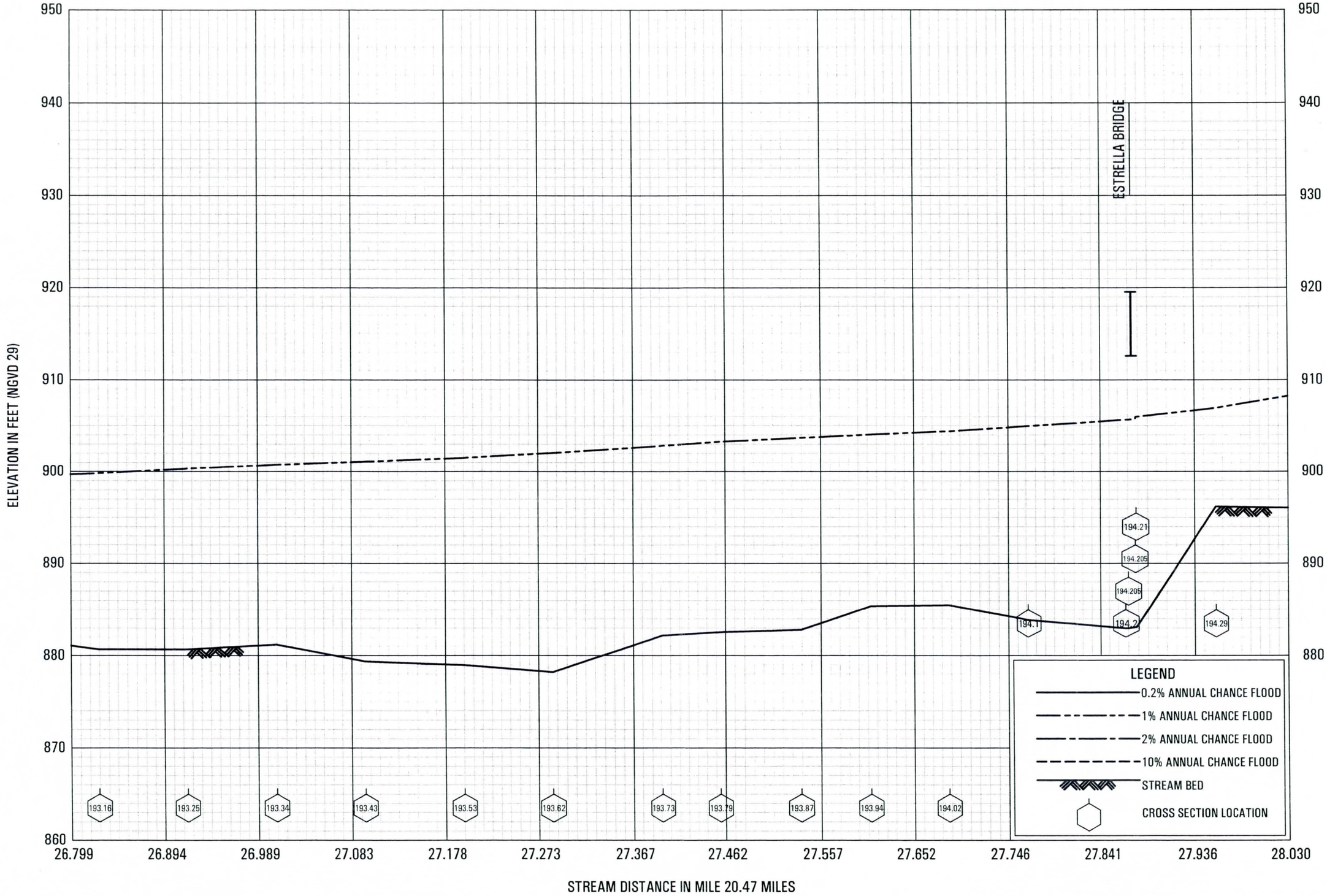
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

05P



FLOOD PROFILES WITH LEVEE

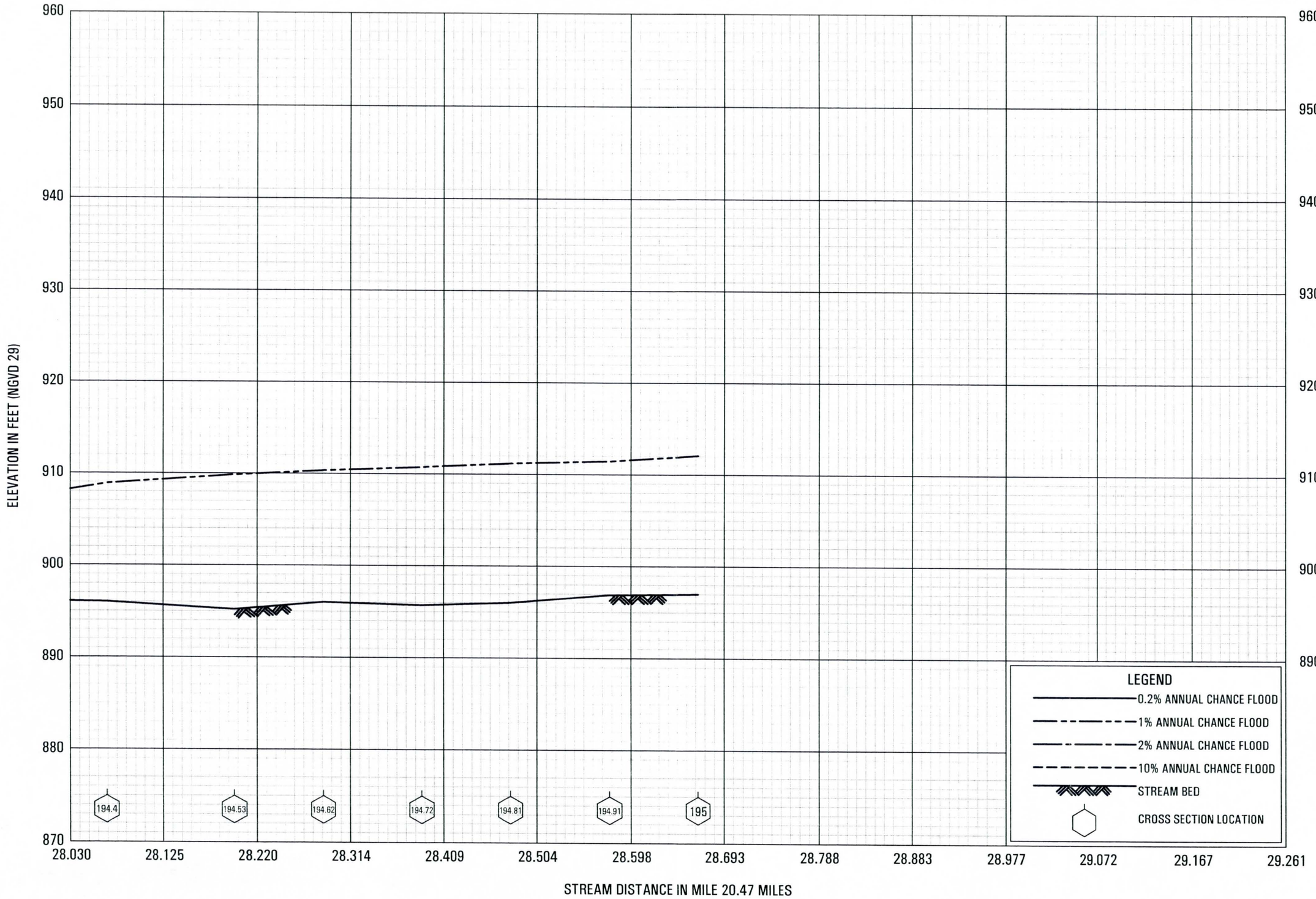
GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

06P



FLOOD PROFILES WITH LEVEE

GILA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GOODYEAR & BUCKEYE, AZ

MARICOPA

07P

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain **areas not in Special Flood Hazard Areas** may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

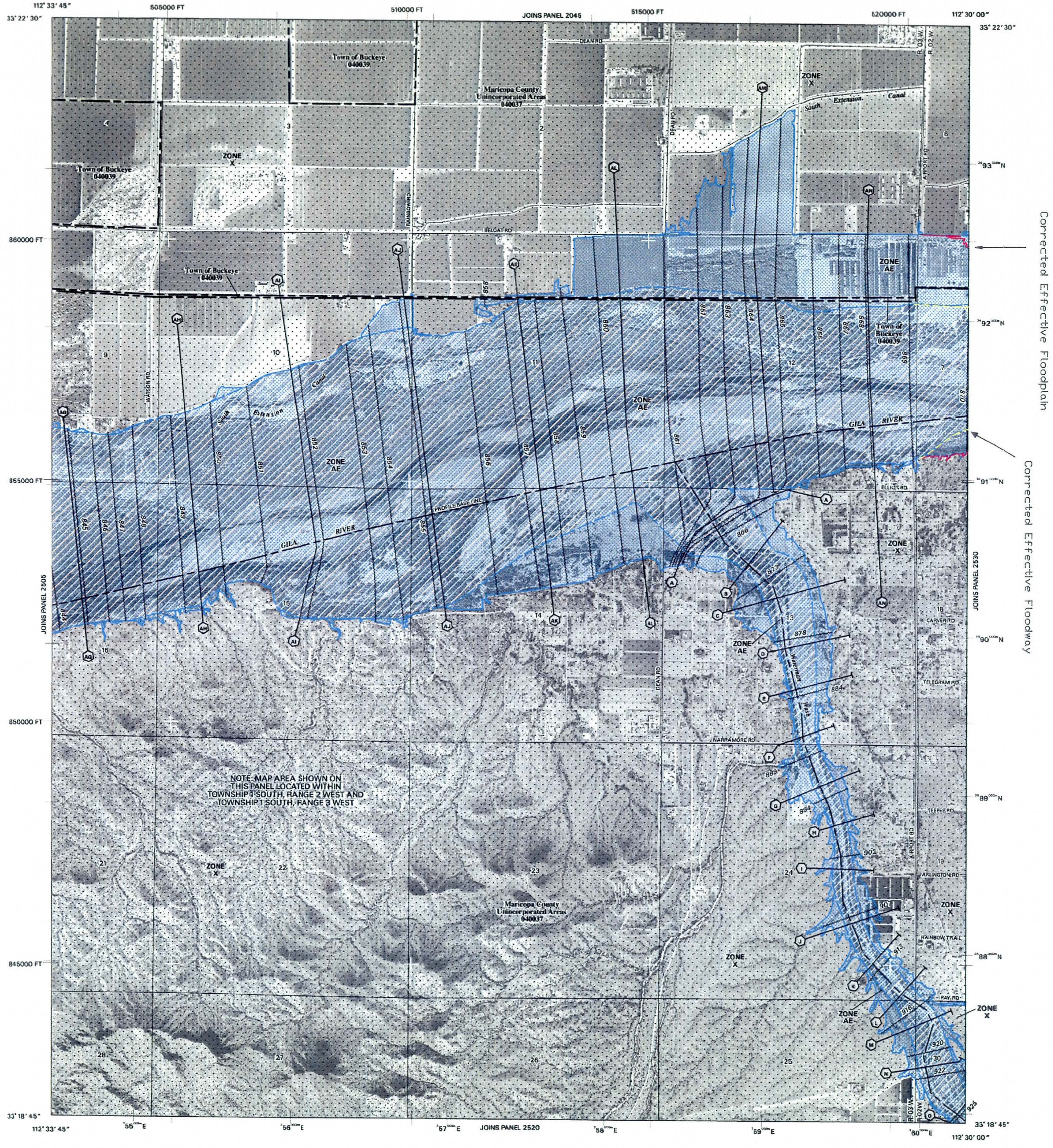
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
~~513~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A)	Cross section line
(2)——(2)	Transect line
112° 07' 08", 33° 25' 41"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere.
376000E	1000 meter Universal Transverse Mercator grid tick values zone 12
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
×DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY

Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 4, 1991, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2510G

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2510 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	2510	G
MARICOPA COUNTY	040037	2510	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2510G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

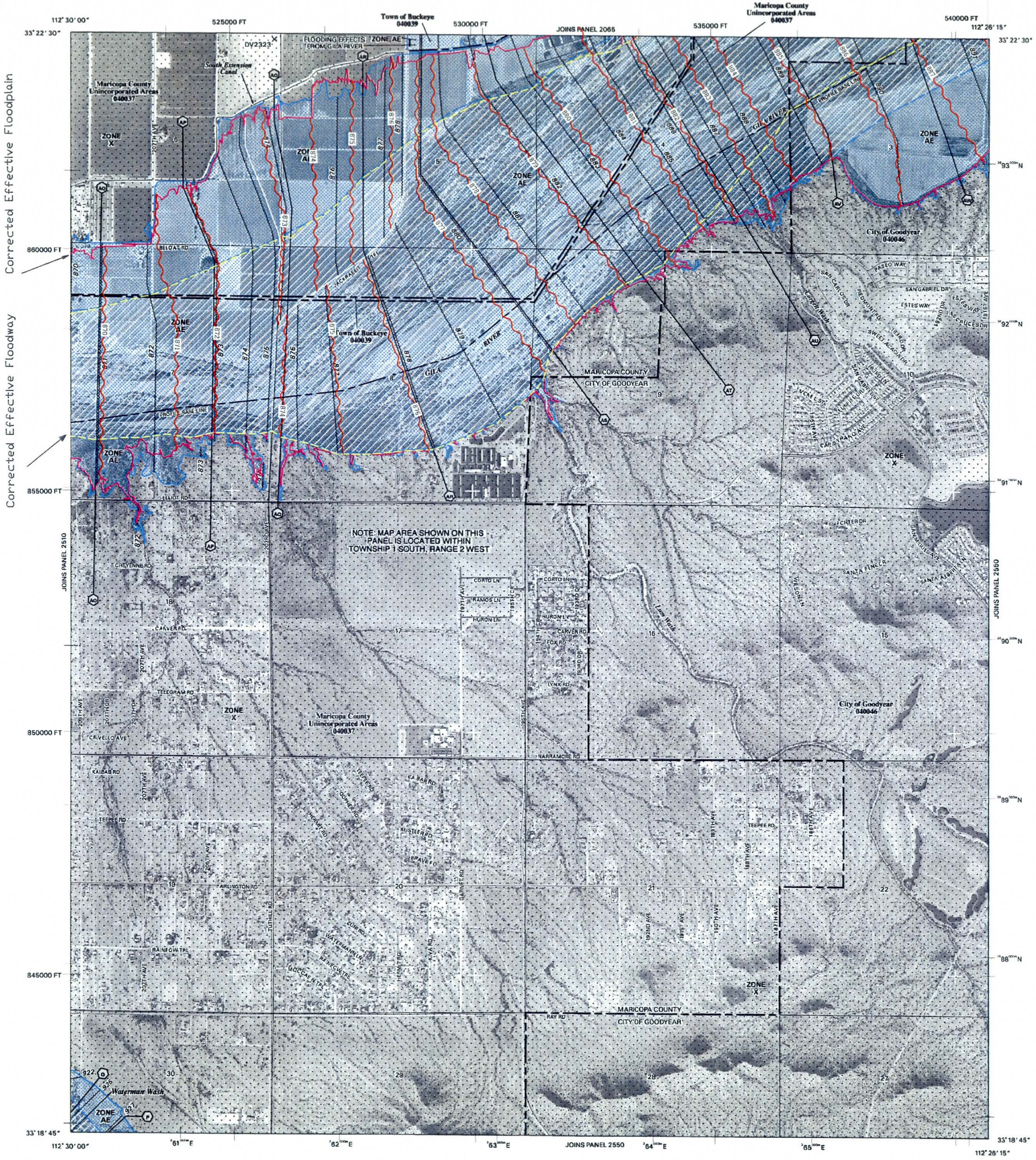
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

~~513~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A)	Cross section line
(2)——(2)	Transect line
112° 07' 08", 33° 25' 41"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
76E	1000-meter Universal Transverse Mercator grid tick values zone 12
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
×DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY

Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 4, 1991, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2530G

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2530 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	2530	G
GOODYEAR, CITY OF	040046	2530	G
MARICOPA COUNTY	040037	2530	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2530G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

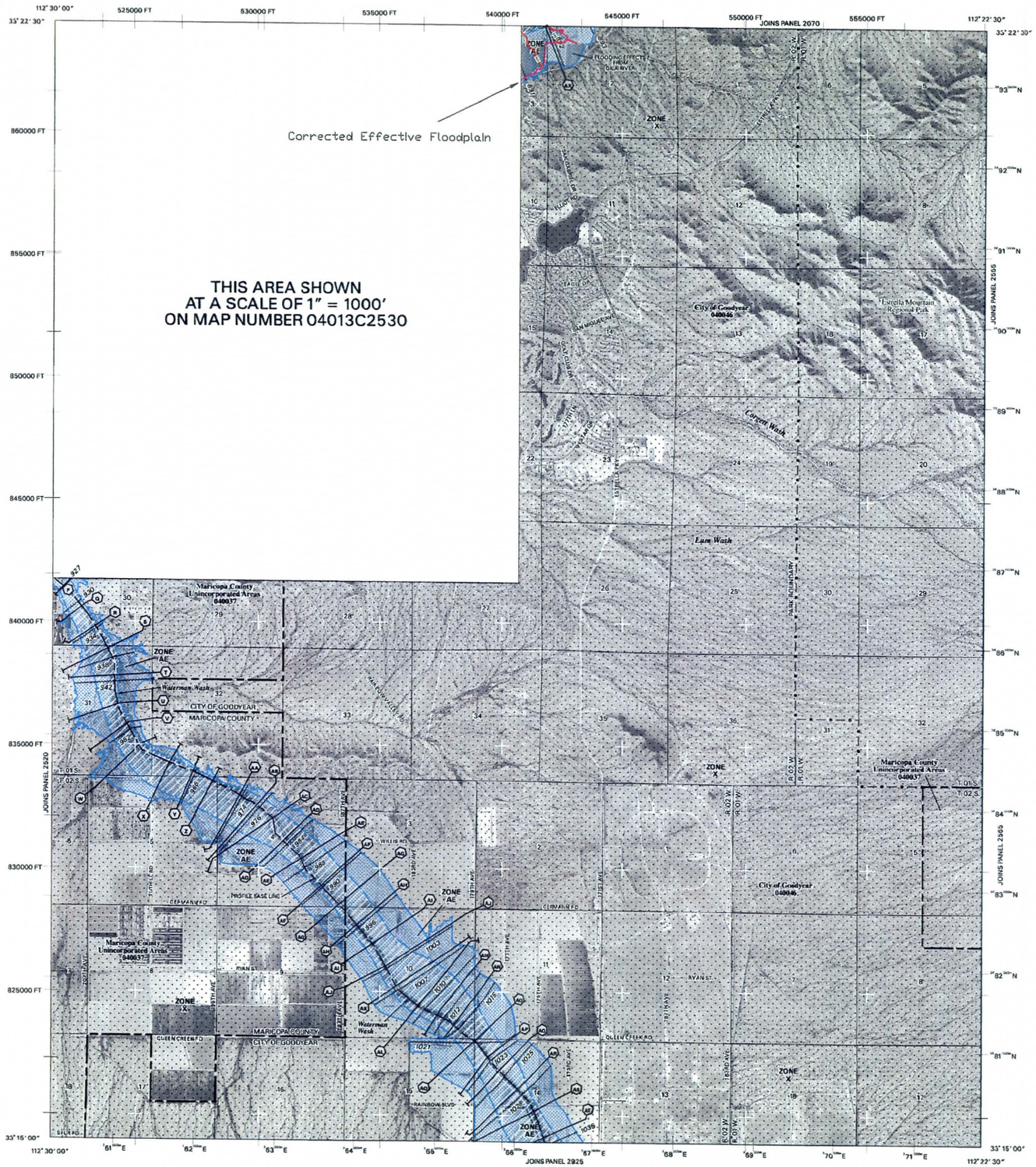
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map**, or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

~~~513~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A) Cross section line

(23)- - - - -(23) Transect line

112° 07' 08", 33° 25' 41" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

7500000 FT 1000-meter Universal Transverse Mercator grid ticks, zones 12

875000 FT 5000-foot grid ticks values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176), NAD83 (Transverse Mercator)

x DV2313 Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, July 19, 2001

September 30, 2005 - To update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2550G

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2550 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GOODYEAR, CITY OF	040046	2550	G
MARICOPA COUNTY	040037	2550	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2550G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency
~~~

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

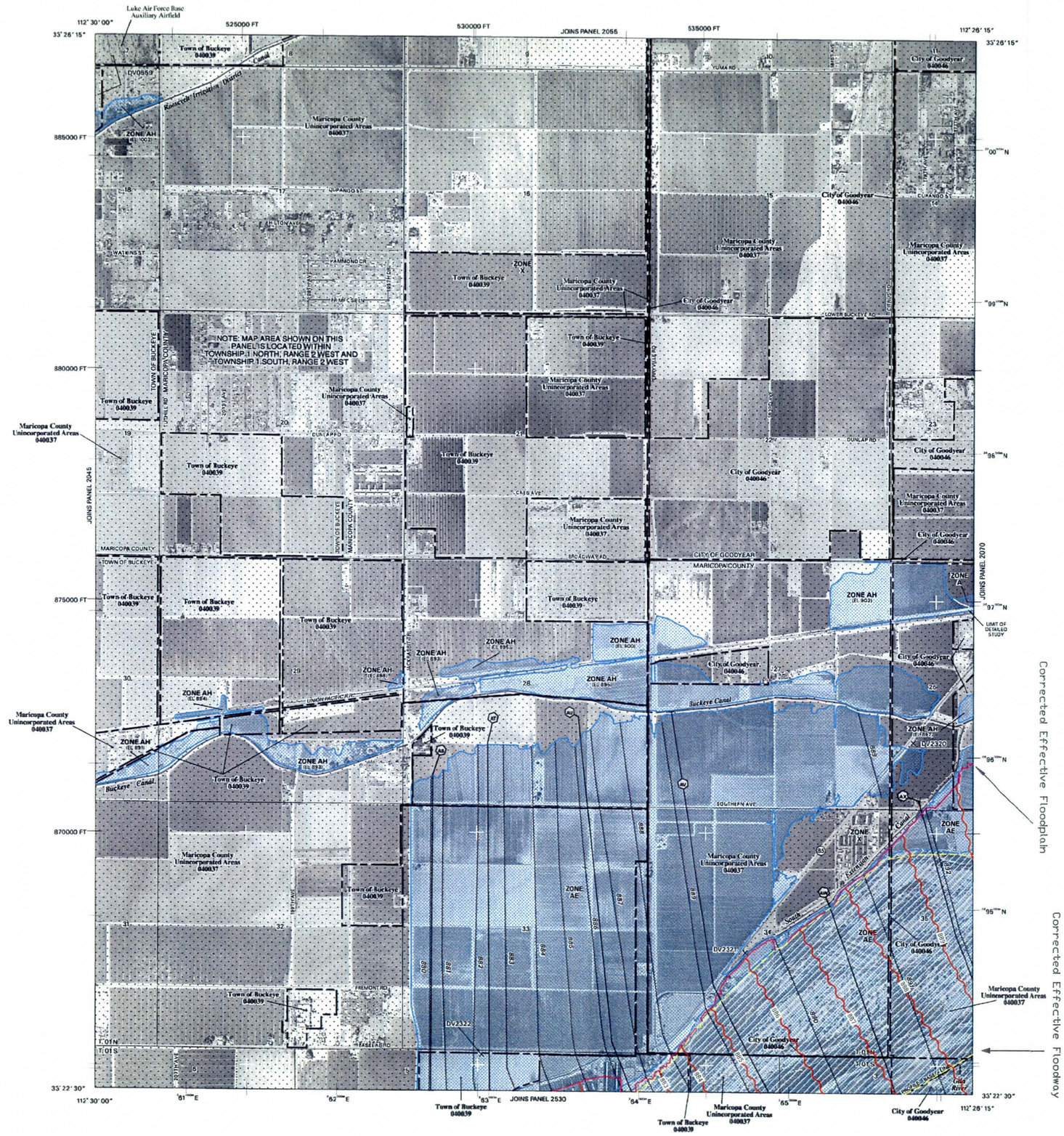
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



Corrected Effective Floodplain

Corrected Effective Floodway

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet.*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet.*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A) Cross section line

(2)- - - -(2) Transect line

112° 07' 08", 33° 25' 41" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

$^{10}76^{000m}$E — 1000-meter Universal Transverse Mercator grid tick values, zone 12

875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176), NAD83 (Transverse Mercator)

×DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, September 30, 1995, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located on the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2065H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2065 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040038	2065	H
GOODYEAR, CITY OF	040046	2065	H
MARICOPA COUNTY	040037	2065	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2065H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

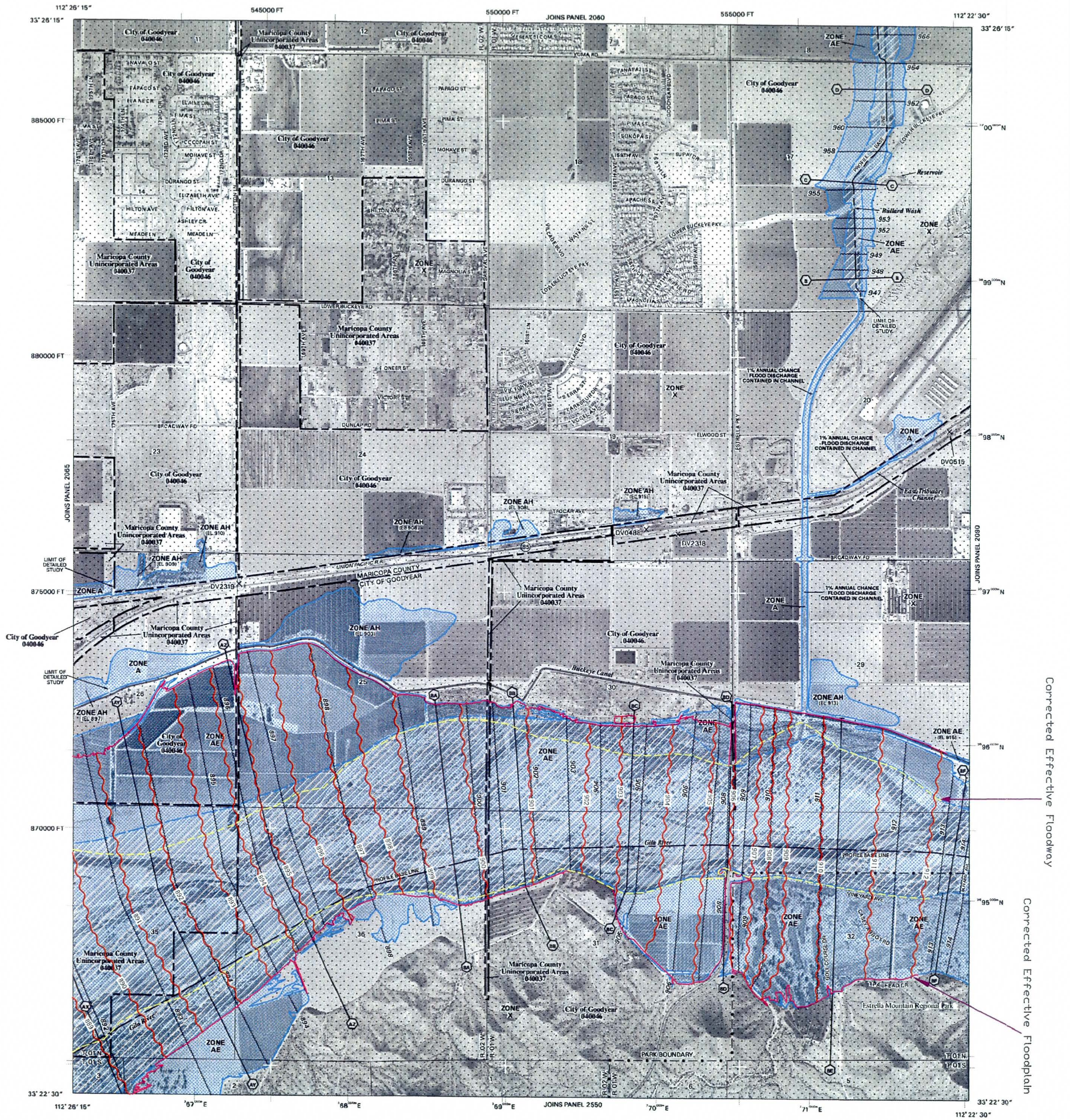
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities

~~~513~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)——(A) Cross section line

(2)——(2) Transect line

112° 07' 08", 33° 25' 41" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

4276000m E 1000-meter Universal Transverse Mercator grid tick values zone 12

875000 FT 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176), NAD83 (Transverse Mercator)

×DV2313 Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, September 30, 1995, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2070H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2070 OF 4350
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GOODYEAR, CITY OF	040046	2070	H
MARICOPA COUNTY	040037	2070	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2070H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency
~~~

A.1 Data collection summary

A.2 Referenced documents

APPENDIX A: REFERENCES

A.1 Data Collection Summary

The following references were utilized in the evaluations for this study:

FEMA, 2005, Flood Insurance Study, Maricopa County, Arizona and Incorporated Areas, Flood Insurance Study Number 0413CV001A, Revised 30 September 2005.

Michael Baker Jr., 1994, Salt -Gila Floodplain Delineation Restudy, "n" Value Report, Dated 1994.

Michael Baker Jr., 1999, Salt-Gila River Floodplain Delineation Restudy Submitted to the Flood Control District of Maricopa County, Dated May 1999.

River Research & Design, Inc., 2007, Norte Vista / King Ranch Floodplain Redelineation, Gila River, Dated June 2007.

Stantec Consulting Inc., 2006, El Rio Watercourse Master Plan, Sedimentation Analysis Book 1- El Rio Existing Condition Sedimentation Analysis, Dated March 2006.

USACE, 1996, Gila River Basin, Arizona, Section 7 Study for Modified Roosevelt Dam, Arizona, Hydrologic Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam, U.S. Army Corps of Engineers, Dated March 1996.

A.2 Referenced Documents

The following references were utilized in the evaluations for this study:

Chow, 1959, Open-Channel Hydraulics.

National Geodetic Survey, 2001, National Geodetic Survey Program VERTCON accessed at http://www.ngs.noaa.gov/cgi-bin/VERTCAN/vert com.prl, Dated August 2001.

USACE, 2005, US Army Corps of Engineers, Hydrologic Engineering Center River Analysis System (HEC-RAS) Version 3.1.3, May 2005.

USGS, 1991, Estimated Manning's n-Values for Stream Channels and Flood Plains in Maricopa County Arizona.

B.1 Special Problem Reports – There is no applicable information for this subsection.

B.2 Contact (telephone) Reports - There is no applicable information for this subsection.

B.3 Meeting Minutes or Reports - There is no applicable information for this subsection.

B.4 General Correspondence

B.5 Contract Documents

APPENDIX B: GENERAL DOCUMENTATION & CORRESPONDENCE

APPENDIX B.4: GENERAL CORRESPONDENCE

AFFIDAVIT OF PUBLICATION
FLOOD DELINEATION/GILA RIVER

01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-7364

ANNOUNCEMENT OF INTENT TO PERFORM FLOODPLAIN/FLOODWAY DELINEATION STUDY ALONG THE GILA RIVER BETWEEN AIRPORT ROAD AND BULLARD AVENUE

The Flood Control District of Maricopa County (District) has contracted with Stantec Consulting, Inc. to perform a floodplain/floodway delineation of approximately 8 miles of the Gila River. The study area is bounded by Airport Road on the west, Bullard Avenue on the east, the Buckeye Canal (west of the MC 85-Buckeye Canal crossing) and MC 85 (east of the MC 85-Buckeye Canal crossing) on the north, and Elliot Road (Airport Road to Rainbow Valley Road) and the Sierra Estrella foothills (Rainbow Valley Road to Bullard Avenue) on the south.

This study will examine and evaluate flood hazards and determine flood elevations for the area. The elevations will then be used to determine the flood insurance rates used by the Federal Emergency Management Agency (FEMA).

This announcement is intended to inform all interested persons and communities so that they may have an opportunity to bring forth any relevant technical information to the District for consideration in this study. Your comments should be addressed to John Hathaway, P.E. at the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009, (602) 506-1501.

Published: June 14, 2007

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Mark Gilmore, being first duly sworn, upon oath deposes and says: That of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

6/14/2007

Sworn to before me this
14TH day of
JUNE 2007

Notary Public

Gerlach, Stephanie

From: Gerlach, Stephanie
Sent: Friday, January 11, 2008 7:48 AM
To: 'Ed Gerak'
Cc: Cooper, Walt; Ellison, Pat
Subject: RE: El Rio Deliniation
Attachments: 2008-01-11 BWCDD.pdf

The attached schematic shows the original floodplain and floodway in blue and the revised in purple. Between Sarival and Estrella the revised floodway was narrowed. At Bullard Wash the revised floodway is wider. The revised was tied into the original just upstream of Bullard Wash. There were no revisions to the floodway upstream of Bullard Ave.

It is unknown how much the floodway can be moved until some type of modeling is completed. The study by River Research ended between Estrella and Bullard.

Please let me know if you have additional questions.

From: Ed Gerak [mailto:egerak@bwcdd.com]
Sent: Friday, January 11, 2008 7:21 AM
To: Gerlach, Stephanie
Cc: Cooper, Walt; Ellison, Pat
Subject: RE: El Rio Deliniation

Was the river analyzed from Sarival east to Litchfield for the redeliniation? I am curious because we have substantial acreage on the north side of the Gila in this stretch and wanted to know if there were any potential changes to the floodway. From your e-mail, it sounds like the area may not have been part of the work that River Research performed and we may be able to get some of our acres out of the floodway. Would you agree?

Ed Gerak
Buckeye Water Conservation & Drainage District
General Manager
(623) 238-1374

From: Gerlach, Stephanie [mailto:stephanie.gerlach@stantec.com]
Sent: Friday, January 11, 2008 6:48 AM
To: Ed Gerak
Cc: Cooper, Walt; Ellison, Pat
Subject: RE: El Rio Deliniation

Yes we are completing the redelineation for the Gila River for the FCDMC. Our tie-in to the existing floodplain occurs just downstream of Bullard Avenue. There are minor changes to the floodplain between Sarival and the tie-in. There are also changes to the floodway within this region. The changes were developed by Spencer Management, Inc. and SD Construction, L.L.C. (their engineer River Research & Design, Inc.) for the Norte Vista / King Ranch Floodplain Redelineation Project. These changes were submitted to FEMA in October.

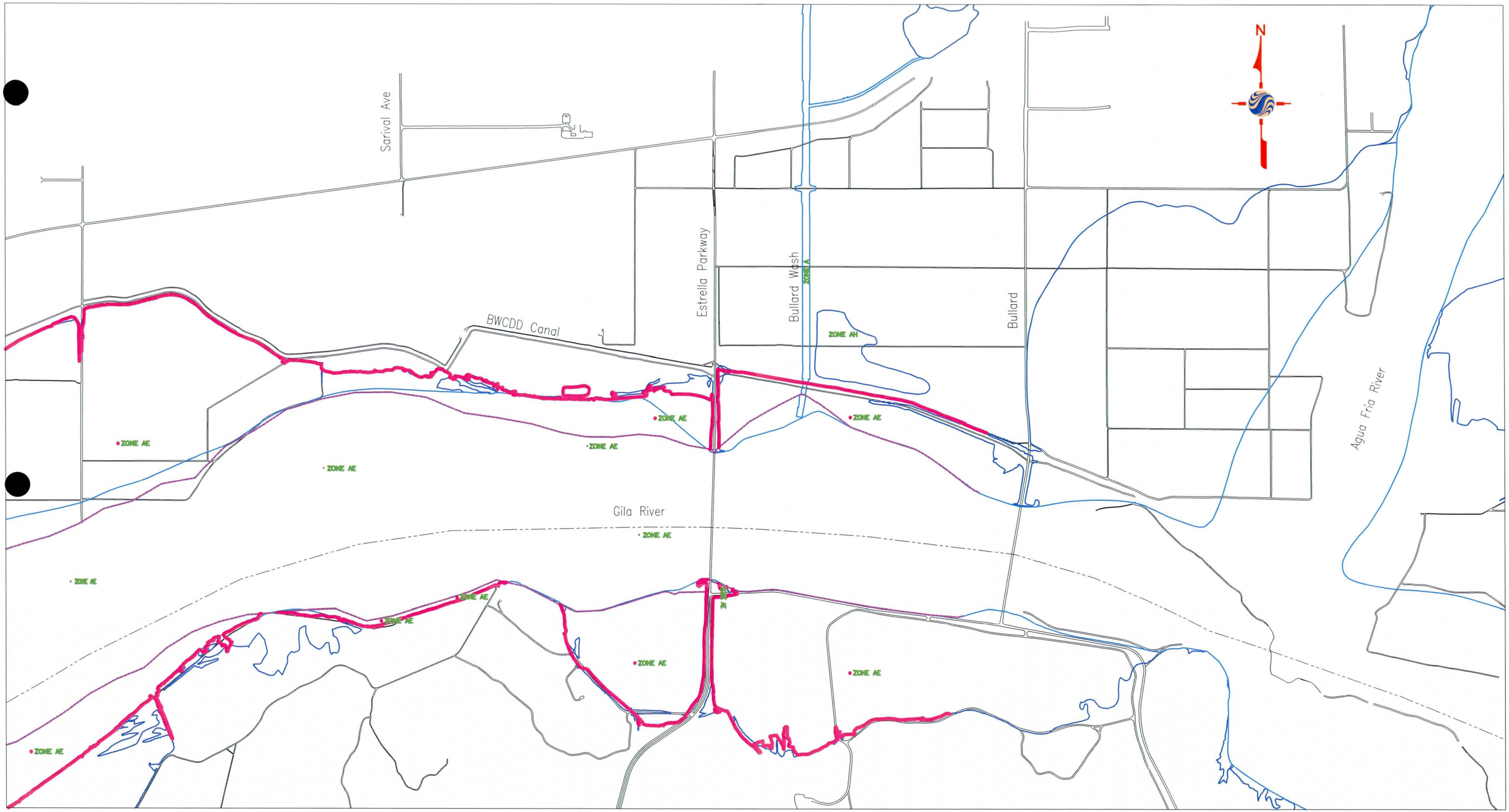
I hope this helps. Please give me a call if you need additional information. We can also meet with you if you have additional questions.

From: Ed Gerak [mailto:egerak@bwcdd.com]
Sent: Tuesday, January 08, 2008 2:57 PM
To: Gerlach, Stephanie
Cc: Cooper, Walt
Subject: El Rio Deliniation

Stephanie,

I met with Flood Control today and they mentioned that you were working on the floodway redeliniation. If this is true, could you let me know if you analyzed from Sarival east to Litchfield. The proposed revisions show a correction just east of Sarival and it is modified west of that connection. To the east it follows the original line. I wanted to know if that area was looked at and the original lines were correct or if that area was not looked at and the lines were brought to meet the original lines at Sarival. If the area was not looked at, we may be interested in getting that area looked at to possibly minimize the floodway on our property between Sarival & Bullard.

Thanks,
Ed Gerak
Buckeye Water Conservation & Drainage District
General Manager
(623) 238-1374



V:\52820\active\182000510\cadd\misc fig\BWCDD.dwg
2008-01-11 07:37AM By: sgerlach

Jan., 2008
182000453

ORIGINAL SHEET - ANSI B

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A.
85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Corrected Effective Floodway
- Corrected Effective Floodplain
- Effective Floodway
- Effective Floodplain
- Baseline

1in=1500ft 0 1500' 2250' 3000'

Client/Project
Flood Control District of Maricopa County
Gila River Floodplain Redelineation Study
FCD No. 2006C013, PCN No. 014.34.01

Figure No.

Title
Comparison of Effective and Corrected

APPENDIX B.5: CONTRACT DOCUMENTS

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

1820-00510

LETTER OF TRANSMITTAL

TO: Scot S. Schlund, PE
Stantec Consulting Inc.
8211 S. 48th St.
Phoenix, AZ 85044-5355

November 7, 2007

SUBJECT: Contract No. 2007C017
Assignment No. 1
Gila River Re-Delineation - Revise Model

WE ARE SENDING YOU THE FOLLOWING ITEMS:
( ) Enclosed ( ) Under separate cover

	Shop Drawings	Prints	Legal Description	Samples
	Specification	Change Order	Copy of Letter	Plans
X	Notice to Proceed			
X	Certificate of Performance			
X	Scope of Work			

THESE ARE TRANSMITTED:

	For Approval	Approved as submitted
X	For your use	Approved as noted
	As requested	Returned for corrections
	Resubmit ( ) copies for approval	For review and comments
	Submit ( ) copies for distribution	Return ( ) corrected prints
	FOR ESTIMATE DUE:	Borrowed prints being returned

Remarks: Please specify assignment number on all correspondence.

SIGNED: Tim Murphy

Tim Murphy, PE, CFM
Floodplain Delineation Branch Manager

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

NOTICE TO PROCEED

TO: Scot S. Schlund, PE
Stantec Consulting Inc.
8211 S. 48th St.
Phoenix, AZ 85044-5355

November 7, 2007

SUBJECT:

PCN	014.34.01	Low Org	6926
FCD Contract No.	2007C017		
Assignment No.	1		

Gila River Re-Delineation - Revise Model

Your not-to-exceed cost estimate of $23,801.84 for Assignment No. 1 has been received and accepted for this project with a completion date of 03/16/2008. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

Revised hydraulic evaluations and floodplain/floodway delineation for the Gila River between Airport Road and Bullard Avenue (approximately River Mile 186.97 to River Mile 195.13), prepared by Stantec under Contract FCD 2006C013, to conform with the LOMR submitted for the Norte Vista subdivision submitted by River Research and Design (2007). See attached Exhibit A - Scope of Work and budget, dated November 7, 2007.

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

SIGNED:

Tim Murphy, PE, CFM
Floodplain Delineation Branch Manager

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

Certificate of Performance of Engineering Open Order Contract and Payment of All Claims

I, _____, hereby certify to the Flood Control District of Maricopa County (FCDMC) that all lawful claims for labor, rental of equipment, material used, and any other claims by company, or its subcontractors in connection with the specific assignment described below and as authorized by the terms of the FCDMC Contract 2007C017 have been paid.

Company understands that with receipt of payment for previously invoiced amounts plus any retained funds, that this is a settlement of all claims of every nature and kind against the FCDMC arising out of the performance of the FCDMC's specific assignment through FCDMC Contract 2007C017 for Assignment No. 1 relating to the material, equipment, and work covered in and required by the contract.

The undersigned hereby certifies that to his/her knowledge, no contractual disputes exist in regard to this contract and that he/she has no knowledge of any pending or potential claims in regard to this contract.

Upon submission of this document and a separate invoice for any retained funds to the FCDMC, invoice processing will be completed within forty-five (45) calendar days.

Signed the _____ day of _____, 200__.

_____

Signature

Title: _____

Stantec Consulting Inc.

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ 85044
Tel: (602) 438-2200 Fax: (602) 431-9562
stantec.com

Stantec

11/7/2007
File: 82000510

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

Attention: Mr. John Hathaway PE

Dear Mr. Hathaway:

Reference: **Work Assignment 1-Gila River Re-Delineation – Revise Model**
CONTRACT FCD 2007C017

At the request of the Flood Control District of Maricopa County (District), Stantec Consulting Inc. (Stantec) has prepared a scope and fee estimate for Work Assignment 1 (Gila River Re-Delineation – Revise Model) to be conducted under the On-Call Engineering and Planning Services Contract FCD 2007C017.

The scope is provided as Exhibit A and the fee estimate and project man-hours are provided in Tables, A, B, and C.

It is our pleasure to provide this service to the District. I look forward to your approval of this request.

Sincerely,

STANTEC CONSULTING INC.

Patrick J Ellison, PE

Associate

Attachment

Copy: File

W:\active\182000510\Cover Letter Work Assigment 1.doc

EXHIBIT A

Flood Control District of Maricopa County

Work Assignment 1
Gila River Re-Delineation – Revise Model

CONTRACT FCD 2007C017
November 07, 2007

On-Call Engineering and Planning Services

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2006C017

TABLE OF CONTENTS

1 Project Description 1
2 Data Collection 1
3 Hydraulic Analyses 1
3.1 HEC-RAS Model and Refinements 1
3.2 Review and Approval 1
4 Work Study Maps 1
4.1 Review and Approval 1
5 Technical Data Memorandum 1
5.1 Review and Approval 2
6 Digital Data Requirements 2
7 FEMA Submittals 2
7.1 District Review 2
8 Agency Coordination 3
9 Response to FEMA Comments 3
10 Public Open House 3

1 Project Description

This scope of work (SOW) is for professional engineering services necessary to revise hydraulic evaluations and the floodplain delineation for a reach of the Gila River that was completed under Contract FCD 2006C013. The study reach approximately 8.2 miles in length commences at the Airport Road crossing of the Gila River (approximately River Mile 186.97) and extends up stream to the Bullard Avenue crossing of the Gila River (approximately River Mile 195.13).

2 Data Collection

The Consultant shall obtain available, hydraulic models, digital floodplain and floodway boundaries and associated BFEs developed for the Norte Vista / King Ranch project (River Research & Design, Inc., 2007).

3 Hydraulic Analyses

3.1 HEC-RAS Model and Refinements

The CONSULTANT shall revise the hydraulic model prepared for the Gila River Floodplain Delineation Study (Contract FCD 2006C013) to be consistent with the hydraulic model developed for the Norte Vista / King Ranch project. Before submitting the revised hydraulic model to the DISTRICT FEMA's CHECK-RAS program shall be run to identify errors in the model input.

3.2 Review and Approval

The CONSULTANT shall submit the revised HEC-RAS Model to the DISTRICT for review and approval. After addressing DISTRICT comments the CONSULTANT will incorporate the final HEC-RAS model into the Technical Data Memorandum.

4 Work Study Maps

The CONSULTANT shall revise Work Study Maps prepared for the Gila River Floodplain Delineation Study to be consistent with the revised HEC-RAS hydraulic model.

4.1 Review and Approval

The CONSULTANT shall submit the revised Work Study Maps to the DISTRICT for review and approval. After addressing District comments the CONSULTANT shall provide permanent non-erasable mylars of the work-study drawings.

5 Technical Data Memorandum

The CONSULTANT shall revise the Technical Data Memorandum (TDN) including FEMA's MT-2 forms, prepared for the Gila River Floodplain Delineation Study to be consistent with the revised HEC-RAS hydraulic model and revised Work Study Maps. The TDN shall be consistent with State Standard 1-97 where applicable.

5.1 Review and Approval

The CONSULTANT will provide 2 copies of the technical memorandum to the DISTRICT for review and approval. After addressing DISTRICT comments the CONSULTANT will provide a final draft in paper and digital formats.

6 Digital Data Requirements

Digital data in GIS format will be prepared in conformance with the DISTRICT's Hydrologic Information System Data Delivery Specifications, Revision 3.1 (or CADD Data Delivery Specifications, Rev. 1.0, January 2000). ArcView shape file format is acceptable. The themes listed in the following HIS Theme Deliverable Table are themes that will be provided for this project. If the CONSULTANT has data that does not fit one of the themes listed here, the DISTRICT's Project Manager shall be contacted to determine the appropriate theme for those data. Digital data **will not** be provided in the DISTRICT's Hydrologic Information System Data Delivery Specifications for the topographic information provided by the DISTRICT and King Ranch Development.

HIS Theme Deliverable Table

CARTO	MISC label, section labels, township/range labels, street names
DQ.tbl	Data Quality
FPBLN	Floodplain Baseline Route System
FPSRFFCD	Floodplain Water Surface Elevation
FPXFCD	Floodplain Cross Sections
FPZNFCD	Floodplain Zones
NDXPRJ	Project Map Index
PRJ	Project Boundaries
PRJDAT.tbl	Project Identification

7 FEMA Submittals

7.1 District Review

The CONSULTANT will submit the following items to the DISTRICT for review by FEMA and any other appropriate governmental agency. All of the following products are considered deliverables for the FEMA submittal:

7.1.1 The DISTRICT will provide the CONSULTANT original affidavits of publication for legal advertisements notifying the public of the delineations or copies of the notifications sent out to notify property owners along the reach about the study.

7.1.2 Five (5) complete sets of topographic base maps with the floodplain/floodway delineations shown (Work Maps). All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant shall provide a specific statement as to what service they performed.

7.1.3 Five (5) complete copies of the Technical Data Notebook, including HEC-RAS digital input/output files on a CD. A project survey report will not be required.

7.1.4 A digital PDF file of the TDN and Work Maps shall be provided to the DISTRICT on a CD.

8 Agency Coordination

The CONSULTANT shall meet with officials from the local communities. The purpose of the meeting is to provide copies of the FEMA submittal and to obtain their signatures on FEMA MT-2 forms.

9 Response to FEMA Comments

Written responses to FEMA comments concerning the LOMR submittal is not included in this scope of work.

10 Public Open House

10.1 The CONSULTANT shall attend a public Open-House to present the results before sending the TDN to FEMA. The CONSULTANT can expect to print two sets of the Floodplain Delineation Work Maps for use in the open house meeting. The CONSULTANT will provide, in digital and printed format, two exhibits to be used during the public meeting. The CONSULTANT shall print and provide all display graphics to the DISTRICT who will approve and mount them.

10.2 The DISTRICT will be responsible for notifying impacted property owners about the results of the study and advertising the public open house.

C.1 Survey field notes for aerial mapping control

C.2 Survey field notes for hydrologic modeling - There is no applicable information for this subsection.

C.3 Survey field notes for hydraulic modeling - There is no applicable information for this subsection.

Field surveys were conducted by Stantec Consulting Inc. (Stantec) during June 2005 and August 2005 and by FCDMC during May 2005 and March 2007. The attached survey field notes are in reference to the work completed by Stantec.

APPENDIX C: SURVEY FIELD NOTES

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ 85044
Tel: (602) 438-2200
Fax: (602) 431-9562

Stantec

March 14, 2008
File: 82000240

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ 85044

Attention: **Pat Ellison, P.E.**

Reference: **El Rio Watercourse Master Plan**

During the Months of June and August, 2005, Stantec Consulting Inc., conducted a GPS RTK survey to obtain profile information across the Gila River at various locations. Major features and grade breaks were located along the profile lines ranging from 0.5 miles to 1.25 miles in length. The lines to be profiled were depicted on an aerial plot with NAD83 state plane coordinates derived from the County's GIS system. Our survey crew then calibrated horizontally and vertically to GDACS points surrounding the area to be surveyed. The profile coordinate values provided are in NAD83 state plane, Arizona Central Zone, horizontally and NAVD88 vertically.

Sincerely,

STANTEC CONSULTING INC.

Ed Balliet, R.L.S.
Project Manager, Survey
Tel: (602) 707-4646
Fax: (602) 431-9562
eballiet@stantec.com

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
31587
EDWIN M.
BALLIET
Date Signed 3/14/08
ARIZONA U.S.A.

Attachment:

c.

emb document2

There is no applicable information for this subsection.

APPENDIX D: HYDROLOGIC ANALYSIS SUPPORTING DOCUMENTATION

E.1 Roughness Coefficient Estimation - Manning's Roughness Coefficients from the Norte Vista / King Ranch Study and Manning's Roughness Coefficient Calculation Sheets for Cross Sections Between 187.06 and 190.05

E.2 Cross section plots

E.3 Expansion and contraction coefficients - There is no applicable information for this subsection.

E.4 Analysis of structures - There is no applicable information for this subsection.

E.5 Hydraulic calculations

APPENDIX E: HYDRAULIC ANALYSIS SUPPORTING DOCUMENTATION

APPENDIX E.1: ROUGHNESS COEFFICIENT ESTIMATION

Except from River Research & Design, Inc., 2007, Norte Vista / King Ranch Floodplain Redelineation, Gila River, Dated June 2007

Photographs are included on the CD in Appendix E.5.

5.2 Work Study Maps

The work study maps are included in the 24" x 36" materials at the end of the document. The work maps consist of 11 maps plus the cover and index sheets. They are produced at a scale of 1" = 400' and include both the effective and existing floodplain and floodway lines for the project reach. The main sheets (3-11) have the effective and newly modeled existing floodplain and floodway shown.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

The Mannings n values determine the resistance to the flow in the hydraulic models. The Mannings n values for the initial HEC-RAS model were chosen based on the information provided in the HEC-RAS model used in the Michael Baker FIS study. The validity of these values were checked to a limited extent but the Baker values were used for preliminary modeling since they were not too dissimilar to values used for the upstream Tres Rios study which was completed in 2004 (WEST 2004).

Manning's n values for the final models were developed based field visits and recent (2004) aerial photos provided by Maricopa County. The photographs taken during the field visits are presented in Appendix E.1.

The Manning's n-values used in the HEC-RAS model for the proposed King Ranch / Cotton Lane Bridge & Channel project have been determined by applying two methodologies found in the following reports:

"Roughness Coefficients for Channels in Arizona" (Aldridge and Garrett, 1973)

"Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" (Thomsen and Hjalmarson, 1991)

"Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona" (Phillips and Ingersoll, 1998)

5.3.1.1 Method 1: BASE "n" VALUES AND ADJUSTMENT FACTORS

The first methodology, which is addressed in the first two reports, is modified from the Chow (1959) approach of establishing a base n-value, which is a function of the stream bed material type and then applying adjustment factors that characterizes the stream irregularity, cross-sectional variations, obstructions, amount of vegetation, and degree of meandering. The consistency throughout all three of these reports indicates that the subsequent two reports (Thomsen and Hjalmarson) and (Phillips and Ingersoll) have been developed based on the Aldridge and Garrett report. The added benefit from the

subsequent two reports comes in the form of additional field studies, which have provided more sample n-values from a greater and more diverse set of streams throughout Arizona. The method in the third report, however; is to determine the n-value by analyzing the flow in a channel during a flow event and then calculating a resulting n-value. Although this report was considered to be a second phase follow-up to Thomsen and Hjalmarson (1991), data were not available for this methodology in this reach of the Gila River.

The first methodology consists of the following equation used to determine a Manning's n-value:

$$n = (n_b + n_1 + n_2 + n_3)m,$$

where,

n_b = base value of n for a straight uniform channel defined by the stream bed material.

n_1 = adjustment factor for surface irregularity

n_2 = adjustment factor for obstructions

n_3 = adjustment factor for vegetation

m = adjustment factor for meandering

Table 2 in "Roughness Coefficients for Channels in Arizona" (Aldridge and Garrett, 1973) provides n-value adjustment factors with their corresponding example descriptions for surface irregularity, obstructions, vegetation, and meandering. Table 1 of the Aldridge and Garrett report provides a list of channel materials and their corresponding n_b values defined by Chow (1959) and defined by Benson and Dalrymple (1967). The difference between Chow and Benson and Dalrymple is that the Chow n_b values characterize the smoothest reach attainable for a given bed material while the Benson and Dalrymple n_b values characterize conditions that are closer to average. Therefore, the Benson and Dalrymple n_b values are assumed to be more representative of natural conditions, and used for this analysis with the adjustment factors from Table 2 of the Aldridge and Garrett report.

The reach of the Gila River that is adjacent to the proposed King Ranch project primarily consists of material ranging from sands to fine gravels. There are, however, randomly distributed areas of bed load that include material up to cobble size material. The selected base n-value for this reach of the Gila River is $n_b = 0.028$, which is the same base n_b value selected by Thomsen and Hjalmarson during their study of the Gila River 1,000 feet upstream from the Bullard Avenue Bridge. This value also agrees well with the value obtained using the Limerinos Equation for the bare bed (USACE 1991). Based on a D_{84} of 30 mm the Limerinos Equation gives a Manning's n value of 0.026.

The vegetation component is then added to the base n_b value to determine the overall n-values for low density, medium density, and high density. Surface irregularities, meandering, and obstructions are considered to be negligible in this reach. Values presented in Thomsen and Hjalmarson (1991) for only the vegetation portion of the equation are presented in Table 2.

Table 2. Description of Vegetation Densities and Associated n Value Adjustment Factors from Thomsen and Hjalmarson, 1991.

Vegetation	Manning's n Value Adjustment	Example
Small	0.002 to 0.010	Dense growth of flexible turf grass, such as Bermuda, or weeds where the average depth of flow is at least 2x the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrow weed, or salt cedar where the average depth of flow is at least 3x the height of the vegetation.
Medium	0.010-0.025	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 1x to 2x the height of the vegetation; moderately dense brush, similar to 1 to 2 year sold saltcedar in the dormant season, along the banks and no significant vegetation along the channel bottoms where the hydraulic radius exceeds 2 feet
Large	0.025-0.050	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.
Very Large	0.050-0.100	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 the side slopes o[r] dense cattails growing along channel bottom; trees intergrown with weeds and brush.

5.3.1.2 METHOD 2 – "n" Values Based on Predominant Vegetation

The second methodology for determining a stream n-value is vegetation dependent, and is addressed in "Roughness Coefficients for Channels in Arizona" (Aldridge and Garrett, 1973). If vegetation is the primary factor that affects the n-value, then the n-value is

determined by the vegetation rather then by the stream bed material and adjustment factors. This consideration is usually consistent in floodplains or areas of the channel that are rarely flooded.

Research conducted by the U.S. Army Corps of Engineers tends to verify the validity of this approach finding that when vegetation was significant the roughness of the bed had little influence on the total n value and could be neglected (Freeman et. al., 2000). The Corps study found that roughness was dependent on flow properties – i.e. depth and velocity – as well as plant characteristics such as stiffness, density and size. This methodology has not been applied to the current study although in earlier studies by WEST, the value for very dense salt cedar communities was estimated to be near 0.200, which is the value determined by the other researchers cited in this analysis.

Table 3 in "Roughness Coefficients for Channels in Arizona" (Aldridge and Garrett, 1973) provides composite n-values for several degrees of vegetal cover in floodplains as well as in different types of constructed channels and provides the basis for this method.

5.3.2 Procedure for Determining the King Ranch Project n Values

Since the proposed Cotton Lane Project requires that a floodplain be delineated, the n-values have been determined by considering both the adjustment factor methodology as well as the vegetation dependent methodology. To apply these guidelines, aerial photography was first used to delineate land use polygons in ArcGIS 9. The study area was classified into eight land use types in which each type was assigned an n-value. Similar to the Thomsen and Hjalmarson report, which uses the adjustment factor methodology, the photographs show that the dominant factors are bed surface material and vegetation with negligible adjustments for surface irregularities and obstructions. However, an argument can also be made for considering the vegetation as the primary factor. Table 4 catalogs the photographs and describes the land use where the photographs were taken. Table 3 lists the land use type, description, and the assigned n-value.

