

International Boundary and Water Commission United States Section

Upper Brownsville Levee Rehabilitation Cameron Counties, Texas

Contract No. IBM09D0006

Order No. IBM11T0002

Design Report Final Design Submittal



May 2012



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**Upper Brownsville Levee Rehabilitation
Cameron Counties, Texas**

**Design Report
Final Design Submittal**

**Prepared for:
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United States Section
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1. Purpose of Project

The United States Section of the International Boundary and Water Commission (USIBWC) operates and maintains the approximately 65-mile Donna Pump to Brownsville levee, which is part of the Lower Rio Grande Flood Control Project (LRGFCP) levee system, located in Hidalgo and Cameron Counties, Texas. The existing levee system was designed to protect the existing farmlands and commercial/residential buildings against the 100-year flood event. The 2006 Federal Emergency Management Agency's (FEMA) decertification of the levee system has resulted in public and local government pressure to upgrade the levees to meet the certification requirements of National Flood Insurance Program (NFIP) regulations (44 CFR 65.10). The USIBWC contracted with Tetra Tech to provide engineering services to prepare levee rehabilitation improvement design and construction documents for the Donna Pump to Brownsville levee project.

As part of the effort to design rehabilitation improvements for the levee to meet the FEMA levee certification requirements for the Donna Pump to Brownsville levee system, Tetra Tech completed the following:

- Review of a detailed field inspection (performed by USIBWC operation and maintenance [O&M] crews)
- Review of all previous reports and studies
- Visual inspection of the existing gatewell structures (approximately 284)
- Geotechnical investigations and analyses
- Field surveys of the levee centerline and right-of-way (ROW) mapping

The minimum freeboard elevations were provided by USIBWC, and minor hydraulic analysis was performed. According to the minimum top of levee spreadsheet, the water surface elevation is 3 feet below the minimum freeboard elevations. The levee rehabilitation will raise the existing levee to a minimum elevation determined by USIBWC. The side slopes of the levee will be cleared of all vegetation with a stem or trunk greater than ½-inch diameter. All levee side slopes that are disturbed during vegetation removal or affected by grading will be reseeded to establish ground cover. On the riverside, the maximum levee side slope will be 3H:1V (horizontal to vertical); on the landside, it will vary between 3H:1V and 2.5H:1V. The top of the levee will be reconstructed to provide a minimum width of 16 feet in most locations, with 6 inches of flexible material (caliche based) on the roadway surface. USIBWC requested that Tetra Tech identify areas where the landside horizontal width is less than 15 feet wide. In these identified areas, USIBWC has determined that the side slopes may be graded at 2.5:1 to maximize the horizontal width.

The design work was utilized in the preparation of plans, specifications, and an engineer's estimate of probable cost to rehabilitate the levee to withstand the 1-percent-annual-chance level flood (100-year flood) and address design related criteria of the FEMA levee certification requirements (44 CFR 65.10).

This project covers the approximately 65-mile Donna Pump to Brownsville reach of the LRGFCP levee system, extending 16 miles and 49 miles within Hidalgo County and Cameron County, respectively (Figure 1.1). For planning purposes, the reach has been divided into five sub-reaches. The proposed levee rehabilitation investigation and design described in this report relate to the Upper Brownsville Levee Rehabilitation (Sub-Reach 4), which extends approximately 12 miles within Cameron County (Figure 1.2).

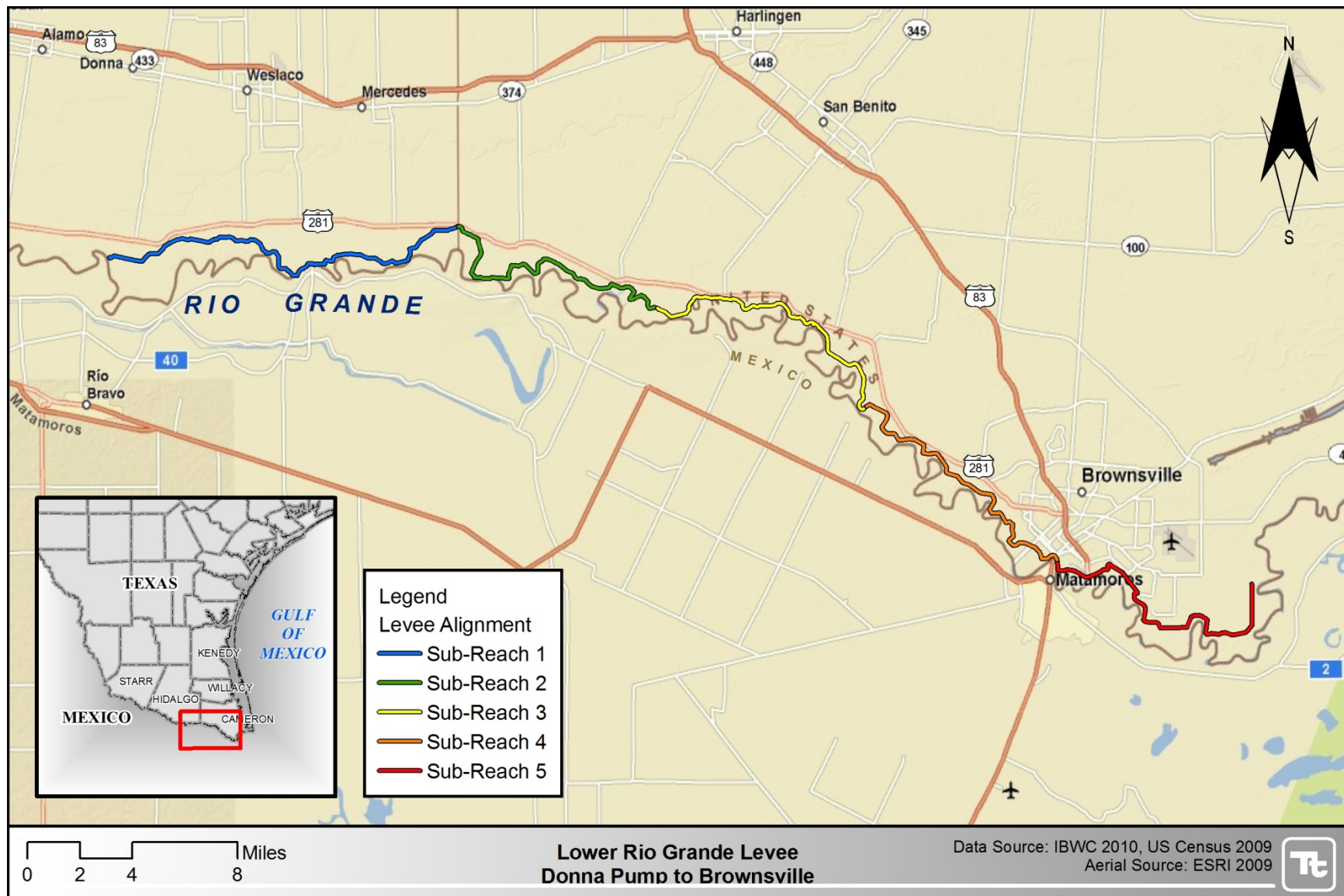


Figure 1.1 – Location Map (Donna Pump to Brownsville Levee System)

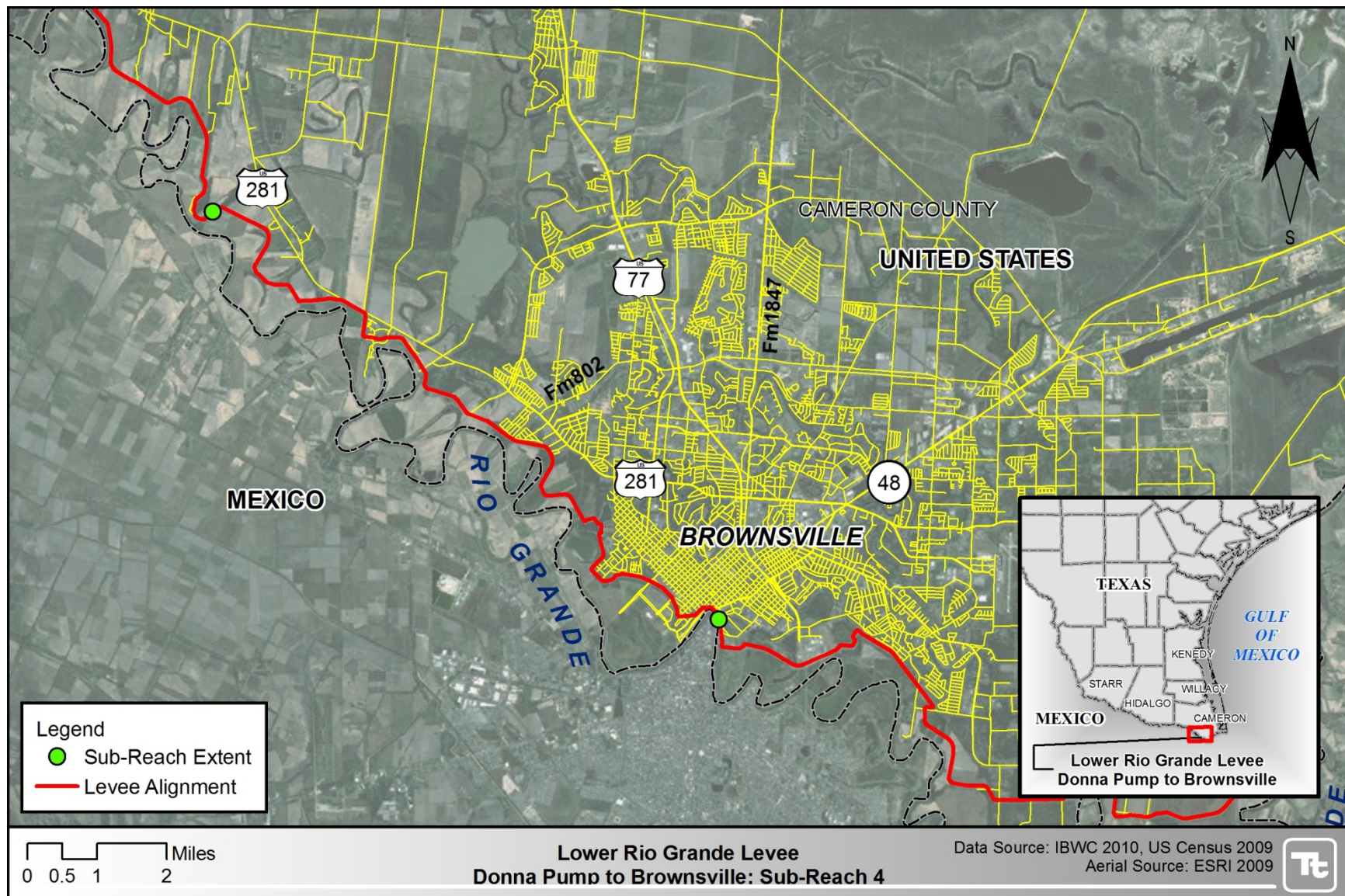


Figure 1.2 – Location Map Upper Brownsville Levee Rehabilitation (Sub-Reach 4)

2. Review of Previous Reports and Studies

2.1 Environmental Assessment

USIBWC completed an environmental assessment (EA) in September 2007 (USIBWC 2007). The proposed project evaluated in the EA would increase the flood containment capacity of the Donna Pump to Brownsville levee system by raising the elevation of a number of levee segments to meet a 3-foot freeboard design criterion for flood protection. Height increases of up to 2 feet were proposed to satisfy the design freeboard requirement. The increase in levee height would result in an expansion of the levee footprint due to lateral extension of the structure. Structural improvements may be required for some levee segments where seepage is a potential problem.

A memorandum submitted to USIBWC documents Tetra Tech's understanding of and assumptions about the 2007 EA (Tetra Tech 2011c). The following assumptions have been incorporated into the design of the Donna Pump to Brownsville levee system:

- The levee is centered in the 160-foot-wide survey corridor.
- The levee footprint can be expanded on one side by 24 feet with an additional 15 feet allowed for clearing and grading of the service area. This expansion can occur on either the landside or riverside of the levee.
- Any proposed expansion of the levee footprint would be located on the landside, except where expansion on the landside is constrained by permanent fencing, canals, and/or ROW, in which case expansion on the riverside would be required.
- The proposed subsurface seepage improvement to include toe drains on the landside of the levee is currently being refined and incorporated in the design plans.
- Per FEMA and U.S. Army Corp of Engineers (USACE) requirements for levee certification, the design of the levee system will include a minimum vegetation-free zone of 15 feet from the levee toe or to ROW on the landside and riverside.
- The proposed vegetation removal within the levee expansion corridor has been evaluated and accepted by USIBWC.
- Ongoing Section 106 consultation with the Texas Historical Commission will be performed by USIBWC.

All levee improvements are anticipated to be within the 160-foot-wide survey corridor as indicated in the EA. The Texas Historical Commission has requested that preliminary plans be submitted for its review as part of the Section 106 consultation.

2.2 Surveying and Mapping

Melden & Hunt, Inc., conducted field surveys along the project levee in January 2011. Existing drainage features, ROW markers, and centerline survey markers were surveyed. The existing ROW markers were verified and, if needed, missing markers will be reestablished based on the recorded ROW. New ROW markers will be installed per USIBWC guidelines.

A survey control plan will be prepared to be included in the design plans to include levee alignment, levee stationing, ROW information, and survey control points.

The horizontal control for the surveying and mapping was established based on the Texas State Plane Central North American Datum of 1983 (NAD83) in feet, and the vertical control was established based on the North American Vertical Datum of 1988 (NAVD88) in feet.

2.3 Survey Control Lines

For the levee remediation design, the existing levee centerline and stationing were obtained from USIBWC survey field books and field survey verification. Design features and existing facilities that are part of this project will be located in the field during construction, based on their positioning relative to the levee centerline.

The existing centerline alignment indicated in the USIBWC survey field books differs from the alignment indicated by the field centerline markers. As a result of research and investigation, an alignment was compiled using the survey field book data and the field survey to correct the field book centerline alignment. The corrected centerline alignment is within the top of the levee. The revised centerline alignment and the stationing are different from those shown in the original survey field books. There is no direct correlation between the USIBWC field book centerline stationing and the as-built plans. There are currently two separate stationings listed in the USIBWC survey field books. From information obtained in response to request for information (RFI) No. 2, it was determined that because of the discrepancies in the USIBWC survey field books, a new survey control line stationing will be used. The first survey control stationing is from Donna Pump to the Hidalgo and Cameron County line, and the second is from the county line to the end of the levee. The following is a summary of the survey control line stationing from Donna Pump to Brownsville.

Table 2.1 – Survey Control Line Summary

Design Sub-Reach	Location	Begin Station	End Station
1	Hidalgo County	1+00.00	0+43.03
2	Cameron County	0+43.03	635+50.41
3	Cameron County	635+50.41	1270+72.00
4	Cameron County	1270+72.00	1904+85.12
5	Cameron County	1904+85.12	2566+63.04

2.4 Right-of-Way

The ROW documents, which were provided by USIBWC, were used to prepare a map for use in the design. The surveyor used this information to re-establish ROW markers in the field if they are missing. The existing levee was verified to be within the existing ROW. Rehabilitation of the levee will be conducted within the existing levee ROW except for locations indicated in Table 2.2.

Table 2.2 – Rehabilitation outside Existing Levee Right-of-Way

Begin Station	End Station	Private Property Owner
1763+00	1765+00	Geo ID: 71-1330-1330-0000-00 BROWNSVILLE PUBLIC UTILITIES BOARD PO Box 3270 Brownsville, TX 78523-3270
1795+00	1802+00	Geo ID: 07-9800-2080-0015-00 EL SABINO INC. 5805 N Laguna Circle South Padre Island, TX 8597-7608 Geo ID: 76-0020-0100-0100-01 LEGGETT VICKI MICHELLE WATERS IND EXCRX ESTATE OF WALT O. WATERS RR 1 Box 688A Harlingen, TX 78552-9689
1862+00	1866+00	Geo ID: 76-0020-0100-0100-01 LEGGETT VICKI MICHELLE WATERS IND EXCRX ESTATE OF WALT O. WATERS RR 1 Box 688A Harlingen, TX 78552-9689

By overlaying the ROW on an aerial photograph, it was determined that several property owners have existing structures within the ROW. These existing structures have been identified and submitted to USIBWC, Real Estate Department. The existing structures within the ROW are summarized in Table 2.3; exhibits depicting existing structures within USIBWC ROW are provided in Appendix A.

On May 16, 2012, USIBWC has noted to Tetra Tech that temporary easement to construct riprap along river sideslope (Design Station 1885+10.00 to 1898+00.00) has been obtained (R.O.W.661C and R.O.W. 662C).

Table 2.3 – Existing Structures within USIBWC Right-of-Way

Approximate Levee Design Station	Owner Contact Information
1327+00	Geo ID: 79-0110-0800-0901-00 Prop ID: 160358 DIAZ MARIA HILARIA CAVAZOS 24 Holly Lane Brownsville, TX 78520-8320
1319+00	Geo ID: 79-0110-0800-0020-00 Prop ID: 160330 DIAZ MARIA HILARIA CAVAZOS 24 Holly Lane Brownsville, TX 78520-8320
1749+00	Geo ID: 71-1330-1330-0000-00 Prop ID: 116215 BROWNSVILLE PUBLIC UTILITIES BOARD PO Box 3270 Brownsville, TX 78523-3270
1831+00 to 1864+00	<p>Geo ID: 01-0000-0080-0081-00 Prop ID: 27431 NOPHAL EDGAR JR. 175 Duval Street Brownsville, TX 78526-4087</p> <p>Geo ID: 01-0000-0090-0111-00 Prop ID: 27445 STUART JERRY R. 2519 Maple Springs Dallas, TX 75235</p> <p>Geo ID: 01-0000-0090-0081-00 Prop ID: 27440 LAURIN ROSARIO T. 5566 Windridge Drive Cincinnati, OH 45248-1743</p> <p>Geo ID: 01-0000-0090-0110-00 Prop ID: 27444 YBARRA MIGUEL c/o Jerry or Maria L. Stuart 2519 Maples Springs Dallas, TX 75235-8225</p> <p>Geo ID: 01-0000-0090-0080-00 Prop ID: 27439 HERNANDEZ JESUS 208 D Street Brownsville, TX 78520-4128</p>

Table 2.3 – Existing Structures within USIBWC Right-of-Way (Continued)

Approximate Levee Design Station	Owner Contact Information
1831+00 to 1864+00 (Continued)	Geo ID: 01-0000-0080-0820-00 NO OWNER INFORMATION
	Geo ID: 01-0000-0060-0080-00 Prop ID: 27417 MARTINEZ ELVIA GLORIA 514 D Street Brownsville, TX 78520
	Geo ID: 01-0000-0090-0070-00 Prop ID: 27438 LAURIN ROSARIO T. 5566 Windridge Drive Cincinnati, OH 45248-1743
	Geo ID: 01-0000-0060-0090-00 Prop ID: 27418 GARZA ANTONIO 414 D Street Brownsville, TX 78520-4130
	Geo ID: 01-0000-0090-0120-00 Prop ID: 27446 RAMIREZ JOSE DE JESUS & TERESA M. 254 D Street Brownsville, TX 78520-4128
	Geo ID: 01-0000-0080-0070-00 Prop ID: 27430 YBARRA FRANCISCO N. ET UX 2106 W. Arbor Street Harlingen, TX 78552-7401
	Geo ID: 01-0000-0090-0091-00 Prop ID: 27442 GOMEZ LUIS LAURO & ROSALVA H. 15 Soto Drive Brownsville, TX, 78520-9420
	Geo ID: 01-0000-0060-0120-00 Prop ID: 27421 RAMIREZ JOSE PABLO ET UX 254 D Street Brownsville, TX 78520-4128

Table 2.3 – Existing Structures within USIBWC Right-of-Way (Continued)

Approximate Levee Design Station	Owner Contact Information
1831+00 to 1864+00 (Continued)	Geo ID: 01-0000-0070-0090-00 Prop ID: 27424 GARZA RAQUEL R. 414 D Street Brownsville, TX 78520-4130
	Geo ID: 01-0000-0060-0100-00 Prop ID: 27419 HERNANDEZ MANUEL S. 536 D Street Brownsville, TX 78520-4131
	Geo ID: 01-0000-0080-0110-00 Prop ID: 27435 GARCIA RAFAELA 344 D Street Brownsville, TX 78520-4129
	Geo ID: 01-0000-0060-0110-00 Prop ID: 27420 CHARLES ERNESTINA 665 Habana Street Brownsville, TX 78526-1845
	Geo ID: 01-0000-0090-0100-00 Prop ID: 27443 MEJORADO JORGE MARTIN 224 D Street Brownsville, TX 78520-4128
	Geo ID: 01-0000-0080-0120-00 Prop ID: 27436 BUSTOS FRANCISCO & FRANCISCA 354 D Street Brownsville, TX 78520-4129
	Geo ID: 01-0000-0070-0100-00 Prop ID: 27426 YANEZ JOSE MARIO & ISABEL 434 D Street Brownsville, TX 78520-4130
	Geo ID: 01-0000-0080-0090-00 Prop ID: 27433 HERRERA DONATO 324 D Street Brownsville, TX 78520

Table 2.3 – Existing Structures within USIBWC Right-of-Way (Continued)

Approximate Levee Design Station	Owner Contact Information
1831+00 to 1864+00 (Continued)	<p>Geo ID: 01-0000-0090-0090-00 Prop ID: 27441 GOMEZ LUIS LAURO & ROSALVA H. 15 Soto Drive Brownsville, TX 78520-9420</p>
	<p>Geo ID: 01-0000-0060-0070-00 Prop ID: 27415 ABREGO CARLOS 1755 N Vermillion Avenue Brownsville, TX 78521-6716</p>
	<p>Geo ID: 01-0000-0080-0100-00 Prop ID: 27434 LOPEZ MARIA 334 D Street Brownsville, TX 78520</p>
	<p>Geo ID: 01-0000-0070-0120-00 Prop ID: 27428 DELGADO ALFONSO M & MARY JAY 444 D Street Brownsville, TX 78520</p>
	<p>Geo ID: 01-0000-0070-0111-00 Prop ID: 27427 RODRIGUEZ CARLOS & GUADALUPE F. 446 East D Street Brownsville, TX 78520-4130</p>
	<p>Geo ID: 01-0000-0070-0070-00 Prop ID: 27423 GARZA ANTONIO JR. ET UX 414 D Street Brownsville, TX 78520-4130</p>
	<p>Geo ID: 01-0000-0070-0070-00 Prop ID: 27423 GARZA ANTONIO JR. ET UX 414 D Street Brownsville, TX 78520-4130</p>

Tetra Tech has identified locations along the Upper Brownsville Levee where the distance from the landside toe to the ROW, existing property fence, or DHS border wall is less than 15 feet (Table 2.4). In such areas, the landside side slope will be excavated to a 2.5H: 1V side slope to provide the maximum horizontal width possible.

Table 2.4 – Existing Landside Toe Locations with Less Than 15 Feet

Begin Station	End Station	Comments
1398+00	1399+00	Existing levee side slopes have been graded to 2.5:1 to provide the maximum horizontal width possible to existing ROW, property fence line or DHS Border Wall.
1404+00	1405+00	
1414+00	1415+00	
1422+00	1423+00	
1502+00	1509+00	
1593+00	-	
1696+00	1698+00	
1764+00	-	
1771+00	1776+00	
1797+00	-	
1807+00	1821+00	
1832+00	-	
1834+00	1837+00	
1842+00	1849+00	
1883+00	1884+00	
1874+00	1875+00	

ROW = right-of-way

3. Field Investigation

The Tetra Tech team conducted a field investigation from January 3 to 7, 2011. The investigation was conducted by driving and walking the entire length of the Upper Brownsville Levee system while visually assessing the existing flood protection elements. Notable findings and the existing conditions of the levee during the walk were documented with photographs, and georeferenced locations were recorded with a GPS unit. During the field investigation, the team used a summary maintenance field log prepared by USIBWC. The field log indicates gatewells that need repair as part of the operation and maintenance and sluice gates that need to be replaced. Heavy vegetated areas on either the landside or riverside of the levee prevented the team from verifying several inlet and outlet structures.

A construction note within the design plans instructs the contractor to clean out or clear the area to allow USIBWC to inspect the gatewells and determine the necessary action. The trees and bushes within the levee's vegetation-free zone need to be completely removed for completion of the investigation and to satisfy USACE/FEMA requirements. The existing gatewells are shown on Figure 3.1 and Figure 3.2. Photographs of the existing levee features are included in Appendix B.

Several gatewells need to be cleaned out because the pipe is silted up and the existing ground is higher than the invert of the pipe. Several gates were observed to have missing parts that prevent them from sealing, making them inoperable. USIBWC has requested a complete replacement of gates, rather than adding or replacing a stem or gate blocks. The findings from the field investigation are summarized in Table 3.1.

The field investigation did not include an inspection of the operation of the sluice gate within the gatewell. It was determined that the USIBWC Mercedes O&M crew is currently performing this activity and that the maintenance summary sheet in the field log provided by USIBWC was sufficient for Tetra Tech's structural verifications (Duran 2011). USIBWC will modify the Tetra Tech scope of work to reflect this revision. The USIBWC Mercedes O&M crew's field investigation from January to February 2011, findings are included in Table 3.1.

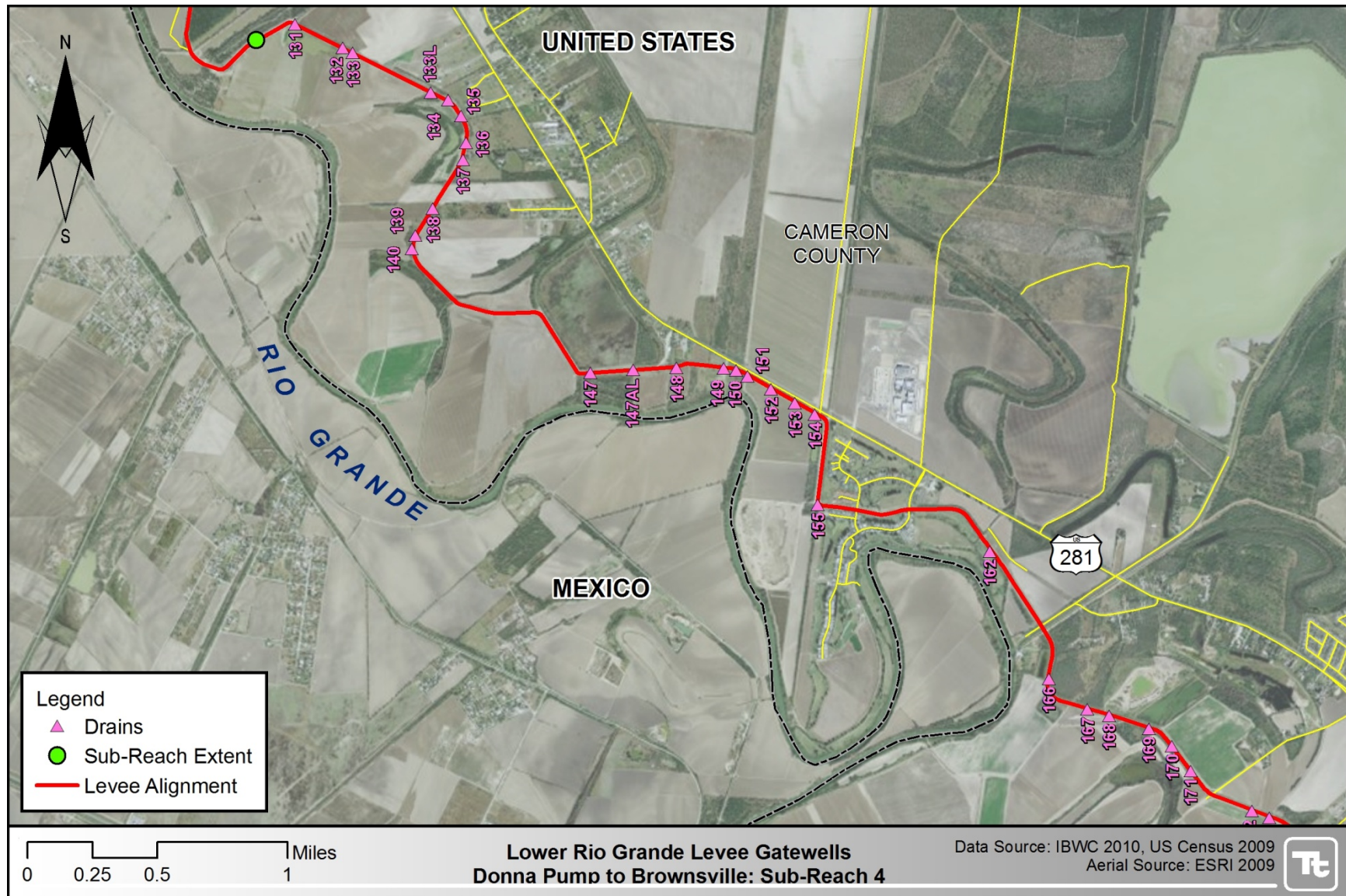


Figure 3.1 – Existing Gatewells Identified during Field Investigation of Upper Brownsville Levee, Gatewells 131 to 171



Figure 3.2 – Existing Gatewells Identified during Field Investigation of Upper Brownsville Levee, Gatewells 172 to 205

Table 3.1 – Summary of Existing Gatewells from Field Investigation of Upper Brownsville Levee

Structure	USIBWC Inspection Notes
131	J.J: 3/8/11 Cleaned and lubed guides and stem. Ran gate open and close. Knocked off a lot of surface rust off the bottom of the ring. Set screw rusted, needs minor concrete repair.
132	J.J: 3/8/11 Cleaned and lubed guides and stem. Ran gate open and close. Knocked off a lot of surface rust off the bottom of the ring. Needs minor concrete repair.
133	J.J: 3/8/11 Cleaned and lubed stem and guides. Ran gate open and close. The ring is pitted and will not seal. The brackets, nuts and bolts that were installed to fix the left guide are corroded.
133L	J.J: 3/8/11 Ran gate open and close. Had to dig out the caliche out of the gate latch slots in order to close the gate. Cannot check the bottom seal of the gate due to too much water. Therefore can't certify. Lateral drain needs clearing of trees.
134	J.J: 3/7/11 Cleaned and lubed guides and stem. Ran gate open and close. The stem needs a stop nut on the bottom part to prevent gate from coming off the guides. The collar needs adjustment and smaller diameter bolts to allow the collar to shift sideways. So the stem is not binding and causing the gate to come off the guides when open.
135	J.J: Plugged str. Needs a foot of dirt to completely fill up the str. Need to clear trees growing out of the str. Needs painting.
136	J.J: 3/7/11 Str. Needs 2 1/2 feet of dirt to completely fill up the str. Need to clear trees growing out of the str.
137	J.J: 3/7/11 Cleaned and lubed guides and stem. Ran gate open and close good seal. Bottom of ring rusty and stem is missing the stop nut. - Headwalls need concrete work.
138	J.J: 3/7/11 Lubed and oiled stem and guides. Ran gate open and close. Bottom ring pitted won't seal. Landside headwall needs replacement or repair.
139	J.J: 3/7/11 Lubed and oiled stem and guides. Ran gate open and close. Seals good, bottom part of the ring is rusty. Headwalls need concrete work.
140	J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Bottom of ring is rusty. - Stop screw to the stop nut is corroded
147	J.J: 3/1/11 Str. Has no hardware. Str. Was plugged with a metal plate, and concrete on the bottom seal.
147AL	J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Right guide is missing all three blocks and bottom bolt and nut. Guide is loose. Left guide is missing the two bottom blocks, bolts, and nuts. Gate will not seal properly.
148	J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Bottom nuts and bolts to both guides are corroded.
149	J.J: 2/25/11 Cleaned and lubed the guides and stem. Ran gate open and close. There's rust by the bottom of the ring. Good seal.
150	J.J: 2/25/11 Did not inspect due to bees inside the marker pipe by the structure.
151	J.J: 2/25/11 Cleaned and lubed the guides and stem. Ran gate open and shut. Good seal. 2 nuts and bolts to gear assembly are corroded, but gear assembly works good. Needs some concrete work.

Structure	USIBWC Inspection Notes
152	J.J: 2/25/11 Did not inspect due to low oxygen level. 18.8
153	J.J: 2/25/11 Did not inspect due to low oxygen level
154	J.J: 2/25/11 Lubed and cleaned the guides and stem. Ran gate open and close. L/S headwall needs a grill, headwall has a drop, it's a safety hazard.
155	Not Inspected by USIBWC
158	Not Found
159	Not Found
162	J.J: 2/24/11 Lubed and cleaned guides and stem. Gate won't open all the way. Need to modify stem. The gate lacks about 1/4" to seal flush with ring. - Need to remove the frozen stop nut, install a new stop nut and adjust it right. - Bolts to both guides are corroded. Still holding but corroded. - Grill needs modification to accommodate wheel. - Gate ring 9 bottom half rusted needs mortar on top of ring.
166	J.J: 2/24/11 Plugged, Str. Needs 7 1/2 ft. of dirt to fill up str. - Real safety hazard. Need to cut two bolts sticking up from pedestal housing. It's a trip hazard.
167	J.J: 2/24/11 Plugged - Entrance handle to str. Is broken with sharp edges. Needs to be cut off with cutting torch. Str. Needs 4 1/2" of dirt.
168	J.J: 2/24/11 Plugged - About 2" of the floodside drain pipe is exposed and broken on the end. Str. Needs 4' of dirt to fill to the top.
169	J.J: 2/24/11 Plugged - Str. Needs 4 1/2' of dirt to fill up the top.
170	J.J: 2/24/11 Plugged - Str. Needs 2 1/1' of dirt to fill the str.
171	J.J: 2/23/11 Lubed and cleaned guides and stem. Ran gate open and close. Good seal. Stem needs a stop nut to prevent gate from going past the seal.
172	J.J: 2/23/11 Lubed and cleaned guides and stem. Ran gate open and close. Good seal. Need to replace the stop nut and re-adjust. - Bottom nut and bolt to the U/S side guide is broken off.
173	J.J: 2/23/11 Plugged Str. Needs 4ft. Of dirt to completely fill the str.
175	J.J: 2/23/11 Cleaned and oiled guides and stem. Ran gate open and close. - Good seal. - Gate has two broken chips on top of gate but still seals. Stem needs a stop nut on top of stem to prevent gate from passing the seal. And needs a stop nut on bottom stem to prevent gate from coming off the guides. - Nuts and bolts to the U/S guide corroded.
176	J.J: 2/23/11 Str. Needs 2ft of dirt to completely fill the str.
177	Not Found
177L	J.J: 2/23/11 - Cannot inspect due to too much water in the well. - Need to vacator out water. - Might need to berm the floodside headwall. With H.E. and set a pump.
178	J.J: 2/17/11 Cleaned and oiled guides and stem. Ran gate open and close. Cannot check the bottom seal because there's a foot of slushy muddy water. Landside headwall needs concrete work. 3 nuts to pedestal gear box corroded.
179	J.J: 2/17/11 Cleaned and oiled guides and stem. Ran gate open and close. Right guide is loose and needs adjustment. When gate is raised all the way it comes off the guides because of the loose right guide. Needs work. Landside headwall needs concrete work.
180	J.J: 2/17/11 Plugged Str. Needs a foot of dirt to fill to the top
181	J.J: 2/17/11 Plugged - Needs 2 1/2ft of dirt to completely fill up to the top of str.

Structure	USIBWC Inspection Notes
181A	J.J.: 2/17/11 Lubed guides and stem. Ran gate open and close. Has a good seal. 15 inches from the face of the ring towards the landside pipe there is a 1/2" crack all the way around the drain pipe that needs to be mortared and sealed. Both headwalls need concrete work.
181AL	J.J.: 2/17/11 The gate was closed and we lubed the stem and opened the gate. Did not go into well because of too much water. Cannot inspect until the water is vactored out. F/S headwall needs concrete work. And clearing of grasses.
182	J.J.: 2/17/11 Plugged, concrete broken up. Needs 1ft of dirt to fill up to the top of str.
183	J.J.: 2/16/11 Str. Needs 2 ft of dirt to fill to the top of the str.
184	J.J.: 2/16/11 str. Needs 1 foot of dirt to completely fill up to the top.
186	J.J.: 2/16/11 Cleaned, lubed guides and stem. Ran gate open and close. Gate seals good. Stem is missing the stop nut.
187	Not Found
188	J.J.: Str. Needs 5ft of dirt to fill up to the top of the str.
189	J.J.: 2/16/11 Lubed guides and stem. Ran gate down but won't close all the way because there is a foot of slushy mud in the well. Needs to be vactored out.
190	Not Found
191	Not Found
191AL	Abandoned Gatewell
191L	Not Inspected by USIBWC
192	J.J.: 2/16/11 Inline str. With no hardware or gate. Headwall on the landside plugged. Pipes from the in-line str. To the floodside headwall are open
193	J.J.: 2/16/11 Plugged needs 2 ft of dirt to fill up to the top of str.
194	J.J.: 2/16/11 Plugged needs 2 ft of dirt to fill up to the top of str.
195	Lou: 2/15/11 Str. Well has 2 ft drop to the dirt.
196	Lou: 2/15/11 PLUGGED - Str. Well uncovered has a 2' drop to the dirt.
197	Lou: 2/15/11 Completely underwater - needs either vactor or 2" pump to pump out the water.
201	Lou: 3/23/11 2/15/11 PLUGGED - needs about 2 ft of dirt in well.
198	Lou: 2/15/11 PLUGGED - Lacking about 4 ft of dirt.
199	Lou: 2/15/11 Need vactor to remove about 2 ft of water in order to inspect. Also needs lighter grill installed preferably expanded metal. (floodside has pipe going from str. To 24" round well where it turns about 45 degrees to the headwall. This is uncovered and a major safety hazard.). Not Inspected by USIBWC
204	Lou: 2/15/11 PLUGGED - Has metal plate cover, bolted down.
204L	Not Inspected by USIBWC
205	Not Inspected by USIBWC

4. Hydrology and Hydraulics

4.1 Hydrology

No hydrologic analysis was performed by Tetra Tech for this project. Based on a study completed by USIBWC in 2003, the design flood for the LRGFCP is based on a peak flow of 250,000 cubic feet per second (cfs) at Rio Grande City, which attenuates to 235,000 cfs at Peñitas. During the design flood, Anzalduas Diversion Dam and Retamal Diversion Dam would each divert 105,000 cfs into the United States and Mexico. Flow diversion during the design flood would limit flood flows through the Brownsville-Matamoros area to 20,000 cfs (USIBWC 2007).

4.2 Hydraulic Model

The hydraulic analysis of the project reach along the Rio Grande was provided by USIBWC (2003). The hydraulic model was created using the Hydrologic Engineering Center-River Analysis System (HEC-RAS) program, version 3.0 (USACE 2001). The 2003 model was based on the geometrical cross-sectional data used in a 1992 HEC-2 model for the channel of the Rio Grande and the floodways in the United States. The Rio Grande data were modified for the established Restricted Use Zone (floodplains on both sides of the Rio Grande) and additional bridges and to include data for 24 additional new cross sections that were surveyed.

The 2003 HEC-RAS model contains 153 cross sections between Anzalduas Diversion Dam and the downstream extent of the U.S. levee embankment near Brownsville, and it extends beyond the limits of this study at the upstream end. A total of 113 HEC-RAS cross sections are located within the project limits for the Donna Pump to Brownsville levee rehabilitation; 33 HEC-RAS cross sections are located within Upper Brownsville Levee. The locations of HEC-RAS cross sections within Upper Brownsville Levee are shown on Figure 4.1.

The computed water surface elevations for the design discharge of 20,000 cfs were used in the hydraulic analysis for the levee rehabilitation (Table 4.1). The elevations in the model are referenced to the NAVD88. The outputs from the HEC-RAS model are included in Appendix C.

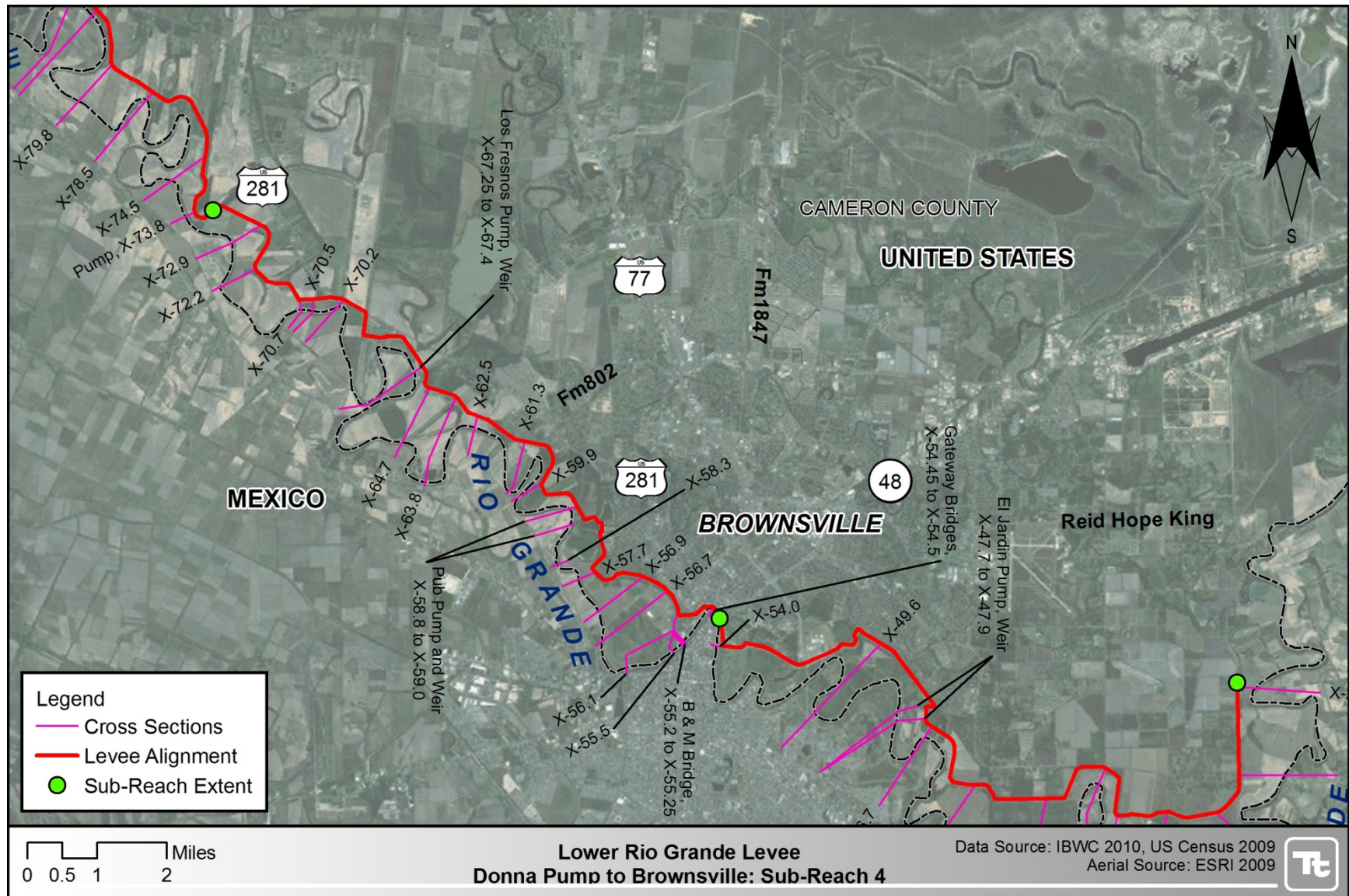


Figure 4.1 – Locations of HEC-RAS Cross Sections

Table 4.1 – Hydraulic Summary along Donna Pump to Brownsville Upper Brownsville Levee (100-Year Flood Discharge)

HEC-RAS River Station	Invert Elevation (feet)	Water Surface Elevation (feet)	Flow Velocity (feet/second)	Top Width (feet)	Froude Number
73.8	14.64	49.97	3.5	1,933.27	0.13
72.9	14.14	49.31	1.83	5,789.94	0.08
72.2	10.74	48.72	3.34	3,727.23	0.12
70.7	15.64	47.76	2.74	1,962.03	0.1
70.5	12.34	47.61	3.22	2,319.55	0.12
70.2	15.44	47.45	2.84	4,389.66	0.1
67.4	15.84	44.96	3.11	6,658.7	0.13
67.25	13.14	44.71	3.95	6,939.18	0.14
64.7	11.64	43.15	3.11	5,891.24	0.11
63.8	7.84	42.81	2.4	4,195.46	0.09
62.5	10.24	42.23	3.57	3,009.07	0.13
61.3	3.04	41.65	2.39	4,190.06	0.1
59.9	9.14	40.55	3.58	2,741.37	0.13
59	4.14	40.15	3.38	3,862.51	0.12
58.8	6.64	40.11	2.65	3,542.62	0.1
58.3	5.64	39.83	3.3	405.77	0.13
57.7	2.74	39.59	3.1	1,516.32	0.11
56.9	7.54	39.26	2.84	1,542.04	0.12
56.7	5.84	38.95	3.15	430.51	0.14
56.1	9.64	38.22	3.53	440.92	0.17
55.5	0.94	37.2	4.52	243.6	0.19
55.25	2.94	36.91	4.09	445.75	0.15
55.23	-0.16	36.93	3.49	428.27	0.13
55.215	Railroad bridge				
55.21	-0.16	36.88	3.5	425.29	0.13
55.2	-0.16	36.88	3.5	425.2	0.13
54.5	-1.46	36.61	3.21	720.25	0.11
54.49	4.94	36.51	3.85	486.11	0.14
54.475	Southbound Gateway International Bridge				
54.47	4.94	36.47	3.86	485.33	0.14
54.46	4.94	36.47	3.86	485.32	0.14
54.45	0.64	36.46	3.86	366.27	0.14
54.435	Northbound Gateway International Bridge				
Note: All elevations are based on NAVD88.					

The minimum amount that the top of the levee must be raised was determined by USIBWC and provided as part of the design. The necessary increases in top of levee elevation are indicated in Table 4.2. It is noted that river station (RS) 73.8 of the existing levee needs to be raised to satisfy FEMA's freeboard requirement of 3 feet. The total length of the existing levee within Upper Brownsville Levee is approximately 12 miles, per USIBWC limits.

Table 4.2 – Top of Levee Increase along Donna Pump to Brownsville Upper Brownsville Levee

HEC-RAS River Station	Existing Top of Levee Elevation ¹ (feet)	Water Surface Elevation ² (feet)	Existing Freeboard (feet)	Minimum Top of Levee Elevation (feet)	Increased top of Levee ³ (feet)
73.8	51.70	49.97	1.73	52.97	1.27
72.9	52.69	49.31	3.37	52.31	0.00
72.2	51.97	48.72	3.25	51.72	0.00
70.7	51.38	47.76	3.62	50.76	0.00
70.5	51.06	47.61	3.45	50.61	0.00
70.2	51.30	47.45	3.85	50.45	0.00
67.4	49.15	44.96	4.19	47.96	0.00
67.25	-	44.71	-	-	-
64.7	47.82	43.15	4.67	46.15	0.00
63.8	-	42.81	-	-	-
62.5	48.15	42.23	5.92	45.23	0.00
61.3	47.15	41.65	5.50	44.65	0.00
59.9	43.55	40.55	3.00	43.55	0.00
59	43.58	40.15	3.43	43.15	0.00
58.8	44.66	40.11	4.55	43.11	0.00
58.3	43.92	39.83	4.09	42.83	0.00
57.7	43.31	39.59	3.72	42.59	0.00
56.9	42.79	39.26	3.53	42.26	0.00
56.7	43.10	38.95	4.15	41.95	0.00
56.1	42.48	38.22	4.26	41.22	0.00
55.5	-	37.20	-	-	-
55.25	-	36.91	-	-	-
55.23	42.73	36.93	5.80	39.93	0.00
55.215	B & M Bridge				
55.21	-	36.88	-	-	-
55.2	-	36.88	-	-	-
54.5	-	36.61	-	-	-
54.49	-	36.51	-	-	-
54.475	Southbound Gateway International Bridge				
54.47	-	36.47	-	-	-
54.46	-	36.47	-	-	-
54.45	-	36.46	-	-	-
54.435	Northbound Gateway International Bridge				

Note: All elevations are based on NAVD88.
¹ Top of levee elevations were provided by USIBWC.
² USIBWC assume 3 feet below minimum top of levee elevation.
³ Increased top of levee done by USIBWC in 2007, not part of this project.
- = no information available

4.3 Gateway International Bridge

The Gateway International Bridge connects Brownsville, Texas, to Matamoros, Tamaulipas, Mexico. The bridge currently includes a southbound (upstream) span and a northbound span, which cross the Rio Grande at RS 54.475 and RS 54.435, respectively.

USIBWC is responsible for operation and maintenance of the levee along the left bank of the Rio Grande. Since the Rio Grande serves as the border between the United States and Mexico, the U.S. Department of Homeland Security (DHS) constructed a border security fence that is located in the access road along the crown of the levee (Figure 4.2). Per USIBWC, the length of levee in this location is not to be part of the Upper Brownsville Levee design. The fence obstructs access to the levee embankment, possibly limiting access by the USIBWC for flood fighting. The location of the levee embankment along the outside of the bend makes the embankment particularly subject to scour and erosion. To reduce the need for access to the levee during flood events, the USIBWC is considering the construction of an erosion protection along the riverward slope of the levee embankment. Although improvements to this location are not part of the Upper Brownsville Levee design, Tetra Tech prepared an analysis of the existing hydraulic conditions and the risk of embankment erosion. The analysis was documented in a technical memorandum submitted to the USIBWC on March 30, 2011 (Tetra Tech 2011a).

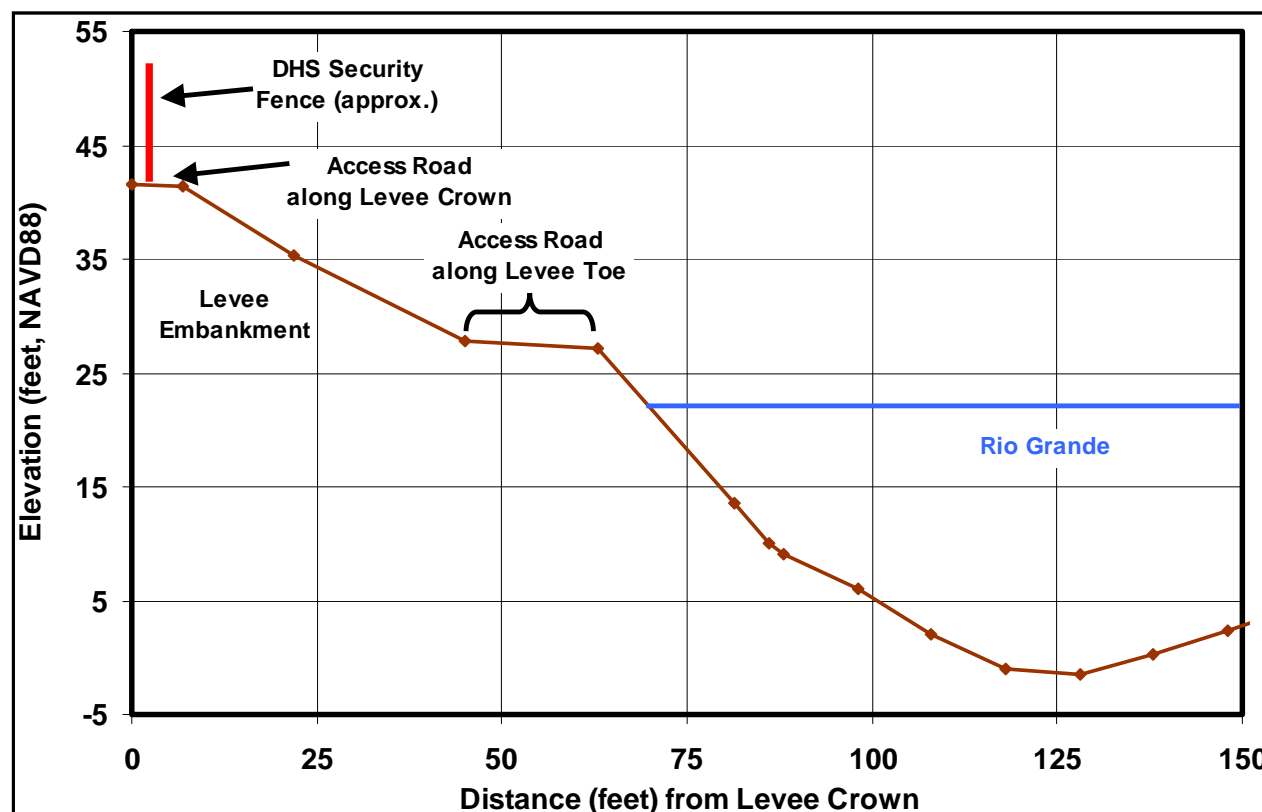


Figure 4.2 – U.S. Levee Embankment, Access Roads, and U.S. Department of Homeland Security Border Security Fence

An analysis was also performed to determine alternatives that would mitigate erosion as a result of the flow velocity as well as to provide a depth of protection based on the expected scour depth. For several of the alternatives, loose rock revetment was assumed as the erosion protection. Future design phases should consider other options for sloped revetment such as concrete slope paving, Armorflex, and soil cement. The results of this analysis are also presented in the memorandum, which is included as Appendix D.

During the 90% Design Review/ Presentation, USIBWC requested that riprap be placed on the riverside banks from the top of levee to the existing riverside access road. Tetra Tech stated that this would be a temporary solution, as the riprap is not properly toed below the river scour potential. The river may scour and wash out the riverside road and the temporary riprap protection.

5. Compliance with Code of Federal Regulations, Title 44, Section 65.10

The Code of Federal Regulations (44 CFR 65.10) includes a description of the types of information FEMA needs in order to recognize (or “accredit”), on NFIP maps, that a levee system provides protection from the base flood. The following information addresses the design criteria identified in 44 CFR 65.10 and is intended to provide additional information for use by USIBWC in developing the FEMA levee certification package. Tetra Tech’s scope of work does not include developing the information/analyses to support the FEMA levee certification package; however, the following information is provided to aid USIBWC in development of that information and analyses.

Specific design criteria are listed, as well as other criteria as specified on the MT-2 Forms. MT-2 Form 3 (Riverine Structures) includes a description of required sediment transport information.

5.1 Freeboard

According to 44 CFR 65.10, the freeboard requirements are as follows:

- A minimum of 3 feet above base flood (100-year) water surface level.
- An additional 1 foot above minimum within 100 feet of structures/bridges/constrictions.
- An additional 0.5 foot at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee.

A comparison of the 100-year water surface elevations from the USIBWC HEC-RAS model of the Rio Grande along Upper Brownsville Levee and the proposed top of levee elevations shown on the drawings of the proposed design (Tetra Tech 2011d) indicates one location where the 3-foot minimum freeboard is not provided. The deficient freeboard is located at the downstream edge of Los Fresnos Pump Canal, where the proposed top of levee elevation is a maximum of 0.88 feet lower than the required height based on the minimum 3 feet of freeboard for a horizontal distance of approximately 115 feet. A strategy for dealing with the deficient freeboard at the canal should be part of the future Los Fresnos Pump Canal closure design.

5.2 Closures

Upper Brownsville Levee includes 58 gatewell structure side drains. Of these gatewells, 33 are operational and 25 have been abandoned. The 33 operational gatewells include working existing sluice gates or will have new sluice gates installed, which meet FEMA’s requirements for a closure device. During construction, the inlet and outlet pipes to the 25 abandoned gatewells will be excavated, and brick and mortar sealed to provide permanent closure. The soil within the existing gatewell structure will be excavated and the steel plates to be removed. The outlet pipe, inlet pipe and cavity of the gatewell structures would be filled with flowable fill. USACE requires that all discharge pipes be inspected using a television camera or other visual inspection at least every 5 years. This is not included specifically as part of FEMA’s requirements for levee certification.

There is one opening along Upper Brownsville Levee where no closure device is provided. This opening is located at the Los Fresnos Pump Canal. The canal does not meet FEMA's requirement of providing a closure at openings along the levee system. The design of a closure device for the canal is not part of Tetra Tech's current scope of work, as it will be designed and constructed under a separate future contract.

5.3 Embankment Protection

According to 44 CFR 65.10, engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood and that anticipated erosion will not result in failure of the levee embankment.

To demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, flow velocities were extracted from the HEC-RAS model of the Rio Grande along Upper Brownsville Levee provided by the USIBWC. No appreciable erosion of the levee embankment is expected during the base flood based on velocities identified in the HEC-RAS model along the left/north bank (maximum of 1.3 feet per second [fps]) or the maximum velocity expected through the bends based on the equation on Plate B-33 in Engineer Manual (EM) 1110-2-1601, a maximum of 1.7 fps (USACE 1994). Flood waters become erosive at velocities greater than 5 fps for grass-lined earthen channels per EM 1110-2-1601.

The one exception is at the Gateway International Bridge. At this location, the main channel is very close to the levee and the main channel velocity rather than left bank velocity was considered. The channel velocity at this location approaches 5 fps, which is the limit of permissible velocities for earthen embankments. Embankment protection should be considered along this reach as discussed in Section 4.3.

5.4 Embankment and Foundation Stability

According to 44 CFR 65.10, engineering analyses must be submitted that demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or levee stability. The geotechnical evaluation of this reach performed by Raba-Kistner Consultants, Inc. (R-K) indicated that construction of internal drainage was required to mitigate potential seepage conditions during flood stage (R-K 2011b). It was recommended that a toe drain with a minimum base width of 3 feet extending at least 18 inches below the landside toe of the levee be included in the proposed rehabilitation design. Seepage analysis indicated that implementation of the toe drain would control seepage pressures within the levee and foundation soils and would reduce hydraulic exit gradients to less than 0.5. The toe drain detail has been incorporated into the design drawings and specifications. With this condition, seepage associated with the base flood is not expected to jeopardize the embankment or foundation stability.

Slope stability analyses were performed on pertinent cross sections of the proposed rehabilitated levee. The results of the analyses relative to FEMA criteria are provided in Table 5.1.

Table 5.1 – Minimum Factors of Safety

Condition	Calculated Minimum Factor of Safety	USACE Required Factor of Safety
End of construction	1.7	1.3
Long-term (steady seepage)	2.1	1.4
Rapid drawdown	1.8	1.0 to 1.2

The results of the analyses indicate that the proposed levee design meets the FEMA levee criteria for embankment and foundation stability.

5.5 Settlement

According to 44 CFR 65.10, engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum freeboard standards. The geotechnical evaluation for this project indicated that placement of 3 feet of additional fill height could induce total settlement (compression and long-term consolidation) of approximately 3-¹/₄ inches. The proposed design would not significantly raise the current levee height but rather it would reconstruct portions of the existing levee with engineered fill. As a conservative measure to maintain the required freeboard, the proposed design height of the levee has been increased by 4 inches to mitigate potential settlement.

5.6 Interior Drainage

According to 44 CFR 65.10, joint probability analysis of the sources of flooding landward of the levee and the river itself must be completed and the extent of the flooded area provided. It is expected that this will be a significant effort because of the number of side drains (approximately 58 over Upper Brownsville Levee) and the ownership of these systems outside of USIBWC right-of-way. USIBWC should note that this analysis will be required as part of a levee certification submittal to FEMA. Tetra Tech's current contract does not include providing any support with regard to the interior drainage analysis.

5.7 Other Design Criteria – Sediment Transport

A sediment transport analysis is required if there is any indication from historical records that scour and deposition can affect the base flood elevation (BFE), or if based on stream morphology, vegetative cover, development of the watershed, and bank conditions, there is a potential for debris and sediment transport to affect the BFE or a structure. If sediment transport will not affect the BFE or any structures, an explanation is required as to why a sediment transport analysis was not performed.

Related to the U.S. (north) levee embankment structure along the Rio Grande between Retamal Dam (south of Donna, Texas) and Brownsville, Texas, the following initial investigations were conducted to identify whether there is potential for sediment transport to affect the BFE or the

levee embankment. These investigations focused on the Rio Grande along Upper Brownsville Levee levee but extended upstream as required by the available information.

5.7.1 Analysis of Long-Term Aggradation/Degradation

A trend of long-term aggradation could reduce channel capacity and impact the freeboard of the levee; a trend of degradation could impact channel stability, which could in turn influence the stability of the levee. A review of hydrologic conditions was conducted to characterize the influence of floods on the potential to mobilize, transport, and deposit sediment within the Rio Grande along the Upper Brownsville Levee levee.

USIBWC operates a flow gage on the Rio Grande upstream of the north levee embankment (Gage No. 08-4692.00 below Anzalduas Dam near Reynosa, Tamaulipas, Mexico). Construction of Anzalduas Dam was completed in April 1960 so that floodwaters could be diverted from the Rio Grande into the interior U.S. floodway. Construction of upgrades to Retamal Dam, located approximately 39 miles downstream of Anzalduas Dam, were completed in May 1975 to divert floodwaters to the interior Mexican floodway and to limit floods at Brownsville-Matamoros to the safe capacity of the Rio Grande. According to USIBWC Minute No. 238, the design flood flow below Anzalduas Dam is 20,000 cfs (USIBWC 2003). A review of the average daily discharges recorded between 1960 (when Anzalduas Dam was constructed) and 2010 indicates that floods in excess of the design flow occurred in 9 years. Other than the flooding associated with Hurricane Beulah in September 1967 (maximum average daily discharge of 121,000 cfs), the maximum average daily flow rate was 41,300 cfs in water year 1972 (Figure 5.1). However, considering only the period after 1975 when the upgrades to Retamal Dam were completed, four floods with maximum average daily discharges exceeding 20,000 cfs occurred; the maximum average daily flow of 27,300 cfs occurred in water year 1976. Further investigation of the magnitude of the design flood is warranted to confirm that 20,000 cfs is consistent with the peak flow during the 100-year flood (i.e., the base flood). The current effective FEMA Flood Insurance Study (FIS) indicates that a discharge of 20,000 cfs has a 500-year recurrence level.

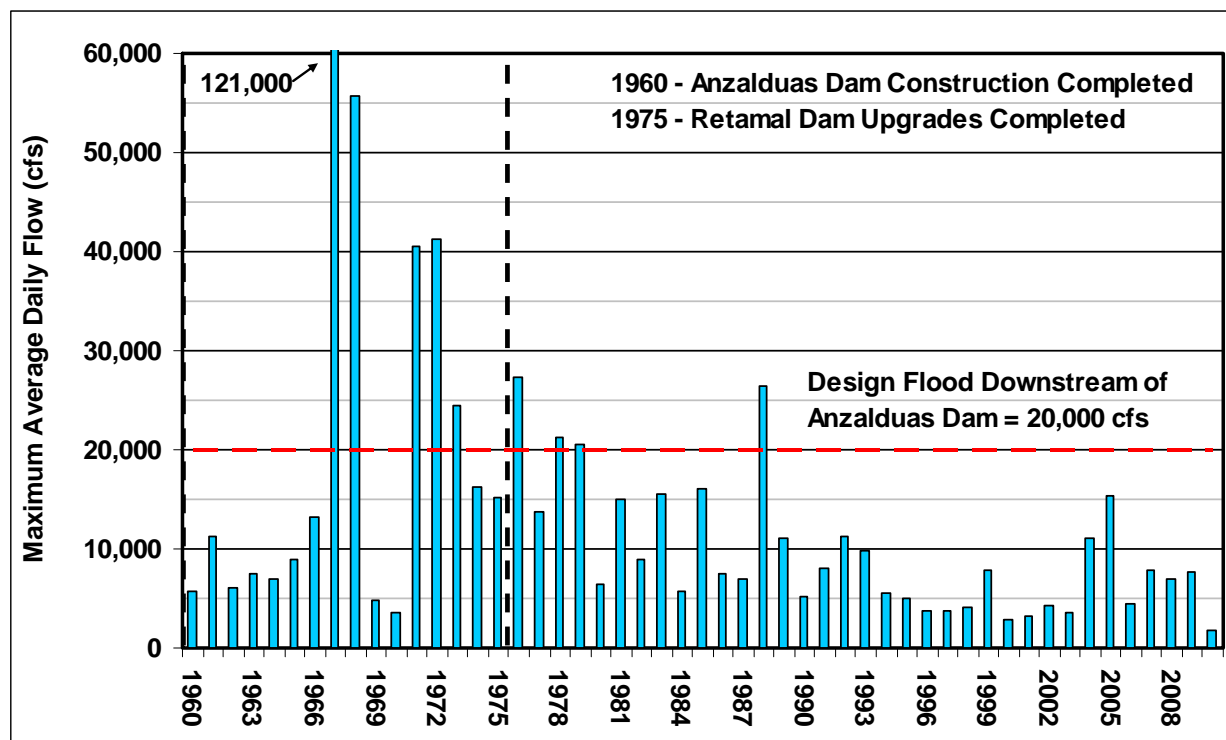


Figure 5.1 – Maximum Average Daily Flow by Water Year Recorded at USIBWC Gage No. 04-4692.00 below Anzalduas Dam

On a long-term basis, most bed material sediment is mobilized, transported, and deposited during flood flows. Since the design flood has been exceeded four times since the upgrades to Retamal Dam were completed in 1975, the system has been tested by major flooding. Assuming the flood regime since 1975 is representative of the future flood regime (due to the regulation of floods by Anzalduas Dam and Retamal Dam), it is expected that future opportunities for floods to transport sediment will be similar. Therefore, any existing trends in long-term aggradation or degradation that are in response to flood hydrology may continue into the future.

Little information was available to evaluate whether long-term aggradation/degradation has the potential to affect the BFE or the Upper Brownsville Levee. Due to the set-back of the levee embankment from the Rio Grande channel, the risk of degradation of the channel and corresponding bank failures appears low; however, this expectation should be confirmed by USIBWC maintenance staff. Confirmation would include a statement that USIBWC does not need to conduct regular dredging of excessive sediment deposits that would indicate the potential for aggradation. The sediment trapping of the impoundments upstream of Anzalduas Dam and Retamal Dam likely limit aggradation potential, but this should be confirmed through USIBWC maintenance records.

5.7.2 Analysis of Bend Scour

In meandering alluvial channels, such as the Rio Grande along Upper Brownsville Levee of the levee, the bed profile and the planform of the river are related. Pools form due to scour in the bends, and riffles or crossings form between bends. The increase in depth through a pool

corresponds to an increase in the height of the bank, which increases the potential for the bend scour to lead to bank instabilities. The planform of the Rio Grande channel was reviewed to identify bends that were located within 500 feet of the levee embankment. An equation developed by Thorne (1988) was used to calculate maximum bend scour as a function of bend geometry. An assumed failure plane with a 2H:1V slope was extended up from the calculated maximum scour depth to evaluate whether bank failure could impact the levee embankment.

Four existing bends in the Rio Grande channel were evaluated along the alignment of the Upper Brownsville Levee. Channel cross-sectional geometry was extracted from the HEC-RAS model provided by USIBWC. Depths during the recommended “formative flow” (Thorne 1988) were based on the design flood flow of 20,000 cfs. Under this flow, the calculated maximum scour depths ranged from 0 to 24.8 feet below the existing channel bottom. At Station 1893+00 near the Gateway International Bridge (cross section 54.49 in the HEC-RAS model), bank failure from the calculated maximum scour at the assumed 2H:1V failure plane would intercept the riverward toe of the levee embankment. Embankment protection along this bend may be warranted to protect the levee (Note: Design recommendations for embankment protection were submitted to USIBWC as a separate memorandum [Tetra Tech 2011a].) For the other three bends evaluated along the Upper Brownsville Levee levee, bank failure associated with calculated maximum bend scour would not impact the levee, and embankment protection may not be required. At each of the four bends, the calculated bend scour is not expected to increase the BFE. Scour protection measures constructed at the bend upstream of the Gateway International Bridge should be evaluated in the future to confirm that they do not increase the BFE.

5.7.3 Conclusion

The initial review of available information related to sediment transport in the Rio Grande along the Upper Brownsville Levee indicates limited potential for increases in the BFE or threats to the integrity and performance of the levee embankment due to local scour or general aggradation/degradation processes. A noted exception is the bend upstream of the Gateway International Bridge, where bend scour may threaten the levee embankment, and embankment protection has been recommended. The combined influence of Anzalduas Dam and Retamal Dam have limited the frequency of major floods capable of transporting substantial amounts of bed material sediment between Retamal Dam and Brownsville. Where existing bends are within 500 feet of the levee embankment, calculations of expected maximum bend scour indicate that except as previously noted, expected bank failure will not likely threaten the levee embankment or foundation.

The potential for long-term aggradation/degradation to affect the BFE or the levee embankment is expected to be minimal due to (1) the controlling influence of the diversion dams on the flood regime, (2) the capacity of the dams to trap sediment that could otherwise aggrade in the channel along Upper Brownsville Levee, and (3) the setback between the Rio Grande channel and the levee embankment, allowing for bank failures without threatening the levee embankment or foundation, but further analyses of operation and maintenance records should be made to confirm this expectation.

It should be noted that the analyses to determine the impact of sediment transport on the water surface elevation and freeboard is not part of Tetra Tech's scope of work. However, this initial information has been developed to aid USIBWC in the development of the necessary information to support a FEMA levee certification package. Details of additional investigations that could be undertaken by USIBWC to further develop the information related to sediment transport and levee certification are identified in the following section.

5.7.4 Additional Investigations

The following additional investigations could be performed to confirm that sediment transport is not expected to increase the BFE or threaten riverine structures:

Specific Gage – Using long-term stage and flow measurements collected at the USIBWC gauging station downstream of Retamal Dam (or the gage near Brownsville, Texas, and Matamoros, Tamaulipas, Mexico, Gage No. 08-4750.00) changes in gage height over time for a specified flow rate can be determined. The specific gage analysis is useful in indicating whether there is a trend of aggradation or degradation. Assuming the USIBWC gage is installed in an alluvial reach of the Rio Grande channel, the history of shifts in the rating curve or a specific gage analysis would indicate changes in channel morphology over time. While this gage is located upstream of Upper Brownsville Levee, the analysis would still provide useful information related to Upper Brownsville Levee.

As-Built Plans –The as-built plans for crossings of the Rio Grande (i.e., bridges, diversion structures, dams, and utilities) should show the local elevation of the Rio Grande channel, possibly even the geometry of the channel. The channel geometry on the plans can be compared to the channel geometry represented in the HEC-RAS model to identify an average rate of change over the period of comparison. Any historical surveys that include the channel geometry could be used for these comparisons.

Comparison of Historical Aerial Photographs – The planform of the Rio Grande can be compared at different points in time (e.g., preceding and following flood events) to identify whether sediment transport is sufficient to alter the alignment of the channel. Initially a comparison could be made using recent imagery and imagery closely following the 1975 completion of the upgrades to Retamal Dam. Comparisons to earlier imagery could be made to determine whether there was an ongoing trend before the construction/upgrades to the diversion dams, but comparisons before and after 1975 need to consider the influence of the dam operations on the hydrologic regime. If substantial changes in planform are apparent between 1975 and 2010, intermediate dates could be compared, preferably close in time to major flooding.

Of specific interest in the comparison of historical aerial photographs would be the location of bends in the Rio Grande channel. It is clear in recent aerial imagery that bends form and cut off over time. If bends have historically migrated across the floodplain and encroached upon the levee embankment, IBWC operation and maintenance procedures may show how USIBWC has historically protected the levee embankment.

Review of Operation and Maintenance Records – The records maintained by USIBWC could be reviewed to identify whether natural responses of unbalanced sediment transport have historically resulted in the need for intervention to maintain channel conveyance. Intervention may include the following:

- Construction of grade control structures (e.g., diversion structures, drop structures, weirs, or sills) to prevent down cutting of the bed
- Installation of revetments to arrest bank erosion
- Excavation/dredging of deposited sediment
- Repairs such as unclogging or reinforcing outlets of drainage structures that enter the channel

5.8 Operation Plans

According to 44 CFR 65.10(c), an officially adopted operation manual will need to be provided. The current IBWC manual may need to be updated to meet FEMA requirements. Because the system includes closures (such as sluice gates at side drains), the following information must be included in the manual:

- Documentation of the flood warning system that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of the mechanized portions of the drainage system
- Specific actions and assignments of responsibility by individual name or title
- Provisions for periodic operation of the closure at not less than 1-year intervals

FEMA will not accept a general operation plan that is not specific to the levee system, i.e., one that covers an entire county or state.

5.9 Maintenance Plans

According to 44 CFR 65.10(d), an officially adopted maintenance manual will need to be provided. Upon submittal of a levee certification request, FEMA may review all available inspection information to ensure that it is in compliance with the maintenance manual. In order for FEMA to recognize the certification and accredit the levee on the NFIP maps, any issues of noncompliance identified during inspections will require documentation of the correction necessary to meet the standards in the maintenance plan.

5.10 Ongoing FEMA Study Efforts

FEMA is currently working with the local communities to update the flood information for the Rio Grande in the project area. USIBWC should consider coordinating with that effort to ensure that all base information (such as the 100-year discharge) is consistent and that no conflicts arise (such as designation of a floodway in an area where levee improvements are planned).

6. Geotechnical Recommendations

In July 2009, Raba Kistner (R-K) completed the subsurface exploration and engineering analyses for the proposed rehabilitation improvements to the Donna Pump to Brownsville levee reach (R-K 2009). The geotechnical analyses of the levee were performed in general accordance with EM 1110-2-1913 (USACE 2000) and FEMA Requirements for Mapping Levees (44 CFR 65.10).

In June 2011, R-K evaluated recently constructed levee fill that was placed along portions of the Donna Pump to Brownsville levee reach (R-K 2011a), see Appendix G. Portions of Upper Brownsville Levee were included in that study. In addition, a subsequent geotechnical memorandum was prepared by R-K specifically for Sub-Reach 4 based on the data contained in its 2009 report (R-K 2011b), see Appendix H. Subsurface conditions for Upper Brownsville Levee were evaluated by drilling 72 borings to a maximum depth of about 50 feet below the existing top of levee using truck-mounted drilling rigs.

6.1 Settlement

On the basis of the review of the conditions encountered along Upper Brownsville Levee, maximum estimated settlements of $3\frac{1}{4}$ inches were calculated (R-K 2011b). Based on the settlement evaluation, the proposed design of the Upper Brownsville Levee includes a vertical overbuild of 4 inches to mitigate potential settlement after construction.

6.2 Seepage

Potential seepage through and under the Upper Brownsville Levee was evaluated by R-K using the computer software SLIDE developed by Rocscience. The analysis indicated that some form of internal drainage was necessary in order to effectively control seepage pressures and hydraulic exit gradients. It was recommended that a toe drain with a minimum base width of 3 feet extending at least 1.5 feet below the landside toe of the levee be included in the proposed levee design. The seepage analysis indicated that implementation of the toe drain would control seepage pressures within the levee and foundation soils and would reduce hydraulic exit gradients to less than 0.5. The toe drain detail has been incorporated into the proposed levee design drawings and specifications.

6.3 Slope Stability

The analyses of slope stability were conducted by R-K using SLIDE. Soil density and strength parameters were based on the data collected as part of the 2009 study (R-K 2009). The assumed parameters consisted of various subsurface conditions shown in (Table 6.1).

Table 6.1 – Soil Density and Strength Parameters

Material (Classification under USCS)	Unit Weight (pounds/cubic foot)	Short-Term and Sudden Drawdown (Undrained)		Long-Term Drawdown (Drained)	
		Cohesion (pounds/square foot)	Friction Angles (degrees)	Cohesion (pounds/square foot)	Friction Angles (degrees)
Poorly Graded Sands and Silts (SP-SM)	117	0	33	0	33
Poorly Graded Silty Sand (SM)	117	0	32	0	32
Clays (CL and CH)	120	400	0	200	25
Gravel (Drainage Blanket)	125	0	35	0	35
Clay Fill (CL)	120	400	0	200	24

USCS = Unified Soil Classification System

The analyses of slope stability included seepage conditions estimated on the basis of a landside toe drain as described in the Section 6.2. The results of the analyses are summarized in Table 6.2.

Table 6.2 – Computed Factors of Safety

End of Construction- Riverside	End of Construction- Landside	Steady State at Flood Stage – Riverside	Steady State at Flood Stage – Landside	Sudden Drawdown – Riverside
1.8	1.7	3.2	2.1	1.8

Based on the results of the analyses, the proposed levee embankment and slope stability for this project meet the current USACE requirements.

6.4 Evaluation of Recent Fill Placement

An evaluation of the recently constructed fills placed on the top of portions of the levee within Upper Brownsville Levee was performed by R-K (R-K 2011a). The evaluation indicated that significant portions of the recent fills were not compacted to the specified density criteria and that some of these fills do not meet the gradation and material type criteria. Therefore, for areas where recent fills have been placed, it was recommended that material be removed to a depth of 18 inches below the top of existing levee before the placement of fill to reach final design grade. In areas where recent fills have not been placed, the removal requirement is 12 inches below the top of existing levee.

6.5 Levee Embankment and Toe Drain Material Specification

On the basis of the field testing, the excavated materials are expected to be reusable as fill materials for the levee embankment. However, the existing caliche-based surface material should be segregated and disposed of offsite. Only material classified as CL soils under the Unified Soil Classification System may be reused for the levee embankment. Material acceptable for reuse should have a maximum liquid limit of 45, and a plasticity index between 20 and 30.

The approved reusable materials or import soils used as levee embankment fill should be placed in loose lifts not exceeding 8 inches in thickness and compacted to at least 95 percent of maximum dry density as determined by ASTM D1557. The moisture content of the fill should be maintained within the range of optimum and 2 percentage points above the optimum moisture content.

The toe drain recommended by R-K will extend a minimum distance of 1.5 feet up (measured from vertical) the landside slope, will extend a minimum depth of 1.5 feet below the landside toe elevation, and will have a minimum bottom width of 3 feet. Toe drain material will consist of gravel meeting the gradation requirement of ASTM International (ASTM) D448 coarse concrete aggregate Size No. 57, 67, or 357. The gravel will be entirely wrapped with a geotextile fabric (Mirafi 160N or equivalent). The geotextile fabric will be buried 6 inches beneath the exposed surfaces of the gravel drain to prevent damage.

Toe drain gaps resulting from access ramp locations, existing structures or DHS border walls have been identified and reviewed for acceptance by R-K (R-K 2011c). The following table provides the location of these gaps.

Table 6.3 – Toe Drain Gap Length Summary

End Toe Drain Station	Begin Toe Drain Station	Gap Length (ft)	Comment
1278+71.24	1279+50.00	78.76	Access Ramps
1293+36.05	1293+86.92	50.87	
1322+36.08	1322+80.82	44.74	
1326+33.32	1326+69.12	35.80	
1337+24.32	1337+72.67	48.35	
1362+56.06	1362+96.75	40.69	
1379+29.55	1398+00.00	1,870.45	DHS Wall
1410+59.47	1411+29.54	70.07	DHS Wall
1425+00.00	1448+00.	2,300.00	DHS Wall
1465+72.42	1466+35.02	62.60	Golf Course Tee Box
1472+35.49	1473+31.19	95.70	Roadway
1483+00.00	1502+00.00	1,900.00	Landside Ditch shown on Report as 1483+00 to 1485+00
1509+42.96	1510+37.00	94.04	Access Ramp
1521+90.83	1525+96.00	405.17	Los Fresnos Canal, canal must be full of water during a storm event
1548+74.75	1549+12.05	37.30	
1577+64.36	1578+48.28	83.92	Flor de Mayo Crossing
1615+86.94	1616+32.38	45.44	
1642+46.39	1642+82.36	35.97	
1656+83.51	1657+09.25	25.74	
1674+02.39	1674+31.24	28.85	

End Toe Drain Station	Begin Toe Drain Station	Gap Length (ft)	Comment
1709+15.99	1709+60.40	44.41	
1732+53.95	1780+30.00	4,776.05	Report 1733+00 to 1780+30
1795+67.67	1796+20.23	52.56	Access Ramp
1801+40.00	1904+85.12	10,345.12	City of Brownsville Homes and Bridges, shown on Report 1801+40 to 1904+85

6.7 Traffic Surface

Based on the information provided, the top of the levee will generally be used for light traffic frequencies to facilitate access but may be subjected to infrequent heavy equipment loads during flood emergencies and maintenance.

Before the gravel surfacing is placed, the subgrade should be scarified and compacted to 95 percent of the maximum density as determined by ASTM D1557 at a range of moisture content from optimum moisture content to 2 percentage points above the optimum moisture content. It was recommended that the gravel layer consist of a minimum of 6 inches of aggregate base selected in accordance with *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges* for Item 247 Flexible Base, Type A or C, Grade 3 (TXDOT 2004).

7. Civil Design

This section summarizes the civil design elements associated with the design of the Donna Pump to Brownsville levee rehabilitation project. It describes the design criteria, assumptions, and constraints associated with the design elements.

7.1 Existing Facilities

As identified during the field investigations (see Figure 3.1 and Figure 3.2) and on the survey mapping, many existing facilities must be considered during the design process. The existing facilities within the project limits include, but are not limited to, storm drain/irrigation culverts, inlet and outlet structures, gatewells, property fences, utility poles, and USIBWC survey control markers. For the scope of this project, the existing facilities will not be relocated, but protected or modified in place.

Existing facilities found in the field and on as-built plans are marked on the construction plans. It is recommended that Texas Excavation Safety System be contacted to mark all utilities along the project reach before construction. Unfortunately, where no vertical information is provided; the contractor will have to proceed with caution near these utilities during construction.

Interfering portions of the existing chain-link fence, fence gate, and wire fence across or along the Donna Pump to Brownsville levee embankment will be removed before construction and replaced afterwards because they will interfere with construction activities and access along the top of levee.

7.2 Gatewell Structures

Existing gatewell structures will be protected in place. There is no anticipated relocation or improvements to these existing structures, unless they are damaged. Existing sluice gates within the gatewells that are inoperable will be replaced completely, because complete replacement is more economical than having a special replacement part made. Furthermore, according to USIBWC, the original gates and their appurtenance are too old and replacement parts are no longer available. A maintenance and replacement summary for the existing gatewells completed during the field investigation is provided in Table 7.1.

Abandoned gatewells are indicated on the USIBWC summary maintenance field log; it was observed in the field that the sluice gate has been removed, and the gatewell is filled with soil. RFI No. 7 was submitted to USIBWC for clarification on abandoned gatewells for preventing flood flows from being conveyed through the inlet and outlet pipes. To ensure that no flood flows would be conveyed through the pipes, the contractor will need to locate and break the inlet and outlet pipes within the ROW and plug them with brick and mortar. The abandoned gatewell will be required to be excavated to remove the steel plate and backfill soil. Contractor to place flowable fill to fill the void within the outlet pipes and cavity of the gatewell structure.

Table 7.1 – Maintenance and Replacement Summary for Existing Structures

Structure No.	Pipe Size	Comments
131	18"	Replace sluice gate per plan
132	18"	Protect in place
133	24"	Replace sluice gate per plan
133L	48"	Remove and replace with new T-Post and USIBWC needs to inspect, City of Brownsville License No. LSF/G-1664
134	18"	Replace sluice gate per plan
135	-	Abandoned structure ¹
136	-	Abandoned structure ¹
137	18"	Remove and replace broken manhole steps, sluice gate per plan and concrete headwall needs work.
138	18"	Replace sluice gate per plan
139	18"	Remove and replace with new T-post and protect in place
140	24"	Remove and replace with new T-post, gatewell rebar cover and sluice gate per plan
147	3'x3'	Replace sluice gate per plan
147AL	3'x3'	Remove and replace with new T-Post, broken manhole steps, gatewell rebar cover and sluice gate per plan. Frank Russell License no. LSF/G-230
148	18"	Remove and replace with new T-post and sluice gate per plan
149	18"	Protect in place
150	18"	Need USIBWC to inspect
151	3'x3'	Remove and replace with new T-post and replace sluice gate per plan
152	18"	Need USIBWC to inspect
153	18"	Need USIBWC to inspect
154	18"	Remove and replace existing gatewell rebar cover and Protect in place
155L	5'x5'	Need USIBWC to inspect, River Bend License No. LSF/G-1345
162	24"	Remove and replace existing gatewell rebar cover and sluice gate per plan
166	-	Abandoned structure ¹
167	-	Abandoned structure ¹
168	-	Abandoned structure ¹
169	-	Abandoned structure ¹
170	-	Abandoned structure ¹
171	18"	Remove and replace with new T-post and sluice gate per plan
172	24"	Remove and replace with new T-post, gatewell rebar cover and sluice gate per plan
173	-	Abandoned structure ¹
175	18"	Replace sluice gate per plan
176	-	Abandoned structure ¹
177L	54"	Need USIBWC to inspect
178	3'x3'	Replace sluice gate per plan, Tetra Tech unable to located headwall during inspections, USIBWC noted in maintenance log that landside concrete headwall need work. Headwall repairs may use as optional items per Spec. 60 66 00.
179	24"	Replace sluice gate per plan, Tetra Tech unable to located headwall during

Table 7.1 – Maintenance and Replacement Summary for Existing Structures

Structure No.	Pipe Size	Comments
		inspections, USIBWC noted in maintenance log that landside concrete headwall need work. Headwall repairs may use as optional items per Spec. 60 66 00.
180	-	Abandoned structure ¹
181	-	Abandoned structure ¹
181A	48"	Protect in place, Tetra Tech unable to located headwall during inspections, USIBWC noted in maintenance log that landside concrete headwall need work. Headwall repairs may use as optional items per Spec. 60 66 00.
181AL	48"	Need USIBWC to inspect, City of Brownsville License No. LSF/G-1045
182	-	Abandoned structure ¹
183	-	Abandoned structure ¹
184	-	Abandoned structure ¹
186	24"	Remove and replace with new T-Post, gatewell rebar cover and sluice gate per plan
188	-	Abandoned structure ¹
189	-	Protect in Place
191A	-	Abandoned structure ¹
191L	36"	Need USIBWC to inspect
193	-	Abandoned structure
194	-	Abandoned structure
195	-	Abandoned structure
196	-	Abandoned structure
197	24"	Need USIBWC to inspect
201	-	Abandoned structure
198	-	Abandoned structure
199	24"	Need USIBWC to inspect
204	-	Abandoned structure ¹
204L	42"	Protect in place ²
205	15"	Need USIBWC to inspect
¹ Contractor to locate and break existing inlet and outlet pipe within right-of-way and plug pipe with brick and mortar per the plan.		
² Contractor to remove existing concrete slab placed on top of gatewell to allow USIBWC to inspect and determine condition of gatewells and sluice gate.		

7.3 Top of Levee Raising and Widening

The analysis of top of levee elevations, which is discussed in Section 4, was conducted to determine the freeboard requirements for the 100-year flood. The minimum top-of-levee elevations were provided by USIBWC. Typical sections showing the levee raising for 100-year flood protection are shown on Figure 7.1 to Figure 7.3. The existing levee control line will be kept at its current location; this line does not represent the centerline of the levee. For levee expansion on the landside, the top of levee on the riverside will be used as a control and offset 16 feet toward the landside, as shown on Figure 7.2. The side slope for levee expansion on the landside will be no steeper than 2.5H:1V, but in most cases 3H:1V would be used in the design, unless the landside horizontal width is less than 15 feet wide. Landside horizontal widths less

than 15 feet wide have been identified in Table 2.4. For levee expansion on the riverside, the top of levee on the landside will be used as a control and offset 16 feet toward the riverside, as shown on Figure 7.3. The side slope for levee expansion on the riverside will be no steeper than 3H:1V.

Improvements to the Donna Pump to Brownsville levee system require excavation and fill activities that would affect plant communities within the area of the expanded levee footprint. As documented in the EA (USIBWC 2007), nearly all vegetation removal (51.5 acres) would be limited to invasive-species grassland that is expected to rapidly become reestablished. While approximately 17 percent of the 65-mile levee system is adjacent to conservation areas, those non-native grasslands are located within the ROW and have very limited value as wildlife habitat (USIBWC 2007). No significant effects are anticipated for any of the 15 threatened and endangered species with potential habitat in the vicinity of the levee system. No wetlands are located within the potential levee expansion area.



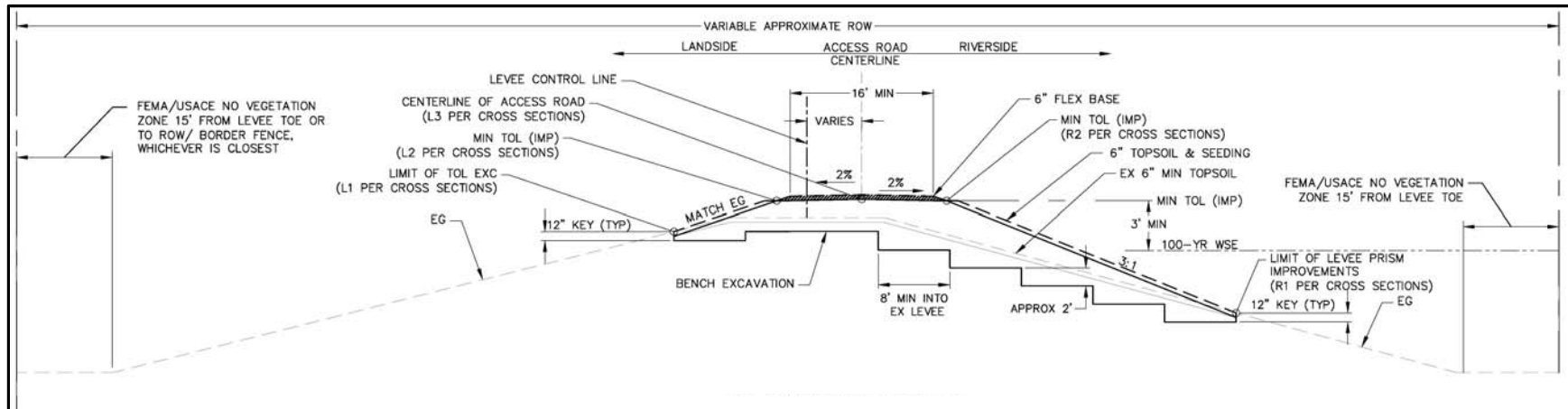


Figure 7.3 – Typical Section Showing Levee Improvements – Levee Raising and Widening (Riverside)

7.4 Effects of Reduced Cross Section on Water Surface Elevations

It is proposed that the levee crown be widened and the riverside levee slope be extended into the channel up to 15.9 feet along an approximately 724.7-foot reach immediately downstream of the Gateway International Bridge. USIBWC's HEC-RAS model was revised to determine whether the reduction in the cross-sectional area of the channel would result in an increase in the water surface elevations along the 724.7-foot reach. The reduction in the cross-sectional area of the channel did not cause an increase in the water surface elevations. The water surface elevations calculated by USIBWC's original HEC-RAS model were identical to those calculated by the revised HEC-RAS model.

7.5 Top of Levee Access Road

The access road on top of the levee will have a minimum width of 16 feet with a 2 percent crowned slope from the centerline of the levee. The top of the roadway will be constructed with 6 inches of flexible base, or caliche-based material. The 6 inches of flexible base is not included as part of the minimum required freeboard. The top of impervious levee will also be crowned and have a 2 percent crowned slope. The existing top of levee will be excavated 12 or 18 inches to remove the existing flexible base. The 18-inch removal depth is intended to remove the existing flexible base and several inches of the existing top of levee to be recompacted according to the geotechnical recommendations, as shown in the Evaluation of Placed Fill Report (R-K 2011a). The side slopes of the levee will be excavated by benching to provide an adequate condition for proper backfill and compaction.

The survey control, northing and easting of the adjacent survey control alignment are provided in a spreadsheet included in Appendix E.

7.6 Roadway Intersections

Existing roadway intersections will be protected in place and all levee access road improvements will join to the existing roadway improvements. The Standard City of Brownsville residential street section has 3-inches of hot mix asphalt concrete (HMAC) and 7-inches of crushed limestone base-course, which are considered as pervious material that will not meet levee freeboard requirements. All roadways crossing the levee with the exception of 10th Street have been verified to meet or exceed levee freeboard requirements. However, the roadway intersection at 10th Street (Approximate Station 1866+39) will require a lime treated impervious levee material over 3-inches of asphalt to provide an impervious barrier within the roadway. The levee intersection with the railroad tracks are further discussed in Section 7.8, as the existing impervious levee does not meet the levee freeboard requirements.

Table 7.2 – Roadway Intersection Impervious Levee Verification Table

Levee Intersection	Approx. Station	100-Yr IBWC Min. Freeboard (ft.) (1)	Surveyed Roadway Elev. (ft.)	Roadway Pervious Depth (ft.) (2)	Top of Levee Impervious Elevation (ft.)
Sacramento River Road	1472+81	49.30	51.25	0.83	50.42
Mississippi River Road	1483+67	49.00	50.37	0.83	49.54
Palm Road	1829+54	42.07	43.00	0.83	42.17
Railroad Tracks	1863+06	41.35	42.00	2.50 (3)	38.85
South 10 th Street	1866+39	41.29	42.05	0.83	41.22
East 12 th Street	1876+81	40.45	43.49	0.83	42.66

- Notes: (1) 100-Yr IBWC Minimum Freeboard provided from USIBWC TOLE Spreadsheet provided on December 2010.
(2) Roadway Pervious Depth taken from City of Brownsville typical street collector section for 3-inches of asphalt and 7-inches of crushed limestone base.
(3) Roadway Pervious Depth taken from Union Pacific Rail Road, typical roadbed section for wooden tie track construction, STD Plan No. 0001B

7.7 Maintenance Access Ramp

The existing maintenance access ramps will be removed and replaced with new access ramps to closely match the existing ramp slopes, but not to exceed a maximum slope of 16%. Flexible base will be placed on the maintenance access ramps to the ROW or 15 feet from the new toe of the access road. The minimum width of the maintenance access ramps is 16 feet. Access ramps on the riverside that are greater than 45 degrees with the levee will have their side slopes protected with riprap.



Figure 7.4 – Typical Maintenance Access Ramp

7.8 Union Pacific Railroad

The Union Pacific Railroad (UP) tracks within Upper Brownsville Levee are currently lower than the minimum top of levee elevation. The UP railroad standard plans for railway sections require ballast and sub-base material to be 2.5 feet deep. This railway section is considered pervious material. The impervious ground provides approximately 6 inches of freeboard during the 100-year flood. On November 21, 2011, USIBWC directed Tetra Tech to remove the railroad improvements from the design documents.

7.9 Maintenance Recommendations

During the January and April 2011 field investigations by Tetra Tech, many of the existing drainage/irrigation gatewells found in the field were plugged with sediment and not functioning. The contractor will be required to remove sediment and clean inlet/outlet structures and pipes. Once completed, the condition of such gatewells will be inspected by the USIBWC O&M crew, and recommendation for repair or replacement of the structures will be made, as appropriate.

Trees and bushes need to be removed from the levee side slopes and toe of the levee to the ROW. The O&M crew needs to closely monitor damage to the levees and perform repairs on an as-needed basis.

7.10 Bridge Closure Device

USIBWC does not have continuous access from the top of levee across the Los Fresnos Pump Canal without driving around the canal. A bridge and closure device will need to be constructed, which is not part of Tetra Tech's current contract. An agreement between USIBWC and the Los Fresnos Irrigation District will be necessary.

7.11 Vegetation Removal Zone

The rehabilitation plans for Upper Brownsville Levee of the Donna Pump to Brownsville levee system will be completed to comply with the FEMA 44 CFR 65.10 freeboard requirements, based on the minimum freeboard requirement provided by the USIBWC. The requirements for a minimal vegetation-free zone, as outlined in Engineer Technical Letter 1110-2-571 (USACE 2009), do not permit vegetation in the area between the riverside access road and the landside horizontal width. There is a basis levee shown on Figure 7.5. Existing levee reaches that do not have the minimum 15 feet of vegetation-free zone are limited to the existing real estate interest or ROW.

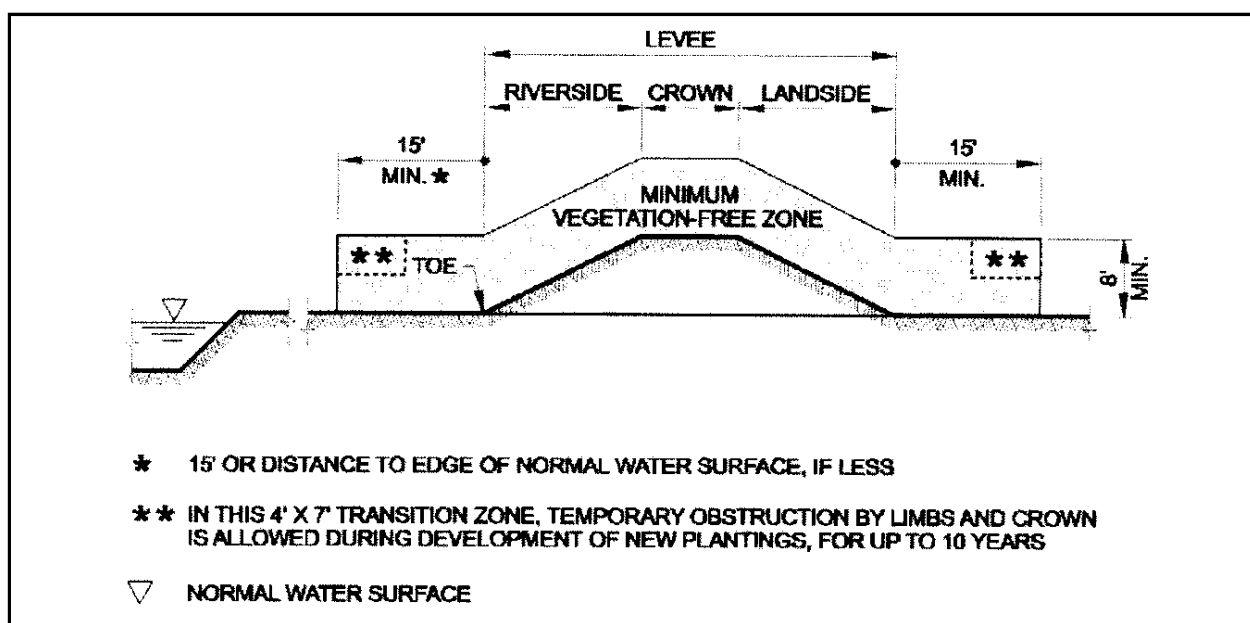


Figure 7.5 – FEMA Minimum Vegetation-Free Zone for Basis Levee

The design plans were verified in the field before the 90% submittal for Upper Brownsville Levee. Existing trees and utilities were verified and are shown on the plans. This effort did not identify all items that the contractor might find in the field during construction, but it constitutes the best of Tetra Tech's ability to identify existing items during the design process.

The FEMA/USACE minimum 15- foot wide, vegetation free zone from the toe of slope has been identified on the design plans. The areas between the FEMA/ USACE minimum vegetation zone and the adjacent DHS border wall, fence or ROW will require mowing by the Contractor. These

areas have also been identified on the design plans to provide USIBWC a mowed vegetation free zone. Where existing DHS border wall or fence is located inside of the 15-foot wide minimum vegetation zone, the border wall or fence will be used as the vegetation free zone boundary. USIBWC will have to grant themselves a vegetation variance for these locations based on an existing physical obstruction.

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8. Engineer's Opinion of Probable Cost

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9. Conclusion

The Donna Pump to Brownsville levee rehabilitation will raise the top of levee, where necessary in order to provide freeboard to satisfy the FEMA requirements. The access road on top of the levee will be a minimum of 16 feet wide and be covered with at least 6 inches of flexible base material (caliche-based material). The side slopes of the levee will be excavated to remove any large shrubs or trees roots systems with a diameter greater than ½ inch. As mitigation for seepage, toe drains will be constructed on the landside toe to control subsurface flows. Most levee improvements will be constructed on the landside, except for, downstream of the Gateway International Bridge, the levee improvements will be constructed on the riverside. There will be no access road improvements where the DHS fence is present as the access road has already been improved by that effort. A HEC-RAS analysis indicated that the water surface elevation would not increase as a result of the proposed riverside improvement.

The 44 CFR 65.10 requirements for freeboard, closures, embankment protection, embankment and foundation stability, settlement, interior drainage, sediment transport, operation plans, and maintenance plans must be met to qualify for FEMA levee certification. It is understood that USIBWC is a federal agency that could issue itself a variance to these requirements. Tetra Tech, under the current scope of work, has completed design plans to raise the levee, provided a 16-foot-wide access road on the top of the levee, addressed the issue of embankment and foundation stability and the issue of settlement, and identified the missing information pertaining to the 44 CFR 65.10 requirements. It is the responsibility of the USIBWC to perform additional work and obtain the necessary documentation to file for a FEMA levee certification.

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10. References

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Appendix A

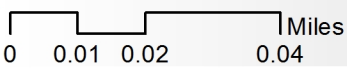
Existing Structures within USIBWC ROW

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Legend

- Sub-Reach Extent
- Levee Alignment
- - - Right of Way






Lower Rio Grande Levee
Donna Pump to Brownsville: Sub-Reach 4 Structures in ROW

Data Source: IBWC 2010, US Census 2009
Aerial Source: ESRI 2009





Legend

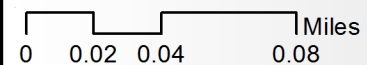
-  Sub-Reach Extent
-  Levee Alignment
-  Right of Way

0 0.02 0.04 0.08 Miles

**Lower Rio Grande Levee
Donna Pump to Brownsville: Sub-Reach 4 Structures in ROW**

Data Source: IBWC 2010, US Census 2009
Aerial Source: ESRI 2009





Lower Rio Grande Levee
Donna Pump to Brownsville: Sub-Reach 4 Structures in ROW

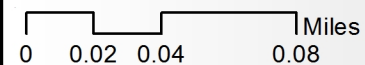
Data Source: IBWC 2010, US Census 2009
Aerial Source: ESRI 2009





Legend

- Sub-Reach Extent
- Levee Alignment
- - - Right of Way



Lower Rio Grande Levee
Donna Pump to Brownsville: Sub-Reach 4 Structures in ROW

Data Source: IBWC 2010, US Census 2009
Aerial Source: ESRI 2009





0 0.02 0.04 0.08 Miles

**Lower Rio Grande Levee
Donna Pump to Brownsville: Sub-Reach 4 Structures in ROW**

Data Source: IBWC 2010, US Census 2009
Aerial Source: ESRI 2009



Appendix B

Field Investigation Forms and Photos

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Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 131

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	131	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16520397.1260, 1276651.8500	Station:	1279+19.08
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	n/r	Paint	Yes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 3/8/11 Cleaned and lubed guides and stem. Ran gate open and close. Knocked off a lot of surface rust off the bottom of the ring. Set screw rusted, needs minor concrete repair.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating is provided.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a landside pond. Tetra Tech unable to inspect the inside of the pipe, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the construction documents to provide access to USIBWC for further inspection.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating
Additional Tetra Tech Comments:			
Tetra Tech Recommended Repair as Shown on Plans:			
Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint existing gatewell cover, re-establish flow path, remove and replace sluice gate assembly.			



Photos 1- Gatewell Structure 131

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 132

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	132	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16520399.6720,1276655.1640	Station:	~1295+82
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	yes		

Deficiencies noted by USIBWC:
J.J: 3/8/11 Cleaned and lubed guides and stem. Ran gate open and close. Knocked off a lot of surface rust off the bottom of the ring. Needs minor concrete repair.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the construction documents to provide access to USIBWC for further inspection.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gateway, remove sediment and clean inlet and outlet structures and pipes, re-establish flow path and paint the structure.



Photo 1- Gatewell Structure 132

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 133

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	133	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16519585.1470, 1278285.1560	Station:	~1297+41
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	n/r	Paint	yes
T-Post	yes		

Deficiencies noted by USIBWC:
J.J: 3/8/11 Cleaned and lubed stem and guides. Ran gate open and close. The ring is pitted and will not seal. The brackets, nuts and bolts that were installed to fix the left guide are

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the construction documents to provide access to USIBWC for further inspection.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint existing gatewell cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell Structure 133

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 133L

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	133L	Pipe Size:	48"
Pipe Material:		# Gates:	1
Coordinates:	16519007.5040, 1279454.3270'	Station:	1310+46
Structure System:	Drainage		

Photo Log:

Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:

Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	n/r		

Deficiencies noted by USIBWC:

J.J: 3/8/11 Ran gate open and close. Had to dig out the caliche out of the gate latch slots in order to close the gate. Cannot check the bottom seal of the gate due to too much water. Therefore can't certify. Lateral drain needs clearing of trees.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech observed heavy vegetation on the inlet and outlet structures that may inhibit flows .	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the construction documents to provide access to USIBWC for further inspection.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gatewell structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating
Additional Tetra Tech Comments: Gatewell Structure 133L was unable to inspect due to heavy vegetation on the riverside and from USIBWC notes the bottom of gatewell is submerged and unable to verify if the sluice gate seals.			
Tetra Tech Recommended Repair as Shown on Plans: Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans. A new T-Post is required to be installed by the Contractor.			



Photo 1- Top of existing Gatewell Structure 133



Photo 2- Riverside Inlet structure buried and unable to inspect

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 134

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	134	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16518830.8680, 1279782.6220	Station:	~1314+19
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J.: 3/7/11 Cleaned and lubed guides and stem. Ran gate open and close. The stem needs a stop nut on the bottom part to prevent gate from coming off the guides. The collar needs adjustment and smaller diameter bolts to allow the collar to shift sideways. So the stem is not binding and causing the gate to come off the guides when open.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint existing gatewell cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell Structure 134

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 135

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	135	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16518162.9290, 1280179.3690	Station:	1322+36
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: Plugged str. Needs a foot of dirt to completely fill up the str. Need to clear trees growing out of the str. Needs painting.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 135 is abandoned, the top of sluice gate has been removed. The gatewell cover is left in place, the structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 135, Abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 136

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	136	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16517307.4490, 1279879.1370	Station:	~1324+00
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	n/r		

Deficiencies noted by USIBWC:
J.J: 3/7/11 Str. Needs 2 1/2 feet of dirt to completely fill up the str. Need to clear trees growing out of the str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 136 is abandoned, the top of sluice gate has been removed. The gatewell cover is left in place, the structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 136, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 137

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	137	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16517160.0910, 1279792.7120	Station:	~1327+50
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tetra Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	1 n/r
Grill Cover	yes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
 J.J: 3/7/11 Cleaned and lubed guides and stem. Ran gate open and close good seal. Bottom of ring rusty and stem is missing the stop nut. - Headwalls need concrete work.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	M	Tetra Tech observed a landside pond. Tetra Tech unable to inspect the inside of the pipe, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gateway structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gateway for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The landside outlet is submerged.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gate cover, re-establish flow path, remove and replace sluice gate assembly. Contractor directed to remove and construct a new manhole step as shown on plans.



