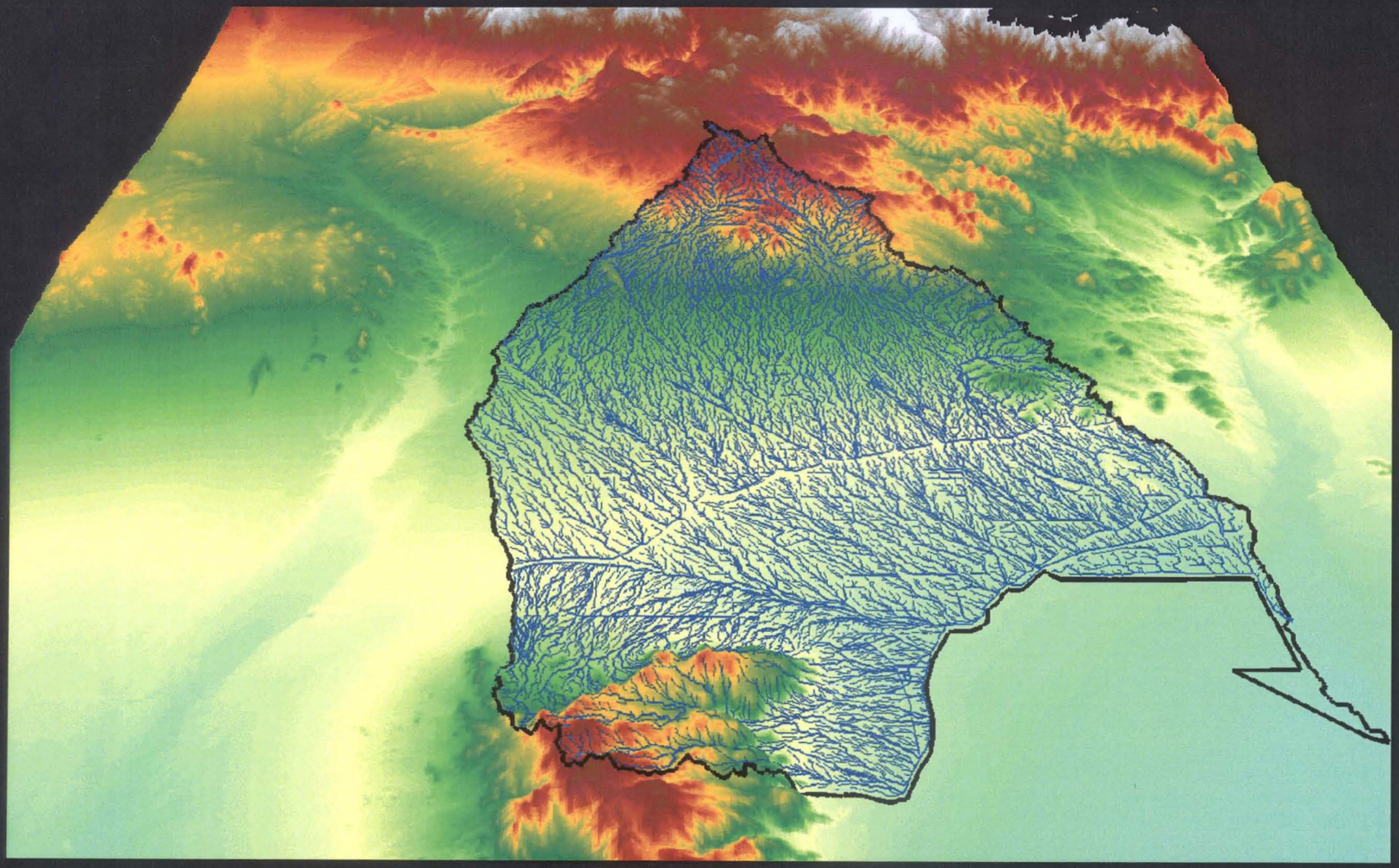
Wittmann Area Drainage Master Plan

Iona Wash Floodplain Delineation
Lone Mountain Road to Carefree Highway
Technical Data Notebook



Prepared for the Flood Control District of Maricopa County

Contract FCD 2004C060

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WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

TECHNICAL DATA NOTEBOOK

IONA WASH FLOODPLAIN DELINEATION LONE MOUNTAIN ROAD TO CAREFREE HIGHWAY

VOLUME HD-1 of 1

Contract FCD 2004C060

April 2009

Prepared by:

Intelligent Engineering

Environmental *Solutions*

Registered Professional Engineer (Civil)
CERTIFICATE NO. 23969
FRANK EDWARD BROWN
Date Signed 30 April 2009
ARIZONA, U.S.A.
Expires 03/31/2010

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WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

FCD 2004C060

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Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 30 April 2008 ARIZONA, U.S.A. Expires 03/31/2011

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Flood Control District of Maricopa County

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

TECHNICAL DATA NOTEBOOK
FLOODPLAIN DELINEATION REPORT - VOLUME HD

SECTION 1: INTRODUCTION

The information and analyses presented in this Technical Data Notebook report are part of the scope of work performed by Entellus, Inc. for the Flood Control District of Maricopa County (District) as part of the Wittmann Area Drainage Master Plan Update (Wittmann ADMPU) under Contract FCD No. 2004C060. The Iona Wash and Iona Stock Tank Wash floodplain delineations tie into the Iona North Wash and Iona Wash floodplains found in the Wittmann Area Drainage Master Study Update (Wittmann ADMSU), performed by Entellus, Inc. in 2005 under Contract FCD No. 2002C029 Change Order No. 5.

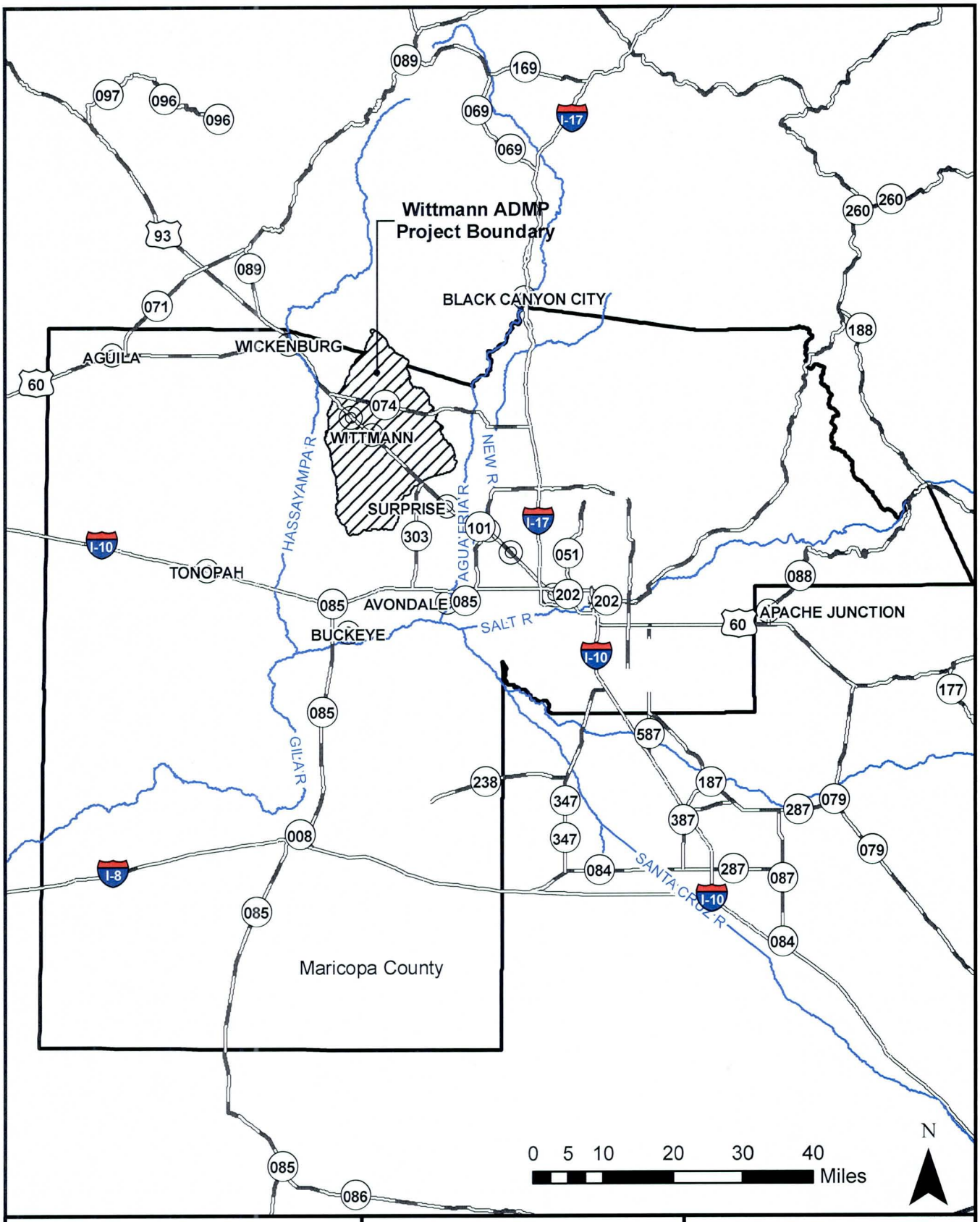
The purpose of this report is to present the results of the hydraulic analysis, and to document the methodology, assumptions, problems and solutions encountered during the development of this floodplain delineation study. About 5.1 miles of floodplains with floodway were mapped by this current project. For this report and associated workmaps, the term "Pending" refers to the ADMSU floodplain data and the term "Effective" refers to the data found on Flood Insurance Rate Maps and Flood Insurance Studies published by FEMA prior to the ADMSU date. In practical terms for tying in the floodplains and floodways at the upstream and downstream study limits, the Pending information is utilized as if it were Effective, because the ADMSU floodplain delineations have been approved by FEMA (FEMA Case Number 07-09-1634P) and are currently awaiting publication of the revised Flood Insurance Rate Maps. If it is unclear which data are referred to, the term "ADMSU" is inserted for clarity.

1.1 Project Location

The study area is located in north-central Maricopa County, shown in the Vicinity Map **Figure 1.1**, and is generally bounded by Carefree Highway to the north, Lone Mountain Road to the south, the 243rd Avenue to the east, and the 251st Avenue to the west (**Figure 1.2,** Study Area Map). The total watershed area is approximately 23.3 square miles at the downstream tie-in to Iona Wash. The study area consists of undeveloped land in

unincorporated Maricopa County, and the study washes are north of the Central Arizona Project (CAP) Canal and west of the US60 / Grand Avenue / Union Pacific Railroad (UPRR). The washes drain from north to south or southeasterly.

The study area is adjacent to several major natural watercourses, namely: Iona Wash, Iona Wash North, Iona Wash Tributary, and Iona East Split -1 Wash. Additionally, two important man-made features are within the study area, namely an earthen diversion dike redirecting runoff towards an earthen stock tank.



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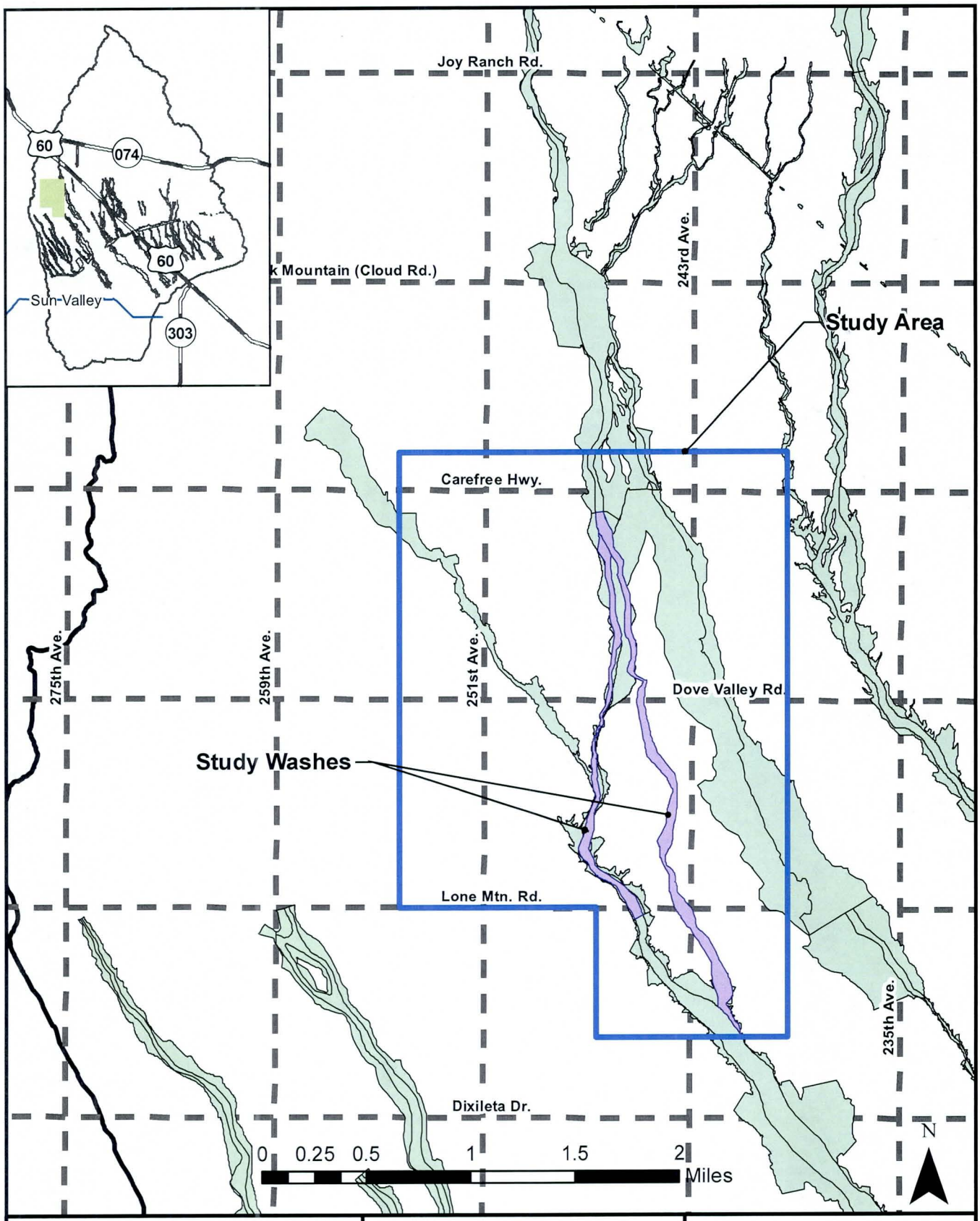
FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
CONTRACT FCD 2004C060

VICINITY MAP
FIGURE 1.1



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Study Area Map
Figure 1.2

1.2 Hydraulic Methodology and Results

The hydraulic analysis was performed using the US Army Corps of Engineer's HEC-RAS V.4.0.0 program finalized in March 2008 (**Reference 7**). The floodplain mapping was accomplished in accordance with HEC-GeoRAS (**Reference 8**). Engineering judgment and comparison to the final HEC-RAS model was utilized in areas where the HEC-GeoRAS results varied from either the topography or the RAS results. The details of the hydraulic methodology are discussed in **Section 5**. The delineated floodplains consider the "with non-levee embankment" and "without non-levee embankment" scenario for the diversion dike and the stock tank. The levee-like embankments are not FEMA-certified and likely will never be certified.

SECTION 2: ADWR/FEMA FORMS

FEMA Form MT-2 Form 1: Overview & Concurrence Form

FEMA MT-2 Form 2: Riverine Hydrology and Hydraulics Form

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

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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 44 CFR Ch. 1, Parts 60, 65 & 72)

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
040037	Maricopa County, Arizona and Uninc. Areas	AZ	04013C	687H	09/30/05
040037 040037	Maricopa County, Arizona and Uninc. Areas Maricopa County, Arizona and Uninc. Areas	AZ AZ	04013C 04013C	689H 690H	09/30/05 09/30/05

2. a. Flooding Source: 1) Iona Wash and 2) Iona Stock Tank Wash

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)

   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Wittmann Area Drainage Master Plan Update/Contract F.C.D. 2004CO60

4. FEMA zone designations affected: A, AE, AO (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 ☐ Base Map Changes

   ☐ Coastal Analysis ☐ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections

   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes

   ☒ New Topographic Data ☐ 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 structures (check all that apply)

   Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert

   ☐ Dam ☐ Fill ☐ Other (Attach Description)

C. REVIEW FEE

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

☐ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/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: Kathryn Gross	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 W. Durango St. Phoenix, AZ 85009	Daytime Telephone No. (602) 506-4837	Fax No. (602) 506-4601
	E-Mail Address: Kag@mail.maricopa.gov	
Signature of Requester (required):	Date: 2/22/2010	

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, PE	Community Name: Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, Arizona 85009	Daytime Telephone No.: 602-506-1501	Fax No.: 602-506-4601
	E-Mail Address: tsp@mail.maricopa.gov	
Community Official's Signature (required):	Date: 2/23/10	

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 data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. 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: Frank Edward Brown, PE, CFM	License No.: 23969	Expiration Date: 3/31/2011
Company Name: Entellus, Inc.	Telephone No.: 602-244-2566	Fax No.: 602-244-8947
Signature: Frank Edward Brown		Date: April 8, 2009

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. 23969 FRANK EDWARD BROWN Date Signed..... ARIZONA, U.S.A.

Expires 03/31/2011

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

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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Flooding Source: Iona Wash
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☒ Not revised (skip to section B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model
☐ 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.

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	See Attached for Iona Wash			
Upstream Limit	See Attached for Iona Wash			

2. Hydraulic Method/Model Used

HEC-RAS V. 4.0

Attachment to MT-2 Form 2 page 1 of 2
Question 1 Models Submitted
Iona Wash

Hydraulics

Reach to be Revised

	Description	Cross Section	Water-Surface Elevation (ft.)	
			Wittmann ADMSU*	New
Downstream Limit	Approximately at Lone Mountain Road	Iona Wash RM 4.844	1695.44	1695.44
Upstream Limit	Approximately 0.1 miles south of Carefree Highway	Iona Wash North RM 0.104	1781.65	1781.76

*Note: The effective model flows are not applicable since the ADMSU model supersedes the effective model. Refer to FEMA Case Number 07-09-1634P.

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 may help 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/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	_____
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	_____
Existing or Pre-Project Conditions Model	File Name: Attached	Plan Name: Attached	File Name: Attached	Plan Name: Attached	
Revised or Post-Project Conditions Model	File Name: Attached	Plan Name: Attached	File Name: Attached	Plan Name: Attached	
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	_____

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

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.).

☒ Digital Mapping (GIS/CADD) Data Submitted

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 (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☒ Yes ☐ No

   a. 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.

   b. 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.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☒ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you 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.

Attachment to MT-2 Form 2 page 2 of 2
Question 4 Models Submitted

Iona Wash Models Submitted – Natural AND Floodway

Downstream Tie-in

Existing or Pre-Project Conditions Model	File Name: IonaWash.prj	Plan Name: IonaWash.p01	Datum: NAVD 1988
Revised or Post-Project Conditions Model	File Name: Iona_Main_Wash.prj	Plan Name: Iona_Main_Wash.p01	Datum: NAVD 1988

Upstream Tie-in

Existing or Pre-Project Conditions Model	File Name: IonaNorth.prj	Plan Name: IonaNorth.p01	Datum: NAVD 1988
Revised or Post-Project Conditions Model	File Name: Iona_Main_Wash.prj	Plan Name: Iona_Main_Wash.p01	Datum: NAVD 1988

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

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

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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Flooding Source: Iona Stock Tank Wash
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☒ Not revised (skip to section B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model
☐ 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.

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	See Attached for Iona Stock Tank Wash			
Upstream Limit	See Attached for Iona Stock Tank Wash			

2. Hydraulic Method/Model Used

HEC-RAS V. 4.0.0 March 2008

Attachment to MT-2 Form 2 page 1 of 2
Question 1 Models Submitted
Iona Stock Tank Wash

Hydraulics

Reach to be Revised

	Description	Cross Section	Water-Surface Elevation (ft.)	
			Wittmann ADMSU*	New
Downstream Limit	Approximately 0.4 miles south of Lone Mountain Road alignment	Iona Wash RM 4.071	1671.92	1671.92
Upstream Limit	Approximately 0.1 miles south of Carefree Highway	Iona Wash North RM 0.104	1781.65	1781.65

*Note: The effective model flows are not applicable since the ADMSU model supersedes the effective model. Refer to FEMA Case Number 07-09-1634P.

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 may help 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/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	_____
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	_____
Existing or Pre-Project Conditions Model	File Name: Attached	Plan Name: Attached	File Name: Attached	Plan Name: Attached	
Revised or Post-Project Conditions Model	File Name: Attached	Plan Name: Attached	File Name: Attached	Plan Name: Attached	
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	_____

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

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.).

☒ Digital Mapping (GIS/CADD) Data Submitted

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 (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☒ Yes ☐ No

   a. 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.

   b. 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.

2. Does the request involve the placement or proposed placement of fill? ☒ Yes ☐ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you 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.

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Question 4 Models Submitted

Iona Stock Tank Wash Models Submitted – Natural AND Floodway

Downstream Tie-in

Existing or Pre-Project Conditions Model	File Name: IonaWash.prj	Plan Name: IonaWash.p01	Datum: NAVD 1988
Revised or Post-Project Conditions Model	File Name: IonaStockTankWash.prj	Plan Name: StockTankWash.p01	Datum: NAVD 1988

Upstream Tie-in

Existing or Pre-Project Conditions Model	File Name: IonaNorth.prj	Plan Name: IonaNorth.p01	Datum: NAVD 1988
Revised or Post-Project Conditions Model	File Name: IonaStockTankWash.prj	Plan Name: StockTankWash.p01	Datum: NAVD 1988

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

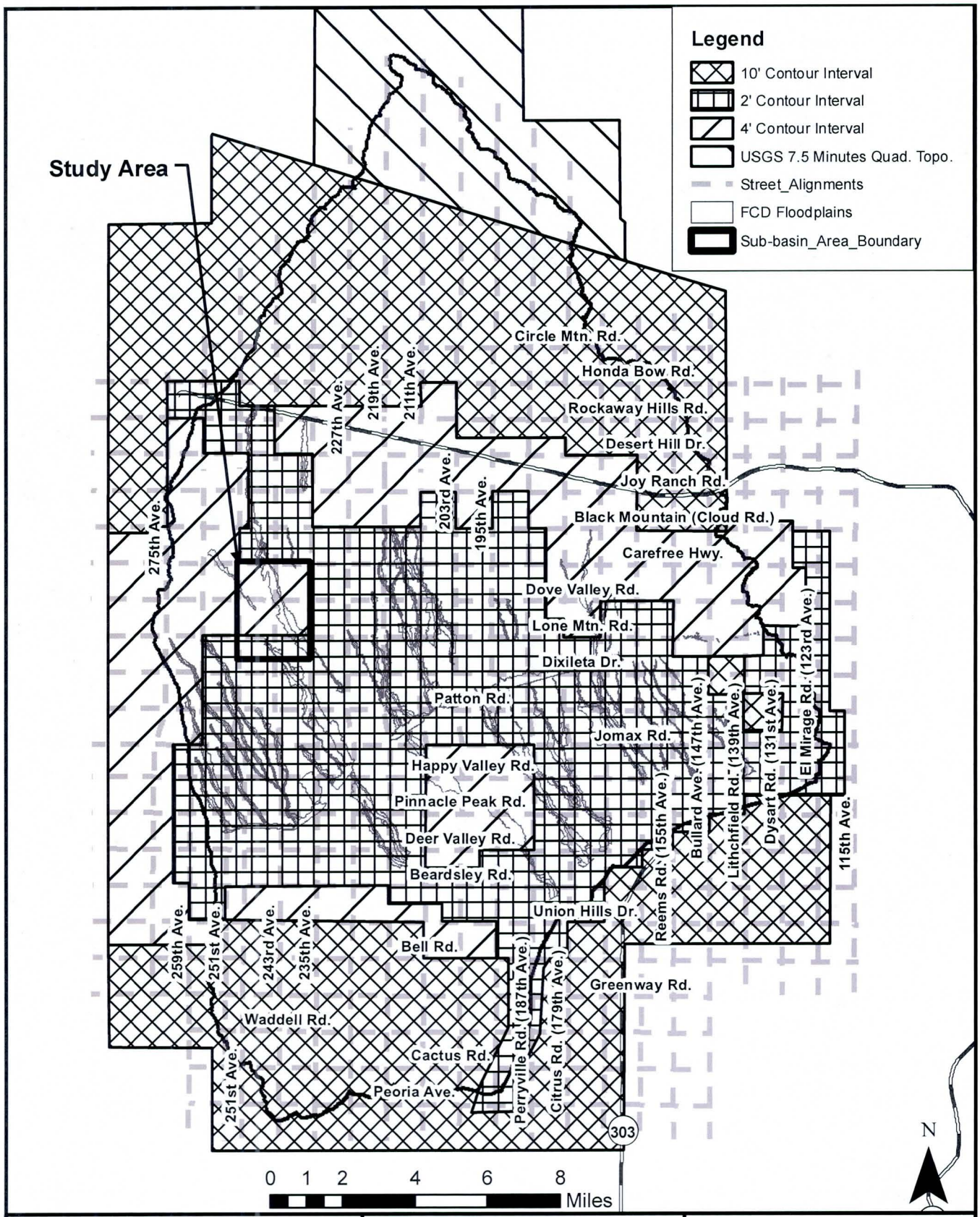
SECTION 3: MAPPING AND SURVEY INFORMATION

Additional survey or mapping was not performed specifically for this hydraulic analysis. The base map used for this study was provided by the District, originating from two different sources:

- 200-scale, 4-foot contour mapping (**Reference 2**)
- 100-scale, 2-foot contour mapping (**Reference 3**)

The mapping coverage locations are shown on **Figure 3.1** All mapping was prepared by Landata, Inc. for the District under separate contract. The vertical control was based on the North American Vertical Datum of 1988 (NAVD-88), and horizontal control was based on State Plane Coordinate System Arizona Central (1983 NAD). The District provided Entellus with a composite ASCII grid file developed from the two mapping sources.

Additional mapping information is available in the *Wittmann ADMSU Addendum* dated *July 2005*.



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WITTMANN
AREA DRAINAGE MASTER PLAN
FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
CONTRACT FCD 2004C060

Mapping Sources
FIGURE 3.1

SECTION 4: HYDROLOGY

Flow rate information is taken from the ADMSU hydrologic analyses, and hydrologic modifications were not made to the Wittmann ADMSU report (**Reference 9**). One intermediate point near the earthen stock tank, at Concentration Point CIW361, is utilized for Iona Stock Tank Wash flow rates. The flows utilized from the Wittmann ADMSU are shown in a table in **Appendix D,** which references the Concentration Point labels.

The flow rates are used to determine the worst case (with and without non-levee embankment) floodplain scenario for either of the study washes. For Iona Wash, flow rates increase substantially after Iona Tributary Wash combines with the main stem wash. For the downstream portion of Iona Stock Tank Wash, there is no flow increase after Iona Tributary, since these two washes are not connected. It must be noted that the source of runoff for Iona Stock Tank Wash is the same as for Iona Wash, since there is one wash system, which could follow one or both flow paths. The Iona Stock Tank Wash hydraulic model simply assumes the diversion dike remains in place and all of the runoff in Iona Wash continues southerly in Iona Stock Tank Wash.

SECTION 5: HYDRAULICS

5.1 Method Description

The floodplains were analyzed using the HEC-GeoRAS program, Version 4.1.1 (Reference 8). HEC-GeoRAS is an ArcGIS extension designed to process hydraulic geospatial data for use with HEC-RAS, Version 4.0.0 (Reference 7). The tools within HEC-GeoRAS allow the user to preprocess the geometric data in a geospatial environment by defining: cross sections, stream centerlines, ineffective flow areas, storage areas, levees, lateral structures, etc. The geometric data is georeferenced and can be exported / imported to and from HEC-RAS while maintaining the georeference information, with the results shown visually in GIS, thus allowing for seamless interconnectivity between the modeling and GIS environments.

Cross sections were extracted from the digital terrain model (DTM) generated as part of the mapping portion of this project.

The subcritical option of HEC-RAS is used in the hydraulic model, which has a defined downstream boundary condition. The downstream starting water surface elevation (downstream boundary condition) for the flooding source is obtained by the known water surface elevation option of HEC-RAS at the tie-in cross section. The downstream boundary condition for the Iona Wash floodplain is at a known water surface elevation from the pending ADMSU cross section on Iona Wash River Mile (RM) 4.844 of 1695.44 ft NAVD88; while the starting floodway point is the known floodway elevation of 1696.42 ft NAVD88. The downstream boundary condition for the Iona Stock Tank Wash floodplain is a known water surface elevation for the pending ADMSU cross section Iona Wash RM 4.071 of 1671.92 ft NAVD88; the floodway is at the known elevation of 1672.13 ft NAVD88. Pending cross sections are a part of the Wittmann ADMSU study (**Reference 10**).

The upstream tie-in comparison for both the Iona Wash and the Iona Stock Tank Wash floodplain is from the pending Iona North Wash HEC-RAS model/workmaps. The upstream tie-in data from the pending ADMSU study is floodplain elevation at 1781.65 and floodway

elevation of 1782.55 ft at Iona North cross section RM 0.104. The downstream tie-in for both study washes occurs in Iona Wash from the pending study, described in the preceding paragraph. This upstream and downstream tie-in information is presented in table format in Section 2, FEMA forms.

Results of the HEC-RAS runs for both study reaches are presented in **Appendix E.6**. The flood profiles are included in **Section 7.4**

5.2 Work Study Maps

Two reaches are delineated as part of this study: Iona Wash and Iona Stock Tank Wash. Iona Wash is delineated as a Zone AE with Floodway; and Iona Stock Tank Wash is delineated as a Zone AE with Floodway. The final name of each HEC-RAS model corresponds to the wash name and is found in the FEMA forms. About 2.6 river miles for Iona Wash and about 2.9 river miles for Iona Stock Tank Wash are delineated, for a project total of about 5.1 river miles.

The majority of the work study maps consist of 4-foot contour intervals topographic mapping. The southern-most portion of the study area of the work maps consists of 2-foot contour intervals topographic mapping. The Lone Mountain Road alignment is the dividing point between the 2-foot and 4-foot contours. The half size workmaps are presented at the end of this section and the full size workmaps are bound in the rear pockets of this report.

5.3 Parameter Estimation

5.3.1 Manning's "n" Value

5.3.1.1 Introduction

The Iona Wash and Iona Stock Tank Wash floodplain delineation study consists of approximately 5.1 linear miles of detailed delineation (floodplain and floodway) under this project. Since the project ties into the northern and southern most part of the Wittmann ADMSU

floodplain delineation study, the "n" Values as part of the ADMSU were used between the project boundary cross sections. New roughness coefficients were determined for the two study washes between the ADMSU reaches, with field reconnaissance taking place in January 2009. Each wash was divided into a few reaches of similar hydraulic characteristics, and Manning's "n" Values were assigned to these reaches based on their typical channel characteristics. The "n" Value location of photographs and limits of each reach are located in **Appendix E.1**. The following factors were considered while calculating the "n" Value for each reach:

- Channel material
- Degree of irregularity of the bank slopes
- Effect of obstructions
- Degree of meandering
- Vegetation type and density
- Variation in channel cross-section

The effect of vegetation cover in this particular area is one of the most important factors in the estimation of "n" Value. The density and type of vegetation have significant impact on the roughness coefficient ("n" Value). The vegetation within the floodplain was identified to include the following:

- Creosote Brush
- Ironwood
- Mesquite
- Saltbrush
- Annual Grasses and Weeds

5.3.1.2 Methodology

Each reach was identified with the aid of aerial photographs. The discerning characteristics were channel size, vegetation density, bed

materials, and development encroachment. Each reach was photographed at representative and accessible locations to document existing conditions. The photograph locations are presented on **Figures E.1,** in **Appendix E.1**.

Manning's roughness coefficients were determined in accordance with the methodology described in *Estimated Manning's Roughness Coefficient for Streams Channels and Flood Plains in Maricopa County, Arizona* (**Reference 11**). The method described in this publication selects a base value for the roughness coefficient based exclusively on bed material. This base value is then adjusted to account for vegetation, irregularities, obstructions and channel cross-section variations. In addition, a multiplier could be applied to the adjusted "n" Value when meandering of the reach was significant. Meander is insignificant in the study washes and a multiplier of 1.0 was utilized.

5.3.1.3 "n" Value Determination

The base roughness coefficient in this study was selected based on the average particle size observed in the field. The typical bed materials in the study area range from coarse sand to gravel and the typical values of the roughness coefficient range from 0.026 to 0.028. After these values were adjusted for the effects of vegetation, irregularities etc., the final determination of the roughness coefficients for overbanks range from 0.032 to 0.056 and they range from 0.045 to 0.049 in the main channel.

The base values, adjustments, and the adjusted values for Manning's roughness coefficient along with the photographic documentation and a location map are included in **Appendix E.1.**

5.3.2 Expansion and Contraction Coefficients

The expansion and contraction coefficients used in the HEC-RAS model were determined using the HEC-RAS *User's Manual* (**Reference 4**). For gradual transitions, which include all reaches in this study, the contraction and expansion coefficients were set as 0.1 and 0.3, respectively.

5.4 Cross-Section Description

The cross-sections used for the hydraulic modeling were based on DTM data provided by the District (**References 1, 2 and 3**). Cross section plots for each wash are included in **Appendix E.2.**

5.4.1 Channels and Overbanks

Prior to extracting the cross sections from the digital terrain model (DTM), the channel bank stations were approximately identified in the field. The exact bank station locations were determined with the aid of the topographic mapping and aerial photography. Typically, heavy vegetation is located within the main channel and the overbanks usually have less density of vegetation. This is typical of ephemeral washes in desert areas where the moisture required for plant growth is often restricted to the watercourses. The plotted cross sections are presented in **Appendix E.2**.

5.4.2 Bridges and Constrictions

5.4.2.1 Minor Hydraulic Structures

There are no bridges or culverts of minor significance within the study area. Unpaved roadway crossings generally do not comprise constrictions to the floodplain.

5.4.2.2 Major Hydraulic Structures

Two major hydraulic structures were found within the study area, a diversion dike and an earthen stock tank. The diversion dike is located

on Iona Stock Tank Wash north of the stock tank, and is about 3 feet high and about 4500 feet (or 0.85 miles) long.

The earthen stock tank is located on Iona Stock Tank Wash near River Mile 1.955, which is opposite Iona Wash River Mile 6.189. Based on current mapping and field reconnaissance, the stock tank is between about 8 to 15 feet deep with a diameter of 350 feet. The stock tank collects flow from Iona North wash / Iona Wash and forces it to flow into Iona Stock Tank Wash. The re-directed runoff eventually overflows the stock tank and drains back into Iona Wash (near Iona Stock Tank Wash River Mile 0.290, which is Iona Wash RM 4.314).

5.5 Modeling Considerations

5.5.1 Hydraulic Jumps and Drop Analysis

For the event of a 100-year storm there is no evidence of a hydraulic jump in the study area for the two reaches as represented in the hydraulic models.

5.5.2 Bridges and Culverts

There are no bridges or culverts within the study area.

5.5.3 Levees and Dikes

As stated previously, the delineated floodplains consider the "with non-levee embankment" and "without non-levee embankment" scenario for the diversion dike and the stock tank. The levee-like embankments are not FEMA-certified and likely will never be certified. The widest floodplains for either levee condition are mapped for Iona Wash, except for the ineffective flow boundary on the west side of the Iona Stock Tank Wash floodplain; refer to Section 5.7.1 Special Problems and Solutions.

Practically speaking, the Iona Wash floodplain assumes that the diversion dike washes out during a 100-year flood, and all of the flood flows continue southerly in Iona Wash. The Iona Stock Tank Wash hydraulic model simply assumes the diversion dike and the earthen stock tank remain in place and all of the runoff in Iona Wash continues southerly in Iona Stock Tank Wash.

5.5.4 Islands and Flow Splits

There are many locations within the washes showing divided flow conditions. For most of these locations, the elevation differences between the island and the surrounding water surface are within the accuracy limits of the mapping (within 1 foot). Therefore, it was assumed that they would be inundated and were kept in the floodplain for the 1% event.

5.5.5 Ineffective Flow Areas

After the preliminary flooding boundaries were plotted, the wash cross-sections were checked to insure that each reflected the actual flow area. Several cross-sections were modified to exclude tributaries and non-effective areas. The ineffective flow area stations were estimated based on topographic mapping. The criteria of 1:1 contraction and 4:1 expansion rates were used for determining the ineffective flow areas upstream and downstream of expansion and contractions. One area of ineffective flow was not mapped; refer to Section 5.7.1 Special Problems and Solutions.

5.5.6 Supercritical Flow

Potential supercritical flow areas were not reported by HEC-RAS, and all of the Froude Numbers are less than 1.0 for the 100-year floodplain.

5.5.7 Blocked Obstructions

The two delineated washes are affected by the one livestock tank. The tank includes a diversion dike to divert runoff from the wash into the tank. The blocked conveyance option of HEC-RAS was not utilized and the effect of the diversion dike was

accounted for in the two RAS models for the two study washes / study wash scenarios.

5.5.8 Special Modeling Considerations

5.5.8.1 Iona Wash

For the flow upstream and near the stock tank, the flow optimization option is not needed, because the floodplain considers either that the full flow continues in Iona Wash or is fully diverted by the diversion dike and through the stock tank. However, the stock tank could fail, thus an approximate floodplain is delineated downstream of the stock tank, assuming a likely flow path and width for flow breaching the tank.

The CHECK-RAS output is located in **Appendix E.7**.

At the upstream and downstream ends of this study segment of Iona Wash, the Zone AE and floodway limits are tied into the pending (ADMSU) Iona North Wash floodplain and floodway. The current effective models were not utilized, and tie-in was based on the pending floodplain and floodway data provided in the ADMSU TDN and associated workmaps.

5.5.8.2 Iona Tributary Wash

The entire reach was previously modeled as a Zone A. For this study, a short reach of Iona Tributary Wash is delineated with an approximate Zone A between the ADMSU downstream limit and Iona Wash. At the downstream end of the wash, the Zone A limits are tied into the current (this study) Iona Wash delineation, using topographic mapping and engineering judgment for the 4,500 cubic feet per second (cfs) flow rate.

5.5.8.3 Iona Stock Tank Wash

The downstream boundary condition was set to a known water surface elevation corresponding to the 100-year floodplain elevation in Iona Wash at RM 4.071.

At the upstream and downstream ends of this study segment of Iona Wash, the Zone AE and floodway limits are tied into the pending (ADMSU) Iona North Wash floodplain and floodway. The current effective models were not utilized, and tie-in was based on the pending floodplain and floodway data provided in the ADMSU TDN and associated workmaps.

The CHECK-RAS output is located in **Appendix E.7**.

5.6 Floodway Modeling

The floodway limits were defined by initially using Method 4 with a maximum surcharge of 1.0 ft, and then running the model. Modifications were made as needed to insure the surcharge did not exceed 1.0 ft, and velocities did not significantly increase. After these modifications were made, Method 1 is used with the known encroachment stations obtained from Method 4. The output was checked again and the floodway inundation limits were defined based on these new encroachment boundaries.

5.7 Problems Encountered During Modeling

5.7.1 Special Problems and Solutions

There is one special problem encountered during this study, which is the ineffective flow boundary on the west side of Iona Stock Tank Wash. This area is from RM 2.751 to RM 2.314. As explained in Section 5.5.3, the higher water surface for the Iona Stock Tank Wash is not extended west into the Iona Wash floodplain because the purpose of the Iona Stock Tank Wash model is to determine the worst-case water surface elevations east of the dike by not allowing effective flow west of the dike

location. Since this assumes flow is contained to the east side of the dike, the floodplain delineated on the west of the dike uses the results of the Iona Wash model.

5.7.2 Modeling Warning and Errors

See **Appendix E**, for the Check-RAS Output for each of the washes.

5.8 Calibration

Since gaging records along the study washes are not available, the results of the HEC-RAS model are not calibrated. The results were carefully examined and found to be reasonable.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The Floodplain Maps, as well as their index are presented in the following **Sheets 1 through 8** in reduced scale. Full size copies are bound separately from this report.

SECTION 6: EROSION AND SEDIMENT TRANSPORT

The contents of this section are not a part of this report.

SECTION 7: DRAFT FIS DATA

7.1 Summary of Discharges

The discharge summary table is provided in Section 7.1 of the Wittmann Area Drainage Master Study Update, Hydrology Report Addendum, FCD No. 2002C029, July 2005, approved by FEMA under FEMA Case Number 07-09-1634P.

7.2 Floodway Data

The floodway data are included in the following pages.

HEC-RAS Plan: IonaMainWash River: Iona_Wash Reach: IonaMainWash

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
IonaMainWash	7.074	1781.76		1782.06	335.14	1014.06	221.68	94.26		9861.46	10015.27	
IonaMainWash	7.074	1782.61	0.86	1783.18	197.00	170.05	1159.95		9792.00	9861.46	10015.27	9989.00
IonaMainWash	6.973	1777.44		1777.69	431.90	1448.51	441.49			9950.11	10039.34	
IonaMainWash	6.973	1777.65	0.21	1777.93	330.16	1385.59	504.41		9702.61	9950.11	10039.34	10039.34
IonaMainWash	6.889	1773.57		1773.75	454.99	771.71	403.08	715.21		9960.70	10029.13	
IonaMainWash	6.889	1774.57	1.00	1774.84	197.27	653.58	792.17	444.25	9878.83	9960.70	10029.13	10092.88
IonaMainWash	6.818	1770.46		1770.66	439.63	495.02	663.02	731.96		9956.14	10037.03	
IonaMainWash	6.818	1771.05	0.59	1771.63	128.57		1275.73	614.27	9956.14	9956.14	10037.03	10084.71
IonaMainWash	6.757	1767.21		1767.39	603.67	446.90	507.54	935.57		9961.78	10035.42	
IonaMainWash	6.757	1768.20	0.99	1768.52	154.90	24.72	889.90	975.38	9957.72	9961.78	10035.42	10112.62
IonaMainWash	6.672	1763.69		1763.86	609.55	83.04	972.33	834.64		9942.80	10046.83	
IonaMainWash	6.672	1764.20	0.51	1764.78	121.72		1798.41	91.59	9942.80	9942.80	10046.83	10064.52
IonaMainWash	6.560	1759.59		1759.76	480.73	144.39	787.24	958.37		9951.79	10056.93	
IonaMainWash	6.560	1760.46	0.88	1760.70	162.49		1168.07	721.93	9951.79	9951.79	10056.93	10114.28
IonaMainWash	6.463	1754.97		1755.35	406.44	238.92	497.74	1153.34		9959.46	10024.44	
IonaMainWash	6.463	1755.66	0.69	1756.46	164.18		949.57	940.43	9959.46	9959.46	10024.44	10123.64
IonaMainWash	6.356	1748.74		1749.18	219.31	411.16	1478.84			9921.44	10035.09	
IonaMainWash	6.356	1749.65	0.91	1750.09	111.95		1890.00		9921.44	9921.44	10035.09	10035.09
IonaMainWash	6.266	1743.48		1744.00	195.79	800.31	1081.14	8.55		9959.89	10024.72	
IonaMainWash	6.266	1743.76	0.28	1744.95	81.56	196.99	1675.33	17.68	9948.30	9959.89	10024.72	10035.86
IonaMainWash	6.189	1739.51		1740.03	180.32	286.11	881.93	721.96		9974.56	10024.66	
IonaMainWash	6.189	1740.43	0.93	1740.95	96.82	204.83	1110.53	574.64	9951.44	9974.56	10024.66	10048.26
IonaMainWash	6.101	1735.30		1735.84	193.93	301.74	724.54	863.72		9979.31	10018.22	
IonaMainWash	6.101	1735.69	0.39	1736.92	72.65		1097.35	792.65	9979.31	9979.31	10018.22	10051.96
IonaMainWash	5.989	1730.93		1731.38	114.30	288.21	1202.39	399.40		9957.83	10016.48	
IonaMainWash	5.989	1731.78	0.84	1732.23	79.27	142.95	1474.74	272.30	9950.04	9957.83	10016.48	10029.31
IonaMainWash	5.899	1725.77		1726.95	94.62	709.54	1146.54	33.92		9974.20	10020.48	
IonaMainWash	5.899	1726.43	0.66	1728.16	51.66	164.43	1725.58		9968.82	9974.20	10020.48	10020.48
IonaMainWash	5.809	1723.71		1723.87	297.23	9.03	1829.07	51.90		9949.12	10099.00	
IonaMainWash	5.809	1724.28	0.57	1724.41	149.88		1890.00		9949.12	9949.12	10099.00	10099.00
IonaMainWash	5.710	1722.12		1722.54	471.67	419.29	4790.74	439.97		9910.87	10042.05	
IonaMainWash	5.710	1722.78	0.66	1723.27	141.83	182.73	5408.07	59.20	9903.72	9910.87	10042.05	10045.55
IonaMainWash	5.629	1720.29		1720.98	252.14	540.12	3909.39	1200.49		9942.26	10031.72	
IonaMainWash	5.629	1720.82	0.54	1721.73	128.61	167.62	4601.35	881.04	9931.79	9942.26	10031.72	10060.40
IonaMainWash	5.557	1717.65		1718.67	241.60	1242.23	3604.26	803.51		9964.24	10029.42	
IonaMainWash	5.557	1718.64	0.99	1719.65	122.84	1304.40	4001.46	344.14	9913.38	9964.24	10029.42	10036.22
IonaMainWash	5.454	1712.96		1713.77	489.46	984.25	2301.95	2363.80		9976.03	10033.94	
IonaMainWash	5.454	1713.43	0.48	1715.00	204.61	361.35	3086.28	2202.37	9897.65	9976.03	10033.94	10118.95
IonaMainWash	5.354	1709.77		1710.00	610.04	3063.25	1792.89	793.86		9931.55	10038.16	
IonaMainWash	5.354	1710.54	0.77	1710.92	251.53	3288.75	2256.16	105.09	9793.07	9931.55	10038.16	10044.60
IonaMainWash	5.278	1708.29		1708.71	345.53	2288.17	2580.64	781.19		9938.15	10034.94	
IonaMainWash	5.278	1709.01	0.72	1709.68	174.62	2154.56	3451.49	43.95	9862.82	9938.15	10034.94	10037.44
IonaMainWash	5.237	1706.63		1707.45	312.18	1102.02	1920.06	2627.92		9973.44	10042.29	
IonaMainWash	5.237	1706.90	0.27	1708.19	181.66	685.42	2380.44	2584.14	9939.26	9973.44	10042.29	10120.92
IonaMainWash	5.146	1702.93		1703.62	260.52	4360.30	1285.25	4.45		9960.86	10026.35	
IonaMainWash	5.146	1703.04	0.10	1703.87	201.69	4313.67	1336.33		9824.66	9960.86	10026.35	10026.35
IonaMainWash	5.083	1700.78		1701.42	350.44	884.15	3619.51	1146.34		9953.00	10066.10	
IonaMainWash	5.083	1700.99	0.21	1701.75	186.77	827.30	3738.28	1084.42	9924.13	9953.00	10066.10	10110.90
IonaMainWash	4.988	1697.95		1698.38	489.97	875.14	4669.48	105.38		9863.80	10101.20	
IonaMainWash	4.988	1698.60	0.65	1699.09	243.41	63.83	5586.17		9857.79	9863.80	10101.20	10101.20
IonaMainWash	4.901	1696.69		1696.89	474.31	2191.22	3022.00	436.78		9812.07	10024.42	
IonaMainWash	4.901	1697.39	0.69	1697.66	296.08	1635.79	4014.21		9728.34	9812.07	10024.42	10024.42
IonaMainWash	4.844	1695.44		1695.94	299.06	195.32	4732.73	721.95		9885.43	10089.66	
IonaMainWash	4.844	1696.42	0.98	1696.85	218.00	183.03	5401.59	65.37	9875.00	9885.43	10089.66	10093.00

HEC-RAS Plan: Iona Stock Tank River: Iona Stock Tank Reach: Iona Stock Tank

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
Iona Stock Tank	2.938	1781.65		1782.03	307.45	1048.73	189.37	91.90		9861.46	10015.27	
Iona Stock Tank	2.938	1782.61	0.96	1783.18	197.00	170.05	1159.95		9792.00	9861.46	10015.27	9989.00
Iona Stock Tank	2.837	1777.52		1777.74	435.12	1459.72	430.28			9950.11	10039.34	
Iona Stock Tank	2.837	1777.75	0.23	1777.99	330.72	1395.58	494.42		9702.61	9950.11	10039.34	10039.34
Iona Stock Tank	2.751	1775.23		1775.43	270.71	437.82	1452.18			9908.89	10033.08	
Iona Stock Tank	2.751	1775.38	0.15	1775.65	149.89	205.08	1684.92		9880.01	9908.89	10033.08	10033.08
Iona Stock Tank	2.674	1772.88		1773.24	364.74	471.08	1418.92			9919.24	10040.31	
Iona Stock Tank	2.674	1773.18	0.30	1773.53	195.50	394.05	1495.95		9844.81	9919.24	10040.31	10040.31
Iona Stock Tank	2.605	1769.52		1769.83	458.06	546.69	1342.58	0.73		9908.02	10023.80	
Iona Stock Tank	2.605	1770.01	0.50	1770.55	115.78		1890.00		9908.02	9908.02	10023.80	10023.80
Iona Stock Tank	2.516	1766.35		1766.53	504.31	1015.33	874.67			9927.73	10026.37	
Iona Stock Tank	2.516	1767.25	0.90	1767.54	155.49	563.98	1326.02		9870.81	9927.73	10026.37	10026.37
Iona Stock Tank	2.403	1760.92		1761.32	381.84	1672.31	216.49	1.21		9989.27	10008.14	
Iona Stock Tank	2.403	1761.77	0.86	1762.60	155.18	1455.96	434.04		9852.96	9989.27	10008.14	10008.14
Iona Stock Tank	2.314	1756.36		1756.60	346.04	536.03	887.14	466.83		9869.84	10017.68	
Iona Stock Tank	2.314	1757.08	0.73	1757.35	194.65	326.64	1369.89	193.47	9839.25	9869.84	10017.68	10033.90
Iona Stock Tank	2.188	1749.70		1750.15	395.69	367.48	1299.31	223.21		9920.02	10039.97	
Iona Stock Tank	2.188	1749.85	0.15	1750.84	119.95		1890.00		9920.02	9920.02	10039.97	10039.97
Iona Stock Tank	2.104	1746.72		1746.81	751.01	260.96	478.98	1150.07		9954.89	10034.29	
Iona Stock Tank	2.104	1747.33	0.61	1747.53	189.82	140.76	843.42	905.82	9933.14	9954.89	10034.29	10122.96
Iona Stock Tank	1.993	1744.35		1745.05	139.19	64.50	1824.44	1.06		9960.97	10051.14	
Iona Stock Tank	1.993	1744.78	0.43	1745.37	90.17		1890.00		9960.97	9960.97	10051.14	10051.14
Iona Stock Tank	1.955	1741.77		1742.30	250.73		539.54	1350.46		9966.64	10030.55	
Iona Stock Tank	1.955	1742.62	0.85	1743.23	178.62		825.68	1064.32	9966.64	9966.64	10030.55	10145.26
Iona Stock Tank	1.891	1738.57		1738.73	636.06	29.97	846.35	1013.68		9990.00	10145.55	
Iona Stock Tank	1.891	1739.34	0.77	1739.70	176.11		1695.89	194.11	9990.00	9990.00	10145.55	10166.11
Iona Stock Tank	1.797	1734.87		1735.02	677.90	181.51	870.61	837.88		9942.18	10121.66	
Iona Stock Tank	1.797	1735.73	0.87	1736.04	185.02		1834.63	55.37	9942.18	9942.18	10121.66	10127.20
Iona Stock Tank	1.714	1731.63		1731.77	789.52	865.72	765.82	258.46		9981.64	10143.00	
Iona Stock Tank	1.714	1732.32	0.70	1732.68	195.09	282.41	1607.59		9947.91	9981.64	10143.00	10143.00
Iona Stock Tank	1.631	1728.40		1728.56	794.11	1400.18	408.72	81.10		9983.94	10159.57	
Iona Stock Tank	1.631	1729.32	0.92	1729.56	290.27	740.72	1149.28		9869.30	9983.94	10159.57	10159.57
Iona Stock Tank	1.553	1725.39		1725.57	638.68	1040.02	501.10	348.88		9997.63	10169.81	
Iona Stock Tank	1.553	1725.98	0.59	1726.44	222.38	716.99	1173.01		9947.43	9997.63	10169.81	10169.81
Iona Stock Tank	1.491	1723.25		1723.40	641.43	98.97	978.01	813.02		9957.68	10134.90	
Iona Stock Tank	1.491	1724.15	0.90	1724.35	222.73		1626.61	263.39	9957.68	9957.68	10134.90	10180.41
Iona Stock Tank	1.406	1719.93		1720.20	578.68	1.61	1073.83	814.55		9935.93	10060.24	
Iona Stock Tank	1.406	1720.31	0.37	1721.06	124.31		1890.00		9935.93	9935.93	10060.24	10060.24
Iona Stock Tank	1.326	1716.81		1716.95	589.31	91.35	611.99	1186.66		9951.47	10093.60	
Iona Stock Tank	1.326	1717.55	0.74	1717.76	242.21		1012.24	877.76	9951.47	9951.47	10093.60	10193.68
Iona Stock Tank	1.24	1712.86		1713.09	680.76	495.85	460.36	933.79		9936.06	10058.23	
Iona Stock Tank	1.24	1713.39	0.53	1714.10	205.15		1206.32	683.68	9936.06	9936.06	10058.23	10141.21
Iona Stock Tank	1.154	1710.77		1710.85	507.93	122.80	1625.07	142.13		9875.58	10254.38	
Iona Stock Tank	1.154	1711.26	0.49	1711.33	378.80		1890.00		9875.58	9875.58	10254.38	10254.38
Iona Stock Tank	1.074	1709.06		1709.42	192.43	1018.13	831.42	40.45		9993.21	10052.35	
Iona Stock Tank	1.074	1709.90	0.84	1710.34	106.59	777.35	1112.65		9945.76	9993.21	10052.35	10052.35
Iona Stock Tank	.972	1706.21		1706.45	431.52	105.53	800.89	983.59		9970.58	10072.15	
Iona Stock Tank	.972	1706.94	0.73	1707.42	134.71		1462.58	427.42	9970.58	9970.58	10072.15	10105.29
Iona Stock Tank	.891	1703.28		1703.50	474.22	59.39	1210.25	620.37		9913.57	10124.10	
Iona Stock Tank	.891	1703.74	0.46	1704.08	210.53		1890.00		9913.57	9913.57	10124.10	10124.10
Iona Stock Tank	.801	1697.42		1697.82	456.55	1752.87	137.11	0.02		9996.33	10024.85	
Iona Stock Tank	.801	1698.22	0.80	1698.67	398.31	1567.81	322.19		9611.02	9996.33	10024.85	10024.85
Iona Stock Tank	.709	1695.65		1695.74	530.73	1683.58	206.10	0.32		9991.20	10054.09	
Iona Stock Tank	.709	1696.40	0.76	1696.52	280.97	1588.64	301.36		9773.12	9991.20	10054.09	10054.09
Iona Stock Tank	.679	1693.53		1693.91	539.46	1575.53	162.65	151.82		9983.30	10023.66	
Iona Stock Tank	.679	1694.34	0.81	1695.22	148.94	1466.58	423.43		9874.72	9983.30	10023.66	10023.66

HEC-RAS Plan: Iona Stock Tank River: Iona Stock Tank Reach: Iona Stock Tank (Continued)

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
Iona Stock Tank	.597	1690.03		1690.20	804.82	184.93	864.25	840.83		9895.09	10105.51	
Iona Stock Tank	.597	1690.73	0.69	1690.97	283.17		1531.78	358.22	9895.09	9895.09	10105.51	10178.26
Iona Stock Tank	.483	1685.47		1685.61	788.36	572.33	444.43	873.23		9924.03	10060.00	
Iona Stock Tank	.483	1686.23	0.76	1686.64	210.21		1199.65	690.35	9924.03	9924.03	10060.00	10134.24
Iona Stock Tank	.400	1681.55		1682.04	420.27		16.00	1874.00		9980.40	10188.18	
Iona Stock Tank	.400	1682.07	0.52	1682.55	416.80		248.12	1641.89	9980.40	9980.40	10188.18	10397.20
Iona Stock Tank	.290	1678.94		1679.15	1135.06	718.16	2691.28	3200.56		9953.90	10139.16	
Iona Stock Tank	.290	1679.07	0.13	1679.14	367.35		1386.63	503.38	9953.90	9953.90	10139.16	10321.25
Iona Stock Tank	.209	1677.01		1677.46	752.88	1779.33	1599.41	3231.26		9942.29	10011.82	
Iona Stock Tank	.209	1677.73	0.73	1678.12	573.13		1773.83	4836.17	9942.29	9942.29	10011.82	10515.42
Iona Stock Tank	.121	1674.76		1675.04	789.61	2443.33	499.44	3667.23		9973.72	10041.09	
Iona Stock Tank	.121	1675.43	0.66	1675.87	487.00	2363.89	883.91	3362.20	9854.00	9973.72	10041.09	10341.00
Iona Stock Tank	.027	1671.92		1672.29	609.17	25.56	2054.38	4530.06		9874.68	10094.73	
Iona Stock Tank	.027	1672.13	0.21	1672.59	474.82		2458.93	4151.07	9874.68	9874.68	10094.73	10349.50

7.3 Annotated Flood Insurance Maps

The most recent *Digital Flood Insurance Rate Maps (DFIRMs)* with effective date September 30, 2005 have been annotated to overlay the proposed floodplain and floodway delineations. The applicable DFIRM panels are: 04013C0687H, 04013C0689H, and 04013C0690H. They are included in the map pockets on the following pages.

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 1:9000 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.

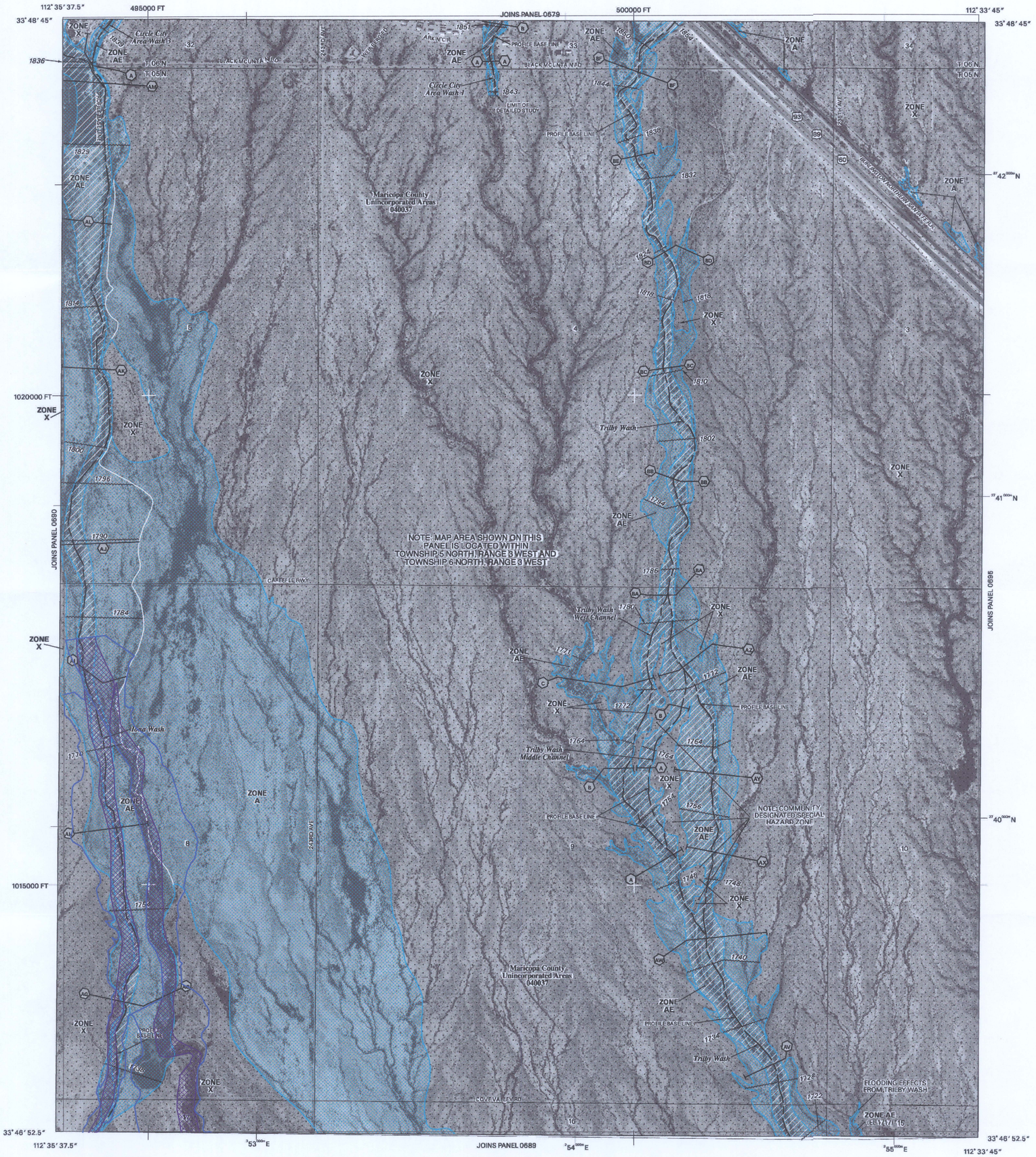
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also 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

Floodway

Floodplain



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.
$^{42}76^{000m}$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 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, December 3, 1993, 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" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0687H

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

PANEL 687 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	0687	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
04013C0687H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

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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

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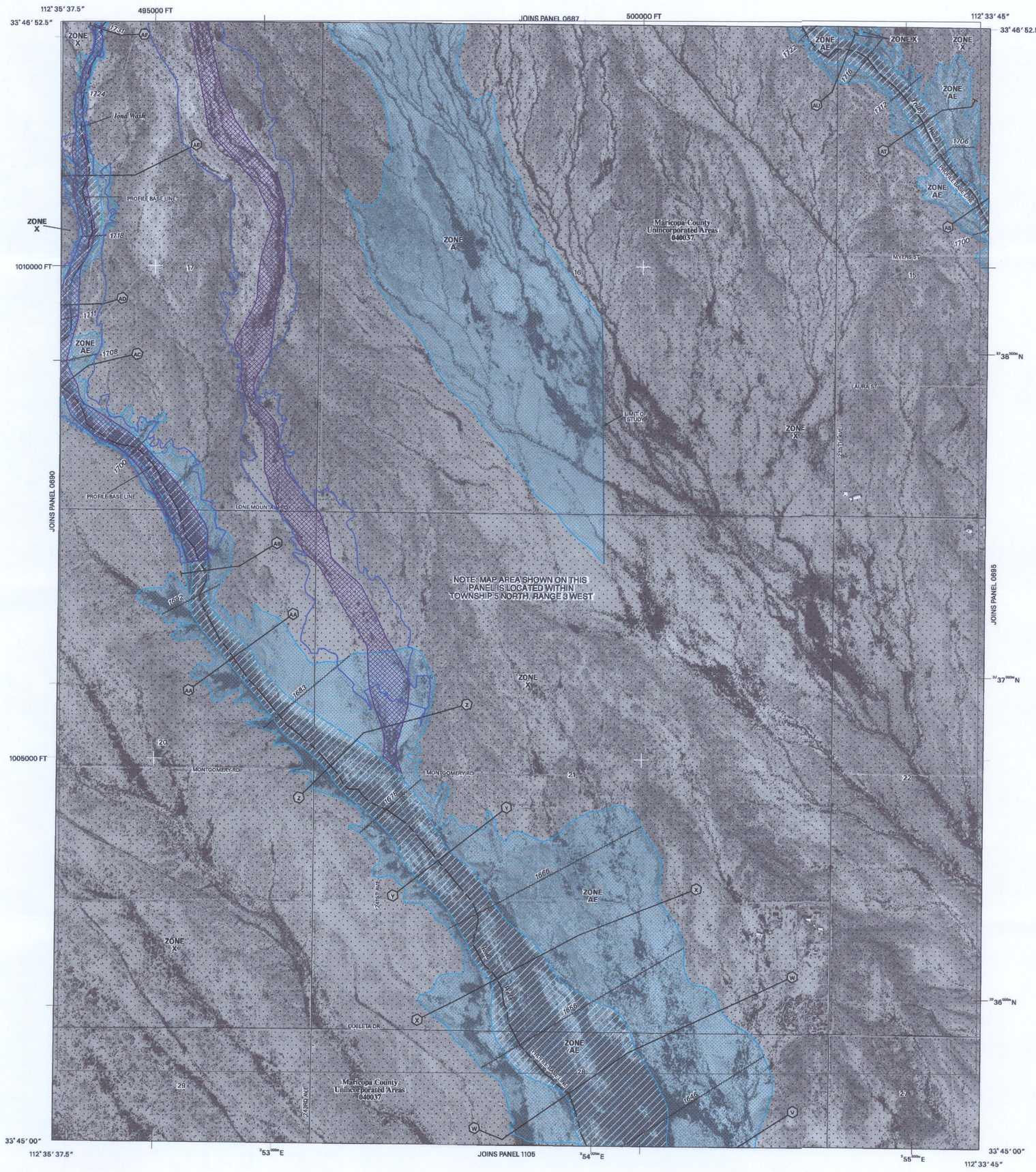
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

- Floodway
- Floodplain



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
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112° 07′ 08″, 33° 25′ 41″	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
43 76000m 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)
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 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
December 3, 1993, 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.

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MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0689H

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

PANEL 689 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	0689	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
04013C0689H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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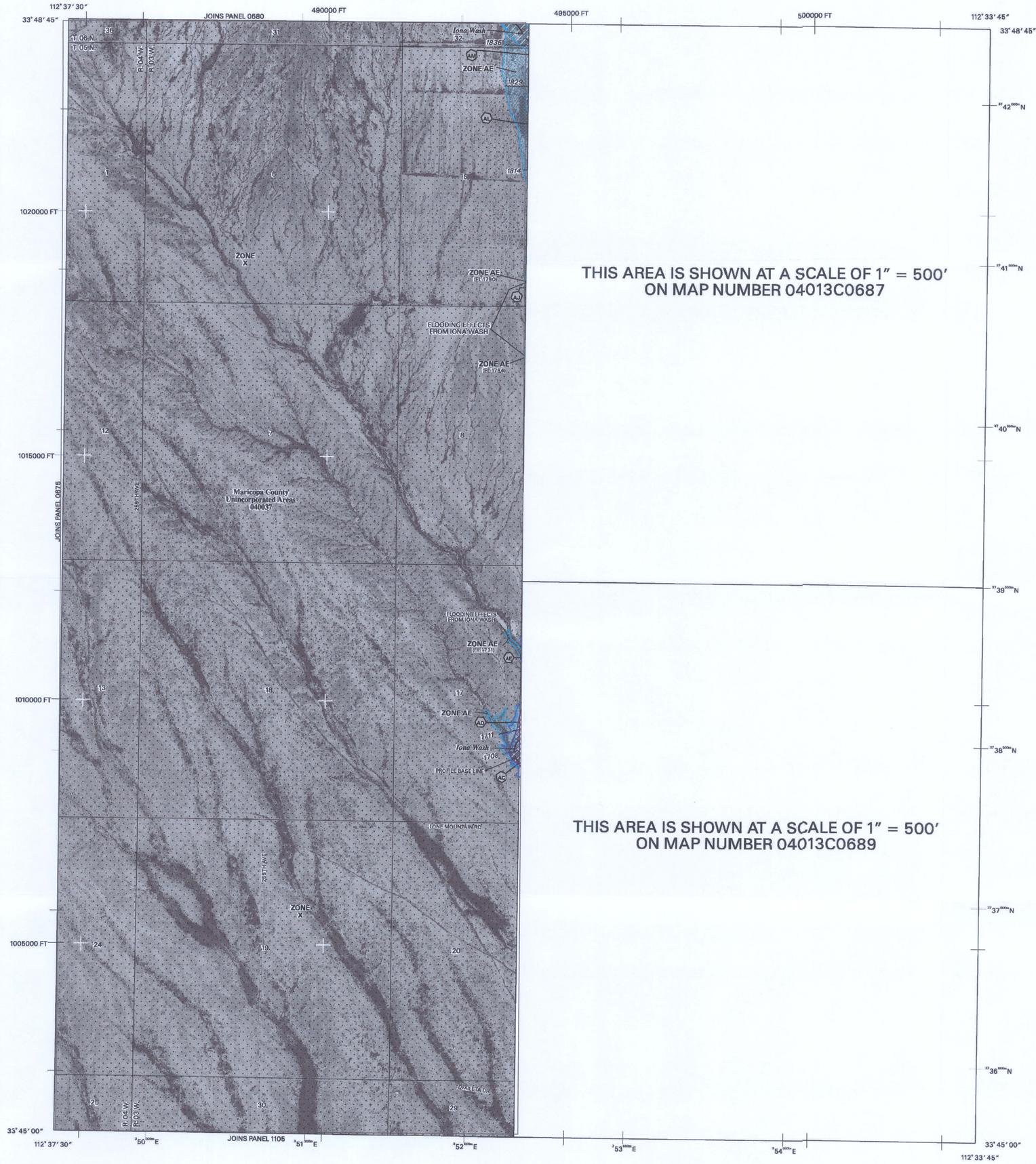
Legend

Floodway

Floodplain



THIS AREA IS SHOWN AT A SCALE OF 1″ = 500′
ON MAP NUMBER 04013C0687

THIS AREA IS SHOWN AT A SCALE OF 1″ = 500′
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LEGEND

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FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, 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.

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500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0690H

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

PANEL 690 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	0690	H

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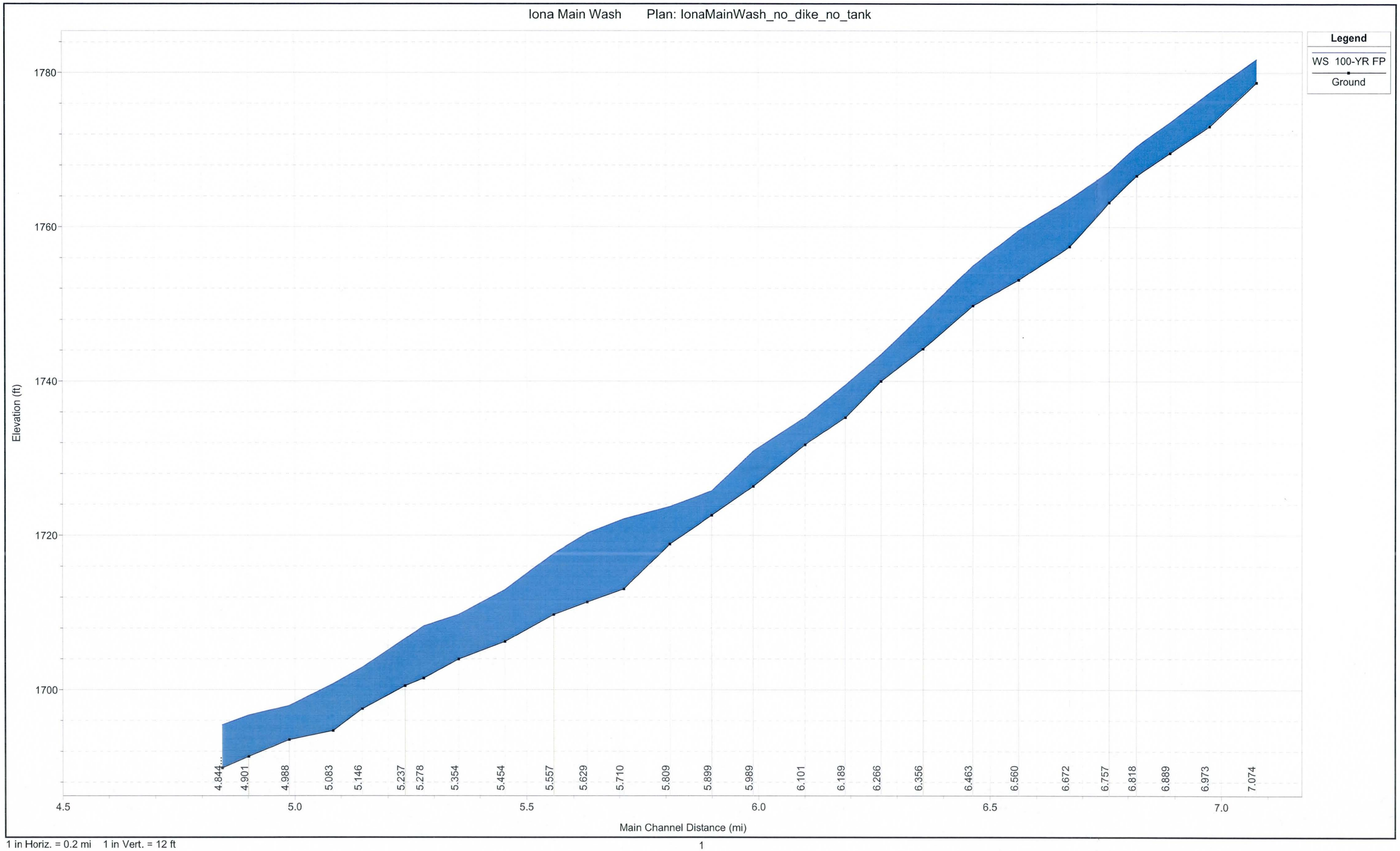
MAP NUMBER
04013C0690H
MAP REVISED
SEPTEMBER 30, 2005

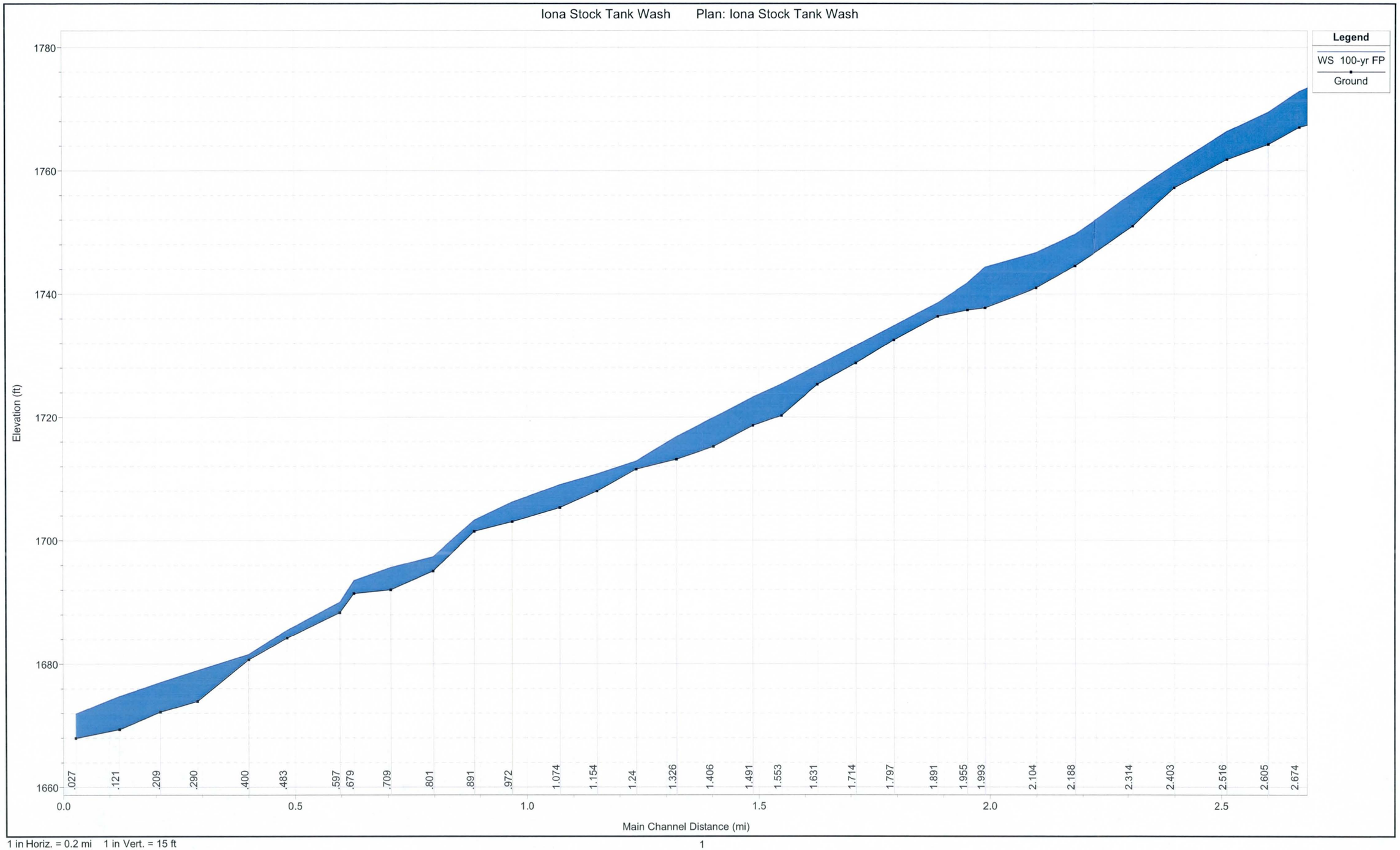
Federal Emergency Management Agency

7.4 Flood Profiles

The flood profiles were prepared from the HEC-RAS output and are included in the following pages.



1 in Horiz. = 0.2 mi 1 in Vert. = 12 ft



1 in Horiz. = 0.2 mi 1 in Vert. = 15 ft

1 in Horiz. = 0.2 mi 1 in Vert. = 15 ft

APPENDIX A. REFERENCES

A.1 Reference Documents

The following is a list of references used during the course of this study:

1 USGS DEM contour mapping composed ASCI Grid file for portions of the study area, by *Landata Inc.*, June 2002.

2 4ft contour mapping composed ASCI Grid file for portions of the study area, by Landata Inc., June 2002.

3 2ft contour mapping composed ASCI Grid file for portions of the study area, by Landata Inc., June 2002

4 U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *HEC-RAS User's Manual,* Version 4.0, March 2008.

5 U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *HEC-RAS Hydraulic Reference Manual,* Version 4.0, March 2008.

6 U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *HEC-RAS Application Guide,* Version 4.0, March 2008.

7 U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *HEC-RAS, River Analysis System, Version 4.0.0,* March 2008.

8 U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, *HEC-GeoRAS, GIS Tools for support of HEC-RAS using ArcGIS, User's Manual,* Version 4, September 2005.

9 Entellus, Inc., Wittmann Area Drainage Master Study Update, Hydrology Report Addendum, Volumes HY-1 through 3 of 3, FCD No. 2002C029, July 2005.

10 Entellus, Inc., Wittmann Area Drainage Master Study Update, Floodplain Delineations Report (a Technical Data Notebook), Volumes HD-1 through 8 of 8), FCD No. 2002C029, July 2005.

11 USGS, Thomsen, B.W. and H.W. Hjalmarson, Estimated Manning's Roughness Coefficient for Streams Channels and Flood Plains in Maricopa County, Arizona, April 1991

APPENDIX B. GENERAL DOCUMENTATION AND CORRESPONDENCE

B.1 Meeting Minutes or Reports

B.2 General Correspondence

B.3 Contract Documents

B.1 Meeting Minutes or Reports

Entellus™

2255 N. 44th Street
Suite 125
Phoenix, AZ 85008
ph (602) 244-2566
fax (602) 244-8947
web www.entellus.com

TO:	Attendees
FROM:	Entellus, Inc.
JOB NO:	310.041
DATE:	March 19th, 2009

PROJECT NAME: **Wittmann ADMP Public Meeting at Nadaburg Elementary School**

MEMORANDUM

Re: **Wittmann ADMP Public Meeting**
6:00 P.M. on March 19, 2009

Attendees:	Greg Jones	FCDMC	Hernan Aristizabal	Entellus, Inc.
	Doug Williams	FCDMC	Frank Brown	Entellus, Inc.
	Theresa Pinto	FCDMC	Chris Christensen	Entellus, Inc.
	Debbi Shortal	FCDMC	Laurie Miller	LTM
	Nicole Scheider	FCDMC	John Griffin	EPG
	Diana Stuart	FCDMC	Scott Peters	EPG
	Kathryn Gross	FCDMC		
	Felicia Terry	FCDMC		
	Jon Loxley	FCDMC		

The following is a summary of items that were discussed and concluded during the meeting of the above referenced project. If the reader's recollection of the events varies from what is stated herein, please contact Entellus with corrections by April 6th, 2009. Otherwise, this memorandum will serve as a record of the meeting.

SUMMARY OF MEETING

PROJECT POWER POINT

- Greg Jones presented the public with the project plan and the status of the project.

QUESTIONS AND ANSWERS

- The following were questions from the public that were addressed at the meeting.
  - Culvert standards?
  - Culvert sizes?
  - Who do we report flooded reports to?
  - Retroactive rules of development? If new current standards apply?
  - How can you build the best drainage structures while also being economical?
  - Do insurance companies have an interest in this study?
  - Will the design of new roadways account for drainage/floodplain?
  - Do new road designs consider drainage?
  - When will we see this kick off? What are the next steps?

- How will this project be funded? With the increase in property taxes?
- How can you tax property that has no direct benefit?
- How do you compensate owners for increased flows?
- Why wait to move forward when City of Surprise has the budget to build drainage structures?

OPEN HOUSE

- Kathryn Gross and Frank Brown answered any questions presented by the public on the most recent Iona Wash floodplain delineation and Iona Stock Tank Wash floodplain delineation, Lone Mountain Road to Carefree Highway.
- Hernan Aristizabal and Chris Christensen operated two GIS workstations, and answered resident's questions.
- The project team members were stationed at the display boards and answered the public's questions and comments.