Following the process of estimating the n-values from the aerial photography, a site visit was conducted to confirm the n-value of each land use type. During the field investigation, the above described methodologies were applied to determine if the estimated n-values were appropriate or if they required modification. Also, the field investigation allowed for an evaluation of the shape of the land use polygons delineated on the aerial photography.

Photographs were taken of the main channel and floodplain areas as a record of the field investigation. The photographs are included in Appendix A-1. The main channel and floodplain areas consisted of the very low, low, medium, medium-high and high density vegetation land use types, which were the focus of this investigation. The general layout of the ArcMap shapefiles is shown in Figure 8. A range of photographs were referenced to (Global Positioning System) GPS points as shown on the aerial photographs in Figure

9 and Figure 10 which also shows the selected n values for the main portion of the study area.

Similar to the Thomsen and Hjalmarson report, which uses the adjustment factor methodology, the photographs show that the dominant factors are bed surface material and vegetation with negligible adjustments for surface irregularities and obstructions.

Table 4 catalogs the photographs and describes the land use where the photographs were taken while the location waypoints are shown in Figures 9 and 10.

Table 3. Assignment of Manning's n Values based on Land Use Type and Vegetation Density

Land Use	Description	n-value
Agricultural	Farmland	0.05
Mountain	Foothills	0.05
Residential	Low Density Industrial and Residential Development – No block walls.	0.04
Very Low Density Vegetation	Open channels with predominately bare bed material	0.03
Low Density Vegetation	Little significant vegetation in site	0.04
Medium Density Vegetation	Significant brush / trees but most of area still conveys flow during flood flows.	0.06
Medium-High Density Vegetation	70% of area or greater covered by dense woody vegetation but open paths exist through area for flows and can walk through most areas sometimes parting the vegetation. Flow depth approximately equal to or up to 2x the height of plants.	0.12
High Density Vegetation	Dense bushy willow, mesquite, and salt cedar (all vegetation in full foliage). Difficult if not impossible to walk through vegetation without either cutting or forcing vegetation out of way. Few, if any direct flow paths through area. Vegetation height is approximately equal to or greater than flow depth.	0.20

Table 4. List of Photographs and Locations with Description of Land Use and Vegetation Density

GPS Point	Photograph Numbers	Land Use Description
10	#4293 - #4296	Very low density vegetation located on the Gila River floodplain. High grass mixed in with light brush and trees. Maximum tree height is approximately 12 feet. Most of this material would either lay flat or be removed during high flows. 100 flood depths are approximately 10 ft in this area. Area could be classed as low density if more extensive.
11, 12, 14, 15, 16, 17	#4298 - #4305 #4306 - #4313	Pictures show both the density of the vegetation and the bed material along the Gila River main channel. If vegetation were more extensive this area would be classified as low density vegetation with light brush and trees. The bed material is mostly made up of coarse sand with random areas of cobble size bed load throughout the main channel. This vegetated area is relatively small and is neglected in comparison with large open areas. Maximum tree height is approximately 15 ft.
18	#4314 - #4320	Interface between farmland and very low density vegetation on the Gila River floodplain. Previously tilled farmland shows mostly tall weeds and some bare top soil
19	#4321 - #4336	Interface between very low density vegetation and low density vegetation. Low density vegetation located on the Gila River floodplain, and on the banks of the main channel. High grass mixed in with light brush and trees. Maximum tree height is approximately 12 feet. Very low density vegetation example photograph #4323 is of the Gila River main channel, and very low density vegetation example photograph #4329 is of the Gila River floodplain.
20	#4337 – 4358	Low density vegetation located near the Gila River main channel and floodplain. Bed material consists of mostly silty-clay with some random areas of cobble size bed load. Maximum tree height is approximately 15 feet. While some pockets of denser vegetation exist, overall this area is still open and does not have significant vegetation to hinder flows.

Table 5. List of Photographs and Locations with Description of Land Use and Vegetation Density (Continued).

GPS Point	Photograph Numbers	Land Use Description
21	#4359 - #4361	Interface between very low density, low density and medium high density vegetation showing a prevalent area of cobble size bed load on the banks of the main channel. The medium high density vegetation is shown in the background beyond the bed material in photographs #4359 and #4360. Photograph # 4361 is looking up the cobble bed at an open area which has been classified low density for this study.
22, 24, 25	#4365 - #4381	Very low density vegetation located near the Gila River main channel. Bed material consists of mostly coarse sand and gravel with some random areas of cobble size bed load.
27, 28, 29	#4382 - #4391	Interface between medium density vegetation and farmland on the Gila River Flood plain showing existing rip-rap protection. Classed as medium density due to numerous flow paths through the vegetated area.
Pictures at Bullard Ave	#4392 - #4411	Photographs show same general vegetation distribution as shown in "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" (Thomsen and Hjalmarson, 1991)

Table 5 compares results from the methodologies used to determine n-values as well as those actually used for the proposed Cotton Lane project. Method 1 is n-values determined by bed material and adjustment factors, and Method 2 is n-values determined by predominant vegetation.

Table 5. Comparison of Manning's n Values Developed by Methods Used in Analysis.

Vegetation Land Use Type	Method 1 (add nb = 0.028) Base n + Adjustment Factors		Method 2 Vegetation Based Values Aldridge & Garrett, 1973		Cotton Lane
	Description	n	Description	n	n
Very Low Density	Dense growth of flexible turf grass (n = 0.002)	0.03	Cleared land with tree stumps, no sprouts (0.030-0.050)	0.03	0.03
Low Density	Occasional trees with some brush (n=0.010)	0.04	Scattered brush, heavy weeds (0.035-0.070)	0.05	0.04
Medium Density	Small trees intergrown with some weeds and brush where hydraulic radius is greater than 2 feet (n = 0.030)	0.06	Light brush and trees, in summer (0.04-0.08)	0.06	0.06
Medium High Density	Trees intergrown with weeds and brush (n = 0.100)	0.128	Heavy stand of timber, few down trees, little undergrowth, with stage reaching branches (0.08-0.16)	0.10	0.12
Very High Density			Dense willow, mesquite, and salt cedar (0.100-0.200)	0.20	0.20
Agricultural	Farmland		Cultivated areas (0.020-0.100)	0.04	0.05
Mountain					0.05
Residential					0.04

It should be noted that the 0.12 or medium-high density classification was added to this analysis since it was thought that the jump from 0.06 to 0.20 was too abrupt and an additional level was needed for vegetation that was dense but not so dense as to be nearly impenetrable by both water and man.

5.3.3 Future Conditions n Value Analysis

No future conditions analysis is included since this LOMR is based on a change in existing conditions rather than proposed modifications.

The n values used existing conditions vegetation were developed for the existing river conditions with approximately 14 years having passed since the 1993 flood event with no maintenance of vegetation. These values were also adjusted upwards and downwards by 10%, 20% and 30% to view the sensitivity of the model to increases in Manning's n values. This modeling indicated that a 10% increase in n values resulted in approximately a 0.6 ft rise in WSE while a 10% decrease in WSE resulted in a 0.65 ft decrease in WSE. The results are shown in Table 6.

5.3.4 Summary of n Value Selection

Fortunately, one of the locations studied in "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" (Thomsen and Hjalmarson, 1991) is the Gila River, approximately 1000 feet upstream of the Bullard Avenue Bridge, and approximately 1 mile upstream from the proposed Cotton Lane project study area. The adjustment factors assessed by Thomsen and Hjalmarson at this cross-section were confirmed during the field investigation and therefore it was concluded that the n-values found in that report could be used as guideline values for this floodplain redelineation study.

After extensive review it is felt that the n-values determined for the using the above procedures are appropriate for use in this reach of the river. The five levels of vegetation density have been the focus of the analysis since those are the land use areas that make up the majority of the Gila River along the proposed King Ranch project. Both methods facilitated an approach to determine an n-value. The n-values determined for low density and medium density by both methods result in approximately the same values. The n-value determined for high density by both methods did result in different values of which the most conservative was chosen. Photographs from the Bullard Avenue Bridge were taken to compare against the photographs found in "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" (Thomsen and Hjalmarson, 1991). The set of photographs provided in this report and the Thomsen and Hjalmarson (1991) report illustrate that the flow patterns and levels of vegetation are generally the same along that reach of the Gila River. The research performed in the Thomsen and Hjalmarson report provided an n-value determination based on depth of flow, while the n-value determination for the proposed King Ranch Project was for a floodplain delineation based on the 100-year storm event.

The only area of difference between the R2D and Stantec modeling efforts was an area just east of Tuthill Bridge in the northern edge of the channel. Stantec modeled the area as having an n value of 0.15 whereas R2D modeled the area with a lower n value. The higher Stantec value was used in the final model in an attempt to be conservative in the flood surface elevations.

Table 6. Change in Water Surface Elevation (in feet) by Percent Change in Manning's n.

	Percent Change in n Value					
	-30%	-20%	-10%	+10%	+20%	+30%
Average Change	-1.99	-1.30	-0.64	0.61	1.20	1.76
Difference (ft)	-0.69	-0.66			0.59	0.56
River Mile						
195.09	-2.09	-1.32	-0.64	0.6	1.15	1.68
195	-1.82	-1.18	-0.58	0.54	1.07	1.57
194.91	-1.8	-1.16	-0.57	0.54	1.07	1.58
194.81	-1.47	-0.99	-0.5	0.5	0.99	1.46
194.72	-1.37	-0.93	-0.48	0.48	0.95	1.42
194.62	-1.25	-0.86	-0.45	0.46	0.93	1.39
194.53	-1.15	-0.81	-0.43	0.46	0.93	1.4
194.4	-0.99	-0.76	-0.43	0.48	0.98	1.49
194.29	-1.88	-1.45	-0.68	0.67	1.32	1.91
194.21	-1.78	-1.22	-0.62	0.63	1.25	1.84
194.205	Estrella Parkway					
194.2	-2.2	-1.41	-0.69	0.66	1.3	1.9
194.1	-2.18	-1.4	-0.68	0.65	1.28	1.87
194.02	-2.17	-1.39	-0.68	0.65	1.28	1.87
193.94	-2.05	-1.34	-0.66	0.63	1.25	1.83
193.87	-1.98	-1.3	-0.64	0.62	1.23	1.8
193.79	-1.94	-1.27	-0.63	0.62	1.23	1.79
193.73	-2.03	-1.34	-0.66	0.64	1.26	1.83
193.62	-2.23	-1.44	-0.7	0.67	1.32	1.91
193.53	-2.22	-1.44	-0.7	0.67	1.32	1.9
193.43	-2.21	-1.44	-0.7	0.68	1.33	1.91
193.34	-2.2	-1.43	-0.7	0.68	1.32	1.91
193.25	-2.27	-1.48	-0.72	0.68	1.34	1.93
193.16	-2.29	-1.48	-0.72	0.69	1.35	1.94
193.07	-2.24	-1.46	-0.71	0.68	1.34	1.93
192.98	-2.18	-1.42	-0.7	0.67	1.31	1.89
192.89	-2.21	-1.44	-0.71	0.67	1.31	1.9
192.79	-2.23	-1.45	-0.71	0.67	1.32	1.92
192.7	-2.21	-1.44	-0.71	0.67	1.31	1.91
192.61	-2.13	-1.39	-0.68	0.65	1.28	1.87
192.52	-2.03	-1.34	-0.66	0.63	1.25	1.84
192.41	-2	-1.32	-0.65	0.63	1.24	1.81
192.39	Cotton Lane Bridge					
192.38	-2.13	-1.39	-0.68	0.64	1.26	1.83
192.33	-2.09	-1.37	-0.67	0.64	1.25	1.83

Table 6. Change in Water Surface Elevation by Percent Change in Manning's n (Cont).

	Percent Change in n Value						
	-30%	-20%	-10%	+10%	+20%	+30%	
192.23	-2.06	-1.35	-0.66	0.64	1.24	1.82	
192.14	-2.2	-1.41	-0.68	0.65	1.26	1.84	
192.04	-2.08	-1.34	-0.65	0.62	1.21	1.77	
191.95	-2	-1.3	-0.64	0.6	1.17	1.72	
191.86	-1.92	-1.25	-0.62	0.58	1.15	1.69	
191.76	-1.93	-1.26	-0.61	0.59	1.15	1.69	
191.67	-1.95	-1.27	-0.62	0.59	1.16	1.7	
191.57	-1.96	-1.27	-0.62	0.6	1.17	1.71	
191.48	-1.98	-1.28	-0.63	0.6	1.17	1.72	
191.38	-2.01	-1.3	-0.63	0.61	1.19	1.74	
191.29	-2	-1.3	-0.63	0.6	1.18	1.73	
191.19	-2.02	-1.31	-0.64	0.61	1.19	1.74	
191.1	-2.01	-1.31	-0.63	0.61	1.19	1.74	
191	-2.04	-1.32	-0.64	0.61	1.2	1.75	
190.91	-2.1	-1.36	-0.66	0.62	1.21	1.77	
190.81	-2.1	-1.35	-0.65	0.62	1.21	1.78	
190.72	-2.08	-1.35	-0.65	0.62	1.21	1.77	
190.62	-2.06	-1.33	-0.64	0.62	1.2	1.76	
190.53	-2.03	-1.32	-0.64	0.6	1.18	1.73	
190.43	-2.01	-1.3	-0.63	0.6	1.17	1.72	
190.34	-1.96	-1.27	-0.62	0.58	1.14	1.67	End of Project
190.24	-1.88	-1.22	-0.59	0.56	1.11	1.62	
190.15	-1.89	-1.22	-0.59	0.56	1.09	1.61	
190.05	-1.73	-1.12	-0.55	0.53	1.03	1.51	
189.96	-1.62	-1.06	-0.52	0.5	0.99	1.45	
189.87	-1.52	-0.99	-0.48	0.48	0.94	1.38	
189.77	-1.4	-0.92	-0.46	0.44	0.87	1.29	Not Used in Average
189.67	-1.3	-0.86	-0.43	0.42	0.82	1.22	Due to Drawdown /
189.58	-1.21	-0.8	-0.4	0.39	0.77	1.14	Backwater Effects
189.48	-1.1	-0.73	-0.37	0.36	0.72	1.07	from Boundary
189.39	-1	-0.67	-0.33	0.34	0.68	1.01	Condition
189.3	-0.91	-0.62	-0.31	0.31	0.62	0.93	
189.21	-0.78	-0.53	-0.26	0.28	0.55	0.83	
189.11	-0.64	-0.44	-0.23	0.23	0.46	0.71	
189.02	-0.52	-0.36	-0.18	0.19	0.39	0.59	
188.81	-0.29	-0.2	-0.1	0.12	0.24	0.37	
188.69	-0.17	-0.12	-0.06	0.07	0.14	0.21	
188.59	0	0	0	0	0	0	

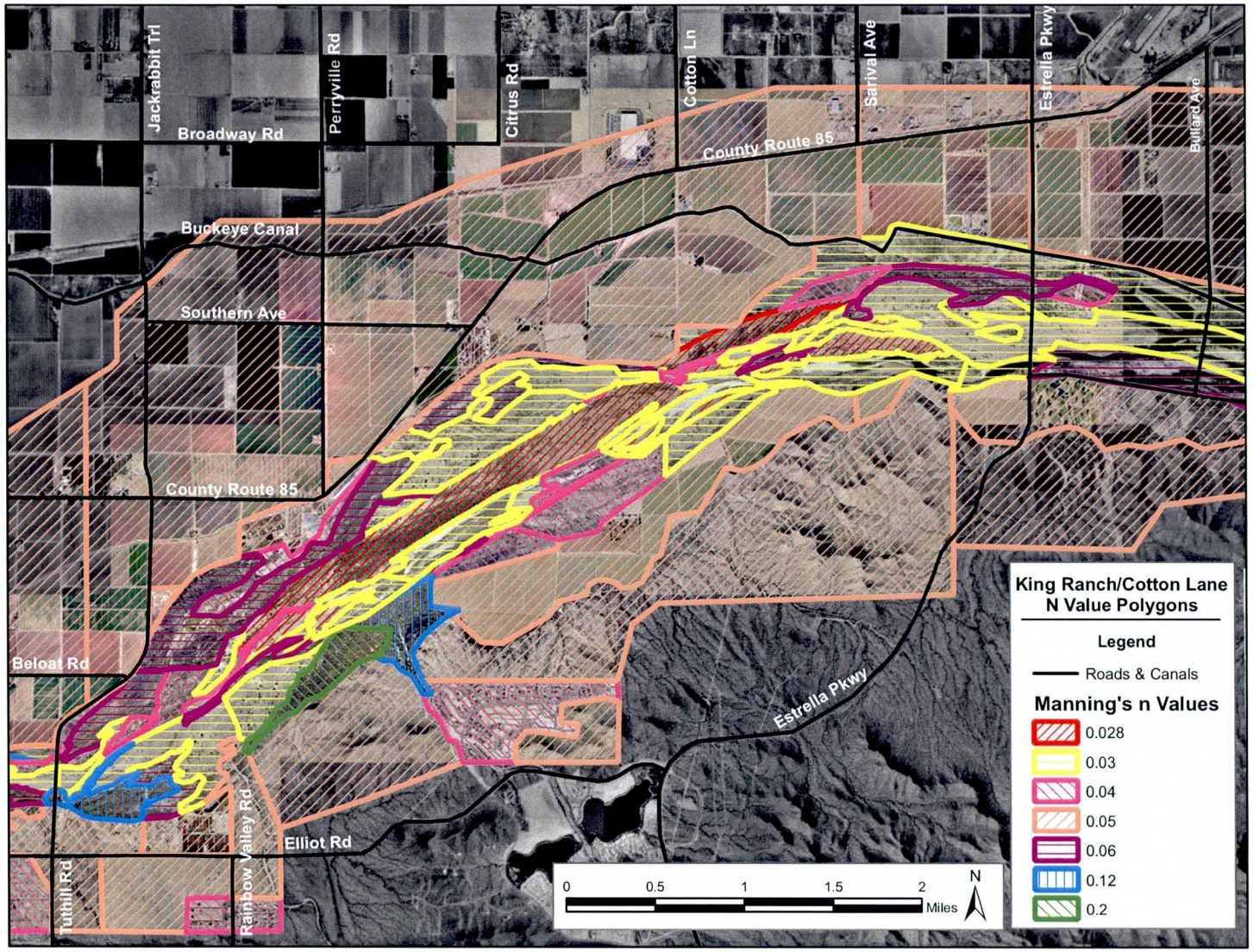


Figure 8. Overview of Selected Manning's n Values for the Cotton Lane Bridge Study Reach.

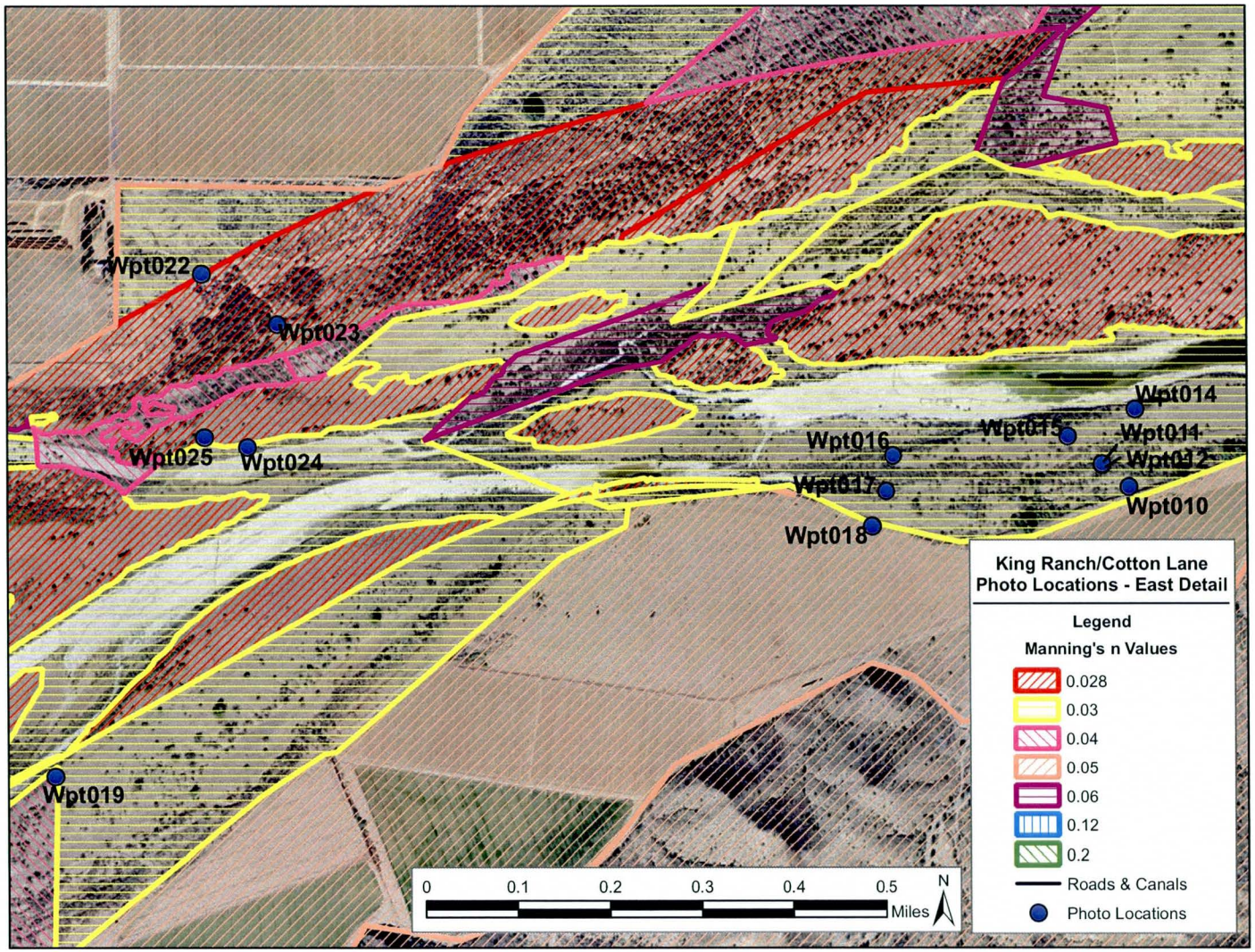


Figure 9. Cotton Lane Field Photo Locations and Associated n Values.

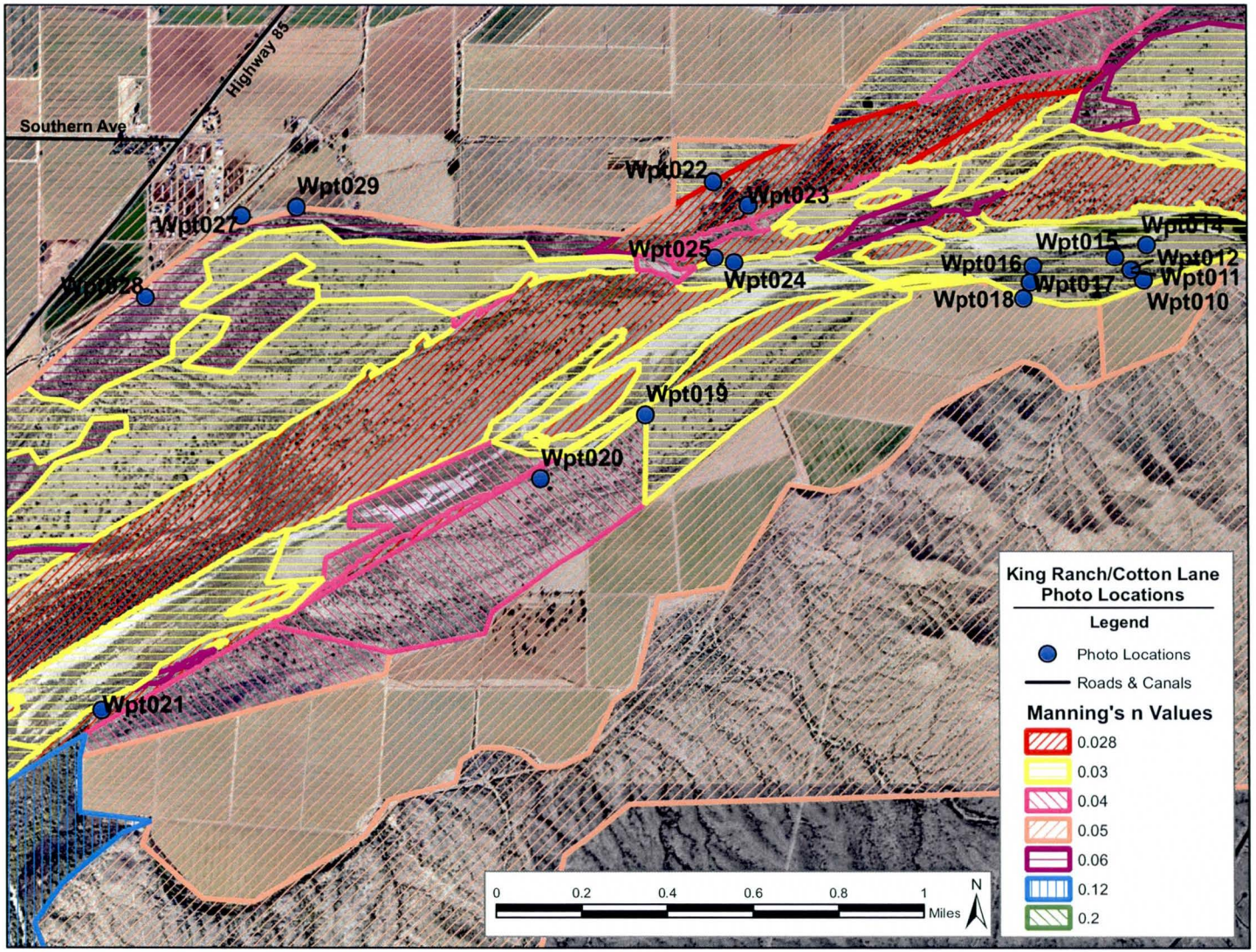


Figure 10. Cotton Lane Field Photo Locations for Central Portion of Study Area.

Roughness Coefficient Estimation by Stantec Consulting Inc.

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035		0.030	
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000		0.000	
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004		0.000	0.000
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010		0.000	
	Medium		0.010 - 0.025			
	Large		0.025 - 0.050			
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	0.000
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.030	0.000
Round values to the nearest 0.005:				**0.000**	**0.030**	**0.000**
Photograph No.: 1, 2, 3						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 2

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035		0.030	
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000			
	Minor		0.001 - 0.005		0.003	
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004		0.000	
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025			
	Large		0.025 - 0.050	0.050		0.050
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.050	0.033	0.050
Round values to the nearest 0.005:				**Composit Value**	**0.040**	**0.000**
Photograph No.: 4,5,6						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 3

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026		0.025	
	Coarse Sand		0.026 - 0.035			
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000			
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020		0.015	
Effects of Obstructions	Negligable	n_2	0.000 - 0.004			
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030		0.025	
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025			
	Large		0.025 - 0.050		0.050	
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000			
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015		0.015	
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.130	0.000
Round values to the nearest 0.005:				**0.000**	**0.150**	**0.000**
Photograph No.: 7,8,9						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 4 Location 1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035		0.030	
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000		0.000	
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004			
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025		0.010	
	Large		0.025 - 0.050			
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	0.000
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.040	0.000
Round values to the nearest 0.005:				**0.000**	**0.040**	**0.000**
Photograph No.: 10,11,12						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 4 Location 2

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035			
	Gravel		0.028 - 0.035		0.030	
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000		0.000	
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004		0.000	
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025		0.010	
	Large		0.025 - 0.050			
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	0.000
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.040	0.000
Round values to the nearest 0.005:				**0.000**	**0.040**	**0.000**
Photograph No.: 13,14,15						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 5

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035		0.030	
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000		0.000	0.000
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004		0.000	0.000
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010		0.006	
	Medium		0.010 - 0.025			
	Large		0.025 - 0.050			
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	0.000
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.036	0.000
Round values to the nearest 0.005:				**0.000**	**0.035**	**0.000**
Photograph No.:16,17,18						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 6

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026		0.025	
	Coarse Sand		0.026 - 0.035			
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000			
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020		0.015	
Effects of Obstructions	Negligable	n_2	0.000 - 0.004			
	Minor		0.005 - 0.015			
	Appreciable		0.020 - 0.030		0.025	
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025			
	Large		0.025 - 0.050		0.050	
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000			
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015		0.015	
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.130	0.000
Round values to the nearest 0.005:				**0.000**	**0.150**	**0.000**
Photograph No.: 19,20,21						

Determination of Manning's n-value by the FCDMC method

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05 By: NDB & PJE Date: 2-Aug-06
Photo Location Site 7

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_0	0.012 - 0.018			
	Rock Cut		0.025			
	Firm Soil		0.025 - 0.032			
	Fine Sand		0.023 - 0.026			
	Coarse Sand		0.026 - 0.035		0.030	
	Gravel		0.028 - 0.035			
	Cobble		0.030 - 0.050			
	Boulder		0.040 - 0.070			
Degree of Irregularity	Smooth	n_1	0.000			
	Minor		0.001 - 0.005			
	Moderate		0.006 - 0.010			
	Severe		0.011 - 0.020			
Effects of Obstructions	Negligable	n_2	0.000 - 0.004			
	Minor		0.005 - 0.015		0.010	
	Appreciable		0.020 - 0.030			
	Severe		0.040 - 0.060			
Vegetation	Small	n_3	0.002 - 0.010			
	Medium		0.010 - 0.025		0.025	
	Large		0.025 - 0.050			
	Very Large		0.050 - 0.100			
Variations in Channel Cross Section	Gradual	n_4	0.000		0.000	
	Alternating (occasionally)		0.001 - 0.005			
	Alternating (frequently)		0.010 - 0.015			
Degree of Meandering	Minor	m	1.00	1.000	1.000	1.000
	Appreciable		1.15			
	Severe		1.30			
$n = (n_0 + n_1 + n_2 + n_3 + n_4)m$				0.000	0.065	0.000
Round values to the nearest 0.005:				**0.000**	**0.065**	**0.000**
Photograph No.: 22,23, 24						

Project: Gila River Floodplain Redelineation Study
Stream: Gila River
Reach: RM 187.06 to RM 190.05

Estimate composite "n" value for braided channel sections.

Given

Depth =	21
Bottom Width =	200
Side Slopes___:1 =	1

		Subarea 1	Channel	Subarea2	Total
Area	A	220.5	4200	220.5	4641
Wetted Perimeter	P	29.698485	200	29.69848481	259.39697
Hydraulic Radius	R	7.4246212	21	7.424621202	17.891497
Estimated					
Manning's "n" value	n	0.05	0.033	0.05	
	K	24957.275	1441034.7	24957.27462	1490949.2

$$nc = \left[\frac{\left(P_1 n_1^{1.5} + P_2 n_2^{1.5} + P_3 n_3^{1.5}\right)}{P} \right]^{2/3}$$

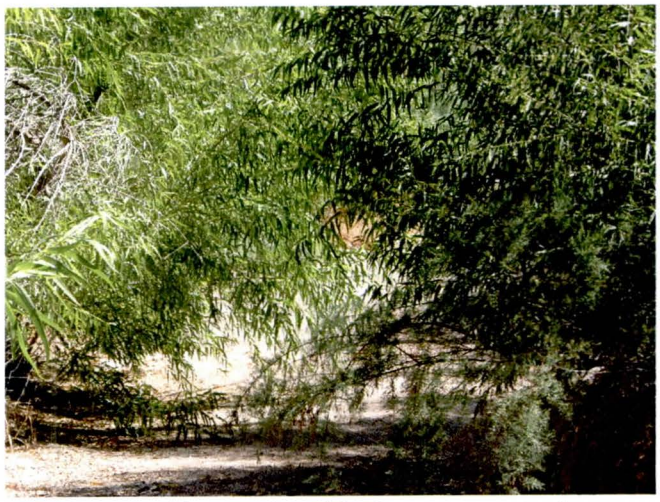
P_1n_1	P_2n_2	P_3n_3	P	nc	Round "n" value up to nearest 0.005
0.332	1.199	0.332	259.397	0.037	0.04

nc = composite "n" value

Photograph 1 Clear Area minor vegetation (Site 1 Upstream View)

Photograph 2 Bed material in Clear Area (Site 1)

Photograph 3 Clear Area minor vegetation (Site 1 Downstream View)

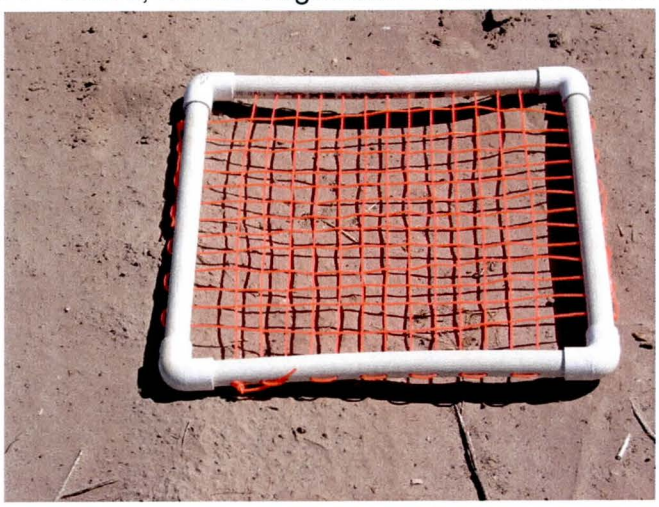


Photograph 4 Site 2, Channels with dense vegetation on side slopes

Photograph 5 Site 2, Bed material of channels with dense vegetation on side slopes.

Photograph 6 Site 2, Channels with dense vegetation on side slopes.

Photograph 7 Site 3, Dense Vegetation Area viewed from open area.



Photograph 8 Site 3, Dense Vegetation Area bed material.

Photograph 9 Site 3, Dense Vegetation Area viewed from open area.

Photograph 10 Site 4, Location 1 example of a 0.040 n value area

Photograph 11 Site 4, Location 1 example of bed material in a 0.040 n value area

Photograph 12 Site 4, Location 1 example of a0.040 n value area

Photograph 13 Site 4, Location 2, example .040 n value area

Photograph 14 Site 4, Location2, example of bed material in an .040 n value area

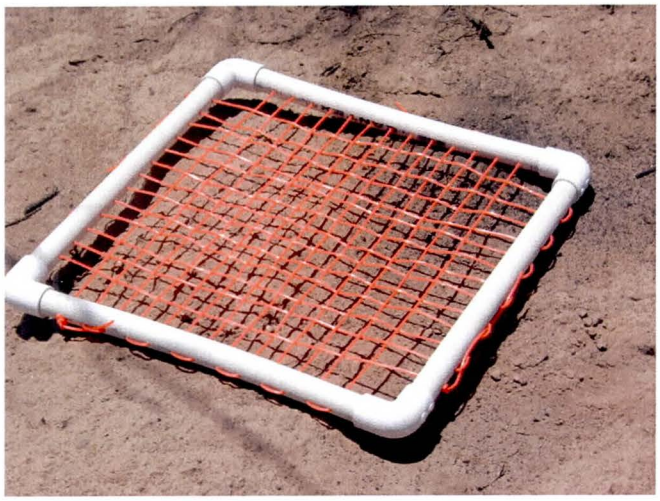
Photograph 15 Site 4, Location 2, example .040 n value area

Photograph 16 Site 5, example of a 0.035 n value area

Photograph 17 Site 5, example of bed material in a 0.035 n value area

Photograph 18 Site 5, example of a 0.035 n value area

Photograph 19 Site 6, burned Dense Vegetation Area



Photograph 20 Site 6, Bed material in burned Dense Vegetation Area

Photograph 21 Site 6, burned Dense Vegetation Area

Photograph 22 Site 7, example of a 0.065 n value area

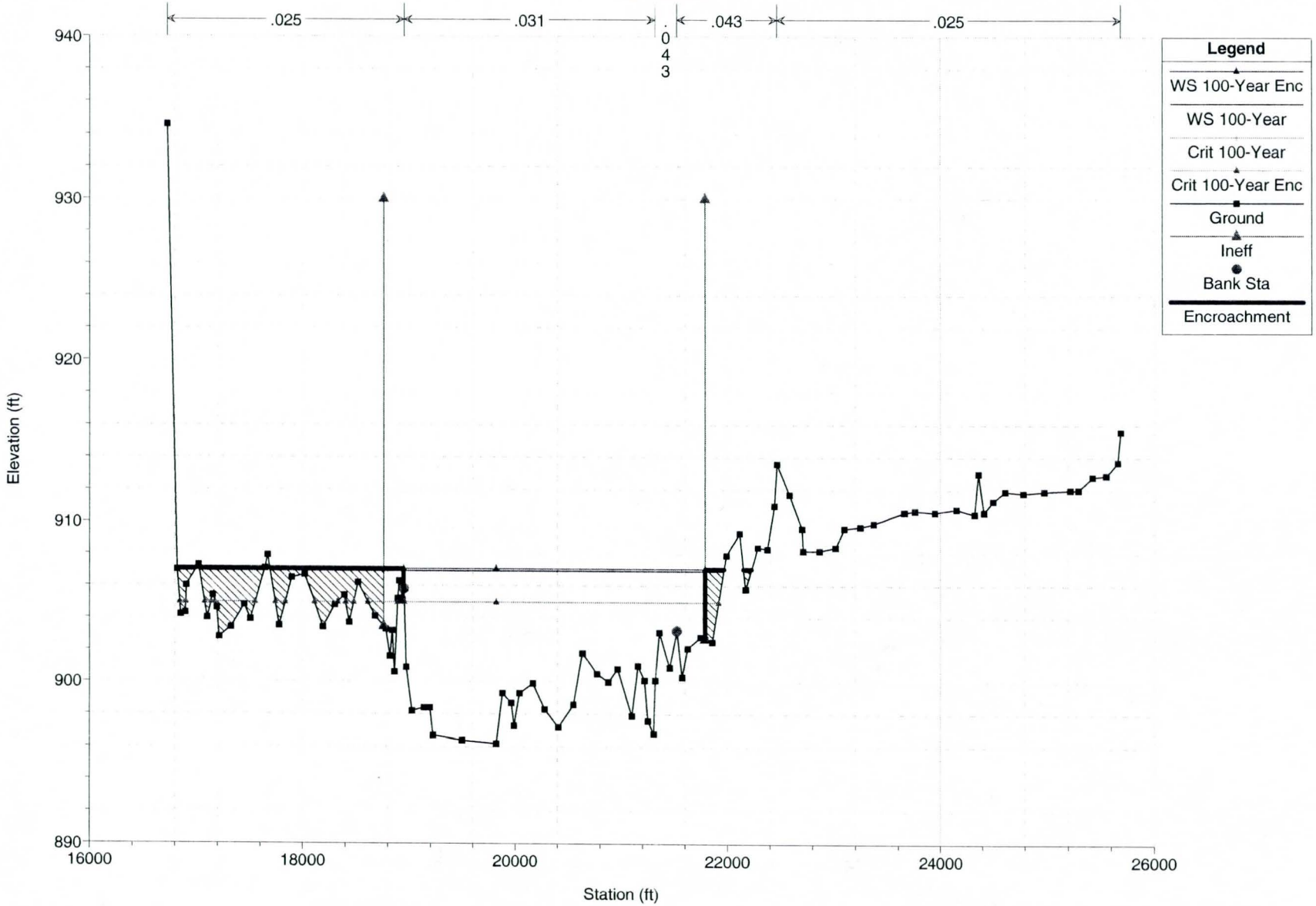
Photograph 23 Site 7, example of a 0.065 n value area

Photograph 24 Site 7, example of a 0.065 n value area, note build up of debris at base of vegetation

APPENDIX E.2: CROSS SECTION PLOTS

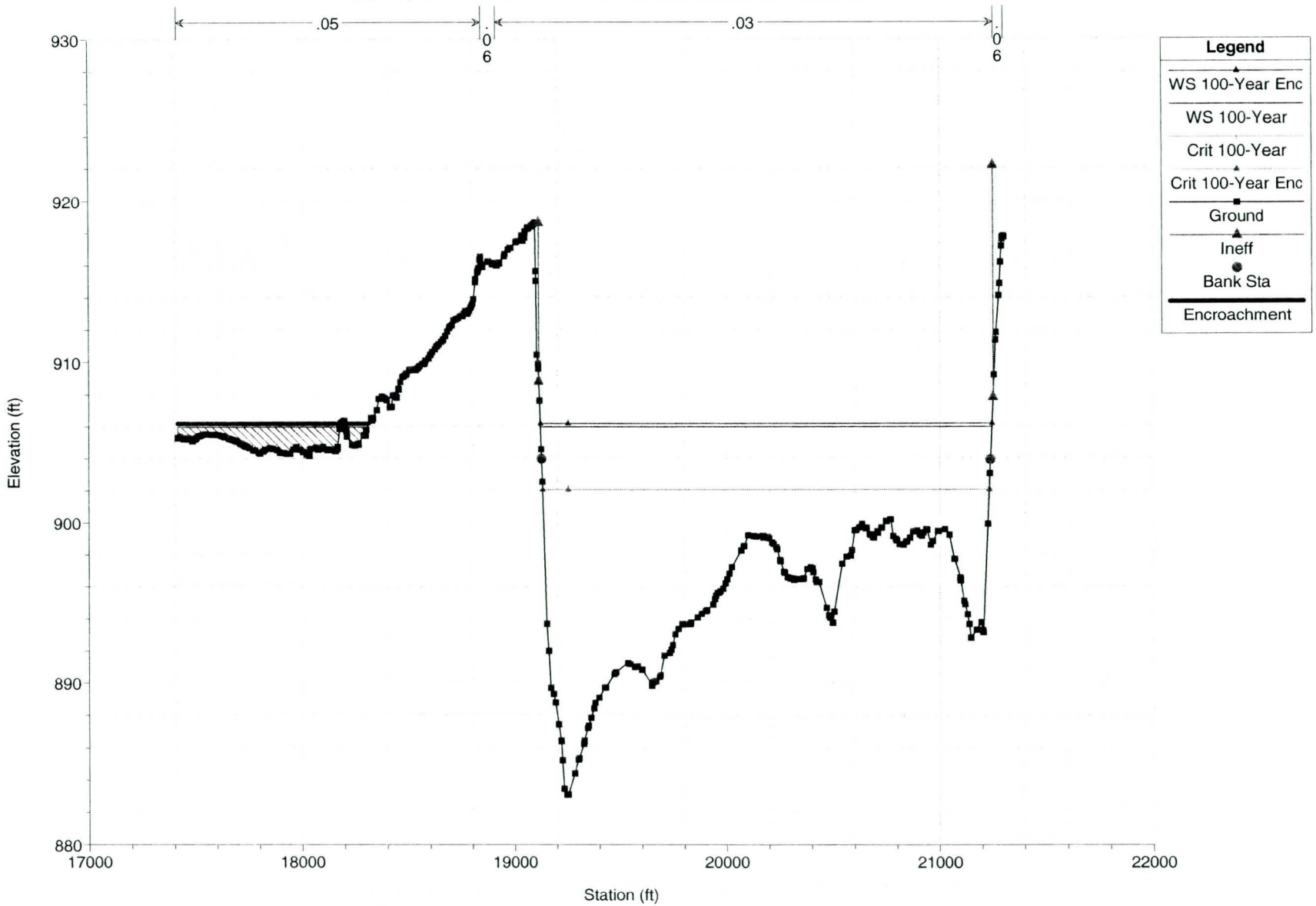
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.29



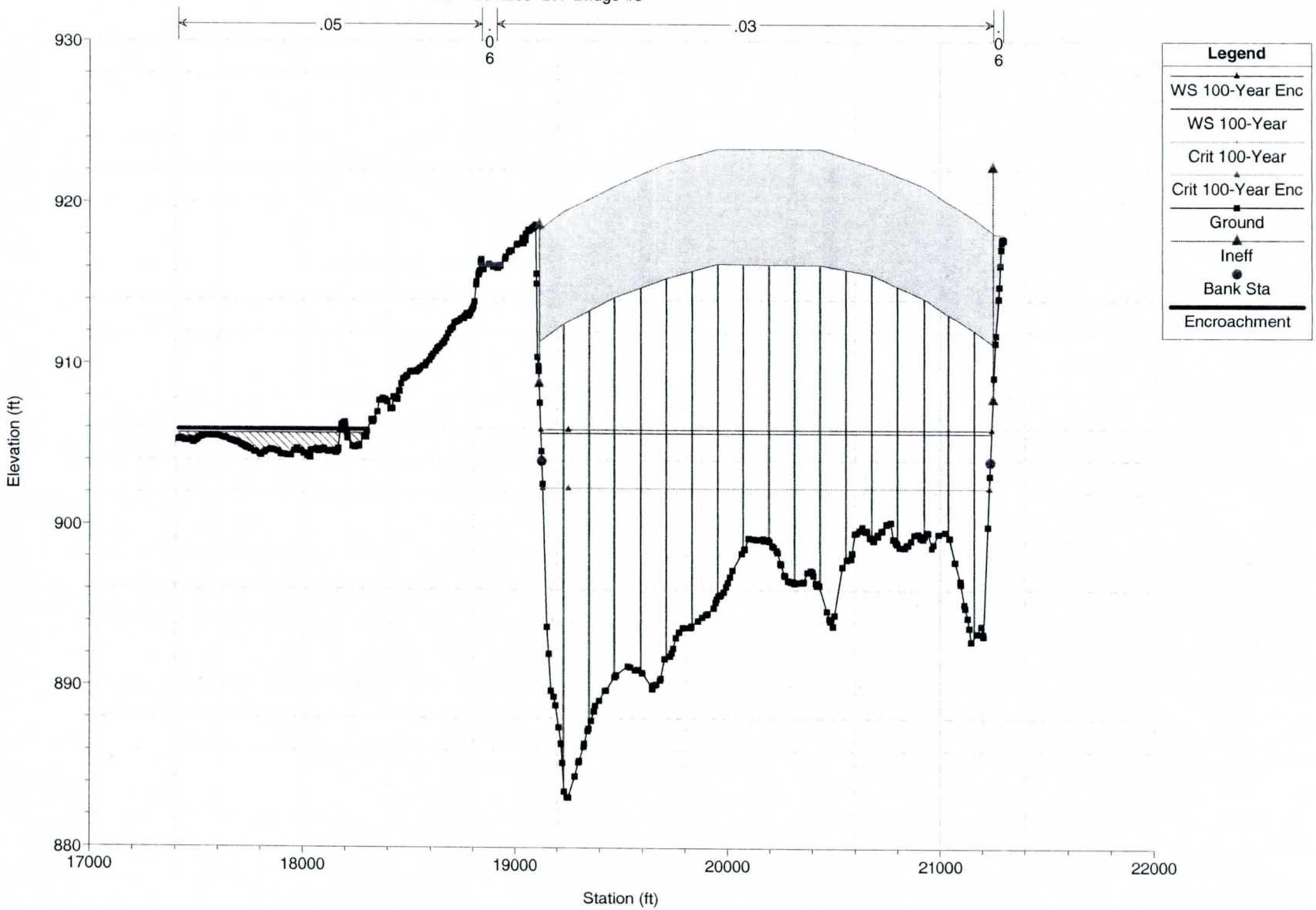
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.21 APPROX. ALIGNMENT OF ESTRELLA PKWY BRIDGE



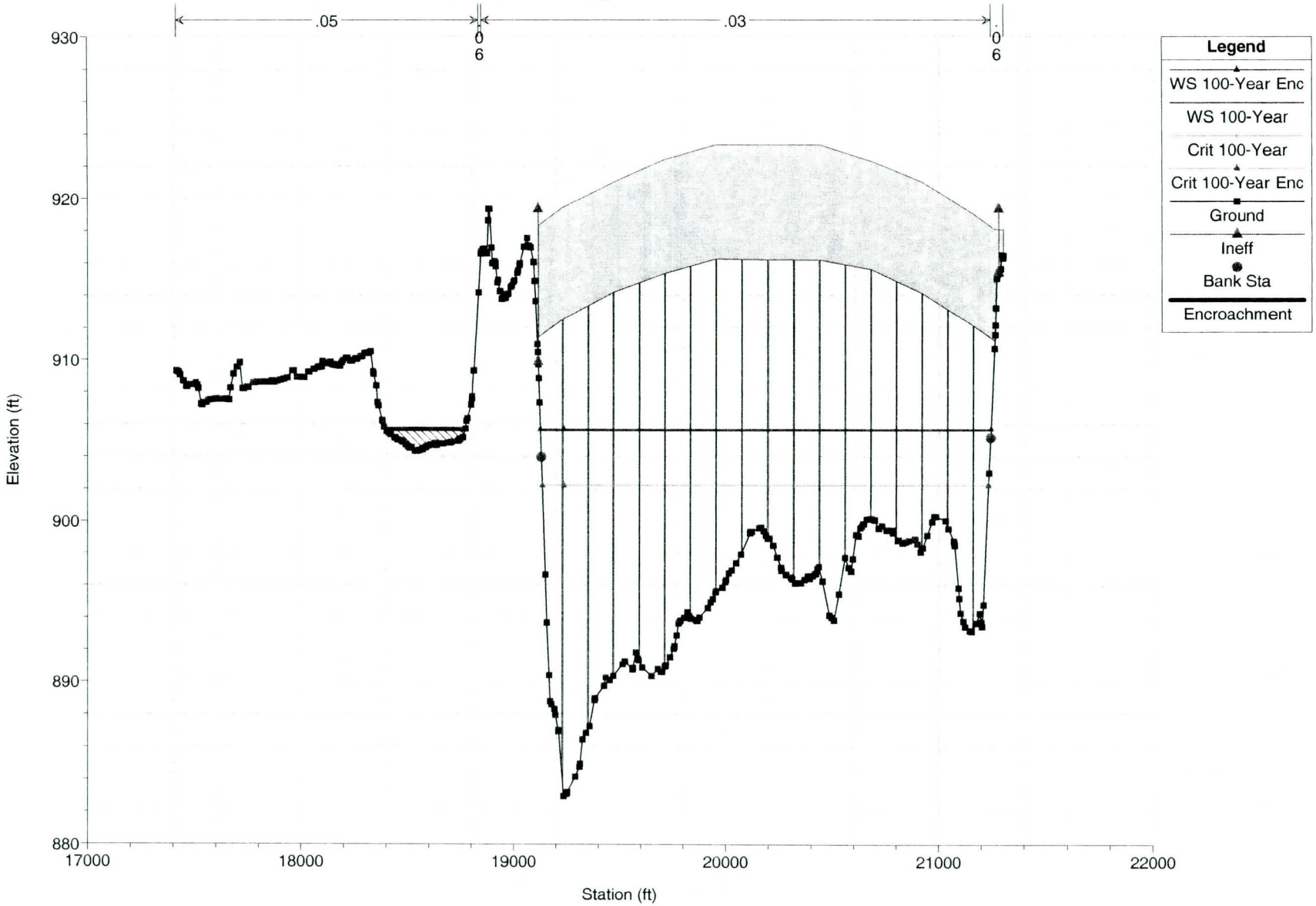
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.205 BR Bridge #3



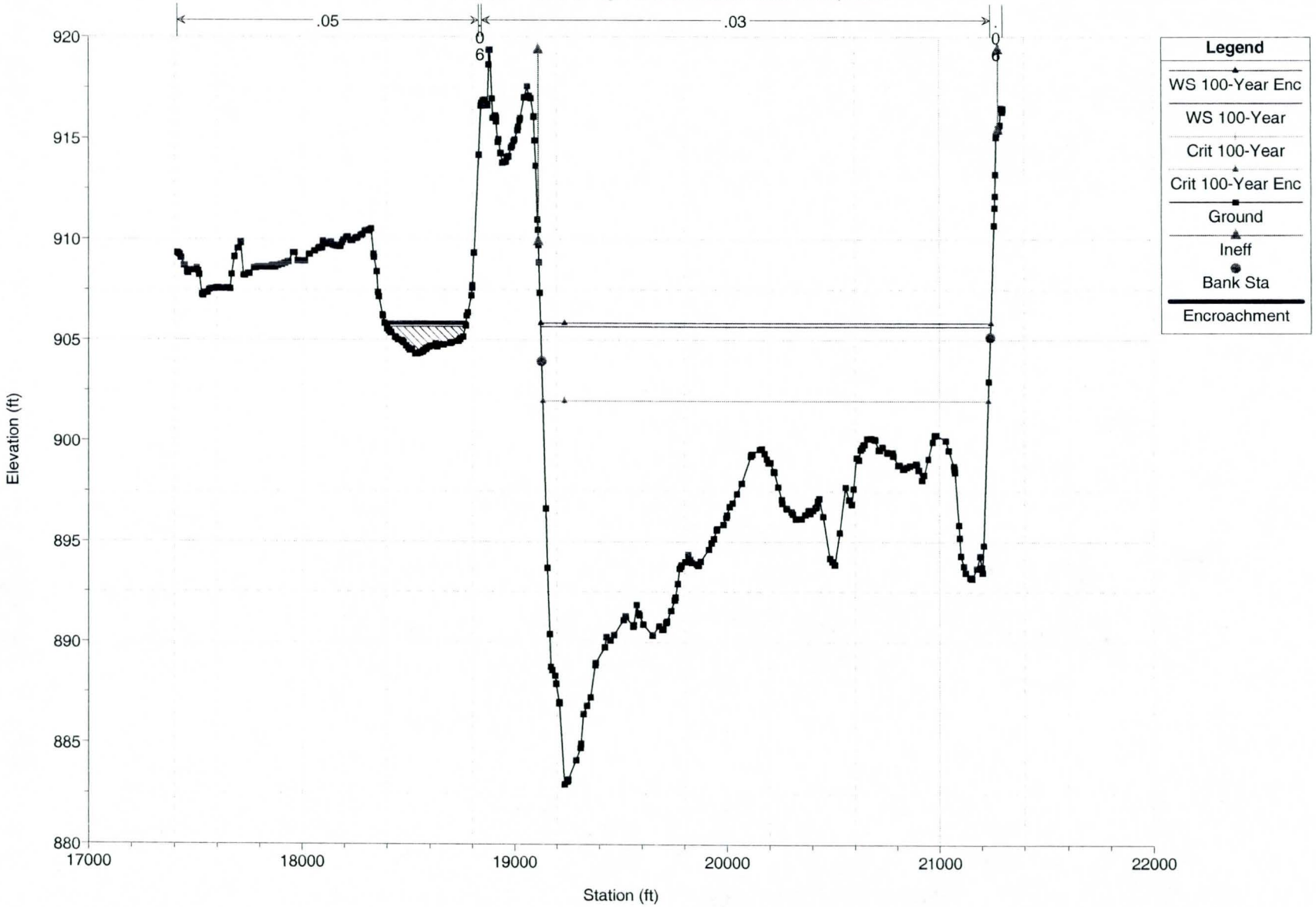
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.205 BR Bridge #3



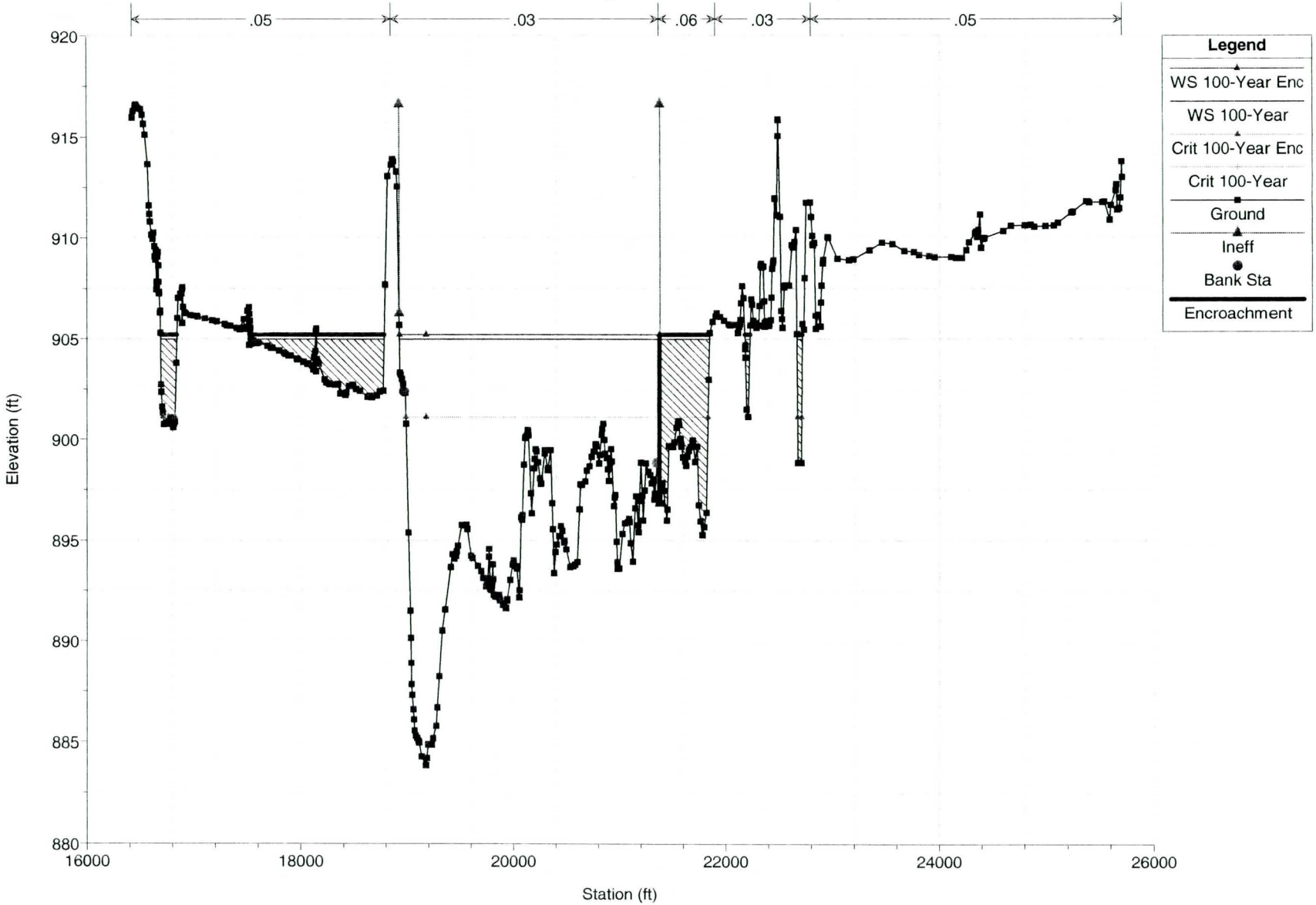
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.2 Left and Right Channel Bank Stations Interpolated