Photo 1- Gatewell Structure 137

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 138

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	138	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16516723.7710, 1279516.9660	Station:	~1338+48
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
 J.J: 3/7/11 Lubed and oiled stem and guides. Ran gate open and close. Bottom ring pitted won't seal. Landside headwall needs replacement or repair.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech observed vegetation on the inlet and outlet structures that may inhibit flows .	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC noted problems with the landside headwall. Tetra Tech unable to located the head during field investigation. If landside headwall requires replacement USIBWC able to use optional items on plans.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell Structure 138



Photo 2- Riverside inlet structure

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 139

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	139	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16516287.068, 1279247.619	Station:	1343+64
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tetra Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	n/r		

Deficiencies noted by USIBWC:
J.J: 3/7/11 Lubed and oiled stem and guides. Ran gate open and close. Seals good, bottom part of the ring is rusty. Headwalls need concrete work.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech unable to locate the inlet and outlet headwalls. USIBWC noted that minor headwall work is required.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gatewell, remove sediment and clean inlet and outlet structures and pipes, re-establish flow path and paint the structure. Contractor direct to install a T-Post as shown on plans. Minor headwall work is required, Tetra Tech unable to verify, optional items to repair or replace the headwall are shown on the plans.



Photo 1- Gatewell Structure 139

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 140

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	140	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16515601.794, 1279137.915	Station:	1350+77
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Bottom of ring is rusty. - Stop screw to the stop nut us corroded

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access inside of the gatewell for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly. A new T-Post and gatewell rebar cover to installed.



Photo 1- Gatewell Structure 140

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 147

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	147	Pipe Size:	4'x4' Box
Pipe Material:	RCP	# Gates:	1
Coordinates:	16513287.437, 1282716.475	Station:	1397+08
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 3/1/11 Str. Has no hardware. Str. Was plugged with a metal plate, and concrete on the bottom seal.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech observed vegetation and debris on the inlet and outlet structures that may inhibit flows .	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes	U	Tetra Tech located the riverside headwall and the pipe is badly need of cleaning out of silt and debris.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. Pipe to be cleaned out.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating
Additional Tetra Tech Comments: Have debris on the riverside, unable to located headwall on the landside due to heavy vegetation. The sluice gate has been removed Tetra tech unable to see to the bottom to verify a closure gate.			
Tetra Tech Recommended Repair as Shown on Plans: Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path, remove and replace sluice gate assembly.			



Photo 1- Gatewell Structure 147, missing top of sluice gate



Photo 2- Riverside inlet to be cleaned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 147A

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	147A	Pipe Size:	2'x2' Box
Pipe Material:	RCP	# Gates:	1
Coordinates:	16513353.01, 1283592.79	Station:	1405+89
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	1 N/R
Grill Cover	N/R	Paint	needs
T-Post	N/R		

Deficiencies noted by USIBWC:

J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Right guide is missing all three blocks and bottom bolt and nut. Guide is loose. Left guide is missing the two bottom blocks, bolts, and nuts. Gate will not seal properly.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech observed vegetation on the inlet and outlet structures that may inhibit flows.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes	A	Tetra Tech inspect the culvert/ pipes on the landside, appears to be recently constructed from the DHS Border Wall construction. Tetra Tech unable to locate the riverside headwall, due to the heavy vegetation on the riverside.	Contractor directed remove sediment and clean inlet and outlet structures and pipes and re-establish flow path. If headwall requires repairs, USIBWC to review optional items as shown on the plans.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Landside headwall appears to new from DHS Border Wall construction.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly. Contractor is directed to construct a new T-Post, remove and replace broken manhole steps and gatewell rebar cover .



Photo 1- Gatewell Structure 147A



Photo 2- landside outlet, to be cleaned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 148

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	148	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16513474.171, 1284746.822	Station:	1417+55
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	yes
T-Post	N/R		

Deficiencies noted by USIBWC:

J.J: 3/1/11 Cleaned and lubed guides and stem. Ran gate open and close. Bottom nuts and bolts to both guides are corroded.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech observed minimal vegetation on the inlet and outlet structures that may inhibit flows. The landside outlets into a channel that appears to maintained by the farmer.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes	A	Tetra Tech inspect the culvert/ pipes on the landside, appears to be recently constructed from the DHS Border Wall construction. Tetra Tech unable to locate the riverside headwall, due to the heavy vegetation on the riverside.	Contractor directed remove sediment and clean inlet and outlet structures and pipes and re-establish flow path. If headwall requires repairs, USIBWC to review optional items as shown on the plans.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly. Contractor is directed to construct a new T-Post.



Photo 1- Gatewell Structure 148

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 149

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	149	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16513437.854, 1285112.488	Station:	1421+24
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/25/11 Cleaned and lubed the guides and stem. Ran gate open and close. There's rust by the bottom of the ring. Good seal.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gatewell, remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path and paint the structure.



Photo 1- Gatewell Structure 149

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 150

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	150	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16513330.649, 1285763.094	Station:	1427+90
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/25/11 Did not inspect due to bees inside the marker pipe by the structure.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Gateway Structure 150 was unable to inspect due to heavy vegetation on the riverside.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to be repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 150

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 151

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	151	Pipe Size:	3'x3' box
Pipe Material:	RCB	# Gates:	1
Coordinates:	16513293.547, 1285826.033	Station:	1428+63
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	n/r		

Deficiencies noted by USIBWC:

J.J.: 2/25/11 Cleaned and lubed the guides and stem. Ran gate open and shut. Good seal. 2 nuts and bolts to gear assembly are corroded, but gear assembly works good. Needs some concrete work.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the riverside inlet structure, minor vegetation or obstructions were observed at the inlet structure. The landside outlet appears to be submerged in the lake and unable to inspect.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a landside pond. Tetra Tech unable to inspect the inside of the pipe, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gateway structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The landside is submerged in the pond and was unable to inspect by Tetra Tech and USIBWC staff.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly. Contractor directed to remove and replace with a new T-Post.



Photo 1- Gatewell Structure 151



Photo 2- Riverside Inlet Ditch with debris and vegetation.

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 152

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	152	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16512986.877, 1286372.226	Station:	1434+90
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/25/11 Did not inspect due to low oxygen level. 18.8

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech was unable inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Gateway Structure 152 was unable to located inlet and outlet structures, might be buried.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 152

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 153

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #: 153		Pipe Size: 18"	
Pipe Material: RCP		# Gates: 1	
Coordinates: 16512668.962, 1286936.836		Station: 1441+39	
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/25/11 Did not inspect due to low oxygen level

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech observed vegetation on the inlet and outlet structures that may inhibit flows.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes	M	Tetra Tech located the riverside inlet, appears to functional.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gatewell structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Gatewell Structure 153 was unable to located inlet and outlet structures, might be buried.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 153



Photo 2- Riverside Inlet, to be cleaned and remove vegetation

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 154

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	154	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16512359.099, 1287463.643	Station:	1447+58
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	n/r	Paint	needs
T-Post	yes		

Deficiencies noted by USIBWC:

J.J: 2/25/11 Lubed and cleaned the guides and stem. Ran gate open and close. L/S headwall needs a grill, headwall has a drop, it's a safety hazard.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech was unable inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

During Tetra Tech's field assessment gateway rebar cover was present, based on USIBWC deficiencies notes gateway rebar cover is missing.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gateway, remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path and paint the structure. Contractor to remove and replace with a new gateway rebar cover.



Photo 1- Gatewell Structure 154

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 155

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	155	Pipe Size:	5'x5' box
Pipe Material:	RCB	# Gates:	1
Coordinates:	16510623.185, 1287363.556	Station:	1465+21
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J: 2/25/11 Did not inspect due to low oxygen level			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the riverside inlet structure, minor vegetation or obstructions was observed at the inlet structure. The landside outlet appears to be submerged in the lake and unable to inspect.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a landside lake. Tetra Tech unable to inspect the inside of the pipe, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The landside is submerged in the lake .	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gatewell structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 155



Photo 2- Riverside Inlet

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 162

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	162	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16509158.394, 1291214.008	Station:	1510+91
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	n/r		

Deficiencies noted by USIBWC:
 J.J: 2/24/11 Lubed and cleaned guides and stem. Gate won't open all the way. Need to modify stem. The gate lacks about 1/4" to seal flush with ring. - Need to remove the frozen stop nut, install a new stop nut and adjust it right. - Bolts to both guides are corroded. Still holding but corroded. - Grill needs modification to accommodate wheel. - Gate ring 9 bottom half rusted, needs mortar on top of ring.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the riverside inlet structure, minor vegetation or obstructions were observed at the inlet structure.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a landside pond. Tetra Tech unable to inspect the inside of the pipe, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gateway structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The landside is submerged in the pond and was unable to inspect by Tetra Tech and USIBWC staff.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly. Contractor directed to remove and replace with a new T-Post.



Photo 1- Gatewell Structure 162



Photo 2- Riverside Inlet

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 166

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	166	Pipe Size:	3'x3' box
Pipe Material:	RCP	# Gates:	-
Coordinates:	16507005.917, 1291970.755	Station:	1535+08
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/24/11 Plugged, Str. Needs 7 1/2 ft. of dirt to fill up str. - Real safety hazard. Need to cut two bolts sticking up from pedestal housing. It's a trip hazard.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 166 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 166, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 167

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	167	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	-
Coordinates:	16506435.585, 1292948.968	Station:	1547+05
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 2/24/11 Plugged - Entrance handle to str. Is broken with sharp edges. Needs to be cut off with cutting torch. Str. Needs 4 1/2" of dirt.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 167 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 167, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 168

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:		
Structure #: 168	Pipe Size: 18"	
Pipe Material: RCP	# Gates: -	
Coordinates: ^{16506311.702,} ^{1293381.13}	Station: 1551+53	
Structure System: -		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/24/11 Plugged - About 2" of the floodside drain pipe is exposed and broken on the end. Str. Needs 4' of dirt to fill to the top.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 168 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 168, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 169

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	169	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	-
Coordinates:	16506047.562, 1294177.462	Station:	1559+95
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/24/11 Plugged - Str. Needs 4 1/2' of dirt to fill up the top.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 169 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 169, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 170

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	170	Pipe Size:	18"
Pipe Material:	RCP (Abandoned)	# Gates:	-
Coordinates:	16505578.307, 1294612.525	Station:	1566+53
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/24/11 Plugged - Str. Needs 2 1/1' of dirt to fill the str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 170 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 170, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 171

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	171	Pipe Size:	18"
Pipe Material:	RCP	# Gates:	No a/b
Coordinates:	16505128.675, 1294958.586	Station:	1572+20
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	needs
T-Post	n/r		

Deficiencies noted by USIBWC:

J.J: 2/23/11 Lubed and cleaned guides and stem. Ran gate open and close. Good seal. Stem needs a stop nut to prevent gate from going past the seal.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the landside outlet structure, it appears to be clean and recently constructed with the DHS Border Wall construction. Tetra Tech was unable to locate the riverside inlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction and establish the flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating
Additional Tetra Tech Comments:			
New landside outlet appears to be from the DHS Border Fence construction.			
Tetra Tech Recommended Repair as Shown on Plans:			
Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.			



Photo 1- Gatewell Structure 171



Photo 2- Landside outlet structure

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 172

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	172	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16504412.343, 1296169.267	Station:	1586+55
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	n/r	Paint	No Notes
T-Post	n/r		

Deficiencies noted by USIBWC:
J.J: 2/23/11 Lubed and cleaned guides and stem. Ran gate open and close. Good seal. Need to replace the stop nut and re-adjust. - Bottom nut and bolt to the U/S side guide is broken off.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the landside outlet structure, it appears to be clean and recently constructed with the DHS Border Wall construction. Tetra Tech was unable to locate the riverside inlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

New landside outlet appears to be from the DHS Border Fence construction.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path, remove and replace sluice gate assembly. Contractor directed to remove and replace with a new T-Post and gateway rebar cover.



Photo 1- Gatewell Structure 172

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 173

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	173	Pipe Size:	4'x4' Box
Pipe Material:	Abandoned	# Gates:	-
Coordinates:	16504269.6, 1296543.226	Station:	1590+53
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 2/24/11 Plugged - Str. Needs 2 1/1' of dirt to fill the str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 170 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 173, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 175

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	175	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	No a/b
Coordinates:	16504243.188, 1296623.102	Station:	1591+39
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	No Notes
T-Post	yes		

Deficiencies noted by USIBWC:

J.J: 2/23/11 Cleaned and oiled guides and stem. Ran gate open and close. - Good seal. - Gate has two broken chips on top of gate but still seals. Stem needs a stop nut on top of stem to prevent gate from passing the seal. And needs a stop nut on bottom stem to prevent gate from coming off the guides. - Nuts and bolts to the U/S guide corroded.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the landside outlet structure, it appears to be clean and recently constructed with the DHS Border Wall construction. Tetra Tech was unable to locate the riverside inlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

New landside outlet appears to be from the DHS Border Fence construction.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell structure 175

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 176

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:		
Structure #: 176	Pipe Size: 5x5	
Pipe Material: Abandoned	# Gates: 1	
Coordinates: 16503665.432, 1297473.264	Station: 1601+75	
Structure System: -		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 2/23/11 Str. Needs 2ft of dirt to completely fill the str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 176 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 176, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 177L

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	177L	Pipe Size:	54"
Pipe Material:	RCP	# Gates:	No a/b
Coordinates:	16503159.271, 1298162.763	Station:	1609+69
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/23/11 - Cannot inspect due to too much water in the well. - Need to vactor out water. - Might need to berm the floodside headwall. With H.E. and set a pump.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the riverside inlet structure, minor vegetation or obstructions observed at the inlet structure.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a landside canal. Tetra Tech unable to inspect the inside of the pipe, there for no rating is provided.	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The riverside is submerged.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

The landside inlet unable to locate appears to join with existing street drainage system.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 177L



Photo 2- Riverside outlet, submerged

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 178

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	178	Pipe Size:	3'x3' box
Pipe Material:	RCB	# Gates:	1
Coordinates:	16502833.036, 1298660.617	Station:	1616+26
Structure System:	Drainage		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	yes
T-Post	yes		

Deficiencies noted by USIBWC:
 J.J: 2/17/11 Cleaned and oiled guides and stem. Ran gate open and close. Cannot check the bottom seal because there's a foot of slushy muddy water. Landside headwall needs concrete work. 3 nuts to pedestal gear box corroded.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the landside inlet structure needs to be cleaned, vegetation or obstruction observed. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell Structure 178



Photo 2- Landside inlet, to be cleaned and vegetation to be removed.

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 179

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	179	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16502824.511, 1298675.601	Station:	1616+42
Structure System:	Drainage		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	yes	Paint	yes
T-Post	yes		

Deficiencies noted by USIBWC:
 J.J: 2/17/11 Cleaned and oiled guides and stem. Ran gate open and close. Right guide is loose and needs adjustment. When gate is raised all the way it comes off the guides because of the loose right guide. Needs work. Landside headwall needs concrete work.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the landside inlet structure it needs to be cleaned, vegetation or obstruction observed. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path, remove and replace sluice gate assembly.



Photo 1- Gatewell Structure 179



Photo 2- Landside inlet, to be cleaned and vegetation removed

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 180

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	180	Pipe Size:	No a/b
Pipe Material:	Abandoned	# Gates:	No a/b
Coordinates:	16502816.881, 1298690.913	Station:	1616+58
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J: 2/17/11 Plugged Str. Needs a foot of dirt to fill to the top			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 180 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 180, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 181

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	181	Pipe Size:	24"
Pipe Material:	Abandoned	# Gates:	1
Coordinates:	16502544.539, 1299701.067	Station:	1627+08
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
J.J: 2/17/11 Plugged - Needs 2 1/2ft of dirt to completely fill up to the top of str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 181 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 181, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 181A

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	181A	Pipe Size:	48"
Pipe Material:	No a/b	# Gates:	1
Coordinates:	16502363.959, 1300645.45	Station:	1636+69
Structure System:	Drainage		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	yes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
 J.J.: 2/17/11 Lubed guides and stem. Ran gate open and close. Has a good seal. 15 inches from the face of the ring towards the landside pipe there is a 1/2" crack all the way around the drain pipe that needs to be mortored and sealed. Both headwalls need concrete work.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the landside inlet structure, no minor vegetation or obstructions observed at the inlet structure. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC has noted that the landside headwall requires some repair. If repairs cannot be made USIBWC may use the optional items to construct a new headwall structure.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes	U	Tetra Tech did not inspect the insides of the culvert/ pipes.	USIBWC noted that the at the gateway landside pipe is cracked and needs repairs. Contractor is directed in the construction documents to located and repair the damaged pipe. If repairs cannot be made USIBWC may use the optional items to construct a new pipe structure.
10. Sluice / Slide Gates	A	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gateway, remove sediment and clean inlet and outlet structures and pipes, re-establish flow path and paint the structure. Contractor to repair the inside of landside pipe to USIBWC conformance compliance or replace with new landside inlet pipe and headwall.



Photo 1- Gatewell Structure 181A



Photo 2- Landside inlet structure

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 181AL

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	181AL	Pipe Size:	48"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16502360.611, 1300657.2	Station:	1636+82
Structure System:	Drainage		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	yes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/17/11 The gate was closed and we lubed the stem and opened the gate. Did not go into well because of too much water. Cannot inspect until the water is vactored out. F/S headwall needs concrete work. And clearing of grasses.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the landside inlet structure, no minor vegetation or obstructions observed at the inlet structure. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The riverside is submerged.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gateway structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

The landside inlet unable to locate appears to join with existing street drainage system.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 181AL



Photo 2-Landside inlet structure

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 182

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	182	Pipe Size:	18"
Pipe Material:	Abandoned	# Gates:	-
Coordinates:	16502228.565, 1301166.704	Station:	1642+18
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	-

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
Not found in the field.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Gatewell Structure not found in field.	Not Applicable
2. Encroachments	N/A	Gatewell Structure not found in field.	Not Applicable
3. Ponding Areas	N/A	Gatewell Structure not found in field.	Not Applicable
4. Fencing/Gates	N/A	Gatewell Structure not found in field.	Not Applicable
5. Concrete Surfaces	N/A	Gatewell Structure not found in field.	Not Applicable
6. Tilt, Slide, Settle	N/A	Gatewell Structure not found in field.	Not Applicable
7. Foundation	N/A	Gatewell Structure not found in field.	Not Applicable
8. Monolith Joints	N/A	Gatewell Structure not found in field.	Not Applicable
9. Culverts / Pipes	N/A	Gatewell Structure not found in field.	Not Applicable
10. Sluice / Slide Gates	N/A	Gatewell Structure not found in field.	Not Applicable
11. Flap Gates / Valves	N/A	Gatewell Structure not found in field.	Not Applicable
12. Trash Racks	N/A	Gatewell Structure not found in field.	Not Applicable
13. Other Metallic Items	N/A	Gatewell Structure not found in field.	Not Applicable
14. Riprap revetment	N/A	Gatewell Structure not found in field.	Not Applicable
15. Other Revetments	N/A	Gatewell Structure not found in field.	Not Applicable

Additional Tetra Tech Comments:
Gatewell Structure 182 was not found in the field.

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 183

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	183	Pipe Size:	-
Pipe Material:	Abandoned	# Gates:	-
Coordinates:	16501631.988, 1301596.697	Station:	1649+68
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J: 2/16/11 Str. Needs 2 ft of dirt to fill to the top of the str.			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 183 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 183, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 184

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	184	Pipe Size:	18"
Pipe Material:	Abandoned	# Gates:	No a/b
Coordinates:	16500938.951, 1301652.426	Station:	1656+90
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J: 2/16/11 str. Needs 1 foot of dirt to completely fill up to the top.			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 184 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 184, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 186

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	186	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	No a/b
Coordinates:	16499316.466, 1300790.882	Station:	1675+21
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	ok
Grill Cover	n/r	Paint	No Notes
T-Post	n/r		

Deficiencies noted by USIBWC:

J.J: 2/16/11 Cleaned, lubed guides and stem. Ran gate open and close. Gate seals good. Stem is missing the stop nut.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the landside inlet structure it needs to be cleaned. Vegetation or obstruction observed at the inlet structure.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gateway structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed in the construction documents to remove and replace with a new sluice gate based on USIBWC recorded deficiencies.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, paint gateway cover, re-establish flow path, remove and replace sluice gate assembly. A new T-Post and gateway rebar cover to be removed and replaced.



Photo 1- Gatewell Structure 186



Photo 2- Landside inlet, to be cleaned and remove vegetation

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 188

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	188	Pipe Size:	No a/b
Pipe Material:	Abandoned	# Gates:	No a/b
Coordinates:	16498440.233, 1303034.884	Station:	1702+96
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J.: Str. Needs 5ft of dirt to fill up to the top of the str.			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 188 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell structure 188, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 189

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	189	Pipe Size:	No a/b
Pipe Material:	No a/b	# Gates:	No a/b
Coordinates:	16497619.632, 1303507.2	Station:	1712+47
Structure System:	Irrigation		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1, 2

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/16/11 Lubed guides and stem. Ran gate down but won't close all the way because there is a foot of slushy mud in the well. Needs to be vactored out.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	A	At the time of Tetra Tech's inspection USIBWC O&M crew were installing and cleaning the inlet and outlet pipes.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes.
10. Sluice / Slide Gates	A	USIBWC to install new sluice gate.	USIBWC does not have any prior deficiencies listed for the sluice gate. The Contractor is directed to protect in place.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to protect in place existing gatewell, remove sediment and clean inlet and outlet structures and pipes, paint gatewell cover, re-establish flow path and paint the structure.



Photo 1- Gatewell structure 189



Photo 2- Gatewell Structure, at the time O&M staff cleaning structure and install new sluice gate

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 191L

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	191L	Pipe Size:	36"
Pipe Material:		# Gates:	No a/b
Coordinates:	16495213.903, 1305275.825	Station:	1751+95
Structure System:	Drainage		

Photo Log:	
Inlet photo #	2
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	yes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/17/11 The gate was closed and we lubed the stem and opened the gate. Did not go into well because of too much water. Cannot inspect until the water is vactored out. F/S headwall needs concrete work. And clearing of grasses.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech was unable inspect the insides of the culvert/ pipes, therefore no rating is provided. The riverside is submerged.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gateway structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell structure 191L

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 193

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	193	Pipe Size:	-
Pipe Material:	Abandoned	# Gates:	-
Coordinates:	16492936.932, 1304643.731	Station:	1778+63
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
J.J: 2/16/11 Plugged needs 2 ft of dirt to fill up to the top of str.			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 193 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 193, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 194

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	194	Pipe Size:	-
Pipe Material:	Abandoned	# Gates:	-
Coordinates:	16492653.283, 1304921.864	Station:	1782+57
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

J.J: 2/16/11 Plugged needs 2 ft of dirt to fill up to the top of str.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 194 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 194, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 195

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	195	Pipe Size:	-
Pipe Material:		# Gates:	-
Coordinates:	16492060.87, 1305508.52	Station:	~1790+98
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

Lou: 2/15/11 Str. Well has 2 ft drop to the dirt.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 195 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell structure 195, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 196

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	196	Pipe Size:	-
Pipe Material:	-	# Gates:	-
Coordinates:	16492041.53, 1305619.78	Station:	~1791+86
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

Lou: 2/15/11 PLUGGED - Str. Well uncovered has a 2' drop to the dirt.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 196 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell structure 196, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 197

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	197	Pipe Size:	24"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16492066.96, 1305747.57	Station:	~1793+14
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:	
Lou: 2/15/11 Completely underwater - needs either vactor or 2" pump to pump out the water.	

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	U	Tetra Tech located the riverside outlet structure, it was submerged within a pond. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas		Tetra Tech observed a riverside pond. Tetra Tech was unable to inspect	USIBWC does not have any prior deficiencies listed in regards to the ponding area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided. The riverside is submerged.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gateway structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates	U	Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	USIBWC does not have any prior deficiencies listed for sluice/ slide gates. The Contractor is directed in the construction documents to clean out gateway structure and provide access for USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gateway and sluice gate, paint existing gateway cover, provide access to allow USIBWC to existing gateway to allow USIBWC to inspect and determine condition of structure and gateway. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 197



Photo 2- Riverside Outlet submerged

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 201

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	201	Pipe Size:	24"
Pipe Material:		# Gates:	1
Coordinates:	16492097.23, 1305880.83	Station:	~1794+45
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:

Lou: 3/23/11 2/15/11 PLUGGED - needs about 2 ft of dirt in well.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 201 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell structure 201, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 198

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:			
Structure #:	198	Pipe Size:	24"
Pipe Material:	-	# Gates:	-
Coordinates:	1309085.15, 16492061.45	Station:	~1829+02
Structure System:	-		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
Lou: 2/15/11 PLUGGED - Lacking about 4 ft of dirt.			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 198 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 198, abandoned

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 199

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #: 199		Pipe Size: 24"	
Pipe Material: RCP		# Gates: 1	
Coordinates: 16492024.98, 1309166.9930		Station: ~1829+93	
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:
 Lou: 2/15/11 Need vector to remove about 2 ft of water in order to inspect. Also needs lighter grill installed preferably expanded metal. (floodside has pipe going from str. To 24" round well where it turns about 45 degrees to the headwall. This is uncovered and a major safety hazard.)

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the landside inlet structure appears vegetation is maintained. Tetra Tech was unable to locate the riverside outlet due to heavy vegetation or obstructions observed.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	A	Tetra Tech did not see trash, debris, unauthorized structures, excavations or other obstructions within the ROW.	Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gatewell structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed to provide access to USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, items not reflected on the As-Built Plans.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, items not reflected on the As-Built Plans.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, items not reflected on the As-Built Plans.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, item not reflected on the As-Built Plans.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, item not reflected on the As-Built Plans.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 199



Photo 2- Landside inlet at bottom of slope.

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 204

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gateway Physical Information:		
Structure #: 204	Pipe Size: 24"	
Pipe Material: -	# Gates: 1	
Coordinates: 16489503.59, 1312573.36	Station: ~1878+72	
Structure System: -		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:	
Lou: 2/15/11 PLUGGED - Has metal plate cover, bolted down.	

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1. Veg & Obstructions	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
2. Encroachments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
3. Ponding Areas	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
4. Fencing/Gates	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
5. Concrete Surfaces	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
6. Tilt, Slide, Settle	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
7. Foundation	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
8. Monolith Joints	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
9. Culverts / Pipes	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
10. Sluice / Slide Gates	N/A	Top of sluice gate removed.	Not Applicable
11. Flap Gates / Valves	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
12. Trash Racks	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
13. Other Metallic Items	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
14. Riprap revetment	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable
15. Other Revetments	N/A	Abandoned structure, inlet and outlet structure not found.	Not Applicable

Additional Tetra Tech Comments:

Gatewell Structure 204 is abandoned, the top of sluice gate has been removed. The gatewell structure is filled with soil.

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed to locate and abandoned inlet and outlet pipes within USIBWC ROW, brick and mortar plug and break away 5-feet of the gatewell structure below existing levee slope and remove the existing T-Post. Remove any soil/debris in gatewell and pipes then fill with flowable backfill.



Photo 1- Gatewell Structure 204, abandoned



Photo 2- Riverside outlet structure, heavy vegetation

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 204L

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	204L	Pipe Size:	42"
Pipe Material:	RCP	# Gates:	1
Coordinates:	16489640.521, 1312820.3460	Station:	~1881+61
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	2
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
None			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions	M	Tetra Tech located the riverside outlet structure. The landside inlet joins with City of Brownsville storm drain system.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	M	Tetra Tech observed a pump house adjacent to the gatewell structure. Tetra Tech and USIBWC was unable to look inside the pump house.	Minimal Acceptable Rating
3. Ponding Areas	N/A	Tetra Tech did not observe ponding areas within the ROW during field assessment	Not Applicable Rating
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gatewell structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed to provide access to USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 204L



Photo 2- Riverside outlet

Donna to Brownsville- Reach 4 Interior Drainage Assessment

Structure No.: 205

Inspector: YHC, AWG (Tetra Tech) and Louis Mesa (USIBWC O&M Staff)

Inspection Date: 1/3/2011 to 1/7/2011

Gatewell Physical Information:			
Structure #:	205	Pipe Size:	No a/b
Pipe Material:		# Gates:	No a/b
Coordinates:	16490012.053, 1313804.3490	Station:	~1893+97
Structure System:	Drainage		

Photo Log:	
Inlet photo #	-
Outlet photo #	-
Gate Well photo #	1

USIBWC Inspection Notes Prior to Tech Tech's Interior Drainage Assessment:			
Gate Operational	No Notes	Steps	No Notes
Grill Cover	No Notes	Paint	No Notes
T-Post	No Notes		

Deficiencies noted by USIBWC:			
None			

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".			
COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
1.Veg & Obstructions		Tetra Tech was unable to locate the inlet and outlet structures, therefore no rating was given. The landside inlet joins the City of Brownsville storm drain system. The riverside outlets to the Rio Grande.	Contractor is directed in the construction documents to locate and clean the inlet structure, outlet structures, pipe/ culverts and re-establish flow direction.
2. Encroachments	M	Tetra Tech observed trash, debris within the levee ROW.	Minimal Acceptable Rating
3. Ponding Areas		Tetra Tech was unable locate the outlet structure within the Rio Grande, therefore no rating was given. It appears to be submerged within the Rio Grande.	USIBWC does not have any prior deficiencies listed in regards to the river area.
4. Fencing/Gates	N/A	Tetra Tech did not observe any fences or gates for safety.	Not Applicable Rating
5. Concrete Surfaces	M	Tetra Tech observed surface cracking and spalling at the top of the gatewell structure, but the immediate integrity or performance of the structure is not threatened.	USIBWC does not have any prior deficiencies listed in regards to concrete surfaces. Tetra Tech was unable to locate the inlet and outlet structures and was not able to gain access for assessment. The Contractor is directed in the construction documents to provide access for further inspection by USIBWC.

Interior Drainage System Inspection Assessment Ratings (A / M / U / NA), USACE "Interim Vegetation Guidance for control of Vegetation on Levees".

COE Category	Tetra Tech's Rating	Tetra Tech's Comments	Tetra Tech's Recommendation
6. Tilt, Slide, Settle	A	Tetra Tech did not observe tilting, sliding or settlement of the gatewell structure that would endanger the integrity of the structure.	USIBWC does not have any prior deficiencies listed in regards to tilt, slide and settling.
7. Foundation	A	Tetra Tech did not observe active erosion, scouring, or bank caving that might endanger the structure's stability.	USIBWC did not have any prior deficiencies listed.
8. Monolith Joints	N/A	Tetra Tech did not observe any monolithic joints.	USIBWC does not have any prior deficiencies listed for monolithic joints.
9. Culverts / Pipes		Tetra Tech did not inspect the insides of the culvert/ pipes, therefore no rating is provided.	USIBWC does not have any prior deficiencies listed for culverts/ pipes. The Contractor is directed in the design plans to clean out gatewell structure and provide access for USIBWC to inspect.
10. Sluice / Slide Gates		Sluice gate was not operated during field assessment, Tetra Tech was directed to use the USIBWC inspections.	The Contractor is directed to provide access to USIBWC to inspect.
11. Flap Gates / Valves	N/A	Tetra Tech did not observe flap gates/ valves, no As-Built Plans was provided to verify.	Not Applicable Rating
12. Trash Racks	N/A	Tetra Tech did not observe trash racks, no As-Built Plans was provided to verify.	Not Applicable Rating
13. Other Metallic Items	N/A	Tetra Tech did not observe other metallic items, no As-Built Plans was provided to verify.	Not Applicable Rating
14. Riprap revetment	N/A	Tetra Tech did not observe riprap revetment, no As-Built Plans was provided to verify.	Not Applicable Rating
15. Other Revetments	N/A	Tetra Tech did not observe other revetments, no As-Built Plans was provided to verify.	Not Applicable Rating

Additional Tetra Tech Comments:

Tetra Tech Recommended Repair as Shown on Plans:

Contractor directed remove sediment and clean inlet and outlet structures and pipes, re-establish flow path, protect in place existing gatewell and sluice gate, paint existing gatewell cover, provide access to allow USIBWC to existing gatewell to allow USIBWC to inspect and determine condition of structure and gatewell. Items that need to repaired may utilize the optional items as shown on the plans.



Photo 1- Gatewell Structure 205, DHS placed the border fence on top of levee. There is no vehicle access from top.

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Appendix C

HEC-RAS Model Outputs

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RIVER: RIVER-1
REACH: Reach-1 RS: 184

INPUT

Description: XS 184 NAVD 88

Station Elevation Data

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	134.84	8	134.64	40	123.84	115	121.64
749	119.64	750	102.98	760	100.94	770	95.94
790	93.94	800	94.64	810	86.64	820	86.94
840	88.64	850	88.64	860	89.64	870	89.94
890	90.94	900	91.64	910	91.94	920	92.94
940	92.94	950	93.94	960	93.64	970	94.94
990	97.64	1000	98.94	1010	100.94	1020	101.94
1031	103.74	1040	108.24	1055	109.64	1071	115.34
1093	114.34	1168	115.44	1176	117.64	1200	110.74
1380	114.74	1510	115.04	1982	116.04	2017	120.54
3883	116.54	3921	119.84	7078	115.14	7617	115.74
8241	126.74	10738	128.24			7689	125.74

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.112	749	.066	750	.015	1030	.066
						1176	.066

Bank Sta: Left Right

749 1086

Lengths: Left Channel Right

8300 12200

8800

Coeff Contr. .1

Expan. .3

Blocked Obstructions

num= 1

Sta L Sta R Elev

1176 10738 117.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	133.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	wt. n-Val.	0.112	0.029	0.066
W.S. Elev (ft)	133.70	Reach Len. (ft)	8300.00	12200.00	8800.00
Crit W.S. (ft)		Flow Area (sq ft)	9364.55	12466.08	122139.60
E.G. Slope (ft/ft)	0.000111	Area (sq ft)	9364.55	12466.08	122139.60
Q Total (cfs)	235000.00	Flow (cfs)	7093.54	70829.46	157077.00
Top width (ft)	10727.20	Top width (ft)	738.20	337.00	9652.00
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	0.76	5.68	1.29
Max chl Dpth (ft)	47.06	Hydr. Depth (ft)	12.69	36.99	12.65
Conv. Total (cfs)	22354370.0	Conv. (cfs)	674773.3	6737652.0	14941950.0
Length wtd. (ft)	962.47	Wetted Per. (ft)	739.85	360.44	9658.75
Min Ch El (ft)	86.64	Shear (lb/sq ft)	0.09	0.24	0.09
Alpha	4.07	Stream Power (lb/ft s)	10738.00	0.00	0.00
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)	334342.80	152915.90	341038.60
C & E Loss (ft)	0.01	Cum SA (acres)	42169.53	6145.30	44952.93

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 182.4

INPUT

Description: XS 182.4 NAVD 88

Station Elevation Data

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	133.24	6	133.24	40	123.24	70	121.84
130	114.64	165	115.84	195	123.14	743	123.24
1300	121.94	1320	121.94	2038	121.24	2068	118.84
2290	115.24	2317	115.94	4032	116.64	4690	117.24
5461	114.94	7054	114.94	8093	114.83	8108	116.84
8158	115.33	8217	112.34	8243	115.24	8269	108.54
8365	106.84	8382	106.64	8387	104.18	8390	102.84
8410	96.64	8420	94.14	8430	91.84	8440	91.14
8460	90.14	8470	89.64	8480	89.64	8490	90.14
8510	89.14	8520	86.14	8530	84.14	8540	82.14
8560	80.14	8570	79.14	8580	82.64	8590	86.14
8610	95.64	8620	102.64	8624	103.67	8626	104.18
8649	123.74	8678	123.38	8706	122.94	11538	122.94
12486	121.34	13954	120.64	15284	120.64	15306	119.74
15336	112.44	15359	125.34	15369	125.34		

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.082	8108	.066	8387	.015	8624	.066
						8637	.061

Bank Sta: Left Right

8382 8637

Lengths: Left Channel Right

11200 11500

11000

Coeff Contr. .1

Expan. .3

Blocked Obstructions

num= 1

Sta L Sta R Elev

0 8108 116.84

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	133.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	wt. n-Val.	0.081	0.023	0.061
W.S. Elev (ft)	132.91	Reach Len. (ft)	11200.00	11500.00	11000.00
Crit W.S. (ft)		Flow Area (sq ft)	125266.80	10640.87	74453.91
E.G. Slope (ft/ft)	0.000058	Area (sq ft)	125266.80	10640.87	74453.91
Q Total (cfs)	235000.00	Flow (cfs)	106840.80	59620.16	68539.02
Top width (ft)	15361.88	Top width (ft)	8374.88	255.00	6732.00

Vel Total (ft/s)	1.12	Avg. Vel. (ft/s)	0.85	5.60	0.92
Max chl Dpth (ft)	53.77	Hydr. Depth (ft)	14.96	41.73	11.06
Conv. Total (cfs)	30830200.0	Conv. (cfs)	14016690.0	7821709.0	8991795.0
Length wtd. (ft)	11208.78	Wetted Per. (ft)	8379.53	276.04	6744.46
Min Ch El (ft)	79.14	Shear (lb/sq ft)	0.05	0.14	0.04
Alpha	6.85	Stream Power (lb/ft s)	15369.00	0.00	0.00
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	321516.40	149680.10	321180.70
C & E Loss (ft)	0.02	Cum SA (acres)	41301.32	6062.40	43297.98

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 180.3

INPUT

Description: XS 180.3 NAVD 88

Station Elevation Data

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	131.14	6	131.14	51	131.14	110	131.14
1264	131.14	1265	112.54	2230	114.14	2258	115.14
2267	113.64	2272	116.14	2279	113.84	2284	113.84
2709	106.64	3052	106.44	3097	106.14	3128	106.04
3220	110.34	3235	112.34	3266	113.84	3273	113.84
3294	103.77	3298	102.54	3300	101.74	3310	98.84
3330	95.84	3340	95.24	3350	93.94	3360	93.54
3380	91.54	3390	90.64	3400	90.04	3410	89.54
3430	87.04	3440	88.54	3450	87.64	3460	87.64
3480	88.54	3490	89.04	3500	88.64	3510	88.64
3530	88.24	3540	89.54	3550	92.04	3560	95.54
3573	102.54	3575	103.77	3580	106.84	3583	114.94
3594	113.53	5681	110.64	5700	111.84	5710	117.84
6423	113.84	6447	114.84	6487	112.54	6640	111.54
7519	109.74	7528	113.04	7555	114.54	9634	119.04
9702	122.64	9709	123.04			9683	119.54

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.157	3273	.066	3294	.015	3575	.066
						3583	.074

Bank Sta: Left Right

3273 3583

Lengths: Left Channel Right

8500 12100

10000

Coeff Contr. .1

Expan. .3

Blocked Obstructions

num= 2

Sta L Sta R Elev

0 3273 113.84

3583 9709 114.94

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	132.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	wt. n-Val.	0.157	0.024	0.074
W.S. Elev (ft)	131.87	Reach Len. (ft)	8500.00	12100.00	10000.00
Crit W.S. (ft)		Flow Area (sq ft)	37048.62	11975.29	98596.02
E.G. Slope (ft/ft)	0.000107	Area (sq ft)	37048.62	11975.29	98596.02
Q Total (cfs)	235000.00	Flow (cfs)	18185.55	86628.20	130186.20
Top width (ft)	9709.00	Top width (ft)	3273.00	310.00	6126.00
Vel Total (ft/s)	1.59	Avg. Vel. (ft/s)	0.49	7.23	1.32
Max chl Dpth (ft)	44.83	Hydr. Depth (ft)	11.32	38.63	16.09
Conv. Total (cfs)	22756880.0	Conv. (cfs)	1761048.0	8388882.0	12606950.0
Length wtd. (ft)	10546.48	Wetted Per. (ft)	3291.67	324.06	6135.91
Min Ch El (ft)	87.04	Shear (lb/sq ft)	0.07	0.25	0.11
Alpha	8.00	Stream Power (lb/ft s)	9709.00	0.00	0.00
Frctn Loss (ft)	1.16	Cum Volume (acre-ft)	300649.40	146694.70	299330.90
C & E Loss (ft)	0.00	Cum SA (acres)	39803.89	5987.82	41674.50

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 178.5

INPUT

Description: XS 178.5 NAVD 88

Station Elevation Data

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	128.94	8	128.94	60	128.94	1499	128.94
5538	116.04	5552	113.04	5610	115.04	6475	113.64
6842	109.34	6772	109.34	6795	112.94	6801	112.94
6814	103.7	6818	102.95	6820	102.5	6830	100.54
6850	92.64	6860	89.64	6870	89.04	6880	88.04
6900	87.04	6910	86.64	6920	87.04	6930	88.04
6950	88.04	6960	88.04	6970	89.04	6980	89.64
7000	91.04	7010	91.54	7020	92.04	7030	93.74
7050	95.04	7060	95.64	7070	98.04	7080	100.64
7101	103.77	7111	107.64	7113	111.14	7121	112.64
						7135	113.3

7239 107.14 7388 106.64 7411 110.14 7432 110.84 8295 113.64
8312 114.64 8327 115.14 8816 117.64 8827 118.64 8840 117.64
10437 114.94 10457 114.94 10475 120.14 10485 120.14 10499 115.54
10516 114.54 10993 115.54 11014 115.04 11045 118.04

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .154 6801 .066 6814 .015 7101 .066 7121 .061

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
6801 7121 6300 8400 7800 .1 .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 6801 112.94 7121 11045 112.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	131.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	wt. n-Val.	0.154	0.024	0.061
W.S. Elev (ft)	130.70	Reach Len. (ft)	6300.00	8400.00	7800.00
Crit W.S. (ft)		Flow Area (sq ft)	88814.39	11720.03	61218.44
E.G. Slope (ft/ft)	0.000114	Area (sq ft)	88814.39	11720.03	61218.44
Q Total (cfs)	235000.00	Flow (cfs)	50744.14	84914.74	99341.12
Top width (ft)	11045.00	Top width (ft)	6801.00	320.00	3924.00
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	0.57	7.25	1.62
Max chl Dpth (ft)	44.06	Hydr. Depth (ft)	13.06	36.63	15.60
Conv. Total (cfs)	21971270.0	Conv. (cfs)	4744313.0	7939086.0	9287876.0
Length wtd. (ft)	7651.56	Wetted Per. (ft)	6818.05	330.29	3938.48
Min Ch El (ft)	85.64	Shear (lb/sq ft)	0.09	0.25	0.11
Alpha	9.55	Stream Power (lb/ft s)	11045.00	0.00	0.00
Frctn Loss (ft)	1.05	Cum Volume (acre-ft)	288369.30	143403.70	280986.80
C & E Loss (ft)	0.02	Cum SA (acres)	38821.00	5900.32	40520.91

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 176.8

INPUT

Description: XS 176.8 NAVD 88
Station Elevation Data num= 75
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 127.54 8 127.24 55 118.54 65 118.14 104 112.94
110 108.64 192 108.34 200 112.74 220 112.04 280 112.64
2704 104.24 2740 108.54 6365 113.64 6440 114.44 6468 112.71
6477 108.44 6506 106.44 6510 104.04 6513 103.6 6518 102.88
6530 101.64 6540 98.84 6550 95.64 6560 92.84 6570 91.64
6580 89.84 6590 88.84 6600 88.84 6610 88.84 6620 88.84
6630 89.64 6640 89.84 6650 90.64 6660 90.84 6670 90.84
6680 91.64 6690 91.64 6700 91.64 6710 91.84 6720 92.64
6730 92.64 6740 91.84 6750 92.64 6760 92.64 6770 92.84
6780 92.84 6790 93.64 6800 93.64 6810 94.64 6820 94.84
6830 95.64 6840 96.64 6850 97.84 6860 100.64 6870 102.64
6871 102.88 6885 111.64 6989 105.35 7117 103.84 8298 108.54
8340 115.24 8353 112.24 8373 115.04 8401 114.54 8439 112.14
8458 118.04 8484 117.54 8489 119.04 8498 119.04 8513 113.04
8545 111.84 8587 113.54 8675 115.04 8692 118.04 8702 118.04

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .154 6440 .066 6513 .015 6871 .066 6885 .084

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
6468 6885 8000 12100 2800 .1 .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 6440 114.44 6885 8702 111.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	129.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	wt. n-Val.	0.153	0.026	0.084
W.S. Elev (ft)	129.48	Reach Len. (ft)	8000.00	12100.00	2800.00
Crit W.S. (ft)		Flow Area (sq ft)	96679.83	14195.42	31304.07
E.G. Slope (ft/ft)	0.000172	Area (sq ft)	96679.83	14195.42	31304.07
Q Total (cfs)	235000.00	Flow (cfs)	74626.85	112232.20	48140.99
Top width (ft)	8702.00	Top width (ft)	6468.00	417.00	1817.00
Vel Total (ft/s)	1.65	Avg. Vel. (ft/s)	0.77	7.91	1.54
Max chl Dpth (ft)	40.64	Hydr. Depth (ft)	14.95	34.04	17.23
Conv. Total (cfs)	17933360.0	Conv. (cfs)	5694939.0	8564682.0	3673744.0
Length wtd. (ft)	8856.77	Wetted Per. (ft)	6471.05	423.96	1831.95
Min Ch El (ft)	88.84	Shear (lb/sq ft)	0.16	0.36	0.18
Alpha	11.17	Stream Power (lb/ft s)	8702.00	0.00	0.00
Frctn Loss (ft)	1.16	Cum Volume (acre-ft)	274955.50	140904.90	272703.10
C & E Loss (ft)	0.01	Cum SA (acres)	37861.46	5829.26	40006.91

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 174.6

INPUT

Description: XS 174.6 NAVD 88
Station Elevation Data num= 81
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 126.54 38 111.44 273 112.84 419 113.04 438 113.94
538 114.84 579 112.74 603 108.94 638 107.44 738 106.24
838 106.44 1058 109.84 1138 99.34 1338 99.24 2338 102.04
3338 107.34 4295 112.44 4338 106.84 4638 109.94 5138 110.54
5338 112.24 5438 111.44 5738 113.54 5938 114.14 6038 113.64
6138 106.04 6338 110.94 6353 109.34 6414 108.94 6438 110.54
6538 110.24 6588 112.64 6612 106.04 6649 104.94 6778 110.04
6784 104.34 6804 100.84 6833 96.24 6863 89.44 6873 87.84
6893 86.84 6933 86.74 6973 86.44 7013 86.54 7053 86.14
7093 86.54 7133 93.84 7143 98.84 7183 104.14 7191 111.44
7212 111.04 7288 111.04 7488 109.04 7688 108.34 7788 107.44
7888 107.24 7914 106.44 8288 104.64 8388 104.44 8688 106.24
8753 104.94 8788 105.54 8848 105.14 8923 109.64 9135 111.64
9156 112.14 9188 112.24 9388 111.24 9438 109.84 9488 111.74
9588 111.44 9624 111.84 9699 115.54 9888 113.24 9906 113.94
9913 112.24 9938 111.84 9945 112.74 9988 111.94 10032 109.44
10078 117.94

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .198 6778 .066 6784 .015 7183 .066 7191 .069

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
6778 7191 9000 14500 9700 .1 .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 6588 112.64 7191 10078 111.44

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	128.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	wt. n-Val.	0.198	0.019	0.069
W.S. Elev (ft)	128.20	Reach Len. (ft)	9000.00	14500.00	9700.00
Crit W.S. (ft)		Flow Area (sq ft)	105503.20	15179.92	47305.11
E.G. Slope (ft/ft)	0.000090	Area (sq ft)	105503.20	15179.92	47305.11
Q Total (cfs)	235000.00	Flow (cfs)	46827.60	125952.50	62219.93
Top width (ft)	10078.00	Top width (ft)	6778.00	413.00	2887.00
Vel Total (ft/s)	1.40	Avg. Vel. (ft/s)	0.44	8.30	1.32
Max chl Dpth (ft)	42.06	Hydr. Depth (ft)	15.57	36.76	16.39
Conv. Total (cfs)	24757380.0	Conv. (cfs)	4933315.0	13269170.0	6554905.0
Length wtd. (ft)	11716.35	Wetted Per. (ft)	6783.46	421.88	2898.28
Min Ch El (ft)	86.14	Shear (lb/sq ft)	0.09	0.20	0.09
Alpha	19.11	Stream Power (lb/ft s)	10078.00	0.00	0.00
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	256389.60	136825.00	270176.60
C & E Loss (ft)	0.12	Cum SA (acres)	36645.12	5713.98	39855.73

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 171.8

INPUT

Description: XS 171.8 NAVD 88
Station Elevation Data num= 71
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 125.44 9 124.94 34 116.74 251 113.94 296 110.64
396 110.84 417 103.6 421 102.22 430 95.74 440 89.24
450 83.74 460 79.84 470 77.84 480 77.24 490 75.24
500 75.24 510 76.24 520 78.24 530 78.24 540 79.24
550 80.24 560 81.64 570 83.24 580 84.64 590 86.24
600 88.24 610 89.64 620 90.64 630 91.94 640 93.64
650 95.24 660 97.24 670 98.94 680 100.64 690 101.24
700 101.64 708 102.22 724 102.74 727 103.54 736 105.94
772 108.94 783 111.64 794 113.44 814 110.94 890 110.44
891 110.57 2135 105.64 2207 110.94 2285 111.44 2705 111.94
2726 112.44 2733 113.44 2740 111.44 2748 113.44 2756 111.44
4445 110.44 4478 110.64 5008 111.14 5980 109.14 5998 112.64
6004 111.14 6013 113.14 6022 111.14 6084 111.14 7270 111.64
7288 112.14 7945 113.14 8294 112.14 8374 111.14 8400 122.14
8410 122.64

Manning's n values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .081 251 .066 417 .015 727 .066 783 .067

Bank Sta: Left Right Lengths: Left Channel Right
396 794 6500 4000
Blocked Obstructions num=
Sta L Sta R Elev
794 8410 113.44

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	127.44	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.19	Wt. n-Val.	0.072	0.030	0.067
W.S. Elev (ft)	127.24	Reach Len. (ft)	3000.00	6500.00	4000.00
Crit W.S. (ft)		Flow Area (sq ft)	5084.58	13738.06	104942.50
E.G. Slope (ft/ft)	0.000125	Area (sq ft)	5084.58	13738.06	104942.50
Q Total (cfs)	235000.00	Flow (cfs)	6483.47	79255.91	149260.60
Top Width (ft)	8410.00	Top width (ft)	396.00	398.00	7616.00
Vel Total (ft/s)	1.90	Avg. Vel. (ft/s)	1.28	5.77	1.42
Max chl Dpth (ft)	52.00	Hydr. Depth (ft)	12.84	34.52	13.78
Conv. Total (cfs)	21049180.0	Conv. (cfs)	580730.8	7099031.0	13369420.0
Length Wtd. (ft)	5143.88	Wetted Per. (ft)	399.27	409.08	7622.38
Min ch El (ft)	75.24	Shear (lb/sq ft)	0.10	0.26	0.11
Alpha	3.48	Stream Power (lb/ft s)	8410.00	0.00	0.00
Frctn Loss (ft)	0.96	Cum Volume (acre-ft)	244965.20	152012.00	253225.30
C & E Loss (ft)	0.19	Cum SA (acres)	35904.00	5579.00	38686.32

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 170.5

INPUT

Description: XS 170.5	NAVD 88	95	Sta	Elev	Sta	Elev	Sta	Elev
Station Elevation Data	num=							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
0 124.04	9 124.04	11 124.14	35 118.54	57 117.54				
228 115.54	250 109.64	273 106.14	300 105.64	700 109.44				
739 103.24	800 103.24	860 106.54	1000 103.14	1200 104.94				
1260 104.84	1500 104.14	1760 106.74	1832 107.44	1851 101.84				
1900 101.04	2100 101.34	2260 104.84	2400 107.84	2600 106.84				
2619 104.44	2700 105.74	2760 104.84	2800 104.04	2900 104.84				
2910 104.44	2928 105.84	3046 107.04	3099 108.54	3106 103.04				
3110 102.19	3120 101.24	3130 100.24	3140 99.64	3150 97.84				
3160 96.24	3170 95.24	3180 94.24	3190 93.24	3200 92.64				
3210 91.64	3220 90.64	3230 89.64	3240 88.64	3250 87.64				
3260 86.24	3270 85.24	3280 83.64	3290 81.64	3300 81.24				
3310 80.24	3320 79.24	3330 77.64	3340 77.24	3350 75.64				
3360 74.24	3370 77.74	3380 83.64	3390 91.64	3400 98.64				
3401 102.19	3404 103.4	3418 109.04	3471 111.64	3550 111.1				
3582 110.54	3890 114.04	4217 110.64	4284 110.44	4422 109.54				
4438 114.54	4451 114.54	4463 109.15	4468 107.14	4474 109.15				
4488 112.24	4512 114.74	4845 119.24	4898 124.04	4979 125.54				
5265 145.54	5555 146.04	6017 141.34	6130 141.54	6145 136.54				
6165 136.54	6185 140.54	6215 142.04	6252 139.54	6280 145.84				

Manning's n values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .186 3099 .066 3106 .015 3404 .066 3471 .076

Bank Sta: Left Right Lengths: Left Channel Right
3099 3418 4300 2000
Blocked Obstructions num=
Sta L Sta R Elev
0 2400 107.84

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	126.29	Element	Left 08	Channel	Right 08
Vel Head (ft)	2.14	Wt. n-Val.	0.186	0.020	0.075
W.S. Elev (ft)	124.15	Reach Len. (ft)	3000.00	4300.00	2000.00
Crit W.S. (ft)		Flow Area (sq ft)	49315.98	11012.80	16153.83
E.G. Slope (ft/ft)	0.000366	Area (sq ft)	49315.98	11012.80	16153.83
Q Total (cfs)	235000.00	Flow (cfs)	47662.20	157451.30	29886.42
Top Width (ft)	4903.97	Top width (ft)	3099.00	319.00	1485.97
Vel Total (ft/s)	3.07	Avg. Vel. (ft/s)	0.97	14.30	1.85
Max chl Dpth (ft)	49.91	Hydr. Depth (ft)	15.91	34.52	10.87
Conv. Total (cfs)	12284100.0	Conv. (cfs)	2491438.0	8230413.0	1562245.0
Length Wtd. (ft)	3719.52	Wetted Per. (ft)	3101.11	333.98	1489.43
Min ch El (ft)	74.24	Shear (lb/sq ft)	0.36	0.75	0.25
Alpha	14.37	Stream Power (lb/ft s)	6280.00	0.00	0.00

Frctn Loss (ft) 1.10 Cum Volume (acre-ft) 243091.90 130165.40 247665.30
C & E Loss (ft) 0.02 Cum SA (acres) 35783.65 5525.50 38268.41

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 170.02

INPUT

Description: XS 170.02	NAVD 88	30	Sta	Elev	Sta	Elev	Sta	Elev
Station Elevation Data	num=							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
0 121.64	110 107.64	220 107.64	650 105.64	890 104.64				
1300 104.64	1305 103.64	1310 89.64	1640 89.64	1645 103.64				
1650 104.64	1680 104.64	1690 105.64	1900 105.64	2100 105.34				
3000 105.64	3750 105.64	3870 107.64	4340 109.64	4550 111.64				
4600 113.64	4680 115.64	4690 117.64	4860 119.64	4900 129.64				
5100 139.64	5200 141.64	5300 143.64	5600 143.64	5700 141.64				

Manning's n values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .177 1300 .066 1305 .015 1645 .066 1650 .131

Bank Sta: Left Right Lengths: Left Channel Right
1300 1650 3500 1000 1000
Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	125.17	Element	Left 08	Channel	Right 08
Vel Head (ft)	2.31	Wt. n-Val.	0.177	0.015	0.131
W.S. Elev (ft)	122.86	Reach Len. (ft)	3500.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	21269.51	11410.25	49510.84
E.G. Slope (ft/ft)	0.000225	Area (sq ft)	21269.51	11410.25	49510.84
Q Total (cfs)	235000.00	Flow (cfs)	17242.63	165708.30	52049.12
Top Width (ft)	4872.86	Top width (ft)	1300.00	350.00	3222.86
Vel Total (ft/s)	2.86	Avg. Vel. (ft/s)	0.81	14.52	1.05
Max chl Dpth (ft)	33.22	Hydr. Depth (ft)	16.36	32.60	15.36
Conv. Total (cfs)	15666920.0	Conv. (cfs)	1149527.0	11047400.0	3469998.0
Length Wtd. (ft)	1172.84	Wetted Per. (ft)	1302.11	368.93	3223.61
Min ch El (ft)	89.64	Shear (lb/sq ft)	0.23	0.43	0.22
Alpha	18.23	Stream Power (lb/ft s)	5700.00	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	240661.30	129058.60	246157.80
C & E Loss (ft)	0.34	Cum SA (acres)	35632.17	5492.48	38160.31

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 169.83

INPUT

Description: XS 169.83	NAVD 88	32	Sta	Elev	Sta	Elev	Sta	Elev
Station Elevation Data	num=							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
0 121.64	30 109.64	100 107.64	670 105.74	910 107.64				
950 108.84	980 107.64	990 105.64	992 103.64	994 89.64				
1244 89.64	1247 103.64	1250 104.64	1450 104.64	1480 105.64				
1600 105.64	1730 105.34	2630 105.64	3380 105.64	3500 107.64				
3970 109.64	4180 111.64	4230 113.64	4310 115.64	4320 117.64				
4490 119.64	4530 129.64	4730 139.64	4830 141.64	4930 143.64				
5230 143.64	5330 141.64							

Manning's n values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .188 990 .066 992 .015 1247 .066 1250 .187

Bank Sta: Left Right Lengths: Left Channel Right
990 1250 2000 3700 2000
Blocked Obstructions num=
Sta L Sta R Elev
0 950 108.84

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	124.61	Element	Left 08	Channel	Right 08
Vel Head (ft)	1.18	Wt. n-Val.	0.188	0.017	0.187
W.S. Elev (ft)	123.43	Reach Len. (ft)	2000.00	3700.00	2000.00
Crit W.S. (ft)		Flow Area (sq ft)	14272.93	8677.96	52081.07
E.G. Slope (ft/ft)	0.000144	Area (sq ft)	14272.93	8677.96	52081.07

Q Total (cfs)	130000.00	Flow (cfs)	7991.86	90495.97	31512.17
Top width (ft)	4505.18	Top width (ft)	990.00	260.00	3255.18
Vel Total (ft/s)	1.73	Avg. Vel. (ft/s)	0.56	10.43	0.61
Max chl Dpth (ft)	33.79	Hydr. Depth (ft)	14.42	33.38	16.00
Conv. Total (cfs)	10838400.0	Conv. (cfs)	666299.8	7544859.0	2627243.0
Length Wtd. (ft)	3441.23	wetted Per. (ft)	994.34	284.45	3255.97
Min ch El (ft)	89.64	Shear (lb/sq ft)	0.13	0.27	0.14
Alpha	25.25	Stream Power (lb/ft s)	5330.00	0.00	0.00
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	239233.40	128828.00	244991.70
C & E Loss (ft)	0.16	Cum SA (acres)	35540.17	5485.48	38085.95

Warning: The cross-section end points had to be extended vertically for the computed water surface.
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.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 169.14

INPUT
Description: XS 169.14 NAVD 88
Station Elevation Data num= 7
Sta Elev Sta Elev Sta Elev Sta Elev
4000 121.14 4067 121.14 4100 121.14 4100 84.64 4623.8 84.64
4623.8 124.74 4723.8 124.74

Manning's n Values num= 4
Sta n Val Sta n Val Sta n Val
4000 .048 4067 .06 4100 .015 4623.8 .06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
4100 4623.8 50 50 .2 .5
Blocked Obstructions num= 1
Sta L Sta R Elev
4000 4000 124.74

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	124.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.	0.051	0.015	
W.S. Elev (ft)	123.50	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	97.05	Flow Area (sq ft)	236.31	20356.48	
E.G. Slope (ft/ft)	0.000038	Area (sq ft)	236.31	20356.48	
Q Total (cfs)	130000.00	Flow (cfs)	73.23	129926.80	
Top width (ft)	623.80	Top width (ft)	100.00	523.80	
Vel Total (ft/s)	6.31	Avg. Vel. (ft/s)	0.31	6.38	
Max chl Dpth (ft)	38.86	Hydr. Depth (ft)	2.36	38.86	
Conv. Total (cfs)	21165240.0	Conv. (cfs)	11923.2	21153310.0	
Length wtd. (ft)	50.00	wetted Per. (ft)	102.36	599.16	
Min ch El (ft)	84.64	Shear (lb/sq ft)	0.01	0.08	
Alpha	1.02	Stream Power (lb/ft s)	4723.80	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	238900.30	127594.90	243796.10
C & E Loss (ft)		Cum SA (acres)	35515.15	5452.19	38011.22

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 169.13

INPUT
Description: Anzalduas Dam
Distance from Upstream XS = 30
Deck/Roadway width = 15
Weir Coefficient = 3.21
Weir Embankment Coordinates num = 2
Sta Elev Sta Elev
4100 124.64 4623.8 124.64

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Weir crest shape = Ogee

INLINE STRUCTURE GATE Gate #1
Height = 34.75
width = 75
Invert = 84.64
Gate Type = Radial Radial Coefficient= .6
Trunion Exponent = .16
Opening Exponent = .72
Head Exponent = .62
Trunion Height = 14
Weir Coefficient = 3.21
Weir crest shape = Ogee
Number of Gate Openings = 6

Sta	Sta	Sta	Sta	Sta	Sta
4137.5	4227.26	4317.02	4406.78	4496.54	4586.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 169.12

INPUT
Description: XS 169.12 NAVD 88
Station Elevation Data num= 6
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 122.84 4100 122.84 4100 122.84 4100 72.14 4623.8 72.14 4623.8 128.54
4723.8 128.54

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .06 4100 .015 4623.8 .06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
4100 4623.8 100 100 .2 .5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	122.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.015	
W.S. Elev (ft)	122.16	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		26198.48	
E.G. Slope (ft/ft)	0.000017	Area (sq ft)		26198.48	
Q Total (cfs)	130000.00	Flow (cfs)		130000.00	
Top width (ft)	523.80	Top width (ft)		523.80	
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)		4.96	
Max chl Dpth (ft)	50.02	Hydr. Depth (ft)		50.02	
Conv. Total (cfs)	31355870.0	Conv. (cfs)		31355870.0	
Length wtd. (ft)	100.00	wetted Per. (ft)		623.83	
Min ch El (ft)	72.14	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)	4723.80	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	238900.30	127574.30	243796.10
C & E Loss (ft)	0.01	Cum SA (acres)	35515.09	5451.59	38011.22

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 169.1

INPUT
Description: XS 169.1 NAVD 88
Station Elevation Data num= 8
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 122.84 99 122.84 100 108.14 100 108.14 100 108.14 100 108.14
757 108.14 758 128.54 857 128.54

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .14 99 .015 758 .14

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
99 758 1200 1200 1200 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	122.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.015	
W.S. Elev (ft)	122.07	Reach Len. (ft)	1200.00	1200.00	1200.00
Crit W.S. (ft)		Flow Area (sq ft)		24033.37	
E.G. Slope (ft/ft)	0.000027	Area (sq ft)		24033.37	
Q Total (cfs)	130000.00	Flow (cfs)		130000.00	
Top width (ft)	658.63	Top width (ft)		658.63	
Vel Total (ft/s)	5.41	Avg. Vel. (ft/s)		5.41	
Max chl Dpth (ft)	38.43	Hydr. Depth (ft)		36.49	
Conv. Total (cfs)	25239390.0	Conv. (cfs)		25239390.0	
Length wtd. (ft)	1200.00	wetted Per. (ft)		696.26	
Min ch El (ft)	83.64	Shear (lb/sq ft)		0.06	
Alpha	1.00	Stream Power (lb/ft s)	857.00	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	238900.30	127516.60	243796.10
C & E Loss (ft)	0.01	Cum SA (acres)	35515.09	5450.23	38011.22

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 168.85

INPUT
Description: XS 168.85 NAVD 88
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	122.84	1000	122.84	2000	122.84	2800	122.84	2999	122.84
3000	109.64	3200	108.44	3360	113.14	3400	110.14	3590	104.84
3600	104.84	3695	108.84	3800	107.34	3890	106.74	3932	109.24
3980	109.24	4000	98.14	4021	99.84	4053	83.54	4070	81.02
4080	79.64	4090	77.64	4100	76.64	4110	75.04	4120	74.64
4130	73.04	4140	72.64	4150	71.64	4160	72.64	4170	72.64
4180	73.04	4190	73.64	4200	73.64	4210	73.04	4220	73.04
4230	74.64	4240	75.04	4250	76.04	4260	76.04	4270	76.04
4280	76.04	4290	76.04	4300	76.64	4310	77.64	4320	79.64
4330	81.02	4338	83.44	4428	81.04	4436	83.52	4478	96.34
4500	109.94	4516	110.24	4524	114.04	4537	114.04	4548	110.34
4602	110.74	4960	111.04	4961	128.54	5830	128.54		

Manning's n	Values	num=	6
Sta	n Val	Sta	n Val
0	.2	4021	.066
4500	.116	4053	.015
		4436	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	3980	4500		3000	3050		.1	.3
Blocked Obstructions	num=	3						
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	3890	122.84	4524	4960	114.04	4960	5830	122.84

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	122.45	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.56	Wt. n-Val.	0.200	0.052	0.116
W.S. Elev (ft)	121.89	Reach Len. (ft)	3000.00	3050.00	3050.00
Crit W.S. (ft)		Flow Area (sq ft)	1191.12	20553.64	3690.01
E.G. Slope (ft/ft)	0.000359	Area (sq ft)	1191.12	20553.64	3690.01
Q Total (cfs)	130000.00	Flow (cfs)	845.54	125609.30	3545.16
Top width (ft)	1070.00	Top width (ft)	90.00	520.00	460.00
Vel Total (ft/s)	5.11	Avg. Vel. (ft/s)	9.37	6.11	0.96
Max Chl Dpth (ft)	50.25	Hydr. Depth (ft)	13.23	39.53	8.02
Conv. Total (cfs)	6859405.0	Conv. (cfs)	44614.5	6627731.0	187059.2
Length wtd. (ft)	3046.73	wetted Per. (ft)	105.23	534.84	468.71
Min Ch El (ft)	71.64	Shear (lb/sq ft)	0.25	0.86	0.18
Alpha	1.38	Stream Power (lb/ft s)	5830.00	0.00	0.00
Frctn Loss (ft)	1.38	Cum volume (acre-ft)	238883.90	126902.50	243745.30
C & E Loss (ft)	0.06	Cum SA (acres)	35513.85	5434.00	38004.89

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 168.3

INPUT	Description:	XS 168.3	NAVD 88
Station Elevation Data	num=	49	
Sta	Elev	Sta	Elev
0	120.74	3501	120.74
4750	106.24	4765	107.84
4861	83.38	4863	82.44
4940	77.34	4950	76.84
4990	76.34	5000	76.34
5040	76.34	5050	76.34
5090	75.94	5100	75.64
5140	75.64	5150	77.34
5196	83.21	5242	97.34
5493	110.84	5740	110.34

Manning's n	Values	num=	6
Sta	n Val	Sta	n Val
0	.2	4793	.2
5242	.116	4827	.066
		4861	.015
		5196	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	4765	5348		4750	4850		.1	.3
Blocked Obstructions	num=	2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	4765	107.84	5493	6730	110.84			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	121.01	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.35	Wt. n-Val.	0.200	0.075	0.116
W.S. Elev (ft)	120.66	Reach Len. (ft)	4750.00	4850.00	4900.00
Crit W.S. (ft)		Flow Area (sq ft)	16171.28	20477.21	4439.04
E.G. Slope (ft/ft)	0.000612	Area (sq ft)	16171.28	20477.21	4439.04
Q Total (cfs)	130000.00	Flow (cfs)	16172.88	106857.50	6969.64
Top width (ft)	2237.60	Top width (ft)	1261.99	583.00	392.61
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	1.00	5.22	1.57
Max Chl Dpth (ft)	45.32	Hydr. Depth (ft)	12.81	35.12	11.31
Conv. Total (cfs)	5255273.0	Conv. (cfs)	653791.4	4319733.0	281748.8
Length wtd. (ft)	4836.09	Wetted Per. (ft)	1273.94	594.03	402.47
Min Ch El (ft)	75.34	Shear (lb/sq ft)	0.48	1.32	0.42

Alpha	2.26	Stream Power (lb/ft s)	6730.00	0.00	0.00
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	238286.00	125466.00	243460.70
C & E Loss (ft)	0.03	Cum SA (acres)	35467.30	5395.38	37975.04

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
 Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 167.4

INPUT	Description:	XS 167.4	NAVD 88
Station Elevation Data	num=	67	
Sta	Elev	Sta	Elev
0	118.64	333	118.64
3018	107.54	3215	107.74
3461	109.24	5340	105.14
5581	92.34	5621	97.34
5858	93.94	5876	95.34
5940	80.94	5953	78.26
5990	76.64	6000	76.64
6040	75.84	6050	76.24
6090	75.24	6100	75.24
6140	74.94	6150	74.64
6190	75.24	6200	78.26
6242	97.24	6303	100.94
6730	106.94	7289	102.74
8690	109.64	8807	131.04

Manning's n	Values	num=	6
Sta	n Val	Sta	n Val
0	.106	5843	.106
6323	.13	5876	.066
		5935	.015
		6208	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	5876	6323		4250	4000		.1	.3
Blocked Obstructions	num=	2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	3377	111.14	6359	8807	108.34			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	119.09	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.25	Wt. n-val.	0.106	0.040	0.130
W.S. Elev (ft)	118.84	Reach Len. (ft)	4250.00	4000.00	4150.00
Crit W.S. (ft)		Flow Area (sq ft)	45032.53	15637.84	25008.70
E.G. Slope (ft/ft)	0.000169	Area (sq ft)	45032.53	15637.84	25008.70
Q Total (cfs)	130000.00	Flow (cfs)	32295.31	80056.09	17648.61
Top width (ft)	8740.29	Top width (ft)	5876.00	447.00	2417.29
Vel Total (ft/s)	1.52	Avg. Vel. (ft/s)	0.72	5.12	0.71
Max Chl Dpth (ft)	44.70	Hydr. Depth (ft)	7.66	34.98	10.35
Conv. Total (cfs)	9994988.0	Conv. (cfs)	2483012.0	6155081.0	1356906.0
Length wtd. (ft)	4111.47	wetted Per. (ft)	5884.57	459.97	2418.14
Min Ch El (ft)	74.14	Shear (lb/sq ft)	0.08	0.36	0.11
Alpha	7.10	Stream Power (lb/ft s)	8807.00	0.00	0.00
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	234949.00	123455.50	241804.40
C & E Loss (ft)	0.05	Cum SA (acres)	35078.12	5338.04	37817.00

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 166.6

INPUT	Description:	XS 166.6	NAVD 88
Station Elevation Data	num=	66	
Sta	Elev	Sta	Elev
0	118.04	4	118.04
72	118.04	499	118.04
3769	105.24	3793	105.94
5122	104.24	5564	106.24
5961	103.34	6129	103.14
8192	103.04	8220	105.44
8283	77.88	8290	76.84
8330	71.64	8340	72.34
8380	71.34	8390	71.34
8430	71.84	8440	71.34
8523	99.64	8537	100.34
		8564	101.78
		9011	104.64
		9192	98.14

9378 102.34 9777 104.04 9870 99.04 10133 92.04 10365 87.84
10478 90.04 10519 102.04 10603 104.04 10750 106.64 12630 109.64
12700 112.74

Manning's n values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .118 8159 .118 8192 .066 8276 .015 8489 .066
8564 .132

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
8220 8523 16100 16100 .1 .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 8220 105.44 9011 12700 104.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	118.55	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.09	wt. n-Val.	0.118	0.035	0.130
W.S. Elev (ft)	118.46	Reach Len. (ft)	16100.00	16100.00	16100.00
Crit W.S. (ft)		Flow Area (sq ft)	100114.20	11642.41	51356.00
E.G. Slope (ft/ft)	0.000073	Area (sq ft)	100114.20	11642.41	51356.00
Q Total (cfs)	130000.00	Flow (cfs)	57005.31	46263.18	26731.50
Top width (ft)	12700.00	Top width (ft)	8220.00	303.00	4177.00
Vel Total (ft/s)	0.80	Avg. Vel. (ft/s)	0.57	3.97	0.52
Max chl Dpth (ft)	47.12	Hydr. Depth (ft)	12.18	38.42	12.29
Conv. Total (cfs)	15249420.0	Conv. (cfs)	6686909.0	5426822.0	3135692.0
Length wtd. (ft)	16100.00	Wetted Per. (ft)	8232.57	316.98	4182.87
Min ch El (ft)	71.34	Shear (lb/sq ft)	0.06	0.17	0.06
Alpha	9.16	Stream Power (lb/ft s)	12700.00	0.00	0.00
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	227868.30	122202.90	238166.70
C & E Loss (ft)	0.00	Cum SA (acres)	34390.47	5303.61	37502.88

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 161.4

INPUT

Description: XS 161.4 NAVD 88
Station Elevation Data num= 79

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	116.94	9	116.04	46	105.44	131	104.04	744	104.94
956	104.74	983	104.54	1605	105.04	1706	101.04	2120	102.04
2733	101.64	2764	101.64	3683	100.94	4155	98.94	4227	100.52
4260	101.24	4279	94.54	4292	81.74	4297	76.81	4305	72.14
4315	70.54	4325	70.14	4335	70.34	4345	70.54	4355	71.34
4365	72.14	4375	72.84	4385	72.14	4395	72.14	4405	74.14
4415	74.14	4425	74.64	4435	74.84	4445	74.44	4455	75.14
4465	75.14	4475	75.64	4485	75.84	4495	76.81	4500	80.04
4523	81.45	4570	84.34	4597	89.34	4622	89.84	4660	103.94
4735	104.34	5155	107.14	5172	105.14	5697	103.74	5709	105.74
5784	104.44	6289	102.74	6424	107.14	6891	106.94	6900	106.64
7445	106.64	8411	106.64	9300	104.44	9400	101.54	9600	100.54
9700	101.54	9800	102.14	9900	103.14	10000	104.64	10563	105.74
11080	105.74	11490	105.74	11504	105.34	11526	114.74	11533	114.74
12077	115.54	12907	115.84	13662	116.24	14377	116.24	14562	111.44
14662	114.24	14902	116.24	15054	119.24	15102	118.14		

Manning's n values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .108 4227 .108 4260 .066 4292 .015 4523 .066
4660 .144

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
4260 4660 25100 25100 .1 .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 4260 101.24 5155 15102 107.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	117.23	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.09	wt. n-Val.	0.108	0.041	0.144
W.S. Elev (ft)	117.14	Reach Len. (ft)	25100.00	25100.00	25100.00
Crit W.S. (ft)		Flow Area (sq ft)	61077.69	14539.19	74669.27
E.G. Slope (ft/ft)	0.000093	Area (sq ft)	61077.69	14539.19	74669.27
Q Total (cfs)	130000.00	Flow (cfs)	47843.24	54288.94	27867.83
Top width (ft)	14947.43	Top width (ft)	4260.00	400.00	10287.43
Vel Total (ft/s)	0.87	Avg. Vel. (ft/s)	0.78	3.73	0.37
Max chl Dpth (ft)	47.00	Hydr. Depth (ft)	14.34	36.35	7.26
Conv. Total (cfs)	13472790.0	Conv. (cfs)	4958321.0	5626333.0	2888133.0
Length wtd. (ft)	25100.00	Wetted Per. (ft)	4261.82	414.31	10289.11
Min ch El (ft)	70.14	Shear (lb/sq ft)	0.08	0.20	0.04
Alpha	8.12	Stream Power (lb/ft s)	15102.00	0.00	0.00
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	198079.60	117364.50	214876.90
C & E Loss (ft)	0.06	Cum SA (acres)	32084.13	5173.69	34829.82

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 157.15

INPUT

Description: XS 157.15 NAVD 88
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	110.64	44	109.64	130	101.64	292	101.64	874	103.64
964	104.04	984	100.14	990	99.74	999	94.94	1007	98.24
1066	97.54	1400	97.44	1609	97.53	1642	97.54	1666	98.54
1682	100.74	1686	101.74	1704	89.64	1723	78.5	1727	76.16
1735	73.64	1745	70.74	1755	69.64	1765	70.14	1775	70.64
1785	71.14	1795	71.64	1805	71.64	1815	71.64	1825	71.64
1835	72.14	1845	72.64	1855	72.64	1865	72.14	1875	72.64
1885	71.64	1895	72.14	1905	72.14	1915	72.14	1925	72.64
1935	72.14	1945	72.14	1955	73.14	1965	73.64	1974	76.16
2008	78.71	2011	78.94	2062	98.64	2090	98.64	2365	99.24
2396	110.74	2402	111.24						

Manning's n values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .102 1609 .102 1642 .066 1723 .015 2008 .066
2090 .078

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
1686 2062 2114 2114 .1 .3
Blocked Obstructions num= 1
Sta L Sta R Elev
0 1686 101.74

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	113.84	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.70	wt. n-Val.	0.100	0.032	0.077
W.S. Elev (ft)	113.14	Reach Len. (ft)	2114.00	2114.00	2114.00
Crit W.S. (ft)		Flow Area (sq ft)	17783.90	13711.71	4575.82
E.G. Slope (ft/ft)	0.000230	Area (sq ft)	17783.90	13711.71	4575.82
Q Total (cfs)	130000.00	Flow (cfs)	19194.80	103249.10	7556.12
Top width (ft)	2402.00	Top width (ft)	1686.00	376.00	340.00
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)	1.08	7.53	1.65
Max chl Dpth (ft)	43.50	Hydr. Depth (ft)	10.55	36.47	13.46
Conv. Total (cfs)	8566940.0	Conv. (cfs)	1264929.0	6804067.0	497944.6
Length wtd. (ft)	2114.00	Wetted Per. (ft)	1689.10	388.58	343.98
Min ch El (ft)	69.64	Shear (lb/sq ft)	0.15	0.51	0.19
Alpha	3.49	Stream Power (lb/ft s)	2402.00	0.00	0.00
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	175358.90	109225.20	192045.80
C & E Loss (ft)	0.01	Cum SA (acres)	30371.04	4950.12	31767.97

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 156.93

INPUT

Description: XS 156.93 NAVD 88
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	107.74	37.9	94.74	40	93.74	42.3	93.04
50	90.64	70	89.74	88	90.64	120	90.14	148	68.74
157	69.24	159	68.6	169	65.38	175	64.34	185	63.94
188	62.34	192.6	61.34	195	61.74	205	62.34	215	62.34
225	62.34	235	62.24	243	62.04	253	62.04	263	62.34
275	62.04	285	62.34	295	62.24	305	62.24	315	61.64
325	60.14	335	59.14	338.6	59.14	343	59.14	345	59.14
355	59.64	365	58.64	375	57.14	385	58.84	395	60.94
405	63.64	411	65.38	418	68.14	420	68.45	425	69.24
432	74.04	468	94.74	488.8	96.74	493.2	97.14	510	98.74
527.9	102.74	535	108.14	540	108.14	541	108.14		

Manning's n values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .14 50 .14 88 .066 159 .015 420 .066
468 .14

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	120	468		86	86	86		.2	.5
CROSS SECTION OUTPUT Profile #PF 1									
E.G. Elev (ft)	113.39		Element	Left	Channel	Right	Channel	Right	Channel
Vel Head (ft)	0.85		wt. n-Val.	0.100	0.033	0.140			
W.S. Elev (ft)	112.55		Reach Len. (ft)	5.00	5.00	5.00			
Crit W.S. (ft)	80.81		Flow Area (sq ft)	2208.75	16141.62	951.76			
E.G. Slope (ft/ft)	0.000179		Area (sq ft)	2208.75	16141.62	951.76			
Q Total (cfs)	125000.00		Flow (cfs)	3110.69	121183.20	706.15			
Top Width (ft)	541.00		Top Width (ft)	120.00	348.00	73.00			
Vel Total (ft/s)	6.48		Avg. Vel. (ft/s)	1.41	7.51	0.74			
Max Chl Dpth (ft)	55.41		Hydr. Depth (ft)	18.41	46.38	13.04			
Conv. Total (cfs)	9330028.0		Conv. (cfs)	232182.6	9045138.0	52707.5			
Length Wtd. (ft)	5.00		Wetted Per. (ft)	127.52	365.04	79.86			
Min Ch El (ft)	57.14		Shear (lb/sq ft)	0.19	0.50	0.13			
Alpha	1.30		Stream Power (lb/ft s)	541.00	0.00	0.00			
Frctn Loss (ft)			Cum Volume (acre-ft)	174873.80	108500.80	191911.60			
C & E Loss (ft)			Cum SA (acres)	30327.22	4932.55	31757.95			

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 156.915

INPUT
Description: Reynosa SB

Distance from Upstream XS =	5													
Deck/Roadway width =	76													
Weir Coefficient =	3.05													
Upstream Deck/Roadway Coordinates														
num=	13													
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	113.74	59.64			3	113.74	107.74			3	113.74	109.64		
37.1	114.54	110.44			37.1	114.54	107.74			187.4	116.04	109.24		
337.8	116.04	109.24			488	114.54	107.74			488	114.54	110.44		
521.9	113.84	109.74			535	113.84	109.74			535	113.84	108.14		
541	113.84	59.64												

Upstream Bridge Cross Section Data													
Station Elevation Data num= 54													
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	107.74	37.9	94.74	40	93.74	42.3	93.04				
50	90.64	70	89.74	88	90.64	120	90.14	148	68.74				
157	69.24	159	68.6	169	65.38	175	64.34	185	63.94				
188.2	63.94	192.6	63.34	195	62.74	205	62.34	215	62.34				
225	62.34	235	62.24	245	62.04	255	62.04	265	62.34				
275	62.04	285	62.34	295	62.24	305	62.24	315	61.64				
325	60.14	335	59.14	338.6	59.14	343	59.14	345	59.14				
355	59.64	365	58.64	375	57.14	385	58.84	395	60.94				
405	63.64	411	65.38	418	68.14	420	68.45	425	69.24				
432	74.04	468	94.74	488.8	96.74	493.2	97.14	510	98.74				
527.9	102.74	535	108.14	540	108.14	541	108.14						

Manning's n Values		num=		6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	50	.14	88	.066	159	.015	420	.066		
468	.14										

Bank Sta: Left Right
120 468
Coeff Contr. Expan.
.2 .5

Downstream Deck/Roadway Coordinates														
num= 13														
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	113.74	59.64			3	113.74	107.74			3	113.74	109.64		
37.1	114.54	110.44			37.1	114.54	107.74			187.4	116.04	109.24		
337.8	116.04	109.24			488	114.54	107.74			488	114.54	110.44		
521.9	113.84	109.74			535	113.84	109.74			535	113.84	108.14		
541	113.84	59.64												

Downstream Bridge Cross Section Data													
Station Elevation Data num= 54													
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	107.74	37.9	94.74	40	93.74	42.3	93.04				
50	90.64	70	89.74	88	90.64	120	90.14	148	68.74				
157	69.24	159	68.6	169	65.38	175	64.34	185	63.94				
188.2	63.94	192.6	63.34	195	62.74	205	62.34	215	62.34				
225	62.34	235	62.24	245	62.04	255	62.04	265	62.34				
275	62.04	285	62.34	295	62.24	305	62.24	315	61.64				
325	60.14	335	59.14	338.6	59.14	343	59.14	345	59.14				
355	59.64	365	58.64	375	57.14	385	58.84	395	60.94				
405	63.64	411	65.38	418	68.14	420	68.45	425	69.24				
432	74.04	468	94.74	488.8	96.74	493.2	97.14	510	98.74				
527.9	102.74	535	108.14	540	108.14	541	108.14						

Manning's n Values		num=		6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	50	.06	88	.066	159	.015	420	.066

468 .06
Bank Sta: Left Right
120 468
Coeff Contr. Expan.
.2 .5
Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 116.4
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Abutments = 1

Abutment Data			
Upstream	num=	2	
Sta	Elev	Sta	Elev
510	98.8	535	108.2
Downstream	num=	2	
Sta	Elev	Sta	Elev
510	98.8	535	108.2

Number of Piers = 4

Pier Data							
Pier Station	Upstream=	37.1	Downstream=	37.1			
Upstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	110.5				
Downstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	110.5				

Pier Data							
Pier Station	Upstream=	187.4	Downstream=	187.4			
Upstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	109.3				
Downstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	109.3				

Pier Data							
Pier Station	Upstream=	337.8	Downstream=	337.8			
Upstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	109.3				
Downstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	109.3				

Pier Data							
Pier Station	Upstream=	488	Downstream=	488			
Upstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	110.5				
Downstream	num=	2					
width	Elev	width	Elev				
4.5	55	4.5	110.5				

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet & Outlet Cd = .8006408
Max Low Cord = 109.6

Additional Bridge Parameters
Add Friction component to Momentum
Do not add weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1							
E.G. US. (ft)	113.39	Element	Inside BR US	Inside BR DS			
W.S. US. (ft)	112.55	E.G. Elev (ft)	113.39	112.86			
Q Total (cfs)	125000.00	W.S. Elev (ft)	110.44	110.44			
Q Bridge (cfs)	125000.00	Crit W.S. (ft)	81.25	81.25			
Q Weir (cfs)		Max Chl Dpth (ft)	53.30	53.30			
Weir Sta Lft (ft)		Vel Total (ft/s)	7.46	7.46			
Weir Sta Rgt (ft)		Flow Area (sq ft)	16756.62	16756.62			
Weir Submerg		Froude # chl	0.20	0.20			
Weir Max Depth (ft)		Specif Force (cu ft)	396198.80	395385.90			
Min El weir Flow (ft)	116.40	Hydr Depth (ft)					
Min El Prs (ft)	109.60	W.P. Total (ft)	1297.24	1297.24			
Delta EG (ft)	0.53	Conv. Total (cfs)	4772358.0	4850586.0			
Delta WS (ft)	0.50	Top width (ft)					

BR Open Area (sq ft) 16756.62 Frctn Loss (ft) C & E Loss (ft) Coef of Q 7.46 Shear Total (lb/sq ft) 0.55 0.54 Br Sel Method Press Only Power Total (lb/ft s) 0.00 0.00

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

CROSS SECTION

RIVER: RIVER-1 REACH: Reach-1 RS: 156.9

INPUT									
Description: XS 156.9 NAVD 88									
Station Elevation Data num= 54									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	107.74	37.9	94.74	40	93.74	42.3	93.04
50	90.64	70	89.74	88	90.64	120	90.14	148	68.74
157	69.24	159	68.64	169	65.38	175	64.34	185	63.94
188.2	63.94	192.6	63.34	195	62.74	205	62.34	215	62.34
225	62.34	235	62.24	245	62.04	255	62.04	265	62.34
275	62.04	285	62.34	295	62.24	305	62.24	315	61.64
325	60.14	335	59.14	338.6	59.14	343	59.14	345	59.14
355	59.64	365	58.64	375	57.14	385	58.84	395	60.94
405	63.64	411	65.38	418	68.14	420	68.45	425	69.24
432	74.04	468	94.74	488.8	96.74	493.2	97.14	510	98.74
527.9	102.74	535	108.14	540	108.14	541	108.14		

Manning's n values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	50	.06	88	.066	159	.015
468	.06					420	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	120	468		199	199	.2	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	112.86	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.82	Wt. n-Val.	0.062	0.033	0.060
W.S. Elev (ft)	112.05	Reach Len. (ft)	199.00	199.00	199.00
Crit W.S. (ft)		Flow Area (sq ft)	2148.90	15968.09	915.36
E.G. Slope (ft/ft)	0.000178	Area (sq ft)	2148.90	15968.09	915.36
Q Total (cfs)	125000.00	Flow (cfs)	4787.12	118667.00	1545.87
Top width (ft)	541.00	Top width (ft)	120.00	348.00	73.00
Vel Total (ft/s)	6.57	Avg. Vel. (ft/s)	2.23	7.43	1.69
Max chl Dpth (ft)	54.91	Hydr. Depth (ft)	17.91	45.89	12.54
Conv. Total (fs)	9357746.0	Conv. cfs)	358373.3	8883646.0	115726.8
Length Wtd. (ft)	199.00	Wetted Per. (ft)	127.02	79.36	79.36
Min ch El (ft)	57.14	Shear (lb/sq ft)	0.19	0.49	0.13
Alpha	1.22	Stream Power (lb/ft s)	541.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	174870.40	108472.00	191910.40
C & E Loss (ft)	0.07	Cum SA (acres)	30327.20	4932.51	31757.94

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.

Note: This may indicate the need for additional cross sections. Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1 REACH: Reach-1 RS: 156.87

INPUT									
Description: XS 156.87 NAVD 88									
Station Elevation Data num= 59									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	108.14	3	108.14	48	100.44	72.3	98.94
77.3	98.64	87	98.04	173.3	84.54	175	84.54	178.3	84.44
270	81.54	274.3	71.44	279.3	70.64	285	68.35	288	67.14
302	65.29	305	65.04	315	63.54	325	63.04	335	63.04
345	62.74	355	61.84	365	61.84	375	61.04	375.3	61.04
380.3	61.14	385	61.34	395	61.64	405	61.84	415	62.34
425	62.34	435	62.34	445	62.14	455	61.34	465	61.84
475	61.64	476.3	61.64	481.3	61.64	485	61.04	495	61.04
505	61.94	515	62.34	525	63.14	535	62.84	545	62.64
555	61.04	565	62.34	575	65.29	577.3	66.34	582.3	68.74
600	87.04	678.1	94.04	683.1	94.44	695	95.54	759	98.54
765.8	99.74	770.8	100.54	813	107.84	819.9	108.14		

Manning's n values num= 5							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	270	.066	285	.015	582.3	.066
						600	.06

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	270	600		91	91	.2	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	112.77	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.68	Wt. n-Val.	0.060	0.025	0.060
W.S. Elev (ft)	112.09	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)	80.10	Flow Area (sq ft)	5341.56	15919.51	3447.90
E.G. Slope (ft/ft)	0.000083	Area (sq ft)	5341.56	15919.51	3447.90
Q Total (cfs)	125000.00	Flow (cfs)	8684.65	111504.70	4810.65
Top width (ft)	819.90	Top width (ft)	270.00	330.00	219.90
Vel Total (ft/s)	5.06	Avg. Vel. (ft/s)	1.63	7.00	1.40
Max chl Dpth (ft)	51.05	Hydr. Depth (ft)	19.78	48.24	15.68
Conv. Total (cfs)	13684370.0	Conv. cfs)	950751.1	12206970.0	526645.3
Length Wtd. (ft)	25.00	Wetted Per. (ft)	277.23	347.13	225.10
Min ch El (ft)	61.04	Shear (lb/sq ft)	0.10	0.24	0.08
Alpha	1.72	Stream Power (lb/ft s)	819.90	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	174853.30	108399.20	191900.40
C & E Loss (ft)	0.00	Cum SA (acres)	30326.31	4930.96	31757.27

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.

Note: This may indicate the need for additional cross sections. Manning's n values were composited to a single value in the main channel.

BRIDGE

RIVER: RIVER-1 REACH: Reach-1 RS: 156.855

INPUT Description: Reynosa NB

Distance from Upstream XS =	25								
Deck/Roadway width =	56								
Weir Coefficient =	2.6								
Upstream Deck/Roadway Coordinates									
num= 14									
Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta
0	117.05	59.64	3	117.05	59.64	3	117.05	109.84	
74.8	119.54	112.34	175.8	122.04	114.84	276.8	124.04	116.84	
377.8	124.84	117.64	478.8	124.14	116.94	579.8	123.34	116.14	
680.6	121.94	114.74	768.3	119.14	111.94	816.9	117.54	110.34	
816.9	117.54	59.64	819.9	117.44	59.64				

Upstream Bridge Cross Section Data									
Station Elevation Data num= 59									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	108.14	35	108.14	48	100.44	72.3	98.94
77.3	98.64	87	98.04	173.3	84.54	175	84.54	178.3	84.44
270	81.54	274.3	71.44	279.3	70.64	285	68.35	288	67.14
302	65.29	305	65.04	315	63.54	325	63.04	335	63.04
345	62.74	355	61.84	365	61.84	375	61.04	375.3	61.04
380.3	61.14	385	61.34	395	61.64	405	61.84	415	62.34
425	62.34	435	62.34	445	62.14	455	61.34	465	61.84
475	61.64	476.3	61.64	481.3	61.64	485	61.04	495	61.04
505	61.94	515	62.34	525	63.14	535	62.84	545	62.64
555	61.04	565	62.34	575	65.29	577.3	66.34	582.3	68.74
600	87.04	678.1	94.04	683.1	94.44	695	95.54	759	98.54
765.8	99.74	770.8	100.54	813	107.84	819.9	108.14		

Manning's n values num= 5							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	270	.066	285	.015	582.3	.066
						600	.06

Bank Sta:	Left	Right	Coeff Contr.	Expan.
	270	600	.2	.5

Downstream Deck/Roadway Coordinates									
num= 14									
Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta
0	117.05	59.64	3	117.05	59.64	3	117.05	109.84	
74.8	119.54	112.34	175.8	122.04	114.84	276.8	124.04	116.84	
377.8	124.84	117.64	478.8	124.14	116.94	579.8	123.34	116.14	
680.6	121.94	114.74	768.3	119.14	111.94	816.9	117.54	110.34	
816.9	117.54	59.64	819.9	117.44	59.64				

Downstream Bridge Cross Section Data									
Station Elevation Data num= 60									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	3	108.14	35	108.14	48	100.44	72.3	98.94
77.3	98.64	87	98.04	173.3	84.54	175	84.54	178.3	84.44
267	81.63	270	81.54	274.3	71.44	279.3	70.64	285	68.35
288	67.14	302	65.29	305	65.04	315	63.54	325	63.04
335	63.04	345	62.74	355	61.84	365	61.84	375	61.04
375.3	61.04	380.3	61.14	385	61.34	395	61.64	405	61.84
415	62.34	425	62.34	435	62.34	445	62.14	455	61.34

465	61.84	475	61.64	476.3	61.64	481.3	61.64	485	61.04
495	61.04	505	61.94	515	62.34	525	63.14	535	62.84
545	62.64	555	61.04	565	62.34	575	65.29	577.3	66.34
582.3	68.74	600	87.04	678.1	94.04	683.1	94.44	695	95.54
759	98.54	765.8	99.74	770.8	100.54	813	107.84	819.9	108.14

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.14	267	.14	270	.066	285	.015	582.3	.066
600	.04								

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
270	600		.2		.5

Upstream Embankment side slope	=	0 horiz. to 1.0 vertical
Downstream Embankment side slope	=	0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow	=	.95
Elevation at which weir flow begins	=	124.9
Energy head used in spillway design	=	
Spillway height used in design	=	
Weir crest shape	=	Broad Crested

Number of Piers = 8

Pier Data	Upstream=	74.8	Downstream=	74.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	102	5	102	5	112.5
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	102	5	102	5	112.5

Pier Data	Upstream=	175.8	Downstream=	175.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	104.5	5	104.5	5	115
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	104.5	5	104.5	5	115

Pier Data	Upstream=	276.8	Downstream=	276.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	106.5	5	106.5	5	117
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	106.5	5	106.5	5	117

Pier Data	Upstream=	377.8	Downstream=	377.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	107.2	5	107.2	5	117.7
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	107.2	5	107.2	5	117.7

Pier Data	Upstream=	478.8	Downstream=	478.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	106.6	5	106.6	5	117.1
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	106.6	5	106.6	5	117.1

Pier Data	Upstream=	579.8	Downstream=	579.8			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	105.8	5	105.8	5	116.3
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	105.8	5	105.8	5	116.3

Pier Data	Upstream=	680.6	Downstream=	680.6			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	104.4	5	104.4	5	114.9
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	104.4	5	104.4	5	114.9

Pier Data	Upstream=	768.3	Downstream=	768.3			
Pier Station	num=	4					
Upstream	width	Elev	width	Elev	width	Elev	
8.2	60	8.2	101.6	5	101.6	5	112.1
Downstream	num=	4					
width	Elev	width	Elev	width	Elev	width	Elev
8.2	60	8.2	101.6	5	101.6	5	112.1

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow	
Submerged Inlet Cd	=
Submerged Inlet + Outlet Cd	= .8
Max Low Cord	=

Additional Bridge Parameters

Add Friction component to Momentum	
Do not add Weight component to Momentum	
Class B Flow critical depth computations use critical depth	
inside the bridge at the upstream end	
Criteria to check for pressure flow = Upstream energy grade line	

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	112.77	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	112.09	E.G. Elev (ft)	112.77	112.74
Q Total (cfs)	125000.00	W.S. Elev (ft)	112.08	111.97
Q Bridge (cfs)	125000.00	Crit W.S. (ft)	81.15	81.15
Q Weir (cfs)		Max Chl Dpth (ft)	51.04	50.93
Weir Sta Lft (ft)		Vel Total (ft/s)	5.52	5.54
Weir Sta Rgt (ft)		Flow Area (sq ft)	22638.13	22567.21
Weir Submerg		Froude # chl	0.16	0.17
Weir Max Depth (ft)		Specif Force (cu ft)	465225.70	464290.20
Min El weir Flow (ft)	124.90	Hydr Depth (ft)	34.22	33.86
Min El Prs (ft)	117.64	W.P. Total (ft)	1418.61	1412.09
Delta EG (ft)	0.05	Conv. Total (cfs)	7423498.0	7161586.0
Delta WS (ft)	0.10	Top Width (ft)	661.57	666.54
BR Open Area (sq ft)	24994.14	Frctn Loss (ft)	0.02	0.00
BR Open Vel (ft/s)	5.54	C & E Loss (ft)	0.02	0.02
Coef of Q		Shear Total (lb/sq ft)	0.28	0.30
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

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

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1	
REACH: Reach-1	RS: 156.84

INPUT

Description: XS 156.84	NAVD 88								
Station Elevation Data	num=	60							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	108.14	3	108.14	35	18.14	48	100.44	72.3	98.94
77.3	98.64	87	98.04	173.3	84.54	175	84.54	178.3	84.44
267	81.63	270	81.54	274.3	71.44	279.3	70.64	285	68.35
288	67.14	302	65.29	305	65.04	315	63.54	325	63.04
335	63.04	345	62.74	355	61.84	365	61.84	375	61.04
375.3	61.04	380.3	61.14	385	61.34	395	61.64	405	61.84
415	62.34	425	62.34	435	62.34	445	62.14	455	61.34
465	61.84	475	61.64	476.3	61.64	481.3	61.64	485	61.04
495	61.04	505	61.94	515	62.34	525	63.14	535	62.84
545	62.64	555	61.04	565	62.34	575	65.29	577.3	66.34
582.3	68.74	600	87.04	678.1	94.04	683.1	94.44	695	95.54
759	98.54	765.8	99.74	770.8	100.54	813	107.84	819.9	108.14

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.14	267	.14	270	.066	285	.015	582.3	.066
600	.04								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
270	600		1100	1020	1100	.2		.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	112.72	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.73	Wt. n-Val.	0.025		0.040
W.S. Elev (ft)	111.99	Reach Len. (ft)	1100.00	1020.00	1100.00
Crit W.S. (ft)		Flow Area (sq ft)	5314.55	15886.22	3425.72
E.G. Slope (ft/ft)	0.000088	Area (sq ft)	5314.55	15886.22	3425.72
Q Total (cfs)	125000.00	Flow (cfs)	7391.15	113889.70	7319.13
Top width (ft)	819.90	Top width (ft)	270.00	330.00	219.90
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)	0.71	7.17	2.14
Max Chl Dpth (ft)	50.95	Hydr. depth (ft)	19.68	48.14	15.58
conv. Total (cfs)	13351140.0	conv. (cfs)	404928.9	12164460.0	781749.6
Length wtd. (ft)	1030.65	wetted Per. (ft)	277.13	347.13	225.00
Min ch El (ft)	61.04	Shear (lb/sq ft)	0.10	0.25	0.08
Alpha	1.83	Stream Power (lb/ft s)	819.90	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	174842.80	108368.50	191893.60
C & E Loss (ft)	0.03	Cum SA (acres)	30325.88	4930.31	31756.91

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 156.6

INPUT									
Description: XS 156.6 NAVD 88									
Station Elevation Data num= 56									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	108.14	100	108.14	200	108.14	300	108.14	500	108.14
539	105.74	551	106.64	604	105.94	1131	104.24	1161	105.24
1167	108.74	1178	106.24	1210	101.24	1222	101.74	1238	107.24
1276	106.74	1319	109.44	1322	109.74	1363	92.44	1420	91.64
1443	93.24	1498	68.38	1505	66.49	1515	61.44	1525	60.94
1535	61.14	1545	61.34	1555	61.74	1565	61.74	1575	61.44
1585	61.74	1595	61.44	1605	61.64	1615	61.54	1625	61.34
1635	61.44	1645	61.44	1655	61.94	1665	62.44	1675	63.34
1685	62.74	1695	62.44	1705	62.74	1715	62.94	1725	63.04
1731	66.49	1733	68.1	1740	83.74	1769	87.14	1789	83.24
1837	83.44	1859	88.34	1870	98.54	2140	99.64	2175	109.54
2183	110.04								

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.076	1322	.076	1363	n Val	1498	.015	1733	n Val
1870	.06								.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
1443	1769		4500	4000		.1	.3
Blocked Obstructions num= 1							
Sta L	Sta R	Elev					
0	1238	107.24					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	112.56	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.035	0.063	0.063
W.S. Elev (ft)	111.90	Reach Len. (ft)	4500.00	4000.00	4600.00	
Crit W.S. (ft)		Flow Area (sq ft)	7681.35	14392.38	6410.52	
E.G. Slope (ft/ft)	0.000194	Area (sq ft)	7681.35	14392.38	6410.52	
Q Total (cfs)	125000.00	Flow (cfs)	8234.98	102841.50	13923.56	
Top width (ft)	2183.00	Top width (ft)	1443.00	326.00	414.00	
Vel Total (ft/s)	4.39	Avg. Vel. (ft/s)	1.07	7.15	2.17	
Max chl Dpth (ft)	50.96	Hydr. Depth (ft)	5.32	44.15	15.48	
Conv. Total (cfs)	8966699.0	conv. (cfs)	590724.4	7377187.0	998787.3	
Length wtd. (ft)	4191.16	wetted Per. (ft)	1451.02	344.77	422.17	
Min ch El (ft)	60.94	Shear (lb/sq ft)	0.06	0.51	0.18	
Alpha	2.21	Stream Power (lb/ft s)	2183.00	0.00	0.00	
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	174678.70	108014.00	191769.40	
C & E Loss (ft)	0.15	Cum SA (acres)	30304.25	4922.63	31748.91	

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 155.7

INPUT									
Description: XS 155.7 NAVD 88									
Station Elevation Data num= 53									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	112.24	9	112.24	46	112.24	57	112.24	378	112.24
379	101.94	663	101.34	723	95.24	1300	93.34	1382	92.84
3748	95.94	3771	97.97	3782	98.94	3798	98.94	3804	99.44
3823	94.14	4063	91.14	4105	90.64	4123	84.24	4155	84.04
4172	79.34	4181	80.24	4187	77.49	4191	75.66	4200	72.64
4210	71.24	4220	70.94	4230	70.94	4240	71.24	4250	70.94
4260	70.64	4270	70.64	4280	70.14	4290	69.64	4300	69.64
4310	69.14	4320	69.14	4330	69.14	4340	69.14	4350	68.64
4360	68.64	4370	69.64	4380	70.94	4390	74.14	4391	75.66
4401	77.58	4406	78.54	4430	100.14	4451	98.04	4650	99.34
5679	96.64	5680	109.94	7926	109.94				

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.092	3771	.092	3804	.066	4187	.015	4401	.066
4430	.06								

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
4063	4430		3600	4100		.1	.3

Blocked Obstructions num= 2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	3804	99.44	4430	7926	100.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	111.68	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.087	0.041	0.060
W.S. Elev (ft)	111.52	Reach Len. (ft)		3600.00	4100.00	3500.00
Crit W.S. (ft)		Flow Area (sq ft)		45562.02	12578.22	17784.35
E.G. Slope (ft/ft)	0.000151	Area (sq ft)		45562.02	12578.22	17784.35
Q Total (cfs)	125000.00	Flow (cfs)		51444.93	57562.67	15992.40
Top width (ft)	7547.93	Top width (ft)		3684.93	367.00	3496.00
Vel Total (ft/s)	1.65	Avg. Vel. (ft/s)		1.13	4.58	0.90
Max chl Dpth (ft)	42.88	Hydr. Depth (ft)		12.36	34.27	5.09
Conv. Total (cfs)	10161860.0	Conv. (cfs)		4182209.0	4679550.0	1300100.0
Length wtd. (ft)	3834.22	wetted Per. (ft)		3694.47	380.46	3506.68
Min ch El (ft)	68.64	Shear (lb/sq ft)		0.12	0.31	0.05
Alpha	3.79	Stream Power (lb/ft s)		7926.00	0.00	0.00
Frctn Loss (ft)	0.86	Cum Volume (acre-ft)		171928.50	106775.60	190491.90
C & E Loss (ft)	0.01	Cum SA (acres)		30039.37	4890.81	31542.46

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 155.01

INPUT									
Description: XS 155.01 NAVD 88									
Station Elevation Data num= 50									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	112.64	14	106.64	80	87.44	112	86.11	145	84.74
162	77.18	166	75.4	175	73.94	185	67.64	195	65.94
205	67.64	215	67.94	225	68.74	235	68.74	245	68.34
255	68.64	265	68.94	275	69.04	285	69.04	295	69.64
305	70.14	315	70.64	325	70.94	335	70.34	345	70.64
355	71.64	365	72.64	372	75.4	375	77.01	390	85.04
410	88.04	579	99.64	683	96.04	1624	94.34	1647	96.64
1975	97.04	2023	103.34	2309	102.54	2960	101.04	3378	101.44
3402	101.44	3412	101.44	4014	101.94	4114	99.94	4149	103.44
4186	103.64	4196	101.94	4504	105.94	4533	113.24	4551	113.24

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.099	112	.092	145	.066	162	.015	375	.066
579									

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
0	579		2500	2650		.1	.3
Blocked Obstructions num= 1							
Sta L	Sta R	Elev					
579	4551	99.64					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	110.81	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.			0.058	0.099
W.S. Elev (ft)	110.60	Reach Len. (ft)		2500.00	2650.00	2500.00
Crit W.S. (ft)		Flow Area (sq ft)			15409.73	36981.63
E.G. Slope (ft/ft)	0.000442	Area (sq ft)			15409.73	36981.63
Q Total (cfs)	125000.00	Flow (cfs)			73120.18	51879.82
Top width (ft)	4517.72	Top width (ft)			574.23	3943.49
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)			4.75	1.40
Max chl Dpth (ft)	43.66	Hydr. Depth (ft)			26.84	9.38
Conv. Total (cfs)	5946213.0	Conv. (cfs)			3478306.0	2467908.0
Length wtd. (ft)	2614.10	wetted Per. (ft)			585.59	3944.68
Min ch El (ft)	66.94	Shear (lb/sq ft)			0.73	0.26
Alpha	2.46	Stream Power (lb/ft s)			4551.00	0.00
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)			170045.80	105458.50
C & E Loss (ft)	0.03	Cum SA (acres)			29887.10	4846.51

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 154.6

INPUT									
Description: XS 154.6 NAVD 88									
Station Elevation Data num= 50									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

5800	112.64	5806	112.44	5840	96.74	6004	97.44	6251	97.94
6448	98.03	6481	98.04	6492	98.04	6508	82.94	6560	78.94
6595	80.94	6659	79.24	6693	76.24	6772	69.74	6777	66.95
6780	65.28	6790	62.44	6800	61.74	6810	61.64	6820	61.24
6830	60.84	6840	60.84	6850	60.64	6860	59.94	6870	59.64
6880	59.14	6890	58.64	6900	57.94	6910	57.24	6920	56.64
6930	55.94	6940	55.64	6950	56.64	6960	61.64	6967	65.28
6969	66.86	7000	101.34	7123	103.34	7157	108.94	7197	109.84
7990	110.54	8635	109.04	8687	102.44	9100	98.74	9145	100.94
9154	102.64	9162	101.74	9476	104.04	9531	111.04	9547	111.04

Manning's n values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
5800	.168	6448	.168	6481	.066	6777	.015	6969	.066
7123	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	6492	7000		3360	3330		.1	.3
Blocked Obstructions			num=	2				
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
5800	6004	97.94	7990	9547	110.54			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	109.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.164	0.051	0.066
W.S. Elev (ft)	109.16	Reach Len. (ft)	3360.00	3330.00	3450.00
Crit W.S. (ft)		Flow Area (sq ft)	7529.84	19037.81	942.68
E.G. Slope (ft/ft)	0.000376	Area (sq ft)	7529.84	19037.81	942.68
Q Total (cfs)	125000.00	Flow (cfs)	6561.85	117043.20	1394.99
Top width (ft)	1353.69	Top width (ft)	678.90	508.00	166.80
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	0.87	6.15	1.48
Max chl dpth (ft)	53.52	Hydr. Depth (ft)	11.09	37.48	5.65
Conv. Total (cfs)	6450104.0	Conv. (cfs)	338596.8	6039524.0	71982.8
Length wtd. (ft)	3344.52	Wetted Per. (ft)	681.46	534.42	167.27
Min ch El (ft)	55.64	Shear (lb/sq ft)	0.26	0.84	0.13
Alpha	1.72	Stream Power (lb/ft s)	9547.00	0.00	0.00
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	169829.70	104410.70	187203.50
C & E Loss (ft)	0.00	Cum SA (acres)	29867.62	4813.59	31125.63

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1

RS: 153.85

INPUT

Description:	XS 153.85	"Z"	NAVD 88
Station Elevation Data	num=	49	
Sta	Elev	Sta	Elev
0	116.04	13	116.24
98	90.84	126	97.44
981	89.94	994	86.24
1025	70.94	1026	68.64
1066	66.84	1076	66.64
1116	67.14	1126	67.04
1166	68.24	1176	68.94
1211	71.54	1231	80.84
1390	93.94	1414	99.34
3596	99.64	3724	99.34

Manning's n values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.132	930	.132	969	.066	1025	.015	1206	.066
1414	.076								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	969	1414		2240	2220		.1	.3
Blocked Obstructions			num=	3				
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
36	480	99.34	1436	2023	99.74	2023	3750	101.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	108.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.132	0.049	0.076
W.S. Elev (ft)	107.60	Reach Len. (ft)	2240.00	2220.00	2300.00
Crit W.S. (ft)		Flow Area (sq ft)	7805.29	13084.87	15007.93
E.G. Slope (ft/ft)	0.000608	Area (sq ft)	7805.29	13084.87	15007.93
Q Total (cfs)	125000.00	Flow (cfs)	8900.15	91110.66	24989.18
Top width (ft)	3717.70	Top width (ft)	936.70	445.00	2336.00
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	1.14	6.96	1.67
Max chl dpth (ft)	41.16	Hydr. Depth (ft)	8.33	29.40	6.42
Conv. Total (cfs)	5068260.0	conv. (cfs)	360865.9	3694180.0	1013213.0
Length wtd. (ft)	2249.59	Wetted Per. (ft)	938.05	457.82	2338.96
Min ch El (ft)	66.44	Shear (lb/sq ft)	0.32	1.09	0.24
Alpha	2.97	Stream Power (lb/ft s)	3750.00	0.00	0.00
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	169238.30	103182.80	186571.80
C & E Loss (ft)	0.13	Cum SA (acres)	29805.31	4777.17	31026.32

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1

RS: 153.36

INPUT

Description: XS 153.36		NAVD 88	
Station Elevation Data		num=	
		59	
Sta	Elev	Sta	Elev
0	106.34	1000	106.34
2510	91.84	2615	91.94
5016	97.94	5408	99.47
5469	93.04	5499	87.74
5566	76.41	5573	71.95
5620	68.34	5640	67.94
5720	67.34	5740	66.94
5780	71.34	5783	71.95
5886	98.54	5940	96.94
6934	74.14	6945	76.67
8380	99.44	10509	96.94
12155	97.74	12986	96.74

Manning's n values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.096	5408	.096	5441	.066	5566	.015	5789	.066
5886	.085								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	5441	5886		4375	4200		.1	.3
Blocked Obstructions			num=	2				
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	5441	100.14	5886	14344	98.54			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	107.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.096	0.045	0.085
W.S. Elev (ft)	107.03	Reach Len. (ft)	4375.00	4200.00	4275.00
Crit W.S. (ft)		Flow Area (sq ft)	21955.24	12767.50	67874.16
E.G. Slope (ft/ft)	0.000173	Area (sq ft)	21955.24	12767.50	67874.16
Q Total (cfs)	125000.00	Flow (cfs)	11321.76	51254.66	62423.58
Top width (ft)	14344.00	Top width (ft)	5441.00	445.00	8458.00
Vel Total (ft/s)	1.22	Avg. Vel. (ft/s)	0.52	4.01	0.92
Max chl dpth (ft)	40.09	Hydr. Depth (ft)	4.04	28.69	8.02
Conv. Total (cfs)	9517304.0	Conv. (cfs)	862021.1	3902449.0	4752834.0
Length wtd. (ft)	4255.86	Wetted Per. (ft)	5447.48	457.27	8466.36
Min ch El (ft)	66.94	Shear (lb/sq ft)	0.04	0.30	0.09
Alpha	4.75	Stream Power (lb/ft s)	14344.00	0.00	0.00
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	168473.10	102524.10	184383.70
C & E Loss (ft)	0.02	Cum SA (acres)	29641.33	4754.49	30741.55

Warning: The cross-section end points had to be extended vertically for the computed water surface.