COMMENT SHEETS

- Three forms were filled out by public attendees. All three forms indicated the public were more than satisfied with the information presented at the meeting; and no additional comments were made on the forms.

Entellus™

2255 N. 44th Street
Suite 125
Phoenix, AZ 85008
ph (602) 244-2566
fax (602) 244-8947
web www.entellus.com

TO:	Attendees
FROM:	Frank Edward Brown, PE, CFM
JOB NO:	310.041
DATE:	March 3rd, 2009

PROJECT NAME: Wittmann ADMP

MEMORANDUM

Re: Progress Meeting
1:30 PM, March 3rd, 2009
FCDMC

Attendees:

Gregory Jones	FCDMC		
Nicole Scheider	FCDMC	Brian Fry	JE Fuller
Kathryn Gross	FCDMC	Scott Peters	EPG
Denise Lacey	MCDOT	John Griffin	EPG
Burton Charron	City of Peoria	Joy Lyndes	SAGE
Jeff Davidson	City of Surprise	Hernan Aristizabal	Entellus, Inc.
Laurie Miller	LTM Engineering	Frank Brown	Entellus, Inc.

The following is a summary of items that were discussed and concluded during the meeting of the above referenced project. If the reader's recollection of the events varies from what is stated herein, please contact Entellus with corrections by March 16, 2009. Otherwise this memorandum will serve as a record of the meeting. This is the last monthly progress meeting for this project.

SUMMARY OF MEETING

- Schedule

  The current schedule for the Level III analysis was given to the Team. The schedule will be tight between now and the end on April 9th; quick review times are critical. Advance notice of submittals should be made. The Phase I hydrology comments were due three weeks ago. The third submittal is planned for March 9th, a few days ahead of schedule.

  The public meeting date is Thursday March 19th. The final submittal should incorporate input from the public meeting and comments from the incorporated cities within the project limits. A copy of the modified schedule is attached.

- Level III Analysis
  - The Analysis / Conceptual Plans were not discussed.
  - The second submittal review comments from FCDMC are promised to Entellus by Friday March 6th.

- Jon Loxely has not yet provided the wildlife corridors to Entellus; Greg will check on this. John Griffin will email Jon to let him know that this is holding up progress.
- The CAP basins were discussed. There is a conflict between the two criteria used to layout these basins (stay within Federal land and stay out of vegetated areas) for the area near US 60. The Federal land width is not sufficient to accommodate the required volume without using the vegetated area. The District instructed the consultants to try to minimize construction outside of federal land but they should meet the project objectives.

- Other Items
  - Frank Brown and Kathryn Gross privately discussed the contents of the floodplain re-study submittal made on February 27th. Comments on Iona Wash will be sent when ready (on or before March 6th) and before Iona Stock Tank-1 Wash comments, in order to speed up the floodway submittal for Iona Wash. The floodway for Iona Stock Tank-1 Wash is not authorized at this time, and may not be since the floodplain is very wide and shallow.
  - Rules of development were discussed. Greg will be sending final comments and a final draft will be presented to the public on March 19th.
  - The Hydrology Memorandum results in graph form were presented and discussed. Entellus should address the written comments and resubmit.
  - The FAQ (Frequently Asked Questions) sheet was given to Burton, Jeff and Greg. Bill Haas (Maricopa County) will be invited to review the sheet.
  - The Level II and Level III Alternatives report will be submitted in late March. Greg and Hernan will review the content of the Level II portion to ensure it adequately covers the issues.

- Action Items
  - The District to provide comments on the recent floodplain submittal by March 6th.
  - The Iona Wash Floodway presented to the public on March 19th must be final. This requires both Entellus and FCD to be diligent and prompt.
  - The District will send comments on Phase II submittal by Friday March 8th.
  - The District will revise the FAQ (Frequently Asked Questions) sheet and LTM Engineering will revise as needed.
  - The District and Hernan will meet on Monday March 9th to plan the public presentations.
  - The District will make additional copies of the FAQ sheet for the public to take home from the meeting.
  - Entellus will send the PDF files for the required public meeting documents to FCD two days before the public meeting (March 17th).
  - Rules of Development comments from the District are due Friday March 6th.
  - Jon Loxley to provide Wildlife Corridors.

ADJOURN

B.2 General Correspondence

Entellus™
2255 N. 44th Street
Suite 125
Phoenix, AZ 85008
ph (602) 244-2566
fax (602) 244-8947
web www.entellus.com

LETTER OF TRANSMITTAL

DATE	JOB NO.
April 2009	310.041

ATTENTION: Ms. Kathryn Gross

Re: Wittmann ADMP
FCD 2004C060

TO: Flood Control District of Maricopa County
Planning and Project Management Division
2801 West Durango Street
Phoenix, Arizona 85009

WE ARE SENDING YOU ☒ Attached and sent by:

☐ Shop Drawings ☐ Prints ☐ Plan ☐ Samples ☐ Specifications
☐ Copy of Letter ☐ Change Order ☐ Other _____

COPIES	DATE	NO.	DESCRIPTION
3	April 2009		Iona Wash Floodplain Delineation Lone Mtn Rd to Carefree Hwy TDN-Final
1	April 2009		Response to 4/21 Comments for Iona Wash Delineation TDN submitted April 2009 by Entellus
1	April 2009		Response to 4/20 Comments for Iona Wash Delineation TDN submitted April 2009 by Entellus
1	April 2009		Returning District TDN and Workmap Redlines

THESE ARE TRANSMITTED as checked below:

☒ For Approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution
☐ As Requested ☐ Returned for corrections ☐ Return ____ corrected prints
☐ For review and comment ☐
☐ FOR BIDS DUE ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS: These are the final documents for this additional delineation.

If you have any questions or require further information, please contact our office.

Thank you.

COPY TO: Greg Jones
Project File

Frank Edward Brown, P.E., CFM
SIGNED Frank Edward Brown

(If enclosures are not as noted, kindly notify us at once.)

April 30, 2009

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

Attn: Kathryn Gross, CFM, Senior Hydrologist, PPM Division
Subject: Iona Wash Delineation TDN submitted April 2009 by Entellus

Dear Kathryn,

This letter is in response to your dated review comments April 20, 2009. The Entellus response comments are noted as such and presented in Italics.

Entellus

Project Names\ Descriptions

1. The wash names of Iona Wash (continuing the original delineation and miles) and Iona Stock Tank Wash are acceptable.

2. In the RAS model, could the project name be revised to Iona Stock Tank Wash instead of Stock Tank Wash All?

Entellus response: The RAS project name for the Stock Tank Wash All model has been renamed to Iona Stock Tank Wash.

3. Both project descriptions appear reasonable.

4. For the final submittal please make sure that the only relevant geometry, flow and plan files are submitted and that the program does not have any warning statements regarding missing files.

Entellus response: The submitted models reflect relevant geometry, flow and plan files and have been checked to exclude warning statements and missing files.

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Iona Wash

Boundary Conditions

1. No comments.

Discharges

1. The wash names of Iona Wash (continuing the original delineation and miles) and Iona Stock Tank Wash are acceptable.

Cross Sections

1. For 7.074, please verify the Sta. 10,000 in the model and the position of the thalweg on the workmap. They do not appear to be in the same place on the cross-section.

Entellus response: These were reviewed and revised.

2. For 6.973, should there be two thalwegs for this locations? It may be better to keep this cross-section with the same channel stations for both the Iona cross-section and the Stock Tank cross-section.

Entellus response: These were reviewed and revised.

3. For 6.889, please reposition the left floodway station to the other side of the dike.

Entellus response: These were reviewed and revised.

4. For 6.266, the bank station is outside of the floodplain limit which impacts the encroachment. Please consider shifting the bank station.

Entellus response: These were reviewed and revised.

5. For 5.989, it may be more appropriate to use a levee station here. Using ineffective flow shows that flows should be included in those channels not mapped into the floodplain.

Entellus response: These were reviewed and revised.

6. For 5.809, please verify the right water surface station.

Entellus response: These were reviewed and revised. The cross section was truncated on the right side.

7. For 5.557, why was this cross –section trimmed? Still feel that flows will be in the area presently mapped out of the floodplain. Let's discuss further.

Entellus response: These were reviewed and revised.

8. For 5.278, please verify the floodway stations on the map.

Entellus response: These were reviewed and revised.

9. For 5.146, please verify the left floodway station on the map.
Entellus response: These were reviewed and revised.

10. For 5.083, please verify the right floodway station on the map.
Entellus response: These were reviewed and revised.

11. For 4.988, please verify the left floodway station on the map.
Entellus response: These were reviewed and revised.

12. For 4.901, please modify the left floodway station. It does not match the model or the tie-in.
Entellus response: These were reviewed and revised.

Cross-section Data on Map

1. For the following cross-sections the elevations given for the floodway need to be corrected.
   - 7.074, 6.973, 6.889, 6.560, 6.463, 5.809, 5.354 (sheet D18), 5.278 (sheet D18), 5.237 (sheet D28), 5.146, 5.083, 4.988, 4.901.

Entellus response: These were reviewed and revised.

BFEs

1. No comments.

Iona Stock Tank Wash

Boundary Conditions

1. No comments.

Discharges

1. No comments.

Cross-sections

1. Why was ineffective flow used for the west side of the cross sections?

- The results show right water surface stations beyond the mapped Iona floodplain limits.

- Would blocks be a better approach?

- What about levee for 2.837-2.674 and maybe ineffective beyond that?
- Further discussion is needed to figure out how this will be explained in the TDN.

Entellus response: This refers mainly to Sheet E-20. Ineffective flow option is used and should be adequately explained in the revised text.

2. For .801, the bank station is outside of the floodplain limit which impacts the encroachment. Please consider shifting the bank station.

Entellus response: These were reviewed and revised.

3. For .709, please verify the floodway stations on the map, they might be off.

Entellus response: These were reviewed, the floodway is mapped correctly, the floodplain was revised.

4. For .209, please verify the floodway stations on the map, they might be off.

Entellus response: These were reviewed and revised.

Cross-section Data on Map

1. For the following cross-sections the floodway elevation needs to be corrected.

   - .597 through .121 and 2.605 (sheet D20)

Entellus response: These were reviewed and revised.

2. For the following cross-sections the floodplain elevation needs to be corrected.
   - .290, 2.938 (sheet D20)

Entellus response: These were reviewed and revised.

Workmap Delineation Comments

1. Further discussion is needed regarding how to show the effective floodplain and potentially the data from the study on these workmaps.

Entellus response: Further discussion was included in the report regarding how the effective floodplain and the data from the study were shown on the workmaps. A note was added to Sheet E-20.

Sheet E17

1. Revise floodway boundary between .209 and .207.

Entellus response: These were reviewed and revised.

Sheet E18

1. Label the Iona cross-section without a label.

Entellus response: The label has been added.

2. Iona 5.146, revise the floodway limit shown.

Entellus response: This was reviewed and revised.

3. Stock Tank at .400 revise floodway limit shown.

Entellus response: This was reviewed and revised.

4. Add Zone X label to sheet.

Entellus response: The Zone X label has been added.

Sheet E19

1. Zone X is needed between the two delineations just north of the Stock Tank.

Entellus response: The Zone X label had been added between the two delineations.

2. In many locations the floodway and floodplain are pretty much coincident. Where the two lines are really close consider drawing them coincident to avoid tiny floodplain fringe polygons. Floodway line symbol will need to be used.

Entellus response: These were reviewed and revised.

3. Between Stock Tank 2.104 and 1.993 the thalweg is outside of the floodway. Please redraw the floodway limit.

Entellus response: The floodway limit was redrawn to include the thalweg between Stock Tank stations 2.104 and 1.993.

4. Further discussion is needed on what zone to place on the Stock Tank Berm.

Entellus response: Further discussion was added in the text regarding the zone in which the Stock Tank Berm was placed.

5. Verify the delineation between Iona 5.629 and 5.454.

Entellus response: This was reviewed and revised as necessary.

Sheet E20

1. Between 6.973 to just south of 6.889 (Iona cross-sections) the floodway line should be shown as the gutter line since the floodway and the floodplain are coincident. It may also be beneficial to have a note on the map stating that.

Entellus response: This was reviewed and revised. A note was added to Sheet E-20.

2. The gutter line for the majority for this sheet, if not all the sheet, will be the floodway symbol.

Entellus response: This was reviewed and revised.

3. Please place a Zone X label between the AE zone and the existing AO zone.

Entellus response: The Zone X label was added between the AE zone and the existing AO zone per comments noted on the map.

Sheet D18

6. No comments.

Sheet D19

7. No comments.

Respectfully Submitted,
Entellus, Inc.

Frank Edward Brown

Frank Edward Brown, PE, CFM
Project Engineer

cc: Greg Jones, PE, Project Manager, PPM Division
Project file

Intelligent Engineering
Environmental Solutions

April 30, 2009

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

Attn: Kathryn Gross, CFM, Senior Hydrologist, PPM Division
Subject: Iona Wash Delineation TDN submitted April 2009 by Entellus

Dear Kathryn,

This letter is in response to your dated review comments April 21, 2009. The Entellus response comments are noted as such and presented in Italics.

Iona Wash Delineation TDN

General

1. Please address the comments highlighted in the report.
Entellus response: Revisions have been applied to the report per comments noted and communications held over the phone and via email with the Flood Control District.

Respectfully Submitted,
Entellus, Inc.

Frank Edward Brown

Frank Edward Brown, PE, CFM
Project Engineer

Cc: Greg Jones, PE, Project Manager, PPM Division
Project file

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Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: April 21, 2009

To: Greg Jones, P.E, Project Manager, PPM Division

From: Kathryn Gross, CFM, Senior Hydrologist, PPM Division

Subject: Iona Wash Delineation TDN

I have reviewed the above submittal. Please address the comments highlighted in the report.

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: April 20, 2009

To: Greg Jones, P.E, Project Manager, PPM Division

From: Kathryn Gross, CFM, Senior Hydrologist, PPM Division

Subject: Iona Wash Delineation submitted April 8, 2009 by Entellus

I have reviewed the above submittal and have the following comments.

Project Names\Descriptions

1. The wash names of Iona Wash (continuing the original delineation and miles) and Iona Stock Tank Wash are acceptable.
2. In the RAS model, could the project name be revised to Iona Stock Tank Wash instead of Stock Tank Wash All?
3. Both project descriptions appear reasonable.
4. For the final submittal please make sure that only relevant geometry, flow and plan files are submitted and that the program does not have any warning statements regarding missing files.

Iona Wash

Boundary Conditions

1. No comments.

Discharges

1. No comments

Cross-sections

1. For 7.074, please verify the Sta. 10,000 in the model and the position of the thalweg on the work map. They do not appear to be in the same place on the cross-section.

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

2. For 6.973, should there be two thalwegs for this location? It may be better to keep this cross-section with the same channel stations for both the Iona cross-section and the Stock Tank cross-section.
3. For 6.889, please reposition the left floodway station to the other side of the dike.
4. For 6.266, the bank station is outside of the floodplain limit which impacts the encroachment. Please consider shifting the bank station.
5. For 5.989, it may be more appropriate to use a levee station here. Using ineffective flow shows that flows should be included in those channels not mapped into the floodplain. Or the floodplain map could be modified to show that area included in the floodplain.
6. For 5.809, please verify the right water surface station.
7. For 5.557, why was this cross-section trimmed? Still feel that flows will be in the area presently mapped out of the floodplain. Let's discuss further.
8. For 5.278, please verify the floodway stations on the map.
9. For 5.146, please verify the left floodway station on the map.
10. For 5.083, please verify the right floodway station on the map.
11. For 4.988, please verify the left floodway station on the map.
12. For 4.901, please modify the left floodway station. It does not match the model or the tie-in.

Cross-section Data on Map

1. For the following cross-sections the elevations given for the floodway need to be corrected.
    - 7.074, 6.973, 6.889, 6.560, 6.463, 5.809, 5.354 (sheet D18), 5.278 (sheet D18), 5.237 (sheet D28), 5.146, 5.083, 4.988, 4.901

BFEs

1. No comments.

Iona Stock Tank Wash

Boundary Conditions

1. No comments.

Discharges

No comments.

Cross-sections

1. Why was ineffective flow used for the west side of the cross-sections?
    - The results show right water surface stations beyond the mapped Iona floodplain limits.
    - Would blocks be a better approach?
    - What about levee for 2.837-2.674 and maybe ineffective beyond that?
    - Further discussion is needed to figure out how this will be explained in the TDN.
2. For .801, the bank station is outside of the floodplain limit which impacts the encroachment. Please consider shifting the bank station.
3. For .709, please verify the floodway stations on the map, they might be off.
4. For .290, please verify the floodway stations on the map, they might be off.

Cross-section Data on Map

1. For the following cross-sections the floodway elevation needs to be corrected.
    - .597 through .121 and 2.605 (sheet D20)
2. For the following cross-sections the floodplain elevation needs to be corrected.
    - .290, 2.938 (sheet D20)

BFEs

1. No comments.

Workmap Delineation Comments

1. Further discussion is needed regarding how to show the effective floodplain and potentially the data from that study on these workmaps.

Sheet E17

1. Revise floodway boundary between .209 and .207.

Sheet E18

1. Label the Iona cross-section without a label.
2. Iona 5.146, revise the floodway limit shown.
3. Stock Tank at .400 revise floodway limit shown.
4. Add Zone X label to sheet.

Sheet E19

1. Zone X is needed between the two delineations just north of the Stock Tank.

2. In many locations the floodway and floodplain are pretty much coincident. Where the two lines are really close consider drawing them coincident to avoid tiny floodplain fringe polygons. Floodway line symbol will need to be used.

3. Between Stock Tank 2.104 and 1.993 the thalweg is outside of the floodway. Please redraw the floodway limit.

4. Further discussion is needed on what zone to place on the Stock Tank Berm.

5. Verify the delineation between Iona 5.629 and 5.454.

Sheet E20

1. Between 6.973 to just south of 6.889 (Iona cross-sections) the floodway line should be shown as the gutter line since the floodway and the floodplain are coincident. It may also be beneficial to have a note on the map stating that.

2. The gutter line for the majority of this sheet, if not all the sheet, will be the floodway symbol.

3. Please place a Zone X label between the AE zone and the existing AO zone.

Sheet D18

1. No comments.

Sheet D19

1. No comments.

I have no more comments at this time.

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

April 20, 2009

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

Attn: Kathryn Gross, CFM, Senior Hydrologist, PPM Division
Subject: Iona Wash Delineation submitted March 18, 2009 by Entellus

Dear Kathryn,

This letter is in response to your dated review comments April 3, 2009. The Entellus response comments are noted as such and presented in Italics.

Iona Wash RAS Model

General

1. Update the description information. Downstream discharge listed needs to be changed. Add study name (Wittmann ADMPU) and contract number.

Entellus response: The RAS project description data was updated.

Boundary Conditions

1. The boundary condition water surface elevations are set to "known water surface". The method is acceptable and the starting water surface elevations are acceptable.

Entellus response: Due to floodway tie-in issues, the tie-in point was moved 1 cross section downstream, still using known water surface.

Discharges

1. The discharges used in the study are accepted.

Cross-section: General

1. For cross-sections 6.189 and 6.101, there is a little tributary that shows floodplain flows in it on the right side of the cross-section. Evaluate whether the tributary should be considered in the delineation. Presently the floodplain limits do not incorporate it but the RAS data shows flow there.

Entellus response: A levee was added at each of those cross sections to exclude from mapped floodplain.

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2. For cross-section 7.074, please remove the very left part of the cross-section. It is causing an extended water surface warning in the model.
Entellus response: This was resolved by copying Iona North Wash cross section at RM 0.104 into the model.

Cross-section: Lengths

1. No comments.

Cross-section: Trimming/Expanding Possibilities

1. Consider trimming cross-sections 5.083 and 4.988.
Entellus response: These two cross sections were trimmed.

2. For cross-section 5.557, the cross-section may need to be extended for flow continuity purposes between the upstream and downstream cross-sections.
Entellus response: The floodplain at the upstream cross section RM 5.629 is drawn correctly, there is high ground just downstream of the cross section, so a levee was added.

Cross-section: Bank Stations

1. For 6.818 consider shifting the main channel to the other wash on the right.
Entellus response: We wanted to avoid a 90 degree thalweg bend at about river mile 6.7.

2. For 6.757 consider shifting the main channel to the other wash on the right.
Entellus response: See response above for RM 6.818

3. For 5.146 consider shifting the left bank station to the right onto the higher elevations.
Entellus response: The bank station was moved.

Cross-section: Levees

1. Consider removing the levee station for cross-sections 6.560 and 5.629.
Entellus response: the worst case floodplain model is needed, therefore the levees are needed.

2. Consider adding a levee station for cross-section 5.809. Flows from Iona should not enter into the delineated tributary channel. If they do then the 5650 discharge should be used for this cross-section.
Entellus response: The flow rate is 1,890 cfs since Iona Tributary Wash has not yet entered the floodplain. Ineffective flow was used. This study is also remapping the

tributary floodplain as Zone A. The floodway was moved to be outside the ineffective area.

N Values

1. N-values appear reasonable.

Floodplain Delineation

1. Please verify cross-section 5.989's left water surface station in relation to the floodplain limits. I could not get a match in the stationing.

Entellus response: This will be reviewed. Ineffective flow was added for the right bank tributary.

2. A shape file is attached showing locations where the floodplain limits could be smoothed. The name of the file is "fpsmooth".

Entellus response: This will be reviewed for the final workmaps.

Floodway Modeling

1. Make sure the next submittal is converted to Method 1.

Entellus response: The Method 4 results were transferred to Method 1.

2. Cross-sections 7.074, 5.278, and 4.988 have water surface increases greater than a foot. Please modify the encroachment stations to result in a foot or less of rise.

Entellus response: All encroachments not meeting the criteria were revised in Method 4.

3. Cross-sections 6.973 and 5.083 have negative surcharges. Please modify the encroachment stations until there are no negative surcharges.

Entellus response: All encroachments not meeting the criteria were revised in Method 4.

4. For 6.889, in order to avoid overlapping floodways with the Stock Tank model move the left encroachment station to the top of the dike.

Entellus response: All encroachments not meeting the criteria were revised in Method 4. The floodway confluence for the two delineated washes needs discussion with the District.

Floodway Delineation

1. For cross-sections 5.278 and 4.988, I cannot verify the left station provided in the model with the location of the floodplain in the digital data. Please verify the floodway limits at this cross-section.

Entellus response: This will be reviewed for the final workmaps.

2. For the following, the floodway delineation extends beyond the floodplain delineation. Please revise.
   - Between cross-sections 5.899 and 5.809
   - Just south of 5.809
   - Just south of 5.629

   Entellus response: These were reviewed and revised.

In addition to the above responses, at RM 5.146 a levee was added to eliminate low lying ground not hydraulically connected. All the BFE locations were recomputed due to some changes in the water surface elevation.

Respectfully Submitted,
Entellus, Inc.

Entellus

Frank Edward Brown

Frank Edward Brown, PE, CFM
Project Engineer

Cc: Greg Jones, PE, Project Manager, PPM Division
Project file

April 20, 2009

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

Attn: Kathryn Gross, CFM, Senior Hydrologist, PPM Division
Subject: Iona Stock Tank Wash Delineation submitted March 18, 2009 by Entellus

Dear Kathryn,

This letter is in response to your review comments via email dated April 3, 2009 at 4:56 pm. The Entellus response comments are noted as such and presented in Italics.

Iona Stock Tank Wash

1. Discharge assignments are reasonable.

2. n values used are reasonable.

3. Adjust length for .709
Entellus response: The downstream distances were revised.

4. We need to discuss why ineffective flow was used for the worst case scenario versus a levee station at the dike. Go ahead and submit as is for next week. I will discuss with Tim.
Entellus response: Entellus would like to discuss this with the District.

5. 2.104 – add more cross-section data on the left. The cross-section is extended. Check for other extended data on effective side of other cross-sections (I did not see any others but I was reviewing fast).
Entellus response: The left end was extended. Other cross sections were extended on the left, as well.

6. 1.553 – move left bank station up a little bit (to the right)
Entellus response: Bank station was moved.

Entellus

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7. .680 – GIS has this station as .679 verify which is correct and make the necessary correction to either the model or the GIS data
Entellus response: The correct label is RM 0.679, maps and models now match.

8. .680 – move levee station to 10644 or trim to 10644
Entellus response: Cross section was truncated.

9. .597 – trim excess, remove levee
Entellus response: The cross section is trimmed on right side, less than one inch of vertical extension results.

10. .483 – trim excess, remove levee, right side will still need to have additional ground data added for continuity of flow from upstream cross-section. Follow the 1686 contour not old x-sec data
Entellus response: The cross section was trimmed, levee removed, Entellus does not believe the floodplain spreads that wide, since in-house models were run only with the 1,890 cfs flow to determine the true confluence location. Cross section end delimiters (bars) will be added to the final workmaps for RM 0.483 and RM 0.400, since the cross sections are no longer shared with Iona Wash.

Entellus™

11. .4 – trim excess, remove levee.
Entellus response: Refer to the response above.

12. I do not see the need for .21-.027 but still submit as is for next week. I will discuss with Tim.
Entellus response: These cross sections are necessary to tie-in the floodway.

13. Did not get a chance to review delineation in regards to comparing to RAS Water Surface Stations. Please make sure limits of floodplain make the reported water surface stations in the RAS output.
Entellus response: These were reviewed will be reviewed once again for the final workmaps.

14. For floodway model, I did not get a chance to review. Most likely since there was very few issues with the Iona if same practices were applied comments would be minimal. Make sure there are no greater than 1 increases or negative surcharges.
Entellus response: All encroachments not meeting the criteria were revised in Method 4.

15. Check to see if floodway extends above cross-section data. Most likely we should not allow that.

Entellus response: We understood this to be no vertical extensions for the floodplain and cross sections not meeting that criterion were revised, except as noted in this letter.

16. Make sure to run floodway model in method 1 after method 4.

Entellus response: The Method 4 results were transferred to Method 1.

17. Make sure floodway limits match encroachment stations reported in RAS output. And that there are no weird changes to floodway width between cross-sections.

Entellus response: These were reviewed will be reviewed once again for the final workmaps. Floodway width changes between adjacent cross sections will be reviewed for the final workmaps, and there may be some limits to modifications due to foldaway criteria.

Entellus

Respectfully Submitted,

Entellus, Inc.

Frank Edward Brown

Frank Edward Brown, PE, CFM
Project Engineer

Cc: Greg Jones, PE, Project Manager, PPM Division
Project file

B.3 Contract Documents

Entellus
ENTELLUS, INC.

Tel: 602.244.2566
Fax: 602.244.8947

Flood Control District of Maricopa County
Wittmann Area Drainage Master Plan
Entellus Project No. 310.041
CHANGE ORDER NO. 5
Iona Wash Delineation

December 12, 2008

PROJECT SCOPE OF WORK

Phase

The Consultant shall provide floodplain and floodway delineation for a portion of Iona Wash and for the Stock Tank Wash that splits from Iona Wash and confluences with Iona Wash. See Attachment No. 1 for locations of the two reaches. The scope of work shall include data collection and review, hydrology, floodplain and floodway delineations (For Iona Wash only), and a Technical Data Notebook. Stock Tank Wash will include floodplain delineations, but the floodway delineations as an OPTIONAL.

1.0 Data Collection

1.1 *Collect/Review Existing Data*

The Consultant will gather and review information that pertains to the study area. The information reviewed will consist primarily of HEC-RAS models for the affected reaches and hydrology models as part of the Wittmann Area Drainage Master Plan Update (WADMSU).

2.0 Survey

2.1 *General*
Survey is not a part of this scope.

2.2 *Survey Control*
Survey is not a part of this scope.

2.3 *Surveys*
Survey is not a part of this scope.

3.0 Mapping

3.1 *General*
No new aerial topography or topographic mapping will be generated as part of this change order. Mapping information will be based on the original mapping developed under the WADMSU contract.

3.2 *Conversion of DTM to GIS format*
The Consultant will use the DTM data originally received as part of the WADMSU as delivered in *.pf and *.lf format. The original files were extracted using AutoCAD and saved as points and lines in AutoCAD format. The points and lines will be converted to GIS format to be used with HEC-GeoRAS in ArcMap.

Entellus
ENTELLUS, INC.

Tel: 602.244.2566
Fax: 602.244.8947

Flood Control District of Maricopa County
Wittmann Area Drainage Master Plan
Entellus Project No. 310.041
CHANGE ORDER NO. 5
Iona Wash Delineation

December 12, 2008

PROJECT SCOPE OF WORK

Phase

4.0 Hydrology

4.1 *Review Existing Data*

No new hydrology will be generated as part of this change order. Hydrology information will be based on the original hydrology developed under the WADMSU contract. The 100yr-24hr and 100yr-6hr existing condition models will be reviewed to determine which storm controls for each reach. The hydrology model used will be called the controlling storm.

4.2 *Hydrologic Analysis*
The Consultant will use the controlling storm to model the reaches. The controlling storm model will be modified in areas where needed based on more detailed information. More detailed information may consist of split flow, with levee and without levee conditions, a new flow location within the reach, etc.

4.3 *Technical Data Notebook*

The Consultant will include hydrology information which will be documented in (Phase 4) the TDN report. Also, any supporting information will be included in the Appendices.

5.0 Floodplain, Floodway Delineation

The Consultant will create hydraulic models for a portion of Iona Wash and the Stock Tank Wash.

Floodplain and Floodway delineations will be modeled for Iona Wash.

Floodplain delineation will be modeled for Stock Tank Wash. Iona Wash will look at two scenarios - with or without levee conditions at the location of the Diversion Dike; also two scenarios will be looked at the Stock Tank - the Stock Tank failure (flow goes towards Iona Wash immediately downstream of the Stock Tank) or Stock Tank non-failure (flow continues within Stock Tank Wash south to confluence of Iona Wash). In both cases, the worst case scenario for floodplain conditions will be shown on the work maps.

5.1 *Delineation of Floodplain and Floodway (Additional Delin. Iona Wash)*
The Consultant will create a hydraulic model for the Iona Wash portion that connects the delineation already done as part of the WADMSU both upstream and downstream, approximately 2.5 linear miles. Both floodplain and floodway delineation will be modeled for this reach. The floodway surcharge for this reach will be 1.0 feet or less.

5.2 *Delineation of Floodplain (Stock Tank Wash w/ levee conditions) - Floodway Delineation will not be performed until AUTHORIZED BY THE DISTRICT*
The Consultant will create a hydraulic model for the wash considering both with levee conditions at the Diversion Dike. Also, the hydraulic model will consider non-failure at the location of the Stock Tank. Stock Tank Wash will tie into Iona Wash at the downstream end which was already delineated as part of the WADMSU. The worst case scenario at both locations, the Diversion Dike and the Stock Tank, will be shown on the map for floodplain conditions (between Phases 5.2 or 5.3).
Floodway delineation will be shown on map for the worst case scenario for either (Phases 5.2 or 5.3) and will not be performed until authorized by the District.

Entellus
ENTELLUS, INC.

Tel: 602.244.2566
Fax: 602.244.8947

Flood Control District of Maricopa County
Wittmann Area Drainage Master Plan
Entellus Project No. 310.041
CHANGE ORDER NO. 5
Iona Wash Delineation

December 12, 2008

PROJECT SCOPE OF WORK

Phase

5.3 *Delineation of Floodplain (Stock Tank Wash w/out levee conditions) - Floodway Delineation will not be performed until AUTHORIZED BY THE DISTRICT*
The Consultant will create a hydraulic model for the wash considering without levee conditions at the Diversion Dike. Also, the hydraulic model will consider failure at the location of the Stock Tank. Stock Tank Wash will tie into Iona Wash at the downstream end which was already delineated as part of the WADMSU. The worst case scenario at both locations, the Diversion Dike and the Stock Tank, will be shown on the map for floodplain conditions (between Phases 5.2 or 5.3).
Floodway delineation will be shown on map for the worst case scenario for either (Phases 5.2 or 5.3) and will not be performed until authorized by the District.

5.4 *Field reconnaissance*

The Consultant will conduct a field reconnaissance of the study reach. This will include observation of channel and floodplain conditions for estimating Manning's "n" values: photographic documentation of floodplain characteristics, determination of channel bank location, observation of possible overflow areas, inspection of levees, inspection of stock tanks, or other flood control structures, and estimates of bridge/culvert dimensions if any.

5.5 *Cross-Sections*
The Consultant will generate the cross-sections using GIS data as mentioned in (Phase 3.0). Additionally, the Consultant will perform field surveys to supplement and verify the cross-section data. Cross Sections for the reaches mentioned in (Phase 5.1), (Phase 5.2), and (Phase 5.3) will be cut at no more than 500 feet apart.

5.6 *Hydraulic Modeling*
The Consultant will create HEC-RAS models for the reaches mentioned in (Phase 5.1), (Phase 5.2), and (Phase 5.3). The levee will be incorporated into the Stock Tank Wash to meet FEMA's criteria and the worst case scenario between the with levee or without levee conditions will be shown on the work maps.

5.7 *Technical Data Notebook*

The Consultant will include hydraulics information which will be documented in (Phase 5) the TDN report. Also, any supporting information will be included in the Appendices.

5.8 *FEMA Forms*
The Consultant will include the necessary FEMA Forms to be included in (Phase 2) of the TDN report.

5.9 *Work Maps*
The Consultant will create approximately 10 worksheets (includes cover sheet) which will be updated/modified at 200 feet scale. The worksheet map number will correspond to the WADMSU index grid.

Entellus
ENTELLUS, INC.

Tel: 602.244.2566
Fax: 602.244.8947

Flood Control District of Maricopa County
Wittmann Area Drainage Master Plan
Entellus Project No. 310.041
CHANGE ORDER NO. 5
Iona Wash Delineation

December 12, 2008

PROJECT SCOPE OF WORK

Phase

6.0 Deliverables

6.1 *District Submittal*
The Consultant will deliver one (1) set of the DRAFT Technical Data Notebook along with blackline topographic base maps to the District for review.

6.1.1 *GIS Deliverables in CAD format*
The Consultant will deliver AutoCAD files that include any new/updated hydraulics information to the District. The deliverables will follow the GIS deliverables as described under the *Computer Aided Drafting & Design (CADD), Data Delivery Specifications, Rev. 1.0, January 2000 as prepared by FCDMC*.

6.2 *FEMA Submittal*
The Consultant shall 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.

6.2.1 *Two (2) sets topographic base maps*
Two complete sets of blackline topographic base maps with the inundation limits will be shown. All drawings will be signed and sealed by persons of appropriate professional registration(s).

6.2.2 *Two (2) copies technical data notebook*
Two complete sets of the Technical Data Notebook. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). These copies will be updated if necessary, based upon FEMA's review comments. Completed FEMA forms will be included in the notebooks.

6.2.3 *CD with maps & digital data*

A CD/DVD will be provided with maps and digital data including models and calculations.

7.0 Project Management & Coordination

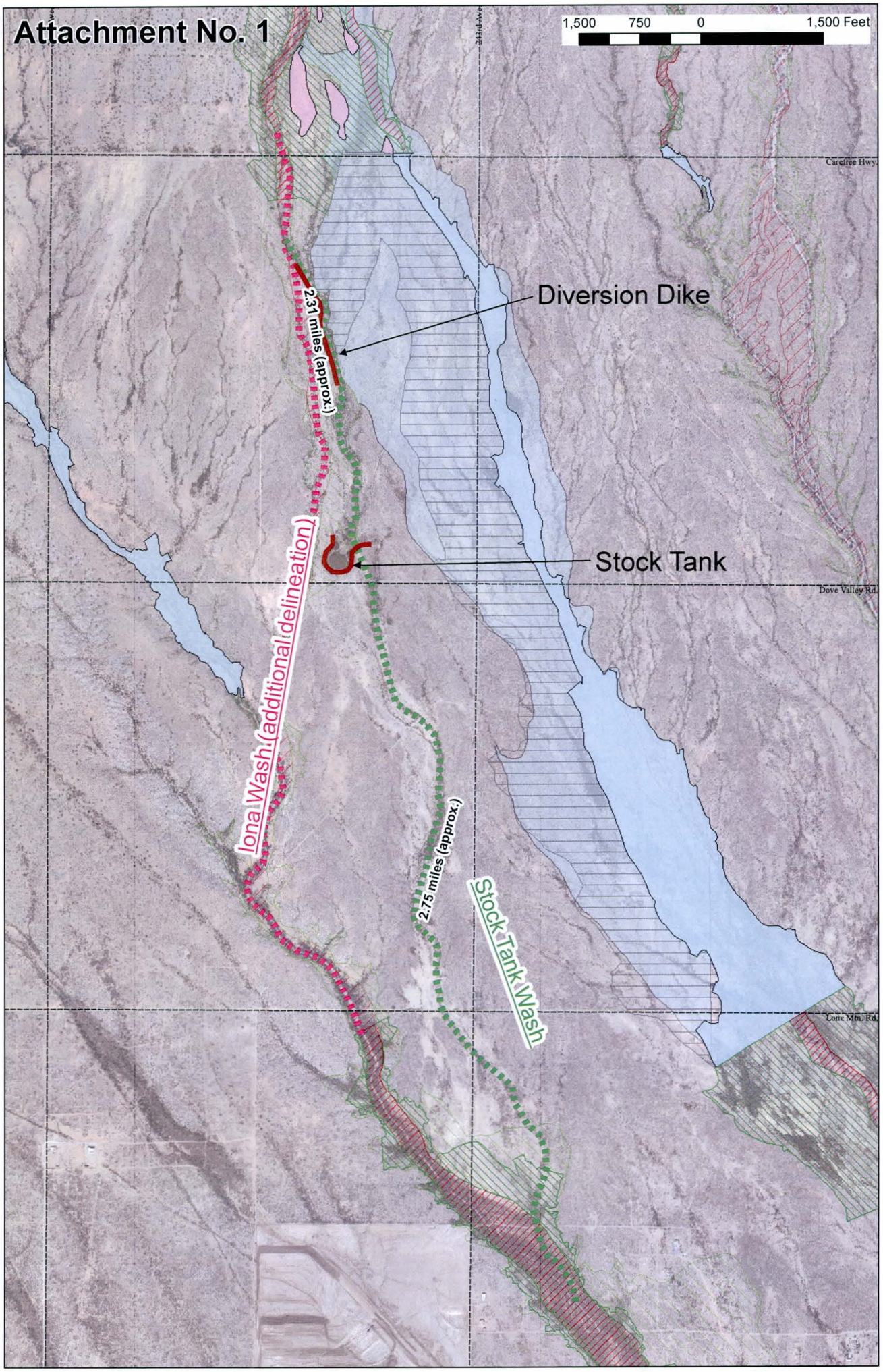
7.1 *Management & Coordination*

The Consultant will provide the District a monthly progress report. The Consulant team will also attend up to two (2) interim progress meetings and one (1) final meeting at the District. The Consultant will prepare material for and attend one (1) presentation.

8.0 Watershed Summary Map

8.1 *Summary Map*
The Consultant will provide the District a map that shows the flows, concentration points, hydrology subbasins, aerials, streets, etc.

Attachment No. 1



AFFIDAVIT OF PUBLICATION

IONA WASH

01

Arizona Business Gazette
The business resource

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

Iona Wash - Lone Mountain to Carefree Highway Floodplain Delineation
Legal Ad

ANNOUNCEMENT OF PUBLIC MEETING TO PRESENT RESULTS OF FLOODPLAIN DELINEATIONS FOR A PORTION OF IONA WASH IN UNINCORPORATED MARICOPA COUNTY, AZ

The Flood Control District of Maricopa County (DISTRICT), under authority of the National Flood Insurance Act of 1968 (PL-90-448), as amended, and the Flood Disaster Protection Act of 1973 (PL93-234) is funding a detailed floodplain/floodway delineation study for a portion of Iona Wash between Lone Mountain Road and Carefree Highway. The DISTRICT has contracted with Entellus Engineering to carry out the study under the Wittmann Area Drainage Master Plan Update (FCD 2004C068).

The study is complete and has evaluated the extent of flood-prone areas. The results will be used by local jurisdictions to regulate development within the identified floodplain and will be submitted to the Federal Emergency Management Agency (FEMA) in order to update the Flood Insurance Rate Maps (FIRMs), which are used to determine Federal flood insurance rates. The study area is bounded by Carefree Highway on the north, Lone Mountain on the south, 251st Avenue on the west, and 243rd Avenue on the east. This announcement is intended to inform all interested persons and communities of a public meeting where results will be presented. The public meeting is to be held on March 19, 2009; 6pm to 8pm. The location is Nadaburg Elementary School, 21419 W. Dove Valley, Wittmann, AZ. The contact person for this project is Mr. Greg Jones, P.E., Project Manager at the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009, or e-mail: gj@mail.maricopa.gov, or phone (602)

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.

3/12/2009

Mark Gilmore

Sworn to before me this
12TH day of
MARCH 2009

Marilyn Greenwood
Notary Public
Maricopa County, Arizona
My Comm. Expires 05-23-11

Marilyn Greenwood
Notary Public

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

Flood Control District
of Maricopa County

ww.fcd.maricopa.gov
!801 West Durango Street
'hoenix, Arizona 85009
'hone: 602-506-1501
'ax: 602-506-4601
TT: 602-505-5897

Click here and type date

Click here and type the Addressse's Name
Click here and type the Street Address
Click here and type the City, State ZIP Code

Dear Click here and type the Salutation:

The Flood Control District of Maricopa County (District) invites all interested persons to attend an open house presenting the results of the updated floodplain/floodway delineation performed for a portion of Iona Wash in northwestern Maricopa County. Based on property ownership records, your property is near or within this recently updated floodplain/floodway.

The District is hosting an open house from 6:00-7:30 p.m. at Nadaburg Elementary School on March 19, 2009 for all property owners located near or within the floodplain delineation. Exhibits of the floodplain delineation will be on display and representatives from the District will be available to answer any questions. The meeting is being conducted in conjunction with the presentation of the Recommended Alternatives associated with the Wittmann Area Drainage Master Plan Update.

The delineation study area is generally bounded by Carefree Highway on the north, one-quarter mile south of Lone Mountain Road on the south, 251st Avenue on the west, and 243rd Avenue on the east.

The study resulted in approximately 2 miles of detailed Zone AE floodplain/floodway along Iona Wash and approximately 2 miles of detailed Zone AE floodplain along Iona Stock Tank Wash

The District's delineation study will be submitted to the Federal Emergency Management Agency (FEMA) for adoption. The approval process may take one year or longer. FEMA will use the study data to update the Flood Insurance Rate Maps for the National Flood Insurance Program. In the interim the District and other jurisdictions will use the data as the "best available information" for floodplain management. Persons with buildings on their property in the updated Iona Wash floodplain/floodway will not be required to purchase flood insurance until after the floodplain is adopted by FEMA and the Flood Insurance Rate Maps are updated. The District, however, recommends that property owners protect buildings on their property with flood insurance.

If you have any questions about the delineations please contact Kathryn Gross, Senior Hydrologist, at (602) 506-4837 or by email at kag@mail.maricopa.gov; or Greg Jones, Project Manager, at (602) 506-5537 or by email at glj@mail.maricopa.gov.

Yours truly,

Kathryn Gross

APN	ADDRESS	CITY	STATE	ZIP
50330012	P O BOX 751	TONOPAH	AZ	853540751
50329008, 50329009, 50329010, 50329013	1400 E SOUTHERN AVE STE 720	TEMPE	AZ	852825679
50329014B	6918 N HIGHLANDS DR	PARADISE VALLEY	AZ	85253
50329003A	18124 WEDGE PKWY	RENO	NV	895118134
50329002D	PO BOX 754	WITTMANN	AZ	853610754
50330018E	7272 E GAINEY RANCH RD UNIT 17	SCOTTSDALE	AZ	852581505
50329014A	6918 N HIGHLANDS DR	SCOTTSDALE	AZ	852533263
50329015	PO BOX 118	MORRISTOWN	AZ	853420118
50330007A, 50330007B	34912 N 14TH ST	PHOENIX	AZ	850869297
50330011B	3302 W DALEY LN	PHOENIX	AZ	850271057
50330018G, 50330018H	7127 E SHEA BLVD STE 102	SCOTTSDALE	AZ	85254
50330018Q, 50330018R	14415 W MANDALAY LN	SURPRISE	AZ	853795709

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Federal Emergency Management Agency

Washington, D.C. 20472

February 8, 2011

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Don Stapley
Chairman, Maricopa County Board of Supervisors
301 West Jefferson Street
Phoenix, AZ 85003

IN REPLY REFER TO:
Case No.: 10-09-1720P
Community Name: Maricopa County, AZ
Community No.: 040037
FIRM Panel Affected: 04013C0687H,
04013C0689H,
04013C0690H

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Dear Mr. Stapley:

In a Letter of Map Revision (LOMR) dated September 17, 2010, you were notified of proposed modified flood elevation determinations affecting the Flood Insurance Rate Map (FIRM), and Flood Insurance Study (FIS) report for Maricopa County, AZ. These determinations were for Iona Wash - from approximately 580 feet downstream of Lone Mountain Road to approximately 11,200 feet upstream; and Iona Stock Tank Wash - from approximately 4,520 feet downstream of Lone Mountain Road to approximately 10,530 feet upstream. The 90-day appeal period that was initiated on October 7, 2010, when the Department of Homeland Security's Federal Emergency Management Agency (FEMA) published a notice of proposed Base Flood Elevations (BFEs) in *The Arizona Business Gazette*, has elapsed.

FEMA received no valid requests for changes to the modified BFEs. Therefore, the modified BFEs that became effective on February 4, 2011, remain valid and revise the FIRM and FIS report that were in effect prior to that date.

The modifications are pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. The community number(s) and suffix code(s) are unaffected by this revision. The community number and appropriate suffix code as shown above will be used by the National Flood Insurance Program (NFIP) for all flood insurance policies and renewals issued for your community.

FEMA has developed criteria for floodplain management as required under the above-mentioned Acts of 1968 and 1973. To continue participation in the NFIP, your community must use the modified BFEs to carry out the floodplain management regulations for the NFIP. The modified BFEs will also be used to calculate the appropriate flood insurance premium rates for all new buildings and their contents and for the second layer of insurance on existing buildings and their contents.

If you have any questions regarding the necessary floodplain management measures for your community or the NFIP in general, please call the Director, Mitigation Division of FEMA in Oakland, California at (510) 627-7103.

If you have any questions regarding the LOMR, the proposed modified BFEs, or mapping issues in general, please call the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

cc: Mr. Timothy S. Philips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Ms. Kathryn Gross, P.E.
Senior Hydrologist
Flood Control District of Maricopa County

Mr. Ted Collins, CFM
Principal Floodplain Coordinator
Flood Control District of Maricopa County

Mr. Jeff Shelton, P.E.
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM
NFIP State Manager
Arizona Department of Water Resources

Mr. Frank Edward Brown, P.E.
Project Manager
Entellus, Inc.

Federal Emergency Management Agency

Washington, D.C. 20472

September 17, 2010

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Don Stapley
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson Street
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	10-09-1720P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	**February 4, 2011**

Dear Mr. Stapley:

The Flood Insurance Study report and Flood Insurance Rate Map for your community has been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Roy E. Wright
Deputy Director, Risk Analysis
Federal Insurance and Mitigation Administration

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

FLOOD CONTROL DISTRICT
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	FMS		P & PM
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ROUTING			

List of Courtesy Copies – Maricopa County, AZ

Mr. Timothy S. Philips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Ms. Kathryn Gross, P.E.
Senior Hydrologist
Flood Control District of Maricopa County

Mr. Ted Collins, CFM
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Arizona Department of Water Resources

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Project Manager
Entellus, Inc.

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Maricopa County Arizona (Unincorporated Areas)	CHANNELIZATION FILL	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040037		
IDENTIFIER	Whittmann Area Drainage Master Plan	APPROXIMATE LATITUDE & LONGITUDE: 33.781, -112.592 SOURCE: Other DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 04013C0687H	DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005
TYPE: FIRM*	NO.: 04013C0689H	DATE: September 30, 2005	PROFILE(S): 950P - 951P, 1700P - 1701P
TYPE: FIRM*	NO.: 04013C0690H	DATE: September 30, 2005	FLOODWAY DATA TABLE: 5
			SUMMARY OF DISCHARGES TABLE: 3

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES) See Page 2 for Additional Flooding Sources

Iona Wash - from approximately 580 feet downstream of Lone Mountain Road to approximately 11,200 feet upstream

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Iona Wash	Zone AE	Zone AE	YES	YES
	BFEs*	BFEs	YES	YES
	Floodway	Floodway	YES	YES
	Zone A	Zone A	YES	NONE

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

118749 PT202.BKR.10091720P.H05 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Iona Stock Tank Wash - from approximately 4,520 feet downstream of Lone Mountain Road to approximately 10,530 feet upstream

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Iona Stock Tank Wash	No BFEs*	BFEs	YES	NONE
	No Floodway	Floodway	YES	NONE
	Zone A	Zone AE	YES	NONE
	Zone X (unshaded)	Zone AE	YES	NONE

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic analysis. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

This revision has met our criteria for removing an area from the base floodplain to reflect the placement of fill. However, we encourage you to require that the lowest adjacent grade and lowest floor (including basement) of any structure placed within the subject area be elevated to or above the Base Flood Elevation.

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRMs and FIS reports for your community and other incorporated communities in Maricopa County, will be submitted to your community for review in October 2010. We will incorporate the modifications made by this LOMR into the countywide FIRM and FIS report before they become effective.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Iona Wash	Approximately160 feet upstream of Lone Mountain Road	1,697	1,696	04013C0689H
	Approximately10,800 feet upstream of Lone Mountain Road	1,777	1,778	04013C0687H
Iona Stock Tank Wash	Approximately 1,850 feet downstream of Lone Mountain Road	NONE	1,684	04013C0689H
	Approximately 10,300 feet upstream of Lone Mountain Road	NONE	1,775	04013C0687H

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below. Please refer to FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp for a more detailed description of proposed BFE changes, which will be posted approximately within a week of the date of this letter.

LOCAL NEWSPAPER Name: *The Arizona Business Gazette*
Dates: 09/30/2010 and 10/07/2010

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Table 3. Summary of Discharges (Continued)

Flooding Source/Location	Drainage Area (Sq. Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Iona Wash					
At Granite Reef Aqueduct (downstream)	31.3	--[1]	--[1]	5,001	--[1]
At Granite Reef Aqueduct (upstream)	31.3	--[1]	--[1]	5,309	--[1]
Approximately 4,000 feeet downstream of Lone Mountain Road	23.8	--[1]	--[1]	5,360	--[1]
Approximately 4,000 feet upstream of Lone Mountain Road	22.1	--[1]	--[1]	4,915	--[1]
At State Route 89	8.9	--[1]	--[1]	2,371	--[1]
Iona Stock Tank Wash					
Approximately 4,000 feet upstream of Lone Mountain Road	23.8	--[1]	--[1]	6,610	--[1]
Monarch Wash					
Approximately 2,500 feet upstream of Hassyampa River	10.73	--[1]	--[1]	3,832	--[1]
Approcimately 20,000 feet upstream or U.S. Highway 60/89	2.31	--[1]	--[1]	1,590	--[1]
Ox Wash					
At Hassyampa River	6.61	--[1]	--[1]	4,447	--[1]
Approximately 1,000 feet downstream of U.S. Highway 60/89	5.62	--[1]	--[1]	4,406	--[1]
Approximately 7,200 feet upstream of U.S. Highway 60/89	3.9	--[1]	--[1]	3,350	--[1]
Powder House Wash Tributary 1					
At Powder House Wash	--[1]	--[1]	--[1]	222	--[1]
Powder House Wash Tributary 2					
At Powder House Wash	--[1]	--[1]	--[1]	133	--[1]
Rio Verde North Wash A					
At Verde River	5.39	--[1]	--[1]	1,140	--[1]

REVISED DATA

REVISED TO REFLECT LOMR EFFECTIVE: February 4, 2011

--[1] Not Computed

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Iona Wash (Cont'd)								
AA	40,301	265	1,380	3.8	1,688.5	1,688.5	1,689.5	1.0
AB	41,314	414	783	6.6	1,693.9	1,693.9	1,694.8	0.9
AC	42,219	243	1,005	5.3	1,696.1	1,696.1	1,696.7	0.6
AD	43,534	182	636	8.9	1,704.7	1,704.7	1,705.0	0.3
AE	45,354	129	743	7.6	1,718.4	1,718.4	1,718.9	0.5
AF	47,254	79	350	5.4	1,729.0	1,729.0	1,729.9	0.9
AG	48,714	82	217	8.7	1,741.6	1,741.6	1,741.9	0.3
AH	50,864	122	317	6.0	1,761.8	1,761.8	1,762.3	0.5
AI	52,984	197	229	5.8	1,779.9	1,779.9	1,780.7	0.8
AJ	54,122	255	314	2.1	1,789.9	1,789.9	1,790.3	0.4
AK	56,091	79	207	3.4	1,807.9	1,807.9	1,808.8	0.9
AL	57,706	365	652	3.3	1,822.1	1,822.1	1,823.1	1.0
AM	59,169	334	1,002	2.4	1,835.0	1,835.0	1,836.0	1.0
AN	60,509	358	288	2.9	1,844.2	1,844.2	1,845.2	1.0
AO	61,924	336	542	3.3	1,857.6	1,857.6	1,858.0	0.4
AP	63,612	528	412	5.8	1,874.8	1,874.8	1,875.4	0.6
AQ	64,441	126	304	7.8	1,882.6	1,882.6	1,883.5	0.9
AR	66,405	163	428	5.5	1,903.4	1,903.4	1,903.7	0.3
AS	67,872	52	208	11.4	1,918.9	1,918.9	1,919.2	0.3
Iona Stock Tank Wash								
A	3,180[2]	283	475	4.0	1,688.1	1,688.1	1,688.8	0.7
B	6,575[2]	205	281	6.7	1,711.0	1,711.0	1,711.5	0.5
C	10,015[2]	176	396	4.8	1,736.7	1,736.7	1,737.4	0.7
D	14,155[2]	195	402	4.7	1,771.0	1,771.0	1,771.3	0.3

REVISED DATA

REVISED DATA

[1]Feet Above Mouth

[2]Feet Above Confluence with Iona Wash

REVISED TO REFLECT LOMR EFFECTIVE: February 4, 2011

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

IONA WASH - IONA STOCK TANK WASH

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

June 7, 2010

LOMR Manager
LOMC Clearinghouse
6730 Santa Barbara Court
Elkridge, MD 21075

Subject: Iona Wash Floodplain Delineation Study – Lone Mountain Road to Carefree Highway (FCD contract 2004C060), by Entellus

Case No.: 10-09-1720P

Communities: Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Iona Wash and Iona Stock Tank Wash

FIRM panels affected: 04013C0687H 04013C0689H 04013C0690H

LOMR Manager:

We have received your comments dated April 22, 2010 and are providing the following responses.

Question 1: "Our detailed review revealed water surface elevations higher than the end points of the cross-section at Cross-sections 4.884, 5.278, and 5.354."

Response: Per a May 17, 2010 phone conversation with Sol Martin, it was determined that the natural water surface elevations were below the endpoints of the cross-sections and that this comment could be disregarded.

Question 2: "Our review of the submitted revised conditions model revealed that the levee option was used at Cross-sections 6.101 and 5.989 along the revised reach of Iona Wash HEC-RAS. However, the use of the ineffective flow area option may be more appropriate. Please provide documentation to support using the levee option, or make the appropriate changes."

Response: Levee stations were used in these cross-sections in place of trimming the cross-section data. The channels that appear at the very end of those cross-sections are local washes that are not hydraulically connected to the Iona Wash channel and floodplain. We would prefer to leave the levee stations in place. Attached please find a print out of the RAS cross-section data for each cross-section of concern as well as a copy of the reduced size workmap and a pdf map of the area that identifies these local washes. For cross-

section 6.101, the local wash is identified in the cross-section plot and on both of the provided maps as Location A. For cross-section 5.989, the local wash is identified in the cross-section plot and on both of the provided maps as Location B.

Regarding the review fee, a check will be sent separate from this comment response letter.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

Enclosure

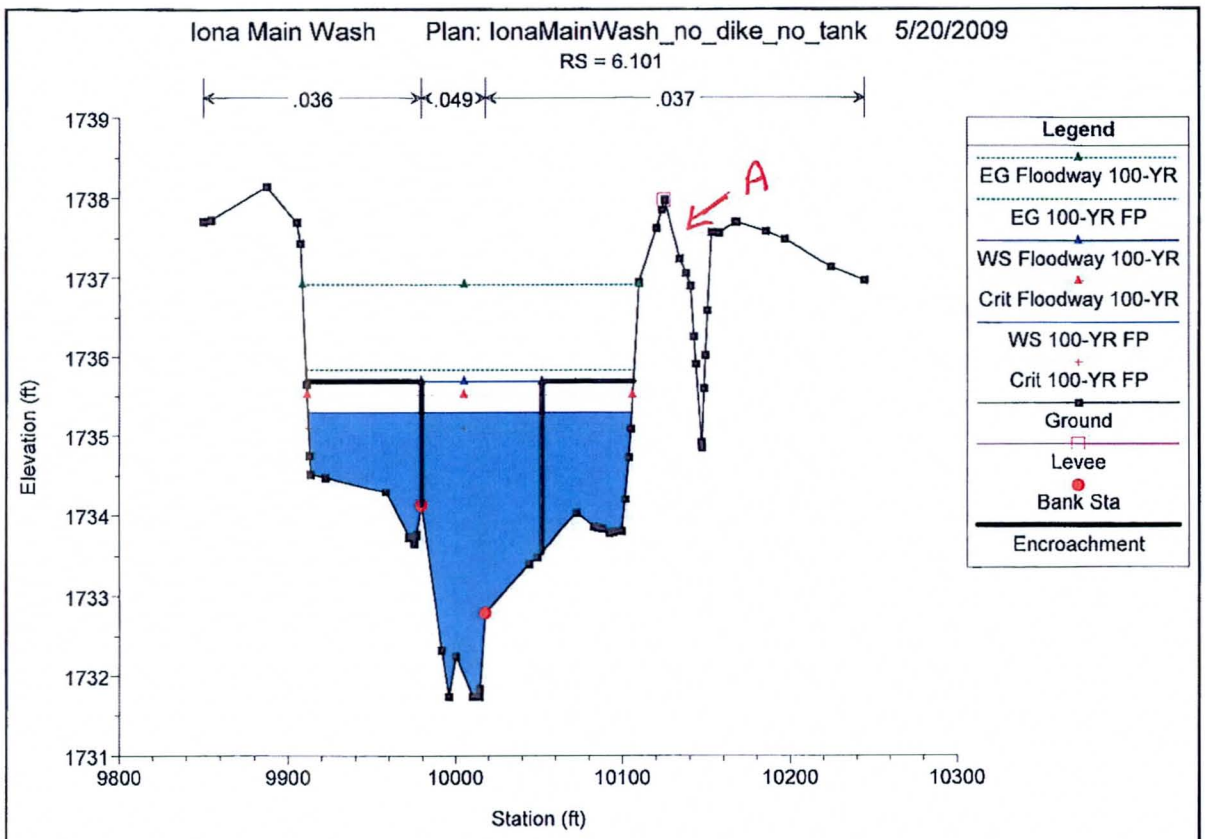
Copy to:

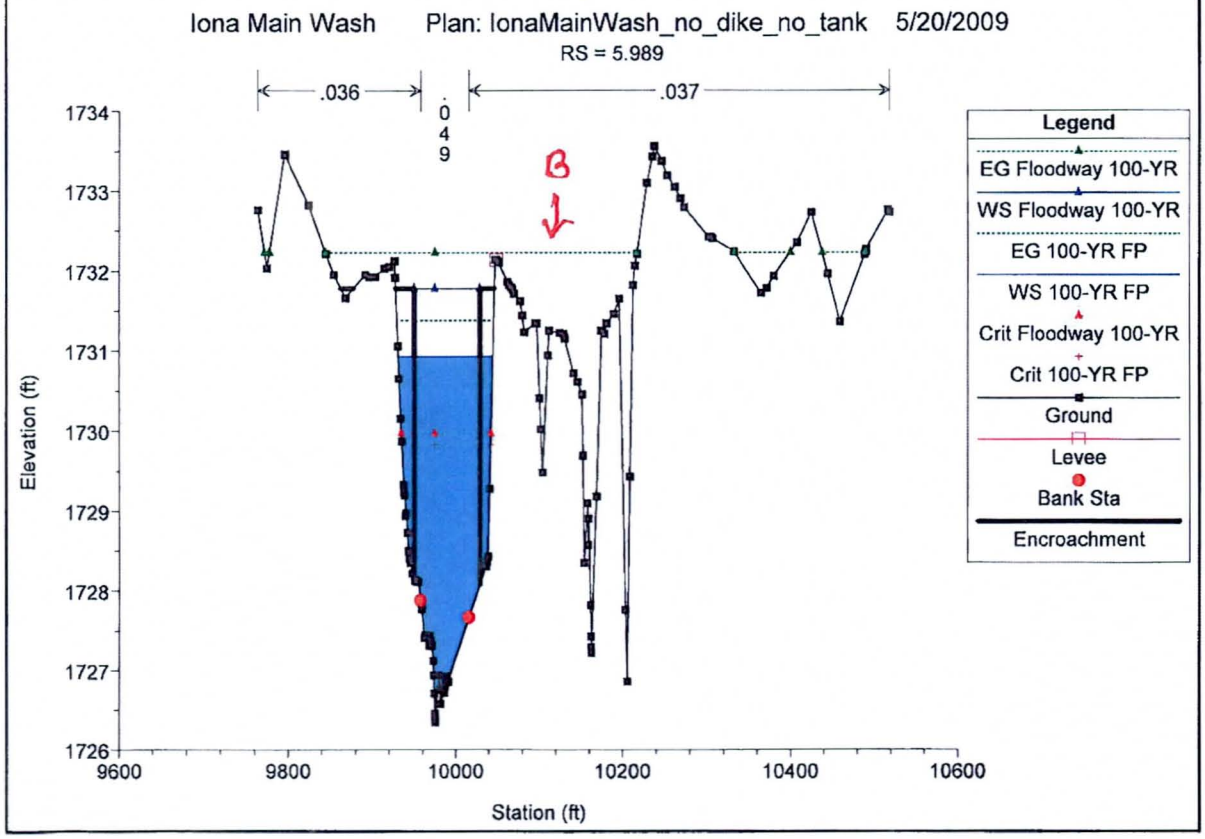
Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

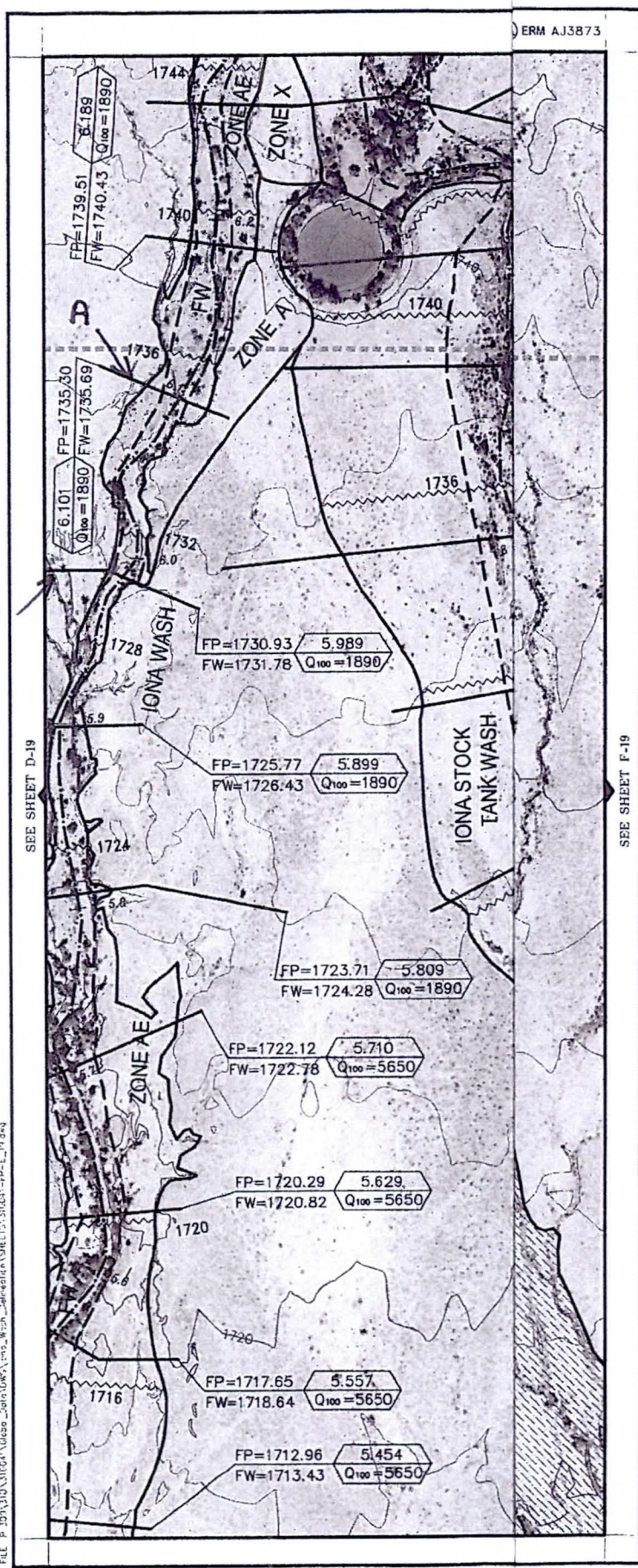
Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Ed Curtis
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Hernan Aristizabal, P.E.
Entellus
2255 N. 44th Street
Phoenix, AZ 85008


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank 5/20/2009
RS = 6.101
.036
.049
.037
A
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
EG 100-YR FP
WS Floodway 100-YR
Crit Floodway 100-YR
WS 100-YR FP
Crit 100-YR FP
Ground
Levee
Bank Sta
Encroachment


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank 5/20/2009
RS = 5.989
.036
.049
.037
B
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Crit Floodway 100-YR
Crit 100-YR FP
Ground
Levee
Bank Sta
Encroachment



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

CONTRACT FCD 2004C060

IONA WASH FLOODPLAIN DELINEATION

LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 FP=1400.55 / Q100=1270 FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

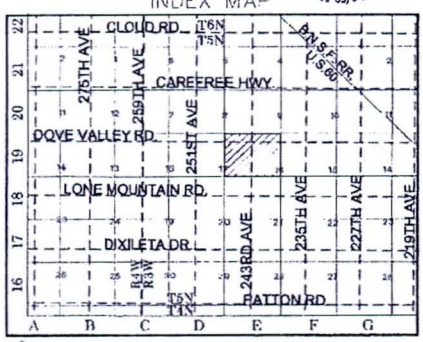
I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE. WWW.NGS.NOAA.GOV

NOTE:

1. NGVD 29 + 2.00 FEET = NAVD 88

Registered Professional Engineer (Civil) CERTIFICATE NO. 23069 FRANK EDWARD BROWN Date Signed Apr. 1 2009 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP



200' 0' 200' 400'

SCALE 1" = 200'

Entellus
2255 N 44th Street Suite 125
Phoenix, AZ 85008-3279
Tel 602.244.2566
Fax 602.244.8947
WEB www.entellus.com

	BY	DATE
DESIGN	AMG	04/2009
DESIGN CHK	FEB	04/2009
PLANS	KAB	04/2009
PLANS CHK	AMG/FEB	04/2009

SUBMITTED BY — DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY — DATE

APPROVED BY — DATE

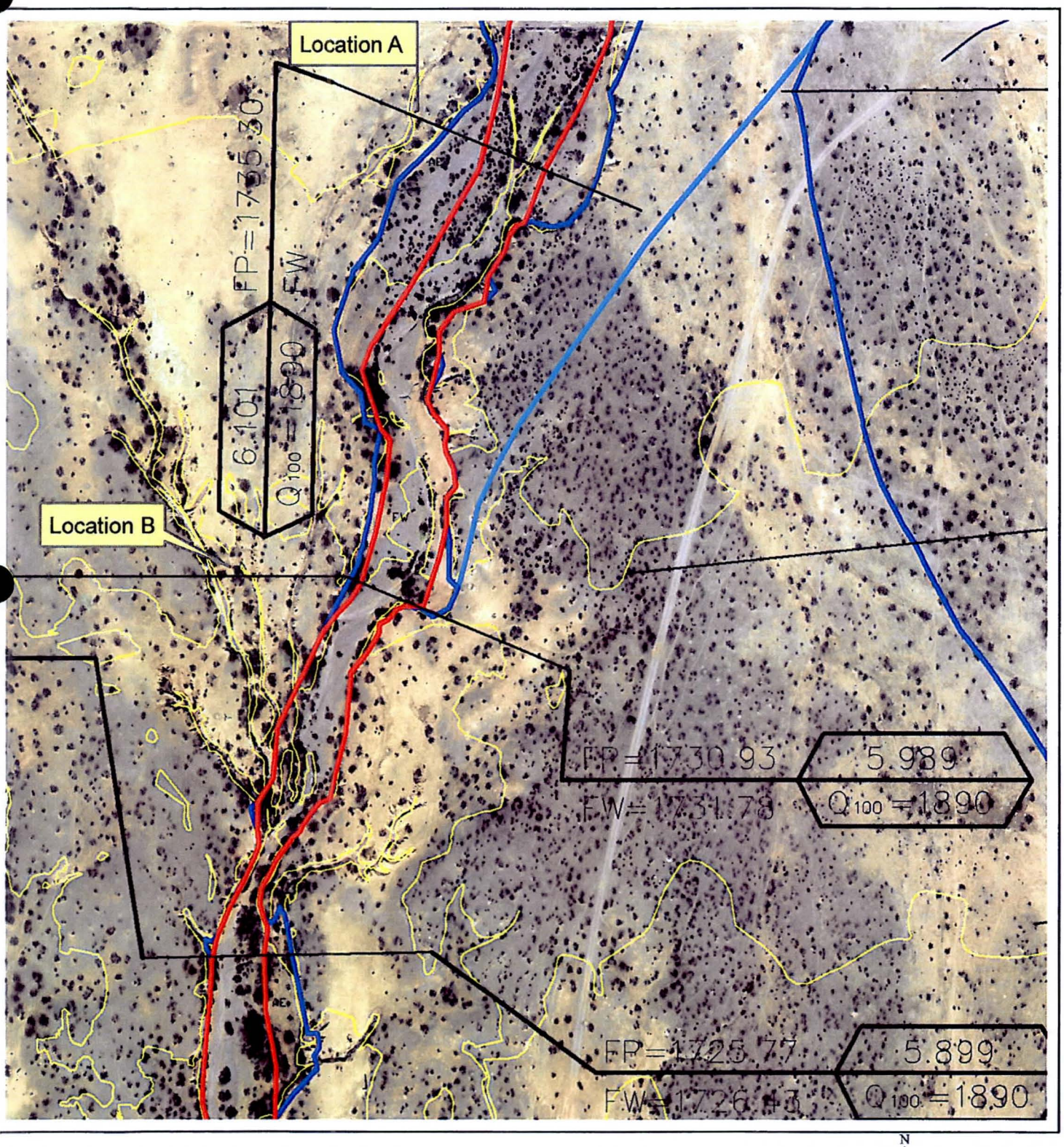
CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-19 OF FLOODPLAIN DELINEATION

FILE P:\3931\3103\MIGAT\Iona_Iona\IONA\Iona_Wash_Delineation\SHEET E-19\MIGAT-FW-E_19.dwg

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/25/02), 1"=1200' (1:14400) (04/23/0

Iona Wash Floodplain Delineation Study
Lone Mountain Road to Carefree Highway



Proposed Iona AE floodplain limits outlined in dark blue

Proposed Floodway outlined in red

N
W
E
S

0 0.005 0.01 0.02 0.03 0.04
Miles

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

FLOOD CONTROL DISTRICT
RECEIVED
APR 26 '10

	CH & GM		FINANCE
	PIO		R.E.D.
	ADMIN		O & M
	FMS		P & PM
	ENG		FILE
	CONTRACTS		
ROUTING			

April 22, 2010

Ms. Kathryn Gross, P.E.
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

IN REPLY REFER TO:
Case No.: 10-09-1720P
Community: Maricopa County, AZ
Community No.: 040037

316-AD

Dear Ms. Gross:

This responds to your request dated March 5, 2010, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for the above-referenced community. Pertinent information about the request is listed below.

Identifier:	Whittmann Area Drainage Master Plan
Flooding Source:	Iona Wash
FIRM Panel(s) Affected:	04013C0687 H, 0689 H, and 0690 H

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register,* is enclosed for your information.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, Mr. Sol Martin, by e-mail at samartin@mbakercorp.com or by telephone at (720) 479-3159, or the Revisions Coordinator for your request, Mr. Joseph Kuechenmeister, CFM, at jkuechenmeister@mbakercorp.com or at (720) 479-3181.

Sincerely,

Syed Qayum

Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM

Enclosures

cc: Mr. Timothy S. Phillips, P.E
Maricopa County

Mr. Frank Edward Brown, P.E.
Entellus, Inc.

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 10-09-1720P

Requester: Ms. Kathryn Gross, P.E.

Community: Maricopa County, AZ

Community No.: 040037

The issues listed below must be addressed before we can continue the review of your request.

1. Our detailed review revealed water surface elevations (WSELs) higher than the end points of the cross section at Cross Sections 4.844, 5.278, and 5.354 in the proposed conditions HEC-RAS hydraulic model along Iona Wash. Please extend the cross sections so that the end points of all cross sections are equal to or higher than the corresponding WSEL.

2. Our review of the submitted revised conditions model revealed that the levee option was used at Cross Sections 6.101 and 5.989 along the revised reach of Iona Wash HEC-RAS. However, the use of the ineffective flow area option may be more appropriate. Please provide documentation to support using the levee option, or make the appropriate changes.

Effective January 13, 2010, the Federal Emergency Management Agency revised the fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register*, is enclosed for your information. In accordance with this schedule, the fee for your request is $5,300 and must be submitted before we can continue processing your request. Payment of this fee must be made in the form of a check or money order, payable in U.S. funds to the National Flood Insurance Program, or a credit card payment (Visa or MasterCard only). For identification purposes, the case number referenced above must be included on the check or money order. We will not perform a detailed technical review of your request until we receive this payment.

Please send the required data and/or fee directly to us at the address shown at the bottom of the first page. For identification purposes, please include the case number referenced above on all correspondence.

Federal Emergency Management Agency

Washington, D.C. 20472

FEE SCHEDULE FOR PROCESSING REQUESTS FOR MAP CHANGES

This notice contains the fee schedule for processing certain types of requests for changes to National Flood Insurance Program (NFIP) maps. The fee schedule allows FEMA to further reduce the expenses to the NFIP by more fully recovering the costs associated with processing conditional and final map change requests. The fee schedule for map changes is effective for all requests dated January 13, 2010, or later and supersedes the fee schedule that was established on October 1, 2007.

To develop the fee schedule for conditional and final map change requests, FEMA evaluated the actual costs of reviewing and processing requests for Conditional Letters of Map Amendment (CLOMAs), Conditional Letters of Map Revision – Based on Fill (CLOMR-Fs), Conditional Letters of Map Revision (CLOMRs), Letters of Map Revision – Based on Fill (LOMR-Fs), and Letters of Map Revision (LOMRs).

Based on our review of actual cost data for Fiscal Years 2007 and 2008, FEMA has maintained the following review and processing fees, which are to be submitted with all requests that are not otherwise exempted under 44 CFR 72.5.

Fee Schedule for Requests for CLOMAs, CLOMR-Fs, and LOMR-Fs

Request for single-lot/single-structure CLOMA and CLOMR-F	$500
Request for single-lot/single structure LOMR-F	$425
Request for single-lot/single-structure LOMR-F based on as-built information (CLOMR-F previously issued by FEMA)	$325
Request for multiple-lot/multiple-structure CLOMA	$700
Request for multiple-lot/multiple-structure CLOMR-F and LOMR-F	$800
Request for multiple-lot/multiple-structure LOMR-F based on as-built information (CLOMR-F previously issued by FEMA)	$700

Based on our review of actual cost data for Fiscal Years 2005 and 2006, FEMA has established the following review and processing fees, which are to be submitted with all requests that are not otherwise exempted.

Fee Schedule for Requests for CLOMRs

Request based on new hydrology, bridge, culvert, channel, or combination of any of these	$4,400
Request based on levee, berm, or other structural measure	$6,050

Fee Schedule for Requests for Map Revisions

Requesters must submit the review and processing fees shown below with requests for LOMRs that are not based on structural measures or alluvial fans.

Request based on bridge, culvert, channel, or combination of these	$5,300
Request based on levee, berm, or other structural measure	$7,150
Request based on as-built information submitted as follow-up to CLOMR	$5,000

Fees for CLOMRs, LOMRs, and PMRs Based on Structural Measures on Alluvial Fans

FEMA has maintained the initial fee for requests for CLOMRs and LOMRs based on structural measures on alluvial fans to $5,600. FEMA will also continue to recover the remainder of the review and processing costs by invoicing the requester before issuing a determination letter, consistent with current practice. The prevailing private-sector labor rate charged to FEMA ($60 per hour) will be used to calculate the total reimbursable fees.

Payment Submission Requirements

Requesters must make fee payments for non-exempt requests before we render services. This payment must be in the form of a check or money order or by credit card payment. Please make all checks and money orders in U.S. funds payable to the *National Flood Insurance Program.* Please mail all payments to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. FEMA will deposit all fees collected to the National Flood Insurance Fund, which is the source of funding for providing these services.

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

March 5, 2010

LOMR Manager
LOMC Clearinghouse
6730 Santa Barbara Court
Elkridge, MD 21075

Subject: Iona Wash Floodplain Delineation Study – Lone Mountain Road to Carefree Highway (FCD contract 2004C060), by Entellus

Communities: Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Iona Wash and Iona Stock Tank Wash

FIRM panels affected: 04013C0687H 04013C0689H 04013C0690H

LOMR Manager:

Enclosed is the technical supporting data for the Iona Wash Floodplain Delineation Study- Lone Mountain Road to Carefree Highway. This study is a re-study of approximately 2.5 linear miles along Iona Wash and approximately 2 linear miles of newly identified floodplain\floodway along Iona Stock Tank Wash between Lone Mountain Road and Carefree Highway. The study area is located in the northwest portion of Maricopa County.

The resulting floodplains are AE floodplain\floodways. The results are presented in one Technical Data Notebook. Hydrologic and hydraulic information is located in Section 4 and 5. The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps along with the Annotated FIRM panels are located at the back of the Notebook. Digital versions of the hydrologic and hydraulic analysis are included on cd in Appendix F.

The digital floodplain limits, cross-sections and topographic contours are included on two respective cds: "Wittman Area Drainage Master Plan Iona Wash Floodplain Delineation Floodplain Workmap DXF files" and "Topographic Data in the Vicinity of Iona Wash in Various Formats". Both cds are located in the front pocket of the Notebook.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, MA
Hydrology and Hydraulics Branch

Enclosure

Copy to:

Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Ed Curtis
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Frank Brown, P.E.
Entellus
2255 N. 44th Street
Phoenix, AZ 85008

APPENDIX C. SURVEY AND FIELD NOTES

No additional survey was prepared as part of this project.