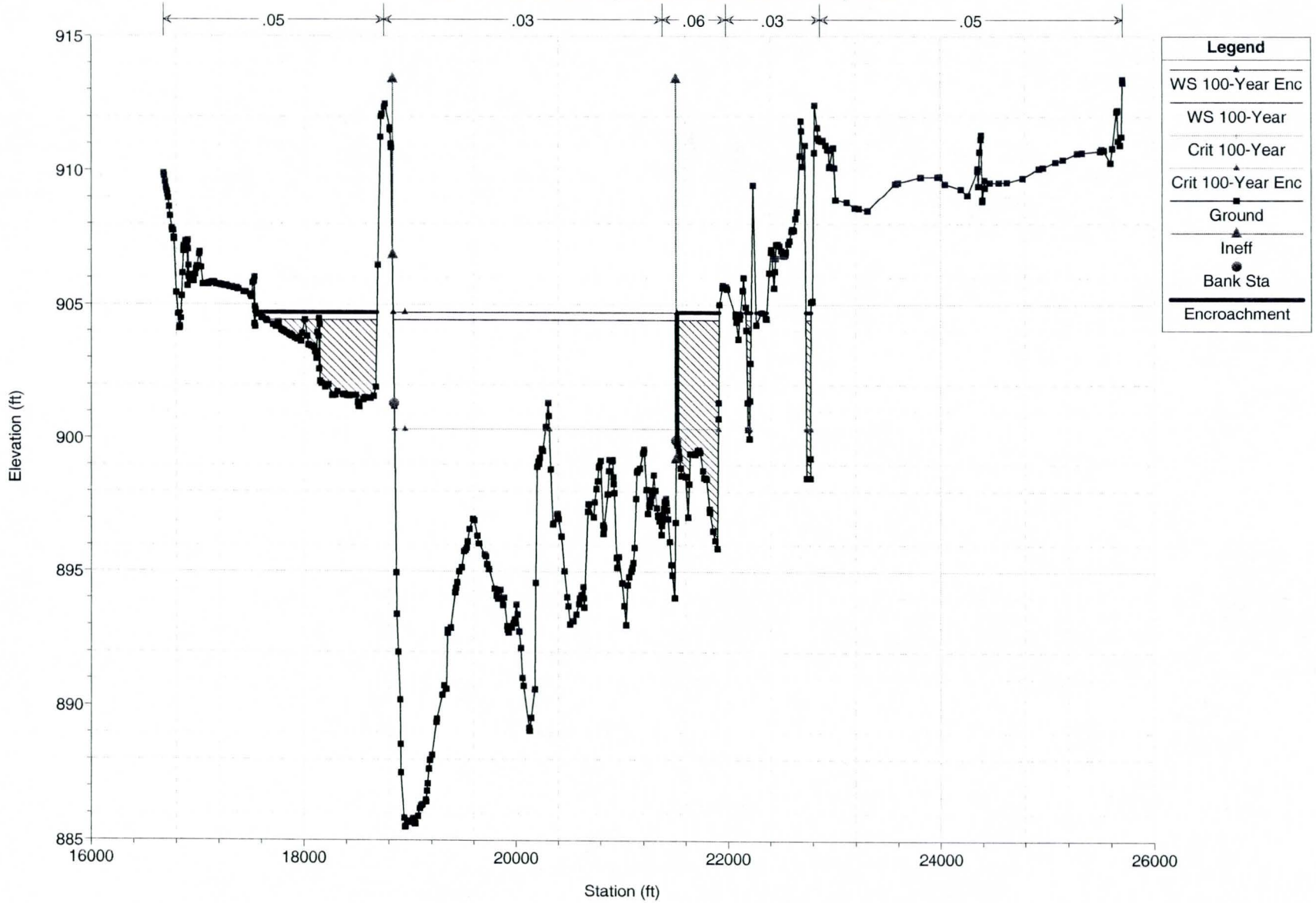
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.1 Left and Right Channel Bank Stations Interpolated



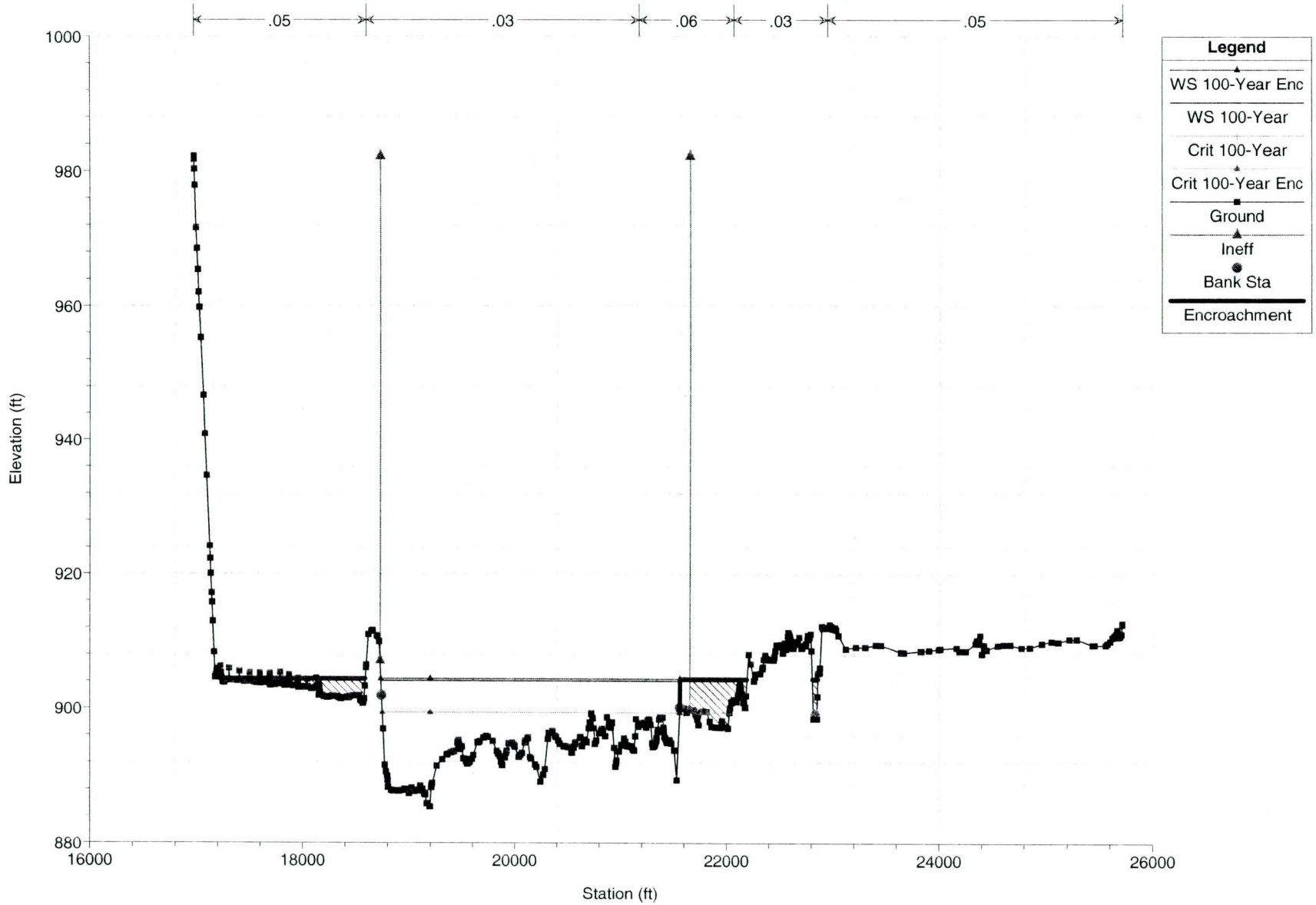
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 194.02 Left and Right Channel Bank Stations Interpolated



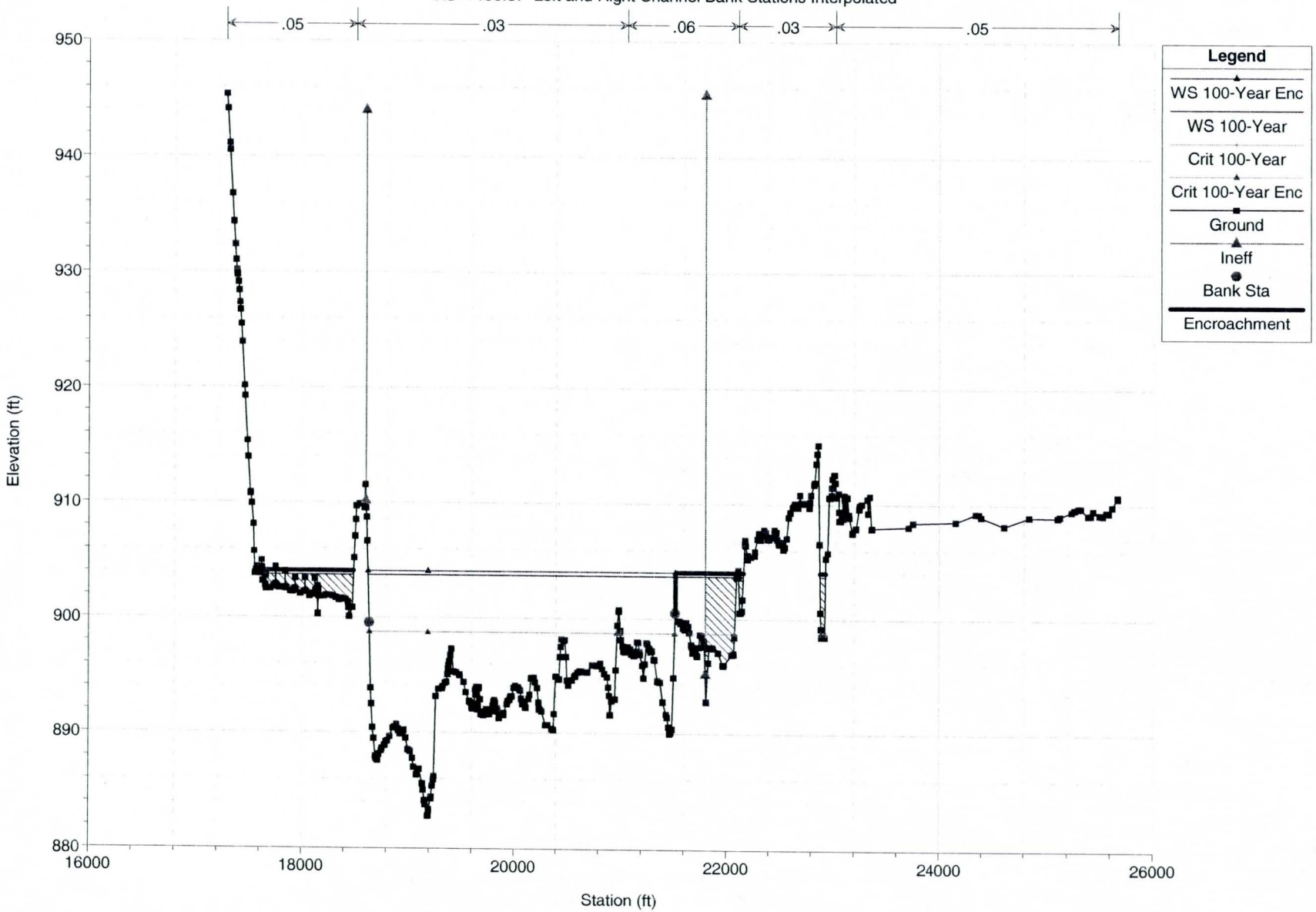
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.94 Left and Right Channel Bank Stations Interpolated



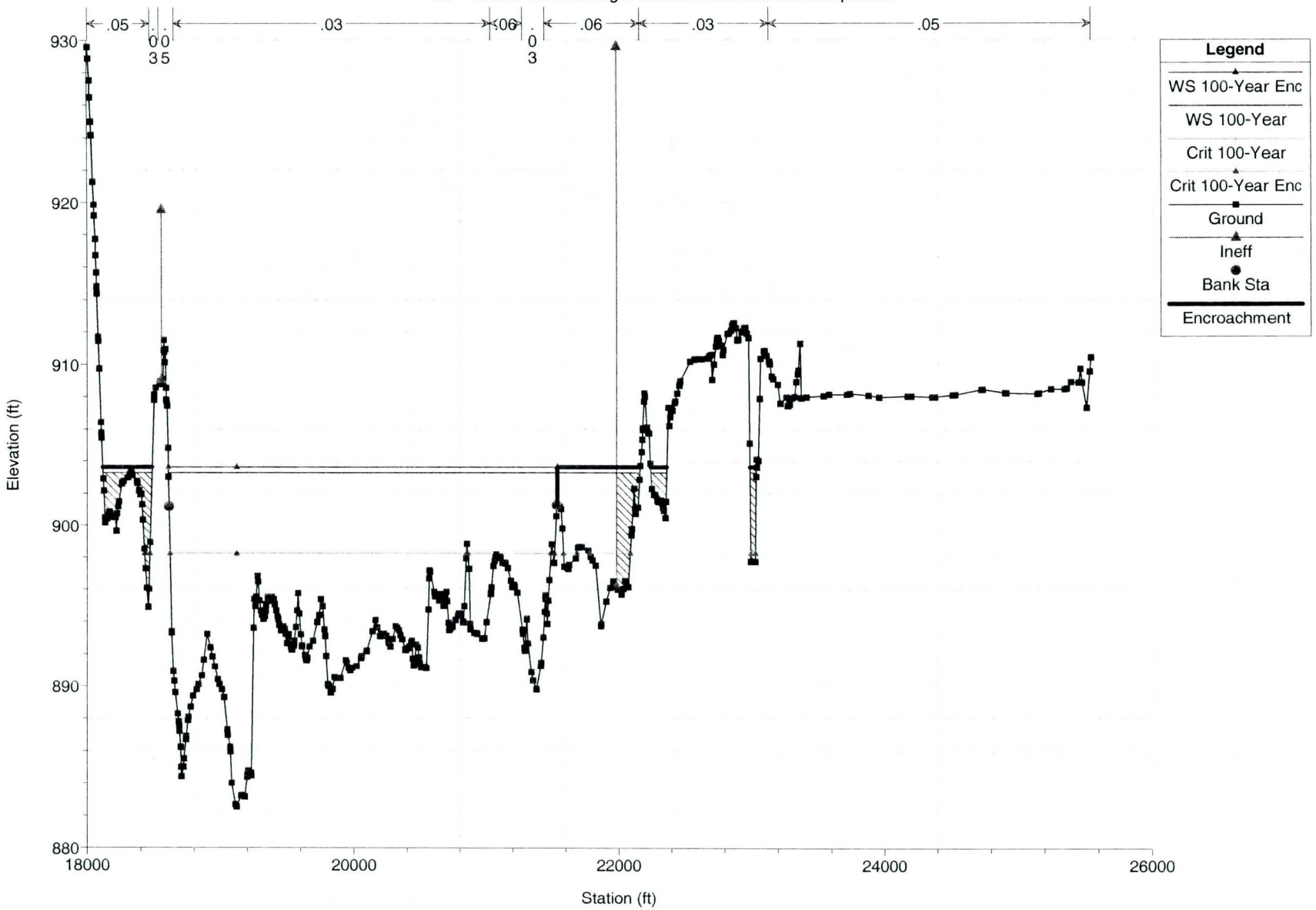
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.87 Left and Right Channel Bank Stations Interpolated



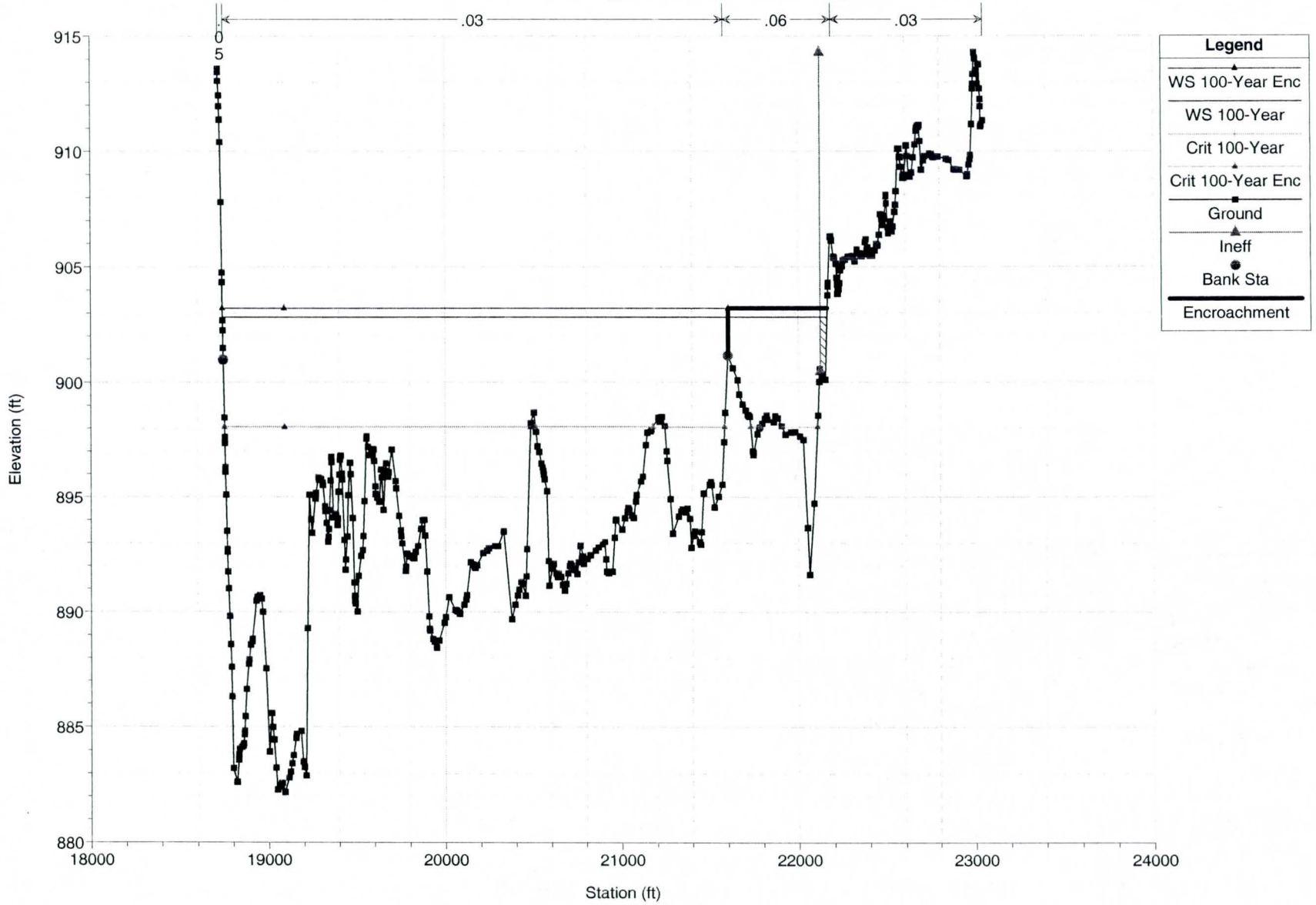
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.79 Left and Right Channel Bank Stations Interpolated



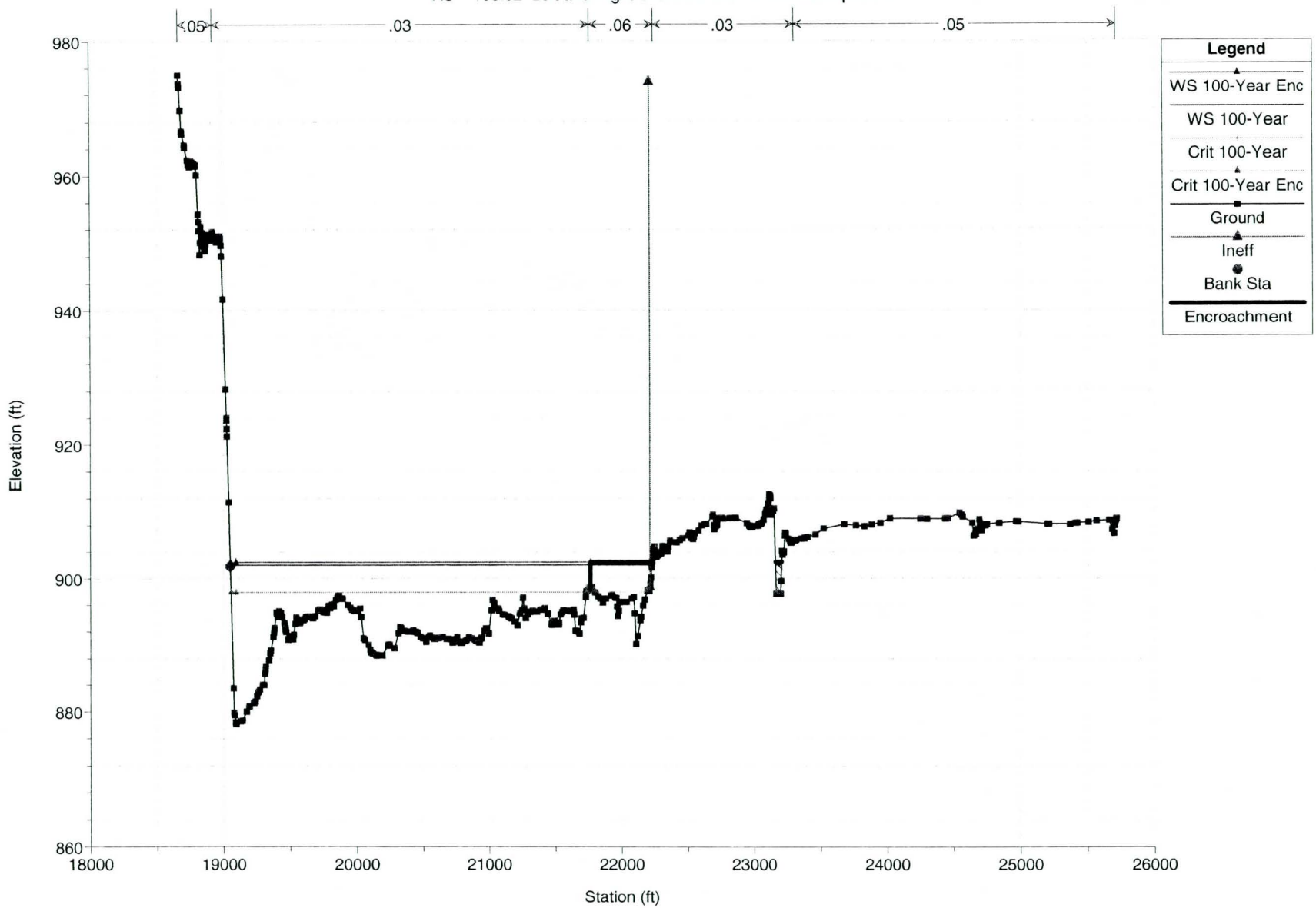
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.73 Left and Right Channel Bank Stations Interpolated

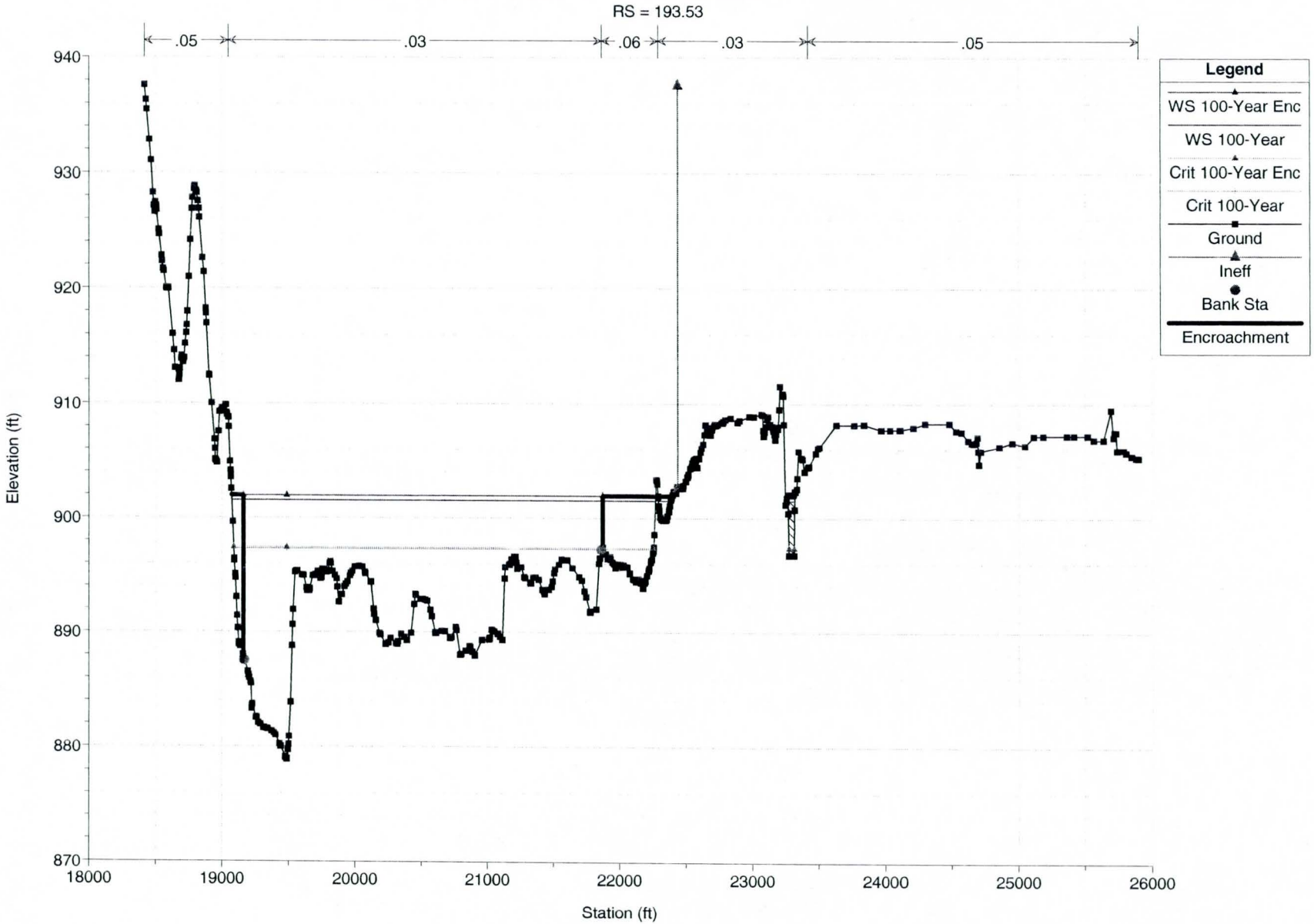


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.62 Left and Right Channel Bank Stations Interpolated

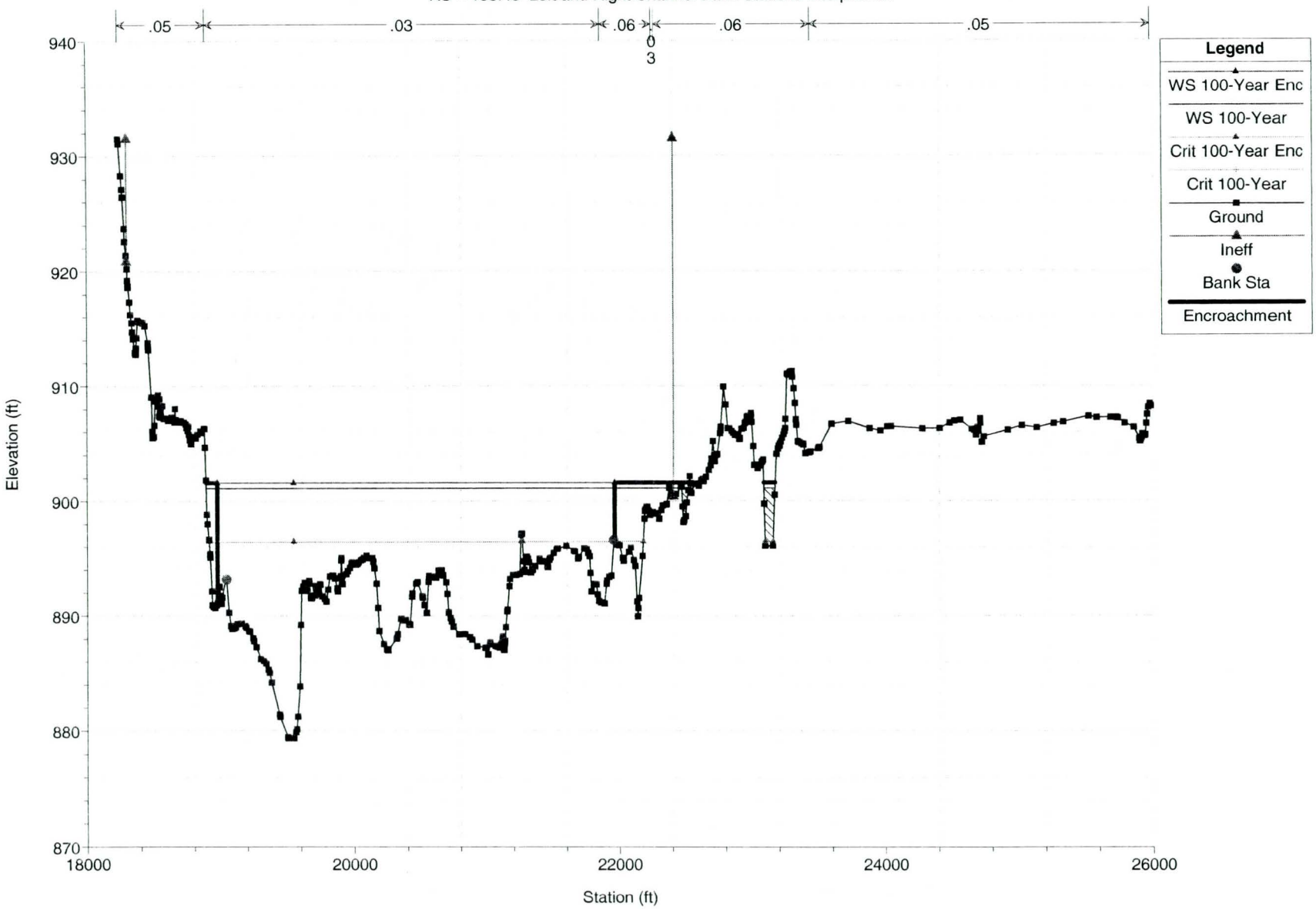


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



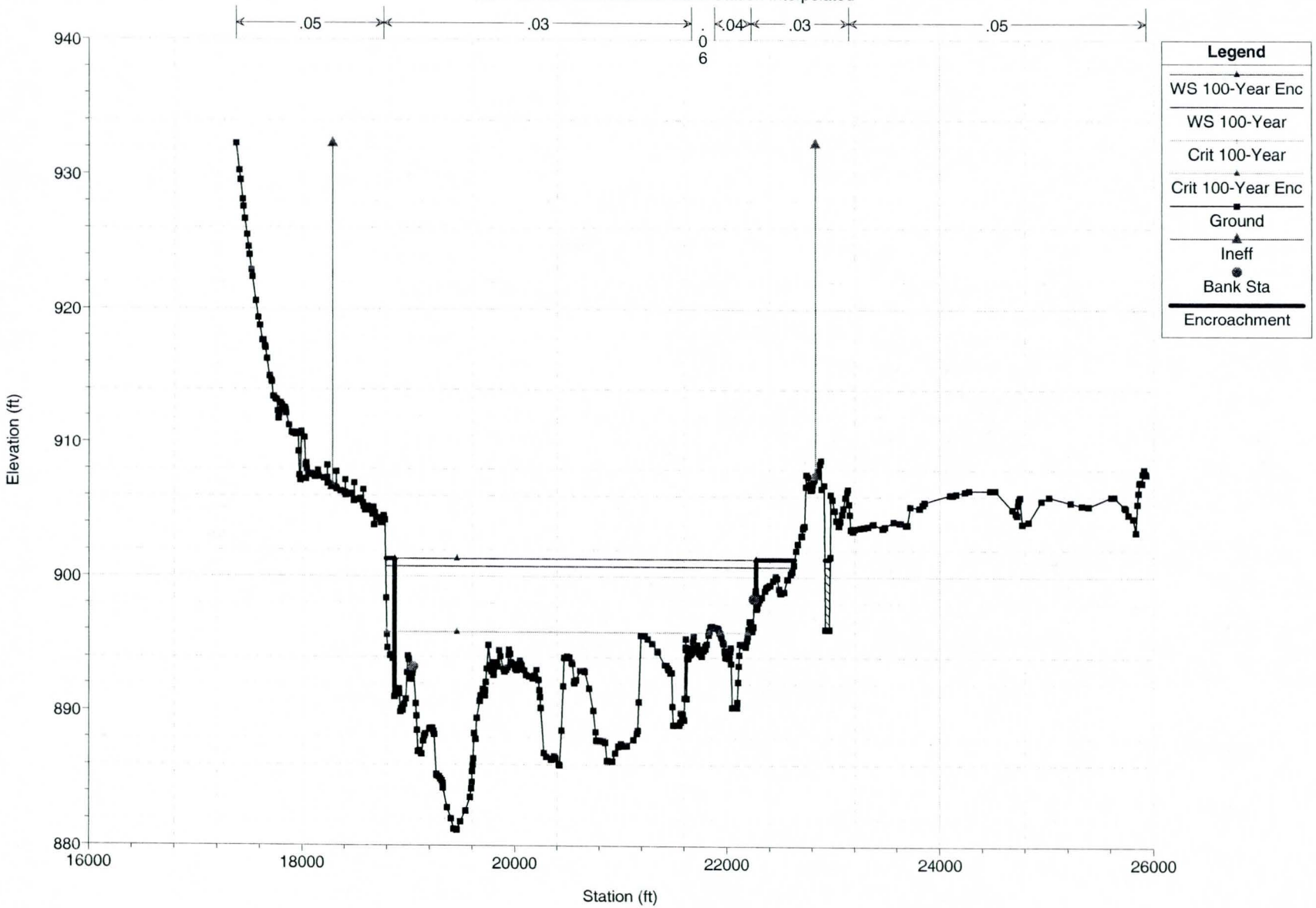
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.43 Left and Right Channel Bank Stations Interpolated



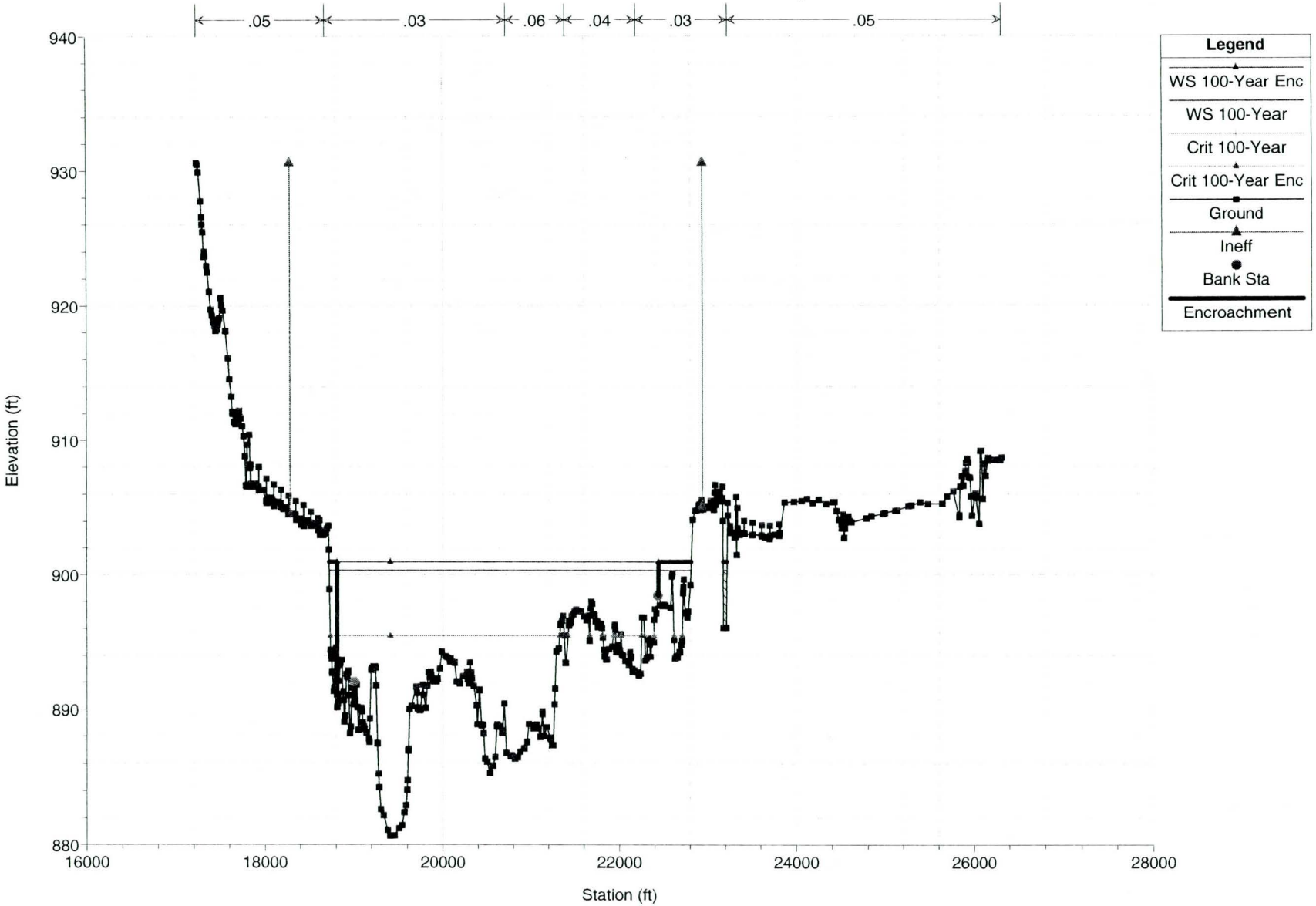
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.34 Left Channel Bank Station Interpolated



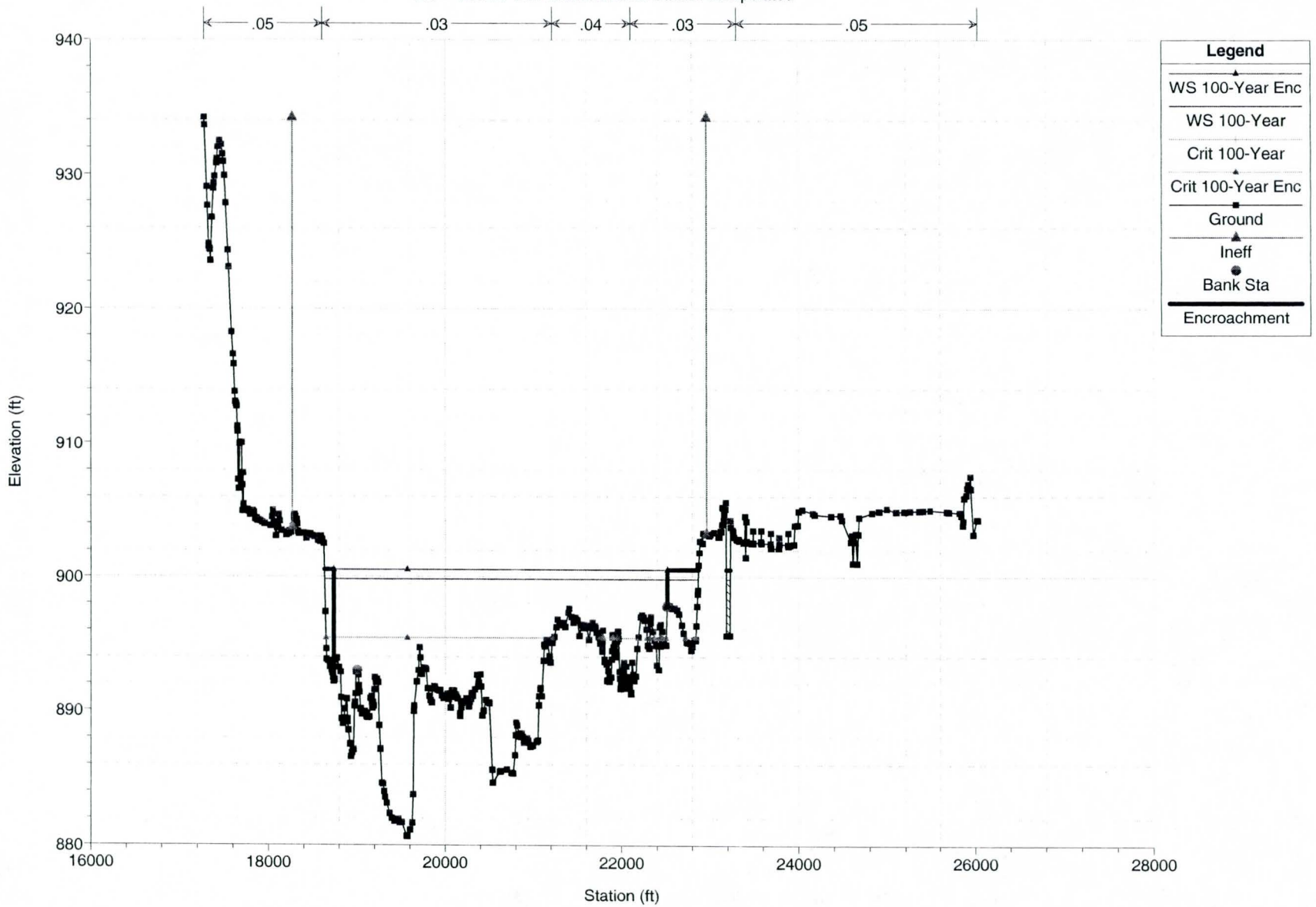
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.25 Left Channel Bank Station Interpolated



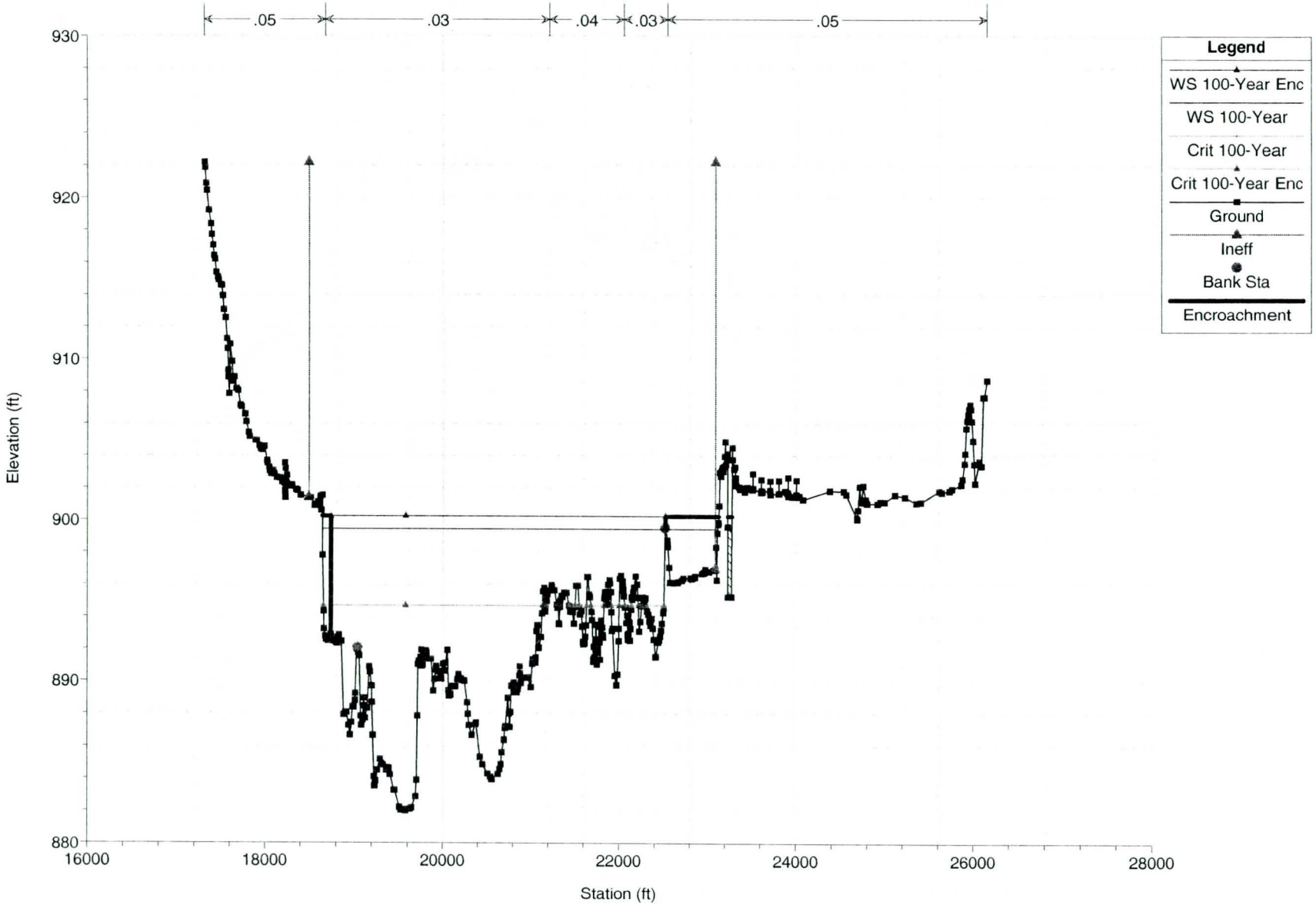
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.16 Left Channel Bank Station Interpolated



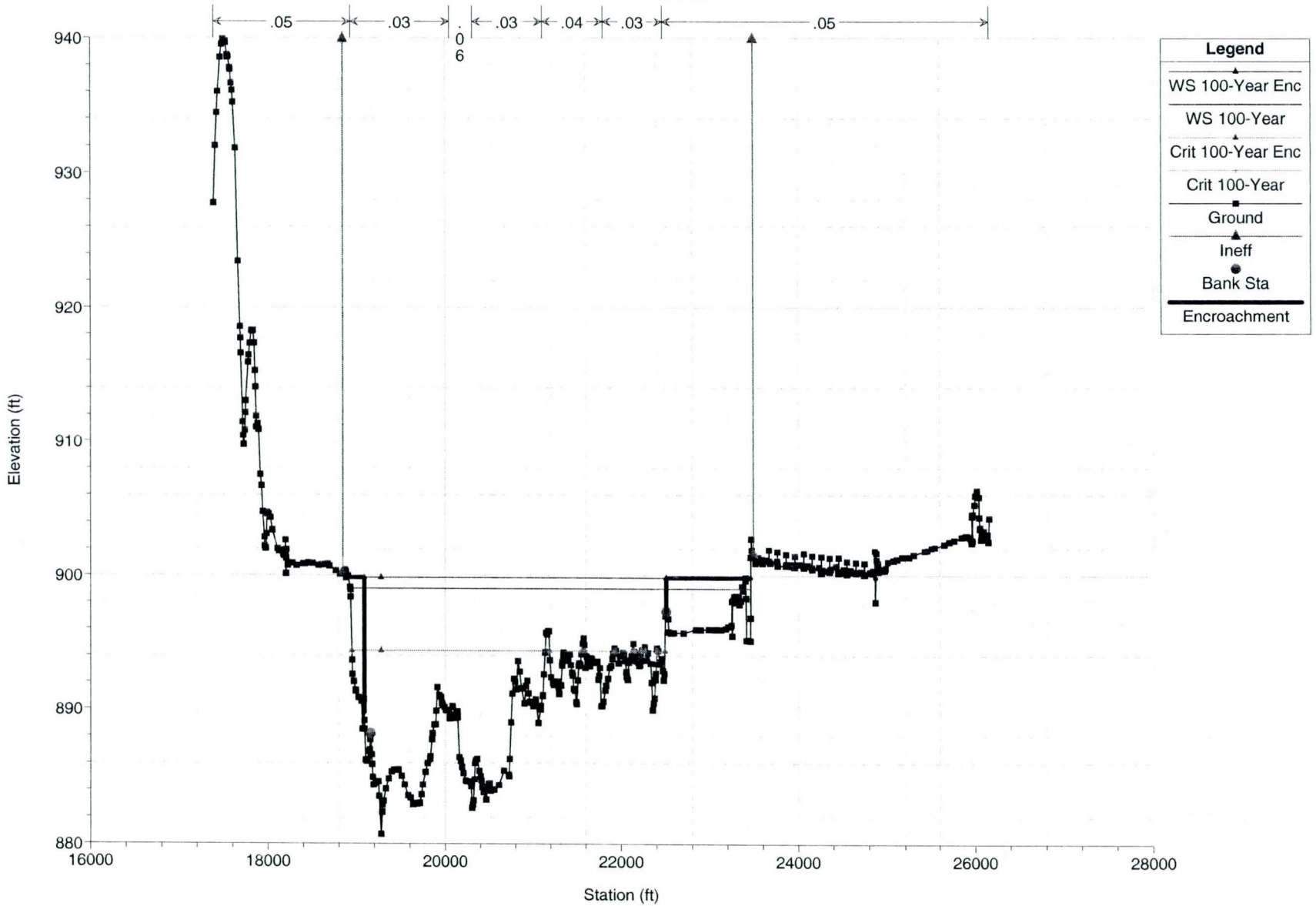
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 193.07



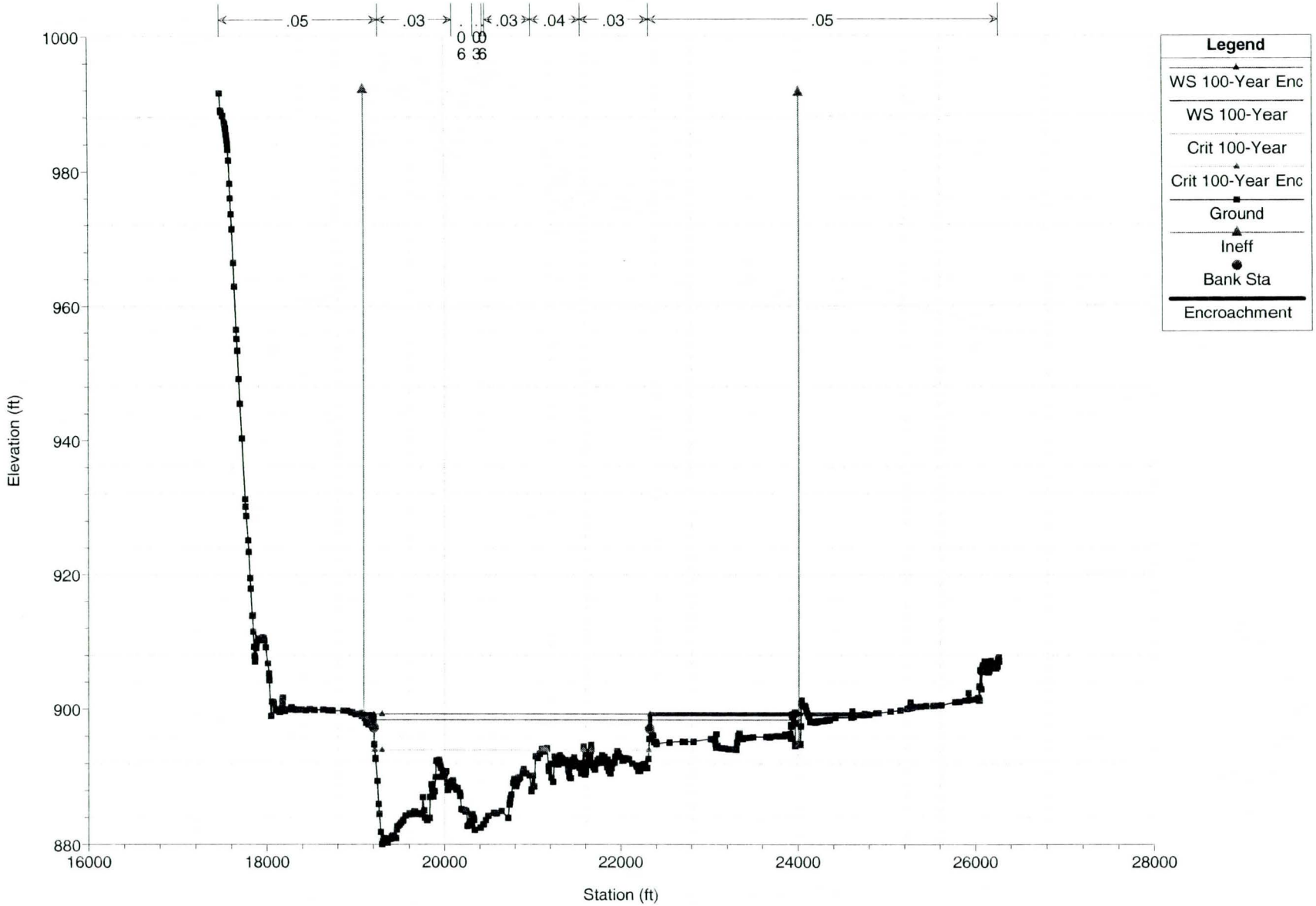
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.98