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1

RS: 152.53

INPUT

Description: XS 152.53		NAVD 88	
Station Elevation Data		num=	
		73	
Sta	Elev	Sta	Elev
0	105.44	6	105.44
1044	93.74	2047	94.64
4122	98.14	4202	98.14
4260	89.94	4273	79.24
4300	66.64	4320	66.64
4400	68.44	4420	68.64
4480	69.64	4490	69.64
4511	75.89	4542	88.64
4700	90.34	4726	90.94
5400	92.14	5518	92.04
7244	89.14	7289	99.14
9546	91.74	11257	87.94
12191	89.84	12201	87.64
14179	97.04	14250	98.34
14467	101.84	14487	116.64

Manning's n values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

CROSS SECTION

Upstream Bridge Cross Section Data					
Station Elevation Data		num=		82	
Sta	Elev	Sta	Elev	Sta	Elev
0	103.64	34	93.7	74	93.29
				90	95.73
				658	96.08

694	96.1	1352	96.51	1388	96.53	2046	96.94	2082	96.96
2719	97.35	2740	96.33	2776	94.92	3434	95.14	3470	95.15
4128	95.37	4164	95.39	4822	95.61	4858	95.62	5194	95.73
5371	96.75	5454	89.74	5516	89.92	5552	90.02	6210	91.89
6246	91.99	6813	92.84	6846	93.7	6904	96.54	6908	94.6
6951	73.7	6997.2	66.88	7001.2	66.29	7004	65.88	7090.4	68.61
7094.4	68.72	7154	71.67	7182	77.76	7183.6	77.86	7187.6	78.12
7201	78.98	7232	90.66	7276.8	91.59	7280.8	91.67	7359	93.29
7370	95.83	7374	96.75	8100.1	97.17	8136.1	97.19	8414	97.35
8651	95.73	8674	90.86	8862.2	97.69	8898.2	97.74	9614	97.35
9624.3	96.91	9660.3	95.35	9774	90.45	9834	90.45	10334	94.11
10386.4	96.77	10422.4	98.15	11148.5	96.18	11184.5	96.08	11614	94.92
11910.6	95.17	11946.6	95.19	12594	95.73	12672.7	93.07	12708.7	91.85
12714	91.67	12750	91.67	12834	98.98	13434.8	98.1	13470.8	98.04
14196.9	96.97	14232.9	96.92	14762	96.14	14784	101.41	14798	101.01
14826	97.76	14959	113.29						

Manning's n	Values		num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	6813	.06	6846	.066	6951	.015	7201	.066
7374	.067								

Bank Sta: Left Right
6904 7374

Coeff Contr. Expan.
.2 .5
Blocked Obstructions num=
2
Sta L Sta R Elev Sta L Sta R Elev
0 6904 95.64 8414 14959 97.35

Downstream	Deck/Roadway	Coordinates							
num=	28								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	125.18	103.64			0	125.18	117.1		
1388	118.99	110.9	2082	118.99	110.9	2776	118.99	110.9	
3470	118.99	110.9	4164	118.99	110.9	4858	118.99	110.9	
5552	118.99	110.9	6246	118.99	110.9	6908	118.99	110.87	
7001.2	118.86	110.78	7094.4	118.86	110.78	7187.6	118.86	110.78	
7280.8	118.93	110.85	7374	118.97	110.88	8136.1	118.99	110.9	
8898.2	118.99	110.9	9660.3	118.99	110.9	10422.4	118.99	110.9	
11184.5	118.99	110.9	11946.6	118.99	110.9	12708.7	118.99	110.9	
13470.8	118.99	110.9	14232.9	124.87	116.79	14959	134.32	126.24	
14959	134.32	113.29							

Downstream	Bridge	Cross	Section	Data					
Station	Elevation	Data	num=	82					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	103.64	34	93.7	74	93.29	90	95.73	658	96.08
694	96.1	1352	96.51	1388	96.53	2046	96.94	2082	96.96
2719	97.35	2740	96.33	2776	94.92	3434	95.14	3470	95.15
4128	95.37	4164	95.39	4822	95.61	4858	95.62	5194	95.73
5371	96.75	5454	89.74	5516	89.92	5552	90.02	6210	91.89
6246	91.99	6813	92.84	6846	93.7	6904	96.54	6908	94.6
6951	73.7	6997.2	66.88	7001.2	66.29	7004	65.88	7090.4	68.61
7094.4	68.72	7154	71.67	7182	77.76	7183.6	77.86	7187.6	78.12
7201	78.98	7232	90.66	7276.8	91.59	7280.8	91.67	7359	93.29
7370	95.83	7374	96.75	8100.1	97.17	8136.1	97.19	8414	97.35
8651	95.73	8674	90.86	8862.2	97.69	8898.2	97.74	9614	97.35
9624.3	96.91	9660.3	95.35	9774	90.45	9834	90.45	10334	94.11
10386.4	96.77	10422.4	98.15	11148.5	96.18	11184.5	96.08	11614	94.92
11910.6	95.17	11946.6	95.19	12594	95.73	12672.7	93.07	12708.7	91.85
12714	91.67	12750	91.67	12834	98.98	13434.8	98.1	13470.8	98.04
14196.9	96.97	14232.9	96.92	14762	96.14	14784	101.41	14798	101.01
14826	97.76	14959	113.29						

Manning's n	Values		num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	6813	.06	6846	.066	6951	.015	7201	.066
7374	.06								

Bank Sta: Left Right
6904 7374

Coeff Contr. Expan.
.2 .5
Blocked Obstructions num=
2
Sta L Sta R Elev Sta L Sta R Elev
0 6904 95.64 8414 14959 97.35

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Abutments = 2

Abutment Data

Upstream num= 2
Sta Elev Sta Elev
0 117.16 50 93.2

Downstream num= 2
Sta Elev Sta Elev
0 117.16 50 93.2

Abutment Data

Upstream num= 2
Sta Elev Sta Elev

14936 111 14959 126.6
Downstream num= 2
Sta Elev Sta Elev
14936 111 14959 126.6

Number of Piers = 24

Pier Data
Pier Station Upstream= 694 Downstream= 694
Upstream num= 2
width Elev width Elev
36 60 36 119.42
Downstream num= 2
width Elev width Elev
36 60 36 119.42

Pier Data
Pier Station Upstream= 1388 Downstream= 1388
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 2082 Downstream= 2082
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 2776 Downstream= 2776
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 3470 Downstream= 3470
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 4164 Downstream= 4164
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 4858 Downstream= 4858
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 5552 Downstream= 5552
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 6246 Downstream= 6246
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 6908 Downstream= 6908
Upstream num= 2
width Elev width Elev
4 60 4 119.31
Downstream num= 2
width Elev width Elev

4 60 4 119.31

Pier Data
Pier Station Upstream= 7001.2 Downstream= 7001.2
Upstream num= 2
width Elev width Elev
4 60 4 119.22
Downstream num= 2
width Elev width Elev
4 60 4 119.22

Pier Data
Pier Station Upstream= 7094.4 Downstream= 7094.4
Upstream num= 2
width Elev width Elev
4 60 4 119.22
Downstream num= 2
width Elev width Elev
4 60 4 119.22

Pier Data
Pier Station Upstream= 7187.6 Downstream= 7187.6
Upstream num= 2
width Elev width Elev
4 60 4 119.22
Downstream num= 2
width Elev width Elev
4 60 4 119.22

Pier Data
Pier Station Upstream= 7280.8 Downstream= 7280.8
Upstream num= 2
width Elev width Elev
4 60 4 119.29
Downstream num= 2
width Elev width Elev
4 60 4 119.29

Pier Data
Pier Station Upstream= 7374 Downstream= 7374
Upstream num= 2
width Elev width Elev
4 60 4 119.33
Downstream num= 2
width Elev width Elev
4 60 4 119.33

Pier Data
Pier Station Upstream= 8136.1 Downstream= 8136.1
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 8898.2 Downstream= 8898.2
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 9660.3 Downstream= 9660.3
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 10422.4 Downstream= 10422.4
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 11184.5 Downstream= 11184.5
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 11946.6 Downstream= 11946.6
Upstream num= 2

width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 12708.7 Downstream= 12708.7
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 13470.8 Downstream= 13470.8
Upstream num= 2
width Elev width Elev
36 60 36 119.35
Downstream num= 2
width Elev width Elev
36 60 36 119.35

Pier Data
Pier Station Upstream= 14232.9 Downstream= 14232.9
Upstream num= 2
width Elev width Elev
36 60 36 125.23
Downstream num= 2
width Elev width Elev
36 60 36 125.23

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow

Submerged Inlet Cd =

Submerged Inlet + Outlet Cd = .8

Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum

Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth

inside the bridge at the upstream end

Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	105.43	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	105.40	E.G. Elev (ft)	105.43	105.42
Q Total (cfs)	125000.00	W.S. Elev (ft)	105.40	105.40
Q Bridge (cfs)	125000.00	Crit W.S. (ft)	90.38	90.38
Q Weir (cfs)		Max Chl Dpth (ft)	39.52	39.52
Weir Sta Lft (ft)		Vel Total (ft/s)	0.96	0.96
Weir Sta Rgt (ft)		Flow Area (sq ft)	129846.40	129817.70
Weir Submerg		Froude # chl	0.08	0.07
Weir Max Depth (ft)		Specif Force (cu ft)	696652.90	696289.40
Min El Weir Flow (ft)	118.87	Hydr Depth (ft)	9.15	9.15
Min El Prs (ft)	126.23	W.P. Total (ft)	14792.71	14792.59
Delta EG (ft)	0.01	Conv. Total (cfs)	14563420.0	15131490.0
Delta WS (ft)	0.01	Top width (ft)	14194.92	14194.90
BR Open Area (sq ft)	219699.60	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	0.96	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.04	0.04
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

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

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

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

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 151.25

INPUT

Description: XS 151.25 NAVD 88

Station Elevation Data num= 82

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	103.64	34	93.7	74	93.29	90	95.73	658	96.08
694	96.1	1352	96.51	1388	96.53	2046	96.94	2082	96.96
2719	97.35	2740	96.33	2776	94.92	3434	95.14	3470	95.15
4128	95.37	4164	95.39	4822	95.61	4858	95.62	5194	95.73
5371	96.75	5454	89.74	5516	89.92	5552	90.02	6210	91.89

6246	91.99	6813	92.84	6846	93.7	6904	96.54	6908	94.6
6951	73.7	6997.2	66.88	7001.2	66.29	7004	65.88	7090.4	68.61
7094.4	68.72	7154	71.67	7182	77.76	7183.6	77.86	7187.6	78.12
7201	78.98	7232	90.66	7276.8	91.59	7280.8	91.67	7359	93.29
7370	95.83	7374	96.75	8100.1	97.17	8136.1	97.19	8414	97.35
8651	95.73	8674	90.86	8862.2	97.69	8898.2	97.74	9614	97.35
9624.3	96.91	9660.3	95.35	9774	90.45	9834	90.45	10334	94.11
10386.4	96.77	10422.4	98.15	11148.5	96.18	11184.5	96.08	11614	94.92
11910.6	95.17	11946.6	95.19	12594	95.73	12672.7	93.07	12708.7	91.85
12714	91.67	12750	91.67	12834	98.98	13434.8	98.1	13470.8	98.04
14196.9	96.97	14232.9	96.92	14762	96.14	14784	101.41	14798	101.01
14826	97.76	14959	113.29						

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.06	6813	.06	6846	.066	6951	.015	7201	.066
7374	.06								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	6904	7374		10		10		.2	.5
Blocked Obstructions	num=	2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	6904	95.64	8414	14959	97.35				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	105.42	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.02	Wt. n-Val.	0.060	0.043	0.060
W.S. Elev (ft)	105.40	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)		Flow Area (sq ft)	64711.16	12251.68	59175.57
E.G. Slope (ft/ft)	0.000057	Area (sq ft)	64711.16	12251.68	59175.57
Q Total (cfs)	125000.00	Flow (cfs)	53717.51	27513.54	43768.96
Top width (ft)	14891.39	Top width (ft)	6904.00	470.00	7517.40
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.83	2.25	0.74
Max chl Dpth (ft)	39.52	Hydr. Depth (ft)	9.37	26.07	7.87
Conv. Total (cfs)	16560250.0	Conv. (cfs)	7116604.0	3645050.0	5798600.0
Length wtd. (ft)	10.00	wetted Per. (ft)	6907.02	479.19	7518.61
Min ch El (ft)	65.88	Shear (lb/sq ft)	0.03	0.09	0.03
Alpha	1.90	Stream Power (lb/ft s)	14959.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	159100.30	99305.59	164113.60
C & E Loss (ft)	0.00	Cum SA (acres)	28226.60	4640.79	28392.08

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 151.24

INPUT

Description:	XS 151.24	NAVD 88							
Station Elevation Data	num=	82							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	103.64	34	93.7	74	93.29	90	95.73	658	96.08
694	96.1	1352	96.51	1388	96.53	2046	96.94	2082	96.96
2719	97.35	2740	96.33	2776	94.92	3434	95.14	3470	95.15
4128	95.37	4164	95.39	4822	95.61	4858	95.62	5194	95.73
5371	96.75	5454	89.74	5516	89.92	5552	90.02	6210	91.89
6246	91.99	6813	93.61	6846	93.7	6904	96.54	6908	94.6
6951	73.7	6997.2	66.88	7001.2	66.29	7004	65.88	7090.4	68.61
7094.4	68.72	7154	71.67	7182	77.76	7183.6	77.86	7187.6	78.12
7201	78.98	7232	90.66	7276.8	91.59	7280.8	91.67	7359	93.29
7370	95.83	7374	96.75	8100.1	97.17	8136.1	97.19	8414	97.35
8651	95.73	8674	90.86	8862.2	97.69	8898.2	97.74	9614	97.35
9624.3	96.91	9660.3	95.35	9774	90.45	9834	90.45	10334	94.11
10386.4	96.77	10422.4	98.15	11148.5	96.18	11184.5	96.08	11614	94.92
11910.6	95.17	11946.6	95.19	12594	95.73	12672.7	93.07	12708.7	91.85
12714	91.67	12750	91.67	12834	98.98	13434.8	98.1	13470.8	98.04
14196.9	96.97	14232.9	96.92	14762	96.14	14784	101.41	14798	101.01
14826	97.76	14959	113.29						

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.06	6813	.06	6846	.066	6951	.015	7201	.066
7374	.067								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	6904	7374		4970		4970		.1	.3
Blocked Obstructions	num=	2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	6904	95.64	8414	14959	97.35				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	105.42	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.03	Wt. n-Val.	0.060	0.043	0.067
W.S. Elev (ft)	105.39	Reach Len. (ft)	4970.00	4970.00	3770.00
Crit W.S. (ft)		Flow Area (sq ft)	64690.37	12250.26	59152.93
E.G. Slope (ft/ft)	0.000061	Area (sq ft)	64690.37	12250.26	59152.93
Q Total (cfs)	125000.00	Flow (cfs)	55754.72	28566.77	40678.50
Top width (ft)	14891.37	Top width (ft)	6904.00	470.00	7517.37
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.86	2.33	0.69

Max chl Dpth (ft)	39.51	Hydr. Depth (ft)	9.37	26.06	7.87
Conv. Total (cfs)	15946620.0	Conv. (cfs)	7112794.0	3644348.0	5189477.0
Length wtd. (ft)	4722.08	wetted Per. (ft)	6907.02	479.19	7518.58
Min ch El (ft)	65.88	Shear (lb/sq ft)	0.04	0.10	0.03
Alpha	2.05	Stream Power (lb/ft s)	14959.00	0.00	0.00
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)	159085.50	99302.77	164100.00
C & E Loss (ft)	0.00	Cum SA (acres)	28225.02	4640.69	28390.35

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 150.31

INPUT

Description:	XS 150.31	NAVD 88							
Station Elevation Data	num=	96							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	103.64	13	103.64	29	103.34	77	90.04	164	94.14
492	94.54	820	94.54	1998	94.34	2041	93.34	2070	84.44
2677	83.94	2720	96.44	2736	96.44	2739	94.14	2789	93.04
3025	93.34	3116	97.14	3182	93.94	3251	97.14	3281	96.54
3323	94.14	3444	93.94	6889	94.44	6934	94.44	6980	87.04
7218	83.84	7382	80.84	7474	80.84	7533	95.94	7546	94.74
7710	91.64	7874	93.34	8038	94.14	8366	93.64	8530	90.64
8694	91.54	8858	94.54	9186	95.24	9350	95.64	9413	96.14
9482	80.94	9678	81.34	9843	81.74	9885	87.54	9962	91.74
10006	90.24	10157	93.44	10334	90.94	10662	93.14	10826	94.14
11319	94.64	11483	95.94	11811	95.24	11975	95.64	12008	95.74
12058	95.74	12069	95.74	12074	96.94	12085	96.94	12091	96.04
12101	92.04	12236	86.94	12278	85.94	12295	81.54	12302	81.54
12319	75.54	12331	74.54	12336	71.47	12340	68.64	12350	65.04
12360	64.94	12380	65.14	12400	65.14	12410	64.64	12420	64.94
12430	65.64	12440	66.24	12460	65.64	12470	65.94	12490	66.64
12500	69.14	12510	71.47	12513	74.44	12533	94.24	12575	94.54
12600	95.54	12831	94.34	13192	94.34	13241	98.34	13363	101.34
13446	99.14	14748	97.34	14774	97.34	14800	98.44	17155	97.54
17215	103.14								

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.09	12058	.09	12091	.066	12331	.015	12513	.066
12575	.102								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	12085	12533		6090		6025		.1	.3
Blocked Obstructions	num=	2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	12085	96.94	13363	17215	101.34				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	105.01	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.05	Wt. n-Val.	0.090	0.049	0.100
W.S. Elev (ft)	104.96	Reach Len. (ft)	6090.00	6025.00	6090.00
Crit W.S. (ft)		Flow Area (sq ft)	96618.76	11793.44	21800.83
E.G. Slope (ft/ft)	0.000146	Area (sq ft)	96618.76	11793.44	21800.83
Q Total (cfs)	125000.00	Flow (cfs)	77002.48	37024.89	10972.63
Top width (ft)	17215.00	Top width (ft)	12085.00	448.00	4682.00
Vel Total (ft/s)	0.96	Avg. Vel. (ft/s)	0.80	3.14	0.50
Max chl Dpth (ft)	40.32	Hydr. Depth (ft)	7.99	26.32	4.66
Conv. Total (cfs)	10352450.0	Conv. (cfs)	6377313.0	3066386.0	908748.8
Length wtd. (ft)	6069.41	wetted Per. (ft)	12087.21	463.00	4684.13
Min ch El (ft)	64.64	Shear (lb/sq ft)	0.07	0.23	0.04
Alpha	3.62	Stream Power (lb/ft s)	17215.00	0.00	0.00
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	149883.10	97931.13	160596.90
C & E Loss (ft)	0.00	Cum SA (acres)	27141.74	4588.32	27862.44

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 147.68

INPUT

Description:	XS 147.68	"y" NAVD 88					
Station Elevation Data	num=	84					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	103.44	10	102.84	43	93.14	65	89.94
391	94.44	428	95.44	544	94.54	1545	93.74
2351	84.64	2519	83.84	2832	87.24	2852	89.34
2887	91.04	5511	92.84	5624	95.04	5995	92.54
7974	95.54	8001	87.54	8017	86.34	8019	83.64
8040	68.84	8042	66.84	8052	62.44	8062	60.04

8082	62.04	8092	62.84	8102	63.84	8112	64.14	8122	65.04
8132	66.04	8142	65.34	8152	66.04	8162	66.54	8172	66.84
8182	67.04	8191	68.84	8194	69.94	8219	73.64	8247	77.14
8258	76.24	8277	79.24	8302	78.94	8311	76.64	8338	87.54
8370	84.84	8392	87.54	8438	78.54	8493	89.74	8504	90.14
8569	91.74	8586	89.64	8755	93.04	8773	89.64	9147	87.04
9196	89.14	9256	89.74	9283	86.64	9372	88.84	9458	81.94
9500	86.24	9519	82.24	9539	87.04	9829	86.94	10219	85.64
10245	96.14	10262	93.04	10357	95.64	10389	96.34	10760	93.44
10941	95.84	11174	96.84	11185	98.14	11237	95.74	13665	95.64
15456	93.54	15474	91.14	15527	111.64	15542	110.74		

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.105	7940	.105	7974	.066	8040	.015	8191	.066
8755	.095								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	7974	8755		14210	14125		.1	.3
Blocked Obstructions	num=	4						
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	7974	95.54	8755	10245	93.04	10389	11185	96.34
11185	15527	98.14						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	104.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.105	0.058	0.095
W.S. Elev (ft)	104.10	Reach Len. (ft)	14210.00	14125.00	14210.00
Crit W.S. (ft)		Flow Area (sq ft)	68060.96	17615.04	49642.04
E.G. Slope (ft/ft)	0.000142	Area (sq ft)	68060.96	17615.04	49642.04
Q Total (cfs)	125000.00	Flow (cfs)	47882.91	42175.29	34941.80
Top width (ft)	15507.50	Top width (ft)	7974.00	781.00	6752.50
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.70	2.39	0.70
Max Chl Dpth (ft)	44.06	Hydr. Depth (ft)	8.54	22.55	7.35
Conv. Total (cfs)	10499900.0	Conv. (cfs)	4022128.0	3542692.0	2935085.0
Length wtd. (ft)	14183.28	Wetted Per. (ft)	7975.73	796.70	6754.61
Min Ch El (ft)	60.04	Shear (lb/sq ft)	0.08	0.20	0.07
Alpha	2.65	Stream Power (lb/ft s)	15542.00	0.00	0.00
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)	138371.40	95897.31	155602.80
C & E Loss (ft)	0.00	Cum SA (acres)	25739.54	4503.32	27063.13

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 145

INPUT	Description:	XS 145	NAVD 88						
Station Elevation Data	num=	63							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	101.74	7	101.34	27	95.84	60	89.44	80	90.54
100	94.84	115	94.14	1200	94.14	1221	91.84	3387	92.24
3421	92.44	3443	95.44	3461	92.44	3526	90.44	6025	90.34
6039	89.84	6055	87.94	6135	86.74	6507	88.44	6723	84.54
6756	83.94	6791	82.64	6820	86.74	6852	78.34	6897	79.64
6926	74.74	6953	74.24	6966	72.12	6972	71.14	6987	72.14
7003	71.44	7014	68.87	7025	66.54	7035	64.84	7045	64.34
7065	63.54	7085	62.54	7105	61.44	7125	60.84	7145	61.34
7155	64.14	7165	68.87	7169	71.8	7195	90.84	7223	90.24
7304	92.24	8747	91.24	9194	91.24	9324	91.24	9404	91.14
9604	92.24	9754	92.24	11248	92.24	11347	93.24	11380	94.64
12020	90.74	12508	93.24	13135	92.44	13465	88.64	14033	88.64
14068	91.14	14102	99.44	14110	99.74				

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.119	6723	.119	6756	.066	6966	.015	7169	.066
7223	.088								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	6820	7195		2650	2550		.1	.3
Blocked Obstructions	num=	2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	3443	95.44	7304	14110	92.24			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	102.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.117	0.088	0.088
W.S. Elev (ft)	102.45	Reach Len. (ft)	2650.00	2550.00	1800.00
Crit W.S. (ft)		Flow Area (sq ft)	67419.39	11603.20	69535.02
E.G. Slope (ft/ft)	0.000088	Area (sq ft)	67419.39	11603.20	69535.02
Q Total (cfs)	125000.00	Flow (cfs)	37280.63	36416.96	51302.41
Top width (ft)	14110.00	Top width (ft)	6820.00	375.00	6915.00
Vel Total (ft/s)	0.84	Avg. Vel. (ft/s)	0.55	3.14	0.74
Max Chl Dpth (ft)	41.61	Hydr. Depth (ft)	9.89	30.94	10.06

Conv. Total (cfs)	13348090.0	Conv. (cfs)	3981003.0	3888777.0	5478315.0
Length wtd. (ft)	2200.29	Wetted Per. (ft)	6822.27	385.99	6918.66
Min Ch El (ft)	60.84	Shear (lb/sq ft)	0.05	0.16	0.06
Alpha	4.50	Stream Power (lb/ft s)	14110.00	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	116273.50	91160.08	136164.00
C & E Loss (ft)	0.00	Cum SA (acres)	23326.52	4315.90	24833.85

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 144.55

INPUT	Description:	XS 144.55	NAVD 88						
Station Elevation Data	num=	51							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	101.64	50	89.64	100	90.14	500	90.94	1000	90.94
6150	90.94	6209	90.68	6242	90.54	6325	92.64	6344	72.19
6348	67.88	6350	66.54	6360	65.34	6370	62.14	6380	58.64
6390	59.64	6400	60.64	6410	60.64	6420	61.64	6430	62.64
6440	62.84	6450	62.84	6460	63.64	6470	64.64	6480	64.64
6490	64.84	6500	67.88	6507	71.59	6519	77.94	6564	76.44
6586	80.54	6607	80.54	6637	87.44	6647	88.94	6650	88.94
6660	88.94	6981	88.44	7008	90.14	7126	95.64	8502	88.64
9609	92.64	10979	87.64	11161	90.44	11197	94.34	11358	94.44
11400	91.74	12190	92.54	14104	86.14	14196	87.64	14228	99.54
14238	99.54								

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.172	6209	.172	6242	.066	6344	.015	6507	.066
6647	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	6325	6647		11550	12000		.1	.3
Blocked Obstructions	num=	2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	6325	92.64	11358	14238	94.44			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	102.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.168	0.045	0.067
W.S. Elev (ft)	102.27	Reach Len. (ft)	11550.00	12000.00	8000.00
Crit W.S. (ft)		Flow Area (sq ft)	60718.35	9851.05	75890.62
E.G. Slope (ft/ft)	0.000088	Area (sq ft)	60718.35	9851.05	75890.62
Q Total (cfs)	125000.00	Flow (cfs)	22698.51	29037.19	73264.30
Top width (ft)	14238.00	Top width (ft)	6325.00	322.00	7591.00
Vel Total (ft/s)	0.85	Avg. Vel. (ft/s)	0.37	2.95	0.97
Max Chl Dpth (ft)	43.63	Hydr. Depth (ft)	9.60	30.59	10.00
Conv. Total (cfs)	13321790.0	Conv. (cfs)	2419079.0	3094620.0	7808095.0
Length wtd. (ft)	10377.93	Wetted Per. (ft)	6326.69	338.90	7595.09
Min Ch El (ft)	58.64	Shear (lb/sq ft)	0.05	0.16	0.05
Alpha	3.56	Stream Power (lb/ft s)	14238.00	0.00	0.00
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	112375.80	90532.11	133159.30
C & E Loss (ft)	0.01	Cum SA (acres)	22926.68	4295.49	24534.13

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 142.5

INPUT	Description:	XS 142.5	NAVD 88						
Station Elevation Data	num=	47							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	100.64	50	89.64	100	90.14	500	91.04	1000	91.04
11400	91.04	11575	90.24	11612	88.84	11648	91.24	11757	83.34
11824	87.64	12034	88.04	12058	82.54	12090	82.24	12103	79.14
12140	75.34	12160	76.24	12173	70.56	12182	66.63	12185	66.04
12195	62.64	12205	60.64	12215	60.14	12225	59.64	12245	58.94
12265	57.84	12285	56.94	12305	60.14	12315	61.54	12325	65.64
12332	66.63	12347	70.69	12352	72.04	12370	91.04	12375	91.04
12405	89.64	12675	87.74	12855	90.64	13340	90.24	13583	91.24
13591	93.94	13602	91.84	13613	93.94	13620	91.24	13650	92.64
13885	99.04	13900	99.14						

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.119	6723	.119	6756	.066	6966	.015	7169	.066
7223	.088								

0 .192 11612 .192 11648 .066 12173 .015 12347 .066
12375 .074

Bank Sta: Left Right Lengths: Left Channel Right
1234 12370 10600 10800 10650
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 11648 91.24 12855 13900 90.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	101.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	wt. n-Val.	0.174	0.044	0.074
W.S. Elev (ft)	100.97	Reach Len. (ft)	10600.00	10800.00	10650.00
Crit W.S. (ft)		Flow Area (sq ft)	118440.50	10333.36	15091.79
E.G. Slope (ft/ft)	0.000178	Area (sq ft)	118440.50	10333.36	15091.79
Q Total (cfs)	125000.00	Flow (cfs)	62222.22	44216.36	18561.42
Top width (ft)	13900.00	Top width (ft)	12034.00	336.00	1530.00
Vel Total (ft/s)	0.87	Avg. Vel. (ft/s)	0.53	4.28	1.23
Max Chl Dpth (ft)	44.03	Hydr. Depth (ft)	9.84	30.75	9.86
Conv. Total (cfs)	9376524.0	Conv. (cfs)	4667425.0	3316767.0	1392333.0
Length wtd. (ft)	10678.77	Wetted Per. (ft)	12035.78	350.11	1533.36
Min Ch El (ft)	56.94	Shear (lb/sq ft)	0.11	0.33	0.11
Alpha	9.06	Stream Power (lb/ft s)	13900.00	0.00	0.00
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	88623.66	87751.89	124804.60
C & E Loss (ft)	0.02	Cum SA (acres)	20492.72	4204.86	23696.58

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 140.74

INPUT
Description: XS 140.74 NAVD 88
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	99.84	8	99.34	70	92.64	115	92.64
143	92.64	162	92.54	200	92.54	2824	85.33
2923	87.94	2946	69.87	2951	65.94	2958	65.39
2975	58.44	2995	57.74	3015	58.14	3035	58.24
3075	59.44	3095	60.04	3105	62.94	3109	65.39
3115	70.11	3123	74.64	3156	80.14	3177	79.24
3362	87.74	4960	85.64	6518	87.34	6538	89.84
6569	89.84	6592	88.34	6707	88.94	8632	91.24
11275	91.74	13595	89.44	13755	90.84	13773	96.64

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.183	2824	.183	2857	.066	2946	.015
3362	.068					3115	.066

Bank Sta: Left Right Lengths: Left Channel Right
2923 3190 6000 5900 6000
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 2923 87.94 3362 13788 87.74

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	99.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	wt. n-Val.	0.174	0.039	0.068
W.S. Elev (ft)	99.71	Reach Len. (ft)	6000.00	5900.00	6000.00
Crit W.S. (ft)		Flow Area (sq ft)	29341.11	8783.80	105208.40
E.G. Slope (ft/ft)	0.000068	Area (sq ft)	29341.11	8783.80	105208.40
Q Total (cfs)	125000.00	Flow (cfs)	9619.39	27680.68	87699.73
Top width (ft)	13785.84	Top width (ft)	2920.85	267.00	10598.00
Vel Total (ft/s)	0.87	Avg. Vel. (ft/s)	0.33	3.15	0.83
Max Chl Dpth (ft)	41.97	Hydr. Depth (ft)	10.05	32.90	9.93
Conv. Total (cfs)	15171110.0	Conv. (cfs)	1167519.0	3359574.0	10644020.0
Length wtd. (ft)	5967.40	Wetted Per. (ft)	2921.22	281.21	10600.96
Min Ch El (ft)	57.74	Shear (lb/sq ft)	0.04	0.13	0.04
Alpha	3.54	Stream Power (lb/ft s)	13788.00	0.00	0.00
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	70642.88	85381.99	110098.50
C & E Loss (ft)	0.02	Cum SA (acres)	18673.14	4130.11	22213.99

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 139.85

INPUT
Description: XS 139.85 NAVD 88
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	98.54	6	98.14	75	86.64	250	85.64	1360	85.64
1870	78.84	2420	78.64	3520	85.64	4070	85.64	4502	84.64
4885	85.14	4890	85.14	4946	94.14	5029	79.94	5156	79.14
5245	84.64	5259	85.81	5287	82.84	5325	83.54	5342	78.24
5365	69.84	5373	69.54	5386	71.94	5390	69.5	5396	65.84
5400	64.84	5410	61.04	5420	60.34	5440	59.64	5460	59.74
5480	60.14	5500	59.84	5520	61.34	5540	61.04	5560	60.34
5580	60.84	5590	61.54	5600	65.84	5605	69.45	5632	88.94
7046	86.64	7133	90.64	9035	86.74	9063	86.94	11406	84.34
11522	88.74	11826	90.44	11851	97.24	11871	97.54		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.157	5287	.157	5325	.066	5390	.015
5632	.074					5605	.066

Bank Sta: Left Right Lengths: Left Channel Right
5325 5632 4300 4300 4400
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 4946 94.14 7133 11871 90.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	99.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	wt. n-Val.	0.157	0.035	0.074
W.S. Elev (ft)	98.98	Reach Len. (ft)	4300.00	4300.00	4400.00
Crit W.S. (ft)		Flow Area (sq ft)	30045.57	10266.21	56017.73
E.G. Slope (ft/ft)	0.000152	Area (sq ft)	30045.57	10266.21	56017.73
Q Total (cfs)	125000.00	Flow (cfs)	11241.98	53817.10	59940.93
Top width (ft)	11871.00	Top width (ft)	5325.00	307.00	6239.00
Vel Total (ft/s)	1.30	Avg. Vel. (ft/s)	0.37	5.24	1.07
Max Chl Dpth (ft)	39.34	Hydr. Depth (ft)	5.64	3.4	8.98
Conv. Total (cfs)	10130640.0	Conv. (cfs)	911108.1	4361615.0	4857922.0
Length wtd. (ft)	4357.04	Wetted Per. (ft)	5327.38	320.55	6241.42
Min Ch El (ft)	59.64	Shear (lb/sq ft)	0.05	0.30	0.09
Alpha	7.36	Stream Power (lb/ft s)	11871.00	0.00	0.00
Frctn Loss (ft)	0.59	Cum Volume (acre-ft)	66552.88	84091.88	98994.80
C & E Loss (ft)	0.04	Cum SA (acres)	18105.25	4091.24	21054.42

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 139.01

INPUT
Description: XS 139.01 NAVD 88
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	97.94	11	97.44	21	97.44	46	88.84	141	88.54
893	86.94	1377	85.94	1970	85.94	2510	85.84	2657	84.24
2690	92.84	2732	92.99	2745	93.04	2765	85.34	2783	84.04
2826	81.54	2848	74.14	2858	74.64	2873	69.84	2880	65.44
2890	61.14	2900	59.74	2910	59.44	2930	59.44	2950	59.44
2970	59.84	2990	59.84	3010	60.14	3030	59.94	3050	60.14
3060	65.44	3068	69	3100	83.24	3108	81.44	3163	80.34
3193	88.54	3207	88.84	3215	85.84	3215	86.34	4755	85.74
6371	88.14	6803	86.64	7313	88.34	9249	86.34	10350	81.44
10378	95.84	10391	96.24						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.094	2732	.094	2765	.066	2873	.015
3163	.06					3068	.066

Bank Sta: Left Right Lengths: Left Channel Right
2745 3100 6800 6900 6550
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 2745 93.04 3207 10391 89.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	98.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	wt. n-Val.	0.045	0.060	0.060
W.S. Elev (ft)	98.48	Reach Len. (ft)	6800.00	6900.00	6550.00
Crit W.S. (ft)		Flow Area (sq ft)	14806.98	10275.12	68613.35
E.G. Slope (ft/ft)	0.000119	Area (sq ft)	14806.98	10275.12	68613.35
Q Total (cfs)	125000.00	Flow (cfs)	7848.88	34505.56	82645.55
Top width (ft)	10391.00	Top width (ft)	2745.00	355.00	7291.00
Vel Total (ft/s)	1.33	Avg. Vel. (ft/s)	0.53	3.36	1.20
Max Chl Dpth (ft)	39.04	Hydr. Depth (ft)	5.39	28.94	9.41

Conv. Total (cfs) 11461730.0 Conv. (cfs) 719693.9 3163948.0 7578092.0
Length wtd. (ft) 6668.06 Wetted Per. (ft) 2746.29 365.89 7296.48
Min Ch El (ft) 59.44 Shear (lb/sq ft) 0.04 0.21 0.07
Alpha 2.30 Stream Power (lb/ft s) 10391.00 0.00 0.00
Frctn Loss (ft) 0.81 Cum Volume (acre-ft) 64339.09 83078.02 92700.30
C & E Loss (ft) 0.00 Cum SA (acres) 17706.94 4058.56 20371.08

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 137.71

INPUT
Description: XS 137.71 NAVD 88
Station Elevation Data num= 51
Sta Elev Sta Elev Sta Elev Sta Elev
0 97.94 4 97.34 39 87.74 56 85.54 235 85.54
2019 86.74 2024 91.14 2030 87.74 2038 92.24 2076 91.74
2086 85.74 3277 85.64 3960 82.74 3979 91.14 4002 90.84
4020 81.84 4046 77.44 4068 76.94 4082 78.44 4131 70.04
4155 69.74 4170 72.44 4176 68.56 4182 64.68 4189 62.64
4199 60.64 4209 60.64 4229 59.94 4249 59.64 4269 59.64
4289 58.64 4309 56.64 4329 56.64 4339 63.44 4354 64.68
4358 68.33 4377 85.64 4405 85.44 5086 86.44 5204 86.94
5704 85.64 6204 84.84 7504 82.84 9215 85.54 9250 84.54
9335 76.54 9553 76.54 9723 85.24 10148 83.94 10176 95.04
10190 95.24

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .102 4002 .102 4046 .066 4176 .015 4358 .066
4405 .067

Bank Sta: Left Right Lengths: Left Channel Right
4002 4377 14900 14900 15100
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 4002 90.84 5204 10190 86.94

CROSS SECTION OUTPUT Profile #PF 1
E.G. Elev (ft) 97.73 Element Left OB Channel Right OB
Vel Head (ft) 0.05 Wt. n-Val. 0.102 0.051 0.067
W.S. Elev (ft) 97.68 Reach Len. (ft) 14900.00 14900.00 15100.00
Crit W.S. (ft) Flow Area (sq ft) 27202.99 10992.38 62959.32
E.G. Slope (ft/ft) 0.000125 Area (sq ft) 27202.99 10992.38 62959.32
Q Total (cfs) 125000.00 Flow (cfs) 15868.10 32884.20 76247.70
Top Width (ft) 10188.24 Top Width (ft) 4000.24 375.00 5813.00
Vel Total (ft/s) 1.24 Avg. Vel. (ft/s) 0.58 2.99 1.21
Max Chl Dpth (ft) 41.04 Hydr. Depth (ft) 6.80 29.31 10.83
Conv. Total (cfs) 11201950.0 Conv. (cfs) 1422029.0 2946937.0 6832982.0
Length wtd. (ft) 15021.81 Wetted Per. (ft) 4001.95 391.72 5816.99
Min Ch El (ft) 56.64 Shear (lb/sq ft) 0.05 0.22 0.08
Alpha 7.26 Stream Power (lb/ft s) 10190.00 0.00 0.00
Frctn Loss (ft) 1.79 Cum Volume (acre-ft) 61060.07 81393.61 82808.18
C & E Loss (ft) 0.00 Cum SA (acres) 17180.45 4000.74 19385.88

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 135

INPUT
Description: XS 135 NAVD 88
Station Elevation Data num= 65
Sta Elev Sta Elev Sta Elev Sta Elev
0 97.64 14 95.84 40 85.84 70 84.64 100 77.14
250 76.34 292 88.24 310 87.74 358 75.84 446 77.54
485 79.94 813 78.24 849 78.07 858 75.24 877 73.54
896 67.84 913 67.34 930 68.14 933 66.78 941 63.14
948 59.74 958 59.14 968 59.24 978 59.64 988 59.64
998 59.34 1008 58.74 1018 58.64 1028 59.14 1038 59.14
1048 58.64 1058 58.84 1068 58.44 1078 58.34 1088 57.94
1098 58.14 1108 58.44 1118 60.14 1128 63.18 1134 67.03
1151 77.94 1171 79.04 1192 84.34 1291 83.94 1317 88.04
1362 86.74 2435 83.84 2468 84.31 2522 84.24 4498 83.84
6104 86.64 7216 82.84 7236 82.64 7833 82.84 7865 87.84
7921 87.34 7954 84.84 8084 86.84 8256 88.24 9313 86.64
9762 85.94 10133 85.44 10200 83.94 10246 93.64 10254 93.64

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .102 4002 .102 4046 .066 4176 .015 4358 .066
4405 .067

0 .101 813 .101 846 .066 933 .015 1134 .066
1317 .074

Bank Sta: Left Right Lengths: Left Channel Right
846 1192 11900 12000 12800
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 292 88.24 1362 10254 86.74

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft) 95.94 Element Left OB Channel Right OB
Vel Head (ft) 0.08 Wt. n-Val. 0.101 0.041 0.074
W.S. Elev (ft) 95.86 Reach Len. (ft) 11900.00 12000.00 12800.00
Crit W.S. (ft) Flow Area (sq ft) 11302.19 10500.88 81816.52
E.G. Slope (ft/ft) 0.000113 Area (sq ft) 11302.19 10500.88 81816.52
Q Total (cfs) 125000.00 Flow (cfs) 10070.40 38919.59 76010.02
Top Width (ft) 10240.18 Top Width (ft) 832.18 346.00 9062.00
Vel Total (ft/s) 1.21 Avg. Vel. (ft/s) 0.89 3.71 0.93
Max Chl Dpth (ft) 37.92 Hydr. Depth (ft) 13.58 30.35 9.03
Conv. Total (cfs) 11745780.0 Conv. (cfs) 946277.6 3657128.0 7142377.0
Length wtd. (ft) 12292.61 Wetted Per. (ft) 835.15 354.85 9065.40
Min Ch El (ft) 57.94 Shear (lb/sq ft) 0.10 0.21 0.06
Alpha 3.34 Stream Power (lb/ft s) 10254.00 0.00 0.00
Frctn Loss (ft) 1.73 Cum Volume (acre-ft) 54474.59 77717.65 57715.03
C & E Loss (ft) 0.02 Cum SA (acres) 16353.97 3877.43 16807.68

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 132.75

INPUT
Description: XS 132.75 NAVD 88
Station Elevation Data num= 44
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 95.34 16 93.24 39 84.44 60 84.14 81 75.64
105 75.44 2134 78.74 2157 84.64 3074 83.44 3108 79.64
4657 80.74 4680 85.04 5714 82.44 6595 82.21 6609 82.21
6624 82.54 6628 79.34 6771 81.34 6795 66.44 6808 61.49
6812 60.04 6822 55.84 6832 54.54 6842 53.94 6852 53.54
6862 54.04 6872 54.14 6882 54.24 6892 54.54 6902 55.04
6912 54.44 6922 54.14 6932 54.54 6942 54.54 6952 54.84
6962 55.64 6967 61.58 6974 65.83 7001 82.24 7137 82.42
7153 84.24 8552 81.04 8688 82.04 8698 91.84

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .118 6595 .118 6628 .066 6795 .015 6974 .066
7137 .067

Bank Sta: Left Right Lengths: Left Channel Right
6771 7001 7625 7650 7565
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 4680 85.04 7153 8698 84.24

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft) 94.19 Element Left OB Channel Right OB
Vel Head (ft) 0.28 Wt. n-Val. 0.115 0.031 0.067
W.S. Elev (ft) 93.91 Reach Len. (ft) 7625.00 7650.00 7565.00
Crit W.S. (ft) Flow Area (sq ft) 64367.11 7812.50 16662.93
E.G. Slope (ft/ft) 0.000185 Area (sq ft) 64367.11 7812.50 16662.93
Q Total (cfs) 125000.00 Flow (cfs) 51129.53 50788.88 23081.58
Top Width (ft) 8687.14 Top Width (ft) 6760.14 230.00 1697.00
Vel Total (ft/s) .41 Avg. Vel. (ft/s) 0.79 6.50 1.39
Max Chl Dpth (ft) 40.37 Hydr. Depth (ft) 9.32 33.97 9.82
Conv. Total (cfs) 9187199.0 Conv. (cfs) 3757898.0 3732861.0 1696441.0
Length wtd. (ft) 7613.96 Wetted Per. (ft) 6762.84 245.02 1702.28
Min Ch El (ft) 53.54 Shear (lb/sq ft) 0.11 0.37 0.11
Alpha 8.98 Stream Power (lb/ft s) 8698.00 0.00 0.00
Frctn Loss (ft) 1.50 Cum Volume (acre-ft) 44138.68 75195.15 43246.06
C & E Loss (ft) 0.04 Cum SA (acres) 15316.91 3798.09 15226.92

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 131.35

INPUT Description: XS 131.35 NAVD 88									
Station Elevation Data num= 77									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	94.54	13	92.94	40	82.94	88	78.94	93	74.54
262	74.54	264	75.44	637	78.34	1586	77.64	1618	82.84
2019	84.14	2023	81.44	2267	81.45	2280	81.14	2288	78.34
2325	80.11	2334	80.54	2358	78.14	2394	65.44	2427	66.64
2429	65.49	2435	62.02	2443	58.54	2453	58.34	2463	57.84
2473	57.54	2483	57.84	2493	57.84	2503	57.44	2513	57.04
2523	56.84	2533	56.84	2543	56.54	2553	56.04	2563	55.84
2573	55.54	2583	55.74	2593	55.44	2603	55.24	2613	56.74
2620	61.98	2623	65.01	2639	81.14	2651	81.04	2673	80.04
2918	79.24	2939	84.94	2944	83.14	2950	85.14	2956	83.04
2977	82.64	4131	77.74	4147	81.94	5894	81.74	5900	81.64
5919	83.14	5929	82.34	6000	82.34	6100	82.74	6146	83.34
6153	83.94	6189	74.84	6200	74.44	6213	74.04	6300	74.04
6400	74.64	6500	75.14	6554	75.44	6594	83.94	6614	82.94
7904	81.44	7914	84.64	7934	84.64	8542	83.64	8586	84.64
8613	92.64	8621	92.64						

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.099	2325	.099	2358	.066	2429	.015	2623	.066
2673	.088								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
0	2334	2639		4500	4350		.1	.3

Blocked Obstructions num= 2									
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	2019	84.14	2956	8621	83.04				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	92.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	wt. n-Val.	0.099	0.042	0.088
W.S. Elev (ft)	92.51	Reach Len. (ft)	4500.00	4350.00	4375.00
Crit W.S. (ft)		Flow Area (sq ft)	20267.57	9118.90	56547.35
E.G. Slope (ft/ft)	0.000212	Area (sq ft)	20267.57	9118.90	56547.35
Q Total (cfs)	125000.00	Flow (cfs)	18773.21	43876.78	62350.02
Top width (ft)	8598.38	Top width (ft)	2319.83	305.00	5973.55
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	0.93	4.81	1.10
Max chl Dpth (ft)	37.27	Hydr. depth (ft)	8.74	29.90	9.47
Conv. Total (cfs)	8587774.0	Conv. (cfs)	1289761.0	3014431.0	4283583.0
Length wtd. (ft)	4384.88	wetted Per. (ft)	2322.69	319.19	5977.00
Min ch El (ft)	55.24	Shear (lb/sq ft)	0.12	0.13	0.13
Alpha	4.19	Stream Power (lb/ft s)	8621.00	0.00	0.00
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	36731.20	73708.41	36888.90
C & E Loss (ft)	0.02	Cum SA (acres)	14522.20	3751.12	14560.86

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 130.51

INPUT Description: XS 130.51 NAVD 88									
Station Elevation Data num= 52									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	92.04	12	92.04	40	92.04	1119	92.04	1266	92.04
1267	80.24	3028	81.04	3042	83.44	3055	83.44	3067	81.24
3275	80.75	3297	80.7	3308	81.64	3320	74.54	3327	73.84
3332	66.34	3336	64.82	3345	61.39	3349	59.74	3359	56.24
3369	55.74	3379	55.44	3389	55.24	3399	55.14	3409	55.64
3419	55.74	3429	56.04	3439	56.14	3449	56.24	3459	56.94
3469	56.74	3479	56.74	3489	56.84	3499	57.14	3509	57.44
3519	58.24	3529	58.74	3539	61.38	3541	63.54	3553	64.86
3571	66.84	3615	76.74	3685	75.84	3724	76.53	4238	78.75
4400	76.74	4831	77.24	5281	74.54	5376	84.24	5681	82.44
5682	92.74	7505	92.74						

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.074	3275	.074	3308	.066	3336	.015	3553	.066
3615	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
0	3308	3615		500	2400		.1	.3

Blocked Obstructions num= 2									
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	3055	83.44	4238	7505	78.75				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	91.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	wt. n-Val.	0.074	0.035	0.067
W.S. Elev (ft)	91.33	Reach Len. (ft)	500.00	2400.00	2400.00

Crit W.S. (ft)		Flow Area (sq ft)	16715.33	9149.84	25289.97
E.G. Slope (ft/ft)	0.000244	Area (sq ft)	16715.33	9149.84	25289.97
Q Total (cfs)	125000.00	Flow (cfs)	21242.27	57396.52	46361.21
Top width (ft)	4415.80	Top width (ft)	2041.94	307.00	2066.86
Vel Total (ft/s)	2.44	Avg. Vel. (ft/s)	1.27	1.27	1.83
Max chl Dpth (ft)	36.19	Hydr. depth (ft)	8.19	29.80	12.24
Conv. Total (cfs)	8008376.0	Conv. (cfs)	1360929.0	3677223.0	2970224.0
Length wtd. (ft)	2058.63	wetted Per. (ft)	2049.43	317.51	2075.24
Min ch El (ft)	55.14	Shear (lb/sq ft)	0.12	0.44	0.19
Alpha	3.28	Stream Power (lb/ft s)	7505.00	0.00	0.00
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	34820.93	72799.23	32779.18
C & E Loss (ft)	0.09	Cum SA (acres)	14296.90	3720.56	14157.08

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.3

INPUT Description: XS 129.3 NAVD 88									
Station Elevation Data num= 43									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
975	91.64	1000	80.24	3028	81.04	3042	83.44	3055	83.44
3067	81.24	3275	80.75	3297	80.7	3308	81.64	3320	74.54
3327	73.84	3332	66.34	3336	64.82	3345	61.39	3349	59.74
3359	56.24	3369	55.74	3379	55.44	3389	55.24	3399	55.14
3409	55.64	3419	55.74	3429	56.04	3439	56.14	3449	56.24
3459	56.94	3469	56.74	3479	56.74	3489	56.84	3499	57.14
3509	57.44	3519	58.24	3529	58.74	3539	61.38	3541	63.54
3553	64.86	3571	66.84	3615	76.74	3685	75.84	3724	76.53
3734	80.64	5124	80.64	5146	91.64				

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
975	.068	3275	.068	3308	.066	3336	.025	3553	.066
3615	.06								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
0	3308	3615		2000	2100		.1	.3

Blocked Obstructions num= 2									
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
975	3055	83.44	4238	5146	78.75				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	91.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	wt. n-Val.	0.068	0.040	0.060
W.S. Elev (ft)	91.28	Reach Len. (ft)	2000.00	2100.00	2600.00
Crit W.S. (ft)		Flow Area (sq ft)	18818.62	9133.74	16664.51
E.G. Slope (ft/ft)	0.000008	Area (sq ft)	18818.62	9133.74	16664.51
Q Total (cfs)	20000.00	Flow (cfs)	4809.97	9303.82	5886.21
Top width (ft)	4169.48	Top width (ft)	2332.21	307.00	1530.28
Vel Total (ft/s)	0.45	Avg. Vel. (ft/s)	0.26	1.02	0.35
Max chl Dpth (ft)	36.14	Hydr. depth (ft)	8.07	29.75	10.89
Conv. Total (cfs)	6879370.0	Conv. (cfs)	1654478.0	3200220.0	2024672.0
Length wtd. (ft)	2161.56	wetted Per. (ft)	2334.15	317.51	1533.61
Min ch El (ft)	55.14	Shear (lb/sq ft)	0.00	0.02	0.01
Alpha	2.66	Stream Power (lb/ft s)	5146.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	34616.99	72292.55	31623.41
C & E Loss (ft)	0.01	Cum SA (acres)	14271.80	3703.64	14057.99

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.23

INPUT Description: XS 129.23 NAVD 88									
Station Elevation Data num= 39									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	12	91.64	40	91.64	71	91.64	1120	91.64
3275	91.64	3307	91.64	3308	81.64	3320	74.54	3327	73.84
3332	66.34	3336	64.82	3345	61.39	3349	59.74	3359	56.24
3369	55.74	3379	55.44	3389	55.24	3399	55.14	3409	55.64
3419	55.74	3429	56.04	3439	56.14	3449	56.24	3459	56.94
3469	56.74	3479	56.74	3489	56.84	3499	57.14	3509	57.44
3519	58.24	3529	58.74	3539	61.38	3541	63.54	3553	64.86
3571	66.84	3615	76.74	3616	91.64	7505	91.64		

Manning's n Values										num=	6
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.144	3275	.144	3308	.066	3336	.025	3553	.066		
3615	.06										

Bank Sta: Left 3308 Right 3615 Lengths: Left 70 Channel 70 Right 70 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	91.25	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.07	wt. n-Val.	0.144	0.040	0.060
W.S. Elev (ft)	91.17	Reach Len. (ft)	70.00	70.00	70.00
Crit W.S. (ft)		Flow Area (sq ft)	4.55	9101.98	6.99
E.G. Slope (ft/ft)	0.000040	Area (sq ft)	4.55	9101.98	6.99
Q Total (cfs)	20000.00	Flow (cfs)	0.18	19999.15	0.67
Top width (ft)	308.92	Top width (ft)	0.95	307.00	0.97
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)	0.04	2.20	0.10
Max Chl Dpth (ft)	36.03	Hydr. depth (ft)	4.77	29.65	7.22
Conv. Total (cfs)	3181830.0	Conv. (cfs)	28.5	3181695.0	106.6
Length wtd. (ft)	70.00	wetted Per. (ft)	9.58	317.51	14.47
Min Ch El (ft)	55.14	Shear (lb/sq ft)	0.00	0.07	0.00
Alpha	1.00	Stream Power (lb/ft s)	7505.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	34184.87	71852.98	31125.87
C & E Loss (ft)	0.00	Cum SA (acres)	14218.24	3688.84	14012.29

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.22

INPUT									
Description: XS 129.22 NAVD 88									
Station Elevation Data num= 39									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	12	91.64	40	91.64	71	91.64	1120	91.64
3275	91.64	3307	91.64	3308	81.64	3320	74.54	3327	73.84
3332	66.34	3336	64.82	3345	61.39	3349	59.74	3359	56.24
3369	55.74	3379	55.44	3389	55.24	3399	55.14	3409	55.64
3419	55.74	3429	56.04	3439	56.14	3449	56.24	3459	56.94
3469	56.74	3479	56.74	3489	56.84	3499	57.14	3509	57.44
3519	58.24	3529	58.74	3539	61.38	3541	63.54	3553	64.86
3571	66.84	3615	76.74	3616	91.64	7505	91.64		
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.144	3275	.144	3308	.066	3336	.025	3553	.066
3615	.06								

Bank Sta: Left 3308 Right 3615 Lengths: Left 70 Channel 70 Right 70 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	91.25	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.07	wt. n-Val.	0.144	0.040	0.060
W.S. Elev (ft)	91.17	Reach Len. (ft)	70.00	70.00	70.00
Crit W.S. (ft)		Flow Area (sq ft)	4.54	9101.13	6.99
E.G. Slope (ft/ft)	0.000040	Area (sq ft)	4.54	9101.13	6.99
Q Total (cfs)	20000.00	Flow (cfs)	0.18	19999.15	0.67
Top width (ft)	308.92	Top width (ft)	0.95	307.00	0.97
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)	0.04	2.20	0.10
Max Chl Dpth (ft)	36.03	Hydr. depth (ft)	4.77	29.65	7.22
Conv. Total (cfs)	3181332.0	Conv. (cfs)	28.5	3181197.0	106.6
Length wtd. (ft)	70.00	wetted Per. (ft)	9.58	317.51	14.46
Min Ch El (ft)	55.14	Shear (lb/sq ft)	0.00	0.07	0.00
Alpha	1.00	Stream Power (lb/ft s)	7505.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	34184.86	71838.35	31125.86
C & E Loss (ft)	0.06	Cum SA (acres)	14218.24	3688.35	14012.29

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.

Note: This may indicate the need for additional cross sections.
Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.216

INPUT									
Description: XS 129.216 NAVD 88									
Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	100	91.64	100	55.64	140	55.64	140	91.64
145	91.64	145	55.64	227	55.64	227	91.64	232	91.64
232	55.64	272	55.64	272	91.64	372	91.64		

Manning's n Values num= 1	
Sta	n Val
0	.015

Bank Sta: Left 145 Right 227 Lengths: Left 20 Channel 20 Right 20 Coeff Contr. .2 Expan. .5

Blocked obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
100 140 87.64 232 272 87.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	91.18	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.72	wt. n-Val.	0.015	0.015	0.015
W.S. Elev (ft)	90.46	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)	67.91	Flow Area (sq ft)	112.81	2855.27	112.81
E.G. Slope (ft/ft)	0.000096	Area (sq ft)	112.81	2855.27	112.81
Q Total (cfs)	20000.00	Flow (cfs)	200.03	19599.94	200.03
Top width (ft)	162.00	Top width (ft)	40.00	82.00	40.00
Vel Total (ft/s)	6.49	Avg. Vel. (ft/s)	1.77	6.86	1.77
Max Chl Dpth (ft)	34.82	Hydr. depth (ft)	2.82	34.82	2.82
Conv. Total (cfs)	2042743.0	Conv. (cfs)	20430.4	2001882.0	20430.4
Length wtd. (ft)	20.00	wetted Per. (ft)	45.64	151.64	45.64
Min Ch El (ft)	55.64	Shear (lb/sq ft)	0.01	0.11	0.01
Alpha	1.10	Stream Power (lb/ft s)	372.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	34184.77	71828.74	31125.76
C & E Loss (ft)		Cum SA (acres)	14218.20	3688.04	14012.26

INLINE STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 129.215

INPUT									
Description: Retamal Dam									
Distance from Upstream XS = 5									
Deck/Roadway Width = 5									
Weir Coefficient = 3.58									
Weir Embankment Coordinates num = 2									
Sta	Elev	Sta	Elev						
0	91.64	372	91.64						
Upstream Embankment side slope = 0 horiz. to 1.0 vertical									
Downstream Embankment side slope = 0 horiz. to 1.0 vertical									
Maximum allowable submergence for weir flow = .95									
Elevation at which weir flow begins =									
Weir crest shape = Ogee									

INLINE STRUCTURE GATE		Gate #1
Height	=	13.75
width	=	82
Invert	=	58.64
Gate Type	=	Radial
Trunion Exponent	=	.16
Opening Exponent	=	.72
Head Exponent	=	.62
Trunion Height	=	.24
Weir Coefficient	=	3.58
Weir crest shape	=	Ogee
Number of Gate Openings	=	1
Sta		
186		

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.214

INPUT									
Description: XS 129.214 NAVD 88									
Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	100	91.64	100	55.64	140	55.64	140	91.64
145	91.64	145	55.64	227	55.64	227	91.64	232	91.64
232	55.64	272	55.64	272	91.64	372	91.64		

Manning's n Values num= 1	
Sta	n Val
0	.015

Bank Sta: Left 145 Right 227 Lengths: Left 25 Channel 25 Right 25 Coeff Contr. .2 Expan. .5

Blocked obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
100 140 87.64 232 272 87.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	84.92	Element	Left 08	Channel	Right 08
Vel Head (ft)	1.17	wt. n-Val.	0.015	0.015	0.015
W.S. Elev (ft)	83.75	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		2304.70	
E.G. Slope (ft/ft)	0.000180	Area (sq ft)		2304.70	
Q Total (cfs)	20000.00	Flow (cfs)		20000.00	
Top width (ft)	82.00	Top width (ft)		82.00	

Vel Total (ft/s)	8.68	Avg. Vel. (ft/s)	8.68
Max Chl Dpth (ft)	28.11	Hydr. Depth (ft)	28.11
Conv. Total (cfs)	1490147.0	Conv. (cfs)	1490147.0
Length wtd. (ft)	25.00	Wetted Per. (ft)	138.21
Min Ch El (ft)	55.64	Shear (lb/sq ft)	0.19
Alpha	1.00	Stream Power (lb/ft s)	372.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	34184.77
C & E Loss (ft)	0.22	Cum SA (acres)	14218.19
			71827.89
			31125.76
			14012.25

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.213

INPUT
Description: XS 129.213 NAVD 88

Station	Elevation	Data	num=	22			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	100	91.64	100	55.64	140	55.64
145	91.64	145	55.64	160.5	55.64	160.5	91.64
170.5	55.64	201.5	55.64	201.5	91.64	211.5	55.64
227	55.64	227	91.64	232	91.64	232	55.64
272	91.64	372	91.64				

Manning's n Values num= 1
Sta n Val
0 .015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
145	227	25	25	25			
Blocked Obstructions num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
100	140	87.64	232	272	87.64		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	84.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.25	Wt. n-Val.		0.015	
W.S. Elev (ft)	82.44	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		1661.73	
E.G. Slope (ft/ft)	0.001013	Area (sq ft)		1661.73	
Q Total (cfs)	20000.00	Flow (cfs)		20000.00	
Top Width (ft)	62.00	Top Width (ft)		62.00	
Vel Total (ft/s)	12.04	Avg. Vel. (ft/s)		12.04	
Max chl Dpth (ft)	26.80	Hydr. Depth (ft)		26.80	
Conv. Total (cfs)	628363.2	Conv. (cfs)		628363.2	
Length wtd. (ft)	25.00	Wetted Per. (ft)		222.81	
Min Ch El (ft)	55.64	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)	372.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	34184.77	71826.75	31125.76
C & E Loss (ft)	0.00	Cum SA (acres)	14218.19	3687.96	14012.25

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.212

INPUT
Description: XS 129.212 NAVD 88

Station	Elevation	Data	num=	22			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	91.64	100	91.64	100	55.64	140	55.64
145	91.64	145	55.64	160.5	55.64	160.5	91.64
170.5	55.64	201.5	55.64	201.5	91.64	211.5	55.64
227	55.64	227	91.64	232	91.64	232	55.64
272	91.64	372	91.64				

Manning's n Values num= 1
Sta n Val
0 .015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
145	227	10	10	10			
Blocked Obstructions num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
100	140	87.64	232	272	87.64		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	84.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.25	Wt. n-Val.		0.015	
W.S. Elev (ft)	82.41	Reach Len. (ft)	10.00	10.00	10.00

Crit W.S. (ft)		Flow Area (sq ft)	1659.86
E.G. Slope (ft/ft)	0.001016	Area (sq ft)	1659.86
Q Total (cfs)	20000.00	Flow (cfs)	20000.00
Top Width (ft)	62.00	Top Width (ft)	62.00
Vel Total (ft/s)	12.05	Avg. Vel. (ft/s)	12.05
Max chl Dpth (ft)	26.77	Hydr. Depth (ft)	26.77
Conv. Total (cfs)	627526.5	Conv. (cfs)	627526.5
Length wtd. (ft)	10.00	Wetted Per. (ft)	222.63
Min Ch El (ft)	55.64	Shear (lb/sq ft)	0.47
Alpha	1.00	Stream Power (lb/ft s)	372.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	34184.77
C & E Loss (ft)	1.05	Cum SA (acres)	14218.19
			71825.80
			3687.92
			14012.25

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.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.211

INPUT
Description: XS 129.211 NAVD 88

Station	Elevation	Data	num=	4	
Sta	Elev	Sta	Elev	Sta	Elev
28	87.14	100	55.64	272	55.64
				344	87.14

Manning's n Values num= 1
Sta n Val
28 .015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
28	344	100	100	100			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	83.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.015	
W.S. Elev (ft)	83.46	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		6554.54	
E.G. Slope (ft/ft)	0.000016	Area (sq ft)		6554.54	
Q Total (cfs)	20000.00	Flow (cfs)		20000.00	
Top Width (ft)	299.18	Top Width (ft)		299.18	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max chl Dpth (ft)	27.82	Hydr. Depth (ft)		21.91	
Conv. Total (cfs)	4956004.0	Conv. (cfs)		4956004.0	
Length wtd. (ft)	100.00	Wetted Per. (ft)		310.82	
Min Ch El (ft)	55.64	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)	344.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	34184.77	71824.85	31125.76
C & E Loss (ft)	0.01	Cum SA (acres)	14218.19	3687.88	14012.25

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.21

INPUT
Description: XS 129.21 NAVD 88

Station	Elevation	Data	num=	4	
Sta	Elev	Sta	Elev	Sta	Elev
14	87.14	86	55.64	286	55.64
				358	87.14

Manning's n Values num= 1
Sta n Val
14 .015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
14	358	400	400	400			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	83.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.015	
W.S. Elev (ft)	83.47	Reach Len. (ft)	400.00	400.00	400.00
Crit W.S. (ft)		Flow Area (sq ft)		7337.84	
E.G. Slope (ft/ft)	0.000013	Area (sq ft)		7337.84	
Q Total (cfs)	20000.00	Flow (cfs)		20000.00	
Top Width (ft)	327.24	Top Width (ft)		327.24	
Vel Total (ft/s)	2.73	Avg. Vel. (ft/s)		2.73	
Max chl Dpth (ft)	27.83	Hydr. Depth (ft)		22.42	
Conv. Total (cfs)	5646932.0	Conv. (cfs)		5646932.0	
Length wtd. (ft)	400.00	Wetted Per. (ft)		338.89	
Min Ch El (ft)	55.64	Shear (lb/sq ft)		0.02	

Alpha	1.00	Stream Power (lb/ft s)	358.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	34184.77	71808.91	31125.76
C & E Loss (ft)	0.00	Cum SA (acres)	14218.19	3687.16	14012.25

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.2

INPUT
Description: XS 129.2 NAVD 88

Station Elevation Data		num=	45						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	87.14	5949	87.14	5950	79.34	6000	79.34	6027	79.04
6041	81.04	6050	81.54	6058	81.54	6066	81.04	6080	76.74
6097	76.24	6100	77.14	6106	74.74	6138	62.64	6144.9	61.18
6147	60.74	6152	58.08	6160	55.64	6170	55.34	6180	55.04
6190	55.64	6200	55.64	6210	55.24	6220	55.24	6230	55.24
6240	55.24	6250	55.04	6260	55.44	6270	55.74	6280	56.04
6290	56.04	6300	56.04	6310	56.04	6320	56.74	6330	57.34
6335	58.08	6340.4	61.16	6343	62.64	6362	73.84	6409	74.64
6420	77.64	6470	80.24	6725	81.04	6726	84.74	9975	84.74

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.168	6027	.168	6066	.066	6152	.025	6335	.066
6470	.067								

Bank Sta: Left 6066 Right 6470 Lengths: Left Channel 1500 Right 1148 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
0	6058	81.54

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	83.58	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.168	0.050	0.067	
W.S. Elev (ft)	83.47	Reach Len. (ft)	1500.00	1148.00	600.00	
Crit W.S. (ft)		Flow Area (sq ft)	226.54	7319.62	722.17	
E.G. Slope (ft/ft)	0.000175	Area (sq ft)	226.54	7319.62	722.17	
Q Total (cfs)	20000.00	Flow (cfs)	40.90	19537.72	421.37	
Top width (ft)	776.19	Top width (ft)	116.53	404.00	255.66	
Vel Total (ft/s)	2.42	Avg. Vel. (ft/s)	0.18	2.67	0.58	
Max chl Dpth (ft)	28.43	Hydr. Depth (ft)	1.94	18.12	2.82	
Conv. Total (cfs)	1511746.0	Conv. (cfs)	3091.7	1476804.0	31850.5	
Length Wtd. (ft)	1140.14	Wetted Per. (ft)	118.24	413.58	257.52	
Min ch El (ft)	55.04	Shear (lb/sq ft)	0.02	0.19	0.03	
Alpha	1.19	Stream Power (lb/ft s)	9975.00	0.00	0.00	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	34183.73	71741.61	31122.45	
C & E Loss (ft)	0.00	Cum SA (acres)	14217.66	3683.80	14011.07	

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 129.03

INPUT
Description: XS 129.03 "W" NAVD 88

Station Elevation Data		num=	79						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	88.14	12	87.74	44	80.04	76	75.64	109	79.24
128	75.44	149	81.94	181	80.54	731	80.84	762	81.74
786	69.24	806	71.14	820	79.84	845	78.64	2917	80.24
2964	78.64	4369	79.24	4575	80.04	5400	81.04	5438	81.04
5475	82.84	5515	81.94	5524	77.74	5540	77.34	5554	69.94
5559	68.94	5568	62.84	5573	59.84	5583	57.84	5593	57.24
5603	57.04	5613	57.14	5623	57.04	5633	57.34	5643	57.04
5653	57.04	5663	56.84	5673	56.44	5683	56.24	5693	56.14
5703	55.24	5713	53.84	5723	53.84	5733	54.14	5743	55.04
5753	55.84	5763	55.84	5773	57.24	5783	61.34	5786	62.84
5808	73.54	5835	73.84	5851	76.34	5958	77.44	5973	82.14
6000	80.24	7195	78.94	7212	83.84	7231	83.84	7241	80.94
8968	78.54	9194	81.14	9319	81.64	9332	82.24	9352	85.04
9393	84.14	9409	81.94	10270	80.14	10516	83.44	10524	83.34
10533	81.24	10827	81.04	10842	80.14	10853	75.94	10864	76.14
10876	78.84	10886	80.34	10898	85.14	10908	85.34		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	5400	.14	5438	.066	5568	.025	5786	.066
6000	.071								

Bank Sta: Left 5475 Right 5973 Lengths: Left Channel 7700 Right 7000 Coeff Contr. .1 Expan. .3

Blocked Obstructions	num=	4				
Sta L Sta R Elev	Sta L	Sta R Elev	Sta L	Sta R Elev		
12 5475 82.84	0	5100	85.34	5973	10898	82.14
6500 10908 85.34						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	83.36	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.126	0.050	0.071	
W.S. Elev (ft)	83.26	Reach Len. (ft)	7700.00	7000.00	4500.00	
Crit W.S. (ft)		Flow Area (sq ft)	159.02	7781.32	592.37	
E.G. Slope (ft/ft)	0.000196	Area (sq ft)	159.02	7781.32	592.37	
Q Total (cfs)	20000.00	Flow (cfs)	14.81	19797.01	188.19	
Top width (ft)	1400.00	Top width (ft)	375.00	498.00	527.00	
Vel Total (ft/s)	2.34	Avg. Vel. (ft/s)	0.09	2.54	0.32	
Max chl Dpth (ft)	29.42	Hydr. Depth (ft)	0.42	15.63	1.12	
Conv. Total (cfs)	1427903.0	Conv. (cfs)	1057.3	1413410.0	13435.6	
Length Wtd. (ft)	6902.81	Wetted Per. (ft)	375.42	508.68	528.12	
Min ch El (ft)	53.84	Shear (lb/sq ft)	0.01	0.19	0.01	
Alpha	1.17	Stream Power (lb/ft s)	10908.00	0.00	0.00	
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	34177.09	71542.62	31113.39	
C & E Loss (ft)	0.02	Cum SA (acres)	14209.20	3671.92	14005.68	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m), between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 127.7

INPUT
Description: XS 127.7 NAVD 88

Station Elevation Data		num=	59						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
19	86.94	32	86.94	87	86.94	1607	86.94	1608	80.34
1679	76.34	2262	77.04	3507	81.04	3580	77.84	5624	77.34
5671	78.34	5820	80.34	5991	77.34	6060	77.34	6066	77.34
6093	79.34	6160	76.64	6180	73.34	6216	73.74	6267	69.74
6294	69.74	6339	69.34	6356	60.16	6373	58.14	6383	57.64
6393	57.14	6403	57.14	6413	56.64	6423	56.84	6433	56.64
6443	55.64	6453	55.94	6463	55.84	6473	55.64	6483	55.64
6493	55.14	6503	55.64	6513	55.14	6523	55.14	6533	54.94
6543	52.64	6553	49.94	6563	51.64	6573	54.34	6575	60.16
6585	63.94	6590	69.04	6610	77.04	6626	77.34	6931	78.34
6958	76.34	7231	75.34	7274	81.04	7283	79.54	7290	81.04
7296	79.54	8482	77.89	8483	84.54	9996	84.54		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
19	.114	6060	.114	6093	.066	6356	.025	6575	.066
6610	.074								

Bank Sta: Left 6093 Right 6610 Lengths: Left Channel 4000 Right 5000 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 2

Sta L	Sta R	Elev
19	5820	80.34
	7290	81.04

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	82.35	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.114	0.051	0.074	
W.S. Elev (ft)	82.30	Reach Len. (ft)	4000.00	5000.00	2125.00	
Crit W.S. (ft)		Flow Area (sq ft)	9264.97	8801.31	5059.61	
E.G. Slope (ft/ft)	0.000093	Area (sq ft)	9264.97	8801.31	5059.61	
Q Total (cfs)	20000.00	Flow (cfs)	1898.82	16198.56	1902.62	
Top width (ft)	6874.96	Top width (ft)	4485.30	517.00	1872.66	
Vel Total (ft/s)	0.86	Avg. Vel. (ft/s)	0.20	1.84	0.38	
Max chl Dpth (ft)	32.36	Hydr. Depth (ft)	2.07	17.02	2.70	
Conv. Total (cfs)	2070367.0	Conv. (cfs)	196562.8	1676849.0	196955.8	
Length Wtd. (ft)	4605.84	Wetted Per. (ft)	4487.10	529.71	1874.49	
Min ch El (ft)	49.94	Shear (lb/sq ft)	0.01	0.10	0.02	
Alpha	3.69	Stream Power (lb/ft s)	9996.00	0.00	0.00	
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	39344.16	70210.22	30821.45	
C & E Loss (ft)	0.00	Cum SA (acres)	13779.62	3590.36	13881.73	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 126.7

INPUT Description: XS 126.7 "V" NAVD 88									
Station Elevation Data num= 66									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	87.49	8.53	87.33	10.01	87.33	14.54	85.82	31	81.54
61	79.84	107	66.84	109	66.14	131	65.54	135	68.24
150	68.14	156	66.74	467	67.74	482	68.64	511	79.24
667	78.84	706	78.14	1298	78.94	1326	79.34	1347	71.14
1361	69.14	1734	69.84	1742	71.44	1809	74.64	1840	75.74
2409	77.34	2442	78.84	4407	79.64	4450	79.54	4464	62.54
4473	56.04	4483	52.04	4493	50.94	4503	51.54	4513	51.54
4523	51.54	4533	51.74	4543	52.74	4553	53.04	4563	52.74
4573	56.04	4583	58.54	4593	60.34	4603	61.44	4613	62.04
4615	62.54	4625	67.94	4641	63.64	4652	63.94	4670	66.54
4688	74.74	4698	73.14	4717	73.34	4791	79.94	4910	76.74
4951	80.24	4998	79.74	5457	80.24	7085	71.75	8204	77.74
8217	77.84	8247	80.44	8278	80.84	9478	78.64	9502	84.24
9514	84.41								

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
55	.11	4407	.11	4450	.066	4464	.025	4615	.066
4791	.074								

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
4450	4791		3500	9000	.1		.3
Blocked Obstructions num= 4							
Sta	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R
61	4407	79.64	4791	4951	79.94	4951	8247
8278	9502	80.84					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	81.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	wt. n-Val.	0.110	0.050	0.074
W.S. Elev (ft)	81.69	Reach Len. (ft)	3500.00	9000.00	6000.00
Crit W.S. (ft)		Flow Area (sq ft)	9046.01	5917.32	6138.04
E.G. Slope (ft/ft)	0.000183	Area (sq ft)	9046.01	5917.32	6138.04
Q Total (cfs)	20000.00	Flow (cfs)	2666.57	15340.08	1993.35
Top Width (ft)	9460.68	Top Width (ft)	4419.59	341.00	4700.09
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.29	2.59	0.32
Max chl Dpth (ft)	30.75	Hydr. Depth (ft)	2.05	17.35	1.31
Conv. Total (cfs)	1477456.0	Conv. (cfs)	196987.3	1133215.0	147254.3
Length wtd. (ft)	8191.20	Wetted Per. (ft)	4419.69	357.50	4700.21
Min ch El (ft)	50.94	Shear (lb/sq ft)	0.02	0.19	0.01
Alpha	5.76	Stream Power (lb/ft s)	9514.00	0.00	0.00
Frctn Loss (ft)	1.17	Cum Volume (acre-ft)	32503.44	69365.48	30548.32
C & E Loss (ft)	0.00	Cum SA (acres)	13370.77	3541.12	13721.41

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 125

INPUT Description: XS 125 NAVD 88									
Station Elevation Data num= 45									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
51.65	87.12	59.65	86.69	61.99	86.69	89.05	77.67	113	73.24
259	73.84	314	71.74	4179	78.24	4202	78.61	4235	79.14
4248	59.22	4250	55.24	4260	51.24	4270	50.64	4280	50.64
4290	50.24	4300	50.64	4310	50.64	4320	51.24	4330	50.94
4340	51.24	4350	51.94	4360	51.24	4370	51.24	4380	51.64
4390	52.74	4400	53.74	4411	59.22	4416	62.44	4453	61.84
4477	73.44	4547	75.24	4563	75.24	5362	77.24	5372	80.74
5379	78.94	5387	81.24	5403	76.64	6421	78.74	6667	78.44
6789	77.24	8326	77.14	8727	76.24	8739	82.84	8743	82.84

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
51.65	.108	4202	.108	4235	.066	4248	.025	4411	.066
4477	.074								

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
4235	4477		6375	8935	.1		.3
Blocked Obstructions num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
51.65	4235	79.14	5387	8743	81.24		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	80.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	wt. n-Val.	0.108	0.042	0.074
W.S. Elev (ft)	80.50	Reach Len. (ft)	6375.00	8935.00	4625.00
Crit W.S. (ft)		Flow Area (sq ft)	5641.66	5911.40	3942.03
E.G. Slope (ft/ft)	0.000102	Area (sq ft)	5641.66	5911.40	3942.03
Q Total (cfs)	20000.00	Flow (cfs)	960.78	16898.77	2140.46

Top Width (ft)	5302.23	Top Width (ft)	4154.44	242.00	905.79
Vel Total (ft/s)	1.29	Avg. Vel. (ft/s)	0.17	2.86	0.54
Max chl Dpth (ft)	30.26	Hydr. Depth (ft)	1.36	24.43	4.35
Conv. Total (cfs)	1981371.0	Conv. (cfs)	95182.9	1674136.0	212051.9
Length wtd. (ft)	8452.66	Wetted Per. (ft)	4154.66	261.14	906.79
Min ch El (ft)	30.24	Shear (lb/sq ft)	0.01	0.14	0.03
Alpha	4.16	Stream Power (lb/ft s)	8743.00	0.00	0.00
Frctn Loss (ft)	0.97	Cum Volume (acre-ft)	31913.37	68143.51	29854.11
C & E Loss (ft)	0.00	Cum SA (acres)	13026.31	3480.89	13335.33

Warning: Divided flow computed for this cross-section.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 123.8

INPUT Description: XS 123.8 "U" NAVD 88									
Station Elevation Data num= 47									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	85.04	18	84.64	92.3	75.94	124	75.54	595	76.14
628	76.14	643	76.24	647	77.74	667	77.24	676	68.54
682	66.34	689	60.44	696	57.64	706	52.04	716	50.94
726	50.64	736	50.44	746	49.94	756	49.74	766	49.94
776	50.64	786	50.64	796	51.54	806	51.64	816	51.54
826	51.74	836	53.64	846	54.44	856	56.64	866	57.74
872	60.44	900	63.84	936	63.54	987	74.34	1113	74.04
1185	75.64	2615	79.54	4547	76.44	4560	79.64	4573	79.84
4587	76.04	5812	71.64	5839	76.24	7218	73.44	7242	76.94
7253	81.74	7263	82.54						

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.1	595	.1	628	.066	689	.025	872	.066
987	.07								

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
647	987		6000	6875	.1		.3
Blocked Obstructions num= 3							
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R
18	647	77.74	987	1185	74.34	2615	7253

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	79.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	wt. n-Val.	0.098	0.047	0.070
W.S. Elev (ft)	79.53	Reach Len. (ft)	6000.00	6875.00	6625.00
Crit W.S. (ft)		Flow Area (sq ft)	1035.74	6832.15	3768.34
E.G. Slope (ft/ft)	0.000132	Area (sq ft)	1035.74	6832.15	3768.34
Q Total (cfs)	20000.00	Flow (cfs)	262.95	18127.86	1609.20
Top Width (ft)	2550.74	Top Width (ft)	585.38	340.00	1625.35
Vel Total (ft/s)	1.72	Avg. Vel. (ft/s)	0.25	2.65	0.43
Max chl Dpth (ft)	29.79	Hydr. Depth (ft)	1.77	20.09	2.32
Conv. Total (cfs)	1741531.0	Conv. (cfs)	22896.4	1578511.0	140123.5
Length wtd. (ft)	6834.96	Wetted Per. (ft)	585.49	350.65	1625.37
Min ch El (ft)	49.74	Shear (lb/sq ft)	0.01	0.16	0.02
Alpha	2.17	Stream Power (lb/ft s)	7263.00	0.00	0.00
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	31424.75	66836.53	29444.78
C & E Loss (ft)	0.00	Cum SA (acres)	12679.47	3421.21	13200.96

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 122.5

INPUT Description: XS 122.5 NAVD 88									
Station Elevation Data num= 63									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
7	87.44	25	86.34	63	74.74	89	75.34	738	74.84
752	71.14	1439	71.84	1474	74.34	2302	74.94	2324	75.24
2345	80.84	2360	80.84	2386	75.74	2445	73.34	2567	72.34
2598	73.24	2613	70.84	2632	69.54	2648	71.64	2674	64.04
2677	76.54	2694	58.64	2695	78.08	2705	55.14	2715	54.64
2725	54.94	2735	54.64	2745	54.44	2753	54.14	2763	54.04
2775	54.34	2785	54.34	2795	54.04	2805	53.84	2815	53.64
2825	53.14	2835	52.44	2845	52.24	2855	52.14	2865	51.94
2875	52.94	2885	52.94	2895	53.14	2905	56.24	2908.1	58.08
2909	58.62	2923	70.54	2925	76.54	2942	77.04	2950	79.24
2959	76.54	2972	76.74	2979	79.24	2985	75.74	2995	75.44
3778	73.64	3798	74.24	3835	72.24	5431	69.54	5457	74.24
5603	73.54	5623	80.94	5637	81.14				

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
7	.099	2302	.099	2345	.066	2694	.025	2909	.066
2950	.066								

Bank Sta: Left 2648	Right 2925	Lengths: 2625	Left Channel 3510	Right 4500	Coeff Contr. .1	Expan. .3
Blocked Obstructions num= 2						
Sta L 7	Sta R 2345	Elev 80.84	Sta L 2950	Sta R 5637	Elev 79.24	
CROSS SECTION OUTPUT Profile #PF 1						
E.G. Elev (ft)	78.84	Element	Left 08	Channel	Right 08	
Vel Head (ft)	0.14	Wt. n-Val.	0.066	0.037	0.066	
W.S. Elev (ft)	78.70	Reach Len. (ft)	2625.00	3510.00	4500.00	
Crit W.S. (ft)		Flow Area (sq ft)	1557.14	6182.13	37.47	
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	1557.14	6182.13	37.47	
Q Total (cfs)	20000.00	Flow (cfs)	1104.65	18883.78	11.57	
Top width (ft)	577.12	Top width (ft)	277.09	277.00	23.03	
Vel Total (ft/s)	2.57	Avg. Vel. (ft/s)	0.71	3.05	0.31	
Max chl Dpth (ft)	26.76	Hydr. Depth (ft)	5.62	22.32	1.63	
Conv. Total (cfs)	2002771.0	Conv. (cfs)	110617.9	1890994.0	1159.1	
Length wtd. (ft)	3555.35	wetted Per. (ft)	277.81	289.70	23.27	
Min Ch El (ft)	51.94	Shear (lb/sq ft)	0.03	0.13	0.01	
Alpha	1.34	Stream Power (lb/ft s)	5637.00	0.00	0.00	
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	31246.18	65809.52	29155.37	
C & E Loss (ft)	0.00	Cum SA (acres)	12620.08	3372.52	13075.61	

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 121.46

INPUT Description: XS 121.46 "T" NAVD 88									
Station Elevation Data num= 38									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.94	21	81.84	38	79.54	86	79.74	100	67.94
107	65.54	111	59.74	113	57.74	123	51.44	133	47.54
143	45.44	153	46.74	163	48.54	173	48.74	183	49.34
193	50.44	203	51.04	213	51.74	223	52.24	233	53.24
243	54.24	253	55.74	263	57.34	268	59.74	272	60.94
292	61.54	303	65.54	313	67.44	337	66.74	438	70.24
480	71.84	517	74.34	544	72.04	821	70.24	1098	70.34
1132	71.44	1154	80.14	1162	80.94				
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.111	38	.111	100	.066	111	.025	268	.066
313	.071								

Bank Sta: Left 100	Right 313	Lengths: 4000	Left Channel 3750	Right 3500	Coeff Contr. .1	Expan. .3
Blocked Obstructions num= 2						
Sta L 0	Sta R 86	Elev 79.74	Sta L 517	Sta R 1162	Elev 74.34	

CROSS SECTION OUTPUT Profile #PF 1						
E.G. Elev (ft)	78.45	Element	Left 08	Channel	Right 08	
Vel Head (ft)	0.15	Wt. n-Val.	0.111	0.038	0.071	
W.S. Elev (ft)	78.30	Reach Len. (ft)	4000.00	3750.00	3500.00	
Crit W.S. (ft)		Flow Area (sq ft)	63.67	5080.02	4241.99	
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	63.67	5080.02	4241.99	
Q Total (cfs)	20000.00	Flow (cfs)	23.05	17147.91	2829.04	
Top width (ft)	1061.64	Top width (ft)	12.29	213.00	836.35	
Vel Total (ft/s)	2.13	Avg. Vel. (ft/s)	0.36	3.38	0.67	
Max chl Dpth (ft)	32.86	Hydr. Depth (ft)	5.18	23.85	5.07	
Conv. Total (cfs)	1851370.0	Conv. (cfs)	12133.8	1587357.0	261879.9	
Length wtd. (ft)	3730.48	wetted Per. (ft)	16.08	222.38	837.29	
Min Ch El (ft)	45.44	Shear (lb/sq ft)	0.03	0.17	0.04	
Alpha	2.17	Stream Power (lb/ft s)	1162.00	0.00	0.00	
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	31197.34	65355.78	28934.32	
C & E Loss (ft)	0.01	Cum SA (acres)	12611.36	3352.77	13031.22	

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 120.7

INPUT Description: XS 120.7 NAVD 88									
Station Elevation Data num= 40									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.24	10	80.64	40	72.94	100	73.94	140	69.34
210	70.94	225	74.64	276	75.37	309	75.84	321	70.94
342	58.13	344	56.76	350	52.64	360	50.84	370	51.64
380	51.84	390	52.14	400	52.14	410	51.84	420	51.84
430	51.64	440	51.84	450	51.84	460	52.14	470	52.64
480	52.64	490	53.14	500	52.84	510	53.14	520	53.84

530	53.34	540	55.64	543.1	56.74	547	58.13	584	59.84
596	64.94	670	71.24	857	73.94	868	79.64	881	79.74
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.075	276	.044	309	.066	342	.025	547	.066

Bank Sta: Left 309	Right 670	Lengths: 465	Left Channel 465	Right 465	Coeff Contr. .1	Expan. .3
Blocked Obstructions num= 1						
Sta L 0	Sta R 309	Elev 75.84				

CROSS SECTION OUTPUT Profile #PF 1						
E.G. Elev (ft)	77.98	Element	Left 08	Channel	Right 08	
Vel Head (ft)	0.11	Wt. n-Val.	0.044	0.045	0.075	
W.S. Elev (ft)	77.88	Reach Len. (ft)	465.00	465.00	465.00	
Crit W.S. (ft)		Flow Area (sq ft)	579.11	7112.10	1003.67	
E.G. Slope (ft/ft)	0.000128	Area (sq ft)	579.11	7112.10	1003.67	
Q Total (cfs)	20000.00	Flow (cfs)	352.72	18976.78	670.30	
Top width (ft)	843.83	Top width (ft)	288.22	361.00	194.60	
Vel Total (ft/s)	2.30	Avg. Vel. (ft/s)	0.61	2.67	0.67	
Max chl Dpth (ft)	27.04	Hydr. Depth (ft)	2.01	19.70	5.16	
Conv. Total (cfs)	1764679.0	Conv. (cfs)	31121.9	1674395.0	59161.3	
Length wtd. (ft)	465.00	wetted Per. (ft)	288.49	369.58	195.58	
Min Ch El (ft)	50.84	Shear (lb/sq ft)	0.02	0.15	0.04	
Alpha	1.28	Stream Power (lb/ft s)	881.00	0.00	0.00	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	31167.83	64830.98	28723.58	
C & E Loss (ft)	0.00	Cum SA (acres)	12597.56	3328.07	12989.80	

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 120.62

INPUT Description: XS 120.62 NAVD 88									
Station Elevation Data num= 68									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.98	10.5	82.09	17	82.14	23	79.94	24	79.54
38	75.44	53.4	75.37	54.7	75.36	83.4	75.22	84.7	75.21
100	75.14	113.4	75.26	114.7	75.27	143.4	75.53	144.7	75.55
166	75.74	173.4	75.86	174.7	75.88	184	76.04	194	76.04
200	76.04	204	76.15	207	76.23	211	76.34	217	71.74
222	69.94	230	63.54	238	57.8	239.3	56.66	240	56.04
250	51.44	260	47.84	270	46.54	280	46.64	290	47.44
300	47.84	310	48.64	320	49.44	330	50.84	340	51.04
350	50.24	360	50.24	370	52.04	376	52.76	380	53.24
390	52.84	400	54.84	410	55.84	417.8	56.62	420	56.84
430	57.8	457	60.94	476	63.54	478	66.34	500	67.94
548	73.74	549	73.76	552	73.84	562	74.09	583.9	74.64
585.2	74.67	600	75.04	617.4	75.78	618.7	75.83	640	76.74
652	79.29	656	80.14	676	81.44				

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.088	166	.088	211	.066	238	.025	430	.066
548	.08								

Bank Sta: Left 211	Right 548	Lengths: 46	Left Channel 46	Right 46	Coeff Contr. .2	Expan. .5
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CROSS SECTION OUTPUT Profile #PF 1						
E.G. Elev (ft)	77.92	Element	Left 08	Channel	Right 08	
Vel Head (ft)	0.13	Wt. n-Val.	0.088	0.045	0.080	
W.S. Elev (ft)	77.79	Reach Len. (ft)	10.00	10.00	10.00	
Crit W.S. (ft)	58.12	Flow Area (sq ft)	398.60	6781.85	254.97	
E.G. Slope (ft/ft)	0.000151	Area (sq ft)	398.60	6781.85	254.97	
Q Total (cfs)	20000.00	Flow (cfs)	140.84	19748.35	110.81	
Top width (ft)	614.93	Top width (ft)	181.01	337.00	96.92	
Vel Total (ft/s)	2.69	Avg. Vel. (ft/s)	0.35	2.91	0.43	
Max chl Dpth (ft)	31.25	Hydr. Depth (ft)	2.20	20.12	2.63	
Conv. Total (cfs)	1627149.0	Conv. (cfs)	11458.4	1606675.0	9014.8	
Length wtd. (ft)	10.00	wetted Per. (ft)	181.35	348.38	97.08	
Min Ch El (ft)	46.54	Shear (lb/sq ft)	0.02	0.18	0.02	
Alpha	1.16	Stream Power (lb/ft s)	676.00	0.00	0.00	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	31162.61	64756.82	28716.86	
C & E Loss (ft)	0.00	Cum SA (acres)	12595.05	3324.34	12988.25	

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

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 120.605

INPUT
Description: Progreso

Distance from Upstream XS = 10
Deck/Roadway width = 26
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates

num= 27												
Sta	Hi	Cord	Lo	Sta	Hi	Cord	Lo	Sta	Hi	Cord	Lo	Cord
0	81.98	81.98		24	82.54	79.54		53.4	83.52	80.52		
54.7	83.57	80.57		83.4	84.53	81.53		84.7	84.58	81.58		
113.4	85.54	82.54		114.7	85.58	82.58		143.4	86.54	83.54		
144.7	86.59	83.59		173.4	87.55	84.55		174.7	87.6	84.6		
194	88.24	85.24		194	88.24	83.29		207	88.61	83.29		
376	90.11	84.76		380	90.11	84.76		549	88.61	83.33		
562	88.02	83.33		562	88.02	85.02		583.9	86.8	83.8		
585.2	86.73	83.73		617.4	84.93	81.93		618.7	84.86	81.86		
652	83	80		656	82.78	80.14		676	81.66	81.44		

Upstream Bridge Cross Section Data

num= 68											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.98	10.5	82.09	17	82.14	23	79.94	24	79.54		
38	75.44	53.4	75.37	54.7	75.36	83.4	75.22	84.7	75.21		
100	75.14	113.4	75.26	114.7	75.27	143.4	75.53	144.7	75.55		
166	75.74	173.4	75.86	174.7	75.88	184	76.04	194	76.04		
200	76.04	204	76.15	207	76.23	211	76.34	217	71.74		
222	69.94	230	63.54	238	57.8	239.3	56.66	240	56.04		
250	51.44	260	47.84	270	46.54	280	46.64	290	47.44		
300	47.84	310	48.64	320	49.44	330	50.84	340	51.04		
350	50.24	360	50.24	370	52.04	376	52.76	380	53.24		
390	52.84	400	54.84	410	55.84	417.8	56.62	420	56.84		
430	57.8	457	60.94	476	63.54	478	66.34	500	67.94		
548	73.74	549	73.76	552	73.84	562	74.09	583.9	74.64		
585.2	74.67	600	75.04	617.4	75.78	618.7	75.83	640	76.74		
652	79.29	656	80.14	676	81.44						

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.088	166	.088	211	.066	238	.025
548	.08					430	.066

Bank Sta: Left Right Coeff Contr. Expan.
211 548 .2 .5

Downstream Deck/Roadway Coordinates

num= 27														
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	81.98	81.98			24	82.54	79.54	53.4	83.52	80.52				
54.7	83.57	80.57			83.4	84.53	81.53	84.7	84.58	81.58				
113.4	85.54	82.54			114.7	85.58	82.58	143.4	86.54	83.54				
144.7	86.59	83.59			173.4	87.55	84.55	174.7	87.6	84.6				
194	88.24	85.24			194	88.24	83.29	207	88.61	83.29				
376	90.11	84.76			380	90.11	84.76	549	88.61	83.33				
562	88.02	83.33			562	88.02	85.02	583.9	86.8	83.8				
585.2	86.73	83.73			617.4	84.93	81.93	618.7	84.86	81.86				
652	83	80			656	82.78	80.14	676	81.66	81.44				

Downstream Bridge Cross Section Data

num= 68											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.98	10.5	82.09	17	82.14	23	79.94	24	79.54		
38	75.44	53.4	75.37	54.7	75.36	83.4	75.22	84.7	75.21		
100	75.14	113.4	75.26	114.7	75.27	143.4	75.53	144.7	75.55		
166	75.74	173.4	75.86	174.7	75.88	184	76.04	194	76.04		
200	76.04	204	76.15	207	76.23	211	76.34	217	71.74		
222	69.94	230	63.54	238	57.8	239.3	56.66	240	56.04		
250	51.44	260	47.84	270	46.54	280	46.64	290	47.44		
300	47.84	310	48.64	320	49.44	330	50.84	340	51.04		
350	50.24	360	50.24	370	52.04	376	52.76	380	53.24		
390	52.84	400	54.84	410	55.84	417.8	56.62	420	56.84		
430	57.8	457	60.94	476	63.54	478	66.34	500	67.94		
548	73.74	549	73.76	552	73.84	562	74.09	583.9	74.64		
585.2	74.67	600	75.04	617.4	75.78	618.7	75.83	640	76.74		
652	79.29	656	80.14	676	81.44						

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.104	166	.104	211	.066	238	.025
548	.06					430	.066

Bank Sta: Left Right Coeff Contr. Expan.
211 548 .2 .5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =

Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 10

Pier Data
Pier Station Upstream= 54.1 Downstream= 54.1

Upstream num= 2
width Elev width Elev
1.3 40 1.3 80.93
Downstream num= 2
width Elev width Elev
1.3 40 1.3 80.93

Pier Data
Pier Station Upstream= 84.1 Downstream= 84.1

Upstream num= 2
width Elev width Elev
1.3 40 1.3 81.94
Downstream num= 2
width Elev width Elev
1.3 40 1.3 81.94

Pier Data
Pier Station Upstream= 114.1 Downstream= 114.1

Upstream num= 2
width Elev width Elev
1.3 40 1.3 82.94
Downstream num= 2
width Elev width Elev
1.3 40 1.3 82.94

Pier Data
Pier Station Upstream= 144.1 Downstream= 144.1

Upstream num= 2
width Elev width Elev
1.3 40 1.3 83.95
Downstream num= 2
width Elev width Elev
1.3 40 1.3 83.95

Pier Data
Pier Station Upstream= 174.1 Downstream= 174.1

Upstream num= 2
width Elev width Elev
1.3 40 1.3 84.96
Downstream num= 2
width Elev width Elev
1.3 40 1.3 84.96

Pier Data
Pier Station Upstream= 200.5 Downstream= 200.5

Upstream num= 2
width Elev width Elev
13 40 13 83.65
Downstream num= 2
width Elev width Elev
13 40 13 83.65

Pier Data
Pier Station Upstream= 378 Downstream= 378

Upstream num= 2
width Elev width Elev
4 40 4 85.12
Downstream num= 2
width Elev width Elev
4 40 4 85.12

Pier Data
Pier Station Upstream= 555.5 Downstream= 555.5

Upstream num= 2
width Elev width Elev
13 40 13 83.69
Downstream num= 2
width Elev width Elev
13 40 13 83.69

Pier Data
Pier Station Upstream= 584.5 Downstream= 584.5

Upstream num= 2
width Elev width Elev
1.3 40 1.3 84.16
Downstream num= 2
width Elev width Elev
1.3 40 1.3 84.16

Pier Data
Pier Station Upstream= 618 Downstream= 618

Upstream num= 2
width Elev width Elev
1.3 40 1.3 82.29
Downstream num= 2
width Elev width Elev
1.3 40 1.3 82.29

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow

Submerged Inlet Cd =

Submerged Inlet + Outlet Cd = .8

Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum

Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth

inside the bridge at the upstream end

Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1				
E.G. US. (ft)	77.92	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	77.79	E.G. Elev (ft)	77.91	77.91
Q Total (cfs)	20000.00	W.S. Elev (ft)	77.78	77.77
Q Bridge (cfs)	20000.00	Crit W.S. (ft)	58.21	58.21
Q Weir (cfs)		Max chl Dpth (ft)	31.23	
Weir Sta Lft (ft)		Vel Total (ft/s)	2.76	2.76
Weir Sta Rgt (ft)		Flow Area (sq ft)	7238.16	7235.09
Weir Submerg		Froude # chl	0.12	0.12
Weir Max Depth (ft)		Specif Force (cu ft)	81692.42	81653.47
Min El weir Flow (ft)	81.67	Hydr Depth (ft)	12.57	12.57
Min El Prs (ft)	85.24	W.P. Total (ft)	681.63	681.48
Delta EG (ft)	0.01	Conv. Total (cfs)	1391446.0	1391389.0
Delta WS (ft)	0.01	Top Width (ft)	575.77	575.73
BR Open Area (sq ft)	10509.57	Frctn Loss (ft)	0.01	0.00
BR Open Vel (ft/s)	2.76	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.14	0.14
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

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

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

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 120.59

INPUT									
Description: XS 120.59 NAVD 88									
Station Elevation Data num= 68									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.98	10.5	82.09	17	82.14	23	79.94	24	79.54
38	75.44	53.4	75.37	54.7	75.36	83.4	75.22	84.7	75.21
100	75.14	113.4	75.26	114.7	75.27	143.4	75.53	144.7	75.55
166	75.74	173.4	75.86	174.7	75.88	184	76.04	194	76.04
200	76.04	204	76.15	207	76.23	211	76.34	217	71.74
222	69.94	230	63.54	238	57.8	239.3	56.66	240	56.04
250	51.44	260	47.84	270	46.54	280	46.64	290	47.44
300	47.84	310	48.64	320	49.44	330	50.84	340	51.04
350	50.24	360	50.24	370	52.04	376	52.76	380	53.24
390	52.84	400	54.84	410	55.84	417.8	56.62	420	56.84
430	57.8	457	60.94	476	63.54	478	66.34	500	67.94
548	73.74	549	73.76	552	73.84	562	74.09	583.9	74.64
585.2	74.67	600	75.04	617.4	75.78	618.7	75.83	640	76.74
652	79.29	656	80.14	676	81.44				