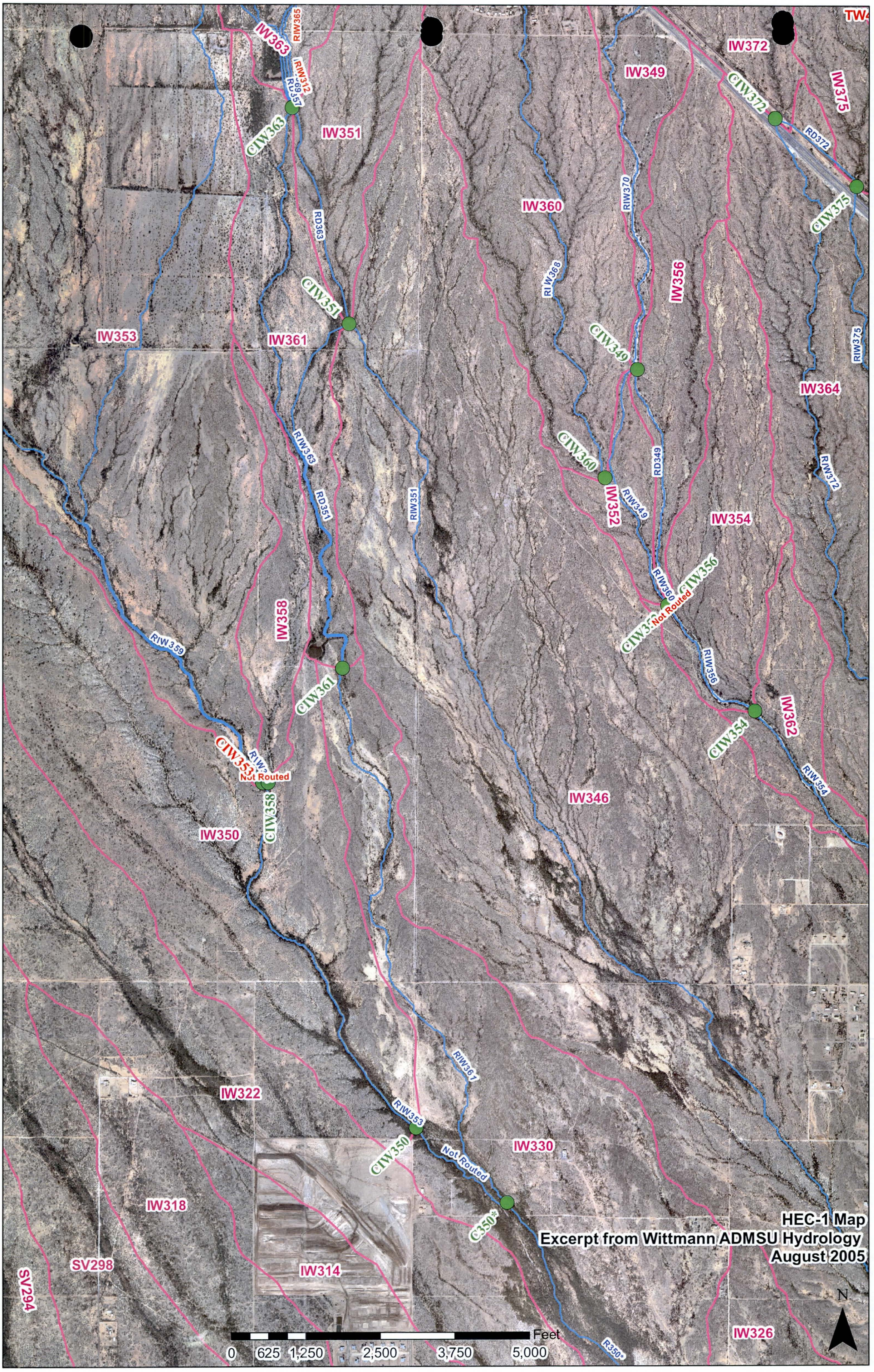
APPENDIX D. HYDROLOGIC ANALYSIS SUPPORTING DOCUMENTATION

Date: 2/10/2009

Iona Wash Flows

	ID	6-hr Drainage Area (sqmi)	6-hr (cfs)	24-hr Drainage Area (sqmi)	24-hr (cfs)	Values for Additional Delineation (Current FDS), cfs: Iona Wash	Values for Additional Delineation (Current FDS), cfs: Iona Stock Tank
Concentration Points	C350*	22.22	6985	22.2	6553		
	CIW300	30.55	6611	30.6	6941		
	CIW330	23.25	6979	23.3	6608	6610 (24 hr)	6610 (24 hr)
	CIW350	17.45	6037	17.4	5647	5650 (24 hr)	N/A
	CIW351	1.67	697	1.7	559		
	CIW353	15.28	5494	15.2	5023		
	CIW361	4.76	1886	4.8	1600	1890 (6 hr)	1890 (6 hr)
	CIW363	4.26	1903	4.4	1640		
	CIW364	2.13	1456	2.1	1337	**1330 (24 hr)	**1330 (24 hr)
Subbasins	IW330	1.04	805	1	619		
	IW350	2.17	1410	2.2	1154		
	IW351	0.32	354	0.3	236		
	IW353	2.8	2512	2.8	2307		
	IW358	0.16	146	0.2	98		
	IW361	0.35	334	0.4	212		
	IW363	0.63	1112	0.6	804		
Routes	R350*	22.22	6886	22.2	6462		
	RD351	1.67	595	1.7	475		
	RD363	4.26	598	4.4	514		
	RIW351	1.67	80	1.7	68		
	RIW353	15.28	5328	15.2	4898		
	RIW359	5.97	3233	6	2943		
	RIW361	4.76	1870	4.8	1591		
	RIW363	4.26	1281	4.4	1098		

Notes:
1. **1330 cfs: Flows from the Iona North Wash obtained from the Wittmann ADMSU 100-year flowrate from workmap Sheet E-20.
2. The 5650 cfs flowrate is from the Wittmann ADMSU 100-year, Flowrate from workmap sheets E-17 and E-18.


HEC-1 Map
Excerpt from Wittmann ADMSU Hydrology
August 2005
N
Feet
0
625
1,250
2,500
3,750
5,000
IW363
RIW365
RIW312
RD357
CIW363
IW351
RD363
CIW351
IW353
IW361
RIW363
RD351
RIW351
IW358
RIW359
CIW361
CIW353
Not Routed
CIW358
IW350
IW322
RIW353
CIW350
RIW367
Not Routed
C350*
R350*
IW330
IW318
SV298
SV294
IW314
IW326
IW349
IW372
CIW372
RD372
IW375
CIW375
RIW375
IW360
RIW370
IW356
RIW368
CIW349
IW364
RIW372
CIW360
IW352
RIW349
RD349
IW354
RIW360
CIW356
Not Routed
RIW356
CIW354
IW362
RIW354
IW346

APPENDIX E. HYDRAULIC ANALYSIS SUPPORTING DOCUMENTATION

E.1 Roughness Coefficient Estimation

E.2 Cross Section Plots

E.3 Expansion and Contraction Coefficients

E.4 Analysis of Structures

E.5 Hydraulic Calculations

E.6 HEC-RAS Output

E.7 CHECK-RAS Output

E.8 Summary of Errors and Warnings

E.1 Roughness Coefficient Estimation

E.1.1 Roughness Coefficient Reference Materials

E.1.2 Study Washes Iona Wash and Iona Stock Tank Wash

E.1.1 Roughness Coefficient Reference Materials

Table E-1

BY FEB DATE 3/12/2009
CHECK HAA DATE 3/12/2009

Project: Wittmann ADMP
Stream: Iona Wash -additional delineation, Lone Mountain Road to Carefree Highway
Location: Reach - Iona - 25X (Between about 0.15 miles north of Lone Mountain Road and Iona Tributary (at about 0.6 miles north)

Channel Conditions		Manning's n Adjustment		Left Overbank (**East**)	Channel	Right Overbank (**West**)
Channel Material	Concrete	n_b	.012-.018			
	Firm Soil		.025-.032			
	Coarse Sand		.026-.035	0.027		0.026
	Gravel		.028-.035		0.028	
	Cobble		.030-.050			
	Boulder		.040-.070			
Degree of Irregularity	Smooth	n_1	0	0.000		0.000
	Minor		.001-.005		0.002	
	Moderate		.006-.010			
	Severe		.011-.020			
Effects of Obstruction	Negligible	n_2	.000-.004	0.000	0.000	0.000
	Minor		.005-.015			
	Appreciable		.020-.030			
	Severe		.040-.060			
Vegetation	Small	n_3	.002-.010			0.005
	Medium		.010-.025	0.010	0.018	
	Large		.025-.050			
	Very Large		.050-.100			
Variations in Channel Cross Section	Gradual	n_4	0			
	Occ. Alt.		.001-.005	0.001	0.001	0.001
	Freq. Alt.		.010-.015			
				0.038	0.049	0.032
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.038**	**0.049**	**0.032**

comparison values >> 0.039 0.046 0.033

^^^^ compare to tie-in at RM 4.844 from Reach Iona-24 ^^^^

Figure E-1
(Iona - 25X)

Figure 1. (Photo #32 on 01/21/2009) Channel looking upstream.

Figure 2. (Photo #16 on 01/21/2009) Right Overbank looking downstream.

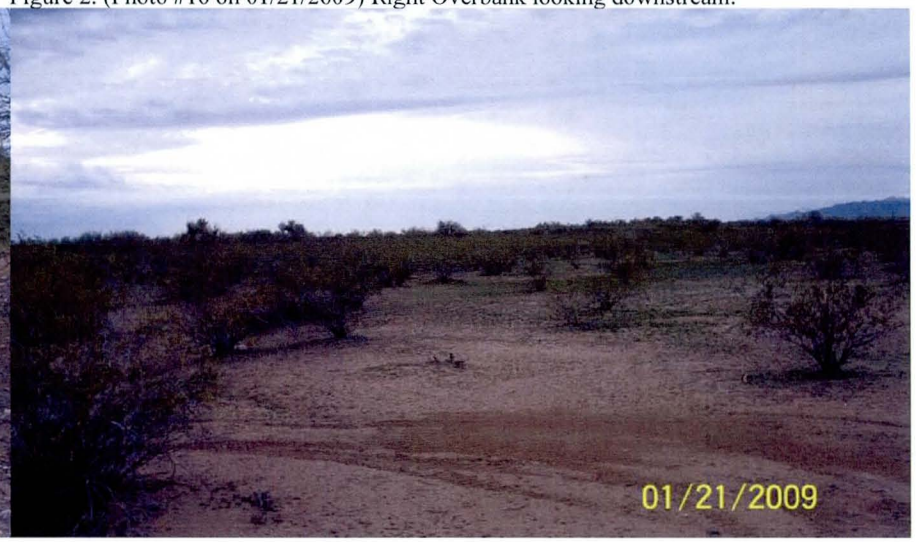


Figure 3. (Photo #11 on 01/21/2009) Left Overbank looking upstream.

Table E-1

BY FEB DATE 3/12/2009
CHECK HAA DATE 3/12/2009

Project: Wittmann ADMP
Stream: Iona Wash -additional delineation, Lone Mountain Road to Carefree Highway
Location: Reach - Iona - 25Y (Between Iona Tributary (at about 0.6 miles north of Lone Mountain) and confluence with Stock Tank Wash (about 0.35 miles north of Dove Valley Road))

Channel Conditions		Manning's n Adjustment		Left Overbank (**East**)	Channel	Right Overbank (**West**)
Channel Material	Concrete	n_b	.012-.018			
	Firm Soil		.025-.032			
	Coarse Sand		.026-.035	0.026		0.026
	Gravel		.028-.035		0.028	
	Cobble		.030-.050			
	Boulder		.040-.070			
Degree of Irregularity	Smooth	n_1	0	0.000		0.000
	Minor		.001-.005		0.004	
	Moderate		.006-.010			
	Severe		.011-.020			
Effects of Obstruction	Negligible	n_2	.000-.004	0.001	0.000	0.001
	Minor		.005-.015			
	Appreciable		.020-.030			
	Severe		.040-.060			
Vegetation	Small	n_3	.002-.010	0.008		
	Medium		.010-.025		0.017	0.010
	Large		.025-.050			
	Very Large		.050-.100			
Variations in Channel Cross Section	Gradual	n_4	0		0.000	0.000
	Occ. Alt.		.001-.005	0.001		
	Freq. Alt.		.010-.015			
				0.036	0.049	0.037
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.036**	**0.049**	**0.037**

Figure E-1
(Iona - 25Y)

Figure 1. (Photo #50 on 01/21/2009) Channel looking downstream

Figure 2. (Photo #80 on 01/21/2009) Right Overbank looking downstream.

Figure 3. (Photo #75 on 01/21/2009) Left Overbank looking upstream.

Table E-1

BY FEB DATE 3/12/2009
CHECK HAA DATE 3/12/2009

Project: Wittmann ADMP
Stream: Iona Wash and Iona Stock Tank Wash
Location: Reach - Iona - 25Z (Between confluence with Stock Tank Wash (about 0.35 miles north of Dove Valley Road) and 0.1 miles south of Carefree Highway)
use the channel n value for Iona Stock Tank Wash

Channel Conditions		Manning's n Adjustment		Left Overbank **(East)**	Channel	Right Overbank **(West)**
Channel Material	Concrete	n_b	.012-.018			
	Firm Soil		.025-.032			
	Coarse Sand		.026-.035	0.026		
	Gravel		.028-.035		0.028	0.028
	Cobble		.030-.050			
	Boulder		.040-.070			
Degree of Irregularity	Smooth	n_1	0	0.000		0.001
	Minor		.001-.005		0.002	
	Moderate		.006-.010			
	Severe		.011-.020			
Effects of Obstruction	Negligible	n_2	.000-.004	0.000	0.000	0.000
	Minor		.005-.015			
	Appreciable		.020-.030			
	Severe		.040-.060			
Vegetation	Small	n_3	.002-.010	0.009		
	Medium		.010-.025		0.017	0.025
	Large		.025-.050			
	Very Large		.050-.100			
Variations in Channel Cross Section	Gradual	n_4	0			
	Occ. Alt.		.001-.005	0.001	0.001	0.002
	Freq. Alt.		.010-.015			
				0.036	0.048	0.056
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.036**	**0.048**	**0.056**

Figure E-1
(Iona - 25Z)

Figure 1. (Photo #121 on 01/21/2009) Channel looking upstream.

Figure 2. (Photo #119 on 01/21/2009) Right Overbank looking downstream

Figure 3. (Photo #126 on 01/21/2009) Left Overbank looking upstream.

Table E-1

BY FEB DATE 3/12/2009
CHECK HAA DATE 3/12/2009

Project: Wittmann ADMP
Stream: Iona Stock Tank Wash
Location: Reach – IST- 25U (Between north of Montgomery Rd. to about 0.35 miles north of Lone Mountain Road)

Channel Conditions		Manning's n Adjustment		Left Overbank (**East**)	Channel	Right Overbank (**West**)
Channel Material	Concrete	n_b	.012-.018			
	Firm Soil		.025-.032			
	Coarse Sand		.026-.035	0.026	0.026	0.026
	Gravel		.028-.035			
	Cobble		.030-.050			
	Boulder		.040-.070			
Degree of Irregularity	Smooth	n_1	0	0.000	0.000	0.000
	Minor		.001-.005			
	Moderate		.006-.010			
	Severe		.011-.020			
Effects of Obstruction	Negligible	n_2	.000-.004	0.001	0.004	0.001
	Minor		.005-.015			
	Appreciable		.020-.030			
	Severe		.040-.060			
Vegetation	Small	n_3	.002-.010	0.006		0.004
	Medium		.010-.025		0.011	
	Large		.025-.050		`	
	Very Large		.050-.100			
Variations in Channel Cross Section	Gradual	n_4	0			
	Occ. Alt.		.001-.005	0.001	0.004	0.001
	Freq. Alt.		.010-.015			
				0.034	0.045	0.032
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.034**	**0.045**	**0.032**

Figure E-1
(IST- 25U)

Figure 1. (Photo #4 on 01/21/2009) Channel looking downstream.

Figure 3. (Photo #8 on 01/21/2009) Right Overbank looking downstream.

Figure 3. (Photo #1 on 01/21/2009) Left Overbank looking downstream.

Table E-1

BY FEB DATE 3/12/2009
CHECK HAA DATE 3/12/2009

Project: Wittmann ADMSU
Stream: Iona Stock Tank Wash
Location: Reach - IST - 25V (Between about 0.35 miles north of Lone Mountain Road and confluence with Iona Wash, about 0.35 miles north of Dove Valley Road)

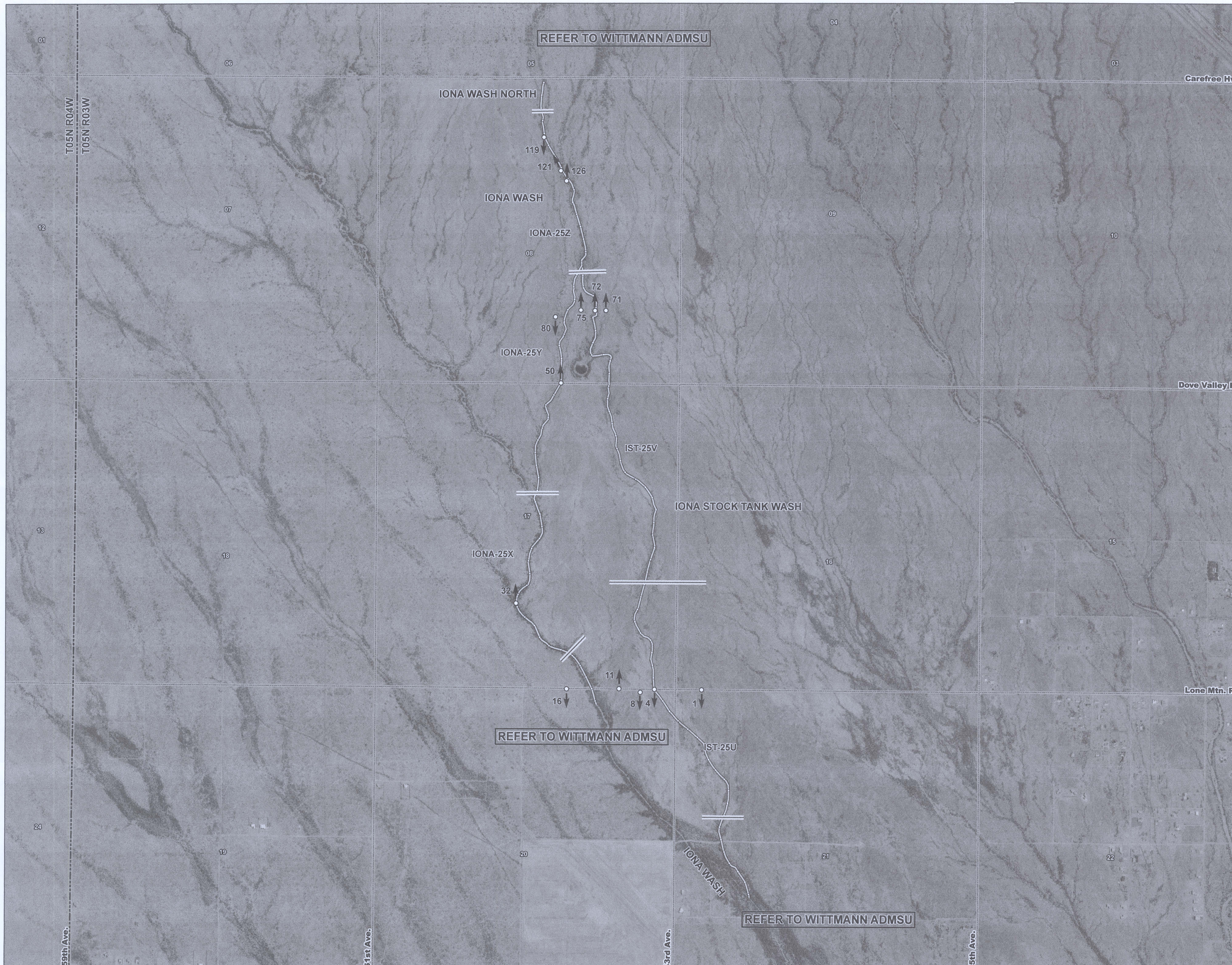
Channel Conditions		Manning's n Adjustment		Left Overbank (**East**)	Channel	Right Overbank (**West**)
Channel Material	Concrete	n_b	.012-.018			
	Firm Soil		.025-.032			
	Coarse Sand		.026-.035	0.026		0.026
	Gravel		.028-.035		0.028	
	Cobble		.030-.050			
	Boulder		.040-.070			
Degree of Irregularity	Smooth	n_1	0	0.000	0.000	0.000
	Minor		.001-.005			
	Moderate		.006-.010			
	Severe		.011-.020			
Effects of Obstruction	Negligible	n_2	.000-.004	0.001	0.001	0.001
	Minor		.005-.015			
	Appreciable		.020-.030			
	Severe		.040-.060			
Vegetation	Small	n_3	.002-.010	0.006		0.008
	Medium		.010-.025		0.017	
	Large		.025-.050			
	Very Large		.050-.100			
Variations in Channel Cross Section	Gradual	n_4	0			
	Occ. Alt.		.001-.005	0.001	0.002	0.001
	Freq. Alt.		.010-.015			
				0.034	0.048	0.036
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
$n=(n_b+n_1+n_2+n_3+n_4)m$				**0.034**	**0.048**	**0.036**

Figure E-1
(IST - 25V)

Figure 1. (Photo #72 on 01/21/2009) Channel looking upstream.

Figure 3. (Photo #75 on 01/21/2009) Right Overbank looking upstream.

Figure 3. (Photo #71 on 01/21/2009) Left Overbank looking upstream.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

CONTRACT FCD 2004C060

IONA WASH FLOODPLAIN DELINEATION LONE MOUNTAIN TO CAREFREE HIGHWAY

(Manning's "n" Value)

LEGEND

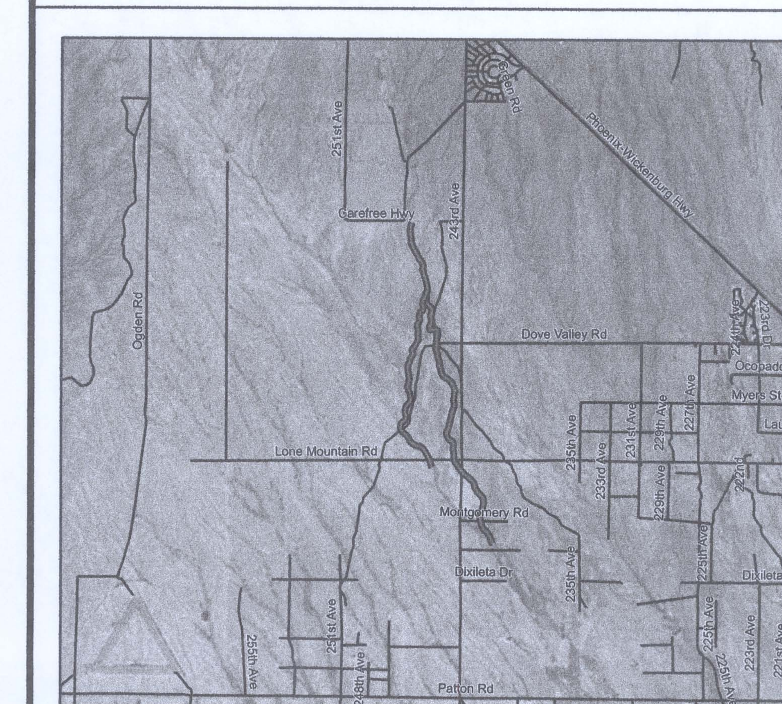
- n-Value Break
- River
- 10 Section
- Township & Range
- Photo Locations
- 35 Photo Number & Direction

NOTES:

1. Reference:

   Refer to Wittmann Area Drainage Master Study Update, Entellus, Inc., FCD No. 2002C029, TDN Vol. IV (Vol. HD-4 of 8), Appendix E.1, Roughness Coefficient Estimation

INDEX MAP



NORTH

0 400 800 1,600 2,400 Feet

Entellus™
2255 N. 44th Street Suite 125
Phoenix, Arizona 85008.3299
Tel. 602.244.2566
Fax. 602.244.8947
Web. www.entellus.com

Registered Professional Engineer (Civil) Certificate No. 23969 FRANK EDWARD BROWN Date Signed 8 April 2009 ARIZONA, U.S.A.
Expires 03/31/2011

	BY	DATE
DESIGN	FEB	04/2009
DESIGN CHECK	HAA	04/2009
PLAN	ZDR	04/2009
PLAN CHECK	FEB	04/2009

ENTELLUS JOB No. 310041

SHEET 1 of 1

P:\300\310\310041\Deliverables\Iona Wash Delineation\MXD\Iona_N_Values.mxd

E.1.2 Study Washes Iona Wash and Iona Stock Tank Wash

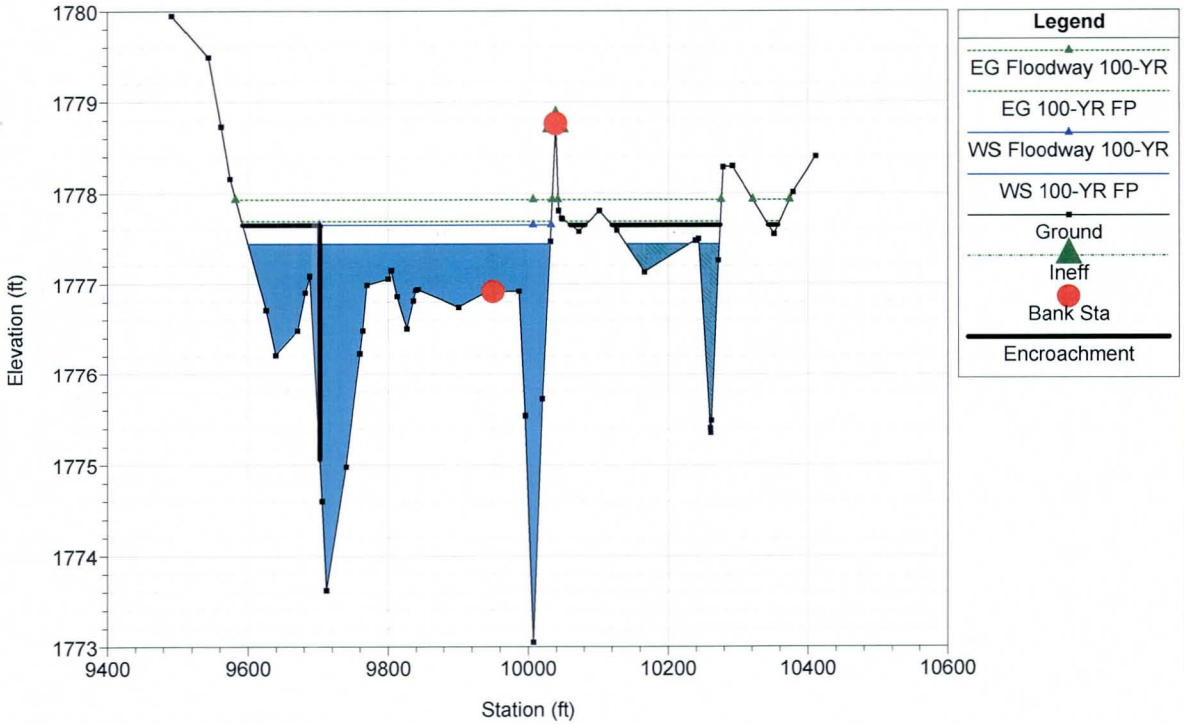
Iona Wash

Iona Stock Tank Wash

E.2 Cross-Section Plots

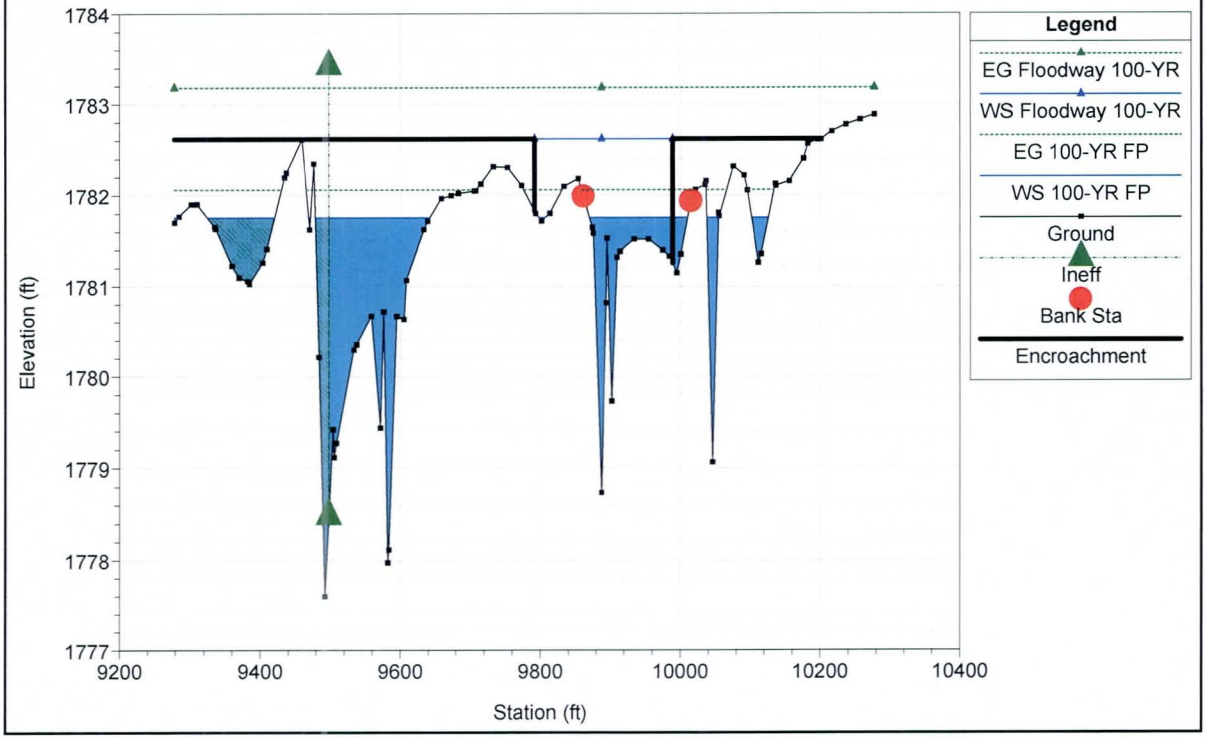
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 6.973



Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 7.074 Tie in at RM 0.104 Iona North Wash and ground data copied from A



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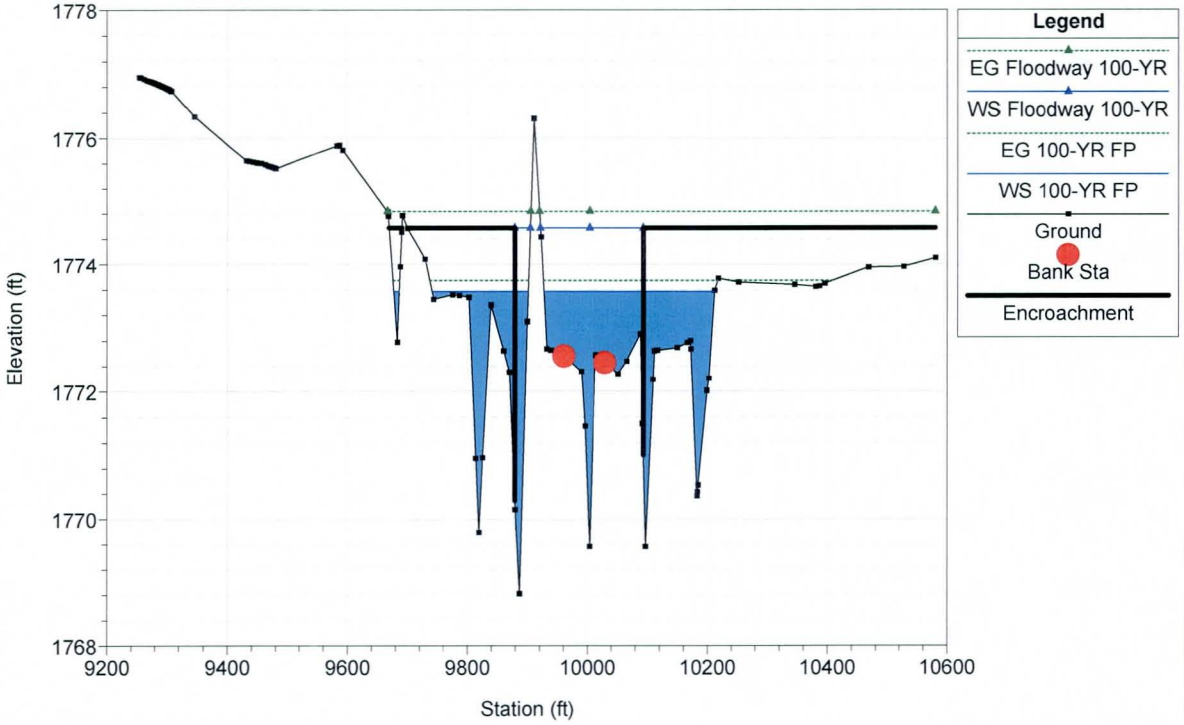
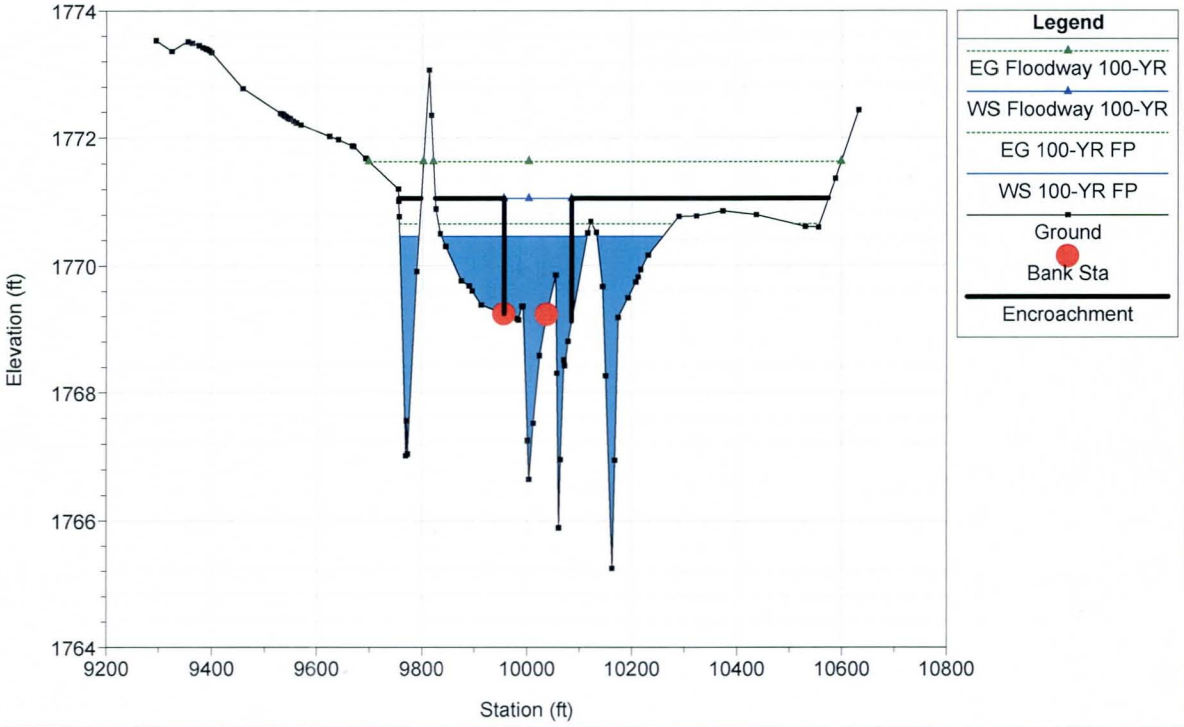
River = Iona_Wash Reach = IonaMainWash RS = 6.889



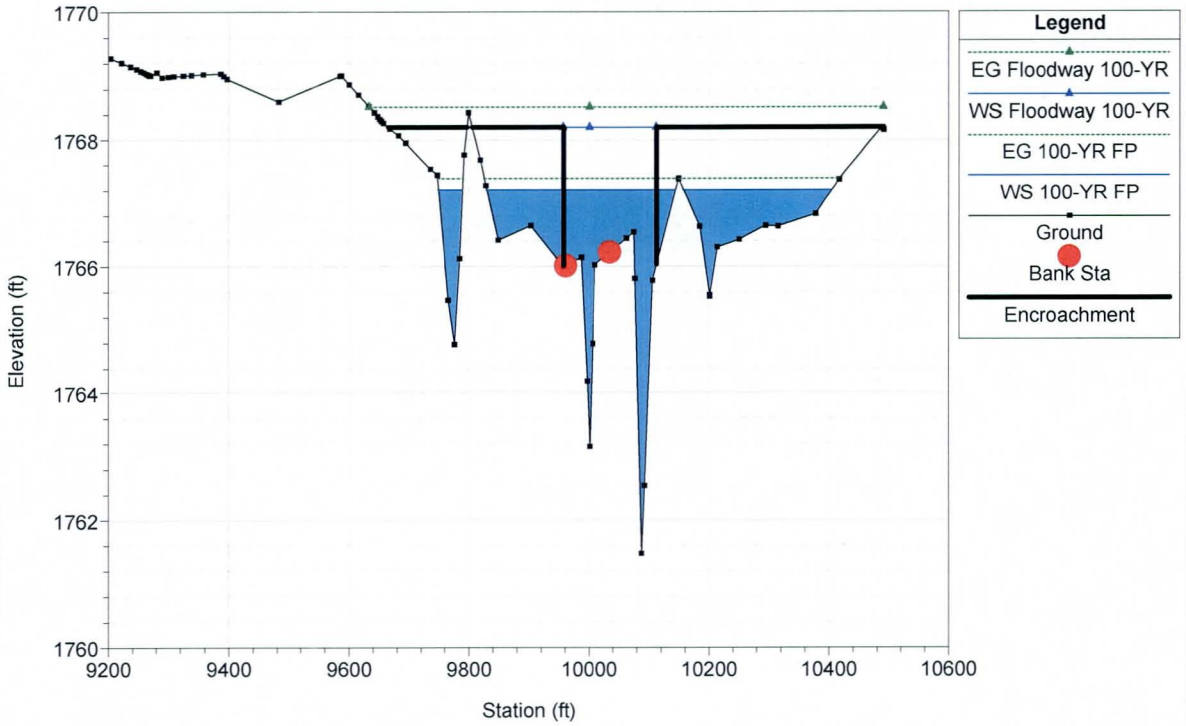
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 6.818



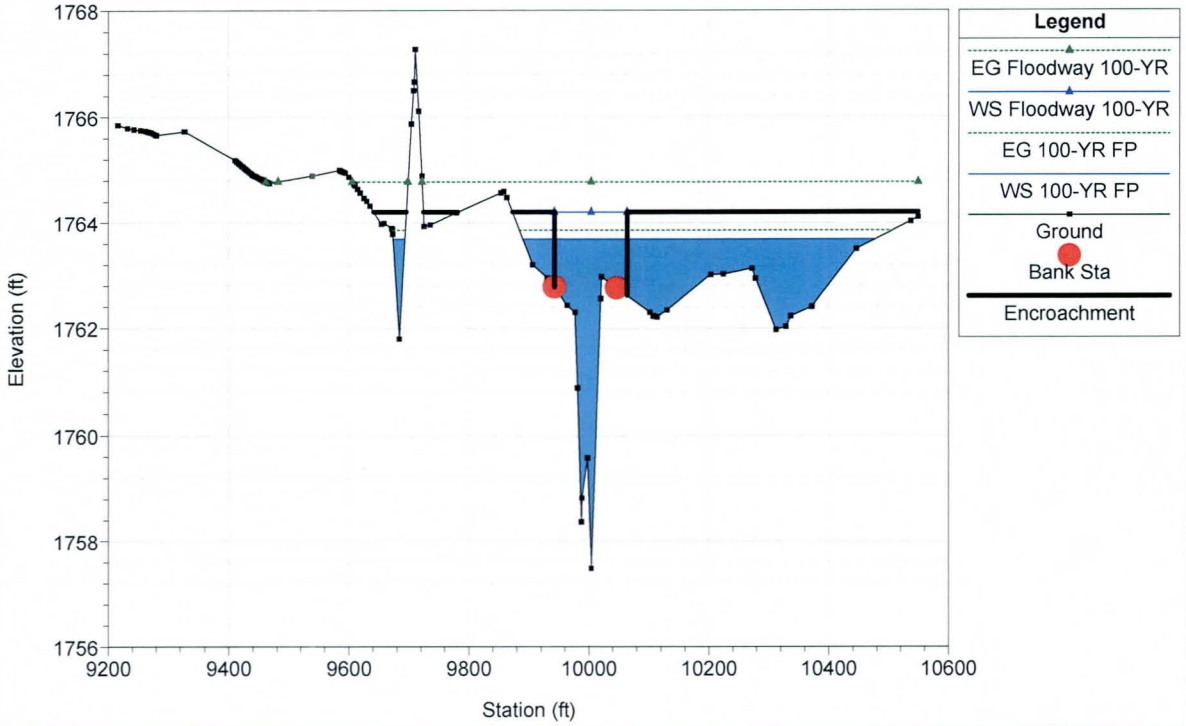
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

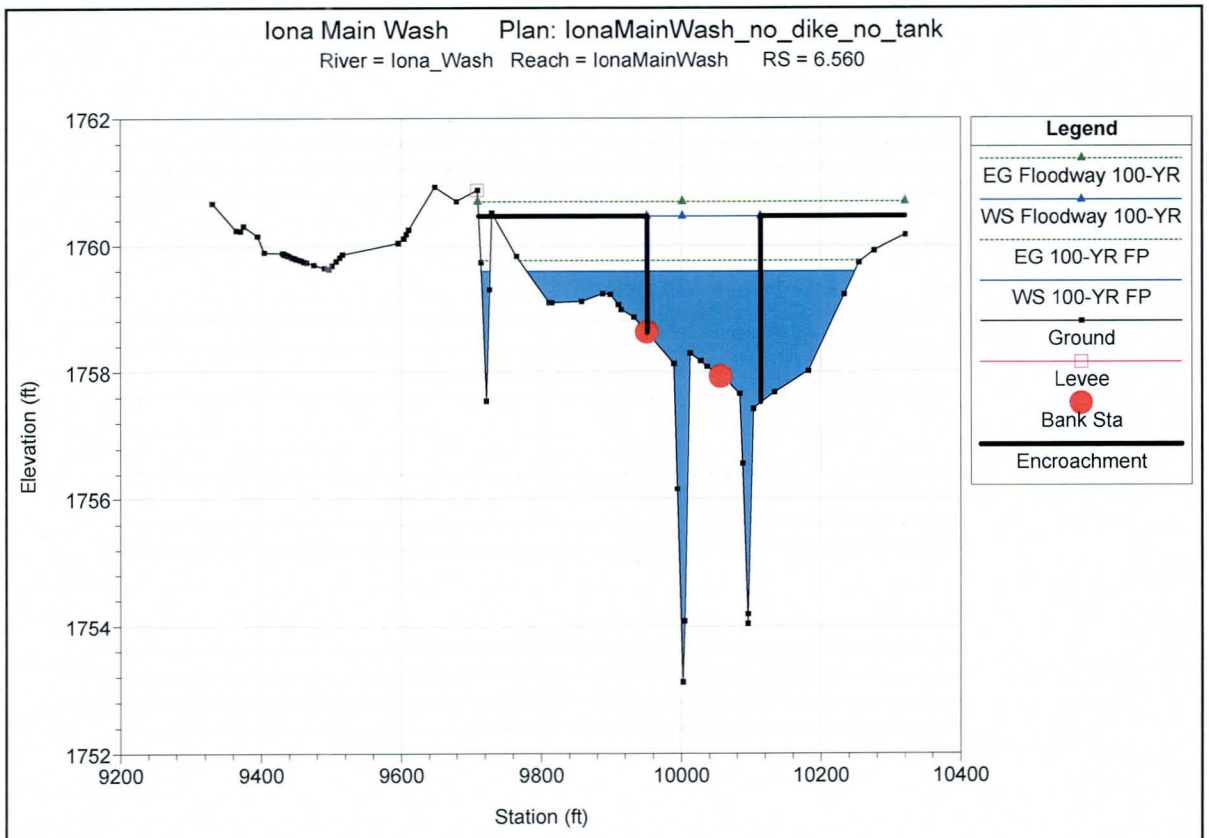
River = Iona_Wash Reach = IonaMainWash RS = 6.757

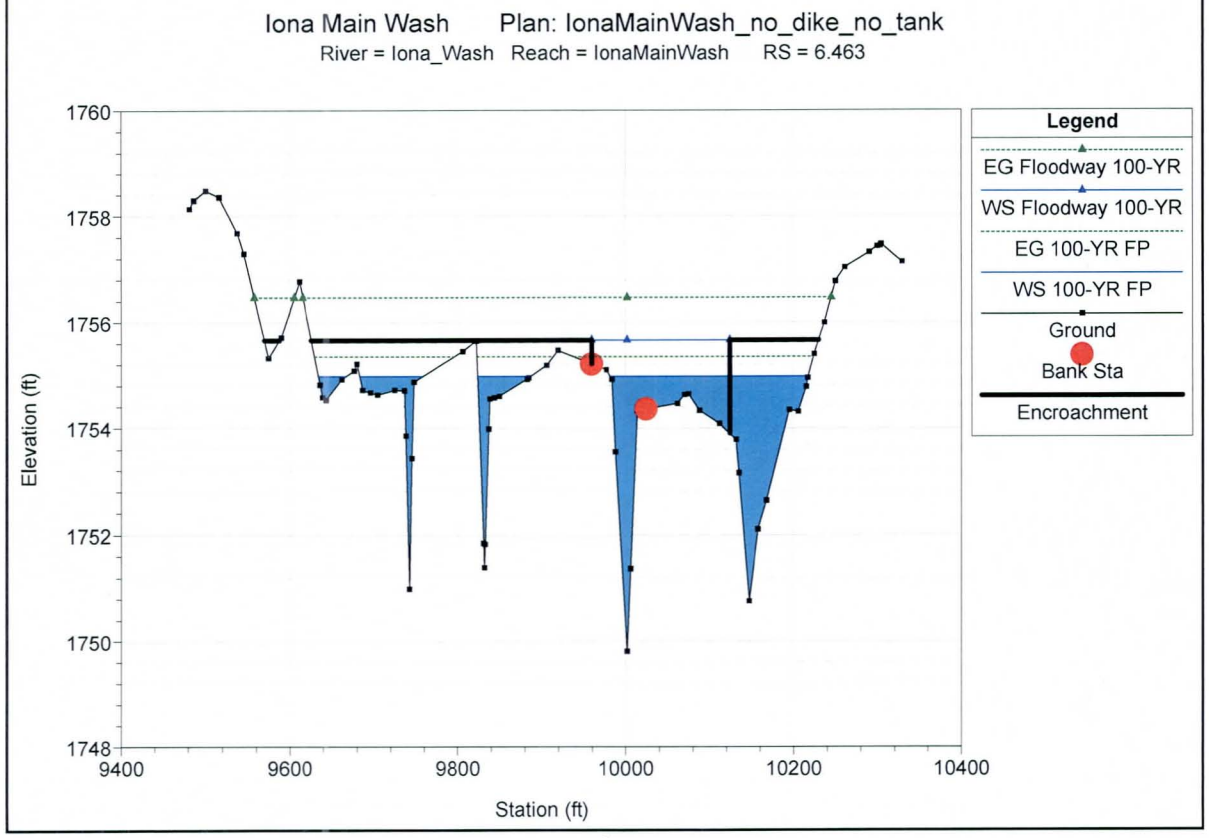


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 6.672




Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 6.560
Elevation (ft)
Station (ft)
1762
1760
1758
1756
1754
1752
9200
9400
9600
9800
10000
10200
10400
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Levee
Bank Sta
Encroachment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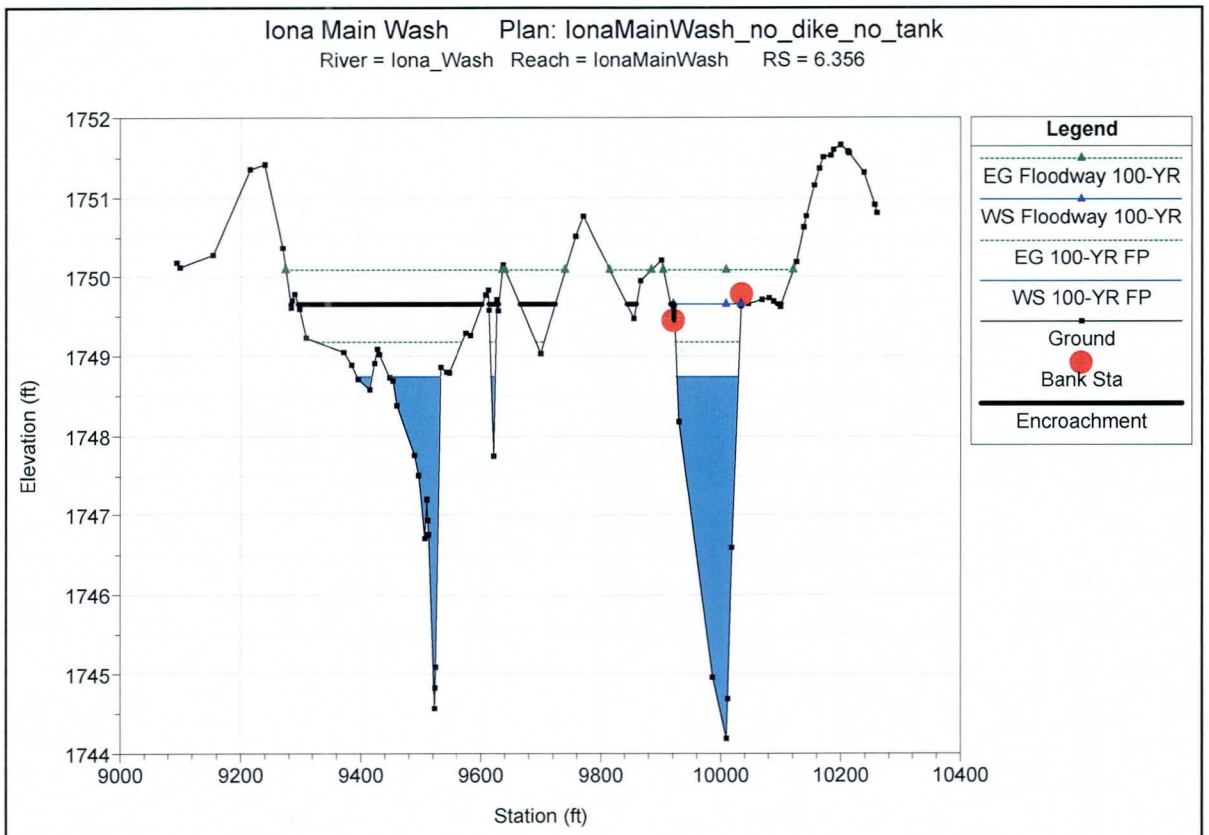
River = Iona_Wash Reach = IonaMainWash RS = 6.463
Elevation (ft)
Station (ft)
1760
1758
1756
1754
1752
1750
1748
9400
9600
9800
10000
10200
10400
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Bank Sta
Encroachment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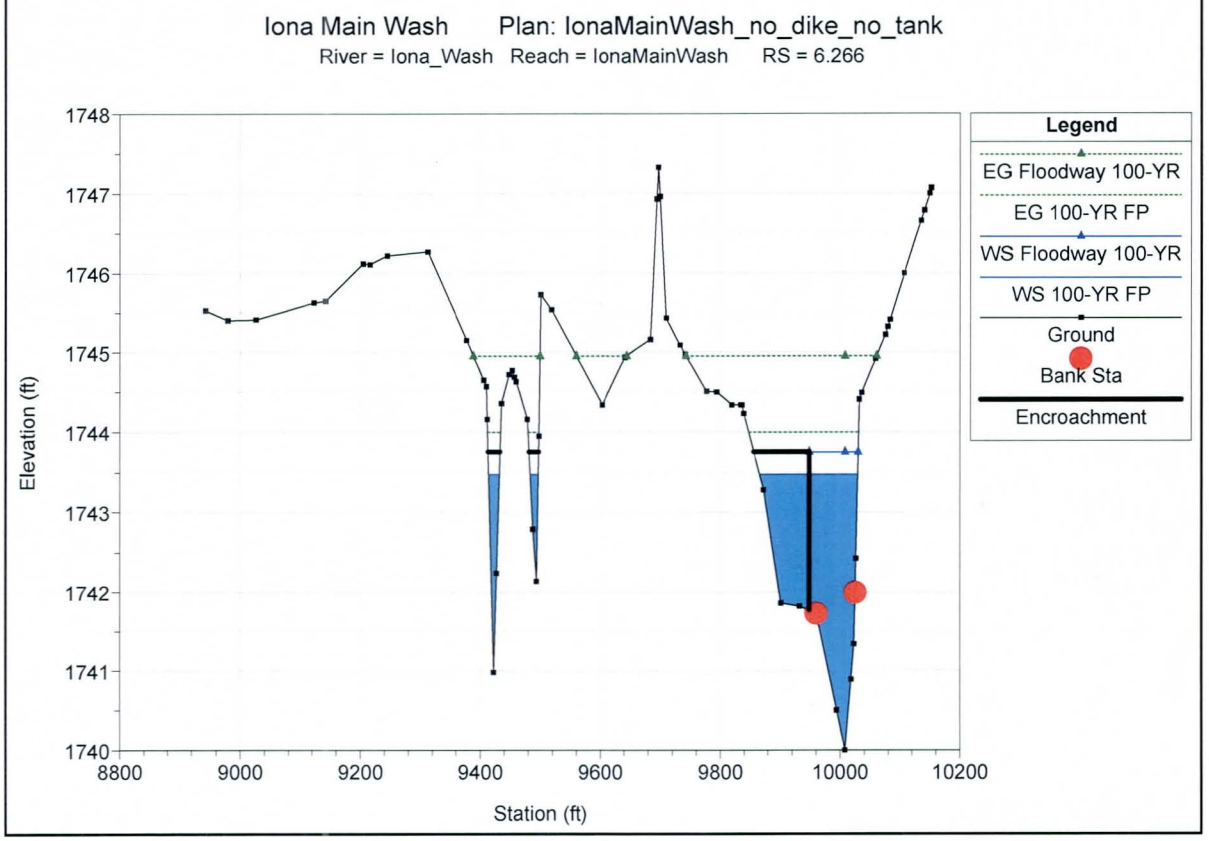
River = Iona_Wash Reach = IonaMainWash RS = 6.356
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Bank Sta
Encroachment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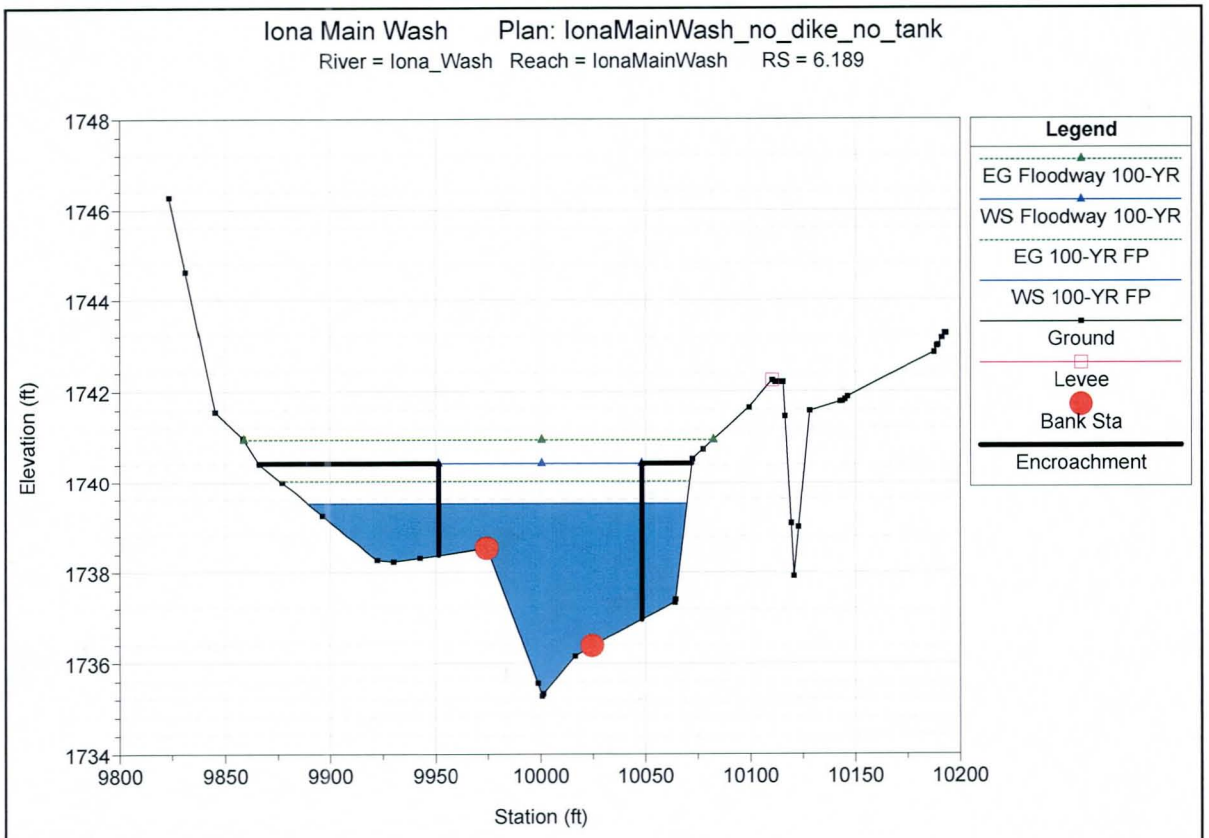
River = Iona_Wash Reach = IonaMainWash RS = 6.266
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
EG 100-YR FP
WS Floodway 100-YR
WS 100-YR FP
Ground
Bank Sta
Encroachment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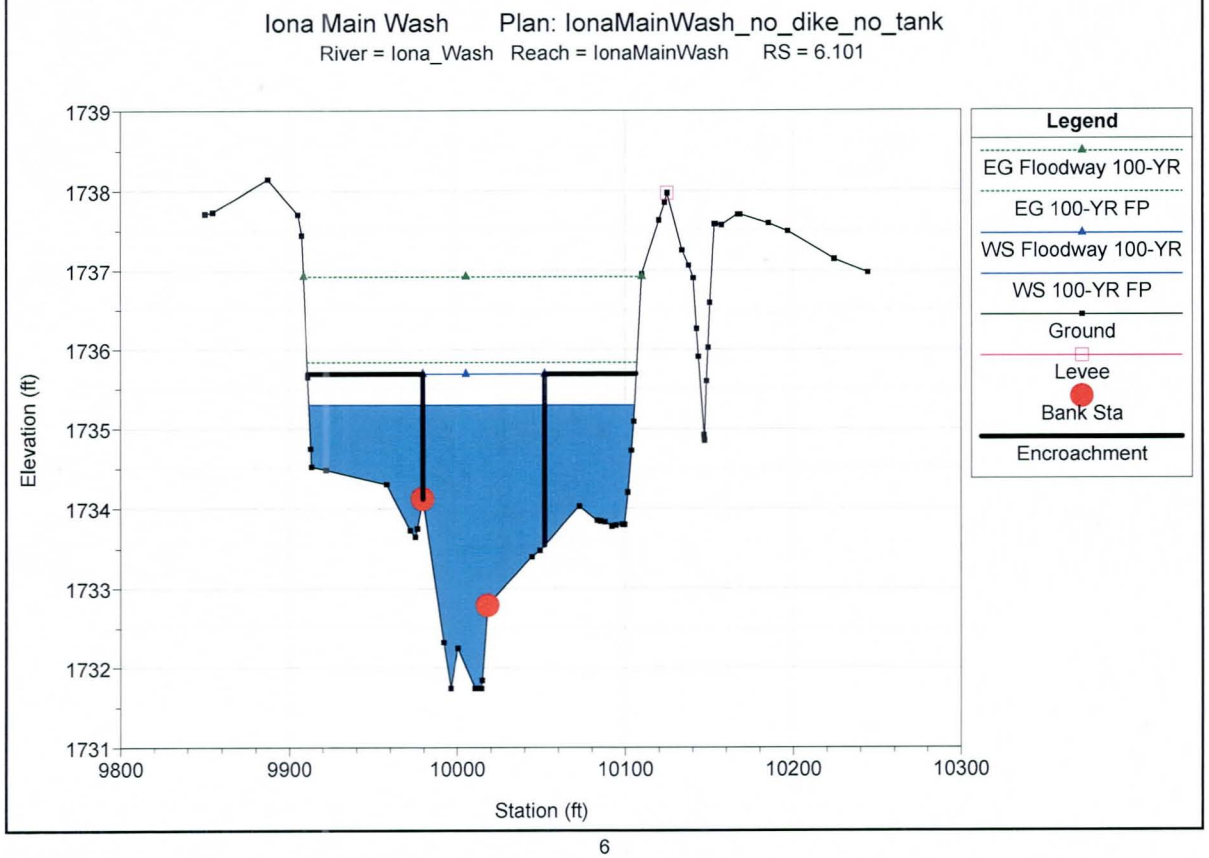
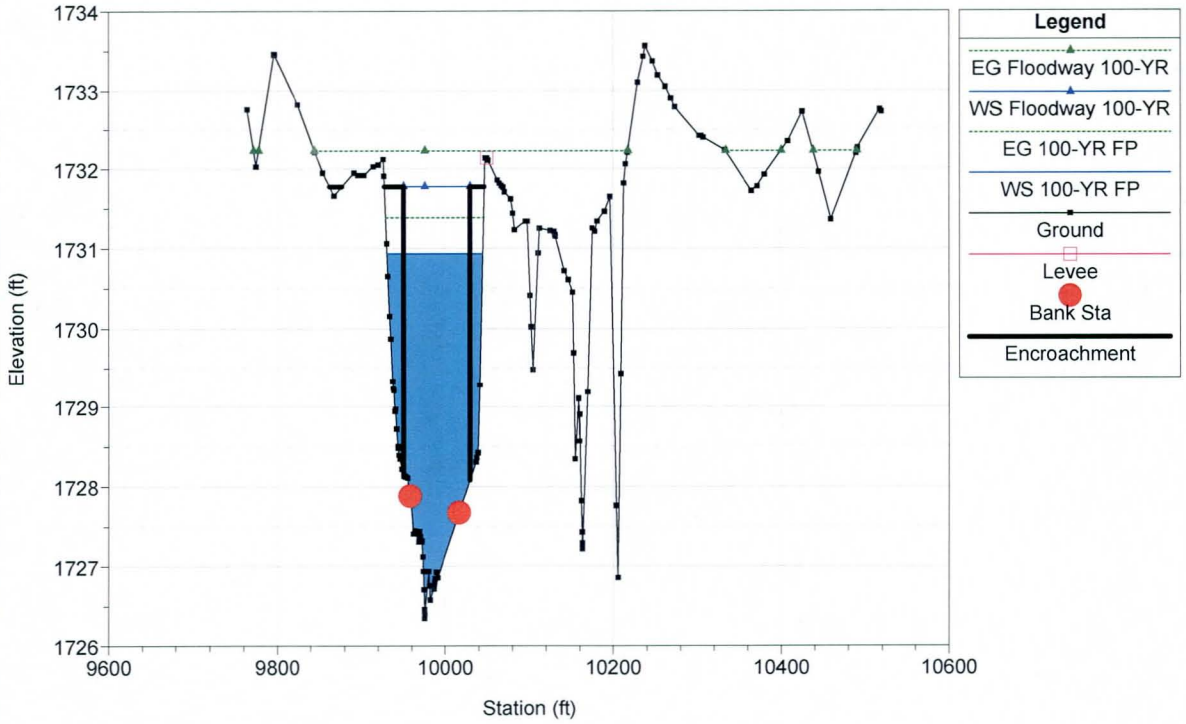
River = Iona_Wash Reach = IonaMainWash RS = 6.189
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Levee
Bank Sta
Encroachment


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 6.101
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
EG 100-YR FP
WS Floodway 100-YR
WS 100-YR FP
Ground
Levee
Bank Sta
Encroachment

Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 5.989



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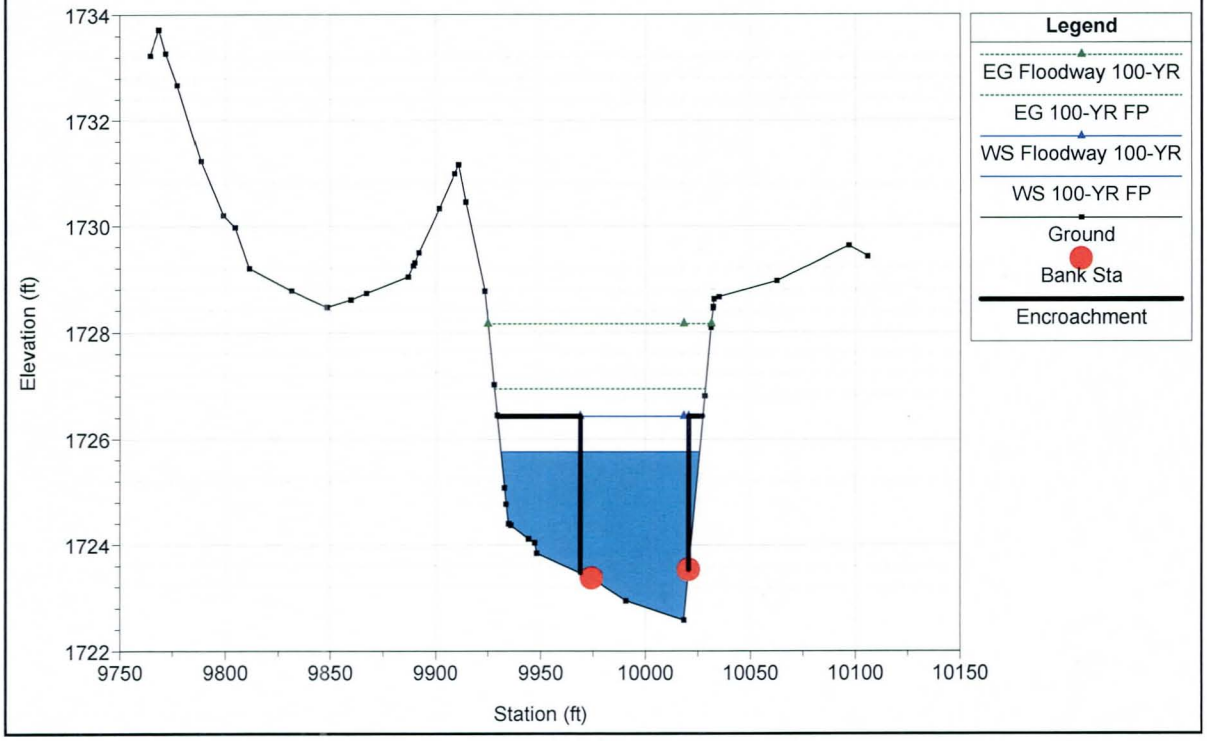
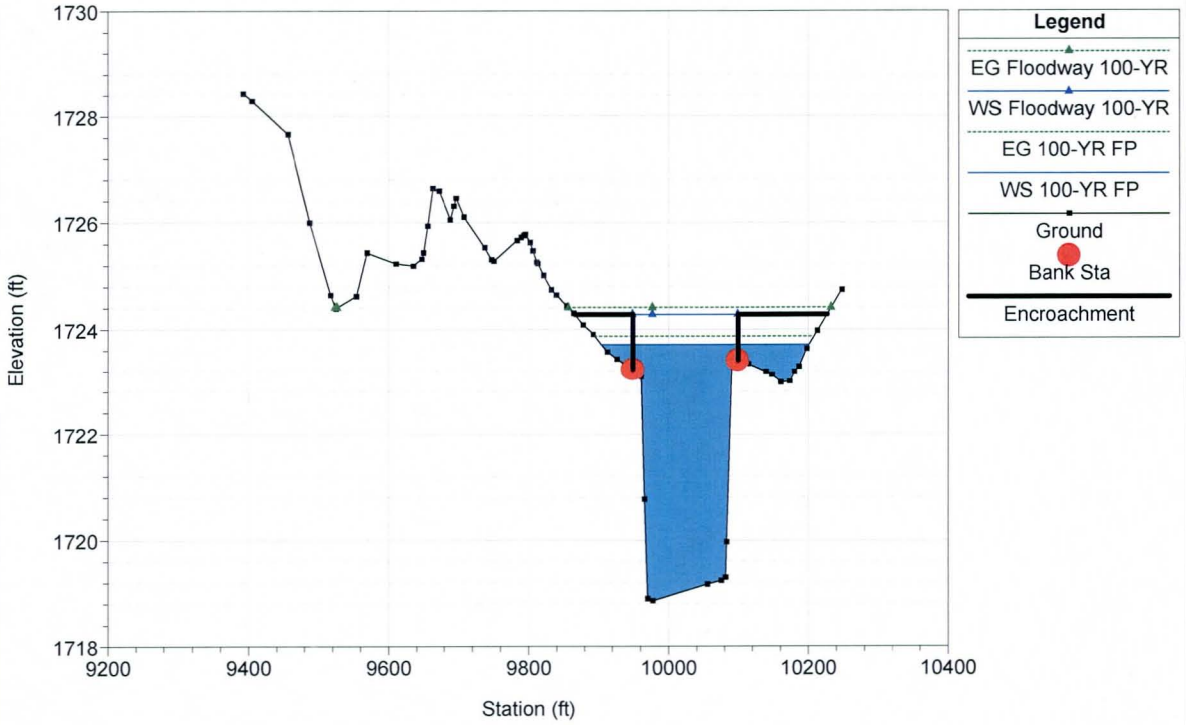
River = Iona_Wash Reach = IonaMainWash RS = 5.899



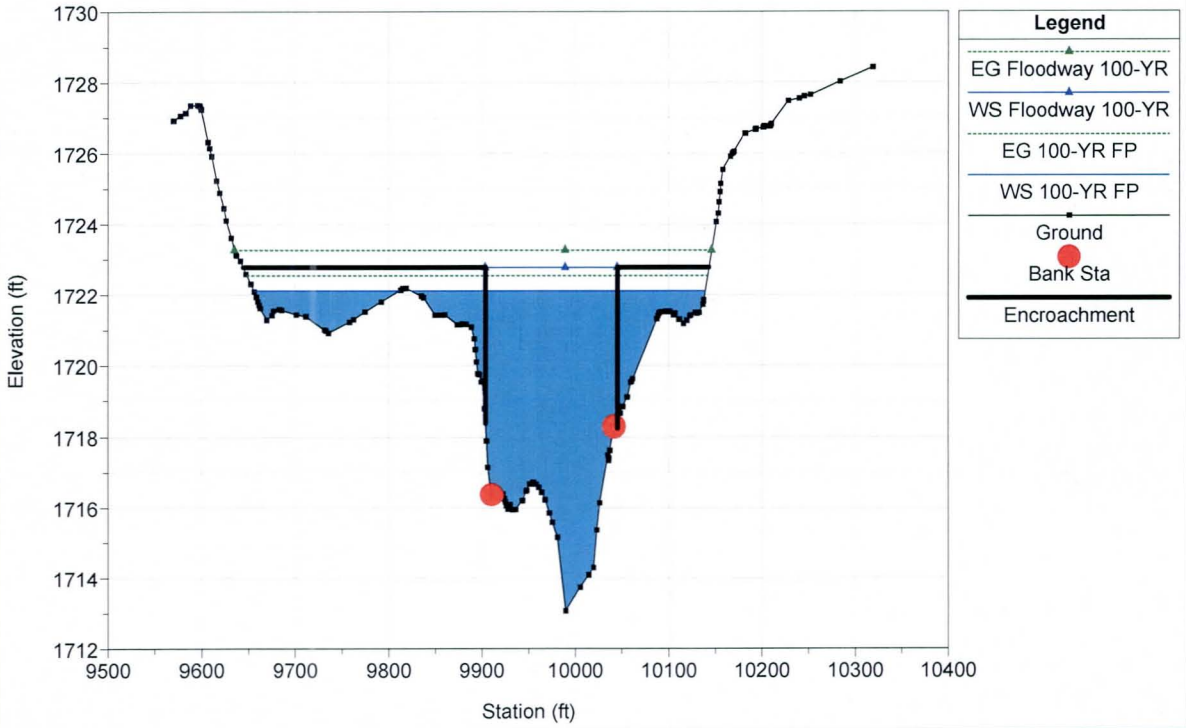
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.809



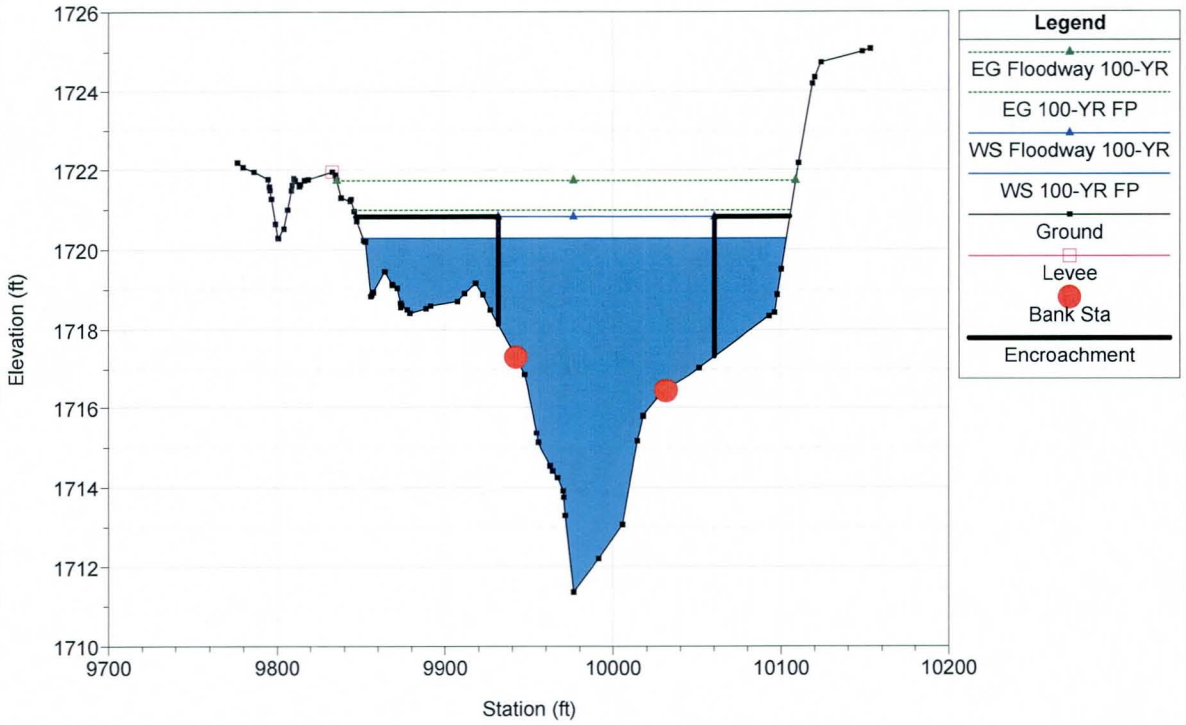
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.710



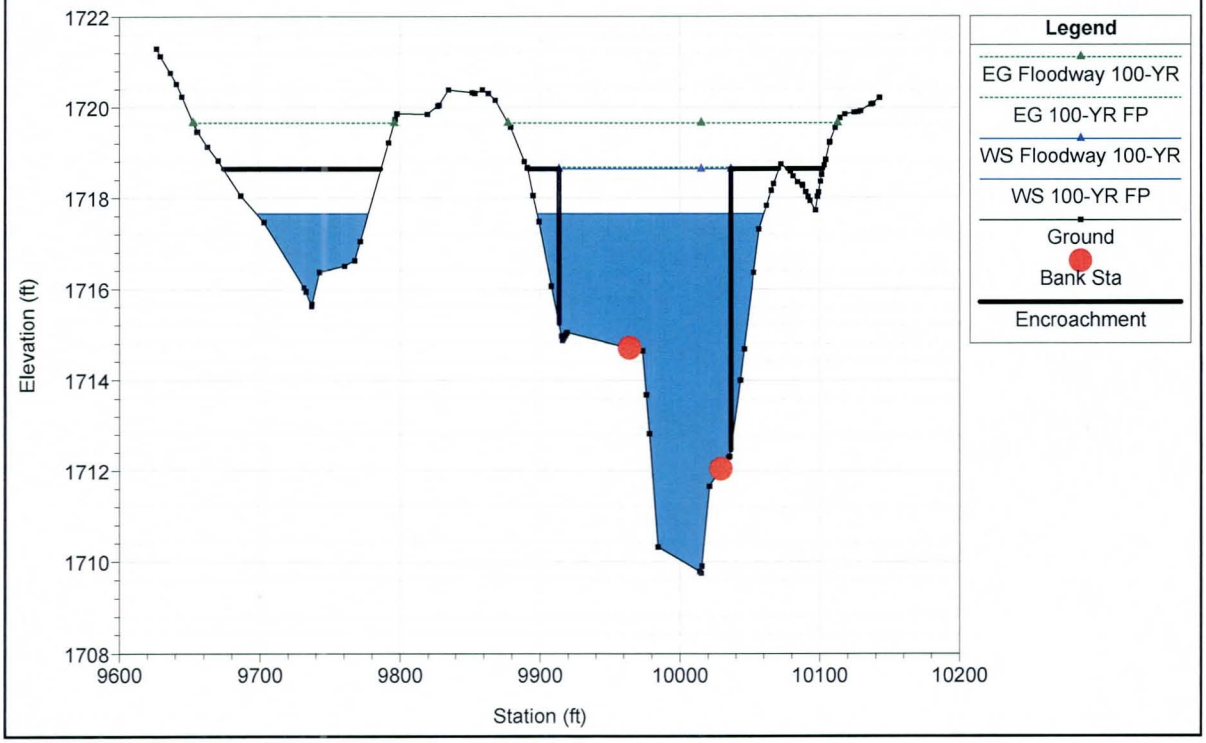
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.629

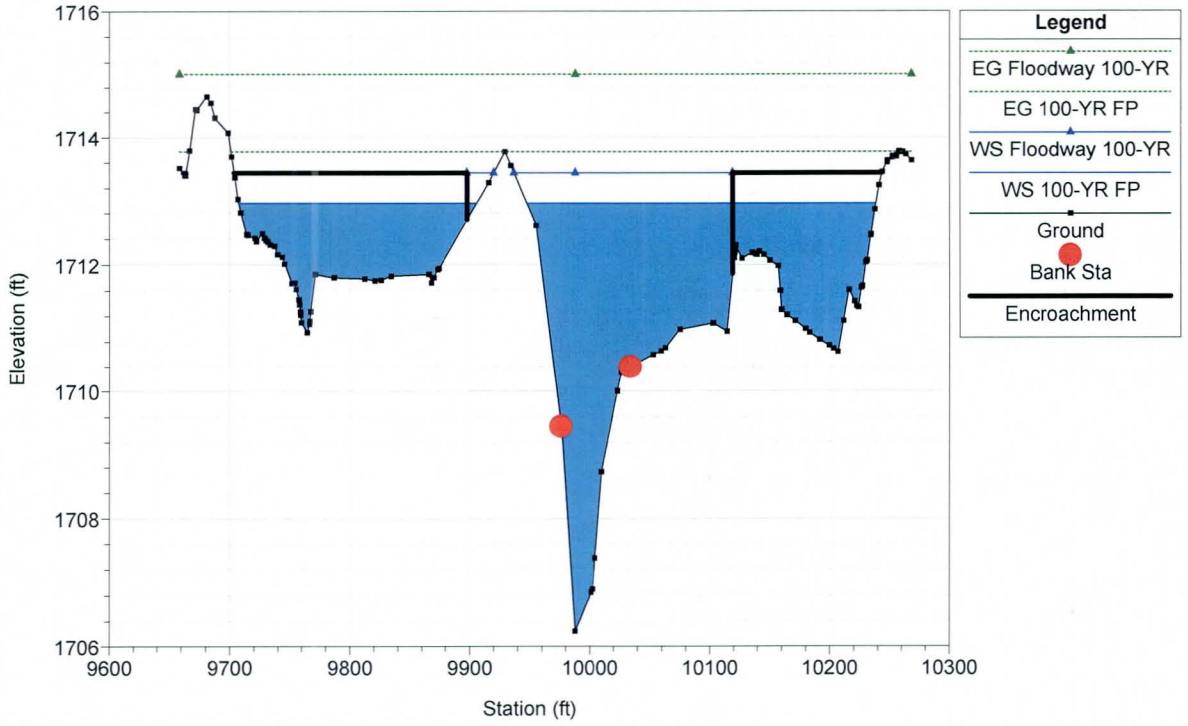


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

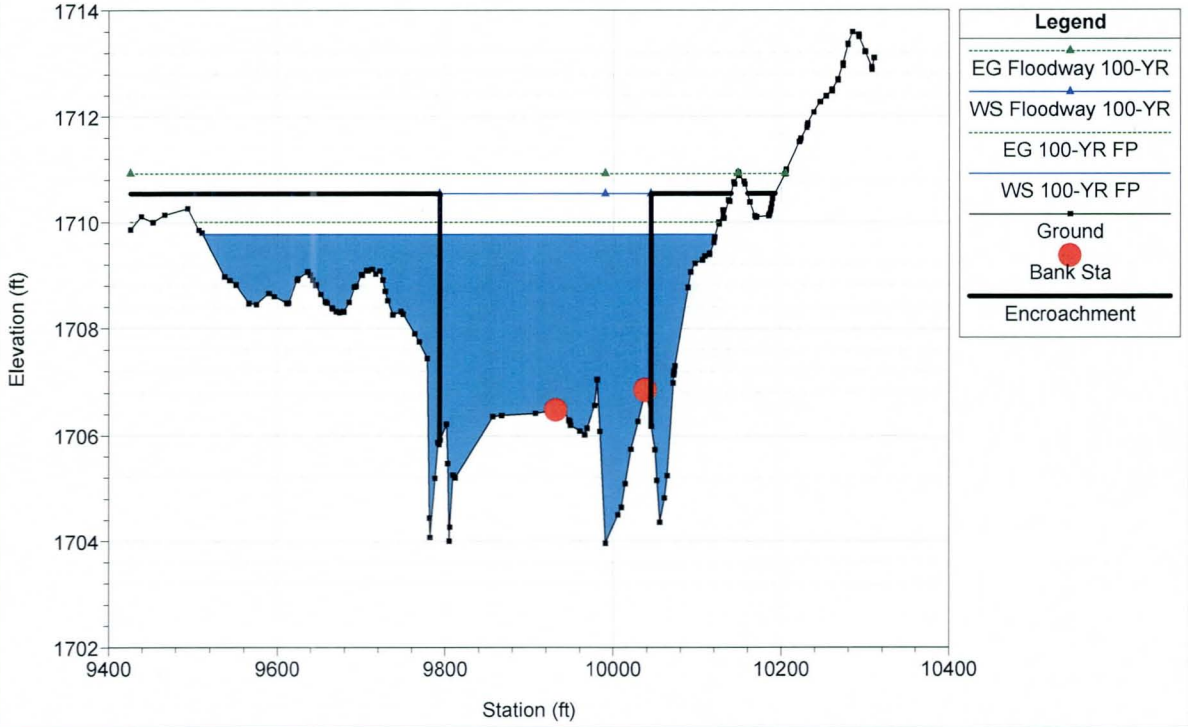
River = Iona_Wash Reach = IonaMainWash RS = 5.557



Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 5.454

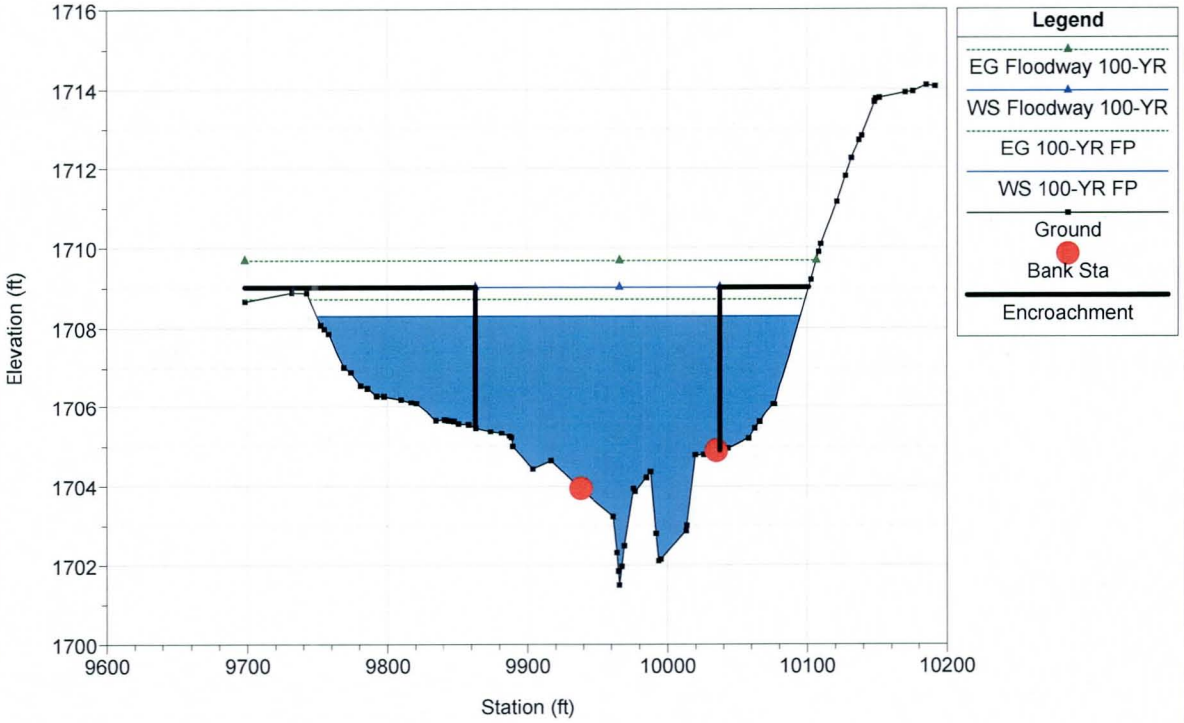


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 5.354



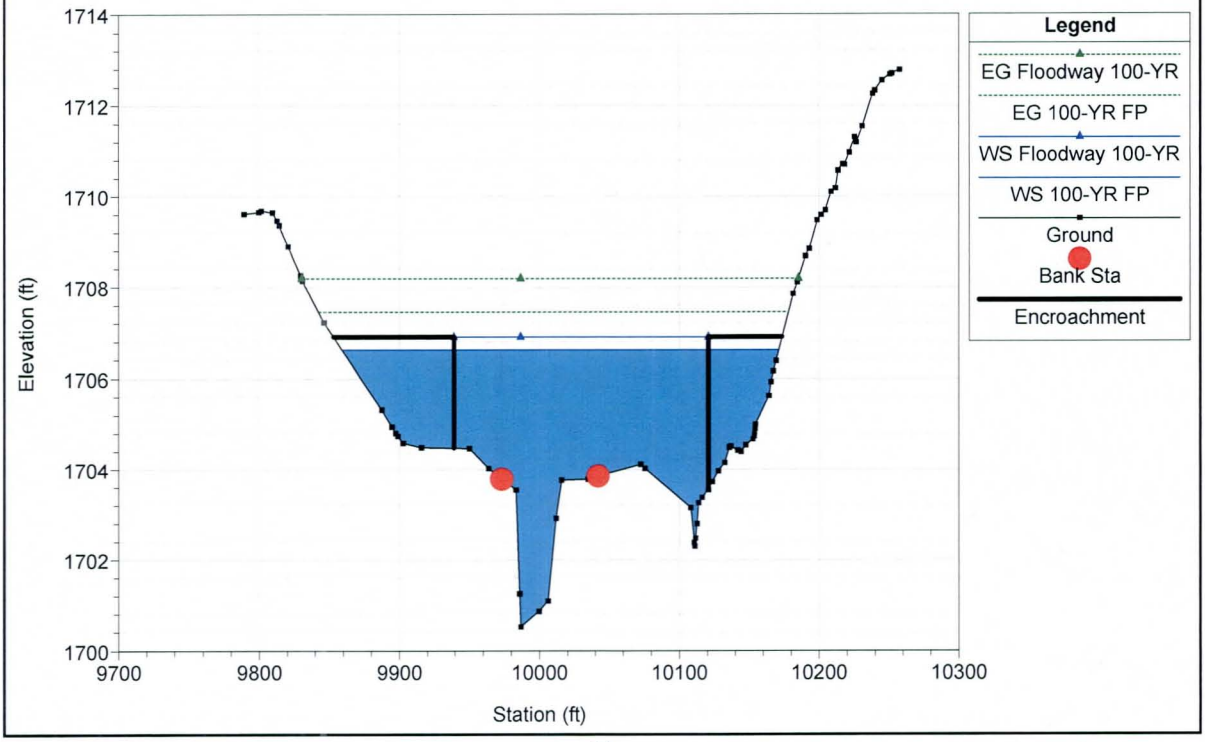
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.278



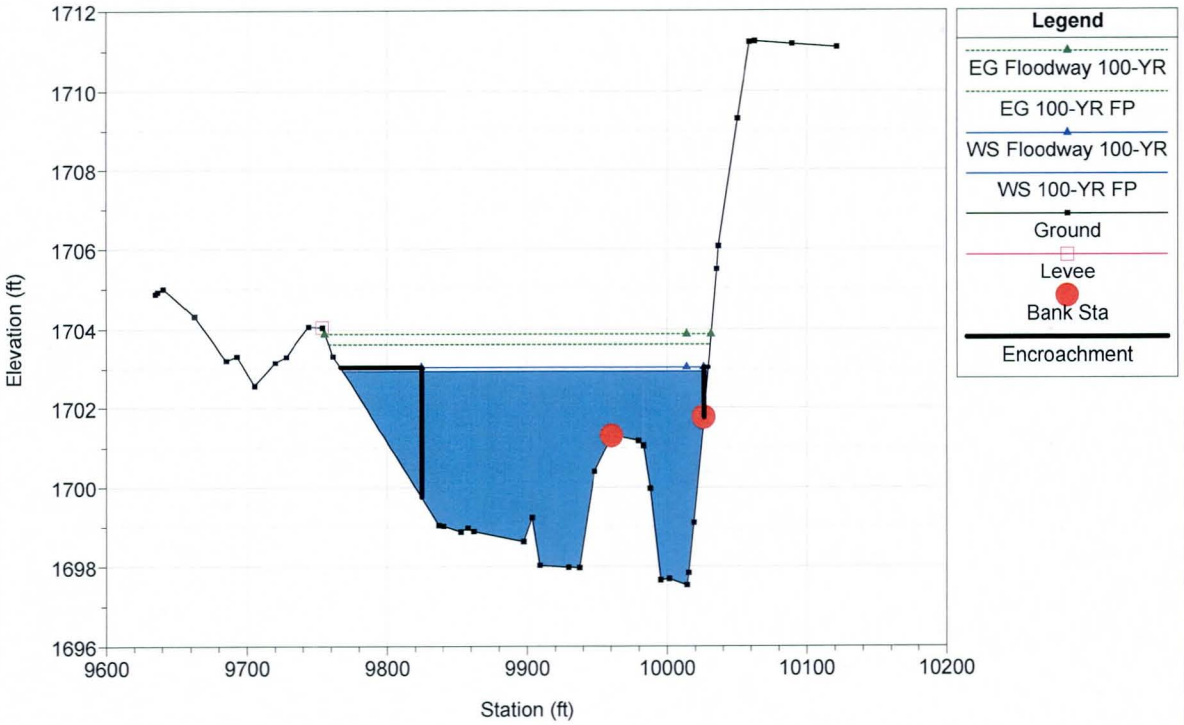
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.237



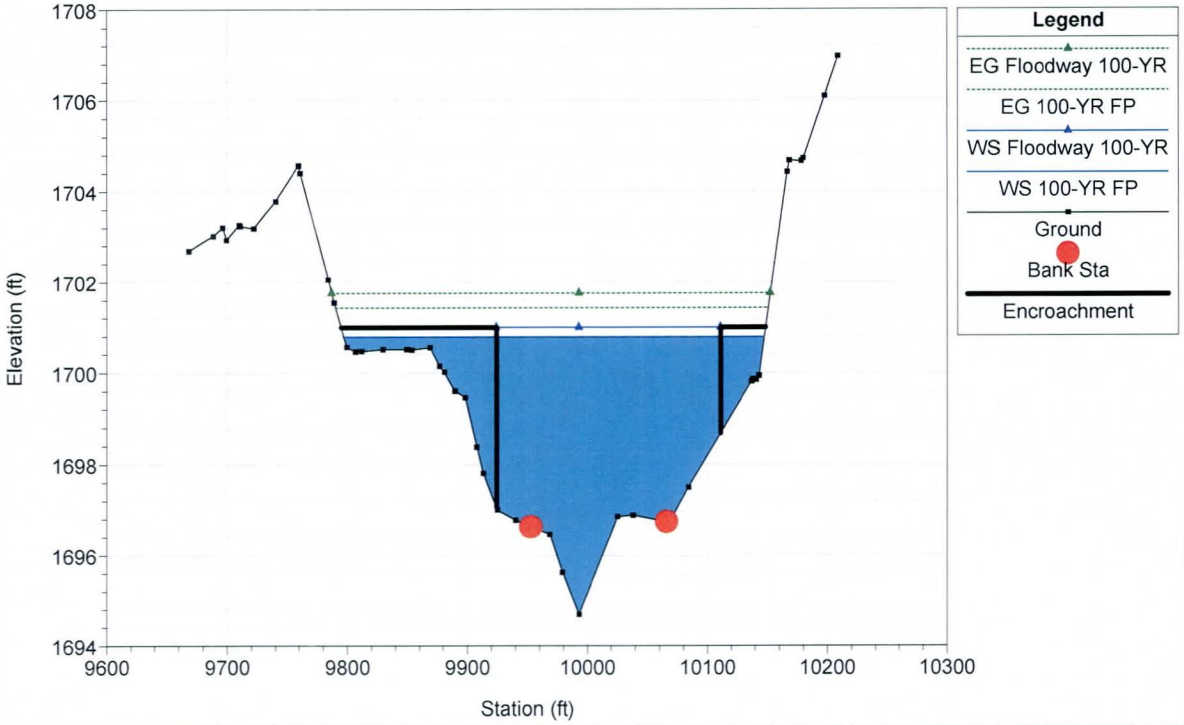
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

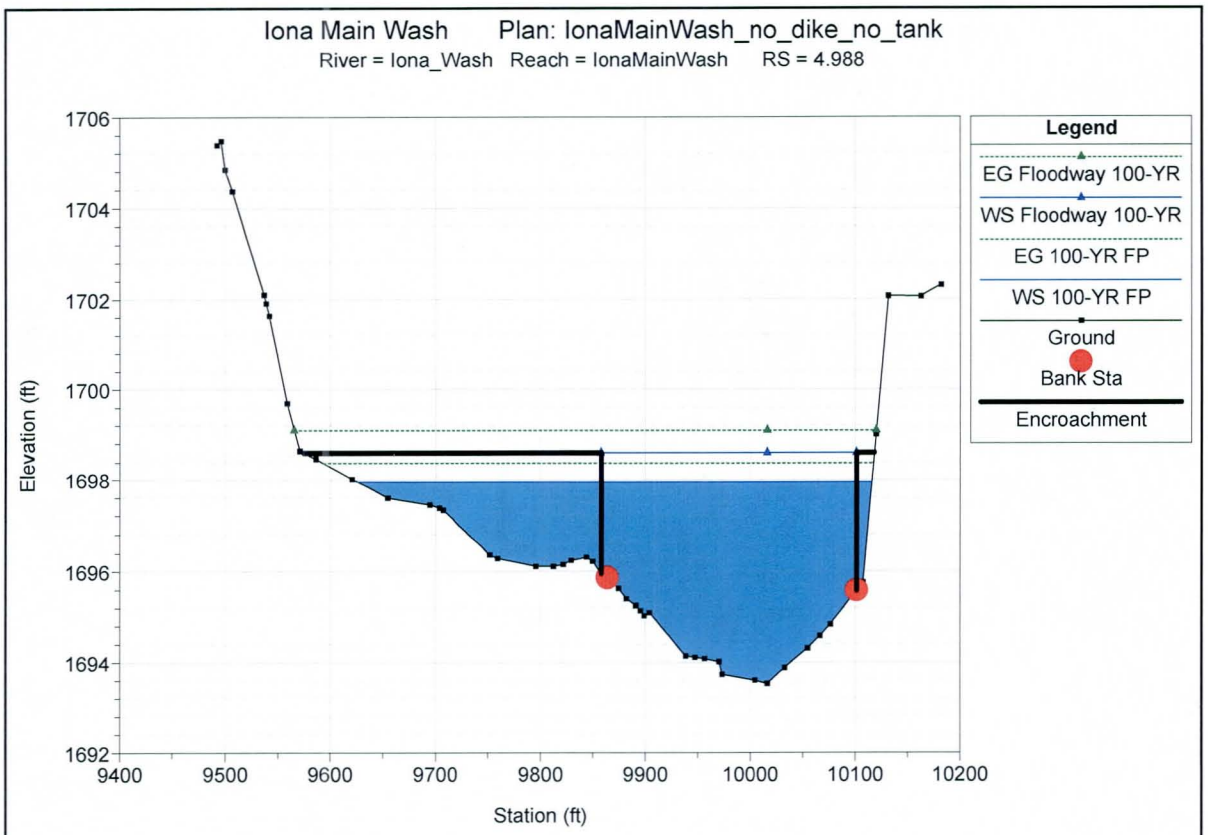
River = Iona_Wash Reach = IonaMainWash RS = 5.146 1300.389 was 1511.860

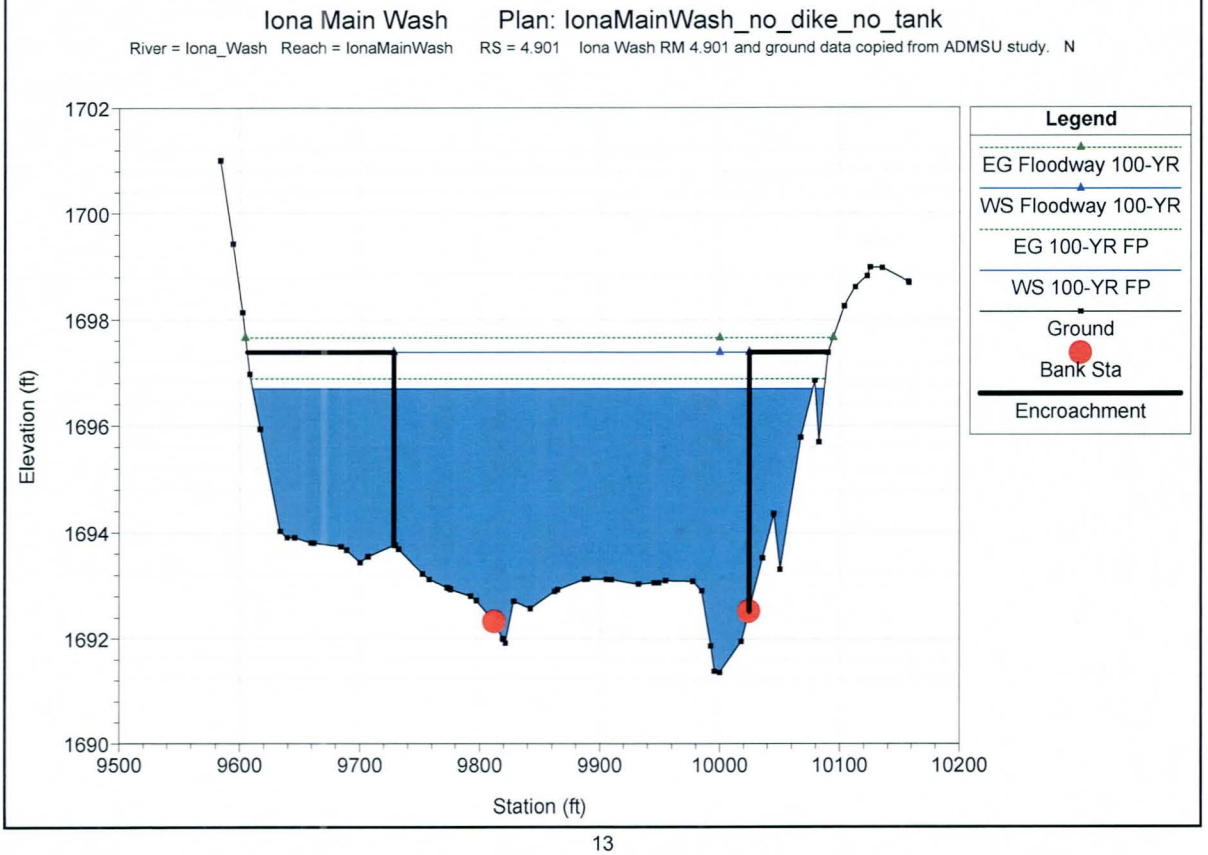


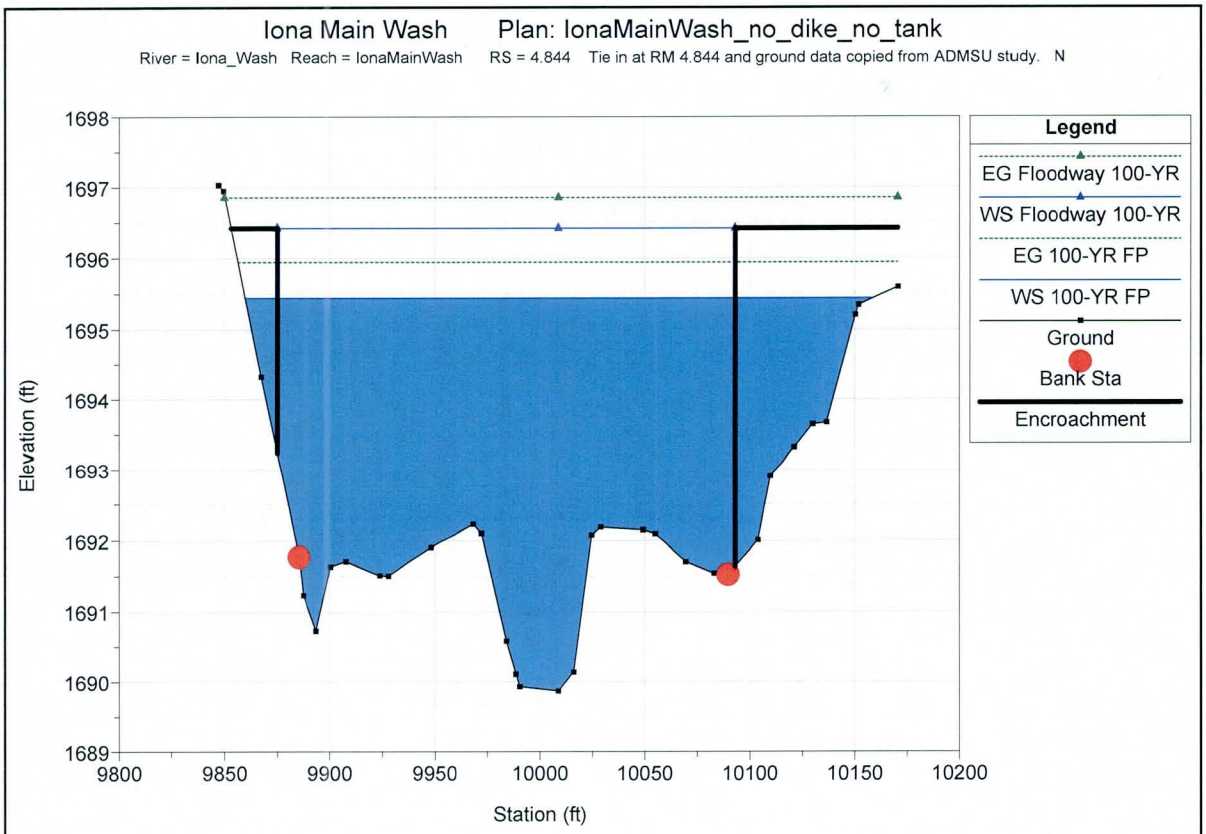
Iona Main Wash Plan: IonaMainWash_no_dike_no_tank

River = Iona_Wash Reach = IonaMainWash RS = 5.083



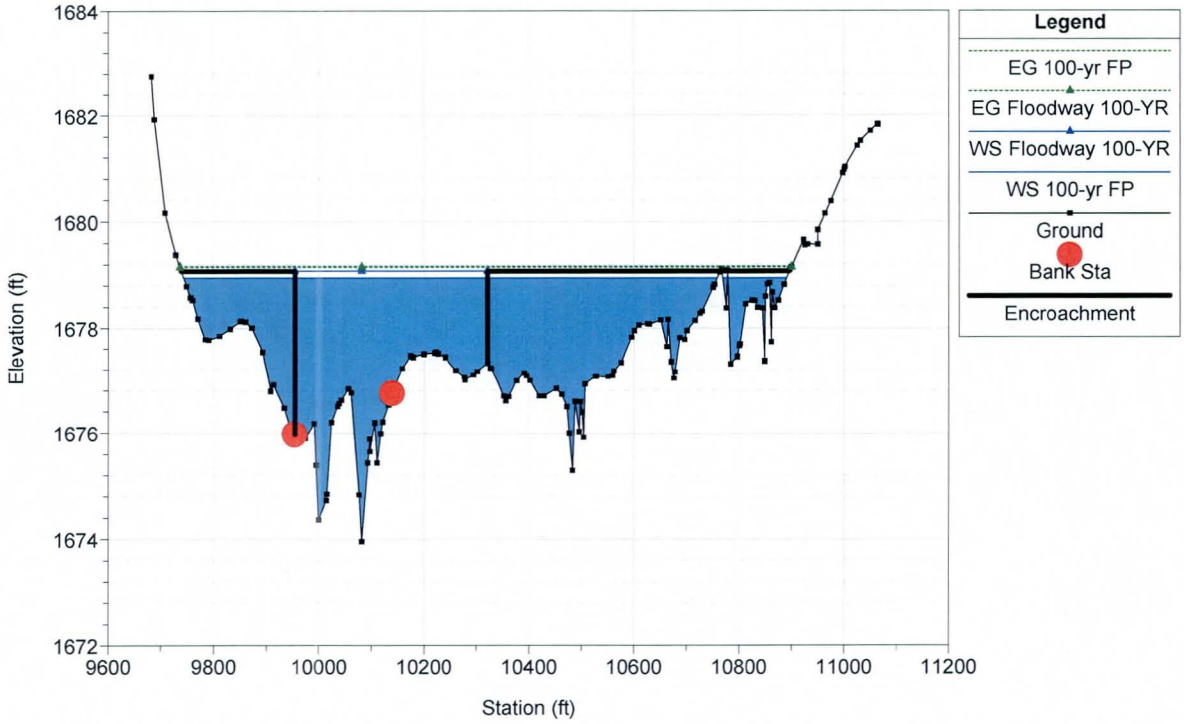

Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 4.988
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Bank Sta
Encroachment


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 4.901 Iona Wash RM 4.901 and ground data copied from ADMSU study. N
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Bank Sta
Encroachment


Iona Main Wash Plan: IonaMainWash_no_dike_no_tank
River = Iona_Wash Reach = IonaMainWash RS = 4.844 Tie in at RM 4.844 and ground data copied from ADMSU study. N
Elevation (ft)
1698
1697
1696
1695
1694
1693
1692
1691
1690
1689
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-YR FP
WS 100-YR FP
Ground
Bank Sta
Encroachment

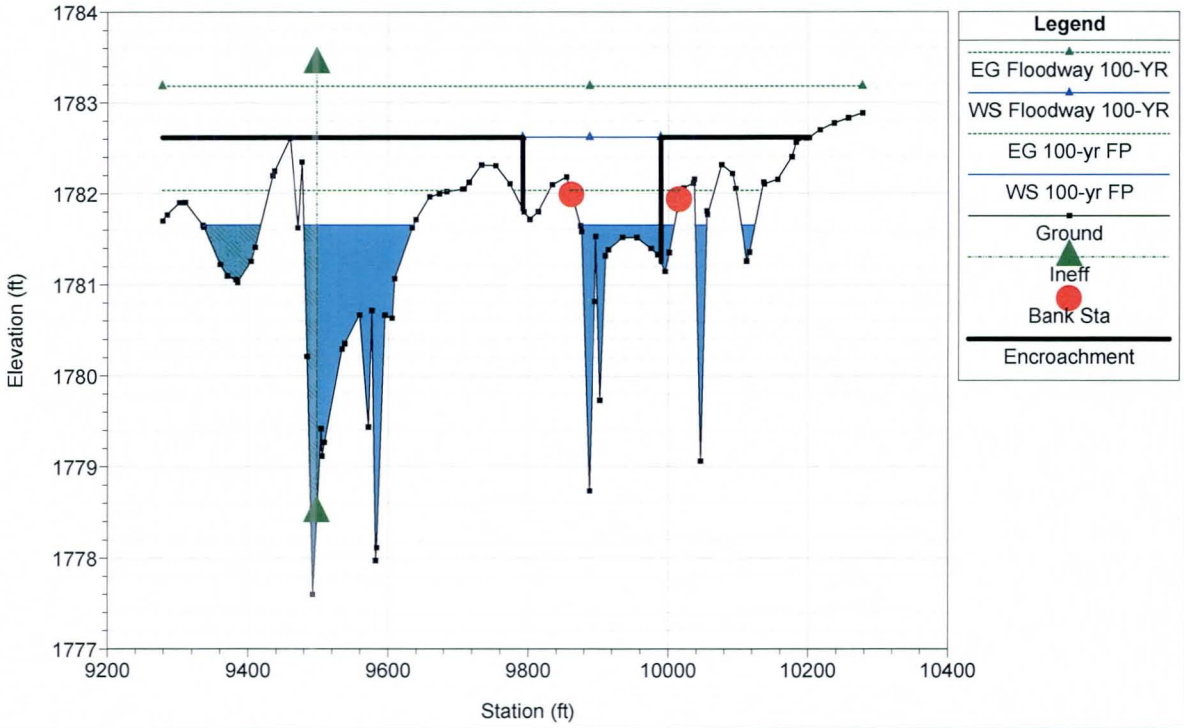
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

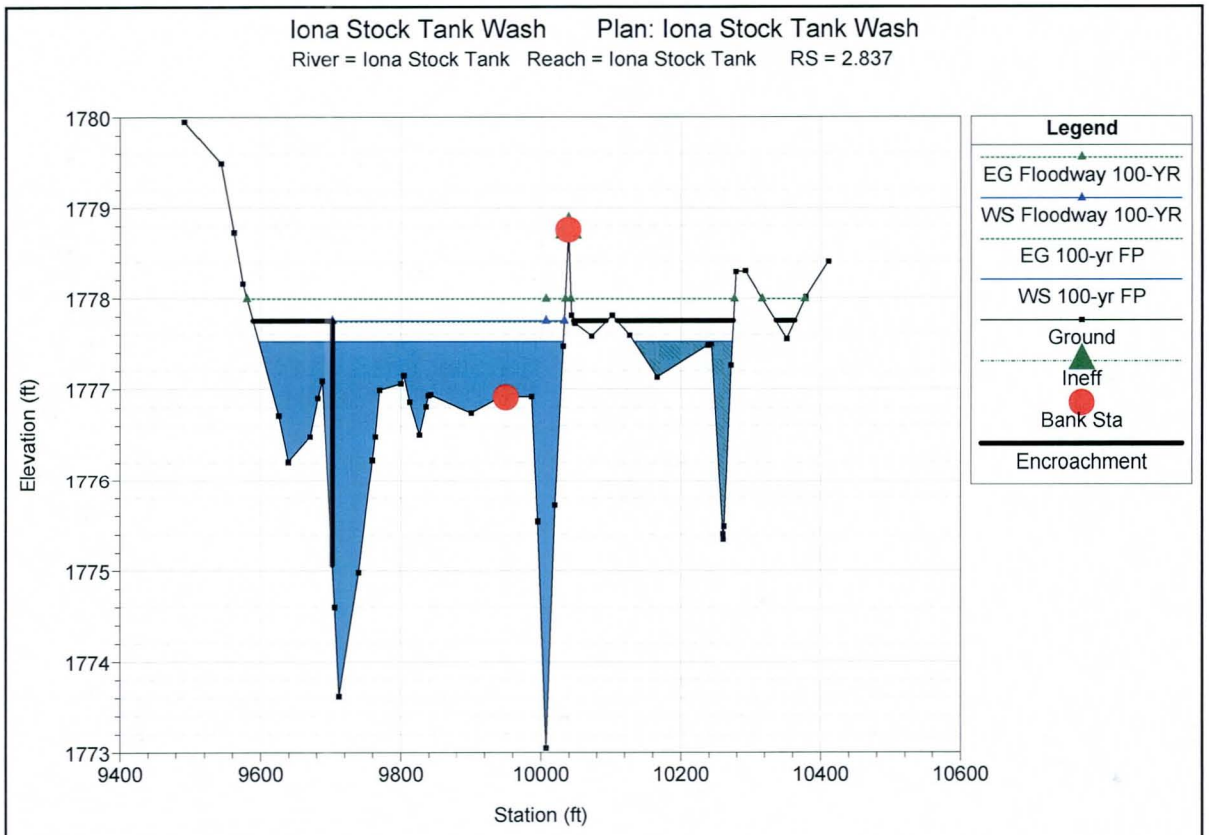
River = Iona Stock Tank Reach = Iona Stock Tank RS = .290 Cross section ground data copied from RM 4.314 Iona Wash ADMSU m

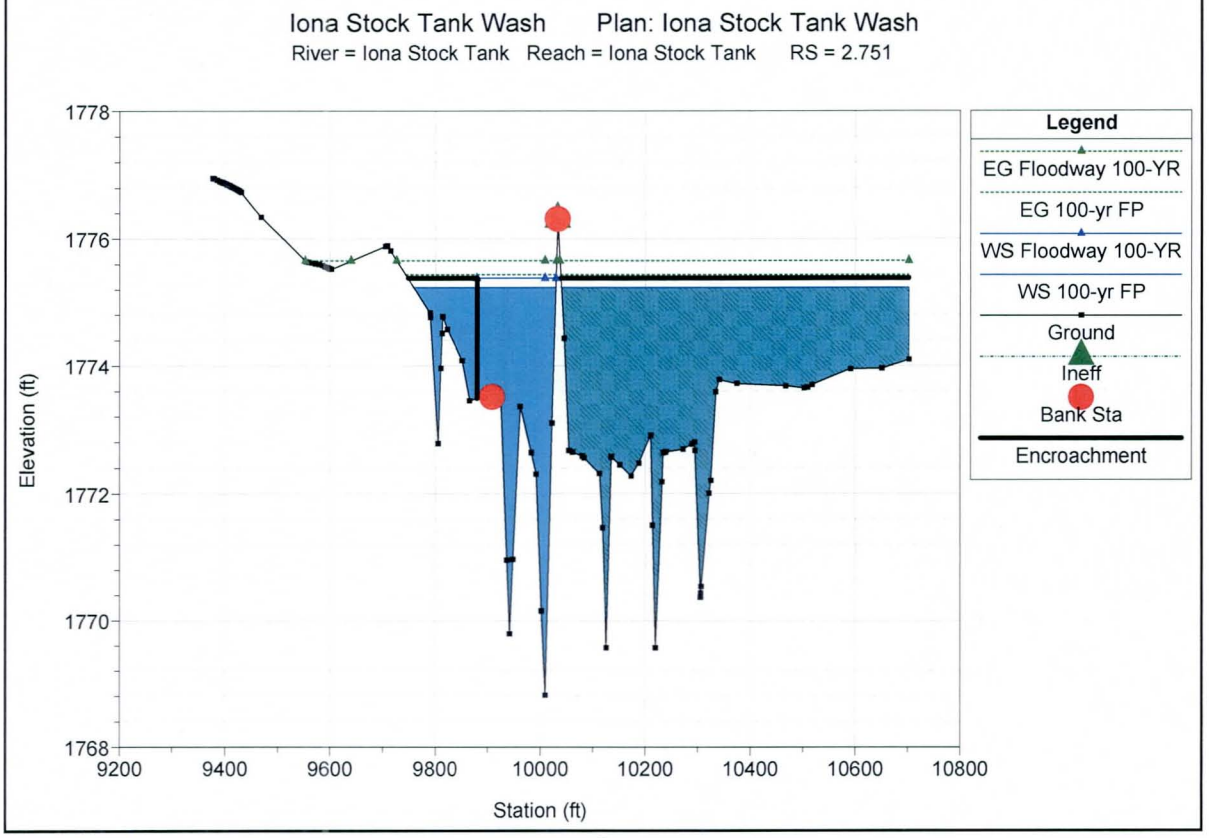


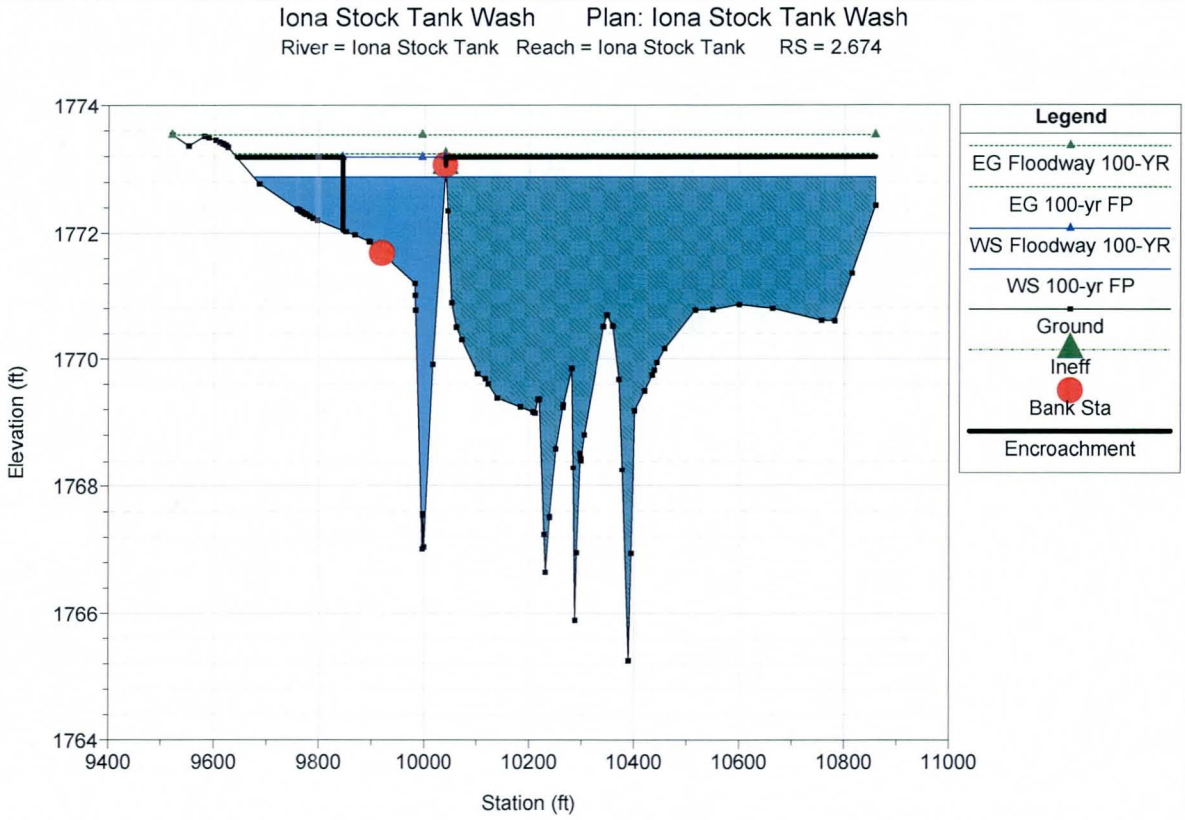
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

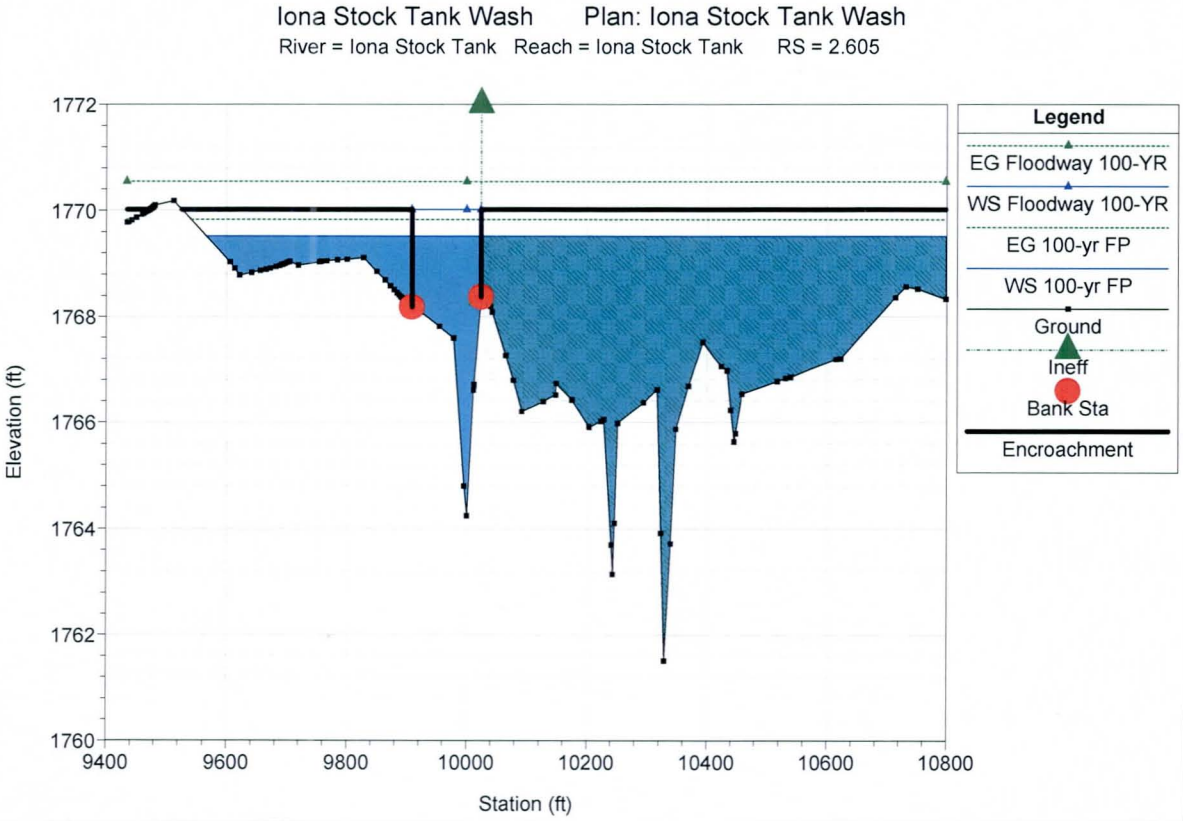
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.938 Tie in at RM 0.104 Iona North Wash and ground data copied from A

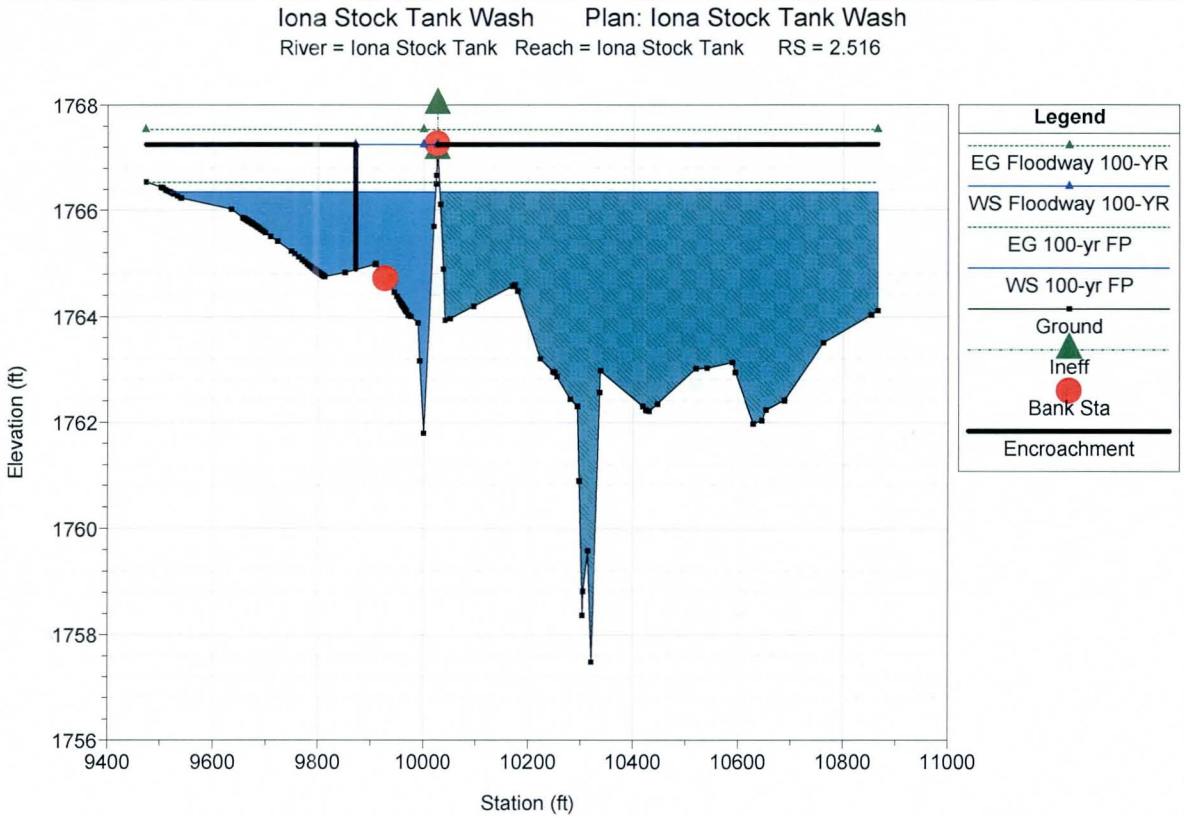


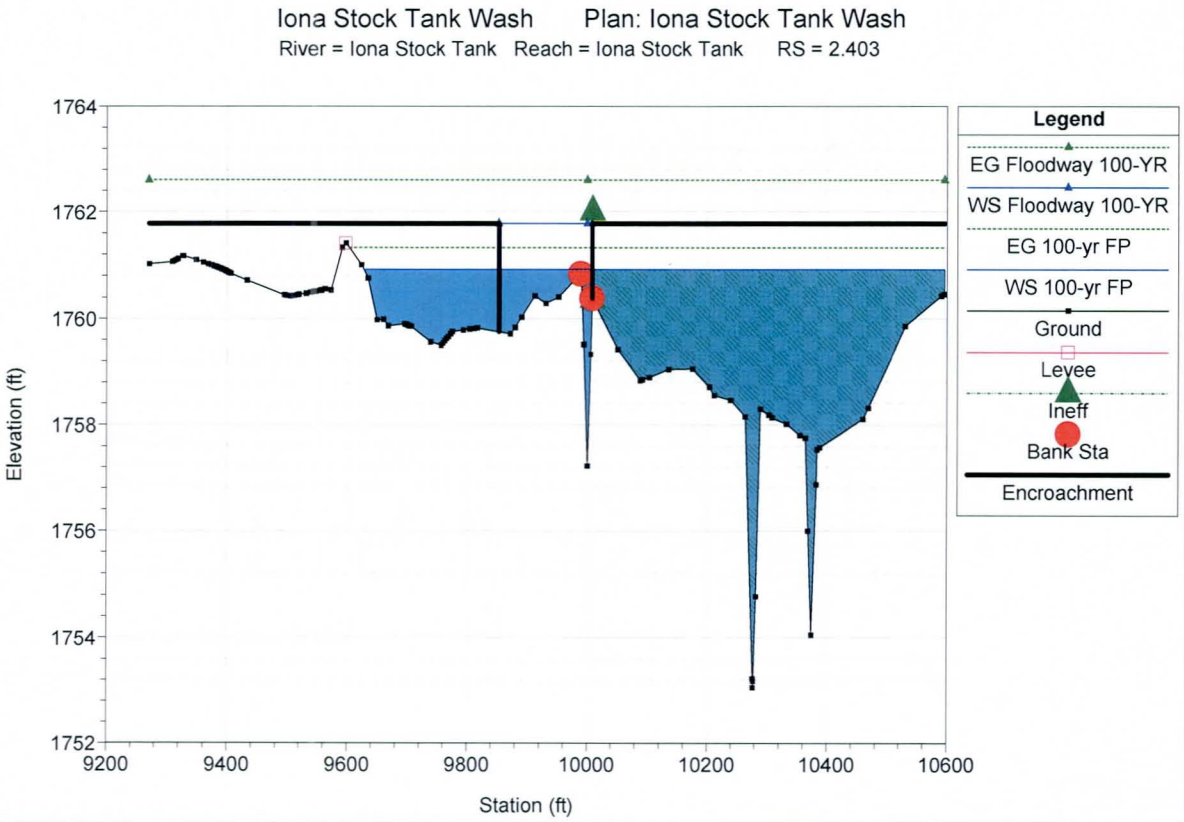

Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.837
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.751
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
EG 100-yr FP
WS Floodway 100-YR
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.674
Elevation (ft)
Station (ft)
1774
1772
1770
1768
1766
1764
9400
9600
9800
10000
10200
10400
10600
10800
11000
Legend
EG Floodway 100-YR
EG 100-yr FP
WS Floodway 100-YR
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment

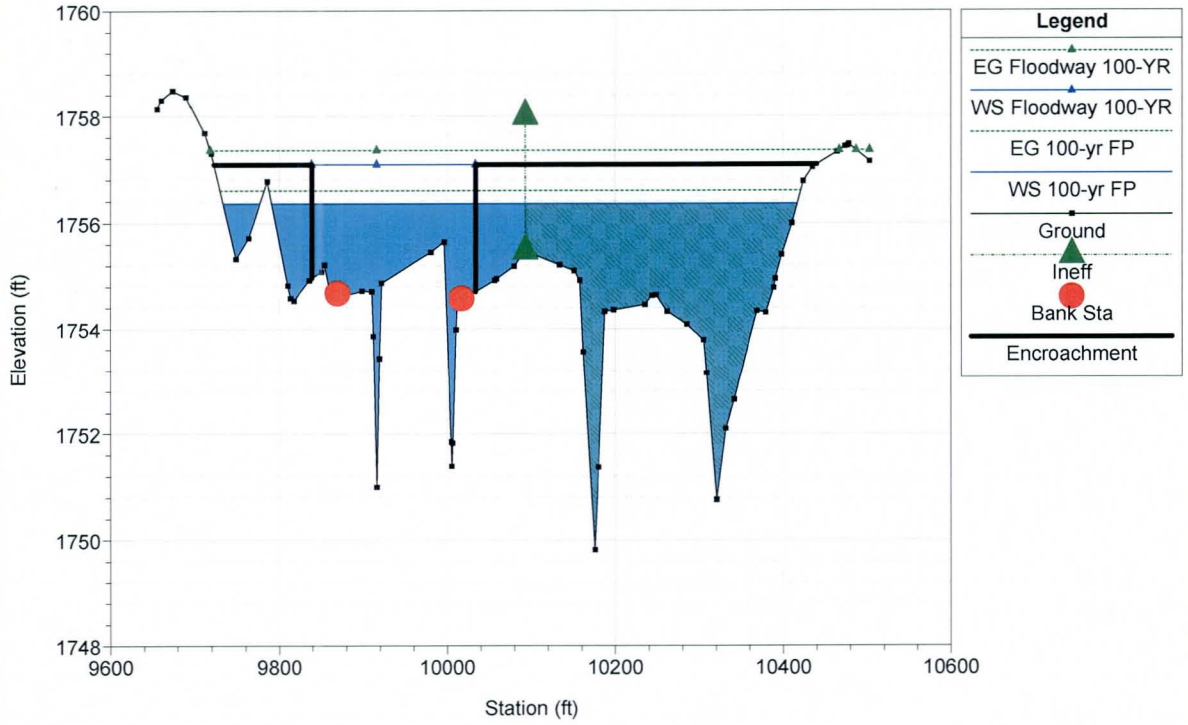

Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.605
Elevation (ft)
Station (ft)
1772
1770
1768
1766
1764
1762
1760
9400
9600
9800
10000
10200
10400
10600
10800
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.516
Elevation (ft)
Station (ft)
1768
1766
1764
1762
1760
1758
1756
9400
9600
9800
10000
10200
10400
10600
10800
11000
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.403
Elevation (ft)
Station (ft)
1764
1762
1760
1758
1756
1754
1752
9200
9400
9600
9800
10000
10200
10400
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Levee
Ineff
Bank Sta
Encroachment

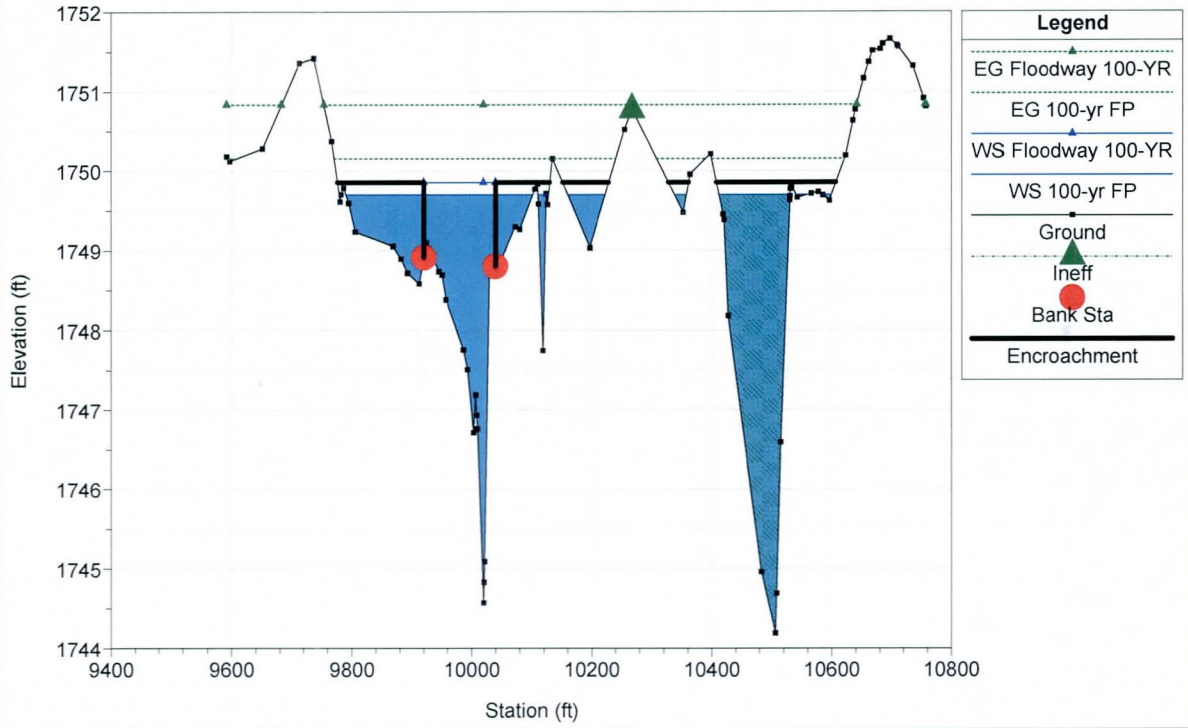
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

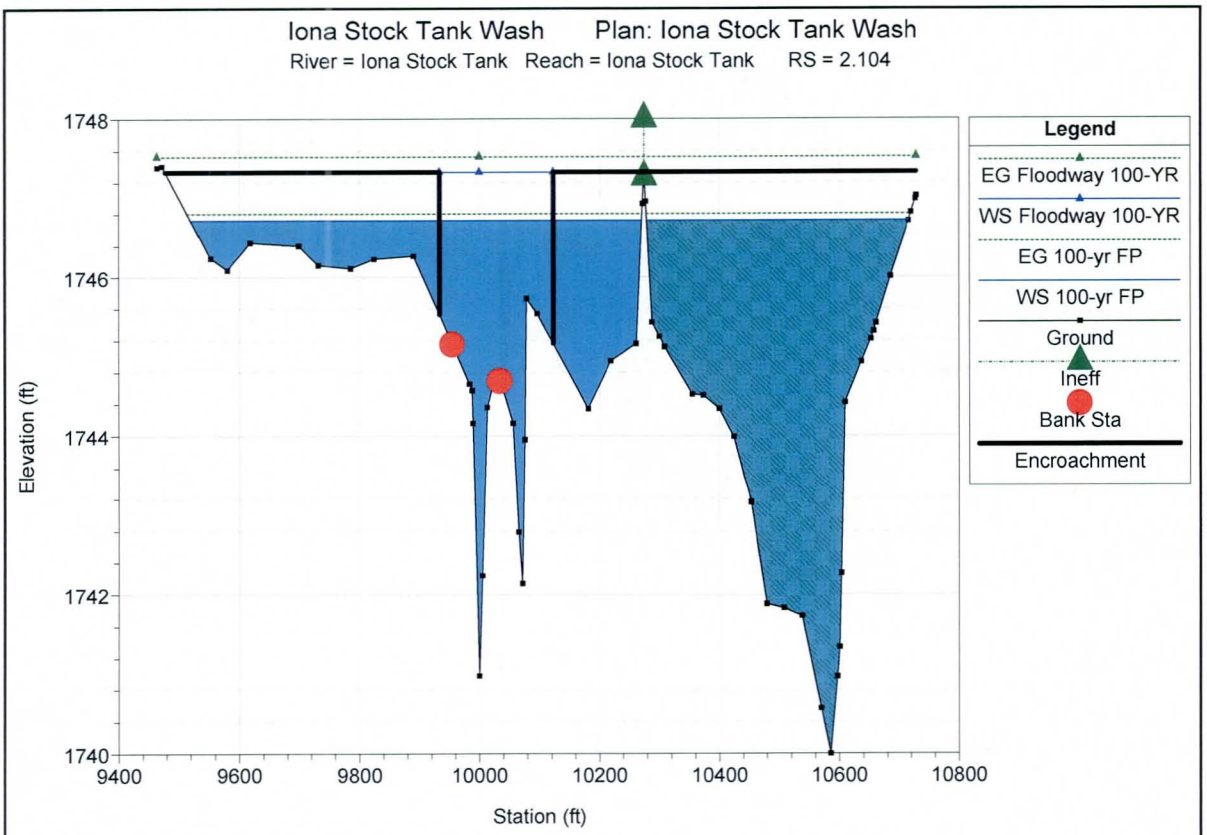
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.314

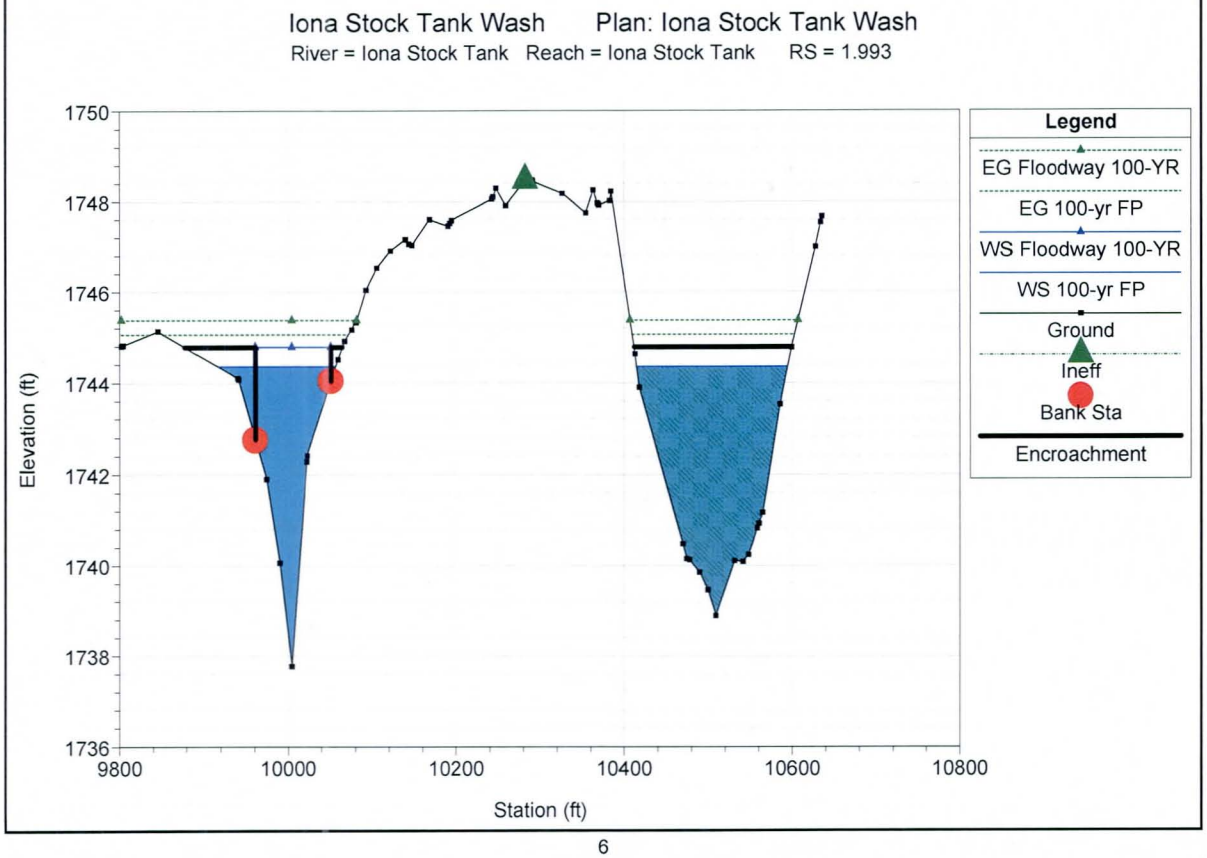


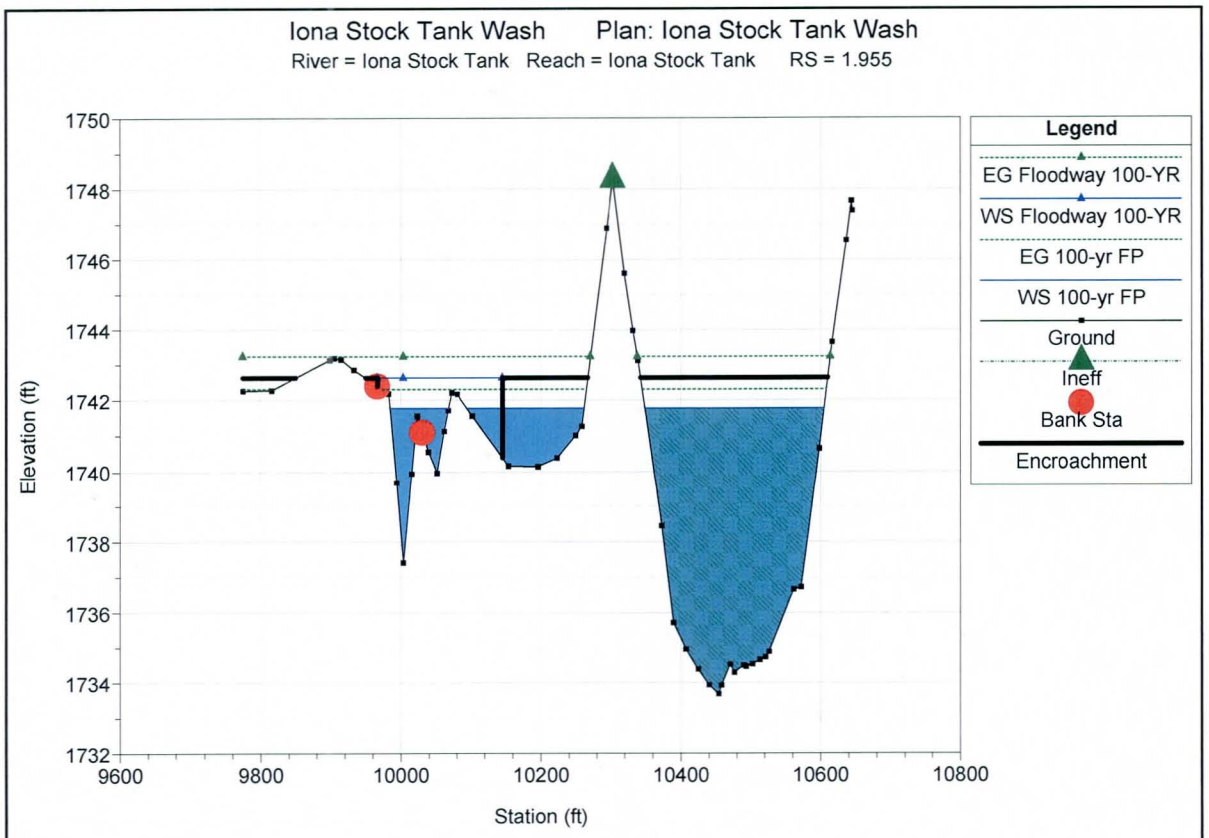
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

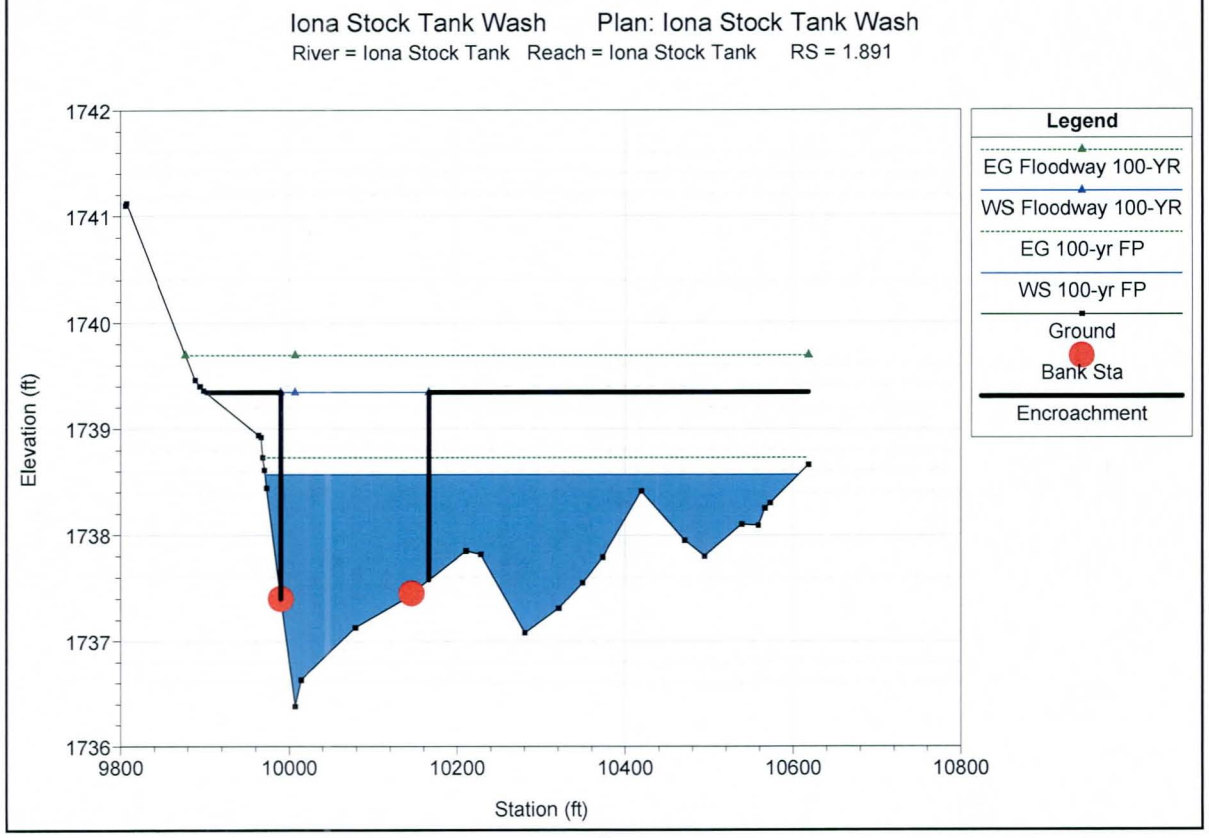
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.188

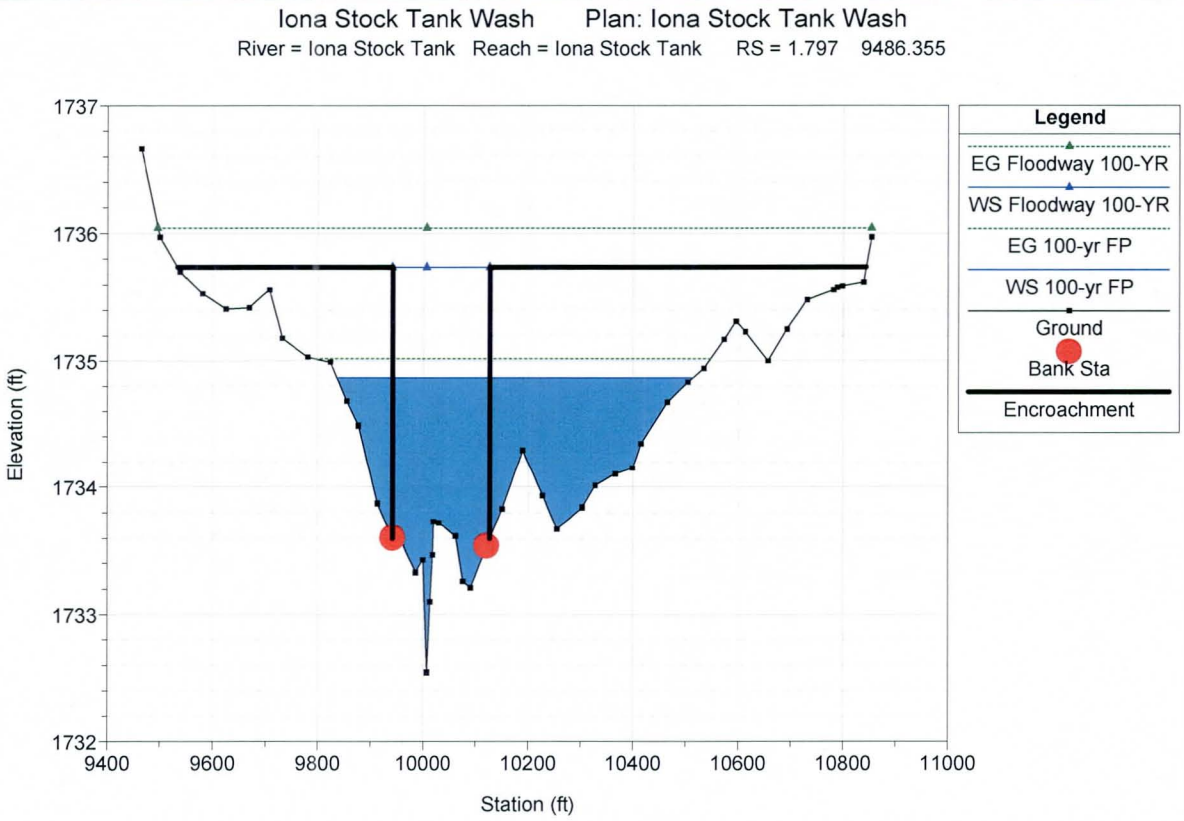


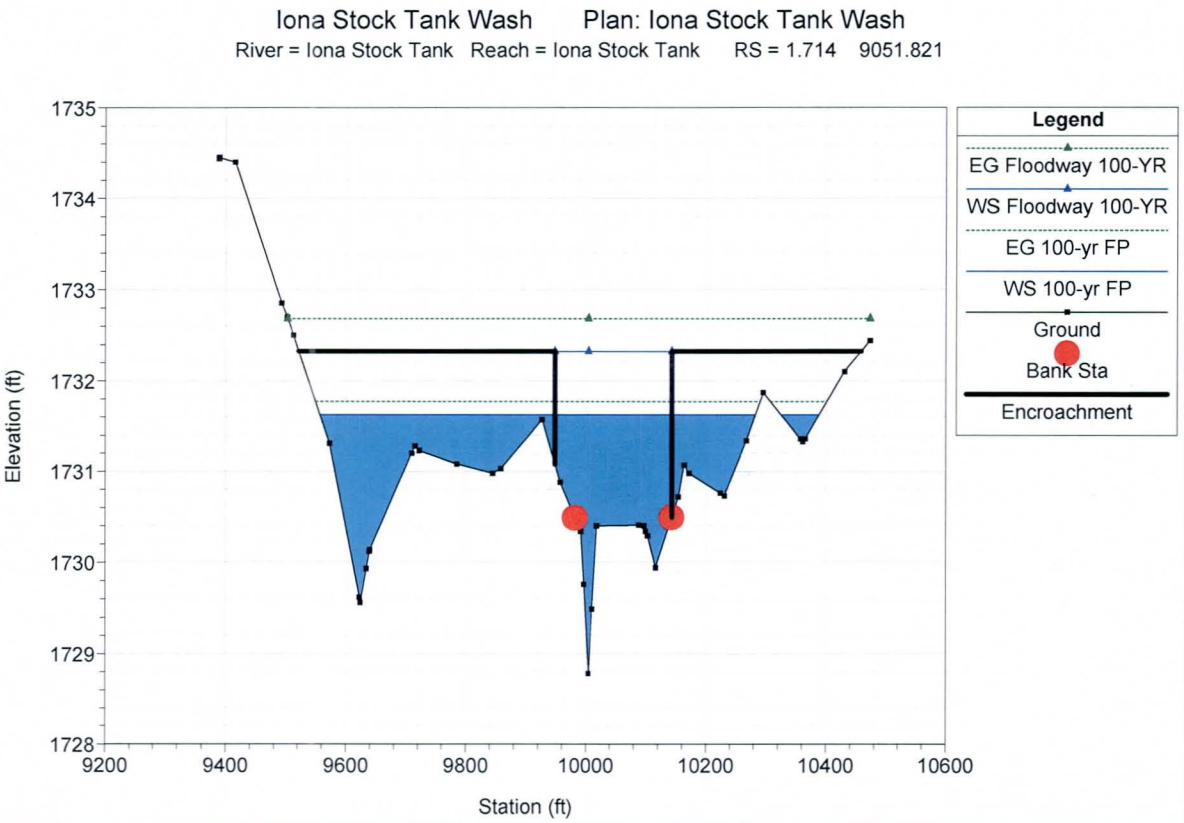

Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 2.104
Elevation (ft)
Station (ft)
1748
1746
1744
1742
1740
9400
9600
9800
10000
10200
10400
10600
10800
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.993
Elevation (ft)
Station (ft)
1750
1748
1746
1744
1742
1740
1738
1736
9800
10000
10200
10400
10600
10800
Legend
EG Floodway 100-YR
EG 100-yr FP
WS Floodway 100-YR
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.955
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment

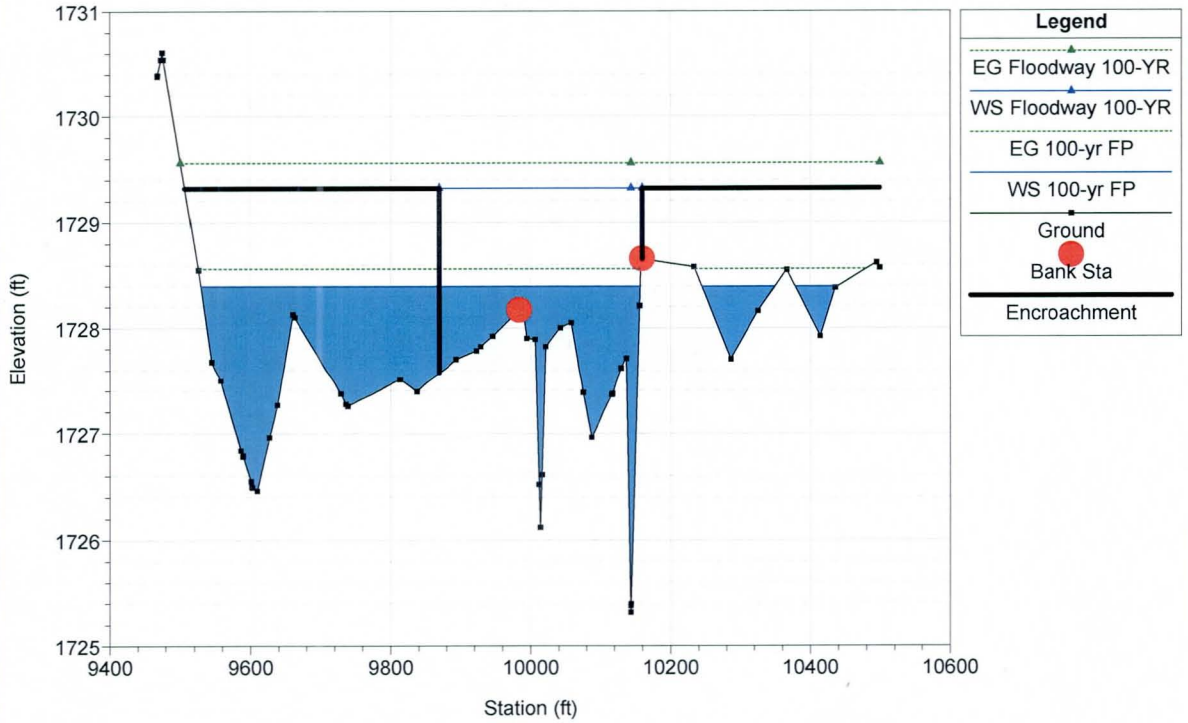

Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.891
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.797 9486.355
Elevation (ft)
Station (ft)
1737
1736
1735
1734
1733
1732
9400
9600
9800
10000
10200
10400
10600
10800
11000
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.714 9051.821
Elevation (ft)
Station (ft)
1735
1734
1733
1732
1731
1730
1729
1728
9200
9400
9600
9800
10000
10200
10400
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment

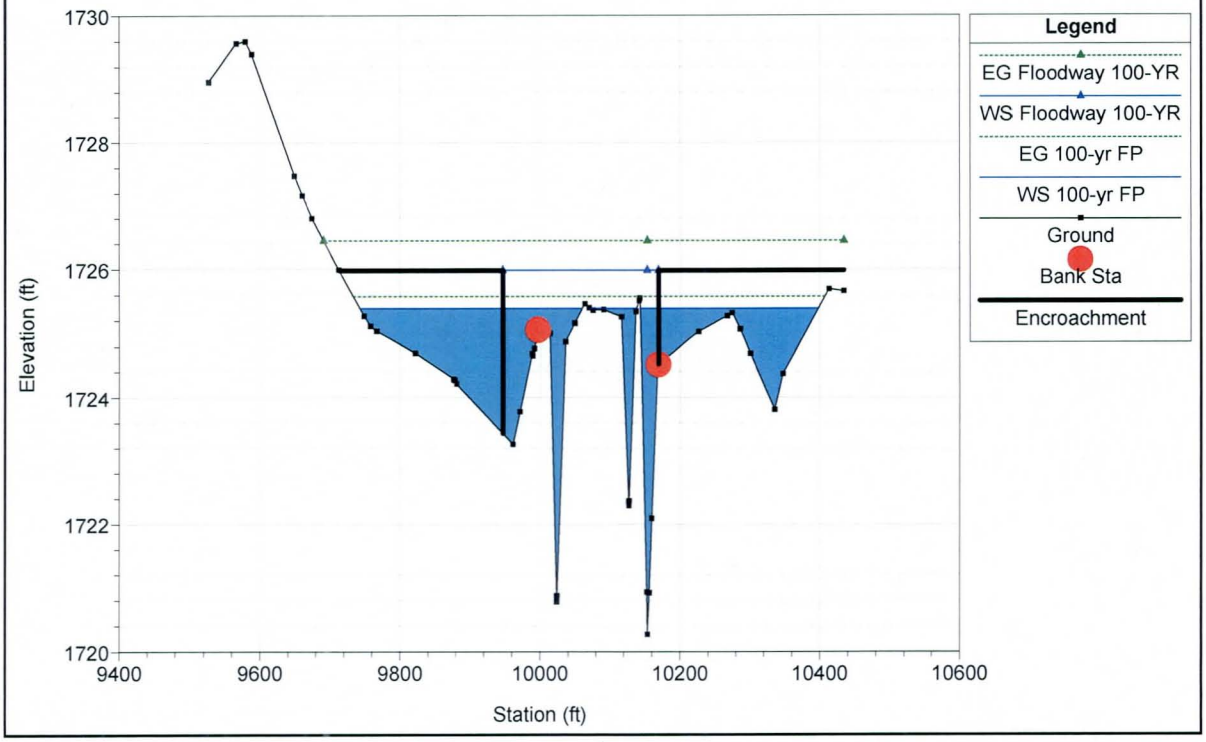
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

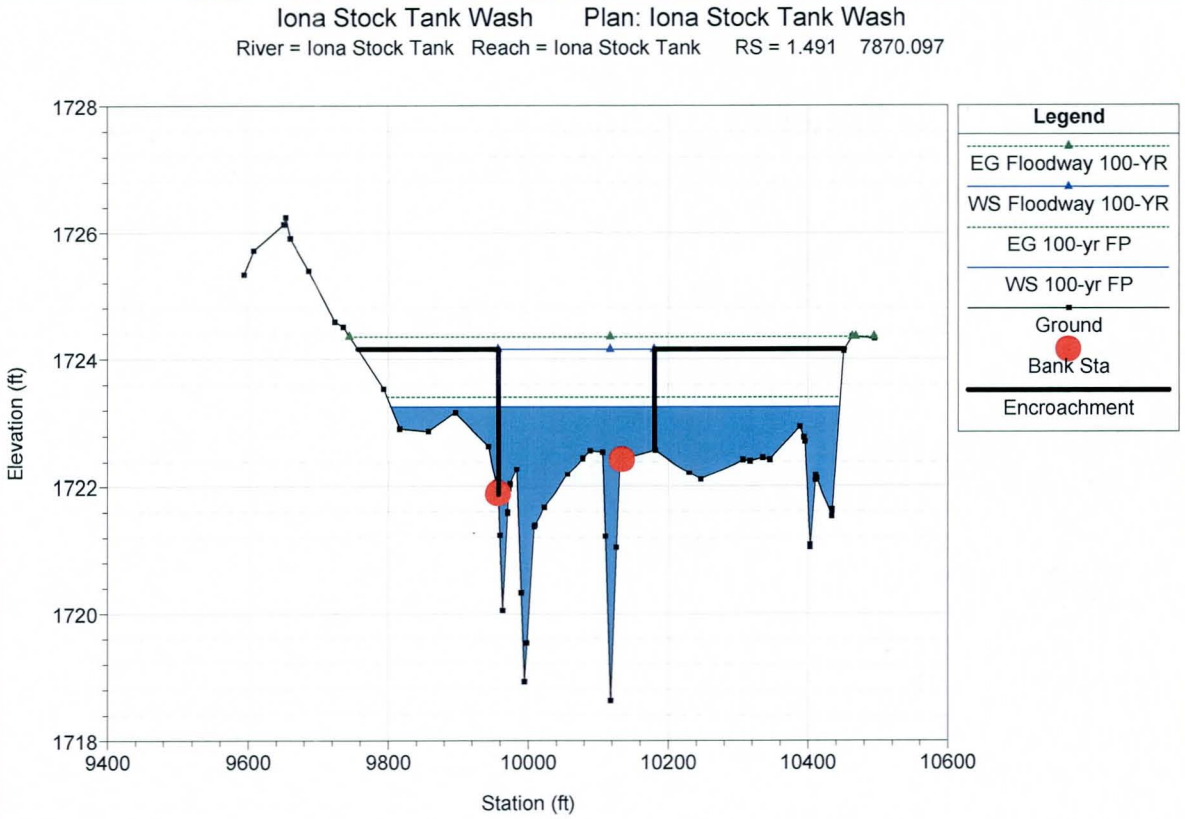
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.631 8614.157