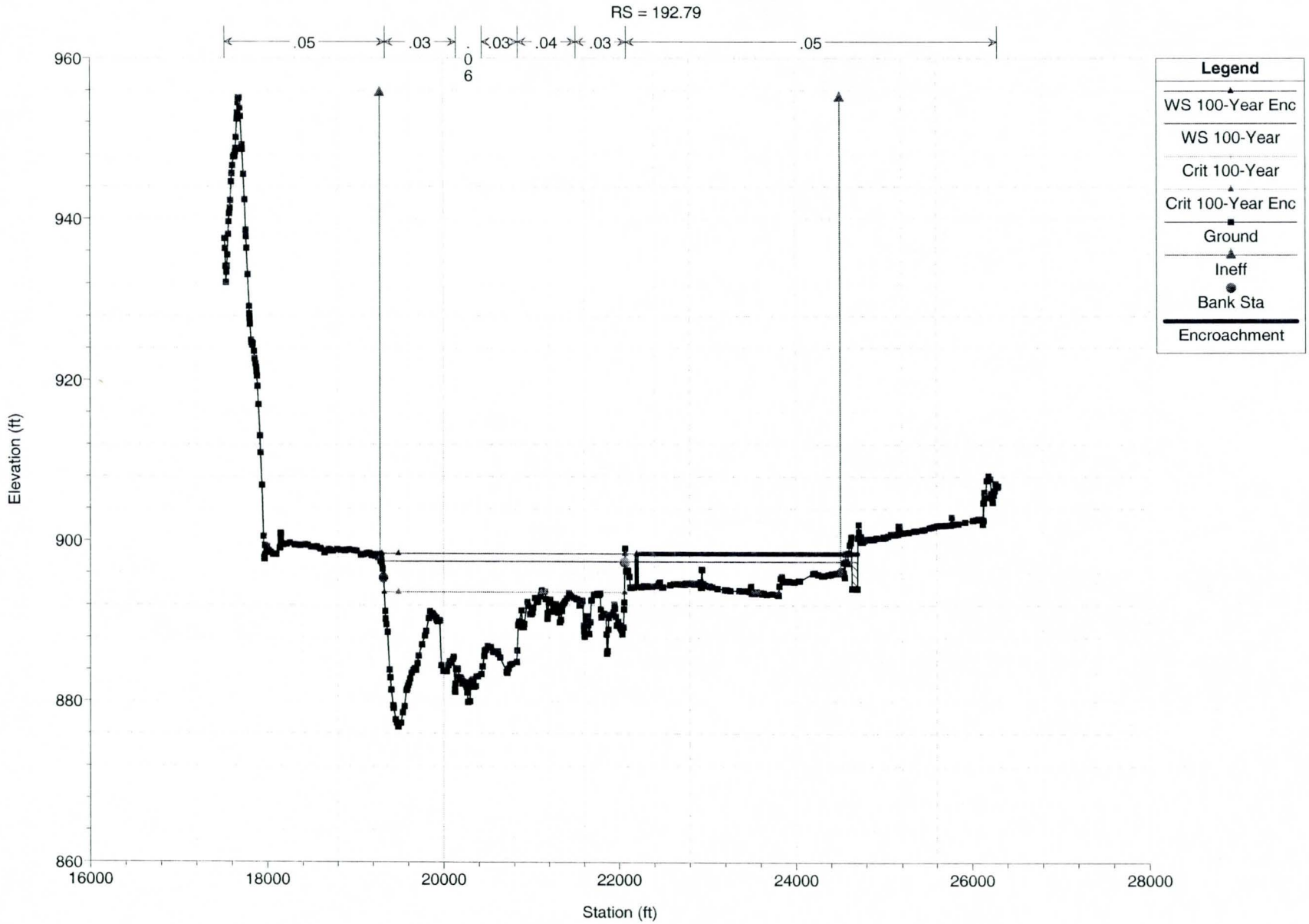


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.89

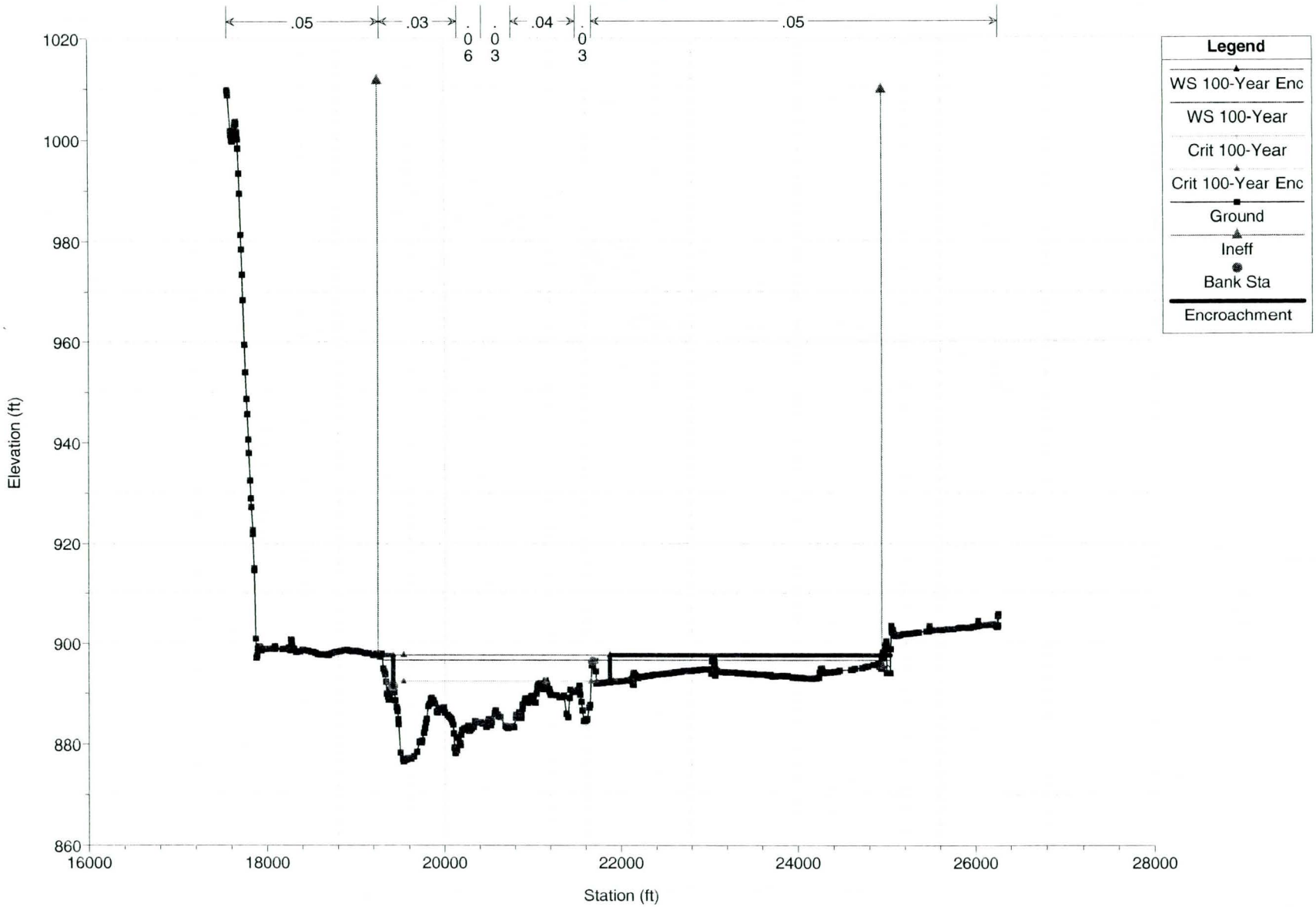


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



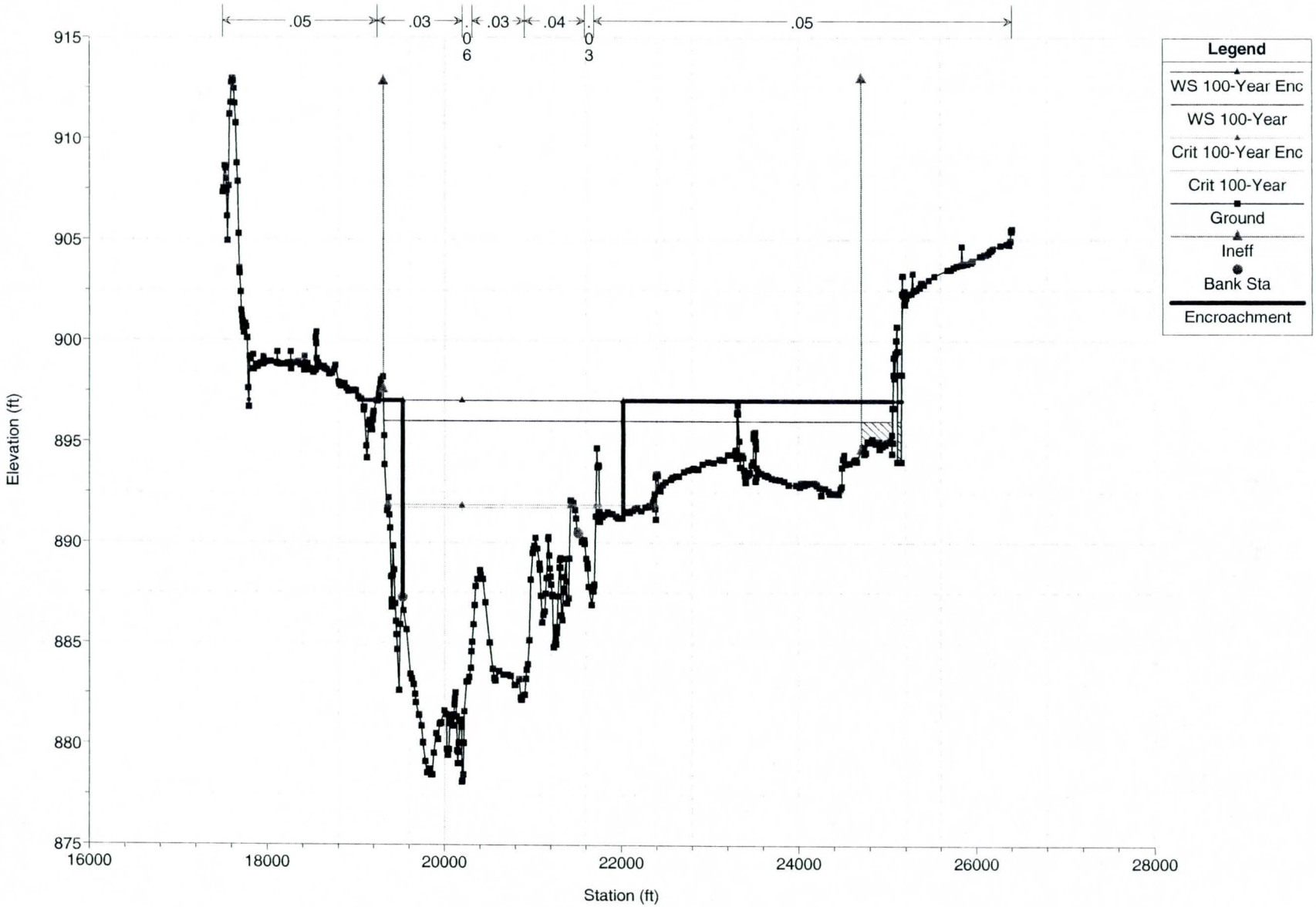
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.7

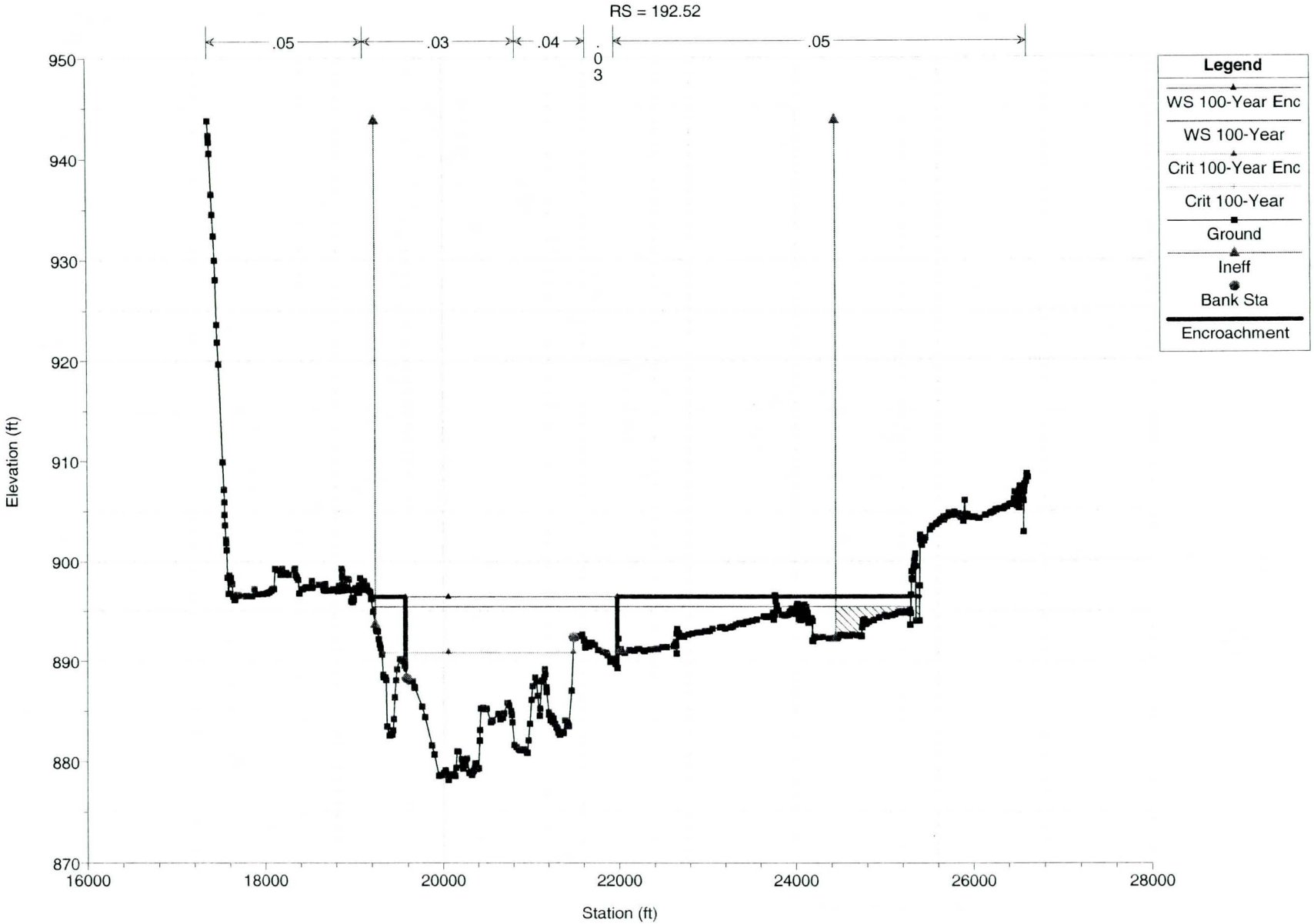


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.61

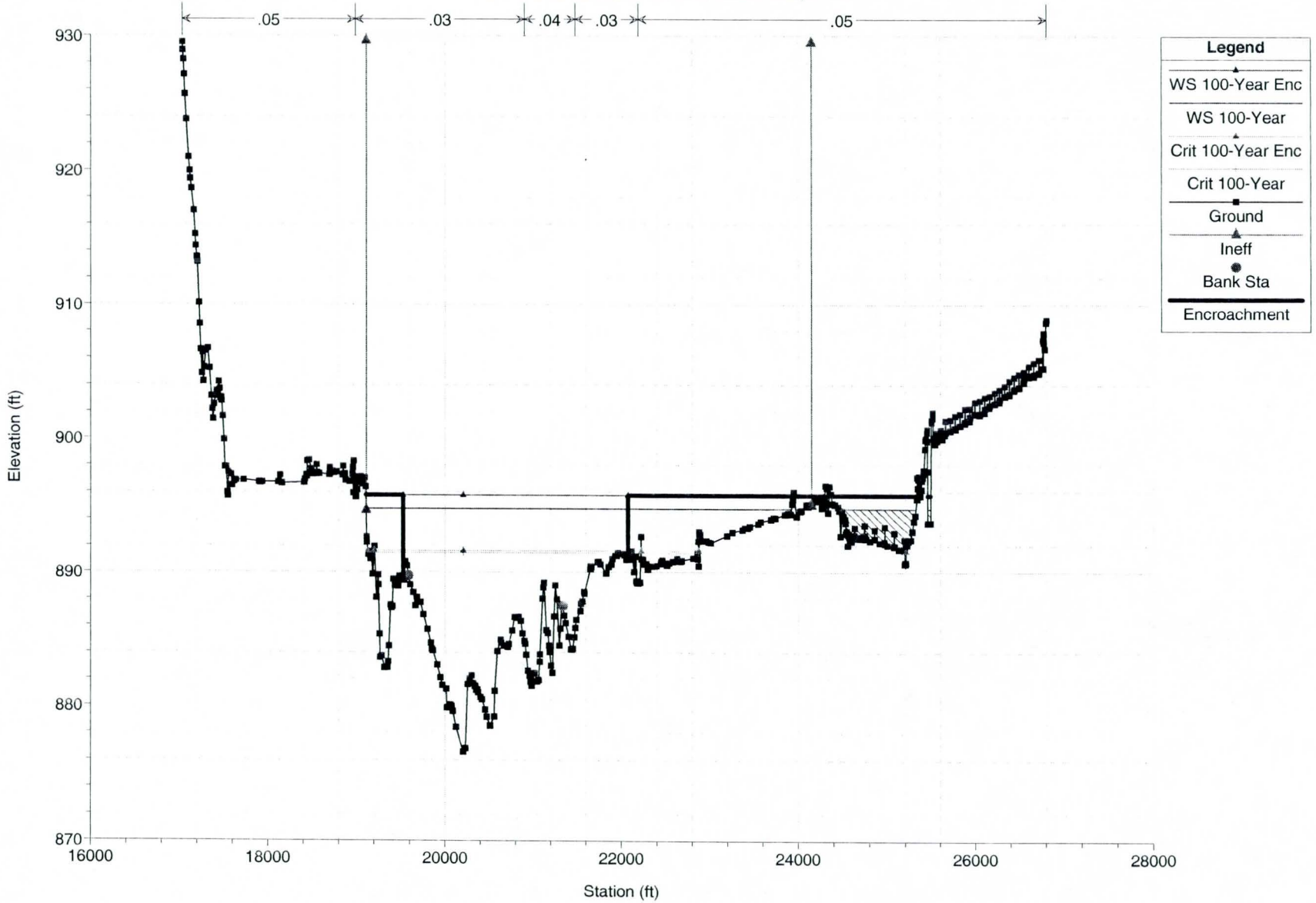


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



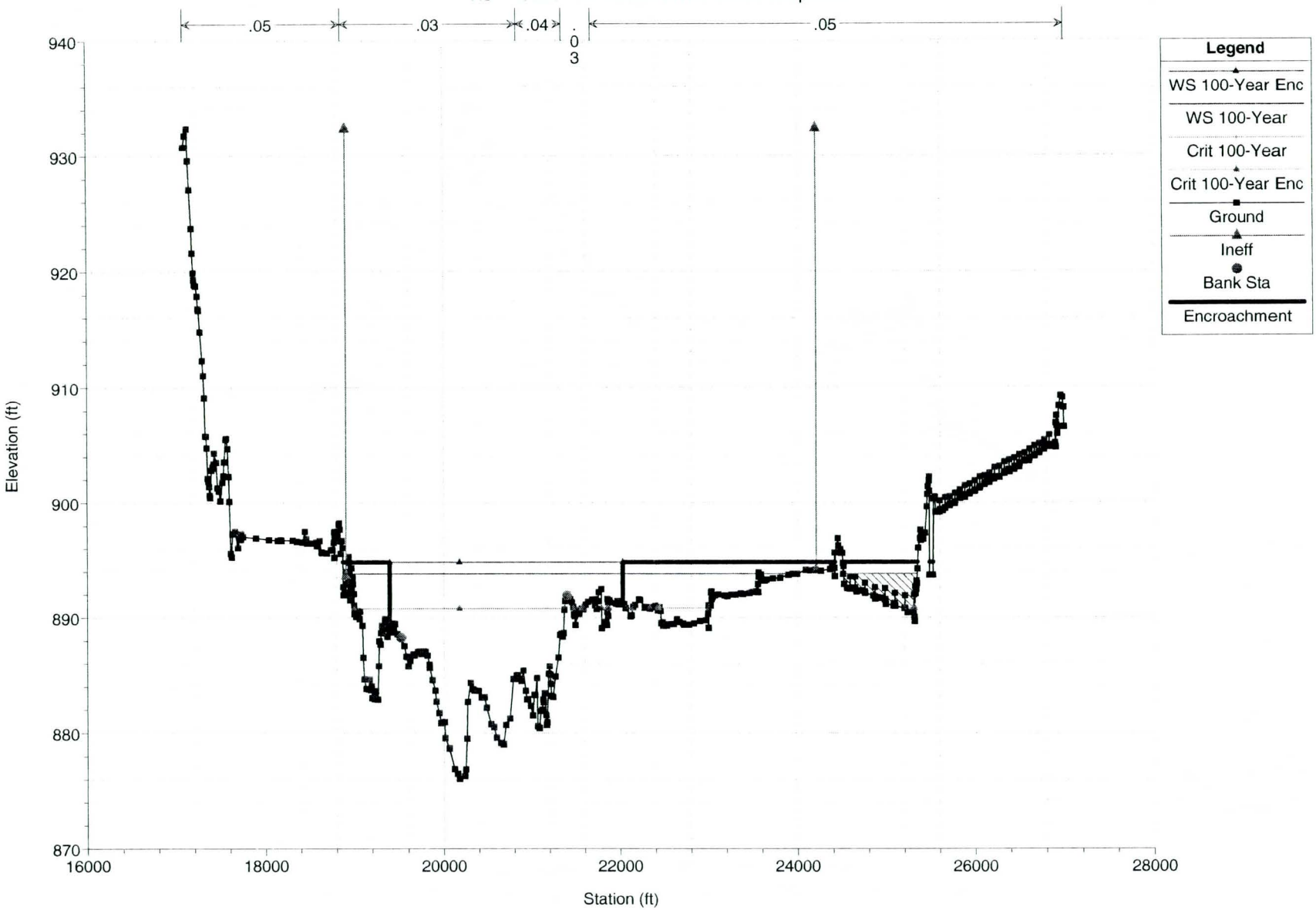
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.42 Left Bank Channel Station Interpolated



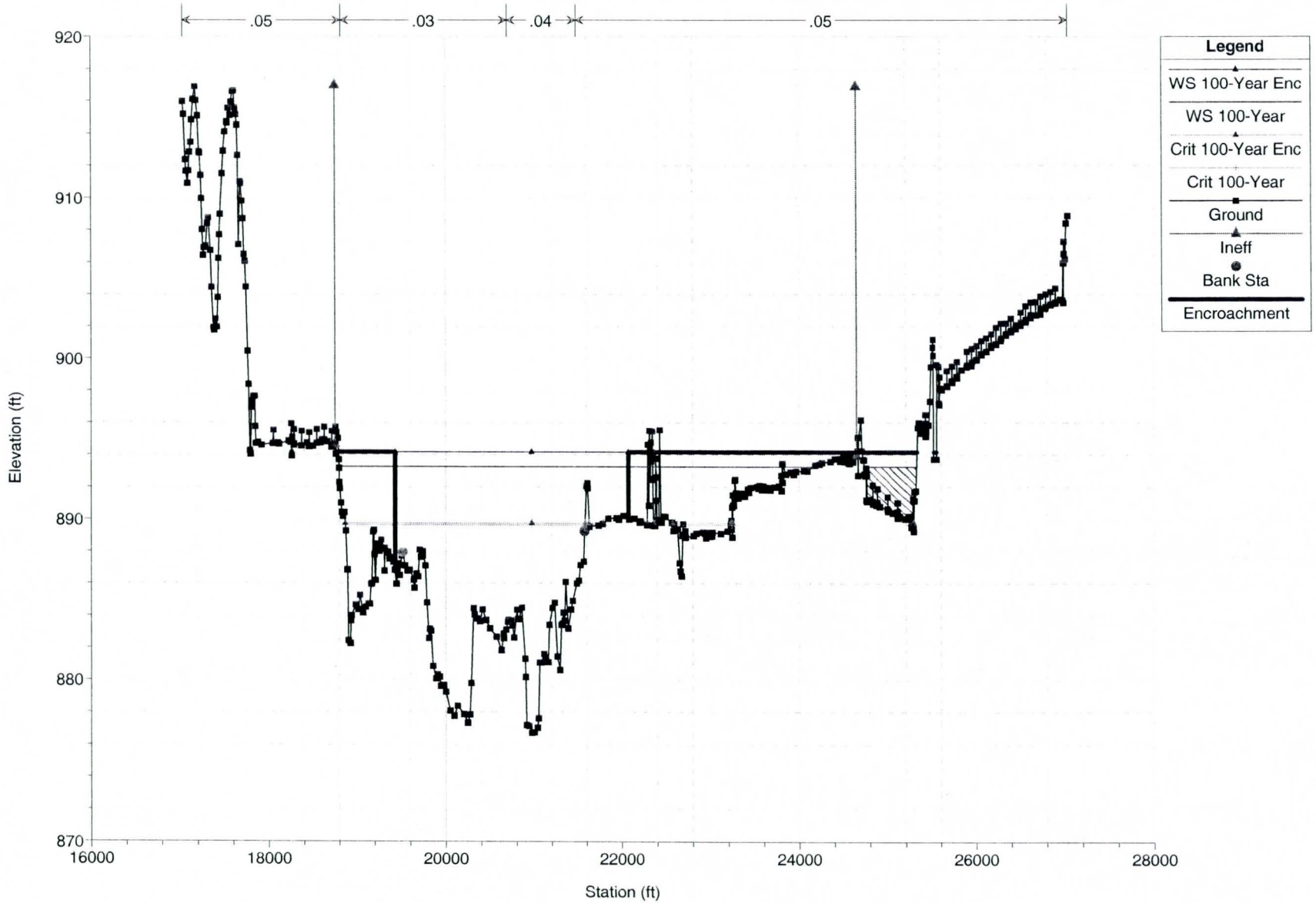
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.33 Left Bank Channel Station Interpolated



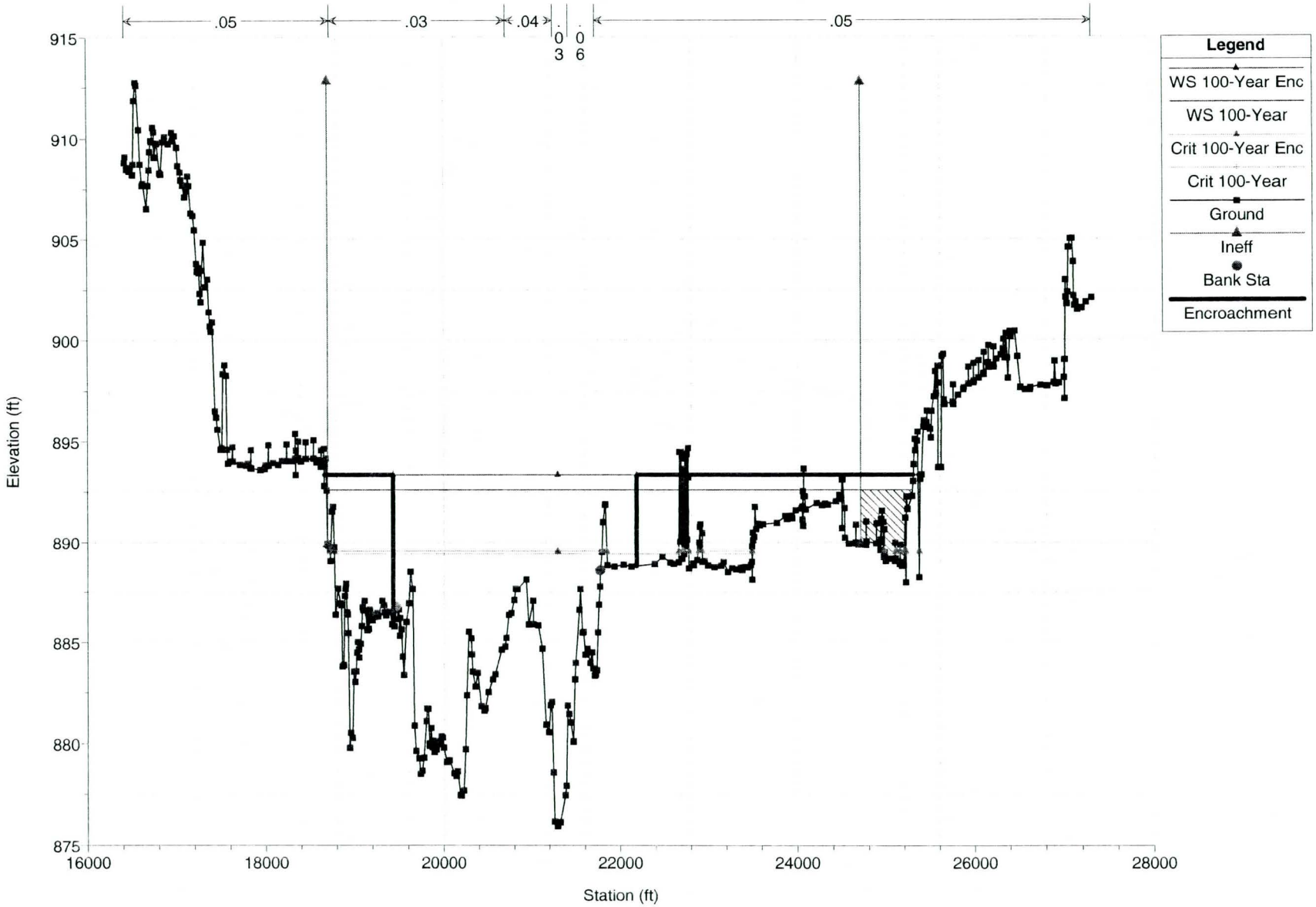
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.23 CROSSES COTTON LN. ALIGNMENT AT CENTERLINE OF 100 YR FLOW

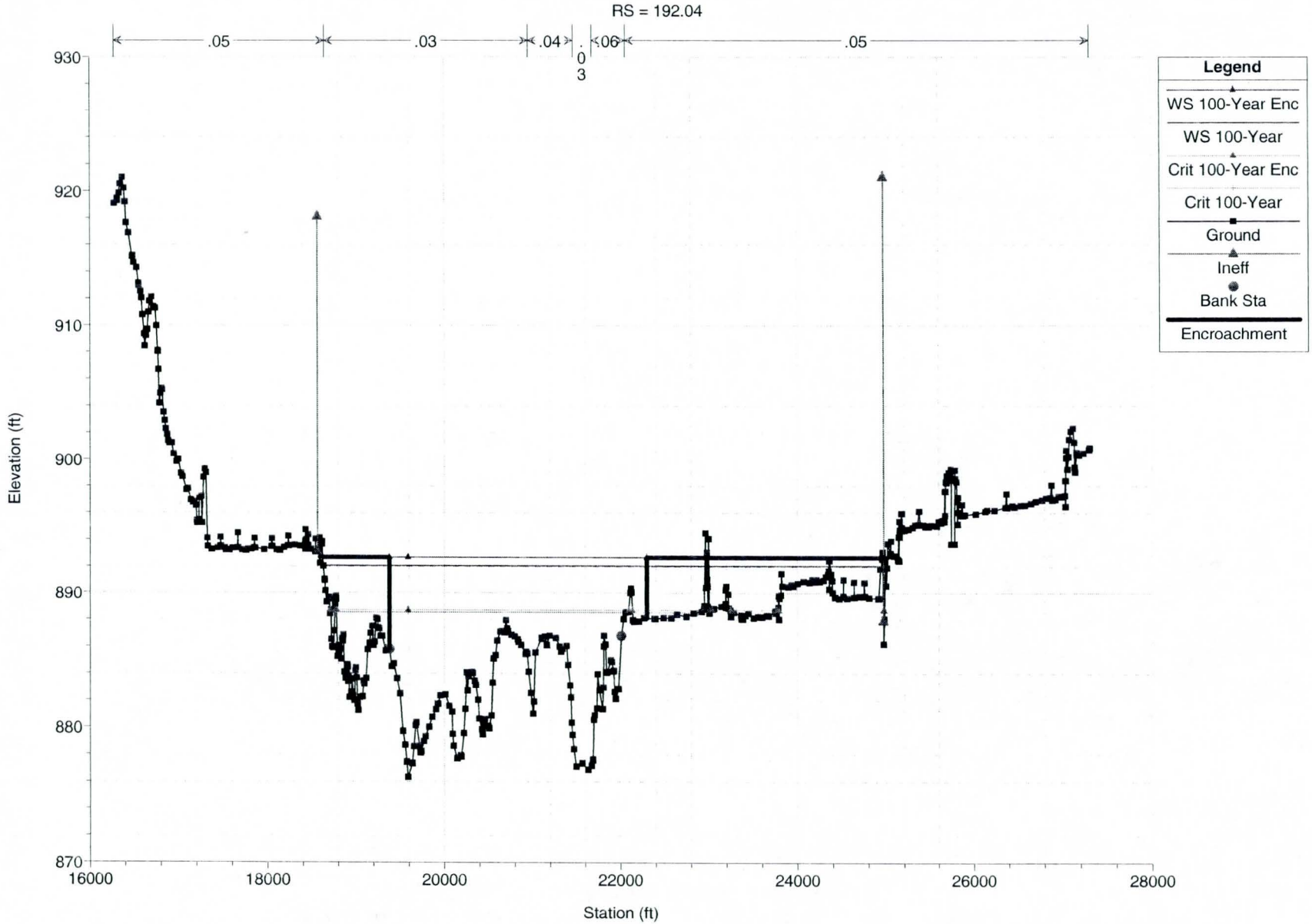


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 192.14 Left Channel Bank Station Interpolated

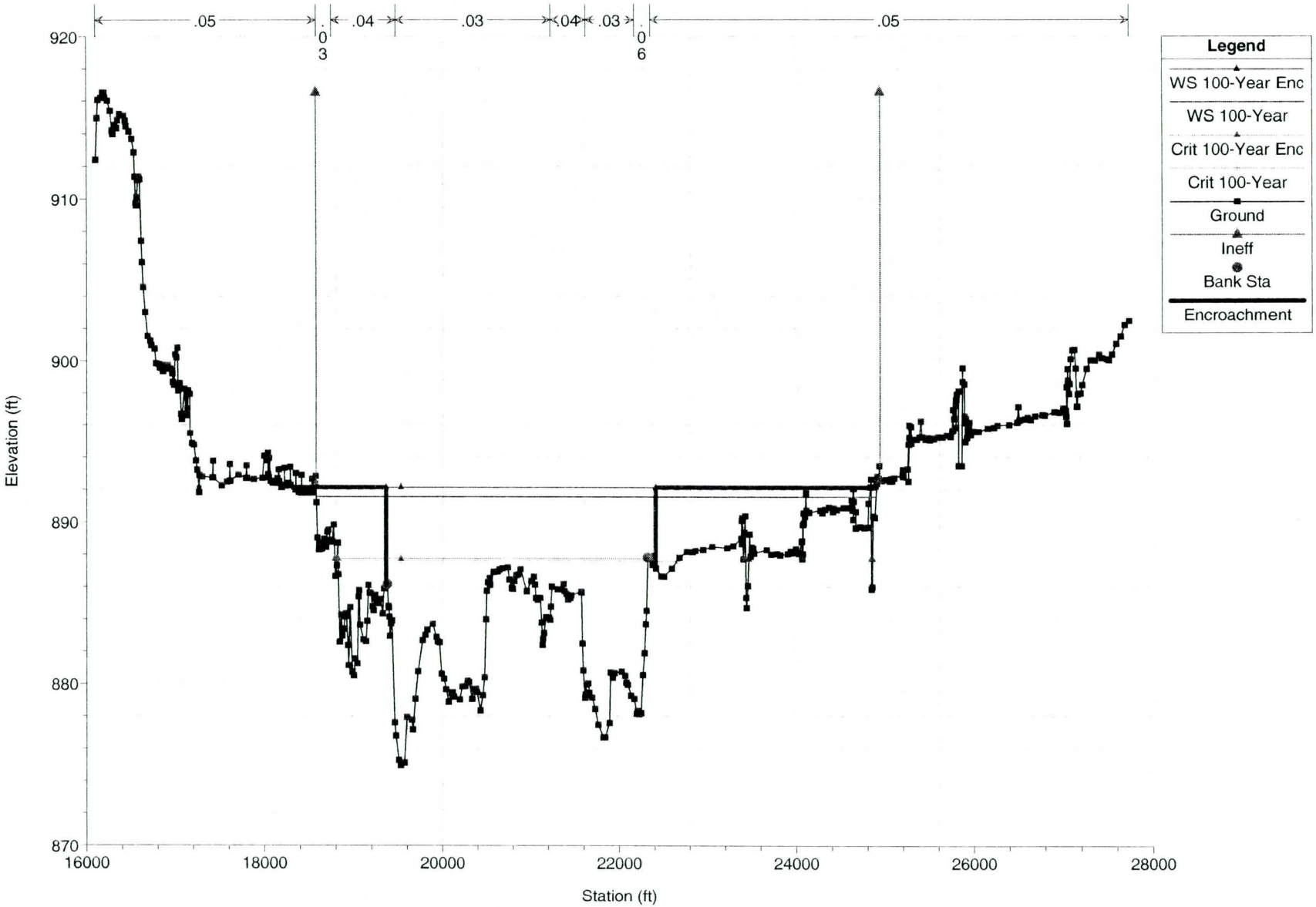


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



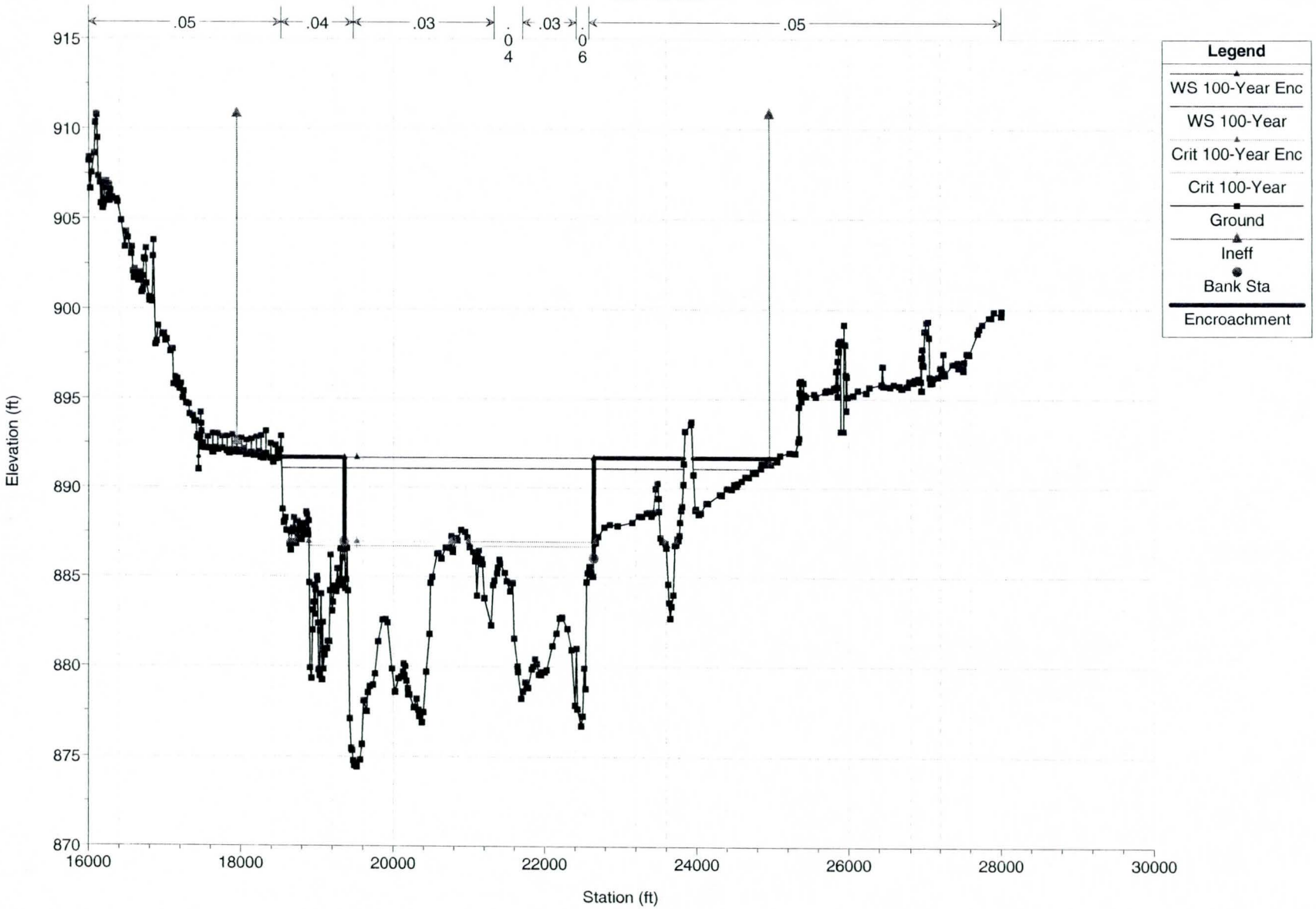
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.95 Left Channel Bank Station Interpolated



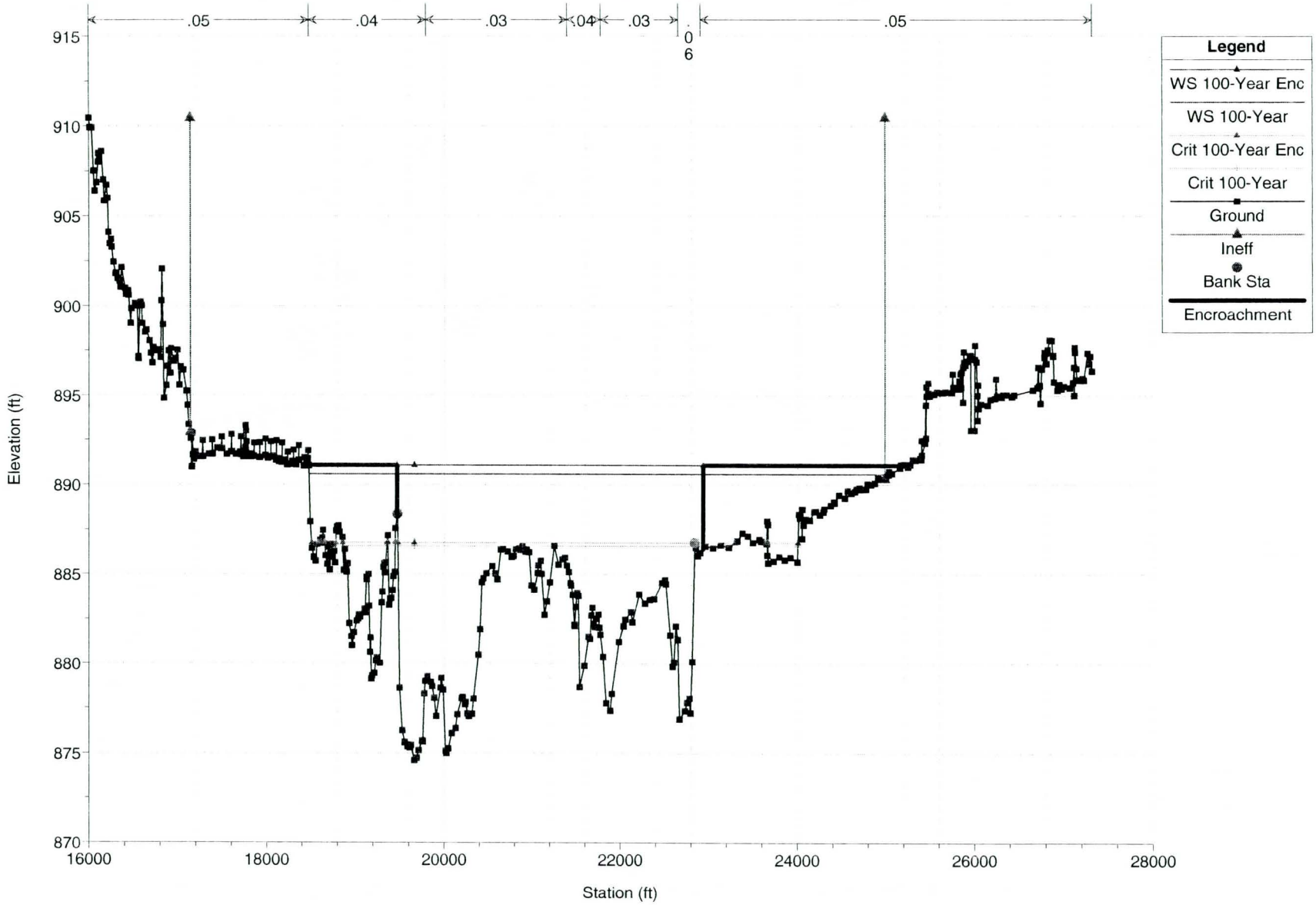
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.86

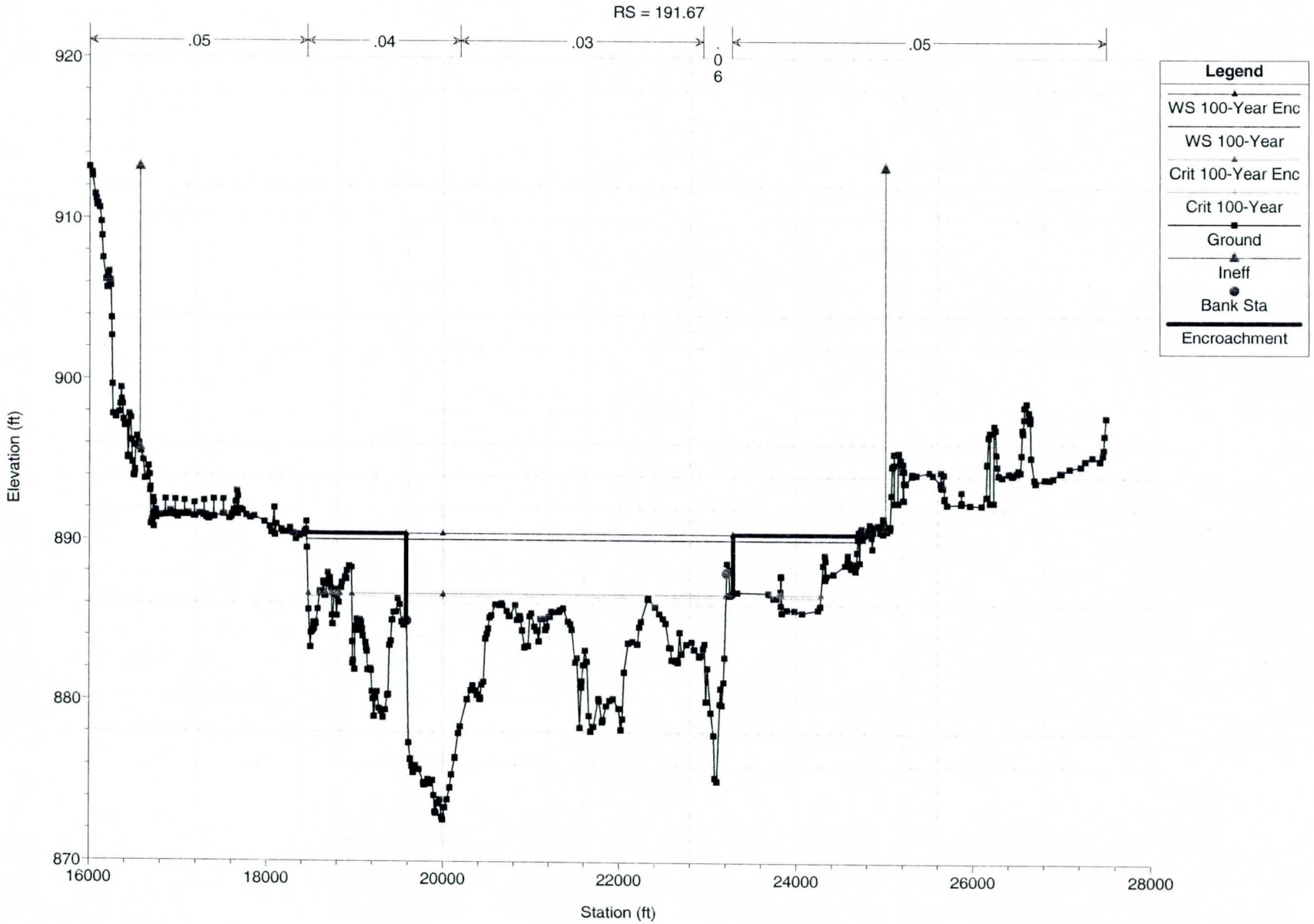


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.76

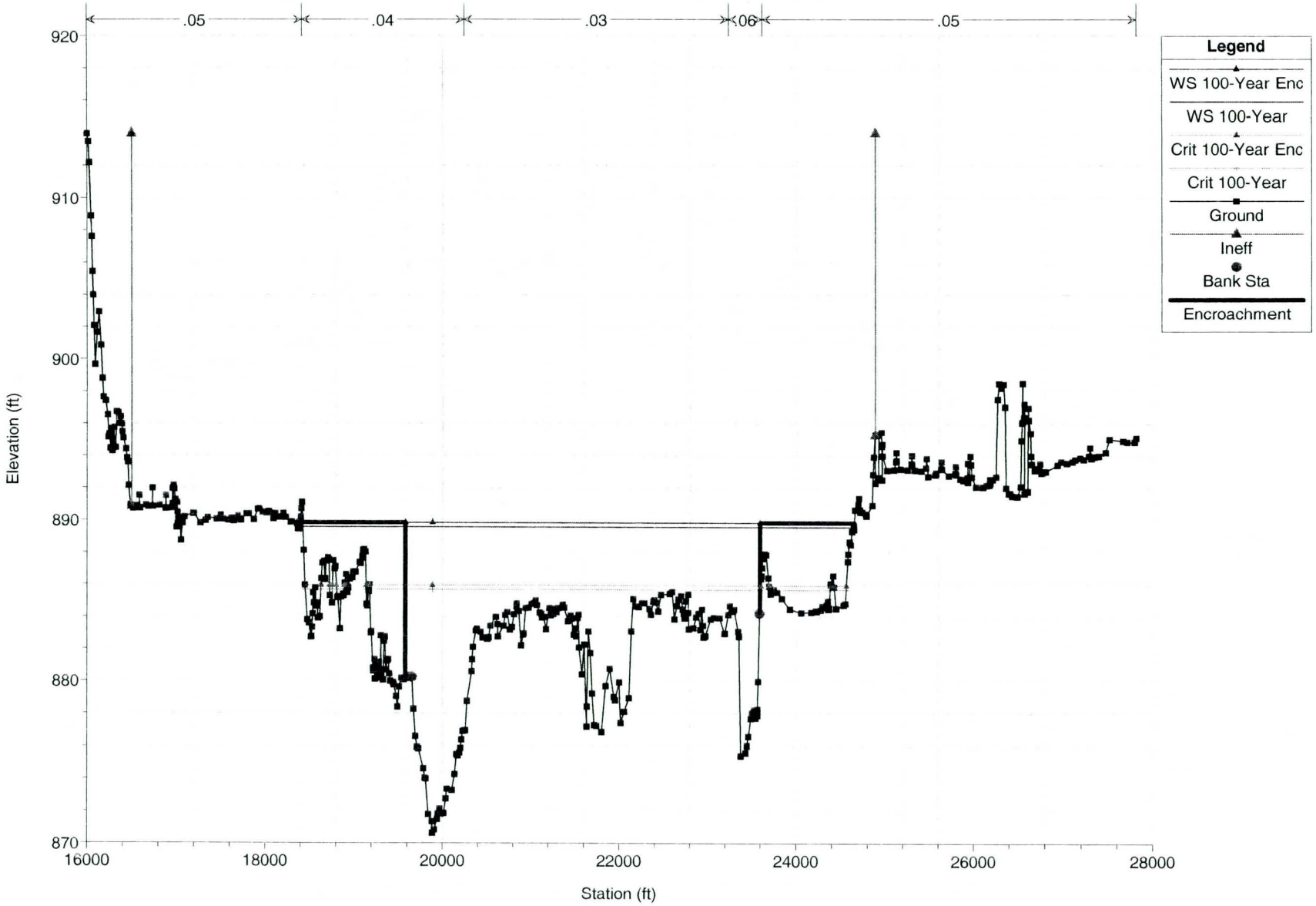


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



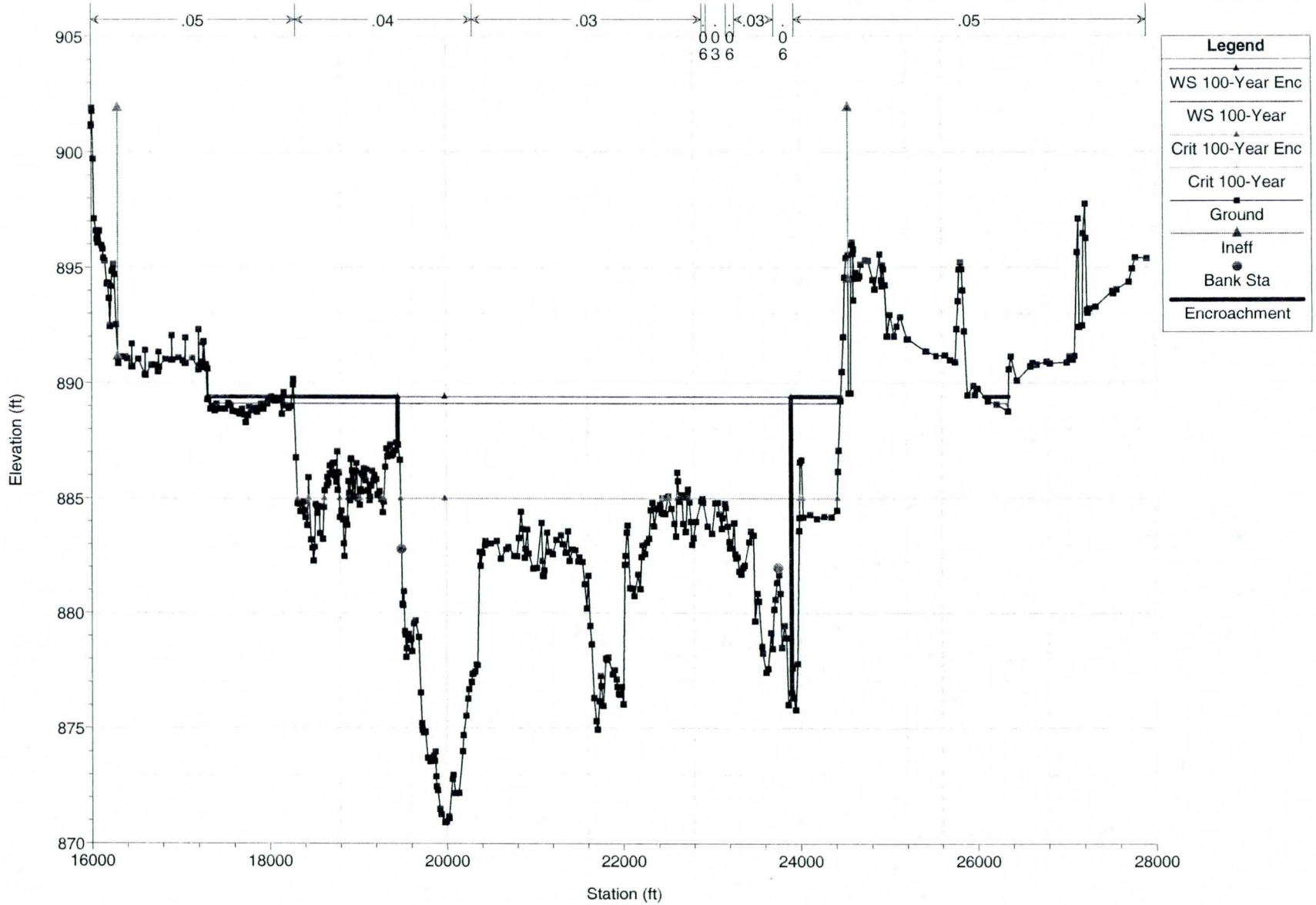
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.57 Eliminate vertical ineffective area in main channel and rt. over



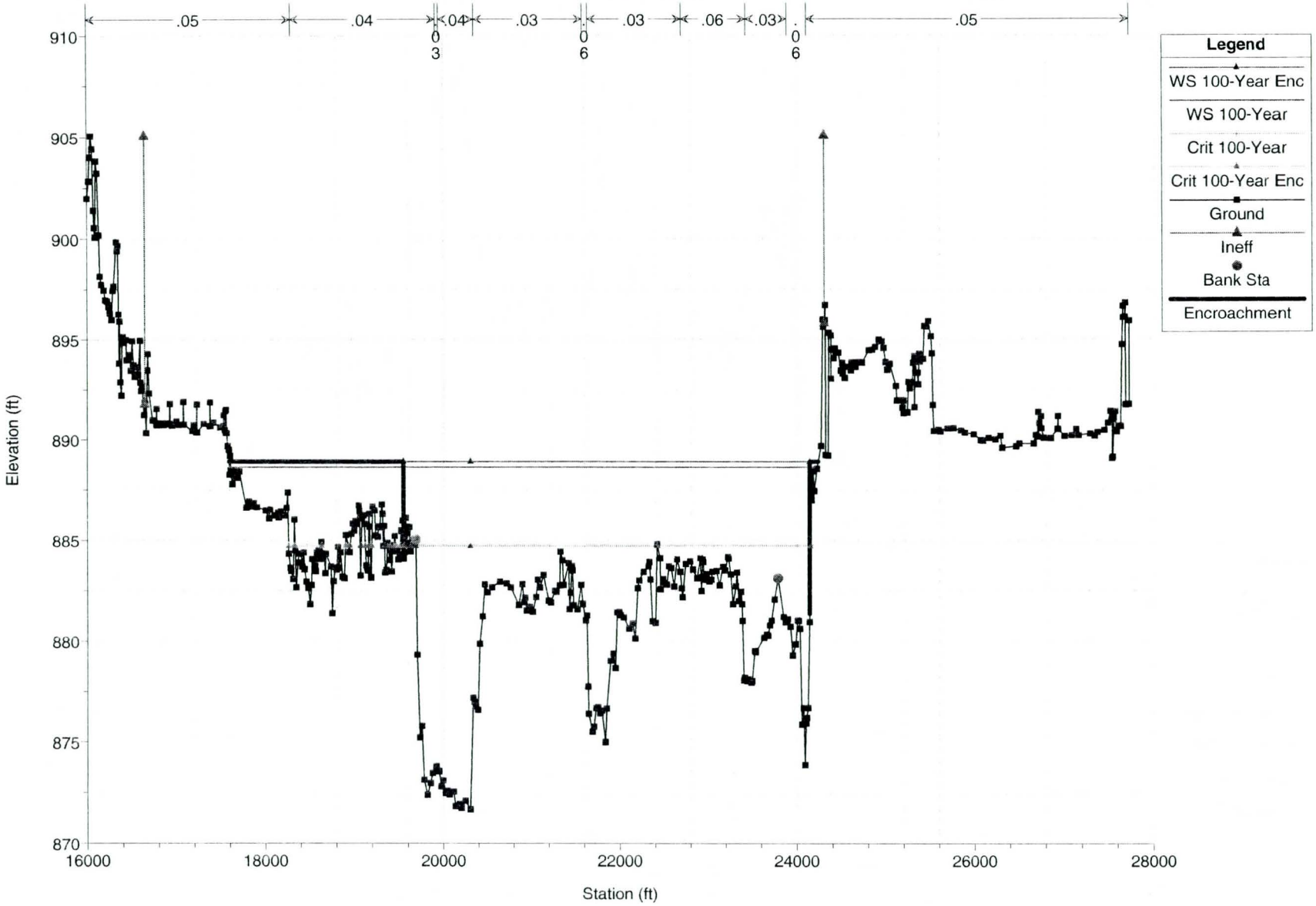
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.48 Eliminate vertical ineffective area in rt. overbank by coding ou



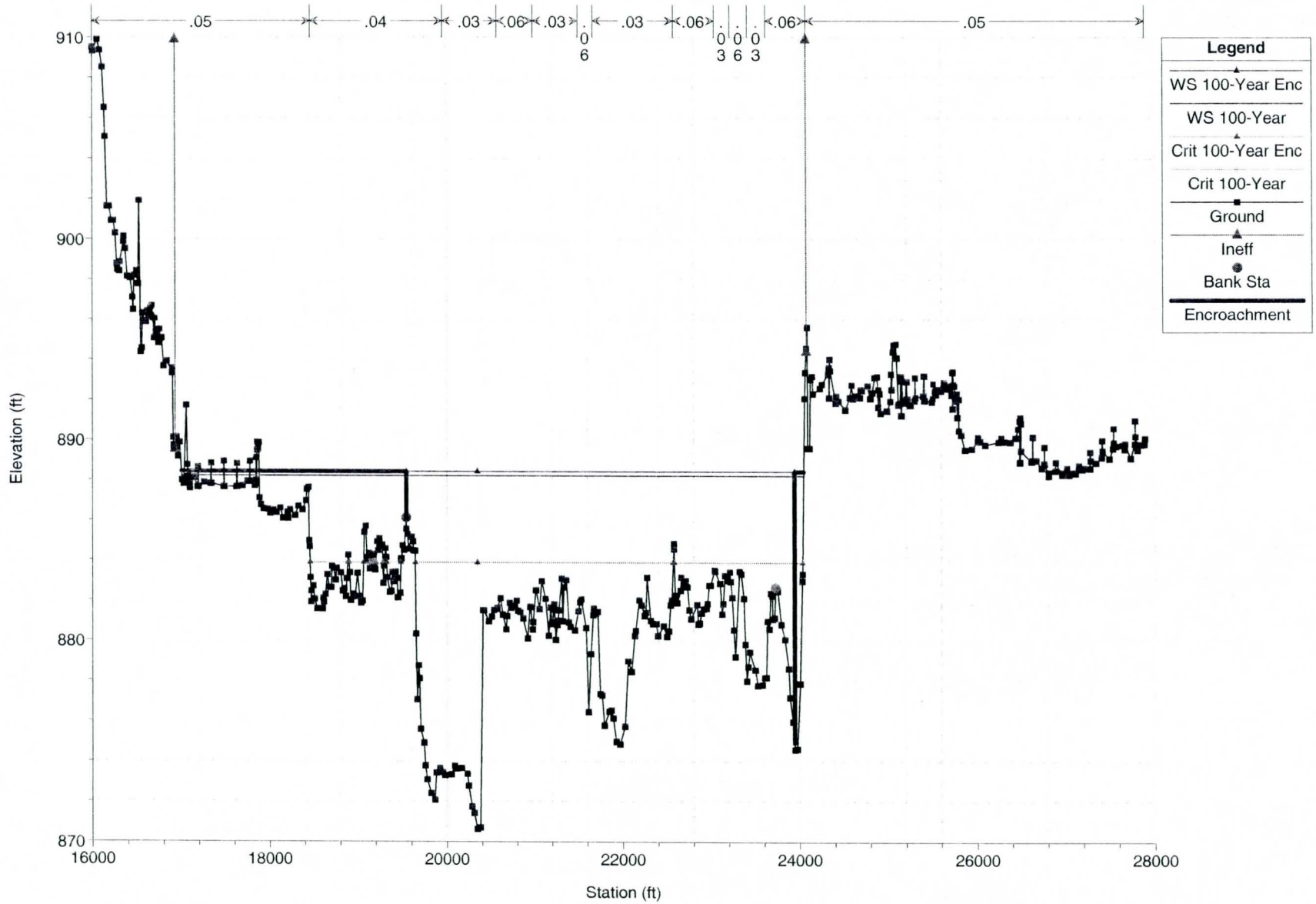
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.38