Manning's n Values		num=		6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.104	166	.104	211	.066	238	.025	430	.066		
548	.06										

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
211	548	640	640	640	.2		.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	77.90	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.13	Wt. n-Val.	0.104	0.045	0.060
W.S. Elev (ft)	77.77	Reach Len. (ft)	640.00	640.00	
Crit W.S. (ft)		Flow Area (sq ft)	396.43	6777.80	253.80
E.G. Slope (ft/ft)	0.000151	Area (sq ft)	396.43	6777.80	253.80
Q Total (cfs)	20000.00	Flow (cfs)	118.16	19735.12	146.72
Top width (ft)	614.83	Top width (ft)	180.97	337.00	96.86
vel Total (ft/s)	2.69	Avg. Vel. (ft/s)	0.30	2.91	0.58
Max chl Dpth (ft)	31.23	Hydr. Depth (ft)	2.19	20.11	2.62
Conv. Total (cfs)	1626621.0	Conv. (cfs)	9610.0	1605078.0	11933.2
Length wtd. (ft)	640.00	wetted Per. (ft)	181.31	348.38	97.02
Min Ch El (ft)	46.54	Shear (lb/sq ft)	0.02	0.18	0.02
Alpha	1.15	Stream Power (lb/ft s)	676.00	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	31162.22	64749.75	28716.64
C & E Loss (ft)	0.02	Cum SA (acres)	12594.88	3323.99	12988.16

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

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 120.5

INPUT									
Description: XS 120.5 NAVD 88									
Station Elevation Data num= 42									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.74	10	81.74	42	74.34	87	72.34	437	73.48
454	73.54	470	74.24	488	74.24	496	70.64	516	70.74
526	57.84	527	55.84	537	53.24	547	51.04	557	50.64
567	49.84	577	49.84	587	50.14	597	50.64	607	51.64
617	51.84	627	52.14	637	51.24	647	51.44	657	51.84
667	52.14	677	53.24	687	53.24	697	53.64	707	53.64
717	53.84	727	54.14	737	56.34	740	57.84	746	60.24
784	60.24	804	66.24	844	69.94	1018	73.74	1300	72.64
1322	80.74	1330	80.74						

Manning's n Values		num=		6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.159	437	.159	470	.066	526	.025	740	.066		
844	.076										

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
516	844	3625	4000	4000	.1		.3
Blocked Obstructions num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
0	470	74.24	1018	1330	73.74		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	77.81	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.10	Wt. n-Val.	0.127	0.042	0.076
W.S. Elev (ft)	77.71	Reach Len. (ft)	3625.00	4000.00	4000.00
Crit W.S. (ft)		Flow Area (sq ft)	1754.81	7031.34	2174.37
E.G. Slope (ft/ft)	0.000096	Area (sq ft)	1754.81	7031.34	2174.37
Q Total (cfs)	20000.00	Flow (cfs)	475.82	18369.34	1154.84
Top width (ft)	1286.35	Top width (ft)	488.57	328.00	469.77
vel Total (ft/s)	1.82	Avg. Vel. (ft/s)	0.27	2.61	0.53
Max chl Dpth (ft)	27.87	Hydr. Depth (ft)	3.59	21.44	4.63
Conv. Total (cfs)	2042639.0	Conv. (cfs)	48596.6	1876096.0	117946.3
Length wtd. (ft)	3958.34	wetted Per. (ft)	489.73	338.48	470.52
Min Ch El (ft)	49.84	Shear (lb/sq ft)	0.02	0.12	0.03
Alpha	1.89	Stream Power (lb/ft s)	1330.00	0.00	0.00
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	31146.42	64648.30	28698.80
C & E Loss (ft)	0.01	Cum SA (acres)	12589.96	3319.10	12983.99

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

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 120.38

INPUT									
Description: XS 120.38 "S" NAVD 88									
Station Elevation Data num= 54									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	81.04	5	80.44	22	75.64	50	73.64	76	68.54
94.2	68.54	127	74.34	334	74.84	370	74.74	377	78.34
390	76.14	398	78.94	412	71.74	470	71.14	3338	71.84
3394	72.04	3409	69.14	3419	59.24	3429	55.54	3439	52.64
3449	52.24	3459	52.24	3469	51.94	3479	51.64	3489	51.64
3499	51.74	3509	51.94	3519	52.04	3529	52.04	3539	52.24
3549	52.04	3559	52.44	3569	52.34	3579	52.74	3589	52.74
3599	53.34	3609	54.74	3619	56.24	3630	59.24	3631	59.74
3673	59.54	3693	61.64	3715	69.54	3723	70.44	3729	74.54
3764	75.24	3920	73.14	3946	72.74	3963	69.34	3987	72.04
4001	66.44	4009	66.84	4038	77.64	4055	76.84		

Manning's n Values					num= 6				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.164	3338	.164	3394	.066	3419	.025	3630	.066
3723	.073								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
3394	3723	4625	13250	5750	.1		.3
Blocked Obstructions num= 3							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
5	398	78.94	398	3394	72.04		
				3764	75.24		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	77.45	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.07	Wt. n-Val.	0.164	0.042	0.073
W.S. Elev (ft)	77.38	Reach Len. (ft)	4625.00	13250.00	5750.00
Crit W.S. (ft)		Flow Area (sq ft)	15960.90	6783.74	698.98
E.G. Slope (ft/ft)	0.000081	Area (sq ft)	15960.90	6783.74	698.98

Q Total (cfs)	20000.00	Flow (cfs)	3968.37	15815.79	215.84
Top Width (ft)	3647.80	Top width (ft)	2992.97	329.00	325.83
Vel Total (ft/s)	0.85	Avg. Vel. (ft/s)	0.25	2.33	0.31
Max chl Dpth (ft)	25.74	Hydr. Depth (ft)	5.33	20.62	2.15
Conv. Total (cfs)	2224019.0	Conv. (cfs)	441285.9	1758731.0	24001.8
Length Wtd (ft)	11611.29	Wetted Per. (ft)	2994.26	336.75	328.04
Min ch El (ft)	51.64	Shear (lb/sq ft)	0.03	0.10	0.01
Alpha	5.92	Stream Power (lb/ft s)	4055.00	0.00	0.00
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	30409.28	64014.00	28566.88
C & E Loss (ft)	0.00	Cum SA (acres)	12445.09	3288.94	12947.46

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 117.87

INPUT
Description: XS 117.87 "R" NAVD 88

Station	Elevation	Data	num=	48			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	80.34	12	80.14	41.3	73.34	71.4	72.54
121	67.44	179	66.74	686	67.44	713	71.84
4573	72.94	4593	74.64	4600	71.24	4648	71.44
4716	69.44	4725	65.24	4739	63.44	4744	58.54
4755	52.04	4765	49.54	4775	49.34	4785	50.04
4805	50.84	4815	50.74	4825	50.74	4835	50.74
4855	50.04	4865	50.24	4875	50.54	4885	50.74
4905	50.84	4915	51.74	4925	53.54	4935	56.54
4953	62.84	4964	67.74	4981	73.84	5008	74.34
5114	72.64	5131	77.34	5142	77.74		

Manning's n values	num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.163	4648	.163	4695	.066	4744	.025
4981	.071					4944	.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
4695	4981		5250	3550		.1	.3
Blocked Obstructions	num=	2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
0	4573	72.94	5008	5142	74.34		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	76.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.163	0.040	0.071
W.S. Elev (ft)	76.24	Reach Len. (ft)	5250.00	3550.00	3750.00
Crit W.S. (ft)		Flow Area (sq ft)	15497.26	5762.66	277.64
E.G. Slope (ft/ft)	0.000114	Area (sq ft)	15497.26	5762.66	277.64
Q Total (cfs)	20000.00	Flow (cfs)	3361.04	16543.83	95.13
Top width (ft)	5098.22	Top width (ft)	4666.20	286.00	146.02
Vel Total (ft/s)	0.93	Avg. Vel. (ft/s)	0.22	2.87	0.34
Max chl Dpth (ft)	26.90	Hydr. Depth (ft)	3.32	20.15	1.90
Conv. Total (cfs)	1872746.0	Conv. (cfs)	314718.8	1549119.0	8907.3
Length wtd. (ft)	3727.82	Wetted Per. (ft)	4667.39	295.69	146.28
Min ch El (ft)	49.34	Shear (lb/sq ft)	0.02	0.14	0.01
Alpha	7.92	Stream Power (lb/ft s)	5142.00	0.00	0.00
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	28739.24	62105.83	28502.42
C & E Loss (ft)	0.00	Cum SA (acres)	12038.49	3195.40	12916.32

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 117.2

INPUT
Description: XS 117.2 NAVD 88

Station	Elevation	Data	num=	43			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8	79.94	20	79.94	60	68.14	109	67.64
3370	71.74	3386	72.14	3391	74.14	3409	68.04
3443	67.74	3452	62.94	3463	57.29	3469.5	53.75
3483	48.34	3493	47.84	3503	47.84	3513	46.84
3533	47.84	3543	47.84	3553	47.84	3563	48.34
3583	47.34	3593	48.34	3603	48.84	3613	49.04
3633	49.84	3643	51.04	3649.5	53.77	3653	55.24
3667	61.64	3677	69.54	3688	72.34	3731	72.64
3872	72.64	3879	78.14	3894	78.64		

Manning's n values	num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
8	.167	3358	.167	3391	.066	3463	.025
						3658	.066

3688	.068						
Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	3391	3688	2310	2575		.1	.3
Blocked Obstructions	num=	2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
8	3391	74.14	3688	3894	72.34		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	75.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.167	0.042	0.068
W.S. Elev (ft)	75.73	Reach Len. (ft)	2310.00	2575.00	2750.00
Crit W.S. (ft)		Flow Area (sq ft)	5337.79	6108.11	619.43
E.G. Slope (ft/ft)	0.000142	Area (sq ft)	5337.79	6108.11	619.43
Q Total (cfs)	20000.00	Flow (cfs)	770.04	18874.55	355.41
Top width (ft)	3841.67	Top width (ft)	3356.73	297.00	187.93
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.14	3.09	0.57
Max chl Dpth (ft)	28.89	Hydr. Depth (ft)	1.59	20.57	3.30
Conv. Total (cfs)	1680477.0	Conv. (cfs)	64701.9	1585912.0	29863.0
Length wtd. (ft)	2567.47	Wetted Per. (ft)	3356.96	308.24	189.02
Min ch El (ft)	46.84	Shear (lb/sq ft)	0.01	0.18	0.03
Alpha	3.28	Stream Power (lb/ft s)	3894.00	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	27483.68	61622.12	28463.80
C & E Loss (ft)	0.00	Cum SA (acres)	11555.01	3171.65	12901.95

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 116.5

INPUT

Description: XS 116.5 "Q" NAVD 88

Station	Elevation	Data	num=	48			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	85.04	32	83.24	103	79.04	187	68.44
968	71.94	1242	70.94	1264	70.74	1278	70.84
1296	71.94	1307	71.84	1325	67.24	1353	67.24
1417	70.04	1421	69.74	1431	63.34	1443	58.94
1454	56.54	1464	54.54	1474	51.54	1484	50.74
1504	47.74	1514	49.54	1524	48.84	1534	47.54
1554	47.74	1564	47.84	1574	48.04	1584	48.34
1604	48.54	1614	49.24	1624	51.04	1634	52.04
1647	57.54	1651	60.84	1667	68.94	1714	76.24
2521	69.44	2541	78.14	2556	78.44		

Manning's n values	num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.13	1379	.13	1417	.066	1448	.025
1667	.068					1647	.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
1417	1667		2315	2250		.1	.3
Blocked Obstructions	num=	2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
103	1288	73.34	1307	1417	70.04	1714	2541

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	75.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.130	0.036	0.068
W.S. Elev (ft)	75.37	Reach Len. (ft)	2315.00	2250.00	1875.00
Crit W.S. (ft)		Flow Area (sq ft)	2964.77	5633.88	132.92
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	2964.77	5633.88	132.92
Q Total (cfs)	20000.00	Flow (cfs)	644.66	19288.71	66.63
Top width (ft)	1576.25	Top width (ft)	1284.88	250.00	41.37
Vel Total (ft/s)	2.29	Avg. Vel. (ft/s)	0.22	3.42	0.50
Max chl Dpth (ft)	27.83	Hydr. Depth (ft)	2.31	22.54	3.21
Conv. Total (cfs)	1883166.0	Conv. (cfs)	60700.1	1816191.0	6274.1
Length wtd. (ft)	2252.42	Wetted Per. (ft)	1285.36	258.60	41.87
Min ch El (ft)	47.54	Shear (lb/sq ft)	0.02	0.15	0.02
Alpha	2.16	Stream Power (lb/ft s)	2556.00	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	27263.54	61275.06	28440.06
C & E Loss (ft)	0.01	Cum SA (acres)	11431.94	3155.48	12894.71

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 116.1

INPUT

Description: XS 116.1 NAVD 88

Station	Elevation	Data	num=	49			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
28	84.74	200	84.74	400	84.74	1343	84.74
1376	72.14	1404	70.34	1429	66.54	1546	66.14
1554	66.14	1560	66.04	1575	57.35	1585	54.34

1595	52.64	1605	51.64	1615	51.64	1625	50.64	1635	50.34
1645	49.84	1655	49.04	1665	48.64	1675	47.84	1685	47.64
1695	47.64	1705	46.84	1715	46.64	1725	46.34	1735	45.84
1745	45.84	1755	46.34	1765	46.64	1775	52.04	1776.5	53.04
1783	57.35	1801	61.84	1813	63.14	1823	67.64	1833	71.14
1858	75.84	1868	73.84	1878	76.64	1888	72.74	1908	72.74
2518	70.64	2521	70.64	2544	78.44	2554	78.44		

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
28	.1	1343	.1	1376	.066	1575	.025	1783	.066
1858	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1546	1858		1750	1935		.1	.3
Blocked Obstructions								
Sta L	Sta R	Elev	num=	Sta L	Sta R	Elev		
28	1376	71.78	2	1858	2554	75.48		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	75.26	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.13	Wt. n-Val.	0.066	0.041	
W.S. Elev (ft)	75.13	Reach Len. (ft)	1750.00	1935.00	2125.00
Crit W.S. (ft)		Flow Area (sq ft)	1278.91	6321.59	
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	1278.91	6321.59	
Q Total (cfs)	20000.00	Flow (cfs)	1227.93	18772.07	
Top width (ft)	478.47	Top width (ft)	170.24	308.23	
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)	0.96	2.97	
Max Chl Dpth (ft)	29.29	Hydr. Depth (ft)	7.51	20.51	
Conv. Total (cfs)	1794817.0	Conv. (cfs)	110195.4	1684622.0	
Length wtd. (ft)	1933.06	wetted Per. (ft)	173.70	317.67	
Min Ch El (ft)	45.84	Shear (lb/sq ft)	0.06	0.15	
Alpha	1.20	Stream Power (lb/ft s)	2554.00	0.00	0.00
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	27150.77	60966.29	28437.20
C & E Loss (ft)	0.00	Cum SA (acres)	11393.27	3141.06	12893.82

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 115.7

INPUT									
Description:	XS 115.7	NAVD 88							
Station Elevation Data	num=	48							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	80.74	200	80.74	400	80.74	1168	80.74	1201	80.74
1237	80.74	1238	71.84	1379	71.34	1393	70.34	1415	59.04
1418	56.84	1428	52.34	1428.9	52.16	1438	50.34	1448	49.54
1458	49.34	1468	48.84	1478	49.14	1488	49.14	1498	49.14
1508	48.84	1518	48.14	1528	48.54	1538	48.84	1548	49.34
1558	50.34	1568	50.34	1578	50.54	1588	50.84	1598	51.84
1599.3	52.17	1608	54.34	1618	56.54	1620	56.84	1642	58.94
1657	66.04	1679	68.24	1698	67.74	1786	67.44	1833	71.74
1910	72.74	1920	74.14	1926	72.04	1934	74.44	1941	71.24
2567	67.34	2589	77.24	2603	77.64				

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1168	.052	1201	.066	1418	.025	1620	.066
1934	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1393	1657		3750	3935		.1	.3
Blocked Obstructions								
Sta L	Sta R	Elev	num=					
1934	2603	74.44	1					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	75.03	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.15	Wt. n-Val.	0.066	0.037	
W.S. Elev (ft)	74.88	Reach Len. (ft)	3750.00	3935.00	3750.00
Crit W.S. (ft)		Flow Area (sq ft)	519.59	5780.33	1718.70
E.G. Slope (ft/ft)	0.000111	Area (sq ft)	519.59	5780.33	1718.70
Q Total (cfs)	20000.00	Flow (cfs)	272.16	18676.51	1051.34
Top width (ft)	1346.10	Top width (ft)	155.34	264.00	926.76
Vel Total (ft/s)	0.52	Avg. Vel. (ft/s)	0.52	3.23	0.61
Max Chl Dpth (ft)	26.74	Hydr. Depth (ft)	3.34	21.90	1.85
Conv. Total (cfs)	1900417.0	Conv. (cfs)	25860.4	1774658.0	99899.1
Length wtd. (ft)	3921.70	wetted Per. (ft)	158.08	271.18	927.98
Min Ch El (ft)	48.14	Shear (lb/sq ft)	0.02	0.15	0.01
Alpha	1.57	Stream Power (lb/ft s)	2603.00	0.00	0.00
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	27114.64	60697.50	28395.27
C & E Loss (ft)	0.00	Cum SA (acres)	11386.73	3128.35	12871.21

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 115

INPUT									
Description:	XS 115	NAVD 88							
Station Elevation Data	num=	41							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	77.54	17	77.54	999	77.54	1000	69.14	1877	70.14
1891	70.64	1896	74.44	1905	71.14	1912	75.24	1930	75.54
1956	74.54	1976	70.44	1982	62.44	1998	60.44	2003	56.12
2010	53.04	2012.4	51.86	2020	48.14	2030	44.14	2040	40.64
2050	37.44	2060	36.14	2070	36.14	2080	37.64	2090	39.64
2100	41.14	2110	43.64	2120	47.64	2130	48.64	2140	50.14
2145.8	51.88	2150	53.14	2157	56.12	2170	61.44	2188	62.34
2215	68.34	2226	68.34	2657	72.54	3420	68.74	3443	78.24
3454	78.24								

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
5	.109	1912	.109	1956	.066	2003	.025	2157	.066
2226	.074								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1956	2215		2250	1810		.1	.3
Blocked Obstructions								
Sta L	Sta R	Elev	num=	Sta L	Sta R	Elev		
5	1930	75.54	2	2657	3454	72.54		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	74.52	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.15	Wt. n-Val.	0.066	0.044	0.074
W.S. Elev (ft)	74.36	Reach Len. (ft)	2250.00	1810.00	1500.00
Crit W.S. (ft)		Flow Area (sq ft)	5688.81	3171.12	3171.12
E.G. Slope (ft/ft)	0.000162	Area (sq ft)	5688.81	3171.12	
Q Total (cfs)	20000.00	Flow (cfs)	18448.32	1551.62	
Top width (ft)	1476.76	Top width (ft)	258.15	1218.62	
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	3.24	0.49	
Max Chl Dpth (ft)	38.22	Hydr. Depth (ft)	22.04	2.60	
Conv. Total (cfs)	1571493.0	Conv. (cfs)	1449571.0	121922.5	
Length wtd. (ft)	1779.89	wetted Per. (ft)	272.45	1219.00	
Min Ch El (ft)	36.14	Shear (lb/sq ft)	0.21	0.03	
Alpha	1.91	Stream Power (lb/ft s)	3454.00	0.00	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	27092.28	60179.46	28184.79
C & E Loss (ft)	0.00	Cum SA (acres)	11380.05	3104.77	12778.87

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 114.8

INPUT									
Description:	XS 114.8	NAVD 88							
Station Elevation Data	num=	37							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	77.24	2000	77.24	4217	77.24	4250	77.24	4336	77.24
4337	69.54	4343	64.14	4357	61.64	4363	56.24	4373	53.64
4383	53.24	4393	52.94	4398	51.44	4403	49.94	4413	49.64
4423	49.64	4433	49.64	4443	49.64	4453	49.64	4463	49.24
4473	49.24	4483	48.94	4493	48.64	4503	47.94	4513	47.64
4523	46.94	4533	47.24	4543	49.84	4547.2	51.44	4553	53.64
4558	56.24	4565	60.24	4576	62.54	4584	70.54	4678	70.84
5903	70.84	5928	78.24						

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	4217	.14	4250	.066	4363	.025	4558	.066
4584	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	4337	4584		750	720		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	74.26	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.15	Wt. n-Val.	0.066	0.037	0.067
W.S. Elev (ft)	74.11	Reach Len. (ft)	750.00	720.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	1.36	5294.56	4346.06
E.G. Slope (ft/ft)	0.000121	Area (sq ft)	1.36	5294.56	4346.06
Q Total (cfs)	20000.00	Flow (cfs)	0.15	17666.17	2333.68
Top width (ft)	1577.64	Top width (ft)	0.59	247.00	1330.05
Vel Total (ft/s)	2.07	Avg. Vel. (ft/s)	0.11	3.34	0.54
Max Chl Dpth (ft)	27.17	Hydr. Depth (ft)	2.29	21.44	3.27
Conv. Total (cfs)	1818528.0	Conv. (cfs)	13.5	1606321.0	212193.1
Length wtd. (ft)	717.57	wetted Per. (ft)	4.61	258.51	1330.52
Min Ch El (ft)	46.94	Shear (lb/sq ft)	0.00	0.15	0.02
Alpha	2.29	Stream Power (lb/ft s)	5928.00	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	27092.24	59951.27	28055.37
C & E Loss (ft)	0.02	Cum SA (acres)	11380.03	3094.27	12734.98

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 114.65

INPUT									
Description: XS 114.65 NAVD 88									
Station Elevation Data num= 36									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	77.14	4799	77.14	4800	69.04	4942	69.53	4975	69.64
5000	74.04	5019	64.64	5051	56.64	5093	55.04	5100	51.49
5101	51.29	5110	49.54	5120	48.74	5130	48.04	5140	47.54
5150	47.24	5160	46.84	5170	46.84	5180	46.84	5190	46.04
5200	45.54	5210	45.04	5220	43.84	5230	43.54	5240	43.24
5250	42.54	5260	42.74	5270	45.74	5280	50.54	5283	51.49
5302	67.04	5323	71.04	5340	70.04	5450	70.64	7075	70.64
7100	78.24								

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.174	4942	.174	4975	.066	5100	.066
5323	.068						

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
5000		5323		2000	4655		.1	.3

Blocked Obstructions					
num= 2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	5000	74.04	5323	7100	71.04

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	74.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	wt. n-Val.	0.145	0.046	0.068
W.S. Elev (ft)	74.07	Reach Len. (ft)	2000.00	4655.00	4550.00
Crit W.S. (ft)	0.000107	Flow Area (sq ft)	7.02	6912.30	5336.42
E.G. Slope (ft/ft)	0.000107	Area (sq ft)	7.02	6912.30	5336.42
Q Total (cfs)	20000.00	Flow (cfs)	0.08	17477.28	2522.64
Top width (ft)	2286.92	Top width (ft)	200.62	323.00	1763.30
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	0.01	2.53	0.47
Max chl Dpth (ft)	31.53	Hydr. depth (ft)	0.03	21.40	3.03
Conv. Total (cfs)	1933983.0	Conv. (cfs)	7.7	1690039.0	243937.0
Length wtd. (ft)	4468.91	Wetted Per. (ft)	200.65	335.11	1763.75
Min ch El (ft)	42.54	Shear (lb/sq ft)	0.00	0.14	0.02
Alpha	2.11	Stream Power (lb/ft s)	7100.00	0.00	0.00
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	27092.17	59850.39	27977.57
C & E Loss (ft)	0.01	Cum SA (acres)	11378.30	3089.56	12710.13

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 114.1

INPUT									
Description: XS 114.1 "P" NAVD 88									
Station Elevation Data num= 65									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	76.36	3.48	77.52	4.96	77.52	12.96	77.68	20.96	77.52
22.45	77.52	47.83	69.06	72	61.54	5399	67.74	5414	79.24
5436	67.64	5457	66.74	5466	60.94	5531	60.94	5540	68.94
5552	70.04	5564	73.54	5575	73.54	5587	75.64	5625	62.34
6297	66.64	8478	71.19	8528	72.14	8578	70.04	8651	71.44
8698	67.94	8714	69.44	8729	67.94	8751	68.04	8774	70.64
8798	66.24	8812	68.34	8919	66.44	8932	61.74	8942	55.44
8956	52.04	8959	51.14	8969	49.04	8979	47.54	8989	47.04
8999	46.64	9009	46.34	9019	46.24	9029	46.04	9039	45.84
9049	45.54	9059	45.34	9069	45.04	9079	44.44	9089	43.94
9099	43.24	9109	42.84	9119	42.04	9129	44.04	9139	48.04
9146	52.04	9164	61.14	9179	69.74	9206	68.84	9220	74.84
9263	70.54	9647	69.44	9673	69.94	9686	69.54	9700	69.74

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.11	8651	.11	8698	.066	8956	.025
9206	.071					9146	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
8698		9206		7750	10000		.1	.3

Blocked Obstructions					
num= 2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	8528	72.14	9220	9700	74.84

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	73.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	wt. n-Val.	0.110	0.053	0.071
W.S. Elev (ft)	73.48	Reach Len. (ft)	7750.00	10000.00	1875.00
Crit W.S. (ft)		Flow Area (sq ft)	11805.70	7557.40	25.12

E.G. Slope (ft/ft)	0.000186	Area (sq ft)	11805.70	7557.40	25.12
Q Total (cfs)	20000.00	Flow (cfs)	2703.29	17284.84	11.87
Top width (ft)	9134.45	Top width (ft)	8615.62	508.00	10.83
Vel Total (ft/s)	1.03	Avg. Vel. (ft/s)	0.23	2.29	0.47
Max chl Dpth (ft)	31.44	Hydr. depth (ft)	1.37	1.88	2.32
Conv. Total (cfs)	1467648.0	Conv. (cfs)	198373.8	1268404.0	871.0
Length wtd. (ft)	9238.29	Wetted Per. (ft)	8617.23	519.02	11.78
Min ch El (ft)	42.04	Shear (lb/sq ft)	0.02	0.17	0.02
Alpha	4.26	Stream Power (lb/ft s)	9700.00	0.00	0.00
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	26820.99	59077.25	27697.55
C & E Loss (ft)	0.00	Cum SA (acres)	11175.91	3045.16	12617.47

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 112.2

INPUT									
Description: XS 112.2 NAVD 88									
Station Elevation Data num= 55									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
22	75.04	32	75.04	3599	75.04	3600	65.54	4049	66.04
4128	63.64	4132	58.04	4162	58.14	4177	65.44	4216	67.54
4270	73.04	4293	73.04	4335	67.34	4363	67.34	5420	67.84
5550	68.54	5569	71.04	5575	69.04	5579	70.74	5621	68.94
5965	68.24	6071	69.84	6188	69.24	6873	66.19	6906	66.04
7049	67.04	7070	58.64	7084	50.91	7087	49.55	7095	45.94
7105	44.64	7115	43.94	7125	42.94	7135	43.44	7145	42.64
7155	41.64	7165	41.64	7175	40.84	7185	40.84	7195	41.94
7205	43.94	7215	46.64	7221.8	49.54	7225	50.91	7230	54.74
7243	57.04	7252	62.04	7258	63.04	7265	70.04	7276	70.34
7328	69.34	10233	66.84	10269	66.74	10287	77.34	10301	78.34

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
22	.075	6873	.075	6906	.066	7084	.025
7265	.074					7225	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
7049		7265		5625	3750		.1	.3

Blocked Obstructions					
num= 2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev
22	5569	71.04	7265	10301	70.04

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	72.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	wt. n-Val.	0.073	0.042	0.074
W.S. Elev (ft)	72.04	Reach Len. (ft)	5625.00	3750.00	3250.00
Crit W.S. (ft)		Flow Area (sq ft)	7763.48	4938.11	6007.72
E.G. Slope (ft/ft)	0.000120	Area (sq ft)	7763.48	4938.11	6007.72
Q Total (cfs)	20000.00	Flow (cfs)	3249.55	14660.84	2089.61
Top width (ft)	6638.43	Top width (ft)	3409.44	216.00	3012.99
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	0.42	2.97	0.35
Max chl Dpth (ft)	31.20	Hydr. depth (ft)	2.28	22.86	1.99
Conv. Total (cfs)	1828912.0	Conv. (cfs)	297156.8	1340670.0	191085.3
Length wtd. (ft)	3868.22	Wetted Per. (ft)	3411.19	228.23	3013.55
Min ch El (ft)	40.84	Shear (lb/sq ft)	0.02	0.16	0.01
Alpha	5.69	Stream Power (lb/ft s)	10301.00	0.00	0.00
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	25080.16	57642.96	27567.71
C & E Loss (ft)	0.01	Cum SA (acres)	10106.18	2962.06	12552.39

Warning: Divided flow computed for this cross-section.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 111.5

INPUT									
Description: XS 111.5 NAVD 88									
Station Elevation Data num= 55									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	74.51	2.88	74.51	7.48	74.85	15.48	75.01	23.48	74.85
24.98	74.85	39.83	69.9	57	66.14	135	64.24	140	64.74
1727	68.14	1749	69.29	1750	69.34	1760	72.64	1765	72.84
1773	70.14	1782	72.24	1795	69.84	1829	67.24	1840	57.74
1846	57.74	1857	51.52	1860	50.54	1862.1	49.03	1870	43.34
1880	40.34	1890	38.54	1900	37.54	1910	38.64	1920	41.64
1930	43.24	1940	44.54	1950	45.24	1960	46.04	1970	46.04
1980	46.84	1990	47.54	2000	48.54	2003.7	49.02	2010	49.84
2021	51.52	2052	59.24	2058	62.64	2076	67.54	2113	67.54
2140	69.94	2484	69.14	2505	69.14	3282	67.34	3398	64.74
3433	61.14	3479	63.94	3503	68.84	3521	77.34	3534	77.84

Manning's n Values			num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	
0	.076	1749	.076	1782	.066	1857	.025	2021	.066	
2140	.067									
Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan	
	1829	2076		3625	4125	5000		.1	.3	
Blocked Obstructions	num=			2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev					
0	1765	72.84	2140	3534	69.94					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	71.59	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	Wt. n-Val.	0.066	0.042	0.067
W.S. Elev (ft)	71.41	Reach Len. (ft)	3625.00	4125.00	5000.00
Crit W.S. (ft)		Flow Area (sq ft)	122.03	5457.05	2228.42
E.G. Slope (ft/ft)	0.000165	Area (sq ft)	122.03	5457.05	2228.42
Q Total (cfs)	20000.00	Flow (cfs)	64.63	19054.81	880.56
Top width (ft)	1732.92	Top width (ft)	53.47	247.00	1432.45
Vel Total (ft/s)	2.36	Avg. Vel. (ft/s)	0.53	3.49	0.40
Max Chl Dpth (ft)	33.87	Hydr. Depth (ft)	2.28	22.09	1.56
Conv. Total (cfs)	1558477.0	Conv. (cfs)	5036.1	1484825.0	68616.6
Length wtd. (ft)	4145.92	wetted Per. (ft)	54.14	258.89	1432.89
Min Ch El (ft)	37.54	Shear (lb/sq ft)	0.02	0.22	0.02
Alpha	1.77	Stream Power (lb/ft s)	3534.00	0.00	0.00
Frctn Loss (ft)	0.66	Cum Volume (acre-ft)	24571.02	57195.51	27260.47
C & E Loss (ft)	0.00	Cum SA (acres)	9882.60	2942.13	12386.56

Warning: Divided flow computed for this cross-section.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 110.7

INPUT
Description: XS 110.7 NAVD 88

Station Elevation Data		num=	46						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	74.74	11	74.74	21	73.94	40	67.64	246	67.24
266	67.44	284	70.84	307	63.84	347	62.04	366	65.14
394	51.33	401.8	48.22	404	47.34	414	45.04	424	43.04
434	42.74	444	42.74	454	42.74	464	42.74	474	43.04
484	42.74	494	42.74	504	43.04	514	43.34	524	43.64
534	43.84	544	44.04	554	44.84	562.9	48.22	564	48.64
571	51.32	583	54.84	598	65.04	618	68.64	672	70.04
700	69.04	1430	68.84	1456	66.94	1814	64.24	2638	60.74
2652	61.54	2803	65.74	2977	65.24	3286	68.74	3306	78.04
3317	78.04								

Manning's n values			num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	
0	.084	246	.084	284	.066	394	.025	571	.066	
672	.074									
Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan	
	366	618		4500	6010	4875	.1	.3		
Blocked Obstructions	num=		2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev					
0	284	70.84	672	3317	70.04					

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	70.94	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	Wt. n-Val.	0.066	0.040	0.073
W.S. Elev (ft)	70.76	Reach Len. (ft)	4500.00	6010.00	4875.00
Crit W.S. (ft)		Flow Area (sq ft)	527.57	5501.55	1956.91
E.G. Slope (ft/ft)	0.000151	Area (sq ft)	527.57	5501.55	1956.91
Q Total (cfs)	20000.00	Flow (cfs)	501.32	19099.32	399.36
Top width (ft)	3006.07	Top width (ft)	81.73	252.00	2672.34
Vel Total (ft/s)	2.50	Avg. Vel. (ft/s)	0.95	3.47	0.20
Max Chl Dpth (ft)	28.02	Hydr. Depth (ft)	6.45	21.83	0.73
Conv. Total (cfs)	1625260.0	Conv. (cfs)	40738.8	1552068.0	32453.4
Length wtd. (ft)	5940.73	wetted Per. (ft)	83.05	261.67	2672.52
Min Ch El (ft)	42.74	Shear (lb/sq ft)	0.06	0.20	0.01
Alpha	1.84	Stream Power (lb/ft s)	3317.00	0.00	0.00
Frctn Loss (ft)	0.74	Cum Volume (acre-ft)	24343.99	56676.64	27020.26
C & E Loss (ft)	0.02	Cum SA (acres)	9876.97	2918.50	12150.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 109.5

INPUT
Description: XS 109.5 NAVD 88

Station Elevation Data		num=	47						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	74.44	13	74.44	62	66.04	107	64.04	920	65.84
988	65.64	2115	66.74	2125	66.66	2140	66.54	2152	68.84
2168	68.84	2188	63.64	2246	63.14	2252	51.27	2257	49.74
2262.3	47.35	2267	43.24	2277	43.24	2287	41.24	2297	40.74
2307	41.24	2317	41.94	2327	42.24	2337	41.64	2347	41.64
2357	41.24	2367	40.94	2377	41.24	2387	40.94	2397	41.64
2407	41.64	2417	41.64	2427	41.94	2437	42.64	2447	45.64
2454.8	47.36	2457	47.84	2467	49.94	2474	51.27	2505	58.74
2525	64.44	2546	64.94	2562	69.24	2581	68.54	3067	67.34
3091	78.34	3104	78.54						

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
6	.068	2125	.068	2168	.066	2252	.025	2474	.066
2562	.074								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	2246	2562		750	1725	2000		.1	.3
Blocked Obstructions	num=		2						
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
6	2168	68.84	2562	3104	69.24				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	70.18	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.11	Wt. n-Val.	0.067	0.040	0.074
W.S. Elev (ft)	70.07	Reach Len. (ft)	750.00	1725.00	2000.00
Crit W.S. (ft)		Flow Area (sq ft)	3072.16	6858.88	421.78
E.G. Slope (ft/ft)	0.000097	Area (sq ft)	3072.16	6858.88	421.78
Q Total (cfs)	20000.00	Flow (cfs)	978.21	18948.42	73.38
Top width (ft)	3034.44	Top width (ft)	2207.49	316.00	510.95
Vel Total (ft/s)	1.93	Avg. Vel. (ft/s)	0.32	2.76	0.17
Max Chl Dpth (ft)	29.33	Hydr. Depth (ft)	1.39	21.71	0.83
Conv. Total (cfs)	2030782.0	Conv. (cfs)	99326.0	1924005.0	7451.0
Length wtd. (ft)	1710.95	wetted Per. (ft)	2208.26	328.32	511.13
Min Ch El (ft)	40.74	Shear (lb/sq ft)	0.01	0.13	0.00
Alpha	1.94	Stream Power (lb/ft s)	3104.00	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	24358.06	55823.95	26887.16
C & E Loss (ft)	0.00	Cum SA (acres)	9758.73	2879.32	11972.85

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 109.2

INPUT
Description: XS 109.2 NAVD 88

Station Elevation Data		num=	30						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	73.94	1352	73.94	1384	73.94	1385	69.04	1413	50.74
1415	48.54	1420.1	47.11	1425	45.74	1435	44.74	1445	44.74
1455	42.24	1465	40.34	1475	39.74	1485	39.74	1495	39.74
1505	40.34	1515	39.74	1525	40.34	1535	40.34	1545	40.74
1555	43.44	1562.5	47.11	1565	48.34	1566	50.74	1775	64.44
1787	68.44	1800	68.24	1976	68.04	4251	68.04	4276	78.24

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.094	1352	.094	1385	.066	1413	.025	1566	.066
1787	.067								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	1385	1787		375	500	500		.1	.3
Blocked Obstructions			num=	1					
Sta L	Sta R	Elev							
1787	4276	68.44							

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	69.95	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.10	Wt. n-Val.	0.094	0.052	0.067
W.S. Elev (ft)	69.86	Reach Len. (ft)	375.00	500.00	500.00
Crit W.S. (ft)		Flow Area (sq ft)	0.07	7118.59	3491.46
E.G. Slope (ft/ft)	0.000192	Area (sq ft)	0.07	7118.59	3491.46
Q Total (cfs)	20000.00	Flow (cfs)	0.00	18648.54	1351.46
Top width (ft)	2870.62	Top width (ft)	0.17	402.00	2468.45
Vel Total (ft/s)	1.88	Avg. Vel. (ft/s)	0.04	2.62	0.39
Max Chl Dpth (ft)	30.12	Hydr. Depth (ft)	0.41	17.71	1.41
Conv. Total (cfs)	1443811.0	Conv. (cfs)	0.2	1346248.0	97562.5
Length wtd. (ft)	500.00	wetted Per. (ft)	0.83	413.62	2468.73
Min Ch El (ft)	39.74	Shear (lb/sq ft)	0.00	0.21	0.02
Alpha	1.80	Stream Power (lb/ft s)	4276.00	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	24331.61	55547.19	26797.32
C & E Loss (ft)	0.01	Cum SA (acres)	9739.72	2865.10	11904.45

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 109.1

INPUT
Description: XS 109.1 NAVD 88

Station Elevation Data		num=	34				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	73.74	964	73.74	996	73.74	997	69.14
1016	64.84	1025	64.84	1046	56.64	1060.6	47.04
1065	45.14	1075	42.84	1085	41.14	1095	41.64
1115	41.64	1125	40.64	1135	39.84	1145	38.64
1165	37.64	1175	36.64	1185	37.64	1195	38.64
1209	46.12	1212.4	47.06	1217	48.34	1223	53.44
1262	66.14	1270	65.14	4345	65.14	4370	78.14

Manning's n Values		num=	6				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.2	964	.2	997	.066	1062	.025
1262	.061						

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1000	1262		4000	3250	1625		
Blocked Obstructions	num=		1					
Sta L	Sta R	Elev						
1262	4370	66.14						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	69.87	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.06	Wt. n-Val.	0.046	0.061	
W.S. Elev (ft)	69.81	Reach Len. (ft)	4000.00	3250.00	1625.00
Crit W.S. (ft)		Flow Area (sq ft)	2.52	5596.38	11330.86
E.G. Slope (ft/ft)	0.000099	Area (sq ft)	2.52	5596.38	11330.86
Q Total (cfs)	20000.00	Flow (cfs)	0.49	13464.32	6535.19
Top width (ft)	3357.12	Top width (ft)	3.15	262.00	3091.98
Vel Total (ft/s)	1.38	Avg. Vel. (ft/s)	0.19	2.41	0.58
Max Chl Dpth (ft)	33.17	Hydr. Depth (ft)	0.80	21.36	3.66
Conv. Total (cfs)	2007398.0	Conv. (cfs)	48.8	1351413.0	655936.8
Length wtd. (ft)	2776.37	wetted Per. (ft)	3.70	274.22	3092.88
Min ch El (ft)	36.64	Shear (lb/sq ft)	0.00	0.13	0.02
Alpha	2.87	Stream Power (lb/ft s)	4370.00	0.00	0.00
Frcn Loss (ft)	0.00	Cum Volume (acre-ft)	24331.60	55474.22	26712.25
C & E Loss (ft)	0.00	Cum SA (acres)	9739.71	2861.29	11872.54

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 108.5

INPUT
Description: XS 108.5 NAVD 88

Station Elevation Data		num=	47				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	73.04	24	73.04	34	72.14	60	64.74
1405	65.04	1424	65.74	1432	66.04	1457	68.74
1484	61.84	1497	63.34	1504	60.34	1513	54.64
1538	47.06	1542	44.34	1550	41.84	1560	41.04
1580	39.64	1590	40.04	1600	39.64	1610	39.44
1630	39.34	1640	39.14	1650	38.94	1660	38.94
1680	40.34	1690	44.34	1693	47.06	1701	50.44
1725	65.34	1740	65.64	1762	62.34	1790	61.04
1851	66.74	2285	67.04	2989	66.04	5341	63.64
6370	77.54	6397	77.94			6299	59.14

Manning's n Values		num=	6				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.105	1424	.105	1457	.066	1538	.025
1725	.067						

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1457	1725		2375	6750	4500		
Blocked Obstructions	num=		2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	1457	68.74	2285	6397	67.04			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	69.57	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.08	Wt. n-Val.	0.105	0.067	
W.S. Elev (ft)	69.50	Reach Len. (ft)	2375.00	6750.00	4500.00
Crit W.S. (ft)		Flow Area (sq ft)	1068.76	5667.23	11724.80
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	1068.76	5667.23	11724.80
Q Total (cfs)	20000.00	Flow (cfs)	134.43	14679.98	5185.59
Top width (ft)	6295.68	Top width (ft)	1413.71	268.00	4613.96
Vel Total (ft/s)	1.08	Avg. Vel. (ft/s)	0.13	0.59	0.44
Max Chl Dpth (ft)	30.56	Hydr. Depth (ft)	0.76	21.15	2.54

Conv. Total (cfs)	1867254.0	Conv. (cfs)	12551.0	1370563.0	484140.3
Length wtd. (ft)	6051.85	wetted Per. (ft)	1413.82	282.34	4615.16
Min ch El (ft)	38.94	Shear (lb/sq ft)	0.01	0.14	0.02
Alpha	4.24	Stream Power (lb/ft s)	6397.00	0.00	0.00
Frcn Loss (ft)	0.78	Cum Volume (acre-ft)	24282.41	55054.03	26282.21
C & E Loss (ft)	0.01	Cum SA (acres)	9674.65	2841.52	11728.80

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 107.6

INPUT
Description: XS 107.6 "o" NAVD 88

Station Elevation Data		num=	42				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	72.64	10	72.34	29	66.64	61	67.04
3747	67.64	3757	67.54	3792	67.44	4330	62.94
4377	63.24	4627	63.24	4662	63.24	4760	58.64
4827	50.74	4849	55.84	4858	54.54	4867	50.64
4885	44.34	4895	42.84	4905	42.34	4915	41.34
4935	40.34	4945	39.84	4955	39.14	4965	38.64
4985	37.64	4995	37.64	5005	40.34	5015	45.34
5040	65.64	5057	66.14	5073	65.04	6371	64.74
7994	76.84	8004	64.64			7949	66.14

Manning's n Values		num=	6				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.105	4627	.105	4662	.066	4878	.025
5040	.071					5015	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	4662	5040		3000	6250	3000		
Blocked Obstructions	num=		3					
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	3747	67.64	3792	4402	65.14	5057	7949	66.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	68.78	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.06	Wt. n-Val.	0.105	0.053	0.071
W.S. Elev (ft)	68.73	Reach Len. (ft)	3000.00	6250.00	3000.00
Crit W.S. (ft)		Flow Area (sq ft)	7229.82	6574.55	7548.16
E.G. Slope (ft/ft)	0.000149	Area (sq ft)	7229.82	6574.55	7548.16
Q Total (cfs)	20000.00	Flow (cfs)	1716.12	14656.24	3627.64
Top width (ft)	7941.18	Top width (ft)	4639.95	378.00	2923.23
Vel Total (ft/s)	0.94	Avg. Vel. (ft/s)	0.24	2.23	0.48
Max Chl Dpth (ft)	31.09	Hydr. Depth (ft)	1.56	17.39	2.58
Conv. Total (cfs)	1638516.0	Conv. (cfs)	140594.2	1200724.0	297197.2
Length wtd. (ft)	5436.48	wetted Per. (ft)	4640.13	391.07	2929.56
Min ch El (ft)	37.64	Shear (lb/sq ft)	0.01	0.16	0.02
Alpha	4.20	Stream Power (lb/ft s)	8004.00	0.00	0.00
Frcn Loss (ft)	0.89	Cum Volume (acre-ft)	24056.18	54105.55	25286.70
C & E Loss (ft)	0.00	Cum SA (acres)	9509.62	2791.47	11339.49

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 106.4

INPUT
Description: XS 106.4 NAVD 88

Station Elevation Data		num=	64				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
7	71.44	20	70.94	52	61.84	116	54.64
231	57.74	1364	58.64	1371	62.34	2217	63.94
2250	64.14	2268	68.94	2275	66.94	2288	60.64
2318	53.84	2326	46.37	2332	42.34	2342	38.34
2362	36.14	2372	35.94	2382	36.34	2392	35.94
2412	35.04	2422	35.34	2432	35.94	2442	38.84
2460	46.37	2506	60.94	2535	57.44	2616	60.94
2664	63.94	2829	64.24	2878	66.24	3429	63.64
3461	63.84	5079	62.84	5163	55.54	5437	58.14
6906	62.74	7298	62.14	7350	54.14	7533	53.94
7838	61.74	7856	58.64	8444	54.94	8494	63
9730	61.34	10225	61.14	10226	79.64	12178	79.64
12576	79.64	14058	79.64	14088	79.64	14103	79.64

Manning's n Values		num=	6				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
7	.101	2235	.101	2268	.066	2326	.025
2638	.074					2460	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	2275	2638		5050	6000	4000		
Blocked Obstructions	num=		1					
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev

Blocked Obstructions		num=	2
Sta L	Sta R	Elev	Elev
7	2268	68.94	2878
Sta L	Sta R	Elev	Elev
14103		66.24	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	67.89	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.07	Wt. n-Val.	0.066	0.053	0.074
W.S. Elev (ft)	67.82	Reach Len. (ft)	5050.00	6000.00	4000.00
Crit W.S. (ft)		Flow Area (sq ft)	1.35	6233.15	12418.87
E.G. Slope (ft/ft)	0.000182	Area (sq ft)	1.35	6233.15	12418.87
Q Total (cfs)	20000.00	Flow (cfs)	0.23	15331.16	4668.60
Top width (ft)	7953.44	Top width (ft)	3.08	363.00	7587.36
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	0.17	2.46	0.38
Max chl Dpth (ft)	32.78	Hydr. Depth (ft)	0.44	17.17	1.64
Conv. Total (cfs)	1483498.0	Conv. (cfs)	17.1	1137188.0	346293.3
Length Wtd. (ft)	5690.64	Wetted Per. (ft)	3.20	376.88	7588.99
Min ch El (ft)	35.04	Shear (lb/sq ft)	0.00	0.19	0.02
Alpha	4.06	Stream Power (lb/ft s)	14103.00	0.00	0.00
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	23807.17	53186.72	24599.13
C & E Loss (ft)	0.01	Cum SA (acres)	9349.74	2738.31	10977.55

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 105.3

INPUT

Description: XS 105.3 "N" NAVD 88

Station Elevation Data		num=	27
Sta	Elev	Sta	Elev
0	70.14	839	69.84
1560	45.54	1610	41.84
1650	29.54	1660	24.54
1700	38.74	1710	39.34
1741	45.54	1757	57.44
2545	63.74	2584	69.04

Manning's n Values		num=	6
Sta	n Val	Sta	n Val
0	.133	1536	.133
1798	.074		

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1566	1798	4825	11690	4500	.1	.3
Blocked Obstructions		num=	1			
Sta L	Sta R	Elev				
1798	2584	63.24				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	66.90	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.17	Wt. n-Val.	0.044	0.074	
W.S. Elev (ft)	66.73	Reach Len. (ft)	4825.00	11690.00	4500.00
Crit W.S. (ft)		Flow Area (sq ft)	5450.03	2605.04	
E.G. Slope (ft/ft)	0.000166	Area (sq ft)	5450.03	2605.04	
Q Total (cfs)	20000.00	Flow (cfs)	18481.58	1518.42	
Top width (ft)	998.93	Top width (ft)	229.92	769.01	
Vel Total (ft/s)	2.48	Avg. Vel. (ft/s)	3.39	0.58	
Max chl Dpth (ft)	42.19	Hydr. Depth (ft)	23.70	3.39	
Conv. Total (cfs)	1553800.0	Conv. (cfs)	1435834.0	117966.2	
Length Wtd. (ft)	10292.63	Wetted Per. (ft)	251.10	769.21	
Min ch El (ft)	24.54	Shear (lb/sq ft)	0.22	0.04	
Alpha	1.73	Stream Power (lb/ft s)	2584.00	0.00	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	23807.10	52382.09	
C & E Loss (ft)	0.03	Cum SA (acres)	9349.56	2697.47	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

Note: need for additional cross sections.
Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 103.1

INPUT

Description: XS 103.1 NAVD 88

Station Elevation Data		num=	65
Sta	Elev	Sta	Elev
10	70.04	23	69.94
511	61.14	621	62.94
680	64.14	793	64.14
4313	60.14	4321	56.84
4973	59.34	5071	59.34
6923	62.38	6956	62.54
7508	60.34	7518	56.04
7585	45.94	7591.6	44.95

7625	40.94	7635	40.14	7645	39.44	7655	38.64	7665	37.14
7675	37.14	7685	36.94	7695	36.44	7705	36.14	7715	36.44
7725	37.24	7735	40.14	7745	44.34	7745.6	44.97	7747	46.45
7763	53.54	7775	57.24	7777	63.94	7798	60.24	8349	63.44
8375	63.94	8401	63.44	9358	59.14	9383	68.94	9398	68.94

Manning's n Values		num=	6
Sta	n Val	Sta	n Val
10	.133	6923	.133
7777	.074		

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
7508	7777	11125	16060	7125	.1	.3
Blocked Obstructions		num=	2			
Sta L	Sta R	Elev	Sta L	Sta R	Elev	
10	6956	62.54	7777	9398	63.94	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	65.55	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.06	Wt. n-Val.	0.107	0.043	0.074
W.S. Elev (ft)	65.49	Reach Len. (ft)	11125.00	16060.00	7125.00
Crit W.S. (ft)		Flow Area (sq ft)	21280.12	5630.28	2472.08
E.G. Slope (ft/ft)	0.000090	Area (sq ft)	21280.12	5630.28	2472.08
Q Total (cfs)	20000.00	Flow (cfs)	5892.81	13478.08	629.11
Top width (ft)	9321.46	Top width (ft)	7455.26	269.00	1597.20
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)	2.85	2.39	0.25
Max chl Dpth (ft)	29.35	Hydr. Depth (ft)	2.85	20.93	1.55
Conv. Total (cfs)	2111288.0	Conv. (cfs)	622071.1	1422805.0	66411.4
Length Wtd. (ft)	14308.22	Wetted Per. (ft)	7457.58	281.44	1597.49
Min ch El (ft)	36.14	Shear (lb/sq ft)	0.02	0.11	0.01
Alpha	8.39	Stream Power (lb/ft s)	9398.00	0.00	0.00
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	22628.53	50895.31	23647.08
C & E Loss (ft)	0.01	Cum SA (acres)	8936.66	2630.53	10471.66

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

Note: need for additional cross sections.
Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 100.1

INPUT

Description: XS 100.1 NAVD 88

Station Elevation Data		num=	76
Sta	Elev	Sta	Elev
25	68.84	799	68.84
1260	59.84	1370	60.84
1560	59.74	1573	58.04
1610	38.24	1620	36.74
1660	37.04	1670	37.04
1710	38.44	1720	38.24
1760	41.44	1762.7	42.01
1957	56.44	1996	62.14
2618	61.64	2808	60.64
3525	60.44	3707	61.84
4416	61.34	4572	62.34
5453	62.44	5649	61.94
6400	61.94	6802	62.04
7417	61.64	7644	60.44
8055	59.84	8267	58.94
8443	65.34		

Manning's n Values		num=	6
Sta	n Val	Sta	n Val
25	.198	1517	.198
2067	.067		

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1550	1785	3625	3875	250	.1	.3
Blocked Obstructions		num=	2			
Sta L	Sta R	Elev	Sta L	Sta R	Elev	
25	1550	62.14	2067	8443	62.54	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	64.13	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.12	Wt. n-Val.	0.198	0.037	0.067
W.S. Elev (ft)	64.01	Reach Len. (ft)	3625.00	3875.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	1401.28	5101.64	10798.83
E.G. Slope (ft/ft)	0.000110	Area (sq ft)	1401.28	5101.64	10798.83
Q Total (cfs)	20000.00	Flow (cfs)	167.05	15966.74	3866.21
Top width (ft)	7628.64	Top width (ft)	750.54	235.00	6643.10
Vel Total (ft/s)	1.16	Avg. Vel. (ft/s)	0.12	3.13	0.36
Max chl Dpth (ft)	27.57	Hydr. Depth (ft)	1.87	21.71	1.63
Conv. Total (cfs)	1906129.0	Conv. (cfs)	15920.9	1521733.0	368475.2
Length Wtd. (ft)	3118.06	Wetted Per. (ft)	752.24	247.02	6643.76
Min ch El (ft)	36.44	Shear (lb/sq ft)	0.01	0.14	0.01
Alpha	5.87	Stream Power (lb/ft s)	8443.00	0.00	0.00

Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	19732.17	48916.95	22561.74
C & E Loss (ft)	0.01	Cum SA (acres)	7888.81	2537.62	9797.73

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 99.51

INPUT
Description: XS 99.51 NAVD 88
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68.54	25	65.64	127	66.74	228	68.14
433	71.54	575	73.14	717	73.94	858	72.74
1250	75.54	1375	75.94	1530	75.04	2285	73.74
2751	72.34	2900	72.34	2978	71.74	2999	72.04
3035	71.04	3061	71.74	3066	68.64	3071	65.64
3080	62.34	3122	62.34	3130	62.34	3155	65.34
3263	57.84	3356	53.94	3432	53.94	3443	45.04
3463	39.74	3466.4	38.82	3473	37.04	3483	35.64
3503	35.64	3513	36.04	3523	36.04	3533	36.64
3553	36.04	3563	36.04	3573	36.64	3583	38.04
3593	41.74	3600	45.04	3607	53.14	3667	56.74
3700	61.34	3790	60.84	7515	60.84	7540	64.74

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.13	3122	.13	3155	.066	3443	.025
3680	.061					3600	.066

Bank Sta: Left 3432 Right 3680 Lengths: Left 625 Channel 1125 Right 125 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 3155 65.34 3680 7540 61.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	63.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	wt. n-Val.	0.066	0.043	0.061
W.S. Elev (ft)	63.65	Reach Len. (ft)	625.00	1125.00	125.00
Crit W.S. (ft)		Flow Area (sq ft)	1624.74	4940.93	8897.40
E.G. Slope (ft/ft)	0.000133	Area (sq ft)	1624.74	4940.93	8897.40
Q Total (cfs)	20000.00	Flow (cfs)	1571.42	14062.26	4366.33
Top width (ft)	4326.62	Top width (ft)	225.59	248.00	3853.04
Vel Total (ft/s)	1.29	Avg. Vel. (ft/s)	0.97	2.85	0.49
Max chl Dpth (ft)	28.01	Hydr. Depth (ft)	7.20	19.92	2.31
Conv. Total (cfs)	1734345.0	Conv. (cfs)	136268.9	1219440.0	378635.7
Length wtd. (ft)	927.25	Wetted Per. (ft)	225.97	259.09	3853.22
Min ch El (ft)	35.64	Shear (lb/sq ft)	0.06	0.16	0.02
Alpha	3.48	Stream Power (lb/ft s)	7540.00	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	19606.26	48470.27	22505.22
C & E Loss (ft)	0.01	Cum SA (acres)	7848.19	2516.13	9767.61

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 99.4

INPUT
Description: XS 99.4 NAVD 88
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68.44	3417	68.44	3449	68.44	3450	64.44
3496	56.24	3521	57.84	3522	54.04	3547.2	38.78
3557	33.64	3567	31.14	3577	30.84	3587	32.34
3607	32.64	3617	32.34	3627	32.34	3637	32.34
3657	32.34	3667	32.34	3677	32.04	3687	32.04
3705	34.66	3709.1	38.83	3710	39.74	3740	43.64
3880	61.24	3980	60.94	4150	60.74	7375	60.74

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.074	3417	.074	3450	.066	3554	.025
3880	.074					3705	.066

Bank Sta: Left 3450 Right 3880 Lengths: Left 4625 Channel 9950 Right 7875 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 1
Sta L Sta R Elev
3880 7400 61.24

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	63.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	wt. n-Val.	0.054	0.074	
W.S. Elev (ft)	63.58	Reach Len. (ft)	4625.00	9950.00	7875.00

Crit W.S. (ft)		Flow Area (sq ft)	8880.67	8195.19
E.G. Slope (ft/ft)	0.000091	Area (sq ft)	8880.67	8195.19
Q Total (cfs)	20000.00	Flow (cfs)	17241.95	2758.05
Top width (ft)	3939.39	Top width (ft)	426.20	3513.19
Vel Total (ft/s)	1.17	Avg. Vel. (ft/s)	1.94	0.34
Max chl Dpth (ft)	32.74	Hydr. Depth (ft)	20.84	2.33
Conv. Total (cfs)	2098812.0	Conv. (cfs)	1809381.0	289431.4
Length wtd. (ft)	9363.60	Wetted Per. (ft)	442.74	3513.37
Min ch El (ft)	30.84	Shear (lb/sq ft)	0.11	0.01
Alpha	2.38	Stream Power (lb/ft s)	7400.00	0.00
Frctn Loss (ft)	1.18	Cum Volume (acre-ft)	19594.61	48291.79
C & E Loss (ft)	0.01	Cum SA (acres)	7846.57	2507.43

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 97.5

INPUT
Description: XS 97.5 NAVD 88
Station Elevation Data num= 61

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68.08	24.67	68.08	32.67	67.92	34.19	67.92
85	57.44	200	58.34	400	58.34	600	58.34
1000	58.34	1200	58.34	1400	58.34	1545	58.34
1614	57.54	1800	57.54	2000	57.44	2200	57.34
2600	57.14	2800	56.94	3000	56.84	3170	56.74
3203	58.34	3218	61.94	3229	62.14	3241	59.14
3456	59.04	3812	56.74	4063	57.04	4070	56.74
4100	52.94	4116	53.54	4137	45.64	4143	45.14
4175	40.34	4180	38.64	4183	34.68	4193	32.64
4213	30.64	4223	29.04	4233	27.94	4243	26.04
4263	26.64	4273	29.64	4283	34.68	4291.9	37.96
4308	48.84	4322	58.14	4331	62.44	4335	62.64
4346	62.94					4339	62.94

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3196	.07	3229	.066	4183	.025
4339	.066					4283	.066

Bank Sta: Left 4070 Right 4339 Lengths: Left 2500 Channel 3650 Right 3400 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 1
Sta L Sta R Elev
0 3229 62.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	62.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	wt. n-Val.	0.066	0.053	
W.S. Elev (ft)	62.33	Reach Len. (ft)	2500.00	3650.00	3400.00
Crit W.S. (ft)		Flow Area (sq ft)	4339.71	5575.19	
E.G. Slope (ft/ft)	0.000205	Area (sq ft)	4339.71	5575.19	
Q Total (cfs)	20000.00	Flow (cfs)	3330.13	16669.87	
Top width (ft)	4279.09	Top width (ft)	4018.33	260.76	
Vel Total (ft/s)	2.02	Avg. Vel. (ft/s)	0.77	2.99	
Max chl Dpth (ft)	36.29	Hydr. Depth (ft)	1.08	21.38	
Conv. Total (cfs)	1396898.0	Conv. (cfs)	232592.5	1164306.0	
Length wtd. (ft)	3374.19	Wetted Per. (ft)	4018.75	275.75	
Min ch El (ft)	26.04	Shear (lb/sq ft)	0.01	0.26	
Alpha	1.86	Stream Power (lb/ft s)	4346.00	0.00	0.00
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	19364.22	46640.78	21739.91
C & E Loss (ft)	0.02	Cum SA (acres)	7633.25	2428.97	9439.48

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 96.82

INPUT
Description: XS 96.82 NAVD 88
Station Elevation Data num= 95

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	67.62	41.01	61.84	82.02	61.84	164.04	61.84
1443.57	57.38	1512.46	44.59	1545.27	44.59	1548.55	44.59
1584.64	44.59	1617.45	44.59	1673.22	57.38	1968.5	58.04
2132.54	56.86	2304.78	58.79	2307.15	58.79	2372.76	58.79
2440.74	58.79	2443.07	58.79	2508.69	59.02	2511.05	59.02
2579.03	59.42	2644.64	59.42	2647.01	59.42	2695.81	60.3
2768	60.93	2779.52	55.41	2786.24	53.22	2795.27	51.25

2801.89	51.15	2818.23	50.66	2839.03	51.35	2861.11	54.5	2872.63	54.82
2876.47	49.48	2890.41	44.49	2896.51	40.32	2903.08	39.01	2910.1	31.53
2919.94	31.2	2923.22	31.69	2936.34	31.53	2942.9	31.2	2952.75	31.53
2969.15	31.2	2985.56	31.37	2997.69	30.81	3001.96	30.81	3004.26	30.81
3018.36	30.71	3021.64	31.04	3028.21	44.95	3041.33	45.15	3059.77	55.38
3084.21	51.77	3097.1	54.76	3105.31	54.76	3105.73	55.02	3125	60.34
3166.72	58.76	3198.68	59.88	3201.96	59.88	3205.24	59.88	3266.1	59.68
3268.46	59.68	3334.08	59.02	3336.44	59.02	3402.06	59.68	3403.3	59.68
3470	59.1	3472.36	59.1	3537.98	58.92	3540.34	58.92	3605.96	59.35
3608.32	59.35	3937	59.1	4265.08	56.7	4675.18	55.35	5003.27	57.27
5249.33	57.65	5396.97	59.12	5485.55	61.62	5528.2	55.32	5610.22	52.36
5793.95	55.35	6053.13	54.82	6069.54	61.71	6092.5	45.91	6128.59	63.35

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.074	2706.68	.074	2768	.066	2910.1	.025	3021.64	.066
3125	.071								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	2768	3125		100	100	100			
Blocked Obstructions	num=	2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
3125	5485.55	60.34	5485.55	6128.59	61.62				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	61.81	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.05	Wt. n-Val.	0.074	0.056	0.071
W.S. Elev (ft)	61.76	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	41.11	Flow Area (sq ft)	9731.78	6053.32	3403.28
E.G. Slope (ft/ft)	0.000161	Area (sq ft)	9731.78	6053.32	3403.28
Q Total (cfs)	20000.00	Flow (cfs)	6049.39	12967.50	983.11
Top width (ft)	5939.45	Top width (ft)	2582.16	357.00	3000.29
Vel Total (ft/s)	1.04	Avg. Vel (ft/s)	0.62	2.14	0.29
Max chl Dpth (ft)	31.05	Hydr. Depth (ft)	3.77	16.96	1.33
Conv. Total (cfs)	1575949.0	Conv. (cfs)	476676.3	1021806.0	77466.5
Length wtd. (ft)	15.00	Wetted Per. (ft)	2584.82	380.46	3000.39
Min ch El (ft)	30.71	Shear (lb/sq ft)	0.04	0.16	0.01
Alpha	2.85	Stream Power (lb/ft s)	6128.59	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	18960.43	46153.59	21607.09
C & E Loss (ft)	0.00	Cum SA (acres)	7443.84	2403.09	9322.39

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

Note: This may indicate the need for additional cross sections.
Manning's n values were composited to a single value in the main channel.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1
RS: 96.805

INPUT

Description: Los Indios
Distance from Upstream XS = 15
Deck/Roadway Width = 70
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num=	86								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	67.62	67.62	41.01	67.09	61.84	820.21	60.4	59.34	
1443.57	59.42	57.38	1512.46	59.42	44.59	1540	59.42	44.59	
1584.64	59.42	55.09	1588	59.42	55.09	1588	59.42	44.59	
1617.45	59.42	44.59	1673.22	59.42	57.38	1968.5	59.42	58.04	
2050.52	61.04	57.22	2132.54	62.7	56.86	2304.78	66.24	58.79	
2304.78	66.24	61.45	2307.44	66.24	61.45	2307.44	66.24	58.79	
2372.76	67.29	58.79	2372.76	67.29	61.45	2375.42	67.29	61.45	
2375.42	67.29	58.79	2440.74	68.87	58.79	2440.74	68.87	61.45	
2443.4	68.87	61.45	2443.4	68.87	58.79	2508.69	70.18	58.79	
2508.69	70.18	61.45	2511.35	70.18	61.45	2511.35	70.18	58.79	
2576.67	72.11	58.79	2576.67	72.11	61.45	2579.33	72.11	61.45	
2579.33	72.11	58.79	2644.64	72.8	58.79	2644.64	72.8	61.45	
2647.3	72.8	61.45	2647.3	72.8	58.79	2698.81	74.02	60.3	
2698.81	74.02	67.19	2795.33	75.72	68.9	2896.51	76.54	69.72	
2903.08	76.54	69.72	2997.69	76.54	69.72	3004.26	76.54	69.72	
3097.1	75.69	68.87	3105.31	75.69	68.87	3201.96	74.11	67.29	
3201.96	74.11	59.88	3266.1	72.8	58.79	3266.1	72.8	61.45	
3268.76	72.8	61.45	3268.76	72.8	58.79	3334.08	71.33	58.79	
3334.08	71.33	61.45	3336.74	71.33	61.45	3336.74	71.33	58.79	
3404.72	70.18	58.79	3470	68.87	58.79	3470	68.87	61.45	
3472.66	68.87	61.45	3472.66	68.87	58.79	3537.98	67.55	58.79	
3537.98	67.55	61.45	3540.64	67.55	61.45	3540.64	67.55	58.79	
3605.96	66.24	58.79	3605.96	66.24	61.45	3608.62	66.24	61.45	
3608.62	66.24	58.79	3937	59.42	59.1	4265.08	59.42	56.7	
4675.18	59.42	55.35	5249.33	59.42	57.65	5396.97	65.96	59.12	
5485.55	69.92	61.62	5528.2	70.34	55.32	5610.22	74.02	52.36	
5793.95	75.1	55.35	6053.13	75	54.82	6069.54	68.21	61.71	
6092.5	66.24	45.91	6128.59	63.35					

Upstream Bridge Cross Section Data	num=	95							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	.074	2706.68	.074	2768	.066	2910.1	.025	3021.64	.066
3125	.071								

0	67.62	41.01	61.84	82.02	61.84	164.04	61.84	820.21	59.34
1443.57	57.38	1512.46	44.59	1545.27	44.59	1548.55	44.59	1581.36	44.59
1584.64	44.59	1617.45	44.59	1673.22	57.38	1968.5	58.04	2050.52	57.22
2132.54	56.86	2304.78	58.79	2307.15	58.79	2372.76	58.79	2375.12	58.79
2440.74	58.79	2443.07	58.79	2508.69	59.02	2511.05	59.02	2576.67	59.42
2579.03	59.42	2644.64	59.42	2647.01	59.42	2695.81	60.3	2706.68	60.53
2768	60.93	2779.52	55.41	2786.24	53.22	2795.27	51.25	2795.33	51.15
2801.89	51.15	2818.23	50.66	2839.03	51.35	2861.11	54.5	2872.63	54.82
2876.47	49.48	2890.41	44.49	2896.51	40.32	2903.08	39.01	2910.1	31.53
2919.94	31.2	2923.22	31.69	2936.34	31.53	2942.9	31.2	2952.75	31.53
2969.15	31.2	2985.56	31.37	2997.69	30.81	3001.96	30.81	3004.26	30.81
3018.36	30.71	3021.64	31.04	3028.21	44.95	3041.33	45.15	3059.77	55.38
3084.21	51.77	3097.1	54.76	3105.31	54.76	3105.73	55.02	3125	60.34
3166.72	58.76	3198.68	59.88	3201.96	59.88	3205.24	59.88	3266.1	59.68
3268.46	59.68	3334.08	59.02	3336.44	59.02	3402.06	59.68	3403.3	59.68
3470	59.1	3472.36	59.1	3537.98	58.92	3540.34	58.92	3605.96	59.35
3608.32	59.35	3937	59.1	4265.08	56.7	4675.18	55.35	5003.27	57.27
5249.33	57.65	5396.97	59.12	5485.55	61.62	5528.2	55.32	5610.22	52.36
5793.95	55.35	6053.13	54.82	6069.54	61.71	6092.5	45.91	6128.59	63.35

Manning's n	Values	num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
0	.074	2706.68	.074	2768	.066	2910.1	.025	3021.64	.066
3125	.071								

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	2768	3125		.2	.5
Blocked Obstructions	num=	2			
Sta	Sta R	Elev	Sta L	Sta R	Elev
3125	5485.55	60.34	5485.55	6128.59	61.62

Downstream Deck/Roadway Coordinates

num=	86								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	67.62	67.62	41.01	67.09	61.84	820.21	60.4	59.34	
1443.57	59.42	57.38	1512.46	59.42	44.59	1540	59.42	44.59	
1540	59.42	55.09	1588	59.42	55.09	1588	59.42	44.59	
1617.45	59.42	44.59	1673.22	59.42	57.38	1968.5	59.42	58.04	
2050.52	61.04	57.22	2132.54	62.7	56.86	2304.78	66.24	58.79	
2304.78	66.24	61.45	2307.44	66.24	61.45	2307.44	66.24	58.79	
2372.76	67.29	58.79	2372.76	67.29	61.45	2375.42	67.29	61.45	
2375.42	67.29	58.79	2440.74	68.87	58.79	2440.74	68.87	61.45	
2443.4	68.87	61.45	2443.4	68.87	58.79	2508.69	70.18	58.79	
2508.69	70.18	61.45	2511.35	70.18	61.45	2511.35	70.18	58.79	
2576.67	72.11	58.79	2576.67	72.11	61.45	2579.33	72.11	61.45	
2579.33	72.11	58.79	2644.64	72.8	58.79	2644.64	72.8	61.45	
2647.3	72.8	61.45	2647.3	72.8	58.79	2698.81	74.02	60.3	
2698.81	74.02	67.19	2795.33	75.72	68.9	2896.51	76.54	69.72	
2903.08	76.54	69.72	2997.69	76.54	69.72	3004.26	76.54	69.72	
3097.1	75.69	68.87	3105.31	75.69	68.87	3201.96	74.11	67.29	
3201.96	74.11	59.88	3266.1	72.8	58.79	3266.1	72.8	61.45	
3268.76	72.8	61.45	3268.76	72.8	58.79	3334.08	71.33	58.79	
3334.08	71.33	61.45	3336.74	71.33	61.45	3336.74	71.33	58.79	
3402.06	70.18	58.79	3402.06	70.18	61.45	3404.72	70.18	61.45	
3404.72	70.18	58.79	3470	68.87	58.79	3470	68.87	61.45	
3472.66	68.87	61.45	3472.66	68.87	58.79	3537.98	67.55	58.79	
3537.98	67.55	61.45	3540.64	67.55	61.45	3540.64	67.55	58.79	
3605.96	66.24	58.79	3605.96	66.24	61.45	3608.62	66.24	61.45	
3608.62	66.24	58.79	3937	59.42	59.1	4265.08	59.42	56.7	
4675.18	59.42	55.35	5249.33	59.42	57.65	5396.97	65.96	59.12	
5485.55	69.92	61.62	5528.2	70.34	55.32	5610.22	74.02	52.36	
5793.95	75.1	55.35	6053.13	75	54.82	6069.54	68.21	61.71	
6092.5	66.24	45.91	6128.59						

Sta L	Sta R	Elev	Sta L	Sta R	Elev
3125	5485.55	60.34	5485.55	6128.59	61.62

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Abutments = 2

Abutment Data			
Upstream	num= 2		
Sta	Elev	Sta	Elev
1540	53.09	1556	44.59
Downstream	num= 2		
Sta	Elev	Sta	Elev
1540	53.09	1556	44.59

Abutment Data			
Upstream	num= 2		
Sta	Elev	Sta	Elev
1572	44.95	1588	53.45
Downstream	num= 2		
Sta	Elev	Sta	Elev
1572	44.95	1588	53.45

Number of Piers = 3

Pier Data			
Pier Station	Upstream= 2899.79	Downstream= 2899.79	
Upstream	num= 2		
width	Elev	width	Elev
6.57	30	6.57	70.08
Downstream	num= 2		
width	Elev	width	Elev
6.57	30	6.57	70.08

Pier Data			
Pier Station	Upstream= 3000.97	Downstream= 3000.97	
Upstream	num= 2		
width	Elev	width	Elev
6.57	30	6.57	70.08
Downstream	num= 2		
width	Elev	width	Elev
6.57	30	6.57	70.08

Pier Data			
Pier Station	Upstream= 3101.2	Downstream= 3101.2	
Upstream	num= 2		
width	Elev	width	Elev
8.21	30	8.21	69.23
Downstream	num= 2		
width	Elev	width	Elev
8.21	30	8.21	69.23

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
criteria to check for pressure Flow = upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	61.81	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	61.76	E.G. Elev (ft)	61.80	61.79
Q Total (cfs)	20000.00	W.S. Elev (ft)	61.74	61.73
Q Bridge (cfs)	11281.17	Crit W.S. (ft)	41.43	41.43
Q Weir (cfs)	8718.83	Max Chl Dpth (ft)	31.03	31.02
Weir Sta Lft (ft)	656.57	Vel Total (ft/s)	1.81	1.81
Weir Sta Rgt (ft)	5303.17	Flow Area (sq ft)	6241.55	6234.98
Weir Submerg	0.98	Froude # Chl	0.06	0.06
Weir Max Depth (ft)	2.39	Specif Force (cu ft)	69806.38	69722.01
Min El Weir Flow (ft)	59.43	Hydr Depth (ft)	12.94	12.94
Min El Prs. (ft)	69.72	W.P. Total (ft)	847.09	846.98
Delta EG (ft)	0.03	Conv. Total (cfs)	812552.9	811495.6
Delta WS (ft)	0.03	Top width (ft)	481.80	481.80
BR Open Area (sq ft)	9683.70	Frctn Loss (ft)	0.01	0.00
BR open Vel (ft/s)	1.81	C & E Loss (ft)	0.00	0.00
Coef of Q		Shear Total (lb/sq ft)	0.28	0.28

Br Sel Method	Energy/weir	Power Total (lb/ft s)	0.00	0.00
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Note: Manning's n values were composited to a single value in the main channel.
Note: Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir
Flow over the embankment. The reported hydraulics are based on the flow and area inside of the bridge.
warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.
Note: Notes(60): This is an inside cross section of a perched bridge that has energy, low flow inside of the bridge and weir
Flow over the embankment. The reported hydraulics are based on the flow and area inside of the bridge.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 96.80

INPUT
Description: XS 96.80 NAVD 88
Station Elevation Data num= 95
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 67.62 41.01 61.84 82.02 61.84 164.04 61.84 820.21 59.34
1443.57 57.38 1512.46 44.59 1545.27 44.59 1548.55 44.59 1581.36 44.59
1584.64 44.59 1617.45 44.59 1673.22 57.38 1968.5 58.04 2050.52 57.22
2132.54 56.86 2304.78 58.79 2307.15 58.79 2372.76 58.79 2375.12 58.79
2440.74 58.79 2443.07 58.79 2508.69 59.02 2511.05 59.02 2576.67 59.42
2579.03 59.42 2644.64 59.42 2647.01 59.42 2695.81 60.3 2706.68 60.53
2768 60.93 2779.52 55.41 2786.24 53.22 2795.27 51.25 2795.33 51.15
2801.89 51.15 2818.23 50.66 2839.03 51.35 2861.11 54.5 2872.63 54.82
2876.47 49.48 2890.41 44.49 2896.51 40.32 2903.08 39.01 2910.1 31.53
2919.94 31.2 2923.22 31.69 2936.34 31.53 2942.9 31.2 2952.75 31.53
2969.15 31.2 2985.56 31.37 2997.69 30.81 3001.96 30.81 3004.26 30.81
3018.36 30.71 3021.64 31.04 3028.21 44.95 3041.33 45.15 3059.77 55.58
3084.21 51.77 3097.1 54.76 3105.31 54.76 3105.73 55.02 3125 60.34
3166.72 58.76 3198.68 59.88 3201.96 59.88 3205.24 59.88 3266.1 59.68
3268.46 59.68 3334.08 59.02 3336.44 59.02 3402.06 59.68 3403.3 59.68
3470 59.1 3472.36 59.1 3537.98 58.92 3540.34 58.92 3605.96 59.35
3608.32 59.35 3937 59.1 4265.08 56.7 4675.18 55.35 5003.27 57.27
5249.33 57.65 5396.97 59.12 5485.55 61.62 5528.2 55.32 5610.22 52.36
5793.95 55.35 6053.13 54.82 6069.54 61.71 6092.5 45.91 6128.59 63.35

Manning's n Values	num= 6
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val	
0 .074 2706.68 .074 2768 .066 2910.1 .025 3021.64 .066	
3125 .071	

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
2768	3125	2410	3450	2450	.2		.5
Blocked Obstructions	num= 2						
Sta L Sta R Elev	Sta L Sta R Elev						
3125 5485.55 60.34	5485.55 6128.59 61.62						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	61.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	wt. n-Val.	0.074	0.056	0.071
W.S. Elev (ft)	61.73	Reach Len. (ft)	2410.00	3450.00	2450.00
Crit W.S. (ft)		Flow Area (sq ft)	9665.43	6044.14	3326.09
E.G. Slope (ft/ft)	0.000163	Area (sq ft)	9665.43	6044.14	3326.09
Q Total (cfs)	20000.00	Flow (cfs)	6030.43	13017.29	952.28
Top width (ft)	5932.65	Top width (ft)	2575.41	357.00	3000.24
Vel Total (ft/s)	1.05	Avg. Vel. (ft/s)	0.62	2.15	0.29
Max Chl Dpth (ft)	31.02	Hydr. Depth (ft)	3.75	16.93	1.11
Conv. Total (cfs)	1565953.0	Conv. (cfs)	472168.0	1019223.0	74561.5
Length wtd. (ft)	3115.12	Wetted Per. (ft)	2578.07	380.46	3000.33
Min Ch El (ft)	30.71	Shear (lb/sq ft)	0.04	0.16	0.01
Alpha	2.84	Stream Power (lb/ft s)	6128.59	0.00	0.00
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	18956.16	46140.50	21605.69
C & E Loss (ft)	0.01	Cum SA (acres)	7442.82	2402.31	9321.20

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 94.05

INPUT
Description: XS 94.05 NAVD 88
Station Elevation Data num= 100
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 67.09 8.99 57.28 18.59 67.08 20.1 67.08 51.2 55.38
94 53.44 153 51.94 171 54.44 175 56.74 186 57.34
300 58.26 310 58.34 333 58.84 342 53.94 353 53.34
370 40.34 378 39.04 381.5 37.1 386 34.6 392 32.64
402 28.64 412 27.64 422 27.64 432 29.14 442 29.14
452 29.14 462 29.34 472 29.64 482 30.14 492 33.64
493 34.6 495.2 37.04 498 40.14 510 42.74 526 46.74
552 50.14 564 53.64 585 52.84 594 55.24 605 53.74

724	55.84	732	56.54	738	57.94	754	58.44	938	58.34
1044	58.34	1150	57.94	1257	57.64	1367	57.64	1470	58.34
1576	58.44	1684	58.94	1795	58.44	1823	57.94	1841	57.34
1857	54.94	1985	51.74	2011	47.74	2069	44.84	2112	43.34
2174	47.94	2222	59.94	2232	59.94	2312	58.34	2412	58.24
2512	58.04	2612	58.24	2712	58.24	2812	58.14	2912	58.24
3012	58.44	3112	58.64	3212	58.64	3312	58.44	3389	59.84
3412	59.94	3415	60.44	3443	48.14	3477	45.44	3489	37.34
3508	36.11	3542	35.34	3568	35.34	3582	35.54	3588	35.54
3594	36.11	3612	36.64	3620	37.14	3647	43.94	3657	45.94
3671	48.14	3712	50.64	3812	56.44	3841	58.14	3912	58.04
4012	58.84	4112	58.74	4379	57.34	4393	62.34	4407	62.84

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.084	300	.084	333	.066	386	.025	493	.066
754	.068								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan
	333	564		1250	1300	.1	.3
Blocked Obstructions			num=	2			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	61.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.084	0.050	0.068
W.S. Elev (ft)	61.23	Reach Len. (ft)	1250.00	1300.00	1550.00
Crit W.S. (ft)		Flow Area (sq ft)	697.02	5184.04	10993.38
E.G. Slope (ft/ft)	0.000136	Area (sq ft)	697.02	5184.04	10993.38
Q Total (cfs)	20000.00	Flow (cfs)	255.13	13838.80	5906.08
Top width (ft)	4351.82	Top width (ft)	295.35	231.00	3825.47
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	0.37	2.67	0.54
Max chl dpth (ft)	33.59	Hydr. depth (ft)	2.36	22.44	2.87
Conv. Total (cfs)	1711849.0	Conv. (cfs)	21837.0	1184496.0	505515.5
Length wtd. (ft)	1352.62	wetted Per. (ft)	295.73	244.12	3827.30
Min ch El (ft)	27.64	Shear (lb/sq ft)	0.02	0.18	0.02
Alpha	3.57	Stream Power (lb/ft s)	4407.00	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	18669.51	45695.86	21202.99
C & E Loss (ft)	0.00	Cum SA (acres)	7363.40	2379.02	9129.25

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 93.81

INPUT
Description: XS 93.81 NAVD 88

Station Elevation Data		num=	40						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
.03	66.93	9.63	67.12	19.23	66.93	20.72	66.93	36	56.44
185	56.64	623	57.61	638	57.64	656	59.14	667	57.14
756	54.24	769	56.64	820	52.24	795	50.94	49	49.44
881	40.04	885	39.54	888.7	36.87	892	34.49	900	30.94
910	30.34	920	29.94	930	29.54	940	30.24	950	29.84
960	29.24	970	27.94	980	29.94	990	29.04	1000	33.54
1007	34.49	1012.3	36.92	1013	37.24	1022	49.24	1070	52.54
1091	59.14	1123	58.64	1180	58.34	4605	58.34	4632	62.24

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
.03	.084	623	.084	656	.066	892	.025	1007	.066
1091	.076								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan
	769	1091		250	100	.1	.3
Blocked obstructions		num=	2				
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
.03	656	59.14	1091	4632	59.14		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	61.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.074	0.054	0.076
W.S. Elev (ft)	60.99	Reach Len. (ft)	250.00	100.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	1731.03	5975.69	6518.49
E.G. Slope (ft/ft)	0.000207	Area (sq ft)	1731.03	5975.69	6518.49
Q Total (cfs)	20000.00	Flow (cfs)	993.10	16244.98	2761.93
Top width (ft)	4593.96	Top width (ft)	739.63	322.00	3532.34
Vel Total (ft/s)	1.41	Avg. Vel. (ft/s)	0.57	2.72	0.42
Max chl dpth (ft)	33.05	Hydr. depth (ft)	2.34	18.56	1.85
Conv. Total (cfs)	1388435.0	Conv. (cfs)	68942.6	1127754.0	191737.6
Length wtd. (ft)	128.20	wetted Per. (ft)	740.00	336.09	3532.47
Min ch El (ft)	27.94	Shear (lb/sq ft)	0.03	0.23	0.02
Alpha	3.06	Stream Power (lb/ft s)	4632.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	18634.67	45529.33	20891.43
C & E Loss (ft)	0.00	Cum SA (acres)	7348.55	2370.77	8998.34

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 93.8

INPUT

Description: XS 93.8 NAVD 88

Station Elevation Data		num=	21						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66.84	47	64.94	538	62.78	571	62.64	724	55.64
824	51.74	858	54.74	890.4	36.63	896	33.5	997	33.45
1014	35.84	1015.1	36.68	1024	43.44	1040	47.04	1084	52.64
1105	59.44	1138	58.84	1179	59.14	1223	58.34	4698	58.34
4723	62.14								

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.218	538	.218	571	.066	896	.025	997	.066
1105	.062								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan
	858	1105		1500	1500	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	61.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.066	0.052	0.062
W.S. Elev (ft)	60.91	Reach Len. (ft)	1500.00	1500.00	1625.00
Crit W.S. (ft)		Flow Area (sq ft)	1119.68	4907.98	5296.02
E.G. Slope (ft/ft)	0.000262	Area (sq ft)	1119.68	4907.98	5296.02
Q Total (cfs)	20000.00	Flow (cfs)	1111.38	16234.48	2654.14
Top width (ft)	4106.07	Top width (ft)	249.17	247.00	3609.90
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	0.99	3.31	0.50
Max chl dpth (ft)	27.46	Hydr. depth (ft)	4.49	19.87	1.47
Conv. Total (cfs)	1234865.0	Conv. (cfs)	68620.2	1002370.0	163875.3
Length wtd. (ft)	1519.26	wetted Per. (ft)	249.30	257.09	3610.01
Min ch El (ft)	33.45	Shear (lb/sq ft)	0.07	0.31	0.02
Alpha	2.88	Stream Power (lb/ft s)	4723.00	0.00	0.00
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	18626.49	45516.84	20857.53
C & E Loss (ft)	0.01	Cum SA (acres)	7345.72	2370.12	8977.85

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 93.5

INPUT

Description: XS 93.5 NAVD 88

Station Elevation Data		num=	93						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
40	67.04	43	67.04	53	65.94	92	55.14	120	52.84
133	51.14	157	51.14	174	57.94	200	57.54	290	57.54
400	57.54	510	57.54	616	57.54	718	57.34	820	57.44
934	58.14	975	60.74	1016	56.44	1112	55.04	1183	52.34
1187	53.44	1216	55.14	1217	51.44	1226	46.14	1256	41.14
1258	38.14	1262.2	36.25	1270	32.73	1280	26.74	1290	27.24
1300	27.44	1310	28.24	1320	29.04	1330	29.44	1340	29.74
1350	29.74	1360	30.74	1368	32.73	1373	34.34	1378.5	36.26
1393	41.34	1400	46.44	1410	52.44	1440	54.04	1452	58.64
1478	57.74	1577	57.94	1683	58.24	1780	58.24	1887	57.54
1990	56.84	2092	56.24	2200	56.24	2291	55.84	2384	56.54
2467	57.24	2535	56.84	2616	56.24	2719	56.04	2818	56.04
2932	56.94	3045	57.74	3143	57.74	3240	57.74	3339	57.94
3440	57.94	3523	57.64	3545	57.34	3554	61.24	3604	57.34
3702	56.84	3823	57.34	3932	56.44	4044	57.84	4160	58.04
4263	57.34	4362	58.34	4458	57.84	4474	58.54	4478	56.24
4483	58.94	4489	54.84	4518	57.04	4560	57.04	4673	56.54
4782	56.84	4902	56.14	5020	55.94	5144	55.84	5234	54.44
5249	56.84	5258	61.44	5265	61.44				

Manning's n Values		num=	6						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
40	.11	934	.11	975	.066	1270	.025	1368	.066
1452	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan
	1216	1452		10125	16190	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	60.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.066	0.052	0.062
W.S. Elev (ft)	60.59	Reach Len. (ft)	10125.00	16190.00	9125.00

Crit W.S. (ft)		Flow Area (sq ft)	1264.49	5145.75	7356.93
E.G. Slope (ft/ft)	0.000191	Area (sq ft)	1264.49	5145.75	7356.93
Q Total (cfs)	20000.00	Flow (cfs)	1192.53	15298.92	3508.55
Top width (ft)	4270.01	Top width (ft)	239.55	236.00	3794.46
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	0.94	2.97	0.48
Max chl Dpth (ft)	33.85	Hydr. Depth (ft)	5.28	21.80	1.94
Conv. Total (cfs)	1445889.0	Conv. (cfs)	86213.2	1106027.0	253648.8
Length wtd. (ft)	14591.00	Wetted Per. (ft)	239.94	251.16	3795.58
Min ch El (ft)	26.74	Shear (lb/sq ft)	0.06	0.24	0.02
Alpha	3.25	Stream Power (lb/ft s)	5265.00	0.00	0.00
Frctn Loss (ft)	2.35	Cum Volume (acre-ft)	18585.44	45343.74	20621.52
C & E Loss (ft)	0.00	Cum SA (acres)	7337.30	2361.80	8839.74

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 90.5

INPUT
Description: XS 90.5 NAVD 88
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
16	62.94	27	62.94	76	45.94	248	46.44
1048	49.94	2646	54.84	2655	51.54	3644	51.14
3688	52.64	4080	51.51	4104	51.44	4113	53.64
4144	39.64	4149.7	34.01	4155	28.77	4160	27.04
4180	27.54	4190	27.54	4200	27.34	4210	27.34
4230	27.54	4240	27.34	4250	27.04	4260	27.24
4283	32.44	4284.5	34.01	4287	36.64	4298	39.64
4394	54.74	4402	57.64	4407	55.84	4412	57.64
4432	54.24	5024	54.44	7270	53.74	7283	59.04

Manning's n	Val	Sta	n Val	Sta	n Val	Sta	n Val
16	.168	4080	.168	4113	.066	4155	.025
4412	.067					4268	.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
4113	4316		5500	15625	.1	.3	
Blocked Obstructions	num=						
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
16	3670	54.14	4412	7296	57.64		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	58.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	wt. n-Val.	0.168	0.047	0.067
W.S. Elev (ft)	58.25	Reach Len. (ft)	5500.00	15625.00	8750.00
Crit W.S. (ft)		Flow Area (sq ft)	17522.12	5066.83	2065.64
E.G. Slope (ft/ft)	0.000130	Area (sq ft)	17522.12	5066.83	2065.64
Q Total (cfs)	20000.00	Flow (cfs)	4681.36	14816.56	502.07
Top width (ft)	7240.53	Top width (ft)	4072.47	203.00	2965.06
Vel Total (ft/s)	0.81	Avg. Vel. (ft/s)	0.27	2.92	0.24
Max chl Dpth (ft)	31.21	Hydr. Depth (ft)	4.30	24.96	0.70
Conv. Total (cfs)	1753063.0	Conv. (cfs)	410336.2	1298718.0	44008.4
Length wtd. (ft)	12353.65	Wetted Per. (ft)	4073.62	218.91	2966.31
Min ch El (ft)	27.04	Shear (lb/sq ft)	0.03	0.19	0.01
Alpha	9.65	Stream Power (lb/ft s)	7296.00	0.00	0.00
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	16402.08	43445.88	19634.60
C & E Loss (ft)	0.02	Cum SA (acres)	6836.16	2280.22	8131.74

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 87.7

INPUT
Description: XS 87.7 NAVD 88
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	61.04	10	60.84	30	55.14	174	47.94
2394	50.84	3750	54.14	3759	54.14	3765	55.34
3773	56.24	3780	53.74	3796	53.24	3852	52.52
3885	53.14	3896	47.24	3970	46.94	3986	49.84
4029	37.24	4038	36.14	4041.3	32.86	4047	27.2
4067	21.44	4077	21.94	4087	21.44	4097	21.04
4117	20.54	4127	22.24	4137	25.54	4143	27.2

4178	47.54	4238	46.24	4253	49.84	4274	49.84	4281	51.74
4303	51.74	6901	49.94	7082	45.04	7129	42.44	7281	42.84
7344	51.64	7390	47.94	7410	49.24	7887	50.44	7909	50.84
7939	47.54	7977	51.04	7993	54.54	8004	54.94		

Manning's n	Val	Sta	n Val	Sta	n Val	Sta	n Val
2	.183	3852	.183	3885	.066	4047	.025
4281	.067					4143	.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
3986	4178		4000	6035	.1	.3	
Blocked Obstructions	num=						
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
2	3773	56.24	4281	8004	51.74		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	57.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	wt. n-Val.	0.098	0.049	0.067
W.S. Elev (ft)	57.20	Reach Len. (ft)	4000.00	6035.00	3750.00
Crit W.S. (ft)		Flow Area (sq ft)	5037.30	4977.58	21232.17
E.G. Slope (ft/ft)	0.000048	Area (sq ft)	5037.30	4977.58	21232.17
Q Total (cfs)	20000.00	Flow (cfs)	918.63	8797.39	10283.99
Top width (ft)	7981.23	Top width (ft)	3963.23	192.00	3826.00
Vel Total (ft/s)	0.64	Avg. Vel. (ft/s)	0.18	1.77	0.48
Max chl Dpth (ft)	36.66	Hydr. Depth (ft)	1.27	25.92	5.55
Conv. Total (cfs)	2889835.0	Conv. (cfs)	132733.9	1271150.0	1485951.0
Length wtd. (ft)	4888.09	Wetted Per. (ft)	3965.59	205.43	3829.26
Min ch El (ft)	20.54	Shear (lb/sq ft)	0.00	0.07	0.02
Alpha	3.65	Stream Power (lb/ft s)	8004.00	0.00	0.00
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	14977.87	41644.41	17294.65
C & E Loss (ft)	0.00	Cum SA (acres)	6328.86	2209.38	7449.67

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 86.6

INPUT
Description: XS 86.6 "M" NAVD 88
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	60.14	7	59.64	60	53.14	132	50.14
182	47.44	223	47.04	1480	50.24	1512	50.14
1533	52.14	1560	53.04	1573	41.64	1581	34.74
1597	24.74	1607	22.64	1617	22.64	1627	22.54
1647	22.54	1657	23.24	1667	24.04	1677	24.24
1697	27.24	1701	29.04	1724	40.94	1735	41.34
2098	54.34	2123	52.84	3627	53.84	5039	51.14
6955	50.24	7007	48.14	7031	50.84	7047	51.34
7071	54.34					7060	53.54

Manning's n	Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.169	1480	.169	1512	.066	1591	.025
						1701	.066

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
1512	2098		7500	14000	.1	.3	
Blocked Obstructions	num=						
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
60	1560	53.04	2098	3627	53.84		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	56.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	wt. n-Val.	0.169	0.060	0.066
W.S. Elev (ft)	56.87	Reach Len. (ft)	7500.00	14000.00	1500.00
Crit W.S. (ft)		Flow Area (sq ft)	5612.79	7411.92	15047.73
E.G. Slope (ft/ft)	0.000121	Area (sq ft)	5612.79	7411.92	15047.73
Q Total (cfs)	20000.00	Flow (cfs)	1319.68	10880.47	7799.85
Top width (ft)	7041.39	Top width (ft)	1482.39	586.00	4973.00
Vel Total (ft/s)	0.71	Avg. Vel. (ft/s)	0.24	1.47	0.52
Max chl Dpth (ft)	34.33	Hydr. Depth (ft)	3.79	1.63	1.03
Conv. Total (cfs)	1816707.0	Conv. (cfs)	119873.1	988331.3	708502.5
Length wtd. (ft)	10161.98	Wetted Per. (ft)	1482.62	600.42	4975.56
Min ch El (ft)	22.54	Shear (lb/sq ft)	0.03	0.09	0.02
Alpha	2.52	Stream Power (lb/ft s)	7071.00	0.00	0.00
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	14488.89	40786.16	15733.02
C & E Loss (ft)	0.01	Cum SA (acres)	6078.83	2155.48	7070.93

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 84

INPUT
Description: XS 84 NAVD 88

Station Elevation Data				num= 37			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	59.14	8	58.84	44	48.74	100	48.64
5766	53.64	5788	47.34	5804	45.94	5891	46.64
5933	48.34	5942	45.64	5953	44.64	5979	35.64
5991.8	31.66	6001	26.13	6010	24.14	6020	24.14
6040	23.74	6050	21.44	6060	22.14	6070	21.64
6090	22.44	6097	26.13	6105.4	31.66	6121	41.94
6158	49.04	6170	51.84	6190	51.94	7004	47.94
7040	54.54	7050	54.34			7028	50.44

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.14	5733	.14	5766	.066	6001	.025
6190	.067			6097	.066		

Bank Sta: Left Right Lengths: Left Channel Right

5933	6170	2	5000	12000	5500	Coeff Contr.	Expan.
						.1	.3

Blocked Obstructions

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	5766	53.64	6190	7050	51.94

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	55.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.052	0.067	
W.S. Elev (ft)	55.31	Reach Len. (ft)	5000.00	12000.00	5500.00
Crit W.S. (ft)		Flow Area (sq ft)	10941.65	5071.32	2933.70
E.G. Slope (ft/ft)	0.000181	Area (sq ft)	10941.65	5071.32	2933.70
Q Total (cfs)	20000.00	Flow (cfs)	3547.04	14501.86	1951.10
Top width (ft)	7029.43	Top width (ft)	5912.43	237.00	880.00
Vel Total (ft/s)	1.06	Avg. Vel. (ft/s)	0.32	2.86	0.67
Max chl Dpth (ft)	34.17	Hydr. Depth (ft)	1.85	21.40	3.33
Conv. Total (cfs)	1487327.0	Conv. (cfs)	263780.4	1078450.0	145096.4
Length wtd. (ft)	9823.91	wetted Per. (ft)	5913.68	249.49	881.41
Min Ch El (ft)	21.14	Shear (lb/sq ft)	0.02	0.23	0.04
Alpha	5.38	Stream Power (lb/ft s)	7050.00	0.00	0.00
Frcn Loss (ft)	1.31	Cum Volume (acre-ft)	13063.75	38780.13	15423.42
C & E Loss (ft)	0.02	Cum SA (acres)	5442.22	2023.23	6970.16

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 82

INPUT
Description: XS 82 "L" NAVD 88

Station Elevation Data				num= 38			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	56.64	13	57.64	43.4	57.04	328	56.34
449	51.84	478	52.24	492	49.14	512	38.94
538	36.14	552	28.74	562	23.74	572	19.74
592	16.24	602	15.74	612	15.04	622	15.24
642	18.74	652	19.74	662	21.94	672	22.94
689	28.74	722	41.74	754	43.14	767	48.84
866	51.54	3302	47.94	6140	50.74	6898	47.94
9058	48.24	9076	53.34	9088	52.64		

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.095	449	.095	478	.066	552	.025
				689	.066		

Bank Sta: Left Right Lengths: Left Channel Right

478	866	3	3000	2500	1000	Coeff Contr.	Expan.
						.1	.3

Blocked Obstructions

Sta L	Sta R	Elev	Sta L	Sta R	Elev
383	478	52.24	866	7402	51.54

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	54.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.095	0.054	0.066
W.S. Elev (ft)	54.05	Reach Len. (ft)	3000.00	2500.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	175.84	7102.65	20103.93
E.G. Slope (ft/ft)	0.000085	Area (sq ft)	175.84	7102.65	20103.93

Q Total (cfs)	20000.00	Flow (cfs)	33.90	12382.27	7583.83
Top width (ft)	8725.01	Top width (ft)	115.01	388.00	8222.00
Vel Total (ft/s)	0.73	Avg. vel. (ft/s)	0.19	1.74	0.38
Max chl Dpth (ft)	39.01	Hydr. Depth (ft)	1.53	18.31	2.45
Conv. Total (cfs)	216032.0	Conv. (cfs)	3672.0	1341082.0	821378.8
Length wtd. (ft)	1913.38	wetted Per. (ft)	115.05	400.55	8223.64
Min ch El (ft)	15.04	Shear (lb/sq ft)	0.01	0.09	0.01
Alpha	3.63	Stream Power (lb/ft s)	9088.00	0.00	0.00
Frcn Loss (ft)	0.16	Cum Volume (acre-ft)	12425.69	37103.28	13969.02
C & E Loss (ft)	0.00	Cum SA (acres)	5096.30	1937.14	6395.53

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 81.5

INPUT
Description: XS 81.5 NAVD 88

Station Elevation Data				num= 47			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	57.14	4	56.34	37	49.14	45	48.84
149	47.34	234	50.04	295	50.88	328	51.34
370.1	30.42	379	24.47	386	23.14	396	23.04
416	23.44	426	23.64	435	23.64	446	23.64
466	23.94	476	23.94	486	23.14	496	22.44
501	27.74	507.9	30.43	511	31.64	543	45.94
589	42.64	616	42.24	638	46.84	654	51.34
779	50.64	798	51.34	825	49.64	2953	46.64
4543	49.24	6327	50.94	6349	51.04	8565	47.64
8604	52.84	8617	52.44			8585	47.44

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.095	295	.095	328	.066	379	.025
654	.067			500	.066		

Bank Sta: Left Right Lengths: Left Channel Right

328	543	7	7000	11450	4125	Coeff Contr.	Expan.
						.1	.3

Blocked Obstructions

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	327	51.34	654	8617	51.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	53.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.095	0.047	0.067
W.S. Elev (ft)	53.87	Reach Len. (ft)	7000.00	11450.00	4125.00
Crit W.S. (ft)		Flow Area (sq ft)	777.75	5166.94	2112.68
E.G. Slope (ft/ft)	0.000078	Area (sq ft)	777.75	5166.94	2112.68
Q Total (cfs)	20000.00	Flow (cfs)	197.51	11666.05	8136.44
Top width (ft)	8601.70	Top width (ft)	312.70	215.00	8074.00
Vel Total (ft/s)	0.74	Avg. vel. (ft/s)	0.25	2.26	0.39
Max chl Dpth (ft)	31.43	Hydr. Depth (ft)	2.49	24.03	2.61
Conv. Total (cfs)	2260038.0	Conv. (cfs)	22318.7	1318286.0	919433.4
Length wtd. (ft)	8742.70	wetted Per. (ft)	312.99	228.75	8077.39
Min ch El (ft)	22.44	Shear (lb/sq ft)	0.01	0.11	0.01
Alpha	5.55	Stream Power (lb/ft s)	8617.00	0.00	0.00
Frcn Loss (ft)	0.82	Cum Volume (acre-ft)	12392.85	36751.19	13495.92
C & E Loss (ft)	0.00	Cum SA (acres)	5081.57	1919.84	6208.48

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 79.8

INPUT
Description: XS 79.8 "K" NAVD 88

Station Elevation Data				num= 35			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	55.24	12	55.64	39	47.74	83	48.64
3407	51.04	3447	49.04	3459	42.54	3473	42.14
3502	36.34	3508	29.94	3518	24.24	3528	22.44
3548	20.94	3558	21.04	3568	21.24	3578	21.24
3598	21.24	3608	20.94	3618	22.04	3628	27.04
3651	37.84	3668	44.14	3756	44.44	3775	49.34
5321	44.84	5459	49.44	6266	46.94	6284	50.54

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.082	3407	.082	3447	.066	3508	.025
				3637			

Bank Sta: Left Right Lengths: Left Channel Right

3447	3775	2	5000	7000	4000	Coeff Contr.	Expan.
						.1	.3

Blocked Obstructions

Sta L	Sta R	Elev	Sta L	Sta R	Elev

12 3407 51.04 3792 6284 49.44

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	53.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	wt. n-Val.	0.082	0.052	0.066
W.S. Elev (ft)	53.06	Reach Len. (ft)	5000.00	7000.00	4000.00
Crit W.S. (ft)		Flow Area (sq ft)	6938.21	6025.16	9094.56
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	6938.21	6025.16	9094.56
Q Total (cfs)	20000.00	Flow (cfs)	2178.09	12617.64	5204.27
Top Width (ft)	6273.17	Top Width (ft)	3426.17	328.00	2519.00
Vel Total (ft/s)	0.91	Avg. Vel. (ft/s)	0.31	2.09	0.57
Max chl Dpth (ft)	32.12	Hydr. Depth (ft)	2.03	18.37	3.61
Conv. Total (cfs)	1850514.0	Conv. (cfs)	201529.3	1167456.0	481528.8
Length wtd. (ft)	5998.11	Wetted Per. (ft)	3426.51	340.31	2521.73
Min ch El (ft)	20.94	Shear (lb/sq ft)	0.01	0.13	0.03
Alpha	3.48	Stream Power (lb/ft s)	6294.00	0.00	0.00
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	11772.88	35280.23	12065.65
C & E Loss (ft)	0.00	Cum SA (acres)	4781.15	1848.47	5706.92

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 78.5

INPUT	Description: XS 78.5	NAVD 88
Station Elevation Data	num= 47	
Sta Elev	Sta Elev	Sta Elev
0 54.94	4 54.84	11 54.14
327 44.94	399 46.44	434 46.94
502 50.54	520 48.04	577 48.84
606 51.14	619 49.14	644 49.27
707.8 28.49	717 23.64	719 23.04
749 15.54	759 17.04	769 19.34
799 23.64	815.7 28.48	848 37.84
958 41.14	978 47.14	1035 46.24
1104 48.74	3304 48.54	3339 49.24
6887 49.84	6898 50.04	6004 45.14

Manning's n Values	num= 6				
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
0 .068	644 .068	677 .066	717 .025	799 .066	
1054 .067					

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
677	1054		8125	22690	5625	.1		.3
Blocked Obstructions	num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	602	51.14	1054	6898	49.94			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	52.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	wt. n-Val.	0.068	0.059	0.067
W.S. Elev (ft)	52.27	Reach Len. (ft)	8125.00	22690.00	5625.00
Crit W.S. (ft)		Flow Area (sq ft)	863.50	6501.15	13591.93
E.G. Slope (ft/ft)	0.000151	Area (sq ft)	863.50	6501.15	13591.93
Q Total (cfs)	20000.00	Flow (cfs)	288.40	13201.70	6509.90
Top Width (ft)	6879.67	Top Width (ft)	658.67	377.00	5844.00
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.33	2.03	0.48
Max chl Dpth (ft)	36.73	Hydr. Depth (ft)	1.31	17.24	2.33
Conv. Total (cfs)	1625278.0	Conv. (cfs)	23436.7	1072822.0	529019.9
Length wtd. (ft)	16340.04	Wetted Per. (ft)	661.54	391.84	5846.23
Min ch El (ft)	15.54	Shear (lb/sq ft)	0.01	0.16	0.02
Alpha	3.07	Stream Power (lb/ft s)	6898.00	0.00	0.00
Frctn Loss (ft)	1.79	Cum Volume (acre-ft)	11325.13	34273.76	11024.03
C & E Loss (ft)	0.00	Cum SA (acres)	4546.72	1791.83	5322.94

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 74.5

INPUT	Description: XS 74.5	NAVD 88
Station Elevation Data	num= 43	
Sta Elev	Sta Elev	Sta Elev
0 53.34	21 52.74	36 44.54
		259 39.94
		367 40.24