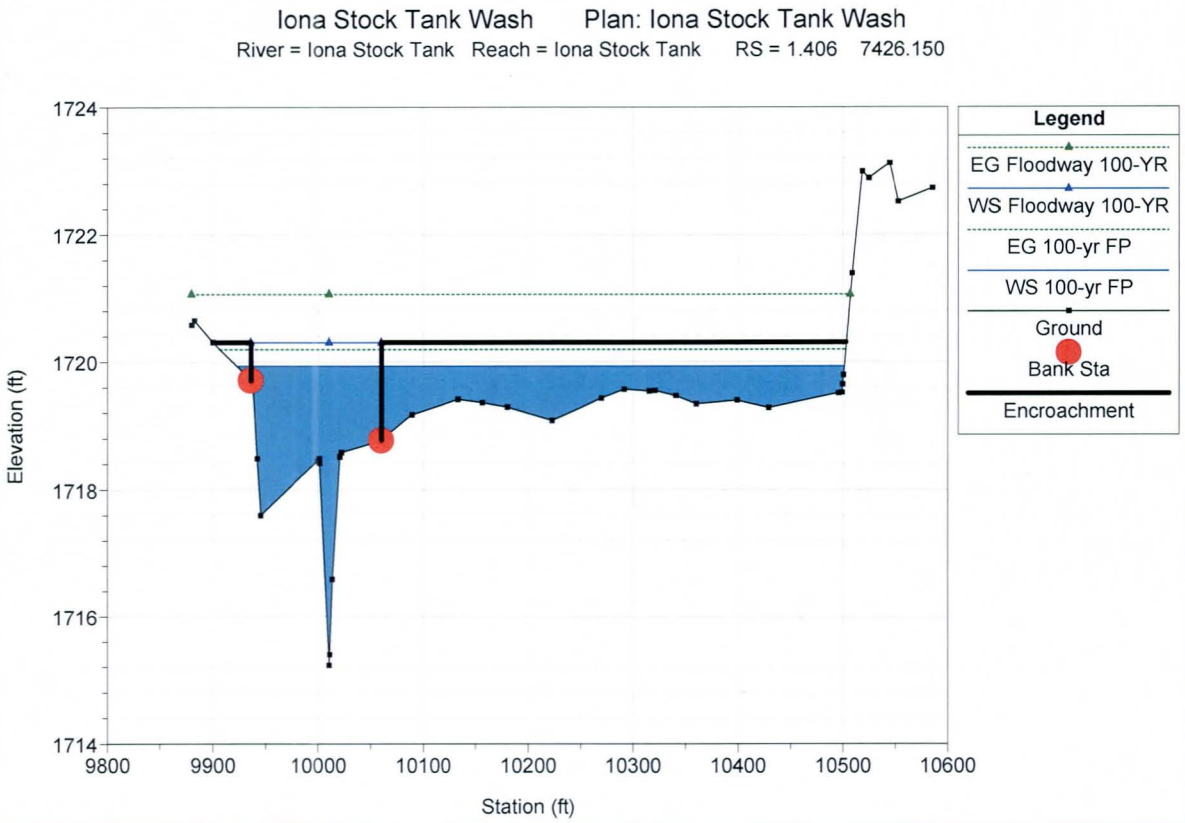


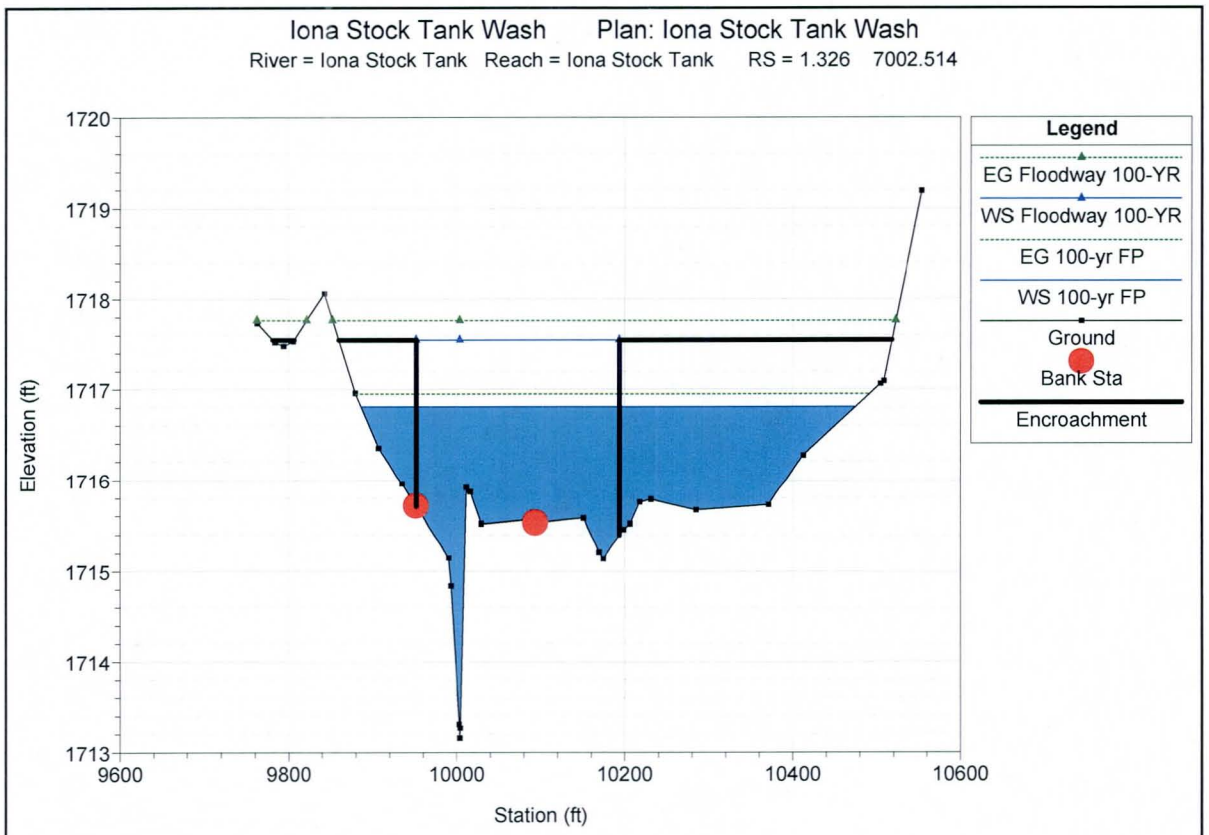
Iona Stock Tank Wash Plan: Iona Stock Tank Wash

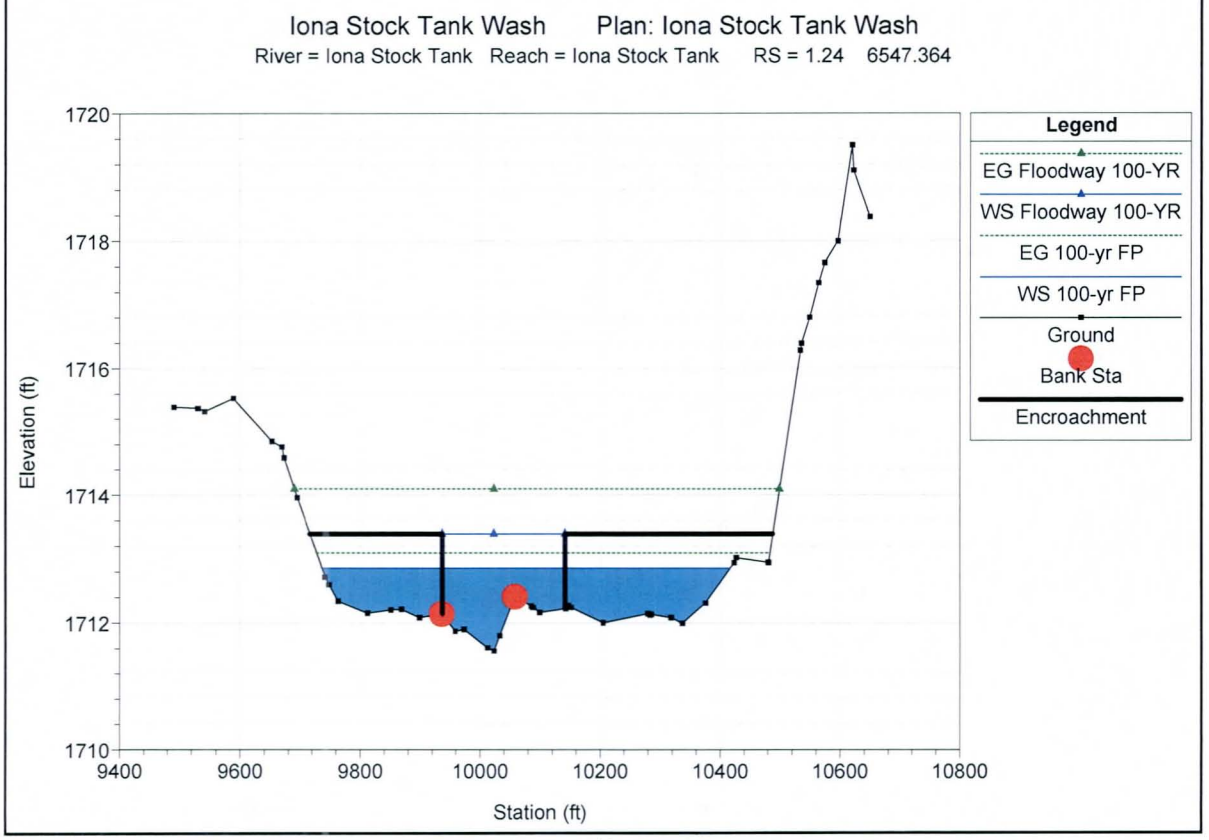
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.553 8200.707

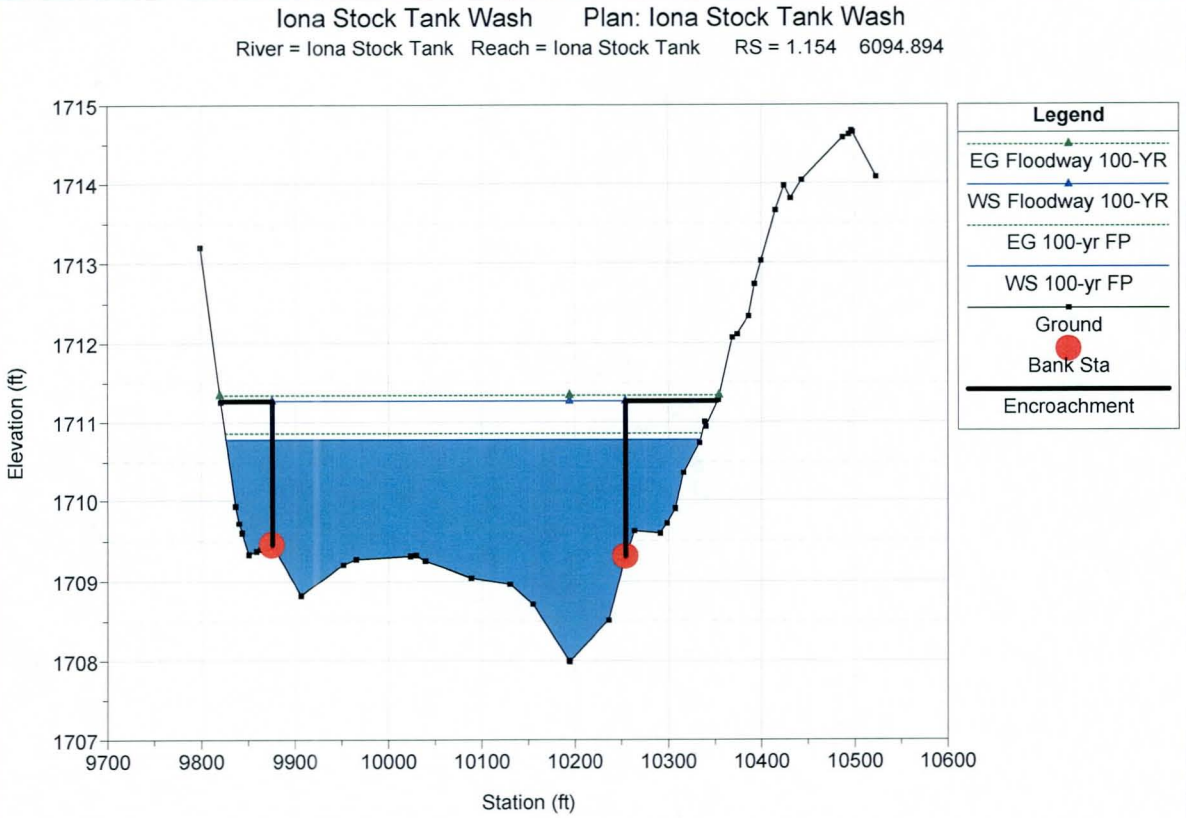


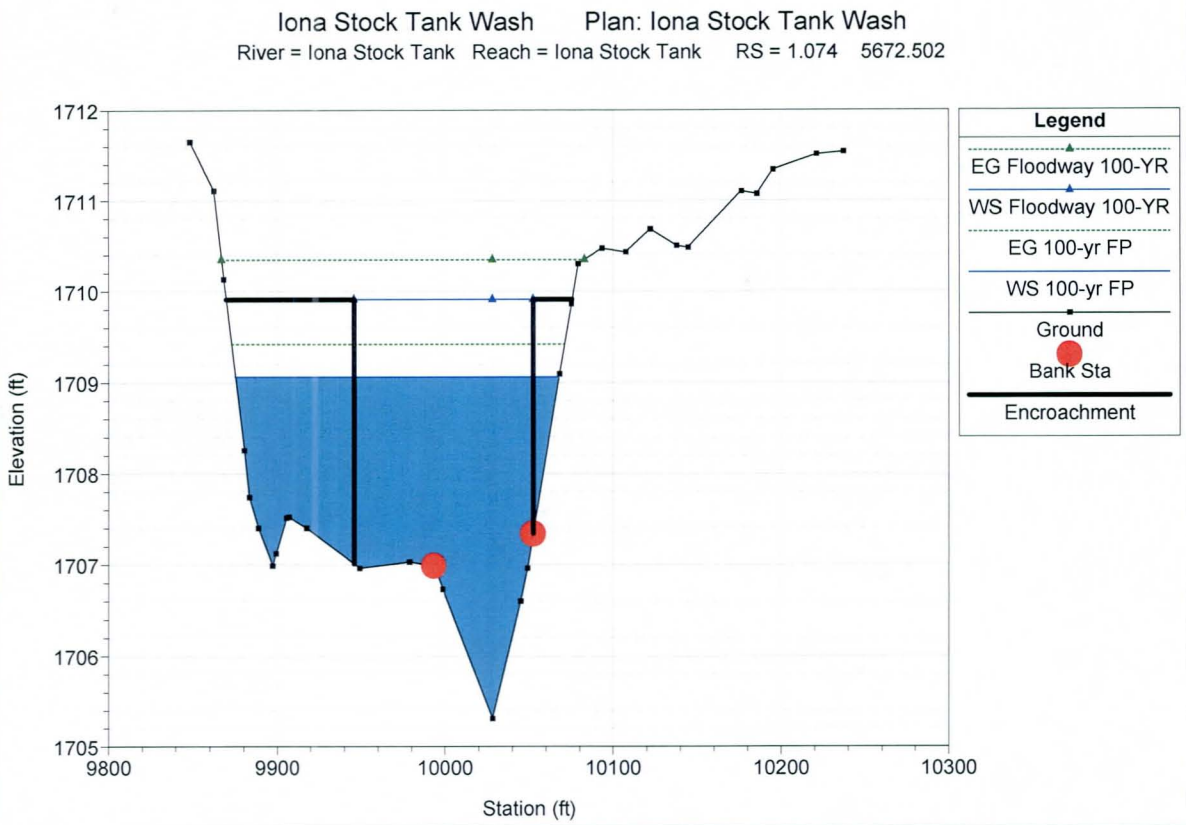

Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.491 7870.097
Elevation (ft)
Station (ft)
1728
1726
1724
1722
1720
1718
9400
9600
9800
10000
10200
10400
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.406 7426.150
Elevation (ft)
Station (ft)
1724
1722
1720
1718
1716
1714
9800
9900
10000
10100
10200
10300
10400
10500
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.326 7002.514
Elevation (ft)
Station (ft)
1720
1719
1718
1717
1716
1715
1714
1713
9600
9800
10000
10200
10400
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.24 6547.364
Elevation (ft)
Station (ft)
1720
1718
1716
1714
1712
1710
9400
9600
9800
10000
10200
10400
10600
10800
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.154 6094.894
Elevation (ft)
Station (ft)
1715
1714
1713
1712
1711
1710
1709
1708
1707
9700
9800
9900
10000
10100
10200
10300
10400
10500
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment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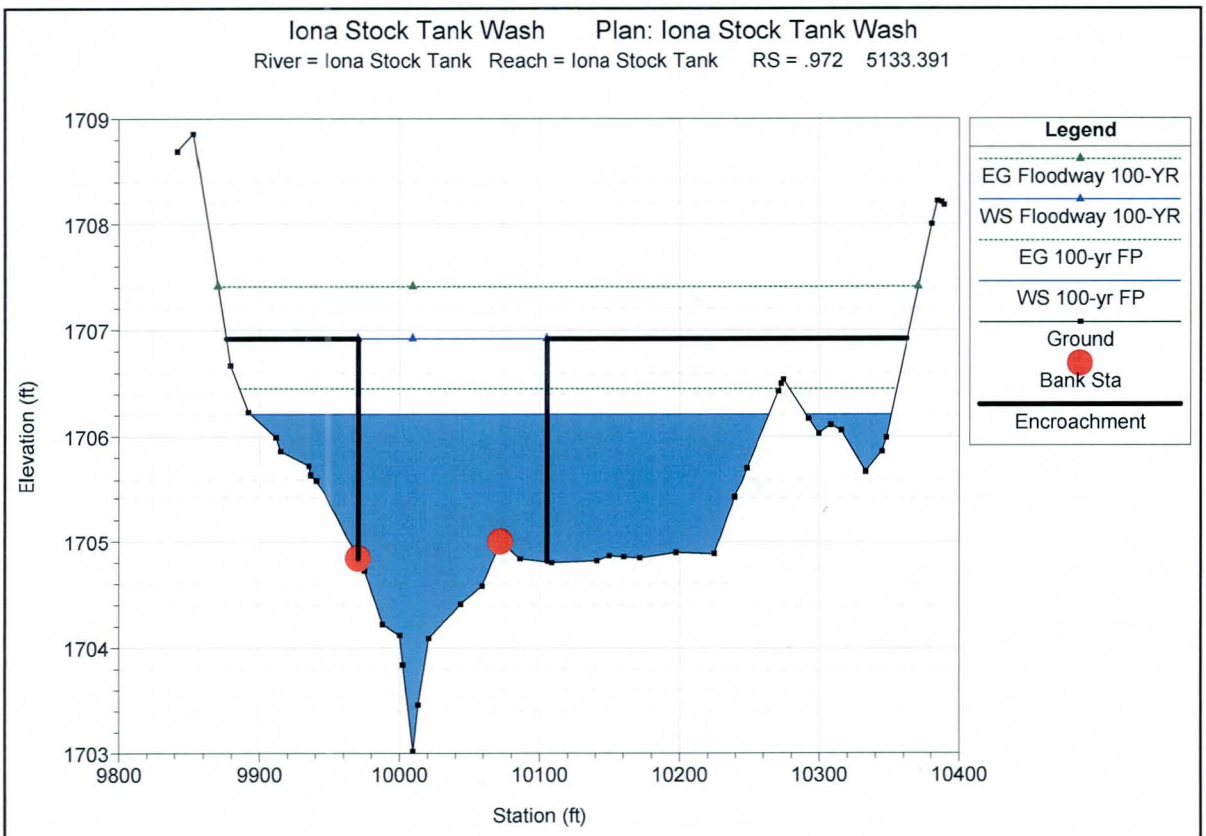
River = Iona Stock Tank Reach = Iona Stock Tank RS = 1.074 5672.502
Elevation (ft)
Station (ft)
1712
1711
1710
1709
1708
1707
1706
1705
9800
9900
10000
10100
10200
10300
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment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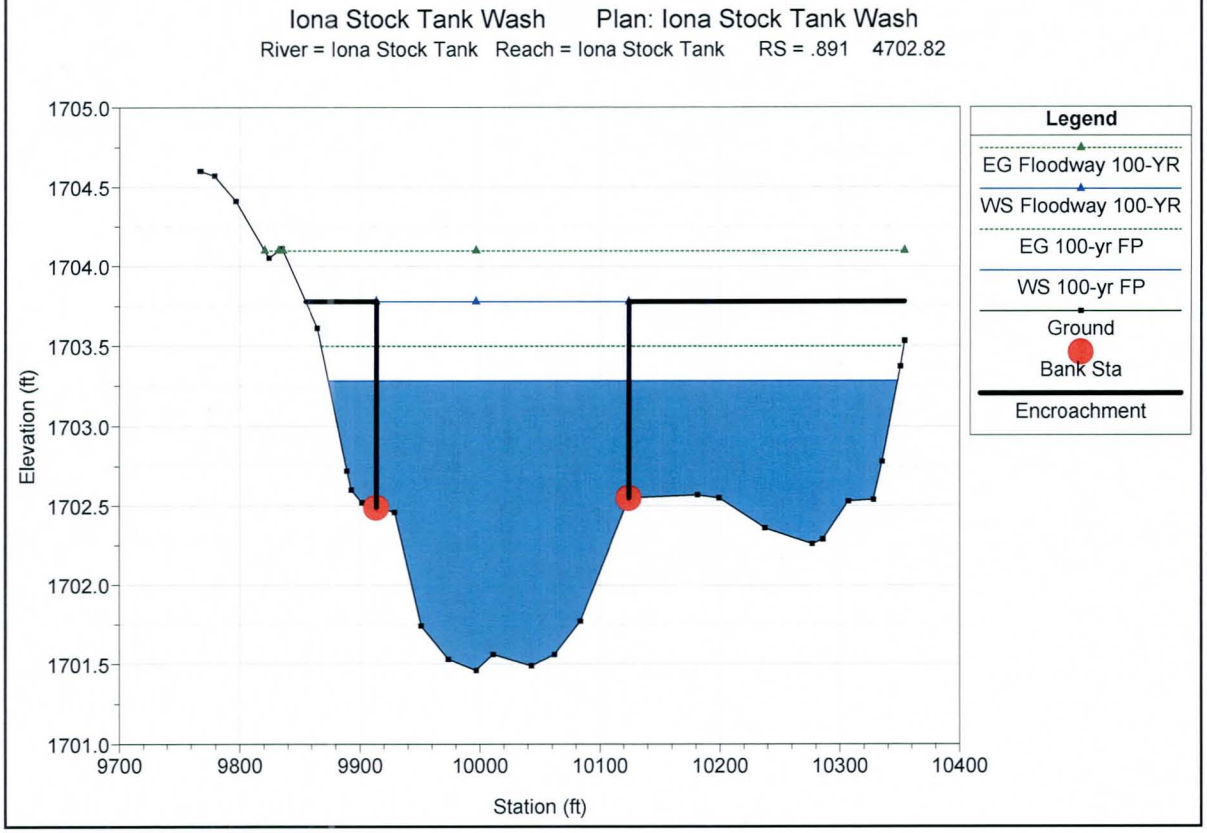
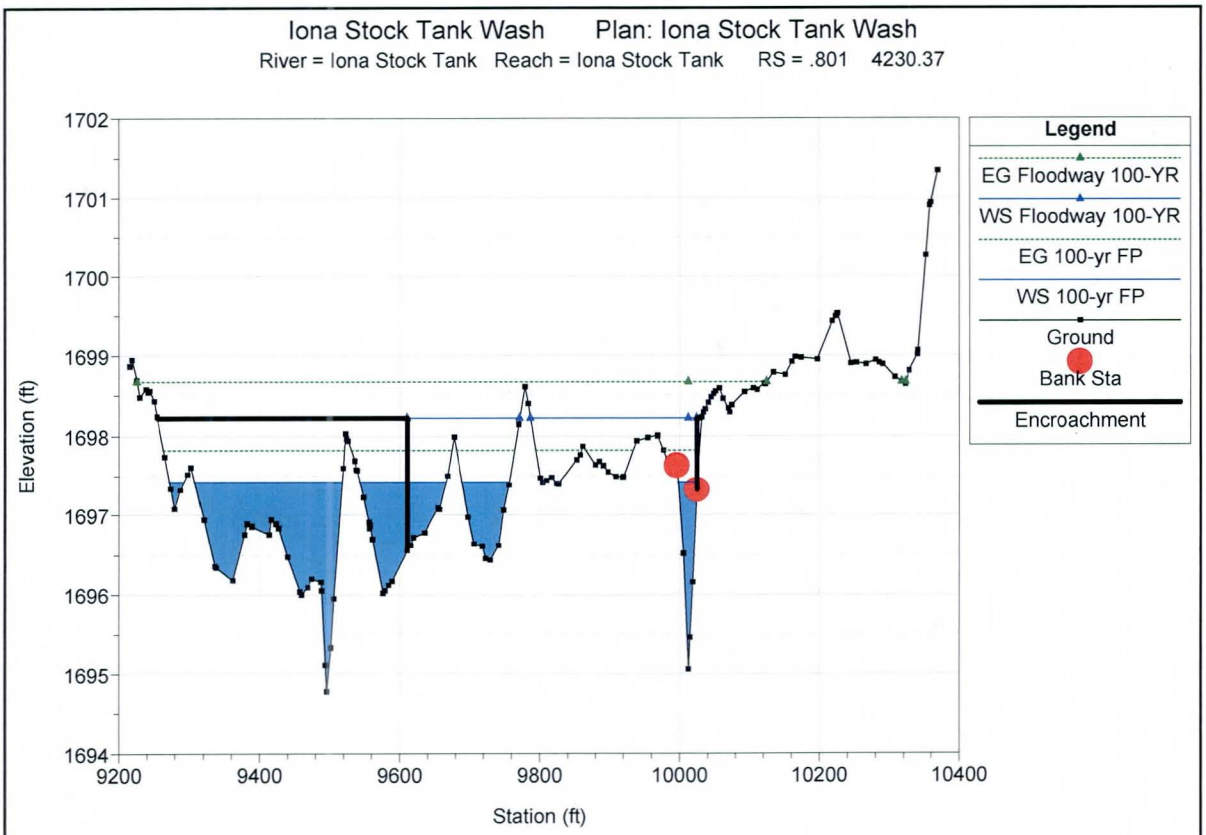
River = Iona Stock Tank Reach = Iona Stock Tank RS = .972 5133.391
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .891 4702.82
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment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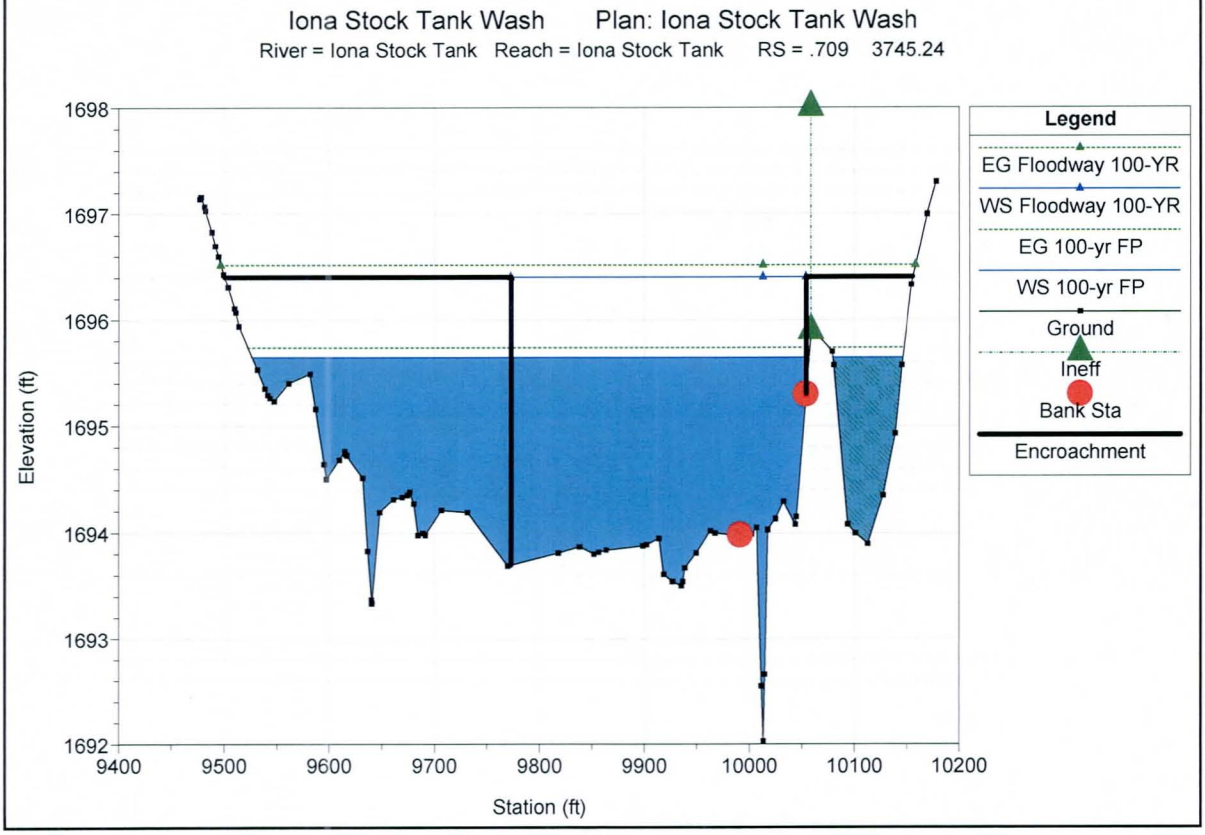
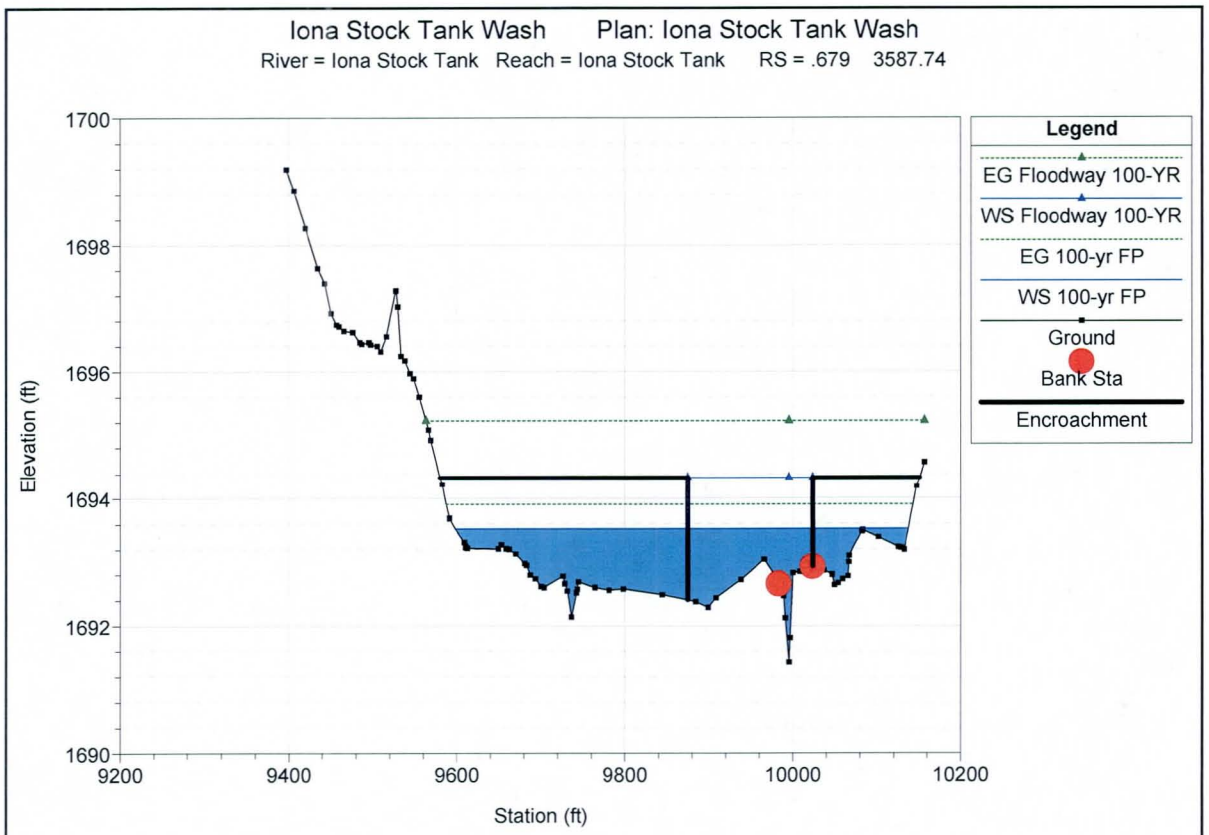
River = Iona Stock Tank Reach = Iona Stock Tank RS = .801 4230.37
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .709 3745.24
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment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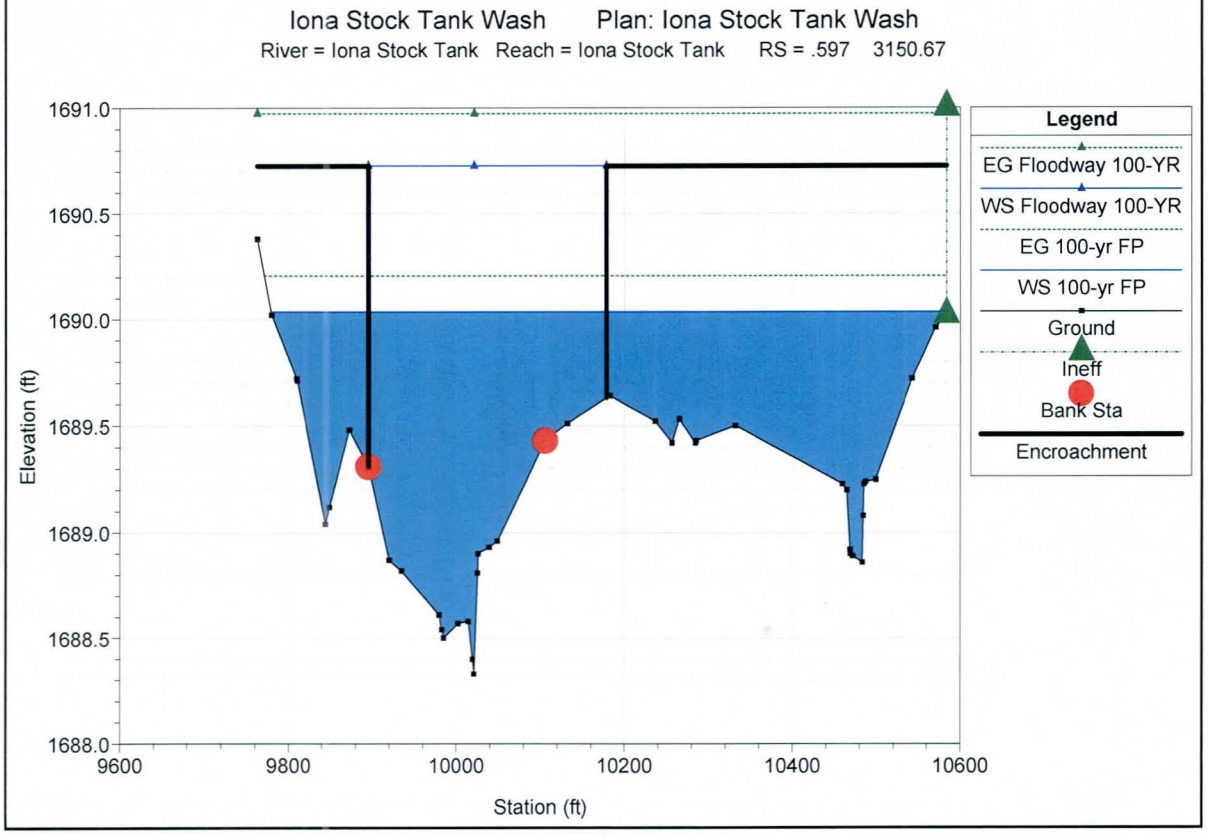
River = Iona Stock Tank Reach = Iona Stock Tank RS = .679 3587.74
Elevation (ft)
Station (ft)
1700
1698
1696
1694
1692
1690
9200
9400
9600
9800
10000
10200
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment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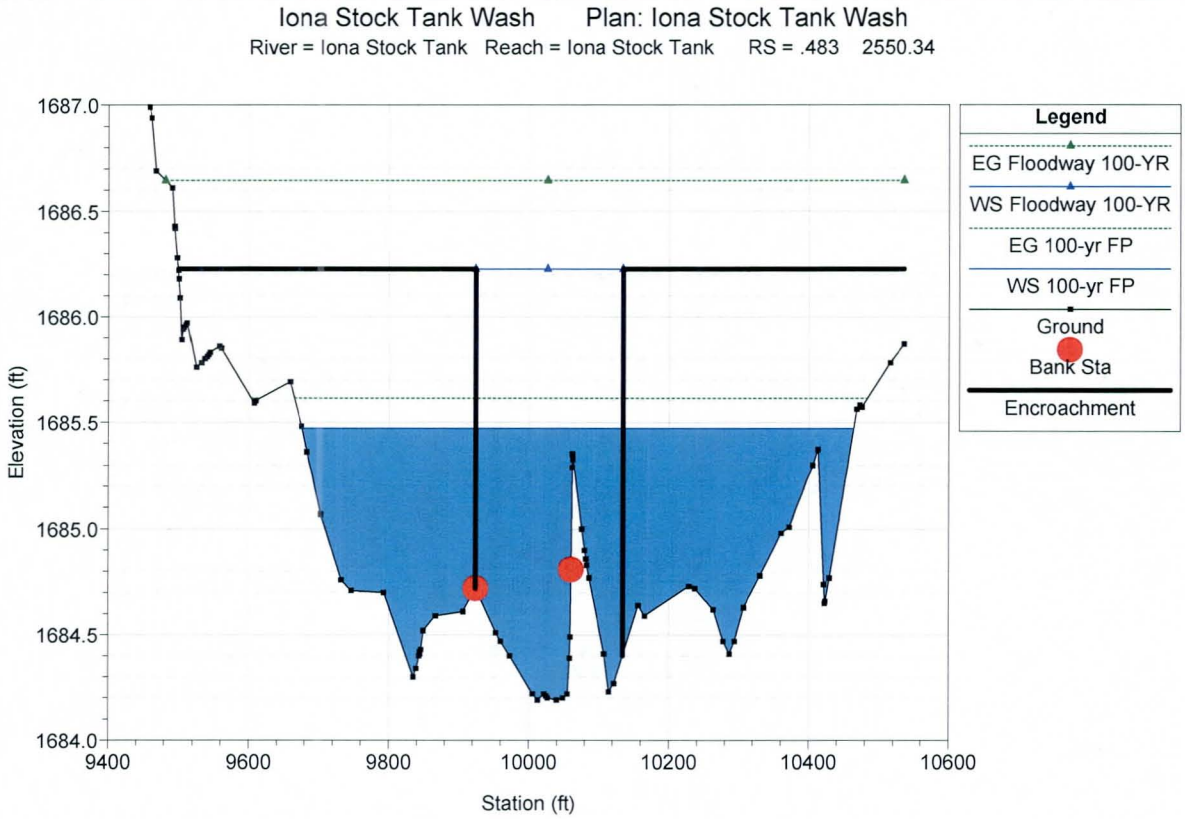
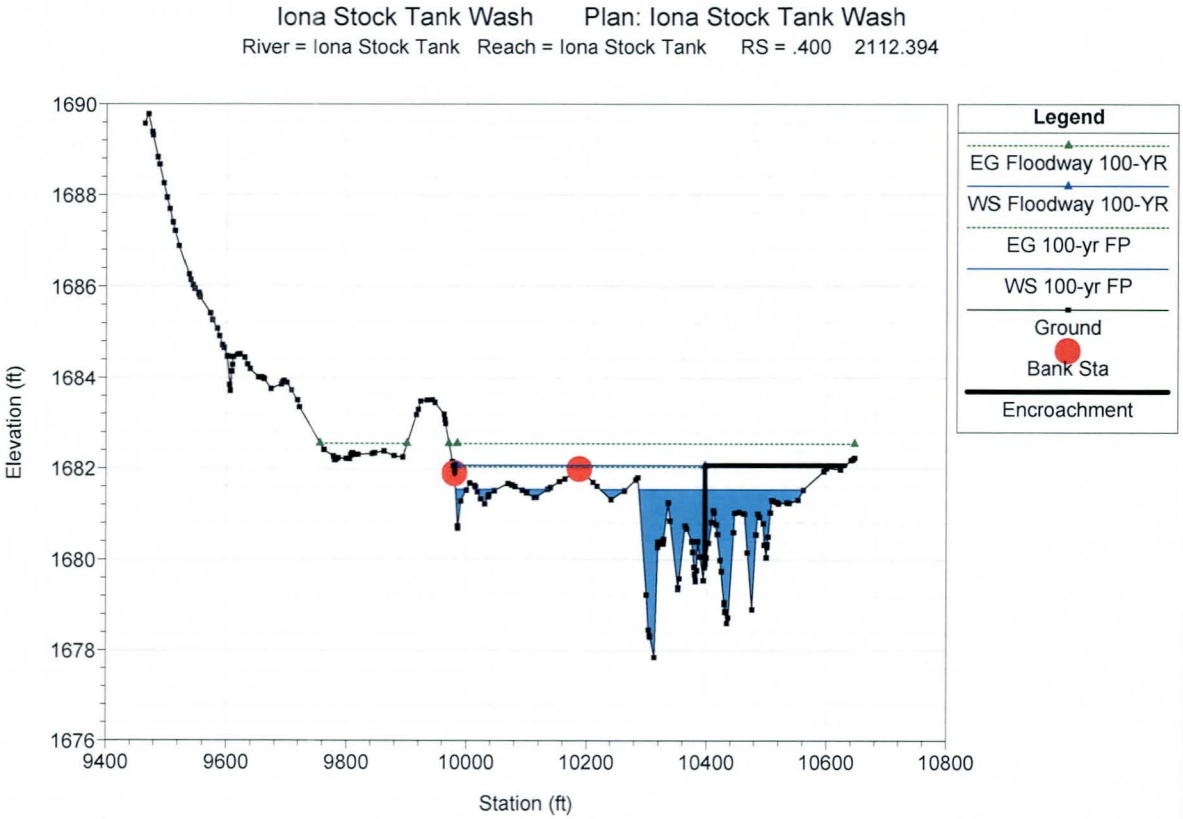
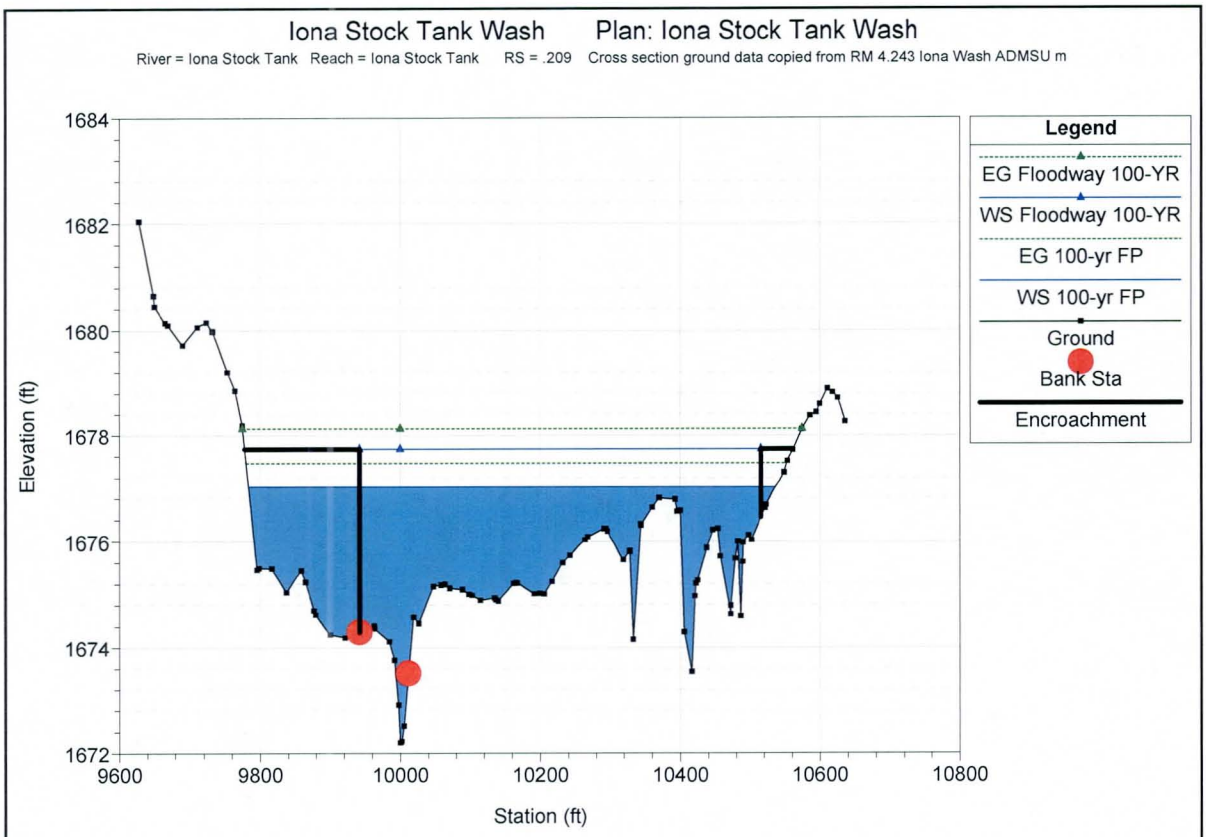
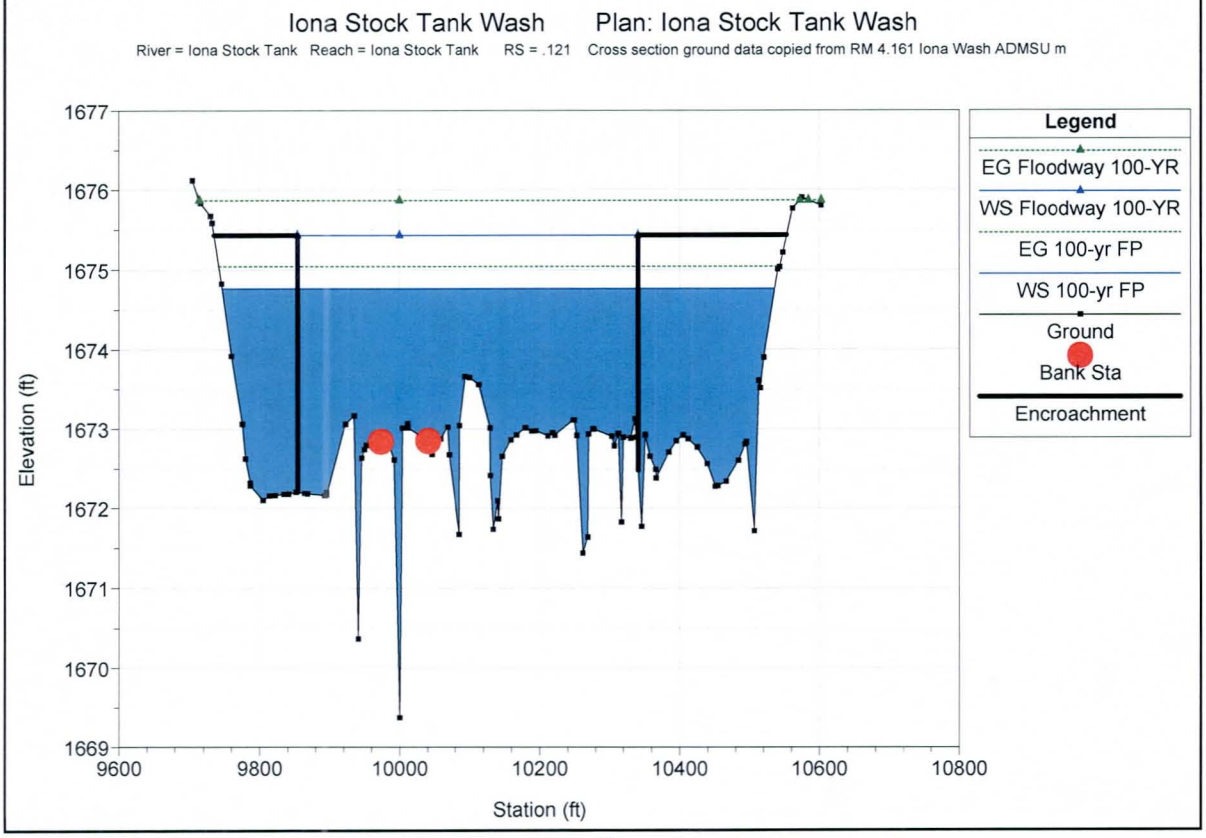
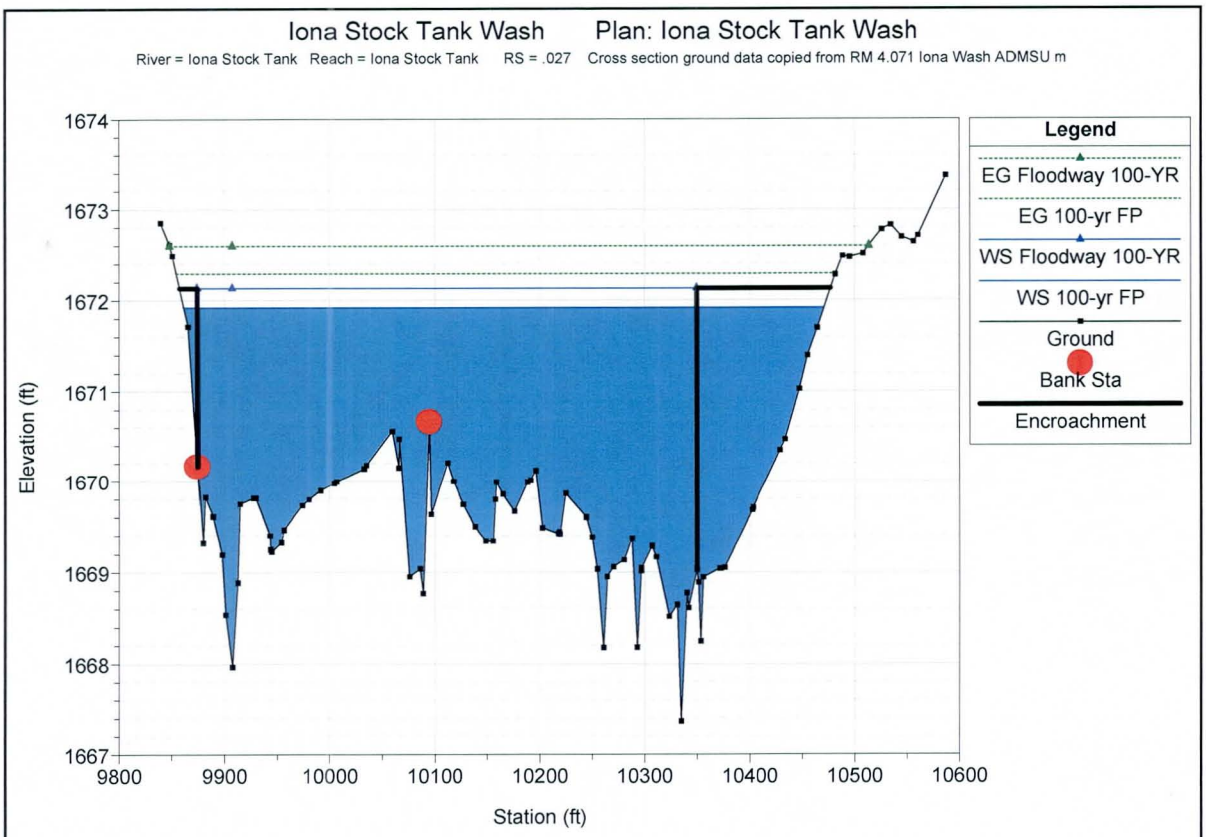
River = Iona Stock Tank Reach = Iona Stock Tank RS = .597 3150.67
Elevation (ft)
Station (ft)
1691.0
1690.5
1690.0
1689.5
1689.0
1688.5
1688.0
9600
9800
10000
10200
10400
10600
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Ineff
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .483 2550.34
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .400 2112.394
Elevation (ft)
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .209 Cross section ground data copied from RM 4.243 Iona Wash ADMSU m
Elevation (ft)
1684
1682
1680
1678
1676
1674
1672
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .121 Cross section ground data copied from RM 4.161 Iona Wash ADMSU m
Elevation (ft)
1677
1676
1675
1674
1673
1672
1671
1670
1669
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
EG Floodway 100-YR
WS Floodway 100-YR
EG 100-yr FP
WS 100-yr FP
Ground
Bank Sta
Encroachment


Iona Stock Tank Wash Plan: Iona Stock Tank Wash
River = Iona Stock Tank Reach = Iona Stock Tank RS = .027 Cross section ground data copied from RM 4.071 Iona Wash ADMSU m
Elevation (ft)
1674
1673
1672
1671
1670
1669
1668
1667
9800
9900
10000
10100
10200
10300
10400
10500
10600
Station (ft)
Legend
EG Floodway 100-YR
EG 100-yr FP
WS Floodway 100-YR
WS 100-yr FP
Ground
Bank Sta
Encroachment

E.3 Expansion and Contraction Coefficients

The expansion and contraction coefficients used in the HEC-RAS model were determined using the HEC-RAS *User's Manual* **(Reference 6)**. More discussion regarding the expansion and contraction coefficients is included in **Section 5.3.2**.

E.4 Analysis of Structures

There are no structures as part of this project.

E.5 Hydraulic Calculations

The hydraulic calculations were made using the US Army Corps of Engineer's HEC-RAS V.4.0.0 program (**Reference 4**). The details of the hydraulic methodology are discussed in **Section 5**. The HEC-RAS output is included in **Appendix E.6.**

E.6 HEC-RAS Output

HEC-RAS Plan: IonaMainWash River: Iona_Wash Reach: IonaMainWash

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
IonaMainWash	7.074	100-YR FP	1330.00	1778.73	1781.76	1781.32	1782.06	0.006943	2.64	323.73	458.52	0.60
IonaMainWash	7.074	Floodway 100-YR	1330.00	1778.73	1782.61	1782.61	1783.18	0.012370	6.31	229.33	197.00	0.93
IonaMainWash	6.973	100-YR FP	1890.00	1773.05	1777.44	1777.18	1777.69	0.009671	3.82	470.01	552.19	0.57
IonaMainWash	6.973	Floodway 100-YR	1890.00	1773.05	1777.65	1776.88	1777.93	0.008100	3.80	450.81	330.16	0.53
IonaMainWash	6.889	100-YR FP	1890.00	1769.57	1773.57		1773.75	0.008226	3.76	572.41	454.99	0.53
IonaMainWash	6.889	Floodway 100-YR	1890.00	1769.57	1774.57		1774.84	0.006120	4.51	467.50	197.27	0.50
IonaMainWash	6.818	100-YR FP	1890.00	1766.65	1770.46		1770.66	0.009045	4.43	562.94	439.63	0.57
IonaMainWash	6.818	Floodway 100-YR	1890.00	1766.65	1771.05		1771.63	0.013686	6.45	312.92	128.57	0.73
IonaMainWash	6.757	100-YR FP	1890.00	1763.16	1767.21	1766.87	1767.39	0.011288	4.40	589.19	603.67	0.62
IonaMainWash	6.757	Floodway 100-YR	1890.00	1763.16	1768.20		1768.52	0.006773	4.73	422.59	154.90	0.52
IonaMainWash	6.672	100-YR FP	1890.00	1757.48	1763.69		1763.86	0.006005	4.10	701.37	609.55	0.48
IonaMainWash	6.672	Floodway 100-YR	1890.00	1757.48	1764.20		1764.78	0.010684	6.20	316.78	121.72	0.65
IonaMainWash	6.560	100-YR FP	1890.00	1753.12	1759.59	1758.82	1759.76	0.006524	3.85	619.51	480.73	0.49
IonaMainWash	6.560	Floodway 100-YR	1890.00	1753.12	1760.46	1759.05	1760.70	0.004258	3.94	490.78	162.49	0.41
IonaMainWash	6.463	100-YR FP	1890.00	1749.81	1754.97		1755.35	0.012473	5.47	404.33	406.44	0.66
IonaMainWash	6.463	Floodway 100-YR	1890.00	1749.81	1755.66	1755.66	1756.46	0.022682	7.19	262.98	164.18	0.89
IonaMainWash	6.356	100-YR FP	1890.00	1744.19	1748.74	1748.06	1749.18	0.010136	5.68	375.71	219.31	0.63
IonaMainWash	6.356	Floodway 100-YR	1890.00	1744.19	1749.65	1748.33	1750.09	0.006513	5.28	358.00	111.95	0.52
IonaMainWash	6.266	100-YR FP	1890.00	1740.00	1743.48		1744.00	0.011976	6.32	331.64	195.79	0.69
IonaMainWash	6.266	Floodway 100-YR	1890.00	1740.00	1743.76	1743.64	1744.95	0.020578	8.86	216.87	81.56	0.91
IonaMainWash	6.189	100-YR FP	1890.00	1735.28	1739.51	1739.13	1740.03	0.008052	5.73	344.91	180.32	0.58
IonaMainWash	6.189	Floodway 100-YR	1890.00	1735.28	1740.43	1739.33	1740.95	0.005307	5.55	334.90	96.82	0.49
IonaMainWash	6.101	100-YR FP	1890.00	1731.74	1735.30	1735.09	1735.84	0.010910	6.41	328.45	193.93	0.66
IonaMainWash	6.101	Floodway 100-YR	1890.00	1731.74	1735.69	1735.52	1736.92	0.017272	8.55	213.05	72.65	0.83
IonaMainWash	5.989	100-YR FP	1890.00	1726.35	1730.93	1729.83	1731.38	0.005449	5.42	352.49	114.30	0.49
IonaMainWash	5.989	Floodway 100-YR	1890.00	1726.35	1731.78	1729.97	1732.23	0.004192	5.43	350.33	79.27	0.45
IonaMainWash	5.899	100-YR FP	1890.00	1722.58	1725.77	1725.77	1726.95	0.020393	8.68	217.89	94.62	0.91
IonaMainWash	5.899	Floodway 100-YR	1890.00	1722.58	1726.43	1726.43	1728.16	0.024937	10.60	178.93	51.66	1.00
IonaMainWash	5.809	100-YR FP	1890.00	1718.86	1723.71		1723.87	0.001875	3.19	634.74	297.23	0.29
IonaMainWash	5.809	Floodway 100-YR	1890.00	1718.86	1724.28		1724.41	0.001284	2.87	658.86	149.88	0.24
IonaMainWash	5.710	100-YR FP	5650.00	1713.07	1722.12		1722.54	0.002765	5.57	1214.02	471.67	0.38
IonaMainWash	5.710	Floodway 100-YR	5650.00	1713.07	1722.78		1723.27	0.002565	5.71	1003.46	141.83	0.37
IonaMainWash	5.629	100-YR FP	5650.00	1711.37	1720.29	1719.31	1720.98	0.004994	7.12	883.99	252.14	0.51
IonaMainWash	5.629	Floodway 100-YR	5650.00	1711.37	1720.82	1719.01	1721.73	0.005228	7.71	742.89	128.61	0.53
IonaMainWash	5.557	100-YR FP	5650.00	1709.75	1717.65	1717.12	1718.67	0.007574	8.85	741.31	241.60	0.62
IonaMainWash	5.557	Floodway 100-YR	5650.00	1709.75	1718.64	1717.10	1719.65	0.005715	8.48	706.40	122.84	0.56
IonaMainWash	5.454	100-YR FP	5650.00	1706.24	1712.96	1712.96	1713.77	0.010577	8.59	851.85	489.46	0.70
IonaMainWash	5.454	Floodway 100-YR	5650.00	1706.24	1713.43	1713.43	1715.00	0.013712	10.44	580.57	204.61	0.81
IonaMainWash	5.354	100-YR FP	5650.00	1703.96	1709.77		1710.00	0.003022	4.19	1488.19	610.04	0.37
IonaMainWash	5.354	Floodway 100-YR	5650.00	1703.96	1710.54		1710.92	0.002662	4.42	1152.57	251.53	0.36
IonaMainWash	5.278	100-YR FP	5650.00	1701.50	1708.29		1708.71	0.004148	5.53	1096.92	345.53	0.44
IonaMainWash	5.278	Floodway 100-YR	5650.00	1701.50	1709.01		1709.68	0.004673	6.43	864.98	174.62	0.48
IonaMainWash	5.237	100-YR FP	5650.00	1700.52	1706.63	1706.21	1707.45	0.008822	7.03	802.81	312.18	0.62
IonaMainWash	5.237	Floodway 100-YR	5650.00	1700.52	1706.90	1706.54	1708.19	0.010866	8.16	635.85	181.66	0.70
IonaMainWash	5.146	100-YR FP	5650.00	1697.53	1702.93	1702.03	1703.62	0.007438	5.81	858.35	260.52	0.56
IonaMainWash	5.146	Floodway 100-YR	5650.00	1697.53	1703.04	1702.10	1703.87	0.007461	5.87	788.05	201.69	0.55
IonaMainWash	5.083	100-YR FP	5650.00	1694.69	1700.78	1699.71	1701.42	0.006198	7.00	932.03	350.44	0.58
IonaMainWash	5.083	Floodway 100-YR	5650.00	1694.69	1700.99		1701.75	0.005674	6.91	810.92	186.77	0.56
IonaMainWash	4.988	100-YR FP	5650.00	1693.53	1697.95		1698.38	0.005630	5.60	1133.89	489.97	0.53
IonaMainWash	4.988	Floodway 100-YR	5650.00	1693.53	1698.60		1699.09	0.004642	5.65	1005.11	243.41	0.49
IonaMainWash	4.901	100-YR FP	5650.00	1691.36	1696.69		1696.89	0.001946	3.58	1590.90	474.31	0.32
IonaMainWash	4.901	Floodway 100-YR	5650.00	1691.36	1697.39		1697.66	0.002072	4.05	1356.51	296.08	0.33
IonaMainWash	4.844	100-YR FP	5650.00	1689.87	1695.44	1694.20	1695.94	0.005126	5.81	1002.65	299.06	0.51
IonaMainWash	4.844	Floodway 100-YR	5650.00	1689.87	1696.42	1694.26	1696.85	0.003211	5.32	1072.13	218.00	0.42

```
                    HEC-RAS Version 4.0.0 March 2008
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California

          X     X  XXXXXX    XXXX        XXXX       XX      XXXX
          X     X  X        X    X       X   X     X  X    X
          X     X  X        X            X   X    X    X   X
          XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
          X     X  X        X            X  X     X    X        X
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          X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
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PROJECT DATA
Project Title: Iona Main Wash
Project File : IonaMainWash.prj
Run Date and Time: 5/4/2009 10:15:55 AM

Project in English units

Project Description:
Prepared by Entellus, Inc., Frank Edward Brown, PE, CFM, updated 08 April 2009
This RAS is part of the Wittmann ADMPU, FCD Contract 2004C060

This model is for Iona Wash only and is the 'without levee model for the Diversion Dike' and it assumes the stock tank on Iona Stock Tank Wash has washed out.

River names in this model: Iona Wash from approximately Carefree Highway alignment to Lone Mountain Road alignment, about 2.2 river miles.

Downstream Tie-In at RM 4.901 from ADMSU study, using 100-year Flow Rate=6,610 cfs, Starting Water Surface=1696.69 Floodplain and 1697.44 Floodway. See Sheet E-18.

Upstream Tie in at RM 0.104 Iona North Wash and ground data copied from ADMSU study, using Flow Rate=1,330 cfs. ADMSU Water Surface=1781.65 Floodplain and 1782.55 Floodway. See Sheets D-20 and E-20.

HEC-RAS Version 4.0.0 March 2008
Aerial photo source: FCD of MC via Wittmann ADMSU
Topographic mapping source: FCD of MC via Wittmann ADMSU
Horizontal Datum: NAD83 state plane coordinates, Central Region, International Feet
Vertical Datum: NAVD 1988
Flow rate source is the Wittmann ADMSU, FCD No. 2002C029
Cross sections derived from TIN developed by Entellus, Inc. using HEC-geoRAS Version 4 September 2005

PLAN DATA

Plan Title: IonaMainWash_no_dike_no_tank
Plan File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Wash\IonaMainWash.p01

Geometry Title: IonaMainWash_no_dike_no_tank
Geometry File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Wash\IonaMainWash.g01

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          Flow File      : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-
RAS\Iona Wash\IonaMainWash.f01

Plan Summary Information:
Number of:  Cross Sections =   27    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

River = Iona_Wash        Reach = IonaMainWash
RS      Profile           Method  Value1  Value2
7.074   Floodway 100-YR        1    9792    9989
6.973   Floodway 100-YR        1 9702.6110039.34
6.889   Floodway 100-YR        1 9878.8310092.88
6.818   Floodway 100-YR        1 9956.1410084.71
6.757   Floodway 100-YR        1 9957.7210112.62
6.672   Floodway 100-YR        1  9942.810064.52
6.560   Floodway 100-YR        1 9951.7910114.28
6.463   Floodway 100-YR        1 9959.4610123.64
6.356   Floodway 100-YR        1 9921.4410035.09
6.266   Floodway 100-YR        1  9948.310035.86
6.189   Floodway 100-YR        1 9951.4410048.26
6.101   Floodway 100-YR        1 9979.3110051.96
5.989   Floodway 100-YR        1 9950.0410029.31
5.899   Floodway 100-YR        1 9968.8210020.48
5.809   Floodway 100-YR        1 9949.12   10099
5.710   Floodway 100-YR        1 9903.7210045.55
5.629   Floodway 100-YR        1 9931.79 10060.4
5.557   Floodway 100-YR        1 9913.3810036.22
5.454   Floodway 100-YR        1 9897.6510118.95
5.354   Floodway 100-YR        1 9793.07 10044.6
5.278   Floodway 100-YR        1 9862.8210037.44
5.237   Floodway 100-YR        1 9939.2610120.92
5.146   Floodway 100-YR        1 9824.6610026.35
5.083   Floodway 100-YR        1 9924.13 10110.9
4.988   Floodway 100-YR        1 9857.79 10101.2
4.901   Floodway 100-YR        1 9728.3410024.42
4.844   Floodway 100-YR        1    9875   10093


FLOW DATA

Flow Title: IonaMainWash_no_dike_no_tank
Flow File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona
Wash\IonaMainWash.f01

Flow Data (cfs)

  River          Reach          RS              100-YR FP Floodway 100-YR
  Iona_Wash      IonaMainWash   7.074                1330            1330
  Iona_Wash      IonaMainWash   6.973                1890            1890
  Iona_Wash      IonaMainWash   5.710                5650            5650


Boundary Conditions
```

River	Reach	Profile	Upstream	Downstream
Iona_Wash	IonaMainWash	100-YR FP		Known WS = 1695.44
Iona_Wash	IonaMainWash	Floodway 100-YR		Known WS = 1696.42

GEOMETRY DATA

Geometry Title: IonaMainWash_no_dike_no_tank
Geometry File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Wash\IonaMainWash.g01

CROSS SECTION

RIVER: Iona_Wash
REACH: IonaMainWash RS: 7.074

INPUT
Description: Tie in at RM 0.104 Iona North Wash and ground data copied from ADMSU study. N values are 0.033-0.039-0.033 (left-channel-right) from Iona North.prj RAS file. Flow Rate=1,330 cfs. ADMSU Water Surface=1781.65 Floodplain and 1782.55 Floodway. See Sheets D-20 and E-20.

Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9278.77	1781.701	9285.24	1781.767	9302.66	1781.9	9310.12	1781.902	9335	1781.652
9336.29	1781.631	9359.88	1781.221	9369.91	1781.093	9382.08	1781.053	9384.75	1781.022
9403.54	1781.257	9409.63	1781.407	9434.51	1782.195	9437.16	1782.246	9459.39	1782.609
9470.79	1781.621	9476.68	1782.345	9484.27	1780.214	9492.71	1777.597	9504.41	1779.417
9505.87	1779.115	9509.15	1779.269	9534.03	1780.295	9538.04	1780.353	9558.91	1780.668
9571.66	1779.436	9576.46	1780.716	9582.32	1777.972	9583.79	1778.113	9595.03	1780.664
9605.28	1780.631	9608.67	1781.065	9633.55	1781.621	9638.91	1781.714	9658.43	1781.962
9672.53	1781.995	9683.31	1782.021	9706.16	1782.047	9708.19	1782.05	9715.45	1782.122
9733.07	1782.312	9753.23	1782.304	9773.38	1782.107	9793.54	1781.799	9801.86	1781.716
9813.7	1781.8	9833.86	1782.095	9854.01	1782.179	9861.46	1781.99	9874.17	1781.644
9875.56	1781.581	9887.69	1778.734	9894.33	1780.814	9895.88	1781.528	9902.48	1779.731
9910.21	1781.316	9914.48	1781.38	9934.64	1781.516	9954.8	1781.515	9974.96	1781.393
9984.49	1781.327	9995.11	1781.14	10001.13	1781.35	10015.27	1781.93	10021.87	1782.059
10035.43	1782.115	10036.71	1782.156	10046.28	1779.061	10054.81	1781.806	10055.59	1781.769
10075.74	1782.314	10091.08	1782.217	10095.91	1782.054	10111.78	1781.258	10116.06	1781.352
10136.22	1782.123	10136.96	1782.103	10156.37	1782.152	10176.53	1782.401	10182.27	1782.559
10196.69	1782.606	10201.2	1782.608	10216.84	1782.698	1023	71782.77	1102	57.16 1782.83
10277.32	1782.881								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9278.77	.033	10015.27	.039	10075.74	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9861.46	10015.27	514.42	533.21	536.53	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
9278.77	9498.45	1783.42	F

CROSS SECTION

RIVER: Iona_Wash
REACH: IonaMainWash RS: 6.973

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9492.02	1779.95	9543.42	1779.49	9561.58	1778.73	9574.27	1778.16	9625.47	1776.71
9638.99	1776.21	9670.82	1776.48	9681.85	1776.9	9688.19	1777.09	9705.86	1774.6
9711.98	1773.62	9740.1	1774.98	9759.49	1776.23	9763.66	1776.48	9769.49	1776.99
9799.97	1777.06	9804.13	1777.15	9812.57	1776.86	9826.44	1776.5	9835.71	1776.81
9839.23	1776.93	9842.14	1776.94	9900.92	1776.74	9941.88	1776.91	9950.11	1776.912
9986.83	1776.92	9995.67	1775.54	10007.55	1773.05	10020.05	1775.72	10031.68	1777.47
10039.34	1778.76	10043.15	1777.81	10047.14	1777.73	10048.69	1777.72	10072.25	1777.58

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10102.13 1777.81   10127 1777.5910166.35 1777.1310238.57 1777.4810243.29  1777.5
10260.02 1775.4110260.62 1775.3510261.46 1775.4910271.51 1777.2610278.43 1778.29
10291.82  1778.310351.48 1777.5510378.37 1778.0110410.78  1778.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9492.02    .036 9950.11    .04810039.34    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9950.1110039.34           438.38   443.7  441.06             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10039.3410410.78 1778.76       F

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 6.889

INPUT
Description:
Station Elevation Data    num=      97
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9254.23 1776.95 9256.65 1776.94 9262.14 1776.92 9266.73  1776.9 9270.61 1776.89
 9273.93 1776.88  9276.8 1776.87 9279.29 1776.86 9281.48 1776.85 9285.12 1776.84
 9286.64 1776.83 9289.22 1776.82 9291.32 1776.81 9293.79  1776.8 9296.25 1776.79
 9298.67 1776.78 9300.92 1776.77  9302.9 1776.76 9304.48 1776.75 9306.55 1776.74
 9307.77 1776.73 9345.38 1776.34 9431.67 1775.64 9436.58 1775.63 9442.64 1775.62
 9448.82 1775.61 9456.33  1775.6 9462.87 1775.58 9467.17 1775.56 9470.96 1775.55
 9474.32 1775.54 9477.31 1775.53 9479.98 1775.52 9582.46 1775.88 9586.48 1775.89
 9592.16 1775.81    9667 1774.83 9667.13 1774.82 9667.57 1774.76 9682.82 1772.78
  9687.6 1773.96 9690.03 1774.51 9691.25 1774.77 9699.84 1774.57 9728.84 1774.08
 9743.05 1773.45 9775.58 1773.52 9786.43 1773.51  9802.4 1773.48 9813.67 1770.96
 9819.35 1769.79 9825.38 1770.97 9839.19 1773.36 9860.23 1772.64 9869.65 1772.31
 9879.46 1770.15 9886.95 1768.82 9899.67  1773.1 9910.62 1776.31 9922.38 1774.43
 9931.68 1772.67 9938.55 1772.65 9956.67 1772.59  9960.7 1772.56  9989.9 1772.32
 9995.86 1771.4710003.58 1769.5710013.02 1772.5710013.06 1772.5810029.13 1772.46
10051.07 1772.2810065.57 1772.4810088.23 1772.9110091.48 1771.5110096.88 1769.57
 10109.4 1772.1910111.73 1772.6410116.58 1772.6510149.34 1772.6910166.57 1772.77
10171.42  1772.810171.88 1772.6710182.68 1770.3710183.12 1770.4410184.05 1770.54
10198.74 1772.0110202.27 1772.2110211.71 1773.5910217.98 1773.7810251.53 1773.72
10345.35 1773.6810380.59 1773.6510386.83 1773.6610395.65  1773.710468.53 1773.95
10527.83 1773.9610580.43  1774.1

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9254.23    .036 9786.43    .048 9938.55    .056  9960.7    .04810029.13    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9960.710029.13           376.7  373.81  328.72             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 6.818

INPUT
Description:
Station Elevation Data    num=      84
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9294.98 1773.53 9325.01 1773.36 9354.36 1773.51 9362.48 1773.49 9375.32 1773.45
 9382.88 1773.42  9387.7  1773.4 9390.93 1773.39 9395.25 1773.37 9399.04 1773.34
 9458.64 1772.77 9529.66 1772.38 9532.36 1772.37 9535.09 1772.36 9537.86 1772.34
 9540.64 1772.33 9543.45 1772.31 9546.26  1772.3 9549.08 1772.29 9554.91 1772.26
 9560.69 1772.23 9569.48  1772.2 9623.81 1772.02 9640.64 1771.97 9667.14 1771.87
 9669.66 1771.86 9692.28 1771.68  9754.7  1771.2 9755.19 1771.01 9756.24 1770.77
 9769.05 1767.02 9770.03 1767.56 9772.14 1767.05 9789.25 1769.91 9813.35 1773.06
 9817.38 1772.35 9825.76 1770.89 9834.42  1770.5 9845.13  1770.3 9874.71 1769.76
 9889.49 1769.68 9895.37  1769.6 9912.51 1769.38 9956.14 1769.24 9980.34 1769.16
 9983.87 1769.14  9989.9 1769.36 9990.92 1769.35 9992.05 1769.3610001.12 1767.25
10003.77 1766.65 10011.7 1767.5210023.53 1768.5810037.03 1769.2310037.96 1769.27
10054.18 1769.8510056.54  1768.310060.21 1765.8910063.21 1766.9610070.02 1768.51
10071.01 1768.44 10071.6 1768.4210077.89  1768.810114.77 1770.5110121.34 1770.69
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10132.34 1770.5210144.16 1769.6710150.27 1768.2610162.69 1765.2510167.72 1766.95
10173.94 1769.1810192.87 1769.4910207.51 1769.7410211.72 1769.8210216.65 1769.94
10231.17 1770.1610289.18 1770.7710322.47 1770.7810372.57 1770.8610436.78  1770.8
 10529.9 1770.6110555.01  1770.610587.56 1771.36   10632 1772.43

Manning's n Values          num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9294.98    .036 9692.28    .048 9845.13    .056 9956.14    .04810037.03    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9956.1410037.03           317.27  323.95  326.29             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 6.757

INPUT
Description:
Station Elevation Data     num=      75
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9203.95 1769.28  9221.7 1769.21 9236.74 1769.15 9246.72 1769.11 9253.77 1769.08
 9258.98 1769.06 9262.95 1769.04 9266.06 1769.03 9268.53 1769.02 9270.48 1769.01
 9281.33 1769.06  9289.8 1768.98 9300.36 1768.99 9309.25    1769 9324.84 1769.01
 9337.73 1769.02 9357.48 1769.03 9386.35 1769.04 9391.26    1769 9396.83 1768.96
 9482.83  1768.6 9585.04    1769 9587.36 1769.01 9600.52 1768.87 9615.95 1768.71
 9633.15 1768.53 9642.15 1768.43 9647.64 1768.37 9651.31 1768.33 9653.92  1768.3
 9657.53 1768.27 9668.23 1768.18 9682.37 1768.07 9694.33 1767.95 9735.27 1767.53
 9746.82 1767.44 9765.55 1765.47 9776.18 1764.78 9784.71 1766.12 9792.06 1767.76
 9799.47 1768.43 9819.16 1767.68  9828.4 1767.28 9848.83 1766.41 9902.92 1766.64
 9956.39    1766 9961.781766.006 9965.54 1766.01 9969.27 1766.05 9987.14 1766.14
 9997.15  1764.210001.56 1763.1610006.72 1764.7910009.83 1766.0210035.42 1766.22
10062.88 1766.4410074.91 1766.5410076.72 1765.8110087.59 1761.4810092.58 1762.55
10105.92 1765.7810149.22 1767.3810149.57 1767.3910184.39 1766.6310200.66 1765.55
10201.06 1765.5310201.34 1765.5410213.61  1766.310250.44 1766.4210294.75 1766.64
 10315.4 1766.6310378.16 1766.8310417.31 1767.37 10486.8 1768.1910491.46 1768.16

Manning's n Values          num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9203.95    .036 9668.23    .048  9828.4    .056 9961.78    .04810035.42    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9961.7810035.42           449.28  446.36  429.75             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 6.672

INPUT
Description:
Station Elevation Data     num=     104
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9215.82 1765.85 9231.81 1765.79 9242.68 1765.77 9253.73 1765.75 9262.19 1765.74
 9265.06 1765.73  9267.6 1765.72 9271.96 1765.71  9275.5 1765.69 9278.42 1765.67
 9280.86 1765.66 9326.95 1765.73 9410.39 1765.19 9413.08 1765.16 9415.76 1765.13
 9418.41 1765.11 9421.03 1765.08 9423.63 1765.06 9426.19 1765.03  9428.7 1765.01
 9431.18 1764.99  9433.6 1764.96 9435.97 1764.94 9438.29 1764.92 9440.14  1764.9
 9442.55 1764.89 9444.37 1764.88 9446.01 1764.87 9448.94 1764.85 9451.35 1764.84
 9453.35 1764.83 9455.03 1764.82 9456.44 1764.81 9457.64  1764.8 9459.64 1764.79
 9461.08 1764.78 9463.64 1764.77 9465.09 1764.76 9467.45 1764.75 9539.21 1764.89
  9584.5    1765 9585.95 1764.99 9587.46 1764.98 9589.84 1764.97 9592.36 1764.96
 9594.14 1764.95 9600.01 1764.87 9608.45 1764.74 9610.29 1764.71 9614.47 1764.64
 9618.97 1764.57 9625.34 1764.47 9629.55 1764.41 9634.87 1764.32 9654.35 1763.97
 9658.41 1763.99 9671.25 1763.89 9672.54 1763.88 9672.99 1763.78 9684.01  1761.8
 9704.08 1765.87  9707.5  1766.5 9708.54 1766.66  9710.4 1767.27 9715.92 1766.11
  9721.7 1764.89  9725.1 1763.93 9735.34 1763.96 9779.81 1764.19 9853.64 1764.57
 9858.61  1764.6 9863.37 1764.48 9906.32  1763.2 9930.31 1762.95 9933.82 1762.93
 9937.89 1762.86  9942.8 1762.78 9963.55 1762.43 9976.87  1762.3 9980.89 1760.88
 9987.35 1758.37 9988.35 1758.82 9997.38 1759.5810004.11 1757.4810020.33 1762.56
10021.65 1762.9710046.83 1762.76 10101.9  1762.310107.49 1762.2310109.36 1762.22
10114.26 1762.21 10130.4 1762.3410203.21 1763.0110224.06 1763.0210272.43 1763.13
10277.97 1762.9410312.39 1761.9710329.02 1762.0310336.96 1762.2310371.76  1762.4
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10372.54 1762.4110446.22  1763.510537.49 1764.0310549.73 1764.11

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9215.82    .036 9610.29    .048 9715.92    .056  9942.8    .04810046.83    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9942.810046.83           566.76  591.92  731.58             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 6.560

INPUT
Description:
Station Elevation Data    num=      67
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9330.73 1760.67  9364.6 1760.24 9370.84 1760.23 9375.12 1760.31 9394.83 1760.15
 9404.62 1759.89  9430.8 1759.88 9432.19 1759.87 9433.59 1759.86 9436.36 1759.85
 9437.71 1759.84 9440.27 1759.83 9443.84 1759.81 9447.59  1759.8 9450.51 1759.78
 9453.95 1759.77 9457.24 1759.76 9460.96 1759.74  9465.2 1759.73 9475.95 1759.69
 9490.94 1759.64 9497.23 1759.62 9501.89 1759.68 9507.73 1759.75 9512.56 1759.81
 9516.61 1759.86 9595.94 1760.04  9604.2 1760.11 9607.35 1760.18 9610.94 1760.25
 9647.85 1760.93  9679.3  1760.7  9709.5 1760.88 9714.52 1759.73 9722.01 1757.54
  9726.6  1759.3 9729.84 1760.52  9765.1 1759.83 9811.21 1759.09 9815.161759.092
 9857.62 1759.11 9887.75 1759.23 9899.22 1759.22 9910.89 1759.06 9914.92 1758.98
 9932.84 1758.86 9951.79 1758.62 9989.68 1758.13 9994.57 1756.1510002.53 1753.12
10005.06 1754.0810013.02 1758.2910027.92 1758.1710036.92 1758.0810056.93 1757.93
10062.76 1757.8910083.73 1757.6610087.86 1756.5710095.15 1754.0410095.49 1754.19
10103.17 1757.4210134.02 1757.6810181.99 1758.0110233.34 1759.2210254.38 1759.73
10275.98 1759.9210320.78 1760.17

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9330.73    .036 9607.35    .048 9815.16    .056 9951.79    .04810056.93    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9951.7910056.93           496.38  517.75  487.03             .1       .3
Left Levee      Station=  9709.5      Elevation= 1760.88