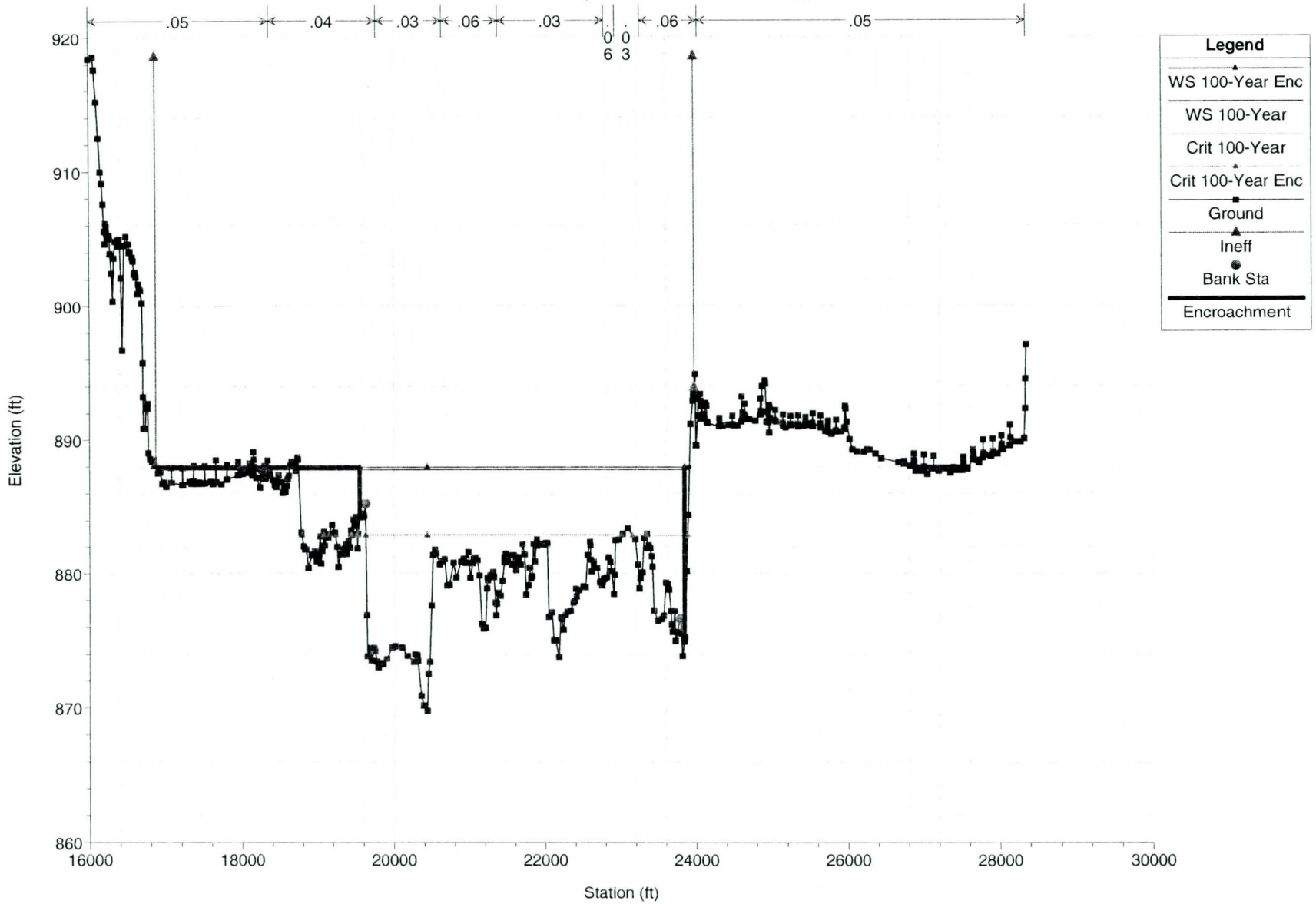
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.29



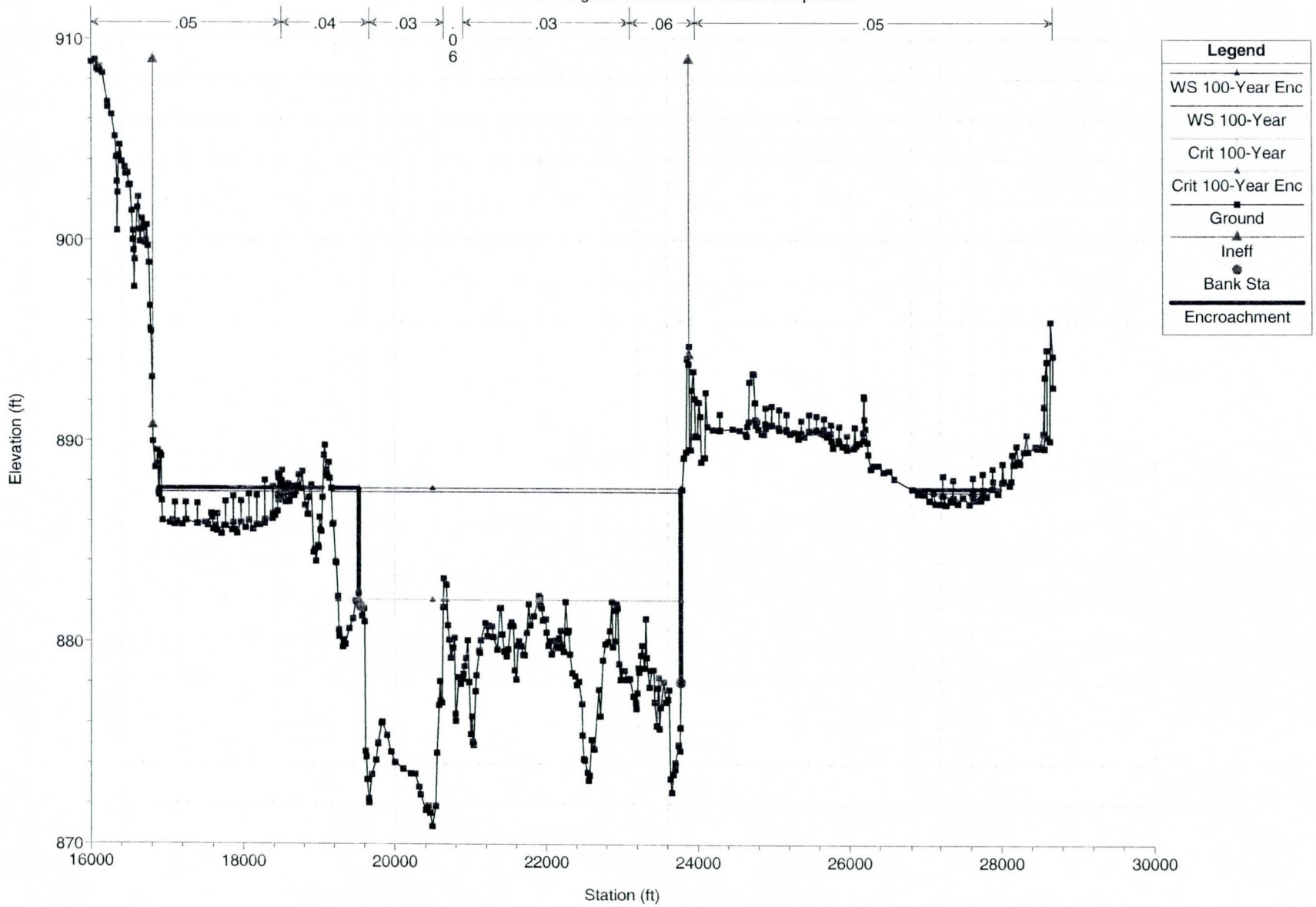
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.19 Right Channel Bank Station Interpolated



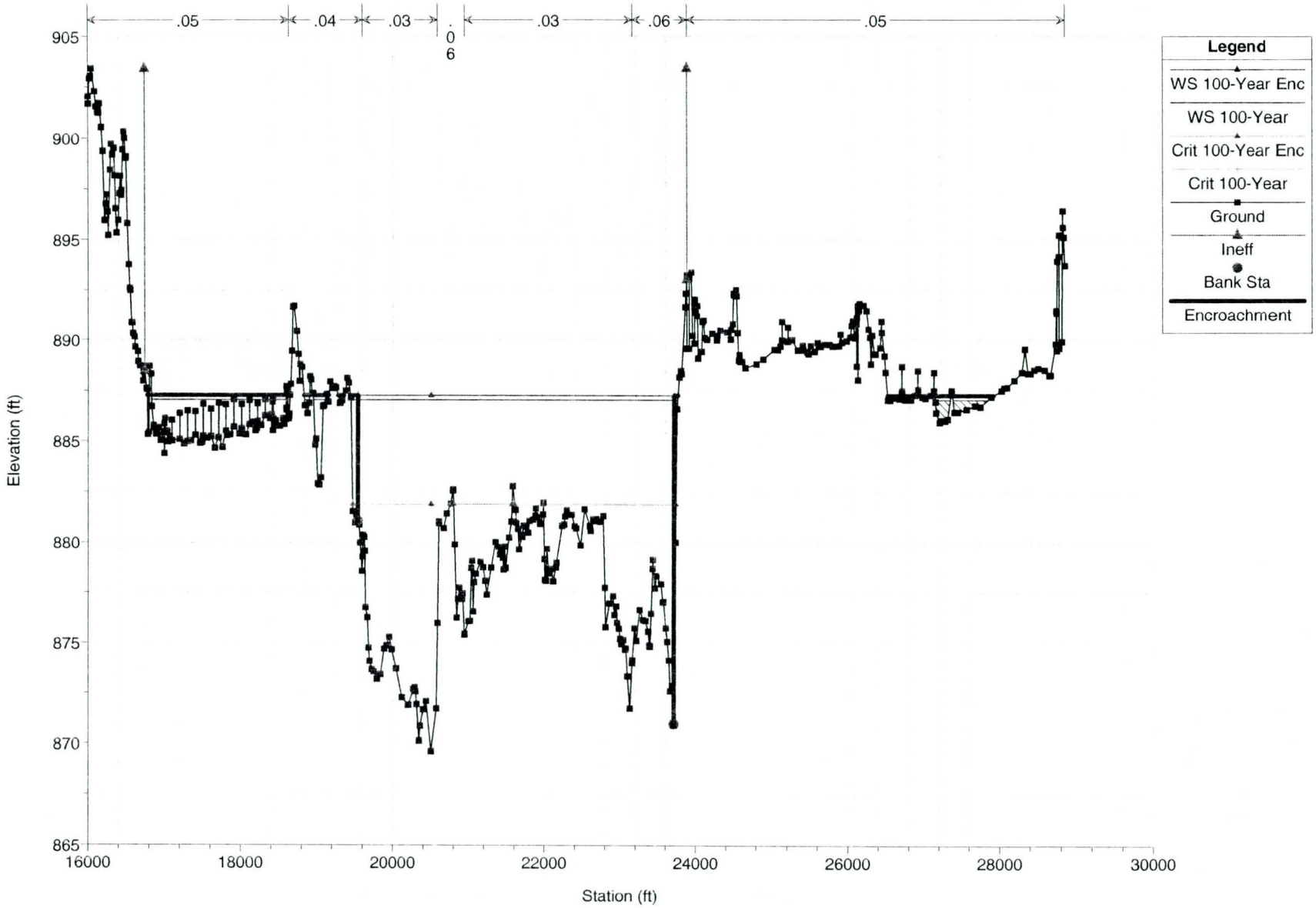
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191.1 Right Channel Bank Station Interpolated

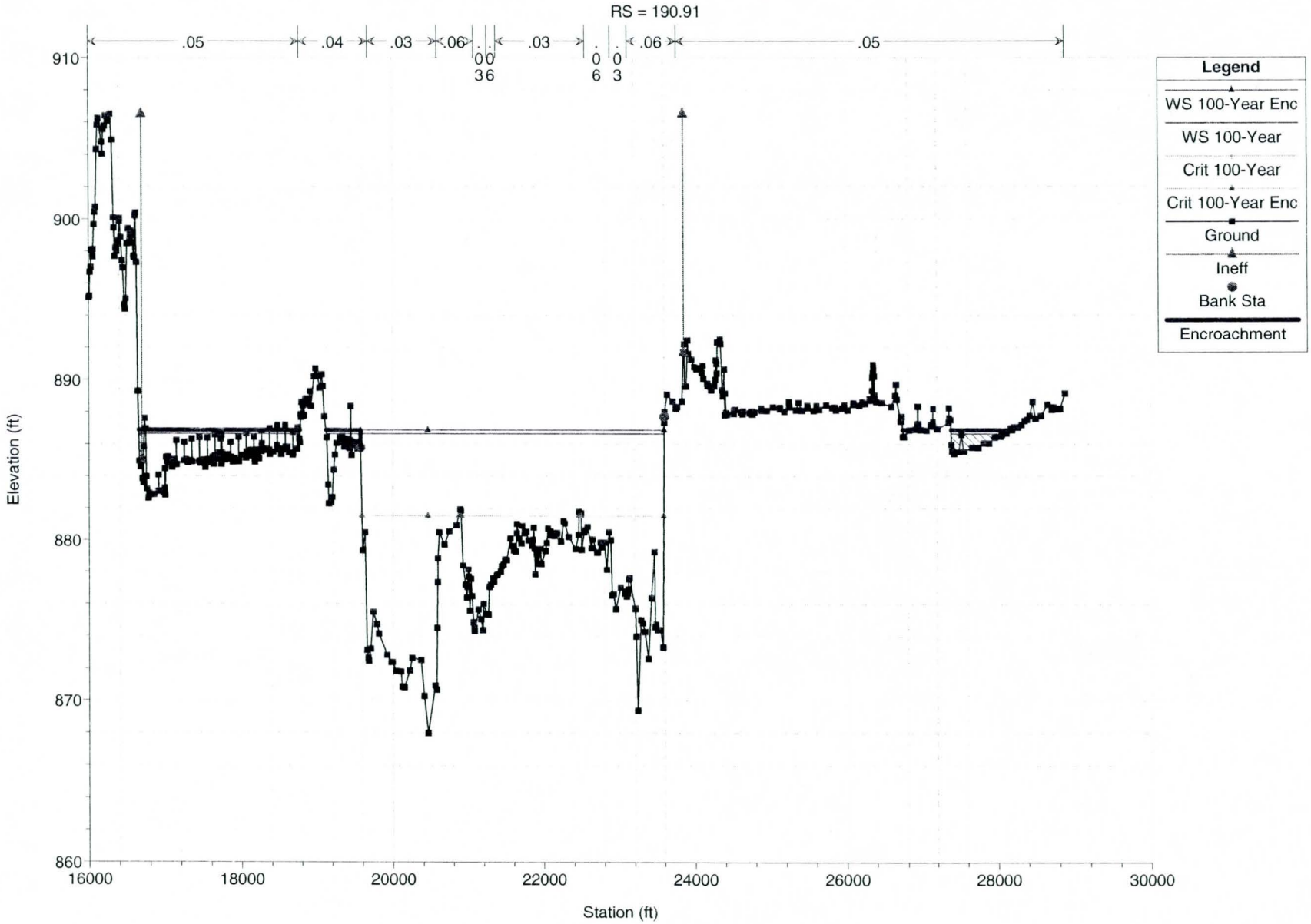


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 191

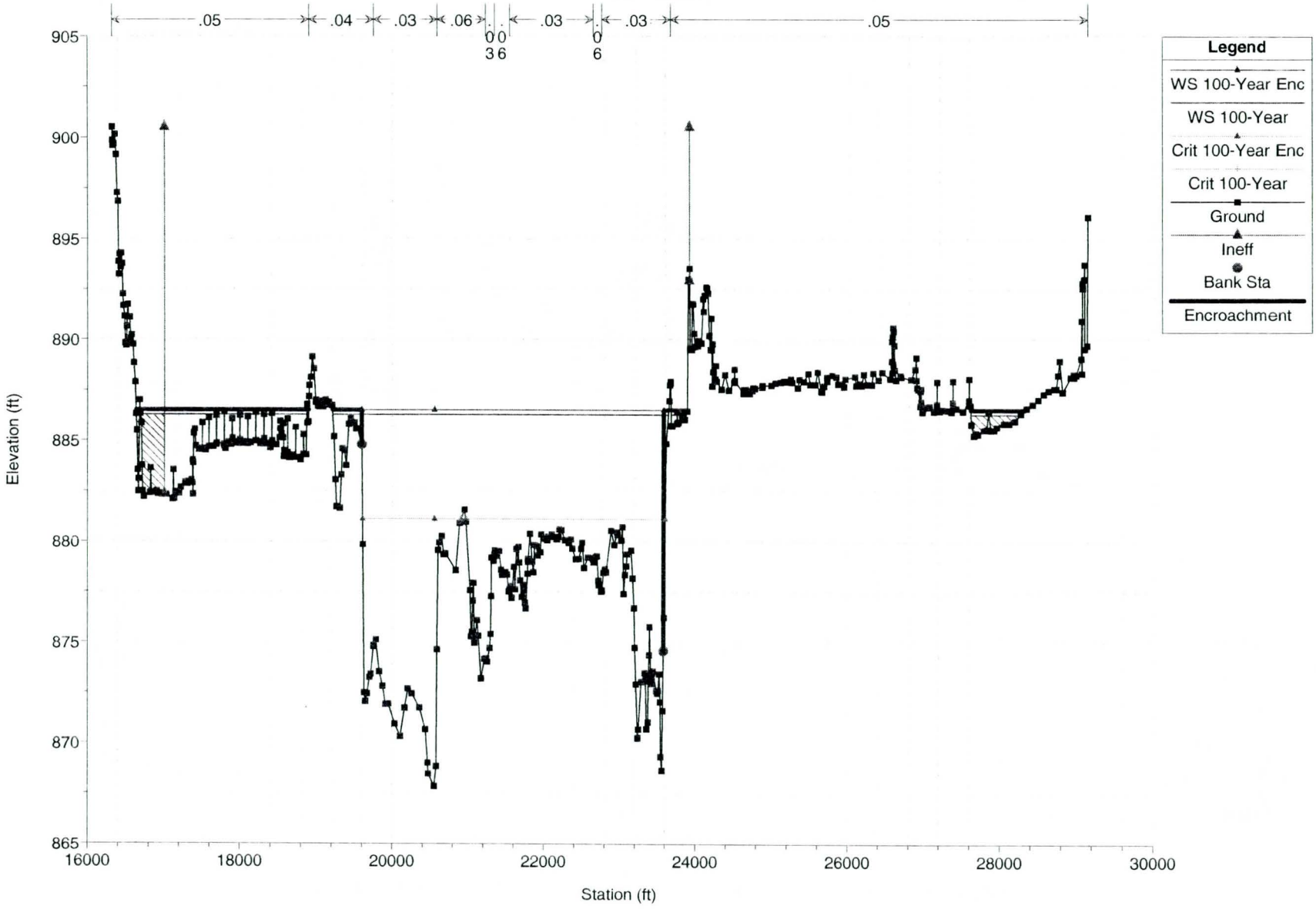


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



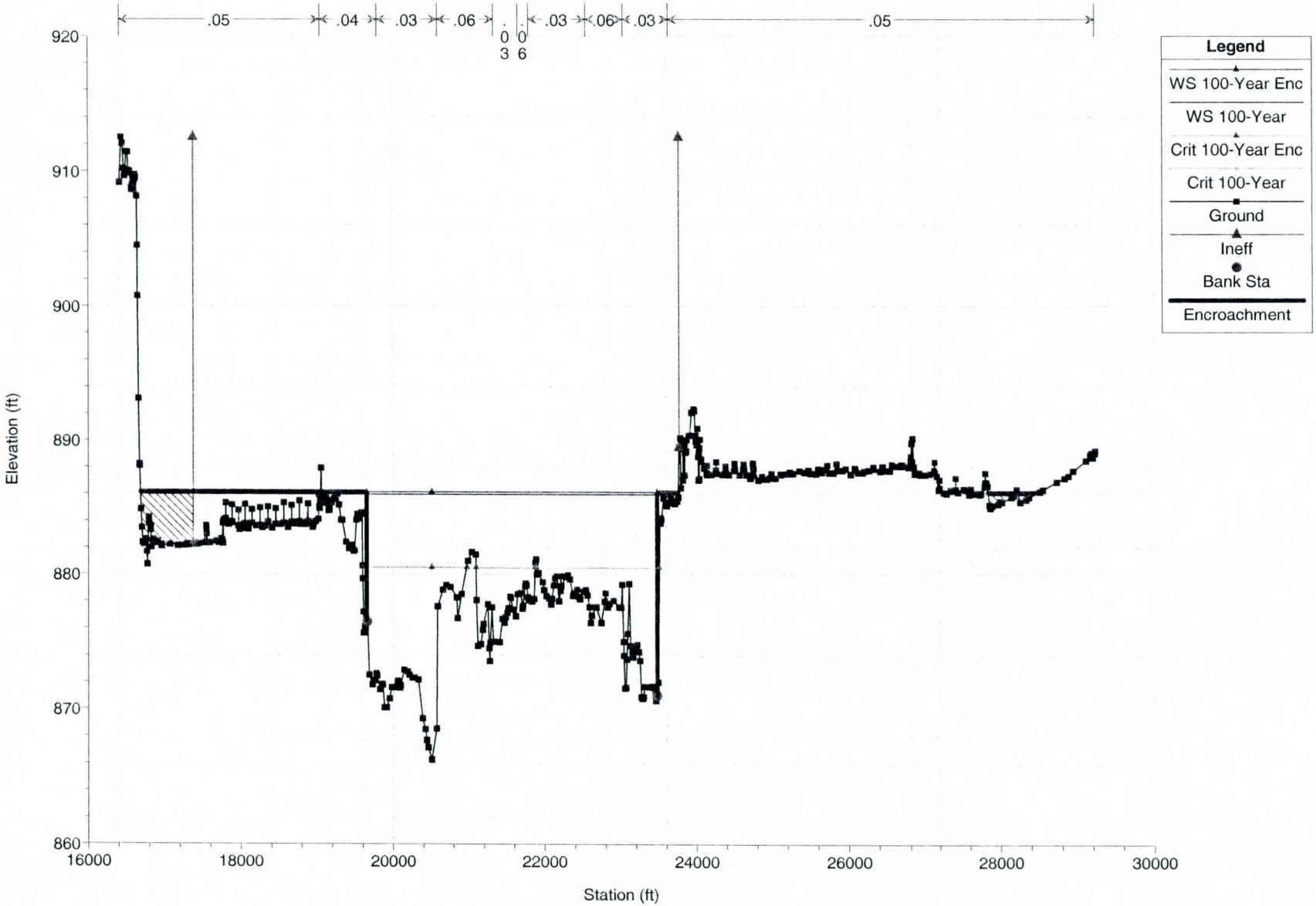
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.81

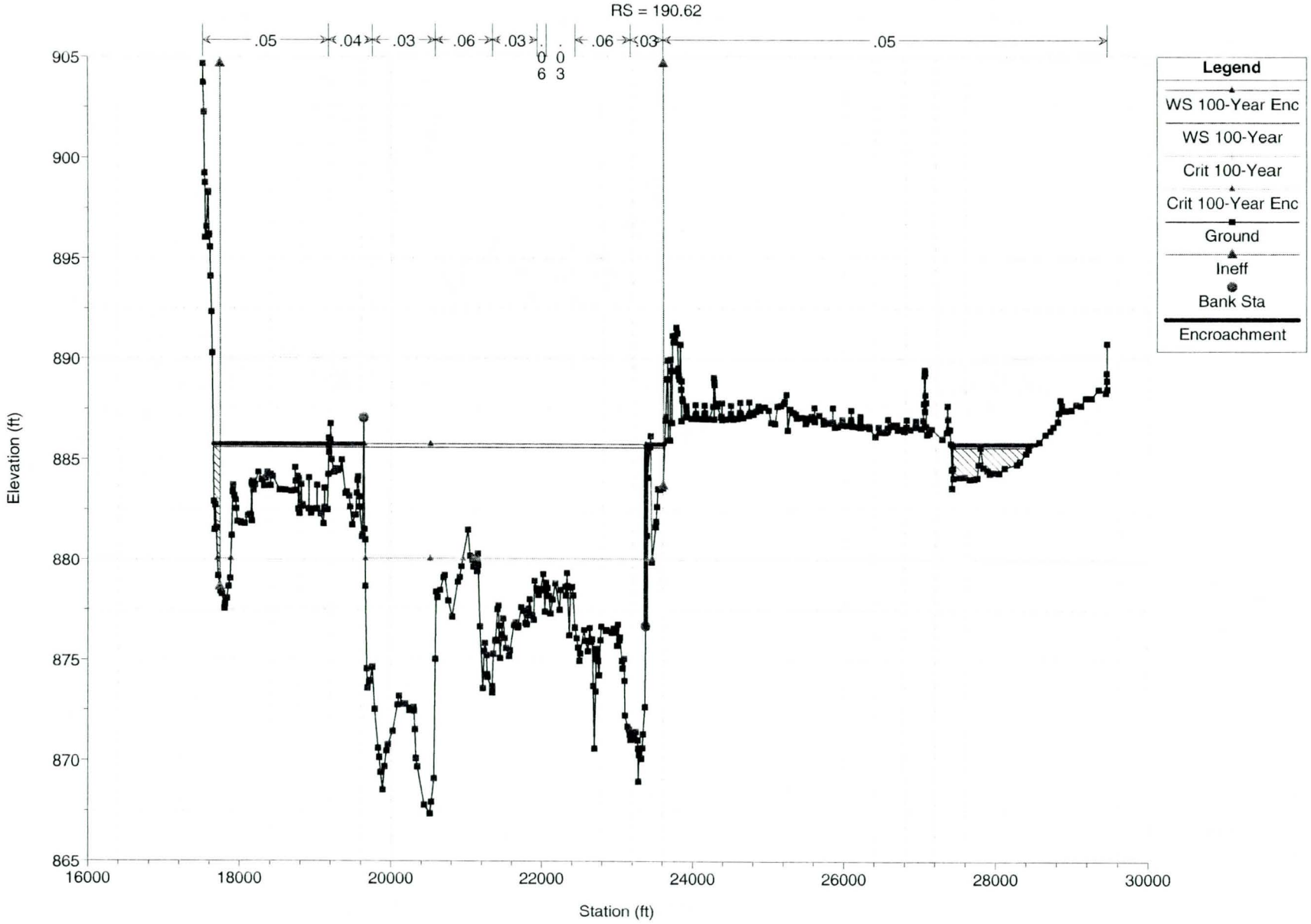


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.72

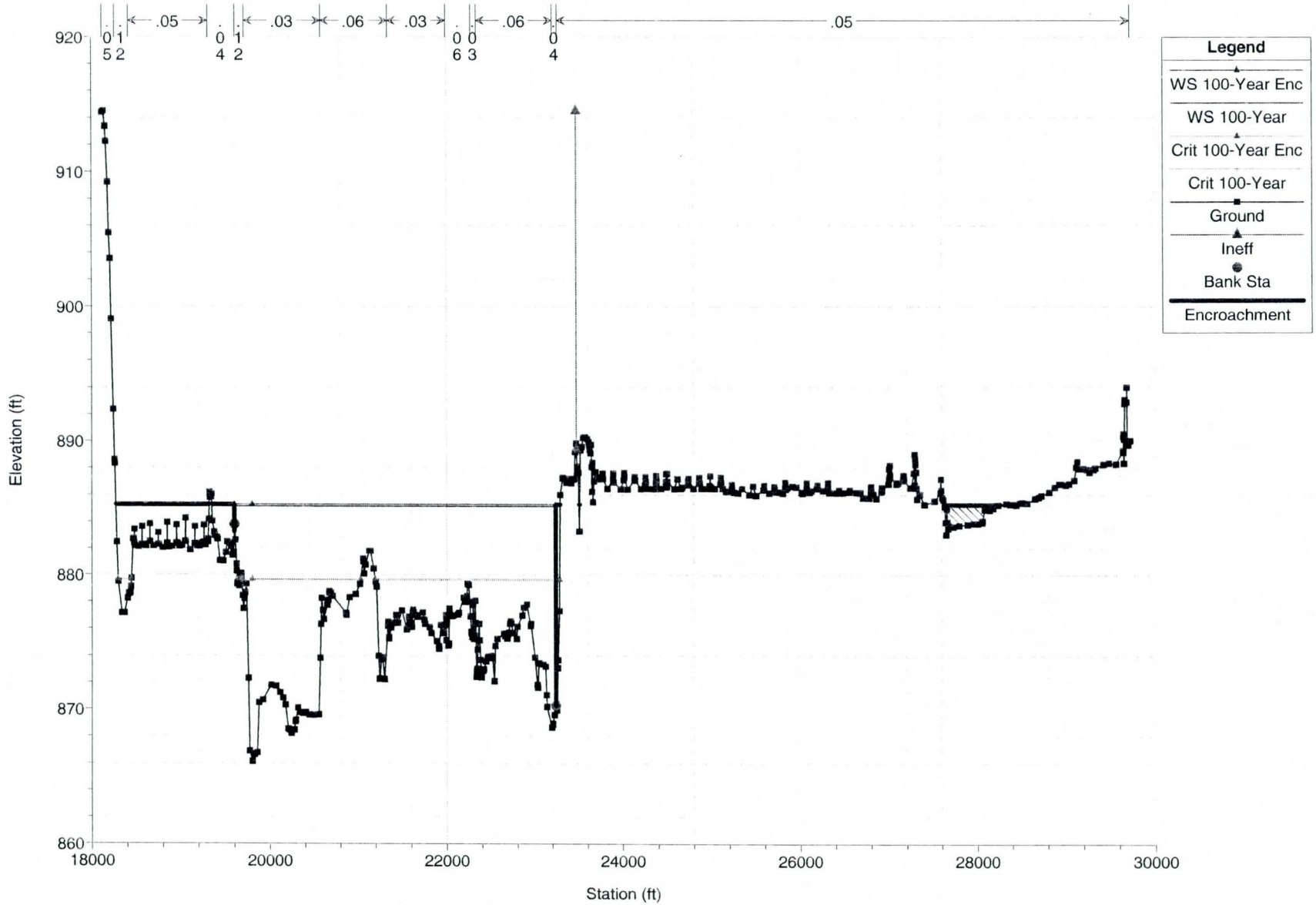


Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008



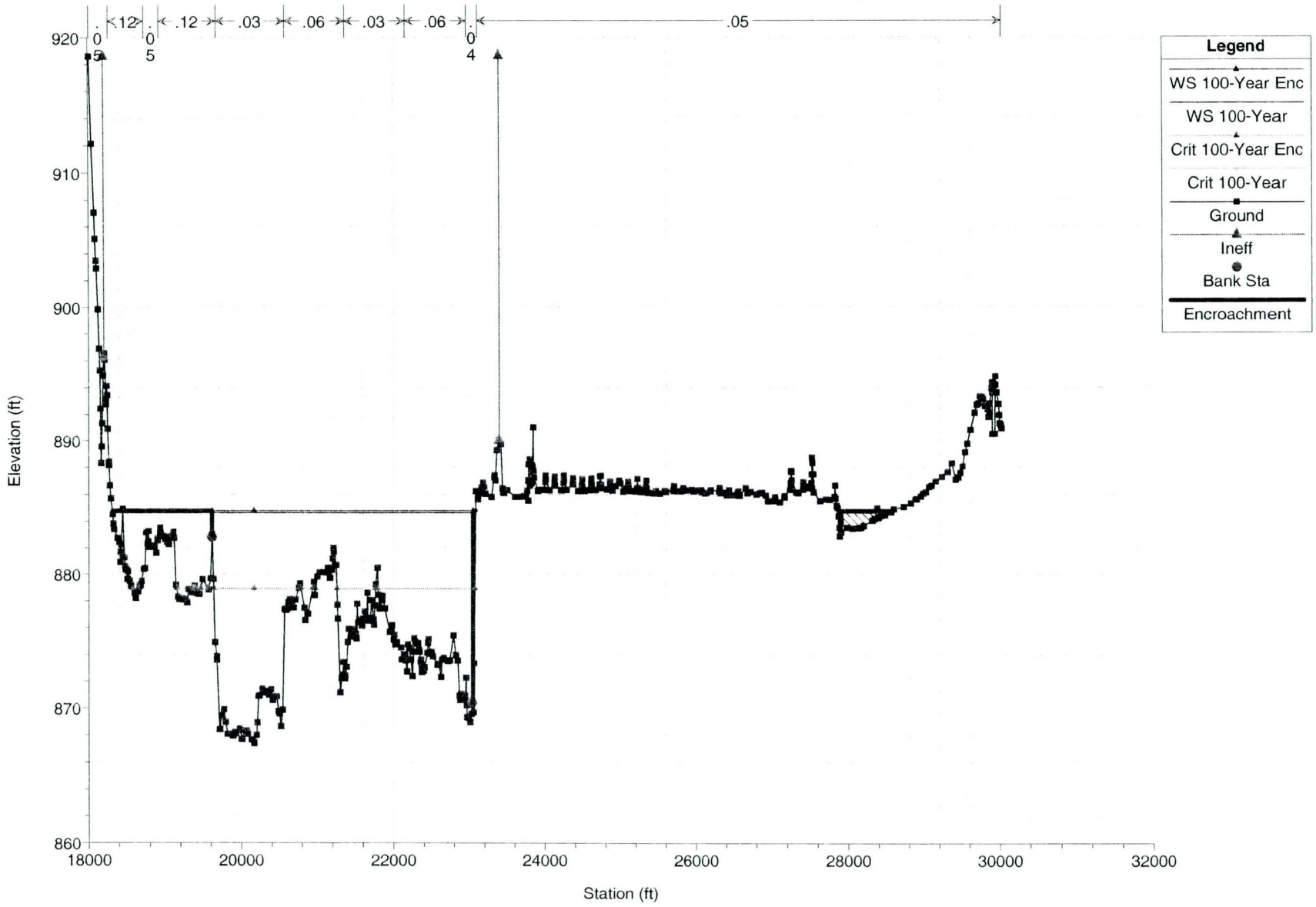
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.53



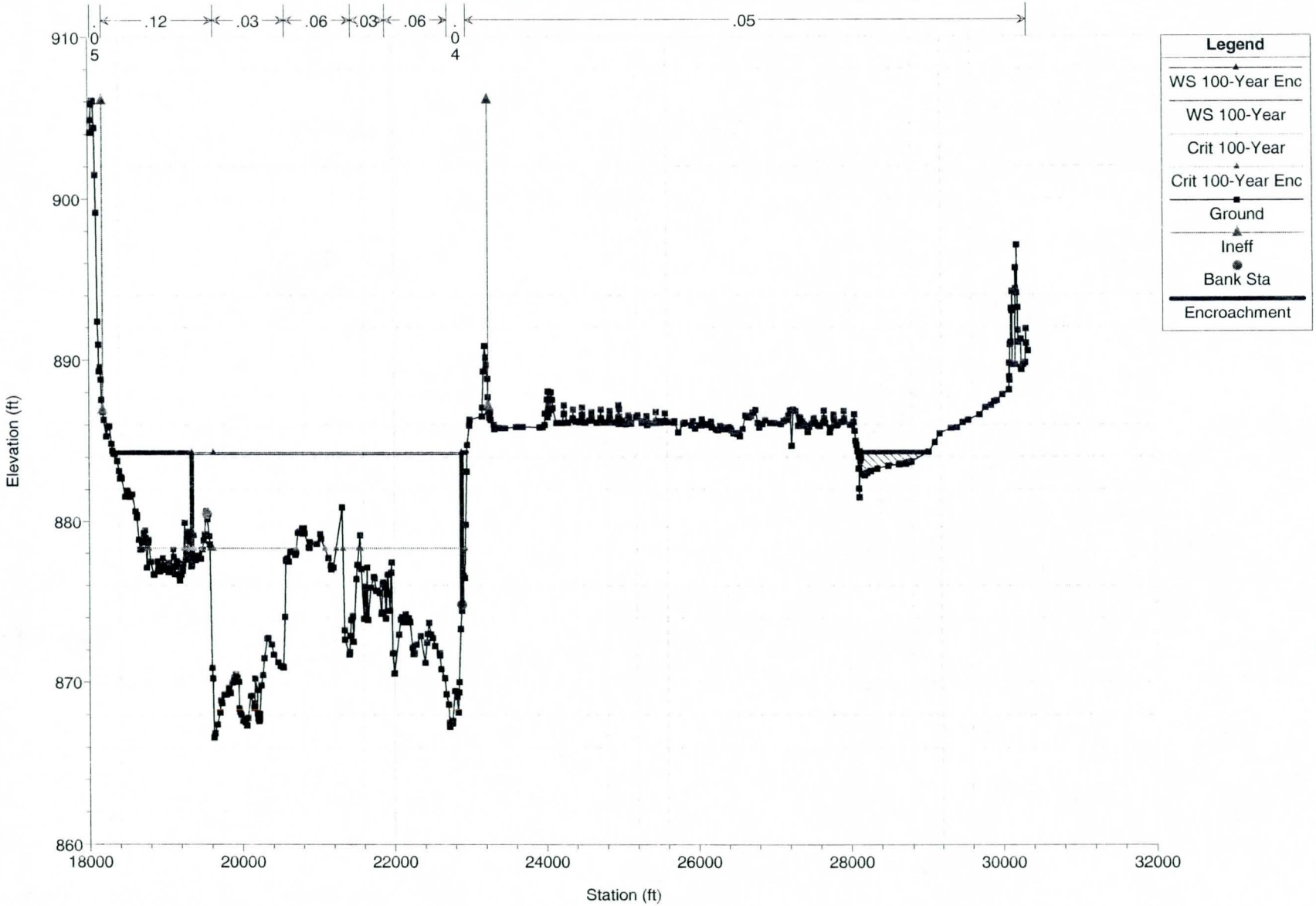
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.43 Eliminate vertical ineffective area in main channel by coding ou



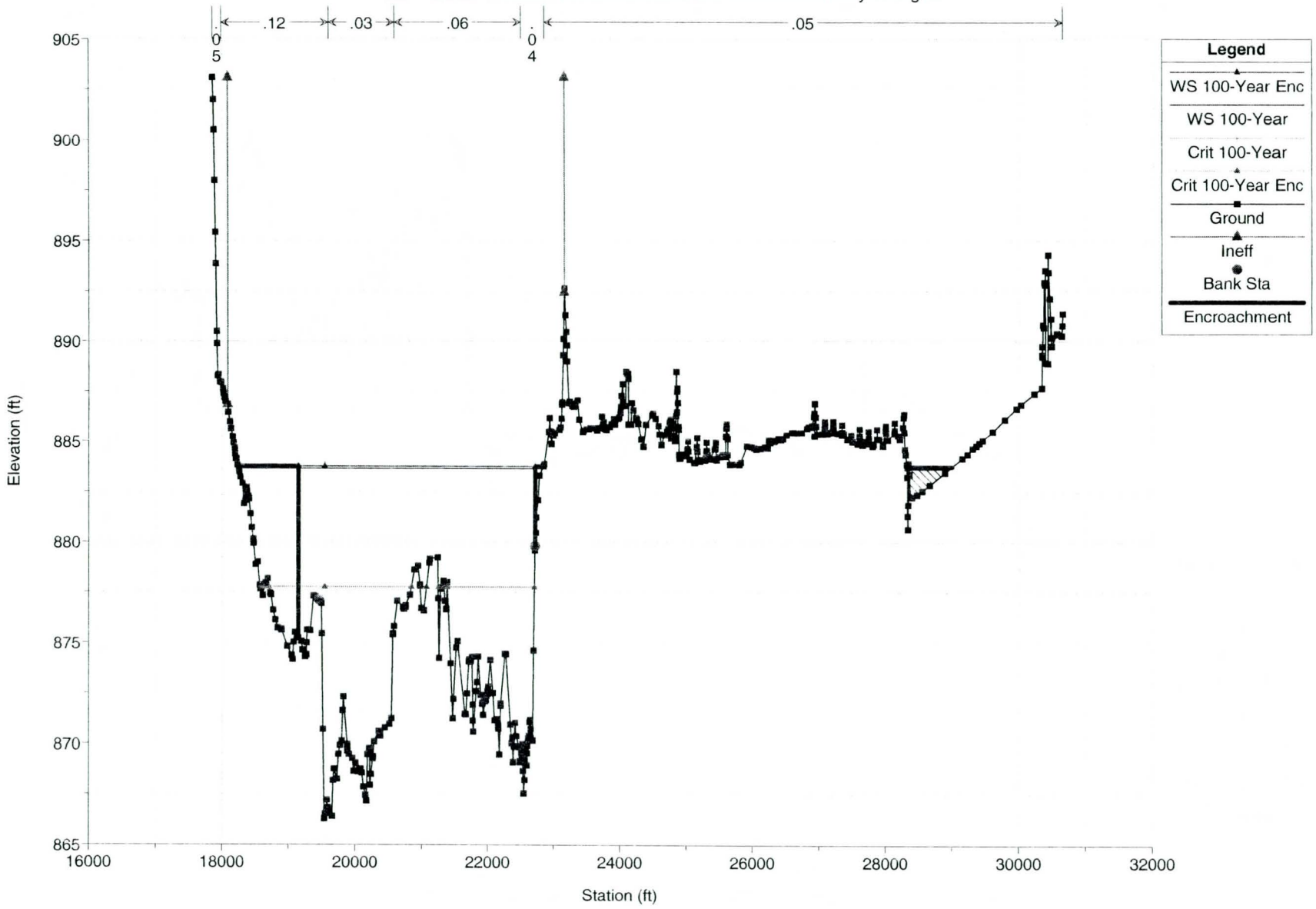
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.34 Eliminate vertical ineffective area in main channel by coding ou



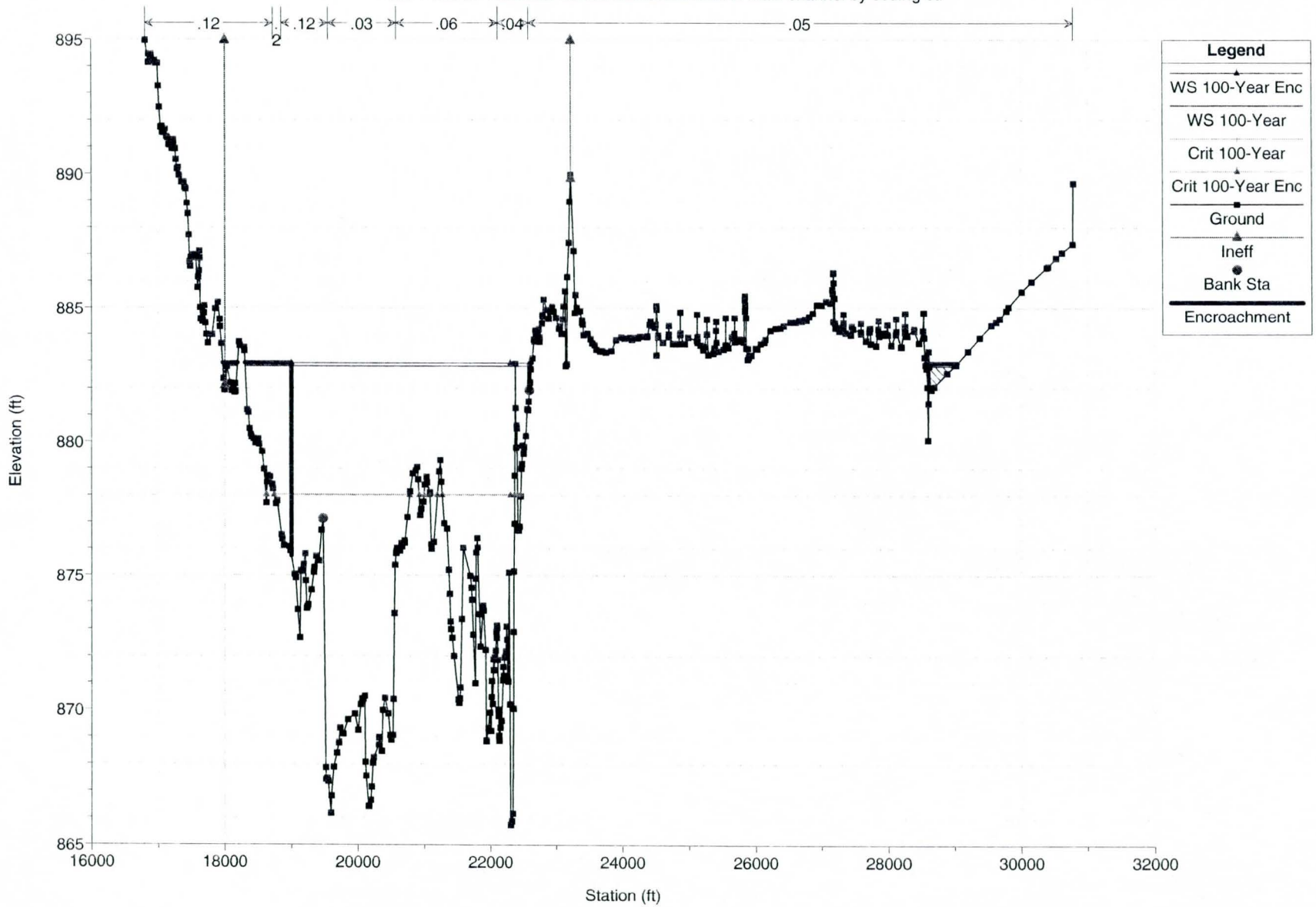
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.24 Eliminate vertical ineffective area in main channel by coding ou



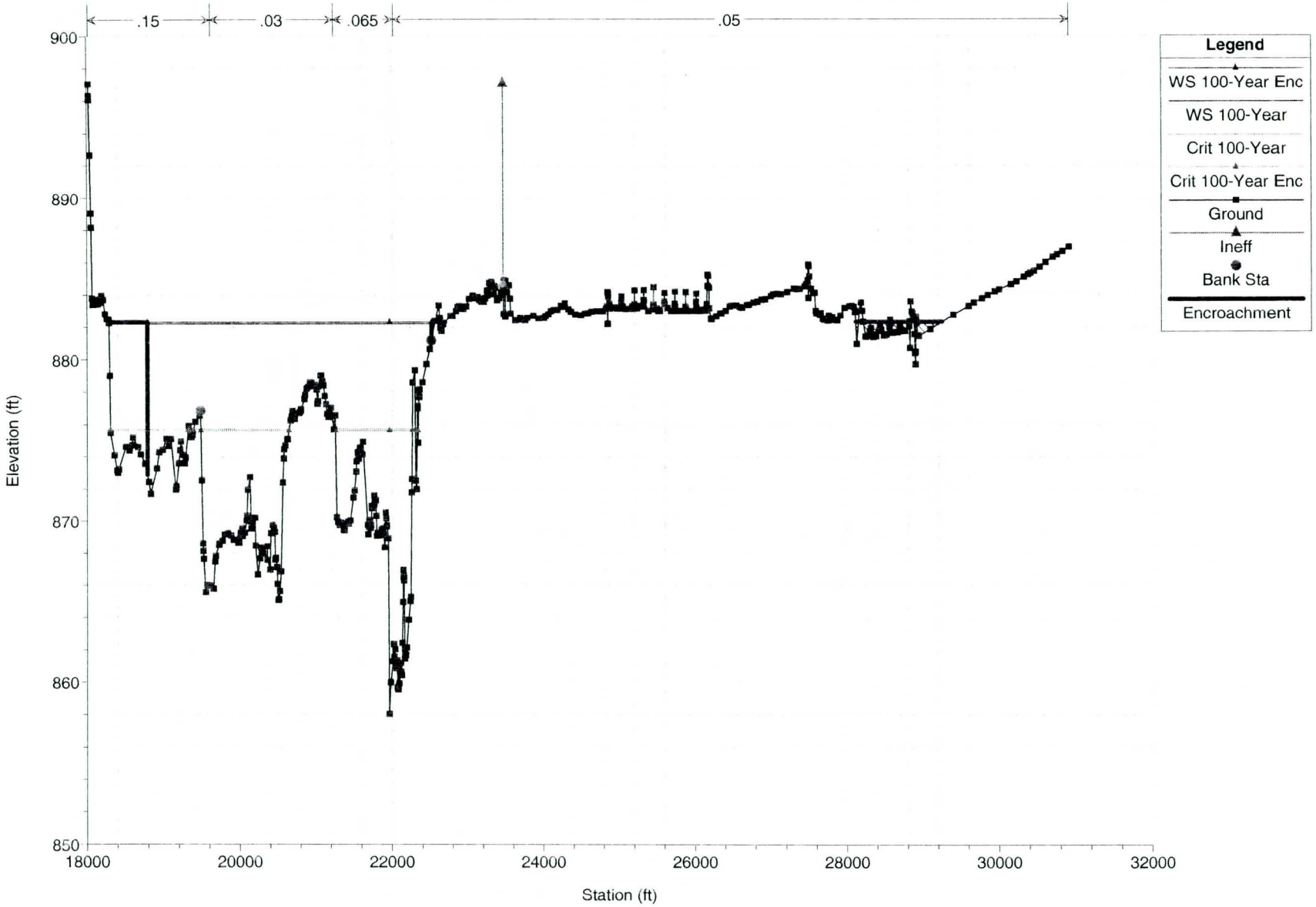
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.15 Eliminate vertical ineffective area in main channel by coding ou



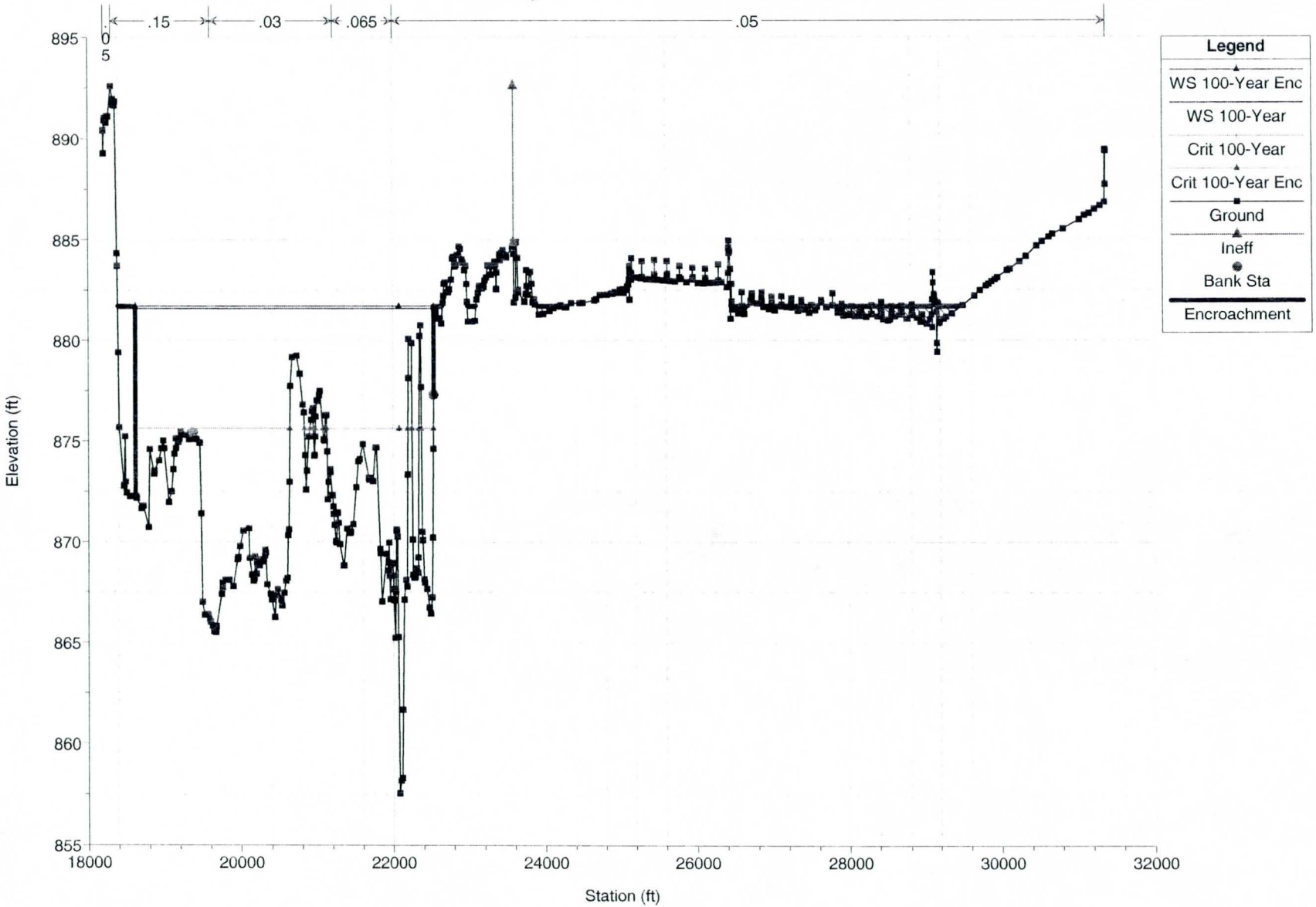
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 190.05 Eliminate vertical ineffective area in main channel by coding ou



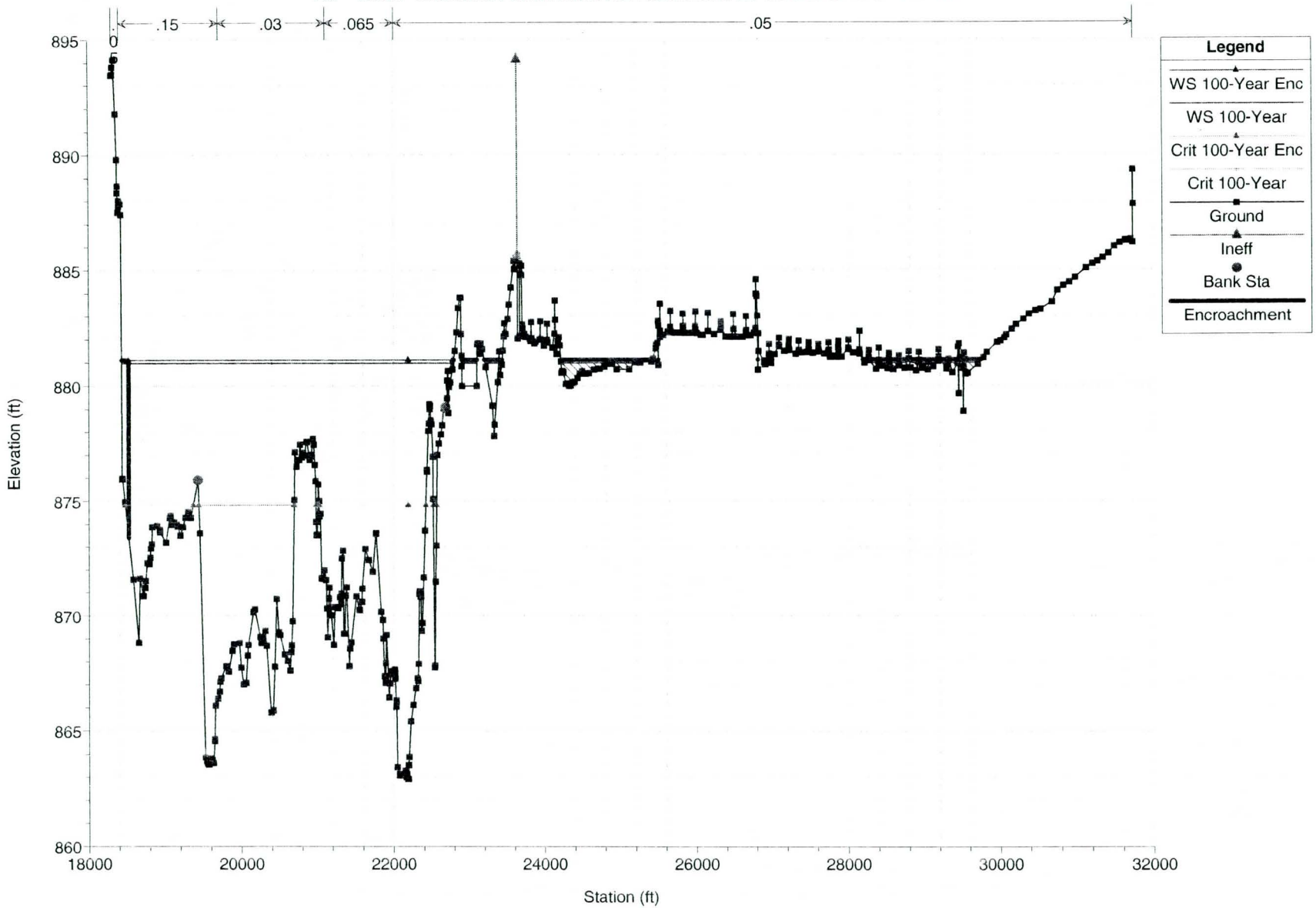
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.96 Right ineffective flow station from FEMA w/levee model