389 45.04	420 45.44	2220 47.94	2237 47.94	3049 46.54
3054 47.54	3067 47.04	3337 46.05	3341 46.04	3370 46.04
3396.4 26.21	3400 23.51	3406 20.74	3416 16.84	3426 17.34
3436 17.34	3446 17.94	3456 16.74	3466 18.54	3476 18.84
3486 19.34	3496 19.34	3506 20.94	3515 23.51	3520.4 26.26
3530 31.14	3544 27.44	3571 34.44	3579 39.44	3595 41.94
3615 41.74	3870 40.94	4148 45.24	4601 47.44	5240 47.14
6178 46.14	6193 50.44	6205 50.44		

Manning's n Values	num= 6				
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
0 .074	3337 .074	3370 .066	3400 .025	3515 .066	
3595 .067					

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
3370	3595		4250	3440	3250	.1		.3
Blocked Obstructions	num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	2220	47.94	4601	6205	47.44			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	50.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	wt. n-Val.	0.074	0.048	0.067
W.S. Elev (ft)	50.48	Reach Len. (ft)	4250.00	3440.00	3250.00
Crit W.S. (ft)		Flow Area (sq ft)	9515.52	5549.45	11261.54
E.G. Slope (ft/ft)	0.000067	Area (sq ft)	9515.52	5549.45	11261.54
Q Total (cfs)	20000.00	Flow (cfs)	3155.04	11409.67	5435.29
Top Width (ft)	6179.87	Top Width (ft)	3344.87	225.00	2610.00
Vel Total (ft/s)	0.76	Avg. Vel. (ft/s)	0.33	2.06	0.48
Max chl Dpth (ft)	33.74	Hydr. Depth (ft)	2.84	24.66	4.31
Conv. Total (cfs)	2435422.0	Conv. (cfs)	384193.3	1389368.0	661861.2
Length wtd. (ft)	3514.37	Wetted Per. (ft)	3345.63	239.46	2610.50
Min ch El (ft)	16.74	Shear (lb/sq ft)	0.01	0.10	0.02
Alpha	4.32	Stream Power (lb/ft s)	6205.00	0.00	0.00
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	10357.16	31135.24	9419.34
C & E Loss (ft)	0.01	Cum SA (acres)	4173.34	1635.04	4777.10

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 73.8

INPUT	Description: XS 73.8	NAVD 88
Station Elevation Data	num= 42	
Sta Elev	Sta Elev	Sta Elev
29 53.64	36 53.24	57 46.84
512 46.64	531 35.34	549 35.34
610 37.24	645 36.74	675 39.19
726 40.24	746.7 25.94	750 23.66
780 20.44	790 19.54	800 19.14
830 17.14	840 14.64	850 14.64
873.6 25.93	883 31.84	894 39.14
932 44.84	940 49.24	973 46.64
1971 49.94	1980 49.54	1943 44.74

Manning's n Values	num= 6				
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
29 .088	675 .088	708 .066	750 .025	870 .066	
940 .06					

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
708	940		4625	4315	3300	.1		.3
Blocked Obstructions	num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
29	708	43.74	940	1980	49.24			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	50.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	wt. n-Val.	0.088	0.048	0.060
W.S. Elev (ft)	49.97	Reach Len. (ft)	4625.00	4315.00	3300.00
Crit W.S. (ft)		Flow Area (sq ft)	2780.13	5117.30	753.33
E.G. Slope (ft/ft)	0.000226	Area (sq ft)	2780.13	5117.30	753.33
Q Total (cfs)	20000.00	Flow (cfs)	1845.22	17928.87	225.91
Top Width (ft)	1933.27	Top Width (ft)	661.27	232.00	1040.00
Vel Total (ft/s)	2.31	Avg. Vel. (ft/s)	0.66	3.50	0.30
Max chl Dpth (ft)	35.33	Hydr. Depth (ft)	4.20	22.06	0.72
Conv. Total (cfs)	133704.0	Conv. (cfs)	122864.3	1193797.0	15042.4
Length wtd. (ft)	4304.65	Wetted Per. (ft)	663.06	247.88	1040.54
Min ch El (ft)	14.64	Shear (lb/sq ft)	0.06	0.29	0.01
Alpha	2.07	Stream Power (lb/ft s)	1980.00	0.00	0.00
Frctn Loss (ft)	0.75	Cum Volume (acre-ft)	9757.33	30714.05	8971.13
C & E Loss (ft)	0.04	Cum SA (acres)	3977.91	1616.99	4640.94

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 72.9

INPUT									
Description: XS 72.9 "J" NAVD 88									
Station Elevation Data num= 40									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	52.54	5	52.44	39	44.14	93	41.64	210	43.44
287	33.84	417	35.34	460	36.64	488	36.74	764	44.54
2636	45.84	2673	45.44	2686	35.84	2701	27.64	2710	19.14
2720	15.94	2730	14.14	2740	14.14	2750	14.64	2760	14.84
2770	17.64	2780	19.64	2790	21.44	2800	23.14	2810	23.94
2820	25.44	2828	27.64	2845	30.44	2874	30.14	2884	33.74
2921	37.24	2938	37.44	2977	40.04	3144	45.34	3274	44.94
3409	47.64	4331	42.94	5786	44.34	5809	50.64	5821	48.74

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.082	2636	.082	2673	.066	2701	.025
3144	.06					2828	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	2673	3144		3	3625		.1	.3
Blocked obstructions num= 3								
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	2636	45.84	3144	3409	45.34	3409	5809	47.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	49.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	wt. n-Val.	0.082	0.056	0.060
W.S. Elev (ft)	49.31	Reach Len. (ft)	3500.00	3625.00	3200.00
Crit W.S. (ft)		Flow Area (sq ft)	9200.61	7501.15	4920.04
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	9200.61	7501.15	4920.04
Q Total (cfs)	20000.00	Flow (cfs)	4251.23	13704.99	2043.78
Top width (ft)	5789.95	Top width (ft)	2655.19	471.00	2663.76
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.46	1.83	0.42
Max chl Dpth (ft)	35.17	Hydr. depth (ft)	3.47	15.93	1.85
Conv. Total (cfs)	1795950.0	Conv. (cfs)	381749.4	1230674.0	183526.7
Length wtd. (ft)	3570.89	wetted Per. (ft)	2655.61	482.83	2664.63
Min ch El (ft)	14.14	Shear (lb/sq ft)	0.03	0.12	0.01
Alpha	2.75	Stream Power (lb/ft s)	5821.00	0.00	0.00
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	9121.30	30089.07	8756.23
C & E Loss (ft)	0.01	Cum SA (acres)	3801.84	1582.17	4500.65

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 72.2

INPUT
Description: XS 72.2 NAVD 88

Station Elevation Data num= 36									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	52.64	18	51.94	52	43.64	184	43.64	1157	39.34
2487	47.24	2490	46.64	2504	42.54	2510	42.54	2858	43.14
2891	43.24	2922	41.44	3001	40.04	3013	39.04	3025	34.08
3038	30.54	3044.2	25.29	3046	23.77	3055	20.04	3065	18.74
3075	17.44	3085	15.44	3095	15.04	3105	12.34	3115	10.74
3125	12.24	3135	16.74	3145	21.44	3155	23.77	3159.2	25.29
3188	35.74	3198	45.04	3227	46.14	3752	46.24	3765	51.24
3781	51.24								

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
6	.075	2858	.075	2891	.066	3046	.025
3198	.06					3155	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	3013	3198		5450	8440		.1	.3
Blocked obstructions num= 1								
Sta L	Sta R	Elev						
6	2487	47.24						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	48.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	wt. n-Val.	0.072	0.045	0.060
W.S. Elev (ft)	48.72	Reach Len. (ft)	5450.00	8440.00	8125.00

Crit W.S. (ft)		Flow Area (sq ft)	6877.63	4733.41	1424.72
E.G. Slope (ft/ft)	0.000150	Area (sq ft)	6877.63	4733.41	1424.72
Q Total (cfs)	20000.00	Flow (cfs)	3384.67	15811.86	803.47
Top width (ft)	3727.23	Top width (ft)	2981.79	185.00	560.44
Vel Total (ft/s)	1.53	Avg. Vel. (ft/s)	0.49	3.34	0.56
Max chl Dpth (ft)	37.98	Hydr. depth (ft)	2.31	25.59	2.54
Conv. Total (cfs)	1635028.0	Conv. (cfs)	276701.6	1292642.0	65684.4
Length wtd. (ft)	8113.34	wetted Per. (ft)	2982.72	198.70	560.92
Min ch El (ft)	10.74	Shear (lb/sq ft)	0.02	0.22	0.02
Alpha	3.77	Stream Power (lb/ft s)	3781.00	0.00	0.00
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	8475.37	29580.00	8523.18
C & E Loss (ft)	0.02	Cum SA (acres)	3575.38	1554.88	4382.22

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 70.7

INPUT									
Description: XS 70.7 "I" NAVD 88									
Station Elevation Data num= 39									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	53.34	6	53.24	12	53.24	30	53.34	62	42.34
254	43.14	363	44.84	379	48.14	395	47.74	410	44.44
624	44.44	641	40.64	653	43.74	667	24.64	670	22.14
680	17.64	690	15.94	700	15.64	710	15.64	720	15.94
730	16.14	740	16.64	750	17.14	760	17.84	770	18.84
780	20.14	790	20.64	800	21.84	810	24.64	823	31.34
833	29.04	843	29.54	870	39.24	897	37.54	1601	44.54
2334	43.34	2345	42.74	2358	48.64	2371	48.54		

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
870	.062	624	.076	653	.066	667	.025
						810	.066

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	653	870		1100	1000		.1	.3
Blocked obstructions num= 3								
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
30	379	48.14	870	1601	39.24	1601	2350	44.54

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	47.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	wt. n-Val.	0.076	0.043	0.062
W.S. Elev (ft)	47.76	Reach Len. (ft)	1100.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	892.33	5394.81	7242.41
E.G. Slope (ft/ft)	0.000094	Area (sq ft)	892.33	5394.81	7242.41
Q Total (cfs)	20000.00	Flow (cfs)	391.64	14776.25	4832.12
Top width (ft)	1962.06	Top width (ft)	258.99	217.00	1486.07
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)	0.44	2.74	0.67
Max chl Dpth (ft)	32.12	Hydr. depth (ft)	3.45	24.86	4.87
Conv. Total (cfs)	2064433.0	Conv. (cfs)	40425.2	1525228.0	498779.1
Length wtd. (ft)	1000.98	wetted Per. (ft)	260.16	232.95	1486.80
Min ch El (ft)	15.64	Shear (lb/sq ft)	0.02	0.14	0.03
Alpha	2.59	Stream Power (lb/ft s)	2371.00	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	7989.30	28598.80	7714.86
C & E Loss (ft)	0.00	Cum SA (acres)	3372.65	1515.93	4191.36

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 70.5

INPUT									
Description: XS 70.5 "H" NAVD 88									
Station Elevation Data num= 36									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	51.24	12	51.24	137	49.54	663	52.74	709	54.94
755	49.04	837	47.44	856	41.04	862	35.34	871	30.54
877	24.84	879	22.64	889	14.74	899	13.84	909	12.34
919	12.84	929	14.64	939	15.44	949	16.34	959	17.84
969	18.04	979	18.84	989	20.64	999	24.84	1014	33.74
1023	33.94	1040	41.84	1053	38.14	1154	38.34	1173	44.24
1196	42.94	1683	44.24	3097	39.94	3114	40.34	3135	47.24
3148	46.84								

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.078	709	.078	755	.066	877	.025
1040	.065					999	.066

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

837	1040		1700	1500	1250		.1	.3
Blocked Obstructions	num=	3						
Sta L Sta R Elev	Sta L Elev	Sta R Elev	Sta L Elev	Sta R Elev	Sta L Elev	Sta R Elev		
0 709 54.94	1040	1173 41.84	1173	3135 44.24				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	47.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.066	0.045	0.065
W.S. Elev (ft)	47.61	Reach Len. (ft)	1700.00	1500.00	1250.00
Crit W.S. (ft)		Flow Area (sq ft)	0.72	4703.70	7358.53
E.G. Slope (ft/ft)	0.000157	Area (sq ft)	0.72	4703.70	7358.53
Q Total (cfs)	20000.00	Flow (cfs)	0.04	15156.88	4843.08
Top width (ft)	2319.59	Top width (ft)	8.58	203.00	2108.00
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.05	3.22	0.66
Max chl Dpth (ft)	35.27	Hydr. Depth (ft)	0.08	23.17	3.49
Conv. Total (cfs)	1597739.0	Conv. (cfs)	3.1	1210837.0	386899.0
Length Wtd. (ft)	1454.35	Wetted Per. (ft)	8.59	219.26	2109.62
Min Ch El (ft)	12.34	Shear (lb/sq ft)	0.00	0.21	0.03
Alpha	2.90	Stream Power (lb/ft s)	3148.00	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	7978.03	28482.88	7547.27
C & E Loss (ft)	0.01	Cum SA (acres)	3369.27	1511.11	4150.10

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 70.2

INPUT

Description: XS 70.2 NAVD 88

Station Elevation Data	num=	46						
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	
0 51.14	8 51.24	42 42.84	82 42.84	265 45.54				
323 46.04	337 43.14	374 41.24	491 42.84	576 42.84				
609 42.84	619 41.44	643 36.44	725 35.44	746 38.04				
756 39.64	765 35.64	771 35.44	775 31.94	782 30.64				
790.6 24.5	792 23.5	797 20.84	807 17.94	817 16.54				
827 15.84	837 16.54	847 16.14	857 15.44	867 15.74				
877 16.04	887 16.04	897 17.74	907 19.84	912 23.5				
913.4 24.48	929 35.34	936 44.54	963 44.54	1301 42.84				
1712 41.94	3333 40.84	3388 41.24	4381 38.64	4402 46.94				
4413 47.04								

Manning's n Values	num=	6						
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	
0 .079	576 .079	609 .066	792 .025	912 .066				
936 .067								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
756 936 10750 19375 7375 .1 .3

Blocked Obstructions	num=	2						
Sta L Sta R Elev	Sta L Elev	Sta R Elev						
0 609 42.84	936	4413 44.54						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	47.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.071	0.043	0.067
W.S. Elev (ft)	47.45	Reach Len. (ft)	10750.00	19375.00	7375.00
Crit W.S. (ft)		Flow Area (sq ft)	3725.49	4522.14	10083.69
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	3725.49	4522.14	10083.69
Q Total (cfs)	20000.00	Flow (cfs)	2619.85	12823.39	4556.76
Top width (ft)	4389.66	Top width (ft)	732.66	180.00	3477.00
Vel Total (ft/s)	1.09	Avg. Vel. (ft/s)	0.70	2.84	0.45
Max chl Dpth (ft)	32.01	Hydr. Depth (ft)	5.08	25.12	2.90
Conv. Total (cfs)	1995806.0	Conv. (cfs)	261435.5	1279650.0	454719.9
Length Wtd. (ft)	17389.32	Wetted Per. (ft)	734.45	195.67	3477.87
Min Ch El (ft)	15.44	Shear (lb/sq ft)	0.03	0.14	0.02
Alpha	4.42	Stream Power (lb/ft s)	4413.00	0.00	0.00
Frctn Loss (ft)	2.42	Cum Volume (acre-ft)	7905.31	28324.04	7297.01
C & E Loss (ft)	0.01	Cum SA (acres)	3354.80	1504.52	4069.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 67.4

INPUT

Description: XS 67.4 NAVD 88

Station Elevation Data	num=	35						
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	
0 49.24	11 49.24	38 48.24	535 47.3	568 47.24				
608 41.64	668 43.24	681 44.24	713 26.64	720 23.35				
725 22.34	726 9 18.94	735 18.94	745 17.04	755 16.64				
765 16.64	785 16.84	795 16.64	805 16.94	815 17.04				
825 16.04	835 15.84	845 15.84	855 16.64	865 16.64				
875 21.34	875.6 21.74	878 23.35	889 30.74	992 35.24				
1022 44.74	1054 42.24	1143 42.24	7218 42.24	7243 44.84				

Manning's n Values	num=	6						
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	
0 .071	535 .071	568 .066	720 .025	878 .066				
1022 .067								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
681 1022 2 750 250 .1 .3

Blocked Obstructions	num=	2						
Sta L Sta R Elev	Sta L Elev	Sta R Elev						
0 681 44.24	1022	7243 44.74						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	45.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.066	0.050	0.067
W.S. Elev (ft)	44.96	Reach Len. (ft)	1250.00	750.00	250.00
Crit W.S. (ft)		Flow Area (sq ft)	67.78	6382.92	1368.60
E.G. Slope (ft/ft)	0.000226	Area (sq ft)	67.78	6382.92	1368.60
Q Total (cfs)	20000.00	Flow (cfs)	18.08	19815.75	166.16
Top width (ft)	6658.71	Top width (ft)	96.71	341.00	6221.00
Vel Total (ft/s)	2.56	Avg. Vel. (ft/s)	0.27	3.10	0.12
Max chl Dpth (ft)	29.12	Hydr. Depth (ft)	0.70	18.72	0.22
Conv. Total (cfs)	1331361.0	Conv. (cfs)	1203.7	1319096.0	11061.2
Length Wtd. (ft)	761.10	Wetted Per. (ft)	96.76	352.68	6221.13
Min Ch El (ft)	15.84	Shear (lb/sq ft)	0.01	0.25	0.00
Alpha	1.46	Stream Power (lb/ft s)	7243.00	0.00	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	7437.25	25898.81	6327.53
C & E Loss (ft)	0.01	Cum SA (acres)	3252.46	1388.65	3249.00

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 67.25

INPUT

Description: XS 67.25 NAVD 88

Station Elevation Data	num=	46						
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	
0 48.64	12 48.84	33 42.84	42 42.84	54 39.84				
90 40.64	146 34.84	175 38.84	278 40.64	505 40.24				
506 40.24	525 40.64	538 44.24	549 41.84	573 40.64				
599 42.04	603 42.64	632 33.14	645 33.14	665 38.14				
699 35.64	714 24.76	717 21.6	722 16.34	732 13.44				
742 13.44	752 13.94	762 13.14	772 13.94	782 13.94				
792 15.74	802 15.24	812 15.74	822 16.94	832 17.44				
842 18.44	852 21.74	859 24.76	885 39.44	897 39.84				
906 42.14	939 44.64	981 43.64	1116 42.84	6941 42.84				
6966 44.74								

Manning's n Values	num=	6						
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	
0 .074	505 .074	538 .066	714 .025	859 .066				
939 .144								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
699 906 4125 11500 8000 .1 .3

Blocked Obstructions	num=	2						
Sta L Sta R Elev	Sta L Elev	Sta R Elev						
0 538 44.24	939	6966 44.64						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	44.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.066	0.040	0.098
W.S. Elev (ft)	44.71	Reach Len. (ft)	4125.00	11500.00	8000.00
Crit W.S. (ft)		Flow Area (sq ft)	1236.70	4792.19	487.42
E.G. Slope (ft/ft)	0.000188	Area (sq ft)	1236.70	4792.19	487.42
Q Total (cfs)	20000.00	Flow (cfs)	1063.03	18909.73	27.24
Top width (ft)	6939.21	Top width (ft)	672.56	207.00	6059.65
Vel Total (ft/s)	3.07	Avg. Vel. (ft/s)	0.86	3.95	0.06
Max chl Dpth (ft)	31.57	Hydr. Depth (ft)	1.84	23.15	0.08
Conv. Total (cfs)	1459303.0	Conv. (cfs)	77564.4	1379751.0	1987.6
Length Wtd. (ft)	10582.93	Wetted Per. (ft)	675.22	220.26	6059.75
Min Ch El (ft)	13.14	Shear (lb/sq ft)	0.02	0.26	0.00
Alpha	1.57	Stream Power (lb/ft s)	6966.00	0.00	0.00
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)	7418.53	25802.61	6322.21
C & E Loss (ft)	0.03	Cum SA (acres)	3241.43	1383.93	3213.76

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may

indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 64.7

INPUT
Description: XS 64.7 NAVD 88

Station Elevation Data		num=		50					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	49.24	13	48.64	57	41.24	105	39.64	427	36.64
505	36.94	534	38.04	1843	41.24	1905	38.74	3886	38.24
3946	39.94	4065	36.64	4355	37.24	4389	38.74	4400	41.64
4409	41.24	4435	33.84	4512	32.24	4532	35.14	4543	37.04
4558	30.64	4566	30.24	4578.7	20.1	4580	19.06	4585	13.54
4595	11.64	4605	12.44	4615	12.84	4625	12.54	4635	13.34
4645	14.04	4655	14.34	4665	13.94	4675	14.24	4685	14.24
4695	15.04	4705	15.84	4715	19.06	4716.8	20.13	4746	37.54
4805	36.28	4811	36.94	4818	39.94	4974	38.34	5044	39.94
5615	34.54	5652	41.14	5920	40.34	5938	43.34	5946	43.34

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.076	4355	.076	4400	.066	4580	.025
4818	.088					4715	.066

Bank Sta: Left 4543 Right 4746
Blocked Obstructions num= 2
Coeff Contr. .1
Expan. .3

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	4400	41.64	4818	5946	39.94

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	43.27	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.11	Wt. n-Val.	0.072	0.042	0.083
W.S. Elev (ft)	43.16	Reach Len. (ft)	2000.00	4810.00	4000.00
Crit W.S. (ft)		Flow Area (sq ft)	7800.37	4897.81	3789.79
E.G. Slope (ft/ft)	0.000122	Area (sq ft)	7800.37	4897.81	3789.79
Q Total (cfs)	20000.00	Flow (cfs)	3110.38	15230.00	1659.62
Top width (ft)	5891.29	Top width (ft)	4497.39	203.00	1190.89
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	0.40	3.11	0.44
Max chl Dpth (ft)	31.52	Hydr. Depth (ft)	1.73	24.13	3.18
Conv. Total (cfs)	1812844.0	Conv. (cfs)	281931.7	1380481.0	150431.3
Length wtd. (ft)	3907.93	Wetted Per. (ft)	4498.95	216.64	1191.90
Min ch El (ft)	11.64	Shear (lb/sq ft)	0.01	0.17	0.02
Alpha	5.03	Stream Power (lb/ft s)	5946.00	0.00	0.00
Frcn Loss (ft)	0.38	Cum Volume (acre-ft)	6990.64	24523.51	5929.44
C & E Loss (ft)	0.02	Cum SA (acres)	2996.64	1329.81	2347.96

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 63.8

INPUT
Description: XS 63.8 "F" NAVD 88

Station Elevation Data		num=		58					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
17	48.04	52	37.94	74	37.04	90	34.34	101	33.24
257	33.04	296	40.74	330	41.14	512	41.34	516	43.04
523	42.24	574	21.04	1111	21.54	1161	42.34	1223	41.24
2543	41.24	2577	40.64	2583	41.44	2600	42.04	2651	28.44
2678	27.94	2879	26.64	2951	28.24	2986	43.04	3001	44.04
3005	40.54	3062	40.54	4207	38.94	5705	38.54	5740	38.84
5759	28.64	5820	22.44	5891	20.14	6508	19.04	6836	21.04
6865	34.24	6880	35.14	6889	30.34	6906	24.14	6913	20.74
6917	18.24	6927	17.34	6937	16.14	6947	13.54	6957	12.24
6967	11.74	6977	10.34	6987	9.24	6997	7.84	7007	8.24
7017	12.34	7027	20.74	7037	31.44	7048	31.24	7065	37.24
7179	35.74	7199	43.24	7212	43.24				

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
17	.075	6836	.075	6880	.053	6913	.025
7037	.077					7027	.053

Bank Sta: Left 6880 Right 7065
Blocked Obstructions num= 2
Coeff Contr. .1
Expan. .3

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	3001	44.04	5740	6880	35.14

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	42.87	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.05	Wt. n-Val.	0.075	0.042	0.077

W.S. Elev (ft)	42.82	Reach Len. (ft)	3000.00	7000.00	5750.00
Crit W.S. (ft)		Flow Area (sq ft)	18651.12	4355.95	788.21
E.G. Slope (ft/ft)	0.000075	Area (sq ft)	18651.12	4355.95	788.21
Q Total (cfs)	20000.00	Flow (cfs)	9128.52	10442.92	428.56
Top width (ft)	4195.48	Top width (ft)	3877.60	185.00	132.88
Vel Total (ft/s)	0.84	Avg. Vel. (ft/s)	0.49	2.40	0.54
Max chl Dpth (ft)	34.98	Hydr. Depth (ft)	4.81	23.55	5.93
Conv. Total (cfs)	2311145.0	Conv. (cfs)	1054866.0	1206755.0	49522.7
Length wtd. (ft)	5947.72	Wetted Per. (ft)	3879.39	199.14	134.17
Min ch El (ft)	7.84	Shear (lb/sq ft)	0.02	0.10	0.03
Alpha	4.41	Stream Power (lb/ft s)	7212.00	0.00	0.00
Frcn Loss (ft)	0.45	Cum Volume (acre-ft)	6383.40	24012.60	5719.25
C & E Loss (ft)	0.01	Cum SA (acres)	2804.37	1308.39	2487.18

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 62.5

INPUT
Description: XS 62.5 NAVD 88

Station Elevation Data		num=		38					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	48.54	9	47.94	39	37.24	49	36.24	342	33.14
534	37.24	755	38.64	789	39.98	795	39.24	806	29.84
815	19.22	815.8	18.63	820	15.54	830	10.74	840	10.64
850	10.64	860	10.24	870	11.24	880	11.64	890	11.94
900	12.24	910	12.24	920	13.64	930	13.84	940	14.74
950.4	18.62	952	19.22	984	34.24	998	34.74	1096	32.74
1109	38.64	1125	37.94	1167	38.24	1195	40.54	3010	35.94
3024	36.84	3039	44.84	3050	44.24				

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.074	755	.08	795	.04	815	.025
1195	.067					952	.04

Bank Sta: Left 795 Right 984
Blocked Obstructions num= 2
Coeff Contr. .1
Expan. .3

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	789	39.98	1195	3050	40.54

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	42.40	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.17	Wt. n-Val.	0.074	0.030	0.050
W.S. Elev (ft)	42.23	Reach Len. (ft)	4250.00	6125.00	4125.00
Crit W.S. (ft)		Flow Area (sq ft)	1728.25	4793.12	4448.96
E.G. Slope (ft/ft)	0.000078	Area (sq ft)	1728.25	4793.12	4448.96
Q Total (cfs)	20000.00	Flow (cfs)	521.99	17115.12	2362.88
Top width (ft)	3009.10	Top width (ft)	769.99	189.00	2050.11
Vel Total (ft/s)	1.82	Avg. Vel. (ft/s)	0.30	3.57	0.53
Max chl Dpth (ft)	31.99	Hydr. Depth (ft)	2.24	23.36	2.17
Conv. Total (cfs)	2269261.0	Conv. (cfs)	59227.1	1941934.0	268100.0
Length wtd. (ft)	5833.27	Wetted Per. (ft)	770.43	204.06	2051.95
Min ch El (ft)	10.24	Shear (lb/sq ft)	0.01	0.11	0.01
Alpha	3.29	Stream Power (lb/ft s)	3050.00	0.00	0.00
Frcn Loss (ft)	0.64	Cum Volume (acre-ft)	5681.63	23277.48	5373.59
C & E Loss (ft)	0.03	Cum SA (acres)	2644.33	1278.34	2343.10

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

Note: This may indicate the need for additional cross sections.
Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 61.3

INPUT
Description: XS 61.3 "E" NAVD 88

Station Elevation Data		num=		52					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	47.64	11	47.04	40	38.94	56	36.54	407	35.04
419	33.14	538	31.84	564	33.74	597	37.24	814	38.54
889	38.64	1390	37.24	2209	38.54	3148	39.74	3219	36.74
3266	33.94	3276	36.14	3291	36.44	3323	21.14	3592	21.54
3640	30.54	3647	35.14	3710	36.54	3724	33.14	3735	27.94
3769	27.44	3787	31.24	3821	33.34	3893	28.84	3918	27.74
3989	24.94	3997	22.94	4000	19.54	4002	17.04	4012	13.74
4022	9.54	4032	7.34	4042	4.24	4052	3.54	4062	3.04
4072	6.74	4082	9.24	4092	13.34	4100	19.54	4102	21.34
4109	21.54	4125	34.74	4147	40.74	4199	37.94	4214	39.34
4225	43.34	4237	43.04						

Manning's n Values

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

0	.1	3787	.08	3821	.04	4000	.025	4100	.04
4225	.067								
Bank Sta:	Left	Right	Lengths:	Left Channel	Right		Coeff	Contr.	Expan.
	3787	4147		5375	7565	1750		.1	.3
Blocked Obstructions	num=								
	4								
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev	
0	3148	39.74	3148	3710	36.54	3710	3821	33.34	
4147	4237	40.74							

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	41.73	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.053	0.040
W.S. Elev (ft)	41.66	Reach Len. (ft)	5375.00	7565.00	1750.00
Crit W.S. (ft)		Flow Area (sq ft)	8729.57	7046.06	66.22
E.G. Slope (ft/ft)	0.000186	Area (sq ft)	8729.57	7046.06	66.22
Q Total (cfs)	20000.00	Flow (cfs)	3147.81	16820.89	31.30
Top width (ft)	4190.11	Top width (ft)	3679.73	437.00	73.38
Vel Total (ft/s)	1.26	Avg. Vel. (ft/s)	0.36	2.39	0.47
Max chl Dpth (ft)	38.62	Hydr. Depth (ft)	2.37	16.12	0.90
Conv. Total (cfs)	1465888.0	Conv. (cfs)	230716.9	1232878.0	2293.9
Length Wtd. (ft)	7067.50	Wetted Per. (ft)	3680.06	452.85	73.54
Min ch El (ft)	3.04	Shear (lb/sq ft)	0.03	0.18	0.01
Alpha	3.02	Stream Power (lb/ft s)	4237.00	0.00	0.00
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	5171.46	22445.12	5159.80
C & E Loss (ft)	0.01	Cum SA (acres)	2427.26	1234.33	2242.56

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 59.9

INPUT

Description: XS 59.9 NAVD 88

Station Elevation Data	num=	42							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	44.74	9	44.74	28	38.74	77	37.24	1121	38.14
1187	38.74	1198	39.74	1208	37.24	1217	39.74	1227	38.74
1258	39.08	1291	39.44	1318	36.94	1337	31.44	1352	31.74
1374	22.44	1380	19.15	1384	16.59	1390	12.74	1400	9.84
1410	9.84	1420	9.84	1430	9.84	1440	10.14	1450	10.14
1460	9.14	1470	9.84	1480	10.64	1490	10.64	1500	12.64
1510	16.14	1511.2	16.59	1518	19.15	1535	34.14	1555	32.34
1633	32.84	1688	35.14	1751	38.14	1931	38.84	2754	36.74
2771	43.44	2780	43.14						

Manning's n Values	num=	6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.091	1258	.08	1291	.04	1380	.025	1518	.04
1931	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right		Coeff	Contr.	Expan.
	1318	1535		4750	5440	3000		.1	.3
Blocked Obstructions	num=								
	2								
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	1217	39.74	1931	2780	38.84				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	40.73	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	Wt. n-Val.	0.080	0.031	0.046
W.S. Elev (ft)	40.56	Reach Len. (ft)	4750.00	5440.00	3000.00
Crit W.S. (ft)		Flow Area (sq ft)	1145.21	4942.39	3173.02
E.G. Slope (ft/ft)	0.000094	Area (sq ft)	1145.21	4942.39	3173.02
Q Total (cfs)	20000.00	Flow (cfs)	196.33	17672.21	2131.47
Top width (ft)	2741.44	Top width (ft)	1295.75	217.00	1228.68
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)	0.17	3.58	0.67
Max chl Dpth (ft)	31.42	Hydr. Depth (ft)	0.88	22.78	2.58
Conv. Total (cfs)	2062670.0	Conv. (cfs)	20248.0	1822597.0	219825.8
Length Wtd. (ft)	4996.38	Wetted Per. (ft)	1296.05	229.73	1229.21
Min ch El (ft)	9.14	Shear (lb/sq ft)	0.01	0.13	0.02
Alpha	2.43	Stream Power (lb/ft s)	2780.00	0.00	0.00
Frctn Loss (ft)	0.42	Cum Volume (acre-ft)	4562.23	21404.11	5094.74
C & E Loss (ft)	0.01	Cum SA (acres)	2120.29	1177.54	2216.40

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 59

INPUT

Description: XS 59 NAVD 88

Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	44.14	10	44.04	38	37.24	61	34.24	90	35.94
337	36.84	359	37.08	392	37.44	427	18.2	432.3	15.41
433	15.04	443	12.64	453	9.14	463	6.94	473	4.19
483	4.14	493	10.64	503	8.14	513	11.64	523	12.84
533	13.64	538.4	15.42	543	16.94	548	18.2	571	31.84
577	31.84	653	28.64	753	35.84	864	35.84	940	37.74
1608	36.44	1636	36.54	2009	36.74	2336	35.74	2692	38.04
3057	36.54	3397	36.54	3874	36.54	3881	37.14	3896	43.14
4009	42.74								

Manning's n Values	num=	6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.078	359	.08	392	.04	427	.025	548	.04
753	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right		Coeff	Contr.	Expan.
	392	571		1000	1030	1375		.1	.3
Blocked Obstructions	num=								
	2								
Sta L	Sta R	Elev	Sta L	Sta R	Elev				
0	392	37.44	940	4009	37.74				

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	40.29	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.13	Wt. n-Val.	0.078	0.031	0.055
W.S. Elev (ft)	40.16	Reach Len. (ft)	1000.00	1030.00	1375.00
Crit W.S. (ft)		Flow Area (sq ft)	981.50	4353.08	9452.13
E.G. Slope (ft/ft)	0.000076	Area (sq ft)	981.50	4353.08	9452.13
Q Total (cfs)	20000.00	Flow (cfs)	313.64	14689.64	4996.72
Top width (ft)	3862.59	Top width (ft)	366.04	179.00	3317.56
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)	0.32	3.37	0.53
Max chl Dpth (ft)	36.02	Hydr. Depth (ft)	2.68	24.32	2.85
Conv. Total (cfs)	2294611.0	Conv. (cfs)	35984.1	1685351.0	573276.0
Length Wtd. (ft)	1111.40	Wetted Per. (ft)	366.36	193.57	3318.38
Min ch El (ft)	4.14	Shear (lb/sq ft)	0.01	0.11	0.01
Alpha	4.61	Stream Power (lb/ft s)	4009.00	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	4446.27	20823.68	4659.98
C & E Loss (ft)	0.01	Cum SA (acres)	2029.69	1152.81	2059.85

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 58.8

INPUT

Description: XS 58.8 NAVD 88

Station Elevation Data	num=	31							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
446	44.04	447	36.94	714	36.94	725	36.94	747	37.04
792	27.54	810	23.24	822.5	15.32	827	12.47	832	8.44
842	6.64	852	6.94	862	7.64	872	7.64	882	8.24
892	8.24	902	8.64	912	8.84	922	8.74	932	8.74
942	9.04	952	11.04	954	12.47	959.6	15.3	969	20.04
997	31.84	1005	31.64	1110	36.54	1150	36.54	3975	36.54
4000	42.84								

Manning's n Values	num=	6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
446	.108	714	.05	747	.04	810	.025	952	.04
1110	.067								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right		Coeff	Contr.	Expan.
	747	997		2750	2660	3250		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	40.21	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.08	Wt. n-Val.	0.096	0.032	0.063
W.S. Elev (ft)	40.13	Reach Len. (ft)	2750.00	2660.00	3250.00
Crit W.S. (ft)		Flow Area (sq ft)	955.18	5780.94	10997.88
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	955.18	5780.94	10997.88
Q Total (cfs)	20000.00	Flow (cfs)	229.61	15281.89	4488.50
Top width (ft)	3542.68	Top width (ft)	300.45	250.00	2992.23
Vel Total (ft/s)	1.13	Avg. Vel. (ft/s)	0.24	2.64	0.41
Max chl Dpth (ft)	33.49	Hydr. Depth (ft)	3.18	23.12	3.68
Conv. Total (cfs)	2770736.0	Conv. (cfs)	31809.2	2117105.0	621822.4
Length Wtd. (ft)	2727.71	Wetted Per. (ft)	303.22	261.11	2992.79
Min ch El (ft)	6.64	Shear (lb/sq ft)	0.01	0.07	0.01
Alpha	4.23	Stream Power (lb/ft s)	4000.00	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	4424.04	20703.87	4337.23
C & E Loss (ft)	0.01	Cum SA (acres)	2022.04	1147.74	1960.27

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 58.3

INPUT									
Description: XS 58.3 "D" NAVD 88									
Station Elevation Data num= 24									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	40.44	11	40.14	33	34.54	80	34.24	93	30.54
142	25.54	170	19.24	177	15.64	180	11.54	190	8.64
200	6.64	210	5.84	220	5.64	230	5.94	240	5.64
250	6.14	260	6.44	270	7.64	280	9.14	290	15.64
325	28.14	354	32.24	374	37.84	418	37.14		

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.081	33	.05	80	.04	177	.025	290	.04
374	.081								

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
80	374		3000	3000	1500		.1	.3
Blocked Obstructions num= 1								
Sta L	Sta R	Elev						
374	418	37.84						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	40.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.052	0.035	0.081
W.S. Elev (ft)	39.84	Reach Len. (ft)	3000.00	3000.00	1500.00
Crit W.S. (ft)		Flow Area (sq ft)	311.33	5972.81	88.00
E.G. Slope (ft/ft)	0.000111	Area (sq ft)	311.33	5972.81	88.00
Q Total (cfs)	20000.00	Flow (cfs)	268.92	19704.81	26.26
Top width (ft)	405.82	Top width (ft)	67.82	294.00	44.00
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	0.86	0.30	0.30
Max chl Dpth (ft)	34.20	Hydr. Depth (ft)	4.59	20.32	2.00
Conv. Total (cfs)	1894445.0	Conv. (cfs)	25473.0	1866484.0	2487.8
Length wtd. (ft)	2913.21	Wetted Per. (ft)	68.49	304.43	46.00
Min Ch El (ft)	5.64	Shear (lb/sq ft)	0.03	0.14	0.01
Alpha	1.09	Stream Power (lb/ft s)	418.00	0.00	0.00
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	4384.06	20344.99	3923.67
C & E Loss (ft)	0.01	Cum SA (acres)	2010.41	1131.13	1847.00

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 57.7

INPUT									
Description: XS 57.7 NAVD 88									
Station Elevation Data num= 36									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	44.04	7	43.84	39	34.94	238	34.04	1104	33.84
1115	33.84	1124	35.14	1137	39.84	1149	39.84	1159	36.54
1242	35.14	1249	29.64	1272	22.34	1286.1	14.91	1295	10.22
1304	5.24	1314	3.94	1324	3.74	1334	3.14	1344	2.74
1354	4.04	1364	5.94	1374	6.94	1384	7.84	1394	8.24
1404	10.22	1417.8	14.9	1440	22.44	1456	31.14	1556	32.44
1568	36.34	1592	36.44	2628	32.44	2645	33.04	2672	41.44
2681	41.74								

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.081	1104	.05	1137	.04	1295	.025	1404	.04
1592	.067								

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
1242	1456		4250	4220	4500		.1	.3
Blocked Obstructions num= 2								
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
0	1137	39.84	1592	2681	36.44			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	39.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.040	0.033	0.055
W.S. Elev (ft)	39.61	Reach Len. (ft)	4250.00	4220.00	4500.00
Crit W.S. (ft)		Flow Area (sq ft)	327.01	5648.27	4308.37
E.G. Slope (ft/ft)	0.000065	Area (sq ft)	327.01	5648.27	4308.37
Q Total (cfs)	20000.00	Flow (cfs)	226.89	17484.94	2288.18
Top width (ft)	1516.41	Top width (ft)	92.30	214.00	1210.11
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)	0.69	3.10	0.53
Max chl Dpth (ft)	36.87	Hydr. Depth (ft)	3.54	26.39	3.56
Conv. Total (cfs)	2479623.0	Conv. (cfs)	28129.8	2167802.0	283690.8
Length wtd. (ft)	4247.38	Wetted Per. (ft)	92.80	226.21	1211.22
Min Ch El (ft)	2.74	Shear (lb/sq ft)	0.01	0.10	0.01
Alpha	2.22	Stream Power (lb/ft s)	2681.00	0.00	0.00
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	4362.08	19944.82	3847.97
C & E Loss (ft)	0.00	Cum SA (acres)	2004.90	1113.64	1825.41

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 56.9

INPUT									
Description: XS 56.9 NAVD88									
Station Elevation Data num= 36									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1960	42.34	1978	42.34	2000	31.34	4715	33.74	4782	35.05
4792	35.24	4810	40.24	4815	40.44	4821	40.04	4837	35.54
4879	35.24	4897	31.94	4920	17.54	4924.1	14.53	4930	10.19
4940	7.54	4950	7.74	4960	7.54	4970	7.54	4980	8.44
4990	8.44	5000	7.74	5010	7.54	5020	7.54	5030	8.44
5040	8.94	5050	10.19	5055.1	14.59	5065	23.14	5132	25.94
5158	29.94	5173	30.74	5193	35.54	6347	34.14	6376	42.04
6377	41.64								

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1960	.06	4782	.05	4815	.04	4930	.025	5050	.04
5193	.1								

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
4815	4782		2000	2000	2000		.1	.3
Blocked Obstructions num= 2								
Sta L	Sta R	Elev	Sta L	Sta R	Elev			
1960	4815	40.44	5193	6377	35.54			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	39.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.036	0.100	0.100
W.S. Elev (ft)	39.28	Reach Len. (ft)	2000.00	2000.00	2000.00
Crit W.S. (ft)		Flow Area (sq ft)	6493.85	4356.93	4356.93
E.G. Slope (ft/ft)	0.000106	Area (sq ft)	6493.85	4356.93	4356.93
Q Total (cfs)	20000.00	Flow (cfs)	18401.73	1598.27	1598.27
Top width (ft)	1542.14	Top width (ft)	369.29	1172.86	1172.86
Vel Total (ft/s)	1.84	Avg. Vel. (ft/s)	2.83	0.37	0.37
Max chl Dpth (ft)	31.74	Hydr. Depth (ft)	17.58	3.71	3.71
Conv. Total (cfs)	1942627.0	Conv. (cfs)	1787384.0	155242.3	155242.3
Length wtd. (ft)	2000.00	Wetted Per. (ft)	382.97	1173.36	1173.36
Min Ch El (ft)	7.54	Shear (lb/sq ft)	0.11	0.02	0.02
Alpha	2.18	Stream Power (lb/ft s)	6377.00	0.00	0.00
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	4346.13	19356.67	3400.39
C & E Loss (ft)	0.00	Cum SA (acres)	2000.39	1085.38	1702.32

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 56.7

INPUT									
Description: XS 56.7 "C" NAVD 88									
Station Elevation Data num= 52									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	42.94	8	42.74	40	32.44	97	26.24	130	22.04
192	21.74	207	26.84	522	32.14	2270	34.44	2713	31.44
2726	30.84	2766	24.74	2787	19.04	2974	18.04	3024	27.74
3249	34.24	4198	35.34	4480	25.34	4498	19.94	4556	21.34
4584	27.54	4646	30.34	5449	34.94	6699	36.64	6713	39.44
6723	39.94	6733	40.04	6741	36.64	6788	34.54	6811	30.64
6890	28.04	6918	29.34	6945	23.64	6951	19.94	6979	19.14
6984	17.54	6991	13.24	7000	8.24	7010	8.24	7020	7.44
7030	7.14	7040	6.84	7050	6.14	7060	6.44	7070	5.84
7080	9.24	7093	13.24	7096	16.24	7122	34.54	7155	35.44
7172	40.84	7179	40.94						

Manning's n Values num= 5									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	6699	.05	6733	.04	6991	.025	7093	.04

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
6733	7179		3000	3000	3000		.1	.3
Blocked Obstructions num= 1								
Sta L	Sta R	Elev						
0	6733	40.94						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	39.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.037	0.037	0.037
W.S. Elev (ft)	38.97	Reach Len. (ft)	3000.00	3000.00	3000.00
Crit W.S. (ft)		Flow Area (sq ft)	6353.45	6353.45	6353.45
E.G. Slope (ft/ft)	0.000175	Area (sq ft)	6353.45	6353.45	6353.45
Q Total (cfs)	20000.00	Flow (cfs)	20000.00	20000.00	20000.00
Top width (ft)	430.59	Top width (ft)	430.59	430.59	430.59

Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	3.15
Max Chl Dpth (ft)	33.13	Hydr. Depth (ft)	14.76
Conv. Total (cfs)	1511846.0	Conv. (cfs)	1511846.0
Length Wtd. (ft)	3000.00	Wetted Per. (ft)	444.78
Min Ch El (ft)	5.84	Shear (lb/sq ft)	0.16
Alpha	1.00	Stream Power (lb/ft s)	7179.00
Frctn Loss (ft)	0.69	Cum Volume (acre-ft)	4346.13
C & E Loss (ft)	0.00	Cum SA (acres)	2000.39
			19061.73
			1067.02
			3300.36
			1675.40

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 56.1

INPUT
Description: XS 56.1 "B" NAVD 88

Station	Elevation	Data	num=	46	
Sta	Elev	Sta	Elev	Sta	Elev
0	43.04	9	42.64	29	36.24
101	25.44	117	20.04	148	20.04
1350	33.74	1816	34.24	2604	33.04
3395	19.64	3501	18.44	3546	28.44
6175	35.64	6206	40.04	6220	39.84
6251	34.84	6278	33.74	6309	29.74
6474	12.74	6500	11.04	6507	9.64
6558	13.44	6573	19.14	6591	23.04
6647	34.64	6663	37.04	6669	37.24
6729	43.34			6687	40.54
				6702	40.24

Manning's n Values	num=	6					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	6175	.05	6229	.04	6474	.025
6622	.07			6558	.04		

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
6206	6702		3000	2940	3000	.1		.3
Blocked Obstructions	num=	1						
Sta L	Sta R	Elev						
0	6206	40.04						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	38.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	wt. n-Val.		0.042	
W.S. Elev (ft)	38.24	Reach Len. (ft)	3000.00	2940.00	3000.00
Crit W.S. (ft)		Flow Area (sq ft)		5668.21	
E.G. Slope (ft/ft)	0.000336	Area (sq ft)		5668.21	
Q Total (cfs)	20000.00	Flow (cfs)		20000.00	
Top Width (ft)	441.08	Top Width (ft)		441.08	
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)		3.53	
Max Chl Dpth (ft)	28.60	Hydr. Depth (ft)		12.85	
Conv. Total (cfs)	1090667.0	Conv. (cfs)		1090667.0	
Length Wtd. (ft)	2940.00	Wetted Per. (ft)		454.24	
Min Ch El (ft)	9.64	Shear (lb/sq ft)		0.26	
Alpha	1.00	Stream Power (lb/ft s)	6729.00		0.00
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	4346.13	18647.76	3300.36
C & E Loss (ft)	0.01	Cum SA (acres)	2000.39	1037.00	1675.40

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 55.5

INPUT
Description: XS 55.5 NAVD 88

Station	Elevation	Data	num=	29	
Sta	Elev	Sta	Elev	Sta	Elev
0	41.94	3999	41.94	4000	34.94
4551	35.74	4567	40.34	4571	40.34
4636	30.14	4674	22.94	4687.9	13.88
4712	.94	4722	2.44	4732	2.64
4762	2.44	4772	5.44	4780	9.9
4817	35.74	4833	37.34	4849	41.04
				4858	41.04

Manning's n Values	num=	5					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.056	4544	.05	4577	.04	4694	.025
				4780	.04		

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
4577	4858		1625	1625	1625	.1		.3
Blocked Obstructions	num=	1						
Sta L	Sta R	Elev						
0	4577	40.54						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	37.53	Element	Left OB	Channel	Right OB
----------------	-------	---------	---------	---------	----------

Vel Head (ft)	0.32	wt. n-Val.	0.035
W.S. Elev (ft)	37.22	Reach Len. (ft)	1625.00
Crit W.S. (ft)		Flow Area (sq ft)	1625.00
E.G. Slope (ft/ft)	0.000264	Area (sq ft)	4429.17
Q Total (cfs)	20000.00	Flow (cfs)	20000.00
Top Width (ft)	243.88	Top Width (ft)	243.88
Vel Total (ft/s)	4.52	Avg. Vel. (ft/s)	4.52
Max Chl Dpth (ft)	36.28	Hydr. Depth (ft)	18.16
Conv. Total (cfs)	1231929.0	Conv. (cfs)	1231929.0
Length Wtd. (ft)	1625.00	Wetted Per. (ft)	261.85
Min Ch El (ft)	0.94	Shear (lb/sq ft)	0.28
Alpha	1.00	Stream Power (lb/ft s)	4858.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	4346.13
C & E Loss (ft)	0.02	Cum SA (acres)	2000.39
			18307.01
			1013.89
			3300.36
			1675.40

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 55.25

INPUT
Description: XS 55.25 NAVD 88

Station	Elevation	Data	num=	32	
Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	7	40.54	26	35.44
106	26.74	126	25.64	175	30.14
211	26.64	228	20.74	238	19.64
257	7.74	267	4.94	277	5.04
307	2.94	317	2.94	327	3.44
349	9.25	353	13.74	390	32.74
504	43.74	515	43.74		

Manning's n Values	num=	5					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	186	.04	252	.025	349	.04
				390	.04	390	.04

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
186	390		203	203	203	.1		.3
Blocked Obstructions	num=	1						
Sta L	Sta R	Elev						
0	186	30.14						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	37.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.94	Reach Len. (ft)	203.00	203.00	203.00
Crit W.S. (ft)		Flow Area (sq ft)	796.61	4670.29	170.19
E.G. Slope (ft/ft)	0.000143	Area (sq ft)	796.61	4670.29	170.19
Q Total (cfs)	20000.00	Flow (cfs)	803.13	19068.50	128.38
Top Width (ft)	446.20	Top Width (ft)	165.58	204.00	76.62
Vel Total (ft/s)	3.55	Avg. Vel. (ft/s)	1.01	4.08	0.75
Max Chl Dpth (ft)	34.00	Hydr. Depth (ft)	4.81	22.89	2.22
Conv. Total (cfs)	1675068.0	Conv. (cfs)	67264.6	1597051.0	10752.1
Length Wtd. (ft)	203.00	Wetted Per. (ft)	166.33	217.14	76.74
Min Ch El (ft)	2.94	Shear (lb/sq ft)	0.04	0.19	0.02
Alpha	1.27	Stream Power (lb/ft s)	515.00	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	4331.27	18137.29	3297.19
C & E Loss (ft)	0.02	Cum SA (acres)	1997.31	1005.54	1673.97

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1

RS: 55.23

INPUT
Description: XS 55.23 NAVD 88

Station	Elevation	Data	num=	49	
Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	1000	41.84	2000	41.84
2212	37.84	2213.5	37.79	2221.5	37.52
2309	31.84	2325	29.34	2339	29.5
2392	28.84	2404	20.84	2415	21.84
2447.3	13.11	2456	10.36	2463	6.04
2483	~.16	2493	1.34	2503	2.34
2533	6.04	2543	3.84	2553	4.94
2566.5	12.18	2575.5	18.75	2577	19.84
2619	25.34	2648	28.84	2655	36.44
2701	39.84	2712	41.84	2721	41.84

Manning's n Values	num=	5					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	2368	.04	2456	.025	2564	.04
				2609	.04	2609	.04

Bank Sta: Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
2368	2609		75	75	75	.2		.5
Blocked Obstructions	num=	1						

Sta L Sta R Elev
2609 2729 31.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	37.14	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.96	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)	14.71	Flow Area (sq ft)	554.07	5536.27	249.74
E.G. Slope (ft/ft)	0.000104	Area (sq ft)	554.07	5536.27	249.74
Q Total (cfs)	20000.00	Flow (cfs)	441.45	19316.72	241.83
Top Width (ft)	429.50	Top width (ft)	129.58	241.00	58.92
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	0.80	3.49	0.97
Max Chl Dpth (ft)	37.12	Hydr. Depth (ft)	4.28	22.97	4.24
Conv. Total (cfs)	1959942.0	Conv. (cfs)	43261.0	1892982.0	23698.6
Length Wtd. (ft)	10.00	wetted Per. (ft)	130.11	255.59	61.17
Min Ch El (ft)	-0.16	Shear (lb/sq ft)	0.03	0.14	0.03
Alpha	1.18	Stream Power (lb/ft s)	2729.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4328.12	18113.50	3296.21
C & E Loss (ft)	0.01	Cum SA (acres)	1996.62	1004.50	1673.65

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 55.215

INPUT
Description: B & M

Distance from Upstream XS = 10
Deck/Roadway width = 22
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
2197 50.24 44.69 2729 50.24 44.69

Upstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	1000	41.84	2000	41.84	2200	41.84
2212	37.84	2213.5	37.79	2221.5	37.52	2281	35.54
2309	31.84	2325	29.34	2339	29.5	2348	29.61
2392	28.84	2404	20.84	2415	21.84	2443	14.44
2447.3	13.11	2456	10.36	2463	6.04	2467.3	3.87
2483	-16	2493	1.34	2503	2.34	2513	6.64
2533	6.04	2543	3.84	2553	4.94	2563	9.04
2566.5	12.18	2575.5	18.75	2577	19.84	2599	26.54
2619	25.34	2648	28.84	2655	36.44	2690	37.84
2701	39.84	2712	41.84	2721	41.84	2729	44.69

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .05 2368 .04 2456 .025 2564 .04 2609 .04

Bank Sta: Left Right Coeff Contr. Expan.
2368 2609 .2 .5
Blocked Obstructions num= 1
Sta L Sta R Elev
2609 2729 31.34

Downstream Deck/Roadway Coordinates
num= 2
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
2197 50.24 44.69 2729 50.24 44.69

Downstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	1000	41.84	2000	41.84	2200	41.84
2212	37.84	2213.5	37.79	2221.5	37.52	2281	35.54
2309	31.84	2325	29.34	2339	29.5	2348	29.61
2392	28.84	2404	20.84	2415	21.84	2443	14.44
2447.3	13.11	2456	10.36	2463	6.04	2467.3	3.87
2483	-16	2493	1.34	2503	2.34	2513	6.64
2533	6.04	2543	3.84	2553	4.94	2563	9.04
2566.5	12.18	2575.5	18.75	2577	19.84	2599	26.54
2619	25.34	2648	28.84	2655	36.44	2690	37.84
2701	39.84	2712	41.84	2721	41.84	2729	44.69

Manning's n Values num= 5

Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val
0 .05 2368 .04 2456 .025 2564 .04 2609 .04

Bank Sta: Left Right Coeff Contr. Expan.
2368 2609 .2 .5
Blocked Obstructions num= 1
Sta L Sta R Elev
2609 2729 31.34
Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 5
Pier Data
Pier Station Upstream= 2217.5 Downstream= 2217.5
Upstream num= 2
width Elev width Elev
8 0 8 45.05
Downstream num= 2
width Elev width Elev
8 0 8 45.05

Pier Data
Pier Station Upstream= 2343.5 Downstream= 2343.5
Upstream num= 2
width Elev width Elev
9 0 9 45.05
Downstream num= 2
width Elev width Elev
9 0 9 45.05

Pier Data
Pier Station Upstream= 2457.3 Downstream= 2457.3
Upstream num= 2
width Elev width Elev
20 0 20 45.05
Downstream num= 2
width Elev width Elev
20 0 20 45.05

Pier Data
Pier Station Upstream= 2571 Downstream= 2571
Upstream num= 2
width Elev width Elev
9 0 9 45.05
Downstream num= 2
width Elev width Elev
9 0 9 45.05

Pier Data
Pier Station Upstream= 2697 Downstream= 2697
Upstream num= 2
width Elev width Elev
8 0 8 45.05
Downstream num= 2
width Elev width Elev
8 0 8 45.05

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	37.14	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	36.96	E.G. Elev (ft)	37.13	37.12
Q Total (cfs)	20000.00	W.S. Elev (ft)	36.89	36.88
Q Bridge (cfs)	20000.00	Crit W.S. (ft)	15.20	15.20
Q Weir (cfs)		Max Chl Dpth (ft)	37.05	37.04
Weir Sta Lft (ft)		Vel Total (ft/s)	3.64	3.64
Weir Sta Rgt (ft)		Flow Area (sq ft)	5494.24	5492.35
Weir Submerg		Froude # Chl	0.15	0.15
Weir Max Depth (ft)		Specif force (cu ft)	69565.13	69538.89
Min El Weir Flow (ft)	41.85	Hydr Depth (ft)	14.17	14.18

Min El Prs (ft)	44.69	W.P. Total (ft)	514.98	514.68
Delta EG (ft)	0.05	Conv. Total (cfs)	1356297.0	1355823.0
Delta WS (ft)	0.05	Top Width (ft)	387.62	387.35
BR Open Area (sq ft)	9012.30	Frctn Loss (ft)	0.00	0.01
BR Open Vel (ft/s)	3.64	C & E Loss (ft)	0.00	0.03
Coeff of Q		Shear Total (lb/sq ft)	0.14	0.14
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

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

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 55.21

INPUT
Description: XS 55.21 NAVD 88
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	1000	41.84	2000	41.84	2200	41.84
2212	37.84	2213.5	37.79	2221.5	37.52	2281	35.54
2309	31.84	2325	29.34	2339	29.5	2348	29.61
2392	28.84	2404	20.84	2415	21.84	2443	14.44
2447.3	13.11	2456	10.36	2463	6.04	2467.3	3.87
2483	-1.16	2493	1.34	2503	2.34	2513	6.64
2533	6.04	2543	3.84	2553	4.94	2563	9.04
2566.5	12.18	2575.5	18.75	2577	19.84	2599	26.54
2619	25.34	2648	28.84	2655	36.44	2690	37.84
2701	39.84	2712	41.84	2721	41.84	2729	44.69

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	2368	.04	2456	.025	2564	.04
2609		2729		31.34			

Bank Sta: Left 2368 Right 2609 Lengths: Left Channel 15 Right 15 Coeff Contr. .2 Expan. .5

Blocked Obstructions num= 1

Sta L	Sta R	Elev
2609	2729	31.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	37.09	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.90	Reach Len. (ft)	15.00	15.00	
Crit W.S. (ft)		Flow Area (sq ft)	547.11	5523.25	246.59
E.G. Slope (ft/ft)	0.000105	Flow (cfs)	437.70	19320.98	241.32
Q Total (cfs)	20000.00	Top width (ft)	127.95	241.00	57.57
Top width (ft)	426.52	Avg. Vel. (ft/s)	0.80	3.50	0.98
Vel Total (ft/s)	3.17	Hydr. Depth (ft)	4.28	22.92	4.28
Max chl Dpth (ft)	37.06	Conv. (cfs)	42715.4	1885563.0	23551.1
Conv. Total (cfs)	1951830.0	Wetted Per. (ft)	128.48	255.59	59.82
Length Wtd. (ft)	15.00	Shear (lb/sq ft)	0.03	0.14	0.03
Min ch El (ft)	-0.16	Stream Power (lb/ft s)	2729.00	0.00	
Alpha	1.18	Cum Volume (acre-ft)	4327.26	18104.83	3295.79
Frctn Loss (ft)	0.00	Cum SA (acres)	1996.41	1004.12	1673.55
C & E Loss (ft)	0.00				

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 55.2

INPUT
Description: XS 55.2 NAVD 88
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.84	1000	41.84	2000	41.84	2200	41.84
2212	37.84	2213.5	37.79	2221.5	37.52	2281	35.54
2309	31.84	2325	29.34	2339	29.5	2348	29.61
2392	28.84	2404	20.84	2415	21.84	2443	14.44
2447.3	13.11	2456	10.36	2463	6.04	2467.3	3.87
2483	-1.16	2493	1.34	2503	2.34	2513	6.64
2533	6.04	2543	3.84	2553	4.94	2563	9.04
2566.5	12.18	2568.7	13.79	2575.5	18.75	2577	19.84
2609	31.34	2619	25.34	2648	28.84	2655	36.44
2693	38.39	2701	39.84	2712	41.84	2721	41.84
2729	44.69						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	2368	.04	2456	.025	2564	.04
2609		2729		31.34			

Bank Sta: Left 2368 Right 2609 Lengths: Left Channel 3875 Right 3440 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 1

Sta L Sta R Elev
2609 2729 31.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	37.09	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.18	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.90	Reach Len. (ft)	3875.00	3440.00	3875.00
Crit W.S. (ft)		Flow Area (sq ft)	546.91	5522.84	246.49
E.G. Slope (ft/ft)	0.000105	Area (sq ft)	546.91	5522.84	246.49
Q Total (cfs)	20000.00	Flow (cfs)	437.59	19321.10	241.31
Top width (ft)	426.43	Top width (ft)	127.90	241.00	57.53
Vel Total (ft/s)	3.17	Avg. Vel. (ft/s)	0.80	3.50	0.98
Max chl Dpth (ft)	37.06	Hydr. Depth (ft)	4.28	22.92	4.28
Conv. Total (cfs)	1951579.0	Conv. (cfs)	42699.4	1885332.0	23546.9
Length Wtd. (ft)	3515.93	Wetted Per. (ft)	128.44	255.59	59.78
Min ch El (ft)	-0.16	Shear (lb/sq ft)	0.03	0.14	0.03
Alpha	1.18	Stream Power (lb/ft s)	2729.00	0.00	0.00
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	4327.07	18102.93	3295.70
C & E Loss (ft)	0.02	Cum SA (acres)	1996.36	1004.03	1673.53

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.5

INPUT
Description: XS 54.5 NAVD 88
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.54	7	41.44	22	35.34	45	27.74
81.3	13.55	86	10.03	88	9.04	98	6.04
118	-.96	128	-1.46	138	.34	148	2.44
160	9.74	168	10.03	172.3	13.56	173	14.14
213	19.14	227	23.14	361	22.44	412	26.14
500	29.24	505	27.04	526	27.34	532	29.74
615	31.14	642	32.54	716	34.04	736	35.74

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	63	.04	86	.025	168	.04
227		31.34					

Bank Sta: Left 63 Right 227 Lengths: Left Channel 90 Right 90 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.75	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.12	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.63	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)		Flow Area (sq ft)	283.80	4272.07	4487.14
E.G. Slope (ft/ft)	0.000073	Area (sq ft)	283.80	4272.07	4487.14
Q Total (cfs)	20000.00	Flow (cfs)	244.29	13696.70	6059.01
Top width (ft)	720.39	Top width (ft)	44.18	164.00	512.21
Vel Total (ft/s)	2.21	Avg. Vel. (ft/s)	0.86	3.21	1.35
Max chl Dpth (ft)	38.09	Hydr. Depth (ft)	6.42	26.05	8.76
Conv. Total (cfs)	2334011.0	Conv. (cfs)	28509.3	1598412.0	707089.2
Length Wtd. (ft)	90.00	Wetted Per. (ft)	45.66	178.20	513.59
Min ch El (ft)	-1.46	Shear (lb/sq ft)	0.03	0.11	0.04
Alpha	1.55	Stream Power (lb/ft s)	759.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4290.12	17716.17	3085.16
C & E Loss (ft)	0.01	Cum SA (acres)	1988.71	988.04	1648.19

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.49

INPUT
Description: XS 54.49 NAVD 88
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.54	2	41.13	20	37.44	50.8	25.91
56.5	24.3	62.3	24.14	80	23.64	101.9	13.23
115	9.74	125	9.64	135	8.64	145	4.94
155	5.24	165	6.94	165.1	6.94	175	9.24
194	12.23	238	12.44	239.6	13.23	256.9	21.72
268.4	23.1	278	22.94	304	29.84	360.3	29.84
397	29.84	430	26.34	444	28.04	450	33.14
469.4	34.26	475.2	34.59	523	37.34	542	41.36
562	45.64						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.04	104	.025	194	.04
260		31.34					

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

80 260 85 85 85 .2 .5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.54	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)	18.62	Flow Area (sq ft)	512.28	4432.94	1673.78
E.G. Slope (ft/ft)	0.000108	Area (sq ft)	512.28	4432.94	1673.78
Q Total (cfs)	20000.00	Flow (cfs)	660.98	17061.74	2277.28
Top Width (ft)	486.59	Top Width (ft)	57.58	180.00	249.01
Vel Total (ft/s)	3.02	Avg. Vel (ft/s)	1.29	3.85	1.36
Max chl Dpth (ft)	31.60	Hydr. Depth (ft)	8.90	24.63	6.72
Conv. Total (cfs)	1928612.0	Conv. (cfs)	63738.9	1645274.0	219599.1
Length wtd. (ft)	10.00	Wetted Per. (ft)	59.80	186.74	252.17
Min ch El (ft)	4.94	Shear (lb/sq ft)	0.06	0.16	0.04
Alpha	1.41	Stream Power (lb/ft s)	562.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4289.30	17707.18	3078.79
C & E Loss (ft)	0.01	Cum SA (acres)	1988.61	987.69	1647.40

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

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

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 54.475

INPUT
Description: Gateway SB

Distance from Upstream XS = 10
Deck/Roadway Width = 36
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates									
num=	15								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	44.79	41.54	2	44.88	41.13	50.8	47.14	41.29	
62.3	47.61	41.71	153.5	48.85	42.95	165	48.87	42.97	
256.9	49.07	43.17	268.4	49.09	43.19	360.3	49.29	43.39	
371.8	49.31	43.41	463.7	49.47	43.57	475.2	49.44	43.54	
542	47.52	41.36	557	47.08	44.54	562	46.93	45.66	

Upstream Bridge Cross Section Data									
Station	Elevation	Data	num=	41					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.54	2	41.13	20	37.44	50.8	25.91	55	24.34
56.5	24.3	62.3	24.14	80	23.64	101.9	13.23	104	12.23
115	9.74	125	9.64	135	8.64	145	4.94	153.5	5.2
155	5.24	165	6.94	165.1	6.94	175	9.24	185	11.24
194	12.23	238	12.44	239.6	13.23	256.9	21.72	260	23.24
268.4	23.1	278	22.94	304	29.84	360.3	29.84	371.8	29.84
397	29.84	430	26.34	444	28.04	450	33.14	463.7	33.93
469.4	34.26	475.2	34.59	523	37.34	542	41.36	557	44.54
562	45.64								

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.04	104	.025	194	.04
						260	.04

Bank Sta:	Left	Right	Coeff Contr.	Expan.
80	260		.2	.5

Downstream Deck/Roadway Coordinates									
num=	15								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	44.79	41.54	2	44.88	41.13	50.8	47.14	41.29	
62.3	47.61	41.71	153.5	48.85	42.95	165	48.87	42.97	
256.9	49.07	43.17	268.4	49.09	43.19	360.3	49.29	43.39	
371.8	49.31	43.41	463.7	49.47	43.57	475.2	49.44	43.54	
542	47.52	41.36	557	47.08	44.54	562	46.93	45.66	

Downstream Bridge Cross Section Data									
Station	Elevation	Data	num=	41					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.54	2	41.13	20	37.44	50.8	25.91	55	24.34
56.5	24.3	62.3	24.14	80	23.64	101.9	13.23	104	12.23
115	9.74	125	9.64	135	8.64	145	4.94	153.5	5.2
155	5.24	165	6.94	165.1	6.94	175	9.24	185	11.24
194	12.23	238	12.44	239.6	13.23	256.9	21.72	260	23.24
268.4	23.1	278	22.94	304	29.84	360.3	29.84	371.8	29.84
397	29.84	430	26.34	444	28.04	450	33.14	463.7	33.93
469.4	34.26	475.2	34.59	523	37.34	542	41.36	557	44.54
562	45.64								

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	80	.04	104	.025	194	.04
						260	.04

Bank Sta:	Left	Right	Coeff Contr.	Expan.
80	260		.2	.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 5

Pier Data			
Pier Station	Upstream=	56.55	Downstream= 56.55
Upstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	42.07
Downstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	42.07

Pier Data			
Pier Station	Upstream=	159.25	Downstream= 159.25
Upstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.33
Downstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.33

Pier Data			
Pier Station	Upstream=	262.65	Downstream= 262.65
Upstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.55
Downstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.55

Pier Data			
Pier Station	Upstream=	366.05	Downstream= 366.05
Upstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.77
Downstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.77

Pier Data			
Pier Station	Upstream=	469.45	Downstream= 469.45
Upstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.93
Downstream	num= 2		
width	Elev	width	Elev
11.5	0	11.5	43.93

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum
Do not add weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	36.74	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	36.54	E.G. Elev (ft)	36.73	36.72
Q Total (cfs)	20000.00	W.S. Elev (ft)	36.50	36.49
Q Bridge (cfs)	20000.00	Crit W.S. (ft)	19.45	19.45
Q Weir (cfs)		Max Chl Dpth (ft)	31.56	31.55
Weir Sta Lft (ft)		Vel Total (ft/s)	3.42	3.42
Weir Sta Rgt (ft)		Flow Area (sq ft)	5853.79	5850.35
Weir Submerg		Froude # Chl	0.15	0.15
Weir Max Depth (ft)		Specif Force (cu ft)	60827.31	60781.69
Min El weir Flow (ft)	44.80	Hydr Depth (ft)	13.67	13.66
Min El Pr. (ft)	45.66	W.P. Total (ft)	569.34	569.10
Delta EG (ft)	0.04	Conv. Total (cfs)	1359673.0	1358769.0

Delta WS (ft) 0.04 Top Width (ft) 428.29 428.13
BR Open Area (sq ft) 8773.44 Frctn Loss (ft) 0.01 0.01
BR Open Vel (ft/s) 3.42 C & E Loss (ft) 0.00 0.02
Coef of Q 0.14 Shear Total (lb/sq ft) 0.14 0.14
Br Sel Method Energy only Power Total (lb/ft s) 0.00 0.00

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.47

INPUT
Description: XS 54.47 NAVD 88
Station Elevation Data num= 41
Sta Elev Sta Elev Sta Elev Sta Elev
0 41.54 2 41.13 20 37.44 50.8 25.91 55 24.34
56.5 24.3 62.3 24.14 80 23.64 101.9 13.23 104 12.23
115 9.74 125 9.64 135 8.64 145 4.94 153.5 5.2
155 5.24 165 6.94 165.1 6.94 175 9.24 185 11.24
194 12.23 238 12.44 239.6 13.23 256.9 21.72 260 23.24
268.4 23.1 278 22.94 304 29.84 360.3 29.84 371.8 29.84
397 29.84 430 26.34 444 28.04 450 33.14 463.7 33.93
469.4 34.26 475.2 34.59 523 37.34 542 41.36 557 44.54
562 45.64

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .05 80 .04 104 .025 194 .04 260 .04

Bank Sta: Left 80 Right 260 Lengths: Left Channel 5 Right 5 Coeff Contr. .2 Expan. .5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.70	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.20	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.50	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)		Flow Area (sq ft)	510.05	4425.97	1664.15
E.G. Slope (ft/ft)	0.000108	Area (sq ft)	510.05	4425.97	1664.15
Q Total (cfs)	20000.00	Flow (cfs)	659.20	17073.76	2267.04
Top Width (ft)	485.82	Top width (ft)	57.48	180.00	248.34
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)	1.29	3.86	1.36
Max Chl Dpth (ft)	31.56	Hydr. Depth (ft)	8.87	24.59	6.70
Conv. Total (cfs)	1922208.0	Conv. (cfs)	63355.8	1640966.0	217886.6
Length wtd. (ft)	5.00	Wetted Per. (ft)	59.69	186.74	251.50
Min Ch El (ft)	4.94	Shear (lb/sq ft)	0.06	0.16	0.04
Alpha	1.41	Stream Power (lb/ft s)	562.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4288.49	17699.09	3075.84
C & E Loss (ft)	0.00		1988.51	987.35	1646.96

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.46

INPUT
Description: XS 54.46 NAVD 88
Station Elevation Data num= 40
Sta Elev Sta Elev Sta Elev Sta Elev
0 41.54 2 41.13 20 37.44 50.8 25.91 55 24.34
56.5 24.3 62.3 24.14 80 23.64 101.8 13.28 104 12.23
115 9.74 125 9.64 135 8.64 145 4.94 153.5 5.2
155 5.24 165 6.94 175 9.24 185 11.24 194 12.23
238 12.44 239.7 13.27 256.9 21.72 260 23.24 268.4 23.1
278 22.94 304 29.84 360.3 29.84 371.8 29.84 397 29.84
430 26.34 444 28.04 450 33.14 463.7 33.93 469.4 34.26
475.2 34.59 523 37.34 542 41.36 557 44.54 562 45.64

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .05 80 .04 104 .025 194 .04 260 .04

Bank Sta: Left 80 Right 260 Lengths: Left Channel 4 Right 4 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.70	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.20	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.50	Reach Len. (ft)	4.00	4.00	4.00
Crit W.S. (ft)		Flow Area (sq ft)	510.02	4425.81	1664.01
E.G. Slope (ft/ft)	0.000108	Area (sq ft)	510.02	4425.81	1664.01
Q Total (cfs)	20000.00	Flow (cfs)	659.18	17073.89	2266.93
Top Width (ft)	485.81	Top width (ft)	57.48	180.00	248.33
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)	1.29	3.86	1.36
Max Chl Dpth (ft)	31.56	Hydr. Depth (ft)	8.87	24.59	6.70

Conv. Total (cfs)	1922089.0	Conv. (cfs)	63350.2	1640877.0	217861.7
Length wtd. (ft)	4.00	Wetted Per. (ft)	59.69	186.74	251.49
Min Ch El (ft)	4.94	Shear (lb/sq ft)	0.06	0.16	0.04
Alpha	1.41	Stream Power (lb/ft s)	562.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4288.44	17698.58	3075.65
C & E Loss (ft)	0.00	Cum SA (acres)	1988.50	987.33	1646.93

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.45

INPUT
Description: XS 54.45 NAVD 88
Station Elevation Data num= 53
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 41.44 1.6 39.81 3.8 38.59 27.9 24.94 49.7 24.47
51.3 24.43 56 24.33 60.8 24.22 65.4 24.12 70.1 24.02
71.7 23.98 73.8 23.94 92.3 13.33 94.3 12.18 98.4 10.14
106.6 9.64 114.8 4.84 123 1.64 131.2 1.14 139.4 .64
142.1 1.14 146.9 2 147.6 2.14 151.5 2.86 155.8 3.64
164 6.64 172.2 9.64 180.4 10.74 188.6 11.64 196.8 11.64
205 12.18 214.1 13.33 218.9 13.94 228.2 16.95 233 18.48
237.6 20 242.7 21.64 250.1 22.24 258.3 24.94 286.2 25.54
295.2 30.34 314.3 31.81 317.3 32.04 319.1 31.42 323.7 29.69
331.3 26.94 355.9 29.34 361.6 34.94 372.3 35.74 383.4 40.99
387 42.74 395.9 44.28 398.5 44.74

Manning's n Values num= 5
Sta n Val Sta n Val Sta n Val Sta n Val
0 .05 73.8 .04 94.3 .025 205 .04 258.3 .04

Bank Sta: Left 73.8 Right 258.3 Lengths: Left Channel 80 Right 80 Coeff Contr. .2 Expan. .5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.70	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.032	0.040
W.S. Elev (ft)	36.49	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)		Flow Area (sq ft)	670.52	4656.70	848.51
E.G. Slope (ft/ft)	0.000096	Area (sq ft)	670.52	4656.70	848.51
Q Total (cfs)	20000.00	Flow (cfs)	888.37	17973.35	1138.28
Top Width (ft)	366.36	Top width (ft)	66.28	184.50	115.58
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)	1.32	3.86	1.34
Max Chl Dpth (ft)	35.85	Hydr. Depth (ft)	10.12	25.24	7.34
Conv. Total (cfs)	2036294.0	Conv. (cfs)	90449.1	1829952.0	115893.5
Length wtd. (ft)	5.00	Wetted Per. (ft)	69.34	193.32	120.35
Min Ch El (ft)	0.64	Shear (lb/sq ft)	0.06	0.15	0.04
Alpha	1.29	Stream Power (lb/ft s)	398.50	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4288.38	17698.16	3075.54
C & E Loss (ft)	0.01	Cum SA (acres)	1988.50	987.32	1646.92

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

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 54.435

INPUT
Description: Gateway NB

Distance from Upstream XS = 5
Deck/Roadway Width = 36
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates
num= 22
Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord
0 41.44 40.74 1.6 43.57 39.81 3.8 43.77 38.59
3.8 43.77 41.04 49.7 46.16 41.25 49.7 46.16 38.52
51.3 46.25 38.52 56 46.5 38.76 65.4 46.85 39.25
70.1 46.91 39.49 71.7 46.93 39.49 71.71 46.93 41.75
142.1 47.81 42.63 151.5 47.84 42.67 228.2 48.13 42.95
237.6 48.16 42.98 314.3 48.43 43.25 323.7 48.41 43.23
383.4 45.53 40.99 387 45.35 42.74 395.9 44.93 44.28
398.5 44.74 44.74

Upstream Bridge Cross Section Data
Station Elevation Data num= 53
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 41.44 1.6 39.81 3.8 38.59 27.9 24.94 49.7 24.47

51.3	24.43	56	24.33	60.8	24.22	65.4	24.12	70.1	24.02
71.7	23.98	73.8	23.94	92.3	13.33	94.3	12.18	98.4	10.14
106.6	9.64	114.8	4.84	123	1.64	131.2	1.14	139.4	.64
142.1	1.14	146.9	2	147.6	2.14	151.5	2.86	155.8	3.64
164	6.64	172.2	9.64	180.4	10.74	188.6	11.64	196.8	11.64
205	12.18	214.1	13.33	218.9	13.94	228.2	16.95	233	18.48
237.6	20	242.7	21.64	250.1	22.24	258.3	24.94	286.2	25.54
295.2	30.34	314.3	31.81	317.3	32.04	319.1	31.42	323.7	29.69
331.3	26.94	355.9	29.34	361.6	34.94	372.3	35.74	383.4	40.99
387	42.74	395.9	44.28	398.5	44.74				

Manning's n	Values	num=	5
Sta	n Val	Sta	n Val
0	.05	73.8	.04
		94.3	.025
		205	.04
		258.3	.04

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	73.8	258.3	.2	.5	

Downstream	Deck/Roadway	Coordinates
num=	22	
Sta	Hi	Cord
0	41.44	40.74
3.8	43.77	41.04
51.3	46.25	38.52
70.1	46.91	39.49
142.1	47.81	42.63
237.6	48.16	42.98
383.4	45.53	40.99
398.5	44.74	44.74

Downstream	Bridge	Cross	Section	Data			
Station	Elevation	Data	num=	53			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.44	1.6	39.81	3.8	38.59	27.9	24.94
51.3	24.43	56	24.33	60.8	24.22	65.4	24.12
71.7	23.98	73.8	23.94	92.3	13.33	94.3	12.18
106.6	9.64	114.8	4.84	123	1.64	131.2	1.14
142.1	1.14	146.9	2	147.6	2.14	151.5	2.86
164	6.64	172.2	9.64	180.4	10.74	188.6	11.64
205	12.18	214.1	13.33	218.9	13.94	228.2	16.95
237.6	20	242.7	21.64	250.1	22.24	258.3	24.94
295.2	30.34	314.3	31.81	317.3	32.04	319.1	31.42
331.3	26.94	355.9	29.34	361.6	34.94	372.3	35.74
387	42.74	395.9	44.28	398.5	44.74		

Manning's n	Values	num=	5
Sta	n Val	Sta	n Val
0	.05	73.8	.04
		94.3	.025
		205	.04
		258.3	.04

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	73.8	258.3	.2	.5	

Upstream Embankment side slope	=	0	horiz. to 1.0 vertical
Downstream Embankment side slope	=	0	horiz. to 1.0 vertical
Maximum allowable submergence for weir flow	=	.95	
Elevation at which weir flow begins	=		
Energy head used in spillway design	=		
Spillway height used in design	=		
weir crest shape	=	Broad Crested	

Number of Piers = 6

Pier Data				
Pier Station	Upstream=	50.5	Downstream=	50.5
Upstream	num=	2		
width	Elev	width	Elev	
1.6	0	1.6	38.58	
Downstream	num=	2		
width	Elev	width	Elev	
1.6	0	1.6	38.58	

Pier Data				
Pier Station	Upstream=	60.7	Downstream=	60.7
Upstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	39.31	
Downstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	39.31	

Pier Data				
Pier Station	Upstream=	70.9	Downstream=	70.9
Upstream	num=	2		
width	Elev	width	Elev	
1.6	0	1.6	39.55	
Downstream	num=	2		
width	Elev	width	Elev	
1.6	0	1.6	39.55	

Pier Data				
Pier Station	Upstream=	146.8	Downstream=	146.8
Upstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	42.73	
Downstream	num=	2		

width	Elev	width	Elev	
9.4	0	9.4	42.73	
Pier Data				
Pier Station	Upstream=	232.9	Downstream=	232.9
Upstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	43.04	
Downstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	43.04	

Pier Data				
Pier Station	Upstream=	319	Downstream=	319
Upstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	43.31	
Downstream	num=	2		
width	Elev	width	Elev	
9.4	0	9.4	43.31	

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow	
Submerged Inlet Cd	=
Submerged Inlet + Outlet Cd	= .8
Max Low Cord	=

Additional Bridge Parameters

Add Friction component to Momentum

Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth

inside the bridge at the upstream end

Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	36.70	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	36.49	E.G. Elev (ft)	36.68	36.68
Q Total (cfs)	20000.00	W.S. Elev (ft)	36.42	36.41
Q Bridge (cfs)	20000.00	Crit W.S. (ft)	17.74	17.74
Q Weir (cfs)		Max Chl Dpth (ft)	35.78	35.77
Weir Sta Lft (ft)		Vel Total (ft/s)	3.67	3.67
Weir Sta Rgt (ft)		Flow Area (sq ft)	5455.63	5453.55
Weir Submerg		Froude # chl	0.15	0.15
Weir Max Depth (ft)		Specif Force (cu ft)	64516.11	64482.08
Min El Weir Flow (ft)	41.45	Hydr Depth (ft)	16.77	16.77
Min El Prs (ft)	43.25	W.P. Total (ft)	530.04	529.93
Delta EG (ft)	0.05	Conv. Total (cfs)	1520374.0	1519707.0
Delta WS (ft)	0.05	Top width (ft)	325.29	325.27
BR Open Area (sq ft)	7421.25	Frctn Loss (ft)	0.01	0.01
BR Open Vel (ft/s)	3.67	C & E Loss (ft)	0.00	0.03
Coeff of Q		Shear Total (lb/sq ft)	0.11	0.11
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

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

CROSS SECTION

RIVER: RIVER-1	
REACH: Reach-1	RS: 54.43

INPUT

Description: XS 54.43 NAVD 88

Station	Elevation	Data	num=	53			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.44	1.6	39.81	3.8	38.59	27.9	24.94
51.3	24.43	56	24.33	60.8	24.22	65.4	24.12
71.7	23.98	73.8	23.94	92.3	13.33	94.3	12.18
106.6	9.64	114.8	4.84	123	1.64	131.2	1.14
142.1	1.14	146.9	2	147.6	2.14	151.5	2.86
164	6.64	172.2	9.64	180.4	10.74	188.6	11.64
205	12.18	214.1	13.33	218.9	13.94	228.2	16.95
237.6	20	242.7	21.64	250.1	22.24	258.3	24.94
295.2	30.34	314.3	31.81	317.3	32.04	319.1	31.42
331.3	26.94	355.9	29.34	361.6	34.94	372.3	35.74
387	42.74	395.9	44.28	398.5	44.74		

Manning's n	Values	num=	5
Sta	n Val	Sta	n Val
0	.05	73.8	.04
		94.3	.025
		205	.04
		258.3	.04

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	73.8	258.3	10	10	10	10	.2	.5	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.64	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.032	0.040
W.S. Elev (ft)	36.43	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)		Flow Area (sq ft)	667.03	4646.95	842.41
E.G. Slope (ft/ft)	0.000097	Area (sq ft)	667.03	4646.95	842.41
Q Total (cfs)	20000.00	Flow (cfs)	885.21	17984.70	1130.09
Top width (ft)	366.16	Top width (ft)	66.19	184.50	115.46
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)	1.33	3.87	1.34
Max chl Dpth (ft)	35.79	Hydr. Depth (ft)	10.08	25.19	7.30
Conv. Total (cfs)	2027918.0	Conv. (cfs)	89756.6	1823575.0	114586.6
Length wtd. (ft)	10.00	Wetted Per. (ft)	69.23	193.32	120.23
Min ch El (ft)	0.64	Shear (lb/sq ft)	0.06	0.15	0.04
Alpha	1.29	Stream Power (lb/ft s)	398.50	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4287.36	17690.29	3074.06
C & E Loss (ft)	0.00	Cum SA (acres)	1988.39	987.00	1646.72

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.42

INPUT Description: XS 54.42 NAVD 88									
Station Elevation Data num= 51									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	40.93	33.28	30.34	49.7	24.47	51.3	24.43	56	24.33
60.8	24.22	65.4	24.12	70.1	24.02	71.7	23.98	73.8	23.94
92.3	13.33	94.3	12.18	98.4	10.14	106.6	9.64	114.8	4.84
123	1.64	131.2	1.14	139.4	.64	142.1	1.14	146.9	2
147.6	2.14	151.5	2.86	155.8	3.64	164	6.64	172.2	9.64
180.4	10.74	188.6	11.64	196.8	11.64	205	12.18	214.1	13.33
218.9	13.94	228.2	16.95	233	18.48	237.6	20	242.7	21.64
250.1	22.24	258.3	24.94	286.2	25.54	295.2	30.34	314.3	31.81
317.3	32.04	319.1	31.42	323.7	29.69	331.3	26.94	355.9	29.34
361.6	34.94	372.3	35.74	383.4	40.99	387	42.74	395.8	44.28
398.5	44.74								

Manning's n Values num= 5									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	73.8	.04	94.3	.025	205	.04	258.3	.04
Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.		
73.8	258.3	100	100	100	.1	.3			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.64	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.032	0.040
W.S. Elev (ft)	36.42	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	500.61	4644.73	841.02
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	500.61	4644.73	841.02
Q Total (cfs)	20000.00	Flow (cfs)	602.43	18252.70	1144.87
Top width (ft)	359.57	Top width (ft)	59.63	184.50	115.44
Vel Total (ft/s)	3.34	Avg. Vel. (ft/s)	1.20	3.93	1.36
Max chl Dpth (ft)	35.78	Hydr. Depth (ft)	8.40	25.17	7.29
Conv. Total (cfs)	1996551.0	Conv. (cfs)	60138.7	1822123.0	114289.5
Length wtd. (ft)	100.00	Wetted Per. (ft)	61.60	193.32	120.20
Min ch El (ft)	0.64	Shear (lb/sq ft)	0.05	0.15	0.04
Alpha	1.28	Stream Power (lb/ft s)	398.50	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4287.23	17689.22	3073.86
C & E Loss (ft)	0.00	Cum SA (acres)	1988.38	986.96	1646.69

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.4101*

INPUT Description: XS 54.4 NAVD 88									
Station Elevation Data num= 75									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.13	5.88	41.12	13.88	40.95	46.09	30.71	63	27
65	27	71	27	77	27	82	27	88	27
90	27	93	27	119	19	121	18	127	17
132	16	138	13	143	11	147	8	150	6
153	5	161	3	168	3	172	2	176	2
184	0	187	1	192	1	192	2	194	2
196	2	201	3	203	4	209	6	213	7
217	8	223	9	226	9	233	10	234	10
238	11	243	12	245	13	251	14	260	15
264	16	265	16	273	19	275	19	280	20
284	22	290	23	291	23	297	25	306	29
321	30	331	29	334	29	339	30	352	31
356	31	358	32	360	32	364	32	366	32
371	31	380	32	393	35	398	38	400	39
408	39	418	42	421	43	429	44	431	44

Manning's n Values num= 7									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	93	.04	119	.029	161	.027	245	.04
306	.04	431	.04						
Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.		
93	306	100	100	100	.1	.3			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.63	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.42	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	461.77	5040.34	482.17
E.G. Slope (ft/ft)	0.000109	Area (sq ft)	461.77	5040.34	482.17
Q Total (cfs)	20000.00	Flow (cfs)	522.58	18908.61	568.81
Top width (ft)	367.23	Top width (ft)	64.87	213.00	89.37
Vel Total (ft/s)	3.34	Avg. Vel. (ft/s)	1.13	3.75	1.18
Max chl Dpth (ft)	36.42	Hydr. Depth (ft)	7.12	23.66	5.40
Conv. Total (cfs)	1918185.0	Conv. (cfs)	50120.1	1813511.0	54554.2
Length wtd. (ft)	100.00	Wetted Per. (ft)	66.16	223.41	90.71
Min ch El (ft)	0.00	Shear (lb/sq ft)	0.05	0.15	0.04
Alpha	1.20	Stream Power (lb/ft s)	431.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4286.12	17678.11	3072.34
C & E Loss (ft)	0.00	Cum SA (acres)	1988.23	986.50	1646.46

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.4003*

INPUT Description: XS 54.4 NAVD 88									
Station Elevation Data num= 75									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	40.97	16.63	41.13	24.62	40.97	56.79	30.75	76	30
89	30	92	29	99	29	107	29	109	29
112	29	145	25	148	24	156	23	162	22
170	17	175	13	181	10	185	8	189	6
198	4	199	4	208	4	214	3	218	3
228	0	231	0	236	1	237	1	238	1
241	2	245	3	248	3	254	4	258	5
263	6	268	7	271	8	278	9	280	9
284	10	289	12	291	13	297	16	307	17
310	18	312	19	319	22	321	22	327	22
331	23	337	24	338	24	344	28	353	33
366	34	375	32	378	31	382	30	394	29
397	31	400	32	401	33	405	35	406	36
411	36	418	37	430	40	435	41	437	42
443	42	452	43	455	43	462	44	464	44

Manning's n Values num= 7									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	112	.04	145	.034	181	.025	284	.04
353	.04	464	.04						
Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.		
112	353	4	4	4	.1	.3			

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.61	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.20	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.41	Reach Len. (ft)	4.00	4.00	4.00
Crit W.S. (ft)		Flow Area (sq ft)	420.85	5299.60	241.07
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	420.85	5299.60	241.07
Q Total (cfs)	20000.00	Flow (cfs)	426.92	19339.78	233.30
Top width (ft)	374.93	Top width (ft)	73.04	241.00	60.89
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)	1.01	3.65	0.97
Max chl Dpth (ft)	36.41	Hydr. Depth (ft)	5.76	21.99	3.96
Conv. Total (cfs)	1866779.0	Conv. (cfs)	39848.4	1805155.0	21775.8
Length wtd. (ft)	4.00	Wetted Per. (ft)	74.00	253.03	63.58
Min ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.15	Stream Power (lb/ft s)	464.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4285.11	17666.24	3071.51
C & E Loss (ft)	0.00	Cum SA (acres)	1988.08	985.98	1646.28

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.4

INPUT Description: XS 54.4 NAVD 88									
Station Elevation Data num= 33									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	41.44	10.63	40.97	18.63	41.13	26.62	40.97	58.79	30.75

113	29.54	163	22.54	176.8	13.32	182	9.85	190	6.44
200	3.64	210	4.14	220	2.64	230	-.36	240	1.04
250	3.34	260	5.14	270	7.44	280	8.84	286	9.85
292.9	13.35	299	16.44	312	17.94	321	21.74	340	23.84
359	32.84	368	34.34	380	30.74	396	29.44	408	35.74
420	36.74	438	42.14	465	43.74				

Manning's n Values		num=	5						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	113	.04	182	.025	286	.04	355	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
113	355	100	100	100	100	.1		.3
Blocked Obstructions								
Sta L	Sta R	Elev						
368	465	34.34						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.41	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	389.81	5301.88	120.09
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	389.81	5301.88	120.09
Q Total (cfs)	20000.00	Flow (cfs)	395.08	19527.16	77.76
Top width (ft)	375.02	Top width (ft)	72.02	242.00	61.00
Vel Total (ft/s)	3.44	Avg. Vel. (ft/s)	1.01	3.68	0.65
Max chl Dpth (ft)	36.77	Hydr. Depth (ft)	5.41	21.91	1.97
Conv. Total (cfs)	1793149.0	Conv. (cfs)	35421.7	1750735.0	6972.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)	72.91	253.98	61.46
Min ch El (ft)	-0.36	Shear (lb/sq ft)	0.04	0.16	0.02
Alpha	1.12	Stream Power (lb/ft s)	465.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4285.07	17665.75	3071.50
C & E Loss (ft)	0.00	Cum SA (acres)	1988.07	985.96	1646.28

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

CROSS SECTION

RIVER: RIVER-1	
REACH: Reach-1	RS: 54.3847*

INPUT Description:										
Station	Elevation	Data	num=	53						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	41	13.4842	40.98	21.4842	41.15	30.9842	40.98	63.9242	30	
94	30	112	30	123	30	172	22	186	13	
189	11	191	10	199	7	201	6	208	4	
213	4	218	4	228	3	238	0	248	1	
249	1	258	3	260	4	267	5	272	6	
277	7	283	8	287	9	293	10	294	10	
300	13	305	16	306	16	317	17	319	17	
328	21	339	22	342	23	346	23	347	23	
362	32	376	34	388	31	404	29	409	31	
417	43	429	36	431	37	446	41	448	42	
461	43	471	43	476	44					

Manning's n Values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.05	123	.04	172	.029	191	.025	294	.04
339	.04	362	.04	476	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
123	362	100	100	100	100	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.40	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	439.37	5273.12	266.82
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	439.37	5273.12	266.82
Q Total (cfs)	20000.00	Flow (cfs)	437.70	19303.09	259.21
Top width (ft)	385.07	Top width (ft)	78.27	239.00	67.80
Vel Total (ft/s)	3.34	Avg. Vel. (ft/s)	1.00	3.66	0.97
Max chl Dpth (ft)	36.40	Hydr. Depth (ft)	5.61	22.06	3.94
Conv. Total (cfs)	1868000.0	Conv. (cfs)	40881.4	1802908.0	24210.3
Length Wtd. (ft)	100.00	Wetted Per. (ft)	79.31	250.88	69.90
Min ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.16	Stream Power (lb/ft s)	476.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum volume (acre-ft)	4284.12	17653.61	3071.05
C & E Loss (ft)	0.00	Cum SA (acres)	1987.90	985.41	1646.13

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

CROSS SECTION

RIVER: RIVER-1	
REACH: Reach-1	RS: 54.3695*

INPUT Description:										
Station	Elevation	Data	num=	53						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
1	42	41	9	41	25.8166	41	25.8166	41	56.1066	4
102	30	122	29	134	30	181	22	194	13	
197	11	199	10	207	7	210	6	217	4	
221	4	226	4	236	3	245	0	255	1	
256	2	265	3	268	4	275	5	279	6	
285	7	290	8	295	9	301	10	302	10	
308	13	313	15	314	16	324	17	326	17	
335	21	347	22	349	22	353	23	354	23	
369	32	383	34	396	30	413	29	417	31	
426	35	439	36	440	36	456	41	458	42	
472	42	481	43	487	44					

Manning's n Values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1	.05	134	.04	194	.029	207	.025	302	.04
347	.04	369	.04	487	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
134	369	100	100	100	100	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	wt. n-Val.	0.050	0.034	0.040
W.S. Elev (ft)	36.39	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	537.87	5206.13	289.62
E.G. Slope (ft/ft)	0.000121	Area (sq ft)	537.87	5206.13	289.62
Q Total (cfs)	20000.00	Flow (cfs)	556.79	19150.71	292.50
Top width (ft)	401.58	Top width (ft)	94.34	235.00	72.23
Vel Total (ft/s)	3.31	Avg. Vel. (ft/s)	1.04	3.68	1.01
Max chl Dpth (ft)	36.39	Hydr. Depth (ft)	5.70	22.15	4.01
Conv. Total (cfs)	1819977.0	Conv. (cfs)	50667.3	1742693.0	26617.4
Length Wtd. (ft)	100.00	Wetted Per. (ft)	95.31	247.16	74.43
Min ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.16	0.03
Alpha	1.18	Stream Power (lb/ft s)	487.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4283.00	17641.58	3070.42
C & E Loss (ft)	0.00	Cum SA (acres)	1987.70	984.86	1645.97

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

CROSS SECTION

RIVER: RIVER-1	
REACH: Reach-1	RS: 54.3542*

INPUT Description:										
Station	Elevation	Data	num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
1	42	5	41	10	41	14	40	19	38	
57	30	109	30	131	29	144	29	190	22	
203	13	206	11	208	10	216	7	218	6	
225	4	230	4	234	4	244	3	253	0	
263	1	264	2	273	4	275	4	282	5	
286	6	292	7	298	8	302	8	308	9	
309	10	315	12	320	15	321	15	331	16	
334	17	343	20	354	21	356	22	360	23	
361	23	376	32	391	33	404	30	421	29	
426	31	435	35	448	36	450	36	466	41	
468	41	482	42	492	43	498	43			

Manning's n Values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1	.05	144	.04	191	.029	210	.025	310	.04
350	.04	376	.04	498	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
144	376	100	100	100	100	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.38	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	675.33	5196.36	313.09
E.G. Slope (ft/ft)	0.000112	Area (sq ft)	675.33	5196.36	313.09
Q Total (cfs)	20000.00	Flow (cfs)	680.12	19005.94	313.94
Top width (ft)	424.49	Top width (ft)	117.29	232.00	75.20
Vel Total (ft/s)	3.23	Avg. Vel. (ft/s)	1.01	3.66	1.00
Max chl Dpth (ft)	36.38	Hydr. Depth (ft)	5.76	22.40	4.16
Conv. Total (cfs)	1888581.0	Conv. (cfs)	64222.9	1794713.0	29645.4
Length Wtd. (ft)	100.00	Wetted Per. (ft)	117.98	244.07	76.94
Min ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.22	Stream Power (lb/ft s)	498.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4281.61	17629.64	3069.72
C & E Loss (ft)	0.00	Cum SA (acres)	1987.46	984.33	1645.80

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.3390*

INPUT
Description:

Station Elevation Data		num=	53						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1	42	5	41	11	41	15	40	21	38
61	31	117	31	141	29	154	29	200	22
212	13	215	11	217	10	224	7	227	6
233	4	238	5	242	5	251	3	260	0
270	2	272	2	280	4	283	4	290	5
294	6	300	7	305	8	310	8	315	9
316	10	322	12	327	14	328	15	339	16
341	16	350	19	361	21	363	21	368	22
383	31	398	33	412	30	430	29	435	31
444	34	457	35	459	36	476	40	478	41
493	42	503	43	509	43				

Manning's n values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1	.05	154	.04	201	.029	219	.025	318	.039
357	.04	383	.04	509	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	154	383		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.56	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.20	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.36	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	630.52	5140.85	349.61
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	630.52	5140.85	349.61
Q Total (cfs)	20000.00	Flow (cfs)	589.55	19038.24	372.21
Top width (ft)	430.15	Top width (ft)	123.63	229.00	77.53
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	0.94	3.70	1.06
Max chl Dpth (ft)	36.36	Hydr. Depth (ft)	5.10	22.45	4.51
Conv. Total (cfs)	1877920.0	Conv. (cfs)	55356.1	1787615.0	34949.1
Length wtd. (ft)	100.00	Wetted Per. (ft)	124.18	241.04	79.19
Min Ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.23	Stream Power (lb/ft s)	509.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4280.11	17617.8	3068.96
C & E Loss (ft)	0.00	Cum SA (acres)	1987.18	983.80	1645.63

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.3238*

INPUT
Description:

Station Elevation Data		num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	42	6	41	12	41	16	40	22	38
65	31	125	31	150	29	164	29	209	22
221	13	224	12	226	10	233	7	235	7
242	5	246	5	250	5	259	3	268	0
278	2	279	2	288	4	290	4	297	5
301	6	307	7	313	8	317	8	323	9
324	9	330	12	335	14	336	14	346	15
348	16	357	19	368	20	370	21	375	22
376	22	390	31	406	32	420	30	438	29
443	31	453	34	467	35	468	35	486	40
488	41	503	41	514	43	520	43		

Manning's n values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2	.05	164	.04	210	.028	229	.025	326	.039
364	.04	390	.04	520	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	164	390		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.55	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.35	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	670.01	5084.15	376.23
E.G. Slope (ft/ft)	0.000114	Area (sq ft)	670.01	5084.15	376.23
Q Total (cfs)	20000.00	Flow (cfs)	627.55	18966.78	405.67
Top width (ft)	440.68	Top width (ft)	131.84	226.00	82.84
Vel Total (ft/s)	3.26	Avg. Vel. (ft/s)	0.94	3.73	1.08
Max chl Dpth (ft)	36.35	Hydr. Depth (ft)	5.08	22.50	4.54
Conv. Total (cfs)	1870920.0	Conv. (cfs)	58704.8	1774268.0	37948.7
Length wtd. (ft)	100.00	Wetted Per. (ft)	132.35	237.88	84.09

Min Ch El (ft)	0.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.24	Stream Power (lb/ft s)	520.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4278.62	17606.04	3068.13
C & E Loss (ft)	0.00	Cum SA (acres)	1986.89	983.28	1645.44

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.3085*

INPUT
Description:

Station Elevation Data		num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	42	7	41	13	41	17	40	24	38
69	31	133	31	159	29	175	29	218	21
230	13	233	12	234	10	241	7	243	7
250	5	254	5	258	5	267	3	276	1
285	2	287	2	295	4	298	4	305	5
309	6	315	7	320	8	324	8	330	9
331	9	337	12	342	14	343	14	353	15
355	15	364	18	375	20	377	20	382	21
383	22	397	31	413	32	428	29	447	29
452	30	462	34	476	35	478	35	496	40
498	40	514	41	524	43	531	43		

Manning's n values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2	.05	175	.04	220	.028	238	.025	334	.039
372	.04	397	.04	531	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	175	397		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.54	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.33	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	714.88	5044.19	413.27
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	714.88	5044.19	413.27
Q Total (cfs)	20000.00	Flow (cfs)	668.53	18870.17	461.31
Top width (ft)	448.09	Top width (ft)	140.29	222.00	85.80
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)	0.94	3.74	1.12
Max chl Dpth (ft)	35.33	Hydr. Depth (ft)	5.10	22.72	4.82
Conv. Total (cfs)	1877729.0	Conv. (cfs)	62765.6	1771653.0	43310.5
Length wtd. (ft)	100.00	Wetted Per. (ft)	140.78	233.62	87.22
Min Ch El (ft)	1.00	Shear (lb/sq ft)	0.04	0.15	0.03
Alpha	1.26	Stream Power (lb/ft s)	531.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4277.03	17594.42	3067.22
C & E Loss (ft)	0.00	Cum SA (acres)	1986.57	982.76	1645.25

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2933*

INPUT
Description:

Station Elevation Data		num=	53						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	42	7	42	14	41	19	39	25	38
74	31	141	31	169	29	185	29	227	21
239	13	241	12	243	11	250	8	252	7
258	5	262	5	267	5	275	3	283	1
293	2	294	2	303	4	305	4	312	5
316	6	322	7	327	7	332	8	338	9
344	11	349	12	350	13	360	14	363	15
371	18	382	19	385	20	389	21	390	21
404	30	421	32	436	29	455	28	461	30
470	33	485	34	487	35	506	40	508	40
524	41	535	43	542	43				

Manning's n values		num=	8						
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2	.05	185	.04	230	.028	248	.025	342	.039
379	.04	404	.04	542	.04				

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	185	404		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.53	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.32	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	750.07	5008.80	463.16

E.G. Slope (ft/ft)	0.000112	Area (sq ft)	750.07	5008.80	463.16
Q Total (cfs)	20000.00	Flow (cfs)	695.11	18759.98	544.90
Top width (ft)	455.29	Top width (ft)	148.26	219.00	88.03
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)	0.93	3.75	1.18
Max chl Dpth (ft)	35.32	Hydr. Depth (ft)	5.06	22.87	5.26
Conv. Total (cfs)	1886256.0	Conv. (cfs)	65557.9	1769306.0	51391.4
Length wtd. (ft)	100.00	wetted Per. (ft)	148.71	229.49	89.72
Min Ch El (ft)	1.00	Shear (lb/sq ft)	0.04	0.15	0.04
Alpha	1.28	Stream Power (lb/ft s)	542.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4275.34	17582.88	3066.22
C & E Loss (ft)	0.00	Cum SA (acres)	1986.24	982.26	1645.05

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2781*

INPUT Description: Station Elevation Data									
Sta		Elev		Sta		Elev		Sta	
3		42		8		42		15	
78		31		149		32		178	
247		13		250		12		252	
266		5		271		5		275	
301		2		302		2		310	
324		6		329		7		335	
346		9		352		11		357	
379		17		389		19		392	
411		30		428		31		443	
479		33		495		34		497	
534		40		546		43		552	

Manning's n Values		num=		8	
Sta		n Val		Sta	
3		.05		195	
387		.04		411	

Bank Sta: Left 195 Right 411 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.52	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.31	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	736.77	4961.67	501.67
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	736.77	4961.67	501.67
Q Total (cfs)	20000.00	Flow (cfs)	664.40	18730.61	604.99
Top width (ft)	466.45	Top width (ft)	155.68	216.00	94.77
Vel Total (ft/s)	3.23	Avg. Vel. (ft/s)	0.90	3.78	1.21
Max chl Dpth (ft)	35.31	Hydr. Depth (ft)	4.73	22.97	5.29
Conv. Total (cfs)	1853785.0	Conv. (cfs)	61582.7	1736127.0	56075.7
Length wtd. (ft)	100.00	wetted Per. (ft)	156.20	227.06	96.11
Min Ch El (ft)	1.00	Shear (lb/sq ft)	0.03	0.16	0.04
Alpha	1.29	Stream Power (lb/ft s)	552.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4273.64	17571.43	3065.11
C & E Loss (ft)	0.00	Cum SA (acres)	1985.89	981.76	1644.84

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2628*

INPUT Description: Station Elevation Data									
Sta		Elev		Sta		Elev		Sta	
3		42		8		42		16	
82		32		157		32		188	
256		13		259		12		260	
275		5		279		5		283	
308		2		309		2		318	
331		6		337		7		342	
353		9		359		11		364	
377		14		386		17		397	
404		20		418		30		436	
478		30		488		33		504	
528		39		545		40		557	

Manning's n Values		num=		8	
Sta		n Val		Sta	
3		.05		206	
394		.04		418	

Bank Sta: Left 206 Right 418 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.50	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.29	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	730.14	4901.15	513.59
E.G. Slope (ft/ft)	0.000119	Area (sq ft)	730.14	4901.15	513.59
Q Total (cfs)	20000.00	Flow (cfs)	626.80	18746.12	627.08
Top width (ft)	478.65	Top width (ft)	169.48	212.00	97.16
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)	0.86	3.82	1.22
Max chl Dpth (ft)	35.29	Hydr. Depth (ft)	4.31	23.82	5.29
Conv. Total (cfs)	1830599.0	Conv. (cfs)	57371.1	1715831.0	57396.7
Length wtd. (ft)	100.00	wetted Per. (ft)	169.83	224.01	98.43
Min Ch El (ft)	1.00	Shear (lb/sq ft)	0.03	0.16	0.04
Alpha	1.30	Stream Power (lb/ft s)	563.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4271.95	17560.11	3063.94
C & E Loss (ft)	0.00	Cum SA (acres)	1985.52	981.27	1644.62