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 6.463

INPUT
Description:
Station Elevation Data    num=      68
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9481.78 1758.14 9486.88  1758.3 9500.35 1758.48 9515.99 1758.36 9537.49 1757.68
 9545.32  1757.3 9574.68 1755.32 9589.68 1755.71 9611.69 1756.77 9636.06 1754.82
 9639.26 1754.58 9643.44 1754.53 9662.11 1754.92  9676.8 1755.08 9680.07 1755.21
 9686.59 1754.72 9695.88 1754.67 9704.47 1754.63 9724.77 1754.72 9736.25 1754.71
 9738.03 1753.85  9742.3 1750.99 9745.27 1753.43 9747.83 1754.87  9806.4 1755.45
 9822.21 1755.64 9830.93 1751.85 9831.81 1751.39 9832.85 1751.83 9836.93 1753.98
 9838.16 1754.55 9843.72 1754.57 9849.66  1754.6 9882.77 1754.92 9884.82 1754.95
 9905.69 1755.18 9919.16 1755.47 9959.46 1755.21 9976.83  1755.1  9983.6 1754.92
 9987.89 1753.5510001.93 1749.8110006.15 1751.37 10013.9 1754.3310024.44 1754.36
 10061.7 1754.4610069.97 1754.6310074.65 1754.64 10087.7 1754.3310111.35 1754.08
10131.02 1753.7810134.58 1753.1510146.71 1750.76 10157.6  1752.110167.67 1752.64
 10194.9 1754.3410205.48 1754.3110214.96 1754.7810216.77 1754.9510224.51  1755.4
10236.71 1755.99 10249.9 1756.7710260.99 1757.0310290.22 1757.3210299.68 1757.43
10303.04 1757.4410304.19 1757.4710329.03 1757.14

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9481.78    .034 9695.88    .048 9843.72    .036 9959.46    .04910024.44    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9959.4610024.44           563.56  564.45  519.39             .1       .3

CROSS SECTION
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RIVER: Iona_Wash
REACH: IonaMainWash        RS: 6.356

INPUT
Description:
Station Elevation Data     num=      80
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
 9094.51 1750.18  9099.8 1750.12  9153.8 1750.28 9215.64 1751.36 9239.96 1751.42
 9269.56 1750.37 9283.58 1749.61 9285.13  1749.7 9289.37 1749.78 9297.67 1749.59
 9308.83 1749.23 9371.36 1749.05 9384.39 1748.89 9395.45 1748.71 9414.82 1748.58
 9422.77 1748.91 9427.21 1749.09 9430.74 1749.02  9447.7 1748.73 9453.01 1748.69
 9459.55 1748.38 9489.01 1747.76 9495.81 1747.51 9506.15 1746.71 9509.43 1747.19
 9510.83 1746.93 9512.13 1746.76 9522.73 1744.57 9523.49 1744.83 9524.19 1745.09
 9532.72 1748.86 9542.72  1748.8 9547.17 1748.79 9575.19 1749.29 9582.99 1749.26
 9607.96 1749.77 9612.44 1749.83 9613.53 1749.58 9621.39 1747.75 9626.58 1749.71
 9628.87 1749.57    9637 1750.15 9699.62 1749.03 9757.64 1750.52 9770.31 1750.77
 9855.29 1749.47 9866.45 1749.95 9900.78 1750.21 9921.44 1749.45 9923.31 1749.38
 9929.97 1748.18 9985.87 1744.9610009.12 1744.1910011.21 1744.6910017.83 1746.59
10033.28 1749.6310033.52 1749.6810033.97 1749.7710035.09 1749.7810036.57  1749.8
10045.43 1749.6610068.91 1749.7110080.58 1749.73 10087.9 1749.6910099.25 1749.62
10125.91 1750.1910138.09 1750.6310142.19 1750.7710155.83 1751.1610164.33 1751.37
 10170.6 1751.5110183.37 1751.5310187.87  1751.610199.43 1751.6610211.48 1751.58
10213.73 1751.5610238.41 1751.3210256.15 1750.9110259.99 1750.8110260.18 1750.81

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9094.51    .034 9422.77    .048 9542.72    .036 9921.44    .04910035.09    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9921.4410035.09           459.04  475.19  450.12             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 6.266

INPUT
Description:
Station Elevation Data     num=      62
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
 8941.94 1745.53 8979.08  1745.4 9025.89 1745.41 9122.74 1745.63 9142.35 1745.65
 9204.74 1746.12 9215.85 1746.11  9244.5 1746.22 9311.83 1746.27 9376.91 1745.15
 9405.73 1744.65 9410.06 1744.57  9411.5 1744.16 9422.11 1740.98 9427.05 1742.24
 9435.37 1744.36 9447.91 1744.72  9452.9 1744.77  9456.4 1744.69 9459.62 1744.63
 9478.17 1744.16 9487.48 1742.79 9493.61 1742.14 9497.67 1743.95  9500.5 1745.73
  9518.2 1745.54 9603.09 1744.34 9641.19 1744.94 9683.58 1745.16  9694.1 1746.93
 9696.63 1747.33 9699.57 1746.96 9709.76 1745.43 9732.65 1745.09 9741.21 1744.97
 9776.64 1744.51 9793.63  1744.5 9818.92 1744.34  9833.9 1744.34 9835.69 1744.34
 9838.86 1744.23 9872.01 1743.28 9901.12 1741.86 9932.16 1741.82 9959.89 1741.73
 9993.75  1740.510007.71    174010018.11 1740.8910022.72 1741.3410024.721741.997
10026.04 1742.4310031.75 1744.4110035.86 1744.4910058.79 1744.9210074.97 1745.22
 10079.3 1745.3210082.81 1745.4110106.54    174610135.12 1746.6610140.71 1746.79
10149.76    174710152.03 1747.07

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 8941.94    .034 9376.91    .048  9456.4    .036 9959.89    .04910035.86    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9959.8910024.72           421.38  408.64  391.64             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 6.189

INPUT
Description:
Station Elevation Data     num=      46
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
 9823.59 1746.28 9831.34 1744.62 9845.23 1741.56 9858.35 1740.98 9866.19 1740.41
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    9877 1739.99 9896.29 1739.24 9922.25 1738.27 9929.98 1738.23 9942.51 1738.32
 9974.56 1738.53 9998.69 1735.56 10000.7 1735.2810001.34 1735.3310016.42 1736.15
10024.66 1736.3810064.01 1737.3310064.29  1737.410072.36 1740.5310077.43 1740.74
10099.32 1741.6510110.42 1742.2410111.82  1742.210112.35  1742.210113.08  1742.2
10114.15  1742.210115.32  1742.210115.54  1742.210116.52 1741.4610119.48 1739.08
10120.74 1737.9210122.84    173910128.29 1741.5810142.69 1741.7810143.73 1741.79
10145.02 1741.8310146.32 1741.8910187.51 1742.8410188.87 1742.98 10189.4    1743
 10191.1 1743.1610191.38 1743.1610192.66 1743.2710192.86 1743.2610193.07 1743.26
10193.19 1743.27

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9823.59    .036 9974.56    .04910024.66    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9974.5610024.66           487.39  463.93  420.33             .1       .3
Right Levee     Station=10110.42      Elevation= 1742.24

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 6.101

INPUT
Description:
Station Elevation Data    num=      65
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9850.07 1737.71 9854.63 1737.73 9887.26 1738.14 9905.08  1737.7 9907.39 1737.44
 9911.03 1735.65 9912.87 1734.75 9913.37 1734.52 9922.04 1734.48  9957.9  1734.3
 9971.89 1733.73 9974.98 1733.65 9976.18 1733.75 9979.31 1734.12 9991.78 1732.32
 9996.08 1731.7410000.36 1732.2510010.43 1731.7410012.86 1731.7410014.38 1731.74
10014.82 1731.8410018.22 1732.7910018.43 1732.7910018.67  1732.810044.35  1733.4
10049.25 1733.4810072.53 1734.0310083.15 1733.8510085.15 1733.8410087.88 1733.83
10092.11 1733.7810094.44 1733.7910098.33  1733.810098.62  1733.810098.81  1733.8
10099.22  1733.8 10099.4  1733.810099.59  1733.810101.59  1734.210103.75 1734.73
10105.16 1735.0910109.86 1736.9510120.06 1737.6310123.48 1737.8510124.96 1737.97
10133.76 1737.2510137.71 1737.0610140.42  1736.910142.32 1736.2610143.44 1735.91
10146.87 1734.9210147.05 1734.8710147.13 1734.85 10148.3  1735.610149.25 1736.02
10150.22 1736.5910152.92 1737.5810153.48 1737.5810157.24 1737.57 10166.9  1737.7
10168.28  1737.710185.35 1737.59 10196.7 1737.4910224.38 1737.1410244.39 1736.97

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9850.07    .036 9979.31    .04910018.22    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9979.3110018.22           588.17  592.05  594.78             .1       .3
Right Levee     Station=10124.96      Elevation= 1737.97

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 5.989

INPUT
Description:
Station Elevation Data    num=     152
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9764 1732.76 9774.59 1732.03 9795.71 1733.45  9795.8 1733.46 9796.11 1733.46
 9796.32 1733.45 9824.27 1732.82 9844.75 1732.21 9854.08 1731.95 9867.68 1731.66
 9891.43 1731.95 9896.11 1731.92  9903.2 1731.92 9914.25 1732.03 9919.97 1732.05
 9926.03 1732.12 9926.73 1731.91 9929.99 1731.06 9931.41 1730.65 9933.51 1730.15
 9934.88 1729.87  9937.1 1729.33  9937.8 1729.23 9938.46  1729.2 9939.81 1728.94
 9940.27 1728.97 9941.71 1728.73  9943.4 1728.49 9943.45  1728.5 9944.42  1728.4
 9945.56 1728.35 9948.05 1728.22  9948.1 1728.22 9948.14 1728.22 9948.16 1728.22
 9950.53 1728.14 9950.71 1728.14 9950.72 1728.14 9950.93 1728.13 9952.16 1728.13
 9952.18 1728.12 9953.42 1728.12 9954.63 1728.11 9957.83 1727.88  9959.2 1727.78
 9959.23 1727.77 9961.86 1727.41 9963.49 1727.45 9963.59 1727.44 9963.67 1727.42
 9963.75 1727.42 9968.05 1727.31 9968.36 1727.35 9968.72 1727.44 9969.99 1727.38
 9971.24 1727.31 9971.62 1727.32 9972.85 1727.12 9973.47 1726.94 9974.14 1726.71
 9974.87 1726.46 9974.92 1726.43    9975 1726.35  9975.3 1726.39 9979.86 1726.94
 9980.95 1726.76 9981.62 1726.58 9986.17 1726.72 9986.54 1726.77 9987.08  1726.8
 9987.61 1726.84 9988.02 1726.85 9989.25 1726.93 9990.93 1726.8610016.48 1727.67
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10036.65 1728.3110037.76 1728.3710038.97 1728.4310041.09 1729.2810047.41 1732.14
 10048.3 1732.1410048.78 1732.1410049.26 1732.1410049.44 1732.1410050.84 1732.11
10062.02 1731.8610064.11 1731.8210066.41 1731.7910068.47 1731.7710070.32 1731.71
10077.69 1731.6210080.15 1731.4410082.15 1731.2310095.36 1731.3410097.41 1731.34
10100.62 1730.4110101.98 1730.0210104.07 1729.4810110.39 1730.9410111.72 1731.25
10124.52 1731.2210128.97 1731.2110130.02 1731.17 10130.6 1731.1510141.09 1730.72
10145.98 1730.6110151.26 1730.4510152.52 1729.6910154.31 1728.3510158.45  1729.1
10159.48 1728.5710159.83  1728.910161.83 1727.8210162.65 1727.4310162.79 1727.29
10162.95 1727.2210169.32 1729.1810174.63 1731.2510178.16 1731.2110180.99 1731.34
10189.63 1731.4610195.99 1731.6510203.79 1727.7610205.68 1726.8610208.95 1729.43
10212.45 1731.8210214.71 1732.0610217.05 1732.2110228.82  1733.110235.54 1733.43
10237.82 1733.5610246.34 1733.3710252.71 1733.1910261.73 1733.05 10268.3  1732.9
10273.02 1732.7910302.13 1732.4210304.27 1732.4210306.56  1732.410332.28 1732.24
10364.49 1731.7210371.39 1731.7810380.05 1731.9310407.77 1732.3510424.91 1732.73
10444.34 1731.9610458.75 1731.3610488.76  1732.2   10490 1732.2410490.64 1732.27
10517.02 1732.7610518.79 1732.73

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9764    .036 9957.83    .04910016.48    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9957.8310016.48            437.1  469.99   459.9             .1       .3
Right Levee     Station=10049.44      Elevation= 1732.14

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 5.899

INPUT
Description:
Station Elevation Data    num=      44
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9764.48 1733.23 9768.64 1733.72 9771.86 1733.27 9777.35 1732.67 9788.47 1731.23
    9799  1730.2 9804.49 1729.97 9811.25  1729.2  9831.3 1728.78 9848.25 1728.47
 9859.58 1728.61 9866.96 1728.73 9886.85 1729.04 9889.21 1729.25 9889.88 1729.31
 9891.94 1729.49 9901.68 1730.33 9909.04 1730.99 9911.01 1731.16 9914.45 1730.45
  9923.4 1728.77 9927.88 1727.02 9929.32 1726.45  9932.8 1725.08 9933.57 1724.77
 9934.73  1724.4 9934.83  1724.4 9935.84 1724.37 9944.25 1724.11 9947.22 1724.04
 9948.11 1723.84  9974.2 1723.37 9990.67 1722.9410018.27 1722.5810020.481723.531
 10028.1 1726.8110031.06 1728.0910031.98 1728.4510032.09 1728.4810032.45 1728.62
10034.87 1728.6610062.53 1728.9610096.81 1729.6210105.69 1729.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9764.48    .036  9974.2    .04910020.48    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9974.210020.48            487.7  478.11  535.96             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 5.809

INPUT
Description:
Station Elevation Data    num=      66
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9392.42 1728.43 9404.86 1728.29 9456.22 1727.66 9487.39 1725.99 9517.14 1724.64
  9524.9 1724.39 9554.11 1724.62 9569.09 1725.44 9610.45 1725.23 9635.12 1725.19
 9647.13 1725.32 9649.58 1725.44 9655.58 1725.93 9662.84 1726.64 9672.04 1726.59
 9688.19 1726.05 9693.57  1726.3  9696.6 1726.45 9707.69  1726.1 9737.32 1725.53
 9747.15 1725.31 9750.33 1725.28 9750.56 1725.28  9783.6 1725.66  9789.3 1725.71
 9789.49 1725.72 9793.02 1725.75 9795.36 1725.77 9802.11 1725.62 9806.04 1725.47
  9811.2 1725.26 9812.94 1725.23 9821.08 1725.01  9832.4 1724.74 9839.37 1724.64
 9853.87 1724.44 9864.32  1724.3 9877.74 1724.08 9892.52  1723.9 9912.77 1723.57
 9926.72 1723.43 9949.12 1723.23 9959.65 1723.13 9960.91 1723.09 9965.57 1720.77
 9970.33  1718.9 9977.49 1718.8610055.34 1719.1710075.26 1719.2410081.21  1719.3
10082.81 1719.97 10090.3 1723.42   10099 1723.4110103.59  1723.410114.06 1723.34
 10139.3 1723.1910147.89 1723.13 10160.3 1722.9810160.57 1722.9810160.96 1722.97
10173.42 1722.9910179.91 1723.19 10186.5 1723.2910197.62 1723.6310212.89 1723.97
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10247.88 1724.74

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
 9392.42    .036 9949.12    .049   10099    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9949.12   10099            475.48  522.82  518.26              .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.710

INPUT
Description:
Station Elevation Data     num=     184
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9570.19 1726.92 9570.81 1726.93 9577.82 1727.06 9583.15 1727.14 9588.05 1727.36
 9595.32 1727.37 9596.45 1727.36 9597.43 1727.36 9598.25 1727.34 9598.92 1727.27
 9599.11 1727.25 9599.27 1727.24 9606.51 1726.33 9608.21 1726.15 9610.45 1725.92
 9615.57 1725.23 9618.99 1724.89 9623.42 1724.45 9625.99  1724.1 9631.33 1723.61
 9636.57 1723.14 9637.17 1723.11 9641.27 1722.96 9647.19 1722.59 9652.36 1722.31
 9655.76  1722.1 9658.08 1721.94 9659.76 1721.81 9661.13 1721.71 9662.26 1721.62
 9669.35 1721.29 9674.84 1721.42 9676.42 1721.55 9682.76 1721.59 9685.41 1721.56
 9701.54 1721.44 9711.53 1721.39 9731.31 1721.01 9732.82 1720.99 9735.82 1720.92
 9758.34 1721.23 9762.55  1721.3 9774.76 1721.52 9792.08  1721.8 9812.94 1722.14
 9814.82 1722.18 9818.51 1722.19 9834.58 1721.98 9835.46 1721.96 9837.05 1721.92
 9849.66 1721.43 9853.26 1721.43 9854.15 1721.43 9855.16 1721.43 9857.97 1721.43
 9860.04 1721.44 9873.67 1721.16 9876.42 1721.16 9879.22 1721.18 9882.68 1721.17
 9888.74 1721.09 9891.78 1720.76 9893.01 1720.46 9894.32  1720.1 9895.76 1719.78
 9897.08 1719.75 9899.52 1719.54 9900.64 1719.58 9902.71 1718.78  9904.9  1717.9
 9906.28 1717.15 9909.85 1716.39 9910.87 1716.37 9914.31  1716.3 9914.95 1716.37
 9916.27 1716.34 9917.66 1716.25 9922.32  1716.4 9923.98 1716.26 9924.88 1716.17
 9926.05 1716.06 9927.62 1715.96 9929.87 1716.09 9932.43 1715.94 9932.97 1715.94
 9936.05 1715.95 9943.08 1716.19 9943.65 1716.21  9947.2 1716.47 9947.88  1716.5
 9951.11 1716.67 9954.12 1716.69 9954.78 1716.72 9957.64 1716.67 9960.51 1716.58
 9963.75 1716.44 9967.27 1716.24 9967.49 1716.22 9967.59 1716.22 9971.86 1715.85
 9975.13 1715.59 9980.59 1715.16 9989.46 1713.0710005.32 1713.7410014.36 1714.09
10019.74  1714.310023.28 1715.3710026.48 1716.1410035.19  1717.510035.84 1717.34
10036.53 1717.4210037.32 1717.6310040.44 1718.1510041.01 1718.2710041.58 1718.31
10042.05 1718.2910042.61 1718.2610043.64 1718.1710046.23 1718.27 10046.8 1718.28
10048.81 1718.6610049.63 1718.8410051.24 1718.8410051.43 1718.8410055.57 1719.11
10056.15 1719.1210059.64 1719.5310060.57 1719.5610061.67 1719.6310087.57 1721.32
10088.67 1721.4110089.83 1721.48   10091 1721.5210093.56 1721.5210096.28 1721.52
10097.26 1721.5410100.05 1721.5210100.88 1721.5410105.31 1721.4310105.97 1721.45
10106.62 1721.4810111.04  1721.3 10111.4 1721.3110115.97 1721.1910116.14 1721.19
10116.17 1721.1910119.62 1721.2810122.44  1721.410123.67 1721.4310128.26  1721.5
10130.37 1721.4810132.66  1721.510136.81 1721.7310137.49 1721.8310137.63 1721.86
10150.86 1724.0610153.09  1724.310154.09 1724.6210154.96 1724.9110155.72 1725.14
 10157.9 1725.54 10166.1 1725.9110167.91 1725.9910169.07 1726.0210169.95 1726.05
10181.59 1726.5610182.39 1726.5610182.46 1726.5710182.52 1726.5710182.59 1726.57
10193.04 1726.6710193.78 1726.6910201.67 1726.7310202.23 1726.7510202.73 1726.77
 10208.8 1726.7610209.53 1726.7910210.33 1726.8310228.47 1727.4810240.06 1727.55
10245.28 1727.6110252.08 1727.6510283.97 1728.0210318.94 1728.43

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
 9570.19    .038 9910.87    .04910042.05    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9910.8710042.05            460.39  424.17  391.72              .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.629

INPUT
Description:
Station Elevation Data     num=      81
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9776.42 1722.19 9779.78 1722.07 9786.29 1721.95 9794.63 1721.77 9795.31 1721.58
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 9795.67 1721.49 9796.59 1721.27 9798.97 1720.64 9800.43 1720.29 9800.79 1720.28
  9804.1 1720.52  9806.3    1721 9808.44 1721.48 9808.99 1721.62  9809.9 1721.79
 9810.49 1721.72 9810.65 1721.73  9810.8 1721.74 9813.46 1721.59 9814.12 1721.64
 9816.36 1721.74 9818.55 1721.76 9832.91 1721.95 9834.66 1721.88 9835.27 1721.82
 9835.55 1721.75 9838.25  1721.3 9843.55 1721.22  9844.1 1721.26 9845.96 1720.96
 9847.47 1720.71 9851.64 1720.23 9852.65  1720.2 9855.79 1718.84 9856.52 1718.88
 9857.36 1718.94 9864.16 1719.45 9868.49 1719.13 9868.81 1719.11 9871.53 1719.04
 9873.47 1718.67 9873.61 1718.56  9874.1 1718.61 9877.37  1718.5 9878.97 1718.41
 9888.66 1718.53 9891.35  1718.6 9907.51 1718.71 9911.83 1718.91 9918.29 1719.16
 9922.62 1718.88 9926.95 1718.49 9940.66 1717.44 9942.26  1717.3 9947.41 1716.86
 9954.33 1715.37 9955.45 1715.13 9962.33 1714.54 9963.87 1714.41 9966.72 1714.24
 9970.07 1713.91 9970.43 1713.75 9971.26 1713.29 9976.38 1711.37 9991.53 1712.21
10005.65 1713.0610014.43 1715.1610018.05 1715.7910027.16 1716.2810031.72 1716.42
10051.18 1717.0310093.11 1718.3410096.34 1718.4310097.94 1718.8810100.37 1719.51
10110.49 1722.1810118.71 1724.1910120.11 1724.3510123.85 1724.7310148.39 1725.01
10153.08 1725.08

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9776.42    .038 9942.26    .04910031.72    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9942.2610031.72           414.11  382.07  309.37             .1       .3
Left Levee      Station= 9832.91      Elevation= 1721.95

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 5.557

INPUT
Description:
Station Elevation Data    num=      92
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9626.56  1721.3 9629.34 1721.13 9636.58 1720.76 9640.82 1720.52 9644.79 1720.24
 9655.53 1719.46 9662.67 1719.13 9670.15 1718.82 9686.28 1718.05  9702.8 1717.47
 9731.29 1716.03 9732.72 1715.95 9732.81 1715.94  9736.9 1715.62 9737.27 1715.67
 9742.63 1716.36 9760.52  1716.5 9767.75 1716.62 9771.78 1717.04  9791.8 1719.22
  9796.6 1719.74 9797.75 1719.86 9819.34 1719.85 9826.85 1720.03 9827.83 1720.05
 9834.59 1720.39 9851.63 1720.33 9853.52 1720.31 9858.85 1720.39 9863.15 1720.31
 9868.07 1720.16 9879.03 1719.56 9888.83  1718.8 9890.89 1718.66 9891.04 1718.67
 9895.07 1718.05 9899.14 1717.48 9907.99 1716.06 9915.18 1714.96 9915.89 1714.87
 9916.33  1714.9 9916.99 1714.93 9917.77 1714.97 9918.51 1715.01 9919.13 1715.04
 9964.24  1714.7  9971.3 1714.65  9973.2 1714.64 9975.95 1713.69 9978.25 1712.83
 9984.21 1710.3210014.27 1709.7810015.26 1709.7510015.69  1709.910021.03 1711.66
10029.42 1712.0510034.75  1712.310035.63 1712.3310043.09    171410045.94 1714.68
 10052.7 1716.3510056.46 1717.3110061.93 1717.83 10065.4 1718.1610066.95 1718.31
10072.13 1718.7410078.93 1718.5910080.75 1718.4810084.02 1718.3510087.33 1718.29
10087.68 1718.2610089.84 1718.1310091.53 1718.0210092.92 1717.9310096.93 1717.72
10098.33 1718.0310099.06 1718.1210100.34 1718.3610101.21 1718.5110103.26 1718.72
10104.19 1718.8410106.86 1719.2210107.13 1719.2410111.01 1719.5510114.36 1719.77
10117.83 1719.8510124.34 1719.8910127.13  1719.910129.05 1719.9210136.55 1720.07
 10137.8 1720.0810142.58 1720.21

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9626.56    .038 9964.24    .04910029.42    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9964.2410029.42           504.98  543.42  573.19             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 5.454

INPUT
Description:
Station Elevation Data    num=     120
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9658.63 1713.51 9663.26 1713.39 9666.48 1713.79 9671.53 1714.45 9672.54 1714.43
 9680.83 1714.65 9684.11 1714.55 9687.47 1714.31 9698.48 1714.07 9701.43 1713.69
 9704.07 1713.36 9706.67 1713.02 9708.89 1712.81 9713.82 1712.47 9714.79 1712.46
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 9720.73 1712.41 9721.96 1712.36 9726.85 1712.48 9728.58 1712.41 9729.85 1712.38
 9731.38 1712.35 9733.21 1712.31 9736.82 1712.29 9739.46 1712.16 9743.48 1712.12
 9745.15 1712.01 9751.35 1711.71 9754.19 1711.72 9755.07 1711.62 9757.59 1711.46
 9758.13 1711.38 9758.73 1711.27 9758.85 1711.25 9759.02 1711.22 9759.59  1711.1
 9764.48 1710.94 9766.36 1711.07 9766.64 1711.12 9767.48 1711.27 9771.14 1711.85
 9786.83  1711.8  9812.3 1711.78 9820.71 1711.75 9825.97 1711.76 9834.21 1711.82
 9865.53 1711.85 9867.84 1711.72 9869.67  1711.8 9873.09 1711.92 9874.18 1711.94
 9915.75 1713.28 9929.22 1713.77 9934.08 1713.55 9955.05 1712.61 9975.61 1709.52
 9976.03 1709.45 9976.07 1709.44  9976.2 1709.41 9987.75 1706.2410001.33 1706.85
 10002.4  1706.910004.21 1707.3810009.89 1708.7310022.99    171010026.26 1710.31
10033.94  1710.410036.87 1710.4310052.77 1710.5910059.36 1710.6510062.94  1710.7
10075.08 1710.9910102.65 1711.0910114.15 1710.9610120.29 1712.1110120.75  1712.2
10121.31  1712.310126.82  1712.110135.62 1712.1910138.28 1712.1710139.39 1712.16
10141.27 1712.2110145.07 1712.1610150.03 1712.0710157.11 1711.98 10158.7  1711.6
10159.83  1711.310164.31 1711.2210171.09 1711.13 10179.7    171110183.09 1710.94
10191.75 1710.8310199.49 1710.74 10203.1 1710.6910206.82 1710.6410211.45 1711.13
10215.98 1711.6110220.52 1711.4310222.49 1711.3610223.83 1711.34 10226.3 1711.65
10227.18 1711.6710230.02 1712.0410230.59 1712.06 10231.1 1712.07 10234.1 1712.46
 10234.4 1712.4710237.52 1712.8610240.88 1713.2410243.71 1713.4510247.64  1713.6
10247.91 1713.6310251.95 1713.6810252.18  1713.710255.64 1713.6910255.87 1713.71
10257.86 1713.7810258.86 1713.7610260.81 1713.7710263.56 1713.73 10268.3 1713.63

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9658.63    .038 9976.03    .04910033.94    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9976.0310033.94           492.03  529.22  486.63              .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.354

INPUT
Description:
Station Elevation Data     num=     187
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9425.56 1709.86  9438.7 1710.11 9452.72    1710 9466.55 1710.14 9493.29 1710.26
 9506.38 1709.85    9510  1709.8 9537.05 1708.97 9543.04  1708.9 9550.59 1708.82
 9565.66 1708.47 9574.85 1708.45 9589.35 1708.66 9595.85  1708.6 9610.28 1708.48
 9611.51 1708.47 9612.95 1708.48 9623.36  1708.9 9623.94 1708.91  9624.6 1708.93
 9635.84 1709.06 9636.18 1709.07 9639.06    1709 9642.14 1708.91  9645.5 1708.82
 9646.02 1708.81 9651.39 1708.64 9656.93  1708.5 9658.96 1708.48 9664.73 1708.39
 9665.39 1708.37 9669.78 1708.32 9673.94  1708.3 9677.93 1708.32  9679.1 1708.31
 9685.29 1708.49 9691.44 1708.78 9693.67 1708.79 9699.82 1709.01 9700.93    1709
 9705.97 1709.09 9707.67 1709.08 9712.49 1709.11 9716.83 1709.02 9721.93 1709.08
 9725.14 1708.91 9728.13  1708.7 9730.89 1708.52 9737.16 1708.26 9746.88 1708.32
 9749.24 1708.27 9763.24  1707.9 9768.34 1707.75 9777.96 1707.44 9781.03 1704.44
 9781.59 1704.07 9787.44 1705.19 9791.03 1705.87 9792.41 1705.83 9794.17 1705.92
 9801.66 1706.22 9803.01 1705.47 9804.87    1704 9805.56 1704.27 9809.17 1705.25
 9812.19  1705.2 9856.65 1706.36 9867.05 1706.38 9906.99 1706.42 9922.59 1706.46
 9931.55 1706.49 9938.12 1706.51 9941.22 1706.45 9946.63 1706.29 9947.85 1706.27
 9948.64  1706.2 9959.88 1706.09 9965.79 1706.02 9968.57 1706.14 9978.02 1706.57
 9980.96 1707.05 9984.14 1706.08 9990.87 1703.9610005.81  1704.510009.99 1704.64
10014.49 1705.0910021.22 1705.7410029.36 1706.2710038.16 1706.8610039.31 1706.93
10040.01 1706.8610041.17 1706.7110045.12 1706.1810049.45 1705.7310051.97 1705.15
10055.37 1704.3610060.94 1704.8210064.33 1705.24 10071.2 1706.9910071.76 1707.14
 10072.1 1707.1610072.23 1707.1810072.49 1707.2110073.34  1707.310088.71 1708.77
 10091.9 1709.0610097.04 1709.2210105.65 1709.2810105.91 1709.2910108.64 1709.36
10114.03 1709.3910114.21  1709.410114.33 1709.4110114.43 1709.4210119.36 1709.61
10119.84 1709.6710120.06 1709.7110120.28 1709.7210125.16    171010125.53 1709.96
10130.08 1710.2310130.54 1710.1410131.32 1710.0710131.68 1710.08 10136.5 1710.42
10137.07 1710.4110137.45  1710.410138.16 1710.3910142.85 1710.7610143.21 1710.75
10143.76 1710.7210148.39 1710.9510148.94 1710.9110149.49 1710.8810155.31 1710.77
10156.55 1710.7210162.42 1710.3810168.31 1710.1210169.56 1710.0910170.59  1710.1
10184.98 1710.1210185.49 1710.1410185.96 1710.1610186.82 1710.2110187.24 1710.23
10187.64 1710.2610188.59 1710.3410189.49 1710.4410204.51 1710.9110205.46 1710.98
10206.09    171110221.35 1711.52   10222 1711.53 10222.6 1711.5510223.25 1711.59
10230.25 1711.7910230.85 1711.8410231.44 1711.8710238.52 1712.0810246.02 1712.27
10246.45 1712.2810253.11 1712.3810253.25 1712.3910260.04 1712.4810260.34 1712.49
10260.44 1712.5110267.13 1712.6810267.28 1712.6910267.35  1712.710273.11 1712.99
10273.37 1712.98 10273.4 1712.9710273.43 1712.9610273.64    171310279.15 1713.35
10279.22 1713.3710284.69 1713.5910291.98 1713.5410292.14 1713.5210292.29  1713.5
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 10299.5 1713.2310299.68 1713.2110299.85 1713.2210300.05 1713.2110307.25 1712.93
10307.76 1712.8910310.31  1713.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9425.56    .038 9931.55    .04910038.16    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9931.5510038.16           294.52  403.44  451.22             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.278

INPUT
Description:
Station Elevation Data     num=      73
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9698.22 1708.66 9731.82 1708.88  9742.5 1708.87 9752.41 1708.07    9755 1707.97
 9758.02 1707.85 9768.96 1707.02 9774.07 1706.89 9780.83  1706.5 9785.68 1706.44
 9792.19 1706.27 9797.44 1706.26  9809.6 1706.18 9816.88 1706.11 9820.52 1706.09
 9834.44 1705.65 9840.57 1705.67 9841.92 1705.66 9844.04 1705.64 9847.57 1705.63
 9850.81 1705.57 9858.09 1705.55 9863.32 1705.46 9873.73 1705.37 9881.55 1705.33
  9887.2 1705.25 9888.57 1705.21 9889.51    1705 9903.78 1704.43  9916.8 1704.64
 9938.15 1703.93 9941.26 1703.82 9961.22 1703.23 9964.01 1702.32 9965.09 1701.85
 9965.88  1701.5 9967.62 1701.97 9969.39 1702.49 9975.86 1703.94 9977.05 1703.86
    9985 1704.21    9988 1704.36 9991.94  1702.8 9993.81 1702.11 9995.42 1702.15
10013.39 1702.8710013.81 1703.0110019.93 1704.7810025.98 1704.7910030.54 1704.84
10034.94 1704.8810043.23 1704.9510058.34 1705.1910062.64 1705.4610066.14 1705.62
   10076 1706.0710076.68 1706.0610102.68  1709.210108.19 1709.8910109.64 1710.09
10121.14 1711.1510127.36  1711.810131.53 1712.2510136.96 1712.72 10138.9 1712.83
10147.87 1713.6810148.04 1713.69 10148.8 1713.7610151.49 1713.7810170.16 1713.91
10175.54 1713.9410185.17  1714.1 10191.5 1714.07

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9698.22    .038 9938.15    .04910034.94    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9938.1510034.94           170.43  213.53  244.17             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.237

INPUT
Description:
Station Elevation Data     num=      79
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9789.17 1709.61 9799.73 1709.65 9801.51 1709.68 9809.52 1709.64  9812.6 1709.46
 9814.16 1709.36 9820.61 1708.89 9829.54 1708.25 9830.49 1708.18 9830.97 1708.14
 9846.47 1707.22 9887.49 1705.32 9894.75 1704.95  9897.4 1704.81 9899.02 1704.74
 9902.78 1704.59 9915.73 1704.49 9950.29 1704.47 9963.88 1704.03 9973.44 1703.79
 9983.38 1703.55 9985.95 1701.25 9986.89 1700.52 9999.83 1700.8610006.23 1701.09
10011.99 1702.9210015.97 1703.7710034.79 1703.7910042.29 1703.8610044.35 1703.88
10072.64 1704.1210075.63 1704.0310108.24 1703.1510110.77 1702.3810111.08  1702.3
10111.62 1702.4810112.66  1702.8 10113.8 1703.2610116.41 1703.3810120.77 1703.55
 10123.6 1703.7310128.06 1703.9710132.52 1704.1610135.85 1704.4910136.76 1704.52
10141.87 1704.4310144.08  1704.410147.65 1704.5510152.71 1704.6810153.73 1704.74
10153.99 1704.8210154.26 1704.9110154.55    1705 10164.4 1705.6310165.81 1705.93
10167.46 1706.1610169.36 1706.3810181.58 1707.8510184.49 1708.1110190.31 1708.68
 10193.1 1708.8410198.66 1709.4710201.46 1709.5910204.51 1709.6910208.57  1710.1
10211.73 1710.18 10213.5 1710.5710216.81 1710.7110218.16  1710.710221.65 1710.97
10225.39 1711.3110226.53 1711.1910230.83 1711.5410238.21 1712.2610239.81 1712.33
10244.93 1712.5510250.57 1712.6810251.78  1712.710257.43 1712.78

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9789.17    .038 9973.44    .04910042.29    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
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       9973.4410042.29            451.83  481.77  483.97              .1        .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.146

INPUT
Description: 1300.389   was  1511.860
Station Elevation Data     num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9635.35 1704.87 9636.89 1704.92 9640.87    1705 9662.87 1704.32 9685.42 1703.22
 9692.95 1703.34 9705.57 1702.54 9720.25 1703.16 9728.06 1703.32 9744.29 1704.06
 9754.06 1704.04  9761.6 1703.34 9836.91 1699.04 9840.35 1699.02 9852.85 1698.87
 9857.79 1698.97 9861.97 1698.88 9897.49 1698.63  9903.6 1699.23 9909.04 1698.03
 9929.57 1697.98 9937.36 1697.97 9948.15  1700.4 9960.86 1701.31 9979.56 1701.17
 9983.18 1701.05 9987.94 1699.97  9995.4 1697.6610001.58 1697.69 10014.2 1697.53
10015.36 1697.8410019.05 1699.1110025.81 1701.5510026.35 1701.7710035.59  1705.5
 10036.8 1706.0710050.52  1709.310059.04 1711.2210062.79 1711.2410089.56 1711.17
10121.43 1711.09

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9635.35    .038  9903.6    .04910026.35    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9960.8610026.35            319.92  330.44  304.43              .1        .3
Left Levee      Station= 9754.06      Elevation= 1704.04

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 5.083

INPUT
Description:
Station Elevation Data     num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9668.11 1702.68 9688.23 1703.01 9696.02  1703.2 9699.22 1702.92 9709.94 1703.26
 9710.42 1703.23 9721.98 1703.18 9740.11 1703.78 9759.24 1704.56 9759.37 1704.57
 9760.83  1704.4 9784.02 1702.05 9788.92 1701.54 9799.32 1700.56 9806.79 1700.46
 9811.83 1700.47 9829.55 1700.51 9849.27 1700.51 9853.55  1700.5 9868.64 1700.55
 9876.47 1700.15 9880.77 1700.02  9889.7  1699.6 9898.07 1699.46 9907.65 1698.38
 9913.15 1697.81 9924.95    1697 9940.13 1696.77    9953 1696.63 9968.33 1696.46
  9978.9 1695.62 9992.96 1694.6910025.18 1696.85   10038 1696.88 10066.1 1696.74
10068.55 1696.73 10084.2  1697.510136.91 1699.8210137.92 1699.8610140.57 1699.85
10143.06 1699.94 10166.5 1704.4210168.34 1704.6710178.23 1704.66   10180 1704.72
10197.64 1706.0910208.73 1706.96

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9668.11    .039    9953    .046 10066.1    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9953 10066.1            546.45  503.21   467.3              .1        .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash        RS: 4.988

INPUT
Description:
Station Elevation Data     num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9492.15 1705.38 9496.01 1705.47 9499.62 1704.84 9506.55 1704.37 9536.67  1702.1
 9538.65 1701.91  9541.6 1701.63 9558.54 1699.69 9570.63 1698.64 9586.21 1698.48
 9620.72 1698.01 9654.51 1697.59 9694.51 1697.44 9703.65 1697.37 9707.26 1697.32
 9751.81 1696.37 9759.14 1696.29 9795.76 1696.11 9812.22 1696.11 9821.74 1696.15
 9828.93 1696.24 9843.76 1696.32  9849.6 1696.22 9857.17 1695.96  9863.8 1695.86
 9864.44 1695.85 9874.73 1695.63 9881.91  1695.4 9890.88 1695.25  9895.2 1695.13
 9898.83 1695.02 9903.83 1695.09 9938.47 1694.14 9947.35 1694.11 9956.35 1694.08
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 9969.93 1694.01 9972.99 1693.7310004.39  1693.610016.45 1693.5310032.87 1693.88
10054.68 1694.31 10066.4 1694.5810076.34 1694.83 10101.2 1695.5810107.35 1695.76
10119.71    169910131.05 1702.07 10162.6 1702.0610181.81 1702.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9492.15    .039  9863.8    .046 10101.2    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9863.8 10101.2           465.93  459.18   451.9             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 4.901

INPUT
Description: Iona Wash RM 4.901 and ground data copied from ADMSU study.   N
             values are 0.039-0.046-0.033 (left-channel-right) from Iona
             Wash.prj  RAS model (Reach Iona-24).  Flow Rate=5,650 cfs,
             Comparison Water Surface=1696.69 Floodplain and 1697.44 Floodway.
             See Sheet E-18.
Station Elevation Data    num=      62
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
9583.8721701.0039594.2591699.4299602.2721698.1359608.2151696.9759616.8011695.936
9633.468 1694.039639.3421693.9079645.6321693.904 9659.591693.8059661.8831693.802
9684.4241693.7339688.991 1693.679700.3521693.4389706.9651693.5499728.881 1693.76
9729.5061693.7679732.3511693.6899752.0481693.224 9757.711693.1229772.5131692.964
9774.5891692.9469775.711 1692.939792.4361692.804 9797.131692.7199812.0721692.326
 9819.071692.0019819.6711691.9879821.4191691.9199828.3871692.7039842.2121692.567
 9862.431692.8919864.7531692.9249887.2951693.1219889.6261693.1239905.7891693.122
9909.8361693.1169932.3771693.0289945.3621693.0559949.149 1693.059954.9181693.095
9977.4591693.0819984.9651692.9019992.5081691.8629995.3511691.381   100001691.357
10018.061691.94710022.541692.35310024.421692.51810035.871693.52310045.081694.351
10050.461693.30810067.62 1695.7810079.231696.85210082.581695.69310090.171697.378
10103.741698.25310112.711698.60910122.591698.81810125.141698.98410135.251698.971
 10157.21698.71210157.791698.691

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
9583.872    .0399812.072    .04610024.42    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9812.07210024.42           354.88 299.867 260.043             .1       .3

CROSS SECTION


RIVER: Iona_Wash
REACH: IonaMainWash       RS: 4.844

INPUT
Description: Tie in at RM 4.844 and ground data copied from ADMSU study.   N
             values are 0.039-0.046-0.033 (left-channel-right) from Iona
             Wash.prj  RAS model (Reach Iona-24).  Flow Rate=5,650 cfs,
             Starting Water Surface=1695.44 Floodplain and 1696.42 Floodway.
             See Sheet E-18.
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
9847.067 1697.039849.3831696.9489867.2831694.324 9885.43 1691.76  9887.51691.227
9893.4171690.7279900.4221691.6289907.7161691.7039923.8361691.5069927.9321691.499
9948.1491691.9049968.3651692.2329972.2041692.1059984.1561690.5819988.5811690.109
9990.476 1689.93 10008.81689.86710016.021690.13910024.621692.07710029.01 1692.19
10049.231692.15410055.011692.09810069.451691.69610082.871691.53710089.661691.515
10103.991692.00810109.88  1692.910121.241693.31510130.091693.64910136.631693.672
10150.311695.20310151.821695.34810170.531695.597

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
9847.067    .039 9885.43    .04610089.66    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9885.4310089.66                 0       0       0             .1       .3
```

SUMMARY OF MANNING'S N VALUES

River:Iona_Wash

Reach	River Sta.	n1	n2	n3	n4	n5
IonaMainWash	7.074	.033	.039	.033		
IonaMainWash	6.973	.036	.048	.056		
IonaMainWash	6.889	.036	.048	.056	.048	.056
IonaMainWash	6.818	.036	.048	.056	.048	.056
IonaMainWash	6.757	.036	.048	.056	.048	.056
IonaMainWash	6.672	.036	.048	.056	.048	.056
IonaMainWash	6.560	.036	.048	.056	.048	.056
IonaMainWash	6.463	.034	.048	.036	.049	.037
IonaMainWash	6.356	.034	.048	.036	.049	.037
IonaMainWash	6.266	.034	.048	.036	.049	.037
IonaMainWash	6.189	.036	.049	.037		
IonaMainWash	6.101	.036	.049	.037		
IonaMainWash	5.989	.036	.049	.037		
IonaMainWash	5.899	.036	.049	.037		
IonaMainWash	5.809	.036	.049	.037		
IonaMainWash	5.710	.038	.049	.032		
IonaMainWash	5.629	.038	.049	.032		
IonaMainWash	5.557	.038	.049	.032		
IonaMainWash	5.454	.038	.049	.032		
IonaMainWash	5.354	.038	.049	.032		
IonaMainWash	5.278	.038	.049	.032		
IonaMainWash	5.237	.038	.049	.032		
IonaMainWash	5.146	.038	.049	.032		
IonaMainWash	5.083	.039	.046	.033		
IonaMainWash	4.988	.039	.046	.033		
IonaMainWash	4.901	.039	.046	.033		
IonaMainWash	4.844	.039	.046	.033		

SUMMARY OF REACH LENGTHS

River: Iona_Wash

Reach	River Sta.	Left	Channel	Right
IonaMainWash	7.074	514.42	533.21	536.53
IonaMainWash	6.973	438.38	443.7	441.06
IonaMainWash	6.889	376.7	373.81	328.72
IonaMainWash	6.818	317.27	323.95	326.29
IonaMainWash	6.757	449.28	446.36	429.75
IonaMainWash	6.672	566.76	591.92	731.58
IonaMainWash	6.560	496.38	517.75	487.03
IonaMainWash	6.463	563.56	564.45	519.39
IonaMainWash	6.356	459.04	475.19	450.12
IonaMainWash	6.266	421.38	408.64	391.64
IonaMainWash	6.189	487.39	463.93	420.33
IonaMainWash	6.101	588.17	592.05	594.78
IonaMainWash	5.989	437.1	469.99	459.9
IonaMainWash	5.899	487.7	478.11	535.96
IonaMainWash	5.809	475.48	522.82	518.26
IonaMainWash	5.710	460.39	424.17	391.72
IonaMainWash	5.629	414.11	382.07	309.37
IonaMainWash	5.557	504.98	543.42	573.19
IonaMainWash	5.454	492.03	529.22	486.63
IonaMainWash	5.354	294.52	403.44	451.22
IonaMainWash	5.278	170.43	213.53	244.17
IonaMainWash	5.237	451.83	481.77	483.97
IonaMainWash	5.146	319.92	330.44	304.43
IonaMainWash	5.083	546.45	503.21	467.3
IonaMainWash	4.988	465.93	459.18	451.9
IonaMainWash	4.901	354.88	299.867	260.043
IonaMainWash	4.844	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Iona_Wash

Reach	River Sta.	Contr.	Expan.
IonaMainWash	7.074	.1	.3
IonaMainWash	6.973	.1	.3
IonaMainWash	6.889	.1	.3
IonaMainWash	6.818	.1	.3
IonaMainWash	6.757	.1	.3
IonaMainWash	6.672	.1	.3
IonaMainWash	6.560	.1	.3
IonaMainWash	6.463	.1	.3
IonaMainWash	6.356	.1	.3
IonaMainWash	6.266	.1	.3
IonaMainWash	6.189	.1	.3
IonaMainWash	6.101	.1	.3
IonaMainWash	5.989	.1	.3
IonaMainWash	5.899	.1	.3
IonaMainWash	5.809	.1	.3
IonaMainWash	5.710	.1	.3
IonaMainWash	5.629	.1	.3
IonaMainWash	5.557	.1	.3
IonaMainWash	5.454	.1	.3
IonaMainWash	5.354	.1	.3
IonaMainWash	5.278	.1	.3
IonaMainWash	5.237	.1	.3
IonaMainWash	5.146	.1	.3
IonaMainWash	5.083	.1	.3
IonaMainWash	4.988	.1	.3
IonaMainWash	4.901	.1	.3
IonaMainWash	4.844	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : IonaMainWash

River: Iona_Wash Reach: IonaMainWash RS: 7.074 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 7.074 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 6.973 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was

used.
River: Iona_Wash Reach: IonaMainWash RS: 6.973 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 6.889 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.889 Profile: Floodway 100-YR
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.818 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.818 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.757 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.757 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.672 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.672 Profile: Floodway 100-YR
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.560 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 6.560 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 6.463 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.463 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration
with the lowest energy.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
River: Iona_Wash Reach: IonaMainWash RS: 6.356 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.356 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.266 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.266 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 6.189 Profile: 100-YR FP
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 6.189 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was

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            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 6.101     Profile: 100-YR FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 6.101     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.989     Profile: 100-YR FP
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.989     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.899     Profile: 100-YR FP
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
            for the water surface and continued on with the calculations.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
            program defaulted to critical depth.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.899     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
            for the water surface and continued on with the calculations.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The cross section had to be extended vertically during the critical depth calculations.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
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Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
River: Iona_Wash Reach: IonaMainWash RS: 5.809 Profile: 100-YR FP
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 5.809 Profile: Floodway 100-YR
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 5.710 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 5.710 Profile: Floodway 100-YR
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 5.629 Profile: 100-YR FP
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 5.629 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona_Wash Reach: IonaMainWash RS: 5.557 Profile: 100-YR FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona_Wash Reach: IonaMainWash RS: 5.557 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
River: Iona_Wash Reach: IonaMainWash RS: 5.454 Profile: 100-YR FP
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

```
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
            program defaulted to critical depth.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.454     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
            for the water surface and continued on with the calculations.
     Warning:Divided flow computed for this cross-section.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
            water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
            program defaulted to critical depth.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.354     Profile: 100-YR FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.354     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.278     Profile: 100-YR FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.278     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
            This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.237     Profile: 100-YR FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.237     Profile: Floodway 100-YR
     Warning:Critical depth could not be determined within the specified number of iterations.  The program
used the iteration
            with the lowest energy.
     Warning:The cross section had to be extended vertically during the critical depth calculations.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Warning:The parabolic search method failed to converge on critical depth.  The program will try the
cross section
            slice/secant method to find critical depth.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.146     Profile: 100-YR FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
            the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
            used.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.146     Profile: Floodway 100-YR
```

```
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.083     Profile: 100-YR FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 5.083     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 4.988     Profile: 100-YR FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 4.988     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona_Wash  Reach: IonaMainWash     RS: 4.901     Profile: 100-YR FP
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
```

HEC-RAS Plan: Iona Stock Tank River: Iona Stock Tank Reach: Iona Stock Tank

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Iona Stock Tank	2.938	100-yr FP	1330.00	1778.73	1781.65	1781.32	1782.03	0.008816	2.71	291.11	409.75	0.66
Iona Stock Tank	2.938	Floodway 100-YR	1330.00	1778.73	1782.61	1782.61	1783.18	0.012370	6.31	229.33	197.00	0.93
Iona Stock Tank	2.837	100-yr FP	1890.00	1773.05	1777.52	1777.18	1777.74	0.007751	3.53	503.61	575.41	0.51
Iona Stock Tank	2.837	Floodway 100-YR	1890.00	1773.05	1777.75	1776.88	1777.99	0.006478	3.51	482.27	330.72	0.48
Iona Stock Tank	2.751	100-yr FP	1890.00	1768.82	1775.23	1774.08	1775.43	0.003423	3.84	546.66	933.79	0.38
Iona Stock Tank	2.751	Floodway 100-YR	1890.00	1768.82	1775.38	1774.08	1775.65	0.003984	4.26	449.94	149.89	0.41
Iona Stock Tank	2.674	100-yr FP	1890.00	1767.02	1772.88	1772.68	1773.24	0.009868	5.25	425.61	1182.36	0.62
Iona Stock Tank	2.674	Floodway 100-YR	1890.00	1767.02	1773.18	1772.60	1773.53	0.007308	4.88	402.10	195.50	0.54
Iona Stock Tank	2.605	100-yr FP	1890.00	1764.25	1769.52	1769.39	1769.83	0.008897	5.06	466.14	1232.26	0.59
Iona Stock Tank	2.605	Floodway 100-YR	1890.00	1764.25	1770.01	1769.25	1770.55	0.009534	5.85	322.95	115.78	0.62
Iona Stock Tank	2.516	100-yr FP	1890.00	1761.79	1766.35	1765.83	1766.53	0.005533	4.00	582.63	1339.28	0.46
Iona Stock Tank	2.516	Floodway 100-YR	1890.00	1761.79	1767.25	1766.06	1767.54	0.004376	4.33	438.86	155.49	0.43
Iona Stock Tank	2.403	100-yr FP	1890.00	1757.22	1760.92	1760.86	1761.32	0.015486	5.82	371.76	968.67	0.73
Iona Stock Tank	2.403	Floodway 100-YR	1890.00	1757.22	1761.77	1761.77	1762.60	0.020446	8.13	261.21	155.18	0.85
Iona Stock Tank	2.314	100-yr FP	1890.00	1750.99	1756.36	1755.89	1756.60	0.007001	3.59	485.61	669.76	0.49
Iona Stock Tank	2.314	Floodway 100-YR	1890.00	1750.99	1757.08	1756.17	1757.35	0.005010	3.86	460.86	194.65	0.44
Iona Stock Tank	2.188	100-yr FP	1890.00	1744.57	1749.70	1749.70	1750.15	0.016624	5.93	370.47	572.50	0.77
Iona Stock Tank	2.188	Floodway 100-YR	1890.00	1744.57	1749.85	1749.85	1750.84	0.027484	7.95	237.64	119.95	1.00
Iona Stock Tank	2.104	100-yr FP	1890.00	1740.98	1746.72	1745.66	1746.81	0.001587	2.32	890.53	1187.59	0.25
Iona Stock Tank	2.104	Floodway 100-YR	1890.00	1740.98	1747.33	1745.98	1747.53	0.002435	3.30	535.49	189.82	0.32
Iona Stock Tank	1.993	100-yr FP	1890.00	1737.77	1744.35	1743.76	1745.05	0.011605	6.83	289.70	319.16	0.70
Iona Stock Tank	1.993	Floodway 100-YR	1890.00	1737.77	1744.78	1743.71	1745.37	0.008234	6.18	306.02	90.17	0.59
Iona Stock Tank	1.955	100-yr FP	1890.00	1737.42	1741.77	1741.68	1742.30	0.016212	6.04	323.97	506.98	0.77
Iona Stock Tank	1.955	Floodway 100-YR	1890.00	1737.42	1742.62	1742.45	1743.23	0.014679	6.11	302.84	178.62	0.74
Iona Stock Tank	1.891	100-yr FP	1890.00	1736.38	1738.57		1738.73	0.007412	3.55	595.81	636.06	0.50
Iona Stock Tank	1.891	Floodway 100-YR	1890.00	1736.38	1739.34		1739.70	0.007782	4.73	396.41	176.11	0.55
Iona Stock Tank	1.797	100-yr FP	1890.00	1732.54	1734.87		1735.02	0.007459	3.39	611.17	677.90	0.50
Iona Stock Tank	1.797	Floodway 100-YR	1890.00	1732.54	1735.73		1736.04	0.006921	4.45	424.46	185.02	0.52
Iona Stock Tank	1.714	100-yr FP	1890.00	1728.78	1731.63		1731.77	0.007370	3.35	625.26	789.52	0.50
Iona Stock Tank	1.714	Floodway 100-YR	1890.00	1728.78	1732.32		1732.68	0.008683	4.71	393.89	195.09	0.57
Iona Stock Tank	1.631	100-yr FP	1890.00	1725.32	1728.40	1728.15	1728.56	0.007701	2.56	607.49	794.11	0.47
Iona Stock Tank	1.631	Floodway 100-YR	1890.00	1725.32	1729.32	1728.72	1729.56	0.006062	3.58	490.63	290.27	0.47
Iona Stock Tank	1.553	100-yr FP	1890.00	1720.27	1725.39		1725.57	0.007808	2.89	572.38	638.68	0.48
Iona Stock Tank	1.553	Floodway 100-YR	1890.00	1720.27	1725.98		1726.44	0.010641	4.27	377.17	222.38	0.60
Iona Stock Tank	1.491	100-yr FP	1890.00	1718.63	1723.25		1723.40	0.005776	3.29	633.30	641.43	0.45
Iona Stock Tank	1.491	Floodway 100-YR	1890.00	1718.63	1724.15		1724.35	0.003903	3.57	530.79	222.73	0.39
Iona Stock Tank	1.406	100-yr FP	1890.00	1715.23	1719.93		1720.20	0.011033	4.79	490.20	578.68	0.63
Iona Stock Tank	1.406	Floodway 100-YR	1890.00	1715.23	1720.31		1721.06	0.018758	6.99	270.46	124.31	0.83
Iona Stock Tank	1.326	100-yr FP	1890.00	1713.16	1716.81	1716.35	1716.95	0.005549	2.96	630.73	589.31	0.43
Iona Stock Tank	1.326	Floodway 100-YR	1890.00	1713.16	1717.55	1716.65	1717.76	0.003933	3.24	522.07	242.21	0.39
Iona Stock Tank	1.24	100-yr FP	1890.00	1711.56	1712.86		1713.09	0.015336	3.81	485.38	680.76	0.67
Iona Stock Tank	1.24	Floodway 100-YR	1890.00	1711.56	1713.39	1713.39	1714.10	0.025577	6.50	280.94	205.15	0.93
Iona Stock Tank	1.154	100-yr FP	1890.00	1707.99	1710.77		1710.85	0.002215	2.33	822.58	507.93	0.30
Iona Stock Tank	1.154	Floodway 100-YR	1890.00	1707.99	1711.26		1711.33	0.001375	2.14	883.61	378.80	0.25
Iona Stock Tank	1.074	100-yr FP	1890.00	1705.31	1709.06		1709.42	0.005441	4.91	395.70	192.43	0.51
Iona Stock Tank	1.074	Floodway 100-YR	1890.00	1705.31	1709.90		1710.34	0.004376	5.08	356.68	106.59	0.46
Iona Stock Tank	.972	100-yr FP	1890.00	1703.02	1706.21	1705.81	1706.45	0.006191	4.05	489.50	431.52	0.51
Iona Stock Tank	.972	Floodway 100-YR	1890.00	1703.02	1706.94		1707.42	0.007349	5.38	340.71	134.71	0.58
Iona Stock Tank	.891	100-yr FP	1890.00	1701.46	1703.28	1703.00	1703.50	0.008178	3.88	508.53	474.22	0.56
Iona Stock Tank	.891	Floodway 100-YR	1890.00	1701.46	1703.74		1704.08	0.008159	4.61	409.70	210.53	0.58
Iona Stock Tank	.801	100-yr FP	1890.00	1695.06	1697.42	1697.41	1697.82	0.017051	4.59	371.51	456.55	0.77
Iona Stock Tank	.801	Floodway 100-YR	1890.00	1695.06	1698.22	1698.22	1698.67	0.016386	6.15	351.37	398.31	0.80
Iona Stock Tank	.709	100-yr FP	1890.00	1692.03	1695.65	1694.79	1695.74	0.001939	2.00	782.94	597.21	0.28
Iona Stock Tank	.709	Floodway 100-YR	1890.00	1692.03	1696.40	1694.99	1696.52	0.001198	2.00	713.32	280.97	0.23

HEC-RAS Plan: Iona Stock Tank River: Iona Stock Tank Reach: Iona Stock Tank (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Iona Stock Tank	.679	100-yr FP	1890.00	1691.43	1693.53	1693.53	1693.91	0.018580	4.29	390.01	539.46	0.78
Iona Stock Tank	.679	Floodway 100-YR	1890.00	1691.43	1694.34	1694.34	1695.22	0.016619	6.01	255.28	148.94	0.80
Iona Stock Tank	.597	100-yr FP	1890.00	1688.33	1690.03	1689.88	1690.20	0.009662	3.57	576.21	804.82	0.59
Iona Stock Tank	.597	Floodway 100-YR	1890.00	1688.33	1690.73	1690.16	1690.97	0.006393	3.95	474.47	283.17	0.51
Iona Stock Tank	.483	100-yr FP	1890.00	1684.19	1685.47		1685.61	0.006881	2.94	626.16	788.36	0.49
Iona Stock Tank	.483	Floodway 100-YR	1890.00	1684.19	1686.23		1686.64	0.009038	4.72	371.22	210.21	0.61
Iona Stock Tank	.400	100-yr FP	1890.00	1680.69	1681.55	1681.55	1682.04	0.012180	1.04	347.52	420.27	0.47
Iona Stock Tank	.400	Floodway 100-YR	1890.00	1680.69	1682.07	1682.07	1682.55	0.011314	2.28	386.81	416.80	0.56
Iona Stock Tank	.290	100-yr FP	6610.00	1673.95	1678.94		1679.15	0.002503	4.66	1937.18	1135.06	0.46
Iona Stock Tank	.290	Floodway 100-YR	1890.00	1673.95	1679.07		1679.14	0.000590	2.30	927.52	367.35	0.22
Iona Stock Tank	.209	100-yr FP	6610.00	1672.21	1677.01		1677.46	0.006346	7.27	1317.62	752.88	0.72
Iona Stock Tank	.209	Floodway 100-YR	6610.00	1672.21	1677.73		1678.12	0.004175	6.56	1403.11	573.13	0.59
Iona Stock Tank	.121	100-yr FP	6610.00	1669.38	1674.76	1674.01	1675.04	0.004670	3.37	1616.08	789.61	0.40
Iona Stock Tank	.121	Floodway 100-YR	6610.00	1669.38	1675.43		1675.87	0.006070	4.58	1323.42	487.00	0.48
Iona Stock Tank	.027	100-yr FP	6610.00	1667.96	1671.92	1671.18	1672.29	0.006901	4.19	1377.19	609.17	0.50
Iona Stock Tank	.027	Floodway 100-YR	6610.00	1667.96	1672.13	1671.39	1672.59	0.007408	4.59	1237.70	474.82	0.52

```
                    HEC-RAS Version 4.0.0 March 2008
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California

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

PROJECT DATA
Project Title: Iona Stock Tank Wash
Project File : IonaStockTankWash.prj
Run Date and Time: 5/4/2009 9:29:42 AM

Project in English units

Project Description:
Prepared by Entellus, Inc., Frank Edward Brown, PE, CFM, updated 08 April 2009
This RAS is part of the Wittmann ADMPU, FCD Contract 2004C060

This model is the 'with levee model for the Diversion Dike' and is also the 'with Stock Tank model' for Iona Stock Tank Wash.

River names in this model: Iona Stock Tank Wash from approximately Carefree Highway alignment to Montgomery Road alignment, which includes about 0.5 miles of Iona Wash, limits are from about 0.5 miles south of Carefree Highway alignment to its confluence with Iona Wash about 0.5 miles south of Lone Mountain Road alignment, about 2.7 river miles.

Downstream Tie-In to Iona Wash T RM 4.071 from ADMSU study, using 100-year Flow Rate=6,610 cfs, Starting Water Surface=1671.92 Floodplain and the Starting Water Surface=1672.13 Floodway. See Workmap Sheet E-17. Tie-in extends this far downstream to connect floodways.

Upstream Tie in at RM 0.104 Iona North Wash and ground data copied from ADMSU study, using Flow Rate=1,330 cfs. ADMSU Water Surface=1781.65 Floodplain and 1782.55 Floodway. See Workmap Sheets D-20 and E-20.

HEC-RAS Version 4.0.0 March 2008
Aerial photo source: FCD of MC via Wittmann ADMSU
Topographic mapping source: FCD of MC via Wittmann ADMSU
Horizontal Datum: NAD83 state plane coordinates, Central Region, International Feet
Vertical Datum: NAVD 1988
Flow rate source is the Wittmann ADMSU, FCD No. 2002C029
Cross sections derived from TIN developed by Entellus, Inc. using HEC-geoRAS Version 4 September 2005

PLAN DATA

Plan Title: Iona Stock Tank Wash
Plan File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Stock Tank Wash\IonaStockTankWash.p01

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          Geometry Title: Iona Stock Tank Wash
          Geometry File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-
RAS\Iona Stock Tank Wash\IonaStockTankWash.g04

          Flow Title    : Iona Stock Tank Wash
          Flow File     : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-
RAS\Iona Stock Tank Wash\IonaStockTankWash.f01

Plan Summary Information:
Number of:  Cross Sections =   35    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

River = Iona Stock Tank  Reach = Iona Stock Tank
RS      Profile           Method  Value1  Value2
2.938   Floodway 100-YR        1    9792    9989
2.837   Floodway 100-YR        1 9702.6110039.34
2.751   Floodway 100-YR        1 9880.0110033.08
2.674   Floodway 100-YR        1 9844.8110040.31
2.605   Floodway 100-YR        1 9908.02 10023.8
2.516   Floodway 100-YR        1 9870.8110026.37
2.403   Floodway 100-YR        1 9852.9610008.14
2.314   Floodway 100-YR        1 9839.25 10033.9
2.188   Floodway 100-YR        1 9920.0210039.97
2.104   Floodway 100-YR        1 9933.1410122.96
1.993   Floodway 100-YR        1 9960.9710051.14
1.955   Floodway 100-YR        1 9966.6410145.26
1.891   Floodway 100-YR        1    999010166.11
1.797   Floodway 100-YR        1 9942.18 10127.2
1.714   Floodway 100-YR        1 9947.91   10143
1.631   Floodway 100-YR        1  9869.310159.57
1.553   Floodway 100-YR        1 9947.4310169.81
1.491   Floodway 100-YR        1 9957.6810180.41
1.406   Floodway 100-YR        1 9935.9310060.24
1.326   Floodway 100-YR        1 9951.4710193.68
1.24    Floodway 100-YR        1 9936.0610141.21
1.154   Floodway 100-YR        1 9875.5810254.38
1.074   Floodway 100-YR        1 9945.7610052.35
.972    Floodway 100-YR        1 9970.5810105.29
.891    Floodway 100-YR        1 9913.57 10124.1
.801    Floodway 100-YR        1 9611.0210024.85
.709    Floodway 100-YR        1 9773.1210054.09
.679    Floodway 100-YR        1 9874.7210023.66
.597    Floodway 100-YR        1 9895.0910178.26
.483    Floodway 100-YR        1 9924.0310134.24
.400    Floodway 100-YR        1  9980.4 10397.2
.290    Floodway 100-YR        1  9953.910321.25
.209    Floodway 100-YR        1 9942.2910515.42
.121    Floodway 100-YR        1    9854   10341
.027    Floodway 100-YR        1 9874.68 10349.5


FLOW DATA

Flow Title: Iona Stock Tank Wash
```

Flow File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Stock Tank Wash\IonaStockTankWash.f01

Flow Data (cfs)

River	Reach	RS	100-yr FP	Floodway 100-YR
Stock_Tank_All	StockTankAll	2.938	1330	1330
Stock_Tank_All	StockTankAll	2.837	1890	1890
Stock_Tank_All	StockTankAll	.290	6610	1890
Stock_Tank_All	StockTankAll	.209	6610	6610
Stock_Tank_All	StockTankAll	.027	6610	6610
Iona Stock Tank	Iona Stock Tank	2.938	1330	1330
Iona Stock Tank	Iona Stock Tank	2.837	1890	1890
Iona Stock Tank	Iona Stock Tank	.290	6610	1890
Iona Stock Tank	Iona Stock Tank	.209	6610	6610
Iona Stock Tank	Iona Stock Tank	.027	6610	6610

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Iona Stock Tank	Iona Stock Tank	100-yr FP		Known WS = 1671.92
Iona Stock Tank	Iona Stock Tank	Floodway 100-YR		Known WS = 1672.13

GEOMETRY DATA

Geometry Title: Iona Stock Tank Wash
Geometry File : p:\300\310\310041\Deliverables\Iona Wash Delineation\Final Submittal 4-09\HEC-RAS\Iona Stock Tank Wash\IonaStockTankWash.g04

CROSS SECTION

RIVER: Iona Stock Tank
REACH: Iona Stock Tank RS: 2.938

INPUT
Description: Tie in at RM 0.104 Iona North Wash and ground data copied from ADMSU study. N values are 0.033-0.039-0.033 (left-channel-right) from Iona North.prj RAS file. Flow Rate=1,330 cfs. ADMSU Water Surface=1781.65 Floodplain and 1782.55 Floodway. See Sheets D-20 and E-20.

Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9278.77	1781.701	9285.24	1781.767	9302.66	1781.9	9310.12	1781.902	9335	1781.652
9336.29	1781.631	9359.88	1781.221	9369.91	1781.093	9382.08	1781.053	9384.75	1781.022
9403.54	1781.257	9409.63	1781.407	9434.51	1782.195	9437.16	1782.246	9459.39	1782.609
9470.79	1781.621	9476.68	1782.345	9484.27	1780.214	9492.71	1777.597	9504.41	1779.417
9505.87	1779.115	9509.15	1779.269	9534.03	1780.295	9538.04	1780.353	9558.91	1780.668
9571.66	1779.436	9576.46	1780.716	9582.32	1777.972	9583.79	1778.113	9595.03	1780.664
9605.28	1780.631	9608.67	1781.065	9633.55	1781.621	9638.91	1781.714	9658.43	1781.962
9672.53	1781.995	9683.31	1782.021	9706.16	1782.047	9708.19	1782.05	9715.45	1782.122
9733.07	1782.312	9753.23	1782.304	9773.38	1782.107	9793.54	1781.799	9801.86	1781.716
9813.7	1781.8	9833.86	1782.095	9854.01	1782.179	9861.46	1781.99	9874.17	1781.644
9875.56	1781.581	9887.69	1778.734	9894.33	1780.814	9895.88	1781.528	9902.48	1779.731
9910.21	1781.316	9914.48	1781.38	9934.64	1781.516	9954.8	1781.515	9974.96	1781.393
9984.49	1781.327	9995.11	1781.143	10001.13	1781.351	10015.27	1781.939	10021.87	1782.059
10035.43	1782.115	10036.71	1782.156	10046.28	1779.061	10054.81	1780.806	10055.59	1781.769
10075.74	1782.314	10091.08	1782.217	10095.91	1782.054	10111.78	1781.258	10116.06	1781.352
10136.22	1782.123	10136.96	1782.103	10156.37	1782.152	10176.53	1782.401	10182.27	1782.559
10196.69	1782.606	10201.2	1782.608	10216.84	1782.698	10237	1782.771	10257.16	1782.83
10277.32	1782.881								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9278.77	.033	10015.27	.039	10075.74	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9861.46	10015.27	514.42	533.21	536.53	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent

```
 9278.77 9498.45 1783.42        F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.837

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9492.02 1779.95 9543.42 1779.49 9561.58 1778.73 9574.27 1778.16 9625.47 1776.71
 9638.99 1776.21 9670.82 1776.48 9681.85  1776.9 9688.19 1777.09 9705.86  1774.6
 9711.98 1773.62  9740.1 1774.98 9759.49 1776.23 9763.66 1776.48 9769.49 1776.99
 9799.97 1777.06 9804.13 1777.15 9812.57 1776.86 9826.44  1776.5 9835.71 1776.81
 9839.23 1776.93 9842.14 1776.94 9900.92 1776.74 9941.88 1776.91 9950.111776.912
 9986.83 1776.92 9995.67 1775.5410007.55 1773.0510020.05 1775.7210031.68 1777.47
10039.34 1778.7610043.15 1777.8110047.14 1777.7310048.69 1777.7210072.25 1777.58
10102.13 1777.81   10127 1777.5910166.35 1777.1310238.57 1777.4810243.29  1777.5
10260.02 1775.4110260.62 1775.3510261.46 1775.4910271.51 1777.2610278.43 1778.29
10291.82  1778.310351.48 1777.5510378.37 1778.0110410.78  1778.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9492.02    .036 9950.11    .04810039.34    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9950.1110039.34           474.91  457.77  441.06             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10039.3410410.78 1778.76       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.751

INPUT
Description:
Station Elevation Data    num=      97
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9376.69 1776.95 9379.11 1776.94  9384.6 1776.92 9389.19  1776.9 9393.07 1776.89
 9396.39 1776.88 9399.26 1776.87 9401.75 1776.86 9403.94 1776.85 9407.58 1776.84
  9409.1 1776.83 9411.68 1776.82 9413.78 1776.81 9416.25  1776.8 9418.71 1776.79
 9421.13 1776.78 9423.38 1776.77 9425.36 1776.76 9426.94 1776.75 9429.01 1776.74
 9430.23 1776.73 9467.84 1776.34 9554.13 1775.64 9559.04 1775.63  9565.1 1775.62
 9571.28 1775.61 9578.79  1775.6 9585.33 1775.58 9589.63 1775.56 9593.42 1775.55
 9596.78 1775.54 9599.77 1775.53 9602.44 1775.52 9704.92 1775.88 9708.94 1775.89
 9714.62 1775.81 9789.46 1774.83 9789.59 1774.82 9790.03 1774.76 9805.28 1772.78
 9810.06 1773.96 9812.49 1774.51 9813.71 1774.77  9822.3 1774.57  9851.3 1774.08
 9865.51 1773.45 9898.04 1773.52 9908.89 1773.51 9924.86 1773.48 9936.13 1770.96
 9941.81 1769.79 9947.84 1770.97 9961.65 1773.36 9982.69 1772.64 9992.11 1772.31
10001.92 1770.1510009.41 1768.8210022.13  1773.110033.08 1776.3110044.84 1774.43
10054.14 1772.6710061.01 1772.6510079.13 1772.5910083.16 1772.5610112.36 1772.32
10118.32 1771.4710126.04 1769.5710135.48 1772.5710135.52 1772.5810151.59 1772.46
10173.53 1772.2810188.03 1772.4810210.69 1772.9110213.94 1771.5110219.34 1769.57
10231.86 1772.1910234.19 1772.6410239.04 1772.65 10271.8 1772.6910289.03 1772.77
10293.88  1772.810294.34 1772.6710305.14 1770.3710305.58 1770.4410306.51 1770.54
 10321.2 1772.0110324.73 1772.2110334.17 1773.5910340.44 1773.7810373.99 1773.72
10467.81 1773.6810503.05 1773.6510509.29 1773.6610518.11  1773.710590.99 1773.95
10650.29 1773.9610702.89  1774.1

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9376.69    .036 9908.89    .04810061.01    .05610083.16    .04810151.59    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9908.8910033.08           401.35  402.58  344.91             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10033.0810702.89 1776.31       F

CROSS SECTION
```

```
RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.674

INPUT
Description:
Station Elevation Data    num=      84
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9521.94 1773.53 9551.97 1773.36 9581.32 1773.51 9589.44 1773.49 9602.28 1773.45
 9609.84 1773.42 9614.66  1773.4 9617.89 1773.39 9622.21 1773.37    9626 1773.34
  9685.6 1772.77 9756.62 1772.38 9759.32 1772.37 9762.05 1772.36 9764.82 1772.34
  9767.6 1772.33 9770.41 1772.31 9773.22  1772.3 9776.04 1772.29 9781.87 1772.26
 9787.65 1772.23 9796.44  1772.2 9850.77 1772.02  9867.6 1771.97  9894.1 1771.87
 9896.62 1771.86 9919.24 1771.68 9981.66  1771.2 9982.15 1771.01  9983.2 1770.77
 9996.01 1767.02 9996.99 1767.56  9999.1 1767.0510016.21 1769.9110040.31 1773.06
10044.34 1772.3510052.72 1770.8910061.38  1770.510072.09  1770.310101.67 1769.76
10116.45 1769.6810122.33  1769.610139.47 1769.38 10183.1 1769.24 10207.3 1769.16
10210.83 1769.1410216.86 1769.3610217.88 1769.3510219.01 1769.3610228.08 1767.25
10230.73 1766.6510238.66 1767.5210250.49 1768.5810263.99 1769.2310264.92 1769.27
10281.14 1769.85 10283.5  1768.310287.17 1765.8910290.17 1766.9610296.98 1768.51
10297.97 1768.4410298.56 1768.4210304.85  1768.810341.73 1770.51 10348.3 1770.69
 10359.3 1770.5210371.12 1769.6710377.23 1768.2610389.65 1765.2510394.68 1766.95
 10400.9 1769.1810419.83 1769.4910434.47 1769.7410438.68 1769.8210443.61 1769.94
10458.13 1770.1610516.14 1770.7710549.43 1770.7810599.53 1770.8610663.74  1770.8
10756.86 1770.6110781.97  1770.610814.52 1771.3610858.96 1772.43

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9521.94    .036 9919.24    .04810072.09    .056 10183.1    .04810263.99    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9919.2410040.31           388.48  353.23  331.28             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10040.3110858.96 1773.06       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.605

INPUT
Description:
Station Elevation Data    num=     110
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9434.36 1769.78 9437.32 1769.79 9442.17 1769.82 9449.76 1769.87 9459.75 1769.93
 9462.73 1769.95 9465.07 1769.97 9466.95 1769.98 9468.47 1769.99 9469.73    1770
 9471.76 1770.01 9473.16 1770.02 9474.14 1770.03 9475.54 1770.04 9476.83 1770.05
 9477.93 1770.06 9478.94 1770.07 9479.86 1770.08  9480.7 1770.09 9481.48  1770.1
  9512.6 1770.18 9605.02 1769.03 9612.66 1768.91 9620.89 1768.78 9641.01 1768.83
 9655.26 1768.87 9664.87 1768.89 9671.78 1768.91 9681.17 1768.94 9687.15 1768.96
 9691.27 1768.98 9694.28 1768.99 9696.57    1769 9699.91 1769.02 9703.68 1769.03
 9704.83 1769.04  9719.4 1768.97 9754.32 1769.03  9757.4 1769.04  9766.5 1769.05
 9783.93 1769.07  9800.3 1769.08 9827.22 1769.11 9849.35 1768.85 9863.17 1768.69
 9872.04 1768.58 9878.19 1768.51 9882.71 1768.45 9886.16 1768.41 9888.87 1768.38
 9891.05 1768.36 9892.85 1768.34 9895.69  1768.3 9897.75 1768.28 9899.29 1768.26
 9900.48 1768.24 9901.41 1768.23 9902.86 1768.22 9908.02 1768.18 9922.81 1768.08
 9953.86 1767.81 9977.73 1767.59 9995.26  1764.8   10000 1764.2510011.02  1766.6
10011.37 1766.6710011.63 1766.71 10023.8 1768.3710031.71 1768.4410034.98 1768.37
10039.14 1768.1910041.77 1768.0810064.46 1767.2610077.26 1766.7910091.55  1766.2
10127.12 1766.3910147.72 1766.5110148.25 1766.7310174.44 1766.4210202.71 1765.92
10204.01  1765.910223.66 1766.0210228.44 1766.0510241.11  1763.710243.47 1763.15
10246.58 1764.1110251.47 1765.98 10294.6 1766.3710316.94 1766.6110323.44 1763.92
10329.35 1761.5110339.37 1763.7210348.11 1765.8710369.21 1766.6810392.74 1767.51
10423.55 1767.05 10433.2 1766.9710439.16 1766.2310444.93 1765.6410447.23 1765.79
10458.54 1766.5310517.62 1766.7710530.92 1766.8310539.35 1766.8510615.21 1767.19
10622.68  1767.2 10714.5 1768.3610732.14 1768.5610751.48 1768.52 10798.2 1768.33

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9434.36    .036 9908.02    .04810064.46    .05610223.66    .048 10294.6    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
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       9908.02 10023.8            468.94  473.26  448.28              .1        .3
Ineffective Flow      num=        1
   Sta L   Sta R    Elev  Permanent
   10024 10798.2    1772        F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.516

INPUT
Description:
Station Elevation Data    num=     130
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9472.93 1766.54  9501.7 1766.44 9503.78 1766.43 9505.84 1766.42 9510.06 1766.39
 9514.16 1766.37 9518.13 1766.35 9521.93 1766.33 9525.54 1766.31 9532.63 1766.27
 9538.69 1766.24 9540.52 1766.23 9634.21 1766.02 9655.52 1765.86 9657.46 1765.85
 9659.45 1765.84 9661.55 1765.83 9662.94 1765.82 9664.43 1765.81 9666.03  1765.8
 9667.75 1765.79  9669.6 1765.78 9670.58 1765.77 9672.66 1765.76 9673.76 1765.75
  9674.9 1765.74 9677.34 1765.73 9680.02 1765.71 9682.94 1765.69 9686.15 1765.67
 9689.67 1765.64 9693.56 1765.61 9697.88 1765.58 9708.29 1765.51 9721.62 1765.42
 9747.88 1765.23 9754.57 1765.18 9762.62 1765.12 9769.06 1765.07  9774.3 1765.03
 9778.65 1764.99 9782.31 1764.96 9785.42 1764.94 9788.09 1764.92 9790.41  1764.9
 9792.43 1764.89 9794.21 1764.87 9795.78 1764.86 9797.18 1764.85 9798.43 1764.84
 9800.55 1764.83 9801.45 1764.82 9803.02 1764.81 9804.91  1764.8 9805.92 1764.79
 9807.49 1764.78 9808.61 1764.77 9810.11 1764.76 9811.89 1764.75 9850.75 1764.83
 9907.44 1764.98 9909.45    1765 9920.41 1764.84 9927.73 1764.72 9936.08 1764.59
 9944.19 1764.46 9949.14 1764.38 9952.48 1764.32 9954.89 1764.28  9956.7 1764.25
 9958.12 1764.23 9959.25 1764.21 9960.18  1764.2 9961.63 1764.18 9962.69 1764.16
  9963.5 1764.15 9964.13 1764.14 9964.65 1764.13 9965.07 1764.12 9965.74 1764.11
 9966.23  1764.1 9966.92 1764.09 9970.34 1764.02 9971.31 1764.03  9975.4    1764
 9989.09 1763.88 9992.34 1763.16   10000 1761.7910019.22  1765.710023.48  1766.5
10024.51 1766.6610026.37 1767.2710031.88 1766.1110037.68 1764.8910041.08 1763.93
10051.31 1763.9610095.79 1764.1910169.62 1764.5710174.59  1764.610179.35 1764.48
 10222.3  1763.210246.29 1762.95 10249.8 1762.9310253.87 1762.8610279.53 1762.43
10292.85  1762.310296.87 1760.8810303.32 1758.3710304.32 1758.8210313.35 1759.58
10320.08 1757.4810336.31 1762.5610337.63 1762.9710417.88  1762.310423.47 1762.23
10425.34 1762.2210430.24 1762.2110446.37 1762.3410519.19 1763.0110540.04 1763.02
 10588.4 1763.1310593.95 1762.9410628.37 1761.97   10645 1762.0310652.93 1762.23
10687.74  1762.410688.52 1762.41 10762.2  1763.510853.47 1764.0310865.71 1764.11

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9472.93    .036 9907.44    .04810026.37    .056 10222.3    .04810337.63    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9927.7310026.37           600.35  593.42  587.28              .1        .3
Ineffective Flow      num=        1
   Sta L   Sta R    Elev  Permanent
   1002710865.71    1768        F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.403