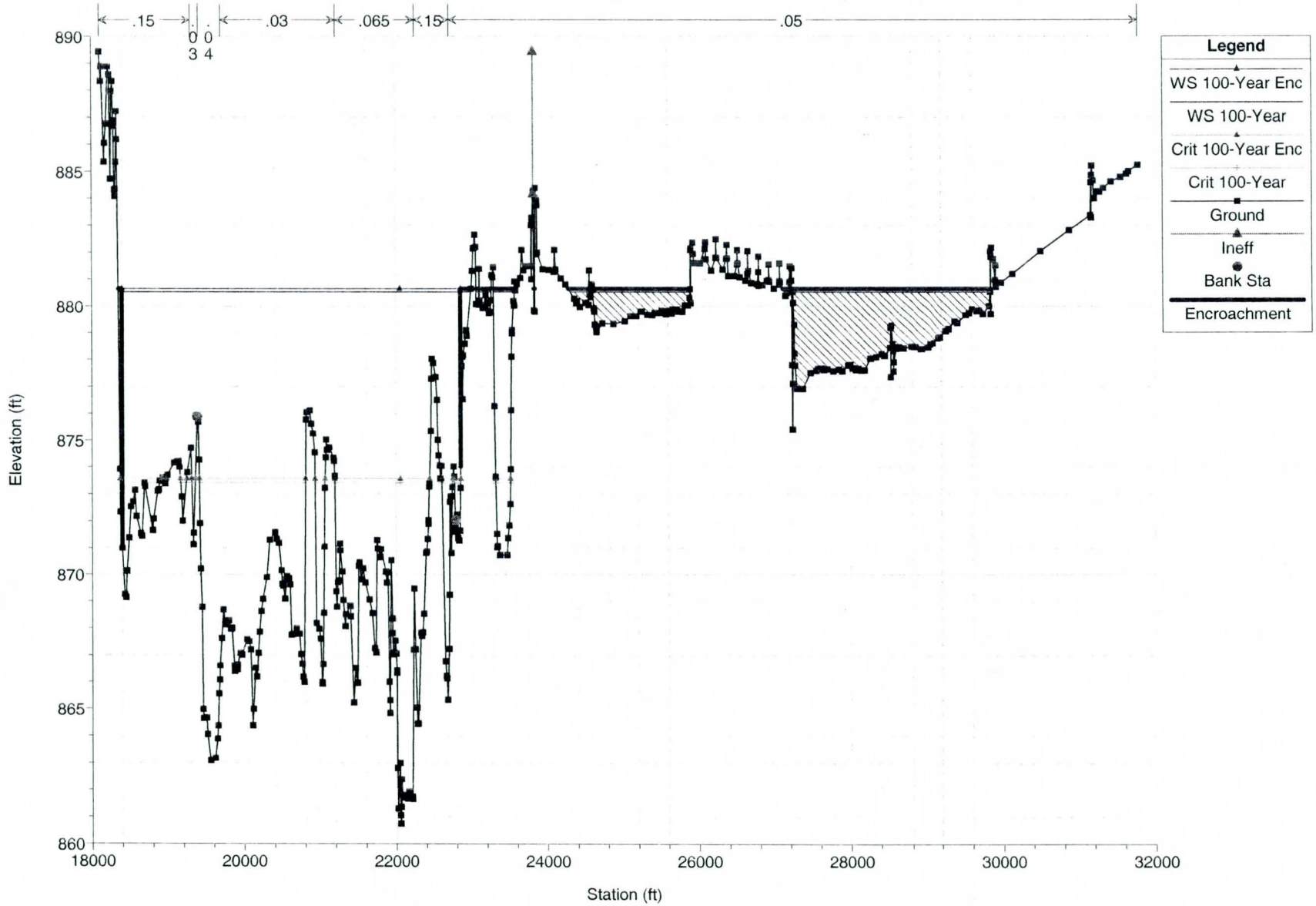
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.87 CROSSES PERRYVILLE RD. ALIGNMENT AT CENTERLINE OF 100 YR FLOW



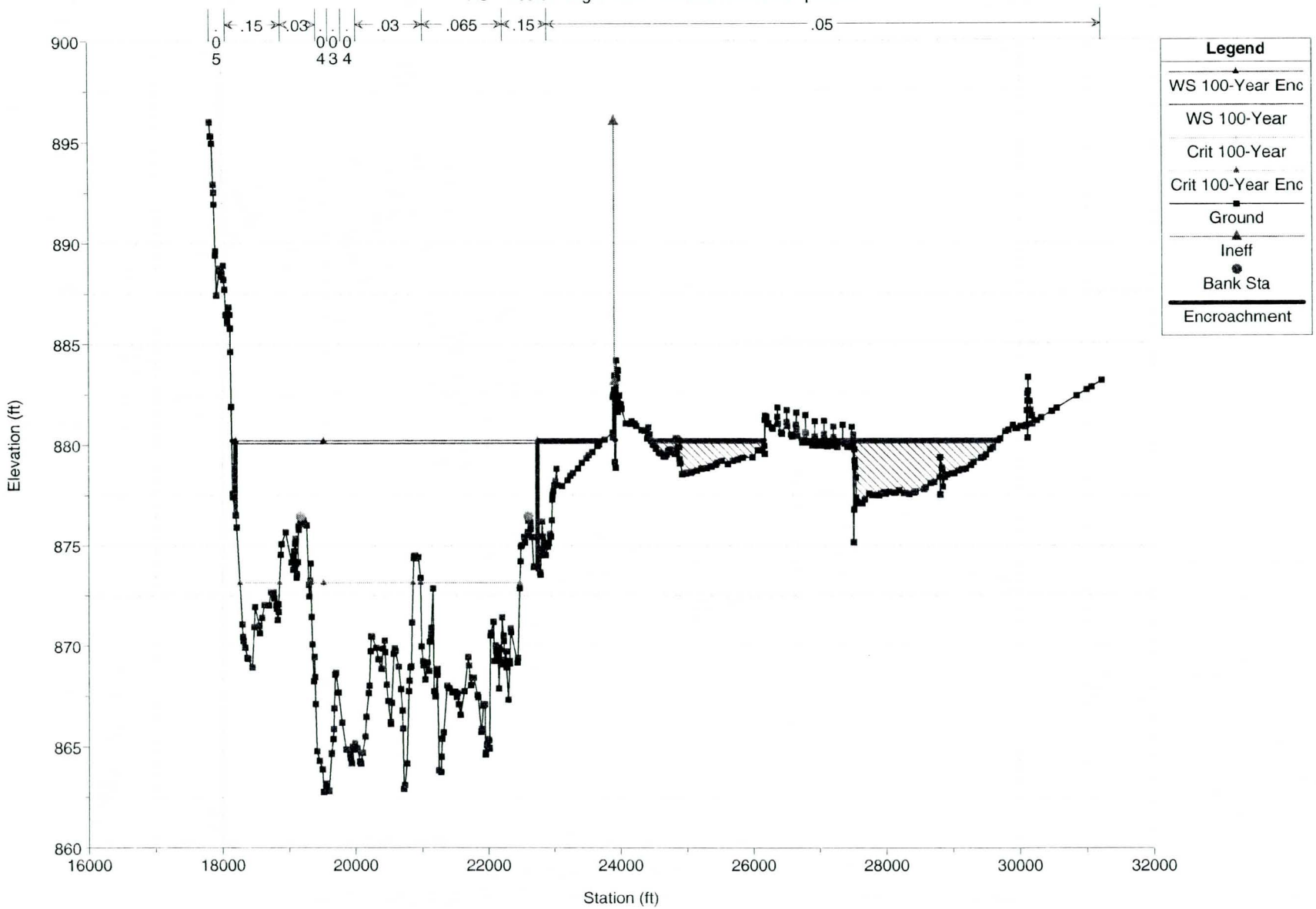
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.77 Left and Right Channel Bank Stations Interpolated



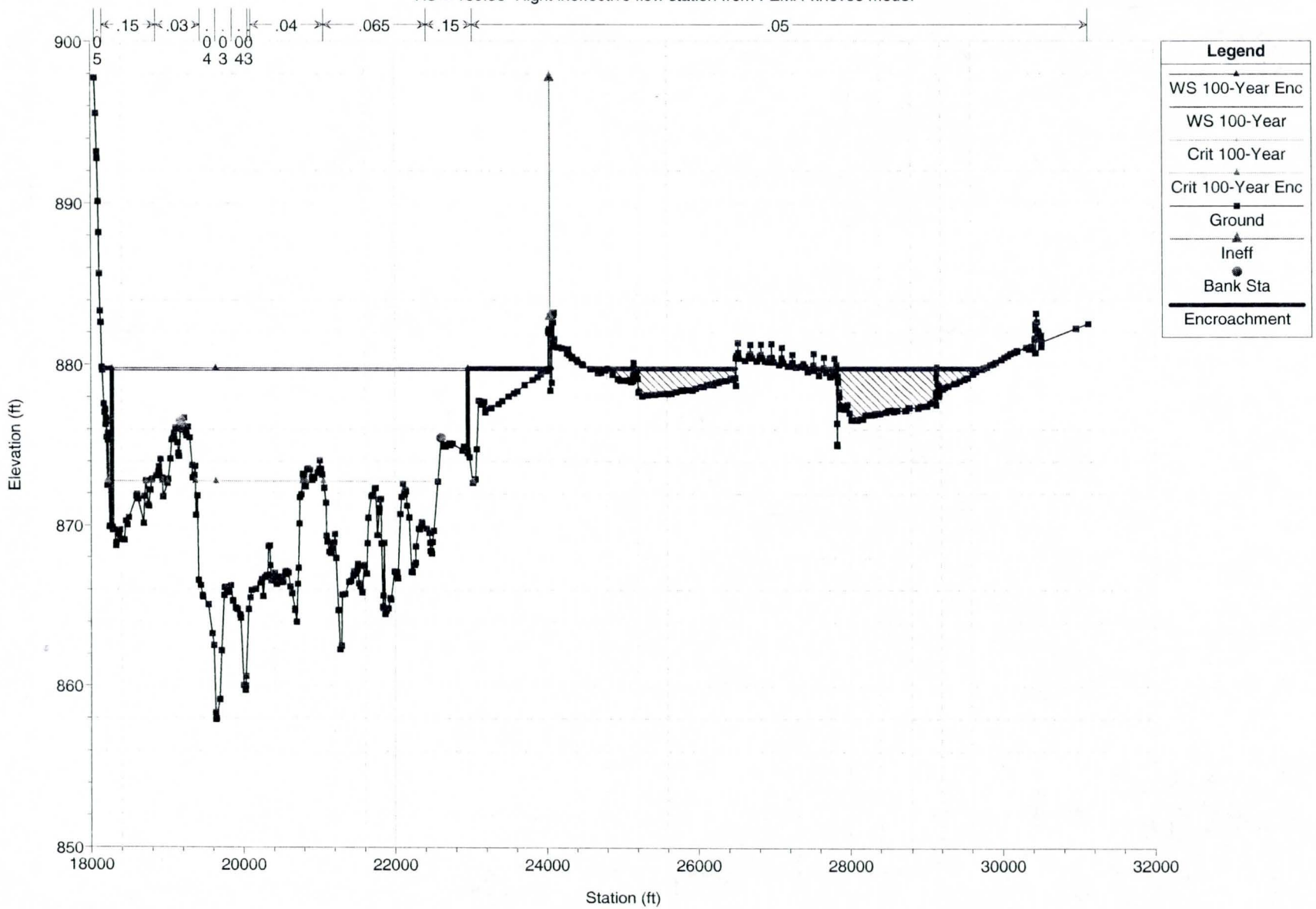
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.67 Right Bank Channel Station Interpolated



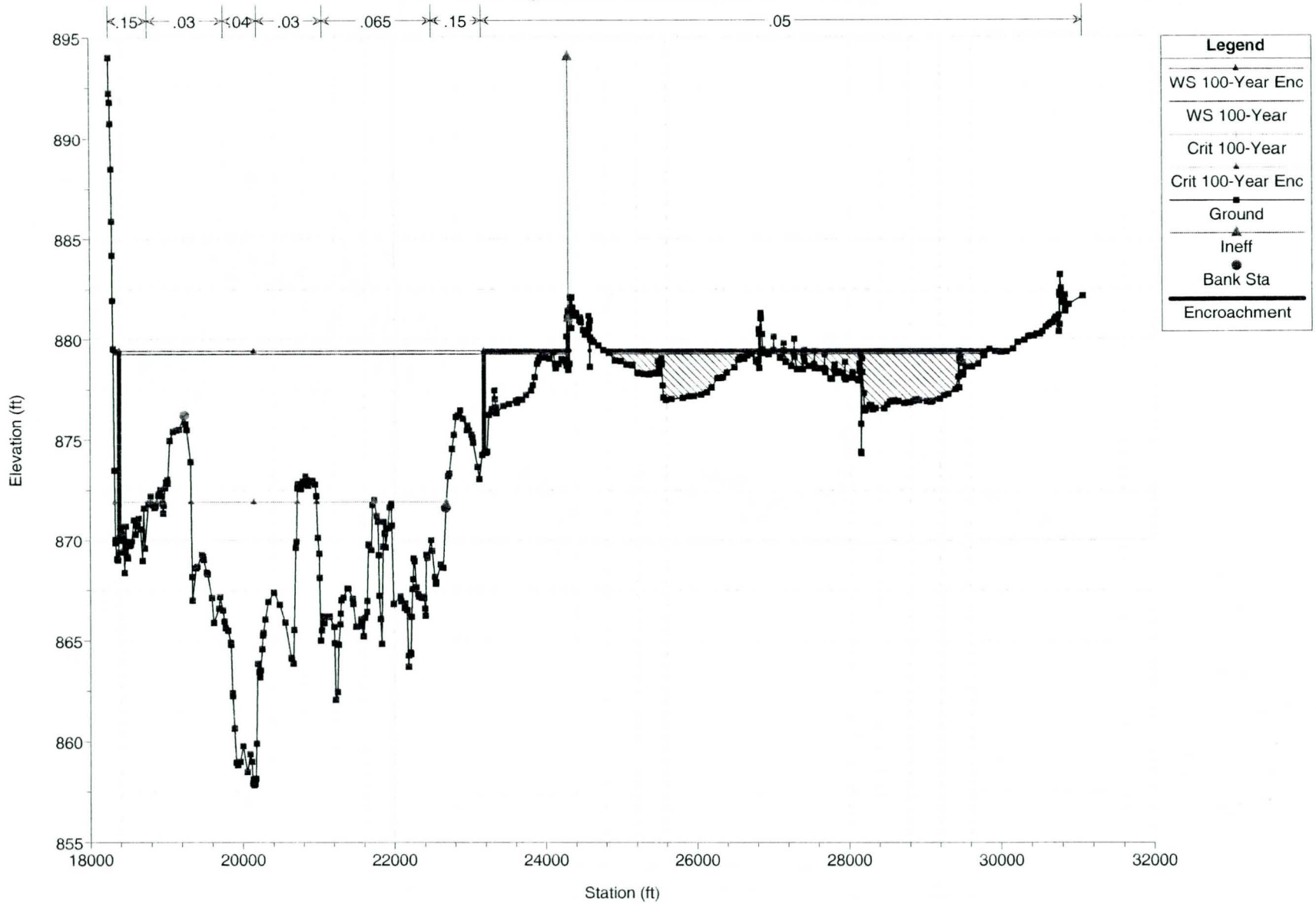
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.58 Right ineffective flow station from FEMA w/levee model



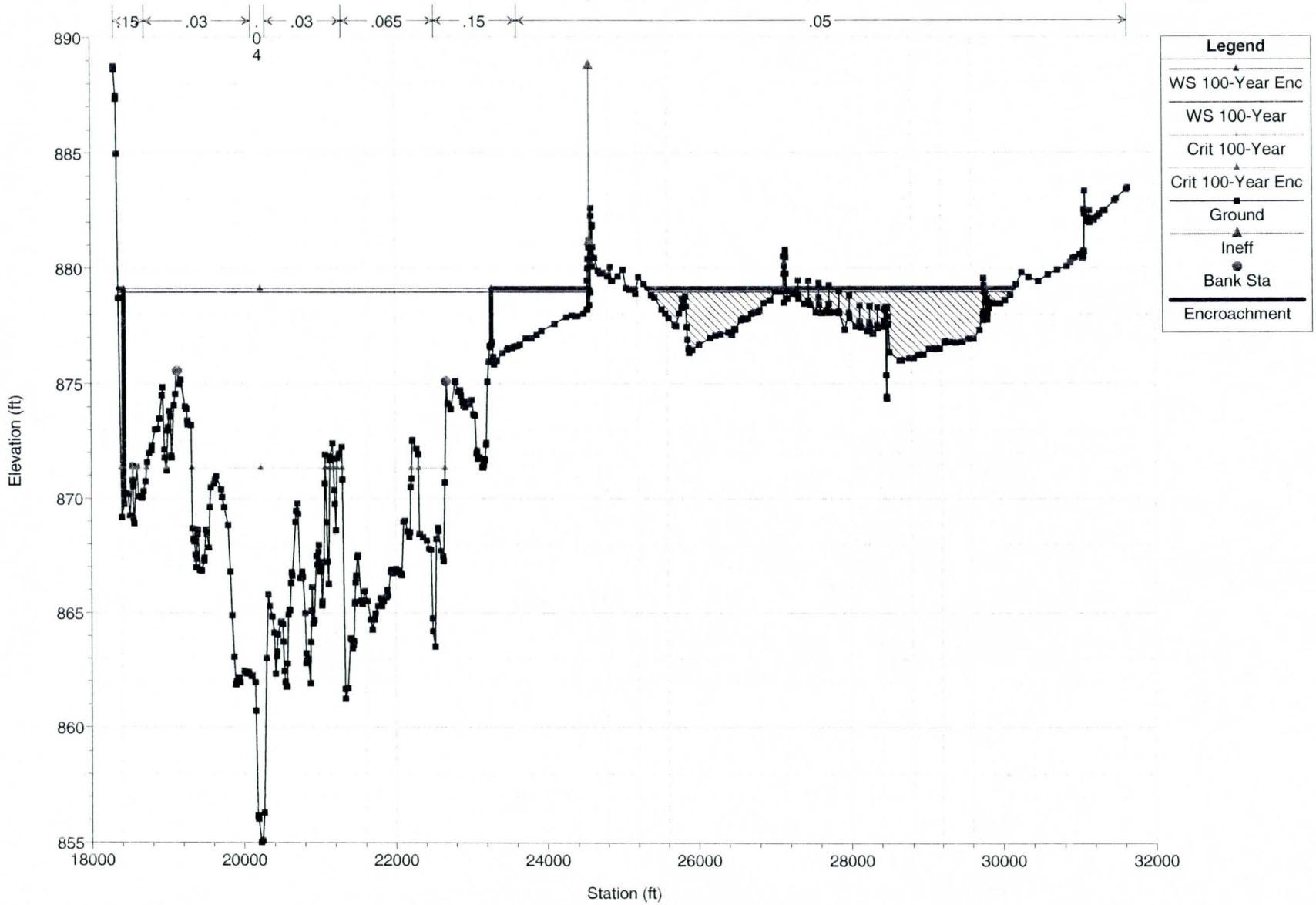
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.48 Right ineffective flow station from FEMA w/levee model



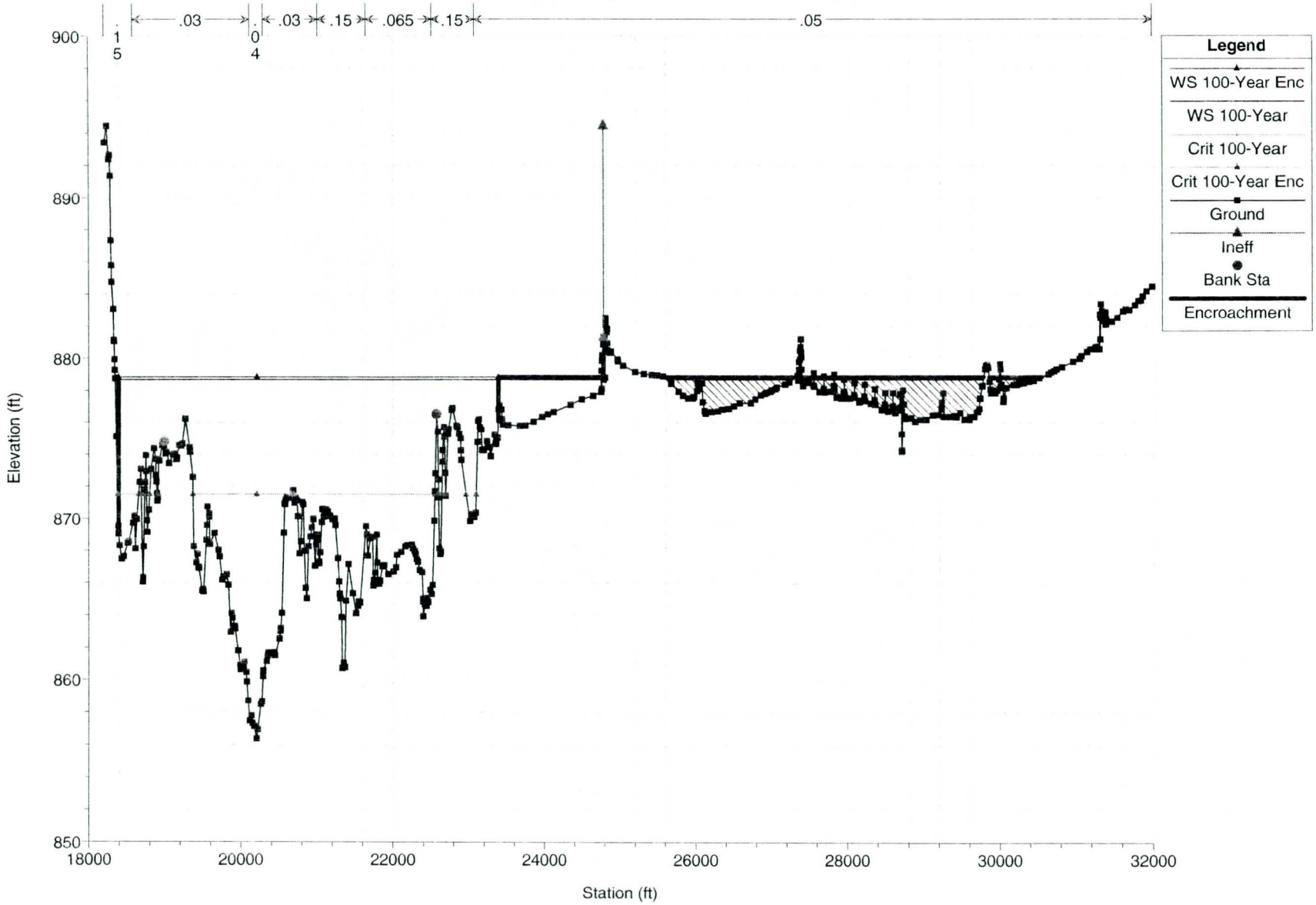
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.39 Right Bank Channel Station Interpolated



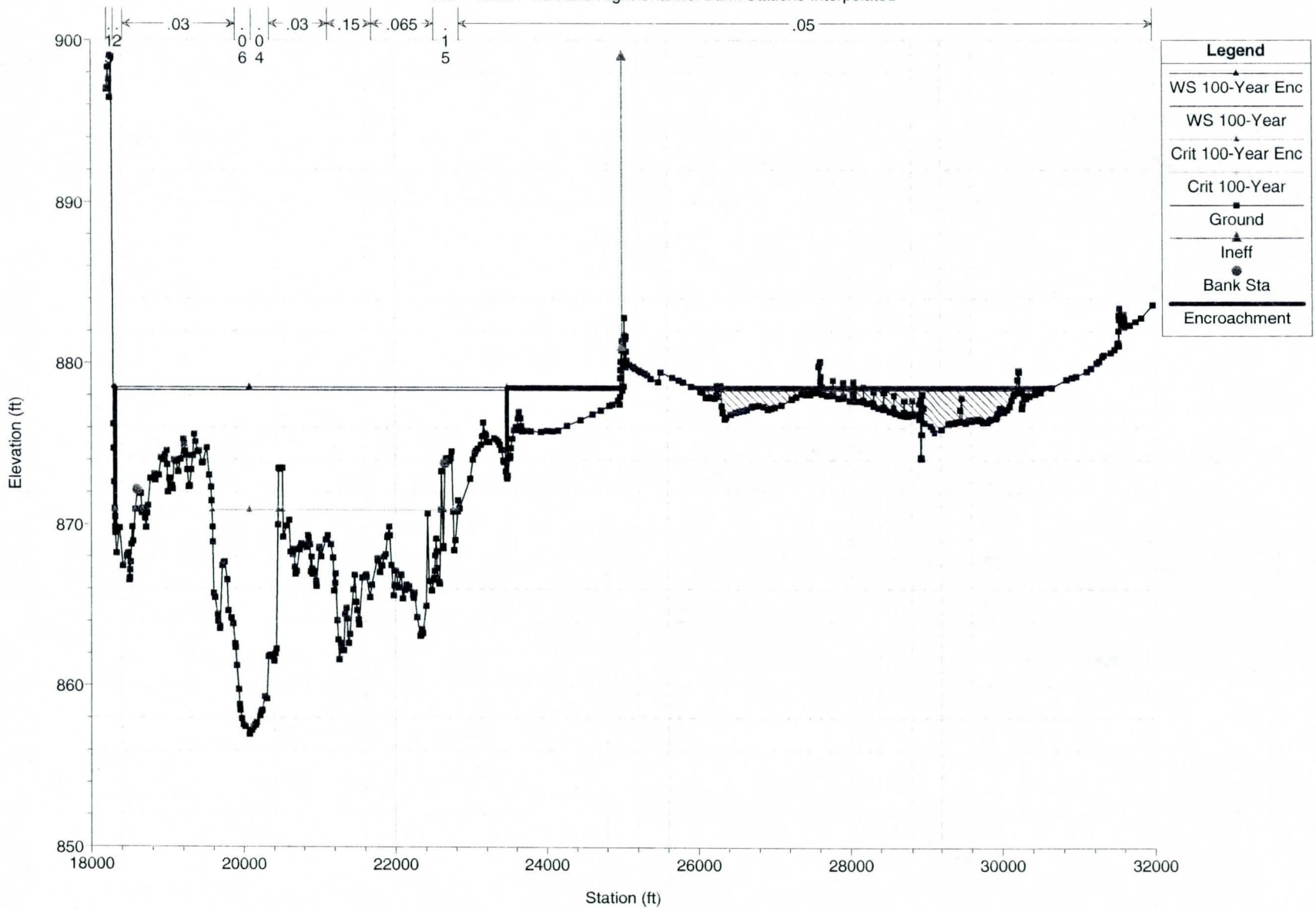
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.3 Left and Right Channel Bank Stations Interpolated



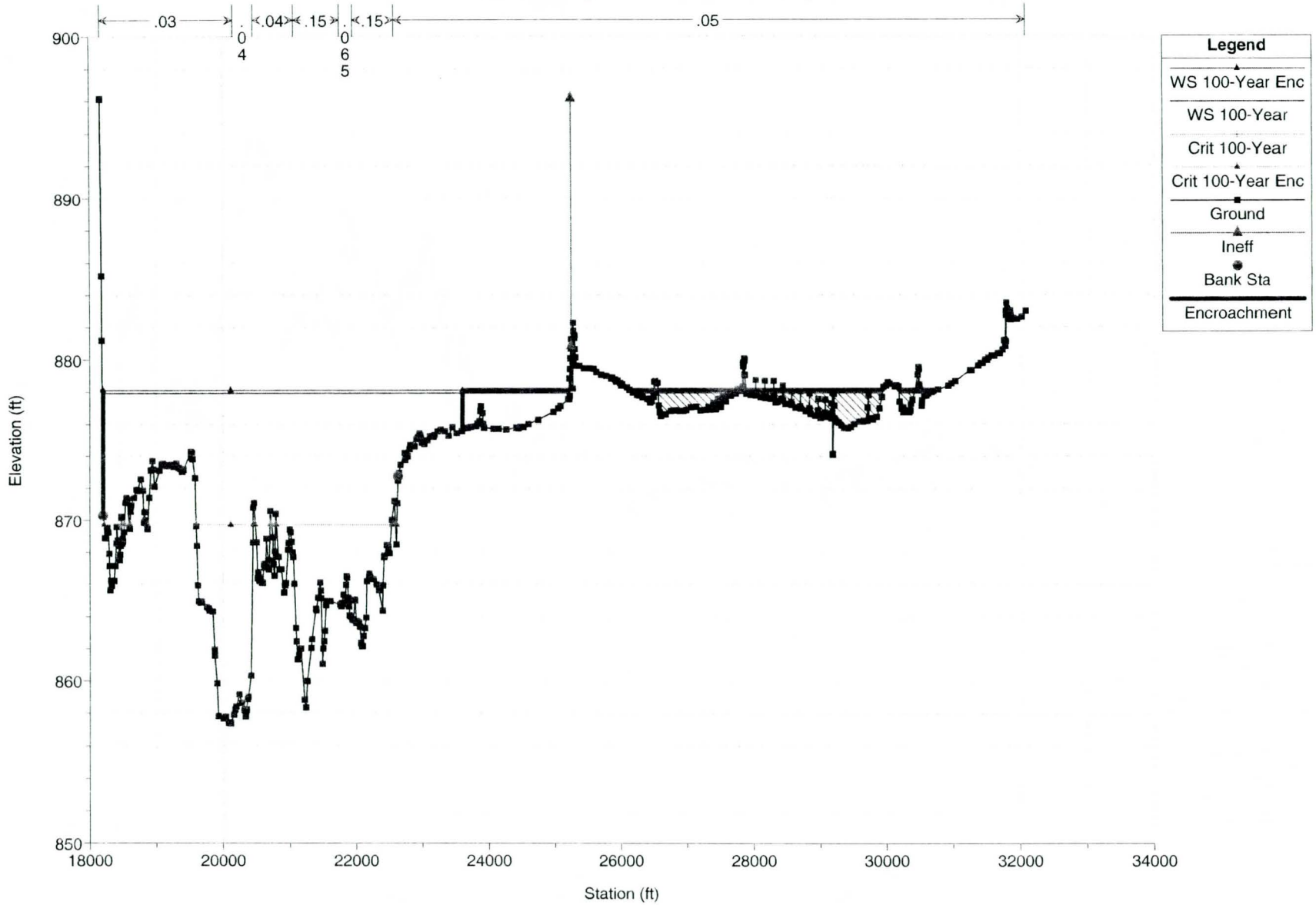
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.21 Left and Right Channel Bank Stations Interpolated



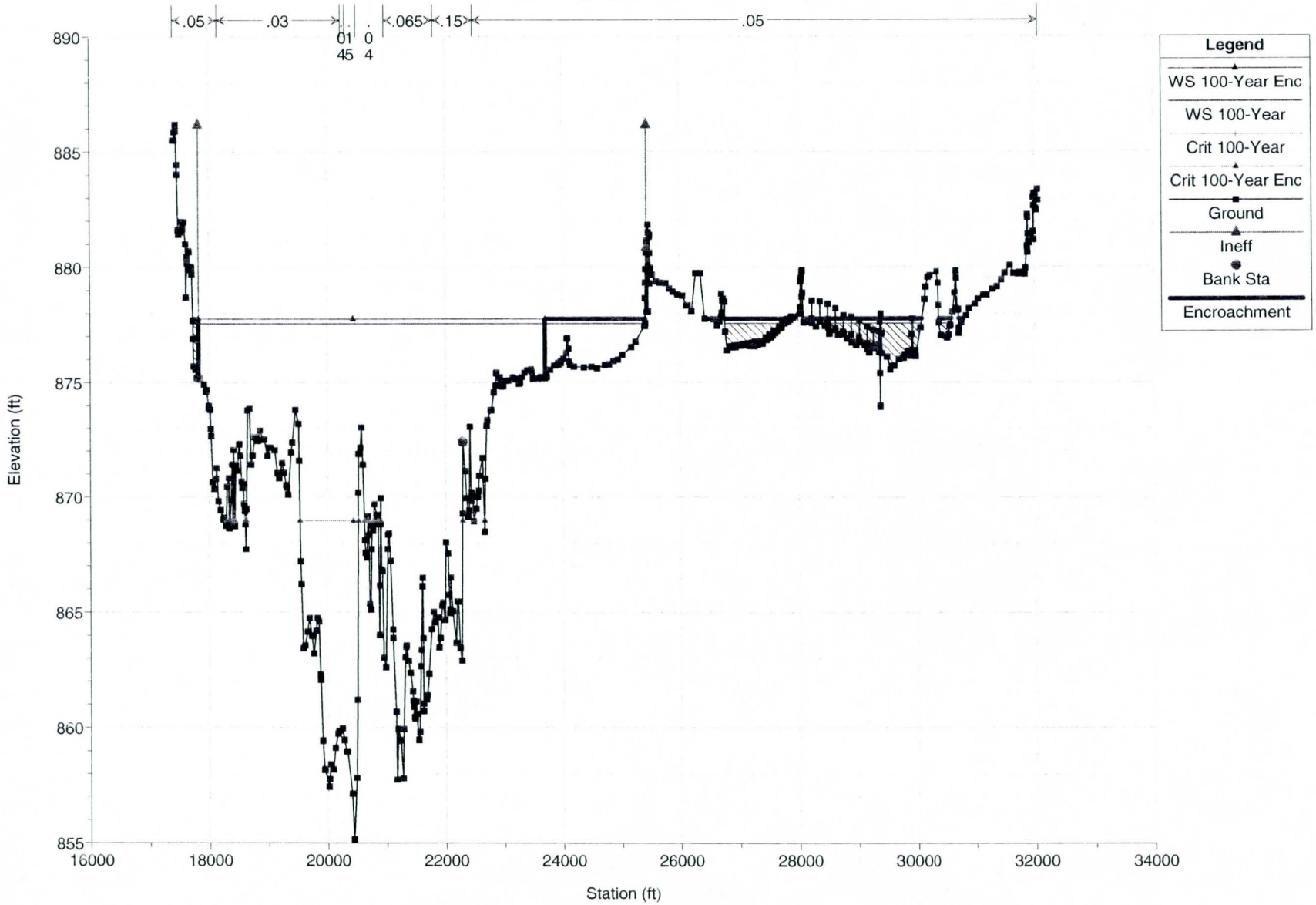
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.11 Right Bank Channel Station Interpolated



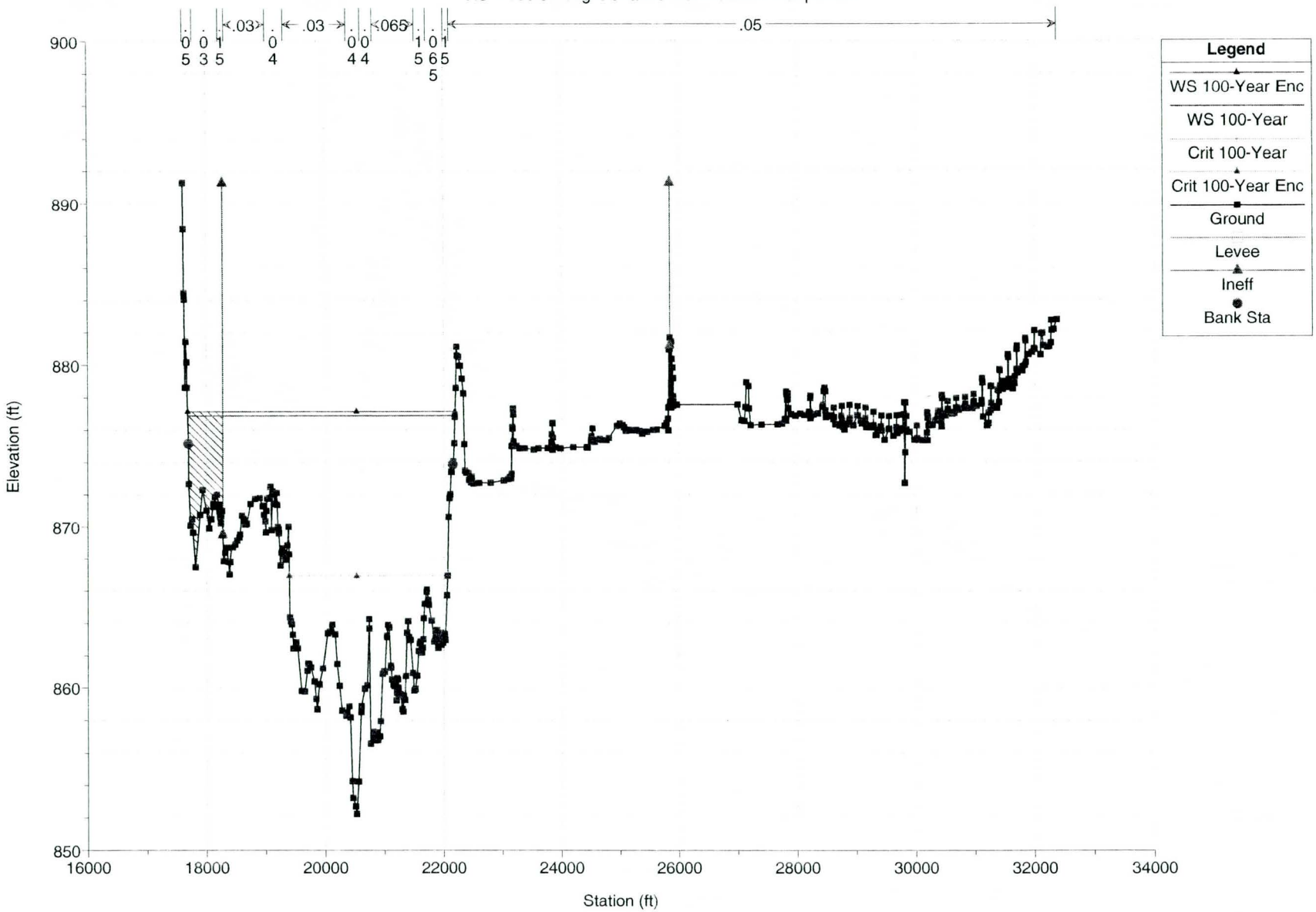
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 189.02 Right Bank Channel Station Interpolated



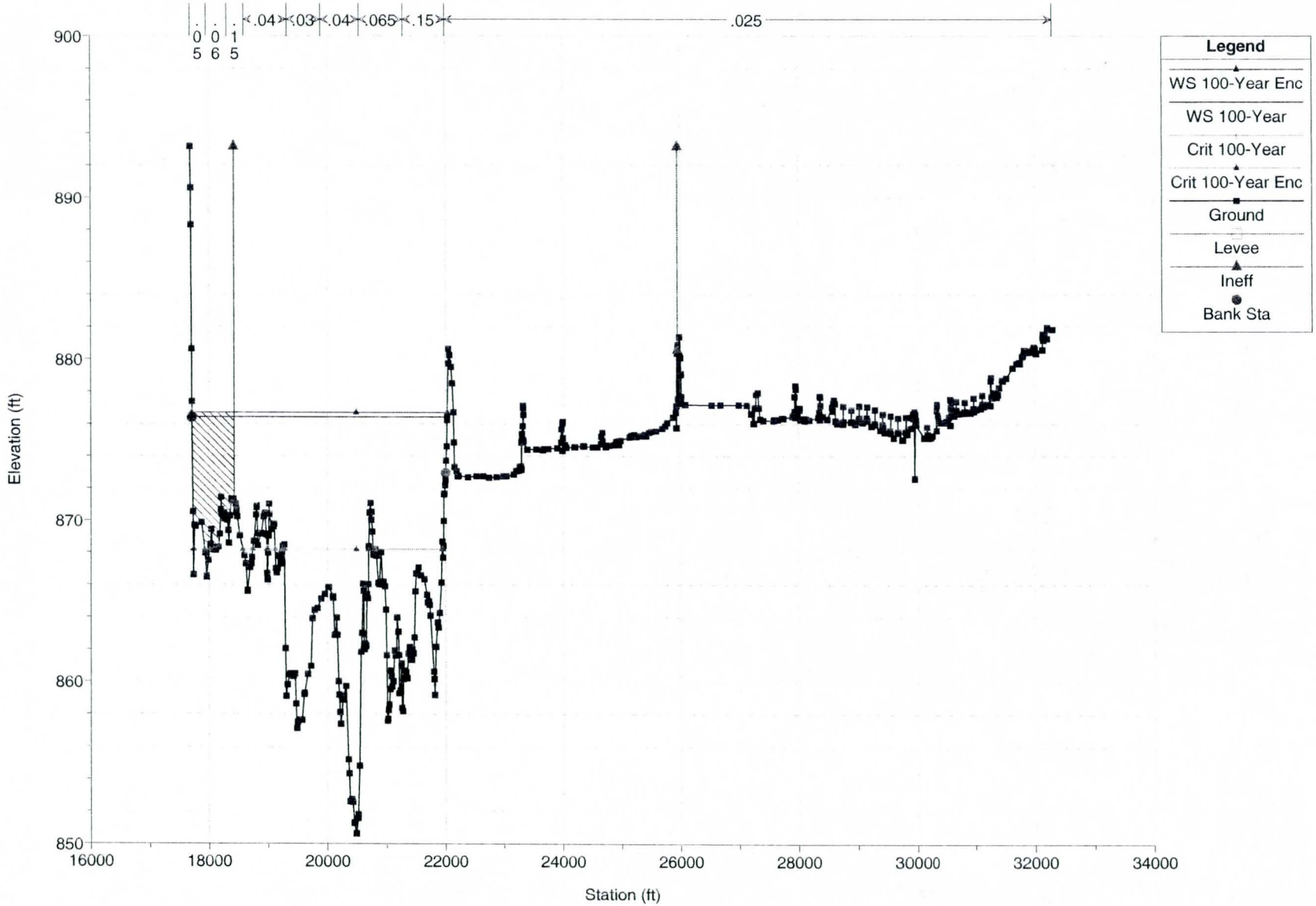
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.81 Right Channel Bank Station Interpolated



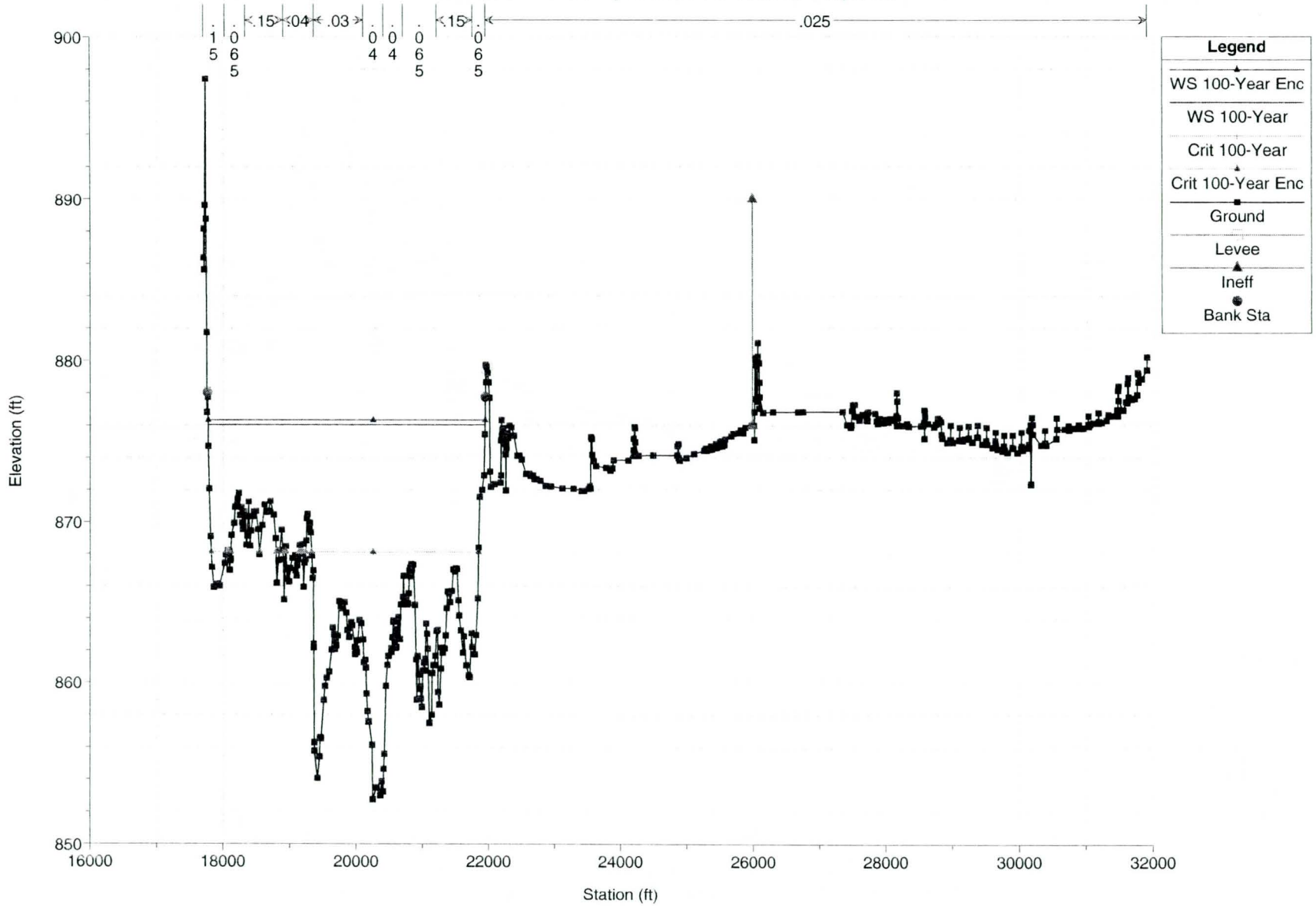
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.69 Left and Right Channel Bank Stations Interpolated



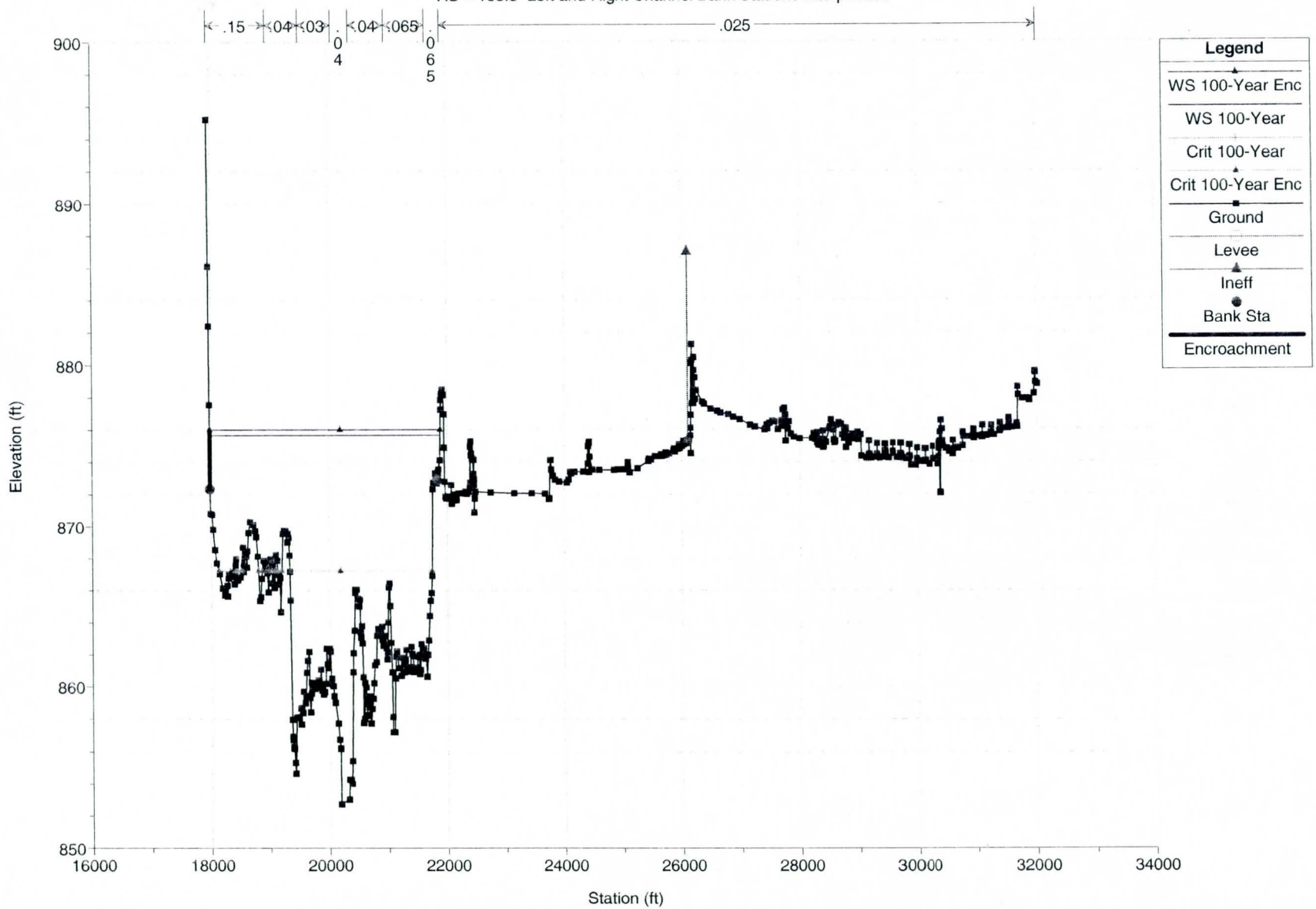
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.59 Left and Right Channel Bank Stations Interpolated



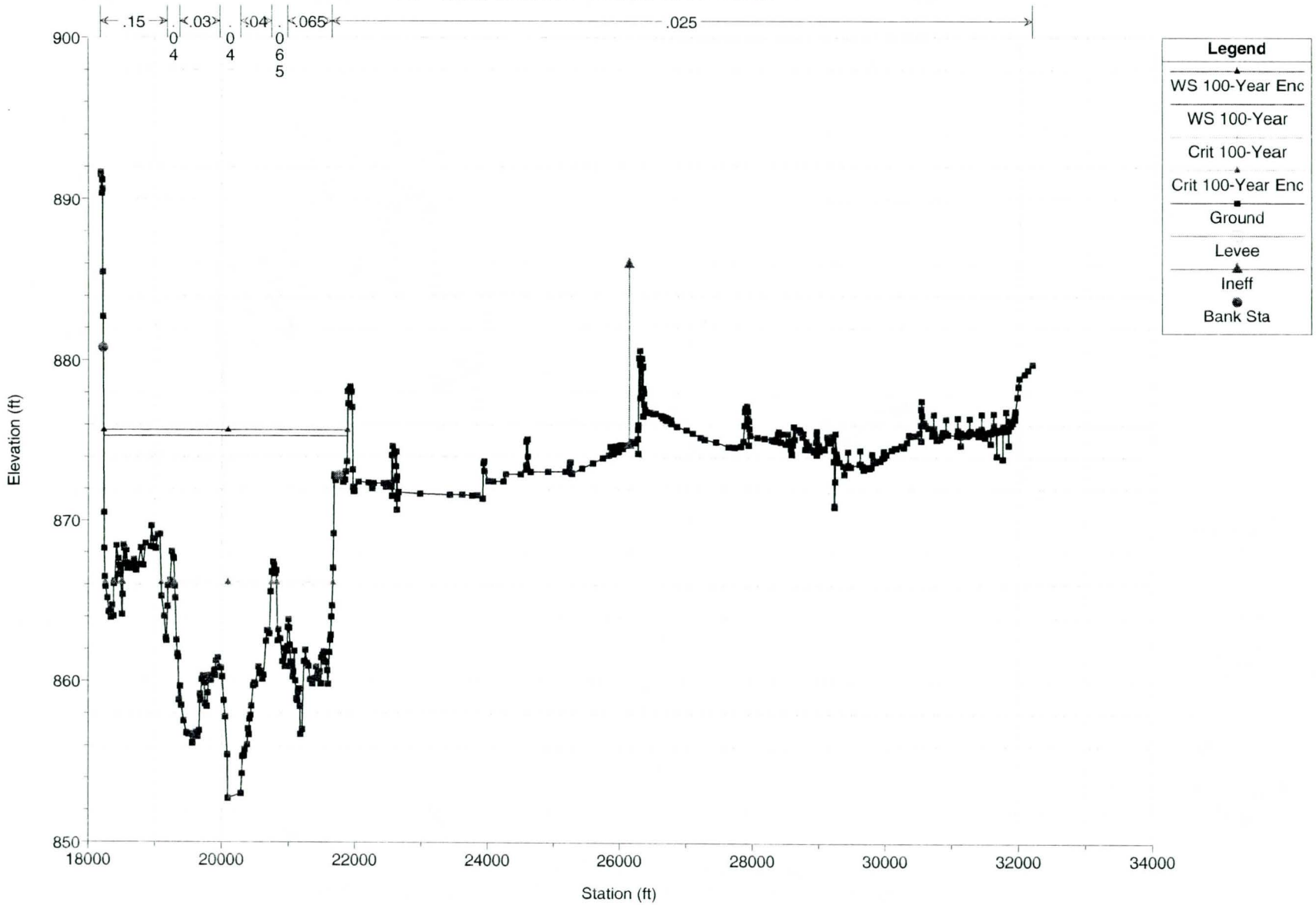
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.5 Left and Right Channel Bank Stations Interpolated



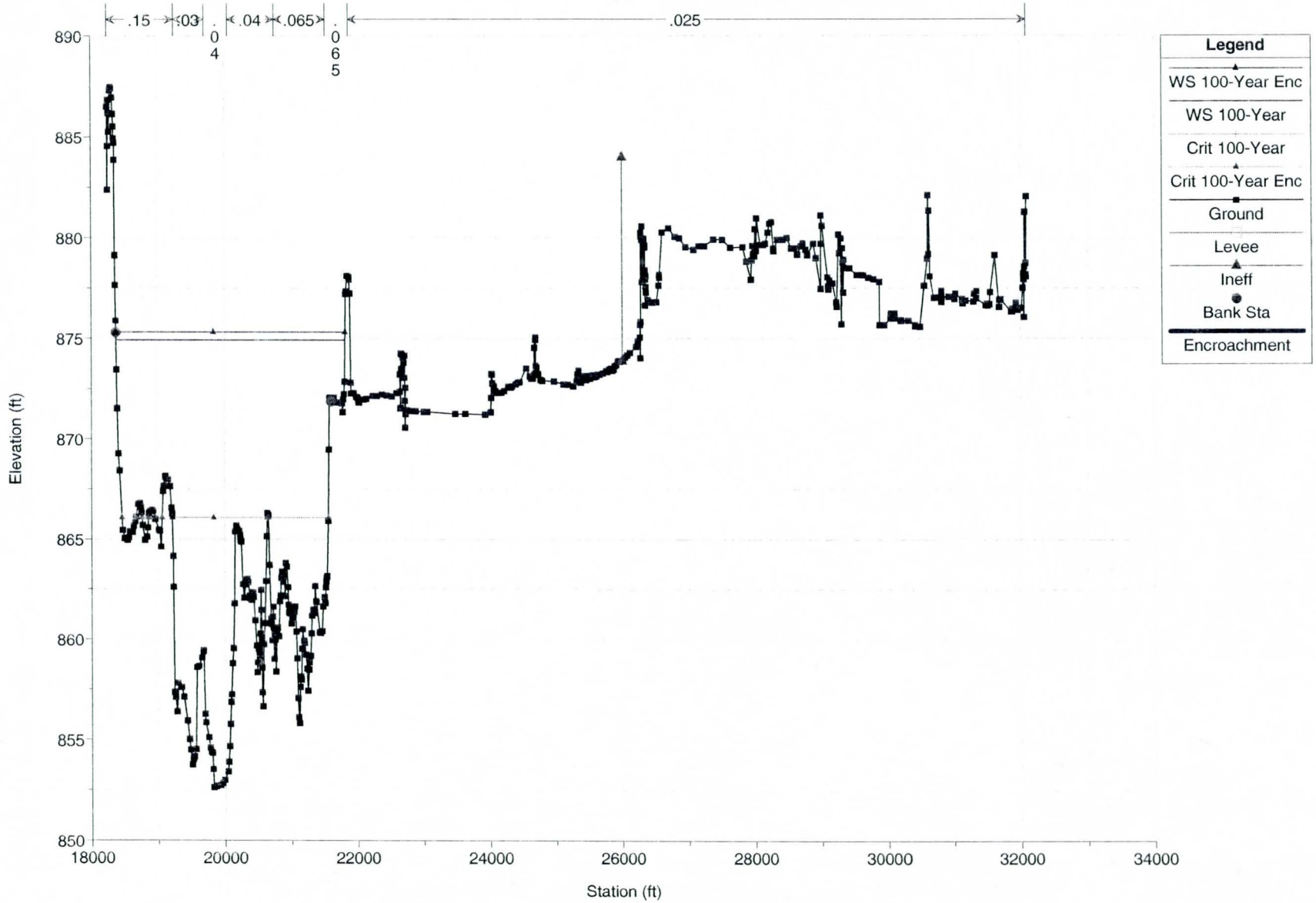
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.39 BEGIN 1:1 TRANSITION TO BRIDGE



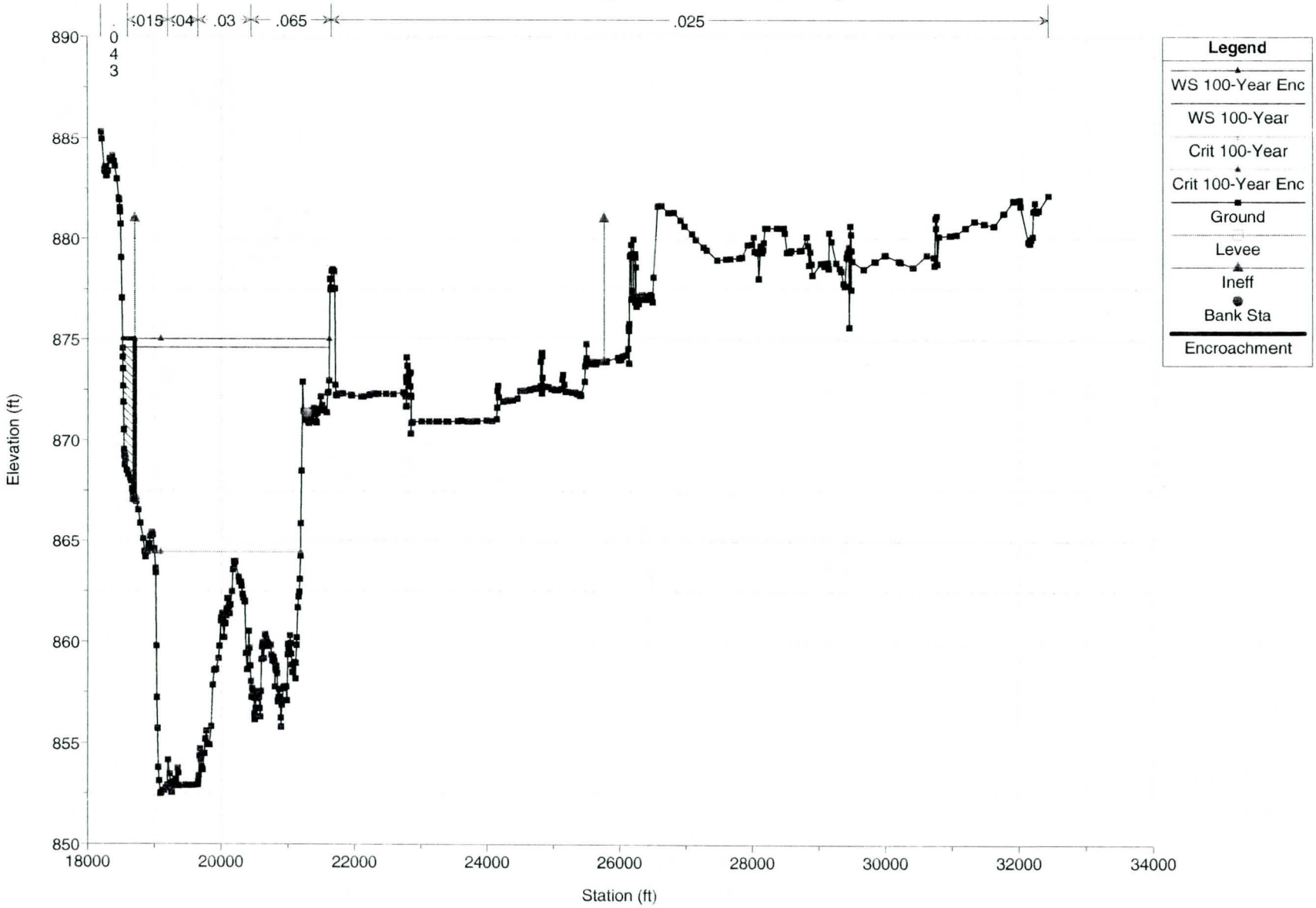
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.29 Left and Right Channel Bank Stations Interpolated