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2476*

INPUT Description: Station Elevation Data									
Sta		Elev		Sta		Elev		Sta	
3		42		9		42		17	
86		32		165		32		197	
265		14		268		12		269	
283		6		287		5		291	
316		2		317		3		325	
339		6		344		7		350	
366		10		371		12		372	
393		16		404		17		406	
425		29		443		31		459	
497		32		513		33		515	
555		40		567		43		574	

Manning's n Values		num=		8	
Sta		n Val		Sta	
3		.05		216	
401		.04		425	

Bank Sta: Left 216 Right 425 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.49	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.21	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.28	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	764.29	4888.39	594.20
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	764.29	4888.39	594.20
Q Total (cfs)	20000.00	Flow (cfs)	644.95	18590.51	764.53
Top width (ft)	488.44	Top width (ft)	177.96	209.00	101.49
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	0.84	3.80	1.29
Max chl Dpth (ft)	35.28	Hydr. Depth (ft)	4.29	23.39	5.86
Conv. Total (cfs)	1858723.0	Conv. (cfs)	59939.6	1727731.0	71052.7
Length wtd. (ft)	100.00	wetted Per. (ft)	178.29	219.95	102.89
Min Ch El (ft)	1.00	Shear (lb/sq ft)	0.03	0.16	0.04
Alpha	1.32	Stream Power (lb/ft s)	574.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4270.24	17548.88	3062.67
C & E Loss (ft)	0.00	Cum SA (acres)	1985.12	980.78	1644.39

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2323*

INPUT									
Description: Station Elevation Data									
Sta		Elev		Sta		Elev		Sta	
4	42	10	42	18	40	23	39	32	37
90	32	173	32	207	29	226	29	264	20
274	14	276	12	278	11	284	8	286	8
291	6	295	6	299	5	306	4	314	1
323	3	325	3	333	4	335	4	342	5
346	6	352	7	357	7	361	7	367	8
368	8	374	10	379	12	389	12	392	13
400	16	411	17	413	18	417	19	418	20
433	29	451	30	467	28	489	28	495	29
506	32	523	33	525	33	546	38	548	39
566	39	578	43	585	43				

Manning's n Values	num=	8							
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
4 .05	226 .04	268 .04	285 .027	374 .038					
409 .04	433 .04	585 .04							

Bank Sta: Left 226 Right 433 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.27	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	793.84	4823.19	622.94
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	793.84	4823.19	622.94
Q Total (cfs)	20000.00	Flow (cfs)	671.45	18517.86	810.69
Top width (ft)	498.21	Top width (ft)	185.49	207.00	105.72
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)	0.85	3.84	1.30
Max Chl Dpth (ft)	35.27	Hydr. Depth (ft)	4.28	23.30	5.89
Conv. Total (cfs)	1850207.0	Conv. (cfs)	62116.3	1713094.0	74997.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	185.81	217.98	106.77
Min ch El (ft)	1.00	Shear (lb/sq ft)	0.03	0.16	0.04
Alpha	1.34	Stream Power (lb/ft s)	585.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4268.45	17537.73	3061.28
C & E Loss (ft)	0.00	Cum SA (acres)	1984.70	980.31	1644.15

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2171*

INPUT									
Description:									
Station Elevation Data	num=	53							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
4 42	10 42	19 40	25 39	33 37					
95 32	181 33	216 29	236 29	273 20					
283 14	285 12	287 11	292 8	294 8					
300 6	303 6	307 6	314 4	321 2					
331 3	332 3	340 4	343 4	350 5					
354 6	359 6	364 7	369 7	374 8					
375 8	381 10	386 11	387 11	397 12					
399 12	407 16	418 16	420 17	425 19					
440 29	458 30	475 28	498 28	504 29					
515 31	532 32	534 33	558 38	558 38					
576 39	589 42	596 43							

Manning's n Values	num=	8							
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
4 .05	236 .04	278 .027	294 .026	382 .038					
416 .04	440 .04	596 .04							

Bank Sta: Left 236 Right 440 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.25	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	763.56	4783.84	661.42
E.G. Slope (ft/ft)	0.000118	Area (sq ft)	763.56	4783.84	661.42
Q Total (cfs)	20000.00	Flow (cfs)	613.89	18500.50	885.61
Top width (ft)	506.03	Top width (ft)	193.72	204.00	108.31
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	0.80	3.87	1.34
Max Chl Dpth (ft)	34.25	Hydr. Depth (ft)	3.94	23.45	6.11
Conv. Total (cfs)	1842114.0	Conv. (cfs)	56542.9	1704002.0	81569.7
Length Wtd. (ft)	100.00	Wetted Per. (ft)	194.13	214.74	109.35
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.03	0.16	0.04
Alpha	1.34	Stream Power (lb/ft s)	596.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4266.66	17526.70	3059.80
C & E Loss (ft)	0.00	Cum SA (acres)	1984.27	979.83	1643.91

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.2019*

INPUT									
Description:									
Station Elevation Data	num=	53							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
4 42	11 42	19 40	26 39	35 37					
99 32	188 33	225 29	247 29	282 20					
292 14	294 12	295 11	301 9	303 8					
308 6	312 6	315 6	322 4	329 2					
338 3	340 3	348 4	350 4	357 5					

361 6	367 6	372 7	376 7	382 8					
388 9	393 11	394 11	404 11	406 12					
415 14	425 16	427 17	432 18	433 19					
447 28	466 29	483 28	506 28	512 29					
524 31	541 32	544 32	565 38	568 38					
587 39	600 42	607 43							

Manning's n Values	num=	8							
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
4 .05	247 .04	287 .027	304 .026	390 .038					
424 .04	447 .04	607 .04							

Bank Sta: Left 247 Right 447 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.24	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	800.98	4733.41	714.19
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	800.98	4733.41	714.19
Q Total (cfs)	20000.00	Flow (cfs)	643.31	18374.88	981.81
Top width (ft)	514.10	Top width (ft)	202.27	200.00	111.84
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	0.80	3.88	1.37
Max Chl Dpth (ft)	34.24	Hydr. Depth (ft)	3.96	23.67	6.39
Conv. Total (cfs)	1850004.0	Conv. (cfs)	59506.1	1699680.0	90818.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	202.65	210.56	112.77
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.03	0.16	0.05
Alpha	1.36	Stream Power (lb/ft s)	607.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4264.87	17515.78	3058.22
C & E Loss (ft)	0.00	Cum SA (acres)	1983.81	979.37	1643.65

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.1866*

INPUT									
Description:									
Station Elevation Data	num=	54							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
5 42	12 42	20 40	27 39	36 37					
103 33	196 33	235 29	257 29	291 20					
300 14	303 12	304 11	309 9	311 8					
316 6	320 6	323 6	330 4	337 2					
346 3	347 3	355 4	358 4	365 5					
369 6	374 6	379 7	383 7	389 7					
390 8	396 9	400 10	401 11	411 11					
413 11	422 14	432 15	435 16	439 18					
440 18	454 28	473 29	491 28	515 27					
521 29	533 31	551 32	553 32	575 37					
578 38	597 38	610 42	618 42						

Manning's n Values	num=	8							
Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val	Sta n Val
5 .05	257 .04	297 .027	313 .026	398 .038					
431 .04	454 .04	618 .04							

Bank Sta: Left 257 Right 454 Lengths: Left Channel 100 Right 100 Coeff Contr. .1 Expan. .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.22	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	749.48	4697.07	751.89
E.G. Slope (ft/ft)	0.000119	Area (sq ft)	749.48	4697.07	751.89
Q Total (cfs)	20000.00	Flow (cfs)	570.37	18386.52	1043.12
Top width (ft)	522.58	Top width (ft)	208.00	197.00	117.58
Vel Total (ft/s)	3.23	Avg. Vel. (ft/s)	0.76	3.91	1.39
Max Chl Dpth (ft)	34.22	Hydr. Depth (ft)	3.60	23.84	6.39
Conv. Total (cfs)	1833908.0	Conv. (cfs)	52300.3	1685959.0	95648.9
Length Wtd. (ft)	100.00	Wetted Per. (ft)	208.30	208.40	118.65
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.03	0.17	0.05
Alpha	1.36	Stream Power (lb/ft s)	618.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4263.09	17504.95	3056.54
C & E Loss (ft)	0.00	Cum SA (acres)	1983.34	978.91	1643.39

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.1714*

INPUT
Description:

Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	42	12	42	21	40	28	39	38	37
107	33	204	33	244	29	267	29	300	19
309	14	311	12	313	11	318	9	320	8
325	7	328	6	331	6	338	4	344	2
354	3	355	3	363	4	365	5	372	5
376	5	382	6	387	7	391	7	396	7
397	8	403	9	408	10	409	10	418	10
421	11	429	13	440	15	442	16	446	18
447	18	461	28	481	29	499	27	523	27
530	28	542	30	560	31	562	32	585	37
588	37	608	38	621	42	629	42		

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
5	.05	267	.04	307	.027	322	.026
439	.04	461	.04	629	.04	406	.038

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	267	461		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.43	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.21	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	775.23	4665.92	823.90
E.G. Slope (ft/ft)	0.000117	Area (sq ft)	775.23	4665.92	823.90
Q Total (cfs)	20000.00	Flow (cfs)	584.89	18228.42	1186.70
Top width (ft)	529.82	Top width (ft)	215.43	194.00	120.38
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	0.75	3.91	1.44
Max chl Dpth (ft)	34.21	Hydr. Depth (ft)	3.60	24.05	6.84
Conv. Total (cfs)	1848276.0	Conv. (cfs)	54051.7	1684557.0	109667.2
Length wtd. (ft)	100.00	Wetted Per. (ft)	215.73	204.96	121.47
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.03	0.17	0.05
Alpha	1.38	Stream Power (lb/ft s)	629.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4261.34	17494.21	3054.73
C & E Loss (ft)	0.00	Cum SA (acres)	1982.86	978.47	1643.12

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.1561*

Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	42	13	42	22	40	30	39	40	36
111	33	212	34	254	29	278	29	309	19
318	14	320	12	321	12	326	9	328	8
333	7	336	6	339	6	346	4	352	2
361	3	362	3	370	4	373	5	380	7
384	5	389	6	394	7	398	7	404	7
405	7	410	9	415	10	416	10	426	10
428	10	436	13	447	14	449	15	453	17
454	18	468	27	488	28	507	27	532	27
538	28	551	30	569	31	572	31	595	37
598	37	618	38	632	42	640	42		

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
5	.05	278	.04	316	.027	332	.026
446	.04	468	.04	640	.04	414	.038

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	278	468		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.42	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.20	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	763.31	4607.22	884.94
E.G. Slope (ft/ft)	0.000118	Area (sq ft)	763.31	4607.22	884.94
Q Total (cfs)	20000.00	Flow (cfs)	533.22	18152.23	1314.55
Top width (ft)	552.59	Top width (ft)	238.66	190.00	123.93
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	0.70	3.94	1.49
Max chl Dpth (ft)	34.20	Hydr. Depth (ft)	3.20	24.25	7.14
Conv. Total (cfs)	1844954.0	Conv. (cfs)	49188.6	1674502.0	121263.9
Length wtd. (ft)	100.00	Wetted Per. (ft)	239.06	200.95	124.91
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.02	0.17	0.05
Alpha	1.39	Stream Power (lb/ft s)	640.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4259.57	17483.56	3052.77
C & E Loss (ft)	0.00	Cum SA (acres)	1982.34	978.02	1642.84

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.1409*

Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	42	13	42	23	40	31	38	41	36
116	33	220	34	263	29	288	29	318	19
327	14	329	12	330	12	335	9	337	9
341	7	344	7	347	6	353	5	360	2
369	3	370	3	378	4	380	5	387	5
391	5	396	6	401	6	406	7	411	7
412	7	418	8	422	9	423	9	433	9
435	10	443	12	454	14	456	15	460	17
461	17	475	27	496	28	515	27	540	27
547	28	560	30	579	31	581	31	605	37
608	37	628	37	643	42	651	42		

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
6	.05	288	.04	326	.027	341	.026
453	.04	475	.04	651	.04	422	.038

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	288	475		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.41	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.22	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.18	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	786.56	4563.93	903.27
E.G. Slope (ft/ft)	0.000119	Area (sq ft)	786.56	4563.93	903.27
Q Total (cfs)	20000.00	Flow (cfs)	549.63	18102.37	1348.00
Top width (ft)	561.66	Top width (ft)	247.92	187.00	126.74
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	0.70	3.97	1.49
Max chl Dpth (ft)	34.18	Hydr. Depth (ft)	3.17	24.41	7.13
Conv. Total (cfs)	1834701.0	Conv. (cfs)	50420.2	1660622.0	123658.8
Length wtd. (ft)	100.00	Wetted Per. (ft)	248.29	198.24	127.68
Min ch El (ft)	2.00	Shear (lb/sq ft)	0.02	0.17	0.05
Alpha	1.41	Stream Power (lb/ft s)	651.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4257.79	17473.03	3050.72
C & E Loss (ft)	0.00	Cum SA (acres)	1981.78	977.59	1642.55

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.1257*

Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6	42	14	42	24	40	32	38	43	36
120	34	228	34	272	29	298	29	328	19
336	14	338	12	339	12	344	9	345	9
349	7	352	7	355	6	361	5	367	3
376	3	378	4	385	4	388	5	395	5
398	5	404	6	409	6	413	7	419	7
425	8	430	9	440	9	442	9	451	12
461	13	463	14	467	16	468	17	482	27
503	27	523	27	549	27	556	28	569	29
588	30	591	30	615	36	618	36	639	37
653	42	662	42						

Manning's n Values							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
6	.05	298	.04	336	.026	351	.026
461	.04	482	.04	662	.04	429	.037

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	298	482		100	100		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.40	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.17	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	715.65	4490.72	996.50
E.G. Slope (ft/ft)	0.000121	Area (sq ft)	715.65	4490.72	996.50
Q Total (cfs)	20000.00	Flow (cfs)	464.19	18031.12	1504.70
Top width (ft)	579.42	Top width (ft)	255.92	184.00	139.51
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	0.65	4.02	1.51
Max chl Dpth (ft)	33.17	Hydr. Depth (ft)	2.80	24.41	7.14
Conv. Total (cfs)	1817320.0	Conv. (cfs)	42178.8	1638415.0	136725.8
Length wtd. (ft)	100.00	Wetted Per. (ft)	256.24	195.41	140.38
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.17	0.05
Alpha	1.42	Stream Power (lb/ft s)	662.00	0.00	0.00

Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4256.07	17462.64	3048.54
C & E Loss (ft)	0.00	Cum SA (acres)	1981.20	977.17	1642.24

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.1104*

INPUT Description:									
Station Elevation Data		num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
7	42	15	42	25	40	33	38	44	36
124	34	236	34	282	29	308	29	337	19
345	14	346	13	348	12	352	10	354	9
358	7	361	7	363	6	369	5	375	3
384	4	385	4	393	5	396	5	402	5
406	5	411	6	416	6	420	6	426	7
427	7	432	8	437	8	438	8	447	9
450	9	458	11	468	13	470	14	474	16
475	16	489	26	511	27	531	26	557	27
564	27	577	29	598	30	600	30	625	36
628	36	649	37	664	42	673	42		
Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
7	.05	308	.04	345	.026	360	.026	437	.037
468	.04	489	.04	673	.04				
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
308 489		100 100		100		.1		.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.38	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.15	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	733.92	4441.51	1058.26
E.G. Slope (ft/ft)	0.000120	Area (sq ft)	733.92	4441.51	1058.26
Q Total (cfs)	20000.00	Flow (cfs)	471.39	17893.43	1635.18
Top width (ft)	588.10	Top width (ft)	264.85	181.00	142.25
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)	0.64	4.03	1.55
Max chl dpth (ft)	33.15	Hydr. depth (ft)	2.77	24.54	7.44
Conv. Total (cfs)	1824222.0	Conv. (cfs)	42996.1	1632079.0	149146.6
Length wtd. (ft)	100.00	wetted Per. (ft)	265.16	191.39	143.21
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.17	0.06
Alpha	1.43	Stream Power (lb/ft s)	673.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4254.40	17452.39	3046.18
C & E Loss (ft)	0.00	Cum SA (acres)	1980.60	976.75	1641.92

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.0952*

INPUT Description:									
Station Elevation Data		num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
7	43	15	42	26	40	34	38	46	36
128	34	244	35	291	29	319	29	346	18
353	14	355	13	356	12	361	10	362	9
366	8	369	7	371	6	377	5	382	3
391	4	393	4	401	5	403	5	410	5
413	5	419	6	424	6	428	6	433	6
434	7	440	7	444	8	445	8	455	8
457	8	465	10	475	12	477	13	481	16
482	16	496	26	518	27	539	26	566	27
573	27	586	29	607	30	609	30	635	36
638	36	660	37	675	42	684	42		
Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
7	.05	319	.04	355	.026	369	.026	445	.037
476	.04	496	.04	684	.04				
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
319 496		100 100		100		.1		.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.37	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.14	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	677.80	4413.47	1078.34
E.G. Slope (ft/ft)	0.000121	Area (sq ft)	677.80	4413.47	1078.34
Q Total (cfs)	20000.00	Flow (cfs)	404.50	17926.27	1669.23

Top width (ft)	595.87	Top width (ft)	273.83	177.00	145.04
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)	0.60	4.06	1.55
Max chl dpth (ft)	33.14	Hydr. Depth (ft)	2.48	24.93	7.43
Conv. Total (cfs)	1820544.0	Conv. (cfs)	36820.9	1631778.0	151945.3
Length wtd. (ft)	100.00	wetted Per. (ft)	274.25	188.28	145.97
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.18	0.06
Alpha	1.43	Stream Power (lb/ft s)	684.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4252.78	17442.22	3043.73
C & E Loss (ft)	0.00	Cum SA (acres)	1979.98	976.34	1641.59

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.08*

INPUT Description:									
Station Elevation Data		num=	52						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
7	43	16	42	27	40	36	38	48	36
133	34	252	35	301	29	329	29	355	18
362	14	364	13	365	12	369	10	371	9
374	8	377	7	380	7	385	5	390	3
399	4	400	4	408	5	411	5	417	5
421	5	426	6	431	6	435	6	441	6
447	7	452	8	462	8	464	8	472	10
482	11	485	13	489	15	489	16	503	25
526	26	547	26	574	26	582	27	595	28
616	29	619	29	645	35	648	35	670	36
686	42	695	42						
Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
7	.05	329	.04	364	.026	379	.026	453	.037
483	.04	503	.04	695	.04				
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
329 503		100 100		100		.1		.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.36	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.13	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	691.43	4359.22	1225.85
E.G. Slope (ft/ft)	0.000120	Area (sq ft)	691.43	4359.22	1225.85
Q Total (cfs)	20000.00	Flow (cfs)	409.24	17715.18	1875.58
Top width (ft)	623.11	Top width (ft)	281.77	174.00	167.34
Vel Total (ft/s)	3.19	Hydr. depth (ft)	0.59	4.06	1.53
Max chl dpth (ft)	33.13	Hydr. depth (ft)	2.45	25.05	7.33
Conv. Total (cfs)	1825209.0	Conv. (cfs)	37347.8	1616696.0	171165.9
Length wtd. (ft)	100.00	wetted Per. (ft)	282.17	185.16	168.22
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.18	0.05
Alpha	1.46	Stream Power (lb/ft s)	695.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4251.21	17432.15	3041.08
C & E Loss (ft)	0.00	Cum SA (acres)	1979.35	975.93	1641.23

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54.0647*

INPUT Description:									
Station Elevation Data		num=	54						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8	43	16	42	28	40	37	38	49	35
137	34	259	35	310	29	339	29	364	18
371	14	373	13	374	12	378	10	379	9
383	8	385	7	388	7	393	5	398	3
407	4	408	4	416	5	418	5	425	5
428	5	434	6	439	6	443	6	448	6
449	6	454	7	459	7	460	7	469	7
471	7	479	9	490	11	492	12	496	15
497	15	510	25	533	26	554	26	583	26
590	27	604	28	626	29	628	29	655	35
658	35	681	36	696	42	706	42		
Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
8	.05	339	.04	374	.026	388	.026	461	.037
490	.04	510	.04	706	.04				
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
339 510		100 100		100		.1		.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.12	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	758.06	4331.29	1248.31
E.G. Slope (ft/ft)	0.000120	Area (sq ft)	758.06	4331.29	1248.31
Q Total (cfs)	20000.00	Flow (cfs)	462.58	17636.11	1901.30
Top width (ft)	636.75	Top width (ft)	294.46	171.00	171.29
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	0.61	4.07	1.52
Max chl Dpth (ft)	33.12	Hydr. Depth (ft)	2.57	25.33	7.29
Conv. Total (cfs)	1827503.0	Conv. (cfs)	42268.7	1611502.0	173732.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	294.96	182.40	172.34
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.18	0.05
Alpha	1.49	Stream Power (lb/ft s)	706.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4249.55	17422.18	3038.24
C & E Loss (ft)	0.00	Cum SA (acres)	1978.68	975.54	1640.84

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.0495*

INPUT Description: Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8	43	17	42	29	40	38	38	51	35
141	35	267	35	319	29	350	29	373	18
380	14	381	13	382	12	386	10	387	10
391	8	393	8	396	7	400	5	405	3
414	4	415	4	423	5	426	5	432	5
436	5	441	6	446	6	450	6	455	6
456	6	462	6	466	7	467	7	476	7
479	7	487	9	497	10	499	12	503	14
504	15	517	25	541	26	562	26	591	26
599	27	613	28	635	28	637	29	665	35
668	35	691	36	707	42	716	42		

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
8	.05	350	.04	384	.026	397	.027	469	.037
498	.04	517	.04	716	.04				

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
350	517		100	100	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.10	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	672.44	4262.60	1281.29
E.G. Slope (ft/ft)	0.000126	Area (sq ft)	672.44	4262.60	1281.29
Q Total (cfs)	20000.00	Flow (cfs)	380.45	17608.15	2011.40
Top width (ft)	645.01	Top width (ft)	303.75	167.00	174.26
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	0.57	4.13	1.57
Max chl Dpth (ft)	33.10	Hydr. Depth (ft)	2.21	25.52	7.35
Conv. Total (cfs)	1782578.0	Conv. (cfs)	33909.4	1569395.0	179273.5
Length Wtd. (ft)	100.00	Wetted Per. (ft)	304.22	179.10	175.29
Min ch El (ft)	3.00	Shear (lb/sq ft)	0.02	0.19	0.06
Alpha	6.474	Stream Power (lb/ft s)	716.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4247.91	17412.31	3035.34
C & E Loss (ft)	0.00	Cum SA (acres)	1978.00	975.15	1640.45

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.0342*

INPUT Description: Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8	43	18	42	30	40	39	38	52	35
145	35	275	35	329	29	360	29	383	18
389	14	390	13	391	12	395	10	396	10
399	8	402	8	404	7	408	5	413	4
422	4	423	4	431	5	433	5	440	5
443	5	448	5	453	6	457	6	463	6
469	6	474	6	484	6	486	7	494	8
504	10	506	11	510	14	511	15	524	24
548	25	570	25	600	26	608	26	622	27
644	28	647	28	675	34	678	35	702	35
718	41	727	41						

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

8	.05	360	.04	393	.025	407	.027	477	.037
505	.04	524	.04	727	.04				
Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.	
	360	524		100 100	100		.1	.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.09	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	685.94	4213.07	1442.90
E.G. Slope (ft/ft)	0.000122	Area (sq ft)	685.94	4213.07	1442.90
Q Total (cfs)	20000.00	Flow (cfs)	379.34	17269.13	2351.52
Top width (ft)	657.62	Top width (ft)	312.72	164.00	180.90
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	0.55	4.10	1.63
Max chl Dpth (ft)	32.09	Hydr. Depth (ft)	2.19	25.69	7.98
Conv. Total (cfs)	1812598.0	Conv. (cfs)	34380.0	1565100.0	213118.4
Length Wtd. (ft)	100.00	Wetted Per. (ft)	313.17	175.54	181.99
Alpha	4.00	Shear (lb/sq ft)	0.02	0.18	0.06
Frctn Loss (ft)	1.49	Stream Power (lb/ft s)	727.00	0.00	0.00
C & E Loss (ft)	0.01	Cum Volume (acre-ft)	4246.35	17402.59	3032.21
	0.00	Cum SA (acres)	1977.29	974.77	1640.04

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.0190*

INPUT Description: Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9	43	18	42	31	40	41	38	54	35
149	35	283	36	338	29	370	29	392	17
398	14	399	13	400	12	403	10	404	10
408	9	410	8	412	7	416	5	420	4
429	4	431	4	438	5	441	5	447	5
451	5	456	5	461	6	465	6	470	6
471	6	476	6	481	6	482	6	491	6
493	6	501	8	511	9	513	11	517	14
518	14	531	24	556	25	578	25	608	26
616	26	631	27	654	28	656	28	685	34
687	34	712	35	729	41	738	41		

Manning's n Values									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9	.05	370	.04	403	.025	416	.027	485	.036
513	.04	531	.04	738	.04				

Bank Sta: Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
370	531		100	100	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.07	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	603.69	4170.56	1479.63
E.G. Slope (ft/ft)	0.000123	Area (sq ft)	603.69	4170.56	1479.63
Q Total (cfs)	20000.00	Flow (cfs)	302.80	17260.51	2436.69
Top width (ft)	665.68	Top width (ft)	320.64	161.00	184.04
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	0.50	4.14	1.65
Max chl Dpth (ft)	32.07	Hydr. Depth (ft)	1.88	25.90	8.04
Conv. Total (cfs)	1804636.0	Conv. (cfs)	27322.2	1557447.0	219866.7
Length Wtd. (ft)	100.00	Wetted Per. (ft)	321.21	173.09	184.95
Min ch El (ft)	4.00	Shear (lb/sq ft)	0.01	0.18	0.06
Alpha	1.48	Stream Power (lb/ft s)	738.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	4244.87	17392.96	3028.86
C & E Loss (ft)	0.00	Cum SA (acres)	1976.56	974.40	1639.62

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

CROSS SECTION

RIVER: RIVER-1
 REACH: Reach-1 RS: 54.0038*

INPUT Description: Station Elevation Data									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9	43	19	42	32	40	42	38	56	35
154	35	291	36	348	29	380	29	401	17
406	14	408	13	409	13	412	11	413	10
416	9	418	8	420	7	424	6	428	4
437	5	438	5	446	5	448	5	455	5
458	5	463	5	468	5	472	5	477	5
478	5	484	6	488	6	489	6	498	5

500	6	508	7	518	9	520	10	524	13
525	14	538	24	563	24	586	25	617	26
625	26	640	27	663	27	666	28	695	34
697	34	722	35	739	41	749	41		

Manning's n values num= 8									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9	.05	380	.04	413	.025	425	.027	493	.036
520	.04	538	.04	749	.04				

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
380		538		25	25	25	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.29	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.033	0.040
W.S. Elev (ft)	36.06	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)	611.91	4117.41	1544.05
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	611.91	4117.41	1544.05
Q Total (cfs)	20000.00	Flow (cfs)	305.50	17098.85	2595.65
Top width (ft)	673.95	Top width (ft)	328.94	158.00	187.00
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	0.50	4.15	1.68
Max chl Dpth (ft)	32.06	Hydr. Depth (ft)	1.86	26.06	8.26
Conv. Total (cfs)	1798742.0	Conv. (cfs)	27475.5	1537821.0	233445.4
Length wtd. (ft)	25.00	Wetted Per. (ft)	329.49	170.24	188.05
Min ch El (ft)	4.00	Shear (lb/sq ft)	0.01	0.19	0.06
Alpha	1.49	Stream Power (lb/ft s)	749.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4243.47	17383.45	3025.38
C & E Loss (ft)	0.00	Cum SA (acres)	1975.82	974.03	1639.19

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 54

INPUT Description: XS 54 NAVD 88 num= 28									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9	42.9	19	42.34	56	34.74	293	36.04	350	28.64
383	29.04	409.9	13.07	415	10.04	420	8.04	430	3.94
440	4.64	450	5.04	460	5.04	470	5.44	480	5.44
490	5.44	500	5.04	510	6.94	520	8.54	522	10.04
526	13.06	540	23.64	627	25.84	668	27.44	697	33.74
725	34.54	742	41.24	752	41.24				

Manning's n values num= 5									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9	.05	383	.04	415	.025	522	.04	540	.04

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
383		540		8660	8100	8000	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	36.29	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.24	Wt. n-Val.	0.050	0.031	0.040
W.S. Elev (ft)	36.05	Reach Len. (ft)	8660.00	8100.00	8000.00
Crit W.S. (ft)		Flow Area (sq ft)	610.58	4115.43	1584.82
E.G. Slope (ft/ft)	0.000106	Area (sq ft)	610.58	4115.43	1584.82
Q Total (cfs)	20000.00	Flow (cfs)	279.29	17226.67	2494.03
Top width (ft)	679.22	Top width (ft)	333.39	157.00	188.84
Vel Total (ft/s)	3.17	Avg. Vel. (ft/s)	0.46	4.19	1.57
Max chl Dpth (ft)	32.11	Hydr. Depth (ft)	1.83	26.21	8.39
Conv. Total (cfs)	1942643.0	Conv. (cfs)	27128.5	1673264.0	242250.8
Length wtd. (ft)	8143.09	Wetted Per. (ft)	334.00	168.82	189.87
Min ch El (ft)	3.94	Shear (lb/sq ft)	0.01	0.16	0.06
Alpha	1.53	Stream Power (lb/ft s)	752.00	0.00	0.00
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)	4243.12	17381.09	3024.49
C & E Loss (ft)	0.04	Cum SA (acres)	1975.63	973.94	1639.09

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 52.4

INPUT Description: XS 52.4 NAVD 88 num= 28									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2106	41.74	2128	30.64	2462	30.64	3140	30.64	3172	30.64
3186	30.64	3206	30.64	3215	30.64	3228	30.64	3245	27.94
3259	29.04	3286	9.74	3290	6.24	3300	1.94	3310	-.46
3320	-.76	3330	1.44	3340	4.04	3350	5.24	3360	8.24
3371	9.74	3384	11.34	3401	17.14	3450	22.04	3484	26.74
3627	30.74	3648	39.14	3654	39.14				

Manning's n values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2106	.2	2462	.05	3186	.04	3286	.025	3371	.04
3627	.04								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
3259		3484		2530	4700	4960	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	35.45	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.12	Wt. n-Val.	0.062	0.035	0.040
W.S. Elev (ft)	35.33	Reach Len. (ft)	2530.00	4700.00	4960.00
Crit W.S. (ft)		Flow Area (sq ft)	5380.74	4940.10	968.91
E.G. Slope (ft/ft)	0.000092	Area (sq ft)	5380.74	4940.10	968.91
Q Total (cfs)	20000.00	Flow (cfs)	3457.67	15347.48	1194.86
Top width (ft)	1519.78	Top width (ft)	1140.30	225.00	154.48
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	0.64	3.11	1.23
Max chl Dpth (ft)	36.09	Hydr. Depth (ft)	4.72	21.96	6.27
Conv. Total (cfs)	2086940.0	Conv. (cfs)	360797.1	1601463.0	124679.8
Length wtd. (ft)	4380.14	Wetted Per. (ft)	1141.67	236.49	155.42
Min ch El (ft)	-0.76	Shear (lb/sq ft)	0.03	0.12	0.04
Alpha	2.41	Stream Power (lb/ft s)	3654.00	0.00	0.00
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	3647.56	16539.15	2789.98
C & E Loss (ft)	0.00	Cum SA (acres)	1829.14	938.42	1607.56

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 51.6

INPUT Description: XS 51.6 NAVD 88 num= 37									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3881	41.74	3882	41.74	3883	41.74	3884	41.74	3902	32.64
4576	32.64	4594	32.04	4608	32.04	6033	32.64	6074	32.64
6084	32.64	6090	31.94	6106	31.64	6136	24.84	6162	24.24
6181	25.24	6209	20.14	6221	13.84	6230	10.04	6235	7.64
6245	4.84	6255	5.04	6265	6.64	6275	7.64	6285	8.64
6295	7.04	6305	5.64	6315	4.74	6325	4.64	6335	6.64
6342	10.04	6354	21.64	6373	27.64	6384	33.64	6462	31.64
6478	37.64	6487	37.64						

Manning's n values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3881	.2	4608	.05	6084	.04	6230	.025	6342	.04
6462	.04								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
6106		6384		1330	1490	540	.1		.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
3881	3884	41.74

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	34.96	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.16	Wt. n-Val.	0.063	0.035	0.040
W.S. Elev (ft)	34.80	Reach Len. (ft)	1330.00	1490.00	540.00
Crit W.S. (ft)		Flow Area (sq ft)	5226.65	5055.13	181.97
E.G. Slope (ft/ft)	0.000140	Area (sq ft)	5226.65	5055.13	181.97
Q Total (cfs)	20000.00	Flow (cfs)	2597.38	17271.11	131.51
Top width (ft)	2572.71	Top width (ft)	2208.28	278.00	86.43
Vel Total (ft/s)	1.91	Avg. Vel. (ft/s)	0.50	3.42	0.72
Max chl Dpth (ft)	30.16	Hydr. Depth (ft)	2.37	18.18	2.11
Conv. Total (cfs)	1690378.0	Conv. (cfs)	219527.4	1459735.0	11115.1
Length wtd. (ft)	1293.52	Wetted Per. (ft)	2208.85	291.13	87.03
Min ch El (ft)	4.64	Shear (lb/sq ft)	0.02	0.15	0.02
Alpha	2.77	Stream Power (lb/ft s)	6487.00	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	3339.52	15999.92	2724.46
C & E Loss (ft)	0.04	Cum SA (acres)	1731.90	911.29	1593.84

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 51.42

INPUT Description: XS 51.42 NAVD 88 num= 62									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3298.74	41.73	3303.66	41.73	3358	29.69	3362.92	29.69	3417.25	29.95

3430.37	29.95	3551.76	29.73	3561.6	29.73	3686.27	29.79	3696.12	29.79
3820.79	30.85	3830.63	30.85	4020.92	31.12	4030.76	31.12	4221.05	31.49
4230.89	31.49	4421.18	32.45	4431.02	32.45	4532.73	32.78	4559.8	24.57
4582.76	24.57	4595.89	25.56	4615.57	25.56	4621.31	26.85	4626.23	26.85
4676.27	20.64	4692.67	12.76	4721.38	4.88	4726.3	4.89	4821.44	5.23
4826.36	5.23	4845.23	5.55	4889.52	27.2	4896.08	27.86	4921.5	29.79
4926.43	29.79	5021.57	29.84	5031.42	29.84	5221.7	29.82	5231.55	29.82
5421.83	29.76	5431.68	29.82	5621.96	29.68	5631.81	29.82	5822.1	29.65
5831.94	29.82	6022.23	29.9	6032.07	29.82	6222.36	29.82	6232.2	29.82
6422.49	29.87	6432.33	29.82	6622.62	29.6	6632.46	29.82	6822.75	29.66
6832.59	29.82	7022.88	29.71	7032.72	29.82	7223.01	29.82	7232.85	29.82
7238.59	29.82	7300.93	41.73						

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3298.74	.2	3696.12	.05	4532.73	.04	4721.38	.025	4845.23	.04
4921.5	.04								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
4532.73	4921.5	110	110	110		.2	.5
Blocked Obstructions num= 2							
Sta L	Sta R	Elev	Sta L	Sta R	Elev		
3298.74	4532.73	32.78	4532.73	4626.23	26.85		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	34.81	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.03	Wt. n-Val.	0.064	0.036	0.040
W.S. Elev (ft)	34.78	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	13.78	Flow Area (sq ft)	2382.97	6965.10	11622.04
E.G. Slope (ft/ft)	0.000037	Area (sq ft)	2382.97	6965.10	11622.04
Q Total (cfs)	20000.00	Flow (cfs)	528.05	11857.14	7614.82
Top width (ft)	3929.50	Top width (ft)	1197.69	388.77	2343.04
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.22	1.70	0.66
Max Chl Dpth (ft)	29.90	Hydr. Depth (ft)	1.99	17.92	4.96
Conv. Total (cfs)	3297601.0	Conv. (cfs)	87064.2	1955005.0	1255531.0
Length wtd. (ft)	15.00	wetted Per. (ft)	1197.91	398.01	2343.51
Min Ch El (ft)	4.88	Shear (lb/sq ft)	0.00	0.04	0.01
Alpha	2.07	Stream Power (lb/ft s)	7300.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	3223.35	15794.34	2651.30
C & E Loss (ft)	0.00	Cum SA (acres)	1679.90	899.88	1578.79

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

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 51.405

INPUT

Description: Los Tomates
Distance from Upstream XS = 15
Deck/Roadway Width = 70
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates num= 50									
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
3298.74	61.94	41.73	3303.66	61.94	41.73	3303.66	61.94	42.59	
3358	62.5	43.14	3362.92	62.5	43.14	3417.25	62.76	43.41	
3430.37	62.76	43.41	3551.76	63.19	43.83	3561.6	63.19	43.83	
3686.27	63.58	44.23	3696.12	63.58	44.23	3820.79	63.99	44.63	
3830.63	63.99	43.32	4020.92	64.59	43.92	4030.76	64.59	43.92	
4221.05	65.19	44.52	4230.89	65.19	44.52	4421.18	66.24	45.57	
4431.02	66.24	45.57	4621.31	68.19	47.52	4626.23	68.19	47.53	
4721.38	69.19	48.52	4726.3	69.19	48.52	4821.44	70.19	49.52	
4826.36	70.19	49.52	5021.57	71.83	51.16	5031.42	71.83	51.16	
5221.7	72.47	51.8	5231.55	72.47	51.8	5421.83	72.09	51.42	
5431.68	72.09	51.42	5621.96	70.69	50.02	5631.81	70.69	50.02	
5822.1	68.69	48.02	5831.94	68.69	48.02	6022.23	66.97	46.3	
6032.07	66.97	46.3	6222.36	66.23	45.57	6232.2	66.23	45.57	
6422.49	65.63	44.96	6432.33	65.63	45.27	6622.62	65.03	44.36	
6632.46	65.03	44.36	6822.75	64.43	43.76	6832.59	64.43	43.76	
7022.88	63.83	43.16	7032.72	63.83	43.16	7223.01	63.15	42.48	
7232.85	63.15	42.48	7300.93	63.09	41.73				

Upstream Bridge Cross Section Data Station Elevation Data num= 62									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3298.74	41.73	3303.66	41.73	3358	29.69	3362.92	29.69	3417.25	29.95
3430.37	29.95	3551.76	29.73	3561.6	29.73	3686.27	29.79	3696.12	29.79
3820.79	30.85	3830.63	30.85	4020.92	31.12	4030.76	31.12	4221.05	31.49
4230.89	31.49	4421.18	32.45	4431.02	32.45	4532.73	32.78	4559.8	24.57
4582.76	24.57	4595.89	25.56	4615.57	25.56	4621.31	26.85	4626.23	26.85
4676.27	20.64	4692.67	12.76	4721.38	4.88	4726.3	4.89	4821.44	5.23
4826.36	5.23	4845.23	5.55	4889.52	27.2	4896.08	27.86	4921.5	29.79
4926.43	29.79	5021.57	29.84	5031.42	29.84	5221.7	29.82	5231.55	29.82
5421.83	29.76	5431.68	29.82	5621.96	29.68	5631.81	29.82	5822.1	29.65
5831.94	29.82	6022.23	29.9	6032.07	29.82	6222.36	29.82	6232.2	29.82
6422.49	29.87	6432.33	29.82	6622.62	29.6	6632.46	29.82	6822.75	29.66
6832.59	29.82	7022.88	29.71	7032.72	29.82	7223.01	29.82	7232.85	29.82
7238.59	29.82	7300.93	41.73						

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3298.74	.2	3696.12	.05	4532.73	.04	4721.38	.025	4845.23	.04
4921.5	.04								

Bank Sta: Left	Right	Coeff	Contr.	Expan.	
4532.73	4921.5		.2	.5	
Blocked Obstructions		num=	2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev
3298.74	4532.73	32.78	4532.73	4626.23	26.85

Downstream Deck/Roadway Coordinates num= 50									
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
3298.74	61.94	41.73	3303.66	61.94	41.73	3303.66	61.94	42.59	
3358	62.5	43.14	3362.92	62.5	43.14	3417.25	62.76	43.41	
3430.37	62.76	43.41	3551.76	63.19	43.83	3561.6	63.19	43.83	
3686.27	63.58	44.23	3696.12	63.58	44.23	3820.79	63.99	44.63	
3830.63	63.99	43.32	4020.92	64.59	43.92	4030.76	64.59	43.92	
4221.05	65.19	44.52	4230.89	65.19	44.52	4421.18	66.24	45.57	
4431.02	66.24	45.57	4621.31	68.19	47.52	4626.23	68.19	47.53	
4721.38	69.19	48.52	4726.3	69.19	48.52	4821.44	70.19	49.52	
4826.36	70.19	49.52	5021.57	71.83	51.16	5031.42	71.83	51.16	
5221.7	72.47	51.8	5231.55	72.47	51.8	5421.83	72.09	51.42	
5431.68	72.09	51.42	5621.96	70.69	50.02	5631.81	70.69	50.02	
5822.1	68.69	48.02	5831.94	68.69	48.02	6022.23	66.97	46.3	
6032.07	66.97	46.3	6222.36	66.23	45.57	6232.2	66.23	45.57	
6422.49	65.63	44.96	6432.33	65.63	45.27	6622.62	65.03	44.36	
6632.46	65.03	44.36	6822.75	64.43	43.76	6832.59	64.43	43.76	
7022.88	63.83	43.16	7032.72	63.83	43.16	7223.01	63.15	42.48	
7232.85	63.15	42.48	7300.93	63.09	41.73				

Downstream Bridge Cross Section Data Station Elevation Data num= 62									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3298.74	41.73	3303.66	41.73	3358	29.69	3362.92	29.69	3417.25	29.95
3430.37	29.95	3551.76	29.73	3561.6	29.73	3686.27	29.79	3696.12	29.79
3820.79	30.85	3830.63	30.85	4020.92	31.12	4030.76	31.12	4221.05	31.49
4230.89	31.49	4421.18	32.45	4431.02	32.45	4532.73	32.78	4559.8	24.57
4582.76	24.57	4595.89	25.56	4615.57	25.56	4621.31	26.85	4626.23	26.85
4676.27	20.64	4692.67	12.76	4721.38	4.88	4726.3	4.89	4821.44	5.23
4826.36	5.23	4845.23	5.55	4889.52	27.2	4896.08	27.86	4921.5	29.79
4926.43	29.79	5021.57	29.84	5031.42	29.84	5221.7	29.82	5231.55	29.82
5421.83	29.76	5431.68	29.82	5621.96	29.68	5631.81	29.82	5822.1	29.65
5831.94	29.82	6022.23	29.9	6032.07	29.82	6222.36	29.82	6232.2	29.82
6422.49	29.87	6432.33	29.82	6622.62	29.6	6632.46	29.82	6822.75	29.66
6832.59	29.82	7022.88	29.71	7032.72	29.82	7223.01	29.82	7232.85	29.82
7238.59	29.82	7300.93	41.73						

Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3298.74	.2	3696.12	.05	4532.73	.04	4721.38	.025	4845.23	.04
4921.5	.04								

Bank Sta: Left	Right	Coeff	Contr.	Expan.	
4532.73	4921.5	.2	.5		
Blocked Obstructions		num=	2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev
3298.74	4532.73	32.42	4532.73	4626.23	26.49

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 23

Pier Data Pier Station Upstream= 3360.46 Downstream= 3360.46

Upstream	num= 2	width	Elev	width	Elev
4.92	0	4.92	43.2		
Downstream	num= 2	width	Elev	width	Elev
4.92	0	4.92	43.2		

Pier Data Pier Station Upstream= 3423.81 Downstream= 3423.81

Pier Station	Upstream= 3423.81		Downstream= 3423.81	
Upstream	num= 2			
width	Elev	width	Elev	
9.84	0	9.84	43.47	
Downstream	num= 2			
width	Elev	width	Elev	
9.84	0	9.84	43.47	

Pier Data
Pier Station Upstream= 3691.2 Downstream= 3691.2
Upstream num= 2
width Elev
9.84 0 9.84 44.29
Downstream num= 2
width Elev
9.84 0 9.84 44.29

Pier Data
Pier Station Upstream= 3825.71 Downstream= 3825.71
Upstream num= 2
width Elev width Elev
9.84 0 9.84 44.69
Downstream num= 2
width Elev width Elev
9.84 0 9.84 44.69

Pier Data
Pier Station Upstream= 4025.84 Downstream= 4025.84
Upstream num= 2
width Elev width Elev
9.84 0 9.84 43.98
Downstream num= 2
width Elev width Elev
9.84 0 9.84 43.98

Pier Data
Pier Station Upstream= 4225.97 Downstream= 4225.97
Upstream num= 2
width Elev width Elev
9.84 0 9.84 44.58
Downstream num= 2
width Elev width Elev
9.84 0 9.84 44.58

Pier Data
Pier Station Upstream= 4426.1 Downstream= 4426.1
Upstream num= 2
width Elev width Elev
9.84 0 9.84 45.63
Downstream num= 2
width Elev width Elev
9.84 0 9.84 45.63

Pier Data
Pier Station Upstream= 4623.77 Downstream= 4623.77
Upstream num= 2
width Elev width Elev
4.92 0 4.92 47.59
Downstream num= 2
width Elev width Elev
4.92 0 4.92 47.59

Pier Data
Pier Station Upstream= 4723.84 Downstream= 4723.84
Upstream num= 2
width Elev width Elev
4.92 0 4.92 48.58
Downstream num= 2
width Elev width Elev
4.92 0 4.92 48.58

Pier Data
Pier Station Upstream= 4823.9 Downstream= 4823.9
Upstream num= 2
width Elev width Elev
4.92 0 4.92 49.58
Downstream num= 2
width Elev width Elev
4.92 0 4.92 49.58

Pier Data
Pier Station Upstream= 5026.5 Downstream= 5026.5
Upstream num= 2
width Elev width Elev
9.84 0 9.84 51.22
Downstream num= 2
width Elev width Elev
9.84 0 9.84 51.22

Pier Data
Pier Station Upstream= 5226.63 Downstream= 5226.63
Upstream num= 2
width Elev width Elev
9.84 0 9.84 51.86
Downstream num= 2
width Elev width Elev
9.84 0 9.84 51.86

Pier Data
Pier Station Upstream= 5426.76 Downstream= 5426.76
Upstream num= 2
width Elev width Elev

9.84 0 9.84 51.48
Downstream num= 2
width Elev
9.84 0 9.84 51.48

Pier Data
Pier Station Upstream= 5626.89 Downstream= 5626.89
Upstream num= 2
width Elev width Elev
9.84 0 9.84 50.08
Downstream num= 2
width Elev width Elev
9.84 0 9.84 50.08

Pier Data
Pier Station Upstream= 5827.02 Downstream= 5827.02
Upstream num= 2
width Elev width Elev
9.84 0 9.84 48.08
Downstream num= 2
width Elev width Elev
9.84 0 9.84 48.08

Pier Data
Pier Station Upstream= 6027.15 Downstream= 6027.15
Upstream num= 2
width Elev width Elev
9.84 0 9.84 46.36
Downstream num= 2
width Elev width Elev
9.84 0 9.84 46.36

Pier Data
Pier Station Upstream= 6227.28 Downstream= 6227.28
Upstream num= 2
width Elev width Elev
9.84 0 9.84 45.63
Downstream num= 2
width Elev width Elev
9.84 0 9.84 45.63

Pier Data
Pier Station Upstream= 6427.41 Downstream= 6427.41
Upstream num= 2
width Elev width Elev
9.84 0 9.84 45.33
Downstream num= 2
width Elev width Elev
9.84 0 9.84 45.33

Pier Data
Pier Station Upstream= 6627.54 Downstream= 6627.54
Upstream num= 2
width Elev width Elev
9.84 0 9.84 44.42
Downstream num= 2
width Elev width Elev
9.84 0 9.84 44.42

Pier Data
Pier Station Upstream= 6827.67 Downstream= 6827.67
Upstream num= 2
width Elev width Elev
9.84 0 9.84 43.82
Downstream num= 2
width Elev width Elev
9.84 0 9.84 43.82

Pier Data
Pier Station Upstream= 7027.8 Downstream= 7027.8
Upstream num= 2
width Elev width Elev
9.84 0 9.84 43.22
Downstream num= 2
width Elev width Elev
9.84 0 9.84 43.22

Pier Data
Pier Station Upstream= 7227.93 Downstream= 7227.93
Upstream num= 2
width Elev width Elev
9.84 0 9.84 42.54
Downstream num= 2
width Elev width Elev
9.84 0 9.84 42.54

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow
Submerged Inlet Cd =

Submerged Inlet + Outlet Cd = .8
Max Low Cord =
Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B Flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure Flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	34.81	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	34.78	E.G. Elev (ft)	34.80	34.80
Q Total (cfs)	20000.00	W.S. Elev (ft)	34.78	34.77
Q Bridge (cfs)	20000.00	Crit W.S. (ft)	14.18	14.18
Q Weir (cfs)		Max Chl Dpth (ft)	29.90	29.89
Weir Sta Lft (ft)		Vel Total (ft/s)	1.00	0.99
Weir Sta Rgt (ft)		Flow Area (sq ft)	19903.74	20296.72
Weir Submerg		Froude # Chl	0.07	0.07
Weir Max Depth (ft)		Specif Force (cu ft)	107654.00	108600.90
Min El weir Flow (ft)	61.95	Hydr Depth (ft)	5.35	5.45
Min El Prs (ft)	51.80	W.P. Total (ft)	4020.07	4025.72
Delta EG (ft)	0.01	Conv. Total (cfs)	2738809.0	2769695.0
Delta WS (ft)	0.01	Top width (ft)	3722.85	3722.81
BR Open Area (sq ft)	63312.27	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	1.00	C & E Loss (ft)	0.00	0.00
Coeff of Q		Shear Total (lb/sq ft)	0.02	0.02
Br Sel Method	Energy only	Power Total (lb/ft s)	3298.74	3298.74

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 51.40

Description: XS 51.40 NAVD 88											
Station Elevation Data num= 62											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3298.74	41.73	3303.66	41.73	3358	29.69	3362.92	29.69	3417.25	29.95		
3430.37	29.95	3551.76	29.73	3561.6	29.73	3686.27	29.79	3696.12	29.79		
3820.79	30.85	3830.63	30.85	4020.92	31.12	4030.76	31.12	4221.05	31.49		
4230.89	31.49	4421.18	32.45	4431.02	32.45	4532.73	32.78	4559.8	24.57		
4582.76	24.57	4595.89	25.56	4615.57	25.56	4621.31	26.85	4626.23	26.85		
4676.27	20.64	4692.67	12.76	4721.38	4.88	4726.3	4.89	4821.44	5.23		
4826.36	5.23	4845.23	5.55	4889.52	27.2	4896.08	27.86	4921.5	29.79		
4926.43	29.79	5021.57	29.84	5031.42	29.84	5221.7	29.82	5231.55	29.82		
5421.83	29.76	5431.68	29.82	5621.96	29.68	5631.81	29.82	5822.1	29.65		
5831.94	29.82	6022.23	29.9	6032.07	29.82	6222.36	29.82	6232.2	29.82		
6422.49	29.87	6432.33	29.82	6622.62	29.6	6632.46	29.82	6822.75	29.66		
6832.59	29.82	7022.88	29.71	7032.72	29.82	7223.01	29.82	7232.85	29.82		
7238.59	29.82	7300.93	41.73								

Manning's n Values num= 6											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3298.74	.2	3696.12	.05	4532.73	.04	4721.38	.025	4845.23	.04		
4921.5	.04										
Bank Sta: Left	4532.73	Right	4921.5	Lengths:	Left Channel	Right		Coeff Contr.	Expan.		
					3100	3500	2200	.2	.5		
Blocked Obstructions num= 2											
Sta L	Sta R	Elev	Sta L	Sta R	Elev						
3298.74	4532.73	32.42	4532.73	4626.23	26.49						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	34.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	wt. n-Val.	0.065	0.036	0.040
W.S. Elev (ft)	34.77	Reach Len. (ft)	3100.00	3500.00	2200.00
Crit W.S. (ft)		Flow Area (sq ft)	2782.51	6986.90	11606.65
E.G. Slope (ft/ft)	0.000036	Area (sq ft)	2782.51	6986.90	11606.65
Q Total (cfs)	20000.00	Flow (cfs)	675.21	11800.72	7524.07
Top width (ft)	3929.43	Top width (ft)	1197.66	388.77	2343.00
Vel Total (ft/s)	0.94	Avg. Vel. (ft/s)	0.24	1.69	0.65
Max chl Dpth (ft)	29.89	Hydr. depth (ft)	2.32	17.97	4.95
Conv. Total (cfs)	3330044.0	Conv. (cfs)	112423.4	1964846.0	1252774.0
Length wtd. (ft)	3095.59	Wetted Per. (ft)	1197.92	398.10	2343.48
Min Ch El (ft)	4.88	Shear (lb/sq ft)	0.01	0.04	0.01
Alpha	2.11	Stream Power (lb/ft s)	7300.93	0.00	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	3217.11	15777.40	2623.18
C & E Loss (ft)	0.01	Cum SA (acres)	1677.03	898.93	1573.11

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 50.8

Description: XS 50.8 NAVD 88											
Station Elevation Data num= 27											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3696	41.74	3700	38.74	3709	31.94	3744	11.24	3745	10.24		
3749	9.54	3755	8.64	3765	8.24	3775	7.94	3785	6.94		
3795	5.24	3805	4.24	3815	3.24	3825	2.94	3835	1.94		
3845	2.64	3855	4.64	3865	8.24	3870	5.54	3875	11.24		
3900	17.64	3907	17.64	3925	24.94	4058	27.44	4200	31.94		
8700	31.94	8713	41.74								

Manning's n Values num= 5											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
3696	.05	3709	.04	3749	.025	3870	.04	4200	.068		
Bank Sta: Left	3709	Right	4200	Lengths:	Left Channel	Right		Coeff Contr.	Expan.		
					2950	5800	3060	.1	.3		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	34.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	wt. n-Val.	0.050	0.037	0.068
W.S. Elev (ft)	34.57	Reach Len. (ft)	2950.00	5800.00	3060.00
Crit W.S. (ft)		Flow Area (sq ft)	4.59	6887.54	11857.11
E.G. Slope (ft/ft)	0.000091	Area (sq ft)	4.59	6887.54	11857.11
Q Total (cfs)	20000.00	Flow (cfs)	1.34	15287.51	4711.15
Top width (ft)	4997.98	Top width (ft)	3.49	491.00	4503.49
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	0.29	2.22	0.40
Max chl Dpth (ft)	32.63	Hydr. depth (ft)	1.32	14.03	2.63
Conv. Total (cfs)	2096997.0	Conv. (cfs)	141.0	1602893.0	493963.0
Length wtd. (ft)	5143.24	Wetted Per. (ft)	4.37	501.19	4504.38
Min Ch El (ft)	1.94	Shear (lb/sq ft)	0.01	0.08	0.01
Alpha	3.34	Stream Power (lb/ft s)	8713.00	0.00	0.00
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)	3117.94	15220.00	2030.66
C & E Loss (ft)	0.00	Cum SA (acres)	1634.29	863.59	1400.22

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 49.6

Description: XS 49.6 NAVD 88											
Station Elevation Data num= 31											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2241	38.44	2254	31.64	3440	31.64	3441	31.64	7021	31.64		
7054	31.64	7071	28.74	7096	25.14	7189	23.64	7218	18.64		
7232	18.14	7241	12.64	7249	10.04	7255	8.54	7265	6.04		
7275	4.64	7285	3.64	7295	2.04	7305	.64	7315	-.96		
7325	-1.96	7335	-1.96	7345	-.36	7355	1.64	7365	6.04		
7376	10.04	7381	14.14	7386	19.04	7402	31.64	7702	31.64		
7715	38.44										

Manning's n Values num= 6											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2241	.06	7021	.08	7054	.04	7249	.025	7376	.04		
7402	.116										
Bank Sta: Left	7054	Right	7402	Lengths:	Left Channel	Right		Coeff Contr.	Expan.		
					4960	7200	5960	.1	.3		

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	34.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	wt. n-Val.	0.060	0.035	0.116
W.S. Elev (ft)	34.16	Reach Len. (ft)	4960.00	7200.00	5960.00
Crit W.S. (ft)		Flow Area (sq ft)	12084.20	6431.72	760.94
E.G. Slope (ft/ft)	0.000068	Area (sq ft)	12084.20	6431.72	760.94
Q Total (cfs)	20000.00	Flow (cfs)	4545.30	15307.32	147.38
Top width (ft)	5457.62	Top width (ft)	4804.81	348.00	304.81
Vel Total (ft/s)	1.04	Avg. Vel. (ft/s)	0.38	2.38	0.19
Max chl Dpth (ft)	36.12	Hydr. depth (ft)	2.52	18.48	2.50
Conv. Total (cfs)	2430932.0	Conv. (cfs)	552465.8	1860553.0	17913.4
Length wtd. (ft)	6842.86	Wetted Per. (ft)	4805.43	361.74	305.43
Min Ch El (ft)	-1.96	Shear (lb/sq ft)	0.01	0.08	0.01
Alpha	4.06	Stream Power (lb/ft s)	7715.00	0.00	0.00
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	2708.59	14333.28	1587.46
C & E Loss (ft)	0.00	Cum SA (acres)	1471.47	807.73	1231.34

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 48.4

INPUT Description: XS 48.4 NAVD 88									
Station Elevation Data num= 31									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
529	37.24	542	31.24	1009	31.24	1042	31.24	1052	30.04
1062	23.64	1072	20.04	1087	20.04	1098	16.64	1115	15.94
1128	9.54	1135	7.74	1145	1.74	1155	.64	1165	2.04
1175	2.74	1185	3.74	1195	4.64	1205	5.04	1215	5.64
1225	6.14	1235	6.64	1245	6.74	1255	7.64	1258	9.54
1270	15.64	1300	25.64	1317	28.04	1395	31.24	4195	31.24
4208	37.24								
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
529	.059	1009	.08	1042	.04	1128	.025	1258	.04
1395	.079								
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
1042	1395			2215	1825	790	.1		.3

CROSS SECTION OUTPUT Profile #PF 1									
E.G. Elev (ft)	33.64	Element		Left OB	Channel	Right OB			
Vel Head (ft)	0.11	wt. n-Val.		0.060	0.035	0.079			
W.S. Elev (ft)	33.53	Reach Len. (ft)		2215.00	1825.00	790.00			
Crit W.S. (ft)		Flow Area (sq ft)		1149.45	5938.11	6410.82			
E.G. Slope (ft/ft)	0.000113	Area (sq ft)		1149.45	5938.11	6410.82			
Q Total (cfs)	20000.00	Flow (cfs)		521.94	17258.56	2219.50			
Top width (ft)	3662.91	Top width (ft)		504.96	353.00	2804.96			
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)		0.45	2.91	0.35			
Max chl Dpth (ft)	32.89	Hydr. depth (ft)		2.28	16.82	2.29			
Conv. Total (cfs)	1885078.0	Conv. (cfs)		49194.7	1626687.0	209196.6			
Length wtd. (ft)	1732.78	Wetted Per. (ft)		505.46	363.71	2805.46			
Min Ch EI (ft)	0.64	Shear (lb/sq ft)		0.02	0.11	0.02			
Alpha	3.33	Stream Power (lb/ft s)		4208.00	0.00	0.00			
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		1955.16	13310.98	1096.83			
C & E Loss (ft)	0.00	Cum SA (acres)		1169.17	749.80	1018.59			

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 47.9

INPUT Description: XS 47.9 NAVD 88									
Station Elevation Data num= 38									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2270	37.64	2285	31.14	2344	31.14	2377	31.14	2391	28.04
2419	24.94	2437	9.04	2447	6.04	2457	5.74	2467	5.74
2477	6.24	2487	5.94	2497	5.54	2507	5.44	2517	5.24
2527	5.24	2537	5.24	2547	5.54	2557	6.04	2567	6.24
2577	7.24	2587	9.04	2594	14.44	2609	22.14	2656	23.14
2682	30.04	2727	30.94	2736	31.14	2743	31.14	2763	31.14
2778	31.14	2805	31.14	3070	31.14	3269	31.14	4195	31.14
4223	31.14	4585	31.14	4598	37.64				
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2270	.074	2344	.08	2377	.04	2437	.025	2587	.04
2743	.072								
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
2377	2682			150	150	150	.1		.3

CROSS SECTION OUTPUT Profile #PF 1									
E.G. Elev (ft)	33.44	Element		Left OB	Channel	Right OB			
Vel Head (ft)	0.15	wt. n-Val.		0.076	0.033	0.070			
W.S. Elev (ft)	33.29	Reach Len. (ft)		150.00	150.00	150.00			
Crit W.S. (ft)		Flow Area (sq ft)		203.45	5675.70	4132.50			
E.G. Slope (ft/ft)	0.000112	Area (sq ft)		203.45	5675.70	4132.50			
Q Total (cfs)	20000.00	Flow (cfs)		68.81	18363.92	1567.27			
Top width (ft)	2309.28	Top width (ft)		96.97	305.00	1907.31			
Vel Total (ft/s)	2.00	Avg. Vel. (ft/s)		0.34	3.24	0.38			
Max chl Dpth (ft)	28.05	Hydr. depth (ft)		2.10	18.61	2.17			
Conv. Total (cfs)	1888715.0	Conv. (cfs)		6498.4	1734211.0	148005.9			
Length wtd. (ft)	150.00	Wetted Per. (ft)		97.42	316.84	1907.83			
Min Ch EI (ft)	5.24	Shear (lb/sq ft)		0.01	0.13	0.02			
Alpha	2.41	Stream Power (lb/ft s)		4598.00	0.00	0.00			
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		1920.77	13067.69	1001.22			
C & E Loss (ft)	0.00	Cum SA (acres)		1153.87	736.01	975.86			

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 47.8

INPUT Description: XS 47.8 NAVD 88									
Station Elevation Data num= 16									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2272	37.64	2285	31.14	2344	31.14	2377	31.14	2391	28.04
2419	24.94	2437	9.04	2587	9.04	2594	14.44	2609	22.14
2656	23.14	2682	30.04	2727	30.94	2736	31.14	4585	31.14
4598	37.64								
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
2272	.067	2344	.08	2377	.04	2437	.025	2587	.04
2736	.068								
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
2377	2736			750	750	750	.1		.3

CROSS SECTION OUTPUT Profile #PF 1									
E.G. Elev (ft)	33.42	Element		Left OB	Channel	Right OB			
Vel Head (ft)	0.16	wt. n-Val.		0.071	0.034	0.068			
W.S. Elev (ft)	33.26	Reach Len. (ft)		750.00	750.00	750.00			
Crit W.S. (ft)		Flow Area (sq ft)		195.25	5359.98	3924.00			
E.G. Slope (ft/ft)	0.000172	Area (sq ft)		195.25	5359.98	3924.00			
Q Total (cfs)	20000.00	Flow (cfs)		86.83	18059.35	1853.82			
Top width (ft)	2300.00	Top width (ft)		92.00	359.00	1849.00			
Vel Total (ft/s)	2.11	Avg. Vel. (ft/s)		0.44	3.37	0.47			
Max chl Dpth (ft)	24.22	Hydr. depth (ft)		2.12	14.93	2.12			
Conv. Total (cfs)	1526539.0	Conv. (cfs)		6627.3	1378415.0	141496.3			
Length wtd. (ft)	750.00	Wetted Per. (ft)		94.12	370.15	1851.12			
Min Ch EI (ft)	9.04	Shear (lb/sq ft)		0.02	0.16	0.02			
Alpha	2.31	Stream Power (lb/ft s)		4598.00	0.00	0.00			
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)		1920.08	13048.69	987.35			
C & E Loss (ft)	0.00	Cum SA (acres)		1153.54	734.87	969.39			

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 47.7

INPUT Description: XS 47.7 NAVD 88									
Station Elevation Data num= 30									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	37.64	13	31.14	34	31.14	44	31.14	49	31.14
78	24.44	100	22.94	113	19.74	189	16.24	197	9.94
200	9.94	206	7.2	216	2.74	226	1.74	236	1.24
246	.74	256	.24	266	-.26	276	.24	286	.74
296	2.24	306	7.2	332	24.14	345	31.14	376	31.14
383	31.14	388	31.14	397	31.14	2300	31.14	2313	37.64
Manning's n Values num= 6									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.067	13	.08	49	.04	216	.025	296	.04
345	.068								
Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.									
49	345			2110	4100	3270	.1		.3

CROSS SECTION OUTPUT Profile #PF 1									
E.G. Elev (ft)	33.31	Element		Left OB	Channel	Right OB			
Vel Head (ft)	0.15	wt. n-Val.		0.080	0.036	0.068			
W.S. Elev (ft)	33.16	Reach Len. (ft)		2110.00	4100.00	3270.00			
Crit W.S. (ft)		Flow Area (sq ft)		76.72	5721.68	3949.04			
E.G. Slope (ft/ft)	0.000127	Area (sq ft)		76.72	5721.68	3949.04			
Q Total (cfs)	20000.00	Flow (cfs)		25.25	18421.81	1552.93			
Top width (ft)	2295.07	Top width (ft)		40.04	296.00	1959.04			
Vel Total (ft/s)	2.05	Avg. Vel. (ft/s)		0.33	3.22	0.39			
Max chl Dpth (ft)	33.42	Hydr. depth (ft)		1.92	19.33	2.02			
Conv. Total (cfs)	1773172.0	Conv. (cfs)		2238.9	1633253.0	137680.9			
Length wtd. (ft)	4001.35	Wetted Per. (ft)		40.51	309.21	1959.51			
Min Ch EI (ft)	-0.26	Shear (lb/sq ft)		0.02	0.15	0.02			
Alpha	2.27	Stream Power (lb/ft s)		2313.00	0.00	0.00			
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)		1917.74	12953.29	919.57			
C & E Loss (ft)	0.02	Cum SA (acres)		1152.40	729.23	936.61			

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 47.4

INPUT									
Description: XS 47.4 NAVD 88									
Station Elevation Data num= 27									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1397	37.34	1410	30.94	3967	30.94	3990	30.94	4000	30.94
4010	30.94	4020	29.64	4060	24.64	4248.5	23.14	4260	21.64
4296.9	14.34	4332.2	4.64	4342.8	-.06	4359.2	-2.26	4375.6	-3.66
4394.5	-3.36	4408.4	-.06	4424.8	6.34	4436.1	14.64	4436.2	20.04
4436.3	20.94	4439.6	24.94	4534.7	26.54	4562.6	25.54	4570.8	30.94
4762	30.94	4775	37.34						

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1397	.067	3967	.08	4000	.04	4342.8	.025
4570.8	.102					4408.4	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	4010	4562.6		1690	3025		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	32.92	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.08	Wt. n-Val.	0.067	0.031	0.084
W.S. Elev (ft)	32.83	Reach Len. (ft)	1690.00	3025.00	1790.00
Crit W.S. (ft)		Flow Area (sq ft)	4921.48	7701.32	402.93
E.G. Slope (ft/ft)	0.000058	Area (sq ft)	4921.48	7701.32	402.93
Q Total (cfs)	20000.00	Flow (cfs)	1273.33	18638.95	87.72
Top width (ft)	3359.68	Top width (ft)	2603.84	552.60	203.24
Vel Total (ft/s)	1.54	Avg. Vel. (ft/s)	0.26	2.42	0.22
Max chl dpth (ft)	36.49	Hydr. Depth (ft)	1.89	13.94	1.98
Conv. Total (cfs)	2621841.0	Conv. (cfs)	166924.0	2443418.0	11499.5
Length wtd. (ft)	2920.24	Wetted Per. (ft)	2604.28	568.62	205.30
Min Ch El (ft)	-3.66	Shear (lb/sq ft)	0.01	0.05	0.01
Alpha	2.32	Stream Power (lb/ft s)	4775.00	0.00	0.00
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	1796.68	12321.58	756.23
C & E Loss (ft)	0.00	Cum SA (acres)	1088.37	689.30	855.45

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.8

INPUT									
Description: XS 46.8 NAVD 88									
Station Elevation Data num= 32									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
287	37.14	300	30.74	967	30.74	1000	30.74	1011	28.44
1020	24.04	1035	18.04	1050	5.94	1063	2.84	1066	-.16
1068	-1.76	1078	-3.16	1088	-2.46	1098	-2.46	1108	-1.66
1118	-1.66	1128	-1.66	1138	-.16	1148	2.84	1166	13.14
1193	16.74	1201	19.74	1274	23.74	1365	25.64	1420	30.74
1811	30.74	1868	30.74	2088	30.74	2444	30.74	2841	30.74
3620	30.74	3633	37.14						

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
287	.112	967	.08	1000	.04	1066	.025
1420	.063					1138	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1000	1420		3480	2800		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	32.68	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.11	Wt. n-Val.	0.110	0.038	0.063
W.S. Elev (ft)	32.58	Reach Len. (ft)	3480.00	2800.00	1580.00
Crit W.S. (ft)		Flow Area (sq ft)	1288.43	6614.95	4042.01
E.G. Slope (ft/ft)	0.000127	Area (sq ft)	1288.43	6614.95	4042.01
Q Total (cfs)	20000.00	Flow (cfs)	293.89	18094.96	1611.15
Top width (ft)	3327.46	Top width (ft)	703.73	420.00	2203.73
Vel Total (ft/s)	1.67	Avg. Vel. (ft/s)	0.23	2.74	0.40
Max chl dpth (ft)	35.74	Hydr. Depth (ft)	1.83	15.75	1.83
Conv. Total (cfs)	1773029.0	Conv. (cfs)	26054.0	1604144.0	142830.9
Length wtd. (ft)	2742.22	Wetted Per. (ft)	704.16	433.44	2204.16
Min Ch El (ft)	-3.16	Shear (lb/sq ft)	0.01	0.12	0.01
Alpha	2.42	Stream Power (lb/ft s)	3633.00	0.00	0.00
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	1676.22	11824.49	664.90
C & E Loss (ft)	0.01	Cum SA (acres)	1024.21	655.52	806.00

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 46.4

INPUT									
Description: XS 46.4 NAVD 88									
Station Elevation Data num= 31									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	36.84	12.4	30.64	30	30.64	722	30.64	740	30.64
745	30.64	755	30.64	760	29.74	910	20.24	930.4	15.14
950.7	7.84	965.8	3.94	977.9	-.96	996.7	-1.16	1009.6	-.76
1024.7	-.96	1036	-.04	1044.3	5.44	1046.5	8.14	1054.8	8.94
1070.7	17.14	1089.5	24.34	1099.3	29.44	1111.4	28.14	1133.3	28.54
1141.5	30.64	1469.6	30.64	1797.7	30.64	2125.8	30.64	2300	30.64
2312	36.84								

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.069	722	.08	755	.04	977.9	.025
1141.5	.067					1036	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	755	1141.5		3270	6300		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	32.24	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.16	Wt. n-Val.	0.069	0.038	0.067
W.S. Elev (ft)	32.08	Reach Len. (ft)	3270.00	6300.00	4540.00
Crit W.S. (ft)		Flow Area (sq ft)	1069.05	5666.67	1666.55
E.G. Slope (ft/ft)	0.000211	Area (sq ft)	1069.05	5666.67	1666.55
Q Total (cfs)	20000.00	Flow (cfs)	422.38	18894.95	682.68
Top width (ft)	2293.26	Top width (ft)	745.47	386.50	1161.28
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	0.40	3.33	0.41
Max chl dpth (ft)	33.24	Hydr. Depth (ft)	1.43	14.66	1.44
Conv. Total (cfs)	1377381.0	Conv. (cfs)	29088.8	1301277.0	47015.3
Length wtd. (ft)	6195.61	Wetted Per. (ft)	745.81	398.11	1161.63
Min Ch El (ft)	-1.16	Shear (lb/sq ft)	0.02	0.19	0.02
Alpha	1.86	Stream Power (lb/ft s)	2312.00	0.00	0.00
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	1582.05	11429.76	561.37
C & E Loss (ft)	0.02	Cum SA (acres)	966.32	629.60	744.97

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 45

INPUT									
Description: XS 45 NAVD 88									
Station Elevation Data num= 38									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	36.04	9	36.04	23	32.04	319	32.04	440	32.24
841	31.94	1852	32.24	2427	35.24	2442	28.24	4078	26.04
4110	26.44	4123	29.94	4145	30.94	4147	29.94	4158	27.84
4243	28.14	4350	30.94	4399	29.74	4415	23.94	4431	26.44
4457	26.44	4467	24.44	4570	24.44	4609	18.04	4683	16.34
4766	3.84	4780	-.16	4785	-2.36	4795	-5.46	4805	-8.16
4815	-10.16	4825	-9.16	4835	-7.16	4845	-3.46	4855	.34
4864	3.94	4890	35.64	4945	30.14				

Manning's n Values num= 6							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.059	4078	.08	4123	.04	4780	.025
4890	.068					4855	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	4457	4890		3110	5000		.1	.3

Blocked Obstructions		
Sta L	Sta R	Elev
0	4145	30.9

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	31.28	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.10	Wt. n-Val.	0.041	0.038	0.068
W.S. Elev (ft)	31.18	Reach Len. (ft)	3110.00	5000.00	3160.00
Crit W.S. (ft)		Flow Area (sq ft)	1222.23	7693.73	5.45
E.G. Slope (ft/ft)	0.000092	Area (sq ft)	1222.23	7693.73	5.45
Q Total (cfs)	20000.00	Flow (cfs)	558.73	19440.57	0.69
Top width (ft)	2463.62	Top width (ft)	2023.83	429.35	10.44
Vel Total (ft/s)	2.24	Avg. Vel. (ft/s)	0.46	2.53	0.13
Max chl dpth (ft)	41.34	Hydr. Depth (ft)	0.60	17.92	0.52
Conv. Total (cfs)	2080548.0	Conv. (cfs)	58123.5	2022353.0	72.3

Length Wtd. (ft)	4891.35	Wetted Per. (ft)	2025.57	448.26	11.54
Min Ch El (ft)	-10.16	Shear (lb/sq ft)	0.00	0.10	0.00
Alpha	1.24	Stream Power (lb/ft s)	4945.00	0.00	0.00
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	1496.05	10463.62	474.24
C & E Loss (ft)	0.01	Cum SA (acres)	862.38	570.61	683.91

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 44

INPUT
Description: XS 44 NAVD 88
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	35.84	6	35.64	33	29.94	79	29.04
475	25.74	4350	25.64	4371	27.34	4384	29.74
4804	28.47	4819	28.44	4837	28.54	4854	24.34
4972	22.24	5030	12.64	5041.7	7.18	5054	1.45
5068	-1.96	5078	-2.76	5088	-3.06	5098	-3.66
5118	-2.56	5128	-.56	5136	1.45	5144.8	7.18
5464	27.44	5501	34.04	5509	34.04	5179	29.44

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.078	4804	.08	4837	.04	5054	.025
5179	.069					5136	.04

Bank Sta: Left 4938 Right 5179 Lengths: Left Channel 6625 Right 8540 Right 8000 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	4384	29.74	5179	5509	29.44

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	30.71	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.20	Wt. n-Val.	0.060	0.035	0.069
W.S. Elev (ft)	30.51	Reach Len. (ft)	6625.00	8540.00	8000.00
Crit W.S. (ft)		Flow Area (sq ft)	4637.85	4888.30	319.41
E.G. Slope (ft/ft)	0.000154	Area (sq ft)	4637.85	4888.30	319.41
Q Total (cfs)	20000.00	Flow (cfs)	1653.86	18257.56	88.57
Top width (ft)	5450.89	Top width (ft)	4907.69	241.00	302.20
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)	0.36	3.73	0.28
Max chl Dpth (ft)	34.57	Hydr. Depth (ft)	0.95	20.28	1.06
Conv. Total (cfs)	1611322.0	Conv. (cfs)	133245.4	1470940.0	7135.9
Length Wtd. (ft)	8438.41	Wetted Per. (ft)	4908.27	254.34	302.29
Min ch El (ft)	-4.06	Shear (lb/sq ft)	0.01	0.18	0.01
Alpha	3.09	Stream Power (lb/ft s)	5509.00	0.00	0.00
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	1286.86	9741.51	462.45
C & E Loss (ft)	0.00	Cum SA (acres)	614.93	532.13	672.57

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 42.4

INPUT
Description: XS 42.4 NAVD 88
Station Elevation Data num= 42

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
14	33.34	22	33.04	49	26.14	91	24.34
2138	26.24	2232	27.24	2266	13.14	2576	21.24
4142	22.34	4156	17.54	6310	22.04	6400	25.34
6439	31.94	6444	31.94	6456	28.34	6467	26.94
6632	26.54	6680	17.94	6710	18.44	6743	18.44
6775.2	6.45	6784	1.92	6790	-.96	6800	-1.56
6820	-2.96	6830	-4.16	6840	-4.36	6850	-3.56
6870	-.96	6876	1.92	6880.8	6.39	6905	28.94
7528	32.04	7540	32.04				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
14	.162	6400	.08	6444	.04	6784	.02
6905	.068					6876	.04

Bank Sta: Left 6632 Right 6905 Lengths: Left Channel 7000 Right 11000 Right 5000 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
14	6444	31.94	6905	7540	28.94

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	29.29	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.23	Wt. n-Val.	0.040	0.034	0.068
W.S. Elev (ft)	29.06	Reach Len. (ft)	7000.00	11000.00	5000.00
Crit W.S. (ft)		Flow Area (sq ft)	464.46	4988.45	71.26
E.G. Slope (ft/ft)	0.000183	Area (sq ft)	464.46	4988.45	71.26
Q Total (cfs)	20000.00	Flow (cfs)	441.66	19553.33	5.01
Top width (ft)	1066.16	Top width (ft)	178.39	273.00	614.77
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	0.95	3.92	0.07
Max chl Dpth (ft)	33.42	Hydr. Depth (ft)	2.60	1.27	0.12
Conv. Total (cfs)	1477585.0	Conv. (cfs)	32629.8	1444585.0	370.2
Length Wtd. (ft)	10650.02	Wetted Per. (ft)	178.59	289.76	614.79
Min ch El (ft)	-4.36	Shear (lb/sq ft)	0.03	0.20	0.00
Alpha	1.15	Stream Power (lb/ft s)	7540.00	0.00	0.00
Frctn Loss (ft)	1.97	Cum Volume (acre-ft)	898.86	8773.33	426.58
C & E Loss (ft)	0.04	Cum SA (acres)	228.17	481.75	588.37

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 40.3

INPUT
Description: XS 40.3 "A" NAVD 88
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	31.64	10	31.14	32	27.24	71.6	24.54
97.3	22.64	107	20.54	142	21.24	1038	22.24
1056	24.14	1066	22.54	1086	12.84	1105	2.94
1112	-1.16	1122	-3.46	1132	-6.26	1142	-5.76
1162	-3.76	1172	-3.46	1182	-2.76	1192	-1.76
1216	9.54	1279	11.94	1334	20.34	1447	22.64
2770	25.24	4200	23.24	5708	23.34	7357	26.34
7448	24.54	7510	26.94	7666	25.14	8390	27.54
8885	27.64	9529	26.64	9574	26.94	9606	26.44
11012	26.34	11028	30.74	11038	29.94		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	1038	.08	1066	.04	1109	.02
1334	.067					1202	.04

Bank Sta: Left 1066 Right 1447 Lengths: Left Channel 5000 Right 7500 Right 1000 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev
71.6	1056	24.14	1924	8390	26.84
			8390	11028	27.54

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	27.28	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.11	Wt. n-Val.	0.060	0.045	0.067
W.S. Elev (ft)	27.18	Reach Len. (ft)	5000.00	7500.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	3077.44	6091.10	3279.77
E.G. Slope (ft/ft)	0.000186	Area (sq ft)	3077.44	6091.10	3279.77
Q Total (cfs)	20000.00	Flow (cfs)	2137.27	17253.83	608.90
Top width (ft)	8247.24	Top width (ft)	1033.06	381.00	6833.18
Vel Total (ft/s)	1.61	Avg. Vel. (ft/s)	0.69	2.83	0.19
Max chl Dpth (ft)	33.44	Hydr. Depth (ft)	2.98	15.99	0.48
Conv. Total (cfs)	1464627.0	Conv. (cfs)	156515.0	1263521.0	44590.5
Length Wtd. (ft)	7078.01	Wetted Per. (ft)	1033.31	391.10	6833.20
Min ch El (ft)	-6.26	Shear (lb/sq ft)	0.03	0.18	0.01
Alpha	2.70	Stream Power (lb/ft s)	11038.00	0.00	0.00
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	614.27	7374.40	234.26
C & E Loss (ft)	0.00	Cum SA (acres)	130.83	399.17	160.91

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 38.9

INPUT
Description: XS 38.9 NAVD 88
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86	32.14	91	32.14	123	24.94	130	21.04
3292	25.64	3311	27.62	3316	28.14	3344	28.64
3422	24.04	3452	21.04	3691	16.44	3704	20.14
3787	13.84	3897	5.64	3904	-1.36	3916	-1.36
3930	-3.66	3940	-4.36	3950	-5.36	3960	-7.36

3980 -6.06 3990 -1.56 3995 -.36 3998 1.49 4003.4 4.82
4007 7.04 4030 13.44 4041 26.64 4059 26.64 4577 25.04
5507 24.84 5898 19.44 6677 16.94 6794 25.14 7248 22.74
7277 22.74 7309 30.14 7314 30.14

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
86 .066 3311 .08 3344 .04 3904 .02 3995 .04
4041 .066

Bank Sta: Left 3766 Right 4041 Lengths: Left Channel 5875 Right 14625 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
86 3344 28.64 4041 7314 26.64

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	26.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	wt. n-Val.	0.040	0.034	
W.S. Elev (ft)	26.15	Reach Len. (ft)	5875.00	14625.00	5000.00
Crit W.S. (ft)		Flow Area (sq ft)	2464.33	5530.69	
E.G. Slope (ft/ft)	0.00097	Area (sq ft)	2464.33	5530.69	
Q Total (cfs)	20000.00	Flow (cfs)	3031.52	16968.48	
Top width (ft)	674.45	Top width (ft)	399.86	274.59	
Vel Total (ft/s)	2.50	Avg. Vel. (ft/s)	1.23	3.07	
Max chl dpth (ft)	34.31	Hydr. Depth (ft)	6.16	20.14	
Conv. Total (cfs)	2027485.0	Conv. (cfs)	307317.9	1720167.0	
Length wtd. (ft)	13679.04	Wetted Per. (ft)	400.65	288.32	
Min ch El (ft)	-8.16	Shear (lb/sq ft)	0.04	0.12	
Alpha	1.31	Stream Power (lb/ft s)	7314.00	0.00	0.00
Frctn Loss (ft)	1.43	Cum Volume (acre-ft)	296.21	6373.90	196.61
C & E Loss (ft)	0.01	Cum SA (acres)	48.59	342.74	82.48

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 36.3

INPUT
Description: XS 36.3 NAVD 88
Station Elevation Data num= 51
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 10.84 10 30.34 30 25.74 90 23.34 176 22.94
200 19.14 236 17.14 282 9.66 433 9.66 675 14.64
690 20.74 2151 21.14 2218 17.14 2700 16.94 2747 21.34
4450 23.54 6420 23.54 6489 24.04 6517 23.54 6533 25.44
6557 18.34 6604 17.54 6685 18.94 6719 10.24 6729 9.24
6737.3 3.79 6742 .7 6754 -1.66 6764 -4.06 6774 -4.26
6784 -4.86 6794 -5.66 6804 -5.66 6814 -6.06 6824 -6.16
6834 -7.16 6844 -6.36 6854 -3.46 6857 .7 6869.9 3.8
6873 4.54 6907 22.84 7025 24.84 7044 22.04 7083 22.54
7139 26.04 7213 26.04 7449 25.04 7489 25.04 7639 25.04
7666 30.04

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .104 6489 .08 6533 .04 6742 .02 6857 .04
7213 .075

Bank Sta: Left 6685 Right 6907 Lengths: Left Channel 6750 Right 12440 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 6533 25.44 7213 7666 26.04

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	24.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	wt. n-Val.	0.040	0.031	0.040
W.S. Elev (ft)	24.62	Reach Len. (ft)	6750.00	12440.00	11000.00
Crit W.S. (ft)		Flow Area (sq ft)	897.28	4837.87	241.38
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	897.28	4837.87	241.38
Q Total (cfs)	20000.00	Flow (cfs)	1165.90	18718.68	115.42
Top width (ft)	569.87	Top width (ft)	149.23	222.00	194.74
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)	1.30	3.87	0.48
Max chl dpth (ft)	31.78	Hydr. Depth (ft)	6.01	21.79	1.24
Conv. Total (cfs)	1882891.0	Conv. (cfs)	109763.0	1762262.0	10866.2
Length wtd. (ft)	12270.00	Wetted Per. (ft)	150.15	233.96	195.01
Min ch El (ft)	-7.16	Shear (lb/sq ft)	0.04	0.15	0.01
Alpha	1.26	Stream Power (lb/ft s)	7665.00	0.00	0.00
Frctn Loss (ft)	1.80	Cum Volume (acre-ft)	69.52	4633.31	182.76
C & E Loss (ft)	0.01	Cum SA (acres)	11.56	259.37	71.30

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 34

INPUT
Description: XS 34 NAVD 88
Station Elevation Data num= 61
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 29.24 10 29.14 41 22.34 62 22.34 230 23.34
235 24.34 262 17.64 283 23.64 291 22.84 1317 24.64
1368 25.14 1386 24.14 1400 20.64 1425 19.34 2156 24.04
4727 22.14 5079 21.54 5358 20.14 6256 20.44 6752 19.54
4300 20.34 4306 23.94 4314 23.94 4325 21.24 4374 20.44
4402.1 3.04 4408 -.61 4410 -4.86 4420 -4.86 4430 -7.66
4440 -8.16 4450 -7.26 4460 -6.76 4470 -6.46 4480 -6.46
4490 -5.66 4500 -4.96 4510 -4.36 4520 -.61 4526.4 3.04
4539 10.24 4600 10.44 4618 13.94 4686 17.44 4705 22.94
4727 22.14 5079 21.54 5358 20.14 6256 20.44 6752 19.54
6940 19.14 7428 17.34 7598 11.74 7606 12.84 7816 8.14
8376 8.14 8878 8.44 9022 17.34 9232 17.44 9284 28.64
9294 28.14

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .094 4258 .08 4306 .04 4408 .02 4520 .04
4705 .087

Bank Sta: Left 4306 Right 4705 Lengths: Left Channel 5125 Right 14060 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
0 4306 23.94 4705 9294 22.94

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	23.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	wt. n-Val.	0.035	0.035	
W.S. Elev (ft)	22.83	Reach Len. (ft)	5125.00	14060.00	10375.00
Crit W.S. (ft)		Flow Area (sq ft)	5590.97	5590.97	
E.G. Slope (ft/ft)	0.000209	Area (sq ft)	5590.97	5590.97	
Q Total (cfs)	20000.00	Flow (cfs)	20000.00	20000.00	
Top width (ft)	386.14	Top width (ft)	386.14	386.14	
Vel Total (ft/s)	3.58	Avg. Vel. (ft/s)	3.58	3.58	
Max chl dpth (ft)	30.99	Hydr. Depth (ft)	14.48	14.48	
Conv. Total (cfs)	1383006.0	Conv. (cfs)	1383006.0	1383006.0	
Length wtd. (ft)	13982.90	Wetted Per. (ft)	400.30	400.30	
Min ch El (ft)	-8.16	Shear (lb/sq ft)	0.18	0.18	
Alpha	1.00	Stream Power (lb/ft s)	9294.00	0.00	0.00
Frctn Loss (ft)	2.47	Cum Volume (acre-ft)	3144.16	152.28	152.28
C & E Loss (ft)	0.01	Cum SA (acres)	172.53	46.71	46.71

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 31.2

INPUT
Description: XS 31.2 NAVD 88
Station Elevation Data num= 63
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 27.54 12 27.14 41 19.04 76 17.64 107 14.34
166 15.24 211 20.64 1583 21.84 1611 14.14 3777 19.94
3810 20.94 3820 15.34 3823 14.44 3829 7.94 3837.8 2.15
3841 .04 3853 -6.36 3863 -8.56 3873 -8.96 3883 -8.16
8893 -6.66 3903 -5.96 3913 -5.46 3923 -4.66 3933 -4.36
3943 -3.66 3953 -3.16 3963 -1.66 3973 .04 3978.5 2.13
4009 13.74 4122 15.94 4137 21.64 4149 20.44 4203 20.44
4363 21.24 4463 19.54 4496 19.94 4510 21.94 4548 21.94
4563 22.64 4574 23.44 4583 21.74 4663 21.14 4763 21.34
4863 19.24 4910 19.44 5259 19.44 5447 18.24 5459 18.84
5708 18.84 6063 19.44 6174 17.24 6590 17.24 6849 14.84
6898 15.34 7324 16.24 7517 14.54 7681 13.64 7811 18.94
7988 17.74 8003 21.54 8018 21.84

Manning's n Values num= 6
Sta n Val Sta n Val Sta n Val Sta n Val
0 .058 3777 .08 3810 .04 3841 .02 3973 .04
4137 .066

Bank Sta: Left 3810 Right 4009 Lengths: Left Channel 8250 Right 16840 Coeff Contr. .1 Expan. .3
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev

0 3810 20.94 4574 8018 23.44

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	20.55	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.32	Wt. n-Val.		0.028	0.040
W.S. Elev (ft)	20.23	Reach Len. (ft)	8250.00	16840.00	7125.00
Crit W.S. (ft)		Flow Area (sq ft)		4118.53	663.03
E.G. Slope (ft/ft)	0.000144	Area (sq ft)		4118.53	663.03
Q Total (cfs)	20000.00	Flow (cfs)		19163.14	836.86
Top width (ft)	397.38	Top width (ft)		197.73	199.66
Vel Total (ft/s)	4.18	Avg. Vel (ft/s)		4.65	1.26
Max chl Dpth (ft)	29.19	Hydr. Depth (ft)		20.83	3.32
Conv. Total (cfs)	1664538.0	Conv. (cfs)		1594888.0	69649.4
Length wtd. (ft)	16584.61	Wetted Per. (ft)		209.22	200.50
Min ch El (ft)	-8.96	Shear (lb/sq ft)	8018.00	0.18	0.03
Alpha	1.19	Stream Power (lb/ft s)		0.00	0.00
Frctn Loss (ft)	2.44	Cum Volume (acre-ft)		1577.18	73.32
C & E Loss (ft)	0.00	Cum SA (acres)		78.31	22.94

Warning: Divided flow computed for this cross-section.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

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

CROSS SECTION

RIVER: RIVER-1

REACH: Reach-1

RS: 28

INPUT

Description: XS 28 NAVD 88

Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	25.44	7	25.04	49	15.84	85	14.14	145	14.54
157	11.04	272	11.04	288	15.84	318	15.34	1885	16.34
1943	16.74	1974	17.24	2017	19.24	2034	3.34	2036	0
2038	-5.36	2048	-3.76	2088	-5.36	2068	-5.66	2078	-5.36
2088	-5.26	2098	-5.46	2108	-5.56	2118	-5.16	2128	-5.86
2138	-6.16	2148	-6.66	2158	-6.16	2168	-4.96	2178	-4.16
2188	-2.16	2196	0	2199	.14	2207	7.44	2226	15.64
2234	15.04	2296	14.14	2308	18.14	2335	18.34	3060	17.44
3460	16.84	3845	16.44	4235	16.14	4860	17.14	5210	19.44
5925	16.04	6363	17.44	6425	19.14	6475	22.94	6482	22.94

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.066	1974	.08	2017	.04	2036	.02	2199	.04
2335	.067								

Bank Sta: Left 2017 Right 2226 Lengths: Left 0 Channel 0 Right 0 Coeff Contr. .1 Expan. .3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	2017	19.24	2335	6482	18.34

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	18.10	Element	Left 08	Channel	Right 08
Vel Head (ft)	0.37	Wt. n-Val.		0.026	0.040
W.S. Elev (ft)	17.73	Reach Len. (ft)			
Crit W.S. (ft)	3.00	Flow Area (sq ft)		4040.84	233.49
E.G. Slope (ft/ft)	0.000150	Area (sq ft)		4040.84	233.49
Q Total (cfs)	20000.00	Flow (cfs)		19785.35	214.65
Top width (ft)	288.17	Top width (ft)		207.39	80.78
Vel Total (ft/s)	4.68	Avg. Vel. (ft/s)		4.90	0.92
Max chl Dpth (ft)	24.39	Hydr. Depth (ft)		19.48	2.89
Conv. Total (cfs)	1631590.0	Conv. (cfs)		1614079.0	17511.0
Length wtd. (ft)		Wetted Per. (ft)		220.86	81.40
Min ch El (ft)	-6.66	Shear (lb/sq ft)	6482.00	0.17	0.03
Alpha	1.08	Stream Power (lb/ft s)		0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

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

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8
Reach-1	186	.114	.066	.015	.066	.062			
Reach-1	184	.112	.066	.015	.066	.066			
Reach-1	182.4	.082	.066	.015	.066	.061			
Reach-1	180.3	.157	.066	.015	.066	.074			
Reach-1	178.5	.154	.066	.015	.066	.061			
Reach-1	176.8	.154	.066	.015	.066	.084			
Reach-1	174.6	.198	.066	.015	.066	.069			

Reach-1	171.8	.081	.066	.015	.066	.067
Reach-1	170.5	.186	.066	.015	.066	.076
Reach-1	170.02	.177	.066	.015	.066	.131
Reach-1	169.83	.188	.066	.015	.066	.187
Reach-1	169.14	.048	.06	.015	.06	
Reach-1	169.13	Inl Struct				
Reach-1	169.12	.06	.015	.06		
Reach-1	169.1	.14	.015	.14		
Reach-1	168.85	.2	.2	.066	.015	.066
Reach-1	168.3	.2	.2	.066	.015	.066
Reach-1	167.4	.106	.106	.066	.015	.066
Reach-1	166.6	.118	.118	.066	.015	.066
Reach-1	161.4	.108	.108	.066	.015	.066
Reach-1	157.15	.102	.102	.066	.015	.066
Reach-1	156.93	.14	.14	.066	.015	.066
Reach-1	156.915	Bridge	.06	.06	.066	.066
Reach-1	156.9	.06	.066	.015	.066	.06
Reach-1	156.87	Bridge	.14	.14	.066	.066
Reach-1	156.855	.14	.14	.066	.015	.066
Reach-1	156.84	.076	.076	.066	.015	.066
Reach-1	155.7	.092	.092	.066	.015	.066
Reach-1	155.01	.092	.092	.066	.015	.066
Reach-1	154.6	.168	.168	.066	.015	.066
Reach-1	153.85	.132	.132	.066	.015	.066
Reach-1	153.36	.096	.096	.066	.015	.066
Reach-1	152.53	.169	.169	.066	.015	.066
Reach-1	151.7	.1	.1	.066	.015	.066
Reach-1	151.27	.06	.066	.015	.066	.067
Reach-1	151.255	Bridge	.06	.06	.066	.066
Reach-1	151.25	.06	.06	.066	.015	.066
Reach-1	151.24	.06	.06	.066	.015	.066
Reach-1	150.31	.09	.09	.066	.015	.066
Reach-1	147.68	.105	.105	.066	.015	.066
Reach-1	145	.119	.119	.066	.015	.066
Reach-1	144.55	.172	.172	.066	.015	.066
Reach-1	142.5	.192	.192	.066	.015	.066
Reach-1	140.74	.183	.183	.066	.015	.066
Reach-1	139.85	.157	.157	.066	.015	.066
Reach-1	139.01	.094	.094	.066	.015	.066
Reach-1	137.71	.102	.102	.066	.015	.066
Reach-1	135	.101	.101	.066	.015	.066
Reach-1	132.75	.118	.118	.066	.015	.066
Reach-1	131.35	.099	.099	.066	.015	.066
Reach-1	130.51	.074	.074	.066	.015	.066
Reach-1	129.3	.068	.068	.066	.025	.066
Reach-1	129.23	.144	.144	.066	.025	.066
Reach-1	129.22	.144	.144	.066	.025	.066
Reach-1	129.216	.015				
Reach-1	129.215	Inl Struct				
Reach-1	129.214	.015				
Reach-1	129.213	.015				
Reach-1	129.212	.015				
Reach-1	129.211	.015				
Reach-1	129.21	.015				
Reach-1	129.2	.168	.066	.025	.066	.067
Reach-1	129.03	.14	.14	.066	.025	.066
Reach-1	127.7	.114	.114	.066	.025	.066
Reach-1	126.7	.11	.11	.066	.025	.066
Reach-1	125	.108	.108	.066	.025	.066
Reach-1	123.8	.1	.1	.066	.025	.066
Reach-1	122.5	.099	.099	.066	.025	.066
Reach-1	121.46	.111	.111	.066	.025	.066
Reach-1	120.7	.044	.044	.066	.025	.066
Reach-1	120.62	.088	.088	.066	.025	.066
Reach-1	120.605	Bridge	.066	.025	.066	.08
Reach-1	120.59	.104	.104	.066	.025	.066
Reach-1	120.5	.159	.159	.066	.025	.066
Reach-1	120.38	.164	.164	.066	.025	.066
Reach-1	117.87	.163	.163	.066	.025	.066
Reach-1	117.2	.167	.167	.066	.025	.066
Reach-1	116.5	.13	.13	.066	.025	.066
Reach-1	116.1	.1	.1	.066	.025	.066
Reach-1	115.7	.052	.052	.066	.025	.066
Reach-1	115	.109	.109	.066	.025	.066
Reach-1	114.8	.14	.14	.066	.025	.066
Reach-1	114.65	.174	.174	.066	.025	.066
Reach-1	114.1	.11	.11	.066	.025	.066
Reach-1	112.2	.075	.075	.066	.025	.066
Reach-1	111.5	.076	.076	.066	.025	.066
Reach-1	110.7	.084	.084	.066	.025	.066
Reach-1	109.5	.068	.068	.066	.025	.066
Reach-1	109.2	.094	.094	.066	.025	.066
Reach-1	109.1	.2	.2	.066	.025	.066
Reach-1	108.5	.105	.105	.066	.025	.066
Reach-1	107.6	.105	.105	.066	.025	.066
Reach-1	106.4	.101	.101	.066	.025	.066
Reach-1	105.33	.133	.133	.066	.025	.066
Reach-1	103.1	.133	.133	.066	.025	.066
Reach-1	100.1	.198	.198	.066	.025	.066
Reach-1	99.51	.13	.13	.066	.025	.066
Reach-1	99.4	.074	.074	.066	.025	.066
Reach-1	97.5	.07	.07	.066	.025	.066
Reach-1	96.82	.074	.074	.066	.025	.066
Reach-1	96.805	Bridge				

Reach-1	96.80	.074	.074	.066	.025	.066	.071	
Reach-1	94.05	.084	.084	.066	.025	.066	.068	
Reach-1	93.81	.084	.084	.066	.025	.066	.076	
Reach-1	93.8	.218	.218	.066	.025	.066	.062	
Reach-1	93.5	.11	.11	.066	.025	.066	.067	
Reach-1	90.5	.168	.168	.066	.025	.066	.067	
Reach-1	87.7	.183	.183	.066	.025	.066	.067	
Reach-1	86.6	.169	.169	.066	.025	.066		
Reach-1	84	.14	.14	.066	.025	.066	.067	
Reach-1	82	.095	.095	.066	.025	.066		
Reach-1	81.5	.095	.095	.066	.025	.066	.067	
Reach-1	79.8	.082	.082	.066	.025	.066		
Reach-1	78.5	.068	.068	.066	.025	.066	.067	
Reach-1	74.5	.074	.074	.066	.025	.066	.067	
Reach-1	73.8	.088	.088	.066	.025	.066	.06	
Reach-1	72.9	.082	.082	.066	.025	.066	.06	
Reach-1	72.2	.075	.075	.066	.025	.066	.06	
Reach-1	70.7	.076	.076	.066	.025	.066	.062	
Reach-1	70.5	.078	.078	.066	.025	.066	.065	
Reach-1	70.2	.079	.079	.066	.025	.066	.067	
Reach-1	67.4	.071	.071	.066	.025	.066	.067	
Reach-1	67.25	.074	.074	.066	.025	.066	.144	
Reach-1	64.7	.076	.076	.066	.025	.066	.088	
Reach-1	63.8	.075	.075	.053	.025	.053	.077	
Reach-1	62.5	.074	.08	.04	.025	.04	.067	
Reach-1	61.3	.1	.08	.04	.025	.04	.067	
Reach-1	59.9	.091	.08	.04	.025	.04	.067	
Reach-1	59	.078	.08	.04	.025	.04	.067	
Reach-1	58.8	.108	.05	.04	.025	.04	.067	
Reach-1	58.3	.081	.05	.04	.025	.04	.081	
Reach-1	57.7	.081	.05	.04	.025	.04	.067	
Reach-1	56.9	.06	.05	.04	.025	.04	.1	
Reach-1	56.7	.06	.05	.04	.025	.04		
Reach-1	56.1	.06	.05	.04	.025	.04	.07	
Reach-1	55.5	.056	.05	.04	.025	.04		
Reach-1	55.25	.05	.04	.025	.04	.04		
Reach-1	55.23	.05	.04	.025	.04	.04		
Reach-1	55.215	Bridge						
Reach-1	55.21	.05	.04	.025	.04	.04		
Reach-1	55.2	.05	.04	.025	.04	.04		
Reach-1	54.5	.05	.04	.025	.04	.04		
Reach-1	54.49	.05	.04	.025	.04	.04		
Reach-1	54.475	Bridge						
Reach-1	54.47	.05	.04	.025	.04	.04		
Reach-1	54.46	.05	.04	.025	.04	.04		
Reach-1	54.45	.05	.04	.025	.04	.04		
Reach-1	54.435	Bridge						
Reach-1	54.43	.05	.04	.025	.04	.04		
Reach-1	54.42	.05	.04	.025	.04	.04		
Reach-1	54.4101*	.05	.04	.029	.027	.04	.04	.04
Reach-1	54.4003*	.05	.04	.034	.025	.04	.04	.04
Reach-1	54.4	.05	.04	.025	.04	.04		
Reach-1	54.3847*	.05	.04	.029	.025	.04	.04	.04
Reach-1	54.3695*	.05	.04	.029	.025	.04	.04	.04
Reach-1	54.3542*	.05	.04	.029	.025	.04	.04	.04
Reach-1	54.3390*	.05	.04	.029	.025	.039	.04	.04
Reach-1	54.3238*	.05	.04	.028	.025	.039	.04	.04
Reach-1	54.3085*	.05	.04	.028	.025	.039	.04	.04
Reach-1	54.2933*	.05	.04	.028	.025	.039	.04	.04
Reach-1	54.2781*	.05	.04	.028	.026	.039	.04	.04
Reach-1	54.2628*	.05	.04	.028	.026	.039	.04	.04
Reach-1	54.2476*	.05	.04	.028	.026	.039	.04	.04
Reach-1	54.2323*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.2171*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.2019*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.1866*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.1714*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.1561*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.1409*	.05	.04	.027	.026	.038	.04	.04
Reach-1	54.1257*	.05	.04	.026	.026	.037	.04	.04
Reach-1	54.1104*	.05	.04	.026	.026	.037	.04	.04
Reach-1	54.0952*	.05	.04	.026	.026	.037	.04	.04
Reach-1	54.08*	.05	.04	.026	.026	.037	.04	.04
Reach-1	54.0647*	.05	.04	.026	.026	.037	.04	.04
Reach-1	54.0495*	.05	.04	.026	.027	.037	.04	.04
Reach-1	54.0342*	.05	.04	.025	.027	.037	.04	.04
Reach-1	54.0190*	.05	.04	.025	.027	.036	.04	.04
Reach-1	54.0038*	.05	.04	.025	.027	.036	.04	.04
Reach-1	54	.05	.04	.025	.04	.04		
Reach-1	52.4	.2	.05	.04	.025	.04	.04	
Reach-1	51.6	.2	.05	.04	.025	.04	.04	
Reach-1	51.42	.2	.05	.04	.025	.04	.04	
Reach-1	51.405	Bridge						
Reach-1	51.40	.2	.05	.04	.025	.04	.04	
Reach-1	50.8	.05	.04	.025	.04	.068		
Reach-1	49.6	.06	.08	.04	.025	.04	.116	
Reach-1	48.4	.059	.08	.04	.025	.04	.079	
Reach-1	47.9	.074	.08	.04	.025	.04	.072	
Reach-1	47.8	.067	.08	.04	.025	.04	.068	
Reach-1	47.7	.067	.08	.04	.025	.04	.068	
Reach-1	47.4	.067	.08	.04	.025	.04	.102	
Reach-1	46.8	.112	.08	.04	.025	.04	.063	
Reach-1	46.4	.069	.08	.04	.025	.04	.067	
Reach-1	45	.05	.08	.04	.025	.04	.068	
Reach-1	44	.078	.08	.04	.025	.04	.069	