INPUT
Description:
Station Elevation Data    num=     106
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9271.2 1761.02 9309.65 1761.06 9312.83 1761.08 9316.07  1761.1 9319.35 1761.12
 9327.03 1761.17 9348.18  1761.1 9360.15 1761.05  9368.1 1761.02 9373.73    1761
  9377.9 1760.98 9381.08 1760.97 9383.57 1760.96 9385.55 1760.95 9387.15 1760.94
 9389.56 1760.93 9391.34 1760.92 9393.45 1760.91 9395.88  1760.9  9397.2 1760.89
 9398.39 1760.88 9400.46 1760.87 9402.18 1760.86 9403.66 1760.85    9406 1760.84
 9432.72 1760.71 9495.14 1760.44 9497.96 1760.43 9504.97 1760.42 9511.29 1760.43
 9516.91 1760.44 9519.88 1760.45 9531.65 1760.47 9538.96 1760.49 9543.97  1760.5
 9547.63 1760.51 9554.42 1760.52 9557.11 1760.53 9562.86 1760.55 9573.04 1760.53
 9591.53 1761.33 9598.06 1761.41 9623.59    1761 9634.26 1760.75 9649.19 1759.97
 9659.92 1759.98 9667.91 1759.86  9695.2  1759.9 9697.06 1759.89 9698.62 1759.88
 9700.85 1759.87  9702.4 1759.86 9706.17 1759.85 9738.18 1759.56  9756.3  1759.5
 9759.31 1759.54 9762.42 1759.58 9765.63 1759.62 9768.93 1759.66 9772.32 1759.71
 9775.19 1759.75 9793.65 1759.78 9804.16  1759.8 9811.35 1759.81 9816.55 1759.82
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 9871.83 1759.71 9880.03 1759.83 9890.33 1760.02 9912.43 1760.42  9930.5 1760.28
 9951.62  1760.4 9989.27 1760.84 9993.59 1759.51   10000 1757.2210005.71 1759.33
10008.14 1760.38   10051 1759.4210088.52 1758.83 10092.2 1758.8510103.61 1758.89
10135.87 1759.0410175.12 1759.0510203.36 1758.7110211.25 1758.5510238.72 1758.46
10263.54 1758.1510276.61 1753.2310276.98 1753.0610277.32 1753.1810281.88 1754.77
10288.87 1758.2910302.83 1758.1810308.03 1758.1310332.24 1758.0110354.42  1757.8
 10363.8 1757.75 10368.3    175610373.89 1754.0510382.12 1756.8710383.78 1757.53
10388.07 1757.57 10459.8  1758.110468.66 1758.3110530.53 1759.85 10590.6 1760.42
10595.83 1760.45

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
  9271.2    .036 9912.43    .04810088.52    .05610211.25    .04810302.83    .056

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9989.2710008.14           453.38  467.06  526.22             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   1000910595.83    1762       F
Left Levee      Station= 9598.06      Elevation= 1761.41

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.314

INPUT
Description:
Station Elevation Data    num=      68
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9655.74 1758.14 9660.84  1758.3 9674.31 1758.48 9689.95 1758.36 9711.45 1757.68
 9719.28  1757.3 9748.64 1755.32 9763.64 1755.71 9785.65 1756.77 9810.02 1754.82
 9813.22 1754.58  9817.4 1754.53 9836.07 1754.92 9850.76 1755.08 9854.03 1755.21
 9860.55 1754.72 9869.84 1754.67 9878.43 1754.63 9898.73 1754.72 9910.21 1754.71
 9911.99 1753.85 9916.26 1750.99 9919.23 1753.43 9921.79 1754.87 9980.36 1755.45
 9996.17 1755.6410004.89 1751.8510005.77 1751.3910006.81 1751.8310010.89 1753.98
10012.12 1754.5510017.68 1754.5710023.62  1754.610056.73 1754.9210058.78 1754.95
10079.65 1755.1810093.12 1755.4710133.42 1755.2110150.79  1755.110157.56 1754.92
10161.85 1753.5510175.89 1749.8110180.11 1751.3710187.86 1754.33 10198.4 1754.36
10235.66 1754.4610243.93 1754.6310248.61 1754.6410261.66 1754.3310285.31 1754.08
10304.98 1753.7810308.54 1753.1510320.67 1750.7610331.56  1752.110341.63 1752.64
10368.86 1754.3410379.44 1754.3110388.92 1754.7810390.73 1754.9510398.47  1755.4
10410.67 1755.9910423.86 1756.7710434.95 1757.0310464.18 1757.3210473.64 1757.43
   10477 1757.4410478.15 1757.4710502.99 1757.14

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9655.74    .034 9869.84    .04810017.68    .03610133.42    .049 10198.4    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9869.8410017.68             582   669.8  534.98             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10093.1210502.99    1758       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.188

INPUT
Description:
Station Elevation Data    num=      80
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9591.76 1750.18 9597.05 1750.12 9651.05 1750.28 9712.89 1751.36 9737.21 1751.42
 9766.81 1750.37 9780.83 1749.61 9782.38  1749.7 9786.62 1749.78 9794.92 1749.59
 9806.08 1749.23 9868.61 1749.05 9881.64 1748.89  9892.7 1748.71 9912.07 1748.58
 9920.02 1748.91 9924.46 1749.09 9927.99 1749.02 9944.95 1748.73 9950.26 1748.69
  9956.8 1748.38 9986.26 1747.76 9993.06 1747.51 10003.4 1746.7110006.68 1747.19
10008.08 1746.9310009.38 1746.7610019.98 1744.5710020.74 1744.8310021.44 1745.09
10029.97 1748.8610039.97  1748.810044.42 1748.7910072.44 1749.2910080.24 1749.26
10105.21 1749.7710109.69 1749.8310110.78 1749.5810118.64 1747.7510123.83 1749.71
10126.12 1749.5710134.25 1750.1510196.87 1749.0310254.89 1750.5210267.56 1750.77
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10352.54 1749.47 10363.7 1749.9510398.03 1750.2110418.69 1749.4510420.56 1749.38
10427.22 1748.1810483.12 1744.9610506.37 1744.1910508.46 1744.6910515.08 1746.59
10530.53 1749.6310530.77 1749.6810531.22 1749.7710532.34 1749.7810533.82  1749.8
10542.68 1749.6610566.16 1749.7110577.83 1749.7310585.15 1749.69 10596.5 1749.62
10623.16 1750.1910635.34 1750.6310639.44 1750.7710653.08 1751.1610661.58 1751.37
10667.85 1751.5110680.62 1751.5310685.12  1751.610696.68 1751.6610708.73 1751.58
10710.98 1751.5610735.66 1751.32 10753.4 1750.9110757.24 1750.8110757.43 1750.81

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9591.76    .034 9920.02    .04810039.97    .03610418.69    .04910532.34    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9920.0210039.97           484.17  445.74  425.25             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10267.5610757.43 1750.77       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 2.104

INPUT
Description:
Station Elevation Data    num=      60
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9464.03 1747.39 9472.56 1747.41  9552.7 1746.24  9580.3 1746.09 9618.24 1746.44
 9698.51  1746.4 9731.73 1746.15 9785.45 1746.11 9824.62 1746.23 9889.71 1746.27
 9954.89 1745.15 9983.61 1744.65 9987.95 1744.57 9989.38 1744.16   10000 1740.98
10004.93 1742.2410013.26 1744.3610025.79 1744.7210030.78 1744.7710034.28 1744.69
10034.29 1744.69 10037.5 1744.6310056.06 1744.1610065.36 1742.7910071.49 1742.14
10075.55 1743.9510078.38 1745.7310096.09 1745.5410180.98 1744.3410219.08 1744.94
10261.46 1745.1610271.98 1746.9310274.51 1747.3310277.45 1746.9610287.64 1745.43
10299.94 1745.2510308.48 1745.1210354.47 1744.5210372.67 1744.5110399.46 1744.34
10423.41 1743.99 10452.5 1743.1610478.83 1741.8810507.79 1741.8310537.64 1741.73
10569.57 1740.5710585.43    174010596.71 1740.9710600.51 1741.3410603.33 1742.27
 10609.5 1744.4210636.82 1744.9310652.69 1745.2210657.24 1745.3210661.04 1745.42
10684.95 1746.0110715.14 1746.7110719.85 1746.8210727.23 1746.9910728.47 1747.03

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9464.03    .034 9954.89    .04810034.29    .03610537.64    .04910600.51    .037

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9954.8910034.29           443.33  581.61  347.09             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   1027510728.47    1748       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.993

INPUT
Description:
Station Elevation Data    num=      65
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9802.22  1744.8 9804.09 1744.82 9845.82 1745.13 9939.97  1744.1 9940.85 1744.07
 9960.97 1742.76 9974.02 1741.91 9989.79 1740.0710004.13 1737.7710021.95 1742.29
10022.52 1742.42 10050.3 1743.9910051.14 1744.0410059.46 1744.5110067.34 1744.91
10075.72 1745.1610080.17 1745.3310080.91 1745.3210092.56 1746.0410105.44 1746.53
 10121.9 1746.9110139.35 1747.1610143.45 1747.0610147.15 1747.0310168.01  1747.6
10190.09 1747.4610192.25 1747.5210194.32 1747.5810242.62 1748.0610243.68  1748.1
10244.08 1748.1110247.58  1748.310258.97 1747.9110282.14 1748.4710286.32 1748.39
 10286.9 1748.3810290.28 1748.4710290.95 1748.4510326.19 1748.18 10354.1 1747.75
10362.95 1748.2610367.75 1747.9710368.74 1747.9510369.58 1747.9210383.27 1748.02
10384.57 1748.2310413.08 1744.63 10417.9  1743.910469.71 1740.4810474.31 1740.15
10477.62 1740.1310489.41 1739.8510499.52 1739.4610508.87 1738.8910531.34 1740.11
10541.32 1740.0910547.79 1740.2410558.58 1740.8310560.66 1740.9310565.08 1741.17
10585.86 1743.5210599.55 1744.77 10627.9    174710634.01 1747.5410635.56 1747.67
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Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9802.22    .034 9960.97    .04810051.14    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9960.9710051.14           201.24  202.12  191.36            .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10282.1410635.56 1748.47       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.955

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9774.48 1742.26 9815.69 1742.27 9898.86 1743.13 9905.23 1743.18 9914.85 1743.15
    9933 1742.85 9966.64 1742.39  9982.5 1742.18 9993.78 1739.6610003.41 1737.42
10015.44 1739.9510023.13 1741.5510030.55 1741.0810039.02 1740.5410051.44 1739.97
10061.64 1741.1210067.43 1741.7110072.79 1742.21 10080.7 1742.1710102.11 1741.55
 10153.7 1740.15   10196 1740.1410223.12 1740.3710249.58    174110258.29 1741.26
 10294.2 1746.8910302.94 1748.2710319.71 1745.6110331.76 1743.9710338.96 1743.12
 10372.6 1738.4710389.76 1735.7110407.37 1734.9510424.97 1734.3810440.55 1733.93
10454.08 1733.6810458.03 1733.9210470.46 1734.5210476.39 1734.2910490.01 1734.49
10493.03 1734.4610502.52 1734.5310513.11 1734.6510521.55 1734.7310526.44 1734.88
10561.65 1736.6610571.98 1736.7210598.06 1740.6310616.35 1743.6410636.36 1746.55
10643.85 1747.6710645.16 1747.39

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9774.48    .034 9966.64    .04810030.55    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9966.6410030.55           339.94  337.22  322.78            .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10302.9410645.16 1748.27       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.891

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9805.79  1741.1 9806.92 1741.12 9888.79 1739.46 9894.33  1739.4 9898.17 1739.36
 9963.38 1738.94 9966.38 1738.92  9968.2 1738.73 9970.22 1738.61 9972.78 1738.44
    99901737.39910006.87 1736.3810014.04 1736.6310078.88 1737.1310141.42 1737.41
10142.33 1737.4410142.56 1737.4210145.55 1737.4510147.56 1737.46 10210.9 1737.85
10227.97 1737.8210280.58 1737.0810320.97 1737.3110349.38 1737.5510373.21 1737.79
10419.39 1738.4110470.79 1737.9510494.32  1737.810538.67  1738.1 10558.7 1738.09
10566.72 1738.2510572.93  1738.310618.22 1738.66

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9805.79    .034    9990    .04810145.55    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          999010145.55           503.33  497.14  500.47            .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.797

INPUT
Description: 9486.355
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Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9463.99 1736.66 9500.02 1735.97 9538.42  1735.7 9579.88 1735.53 9624.43 1735.41
 9668.62 1735.42  9706.9 1735.56 9731.22 1735.18  9780.4 1735.03 9823.67 1734.99
  9854.6 1734.68 9876.37 1734.49 9876.771734.483 9912.79 1733.87 9942.18  1733.6
 9959.19 1733.56 9985.56 1733.33 9999.21 1733.4310006.77 1732.5510006.87 1732.54
10013.11  1733.110018.08 1733.4710019.59 1733.7310029.81 1733.7210062.13 1733.62
10076.04 1733.2610090.66 1733.2110121.66 1733.5410125.23 1733.5810150.86 1733.83
10189.56 1734.2910227.43 1733.9310254.88 1733.6710303.24 1733.8410327.99 1734.01
10366.42  1734.110399.17 1734.1510415.34 1734.3410465.64 1734.67 10504.3 1734.83
10534.61 1734.9410572.95 1735.1710595.67 1735.3110613.74 1735.2310657.05    1735
10693.29 1735.2510731.43 1735.4810781.75 1735.5610788.59 1735.5810798.36 1735.59
   10839 1735.6210853.82 1735.97

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9463.99    .034 9942.18    .04810121.66    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9942.1810121.66           431.34  434.53  448.46             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.714

INPUT
Description: 9051.821
Station Elevation Data    num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9387.98 1734.44 9388.59 1734.45 9415.16  1734.4 9492.14 1732.85 9501.98  1732.7
 9512.44  1732.5 9572.67 1731.31 9622.37 1729.62 9623.96 1729.56 9633.87 1729.93
 9639.07 1730.12  9639.5 1730.13  9639.8 1730.14 9709.42  1731.2 9714.61 1731.28
 9721.53 1731.23 9784.83 1731.08 9844.64 1730.98 9858.58 1731.03 9926.32 1731.57
  9956.5 1730.88 9981.64 1730.49 9990.97 1730.34 9996.13 1729.76 10004.2 1728.78
10010.33 1729.4910018.09  1730.410088.35 1730.4110096.59  1730.410099.14 1730.34
10102.65 1730.2910116.12 1729.94   101431730.49510153.92 1730.72 10163.5 1731.07
10171.42 1730.9810223.77 1730.7610230.48 1730.7310267.62 1731.3410295.58 1731.87
10357.65 1731.3610361.53 1731.3310365.14 1731.3610430.87  1732.110473.28 1732.44

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9387.98    .034 9981.64    .048   10143    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9981.64   10143           408.26  437.67  496.69             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.631

INPUT
Description: 8614.157
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9467.86 1730.38 9468.24 1730.39 9473.09 1730.54 9475.19 1730.61 9476.43 1730.54
 9526.07 1728.55 9544.55 1727.68 9557.26 1727.49 9586.14 1726.84 9588.81 1726.78
 9589.06 1726.79 9600.59 1726.55 9601.63  1726.5 9602.43 1726.49 9609.37 1726.46
 9626.61 1726.96 9637.89 1727.26 9660.21 1728.13 9662.97  1728.1 9728.78 1727.37
 9735.87 1727.27 9739.01 1727.25 9813.09  1727.5 9837.41 1727.39  9893.8  1727.7
 9922.82 1727.78 9928.67 1727.82  9945.9 1727.92 9983.94 1728.17 9988.42  1728.2
 9994.49  1727.9 10006.3 1727.8910011.64 1726.5210013.65 1726.1210016.07 1726.61
10021.43 1727.8210042.13    172810057.78 1728.0510074.83 1727.3810087.06 1726.96
10116.38 1727.3610117.36 1727.3710129.42 1727.6210136.86 1727.7110143.33 1725.38
 10143.5 1725.3210143.84  1725.410155.95 1728.2110157.88 1728.6610159.571728.658
10233.26 1728.5810286.15  1727.710325.26 1728.1610366.21 1728.5510413.73 1727.92
10435.39 1728.3810494.38 1728.6210498.57 1728.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9467.86    .034 9983.94    .04810159.57    .036
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Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9983.9410159.57           361.01  413.45  466.82            .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.553

INPUT
Description: 8200.707
Station Elevation Data    num=      57
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9527.24 1728.96 9566.36 1729.57 9579.31  1729.6 9588.37  1729.4 9648.94 1727.47
  9660.3 1727.16 9674.57  1726.8 9712.78 1725.99 9748.79 1725.27 9757.91 1725.12
 9766.64 1725.04 9821.66  1724.7 9876.49 1724.29  9877.5 1724.28  9878.5 1724.27
 9880.88 1724.22 9961.55 1723.26 9971.73 1723.78 9989.23 1724.69 9989.88 1724.66
 9992.33 1724.77 9997.63 1725.0610012.96 1725.0110014.11    172510023.67 1720.87
10023.86 1720.7810024.14 1720.8810036.44 1724.8710049.89 1725.1610064.11 1725.46
10070.19  1725.410075.59 1725.36 10090.9 1725.3710116.84 1725.2610127.39 1722.35
10127.57 1722.2910127.83 1722.37 10137.4 1725.3410142.08 1725.5110143.08 1725.55
10152.85 1720.9310153.75 1720.27 10156.4 1720.9210159.91 1722.0910167.57 1724.37
10169.68 1724.5210169.811724.52110173.56 1724.5610226.79 1725.03 10267.7 1725.27
10274.21 1725.3210285.76 1725.0710300.45 1724.6910335.57 1723.81 10347.5 1724.37
10413.14 1725.6910434.18 1725.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9527.24    .034 9997.63    .04810169.81    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9997.6310169.81           363.18  330.61  279.75            .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.491

INPUT
Description: 7870.097
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9594.24 1725.33    9608 1725.71 9651.01 1726.13 9653.57 1726.24 9660.08 1725.91
 9686.78 1725.39 9724.19 1724.58 9736.11  1724.5 9793.54 1723.53 9816.17 1722.91
 9857.11 1722.87 9896.26 1723.16 9943.42 1722.63 9953.94 1722.04 9957.34    1722
 9957.68 1721.88 9959.63 1721.24 9963.54 1720.05 9970.59 1721.59 9972.36 1721.97
 9973.99 1722.03 9983.54 1722.28 9989.98 1720.33 9994.56 1718.93  9998.2 1719.54
10008.36 1721.3810009.71  1721.410022.86 1721.6610055.98 1722.1810077.73 1722.45
10088.35 1722.5610106.44 1722.5410110.77 1721.2210118.18 1718.6310126.26 1721.05
10131.38 1722.42 10134.9 1722.4310139.35 1722.4510181.58 1722.5710229.77 1722.21
10246.38  1722.110306.93 1722.4310317.32 1722.4110335.22 1722.4610345.64 1722.43
10388.23 1722.9410393.84 1722.7810395.47 1722.7110402.63 1721.0910402.83 1721.05
10410.13 1722.0910410.69 1722.18 10412.1 1722.1210433.69 1721.5410434.29 1721.63
10450.85 1724.1210463.63 1724.3510494.75 1724.32

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9594.24    .034 9957.68    .048 10134.9    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9957.68 10134.9           457.72  443.95  363.67            .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.406

INPUT
Description: 7426.150
Station Elevation Data    num=      40
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9879.78 1720.58 9882.27 1720.65 9899.89 1720.31 9935.93 1719.71 9937.65 1719.68
 9941.82 1718.49 9945.37  1717.6 9999.97 1718.4610001.18 1718.4910001.42 1718.42
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```
10010.67 1715.2310011.22  1715.4 10013.7 1716.5910020.88 1718.5210022.24 1718.59
10059.68 1718.7710060.241718.77810089.31 1719.1710133.44 1719.4110156.39 1719.36
10180.11 1719.29 10222.7 1719.0810270.08 1719.4310291.74 1719.5710315.39 1719.54
10320.66 1719.5510340.71 1719.4710360.08 1719.3410398.94  1719.410429.41 1719.28
 10495.6 1719.5110498.94 1719.5210499.61 1719.6510500.39 1719.7910508.66 1721.39
10518.33 1722.9910524.55 1722.8910544.19 1723.1210552.84 1722.5210585.24 1722.73

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9879.78    .034 9935.93    .04810060.24    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9935.9310060.24           420.78  423.64  423.19             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.326

INPUT
Description: 7002.514
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9762.41 1717.73 9783.39 1717.52  9793.5 1717.48 9805.12 1717.53 9842.68 1718.06
 9879.09 1716.96 9906.65 1716.35 9934.68 1715.96 9951.47 1715.71    9990 1715.15
 9993.01 1714.8410002.94 1713.3110003.96 1713.1610004.28 1713.2710011.55 1715.92
10016.21 1715.8710029.15 1715.5210082.07 1715.56 10086.8 1715.5310089.06 1715.51
 10092.2 1715.52 10093.6 1715.5310150.58 1715.5810169.23 1715.2110174.33 1715.14
10198.93 1715.4610206.58 1715.5210217.88 1715.7610231.24 1715.7910284.64 1715.67
10371.31 1715.7310412.76 1716.27 10504.5 1717.0610508.36 1717.0910553.79 1719.19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9762.41    .034 9951.47    .048 10093.6    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9951.47 10093.6            469.9  455.15  430.82             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.24

INPUT
Description: 6547.364
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9490.85 1715.39 9530.49 1715.37 9540.97 1715.32 9588.86 1715.53 9652.63 1714.85
 9669.27 1714.76 9672.84 1714.59 9694.77 1713.96  9741.4 1712.72 9748.18  1712.6
 9763.21 1712.34 9812.03 1712.15 9851.17  1712.2 9868.44 1712.21 9898.68 1712.08
 9936.06 1712.14  9958.4 1711.87 9973.37  1711.910012.34 1711.6110023.21 1711.56
10032.62  1711.810058.23 1712.4110085.04 1712.2610087.78 1712.2410099.04 1712.16
10142.08 1712.2210146.36 1712.2710150.73 1712.2410205.15    171210279.33 1712.14
10283.25 1712.1210284.97 1712.1310317.91 1712.0810337.16 1711.9910375.52 1712.31
10423.05 1712.9410426.58 1713.0210480.27 1712.9510480.61 1712.9410533.88 1716.28
10535.56 1716.3910549.11  1716.810564.23 1717.34 10574.4 1717.6510596.39 1717.99
10620.26  1719.510622.35  1719.110649.48 1718.37

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9490.85    .034 9936.06    .04810058.23    .036

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9936.0610058.23           517.25  452.47  485.05             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.154

INPUT
Description: 6094.894
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```
Station Elevation Data    num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9798.78  1713.2 9820.59 1711.25 9836.25 1709.93 9840.14 1709.72 9843.43  1709.6
 9850.42 1709.33 9858.54 1709.37  9863.1 1709.39 9875.58 1709.45 9906.68 1708.82
 9951.95  1709.2 9965.57 1709.2710023.56 1709.3110029.56 1709.3210039.27 1709.25
 10088.8 1709.04 10130.2 1708.9610154.69 1708.71 10193.4    170810194.09 1707.99
10236.26 1708.5110254.38 1709.3110263.79 1709.6210291.36 1709.5910298.54 1709.72
10307.54  1709.910316.32 1710.3510333.43 1710.7310338.85    171110340.29 1710.94
10353.47 1711.2810368.63 1712.0710373.88 1712.1110386.25 1712.3410392.71 1712.74
10399.81 1713.0310415.34 1713.6610424.46 1713.9710431.37 1713.8110443.41 1714.04
10487.29 1714.5810493.84 1714.6210496.53 1714.6710497.68 1714.6510522.79 1714.08

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9798.78    .034 9875.58    .04510254.38    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9875.5810254.38              437  422.39  446.49             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: 1.074

INPUT
Description: 5672.502
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9848.37 1711.65 9862.45 1711.11 9868.24 1710.13 9880.37 1708.26 9883.36 1707.74
 9888.76  1707.4 9897.19 1706.99 9899.14 1707.12 9905.44 1707.51 9906.82 1707.52
 9917.61  1707.4 9949.15 1706.96 9978.65 1707.03 9993.21 1706.99 9998.47 1706.73
10028.25 1705.3110044.92  1706.610049.01 1706.9610052.35 1707.3410067.91 1709.09
   10075 1709.86 10079.1  1710.310093.58 1710.4710107.57 1710.4310122.18 1710.68
10137.78  1710.510144.69 1710.4810176.35  1711.110185.76 1711.0710195.38 1711.34
10221.26 1711.5110237.26 1711.54

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9848.37    .034 9993.21    .04510052.35    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9993.2110052.35           497.14  539.11  464.11             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .972

INPUT
Description: 5133.391
Station Elevation Data    num=      44
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9841.94 1708.69 9853.18 1708.86 9879.28 1706.67 9891.92 1706.23 9911.59 1705.99
 9914.88 1705.86 9935.23 1705.72  9936.5 1705.64 9940.81 1705.59 9970.58 1704.84
 9974.98 1704.73 9987.86 1704.2210000.16 1704.1210002.34 1703.8410009.53 1703.02
10013.21 1703.4610020.75 1704.0910043.83 1704.4110059.08 1704.5810072.15    1705
10086.15 1704.8410108.56  1704.810140.85 1704.8210149.81 1704.8710160.34 1704.86
10171.73 1704.8510197.45  1704.910224.77 1704.8910239.32 1705.41 10248.2  1705.7
10270.75 1706.4310272.72  1706.510274.22 1706.5410292.14 1706.1710299.46 1706.03
10307.95 1706.1110315.47 1706.06 10332.9 1705.6710344.63 1705.8610347.69 1705.99
10380.35    170810384.51 1708.2210387.26 1708.21 10389.1 1708.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9841.94    .034 9970.58    .04510072.15    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9970.5810072.15           466.08  430.57   393.4             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
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REACH: Iona Stock Tank    RS: .891

INPUT
Description: 4702.82
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9767.23  1704.6 9778.64 1704.57 9796.44 1704.41 9824.07 1704.05  9834.8 1704.11
 9864.43 1703.61 9889.15 1702.72 9892.67  1702.6 9901.64 1702.52 9913.57 1702.49
 9928.78 1702.46 9950.86 1701.74 9973.44 1701.53 9996.95 1701.4610011.05 1701.56
10042.92 1701.4910062.14 1701.5610083.49 1701.77 10124.1 1702.5510181.17 1702.57
10199.16 1702.5510237.67 1702.3610277.02 1702.2610285.86 1702.2910307.13 1702.53
10328.02 1702.5410335.13 1702.7810350.13 1703.3710353.66 1703.53

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9767.23    .034 9913.57    .045 10124.1    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9913.57 10124.1           491.65  472.45  555.01             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .801

INPUT
Description: 4230.37
Station Elevation Data    num=     144
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9215.43 1698.87 9218.35 1698.95 9225.21  1698.7 9229.48 1698.48 9238.47 1698.58
 9241.24 1698.54  9243.5 1698.56 9250.27 1698.43 9254.23 1698.24 9265.41 1697.74
 9274.03 1697.33 9279.78 1697.08 9287.71 1697.31  9298.2 1697.52 9302.95 1697.61
    9321 1696.94 9336.36 1696.36 9338.01 1696.34 9361.76 1696.18  9378.6 1696.76
 9382.06 1696.89 9388.96 1696.86 9413.61 1696.76 9416.52 1696.94 9423.08 1696.89
 9426.82 1696.84 9439.72 1696.48 9457.19 1696.04 9459.56    1696  9468.9 1696.09
  9474.3  1696.2 9488.01 1696.16 9488.68 1696.05 9494.27 1695.11 9496.18 1694.78
    9502 1695.33 9506.15 1695.95 9519.68  1697.6 9522.87 1698.03 9524.02 1697.97
 9526.43 1697.94 9536.14 1697.69 9538.11 1697.58 9539.63 1697.57 9548.49 1697.22
 9556.34 1696.91 9556.94 1696.84 9557.97 1696.87 9561.21  1696.7 9576.42 1696.02
 9579.04 1696.05 9584.13 1696.12 9588.96 1696.17 9610.64 1696.56 9615.69 1696.62
 9619.72 1696.72 9635.46 1696.78 9654.59 1697.09 9656.56 1697.07 9668.41  1697.5
 9677.87 1697.99 9697.82 1696.97 9706.41 1696.64 9718.17 1696.61 9722.87 1696.46
 9729.31 1696.44 9741.74 1696.62 9748.75 1697.06 9756.41 1697.38 9770.25 1698.14
 9779.19 1698.61 9783.76  1698.4 9801.02 1697.47 9804.46 1697.41 9809.68 1697.44
 9816.94 1697.48  9824.3  1697.4  9826.5 1697.39 9827.05  1697.4  9852.6  1697.7
 9857.59 1697.76 9861.35 1697.87 9879.52 1697.64 9885.14 1697.68 9890.82 1697.63
 9897.74 1697.55 9909.26 1697.49 9918.89 1697.48 9920.39 1697.49 9939.17 1697.94
 9954.82 1697.98  9968.6 1698.01 9968.63    1698 9976.95 1697.82 9983.44 1697.67
 9996.33 1697.6310005.78 1696.5210012.75 1695.0610014.98 1695.4610018.81 1696.16
10024.851697.31910025.48 1697.4410031.57 1698.2310034.23 1698.2910036.61 1698.33
   10041 1698.41   10045 1698.4810048.79 1698.5210051.26 1698.5510056.74 1698.59
10062.02 1698.4610069.55 1698.3410071.33 1698.2910074.37 1698.38 10092.6 1698.54
10105.02 1698.5910111.03 1698.5710121.44 1698.6510122.91 1698.6410134.34 1698.79
10151.35 1698.7610160.82 1698.9210165.54 1698.9810173.98 1698.9710197.13 1698.95
10218.27 1699.4310222.65 1699.4910224.77 1699.5210225.89 1699.5310244.67  1698.9
 10252.7 1698.9110266.42 1698.8910280.25 1698.9410285.23 1698.9110290.26 1698.89
10307.66 1698.7310322.77 1698.6410328.18 1698.8110340.54 1699.0110340.96 1699.06
10352.29 1700.27 10357.7  1700.910359.27 1700.9410369.43 1701.34

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9215.43    .034 9996.33    .04510024.85    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9996.3310024.85           454.76  485.13  561.18             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .709

INPUT
Description: 3745.24
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```
Station Elevation Data    num=      89
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9477.43 1697.14 9478.14 1697.16 9481.11 1697.07 9482.04 1697.03 9488.13 1696.83
  9491.3  1696.7 9494.38  1696.6  9499.1 1696.43 9503.44 1696.31 9509.68 1696.11
 9510.72 1696.07 9513.69 1695.94 9531.21 1695.53 9538.41 1695.35 9541.06 1695.29
 9543.13 1695.26 9547.28 1695.23 9561.02  1695.4 9581.43 1695.49 9586.79 1695.16
 9594.97 1694.64 9597.39  1694.5 9609.62 1694.68  9614.6 1694.76  9615.5 1694.73
 9616.63 1694.72 9631.62 1694.51 9636.44 1693.83 9640.13 1693.37 9640.31 1693.34
  9640.4 1693.33 9640.57 1693.34  9647.9 1694.19 9660.98 1694.31 9669.28 1694.33
 9674.17 1694.35 9676.15 1694.38 9680.06 1694.27 9684.38 1693.98 9688.85    1694
 9691.03 1693.98 9706.53 1694.21 9731.58 1694.19 9770.07 1693.69 9817.99 1693.81
    9838 1693.87 9851.96  1693.8 9856.44 1693.82 9863.75 1693.84 9898.67 1693.88
 9902.07 1693.89 9913.89 1693.95 9918.31 1693.61  9926.8 1693.54 9935.23  1693.5
 9936.57 1693.54 9938.58 1693.67 9949.34 1693.81 9962.65 1694.02 9967.16    1694
 9987.86 1693.98  9991.21693.98210001.99 1693.9910006.87 1694.0510011.64 1692.55
10013.51 1692.0310014.85 1692.6610017.49 1694.0310025.03 1694.1310032.65 1694.29
10043.83 1694.08 10044.8 1694.1510054.09  1695.310054.46 1695.3410058.97 1695.89
10059.13 1695.9210063.17 1695.87 10078.9  1695.710080.37 1695.5710093.54 1694.08
10100.92    169410112.72  1693.910127.34 1694.3510138.76 1694.9310145.06 1695.57
10154.27 1696.3310169.47 1696.9910169.71    169710178.06  1697.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9477.43    .034  9991.2    .04510054.09    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9991.210054.09            404.3  416.27  434.35             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   1005910178.06    1698       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .679

INPUT
Description: 3587.74
Station Elevation Data    num=      88
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9396.72 1699.19 9405.85 1698.86 9419.73 1698.27 9434.52 1697.63 9442.84 1697.39
 9450.25 1696.92 9456.78 1696.74  9459.8 1696.71 9465.52 1696.64 9476.12 1696.62
 9484.62 1696.46 9486.72 1696.43 9495.46 1696.46 9497.18 1696.42 9505.07  1696.4
 9509.17 1696.31 9516.05 1696.55    9527 1697.27 9527.48 1697.28 9529.43 1697.02
 9533.41 1696.24 9537.84 1696.17 9543.94 1695.97  9548.2 1695.89 9555.08  1695.6
 9565.88 1695.08 9568.28 1694.92 9581.98 1694.21 9590.88 1693.68 9608.87 1693.31
 9610.33 1693.25 9610.91 1693.23 9612.49 1693.22 9649.44 1693.21 9652.98 1693.27
 9658.73 1693.21 9662.06  1693.2 9669.96 1693.13 9680.32 1692.98 9682.55 1692.95
 9687.18  1692.8 9693.19 1692.74 9699.86 1692.62 9703.64  1692.6 9725.82 1692.78
 9727.94 1692.66 9731.04 1692.55 9736.06 1692.14 9742.14 1692.52  9743.1 1692.58
 9744.32 1692.69 9763.92  1692.6 9781.11 1692.56  9798.3 1692.58 9844.41 1692.49
 9884.22 1692.38 9898.92 1692.29 9908.47 1692.44 9938.04 1692.72 9965.92 1693.04
 9980.85 1692.75  9983.3 1692.66 9988.84 1692.47 9990.89 1692.12 9995.54 1691.43
  9996.8 1691.8110000.13 1692.83 10008.3 1692.8510023.66 1692.9310036.71 1692.87
10046.49 1692.8110046.65  1692.810049.56 1692.6410053.83 1692.6710059.22 1692.73
10065.61 1692.7810066.64    169310067.04  1693.110081.89 1693.4810082.63 1693.49
10082.72  1693.5   10083 1693.5110101.69 1693.3910125.26 1693.2310128.42 1693.22
 10132.6 1693.1910147.55 1694.1810156.96 1694.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9396.72    .034  9983.3    .04510023.66    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9983.310023.66              214     158     151             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .597

INPUT
Description: 3150.67
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```
Station Elevation Data    num=      43
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9762.66 1690.38 9779.44 1690.02  9809.1 1689.72 9809.82 1689.71 9843.95 1689.04
 9848.84 1689.12 9872.25 1689.48 9895.09 1689.31 9919.65 1688.87 9934.18 1688.82
 9978.86 1688.61 9982.07 1688.54 9984.37  1688.510002.18 1688.5710014.24 1688.58
10019.22  1688.4 10020.9 1688.33 10025.1 1688.8110025.77  1688.910039.02 1688.93
10048.62 1688.9610105.51 1689.4310131.72 1689.5110182.63 1689.6410236.33 1689.52
10256.36 1689.4210265.06 1689.5310284.03 1689.4210285.11 1689.4310331.61  1689.5
10459.12 1689.2310464.49  1689.210468.54 1688.92 10468.7  1688.910471.53 1688.89
10483.02 1688.8610484.09 1689.0810484.79 1689.2310486.87 1689.2410498.87 1689.25
10542.52 1689.7210570.59 1689.9610583.59 1690.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9762.66    .034 9895.09    .04510105.51    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9895.0910105.51           659.38  600.33   499.6              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10583.5910583.59    1691       F

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .483

INPUT
Description: 2550.34
Station Elevation Data    num=      90
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9458.92 1686.99 9461.84 1686.94  9468.1 1686.69 9491.38 1686.61 9494.61 1686.43
 9494.96 1686.42 9498.21 1686.28 9500.25 1686.22 9500.78 1686.18 9502.22 1686.09
 9504.97 1685.89  9506.9 1685.94 9508.25 1685.95 9510.88 1685.96 9512.23 1685.97
 9525.21 1685.76 9532.46 1685.78 9537.03  1685.8 9540.41 1685.81 9542.66 1685.82
 9544.52 1685.83 9557.77 1685.86 9560.49 1685.85  9607.4 1685.59 9609.46  1685.6
 9658.71 1685.69 9674.96 1685.48 9682.68 1685.36 9702.65 1685.07  9732.2 1684.76
 9746.36 1684.71 9792.59  1684.7 9834.84  1684.3 9838.95 1684.34  9843.1  1684.4
 9843.95 1684.42 9844.39 1684.41 9845.74 1684.43 9849.04 1684.52 9866.56 1684.59
 9906.36 1684.61 9924.03 1684.72 9953.09 1684.51 9959.71 1684.47 9972.87  1684.4
10005.53 1684.22 10012.9 1684.1910021.86 1684.2210024.66 1684.2110026.86  1684.2
10039.82 1684.1910048.74  1684.210055.16 1684.2210058.18 1684.3910059.07 1684.49
   100601684.809 10061.4 1685.2910061.57 1685.3510062.33 1685.33 10075.2    1685
10079.18  1684.910081.05 1684.8610082.11 1684.8310085.97 1684.7710107.63 1684.41
10114.68 1684.2310122.22 1684.2710156.44 1684.6410165.71 1684.5910228.84 1684.73
10237.01 1684.7210263.28 1684.6210277.37 1684.4710286.44 1684.4110293.64 1684.47
10306.83 1684.6310330.57 1684.7810360.78 1684.9810371.99 1685.0110405.48  1685.3
 10412.8 1685.3710421.12 1684.7410422.43 1684.6510423.26 1684.6610429.55 1684.77
10468.18 1685.5610472.25 1685.5810475.65 1685.5710515.75 1685.7810535.84 1685.87

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9458.92    .034 9924.03    .045   10060    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9924.03   10060           414.32  437.94  383.83              .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .400

INPUT
Description: 2112.394
Station Elevation Data    num=     196
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9463.98 1689.57 9470.23 1689.78 9476.55 1689.39 9477.72 1689.32 9485.79 1688.83
 9488.75 1688.67 9495.72 1688.26 9501.26 1687.94 9505.77 1687.69 9510.99  1687.4
 9514.61 1687.21 9521.32 1686.88 9537.08 1686.26 9540.06 1686.14 9543.78 1686.03
  9546.5 1685.95 9553.01 1685.86 9553.95 1685.82 9555.28 1685.77 9572.62 1685.41
 9575.99 1685.27 9583.99 1685.08 9587.75 1684.91 9592.59 1684.72 9595.08 1684.66
 9600.71 1684.47 9600.78 1684.46 9604.78 1683.84 9605.78 1683.71 9608.46 1684.14
 9609.38 1684.28 9610.25 1684.46 9611.07 1684.45 9617.76  1684.5 9620.02 1684.51
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 9621.83 1684.52 9629.87 1684.44 9634.35 1684.29  9638.7 1684.19 9652.92 1684.01
 9655.07    1684 9657.09 1684.01 9660.68 1683.99 9662.16 1683.97  9673.4 1683.75
 9690.87 1683.85 9692.66  1683.9 9695.17 1683.93 9699.75 1683.89 9707.76 1683.72
 9718.26  1683.5 9721.61 1683.35 9762.51 1682.41 9778.13 1682.27  9779.7 1682.19
 9781.34 1682.18 9783.41 1682.21 9786.14 1682.23 9798.68 1682.22 9805.11 1682.21
 9807.13 1682.29 9808.38 1682.33 9809.41 1682.34 9810.48 1682.33 9814.36  1682.3
 9819.05 1682.31 9842.31 1682.32 9846.52 1682.34 9861.96 1682.38 9878.86 1682.28
 9893.41 1682.25 9915.91 1683.18 9919.12  1683.3 9922.93 1683.48 9933.41  1683.5
 9942.49 1683.51 9946.57 1683.45 9962.42 1683.19 9964.11 1683.07 9965.25 1682.98
 9976.75 1682.15 9979.62 1681.95  9980.4 1681.89 9985.29 1680.73 9985.44 1680.69
 9985.61 1680.71 9990.87 1681.28  9999.7 1681.5210005.61 1681.6810013.71 1681.63
10015.05 1681.5910017.98 1681.4910023.47 1681.3310030.34 1681.2210036.37 1681.38
 10037.3 1681.4210046.58 1681.5110069.15 1681.6710075.63 1681.6410080.76  1681.6
10093.06 1681.52   10100 1681.4710112.92 1681.3610115.87 1681.3710135.08 1681.54
10139.83 1681.5810154.28 1681.7110163.53 1681.7710188.18 1681.9910200.11 1681.83
10210.83  1681.710217.77 1681.6110241.19 1681.32 10263.7 1681.5110282.23 1681.75
10285.56  1681.810299.81 1679.2310303.43 1678.4610304.96 1678.33 10305.7  1678.3
10313.07 1677.8510319.08 1680.2810319.32 1680.3910327.55 1680.3510327.89 1680.36
10328.19 1680.3810328.35  1680.410328.81 1680.4510336.46 1681.2510339.21 1680.85
10352.37 1679.3510352.46 1679.3710352.54 1679.3810352.66 1679.3910354.43 1679.59
 10364.4 1680.7410366.81 1680.6810375.54  1680.410376.96 1680.1710379.29 1679.84
10380.36 1679.6910381.01 1679.6110381.69 1679.5310383.48 1679.7710385.31  1680.4
10389.36 1680.0710394.59 1679.5510396.96 1679.8410397.92 1679.9210399.66 1680.05
10403.47 1680.3710408.43 1680.8210411.54 1681.0810412.16 1681.0310415.79 1680.77
10418.18 1680.5610422.79 1679.9910424.78 1679.7510429.26 1679.0610429.56 1679.02
10430.31 1678.8710430.48 1678.85 10433.6 1678.6110436.07 1678.7310445.27  1680.6
10447.08 1681.0210454.42 1681.0410461.52 1681.0110463.61    168110468.47 1680.16
10476.14 1678.9110482.92 1680.5510485.89    168110488.721680.93410494.89 1680.79
10496.82 1680.3310499.81 1680.0510501.34 1680.28 10501.9 1680.3410503.19  1680.5
10506.72 1681.0310509.46  1681.310510.96 1681.2910516.86 1681.2610520.44 1681.23
10534.27 1681.2510537.79 1681.2410552.99 1681.3110561.31 1681.5310595.66 1681.94
   10599    168210599.88 1682.0110623.27 1681.9810640.57 1682.18 10643.9  1682.2
10646.75 1682.24

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9463.98    .034  9980.4    .04510188.18    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9980.410188.18           590.03  583.27  518.73             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .290

INPUT
Description: Cross section ground data copied from RM 4.314 Iona Wash ADMSU
             model, with cross section stations adjusted to show Iona Stock
             Tank Wash thalweg location and banks.  Offset is 789.65 feet.
Station Elevation Data    num=     149
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9682.42 1682.75 9687.831681.929  9708.31680.161 9728.56 1679.38 9728.771679.373
 9749.231678.786 9756.031678.581 9759.811678.535  9769.71678.176 9783.51 1677.78
 9790.171677.768 9810.631677.846  9831.1 1677.98  9850.21678.122 9851.571678.132
 9859.821678.113 9872.041678.001  9892.5 1677.54  9907.61676.785 9912.971676.902
 9933.441676.459 9944.371676.127 9947.351676.037  9953.9 1675.97 9974.371675.896
 9991.371676.177 9994.841675.395   100001674.36710014.591674.731 10015.31674.848
10024.171676.19910035.771676.49410038.541676.54510042.741676.61210056.241676.828
10061.321676.758 10076.71674.83510081.641673.95410092.941675.43510096.771675.889
10097.171675.65210106.181676.19510110.431675.43910117.641675.98810121.331676.204
10132.711676.52410138.111676.73710139.16 1676.7410158.571677.22810174.181677.469
10179.041677.44910199.511677.50410219.97 1677.5210222.261677.53910226.871677.506
10240.441677.44910260.911677.18510276.83 1677.0510278.311676.99410294.391677.094
10301.771677.16710321.251677.33610326.71 1677.2410327.861677.22510351.651676.698
10355.641676.60310361.341676.68310376.591676.98110390.741677.13710394.821677.079
10401.531676.98610419.551676.69310426.471676.696 10428.31676.69410451.411676.837
10461.781676.725 10471.81676.48810476.35    167610482.431675.30110487.281676.591
10495.251676.02910497.271676.58610501.291676.37910503.721675.92110506.281676.916
10526.231677.06710528.731677.06310551.171677.06210559.111677.08210562.211677.183
10576.111677.35510595.691677.82910601.051677.95110609.541678.05610625.991678.081
10629.171678.07410650.931678.15310662.641677.64210664.991678.16310670.881677.367
10675.871677.02910677.831677.16410687.391677.81610696.121677.77910700.811677.951
10715.861678.14110725.751678.283 10729.61678.32210750.681678.76410753.061678.821
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10763.081679.04810766.771679.11710775.621678.38110777.75 1679.0910783.721677.325
10796.561677.45810800.561677.661 10801.71677.69410812.52 1678.46 10825.51678.529
10830.03 1678.5210835.471678.391 10844.91678.37910849.06 1677.3810850.44  1678.6
10854.271678.82610858.031678.85310861.791677.73510863.511678.67410868.13 1678.39
10875.381678.52810886.211678.81610896.991679.10410900.321679.14310923.051679.662
10925.261679.56210930.47 1679.5810950.011679.579 10950.21679.84210963.95 1680.15
10975.141680.38210997.431680.90911000.081680.97811001.751681.02511025.02 1681.43
 11030.9 1681.5211049.961681.70911063.71 1681.8411064.381681.825

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9682.42    .03410725.75    .04510900.32    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9953.910139.16           434.15  425.22   455.9             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .209

INPUT
Description: Cross section ground data copied from RM 4.243 Iona Wash ADMSU
             model, with cross section stations adjusted to show Iona Stock
             Tank Wash thalweg location and banks.  Offset is 409.42 feet.
Station Elevation Data    num=     105
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9627.651682.046 9648.621680.648 9649.881680.447 9665.671680.142  9669.61680.097
 9690.581679.712 9711.551680.061 9723.521680.154    97321679.985 9732.531679.973
  9753.51679.201 9764.151678.854 9774.48 1678.19 9795.461675.469 9798.32  1675.5
 9816.43 1675.49 9837.411675.042 9858.391675.452 9864.641675.236 9876.871674.698
 9879.361674.618 9900.341674.245 9921.321674.187 9930.971674.232  9939.81674.284
 9942.291674.292  9963.11674.414 9963.271674.362 9984.251674.113 9991.711673.762
 9997.291672.912   100001672.20610002.231672.22510005.221672.51510011.821673.513
10018.831674.573 10026.21674.45710047.171675.15610058.33 1675.1810063.611675.193
10070.58 1675.1210089.141675.09810098.581675.00810102.771674.98810114.66 1674.89
10134.961674.937 10136.71674.89810140.191674.87510162.291675.20910165.71 1675.22
10167.151675.21510191.231675.01610199.341675.02610205.651675.01310216.761675.244
10231.531675.59410232.371675.60110242.281675.74410263.72 1676.0310267.811676.085
10290.891676.23510293.331676.23410295.911676.19210318.851675.65410318.981675.659
 10328.11675.822 10333.11674.15110343.961676.31510344.381676.29810360.291676.623
 10369.91676.80410392.491676.77910395.431676.54310400.021676.563 10405.61674.296
 10416.61673.54110420.951674.97310422.481675.20910424.681675.268 10437.91675.879
10446.471676.21310453.731676.23810456.871675.72410471.991674.628   104721674.791
10478.541675.68510482.031675.99910486.211674.59510489.061675.61810489.671675.976
10497.521676.11910501.841676.02810521.25 1676.6110523.051676.67910548.571677.298
10553.441677.50910561.371677.71810574.091678.11310585.631678.37610594.531678.438
10599.621678.59510610.43 1678.8910617.821678.82310625.141678.71410635.551678.263

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9627.65    .03510263.72     .0510501.84    .034

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9942.2910011.82           377.79  465.31   466.5             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .121

INPUT
Description: Cross section ground data copied from RM 4.161 Iona Wash ADMSU
             model, with cross section stations adjusted to show Iona Stock
             Tank Wash thalweg location and banks.  Offset is 136.00 feet.
Station Elevation Data    num=     105
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9705.211676.118 9716.231675.831 9730.361675.671  9732.41675.584 9745.771674.825
 9759.581673.921  9775.3 1673.06 9779.761672.624 9786.46 1672.32 9786.761672.283
 9804.831672.099 9813.941672.155  9821.91672.159 9834.371672.176 9841.121672.178
 9851.711672.201  9863.91672.187 9868.311672.181 9893.431672.161 9895.491672.196
 9896.07 1672.17 9922.67 1673.06 9922.961673.057 9935.051673.165  9940.81670.367
 9946.031672.636 9949.851672.741  9952.51672.795 9973.721672.837 9977.031672.867
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 9982.031672.875 9991.871672.611   100001669.37510004.21 1673.01 10011.11673.065
10011.561673.013 10031.4  1672.910041.091672.847   10046 1672.6810058.581672.876
10068.521673.02210070.631672.67710085.271671.66910085.761673.04310093.64 1673.66
10100.161673.64910112.941673.56110129.161673.01310129.691672.41210133.741671.734
10140.131672.09510141.211671.86610146.631672.65710159.231672.86210167.311672.922
10179.431673.01210188.761672.97110194.491672.97310211.761672.91110218.291672.949
10221.671672.91910247.82 1673.1110248.851673.11110252.561672.91610261.441671.437
10268.621671.63510269.791672.93310276.031673.00110277.361672.99410303.221672.907
10306.891672.78610312.59 1672.9410317.341671.82610319.951672.895 10330.41672.884
10336.421673.12610338.051672.89310345.96 1671.7710350.911672.92310357.581672.657
10365.95 1672.4910366.45 1672.3810384.761672.70810395.491672.84810404.81 1672.92
10411.941672.87410425.021672.77110439.131672.56610450.511672.27510454.551672.286
10466.31 1672.3410484.091672.60510493.491672.81110495.321672.83610506.791671.714
10513.621673.61210515.441673.51710520.671673.90410540.661675.00210543.151675.034
10547.851675.20810561.611675.76310572.681675.86910575.03  1675.910602.221675.801

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9705.21    .035 9973.72     .0510338.05    .034

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9973.7210041.09           510.41  498.14  478.56             .1       .3

CROSS SECTION


RIVER: Iona Stock Tank
REACH: Iona Stock Tank    RS: .027

INPUT
Description: Cross section ground data copied from RM 4.071 Iona Wash ADMSU
             model, with cross section stations adjusted to show Iona Stock
             Tank Wash thalweg location and banks. Offset is 79.51 feet.
Station Elevation Data    num=      96
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9839.691672.852  9848.31672.608 9851.031672.487 9865.77 1671.71 9874.681670.167
 9879.681669.321  9881.71669.824 9888.91 1669.61 9897.441669.196 9901.071668.534
 9907.381667.963 9912.371668.888 9914.511669.747 9927.451669.811 9929.39 1669.81
 9943.031669.402 9943.551669.252 9944.451669.228 9953.831669.327 9956.181669.463
  9973.7 1669.73 9980.221669.795  9991.51669.89110004.371669.973 10006.61669.992
10032.521670.13810032.981670.14210035.031670.17810059.371670.558 10065.71670.148
10065.991670.47310075.931668.95210085.751669.03910088.771668.76810094.731670.667
10096.361669.63110112.131670.20610117.731669.99610127.031669.73910138.511669.499
10148.571669.33810155.551669.338 10157.71669.79610158.631669.988 10164.91669.852
10175.861669.66410188.361669.98610191.281670.00810196.181670.11710202.411669.486
10217.661669.42210218.45 1669.4410219.031669.41810224.51 1669.8610244.051669.596
 10249.71669.38210254.561669.03510260.591668.17410264.21 1668.9510270.431669.058
10280.361669.13510287.981669.36910292.891668.17710296.731669.01810296.811669.047
10306.821669.28510311.031669.16610323.191668.514 10330.81668.64110334.821667.364
10340.081668.77210341.691668.60810349.581669.02710351.16 1668.8910353.271668.245
10355.711668.94510371.361669.04210372.36 1669.0410375.961669.05210402.341669.675
10403.031669.70310428.731670.34810433.691670.46810447.321671.02910455.111671.393
10464.361671.69410481.491672.28110488.511672.48410495.031672.46910507.881672.508
10525.691672.77510534.261672.82810544.551672.69110556.361672.63710560.641672.707
10587.031673.373

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9839.69    .035 9874.68     .0510094.73    .042

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9874.6810094.73                0       0       0             .1       .3


SUMMARY OF MANNING'S N VALUES

River:Iona Stock Tank

      Reach          River Sta.       n1        n2        n3        n4        n5

 Iona Stock Tank      2.938            .033      .039      .033
 Iona Stock Tank      2.837            .036      .048      .056
 Iona Stock Tank      2.751            .036      .048      .056      .048      .056
 Iona Stock Tank      2.674            .036      .048      .056      .048      .056
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Iona Stock Tank	2.605	.036	.048	.056	.048	.056
Iona Stock Tank	2.516	.036	.048	.056	.048	.056
Iona Stock Tank	2.403	.036	.048	.056	.048	.056
Iona Stock Tank	2.314	.034	.048	.036	.049	.037
Iona Stock Tank	2.188	.034	.048	.036	.049	.037
Iona Stock Tank	2.104	.034	.048	.036	.049	.037
Iona Stock Tank	1.993	.034	.048	.036		
Iona Stock Tank	1.955	.034	.048	.036		
Iona Stock Tank	1.891	.034	.048	.036		
Iona Stock Tank	1.797	.034	.048	.036		
Iona Stock Tank	1.714	.034	.048	.036		
Iona Stock Tank	1.631	.034	.048	.036		
Iona Stock Tank	1.553	.034	.048	.036		
Iona Stock Tank	1.491	.034	.048	.036		
Iona Stock Tank	1.406	.034	.048	.036		
Iona Stock Tank	1.326	.034	.048	.036		
Iona Stock Tank	1.24	.034	.048	.036		
Iona Stock Tank	1.154	.034	.045	.032		
Iona Stock Tank	1.074	.034	.045	.032		
Iona Stock Tank	.972	.034	.045	.032		
Iona Stock Tank	.891	.034	.045	.032		
Iona Stock Tank	.801	.034	.045	.032		
Iona Stock Tank	.709	.034	.045	.032		
Iona Stock Tank	.679	.034	.045	.032		
Iona Stock Tank	.597	.034	.045	.032		
Iona Stock Tank	.483	.034	.045	.032		
Iona Stock Tank	.400	.034	.045	.032		
Iona Stock Tank	.290	.034	.045	.032		
Iona Stock Tank	.209	.035	.05	.034		
Iona Stock Tank	.121	.035	.05	.034		
Iona Stock Tank	.027	.035	.05	.042		

SUMMARY OF REACH LENGTHS

River: Iona Stock Tank

Reach	River Sta.	Left	Channel	Right
Iona Stock Tank	2.938	514.42	533.21	536.53
Iona Stock Tank	2.837	474.91	457.77	441.06
Iona Stock Tank	2.751	401.35	402.58	344.91
Iona Stock Tank	2.674	388.48	353.23	331.28
Iona Stock Tank	2.605	468.94	473.26	448.28
Iona Stock Tank	2.516	600.35	593.42	587.28
Iona Stock Tank	2.403	453.38	467.06	526.22
Iona Stock Tank	2.314	582	669.8	534.98
Iona Stock Tank	2.188	484.17	445.74	425.25
Iona Stock Tank	2.104	443.33	581.61	347.09
Iona Stock Tank	1.993	201.24	202.12	191.36
Iona Stock Tank	1.955	339.94	337.22	322.78
Iona Stock Tank	1.891	503.33	497.14	500.47
Iona Stock Tank	1.797	431.34	434.53	448.46
Iona Stock Tank	1.714	408.26	437.67	496.69
Iona Stock Tank	1.631	361.01	413.45	466.82
Iona Stock Tank	1.553	363.18	330.61	279.75
Iona Stock Tank	1.491	457.72	443.95	363.67
Iona Stock Tank	1.406	420.78	423.64	423.19
Iona Stock Tank	1.326	469.9	455.15	430.82
Iona Stock Tank	1.24	517.25	452.47	485.05
Iona Stock Tank	1.154	437	422.39	446.49
Iona Stock Tank	1.074	497.14	539.11	464.11
Iona Stock Tank	.972	466.08	430.57	393.4
Iona Stock Tank	.891	491.65	472.45	555.01
Iona Stock Tank	.801	454.76	485.13	561.18
Iona Stock Tank	.709	404.3	416.27	434.35
Iona Stock Tank	.679	214	158	151
Iona Stock Tank	.597	659.38	600.33	499.6
Iona Stock Tank	.483	414.32	437.94	383.83
Iona Stock Tank	.400	590.03	583.27	518.73
Iona Stock Tank	.290	434.15	425.22	455.9
Iona Stock Tank	.209	377.79	465.31	466.5
Iona Stock Tank	.121	510.41	498.14	478.56

Iona Stock Tank	.027	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Iona Stock Tank

Reach	River Sta.	Contr.	Expan.
Iona Stock Tank	2.938	.1	.3
Iona Stock Tank	2.837	.1	.3
Iona Stock Tank	2.751	.1	.3
Iona Stock Tank	2.674	.1	.3
Iona Stock Tank	2.605	.1	.3
Iona Stock Tank	2.516	.1	.3
Iona Stock Tank	2.403	.1	.3
Iona Stock Tank	2.314	.1	.3
Iona Stock Tank	2.188	.1	.3
Iona Stock Tank	2.104	.1	.3
Iona Stock Tank	1.993	.1	.3
Iona Stock Tank	1.955	.1	.3
Iona Stock Tank	1.891	.1	.3
Iona Stock Tank	1.797	.1	.3
Iona Stock Tank	1.714	.1	.3
Iona Stock Tank	1.631	.1	.3
Iona Stock Tank	1.553	.1	.3
Iona Stock Tank	1.491	.1	.3
Iona Stock Tank	1.406	.1	.3
Iona Stock Tank	1.326	.1	.3
Iona Stock Tank	1.24	.1	.3
Iona Stock Tank	1.154	.1	.3
Iona Stock Tank	1.074	.1	.3
Iona Stock Tank	.972	.1	.3
Iona Stock Tank	.891	.1	.3
Iona Stock Tank	.801	.1	.3
Iona Stock Tank	.709	.1	.3
Iona Stock Tank	.679	.1	.3
Iona Stock Tank	.597	.1	.3
Iona Stock Tank	.483	.1	.3
Iona Stock Tank	.400	.1	.3
Iona Stock Tank	.290	.1	.3
Iona Stock Tank	.209	.1	.3
Iona Stock Tank	.121	.1	.3
Iona Stock Tank	.027	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Iona Stock Tank

River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.938 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.938 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

Iona Stock Tank	.027	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Iona Stock Tank

Reach	River Sta.	Contr.	Expan.
Iona Stock Tank	2.938	.1	.3
Iona Stock Tank	2.837	.1	.3
Iona Stock Tank	2.751	.1	.3
Iona Stock Tank	2.674	.1	.3
Iona Stock Tank	2.605	.1	.3
Iona Stock Tank	2.516	.1	.3
Iona Stock Tank	2.403	.1	.3
Iona Stock Tank	2.314	.1	.3
Iona Stock Tank	2.188	.1	.3
Iona Stock Tank	2.104	.1	.3
Iona Stock Tank	1.993	.1	.3
Iona Stock Tank	1.955	.1	.3
Iona Stock Tank	1.891	.1	.3
Iona Stock Tank	1.797	.1	.3
Iona Stock Tank	1.714	.1	.3
Iona Stock Tank	1.631	.1	.3
Iona Stock Tank	1.553	.1	.3
Iona Stock Tank	1.491	.1	.3
Iona Stock Tank	1.406	.1	.3
Iona Stock Tank	1.326	.1	.3
Iona Stock Tank	1.24	.1	.3
Iona Stock Tank	1.154	.1	.3
Iona Stock Tank	1.074	.1	.3
Iona Stock Tank	.972	.1	.3
Iona Stock Tank	.891	.1	.3
Iona Stock Tank	.801	.1	.3
Iona Stock Tank	.709	.1	.3
Iona Stock Tank	.679	.1	.3
Iona Stock Tank	.597	.1	.3
Iona Stock Tank	.483	.1	.3
Iona Stock Tank	.400	.1	.3
Iona Stock Tank	.290	.1	.3
Iona Stock Tank	.209	.1	.3
Iona Stock Tank	.121	.1	.3
Iona Stock Tank	.027	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Iona Stock Tank

River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.938 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.938 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

```
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.837     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.837     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.751     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The cross-section end points had to be extended vertically for the computed water surface.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.751     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.674     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The cross-section end points had to be extended vertically for the computed water surface.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.674     Profile: Floodway 100-YR
     Warning:The cross section had to be extended vertically during the critical depth calculations.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.605     Profile: 100-yr FP
     Warning:The cross-section end points had to be extended vertically for the computed water surface.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 2.605     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
```

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.516 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.516 Profile: Floodway 100-YR
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.403 Profile: 100-yr FP
Warning:The cross-section end points had to be extended vertically for the computed water surface.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.403 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.314 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.314 Profile: Floodway 100-YR

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.188 Profile: 100-yr FP
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.188 Profile: Floodway 100-YR
Warning:The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.104 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 2.104 Profile: Floodway 100-YR
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.993 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.

Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.993 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.955 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.955 Profile: Floodway 100-YR
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration
with the lowest energy.
Warning:The cross section had to be extended vertically during the critical depth calculations.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:The parabolic search method failed to converge on critical depth. The program will try the cross section
slice/secant method to find critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.891 Profile: 100-yr FP
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.891 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.797 Profile: 100-yr FP
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.797 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.714 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.714 Profile: Floodway 100-YR
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.631 Profile: 100-yr FP
Warning:Divided flow computed for this cross-section.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Iona Stock Tank Reach: Iona Stock Tank RS: 1.631 Profile: Floodway 100-YR
Warning:Critical depth could not be determined within the specified number of iterations. The program used the iteration
with the lowest energy.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

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     Warning:The parabolic search method failed to converge on critical depth.  The program will try the
cross section
             slice/secant method to find critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.553     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.553     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.491     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.491     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.406     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.406     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.326     Profile: 100-yr FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.326     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:The parabolic search method failed to converge on critical depth.  The program will try the
cross section
             slice/secant method to find critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.24     Profile: 100-yr FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.24     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
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```
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.154     Profile: 100-yr FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.154     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.074     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: 1.074     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .972     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .972     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .891     Profile: 100-yr FP
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .891     Profile: Floodway 100-YR
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .801     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .801     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .709     Profile: 100-yr FP
```

```
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .709     Profile: Floodway 100-YR
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .679     Profile: 100-yr FP
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .679     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for
additional cross sections.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .597     Profile: 100-yr FP
     Warning:The cross-section end points had to be extended vertically for the computed water surface.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .597     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Note:   Multiple critical depths were found at this location.  The critical depth with the lowest,
valid, water surface was
             used.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .483     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .483     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .400     Profile: 100-yr FP
```

```
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .400     Profile: Floodway 100-YR
     Warning:The energy equation could not be balanced within the specified number of iterations.  The
program used critical depth
             for the water surface and continued on with the calculations.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
     Warning:During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated
             water surface came back below critical depth.  This indicates that there is not a valid
subcritical answer.  The
             program defaulted to critical depth.
     Warning:The parabolic search method failed to converge on critical depth.  The program will try the
cross section
             slice/secant method to find critical depth.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .290     Profile: 100-yr FP
     Warning:Divided flow computed for this cross-section.
     Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
             This may indicate the need for additional cross sections.
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .290     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .209     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .209     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .121     Profile: 100-yr FP
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
River: Iona Stock Tank  Reach: Iona Stock Tank     RS: .121     Profile: Floodway 100-YR
     Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section.  This may indicate
             the need for additional cross sections.
```

E.7 CHECK-RAS Output

IonaMainWash.nt
CHECK-RAS Program: NT Check
Manning's n Value and Transition Loss Coefficient Review

Project File: C:\Iona_Wash\IonaMainWash.prj
Plan File: C:\Iona_Wash\IonaMainWash.p01
Geometry File: C:\Iona_Wash\IonaMainWash.g01
Flow File: C:\Iona_Wash\IonaMainWash.f01
Report File: C:\Iona_Wash\IonaMainWash.nt
Selected profiles: 100-YR FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:30:58 AM

SECNO	STRUCTURE	NLOB	NCHL	NROB	CNTR	EXP
Iona_Wash,IonaMainWash						
7.074		0.033	-----	-----	0.1	0.3
6.973		0.036	0.048	0.056	0.1	0.3
6.889		0.036	0.048	0.056	0.1	0.3
		0.048	-----	-----		
		0.056	-----	-----		
6.818		0.036	0.048	0.056	0.1	0.3
		0.048	-----	-----		
		0.056	-----	-----		
6.757		0.036	0.048	0.056	0.1	0.3
		0.048	-----	-----		
		0.056	-----	-----		
6.672		0.036	0.048	0.056	0.1	0.3
		0.048	-----	-----		
		0.056	-----	-----		
6.56		0.036	0.048	0.056	0.1	0.3
		0.048	-----	-----		
		0.056	-----	-----		
6.463		0.034	0.049	0.037	0.1	0.3
		0.048	-----	-----		
		0.036	-----	-----		
6.356		0.034	0.049	0.037	0.1	0.3
		0.048	-----	-----		
		0.036	-----	-----		
6.266		0.034	0.049	0.049	0.1	0.3
		0.048	-----	0.037		
		0.036	-----	-----		
6.189		0.036	0.049	0.037	0.1	0.3
6.101		0.036	0.049	0.037	0.1	0.3
5.989		0.036	0.049	0.037	0.1	0.3
5.899		0.036	0.049	0.037	0.1	0.3
5.809		0.036	0.049	0.037	0.1	0.3
5.71		0.038	0.049	0.032	0.1	0.3
5.629		0.038	0.049	0.032	0.1	0.3
5.557		0.038	0.049	0.032	0.1	0.3
5.454		0.038	0.049	0.032	0.1	0.3
5.354		0.038	0.049	0.032	0.1	0.3
5.278		0.038	0.049	0.032	0.1	0.3
5.237		0.038	0.049	0.032	0.1	0.3
5.146		0.038	-----	-----	0.1	0.3
		0.049	-----	-----		
5.083		0.039	0.046	0.033	0.1	0.3
4.988		0.039	0.046	0.033	0.1	0.3
4.901		0.039	0.046	0.033	0.1	0.3
4.844		0.039	0.046	0.033	0.1	0.3

---Summary of Statistics---

	Minimum	Maximum
Left Overbank n Value:	0.033	0.056
Right Overbank n Value:	0.032	0.056
Channel n Value:	0.046	0.049
Contraction Coefficient:	0.1	0.1
Expansion Coefficient:	0.3	0.3

ROUGHNESS COEFFICIENT CHECK

RS: 7.074
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

OK for all - see TDN and n value calcs

RS: 6.189
NT RC 05 The left overbank n value of 0.036 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 6.101
NT RC 05 The left overbank n value of 0.036 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 5.989
NT RC 05 The left overbank n value of 0.036 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 5.899
NT RC 05 The left overbank n value of 0.036 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 5.809
NT RC 05 The left overbank n value of 0.036 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 5.71
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 5.71
NT RC 05 The left overbank n value of 0.038 and the right overbank n value of 0.032 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

RS: 5.629
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 5.629
NT RC 05 The left overbank n value of 0.038 and the right overbank n value of 0.032 are less than or equal to the channel n value of 0.049
The overbank n values should be reevaluated.

```
RS:       5.557
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.557
NT RC 05 The left overbank n value of 0.038 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.049
         The overbank n values should be reevaluated.

RS:       5.454
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.454
NT RC 05 The left overbank n value of 0.038 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.049
         The overbank n values should be reevaluated.

RS:       5.354
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.354
NT RC 05 The left overbank n value of 0.038 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.049
         The overbank n values should be reevaluated.

RS:       5.278
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.278
NT RC 05 The left overbank n value of 0.038 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.049
         The overbank n values should be reevaluated.

RS:       5.237
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.237
NT RC 05 The left overbank n value of 0.038 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.049
         The overbank n values should be reevaluated.

RS:       5.083
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       5.083
NT RC 05 The left overbank n value of 0.039 and the right overbank n value
         of 0.033 are less than or equal to the channel n value of 0.046
         The overbank n values should be reevaluated.

RS:       4.988
NT RC 01 Right overbank n value is less than 0.035
```

```
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      4.988
NT RC 05 The left overbank n value of 0.039 and the right overbank n value
         of 0.033 are less than or equal to the channel n value of 0.046
         The overbank n values should be reevaluated.

RS:      4.901
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      4.901
NT RC 05 The left overbank n value of 0.039 and the right overbank n value
         of 0.033 are less than or equal to the channel n value of 0.046
         The overbank n values should be reevaluated.

TRANSITION LOSS COEFFICIENT CHECK
---------------------------------

ROUGHNESS COEFFICIENT AT STRUCTURES
-----------------------------------

---END---
```

IonaMainWash.xs
CHECK-RAS Program, XS Check
Cross Section Location and Alignment Review

Project File: C:\Iona_Wash\IonaMainWash.prj
Plan File: C:\Iona_Wash\IonaMainWash.p01
Geometry File: C:\Iona_Wash\IonaMainWash.g01
Flow File: C:\Iona_Wash\IonaMainWash.f01
Report File: C:\Iona_Wash\IonaMainWash.xs
Selected profiles: 100-YR FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:31:09 AM

SECNO	Len Lob	Len Chl	Len Rob	TopWdthAct	Q Total	Flow Code
Iona_Wash,IonaMainWash						
7.074	514.42	533.21	536.53	335.14	1330	D,E
6.973	438.38	443.7	441.06	431.9	1890	
6.889	376.7	373.81	328.72	454.99	1890	D
6.818	317.27	323.95	326.29	439.63	1890	D
6.757	449.28	446.36	429.75	603.67	1890	D
6.672	566.76	591.92	731.58	609.55	1890	D
6.56	496.38	517.75	487.03	480.73	1890	D
6.463	563.56	564.45	519.39	406.44	1890	D
6.356	459.04	475.19	450.12	219.31	1890	D
6.266	421.38	408.64	391.64	195.79	1890	D
6.189	487.39	463.93	420.33	180.32	1890	
6.101	588.17	592.05	594.78	193.93	1890	
5.989	437.1	469.99	459.9	114.3	1890	
5.899	487.7	478.11	535.96	94.62	1890	C
5.809	475.48	522.82	518.26	297.23	1890	
5.71	460.39	424.17	391.72	471.67	5650	D
5.629	414.11	382.07	309.37	252.14	5650	
5.557	504.98	543.42	573.19	241.6	5650	D
5.454	492.03	529.22	486.63	489.46	5650	D,C
5.354	294.52	403.44	451.22	610.04	5650	
5.278	170.43	213.53	244.17	345.53	5650	
5.237	451.83	481.77	483.97	312.18	5650	
5.146	319.92	330.44	304.43	260.52	5650	
5.083	546.45	503.21	467.3	350.44	5650	
4.988	465.93	459.18	451.9	489.97	5650	
4.901	354.88	299.867	260.043	474.31	5650	D
4.844	0	0	0	299.06	5650	

B=blocked obstruction XS SC 05
C=critial depth XS SC 03
D=divided flow XS SC 01
E=cross section extended XS SC 02
K=known water-surface XS SC 04

DISTANCE CHECK

SPACING CHECK

INEFFECTIVE FLOW CHECK

```
RS:       6.56
XS IF 01 Left Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.

RS:       6.189
XS IF 01 Right Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.

RS:       6.101
XS IF 01 Right Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.

RS:       5.989
XS IF 01 Right Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.

RS:       5.629
XS IF 01 Left Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.

RS:       5.146
XS IF 01 Left Levee option is used at this river station
         Please investigate whether the NFIP requirements
         for levees are met.
```

ok for all - See TON report

DISCHARGE CHECK

LOCATION CHECK

```
RS:       5.989
XS LC 01 Lenchl Up/TopwdthAct Dn = 4.97
         MaxChlDpth Up/MaxChlDpth Dn = 1.44
         TopwdthAct Up/TopwdthAct Dn = 1.21
         This cross section is located too far upstream from the
         critical depth cross section.
```

ok

BOUNDARY CONDITION CHECK

```
XS BC 02 The name of the stream is Iona_Wash,IonaMainWash
         Known WS = 1695.44 is specified as the downstream boundary
         for profile 100-YR FP

XS BC 02 The name of the stream is Iona_Wash,IonaMainWash
         Known WS = 1696.42 is specified as the downstream boundary
         for profile Floodway 100-YR

XS BC 03 Maximum number of iterations is 0
         It should not be less than 20.
```

ok, only 2 profiles computed

LATERAL WEIRS CHECK

---END---

IonaMainWash.fw
CHECK-RAS Program: Floodway Check
Encroachment Method, Starting WSEL, Floodway Width, and Surcharge Review

Project File: C:\Iona_Wash\IonaMainWash.prj
Plan File: C:\Iona_Wash\IonaMainWash.p01
Geometry File: C:\Iona_Wash\IonaMainWash.g01
Flow File: C:\Iona_Wash\IonaMainWash.f01
Report File: C:\Iona_Wash\IonaMainWash.fw
Selected profiles: 100-YR FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:31:18 AM

SECNO	Method	Surcharge	EncStaL	EncStaR	LStaEff	RStaEff	Structure
Iona_Wash,IonaMainWash							
7.074					9498.45	10126.59	
7.074	1	0.86	9792	9989	9792	9989	
6.973					9599.6	10031.5	
6.973	19	0.21	9702.61	10039.34	9702.61	10032.77	
6.889					9676.72	10211.59	
6.889	19	1	9878.83	10092.88	9878.83	10092.88	
6.818					9757.3	10259.61	
6.818	19	0.59	9956.14	10084.71	9956.14	10084.71	
6.757					9748.98	10405.96	
6.757	19	0.99	9957.72	10112.62	9957.72	10112.62	
6.672					9673.48	10479.45	
6.672	1	0.51	9942.8	10064.52	9942.8	10064.52	
6.56					9715	10248.53	
6.56	19	0.88	9951.79	10114.28	9951.79	10114.28	
6.463					9634.15	10217.16	
6.463	19	0.69	9959.46	10123.64	9959.46	10123.64	
6.356					9393.55	10028.76	
6.356	19	0.91	9921.44	10035.09	9921.44	10033.39	
6.266					9413.78	10029.06	
6.266	1	0.28	9948.3	10035.86	9948.3	10029.86	
6.189					9889.4	10069.72	
6.189	19	0.93	9951.44	10048.26	9951.44	10048.26	
6.101					9911.75	10105.68	
6.101	19	0.39	9979.31	10051.96	9979.31	10051.96	
5.989					9930.44	10044.74	
5.989	19	0.84	9950.04	10029.31	9950.04	10029.31	
5.899					9931.06	10025.68	
5.899	19	0.66	9968.82	10020.48	9968.82	10020.48	
5.809					9904.07	10201.29	
5.809	19	0.57	9949.12	10099	9949.12	10099	
5.71					9655.43	10139.2	
5.71	19	0.66	9903.72	10045.55	9903.72	10045.55	
5.629					9851.17	10103.31	
5.629	19	0.54	9931.79	10060.4	9931.79	10060.4	
5.557					9697.79	10059.99	
5.557	19	0.99	9913.38	10036.22	9913.38	10036.22	
5.454					9707.34	10238.38	
5.454	19	0.48	9897.65	10118.95	9897.65	10118.95	
5.354					9511.07	10121.11	
5.354	19	0.77	9793.07	10044.6	9793.07	10044.6	
5.278					9749.65	10095.17	
5.278	19	0.72	9862.82	10037.44	9862.82	10037.44	
5.237					9859.25	10171.42	
5.237	19	0.27	9939.26	10120.92	9939.26	10120.92	
5.146					9768.72	10029.23	
5.146	19	0.1	9824.66	10026.35	9824.66	10026.35	

5.083					9797	10147.45
5.083	19	0.21	9924.13	10110.9	9924.13	10110.9
4.988					9625.73	10115.7
4.988	19	0.65	9857.79	10101.2	9857.79	10101.2
4.901					9610.56	10087.08
4.901	19	0.69	9728.34	10024.42	9728.34	10024.42
4.844					9859.67	10158.73
4.844	1	0.98	9875	10093	9875	10093

ENCROACHMENT METHOD CHECK

FLOODWAY WIDTH CHECK

RS: 7.074
FW FW 01 Right encroachment station 9989 is less than right channel bank station 10015.27 and greater than the left channel bank station 9861.46
Right encroachment station is within the channel.
The encroachment station or channel bank station should be adjusted.

OK, tie-in Section. Per ADMSU

RS: 6.973
FW FW 03 The Left channel bank station may not be at the proper location.

OK for all

RS: 6.889
FW FW 03 The right channel bank station may not be at the proper location.

RS: 6.757
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 6.757
FW FW 03 The right channel bank station may not be at the proper location.

RS: 6.672
FW FW 03 The right channel bank station may not be at the proper location.

RS: 6.266
FW FW 04 The right station effective of 10029.06 for 1% annual chance floodplain
is greater than the right channel bank station (10024.72).
The 1% annual chance floodplain is outside the channel.
However, the right encroachment station (10035.86) is outside of 1% annual
chance floodplain.
The right encroachment station should be adjusted.

RS: 5.989
FW FW 03 The right channel bank station may not be at the proper location.

RS: 5.899
FW FW 03 The right channel bank station may not be at the proper location.

```
RS:        5.809
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        5.71
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        5.629
FW FW 03   The Left channel bank station may not be at the proper
           location.

RS:        5.629
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        5.557
FW FW 03   The Left channel bank station may not be at the proper
           location.

RS:        5.557
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        5.354
FW FW 03   The Left channel bank station may not be at the proper
           location.

RS:        5.237
FW FW 03   The Left channel bank station may not be at the proper
           location.

RS:        5.237
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        5.146
FW FW 03   The Left channel bank station may not be at the proper
           location.

RS:        4.901
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        4.844
FW FW 03   The right channel bank station may not be at the proper
           location.


SURCHARGE CHECK
----------------


DISCHARGE CHECK
----------------


STARTING WATER-SURFACE ELEVATION CHECK
--------------------------------------

FW SW 04   The name of the stream is Iona_Wash
           Encroachment method 1 is used.
```

```
Total conveyance for the natural profile is 78915.2
Total conveyance for the floodway profile is 99711
The difference in conveyance between the floodway profile and the
natural profile is more than 1%.
Normal Depth option with the same energy slope as the natural
profile must be used for the floodway profile and rerun the plan.
This message is not applicable for the revisions.

---END---
```

IonaStockTankWash.nt
CHECK-RAS Program: NT Check
Manning's n Value and Transition Loss Coefficient Review

Project File: C:\Iona_STOCK\IonaStockTankWash.prj
Plan File: C:\Iona_STOCK\IonaStockTankWash.p01
Geometry File: C:\Iona_STOCK\IonaStockTankWash.g04
Flow File: C:\Iona_STOCK\IonaStockTankWash.f01
Report File: C:\Iona_STOCK\IonaStockTankWash.nt
Selected profiles: 100-yr FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:27:48 AM

SECNO	STRUCTURE	NLOB	NCHL	NROB	CNTR	EXP
--						
Iona Stock Tank,Iona Stock Tank						
2.938		0.033	-----	-----	0.1	0.3
2.837		0.036	0.048	0.056	0.1	0.3
2.751		0.036	0.048	0.048	0.1	0.3
		-----	-----	0.056		
		-----	-----	0.048		
		-----	-----	0.056		
2.674		0.036	0.048	0.048	0.1	0.3
		-----	-----	0.056		
		-----	-----	0.048		
		-----	-----	0.056		
2.605		0.036	0.048	0.048	0.1	0.3
		-----	-----	0.056		
		-----	-----	0.048		
		-----	-----	0.056		
2.516		0.036	-----	-----	0.1	0.3
		0.048	-----	-----		
2.403		0.036	-----	-----	0.1	0.3
		0.048	-----	-----		
2.314		0.034	0.048	0.036	0.1	0.3
		-----	-----	0.049		
		-----	-----	0.037		
2.188		0.034	0.048	0.036	0.1	0.3
		-----	-----	0.049		
		-----	-----	0.037		
2.104		0.034	0.048	0.036	0.1	0.3
		-----	-----	0.049		
		-----	-----	0.037		
1.993		0.034	0.048	0.036	0.1	0.3
1.955		0.034	0.048	0.036	0.1	0.3
1.891		0.034	0.048	0.036	0.1	0.3
1.797		0.034	0.048	0.036	0.1	0.3
1.714		0.034	0.048	0.036	0.1	0.3
1.631		0.034	0.048	0.036	0.1	0.3
1.553		0.034	0.048	0.036	0.1	0.3
1.491		0.034	0.048	0.036	0.1	0.3
1.406		0.034	0.048	0.036	0.1	0.3
1.326		0.034	0.048	0.036	0.1	0.3
1.24		0.034	0.048	0.036	0.1	0.3
1.154		0.034	0.045	0.032	0.1	0.3
1.074		0.034	0.045	0.032	0.1	0.3
.972		0.034	0.045	0.032	0.1	0.3
.891		0.034	0.045	0.032	0.1	0.3
.801		0.034	0.045	0.032	0.1	0.3
.709		0.034	0.045	0.032	0.1	0.3
.679		0.034	0.045	0.032	0.1	0.3
.597		0.034	0.045	0.032	0.1	0.3

```
                                IonaStockTankWash.nt
 .483                           0.034     0.045     0.032     0.1       0.3
 .4                             0.034     0.045     0.032     0.1       0.3
 .29                            0.034     -----     -----     0.1       0.3
 .209                           0.035     -----     -----     0.1       0.3
 .121                           0.035     0.05      0.05      0.1       0.3
                                -----     -----     0.034
 .027                           0.035     0.05      0.042     0.1       0.3
-----------------------------------------------------------------------------
--

---Summary of Statistics---
                                Minimum         Maximum
Left Overbank n Value:           0.033           0.048
Right Overbank n Value:          0.032           0.056
Channel n Value:                 0.045           0.05
Contraction Coefficient:         0.1             0.1
Expansion   Coefficient:         0.3             0.3


ROUGHNESS COEFFICIENT CHECK
-----------------------------------

RS:       2.938
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       2.314
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       2.188
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       2.104
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.993
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.993
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.955
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.955
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.
```

OK for all - See TDN and nvalue calcs.