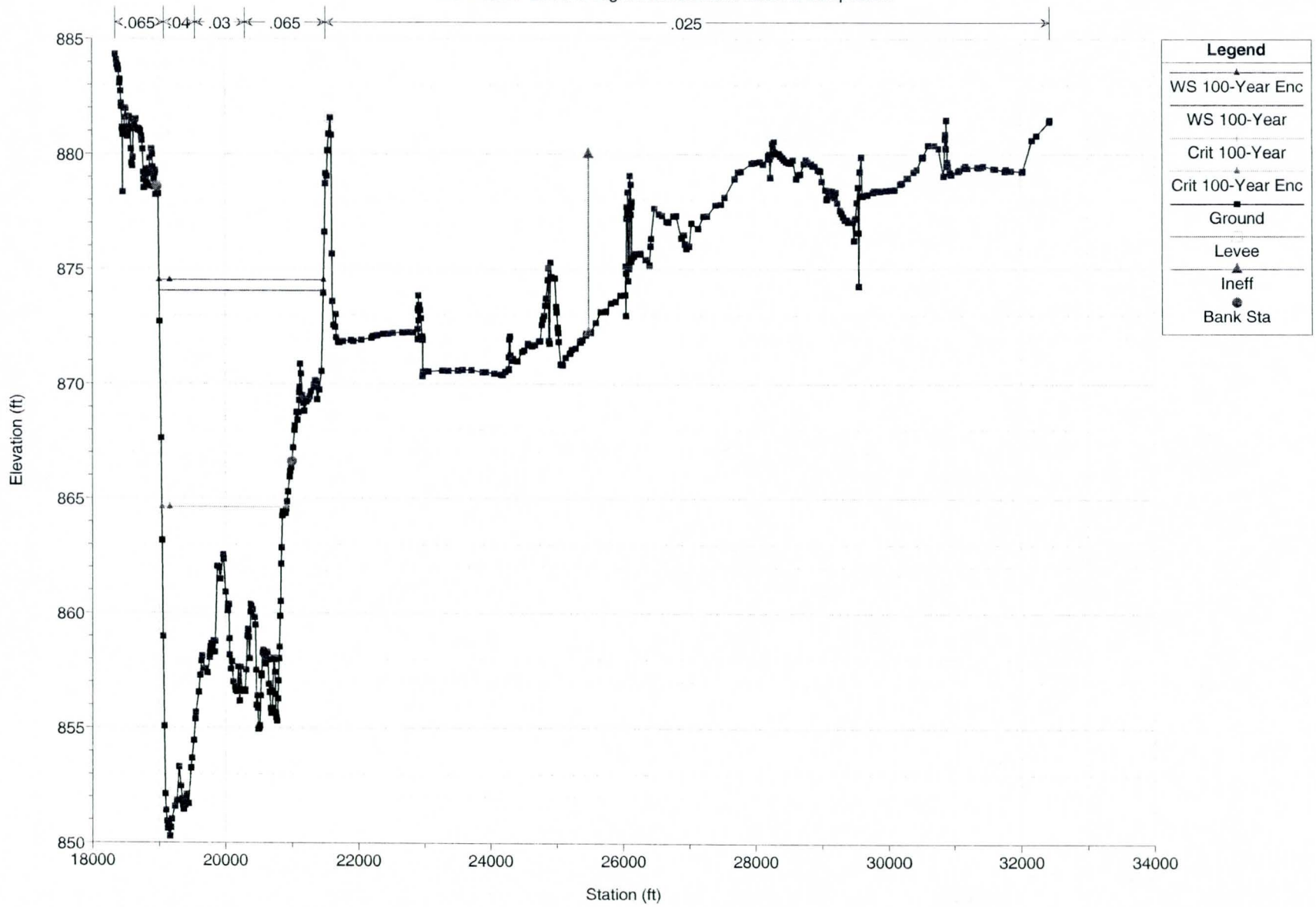
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.2 Left and Right Bank Channel Stations Interpolated



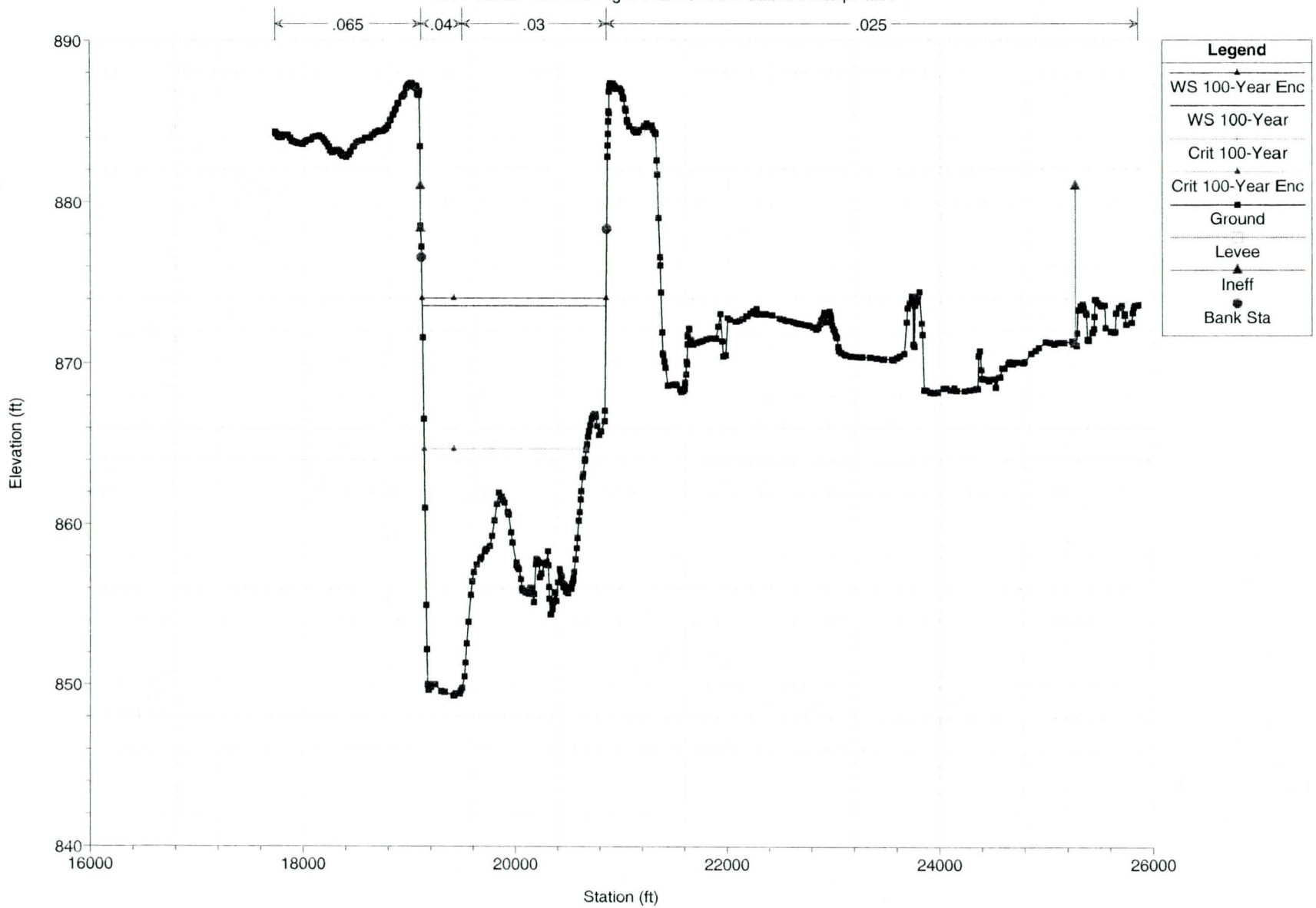
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.1 Left and Right Channel Bank Stations Interpolated



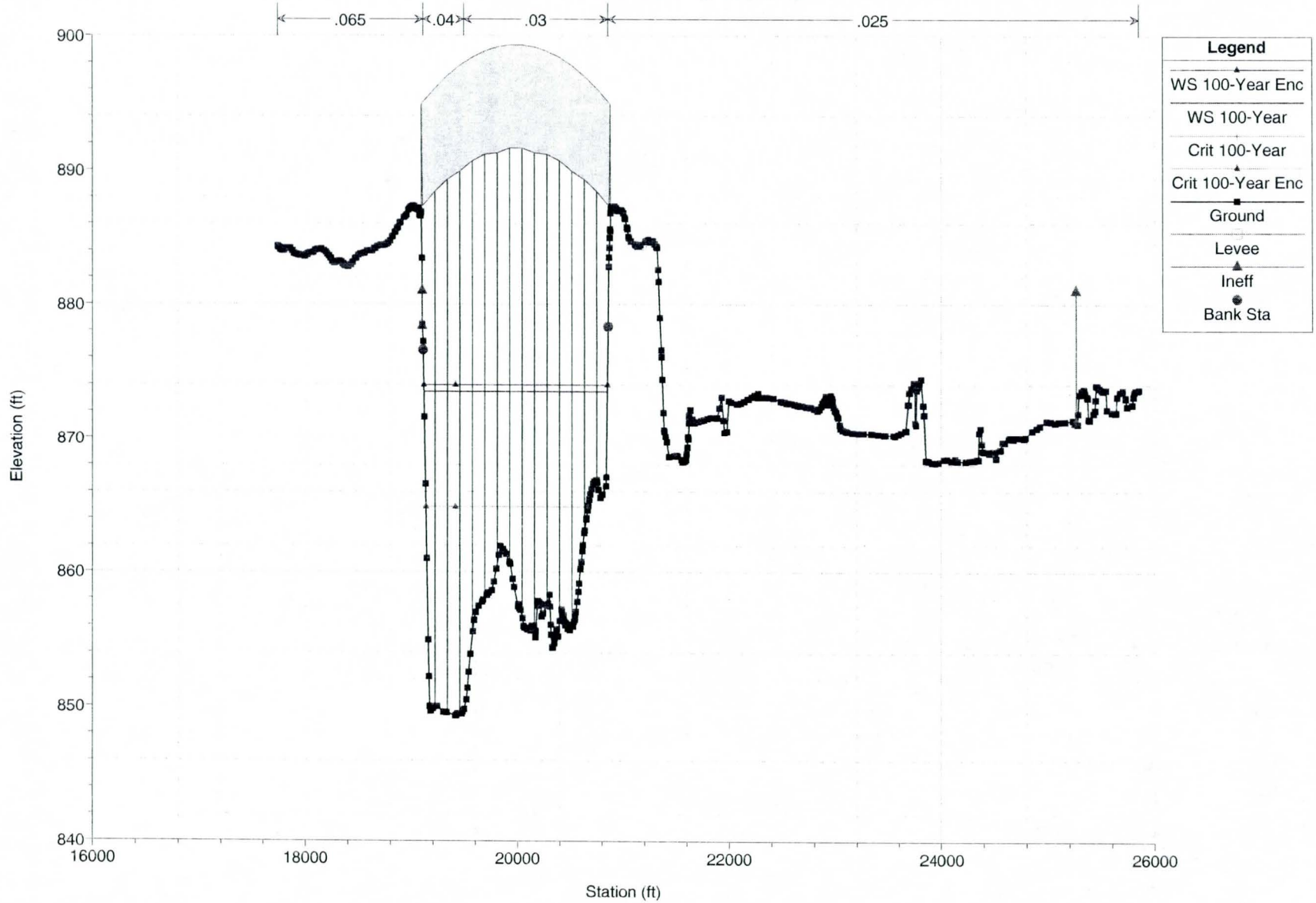
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.07 Left and Right Channel Bank Stations Interpolated



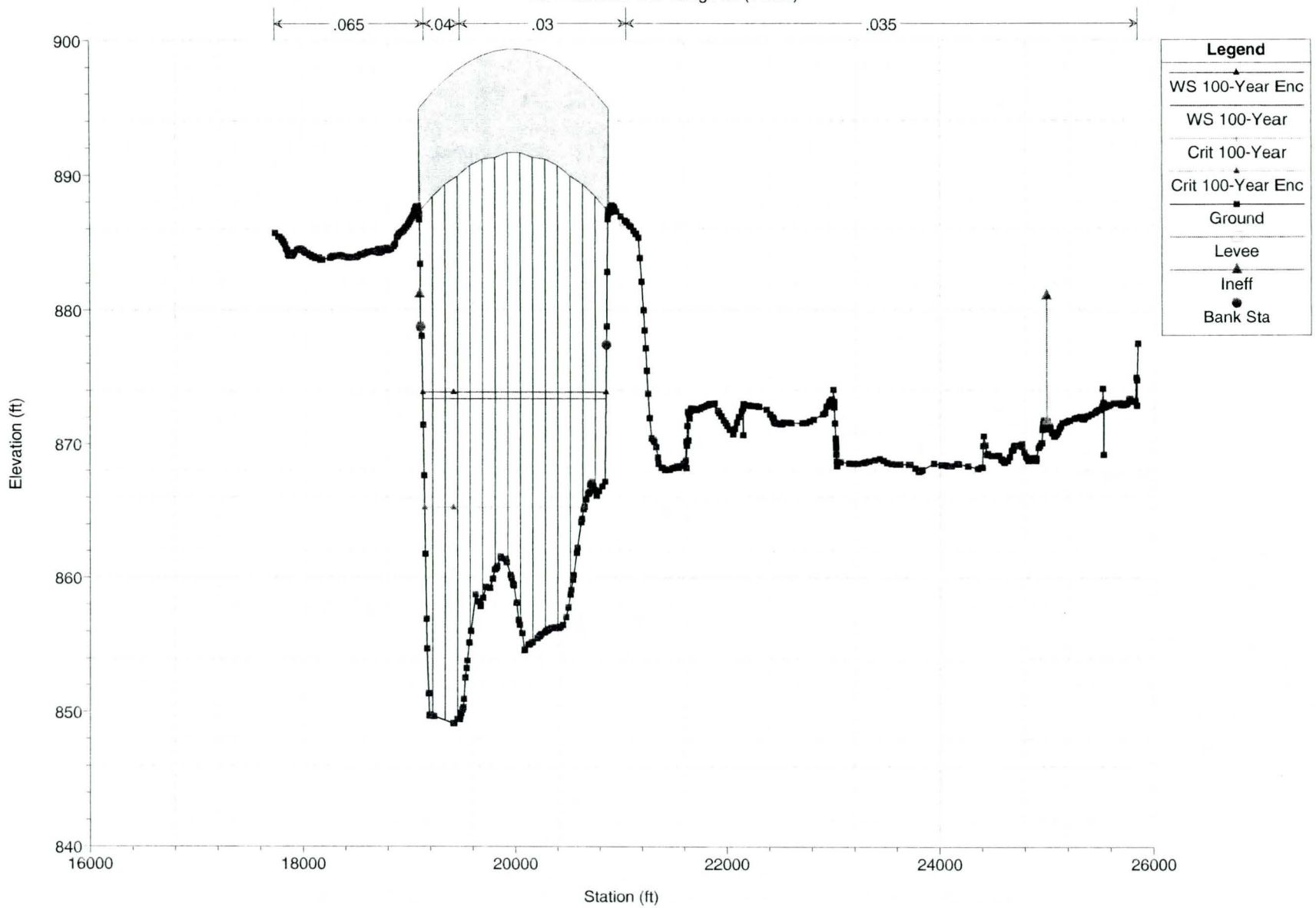
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.055 BR Bridge #2 (Tuthill)



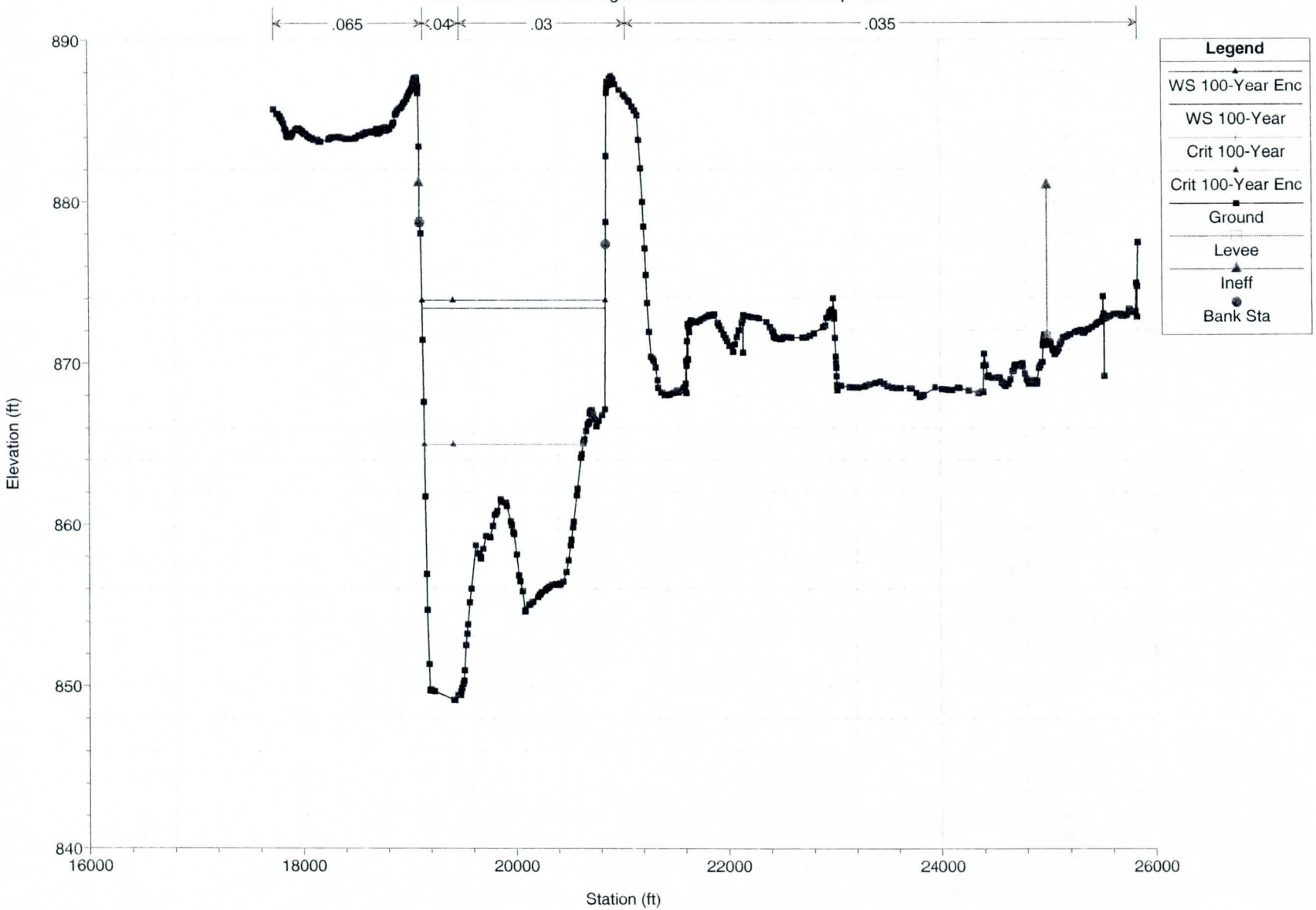
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.055 BR Bridge #2 (Tuthill)



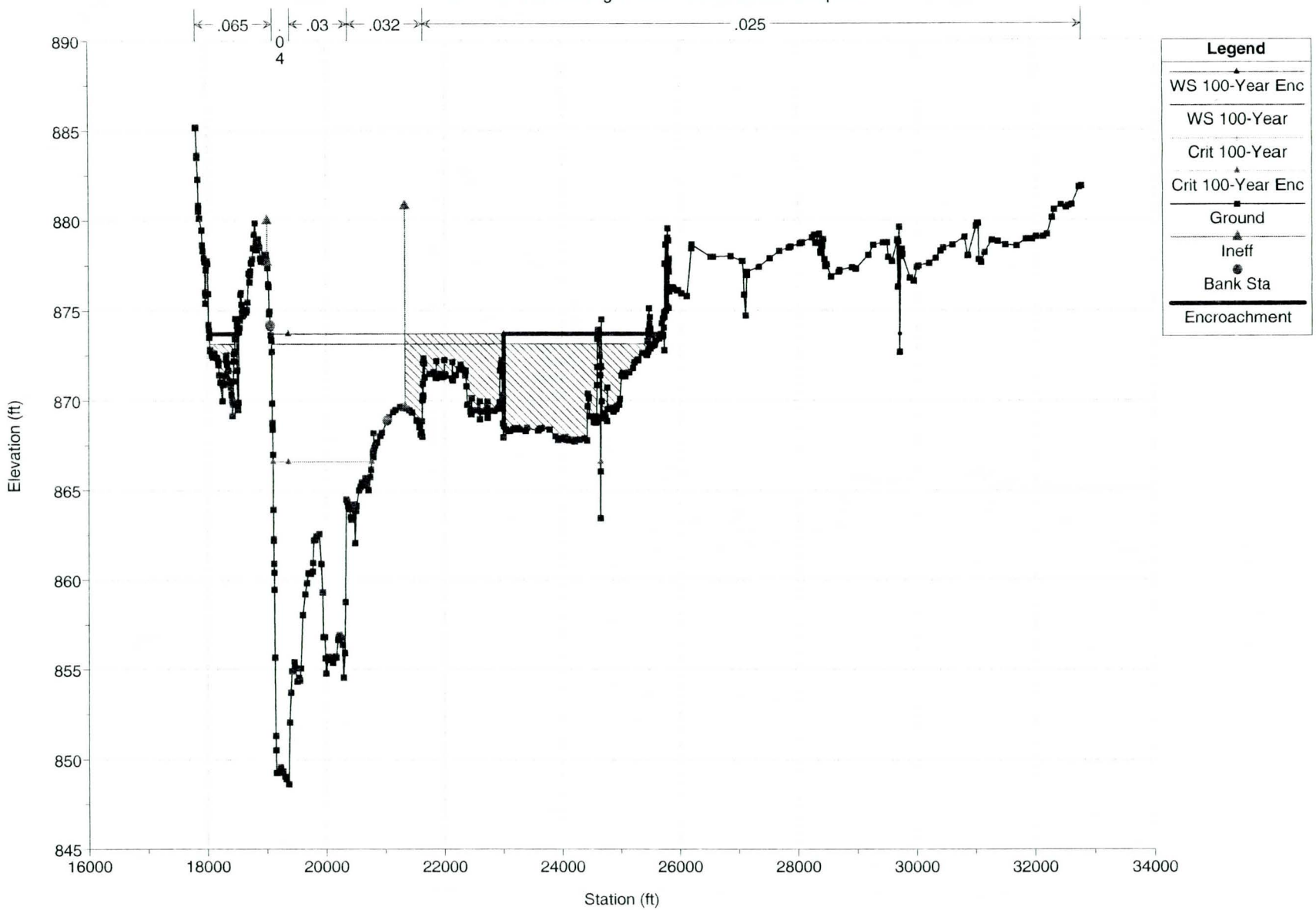
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188.04 Left and Right Channel Bank Stations Interpolated



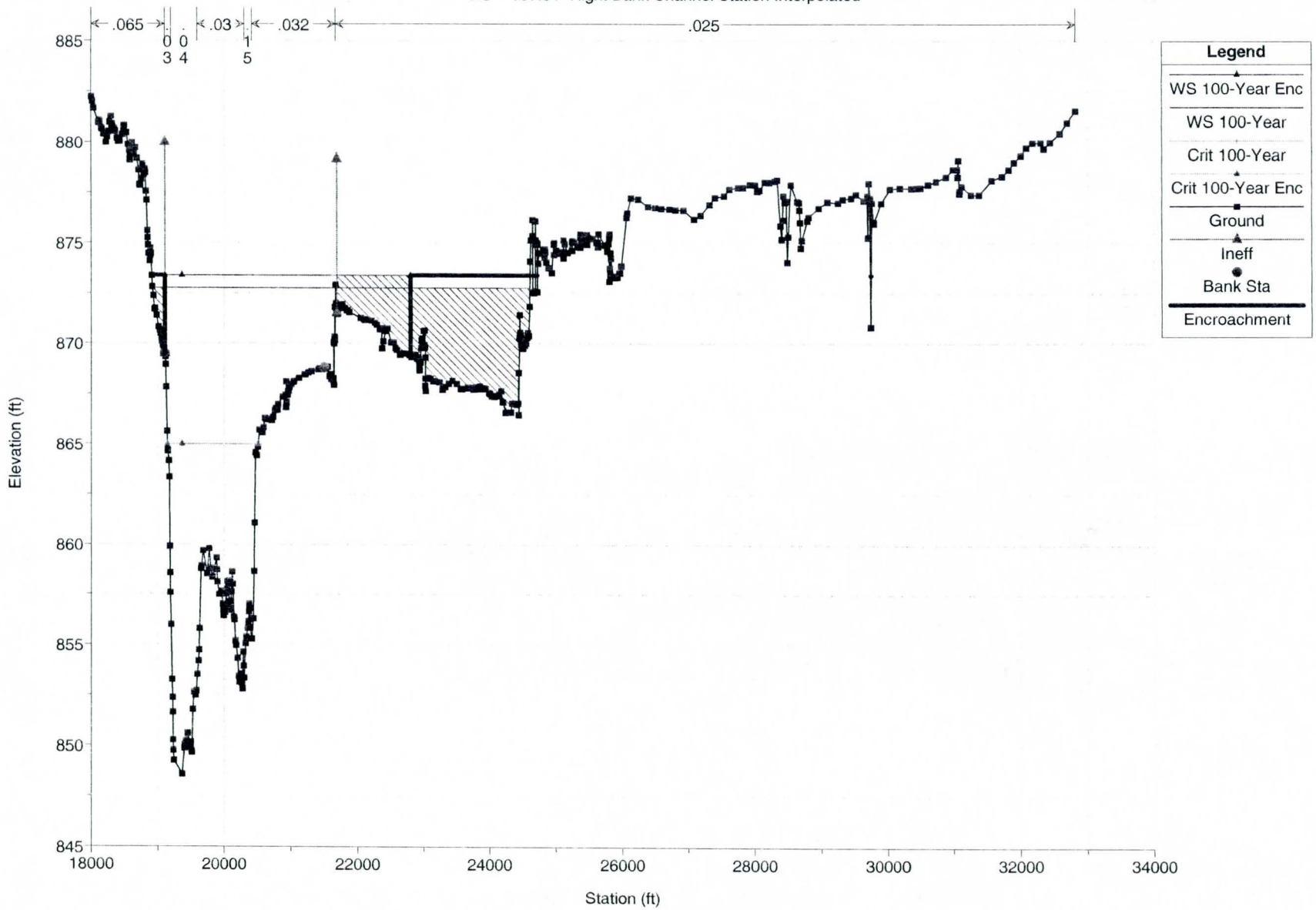
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 188 Left and Right Bank Channel Station Interpolated



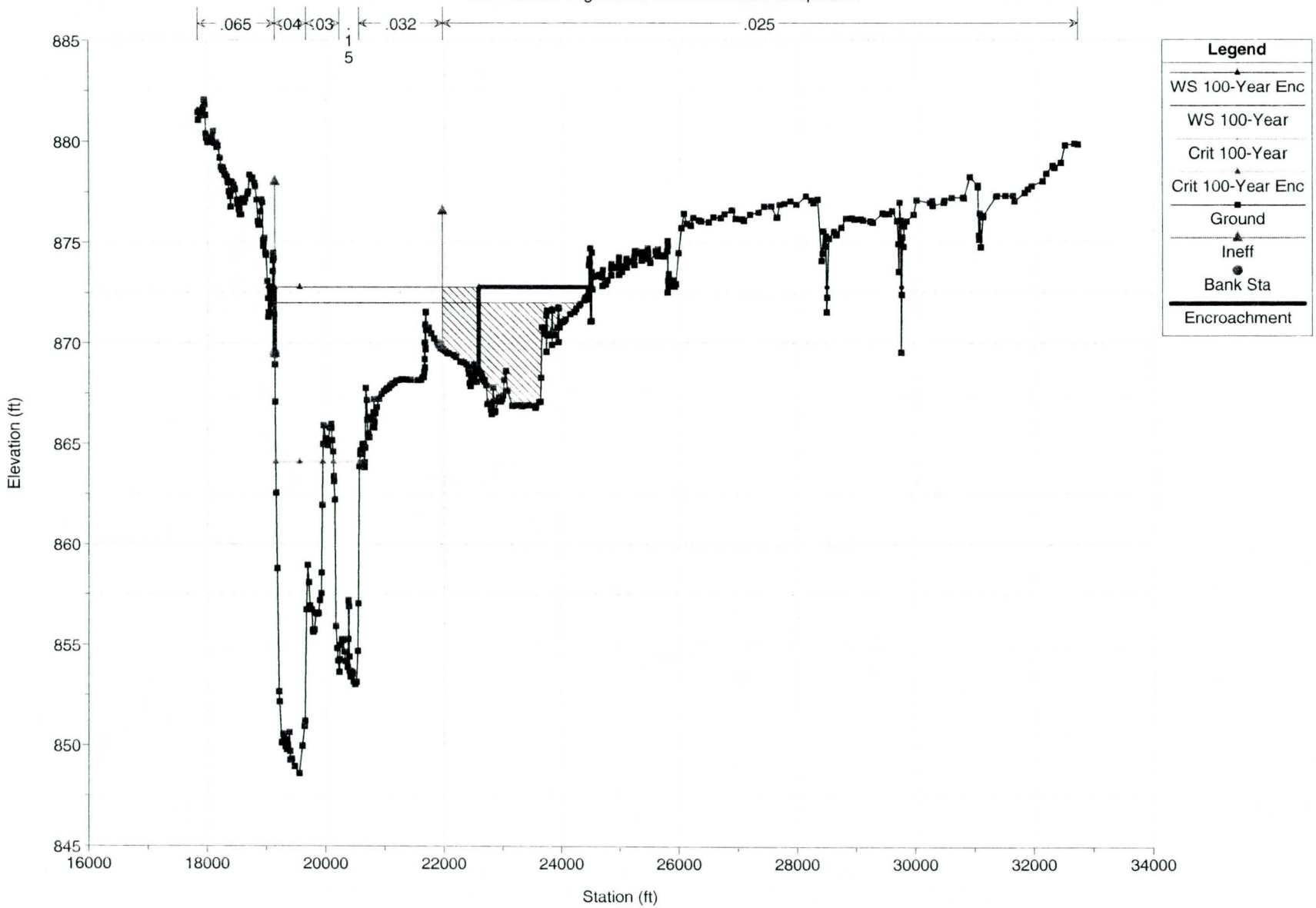
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.91 Right Bank Channel Station Interpolated



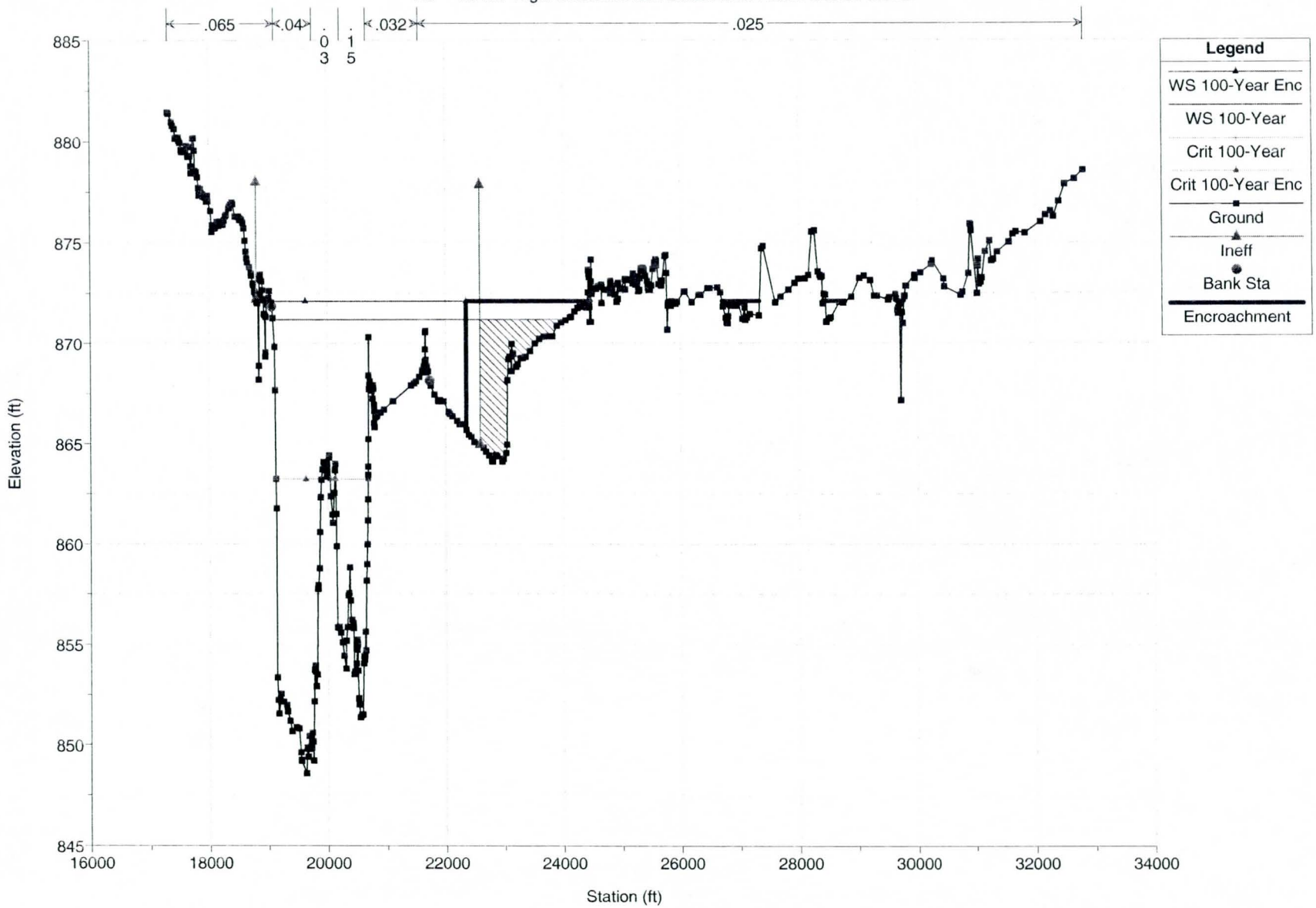
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.82 Right Bank Channel Station Interpolated



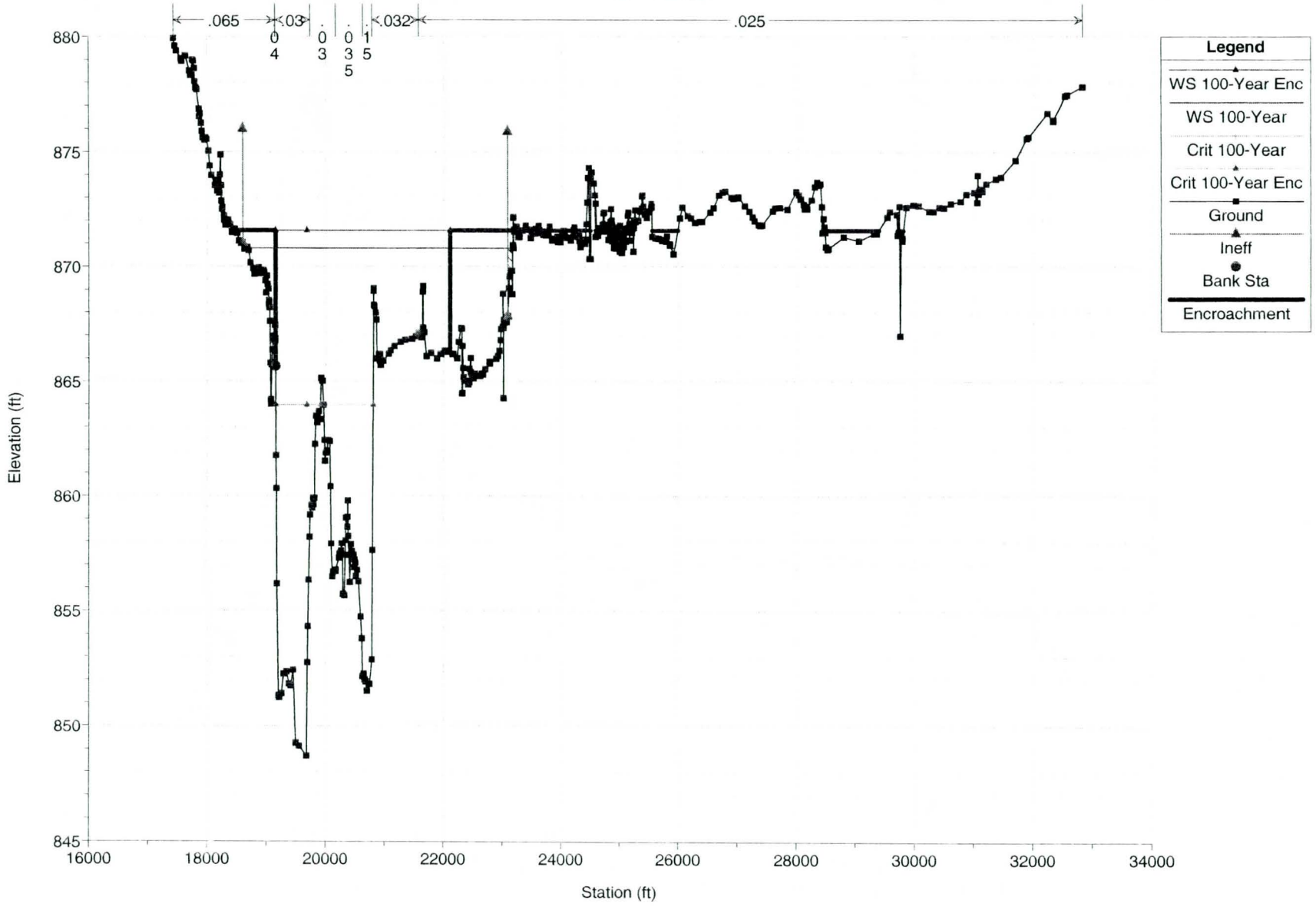
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.73 Right ineffective flow station from FEMA w/levee model



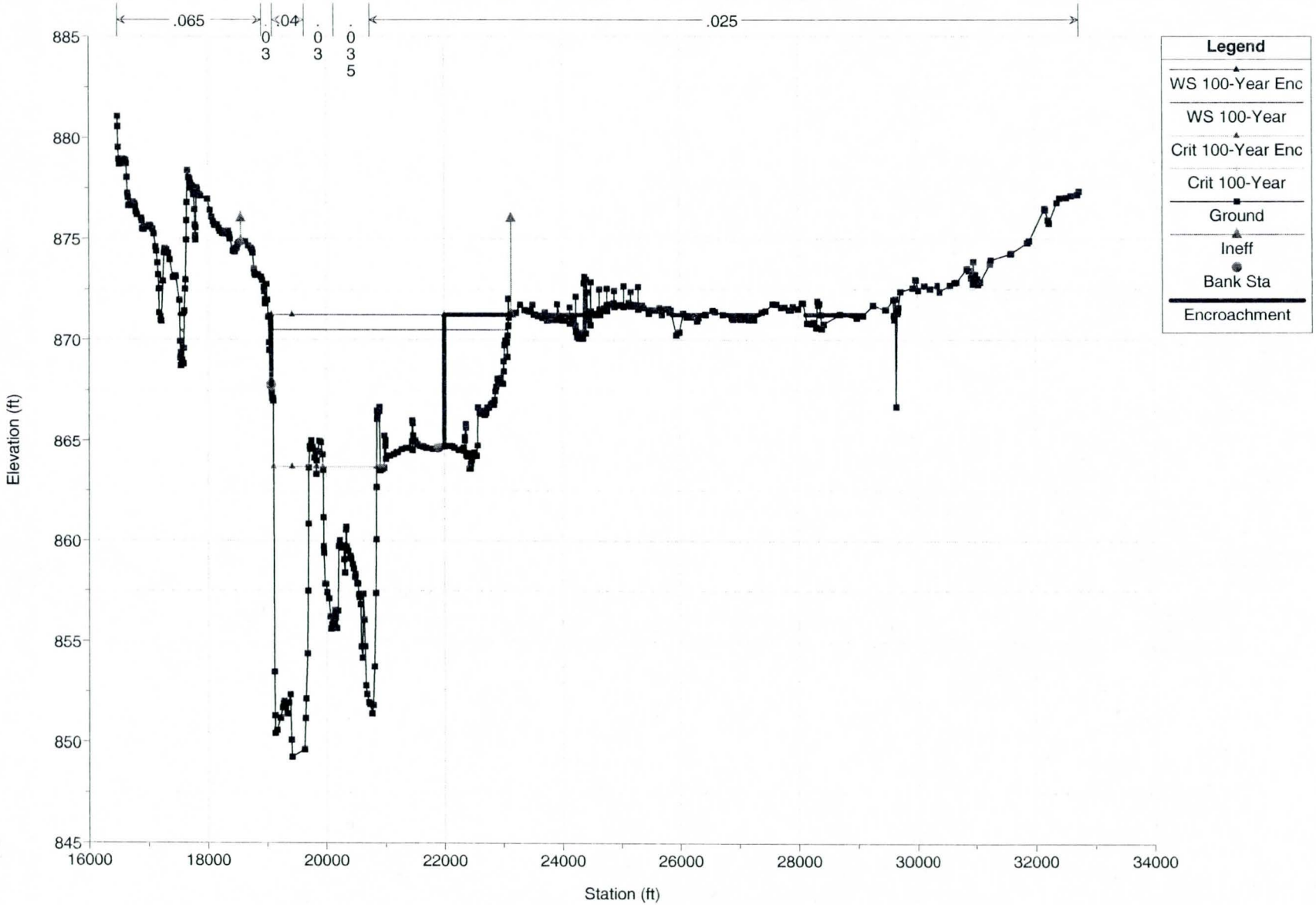
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.64



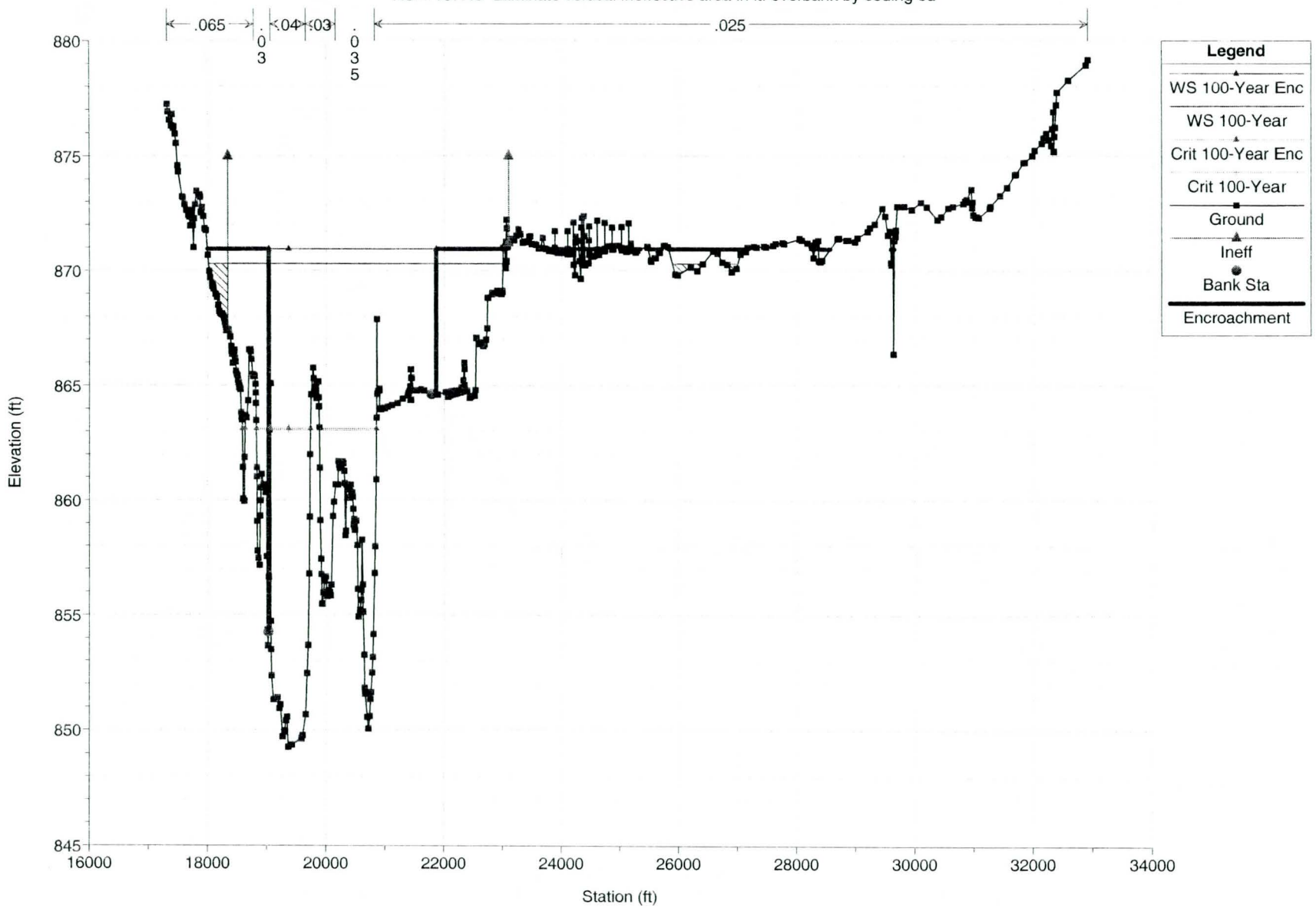
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.54 Left Channel Bank Station Interpolated



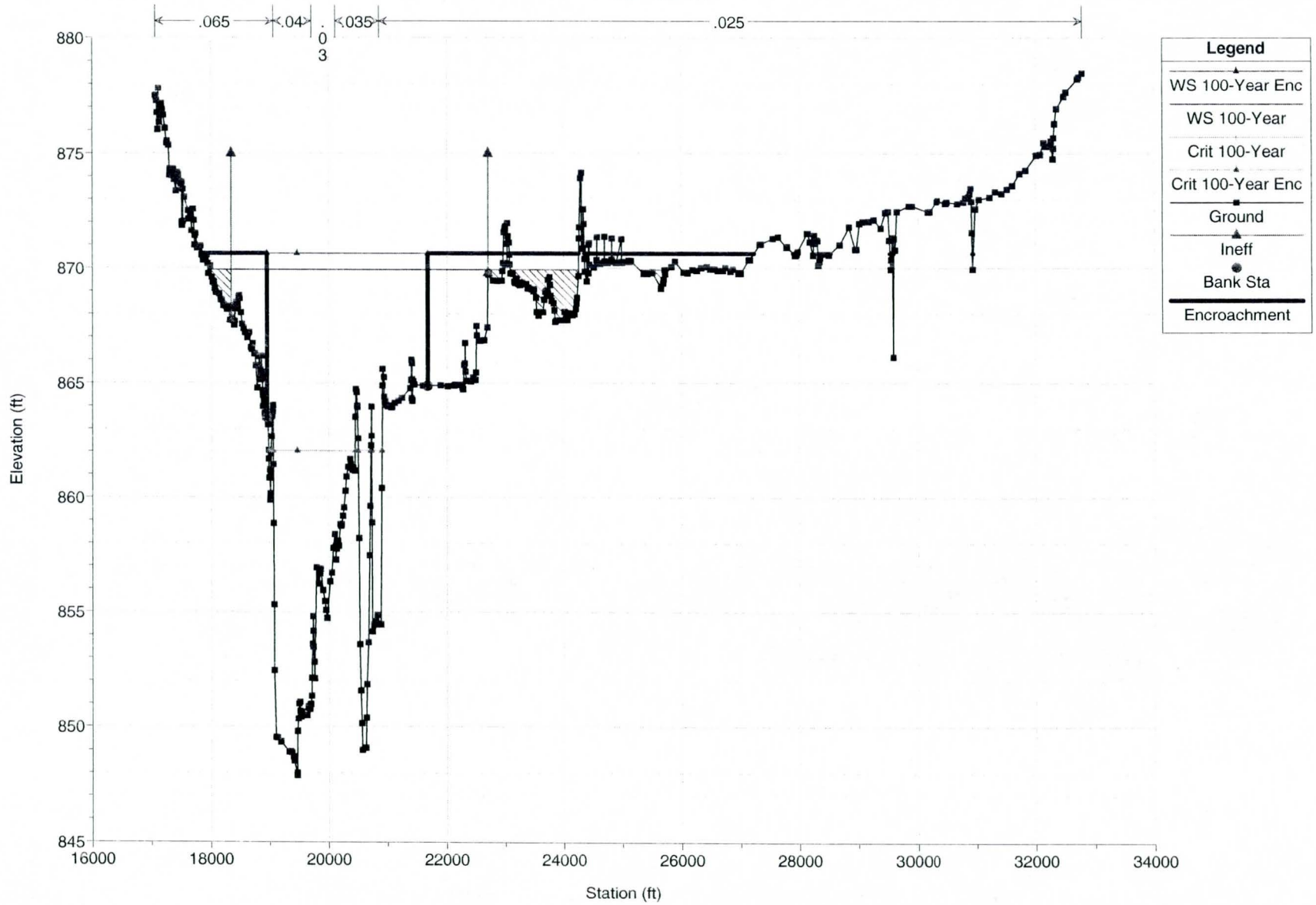
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.45 Eliminate vertical ineffective area in lt. overbank by coding ou



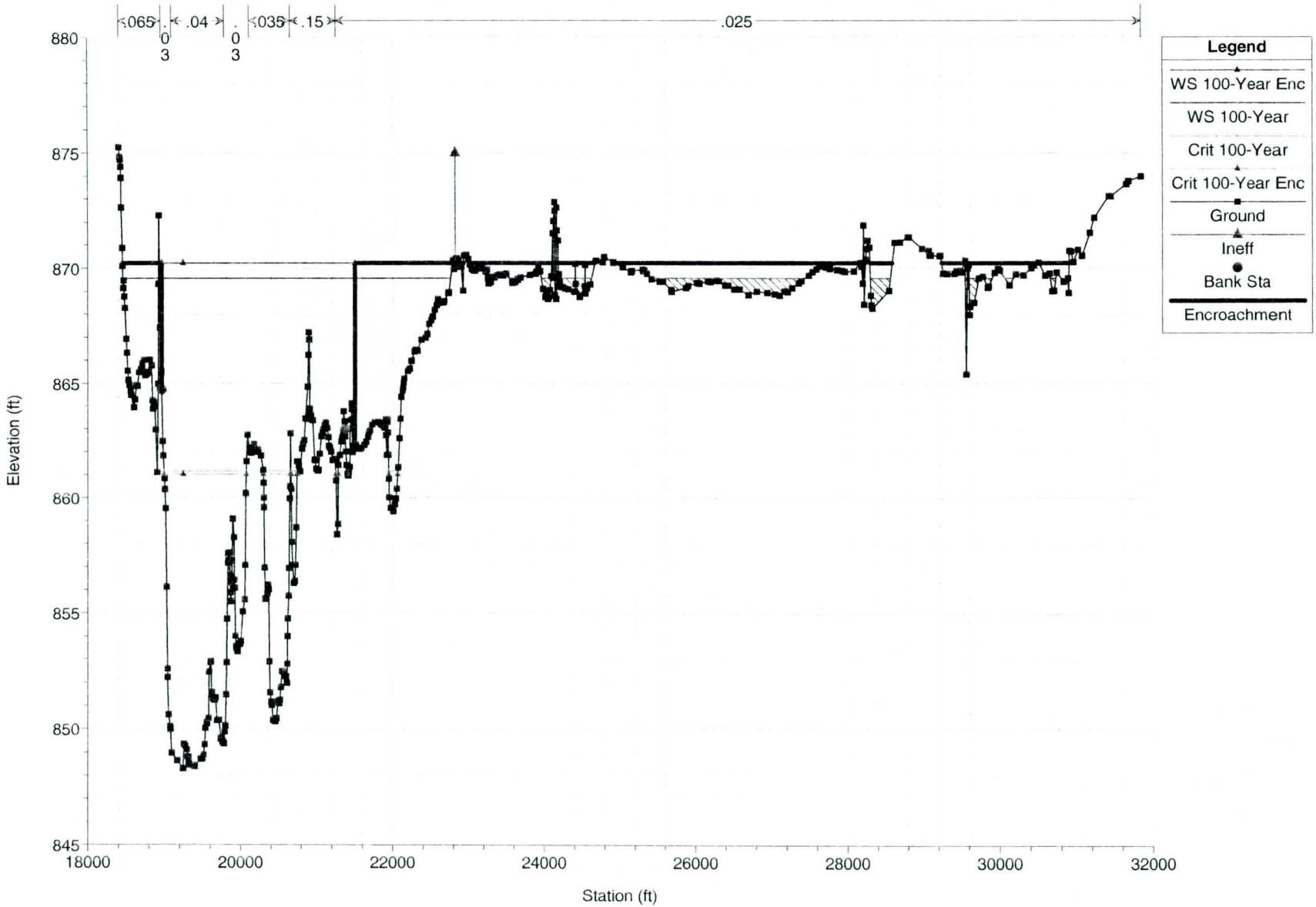
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.36



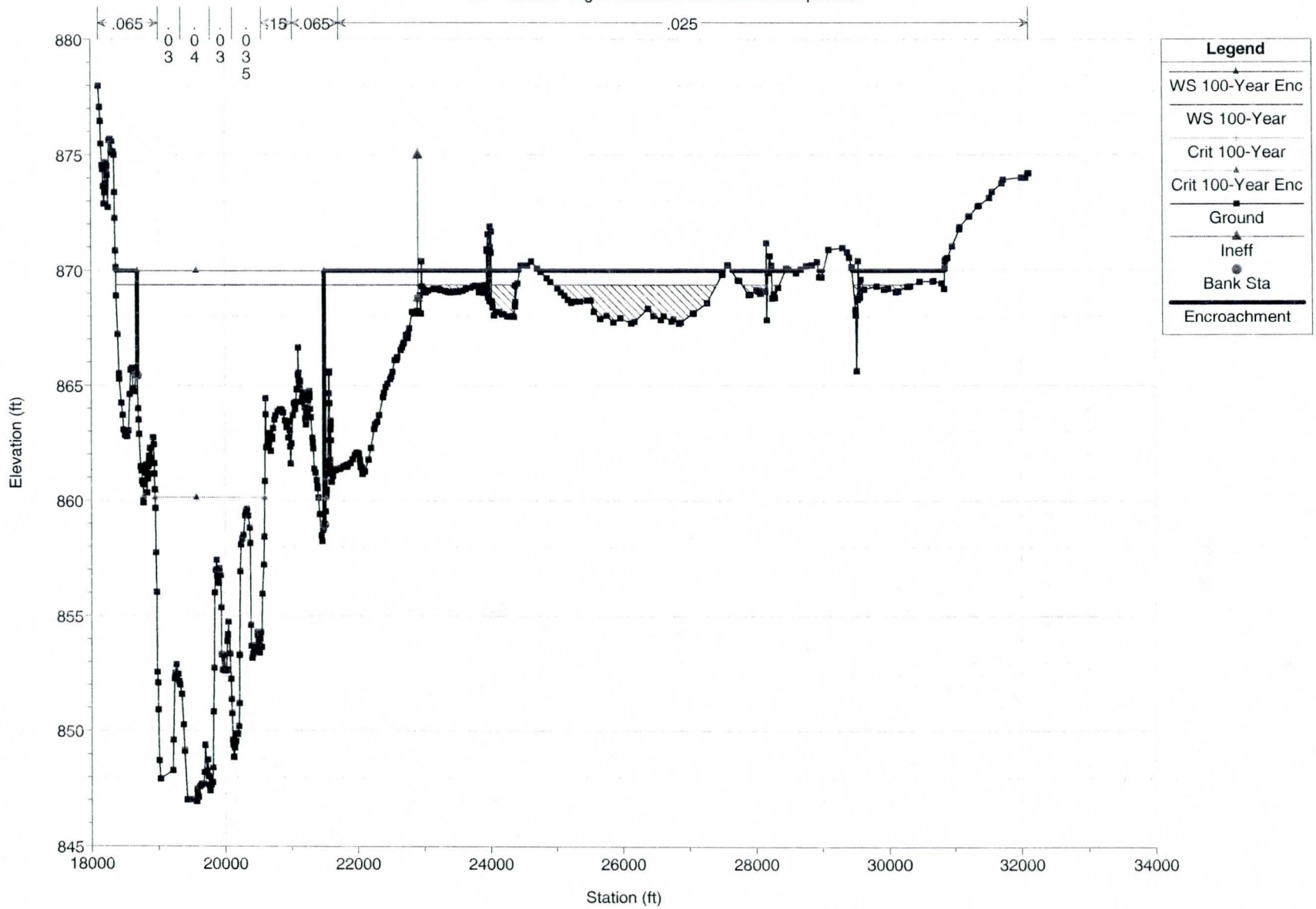
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.24



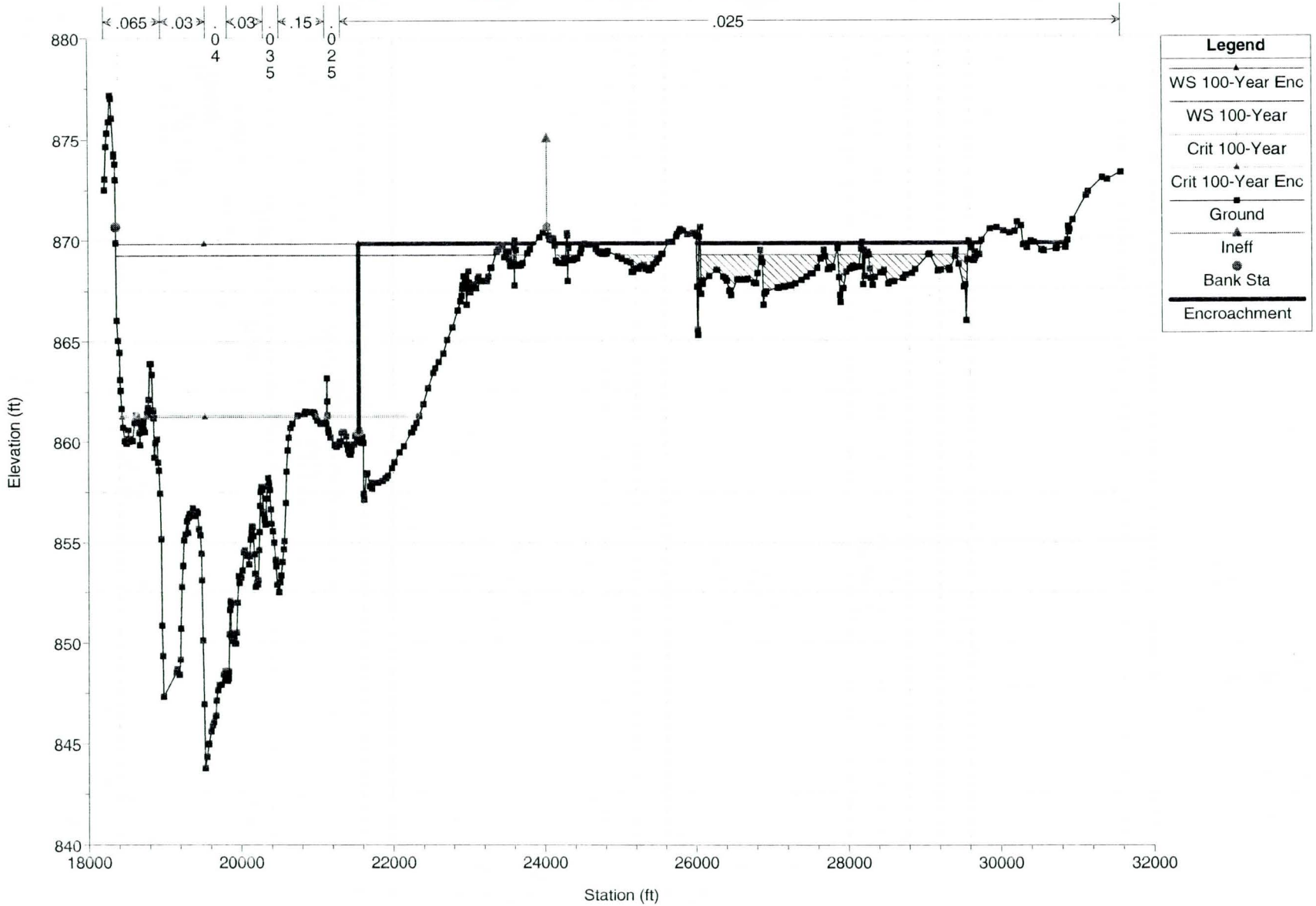
Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.15 Right Channel Bank Station Interpolated



Revised El Rio Base File 2007R Plan: Redelineation with levee 1/29/2008

RS = 187.06 APPROX. ALIGNMENT OF AIRPORT RD. Left and



Comparison of Cross Section Alignments Between Effective and Corrected Effective Models

CD with Project Data

APPENDIX E.5: HYDRAULIC CALCULATIONS

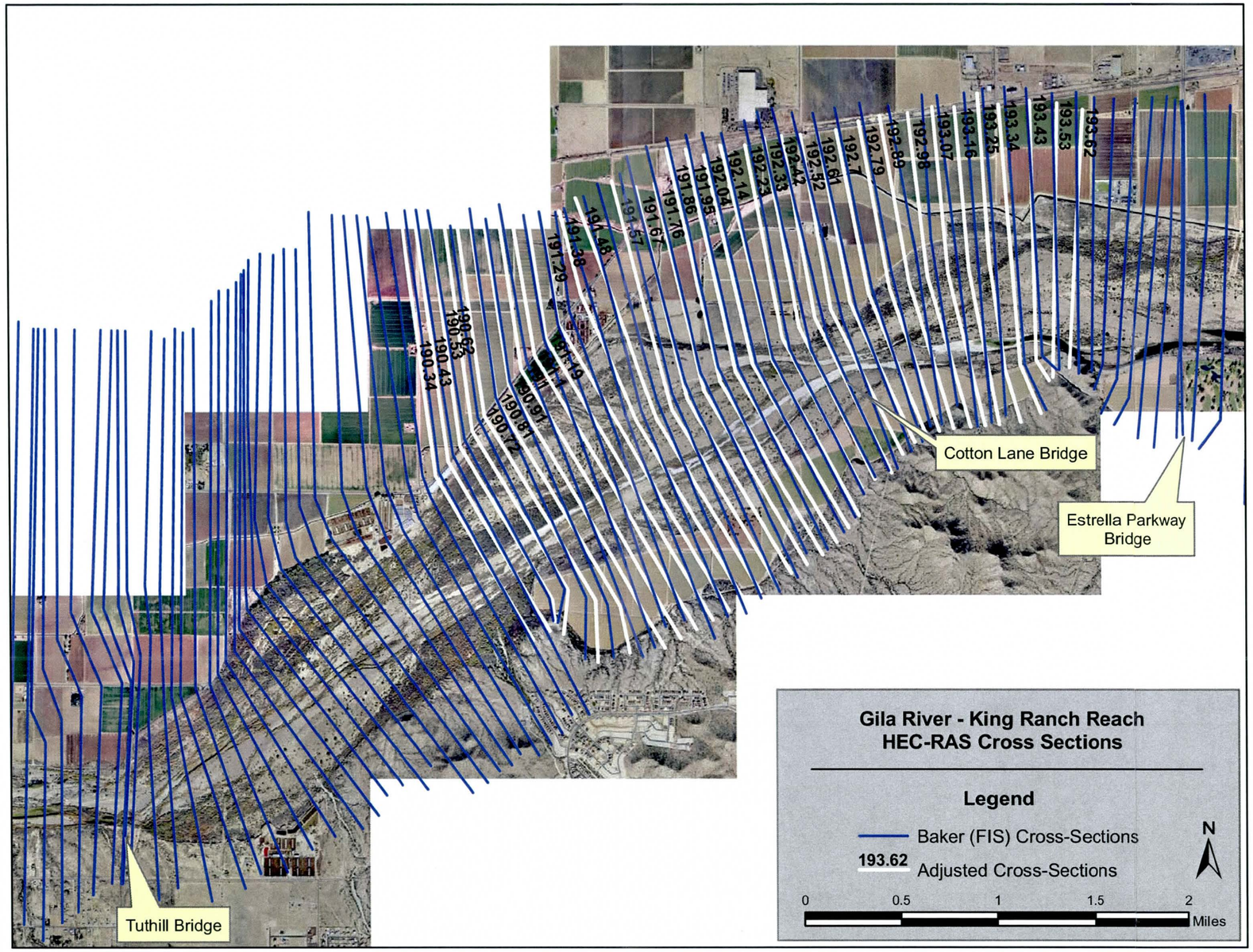


Figure 7. Original and Modified Cross Sections for the Study Reach. Original Cross Sections are shown in Blue and Modified Cross Section are shown inWhite.