Reach-1	42.4	.162	.08	.04	.02	.04	.068
Reach-1	40.3	.06	.08	.04	.02	.04	.067
Reach-1	38.9	.066	.08	.04	.02	.04	.066
Reach-1	36.3	.104	.08	.04	.02	.04	.075
Reach-1	34	.094	.08	.04	.02	.04	.087
Reach-1	31.2	.058	.08	.04	.02	.04	.066
Reach-1	28	.066	.08	.04	.02	.04	.067
SUMMARY OF REACH LENGTHS							
River: RIVER-1							
Reach	River Sta.	Left	Channel	Right			
Reach-1	186	3400	7800	4300			
Reach-1	184	8300	12200	8800			
Reach-1	182.4	11200	11500	11000			
Reach-1	180.3	8500	12100	10000			
Reach-1	178.5	6300	8400	7800			
Reach-1	176.8	8000	12100	2800			
Reach-1	174.6	9000	14500	9700			
Reach-1	171.8	3000	6500	4000			
Reach-1	170.5	3000	4300	2000			
Reach-1	170.02	3500	1000	1000			
Reach-1	169.83	2000	3700	2000			
Reach-1	169.14	50	50	50			
Reach-1	169.13	Inl Struct					
Reach-1	169.12	100	100	100			
Reach-1	169.1	1200	1200	1200			
Reach-1	168.85	3000	3050	3050			
Reach-1	168.3	4750	4850	4900			
Reach-1	167.4	4250	4000	4150			
Reach-1	166.6	16100	16100	16100			
Reach-1	161.4	25100	25100	25100			
Reach-1	157.15	2114	2114	2114			
Reach-1	156.93	86	86	86			
Reach-1	156.915	Bridge					
Reach-1	156.9	199	199	199			
Reach-1	156.87	91	91	91			
Reach-1	156.855	Bridge					
Reach-1	156.84	1100	1020	1100			
Reach-1	156.6	4500	4000	4600			
Reach-1	155.7	3600	4100	3500			
Reach-1	155.01	2500	2650	2500			
Reach-1	154.6	3360	3330	3450			
Reach-1	153.85	2240	2220	2300			
Reach-1	153.36	4375	4200	4275			
Reach-1	152.53	4625	4600	4425			
Reach-1	151.7	2220	2470	3420			
Reach-1	151.27	90	90	90			
Reach-1	151.255	Bridge					
Reach-1	151.25	10	10	10			
Reach-1	151.24	4970	4970	3770			
Reach-1	150.31	6090	6025	6090			
Reach-1	147.68	14210	14125	14210			
Reach-1	145	2650	2550	1800			
Reach-1	144.55	11550	12000	8000			
Reach-1	142.5	10600	10800	10650			
Reach-1	140.74	6000	5900	6000			
Reach-1	139.85	4300	4300	4400			
Reach-1	139.01	6800	6900	6550			
Reach-1	137.71	14900	14900	15100			
Reach-1	135	11900	12000	12800			
Reach-1	132.75	7625	7650	7565			
Reach-1	131.35	4500	4350	4375			
Reach-1	130.51	500	2400	2400			
Reach-1	129.3	2000	2100	2600			
Reach-1	129.23	70	70	70			
Reach-1	129.22	70	70	70			
Reach-1	129.216	20	20	20			
Reach-1	129.215	Inl Struct					
Reach-1	129.214	25	25	25			
Reach-1	129.213	25	25	25			
Reach-1	129.212	10	10	10			
Reach-1	129.211	100	100	100			
Reach-1	129.21	400	400	400			
Reach-1	129.2	1500	1148	600			
Reach-1	129.03	7700	7000	4500			
Reach-1	127.7	4000	5000	2125			
Reach-1	126.7	3500	9000	6000			
Reach-1	125	6375	8935	4625			
Reach-1	123.8	6000	6875	6625			
Reach-1	122.5	2625	3510	4500			
Reach-1	121.46	4000	3750	3500			
Reach-1	120.7	465	465	465			
Reach-1	120.62	46	46	46			
Reach-1	120.605	Bridge					
Reach-1	120.59	640	640	640			
Reach-1	120.5	3625	4000	4000			
Reach-1	120.38	4625	13250	5750			
Reach-1	117.87	5250	3550	3750			
Reach-1	117.2	2310	2575	2750			

Reach-1	116.5	2315	2250	1875
Reach-1	116.1	1750	1935	2125
Reach-1	115.7	3750	3935	3750
Reach-1	115	2250	1810	1500
Reach-1	114.8	750	720	700
Reach-1	114.65	2000	4655	4550
Reach-1	114.1	7750	10000	1875
Reach-1	112.2	5625	3750	3250
Reach-1	111.5	3625	4125	5000
Reach-1	110.7	4500	6010	4875
Reach-1	109.5	750	1725	2000
Reach-1	109.2	375	500	500
Reach-1	109.1	4000	3250	1625
Reach-1	108.5	2375	6750	4500
Reach-1	107.6	3000	6250	3000
Reach-1	106.4	5050	6000	4000
Reach-1	105.3	4825	11690	4500
Reach-1	103.1	11125	16060	7125
Reach-1	100.1	3625	3875	250
Reach-1	99.51	625	1125	125
Reach-1	99.4	4625	9950	7875
Reach-1	97.5	2500	3650	3400
Reach-1	96.82	100	100	100
Reach-1	96.805	Bridge		
Reach-1	96.80	2410	3450	2450
Reach-1	94.05	1250	1300	1550
Reach-1	93.81	250	100	250
Reach-1	93.8	1500	1500	1625
Reach-1	93.5	10125	16190	9125
Reach-1	90.5	5500	15625	8750
Reach-1	87.7	4000	6035	3750
Reach-1	86.6	7500	14000	1500
Reach-1	84	5000	12000	5500
Reach-1	82	3000	2500	1000
Reach-1	81.5	7000	11450	4125
Reach-1	79.8	5000	7000	4000
Reach-1	78.5	8125	22690	5625
Reach-1	74.5	4250	3440	3250
Reach-1	73.8	4625	4315	3300
Reach-1	72.9	3500	3625	3200
Reach-1	72.2	8450	8125	8440
Reach-1	70.7	1100	1000	1000
Reach-1	70.5	1700	1500	1250
Reach-1	70.2	10750	19375	7375
Reach-1	67.4	1250	750	250
Reach-1	67.25	4125	11500	8000
Reach-1	64.7	2000	4810	4000
Reach-1	63.8	3000	7000	5750
Reach-1	62.5	4250	6125	4125
Reach-1	61.3	5375	7565	1750
Reach-1	59.9	4750	5440	3000
Reach-1	59	1000	1030	1375
Reach-1	58.8	2750	2660	3250
Reach-1	58.3	3000	3000	1500
Reach-1	57.7	4250	4220	4500
Reach-1	56.9	2000	2000	2000
Reach-1	56.7	3000	3000	3000
Reach-1	56.1	3000	2940	3000
Reach-1	55.5	1625	1625	1625
Reach-1	55.25	203	203	203
Reach-1	55.23	75	75	75
Reach-1	55.215	Bridge		
Reach-1	55.21	15	15	15
Reach-1	55.2	3875	3440	3875
Reach-1	54.5	90	90	90
Reach-1	54.49	85	85	85
Reach-1	54.475	Bridge		
Reach-1	54.47	5	5	5
Reach-1	54.46	4	4	4
Reach-1	54.45	80	80	80
Reach-1	54.435	Bridge		
Reach-1	54.43	10	10	10
Reach-1	54.42	100	100	100
Reach-1	54.4101*	100	100	100
Reach-1	54.4003*	4	4	4
Reach-1	54.4	100	100	100
Reach-1	54.3847*	100	100	100
Reach-1	54.3695*	100	100	100
Reach-1	54.3542*	100	100	100
Reach-1	54.3390*	100	100	100
Reach-1	54.3238*	100	100	100
Reach-1	54.3085*	100	100	100
Reach-1	54.2933*	100	100	100
Reach-1	54.2781*	100	100	100
Reach-1	54.2628*	100	100	100
Reach-1	54.2476*	100	100	100
Reach-1	54.2323*	100	100	100
Reach-1	54.2171*	100	100	100
Reach-1	54.2019*	100	100	100
Reach-1	54.1866*	100	100	100
Reach-1	54.1714*	100	100	100
Reach-1	54.1561*	100	100	100
Reach-1	54.1409*	100	100	100
Reach-1	54.1257*	100	100	100
Reach-1	54.1104*	100	100	100

Reach-1	54.0952*	100	100	100
Reach-1	54.08*	100	100	100
Reach-1	54.0647*	100	100	100
Reach-1	54.0495*	100	100	100
Reach-1	54.0342*	100	100	100
Reach-1	54.0190*	100	100	100
Reach-1	54.0038*	25	25	25
Reach-1	54	8660	8100	8000
Reach-1	52.4	2530	4700	4960
Reach-1	51.6	1330	1490	540
Reach-1	51.42	110	110	110
Reach-1	51.405	Bridge		
Reach-1	51.40	3100	3500	2200
Reach-1	50.8	2950	5800	3060
Reach-1	49.6	4960	7200	5960
Reach-1	48.4	2215	1825	790
Reach-1	47.9	150	150	150
Reach-1	47.8	750	750	750
Reach-1	47.7	2110	4100	3270
Reach-1	47.4	1690	3025	1790
Reach-1	46.8	3480	2800	1580
Reach-1	46.4	3270	6300	4540
Reach-1	45	3110	5000	3160
Reach-1	44	6625	8540	8000
Reach-1	42.4	7000	11000	5000
Reach-1	40.3	5000	7500	1000
Reach-1	38.9	5875	14625	5000
Reach-1	36.3	6750	12440	11000
Reach-1	34	5125	14060	10375
Reach-1	31.2	8250	16840	7125
Reach-1	28	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	186	.1	.3
Reach-1	184	.1	.3
Reach-1	182.4	.1	.3
Reach-1	180.3	.1	.3
Reach-1	178.5	.1	.3
Reach-1	176.8	.1	.3
Reach-1	174.6	.1	.3
Reach-1	171.8	.1	.3
Reach-1	170.5	.1	.3
Reach-1	170.02	.1	.3
Reach-1	169.83	.1	.3
Reach-1	169.14	.2	.5
Reach-1	169.13	Inl Struct	
Reach-1	169.12	.2	.5
Reach-1	169.1	.1	.3
Reach-1	168.85	.1	.3
Reach-1	168.3	.1	.3
Reach-1	167.4	.1	.3
Reach-1	166.6	.1	.3
Reach-1	161.4	.1	.3
Reach-1	157.15	.1	.3
Reach-1	156.93	.2	.5
Reach-1	156.915	Bridge	
Reach-1	156.9	.2	.5
Reach-1	156.87	.2	.5
Reach-1	156.855	Bridge	
Reach-1	156.84	.2	.5
Reach-1	156.6	.1	.3
Reach-1	155.7	.1	.3
Reach-1	155.01	.1	.3
Reach-1	154.6	.1	.3
Reach-1	153.85	.1	.3
Reach-1	153.36	.1	.3
Reach-1	152.53	.1	.3
Reach-1	151.7	.1	.3
Reach-1	151.27	.2	.5
Reach-1	151.255	Bridge	
Reach-1	151.25	.2	.5
Reach-1	151.24	.1	.3
Reach-1	150.31	.1	.3
Reach-1	147.68	.1	.3
Reach-1	145	.1	.3
Reach-1	144.55	.1	.3
Reach-1	142.5	.1	.3
Reach-1	140.74	.1	.3
Reach-1	139.85	.1	.3
Reach-1	139.01	.1	.3
Reach-1	137.71	.1	.3
Reach-1	135	.1	.3
Reach-1	132.75	.1	.3
Reach-1	131.35	.1	.3
Reach-1	130.51	.1	.3
Reach-1	129.3	.1	.3
Reach-1	129.23	.1	.3

Reach-1	129.22	.1	.3
Reach-1	129.216	.2	.5
Reach-1	129.215	Inl Struct	
Reach-1	129.214	.2	.5
Reach-1	129.213	.2	.5
Reach-1	129.212	.2	.5
Reach-1	129.211	.2	.5
Reach-1	129.21	.2	.5
Reach-1	129.2	.1	.3
Reach-1	129.03	.1	.3
Reach-1	127.7	.1	.3
Reach-1	126.7	.1	.3
Reach-1	125	.1	.3
Reach-1	123.8	.1	.3
Reach-1	122.5	.1	.3
Reach-1	121.46	.1	.3
Reach-1	120.7	.1	.3
Reach-1	120.62	.2	.5
Reach-1	120.605	Bridge	
Reach-1	120.59	.2	.5
Reach-1	120.5	.1	.3
Reach-1	120.38	.1	.3
Reach-1	117.87	.1	.3
Reach-1	117.2	.1	.3
Reach-1	116.5	.1	.3
Reach-1	116.1	.1	.3
Reach-1	115.7	.1	.3
Reach-1	115	.1	.3
Reach-1	114.8	.1	.3
Reach-1	114.65	.1	.3
Reach-1	114.1	.1	.3
Reach-1	112.2	.1	.3
Reach-1	111.5	.1	.3
Reach-1	110.7	.1	.3
Reach-1	109.5	.1	.3
Reach-1	109.2	.1	.3
Reach-1	109.1	.1	.3
Reach-1	108.5	.1	.3
Reach-1	107.6	.1	.3
Reach-1	106.4	.1	.3
Reach-1	105.3	.1	.3
Reach-1	103.1	.1	.3
Reach-1	100.1	.1	.3
Reach-1	99.51	.1	.3
Reach-1	99.4	.1	.3
Reach-1	97.5	.1	.3
Reach-1	96.82	.2	.5
Reach-1	96.805	Bridge	
Reach-1	96.80	.2	.5
Reach-1	94.05	.1	.3
Reach-1	93.81	.1	.3
Reach-1	93.8	.1	.3
Reach-1	93.5	.1	.3
Reach-1	90.5	.1	.3
Reach-1	87.7	.1	.3
Reach-1	86.6	.1	.3
Reach-1	84	.1	.3
Reach-1	82	.1	.3
Reach-1	81.5	.1	.3
Reach-1	79.8	.1	.3
Reach-1	78.5	.1	.3
Reach-1	74.5	.1	.3
Reach-1	73.8	.1	.3
Reach-1	72.9	.1	.3
Reach-1	72.2	.1	.3
Reach-1	70.7	.1	.3
Reach-1	70.5	.1	.3
Reach-1	70.2	.1	.3
Reach-1	67.4	.1	.3
Reach-1	67.25	.1	.3
Reach-1	64.7	.1	.3
Reach-1	63.8	.1	.3
Reach-1	62.5	.1	.3
Reach-1	61.3	.1	.3
Reach-1	59.9	.1	.3
Reach-1	59	.1	.3
Reach-1	58.8	.1	.3
Reach-1	58.3	.1	.3
Reach-1	57.7	.1	.3
Reach-1	56.9	.1	.3
Reach-1	56.7	.1	.3
Reach-1	56.1	.1	.3
Reach-1	55.5	.1	.3
Reach-1	55.25	.1	.3
Reach-1	55.23	.2	.5
Reach-1	55.215	Bridge	
Reach-1	55.21	.2	.5
Reach-1	55.2	.1	.3
Reach-1	54.5	.1	.3
Reach-1	54.49	.2	.5
Reach-1	54.475	Bridge	
Reach-1	54.47	.2	.5
Reach-1	54.46	.1	.3
Reach-1	54.45	.2	.5
Reach-1	54.435	Bridge	

Reach-1	54.43	.2	.5
Reach-1	54.42	.1	.3
Reach-1	54.4101*	.1	.3
Reach-1	54.4003*	.1	.3
Reach-1	54.4	.1	.3
Reach-1	54.3847*	.1	.3
Reach-1	54.3695*	.1	.3
Reach-1	54.3542*	.1	.3
Reach-1	54.3390*	.1	.3
Reach-1	54.3238*	.1	.3
Reach-1	54.3085*	.1	.3
Reach-1	54.2933*	.1	.3
Reach-1	54.2781*	.1	.3
Reach-1	54.2628*	.1	.3
Reach-1	54.2476*	.1	.3
Reach-1	54.2323*	.1	.3
Reach-1	54.2171*	.1	.3
Reach-1	54.2019*	.1	.3
Reach-1	54.1866*	.1	.3
Reach-1	54.1714*	.1	.3
Reach-1	54.1561*	.1	.3
Reach-1	54.1409*	.1	.3
Reach-1	54.1257*	.1	.3
Reach-1	54.1104*	.1	.3
Reach-1	54.0952*	.1	.3
Reach-1	54.08*	.1	.3
Reach-1	54.0647*	.1	.3
Reach-1	54.0495*	.1	.3
Reach-1	54.0342*	.1	.3
Reach-1	54.0190*	.1	.3
Reach-1	54.0038*	.1	.3
Reach-1	54	.1	.3
Reach-1	52.4	.1	.3
Reach-1	51.6	.1	.3
Reach-1	51.42	.2	.5
Reach-1	51.405	Bridge	
Reach-1	51.40	.2	.5
Reach-1	50.8	.1	.3
Reach-1	49.6	.1	.3
Reach-1	48.4	.1	.3
Reach-1	47.9	.1	.3
Reach-1	47.8	.1	.3
Reach-1	47.7	.1	.3
Reach-1	47.4	.1	.3
Reach-1	46.8	.1	.3
Reach-1	46.4	.1	.3
Reach-1	45	.1	.3
Reach-1	44	.1	.3
Reach-1	42.4	.1	.3
Reach-1	40.3	.1	.3
Reach-1	38.9	.1	.3
Reach-1	36.3	.1	.3
Reach-1	34	.1	.3
Reach-1	31.2	.1	.3
Reach-1	28	.1	.3

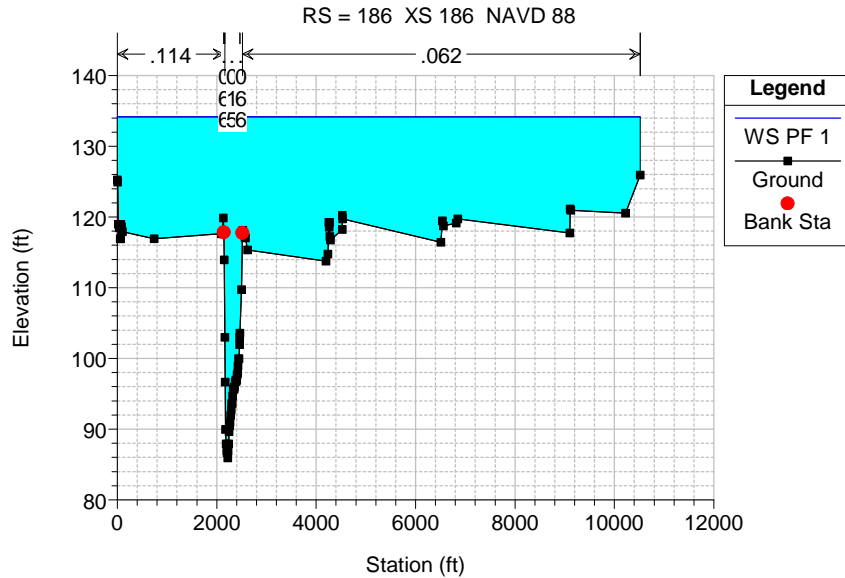
Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	186	PF 1	235000.00	85.94	134.18		134.27	0.000059	4.37	178389.10	10519.00	0.13
Reach-1	184	PF 1	235000.00	86.64	133.70		133.86	0.000111	5.68	143970.30	10727.20	0.16
Reach-1	182.4	PF 1	235000.00	79.14	132.91		133.04	0.000058	5.60	210361.60	15361.88	0.15
Reach-1	180.3	PF 1	235000.00	87.04	131.87		132.18	0.000107	7.23	147619.90	9709.00	0.21
Reach-1	178.5	PF 1	235000.00	86.64	130.70		131.02	0.000114	7.25	161752.90	11045.00	0.21
Reach-1	176.8	PF 1	235000.00	88.84	129.48		129.95	0.000172	7.91	142179.30	8702.00	0.24
Reach-1	174.6	PF 1	235000.00	86.14	128.20		128.78	0.000090	8.30	167988.30	10078.00	0.24
Reach-1	171.8	PF 1	235000.00	75.24	127.24		127.44	0.000125	5.77	123765.20	8410.00	0.17
Reach-1	170.5	PF 1	235000.00	74.24	124.15		126.29	0.000366	14.30	76482.61	4903.97	0.43
Reach-1	170.02	PF 1	235000.00	89.64	122.86		125.17	0.000225	14.52	82190.59	4872.86	0.45
Reach-1	169.83	PF 1	130000.00	89.64	123.43		124.61	0.000144	10.43	75031.96	4505.18	0.32
Reach-1	169.14	PF 1	130000.00	84.64	123.50	97.05	124.14	0.000038	6.38	20592.79	623.80	0.18
Reach-1	169.13		Inl Struct									
Reach-1	169.12	PF 1	130000.00	72.14	122.16		122.54	0.000017	4.96	26198.48	523.80	0.12
Reach-1	169.1	PF 1	130000.00	83.64	122.07		122.52	0.000027	5.41	24033.37	658.63	0.16
Reach-1	168.85	PF 1	130000.00	71.64	121.89		122.45	0.000359	6.11	25434.77	1070.00	0.17
Reach-1	168.3	PF 1	130000.00	75.34	120.66		121.01	0.000612	5.22	41087.52	2237.60	0.16
Reach-1	167.4	PF 1	130000.00	74.14	118.84		119.09	0.000169	5.12	85679.06	8740.29	0.15
Reach-1	166.6	PF 1	130000.00	71.34	118.46		118.55	0.000073	3.97	163112.60	12700.00	0.11
Reach-1	161.4	PF 1	130000.00	70.14	117.14		117.23	0.000093	3.73	150286.20	14947.43	0.11
Reach-1	157.15	PF 1	130000.00	69.64	113.14		113.84	0.000230	7.53	36071.43	2402.00	0.22
Reach-1	156.93	PF 1	125000.00	57.14	112.55	80.81	113.39	0.000179	7.51	19302.13	541.00	0.19
Reach-1	156.915		Bridge									
Reach-1	156.9	PF 1	125000.00	57.14	112.05		112.86	0.000178	7.43	19032.35	541.00	0.19
Reach-1	156.87	PF 1	125000.00	61.04	112.09	80.10	112.77	0.000083	7.00	24708.96	819.90	0.18
Reach-1	156.855		Bridge									
Reach-1	156.84	PF 1	125000.00	61.04	111.99		112.72	0.000088	7.17	24626.48	819.90	0.18
Reach-1	156.6	PF 1	125000.00	60.94	111.90		112.56	0.000194	7.15	28484.25	2183.00	0.19
Reach-1	155.7	PF 1	125000.00	68.64	111.52		111.68	0.000151	4.58	75924.59	7547.93	0.14
Reach-1	155.01	PF 1	125000.00	66.94	110.60		110.81	0.000442	4.75	52391.36	4517.72	0.16
Reach-1	154.6	PF 1	125000.00	55.64	109.16		109.71	0.000376	6.15	27510.33	1353.69	0.18
Reach-1	153.85	PF 1	125000.00	66.44	107.60		108.16	0.000608	6.96	35898.08	3717.70	0.23
Reach-1	153.36	PF 1	125000.00	66.94	107.03		107.14	0.000173	4.01	102596.90	14344.00	0.13
Reach-1	152.53	PF 1	125000.00	66.64	106.34		106.40	0.000171	3.06	127708.80	14473.09	0.10
Reach-1	151.7	PF 1	125000.00	65.04	105.65		105.70	0.000135	3.26	123089.80	14130.56	0.11
Reach-1	151.27	PF 1	125000.00	65.88	105.40	89.78	105.43	0.000061	2.33	136234.90	14891.45	0.08
Reach-1	151.255		Bridge									
Reach-1	151.25	PF 1	125000.00	65.88	105.40		105.42	0.000057	2.25	136138.40	14891.39	0.08
Reach-1	151.24	PF 1	125000.00	65.88	105.39		105.42	0.000061	2.33	136093.60	14891.37	0.08
Reach-1	150.31	PF 1	125000.00	64.64	104.96		105.01	0.000146	3.14	130213.00	17215.00	0.11
Reach-1	147.68	PF 1	125000.00	60.04	104.10		104.13	0.000142	2.39	135318.00	15507.50	0.09
Reach-1	145	PF 1	125000.00	60.84	102.45		102.50	0.000088	3.14	148557.60	14110.00	0.10
Reach-1	144.55	PF 1	125000.00	58.64	102.27		102.31	0.000088	2.95	146460.00	14238.00	0.09
Reach-1	142.5	PF 1	125000.00	56.94	100.97		101.08	0.000178	4.28	143865.70	13900.00	0.14
Reach-1	140.74	PF 1	125000.00	57.74	99.71		99.75	0.000068	3.15	143333.30	13785.84	0.10
Reach-1	139.85	PF 1	125000.00	59.64	98.98		99.17	0.000152	5.24	96329.50	11871.00	0.16
Reach-1	139.01	PF 1	125000.00	59.44	98.48		98.54	0.000119	3.36	93695.45	10391.00	0.11
Reach-1	137.71	PF 1	125000.00	56.64	97.68		97.73	0.000125	2.99	101154.70	10188.24	0.10
Reach-1	135	PF 1	125000.00	57.94	95.86		95.94	0.000113	3.71	103619.60	10240.18	0.12
Reach-1	132.75	PF 1	125000.00	53.54	93.91		94.19	0.000185	6.50	88842.54	8687.14	0.20
Reach-1	131.35	PF 1	125000.00	55.24	92.51		92.64	0.000212	4.81	85933.82	8598.38	0.16
Reach-1	130.51	PF 1	125000.00	55.14	91.33		91.63	0.000244	6.27	51155.14	4415.80	0.20
Reach-1	129.3	PF 1	20000.00	55.14	91.28		91.29	0.000008	1.02	44616.88	4169.48	0.03
Reach-1	129.23	PF 1	20000.00	55.14	91.17		91.25	0.000040	2.20	9113.52	308.92	0.07
Reach-1	129.22	PF 1	20000.00	55.14	91.17		91.25	0.000040	2.20	9112.66	308.92	0.07
Reach-1	129.216	PF 1	20000.00	55.64	90.46	67.91	91.18	0.000096	6.86	3080.90	162.00	0.21
Reach-1	129.215		Inl Struct									
Reach-1	129.214	PF 1	20000.00	55.64	83.75		84.92	0.000180	8.68	2304.70	82.00	0.29
Reach-1	129.213	PF 1	20000.00	55.64	82.44		84.69	0.001013	12.04	1661.73	62.00	0.41
Reach-1	129.212	PF 1	20000.00	55.64	82.41		84.67	0.001016	12.05	1659.86	62.00	0.41
Reach-1	129.211	PF 1	20000.00	55.64	83.46		83.61	0.000016	3.05	6554.54	299.18	0.11
Reach-1	129.21	PF 1	20000.00	55.64	83.47		83.59	0.000013	2.73	7337.84	327.24	0.10
Reach-1	129.2	PF 1	20000.00	55.04	83.47		83.58	0.000175	2.67	8268.32	776.19	0.11
Reach-1	129.03	PF 1	20000.00	53.84	83.26		83.36	0.000196	2.54	8532.72	1400.00	0.11
Reach-1	127.7	PF 1	20000.00	49.94	82.30		82.35	0.000093	1.84	23125.89	6874.96	0.08
Reach-1	126.7	PF 1	20000.00	50.94	81.69		81.77	0.000183	2.59	21101.36	9460.68	0.11
Reach-1	125	PF 1	20000.00	50.24	80.50		80.61	0.000102	2.86	15495.08	5302.23	0.10
Reach-1	123.8	PF 1	20000.00	49.74	79.53		79.63	0.000132	2.65	11636.22	2550.74	0.10
Reach-1	122.5	PF 1	20000.00	51.94	78.70		78.84	0.000100	3.05	7776.74	577.12	0.11
Reach-1	121.46	PF 1	20000.00	45.44	78.30		78.45	0.000117	3.38	9385.68	1061.64	0.12
Reach-1	120.7	PF 1	20000.00	50.84	77.88		77.98	0.000128	2.67	8694.88	843.83	0.11
Reach-1	120.62	PF 1	20000.00	46.54	77.79	58.12	77.92	0.000151	2.91	7435.42	614.93	0.11
Reach-1	120.605		Bridge									
Reach-1	120.59	PF 1	20000.00	46.54	77.77		77.90	0.000151	2.91	7428.04	614.83	0.11
Reach-1	120.5	PF 1	20000.00	49.84	77.71		77.81	0.000096	2.61	10960.52	1286.35	0.10
Reach-1	120.38	PF 1	20000.00	51.64	77.38		77.45	0.000081	2.33	23443.61	3647.80	0.09

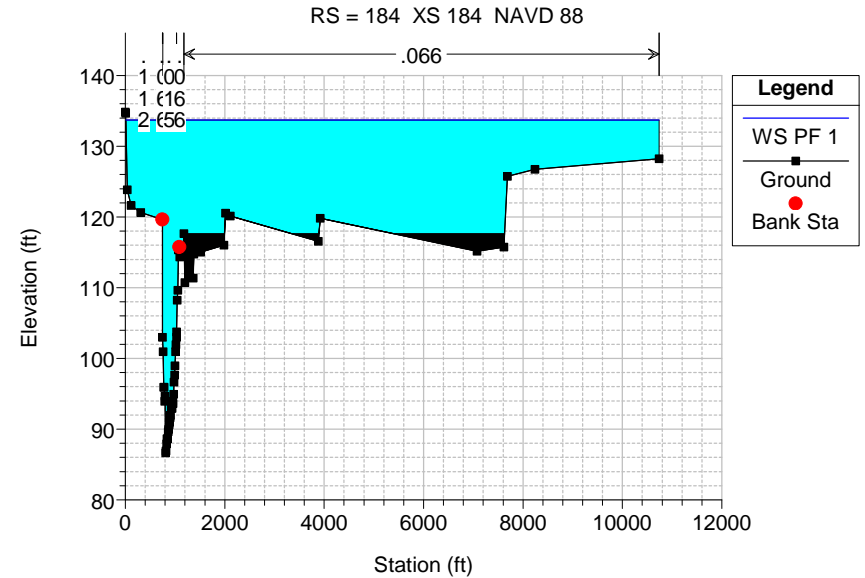
Reach-1	117.87	PF	1	20000.00	49.34	76.24	76.35	0.000114	2.87	21537.56	5098.22	0.11
Reach-1	117.2	PF	1	20000.00	46.84	75.73	75.87	0.000142	3.09	12065.34	3841.67	0.12
Reach-1	116.5	PF	1	20000.00	47.54	75.37	75.54	0.000113	3.42	8731.57	1576.25	0.13
Reach-1	116.1	PF	1	20000.00	45.84	75.13	75.26	0.000124	2.97	7600.51	478.47	0.12
Reach-1	115.7	PF	1	20000.00	48.14	74.88	75.03	0.000111	3.23	8018.62	1346.10	0.12
Reach-1	115	PF	1	20000.00	36.14	74.36	74.52	0.000162	3.24	8859.94	1476.76	0.12
Reach-1	114.8	PF	1	20000.00	46.94	74.11	74.26	0.000121	3.34	9641.98	1577.64	0.13
Reach-1	114.65	PF	1	20000.00	42.54	74.07	74.16	0.000107	2.53	12255.73	2286.92	0.10
Reach-1	114.1	PF	1	20000.00	42.04	73.48	73.55	0.000186	2.29	19388.22	9134.45	0.10
Reach-1	112.2	PF	1	20000.00	40.84	72.04	72.14	0.000120	2.97	18709.30	6638.43	0.11
Reach-1	111.5	PF	1	20000.00	37.54	71.41	71.59	0.000165	3.49	7807.50	1732.92	0.13
Reach-1	110.7	PF	1	20000.00	42.74	70.76	70.94	0.000151	3.47	7986.03	3006.07	0.13
Reach-1	109.5	PF	1	20000.00	40.74	70.07	70.18	0.000097	2.76	10352.82	3034.44	0.10
Reach-1	109.2	PF	1	20000.00	39.74	69.86	69.95	0.000192	2.62	10610.11	2870.62	0.11
Reach-1	109.1	PF	1	20000.00	36.64	69.81	69.87	0.000099	2.41	16929.76	3357.12	0.09
Reach-1	108.5	PF	1	20000.00	38.94	69.50	69.57	0.000115	2.59	18460.78	6295.68	0.10
Reach-1	107.6	PF	1	20000.00	37.64	68.73	68.78	0.000149	2.23	21352.53	7941.18	0.09
Reach-1	106.4	PF	1	20000.00	35.04	67.82	67.89	0.000182	2.46	18653.38	7953.44	0.10
Reach-1	105.3	PF	1	20000.00	24.54	66.73	66.90	0.000166	3.39	8055.06	998.93	0.12
Reach-1	103.1	PF	1	20000.00	36.14	65.49	65.55	0.000090	2.39	29382.48	9321.46	0.09
Reach-1	100.1	PF	1	20000.00	36.44	64.01	64.13	0.000110	3.13	17301.75	7628.64	0.12
Reach-1	99.51	PF	1	20000.00	35.64	63.65	63.74	0.000133	2.85	15463.07	4326.62	0.11
Reach-1	99.4	PF	1	20000.00	30.84	63.58	63.63	0.000091	1.94	17075.86	3939.39	0.07
Reach-1	97.5	PF	1	20000.00	26.04	62.33	62.44	0.000205	2.99	9914.91	4279.09	0.11
Reach-1	96.82	PF	1	20000.00	30.71	61.76	61.81	0.000161	2.14	19188.37	5939.45	0.09
Reach-1	96.805			Bridge								
Reach-1	96.80	PF	1	20000.00	30.71	61.73	61.78	0.000163	2.15	19035.66	5932.65	0.09
Reach-1	94.05	PF	1	20000.00	27.64	61.23	61.31	0.000136	2.67	16874.44	4351.82	0.10
Reach-1	93.81	PF	1	20000.00	27.94	60.99	61.08	0.000207	2.72	14225.20	4593.96	0.11
Reach-1	93.8	PF	1	20000.00	33.45	60.91	61.05	0.000262	3.31	11323.67	4106.07	0.13
Reach-1	93.5	PF	1	20000.00	26.74	60.59	60.69	0.000191	2.97	13767.17	4270.01	0.11
Reach-1	90.5	PF	1	20000.00	27.04	58.25	58.35	0.000130	2.92	24654.59	7240.53	0.10
Reach-1	87.7	PF	1	20000.00	20.54	57.20	57.22	0.000048	1.77	31247.05	7981.23	0.06
Reach-1	86.6	PF	1	20000.00	22.54	56.87	56.89	0.000121	1.47	28072.44	7041.39	0.07
Reach-1	84	PF	1	20000.00	21.14	55.31	55.41	0.000181	2.86	18946.67	7029.43	0.11
Reach-1	82	PF	1	20000.00	15.04	54.05	54.08	0.000085	1.74	27382.41	8725.01	0.07
Reach-1	81.5	PF	1	20000.00	22.44	53.87	53.92	0.000078	2.26	27057.38	8601.70	0.08
Reach-1	79.8	PF	1	20000.00	20.94	53.06	53.10	0.000117	2.09	22057.93	6273.17	0.09
Reach-1	78.5	PF	1	20000.00	15.54	52.27	52.31	0.000151	2.03	20956.58	6879.67	0.09
Reach-1	74.5	PF	1	20000.00	16.74	50.48	50.52	0.000067	2.06	26326.51	6179.87	0.07
Reach-1	73.8	PF	1	20000.00	14.64	49.97	50.14	0.000226	3.50	8650.76	1933.27	0.13
Reach-1	72.9	PF	1	20000.00	14.14	49.31	49.35	0.000124	1.83	21621.80	5789.95	0.08
Reach-1	72.2	PF	1	20000.00	10.74	48.72	48.85	0.000150	3.34	13035.76	3727.23	0.12
Reach-1	70.7	PF	1	20000.00	15.64	47.76	47.85	0.000094	2.74	13529.55	1962.06	0.10
Reach-1	70.5	PF	1	20000.00	12.34	47.61	47.73	0.000157	3.22	12062.95	2319.59	0.12
Reach-1	70.2	PF	1	20000.00	15.44	47.45	47.53	0.000100	2.84	18331.32	4389.66	0.10
Reach-1	67.4	PF	1	20000.00	15.84	44.96	45.11	0.000226	3.10	7819.30	6658.71	0.13
Reach-1	67.25	PF	1	20000.00	13.14	44.71	44.94	0.000188	3.95	6516.31	6939.21	0.14
Reach-1	64.7	PF	1	20000.00	11.64	43.16	43.27	0.000122	3.11	16487.97	5891.29	0.11
Reach-1	63.8	PF	1	20000.00	7.84	42.82	42.87	0.000075	2.40	23795.29	4195.48	0.09
Reach-1	62.5	PF	1	20000.00	10.24	42.23	42.40	0.000078	3.57	10970.32	3009.10	0.12
Reach-1	61.3	PF	1	20000.00	3.04	41.66	41.73	0.000186	2.39	15841.85	4190.11	0.10
Reach-1	59.9	PF	1	20000.00	9.14	40.56	40.73	0.000094	3.58	9260.61	2741.44	0.13
Reach-1	59	PF	1	20000.00	4.14	40.16	40.29	0.000076	3.37	14786.71	3862.59	0.12
Reach-1	58.8	PF	1	20000.00	6.64	40.13	40.21	0.000052	2.64	17734.00	3542.68	0.10
Reach-1	58.3	PF	1	20000.00	5.64	39.84	40.01	0.000111	3.30	6372.14	405.82	0.13
Reach-1	57.7	PF	1	20000.00	2.74	39.61	39.74	0.000065	3.10	10283.65	1516.41	0.11
Reach-1	56.9	PF	1	20000.00	7.54	39.28	39.39	0.000106	2.83	10850.79	1542.14	0.12
Reach-1	56.7	PF	1	20000.00	5.84	38.97	39.12	0.000175	3.15	6353.45	430.59	0.14
Reach-1	56.1	PF	1	20000.00	9.64	38.24	38.43	0.000336	3.53	5668.21	441.08	0.17
Reach-1	55.5	PF	1	20000.00	0.94	37.22	37.53	0.000264	4.52	4429.17	243.88	0.19
Reach-1	55.25	PF	1	20000.00	2.94	36.94	37.18	0.000143	4.08	5637.09	446.20	0.15
Reach-1	55.23	PF	1	20000.00	-0.16	36.96	37.14	0.000104	3.49	6340.08	429.50	0.13
Reach-1	55.215			Bridge								
Reach-1	55.21	PF	1	20000.00	-0.16	36.90	37.09	0.000105	3.50	6316.94	426.52	0.13
Reach-1	55.2	PF	1	20000.00	-0.16	36.90	37.09	0.000105	3.50	6316.24	426.43	0.13
Reach-1	54.5	PF	1	20000.00	-1.46	36.63	36.75	0.000073	3.21	9043.01	720.39	0.11
Reach-1	54.49	PF	1	20000.00	4.94	36.54	36.74	0.000108	3.85	6619.00	486.59	0.14
Reach-1	54.475			Bridge								
Reach-1	54.47	PF	1	20000.00	4.94	36.50	36.70	0.000108	3.86	6600.17	485.82	0.14
Reach-1	54.46	PF	1	20000.00	4.94	36.50	36.70	0.000108	3.86	6599.84	485.81	0.14
Reach-1	54.45	PF	1	20000.00	0.64	36.49	36.70	0.000096	3.86	6175.73	366.36	0.14
Reach-1	54.435			Bridge								
Reach-1	54.43	PF	1	20000.00	0.64	36.43	36.64	0.000097	3.87	6156.39	366.16	0.14
Reach-1	54.42	PF	1	20000.00	0.64	36.42	36.64	0.000100	3.93	5986.36	359.57	0.14
Reach-1	54.4101*	PF	1	20000.00	0.00	36.42	36.63	0.000109	3.75	5984.28	367.23	0.14
Reach-1	54.4003*	PF	1	20000.00	0.00	36.41	36.61	0.000115	3.65	5961.51	374.93	0.14
Reach-1	54.4	PF	1	20000.00	-0.36	36.41	36.61	0.000124	3.68	5811.78	375.02	0.14
Reach-1	54.3847*	PF	1	20000.00	0.00	36.40	36.60	0.000115	3.66	5979.30	385.07	0.14
Reach-1	54.3695*	PF	1	20000.00	0.00	36.39	36.59	0.000121	3.68	6033.62	401.58	0.14
Reach-1	54.3542*	PF	1	20000.00	0.00	36.38	36.57	0.000112	3.66	6184.78	424.49	0.14
Reach-1	54.3390*	PF	1	20000.00	0.00	36.36	36.56	0.000113	3.70	6120.98	430.15	0.14

Reach-1	54.3238*	PF 1	20000.00	0.00	36.35		36.55	0.000114	3.73	6130.39	440.68	0.14
Reach-1	54.3085*	PF 1	20000.00	1.00	36.33		36.54	0.000113	3.74	6172.35	448.09	0.14
Reach-1	54.2933*	PF 1	20000.00	1.00	36.32		36.53	0.000112	3.75	6222.02	455.29	0.14
Reach-1	54.2781*	PF 1	20000.00	1.00	36.31		36.52	0.000116	3.78	6200.11	466.45	0.14
Reach-1	54.2628*	PF 1	20000.00	1.00	36.29		36.50	0.000119	3.82	6144.88	478.65	0.14
Reach-1	54.2476*	PF 1	20000.00	1.00	36.28		36.49	0.000116	3.80	6246.88	488.44	0.14
Reach-1	54.2323*	PF 1	20000.00	1.00	36.27		36.48	0.000117	3.84	6239.97	498.21	0.14
Reach-1	54.2171*	PF 1	20000.00	2.00	36.25		36.47	0.000118	3.87	6208.82	506.03	0.14
Reach-1	54.2019*	PF 1	20000.00	2.00	36.24		36.46	0.000117	3.88	6248.58	514.10	0.14
Reach-1	54.1866*	PF 1	20000.00	2.00	36.22		36.44	0.000119	3.91	6198.44	522.58	0.14
Reach-1	54.1714*	PF 1	20000.00	2.00	36.21		36.43	0.000117	3.91	6265.05	529.82	0.14
Reach-1	54.1561*	PF 1	20000.00	2.00	36.20		36.42	0.000118	3.94	6255.48	552.59	0.14
Reach-1	54.1409*	PF 1	20000.00	2.00	36.18		36.41	0.000119	3.97	6253.76	561.66	0.14
Reach-1	54.1257*	PF 1	20000.00	3.00	36.17		36.40	0.000121	4.02	6202.87	579.42	0.14
Reach-1	54.1104*	PF 1	20000.00	3.00	36.15		36.38	0.000120	4.03	6233.68	588.10	0.14
Reach-1	54.0952*	PF 1	20000.00	3.00	36.14		36.37	0.000121	4.06	6169.61	595.87	0.14
Reach-1	54.08*	PF 1	20000.00	3.00	36.13		36.36	0.000120	4.06	6276.50	623.11	0.14
Reach-1	54.0647*	PF 1	20000.00	3.00	36.12		36.35	0.000120	4.07	6337.66	636.75	0.14
Reach-1	54.0495*	PF 1	20000.00	3.00	36.10		36.33	0.000126	4.13	6216.34	645.01	0.14
Reach-1	54.0342*	PF 1	20000.00	4.00	36.09		36.32	0.000122	4.10	6341.90	657.62	0.14
Reach-1	54.0190*	PF 1	20000.00	4.00	36.07		36.31	0.000123	4.14	6253.88	665.68	0.14
Reach-1	54.0038*	PF 1	20000.00	4.00	36.06		36.29	0.000124	4.15	6273.37	673.95	0.14
Reach-1	54	PF 1	20000.00	3.94	36.05		36.29	0.000106	4.19	6310.83	679.22	0.14
Reach-1	52.4	PF 1	20000.00	-0.76	35.33		35.45	0.000092	3.11	11289.75	1519.78	0.12
Reach-1	51.6	PF 1	20000.00	4.64	34.80		34.96	0.000140	3.42	10463.75	2572.71	0.14
Reach-1	51.42	PF 1	20000.00	4.88	34.78	13.78	34.81	0.000037	1.70	20970.11	3929.50	0.07
Reach-1	51.405		Bridge									
Reach-1	51.40	PF 1	20000.00	4.88	34.77		34.80	0.000036	1.69	21376.06	3929.43	0.07
Reach-1	50.8	PF 1	20000.00	1.94	34.57		34.63	0.000091	2.22	18749.24	4997.98	0.10
Reach-1	49.6	PF 1	20000.00	-1.96	34.16		34.22	0.000068	2.38	19276.85	5457.62	0.10
Reach-1	48.4	PF 1	20000.00	0.64	33.53		33.64	0.000113	2.91	13498.37	3662.91	0.12
Reach-1	47.9	PF 1	20000.00	5.24	33.29		33.44	0.000112	3.24	10011.66	2309.28	0.13
Reach-1	47.8	PF 1	20000.00	9.04	33.26		33.42	0.000172	3.37	9479.23	2300.00	0.15
Reach-1	47.7	PF 1	20000.00	-0.26	33.16		33.31	0.000127	3.22	9747.44	2295.07	0.13
Reach-1	47.4	PF 1	20000.00	-3.66	32.83		32.92	0.000058	2.42	13025.73	3359.68	0.11
Reach-1	46.8	PF 1	20000.00	-3.16	32.58		32.68	0.000127	2.74	11945.39	3327.46	0.12
Reach-1	46.4	PF 1	20000.00	-1.16	32.08		32.24	0.000211	3.33	8402.27	2293.26	0.15
Reach-1	45	PF 1	20000.00	-10.16	31.18		31.28	0.000092	2.53	8921.41	2463.62	0.11
Reach-1	44	PF 1	20000.00	-4.06	30.51		30.71	0.000154	3.73	9845.56	5450.89	0.15
Reach-1	42.4	PF 1	20000.00	-4.36	29.06		29.29	0.000183	3.92	5524.17	1066.16	0.16
Reach-1	40.3	PF 1	20000.00	-6.26	27.18		27.28	0.000186	2.83	12448.31	8247.24	0.12
Reach-1	38.9	PF 1	20000.00	-8.16	26.15		26.28	0.000097	3.07	7995.02	674.45	0.12
Reach-1	36.3	PF 1	20000.00	-7.16	24.62		24.84	0.000113	3.87	5976.52	565.97	0.15
Reach-1	34	PF 1	20000.00	-8.16	22.83		23.03	0.000209	3.58	5590.97	386.14	0.17
Reach-1	31.2	PF 1	20000.00	-8.96	20.23		20.55	0.000144	4.65	4781.56	397.38	0.18
Reach-1	28	PF 1	20000.00	-6.66	17.73	3.00	18.10	0.000150	4.90	4274.33	288.17	0.20

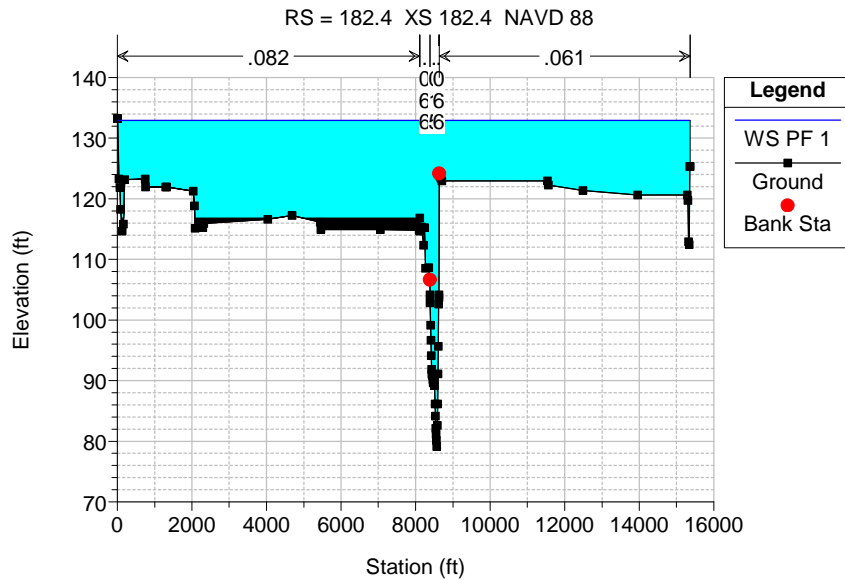
Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



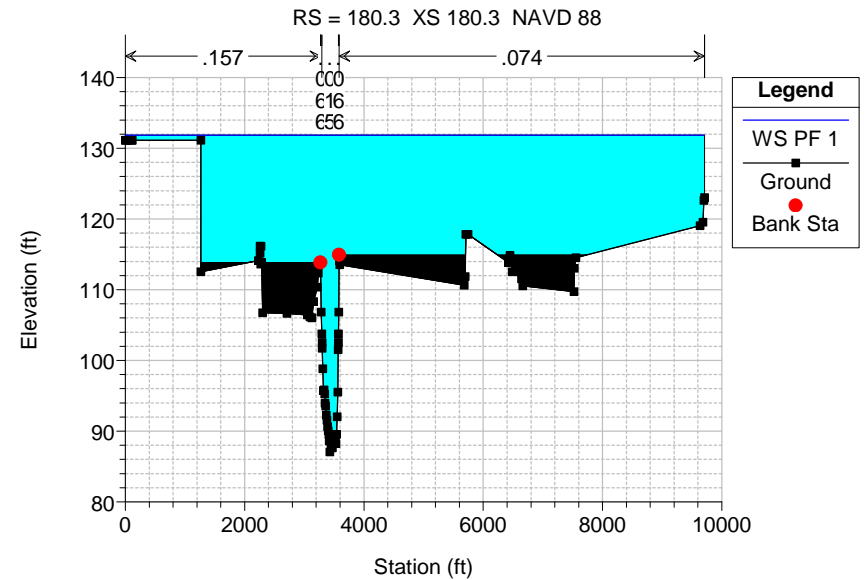
Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



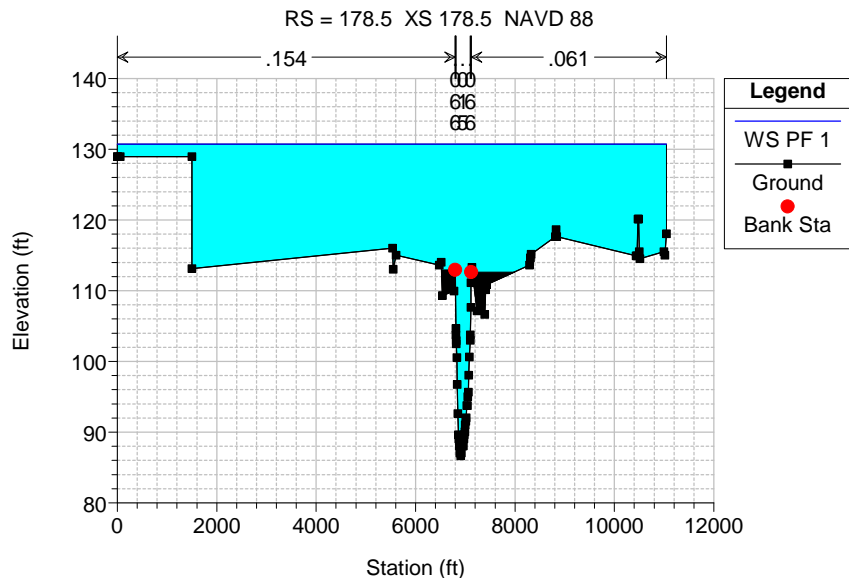
Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