```
RS:       1.891
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.891
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.797
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.797
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.714
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.714
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.631
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.631
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.553
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.553
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.491
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       1.491
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.036 are less than or equal to the channel n value of 0.048
         The overbank n values should be reevaluated.

RS:       1.406
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
```

```
          The n value should be reevaluated.

RS:       1.406
NT RC 05  The left overbank n value of 0.034 and the right overbank n value
          of 0.036 are less than or equal to the channel n value of 0.048
          The overbank n values should be reevaluated.

RS:       1.326
NT RC 01  Left overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.326
NT RC 05  The left overbank n value of 0.034 and the right overbank n value
          of 0.036 are less than or equal to the channel n value of 0.048
          The overbank n values should be reevaluated.

RS:       1.24
NT RC 01  Left overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.24
NT RC 05  The left overbank n value of 0.034 and the right overbank n value
          of 0.036 are less than or equal to the channel n value of 0.048
          The overbank n values should be reevaluated.

RS:       1.154
NT RC 01  Left overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.154
NT RC 01  Right overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.154
NT RC 05  The left overbank n value of 0.034 and the right overbank n value
          of 0.032 are less than or equal to the channel n value of 0.045
          The overbank n values should be reevaluated.

RS:       1.074
NT RC 01  Left overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.074
NT RC 01  Right overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       1.074
NT RC 05  The left overbank n value of 0.034 and the right overbank n value
          of 0.032 are less than or equal to the channel n value of 0.045
          The overbank n values should be reevaluated.

RS:       0.972
NT RC 01  Left overbank n value is less than 0.035
          The n value for overbank is usually larger then 0.035.
          The n value should be reevaluated.

RS:       0.972
```

```
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.972
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:      0.891
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.891
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.891
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:      0.801
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.801
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.801
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:      0.709
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.709
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.709
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:      0.679
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:      0.679
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.
```

```
RS:       0.679
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:       0.597
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.597
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.597
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:       0.483
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.483
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.483
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:       0.4
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.4
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       0.4
NT RC 05 The left overbank n value of 0.034 and the right overbank n value
         of 0.032 are less than or equal to the channel n value of 0.045
         The overbank n values should be reevaluated.

RS:       0.29
NT RC 01 Left overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

TRANSITION LOSS COEFFICIENT CHECK
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ROUGHNESS COEFFICIENT AT STRUCTURES
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---END---
```

IonaStockTankWash.xs
CHECK-RAS Program, XS Check
Cross Section Location and Alignment Review

Project File: C:\Iona_STOCK\IonaStockTankWash.prj
Plan File: C:\Iona_STOCK\IonaStockTankWash.p01
Geometry File: C:\Iona_STOCK\IonaStockTankWash.g04
Flow File: C:\Iona_STOCK\IonaStockTankWash.f01
Report File: C:\Iona_STOCK\IonaStockTankWash.xs
Selected profiles: 100-yr FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:28:26 AM

SECNO	Len Lob	Len Chl	Len Rob	TopWdthAct	Q Total	Flow Code
Iona Stock Tank,Iona Stock Tank						
2.938	514.42	533.21	536.53	307.45	1330	D
2.837	474.91	457.77	441.06	435.12	1890	
2.751	401.35	402.58	344.91	270.71	1890	E
2.674	388.48	353.23	331.28	364.74	1890	E
2.605	468.94	473.26	448.28	458.06	1890	E
2.516	600.35	593.42	587.28	504.31	1890	E
2.403	453.38	467.06	526.22	381.84	1890	E
2.314	582	669.8	534.98	346.04	1890	D
2.188	484.17	445.74	425.25	395.69	1890	D,C
2.104	443.33	581.61	347.09	751.01	1890	
1.993	201.24	202.12	191.36	139.19	1890	
1.955	339.94	337.22	322.78	250.73	1890	D
1.891	503.33	497.14	500.47	636.06	1890	
1.797	431.34	434.53	448.46	677.9	1890	
1.714	408.26	437.67	496.69	789.52	1890	D
1.631	361.01	413.45	466.82	794.11	1890	D
1.553	363.18	330.61	279.75	638.68	1890	D
1.491	457.72	443.95	363.67	641.43	1890	
1.406	420.78	423.64	423.19	578.68	1890	
1.326	469.9	455.15	430.82	589.31	1890	
1.24	517.25	452.47	485.05	680.76	1890	
1.154	437	422.39	446.49	507.93	1890	
1.074	497.14	539.11	464.11	192.43	1890	
.972	466.08	430.57	393.4	431.52	1890	D
.891	491.65	472.45	555.01	474.22	1890	
.801	454.76	485.13	561.18	456.55	1890	D
.709	404.3	416.27	434.35	530.73	1890	
.679	214	158	151	539.46	1890	C
.597	659.38	600.33	499.6	804.82	1890	E
.483	414.32	437.94	383.83	788.36	1890	
.4	590.03	583.27	518.73	420.27	1890	D,C
.29	434.15	425.22	455.9	1135.06	6610	D
.209	377.79	465.31	466.5	752.88	6610	
.121	510.41	498.14	478.56	789.61	6610	
.027	0	0	0	609.17	6610	

B=blocked obstruction XS SC 05
C=critial depth XS SC 03
D=divided flow XS SC 01
E=cross section extended XS SC 02
K=known water-surface XS SC 04

DISTANCE CHECK

SPACING CHECK

INEFFECTIVE FLOW CHECK

RS: 2.403
XS IF 01 Left Levee option is used at this river station
Please investigate whether the NFIP requirements
for levees are met.

ok - see TDN report

DISCHARGE CHECK

LOCATION CHECK

BOUNDARY CONDITION CHECK

XS BC 02 The name of the stream is Iona Stock Tank,Iona Stock Tank
Known WS = 1671.92 is specified as the downstream boundary
for profile 100-yr FP

XS BC 02 The name of the stream is Iona Stock Tank,Iona Stock Tank
Known WS = 1672.13 is specified as the downstream boundary
for profile Floodway 100-YR

XS BC 03 Maximum number of iterations is 0
It should not be less than 20.

ok, only 2 profiles computed

LATERAL WEIRS CHECK

---END---

IonaStockTankWash.fw
CHECK-RAS Program: Floodway Check
Encroachment Method, Starting WSEL, Floodway Width, and Surcharge Review

Project File: C:\Iona_STOCK\IonaStockTankWash.prj
Plan File: C:\Iona_STOCK\IonaStockTankWash.p01
Geometry File: C:\Iona_STOCK\IonaStockTankWash.g04
Flow File: C:\Iona_STOCK\IonaStockTankWash.f01
Report File: C:\Iona_STOCK\IonaStockTankWash.fw
Selected profiles: 100-yr FP;Floodway 100-YR
Date: 5/5/2009
Time: 11:28:45 AM

SECNO	Method	Surcharge	EncStaL	EncStaR	LStaEff	RStaEff	Structure
Iona Stock Tank,Iona Stock Tank							
2.938					9498.45	10123.91	
2.938	1	0.96	9792	9989	9792	9989	
2.837					9596.86	10031.98	
2.837	19	0.23	9702.61	10039.34	9702.61	10033.33	
2.751					9758.69	10029.41	
2.751	19	0.15	9880.01	10033.08	9880.01	10029.9	
2.674					9674.19	10038.93	
2.674	19	0.3	9844.81	10040.31	9844.81	10040.31	
2.605					9565.94	10024	
2.605	19	0.5	9908.02	10023.8	9908.02	10023.8	
2.516					9518.36	10022.67	
2.516	19	0.9	9870.81	10026.37	9870.81	10026.3	
2.403					9627.16	10009	
2.403	19	0.86	9852.96	10008.14	9852.96	10008.14	
2.314					9733.29	10093.12	
2.314	19	0.73	9839.25	10033.9	9839.25	10033.9	
2.188					9779.19	10222.92	
2.188	19	0.15	9920.02	10039.97	9920.02	10039.97	
2.104					9519.73	10270.74	
2.104	19	0.61	9933.14	10122.96	9933.14	10122.96	
1.993					9917.39	10056.58	
1.993	19	0.43	9960.97	10051.14	9960.97	10051.14	
1.955					9984.34	10261.54	
1.955	19	0.85	9966.64	10145.26	9966.64	10145.26	
1.891					9970.82	10606.89	
1.891	1	0.77	9990	10166.11	9990	10166.11	
1.797					9836.12	10514.02	
1.797	19	0.87	9942.18	10127.2	9942.18	10127.2	
1.714					9556.68	10388.77	
1.714	19	0.7	9947.91	10143	9947.91	10143	
1.631					9529.36	10439.08	
1.631	1	0.92	9869.3	10159.57	9869.3	10159.57	
1.553					9743.01	10398.01	
1.553	19	0.59	9947.43	10169.81	9947.43	10169.81	
1.491					9803.65	10445.08	
1.491	19	0.9	9957.68	10180.41	9957.68	10180.41	
1.406					9922.46	10501.14	
1.406	19	0.37	9935.93	10060.24	9935.93	10060.24	
1.326					9885.95	10475.26	
1.326	19	0.74	9951.47	10193.68	9951.47	10193.68	
1.24					9736.18	10416.93	
1.24	19	0.53	9936.06	10141.21	9936.06	10141.21	
1.154					9826.29	10334.22	
1.154	19	0.49	9875.58	10254.38	9875.58	10254.38	
1.074					9875.19	10067.63	
1.074	19	0.84	9945.76	10052.35	9945.76	10052.35	

0.972					9893.53	10351.27
0.972	19	0.73	9970.58	10105.29	9970.58	10105.29
0.891					9873.61	10347.83
0.891	19	0.46	9913.57	10124.1	9913.57	10124.1
0.801					9272.19	10025.36
0.801	19	0.8	9611.02	10024.85	9611.02	10024.85
0.709					9526.24	10056.97
0.709	19	0.76	9773.12	10054.09	9773.12	10054.09
0.679					9598.25	10137.71
0.679	19	0.81	9874.72	10023.66	9874.72	10023.66
0.597					9778.77	10583.59
0.597	19	0.69	9895.09	10178.26	9895.09	10178.26
0.483					9675.49	10463.86
0.483	19	0.76	9924.03	10134.24	9924.03	10134.24
0.4					9981.85	10562.67
0.4	1	0.52	9980.4	10397.2	9980.4	10397.2
0.29					9743.96	10890.74
0.29	1	0.13	9953.9	10321.25	9953.9	10321.25
0.209					9783.62	10536.5
0.209	19	0.73	9942.29	10515.42	9942.29	10515.42
0.121					9746.71	10536.32
0.121	1	0.66	9854	10341	9854	10341
0.027					9861.79	10470.96
0.027	19	0.21	9874.68	10349.5	9874.68	10349.5

-

ENCROACHMENT METHOD CHECK

FLOODWAY WIDTH CHECK

OK, tie-in Section per ADMSU

RS: 2.938
FW FW 01 Right encroachment station 9989 is less than right channel bank station 10015.27 and greater than the left channel bank station 9861.46
Right encroachment station is within the channel.
The encroachment station or channel bank station should be adjusted.

RS: 2.837
FW FW 03 The Left channel bank station may not be at the proper location.

OK for all

RS: 2.674
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 2.605
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 2.516
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 2.314
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 2.314

FW FW 03 The right channel bank station may not be at the proper location.

RS: 2.188
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 2.104
FW FW 03 The right channel bank station may not be at the proper location.

RS: 1.955
FW FW 03 The right channel bank station may not be at the proper location.

RS: 1.891
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 1.797
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 1.797
FW FW 03 The right channel bank station may not be at the proper location.

RS: 1.553
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 1.553
FW FW 03 The right channel bank station may not be at the proper location.

RS: 1.491
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 1.491
FW FW 03 The right channel bank station may not be at the proper location.

RS: 1.326
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.972
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.891
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.679
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.483
FW FW 03 The right channel bank station may not be at the proper location.

RS: 0.29
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.29
FW FW 03 The right channel bank station may not be at the proper location.

RS: 0.209
FW FW 03 The right channel bank station may not be at the proper location.

RS: 0.121
FW FW 03 The right channel bank station may not be at the proper location.

RS: 0.027
FW FW 03 The Left channel bank station may not be at the proper location.

RS: 0.027
FW FW 03 The right channel bank station may not be at the proper location.

SURCHARGE CHECK

DISCHARGE CHECK

RS: 0.29
FW FD 01 The floodway discharge of 1890 is not equal to the natural 1% chance discharge of 6610
Please justify the use of different discharges for the natural and floodway profiles. See workmap, floodway tie-in at a location different than floodplain, okay.

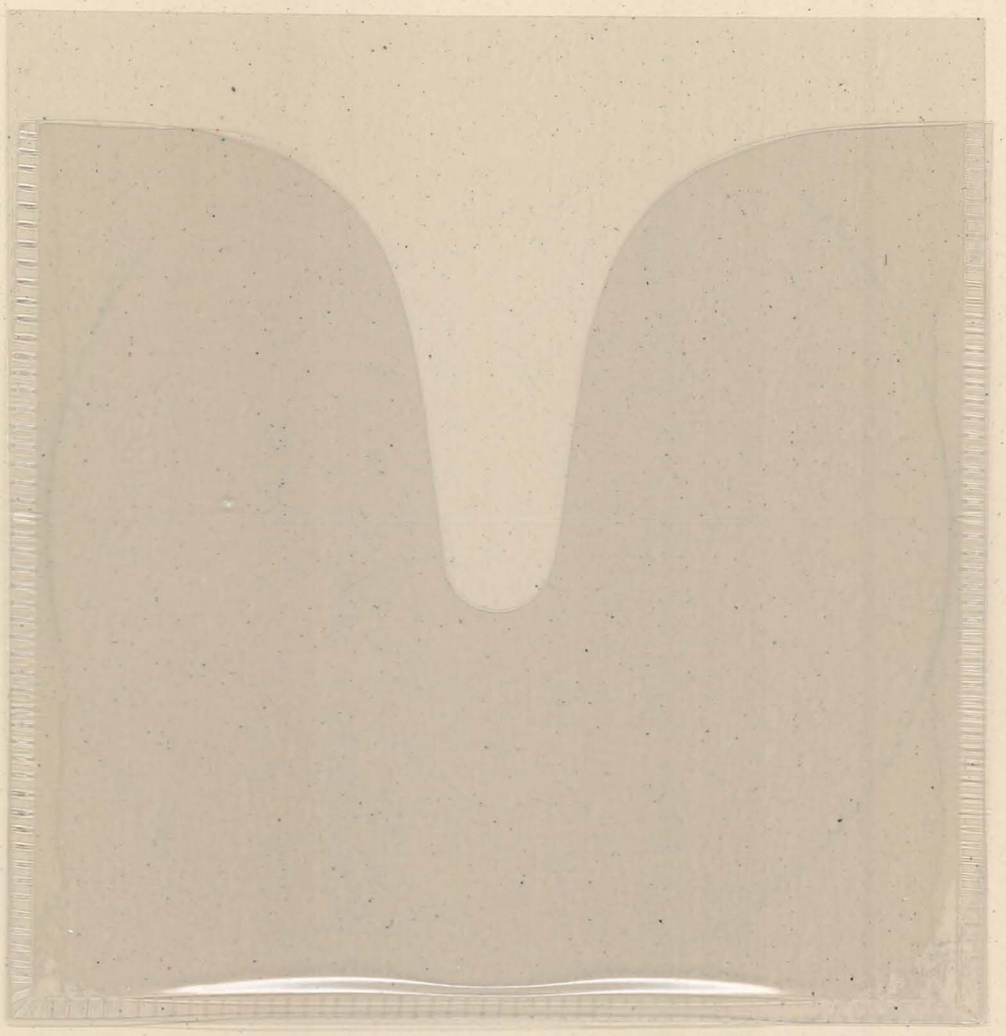
STARTING WATER-SURFACE ELEVATION CHECK

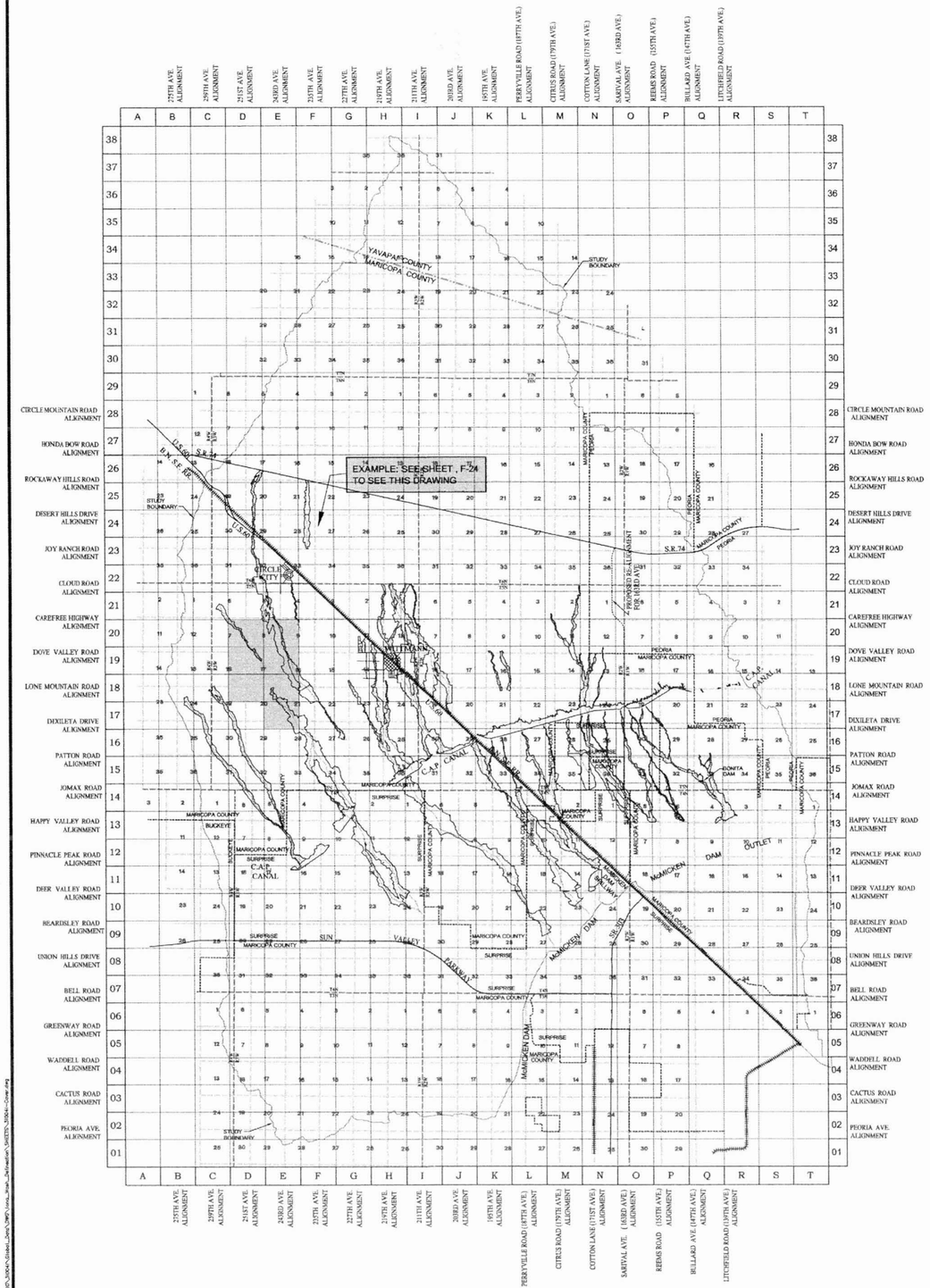
---END---

E.8 Summary of Errors and Warnings

Included in Appendix E.6

APPENDIX F. CD

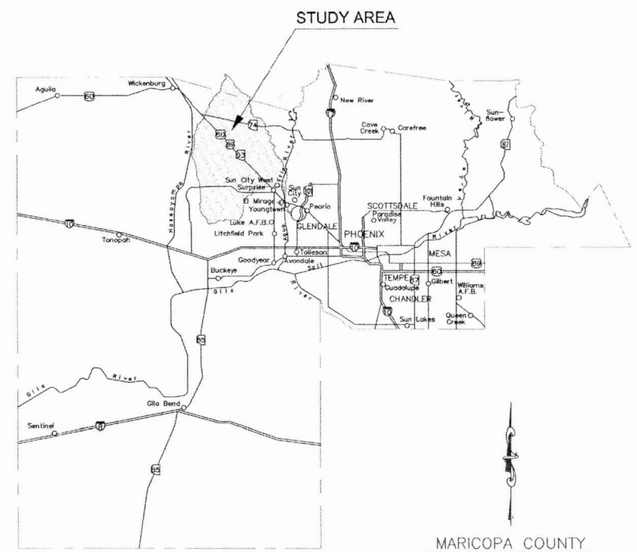




FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN ROAD TO CAREFREE HIGHWAY
CONTRACT F.C.D. 2004C060



LOCATION MAP

AERIAL MAPPING

NOT A PART OF THIS CONTRACT.
SUPPLIED BY THE FLOOD CONTROL DISTRICT.
CONTRACT F.C.D. 2001C021

HYDROLOGY

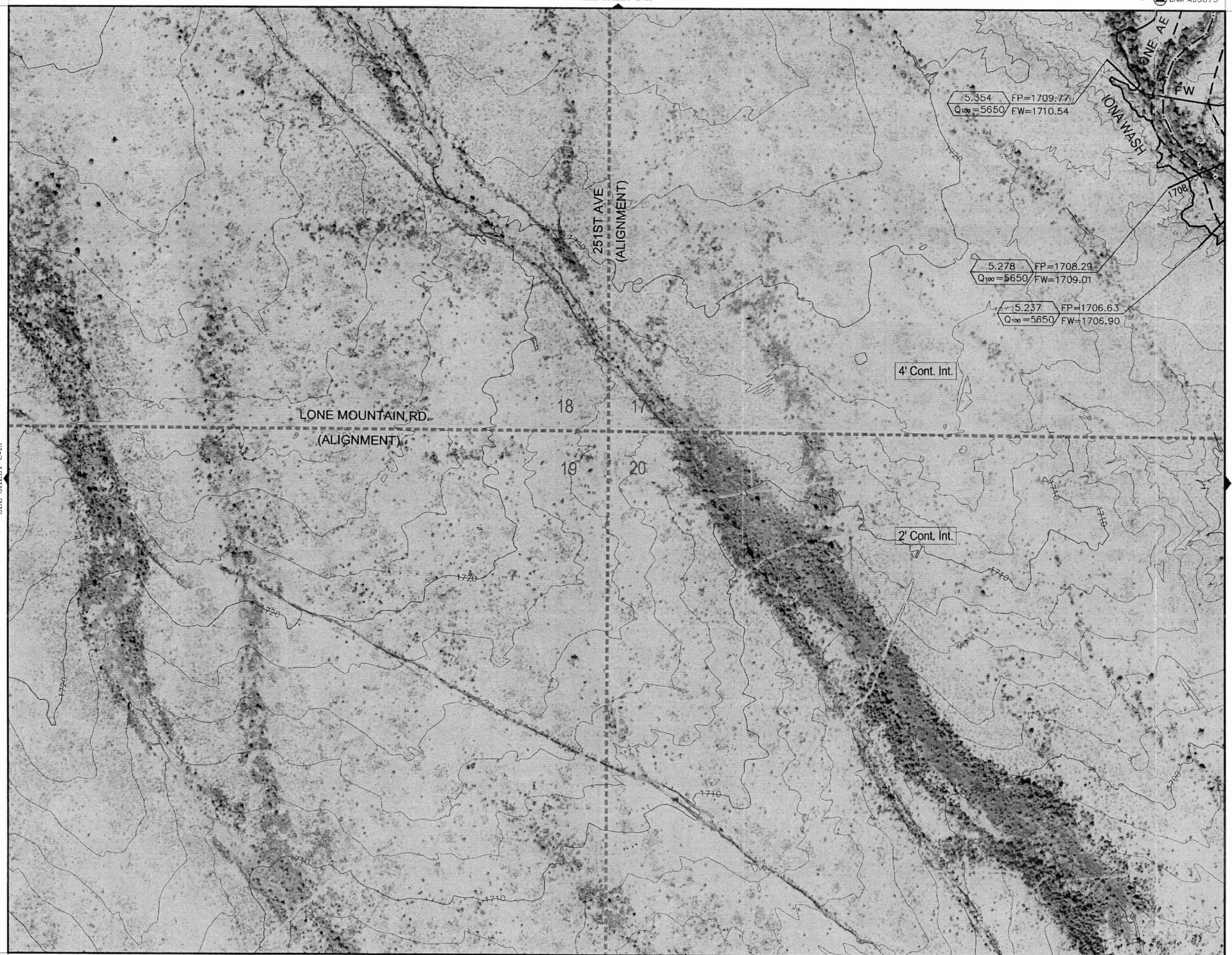
REFER TO WITTMANN A.D.M.S.U.
PERFORMED BY:
Entellus, Inc.
2255 North 44th Street, Suite 125
Phoenix, Az. 85008-3279

HYDRAULICS

Entellus, Inc.
2255 North 44th Street, Suite 125
Phoenix, Az. 85008-3279

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 3/3/2009 ARIZONA, U.S.A. Expires 03/31/2011

Entellus			2255 N. 44th Street Suite 125 Phoenix, AZ 85008-3279 Tel 602.244.2566 Fax 602.244.8947 WEB www.entellus.com
DESIGN	BY AMB	DATE 04/2009	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	FEB	04/2009	
PLANS	KAB	04/2009	RECOMMENDED BY: DATE
PLANS CHK.	FEB	04/2009	APPROVED BY: DATE
SUBMITTED BY: DATE:			CHIEF ENGINEER AND GENERAL MANAGER
			SHEET 1 OF 8



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)
HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 FP=1400.55 / Q100=1270 FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

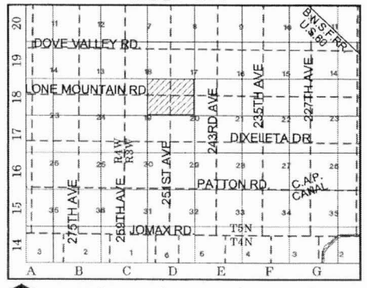
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 1.90 FEET = NAVD 88.

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 04/21/2009 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP



SCALE: 1" = 200'

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Fax 602.244.8947
WEB www.entellus.com

	BY	DATE
DESIGN	AMG	04/2009
DESIGN CHK.	FEB	04/2009
PLANS	KAB	04/2009
PLANS CHK.	AMG/FEB	04/2009

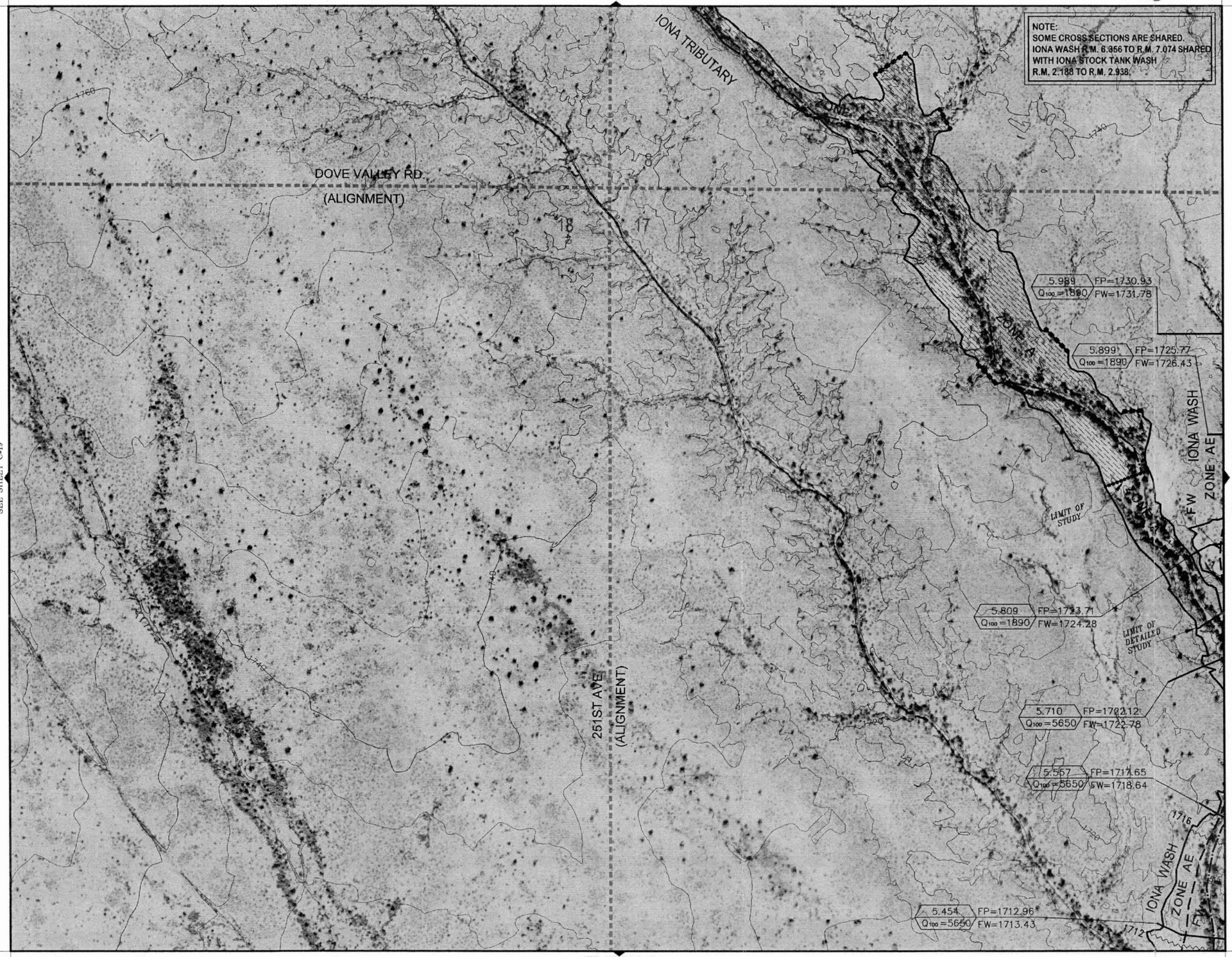
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY: DATE

SHEET D-18 OF FLOODPLAIN DELINEATION

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

FILE: P:\300\310\310041\Photo\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-D_18.dwg



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 — FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

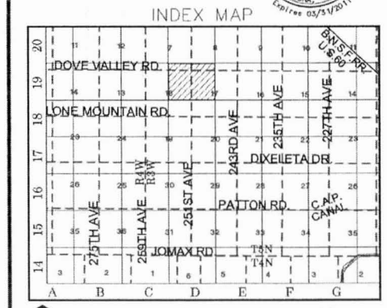
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 2.00 FEET = NAVD 88.

Registered Professional Engineer (Civil) CERTIFICATE NO. 23069 FRANK EDWARD BROWN 30 April 2009 ARIZONA U.S.A. Expires 03/31/2011

INDEX MAP



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WEB www.entellus.com

	BY	DATE	
DESIGN	AMG	04/2009	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	FEB	04/2009	RECOMMENDED BY: DATE
PLANS	KAB	04/2009	APPROVED BY: DATE
PLANS CHK.	AMG/FEB	04/2009	CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY:		DATE:	SHEET D-19 OF FLOODPLAIN DELINEATION

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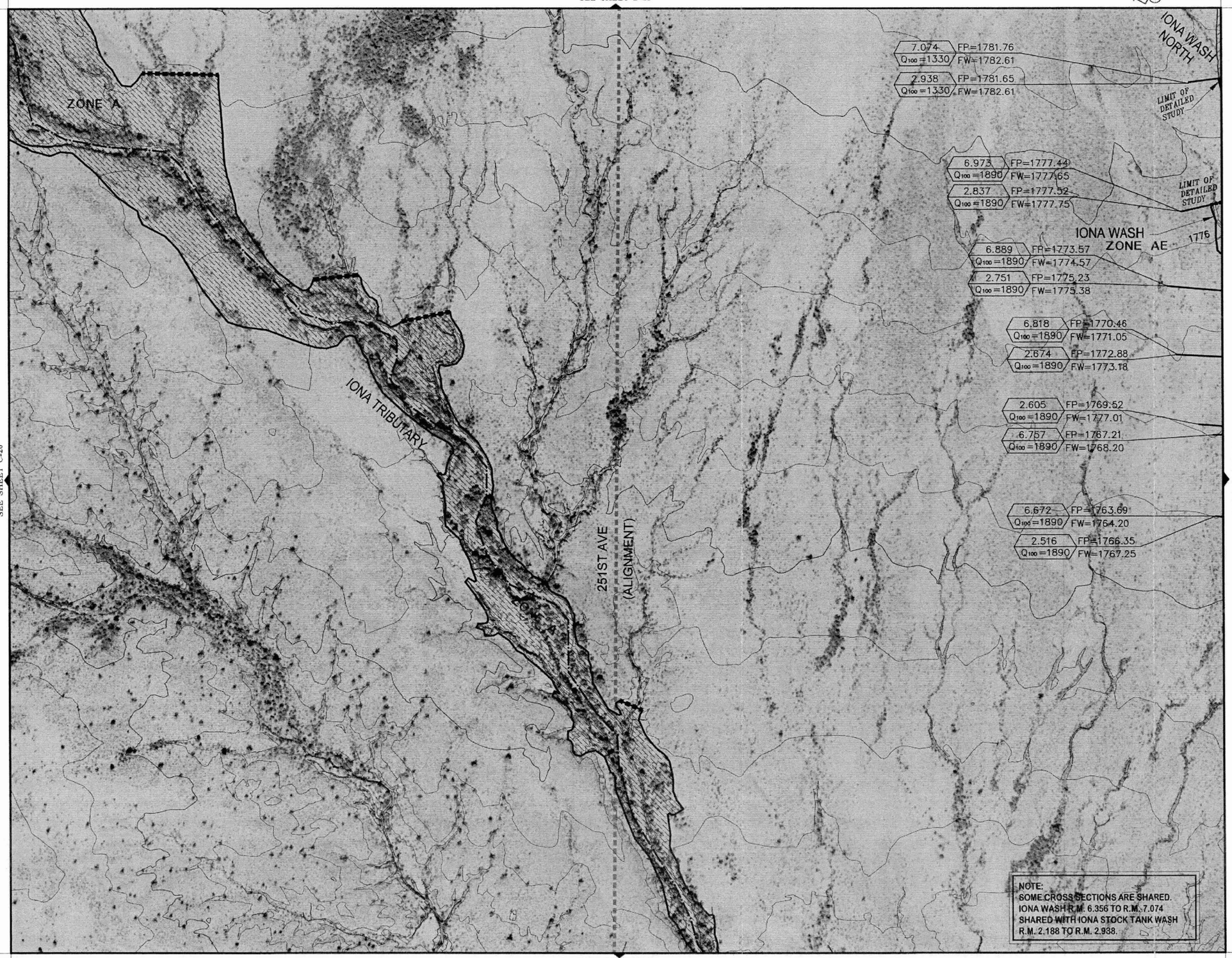
1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES



NOTE:
SOME CROSS SECTIONS ARE SHARED.
IONA WASH R.M. 6.356 TO R.M. 7.074
SHARED WITH IONA STOCK TANK WASH
R.M. 2.188 TO R.M. 2.938.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE
MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 FP=1400.55 / Q100 =1270 FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

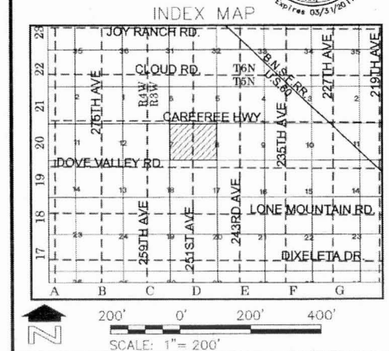
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3877		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 2.00 FEET = NAVD 88.

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 20 April 2009 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP



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	BY	DATE	
DESIGN	AMG	04/2009	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	FEB	04/2009	
PLANS	KAB	04/2009	RECOMMENDED BY: DATE
PLANS CHK.	AMG/FEB	04/2009	APPROVED BY: DATE
SUBMITTED BY: DATE:			CHIEF ENGINEER AND GENERAL MANAGER

SHEET D-20 OF FLOODPLAIN DELINEATION

FILE: P:\300\310\310041\GIS\ADWG\Iona_Wash_Delineation\SHEETS\310041-FP-D_20.dwg

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 FP=1400.55 Q100=1270 FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
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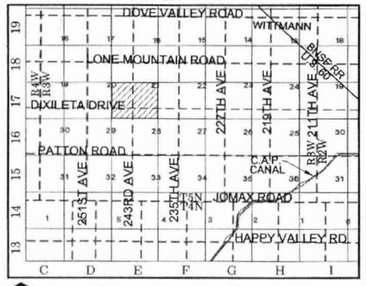
Registered Professional Engineer (Civil) CERTIFICATE NO. 23069 FRANK EDWARD BROWN 30 April 2009 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP



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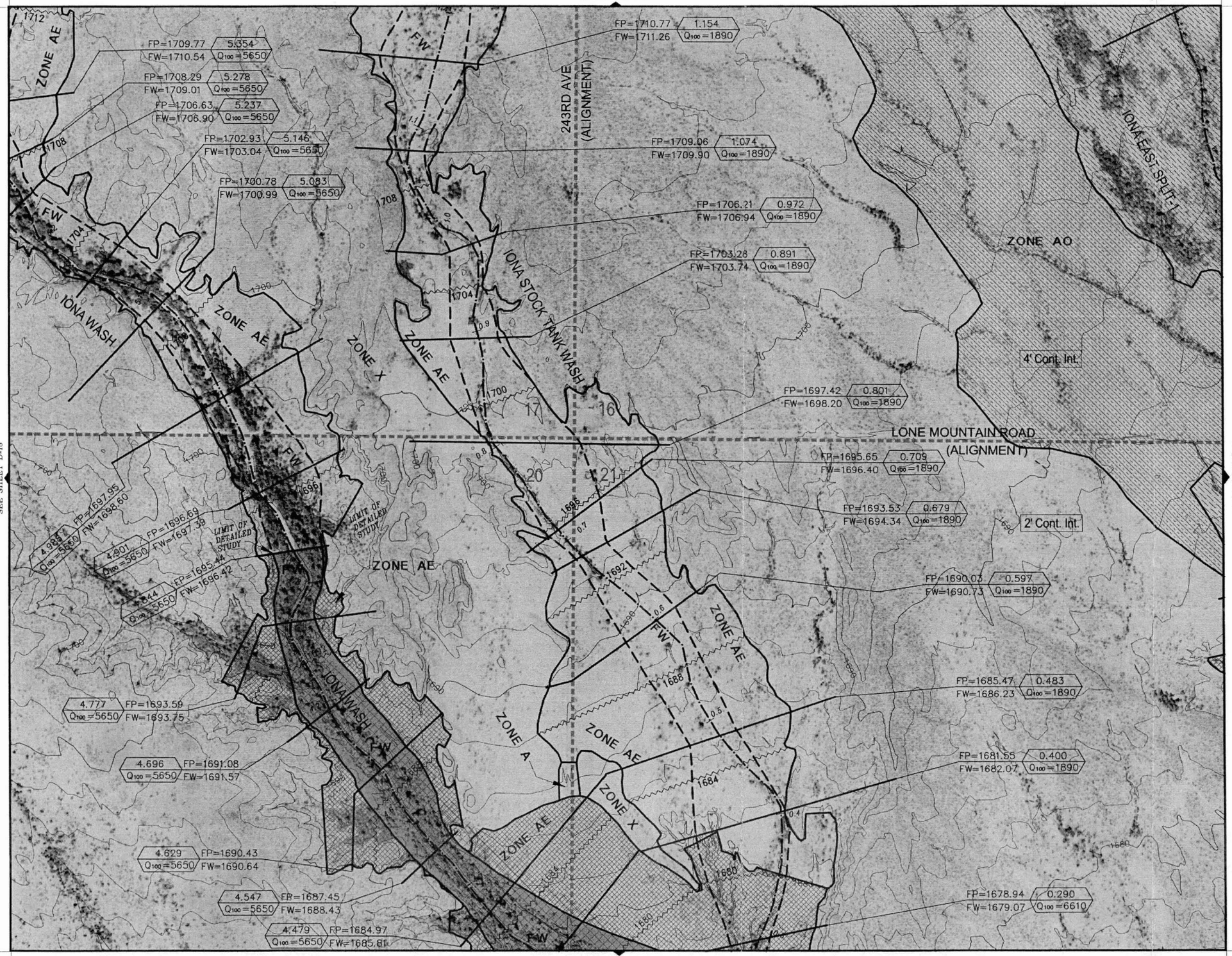
	BY	DATE	
DESIGN	AMG	04/2009	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	FEB	04/2009	RECOMMENDED BY: DATE
PLANS	KAB	04/2009	APPROVED BY: DATE
PLANS CHK.	AMG/FEB	04/2009	CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY:		DATE:	SHEET E-17 OF FLOODPLAIN DELINEATION

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

FILE: P:\500\310\310041\GIS\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-E_17.dwg



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE — 137
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 / FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

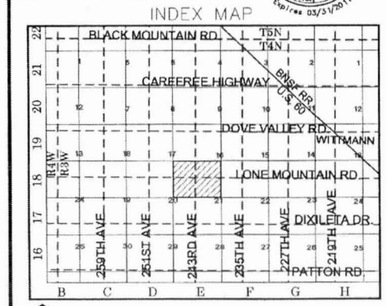
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 1.90 FEET = NAVD 88

Registered Professional Land Surveyor
Certificate No. 23959
FRANK EDWARD BROWN
Date Signed 04/23/2009
ARIZONA, U.S.A.
Expires 03/31/2011

INDEX MAP



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Tel 602.244.2566
Fax 602.244.8947
WEB www.entellus.com

	BY	DATE	
DESIGN	AMG	04/2009	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	FEB	04/2009	
PLANS	KAB	04/2009	RECOMMENDED BY: DATE
PLANS CHK.	AMG/FEB	04/2009	APPROVED BY: DATE
SUBMITTED BY:		DATE:	CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-18 OF FLOODPLAIN DELINEATION

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

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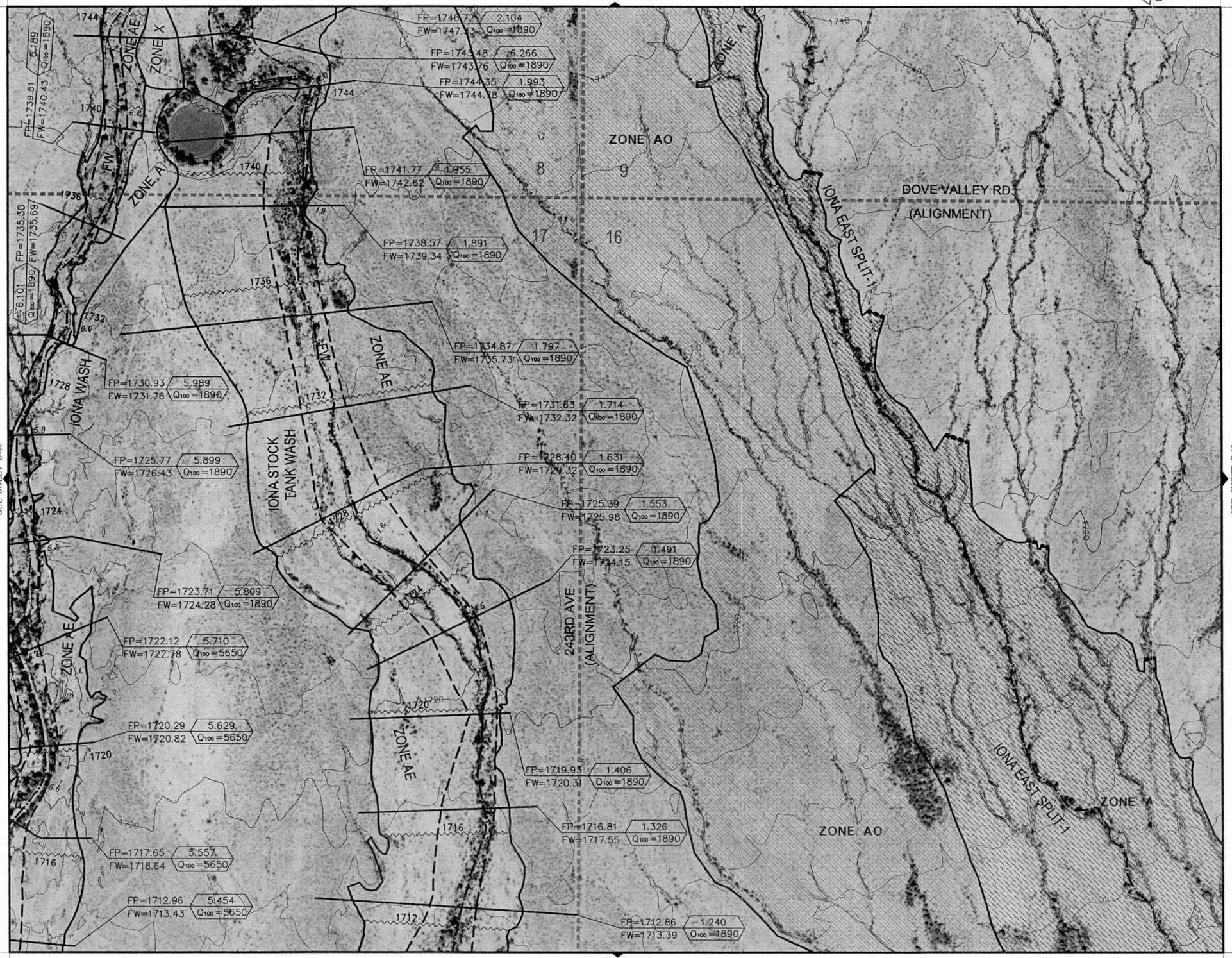

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 / FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

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NOTE:
1. NGVD 29 + 2.00 FEET = NAVD 88

Registered Professional Engineer (Civil) CERTIFICATE NO. 23060 FRANK EDWARD BROWN Date Signed 30 APRIL 2009 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP

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DESIGN	AMG	04/2009
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PLANS CHK.	AMG/FEB	04/2009
SUBMITTED BY:		DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-19 OF FLOODPLAIN DELINEATION

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02). 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

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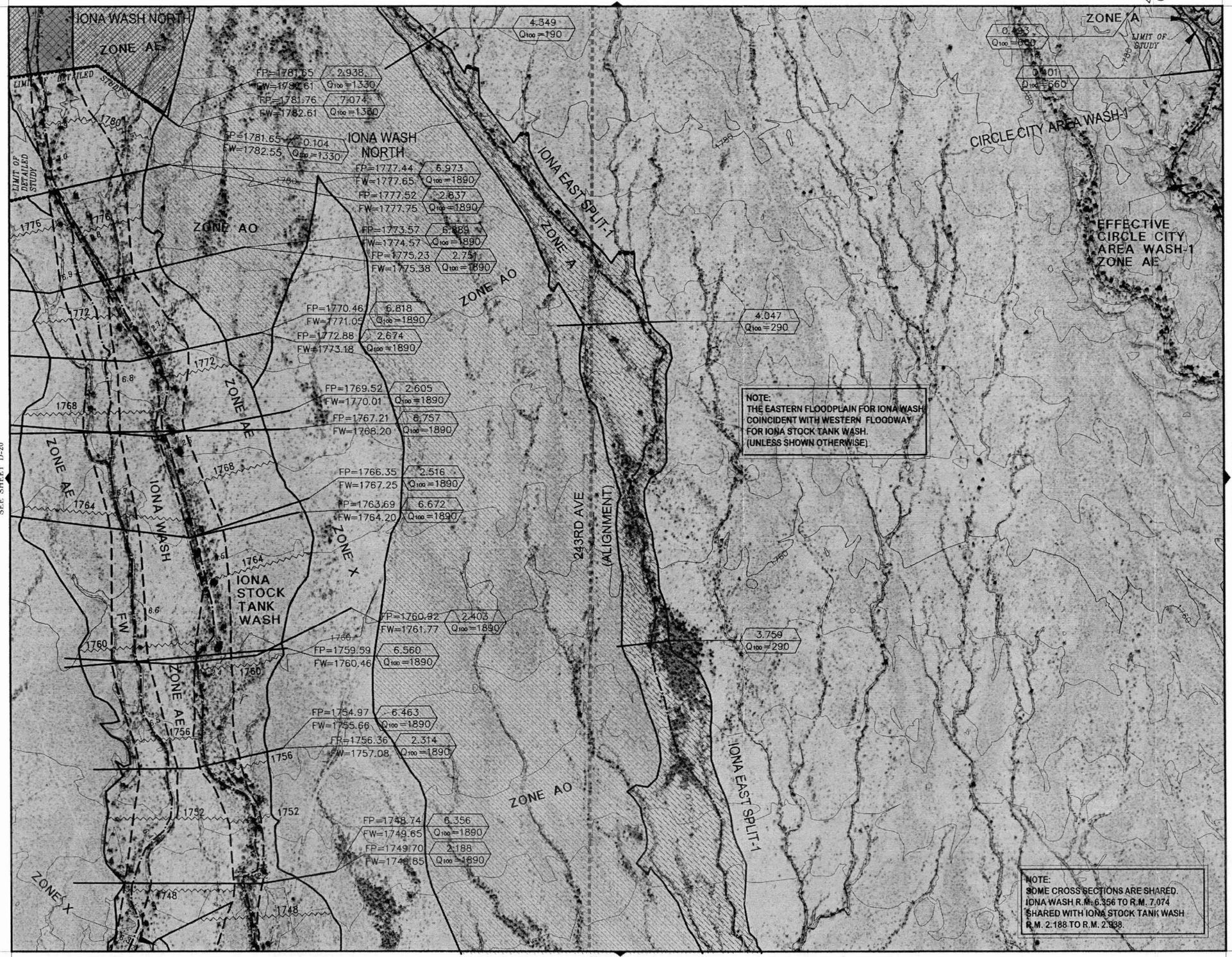

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 — FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
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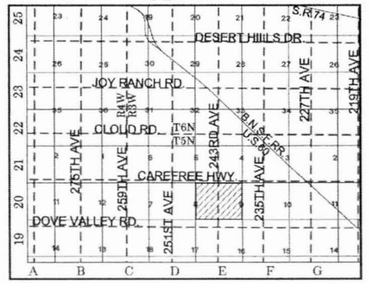
INDEX MAP



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SHEET E-20 OF FLOODPLAIN DELINEATION

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Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: July 17, 2009

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

From: Kathryn Gross, CFM, Planning and Project Management Division

Subject: Wittmann Area Drainage Master Plan Update: Iona Wash Floodplain Delineation Study – Lone Mountain Road to Carefree Highway TDN (FCD 2004C060)

The floodplain delineation study of Iona Wash between Lone Mountain Road and Carefree Highway is ready for use as the best available technical information. The study will be sent to FEMA for review once coordination with the City of Surprise is complete. Prior to submitting the study, you will be provided with the FEMA forms for your signature.

The background on the study includes the following:

The study used hydrology developed under the Wittmann Area Drainage Master Study Update (WADMSU). The purpose of the study was to update a portion of the original Iona Wash delineation that was not updated under the WADMSU floodplain delineations. The study resulted in approximately 2 miles of updated detailed Zone AE floodplain/floodway along Iona Wash and approximately 2.5 new miles of detailed Zone AE floodplain along Iona Stock Tank Wash. The topographic basis for the study is the 2-foot and 4-foot contour interval mapping in NAVD88 vertical datum, by Landata Airborne Systems Inc., flown in December of 2002. Entellus performed the delineation. The District's project manager is Greg Jones, P.E. and the floodplain reviewer was Kathryn Gross. Please concur and authorize below the use of this new study.

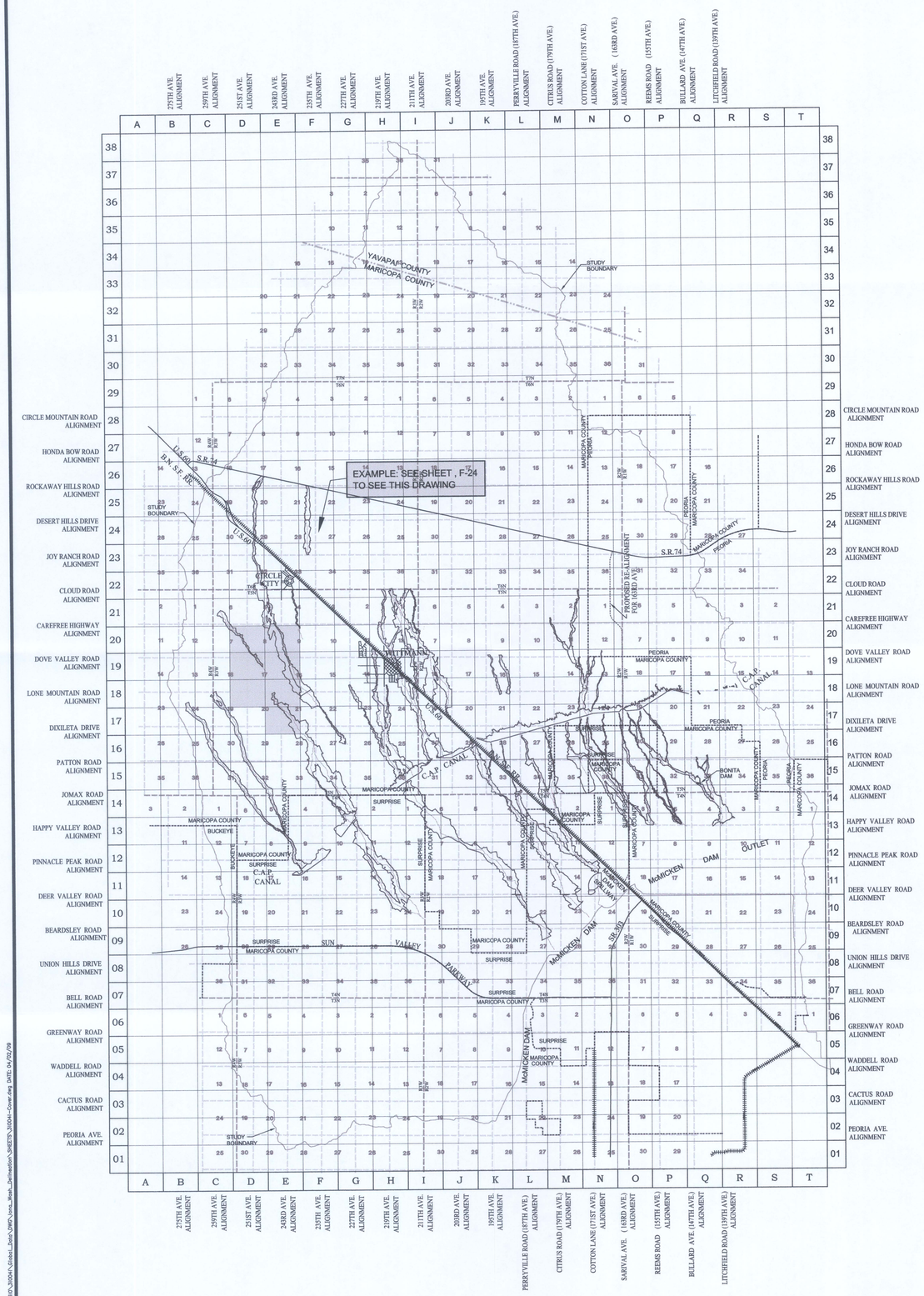
Project Manager Date: 8/6/09	Timothy S. Phillips, P.E. Chief Engineer and General Manager Date: 8/13/09
Flood Delineation Branch Manager Date: 7/20/09	Floodplain Delineation Reviewer Date: 7/17/09
PPM Division Manager Date: 8/10/09	FMS Division Manager Date: 7/21/09
Engineering Division Manager Date: 8/12/09	Hydrology/Hydraulics Branch Manager Date: 8/11/09
File Copies: 1. _____ 2. _____	YES ☐ GIS Posted (Pending Floodplain Only) Date: N/A ☐ No County Permits in this area Date:

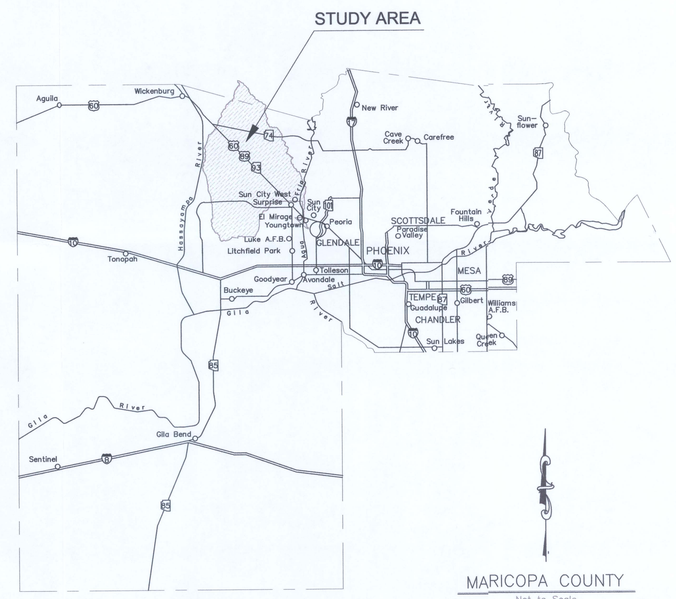
2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN ROAD TO CAREFREE HIGHWAY
CONTRACT F.C.D. 2004C060





LOCATION MAP

MARICOPA COUNTY
Not to Scale

AERIAL MAPPING

NOT A PART OF THIS CONTRACT.
SUPPLIED BY THE FLOOD CONTROL DISTRICT.
CONTRACT F.C.D. 2001C021

HYDROLOGY

REFER TO WITTMANN A.D.M.S.U.
PERFORMED BY:
Entellus, Inc.
2255 North 44th Street, Suite 125
Phoenix, Az. 85008-3279

HYDRAULICS

Entellus, Inc.
2255 North 44th Street, Suite 125
Phoenix, Az. 85008-3279

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN 30 April 2009 Signed ARIZONA, U.S.A. Expires 03/31/2011

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SUBMITTED BY: DATE:			CHIEF ENGINEER AND GENERAL MANAGER
			SHEET 1 OF 8

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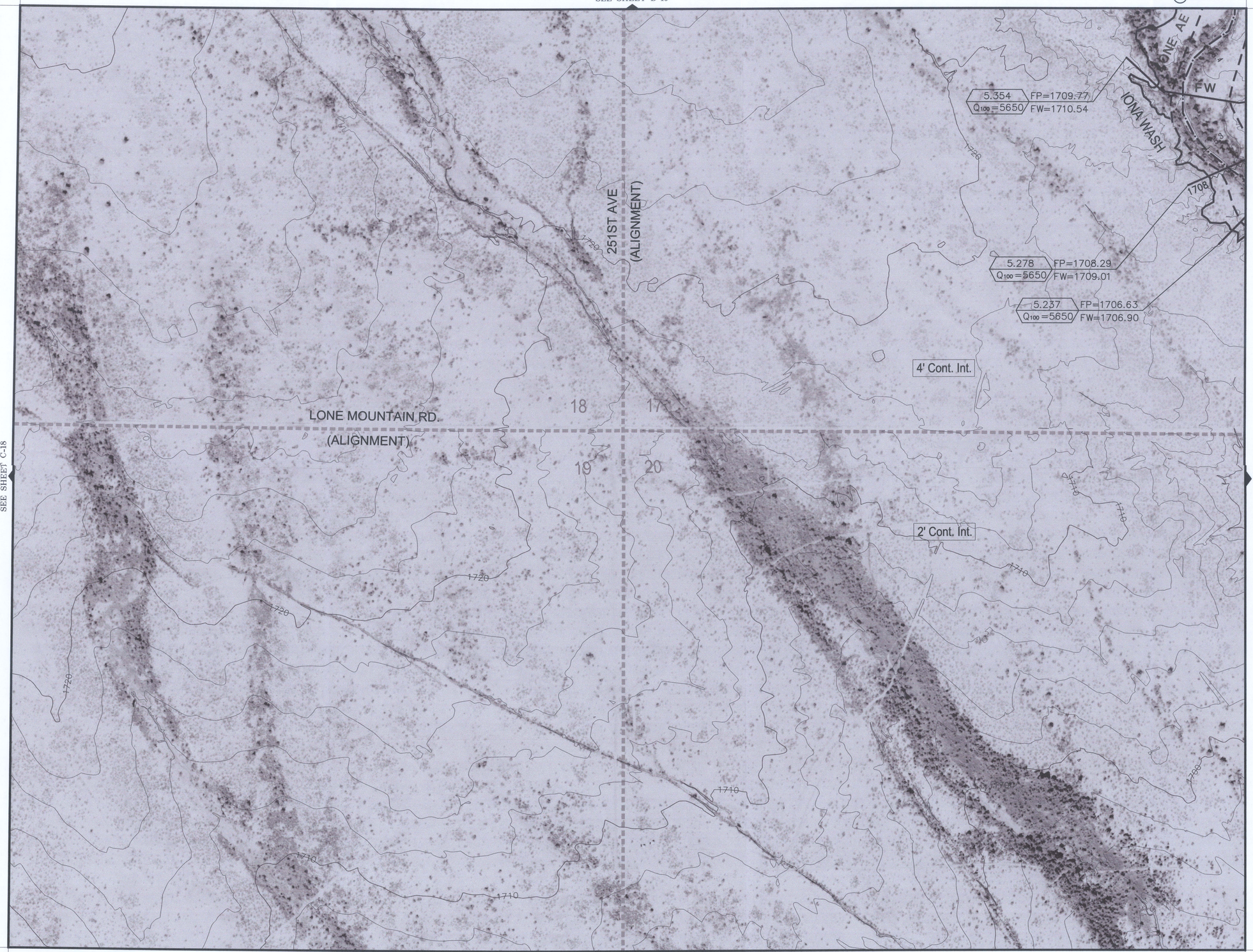

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)
HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 FP=1400.55 Q100=1270 FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

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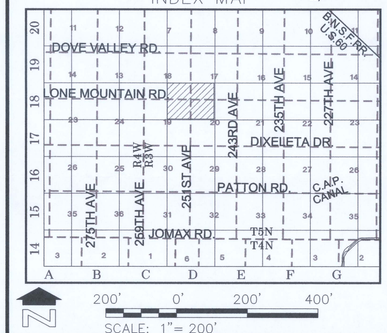
INDEX MAP



200' 0' 200' 400'
SCALE: 1" = 200'

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SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET D-18 OF FLOODPLAIN DELINEATION

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1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

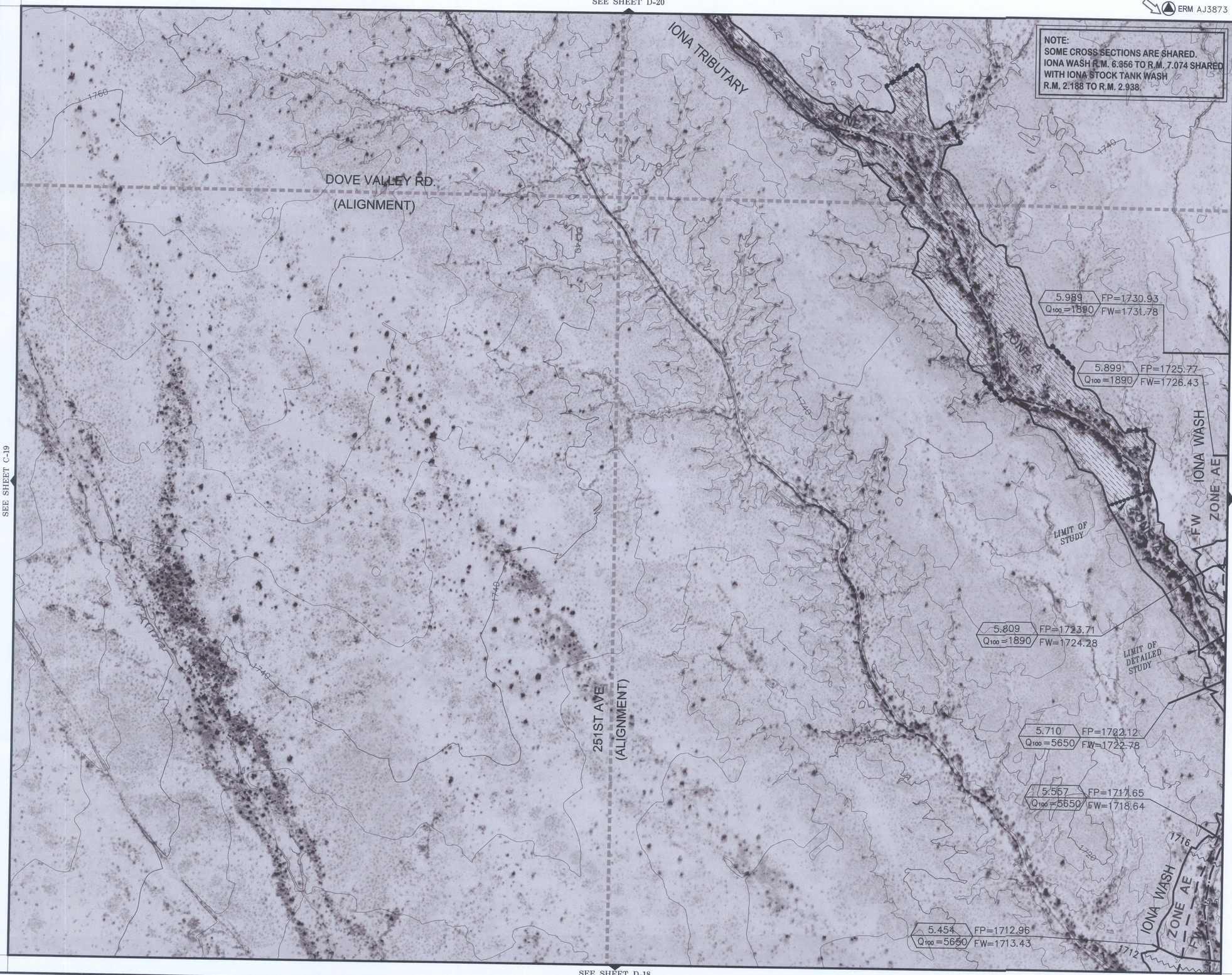
SEE SHEET D-20

ERM AJ3873

SEE SHEET C-19

SEE SHEET E-19

SEE SHEET D-18



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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE

CONTRACT FCD 2004C060

IONA WASH FLOODPLAIN DELINEATION

LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A	PENDING ZONE A	ZONE A
EFFECTIVE ZONE AE	PENDING ZONE AE	ZONE AH
EFFECTIVE ZONE AH	PENDING ZONE AH	ZONE AE
EFFECTIVE FLOODWAY	PENDING FLOODWAY	FLOODWAY (FW)
	PENDING ZONE AO	

HYDRAULIC BASE LINE — B-1

ZONE DESIGNATION — ZONE A

WASH I.D. LABEL — WASH 9 EAST

ELEVATION REFERENCE MARK — ERM AJ3866

CROSS SECTION — 2.199 (Q100=1270) FP=1400.55 FW=1400.56

BASE FLOOD ELEVATION — 1320

DIKE / LEVEE — DIKE

COUNTY BOUNDARY

CORPORATE LIMIT

LIMIT OF STUDY

LIMIT OF DETAILED STUDY

TOWNSHIP/RANGE LINE

SECTION LINE

SECTION NUMBER — 29

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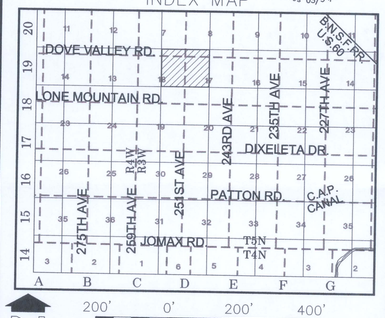

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CHIEF ENGINEER AND GENERAL MANAGER

SHEET D-19 OF FLOODPLAIN DELINEATION

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

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EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE — B-1
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AJ3877		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

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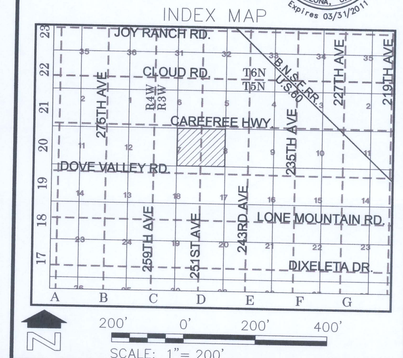
INDEX MAP



N
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SCALE: 1"= 200'

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SUBMITTED BY: DATE:			CHIEF ENGINEER AND GENERAL MANAGER
			SHEET D-20 OF FLOODPLAIN DELINEATION

FILE: P:\300\310\310041\Global_Data\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-D_20.dwg DATE: 04/03/09

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

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EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
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PENDING ZONE AE
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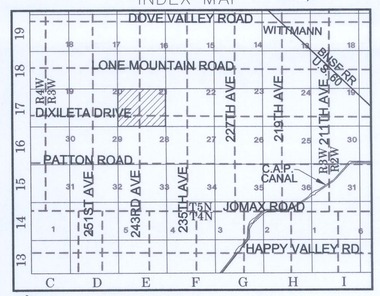

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SCALE: 1" = 200'

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PLANS	KAB	04/2009
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SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-17 OF FLOODPLAIN DELINEATION

FILE: P:\300\310\310041\Global_Data\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-E_17.dwg

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 — FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

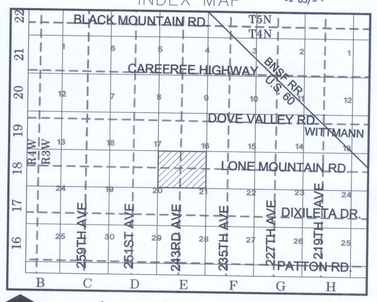
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 1.90 FEET = NAVD 88.

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 3/31/09 ARIZONA, U.S.A. Expires 03/31/2011

INDEX MAP



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Tel 602.244.2566
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	BY	DATE
DESIGN	AMG	04/2009
DESIGN CHK.	FEB	04/2009
PLANS	KAB	04/2009
PLANS CHK.	AMG/FEB	04/2009

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-18 OF FLOODPLAIN DELINEATION

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

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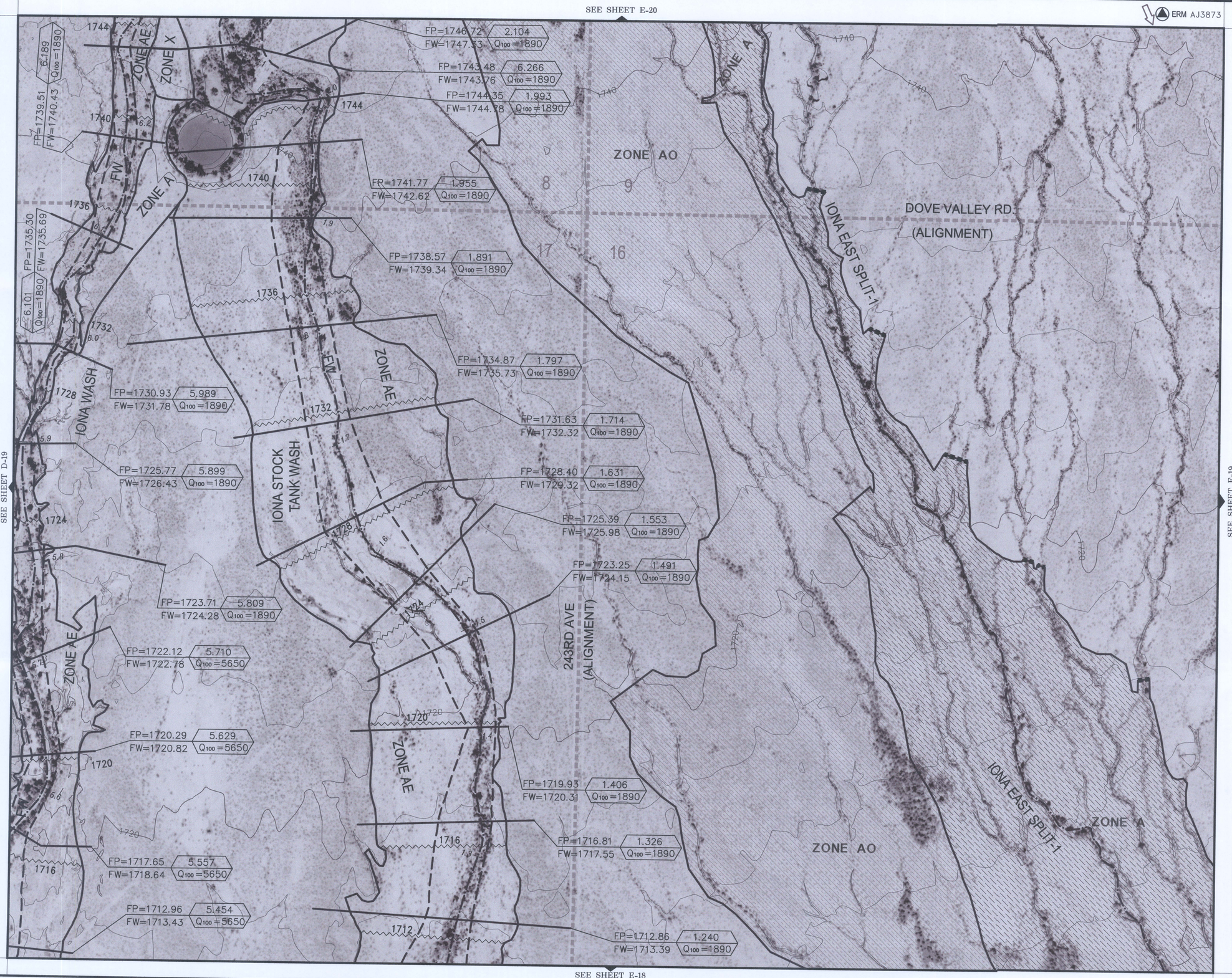


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

HYDRAULIC BASE LINE
ZONE DESIGNATION — ZONE A
WASH I.D. LABEL — WASH 9 EAST
ELEVATION REFERENCE MARK — ERM AJ3866
CROSS SECTION — 2.199 / Q100=1270 / FP=1400.55 / FW=1400.56
BASE FLOOD ELEVATION — 1320
DIKE / LEVEE — DIKE
COUNTY BOUNDARY
CORPORATE LIMIT
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
SECTION NUMBER — 29

ELEVATION REFERENCE MARKS

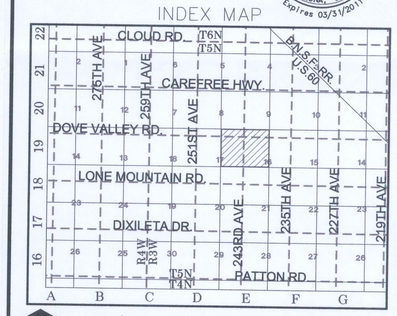
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
AJ3873		NOTE: FOR ERM DESCRIPTION AND ELEVATIONS GO TO THE NATIONAL GEODETIC SURVEY WEB SITE, WWW.NGS.NOAA.GOV

NOTE:
1. NGVD 29 + 2.00 FEET = NAVD 88.

Registered Professional Engineer (Civil) — Certificate No. 22969 — FRANK EDWARD BROWN — Date Signed 30 April 2009 — ARIZONA, U.S.A. — Expires 03/31/2011

INDEX MAP



N
200' 0' 200' 400'
SCALE: 1"= 200'

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	BY	DATE
DESIGN	AMG	04/2009
DESIGN CHK.	FEB	04/2009
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PLANS CHK.	AMG/FEB	04/2009
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

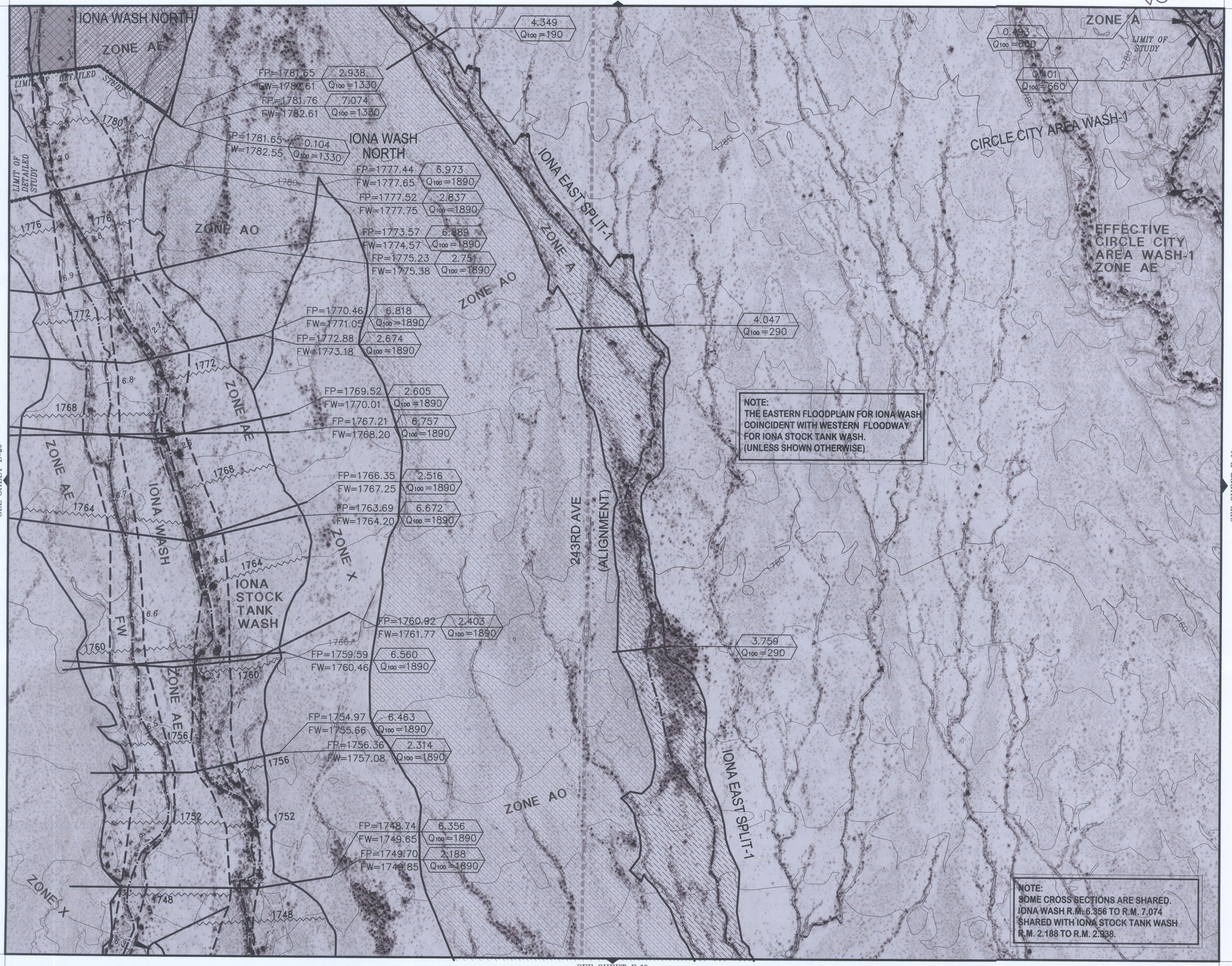
SHEET E-19 OF FLOODPLAIN DELINEATION

FILE: P:\300\310\310041\Global_Data\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-E_19.dwg

1" = 600' (1:7200) FLIGHT DATES: (04/18/02), (04/19/02), (04/23/02), 1"=1200' (1:14400) (04/23/02) BY: STEWART GEO TECHNOLOGIES

SEE SHEET E-21

ERM AJ3873



SEE SHEET D-20

SEE SHEET F-20

SEE SHEET E-19

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WITTMANN AREA DRAINAGE MASTER PLAN UPDATE
CONTRACT FCD 2004C060
IONA WASH FLOODPLAIN DELINEATION
LONE MOUNTAIN TO CAREFREE HIGHWAY

LEGEND

EFFECTIVE ZONE A
EFFECTIVE ZONE AE
EFFECTIVE ZONE AH
EFFECTIVE FLOODWAY
PENDING ZONE A
PENDING ZONE AE
PENDING ZONE AH
PENDING FLOODWAY
PENDING ZONE AO
ZONE A
ZONE AH
ZONE AE
FLOODWAY (FW)

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LIMIT OF STUDY
LIMIT OF DETAILED STUDY
TOWNSHIP/RANGE LINE
SECTION LINE
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ELEVATION REFERENCE MARKS

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I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
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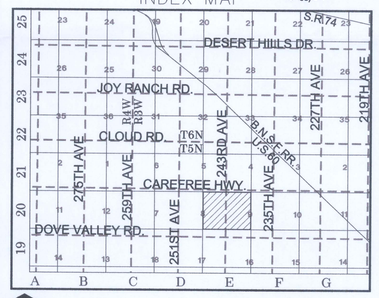

200' 0' 200' 400'
SCALE: 1" = 200'

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DESIGN CHK.	FEB	04/2009
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PLANS CHK.	AMG/FEB	04/2009
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
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CHIEF ENGINEER AND GENERAL MANAGER

SHEET E-20 OF FLOODPLAIN DELINEATION

FILE: P:\300\310\310041\Global_Data\DWG\Iona_Wash_Delineation\SHEETS\310041-FP-E_20.dwg DATE:

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