The CD contains the following:

- Corrected Effective HEC-RAS model
- Effective HEC-RAS model
- CHECKRAS reports as PDF
- Printouts of the input and output files of the Corrected Effective HEC-RAS model as PDF
- Copy of the *Norte Vista / King Ranch Floodplain Redelineation, Gila River*, Dated June 2007 by River Research & Design, Inc.
- FCDMC HIS Submittal

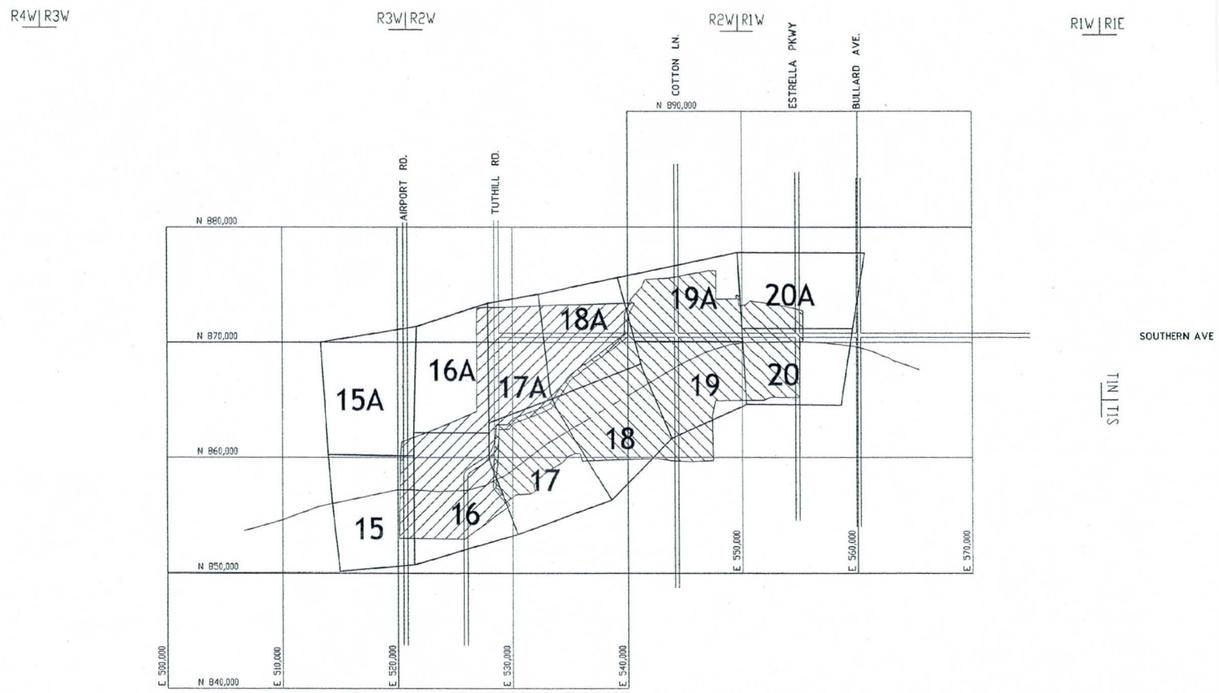
There is no applicable information for this subsection.

APPENDIX F: EROSION AND SEDIMENT TRANSPORT ANALYSIS SUPPORTING DOCUMENTATION

EXHIBIT MAPS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017
PCN NO. 014.34.01



The following certification descriptions apply to all sealed sheets for this study.

Registered Professional Engineer (Civil) CERTIFICATE NO. 33969 STEPHANIE R. GERLACH Date Signed 03/13/08 ARIZONA U.S.A.

Stephanie Gerlach

expires 09/30/2008

This is to certify that all work accomplished in the conduct of this FIS was done in accordance with the Statement of Work and general Provisions of Contract 2007C017. The hydraulics and floodplain/floodway delineation have been accomplished, based on the aerial mapping shown on these workmaps, in accordance with sound and accepted engineering practice under my supervision within the contract provisions for respective phases of work. Stantec Consulting, Inc.

Legend	Origin of Topographic Data	Starting RM Station	Ending RM Station	Remark	Mapping Consultant	Surveying Consultant	Flight Date	Vertical Datum	Horizontal Datum	Contour Interval
	Flood Delineation Study of Salt–Gila Rivers supplied by FCDMC	178.61 194.29	186.97 199.07		Michael Baker Jr., Inc. / McLain Harbers Co., Inc.	Joykim Engineers & Greiner Engineers	April 1993	NGVD29	NAD83 State Plane Coordinate System (AZ Central Zone, International Feet)	4'
	New Topography Supplied by FCDMC	187.05 188.69	188.59 191.38	Used for right overbank.	Vertical Mapping Resources, Inc.	RBF Consulting Inc.	March 13, 2006	NGVD88	NAD83 State Plane Coordinate System (AZ Central Zone, International Feet)	2'
	Cotton Lane Bridge / King Ranch Floodplain Redelineation supplied by River Research & Design, Inc.	188.69	191.38		Kenney Aerial Mapping, Inc.	Coe & Van Loo Consultants, Inc.	2003 2004 2005	NGVD29	Cotton Lane Project Coordinate System	Varies 1' to 2'

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988.
CONVERSION FACTOR 1988 NAVD = +2.1ft TO 1929 NGVD
CORRECTED EFFECTIVE WORK MAPS SHEET LAYOUT AND PAGE NUMBERING MATCH THE EFFECTIVE WORK MAPS SO THAT SHEETS FROM EFFECTIVE STUDY COULD BE REPLACED WITH THIS STUDY

NOT TO SCALE

STANTEC CONSULTING, INC.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

COVER SHEET

MATCH LINE SHEET 16

MATCH LINE SHEET 15A

MATCH LINE SHEET 14

LEGEND

100-YR CORRECTED EFFECITVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
100-YR EFFECTIVE FLOODPLAIN BOUNDARY	
EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	(A) 0.10 — FP= 1888.74, FW= 1889.54, Q = CFS
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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

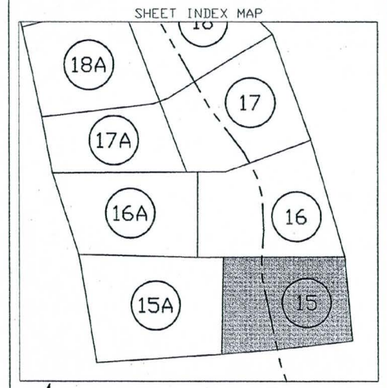
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. Number	ELEVATION (FT)	DESCRIPTION/LOCATION
31	859.05	A BC in a HH in the intersection of Beloat Rd. and Dean Rd. This point is the NE corner of Sec. 11, T1S, R3W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



N

400 0' 400 800

SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 03/30/08 ARIZONA, U.S.A.

Stephanie R. Gerlach

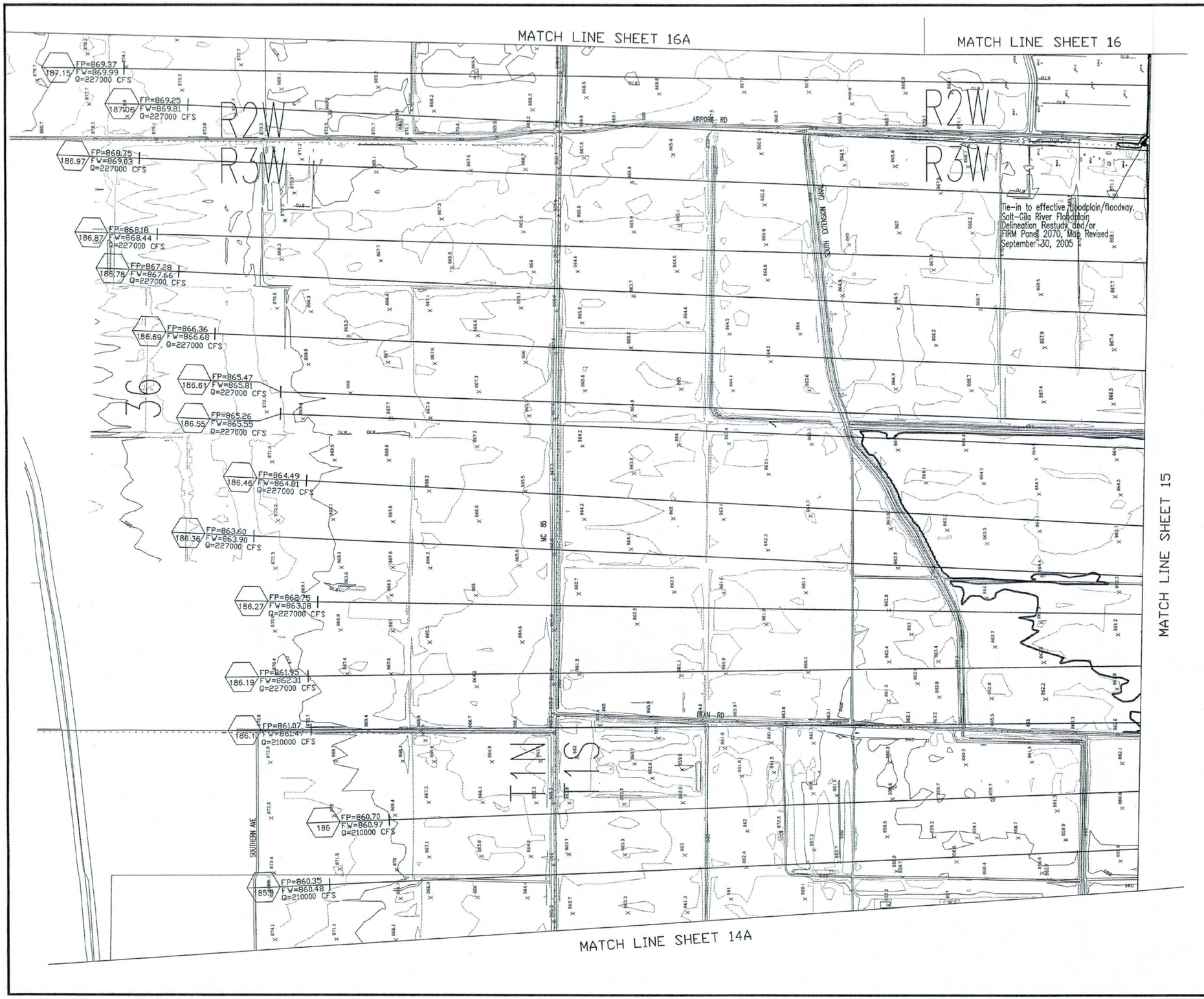
expires 09/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	3/2008
DESIGN CHK.	PJE	3/2008
PLANS	AML	3/2008
PLANS CHK.	PJE	3/2008

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECITVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
100-YR EFFECTIVE FLOODPLAIN BOUNDARY	
EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 — FW= 1889.54 — Q = CFS
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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

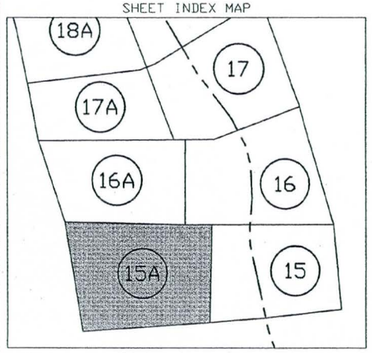
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
30	856.82	A BC in a HH in the intersection of Beloat Rd. and Rainbow Rd. This point is the NE corner of Sec. 10, T1S, R3W of the G&SRB&M, Maricopa County, Arizona. (Located on Sheet 14A)
31	859.05	A BC in a HH in the intersection of Beloat Rd. and Dean Rd. This point is the NE corner of Sec. 11, T1S, R3W of the G&SRB&M, Maricopa County, Arizona. (Located on Sheet 15)

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Arizona U.S.A.

Stephanie R. Gerlach
EXPIRES 09/30/2008

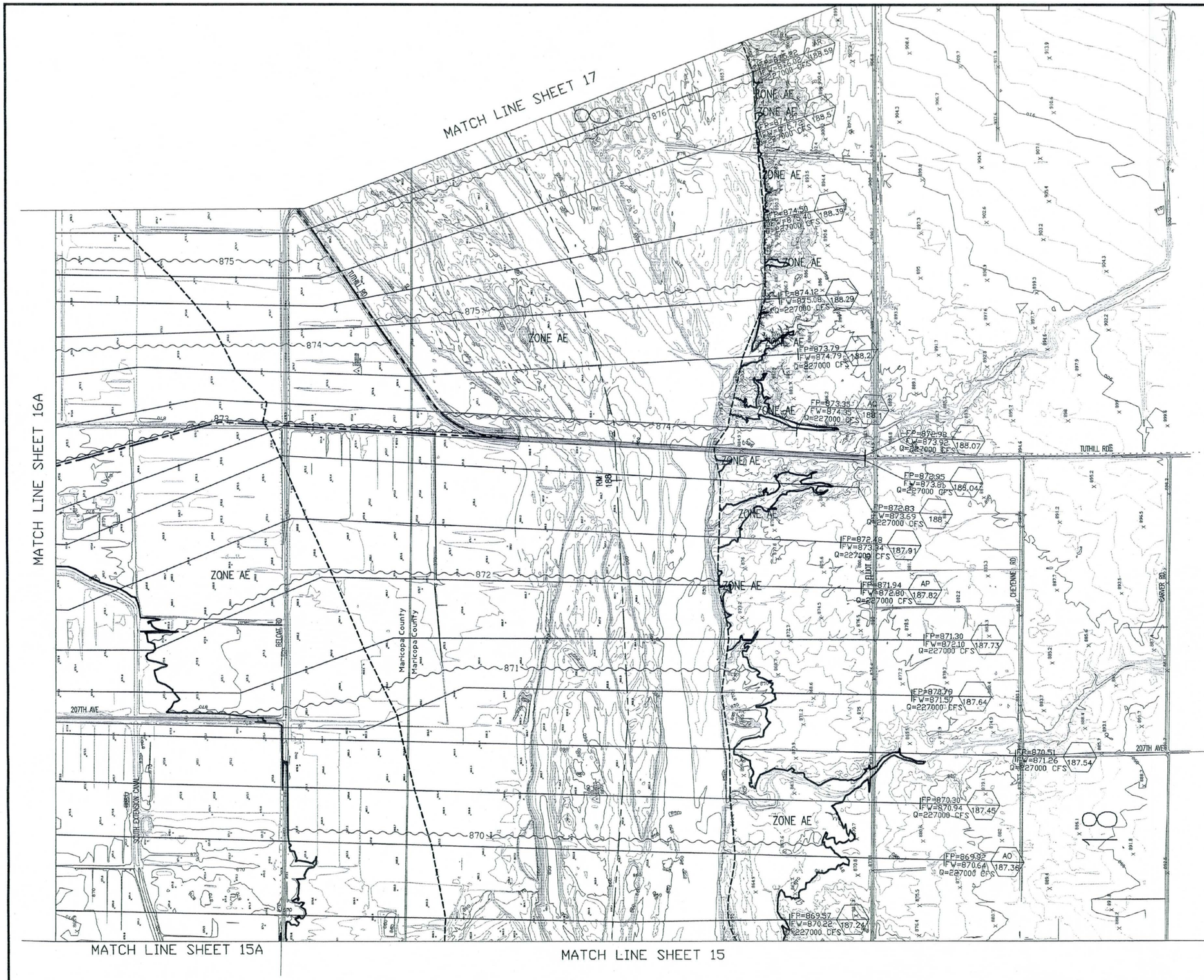
STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 15A OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION) — FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION) — Q = CFS (100 YEAR DISCHARGE) — FEMA CROSS SECTION DESIGNATION — CROSS SECTION DISTANCE FROM BASE LINE 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
ZONE GUTTER	
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

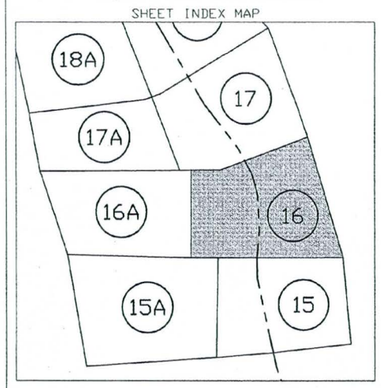
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
34	868.82	A BC in a HH in the intersection of Beloat Rd. and Tuthill Rd. This point is the S corner of Sec. 6, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.
35	885.99	A BC in a HH in the intersection of Tuthill Rd. and Elliot Rd. This point is the NE corner of Sec. 18, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



N

400 0' 400 800

SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) Certificate No. 33999 STEPHANIE R. GERLACH Date Signed 3/31/08 ARIZONA, U.S.A.

Stephanie R. Gerlach

expires 03/31/2008

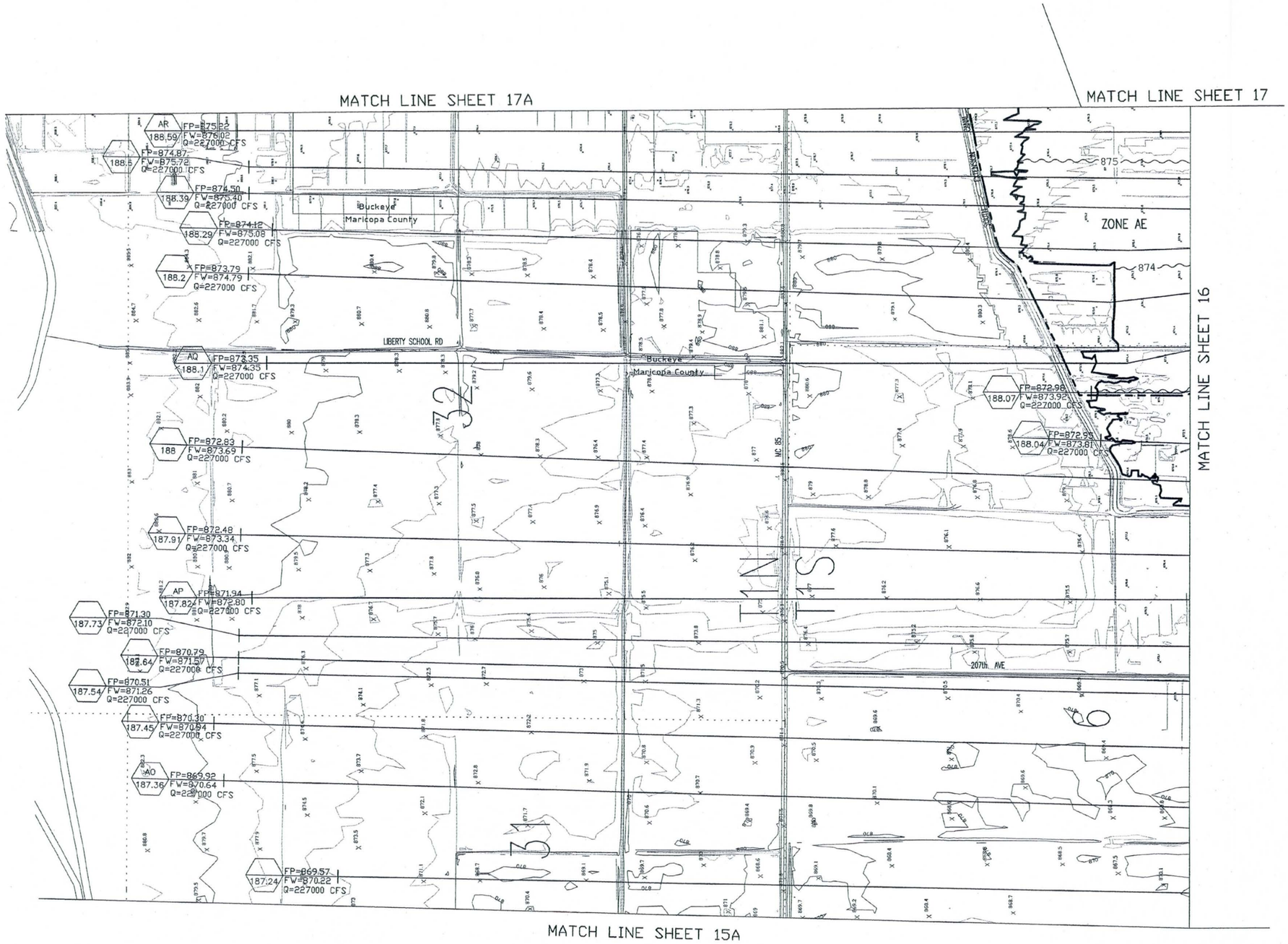
STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	3/2008
DESIGN CHK.	PJE	3/2008
PLANS	AML	3/2008
PLANS CHK.	PJE	3/2008

SHEET 16 OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q = CFS (100 YEAR DISCHARGE); FEMA CROSS SECTION DESIGNATION; CROSS SECTION RIVER MILE 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
ZONE GUTTER	
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

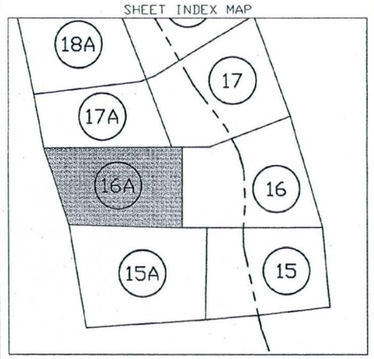
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
34	868.82	A BC in a HH in the intersection of Beloat Rd. and Tuthill Rd. This point is the S corner of Sec. 6, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.
35	885.99	A BC in a HH in the intersection of Tuthill Rd. and Elliot Rd. This point is the NE corner of Sec. 18, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.
36	917.07	A BC in a HH in the intersection of Elliot Rd. and Rainbow Bailey Rd. This point is the NE corner of Sec. 17, T1S, R2W of the G&SRB&M, Maricopa County, Arizona. (Located on Sheet 17)

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



N

400 0' 400 800

SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
1			
2			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 3/31/08 ARIZONA U.S.A.

Stephanie R. Gerlach

expires 03/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 16A OF 46

LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	FEMA CROSS SECTION DESIGNATION; CROSS SECTION INDEX NO.; DESIGNATION; A 0.10; FP= 1888.74 FLOODWAY W.S. SURFACE ELEVATION; FW= 1889.54 ENCROACHED WATER SURFACE ELEVATION; Q = CFS 100 YEAR DISCHARGE
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
ZONE GUTTER	
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

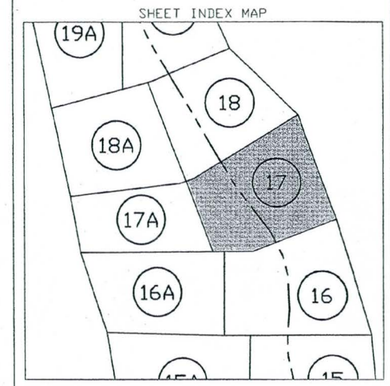
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
36	917.07	A BC in a HH in the intersection of Elliot Rd. and Rainbow Valley Rd. This point is the NE corner of Sec. 17, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
1			
2			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

STANTEC CONSULTING, Inc.

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 3/31/08

Stephanie R. Gerlach

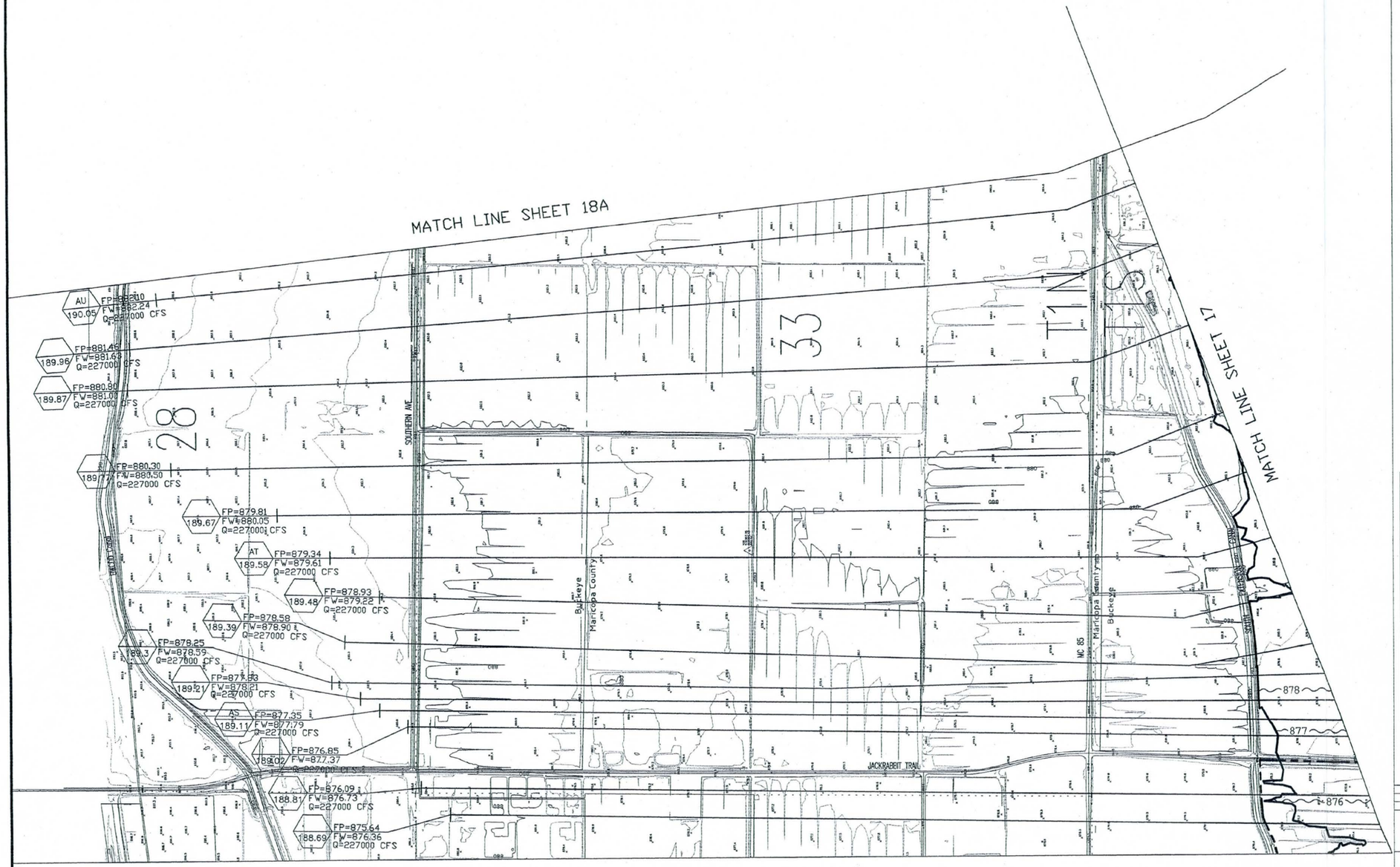
expires 09/30/2008

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 17 OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION); Q = CFS (100 YEAR DISCHARGE); (TRIM CROSS SECTION DESIGNATION; CROSS SECTION SPACE MILE, INTRODUCTION)
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
ZONE GUTTER	
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

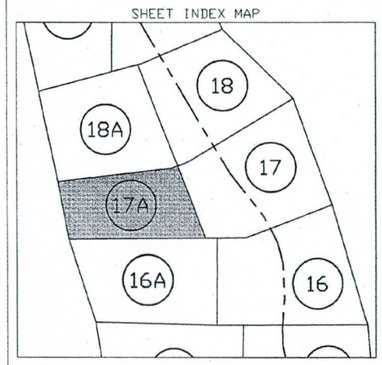
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
36	917.07	A BC in a HH in the intersection of Elliot Rd. and Rainbow Valley Rd. This point is the NE corner of Sec. 17, T1S, R2W of the G&SRB&M, Maricopa County, Arizona. (Located on Sheet 17)
37	887.63	An ADOT BC in the center of an irrigation structure headwall, approximately 36 feet southerly of the centerline of SR 85, and 25 feet easterly of the centerline of Perryville Rd. This point is located in the proximity of the SE corner of Sec. 33, T1N, R2W of the G&SRB&M, Maricopa County, Arizona. (LOCATED ON SHEET 18A)

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800

SCALE: 1"= 400 FEET

CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 3/14/08 ARIZONA, U.S.A.

Stephanie R. Gerlach

expires 09/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 17A OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION

LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	(A) 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION); Q = CFS (100 YEAR DISCHARGE); FDAL CROSS SECTION IDENTIFICATION; CROSS SECTION: RIVER MILE 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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

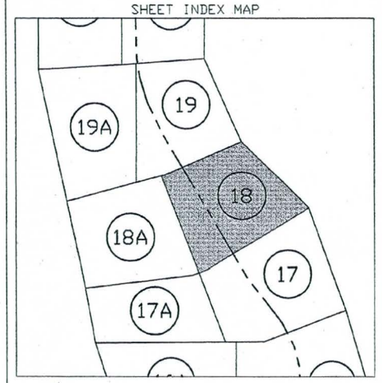
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
38	945.73	A BC on 2" pipe. This point is the SE corner of Sec. 3, T1S, R2W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 2/26/08 Arizona U.S.A.

Stephanie R. Gerlach

expires 09/30/2008

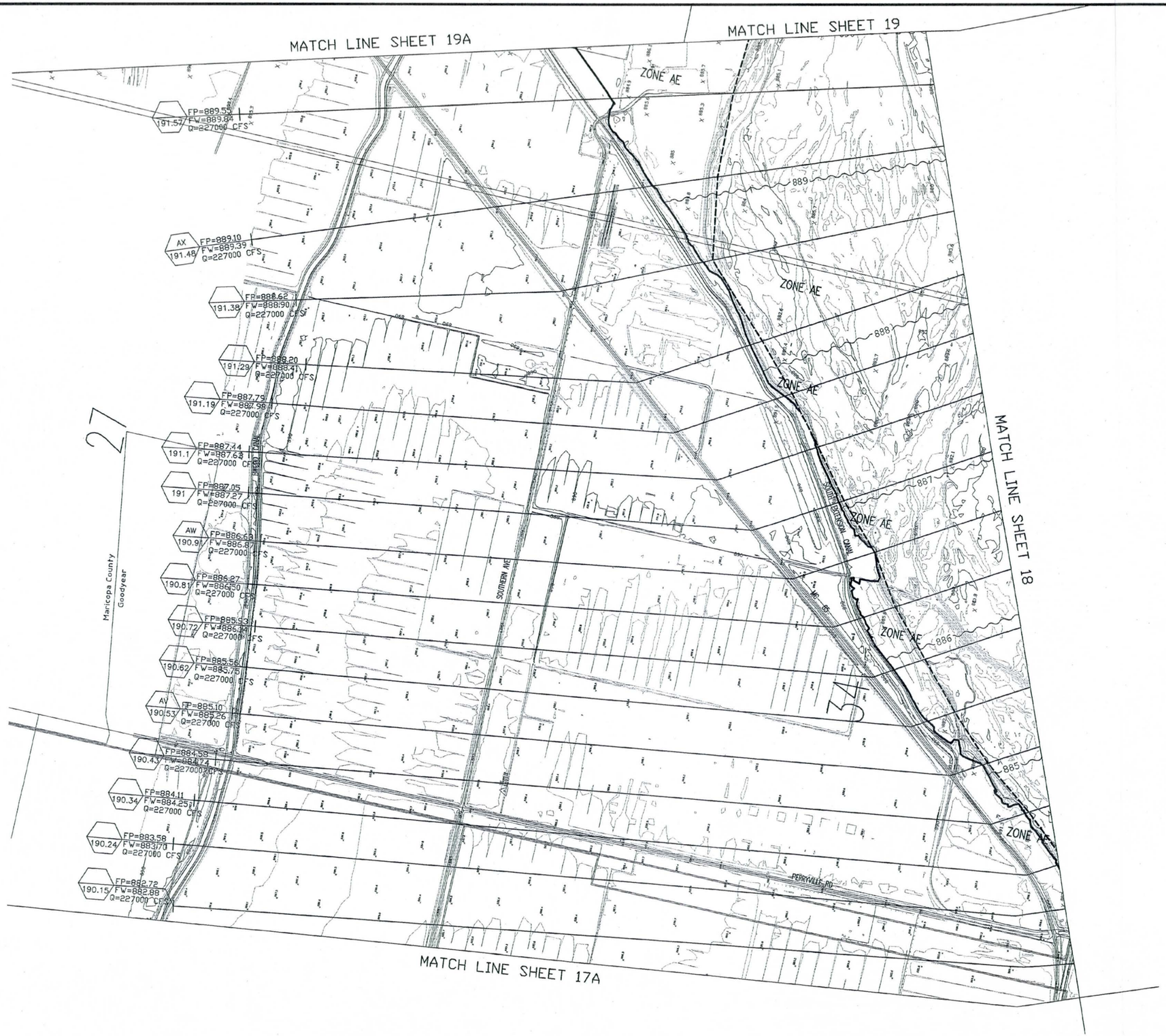
STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 18 OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION) — FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION) — Q = CFS (100 YEAR DISCHARGE) — FINAL CROSS SECTION DESIGNATION — CROSS SECTION RIVER MILE, REACH/ZONE
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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

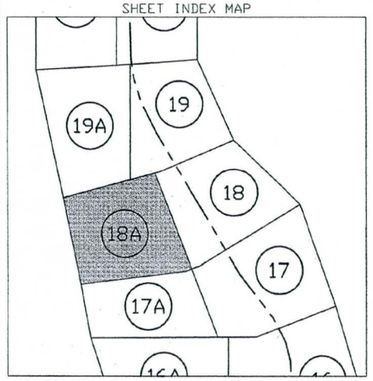
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
37	887.63	An ADOT BC in the center of an irrigation structure headwall, approximately 36 feet southerly of the centerline of SR 85, and 25 feet easterly of the centerline of Perryville Rd. This point is located in the proximity of the SE corner of Sec. 33, T1N, R2W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20.000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH, R.E. ARIZONA U.S.A.

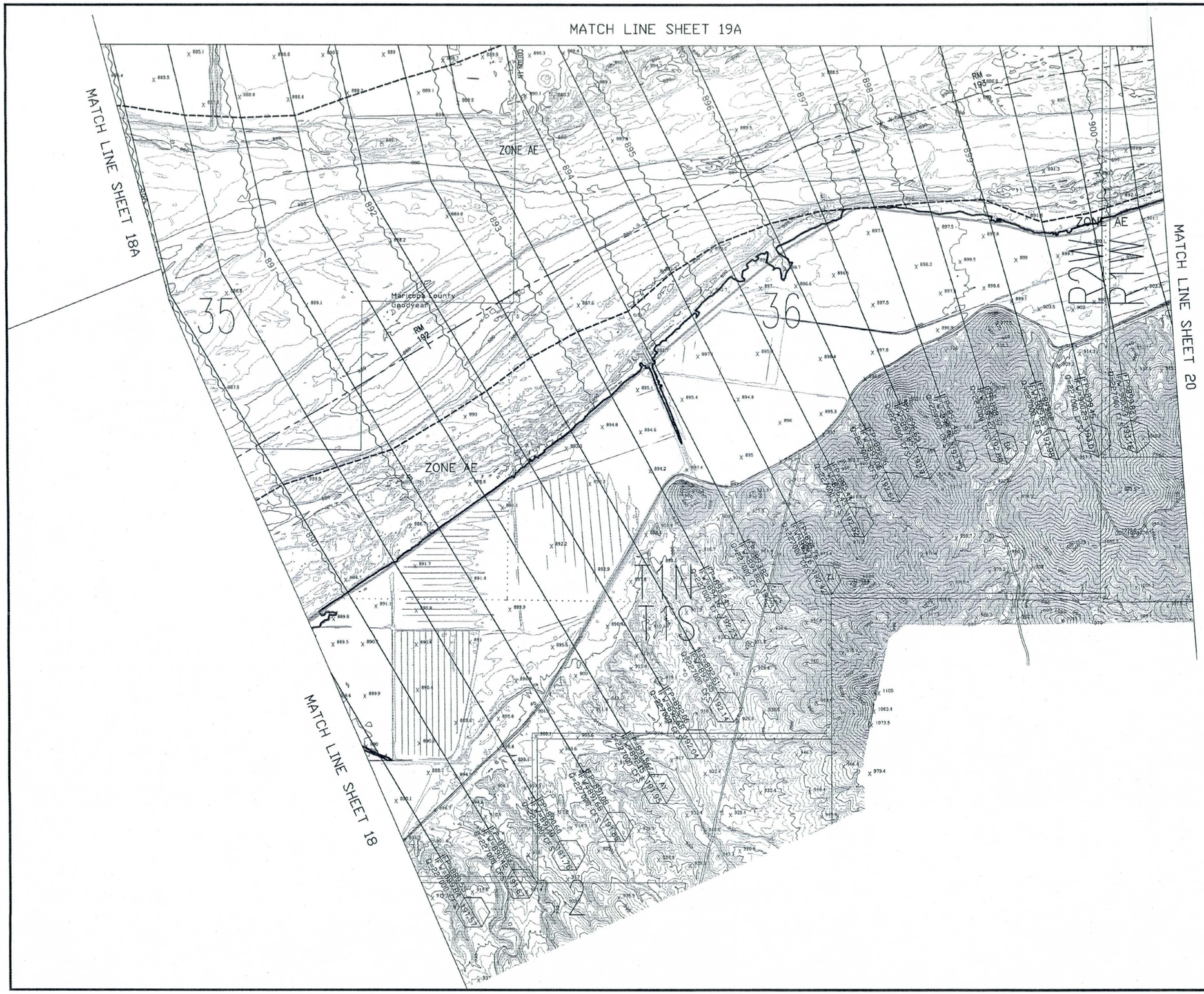
Stephanie R. Gerlach

expires 09/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 18A OF 46



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 — FP= 1888.74 FW= 1889.54 Q = CFS
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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

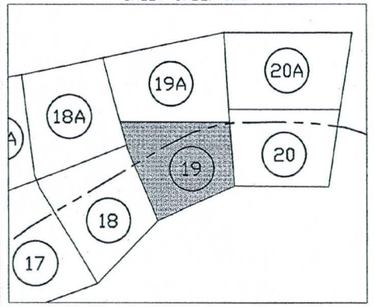
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
37	887.63	An ADOT BC in the center of an irrigation structure headwall, approximately 36 feet southerly of the centerline of SR 85, and 25 feet easterly of the centerline of Perryville Rd. This point is located in the proximity of the SE corner of Sec. 33, T1N, R2W of the G&SRB&M, Maricopa County, Arizona.
39	909.14	An ADOT BC in the center of an irrigation structure headwall, approximately 25 feet southerly of the centerline of SR 85, and 100 feet easterly of the centerline of Cotton Ln. This point is located approximately 700 ft S and 100 ft E of the NW corner of Sec. 25, T1N, R2W of the G&SRB&M, Maricopa County, Arizona. (LOCATED ON SHEET 19A)
40	905.44	An ADOT BC in the center of an culvert headwall, approximately 25 feet southerly of the centerline of SR 85, and 500 feet easterly of the North-South mid-section line of Sec. 25, T1N, R2W of the G&SRB&M, Maricopa County, Arizona. (LOCATED ON SHEET 19A)

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

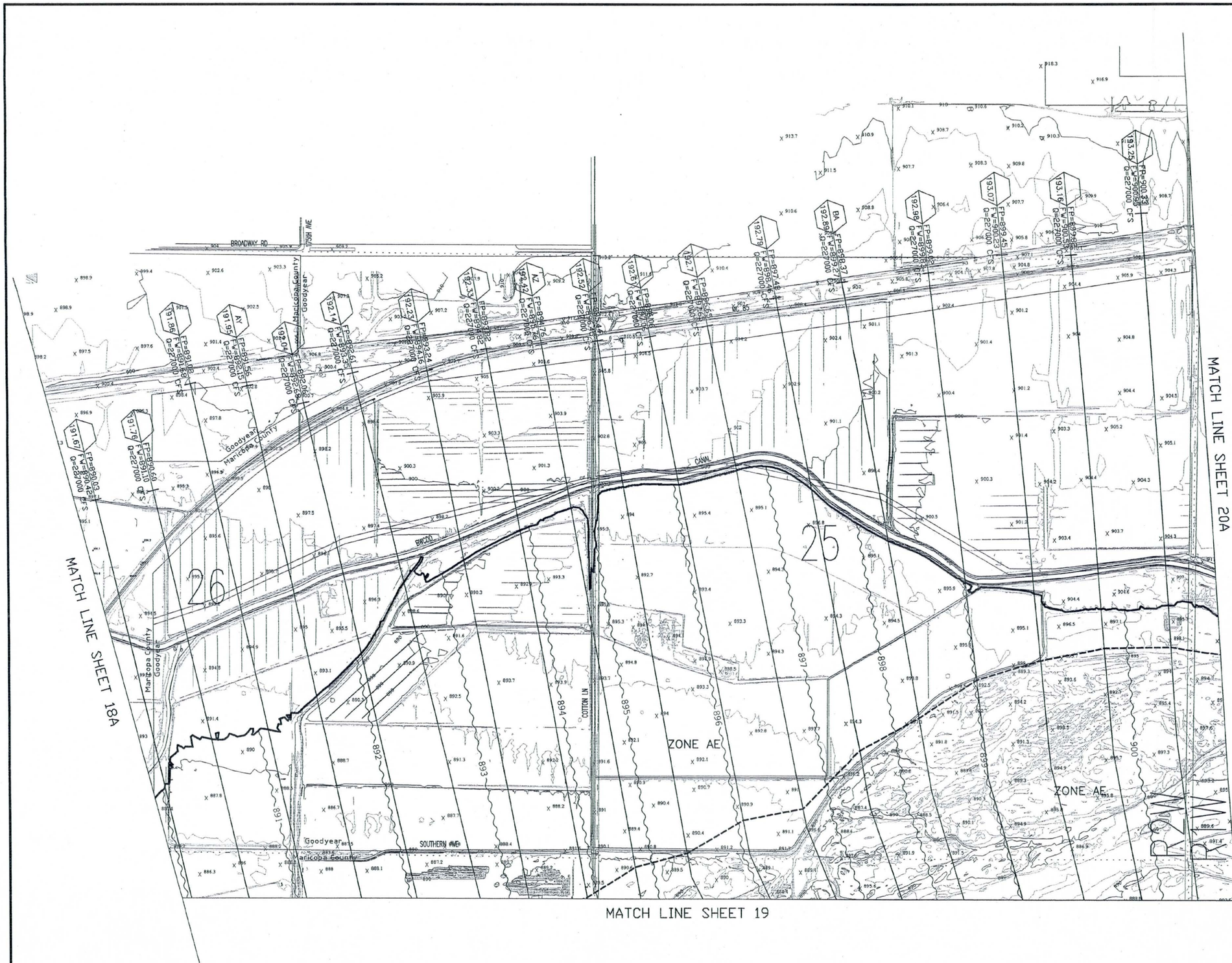
F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 3/6/08 Arizona U.S.A.
Stephanie R. Gerlach
expires 09/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008



LEGEND

100-YR CORRECTED EFFECTIVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	(A) 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q = CFS (100 YEAR DISCHARGE); 10th CROSS SECTION DESIGNATION; CROSS SECTION RIVER MILE 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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

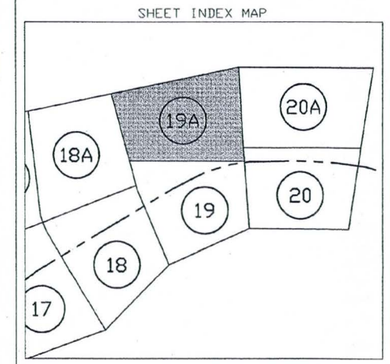
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
39	909.14	An ADOT BC in the center of an irrigation structure headwall, approximately 25 feet southerly of the centerline of SR 85, and 100 feet easterly of the centerline of Cotton Ln. This point is located approximately 700 ft S and 100 ft E of the NW corner of Sec. 25, T1N, R2W of the G&SRB&M, Maricopa County, Arizona. (LOCATED ON SHEET 19A)
40	905.44	An ADOT BC in the center of an culvert headwall, approximately 25 feet southerly of the centerline of SR 85, and 500 feet easterly of the North-South mid-section line of Sec. 25, T1N, R2W of the G&SRB&M, Maricopa County, Arizona. (LOCATED ON SHEET 19A)

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800
SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Arizona U.S.A.

Stephanie R. Gerlach

expires 09/30/2008

STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 19A OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION

LEGEND

100-YR CORRECTED EFFECITVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
100-YR EFFECTIVE FLOODPLAIN BOUNDARY	
EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	(A) 0.10 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION) FW= 1889.54 (FLOODWAY WATER SURFACE ELEVATION) Q = CFS (100 YEAR DISCHARGE) — FINAL CROSS SECTION DESIGNATION — CROSS SECTION BASE MILE 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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

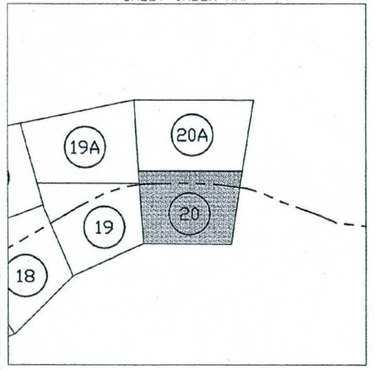
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1ft TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
42	916.49	A BC flush with pavement on the W edge of Estrella Pkwy. at the intersection of Vineyard Rd. This point is approximately one quarter of a mile S of the NE corner of Sec. 31, T1N, R1W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



N

400 0' 400 800

SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 2/4/08 ARIZONA U.S.A.

Stephanie R. Gerlach

expires 09/30/2008

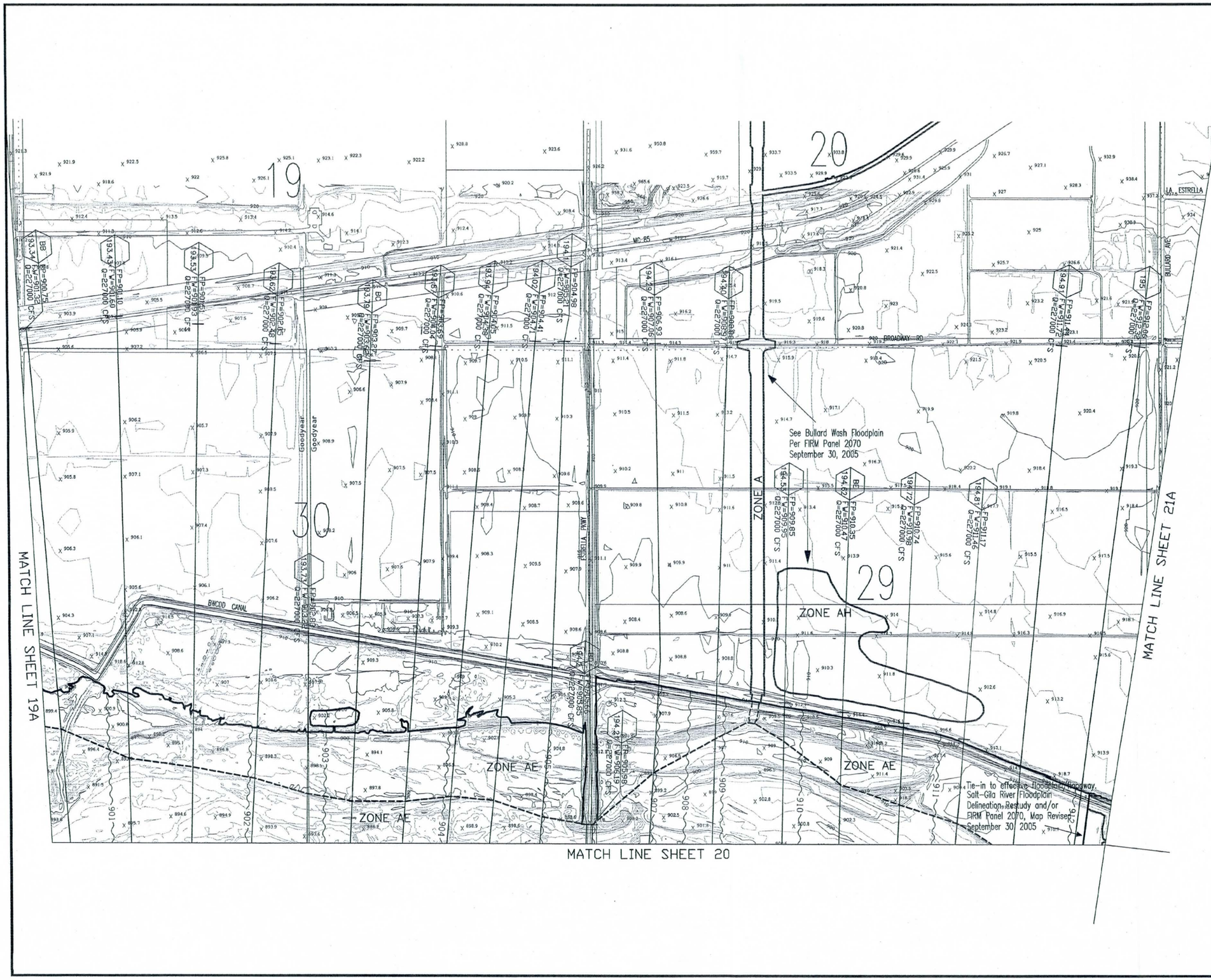
STANTEC CONSULTING, Inc.

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 20 OF 45

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION



LEGEND

100-YR CORRECTED EFFECITVE FLOODPLAIN BOUNDARY	
CORRECTED EFFECTIVE FLOODWAY BOUNDARY	
100-YR EFFECTIVE FLOODPLAIN BOUNDARY	
EFFECTIVE FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	RM 186 — RM 187
EROSION SETBACK (WHEN APPLICABLE)	
CROSS SECTION	A 0.10 FP= 1888.74 FW= 1889.54 Q = CFS
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
SECTION/TOWNSHIP/RANGE	

ELEVATION REFERENCE MARKS

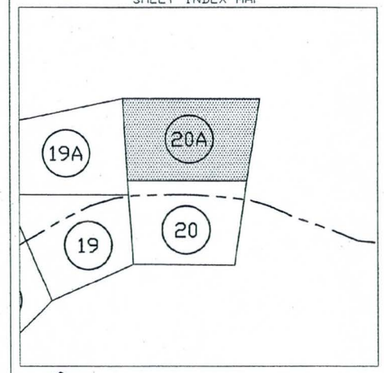
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR 1988 NAVD= +2.1 TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
41	913.48	An ADOT BC in the center of a culvert headwall, located approximately 25 feet southerly of the centerline of SR 85, and 500 feet easterly of the North-South mid-section line of Sec. 19, T1N, R1W of the G&SRB&M, Maricopa County, Arizona.

NOTES

1. THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 20,000 UNLESS NOTED OTHERWISE

SHEET INDEX MAP



400 0' 400 800

SCALE: 1"= 400 FEET
CONTOUR INTERVAL = 2 FEET

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA RIVER FLOODPLAIN REDELINEATION STUDY

F.C.D. CONTRACT NO. 2007C017

PCN NO. 014.34.01

STANTEC CONSULTING, Inc.

Registered Professional Engineer (Civil) CERTIFICATE NO. 33989 STEPHANIE R. GERLACH Date Signed 3/6/08 ARIZONA U.S.A.

Stephanie Gerlach

EXPIRES 09/30/2008

	BY	DATE
DESIGN	SRG	03/2008
DESIGN CHK.	PJE	03/2008
PLANS	AML	03/2008
PLANS CHK.	PJE	03/2008

SHEET 20A OF 46

SEE COVER SHEET FOR MAPPING AND SURVEYING INFORMATION

SEE COVER SHEET FOR INDIVIDUAL DISCIPLINES' CERTIFICATION