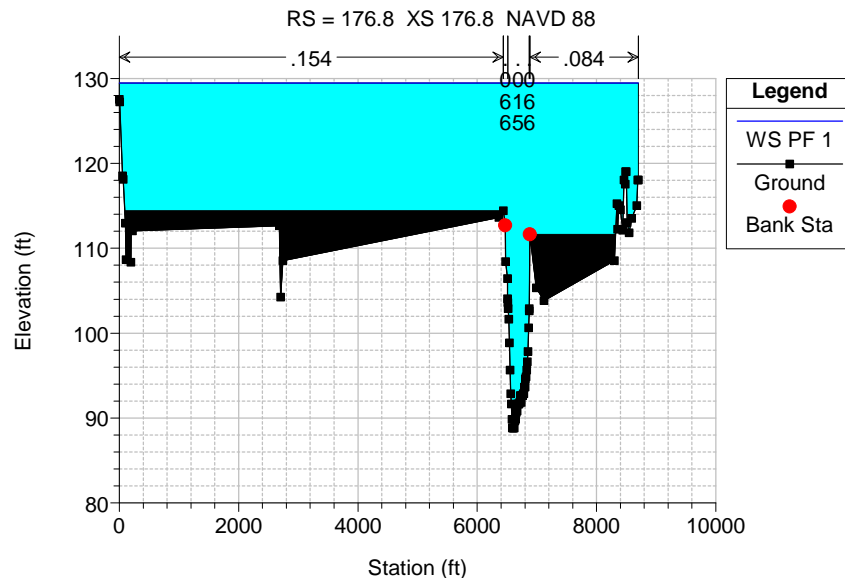
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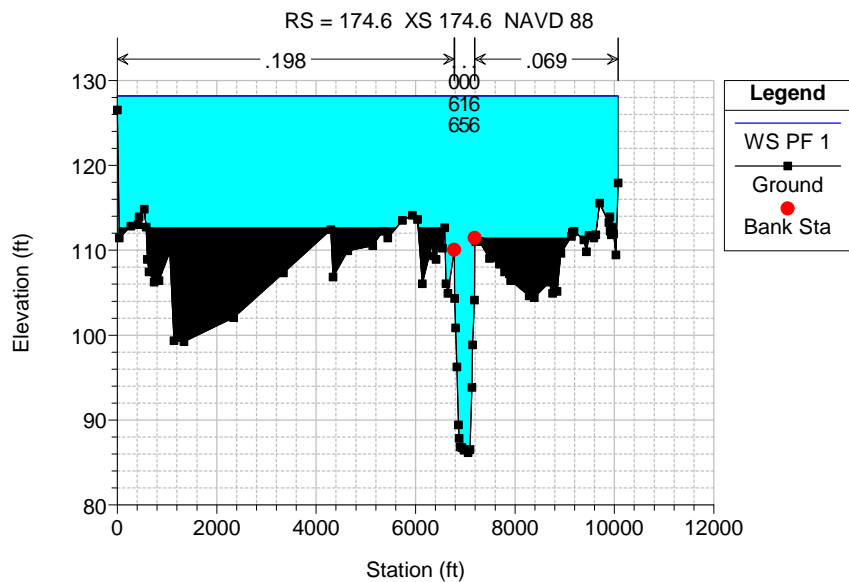
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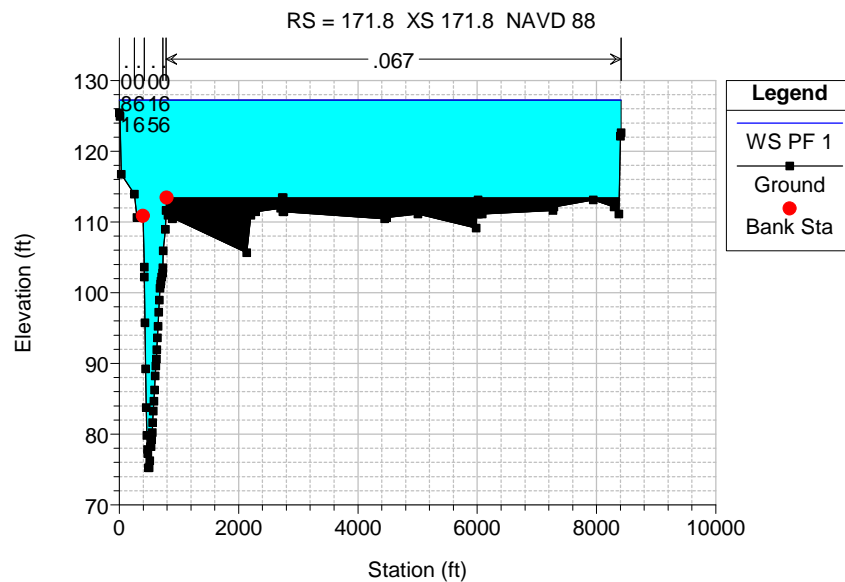
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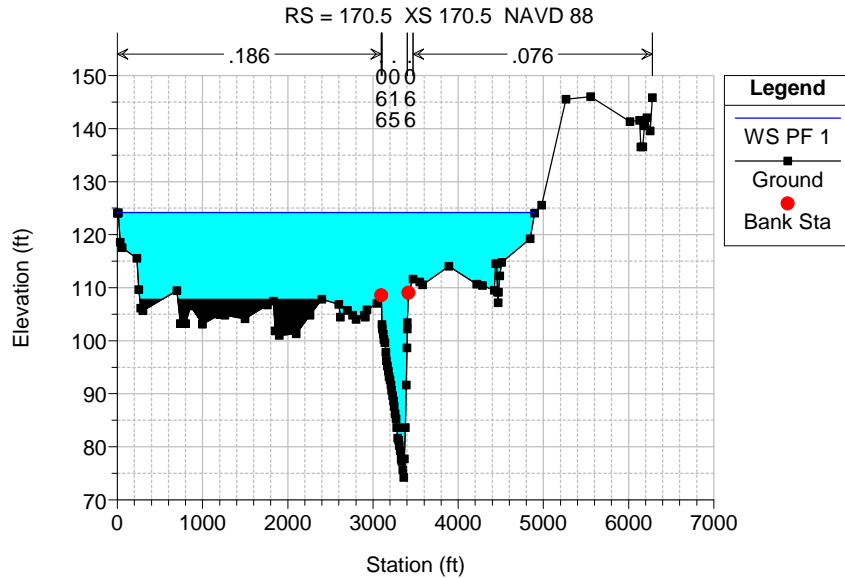
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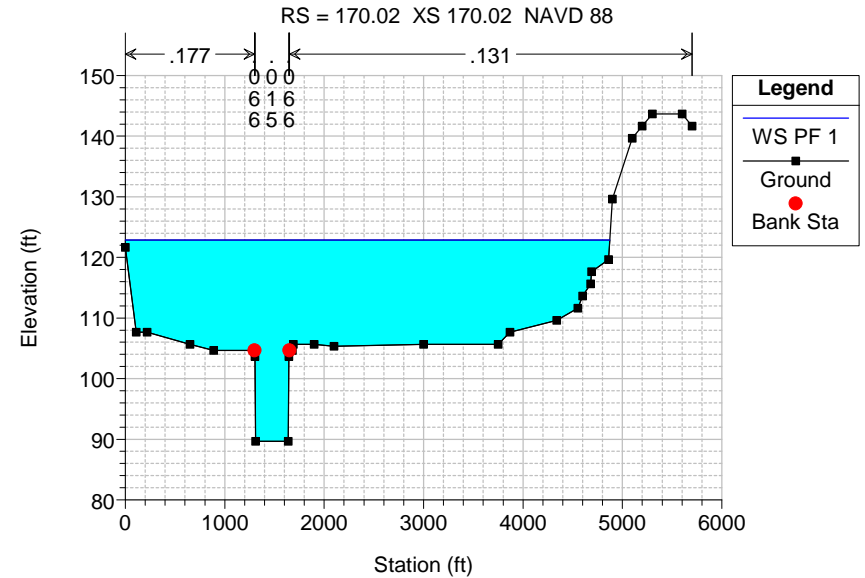
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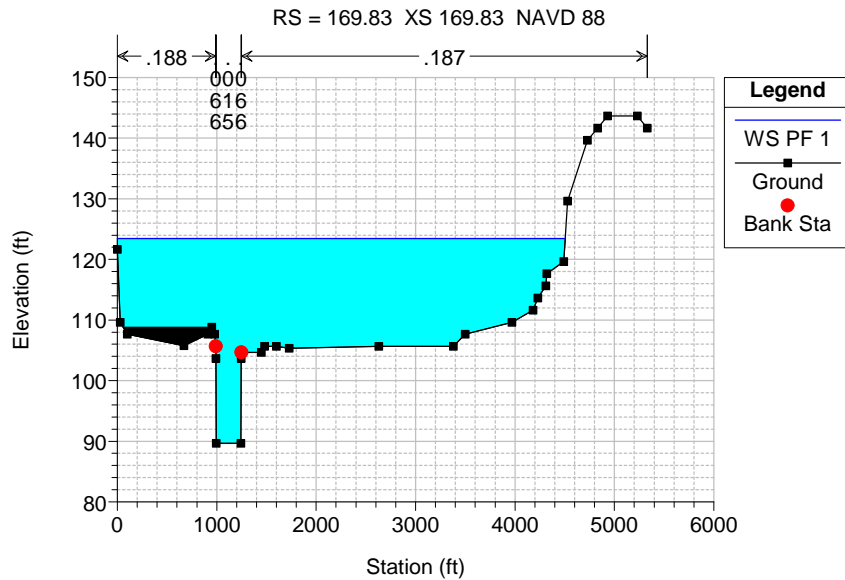
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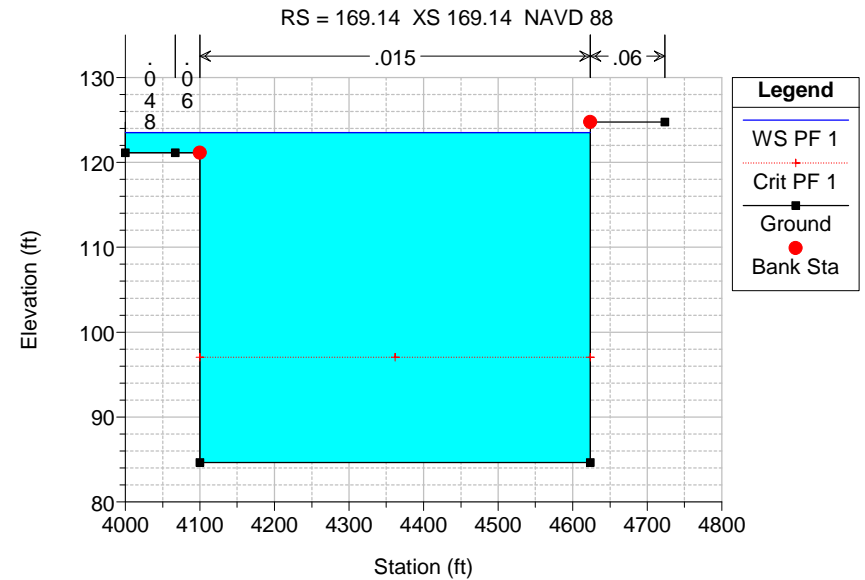
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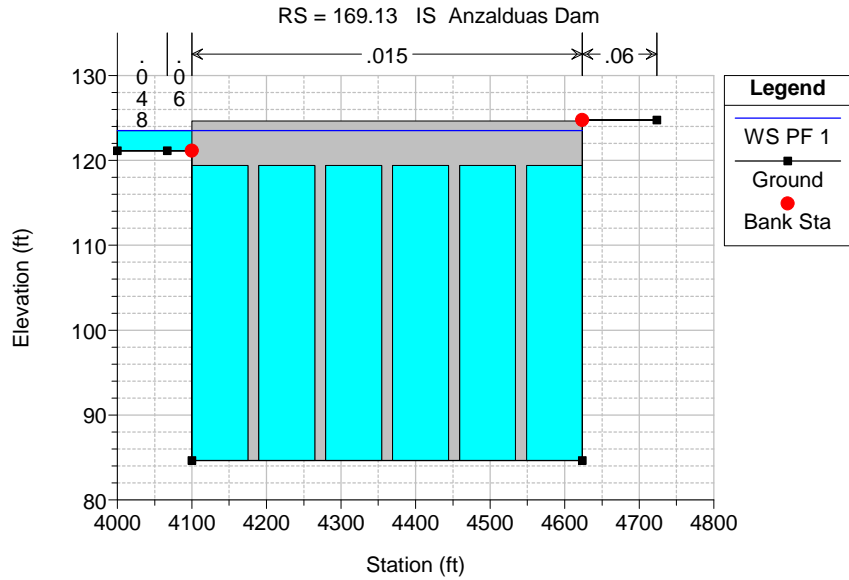
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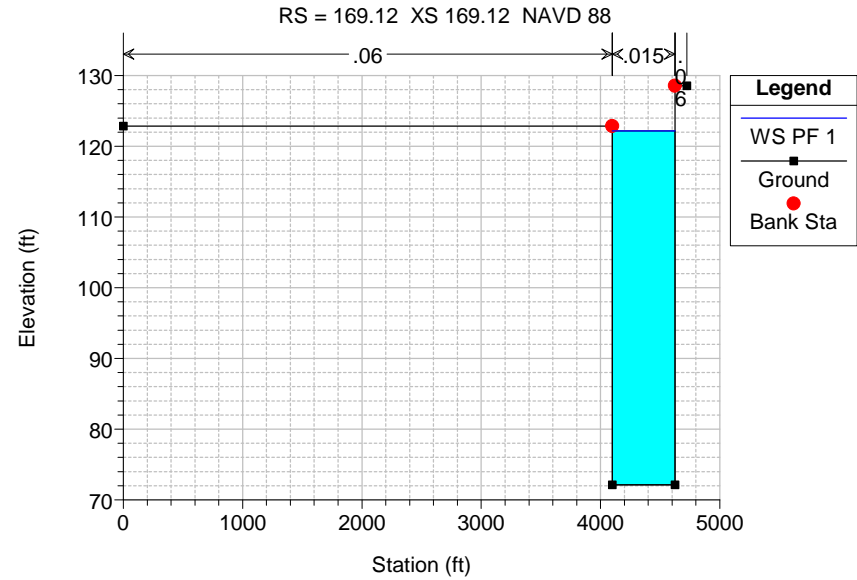
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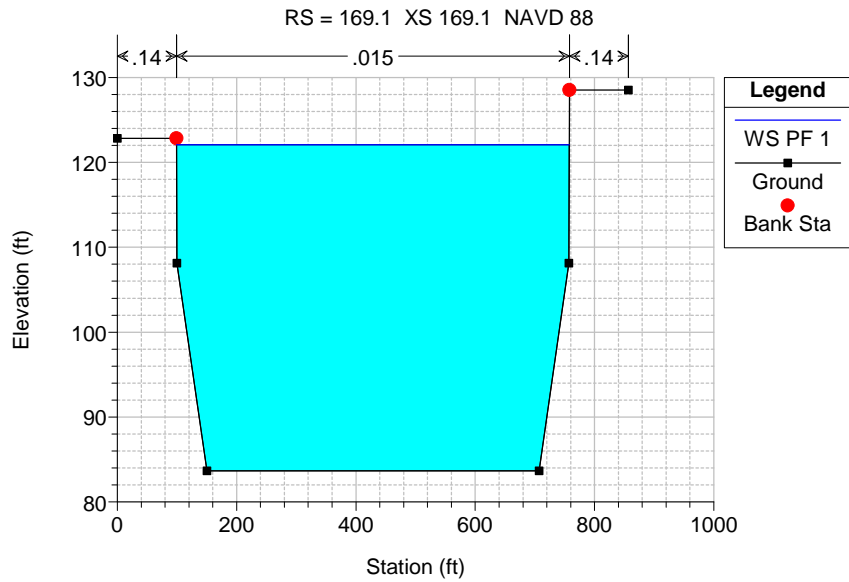
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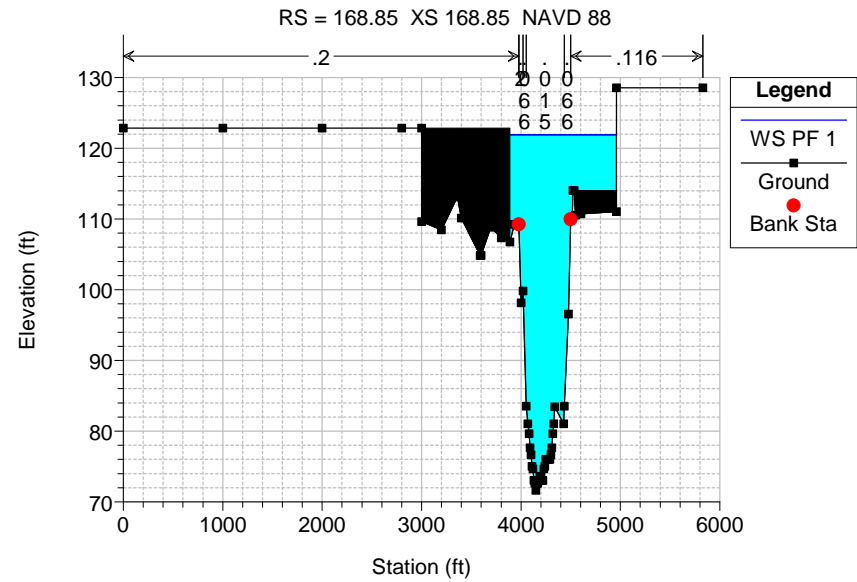
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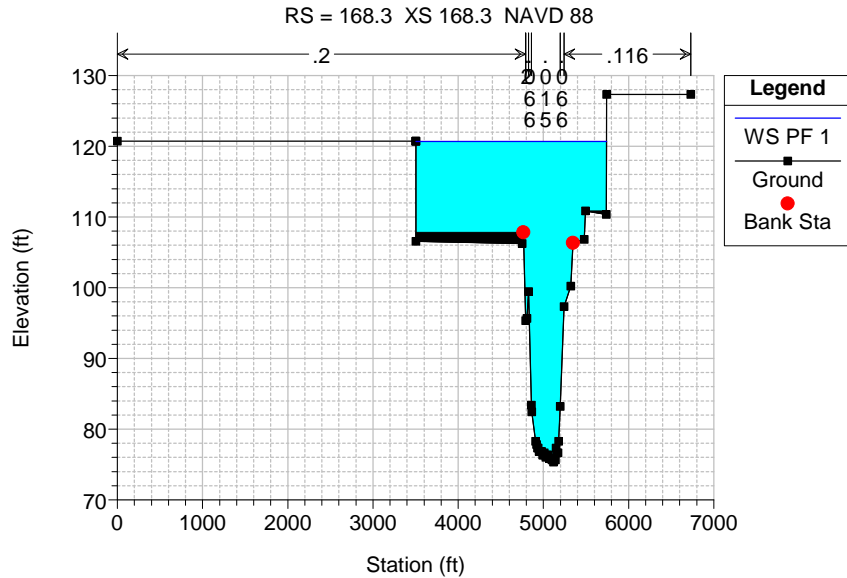
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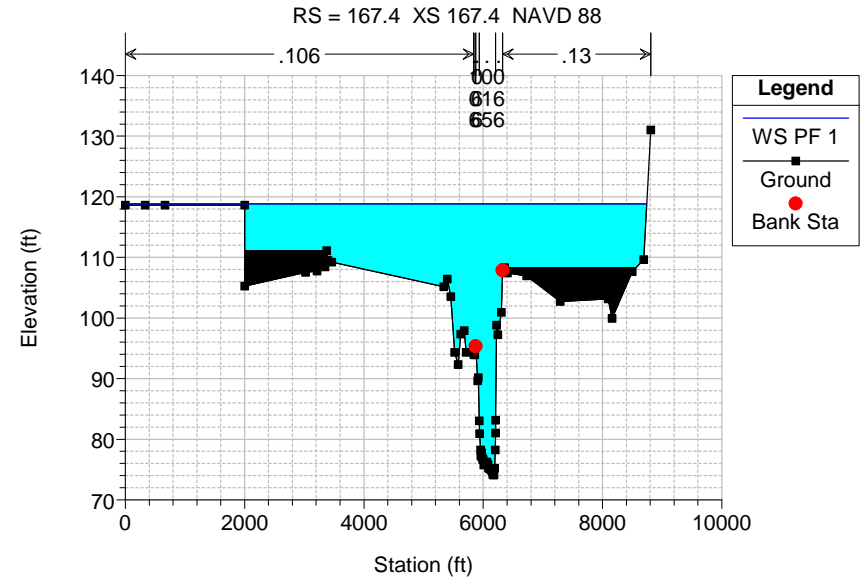
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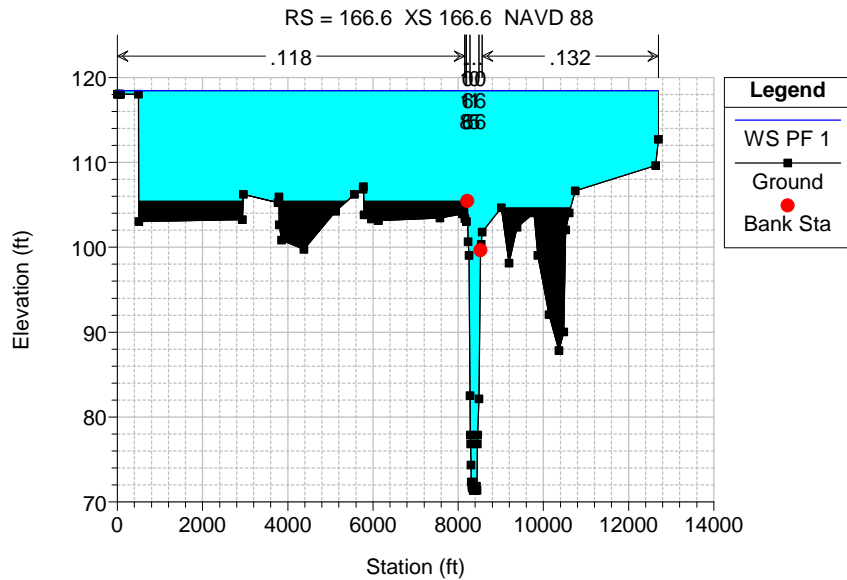
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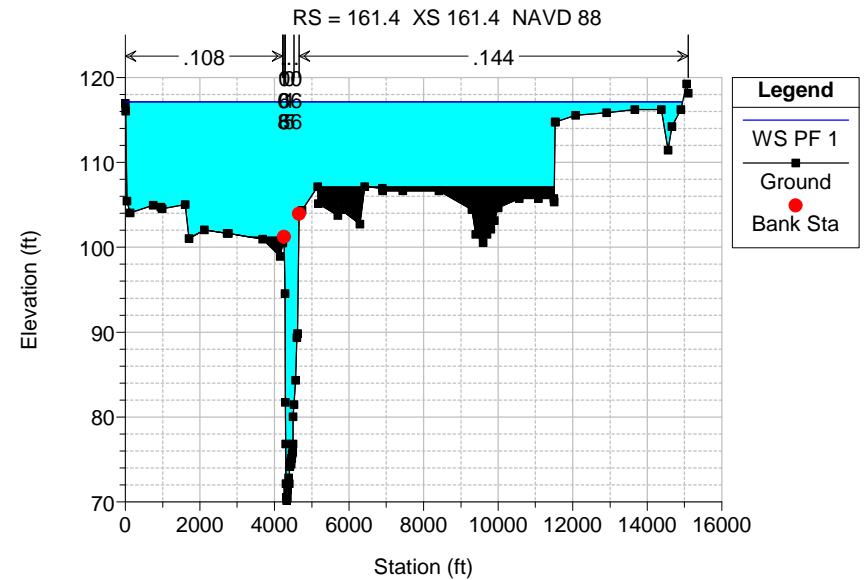
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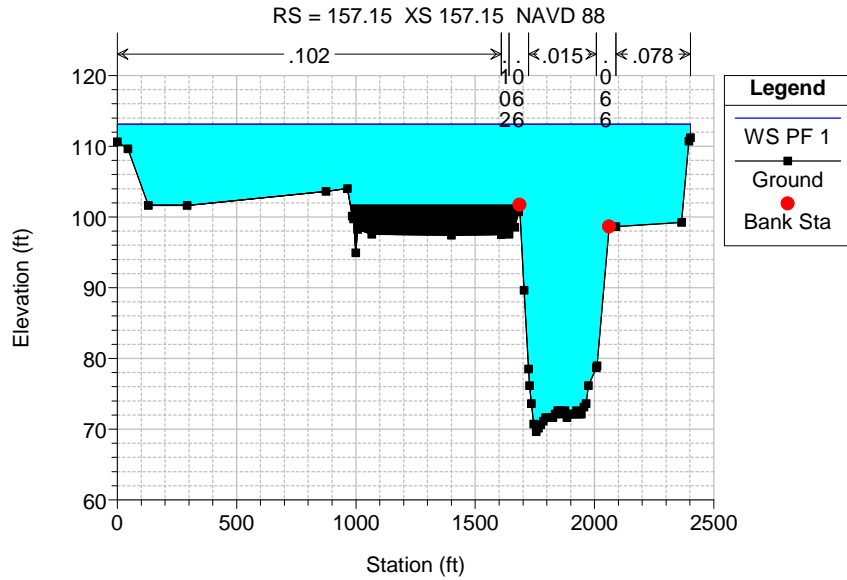
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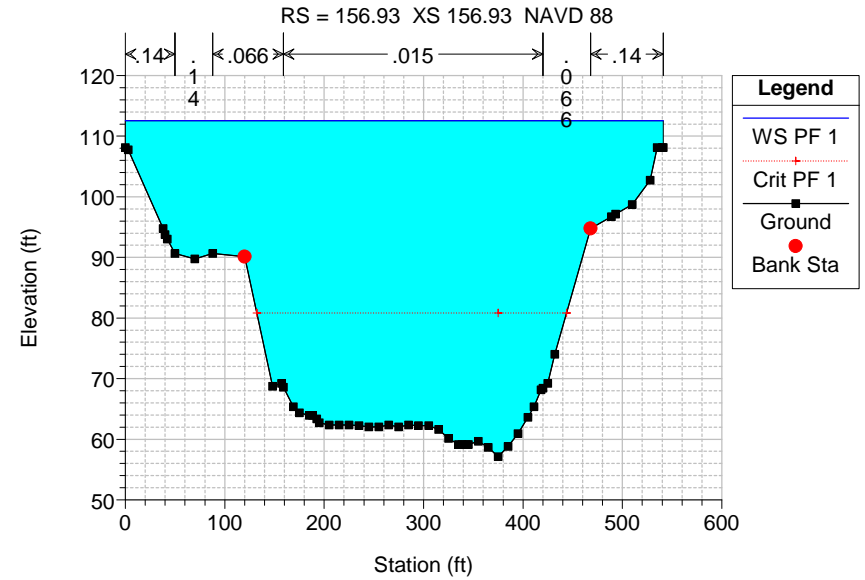
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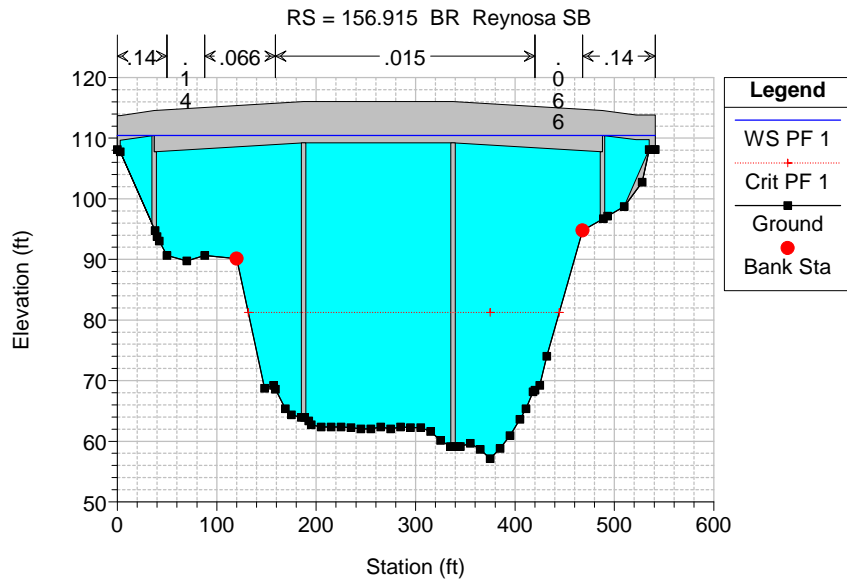
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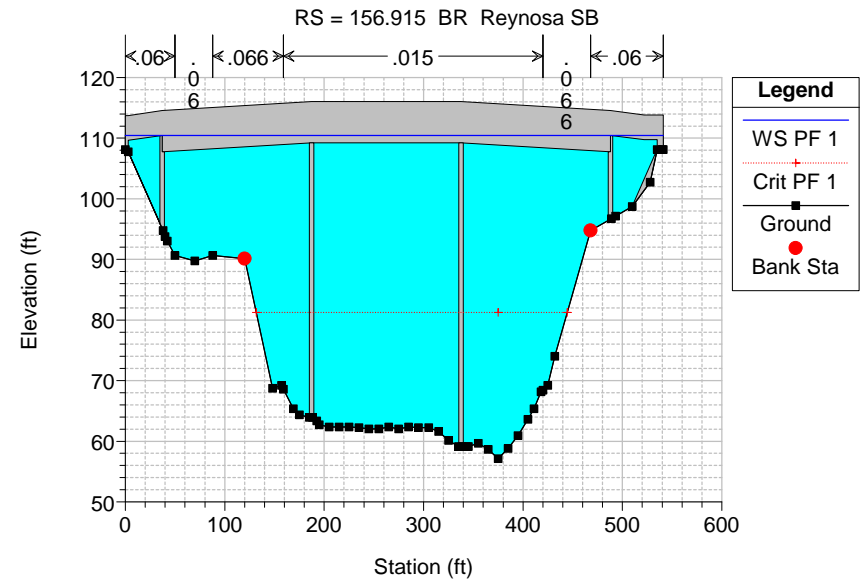
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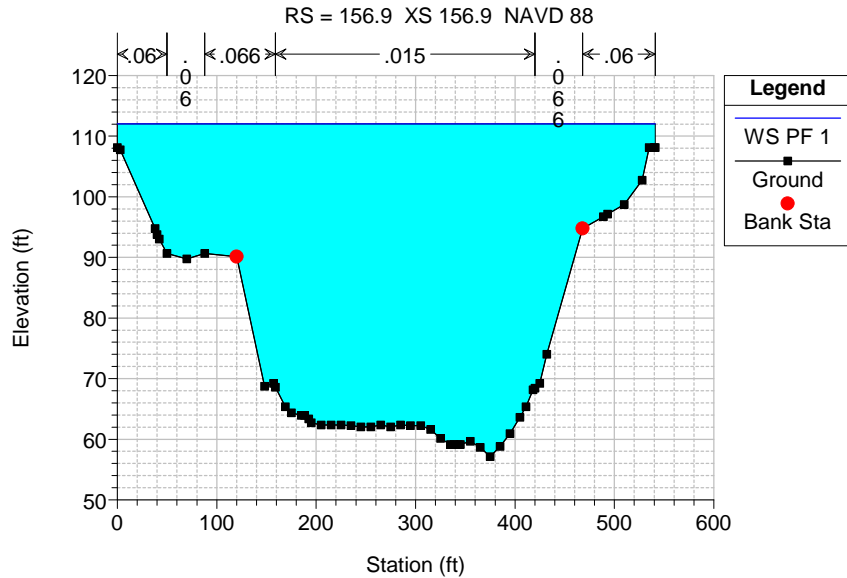
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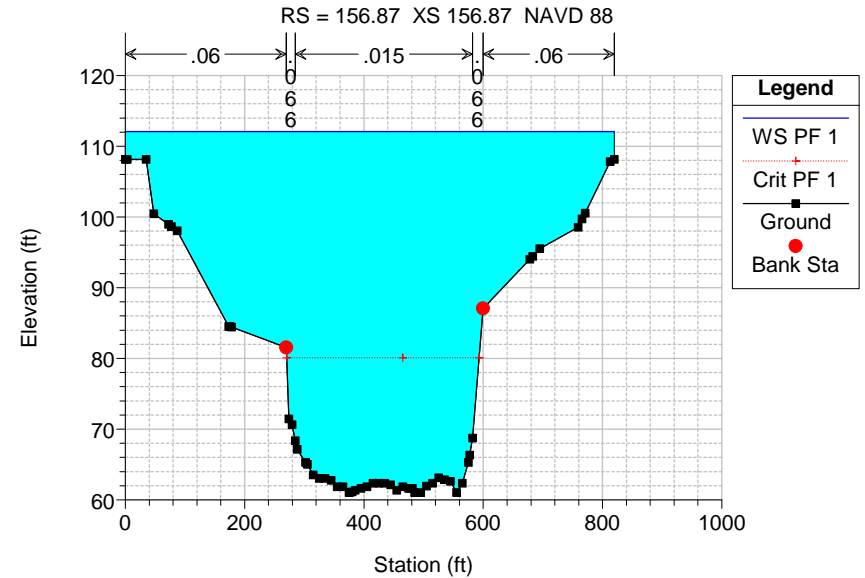
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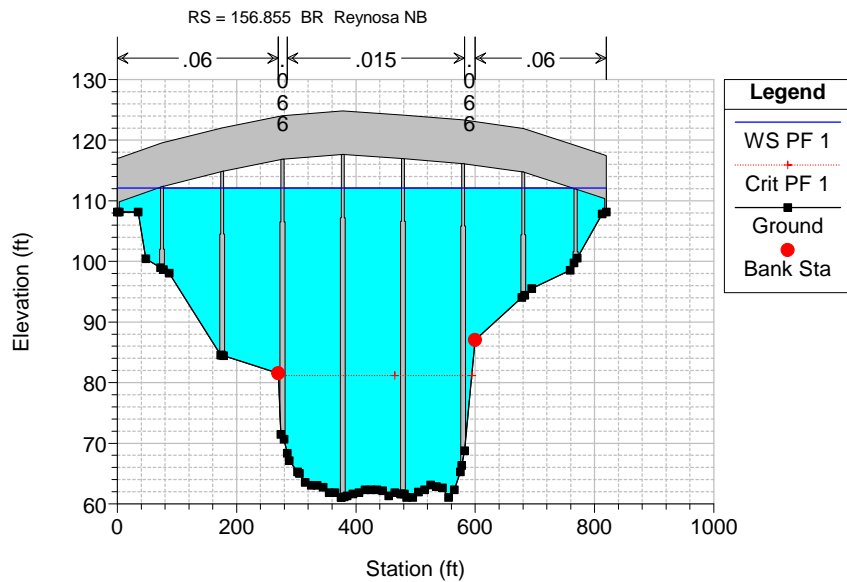
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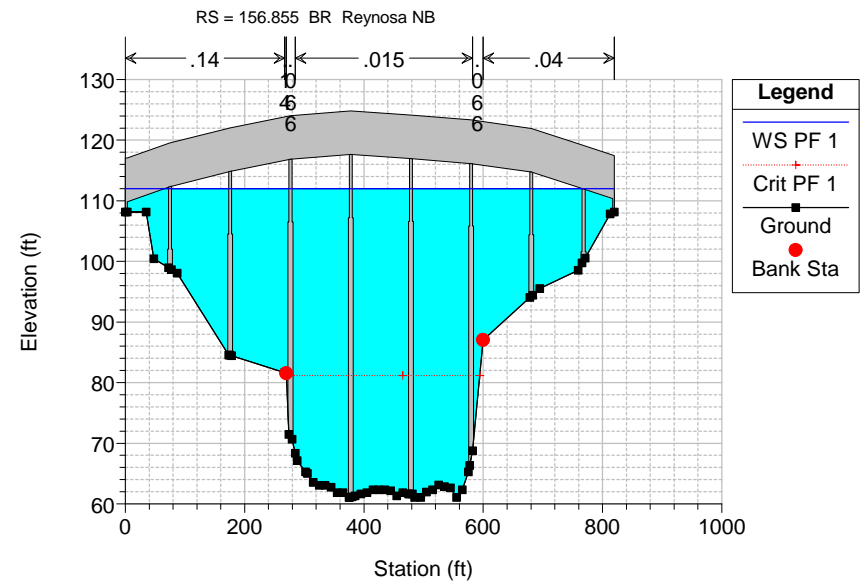
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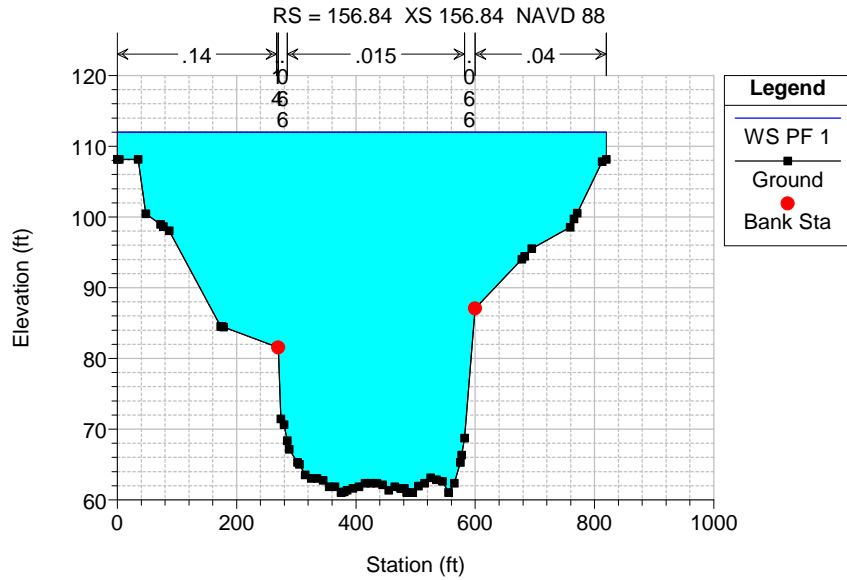
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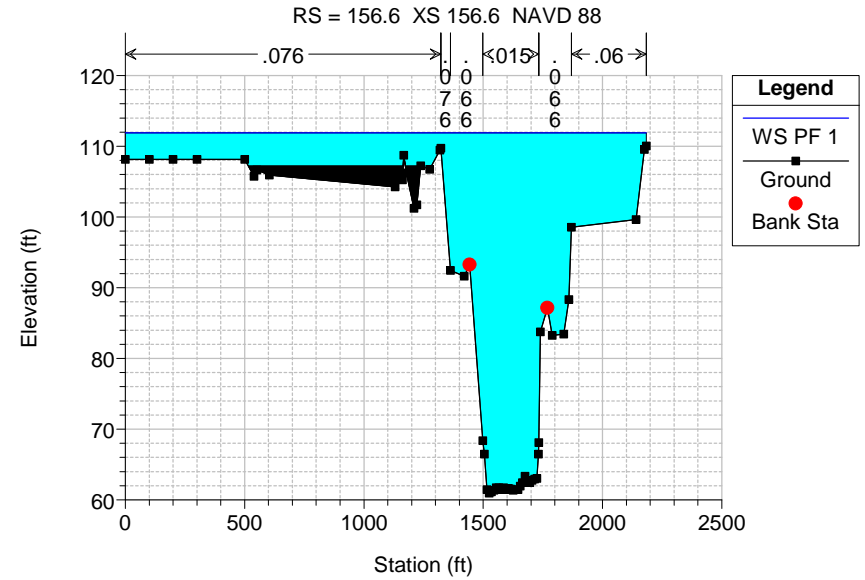
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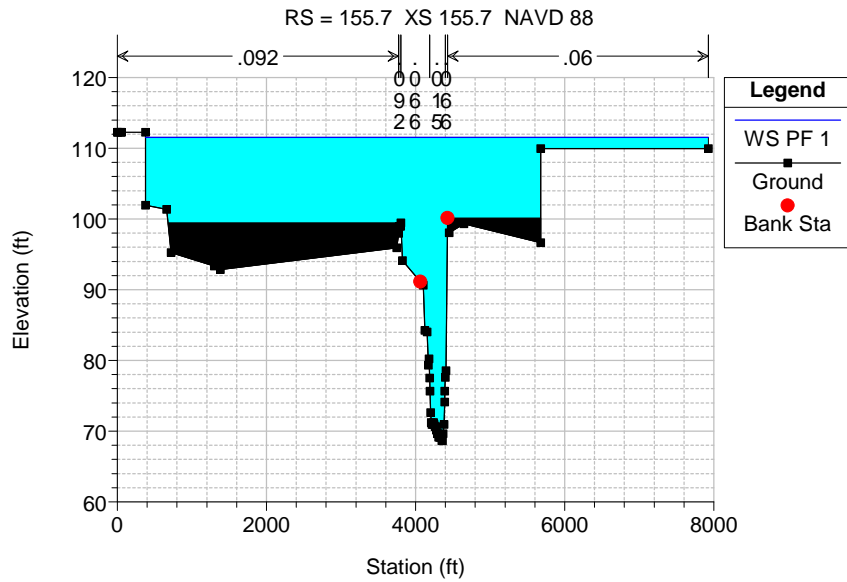
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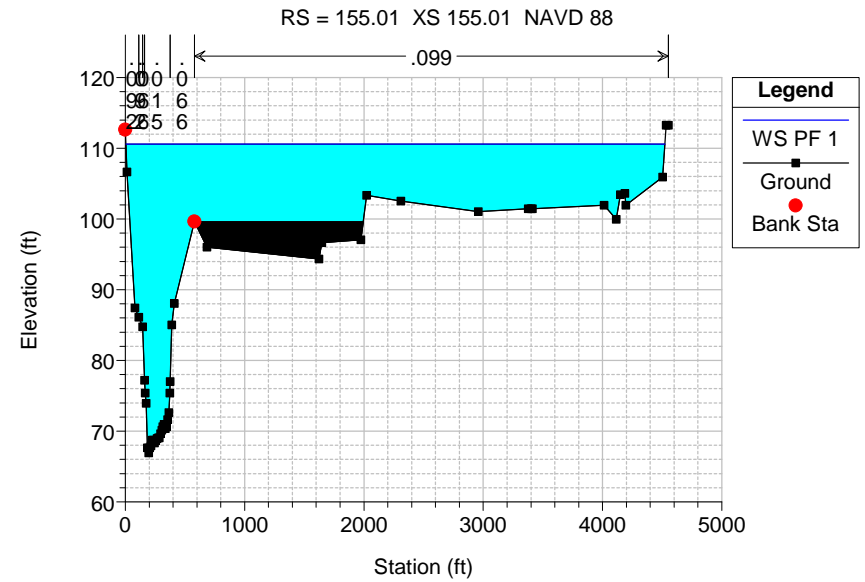
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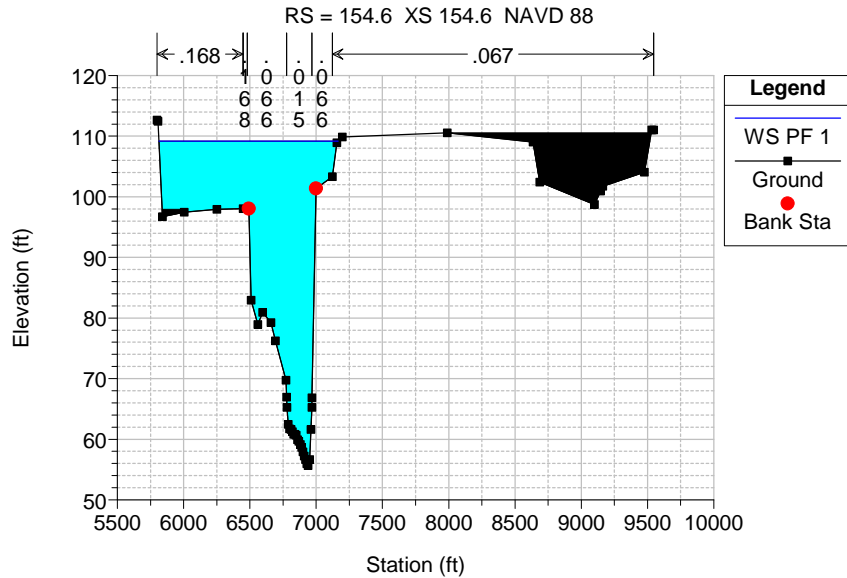
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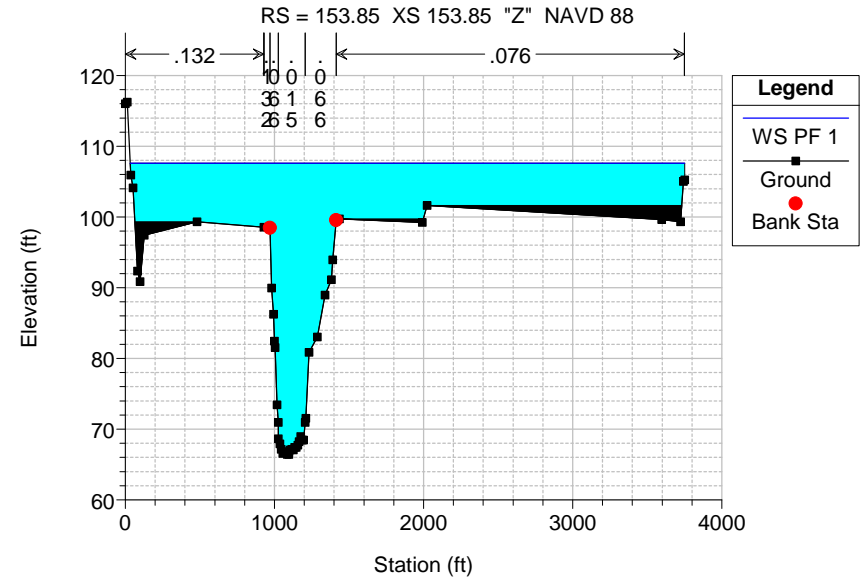
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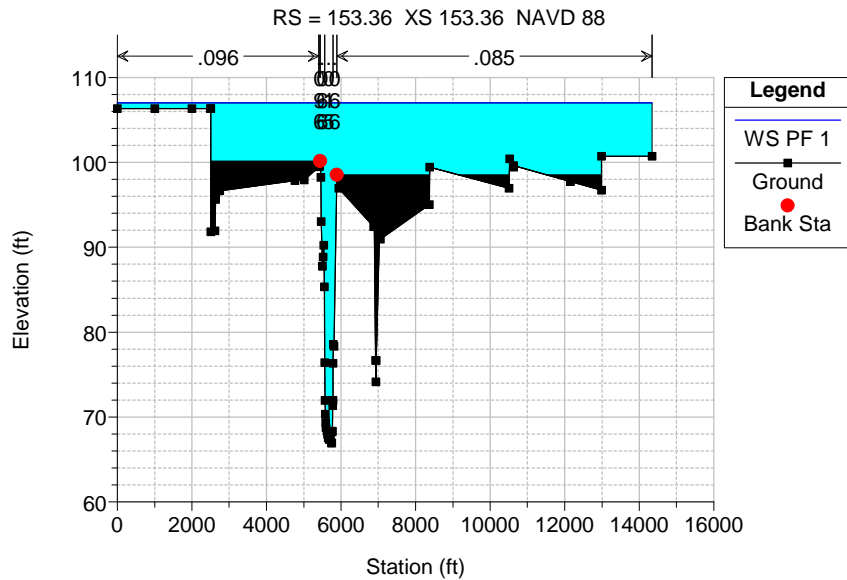
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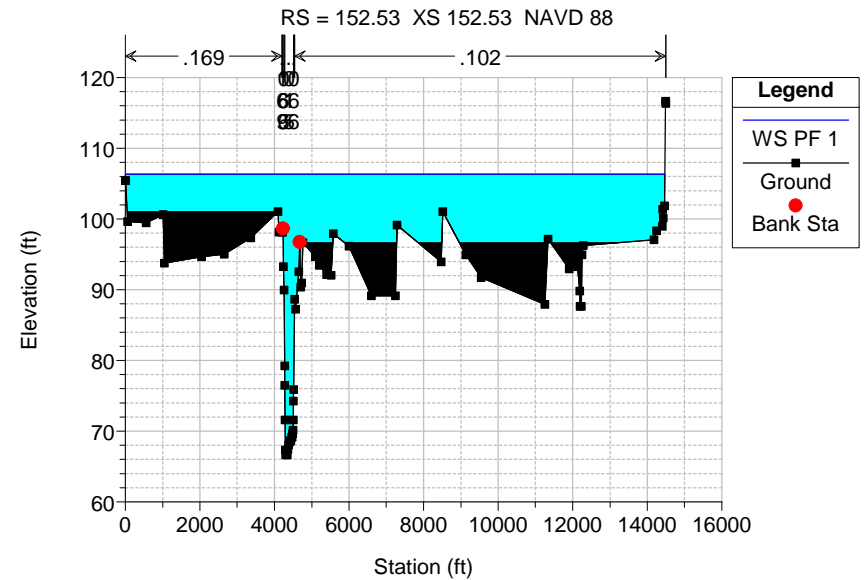
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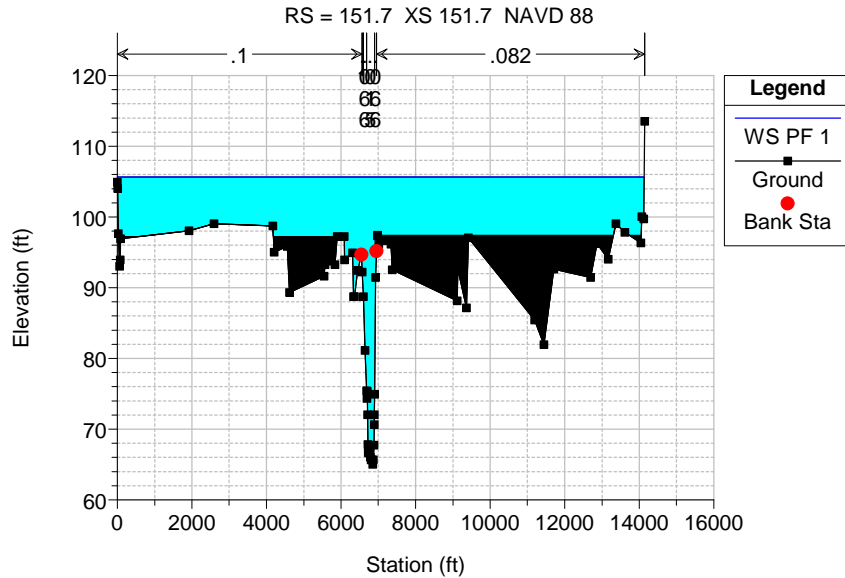
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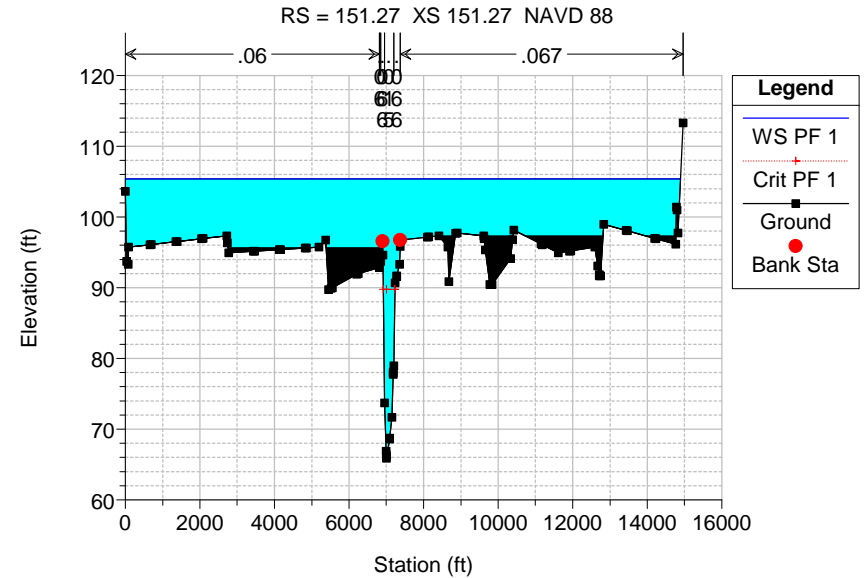
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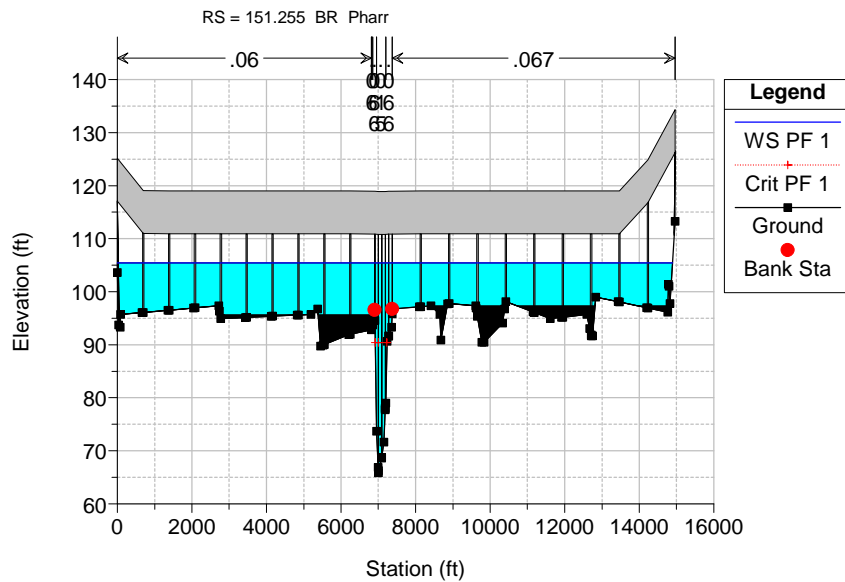
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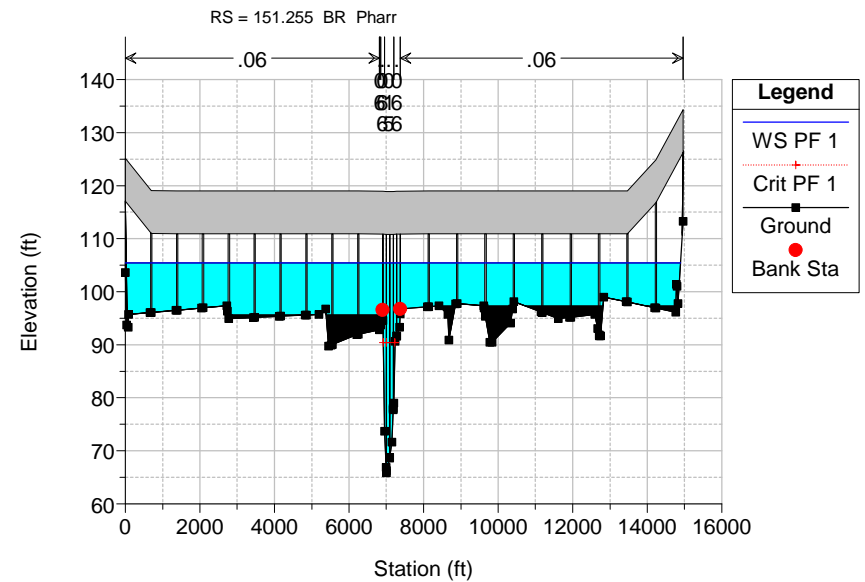
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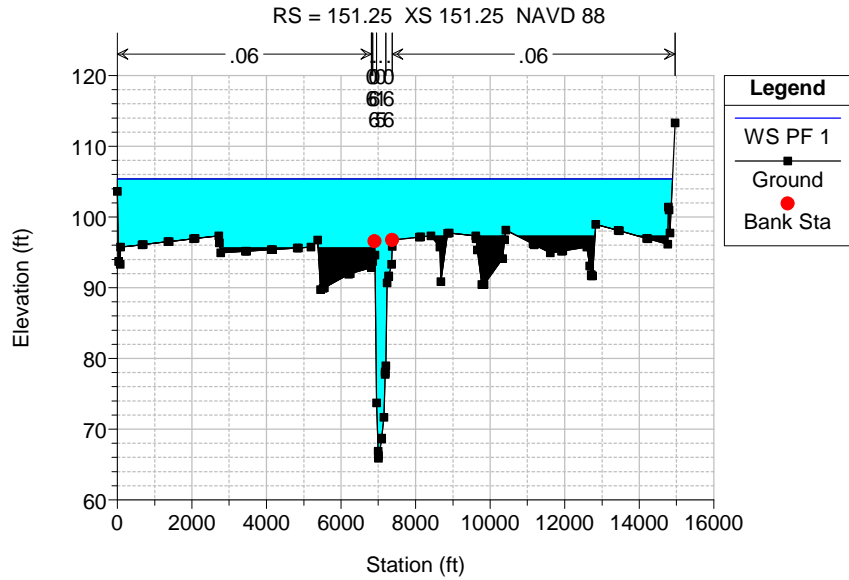
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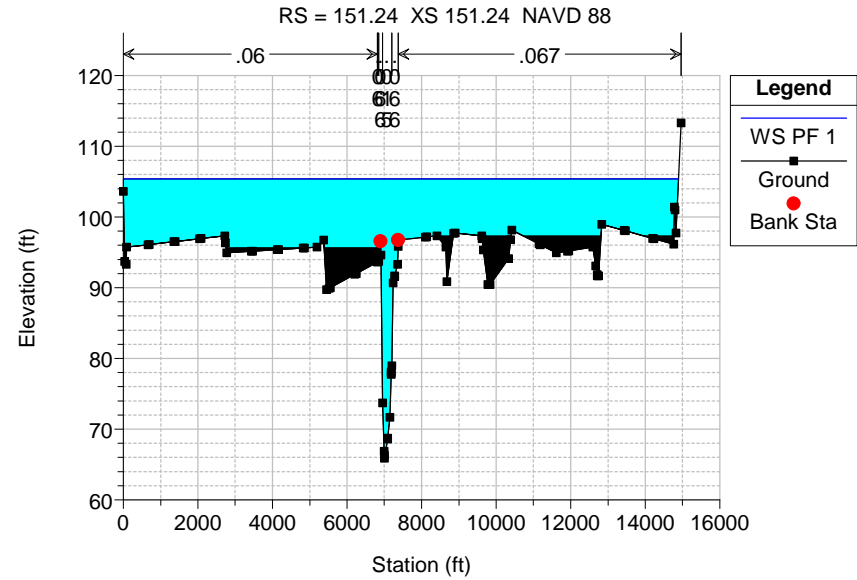
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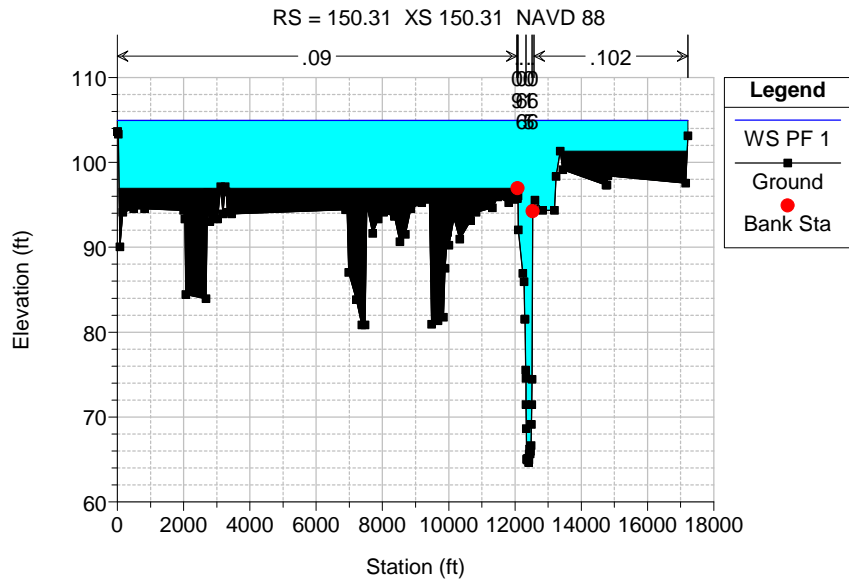
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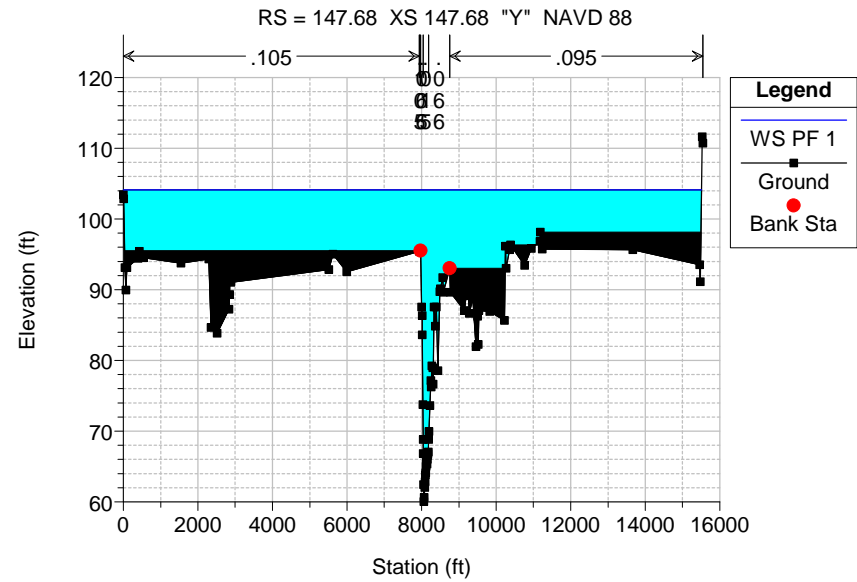
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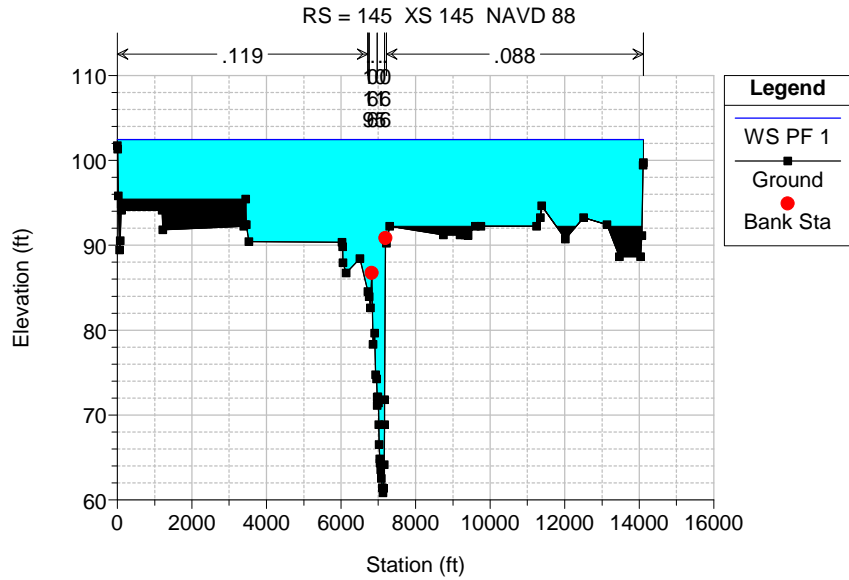
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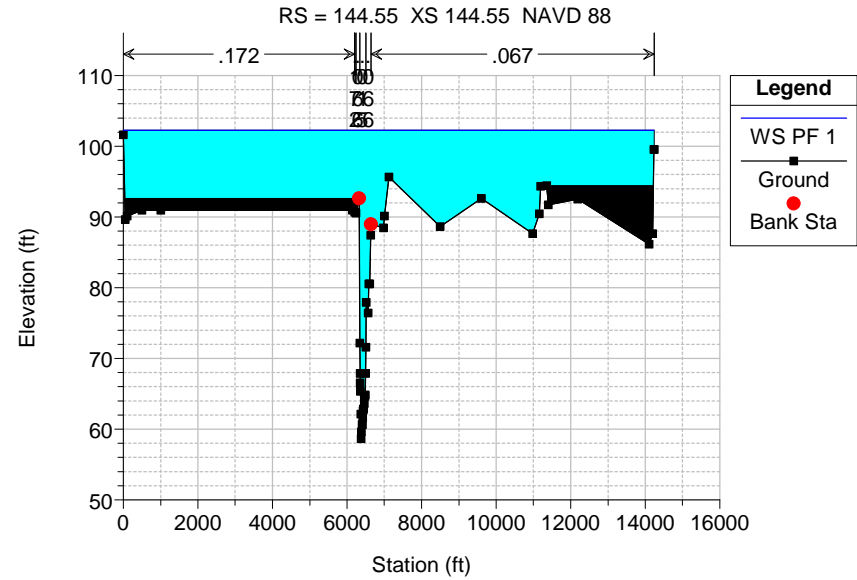
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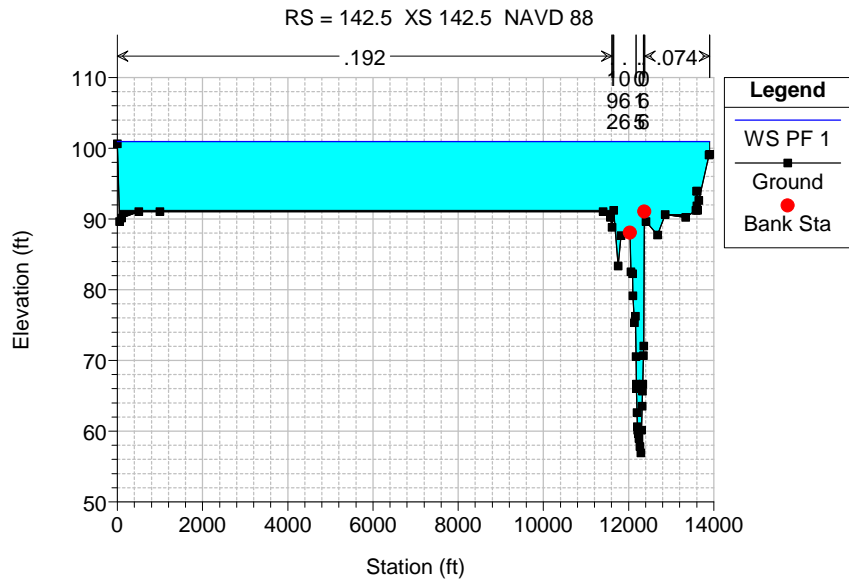
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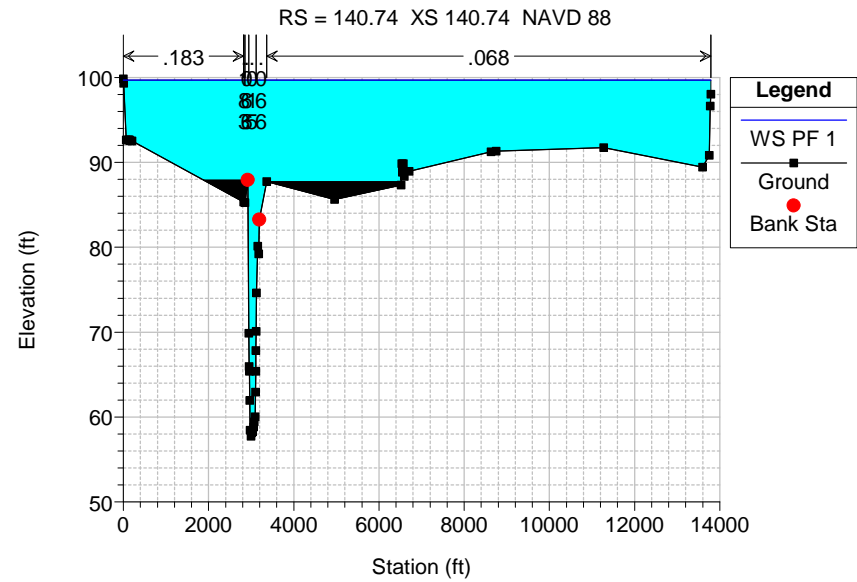
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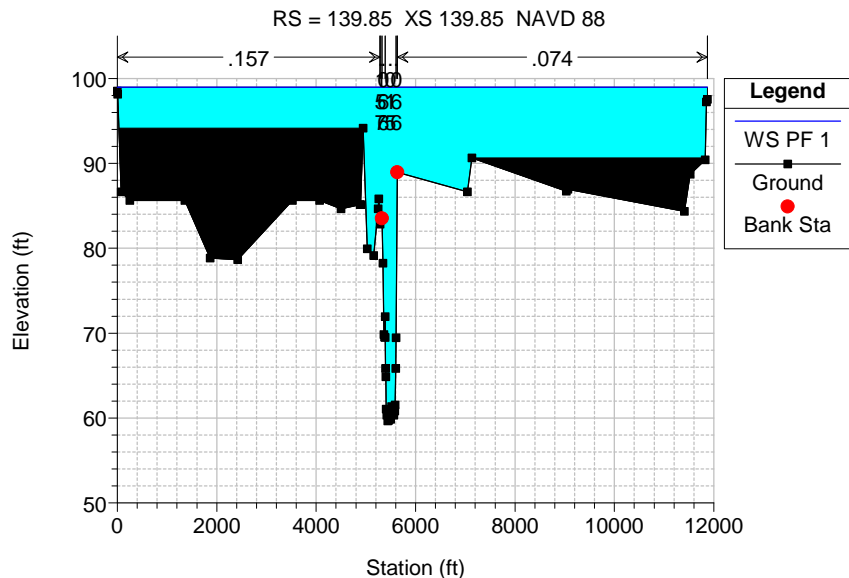
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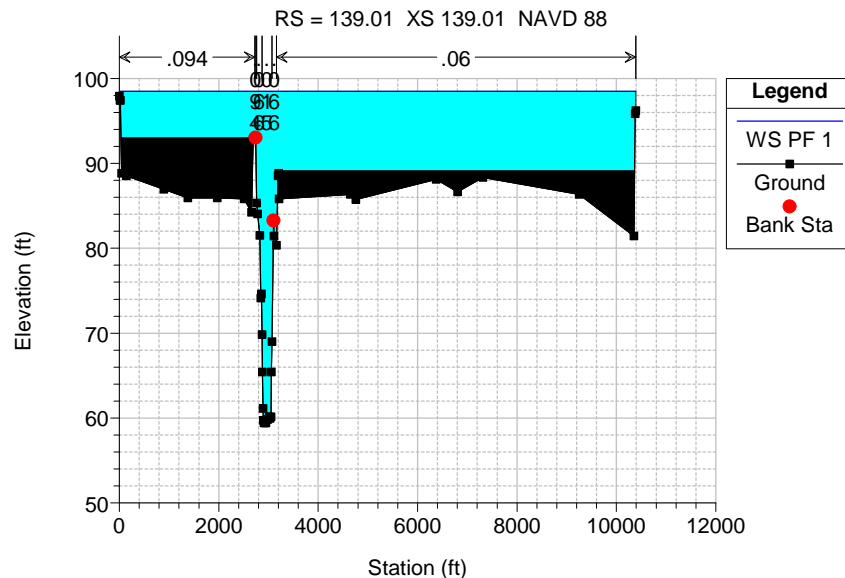
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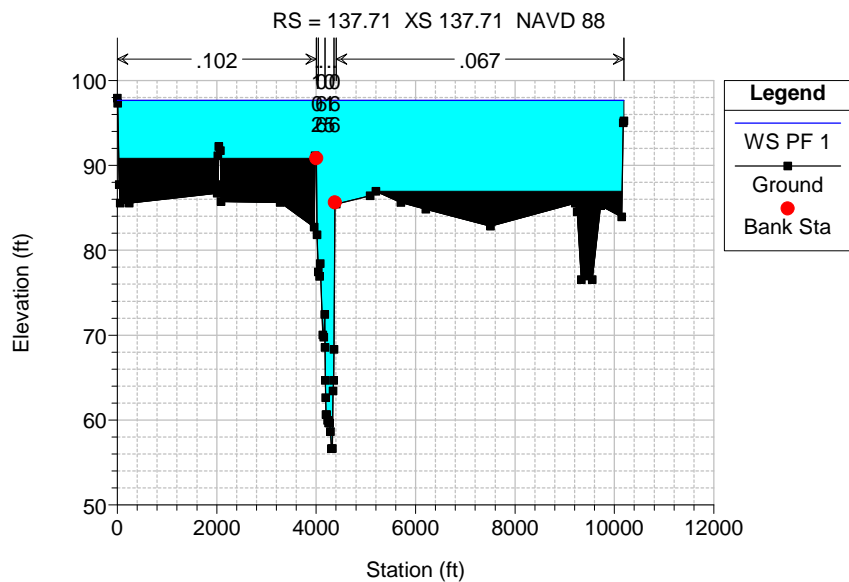
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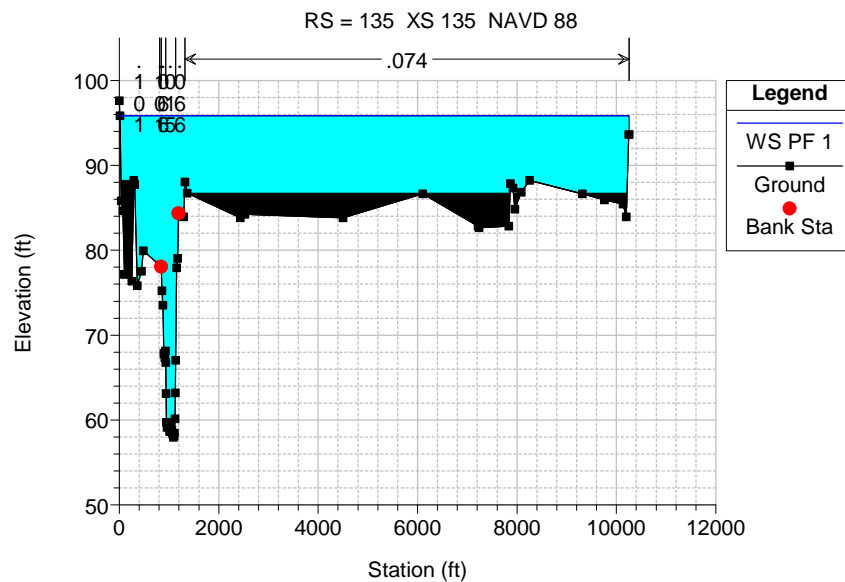
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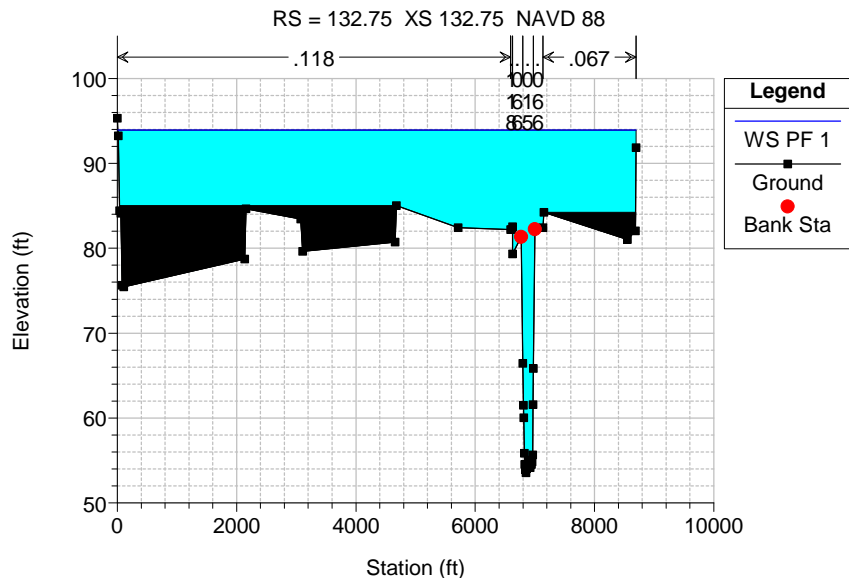
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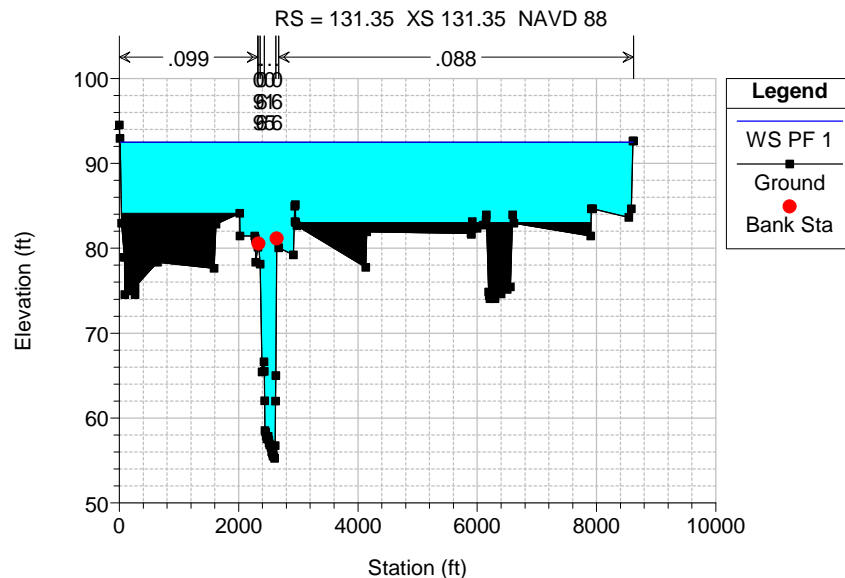
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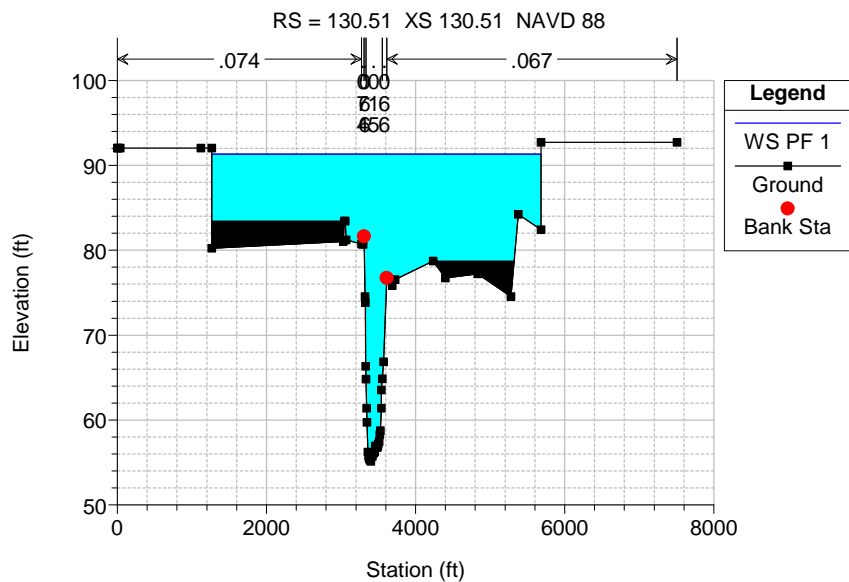
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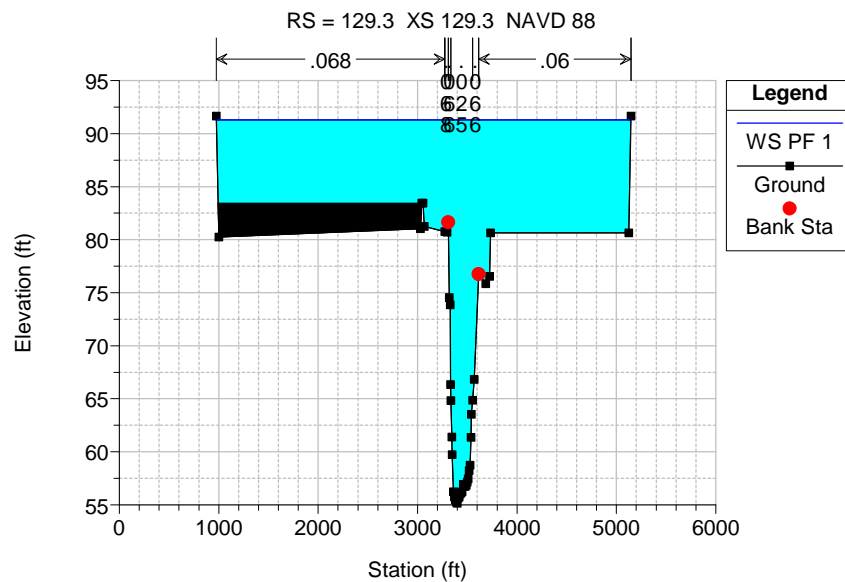
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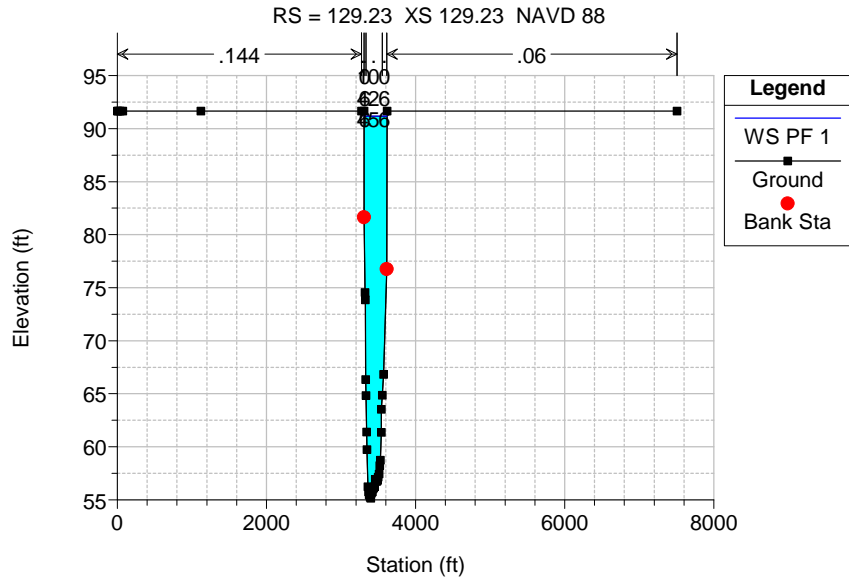
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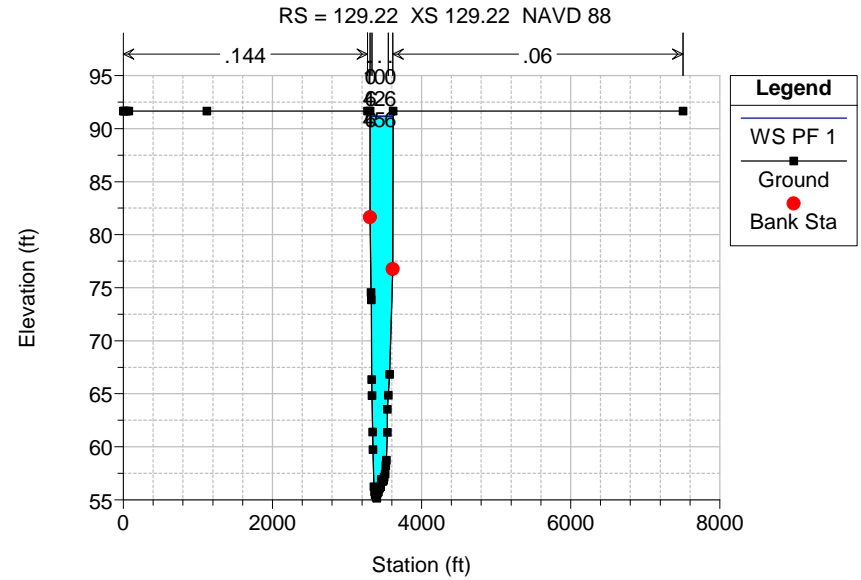
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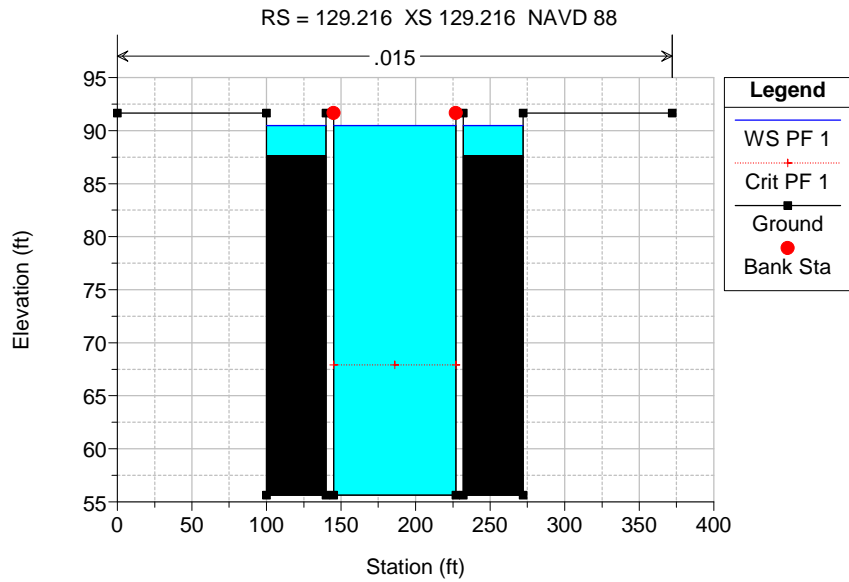
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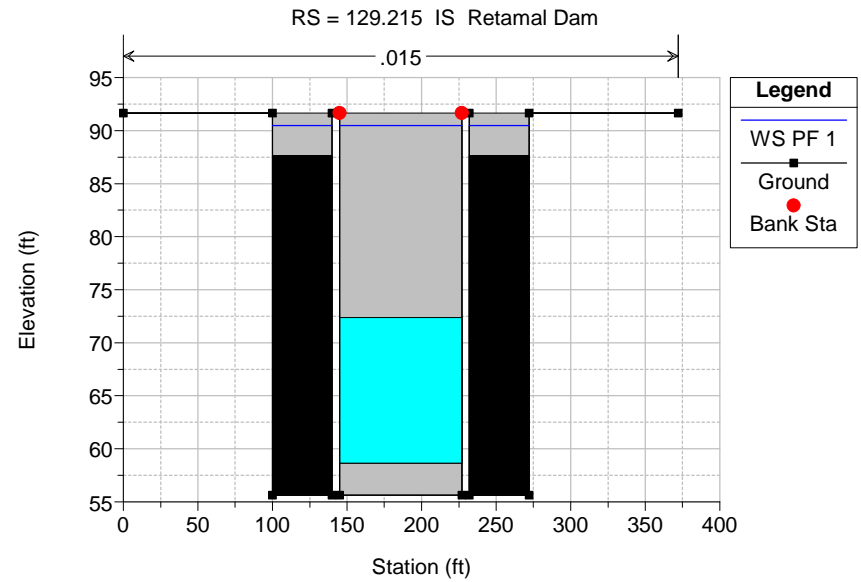
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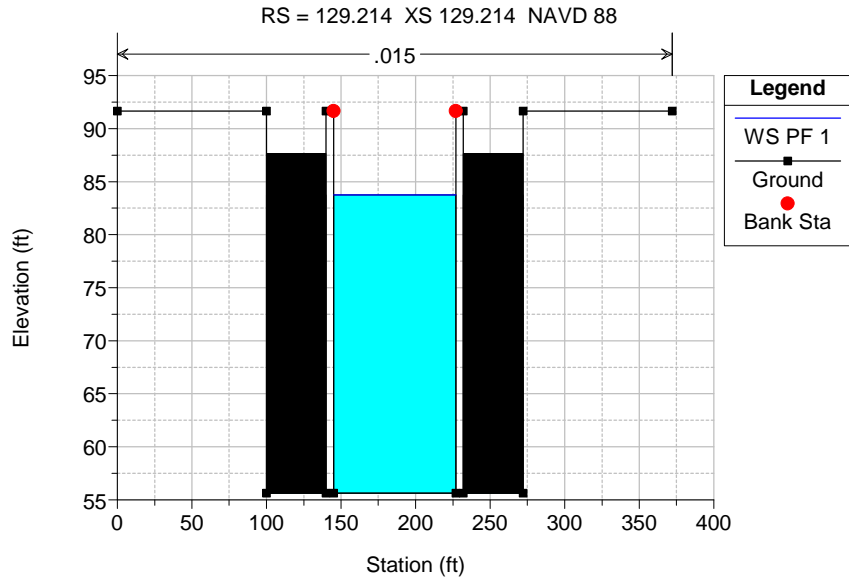
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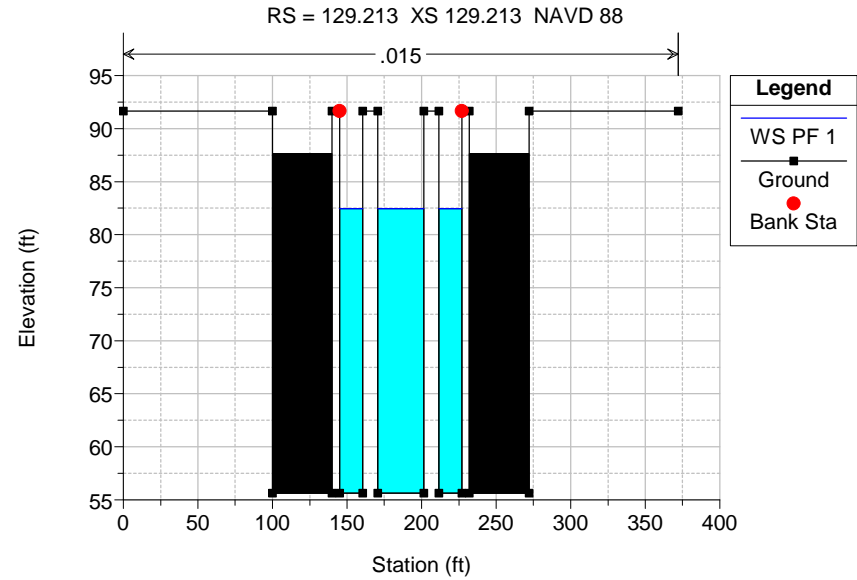
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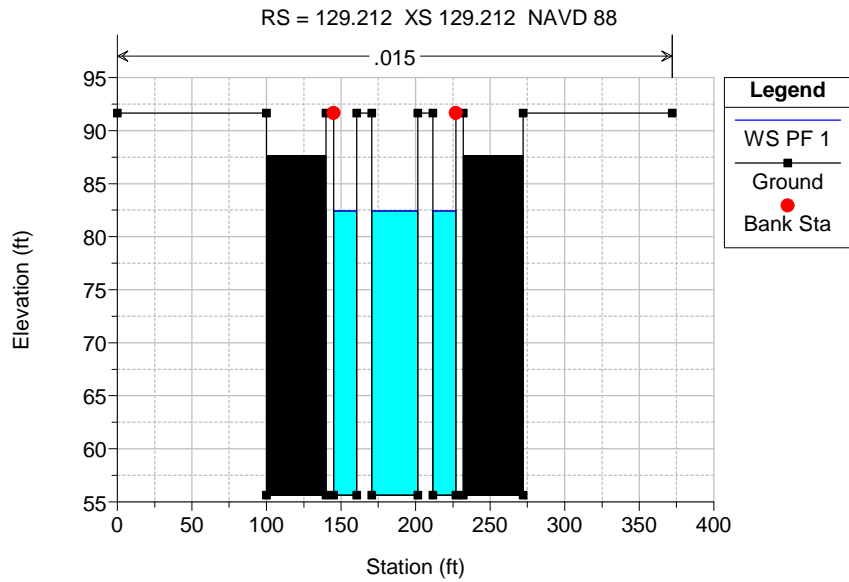
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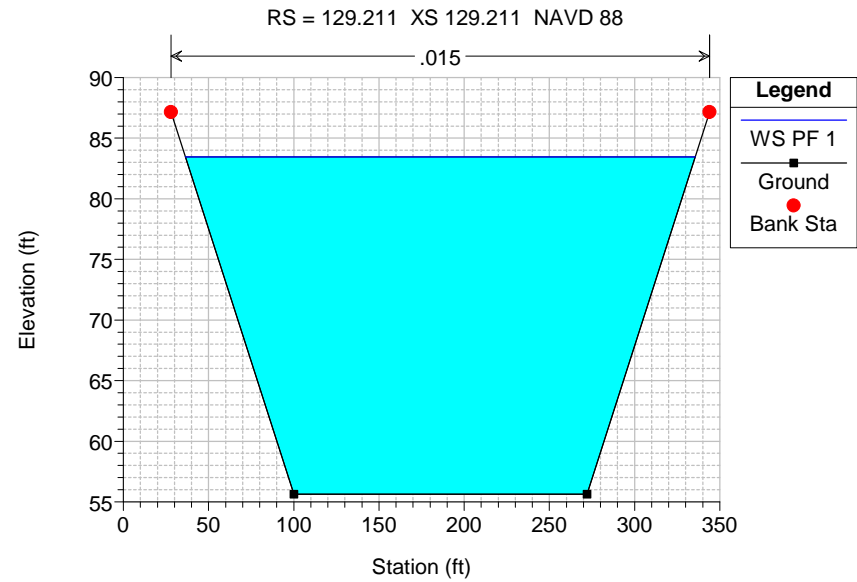
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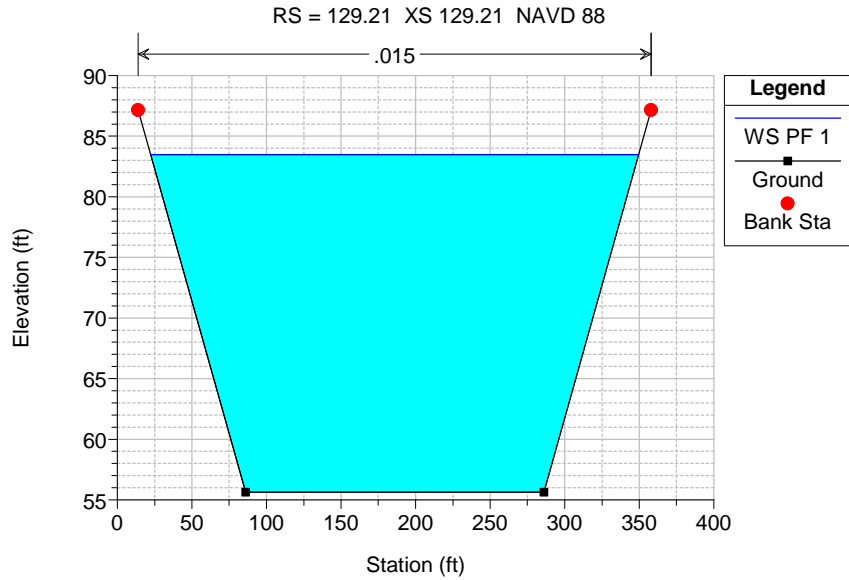
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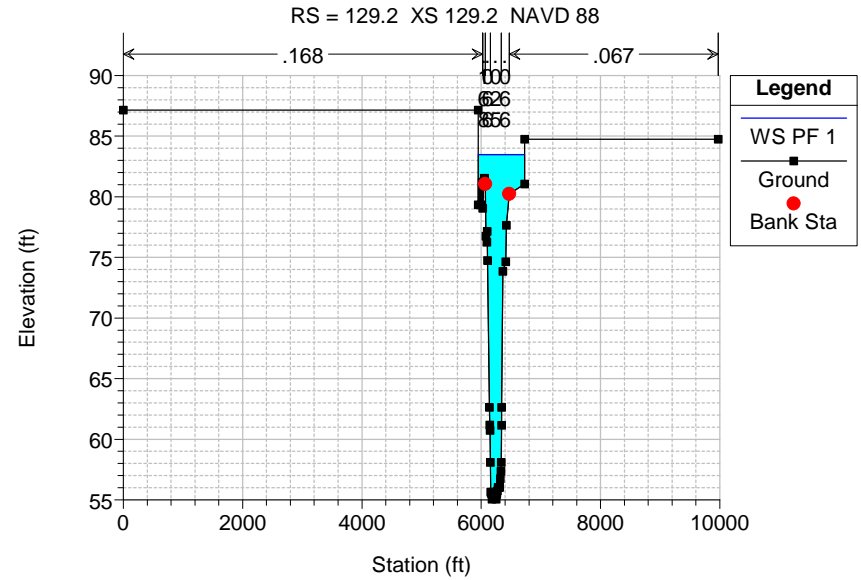
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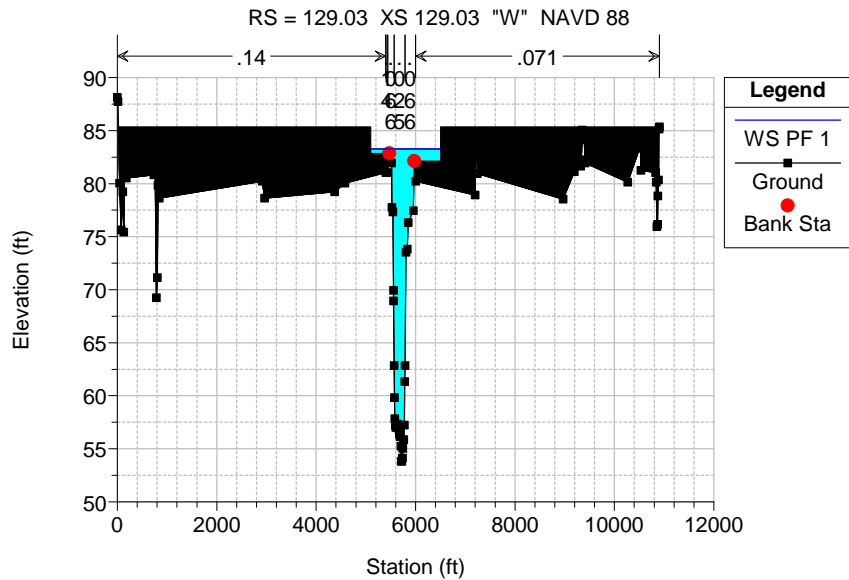
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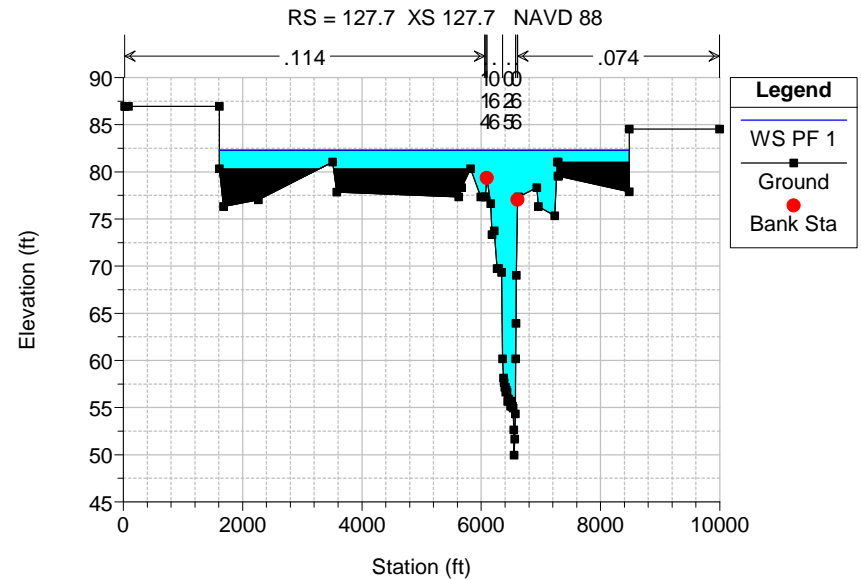
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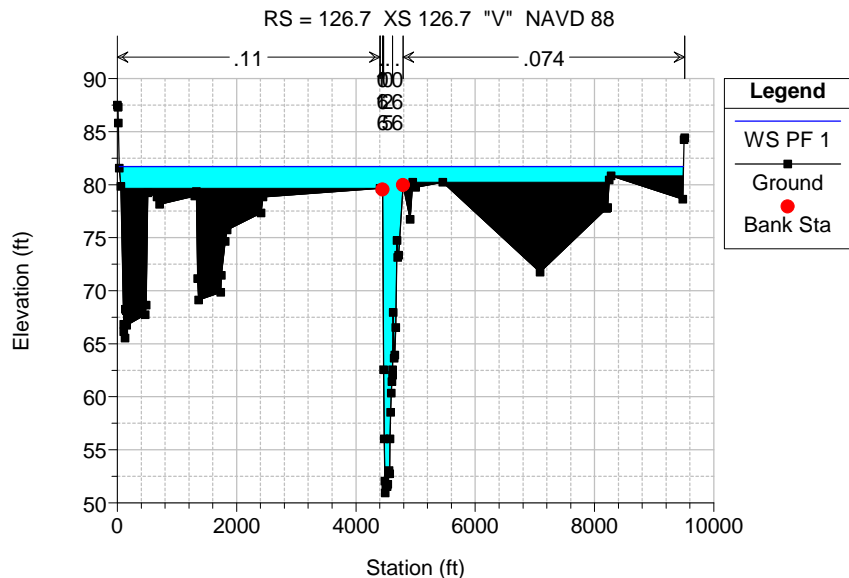
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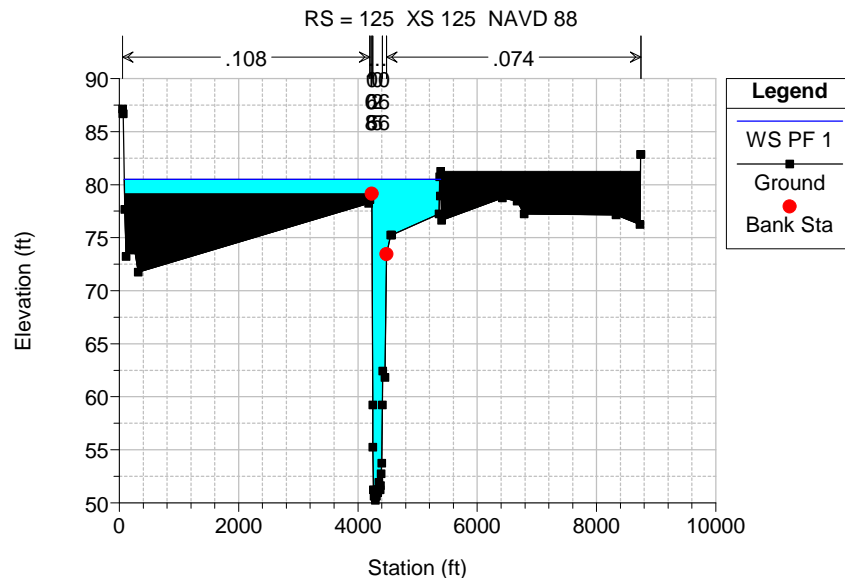
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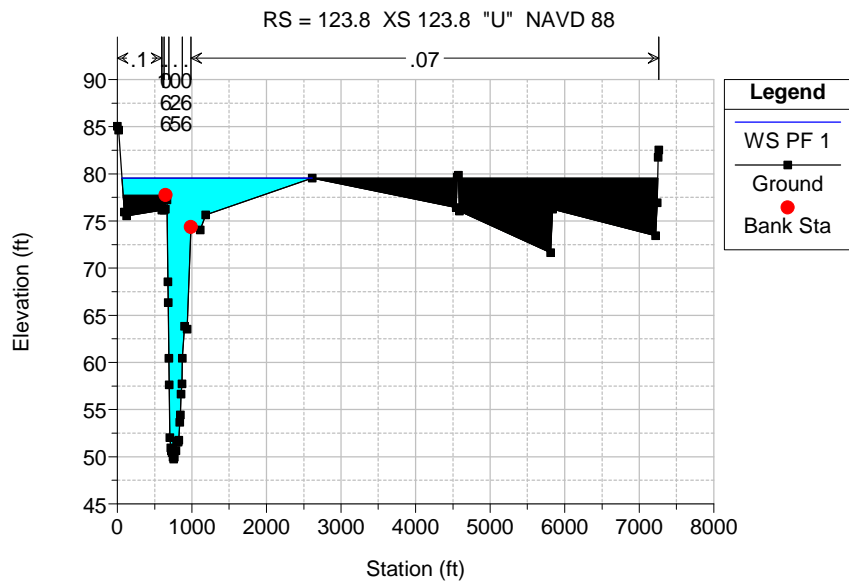
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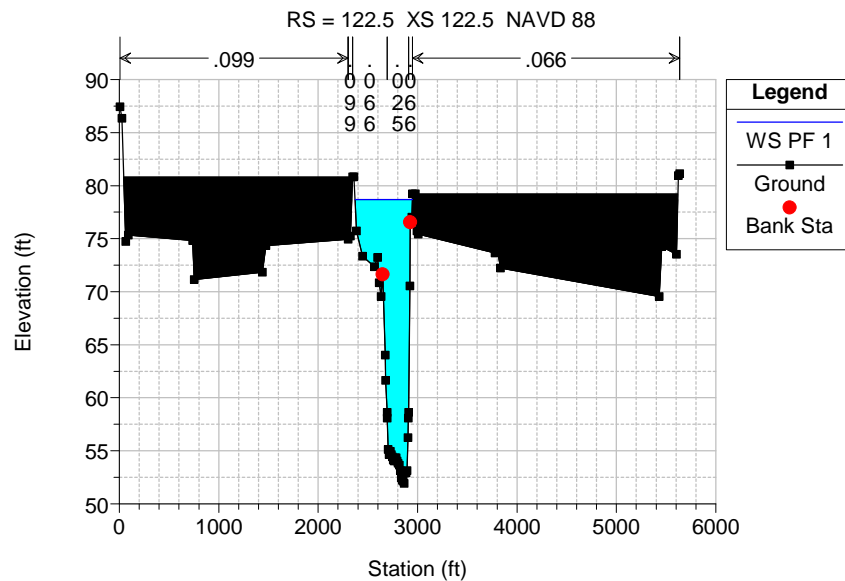
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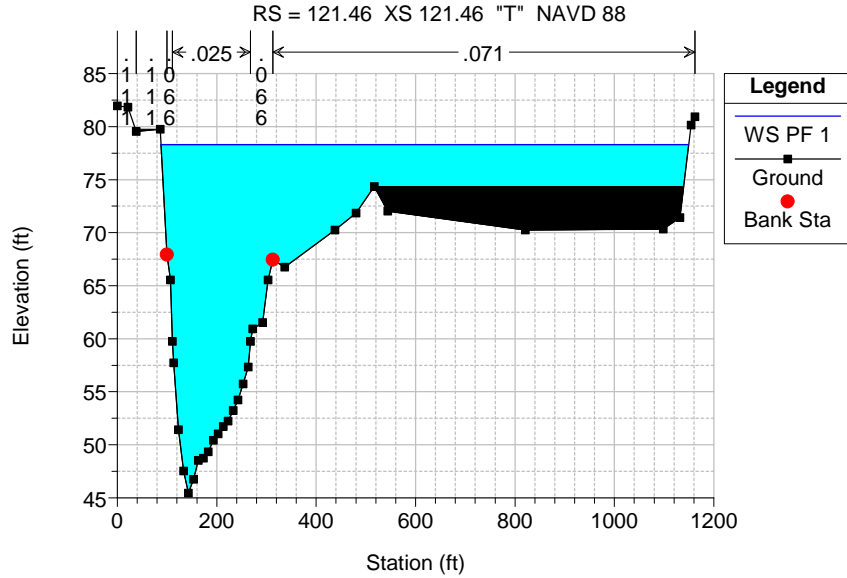
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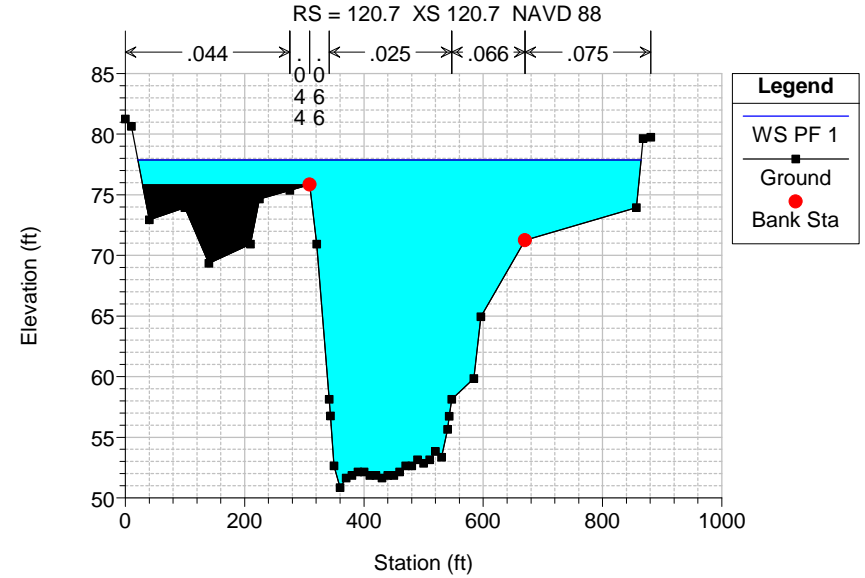
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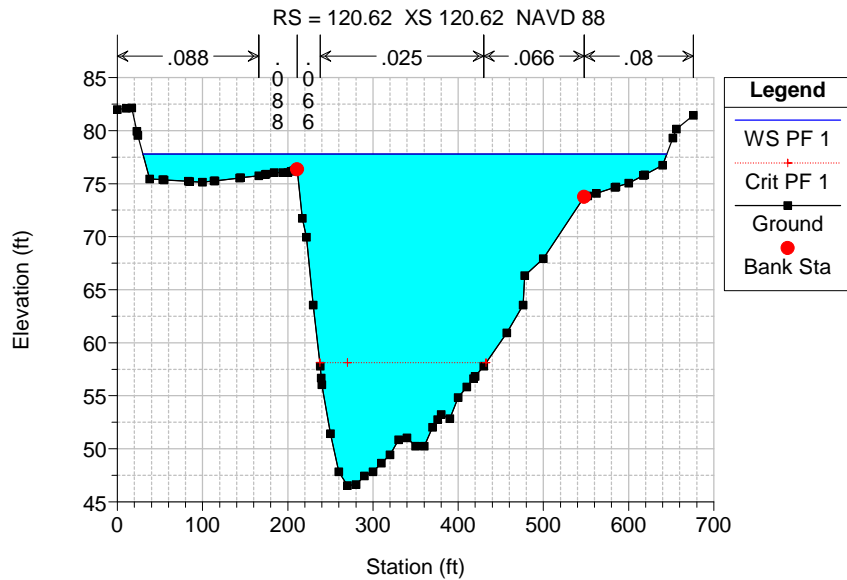
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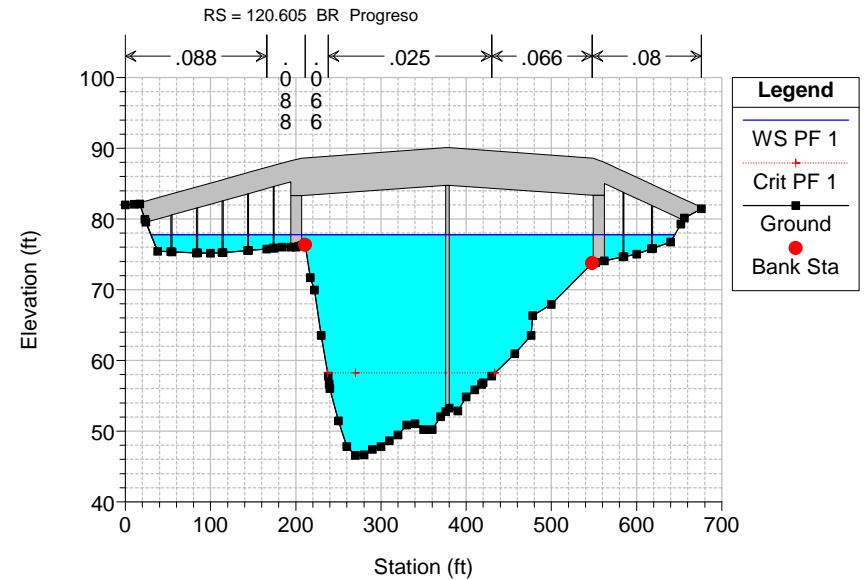
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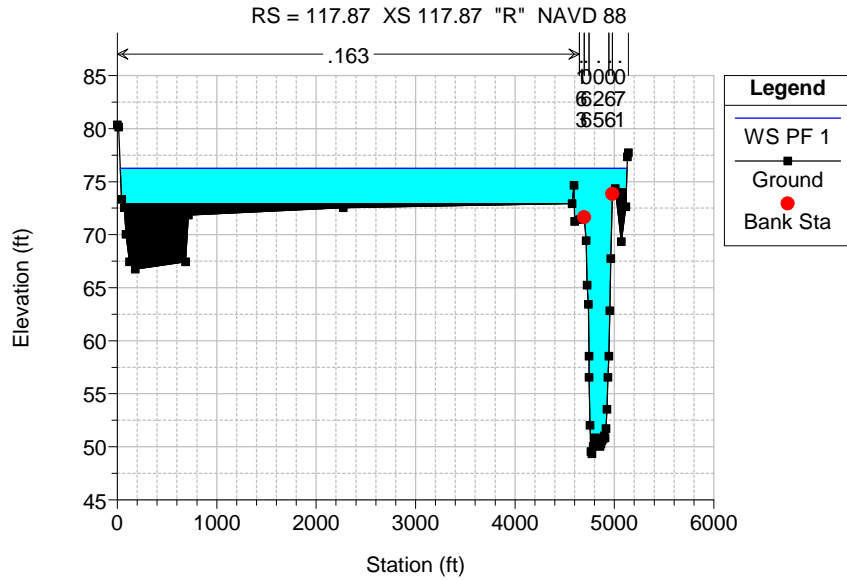
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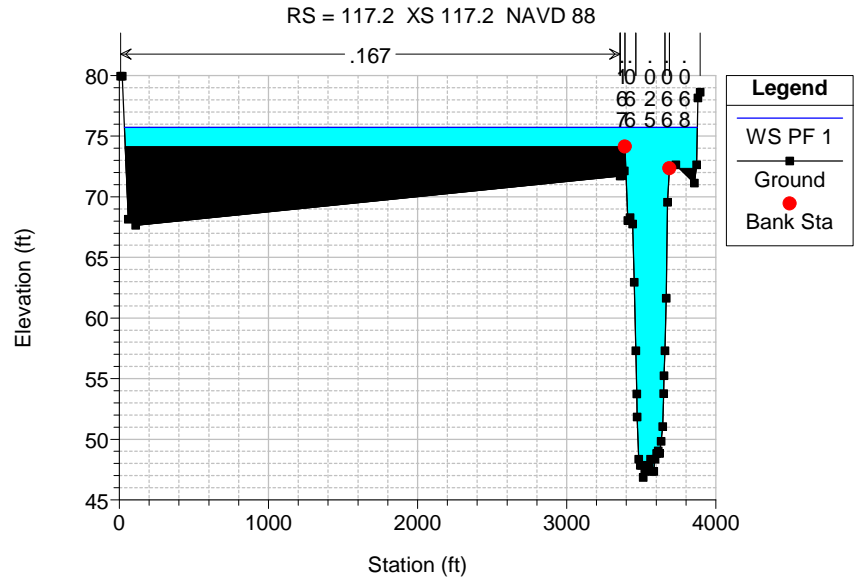
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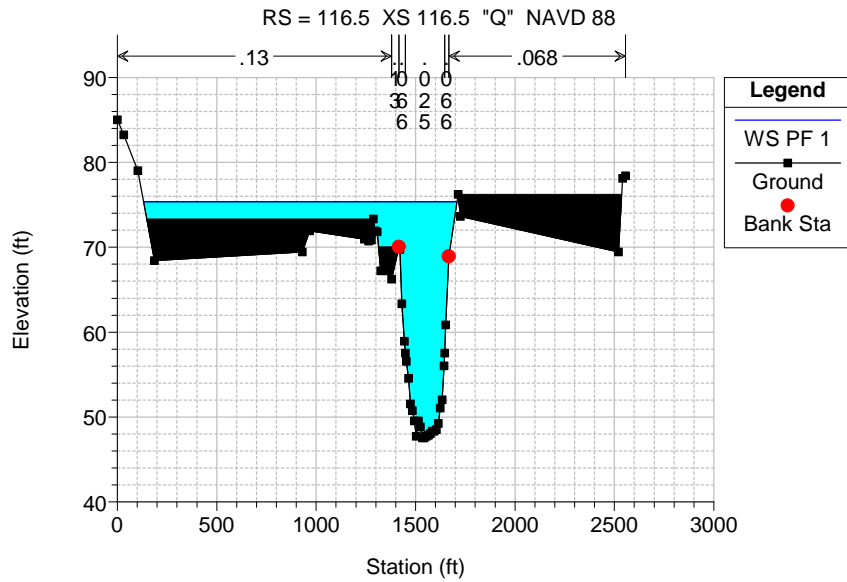
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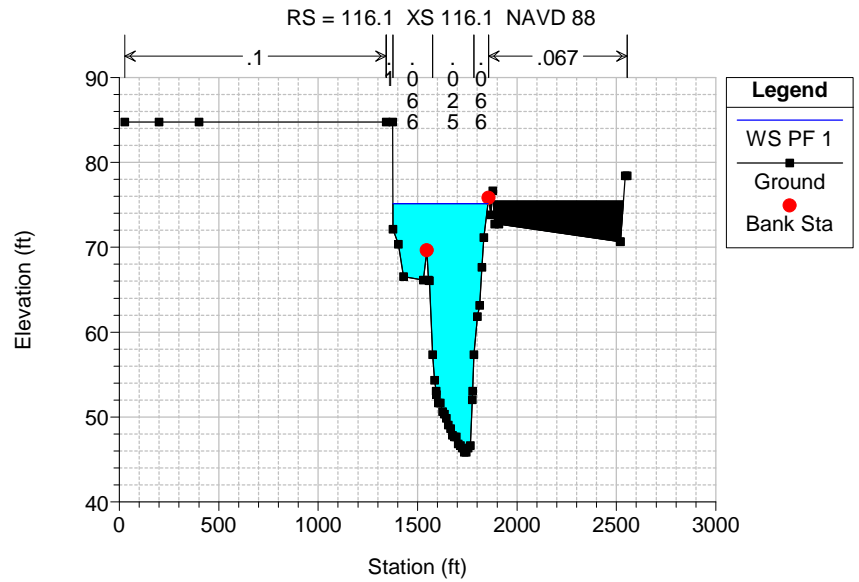
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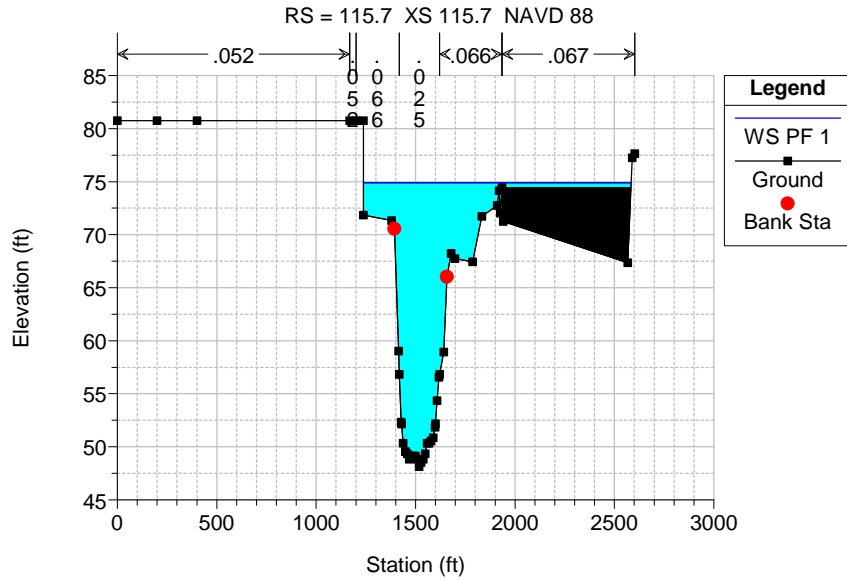
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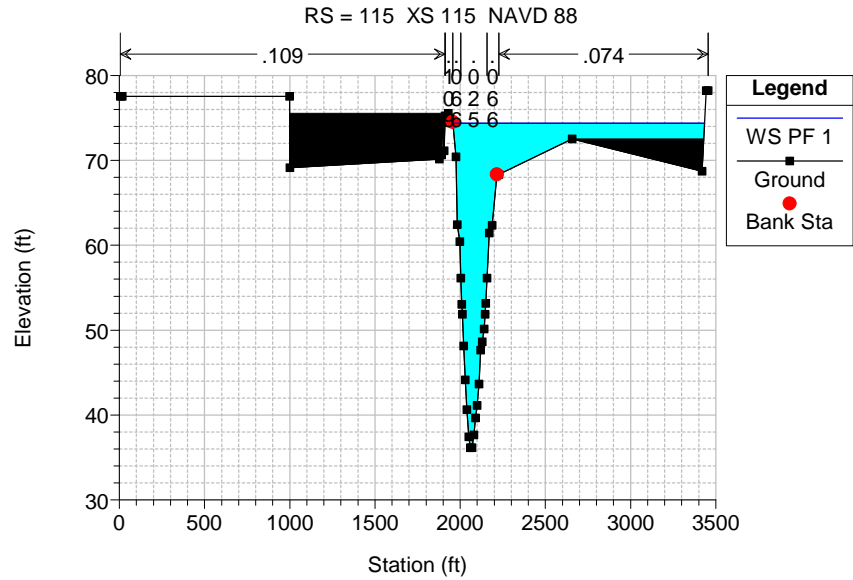
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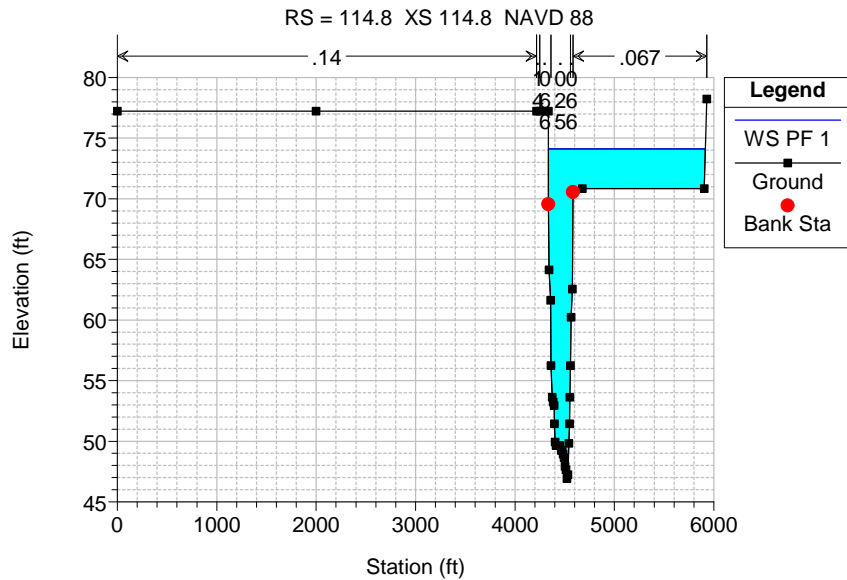
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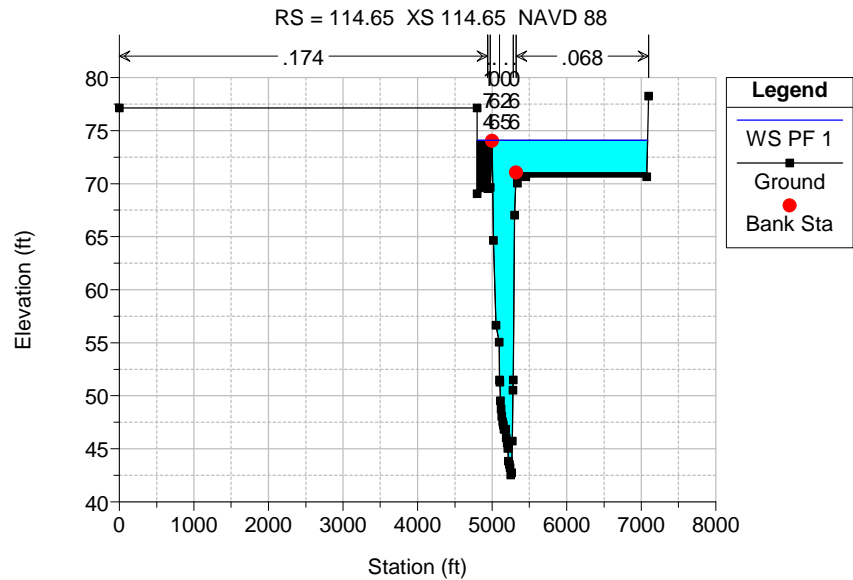
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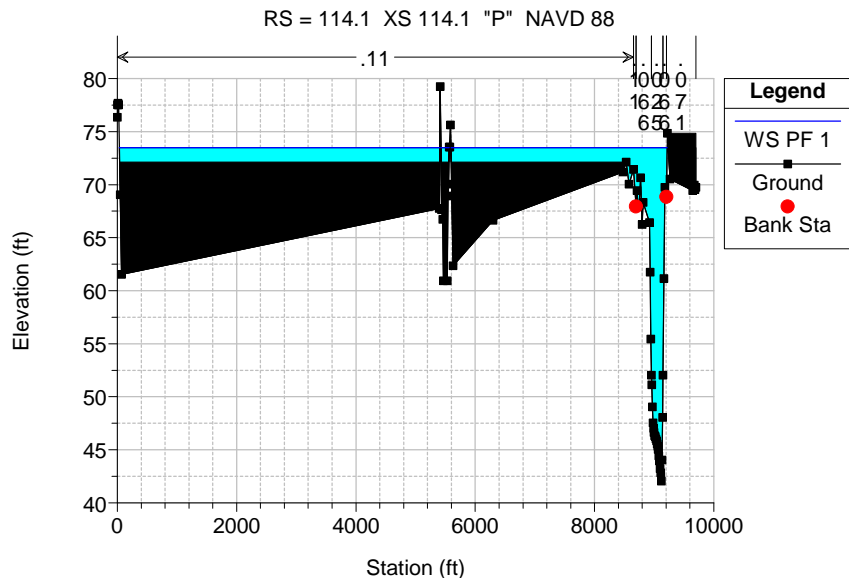
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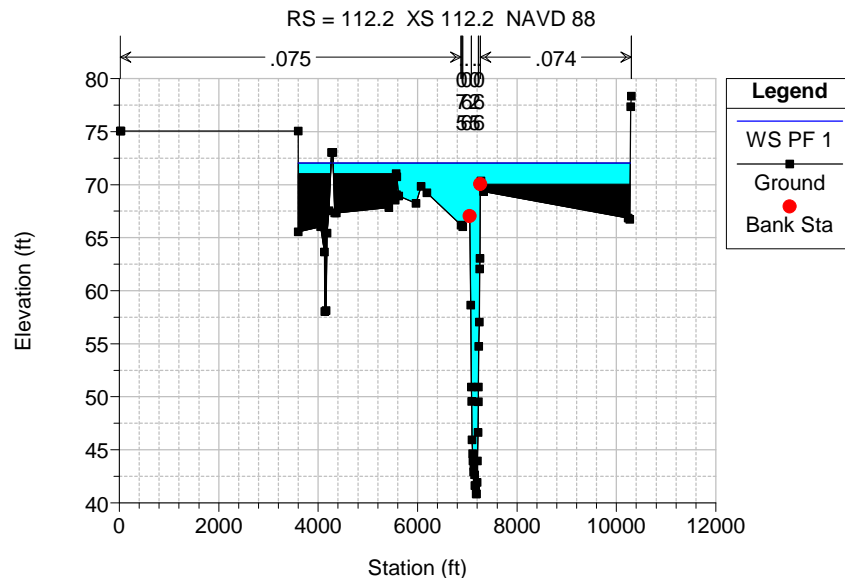
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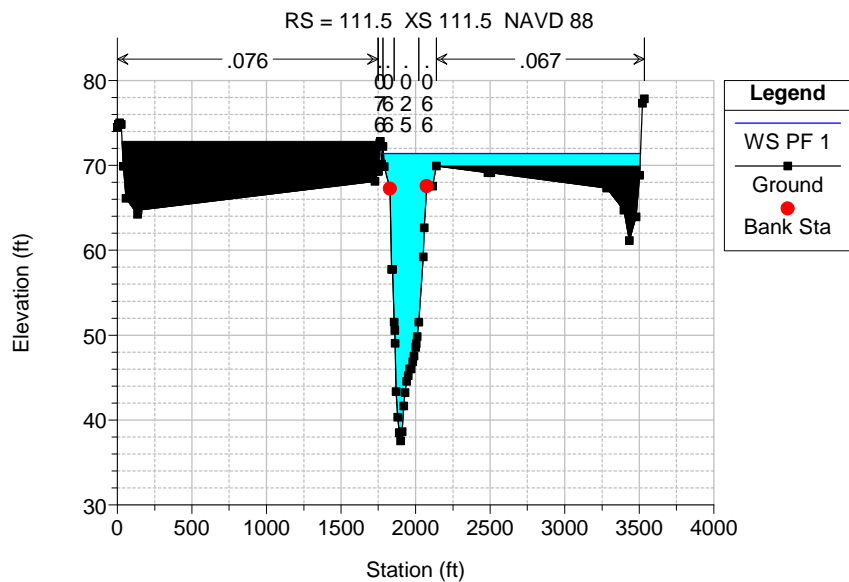
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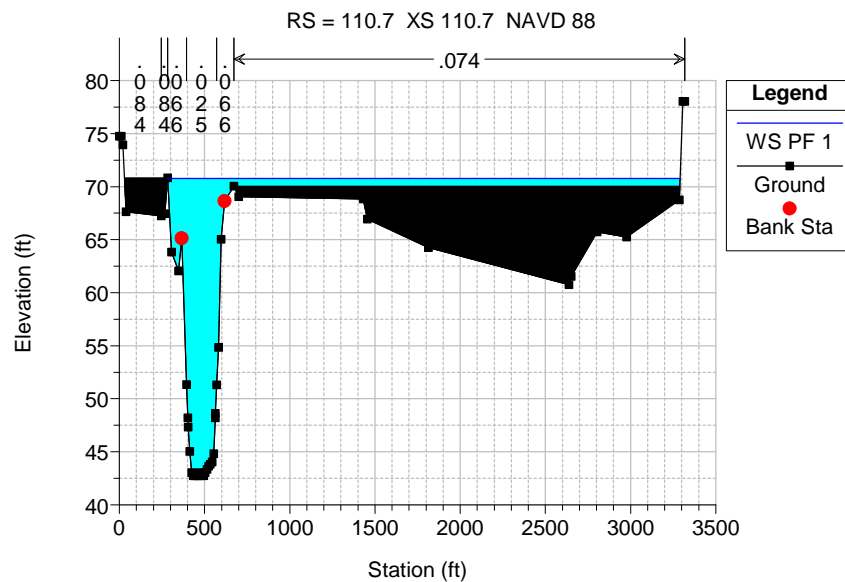
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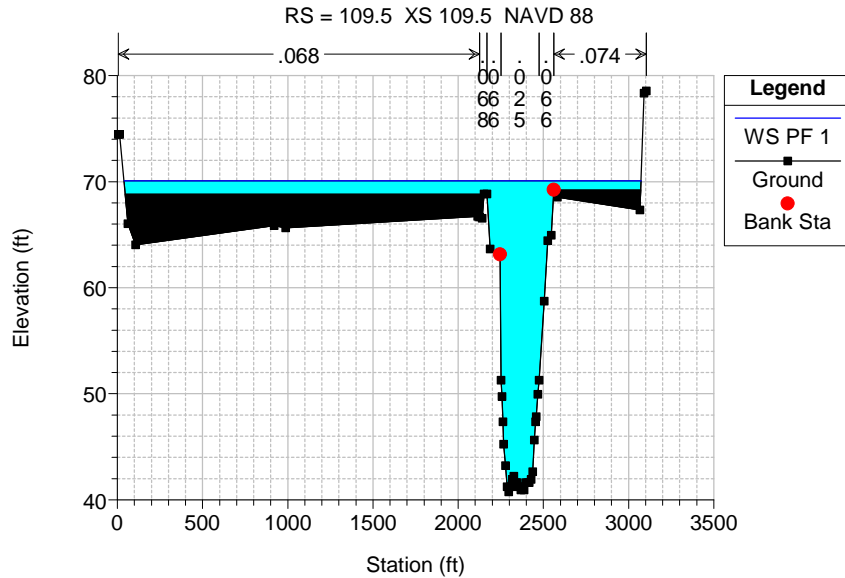
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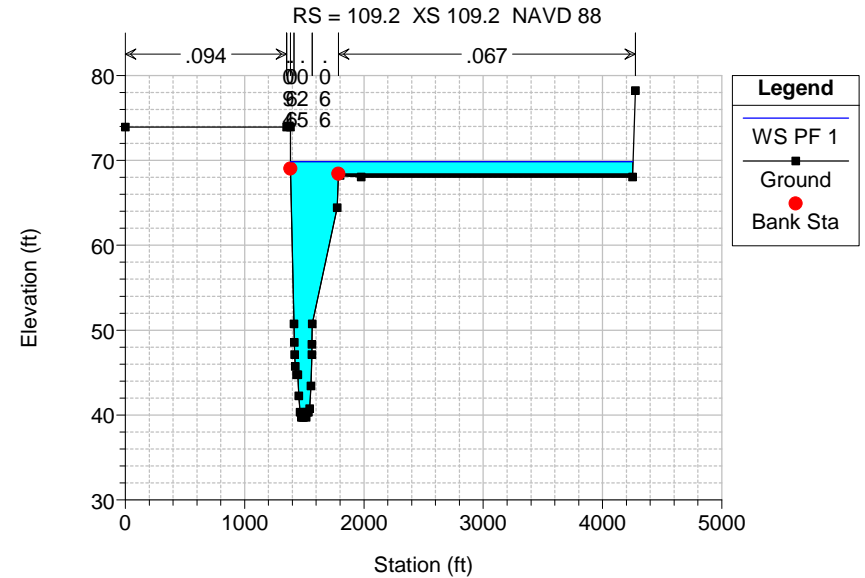
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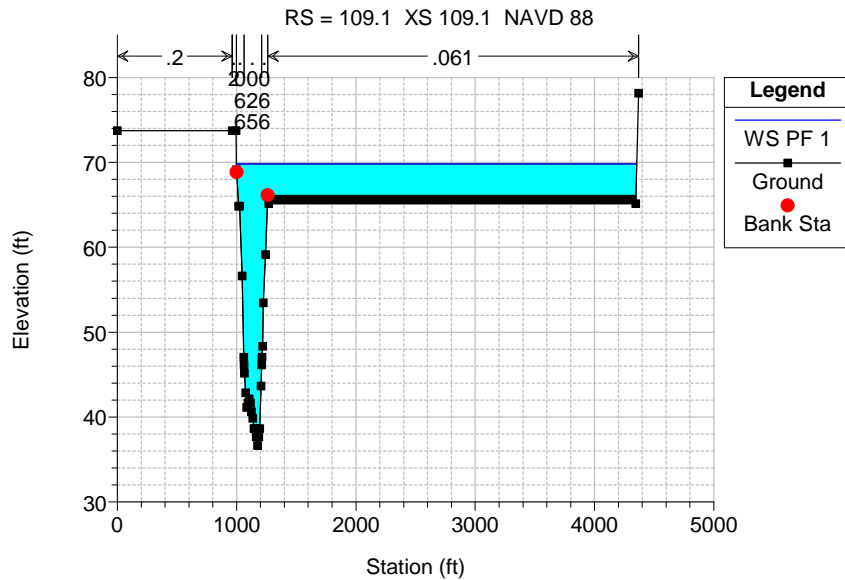
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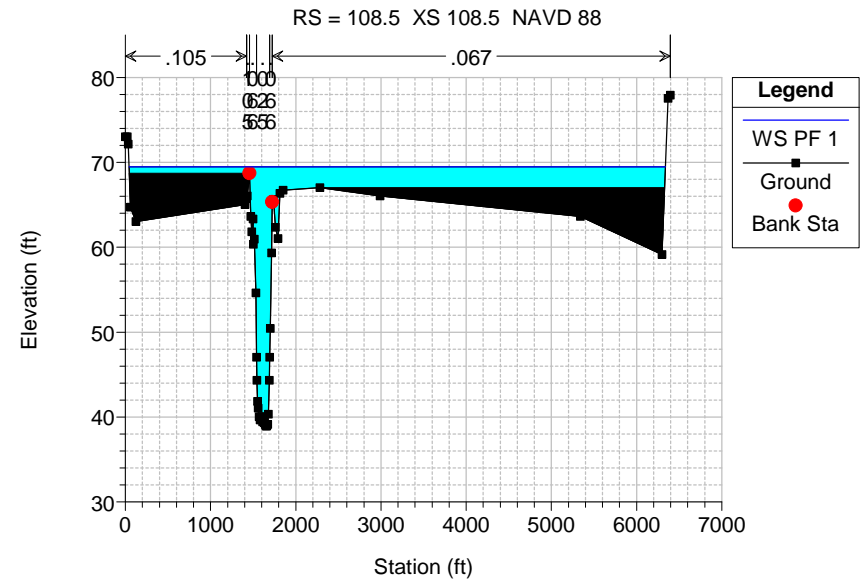
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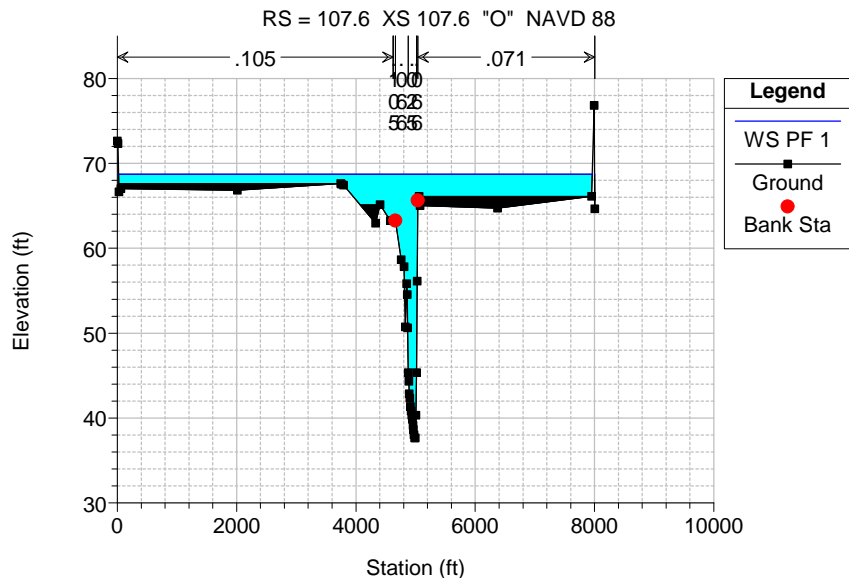
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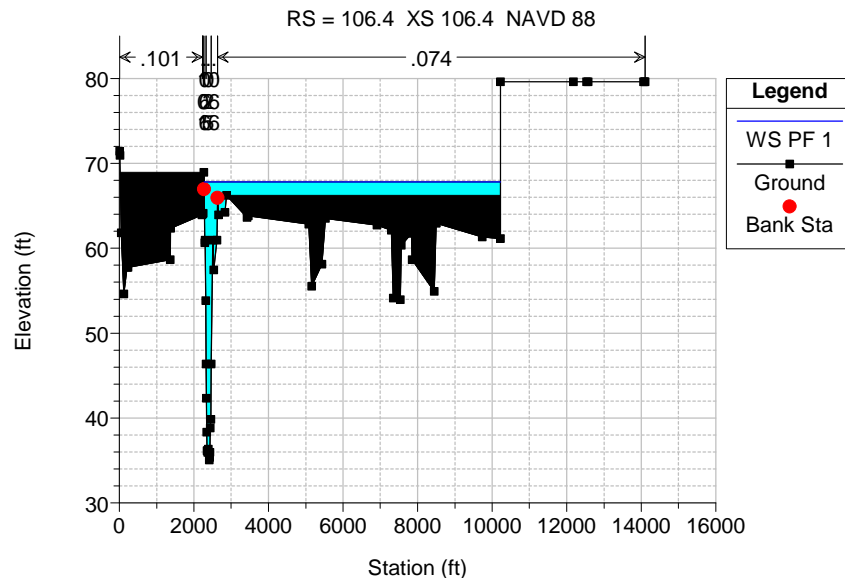
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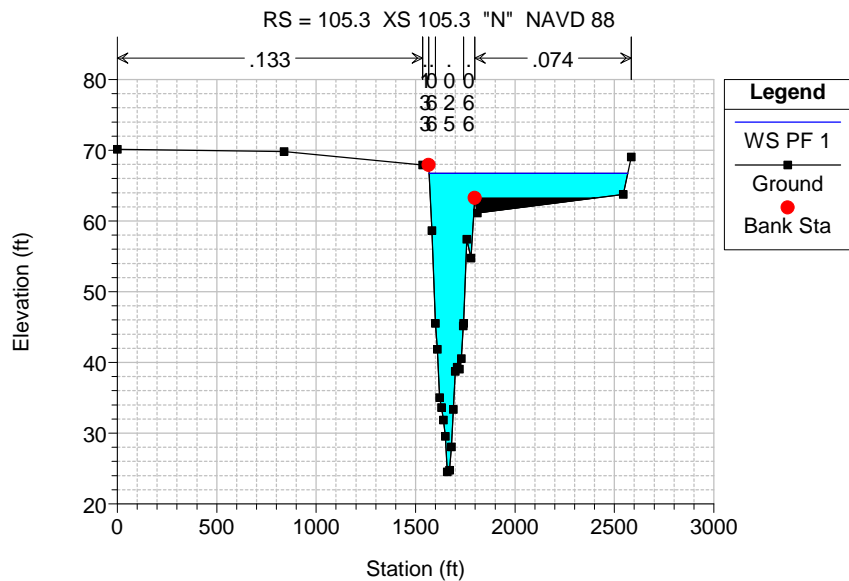
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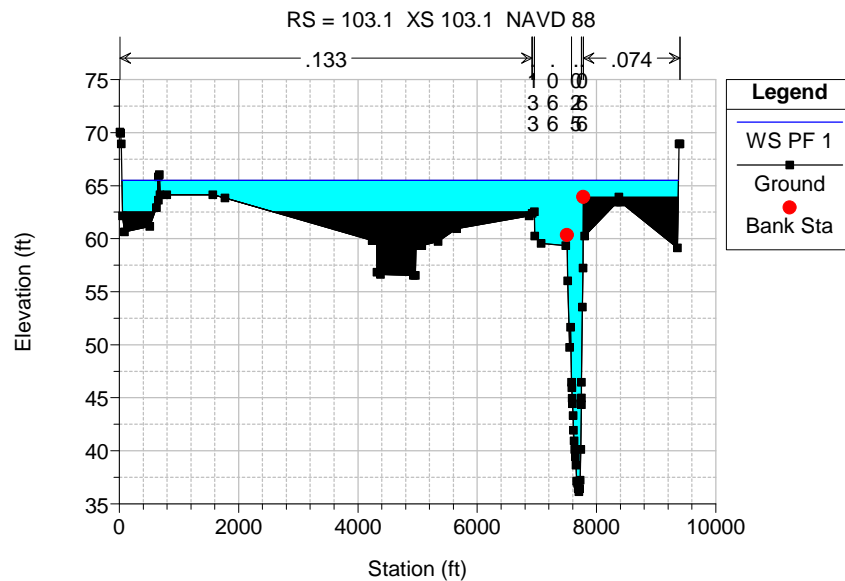
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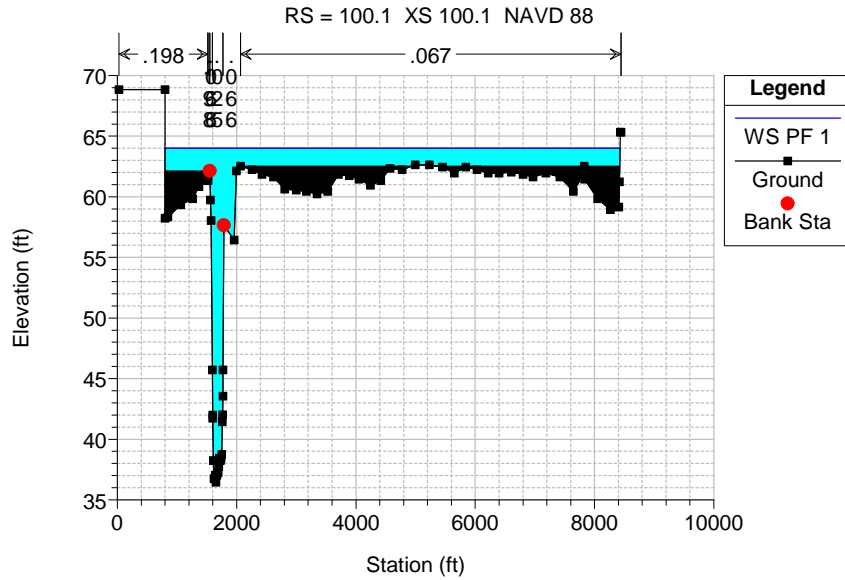
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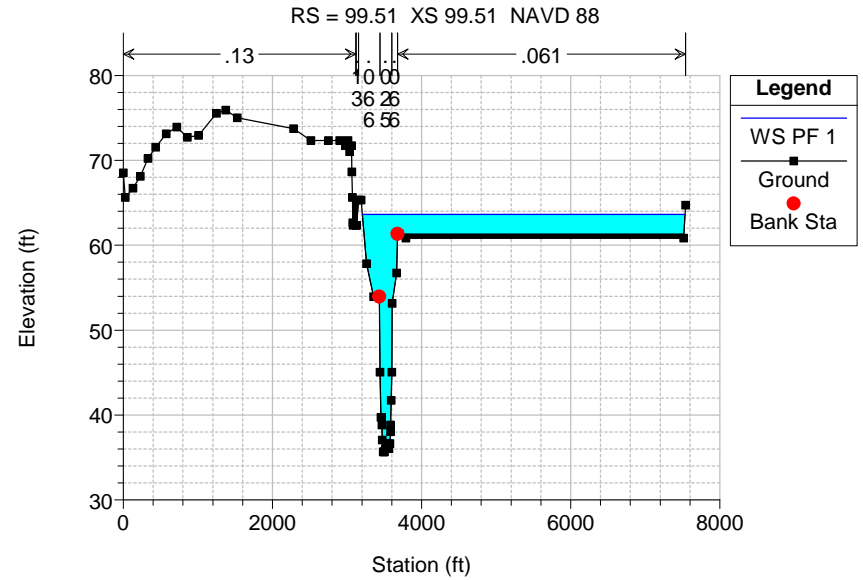
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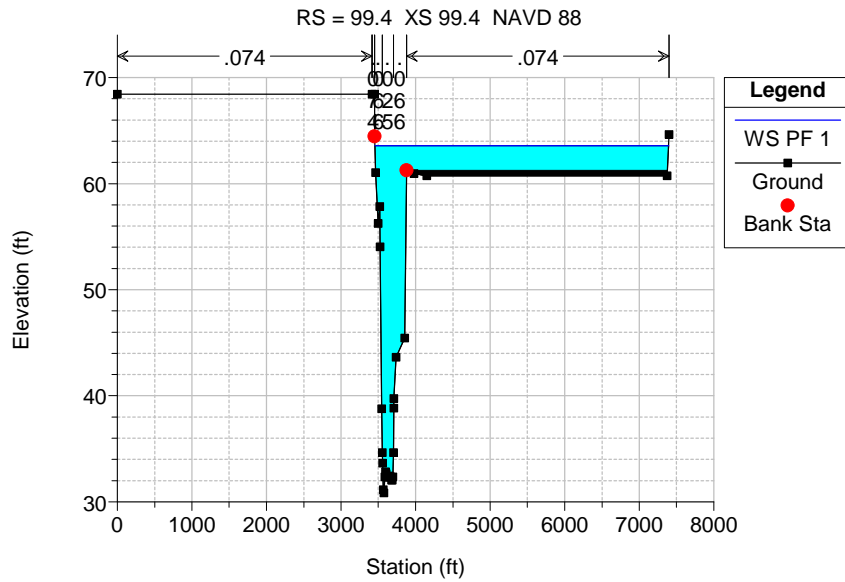
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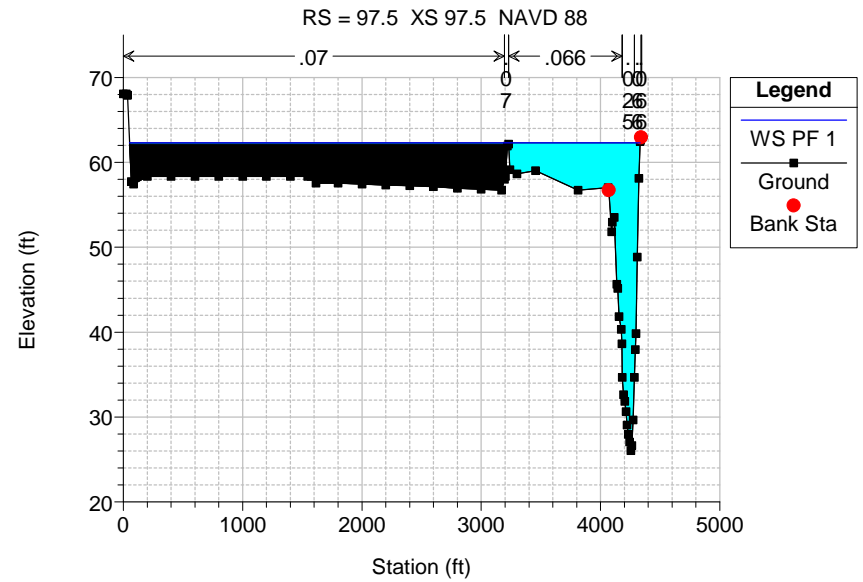
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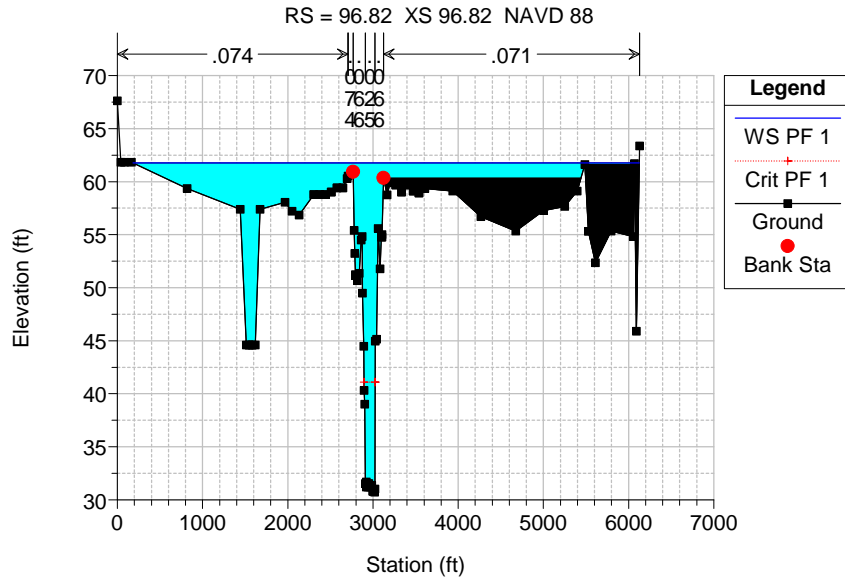
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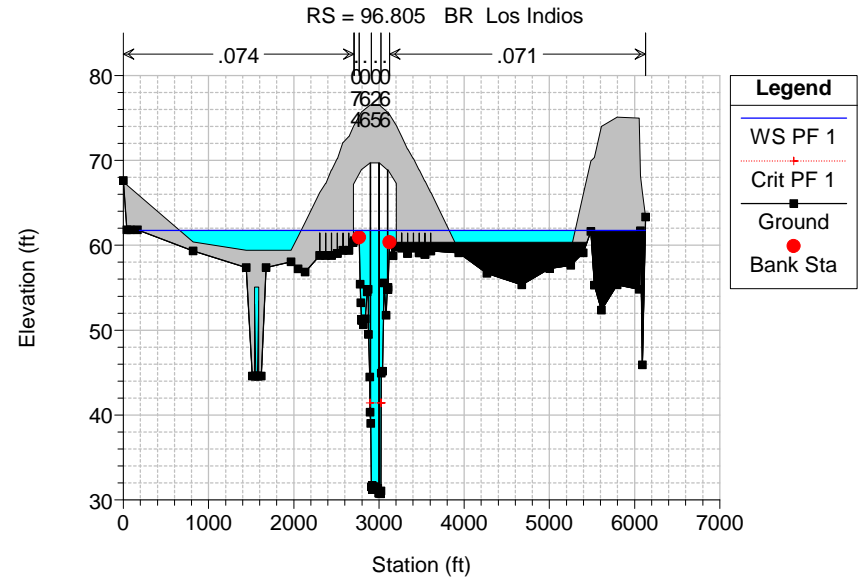
Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



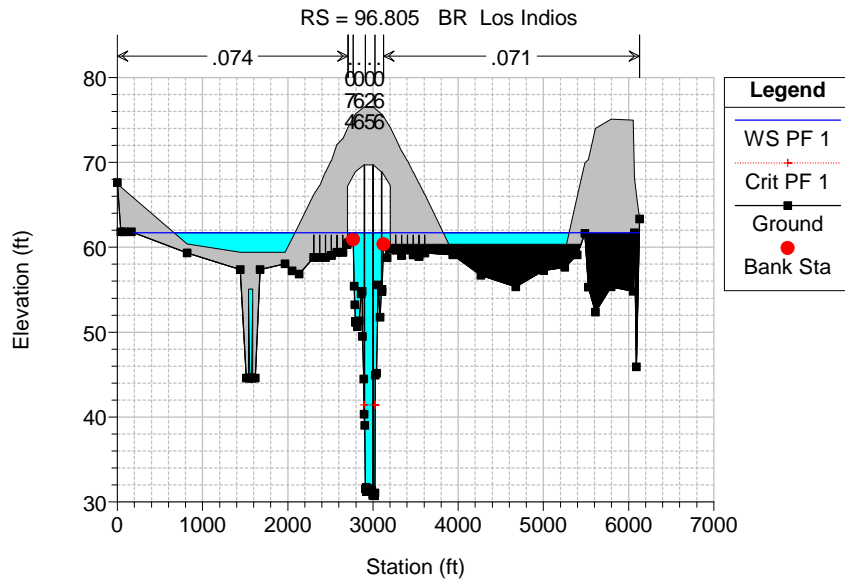
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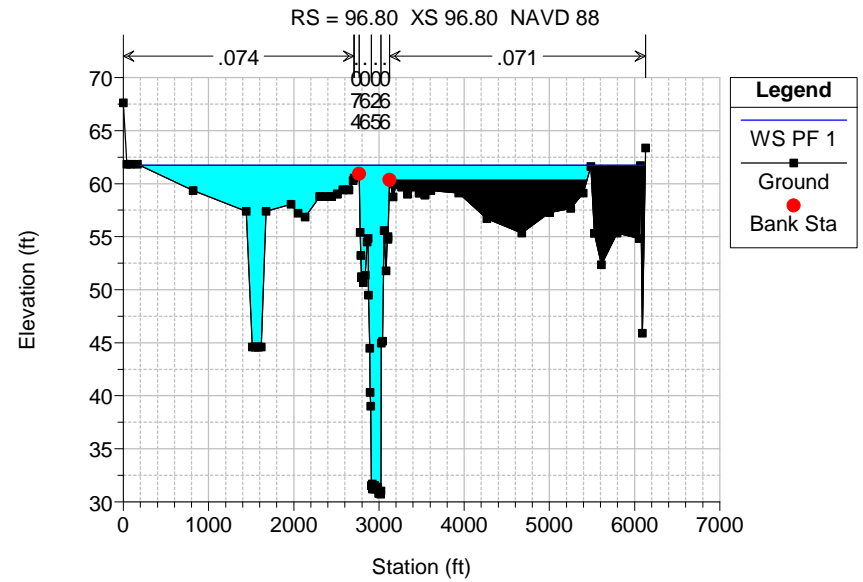
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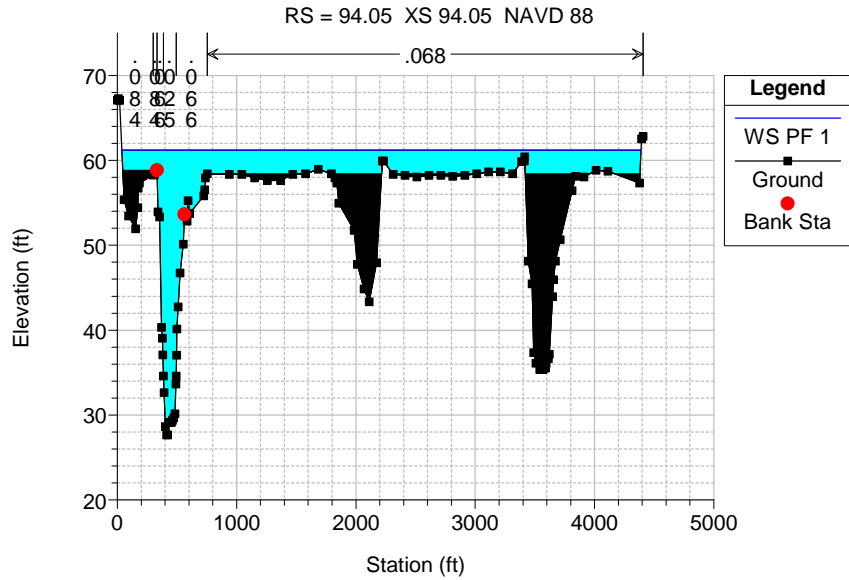
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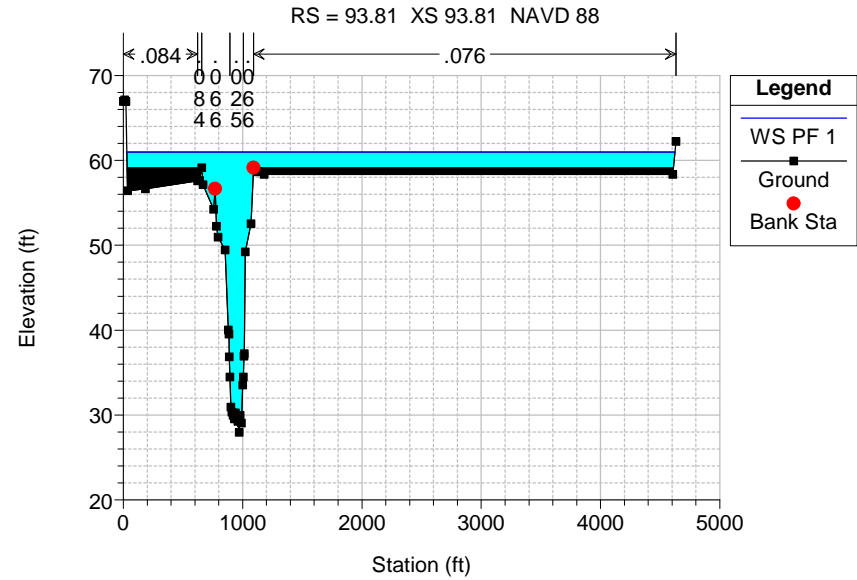
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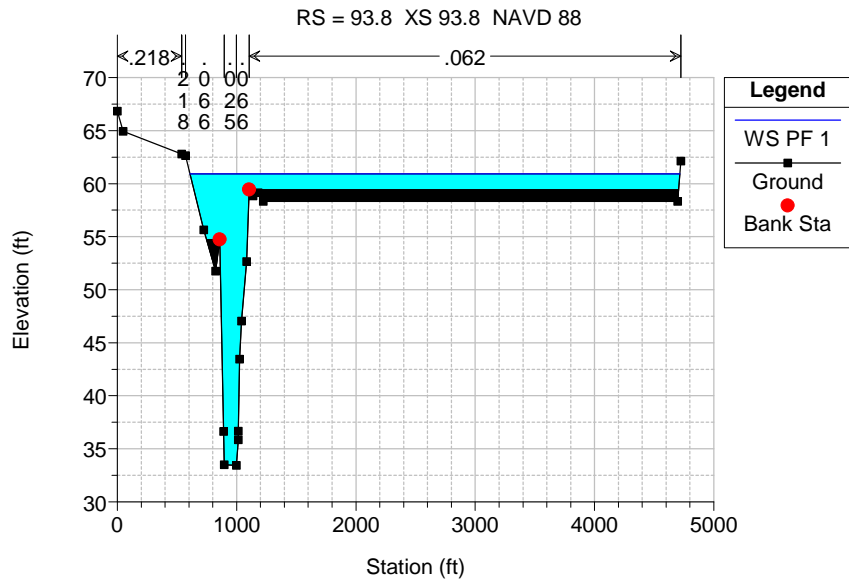
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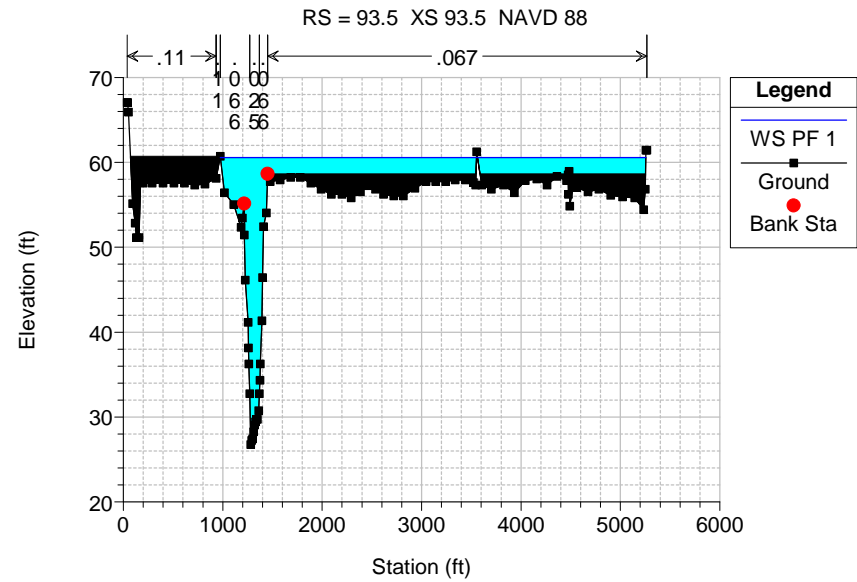
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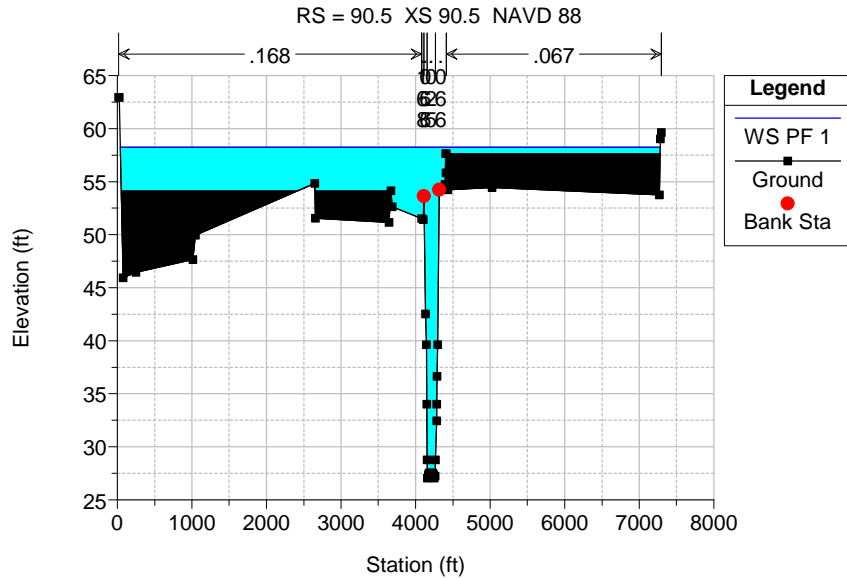
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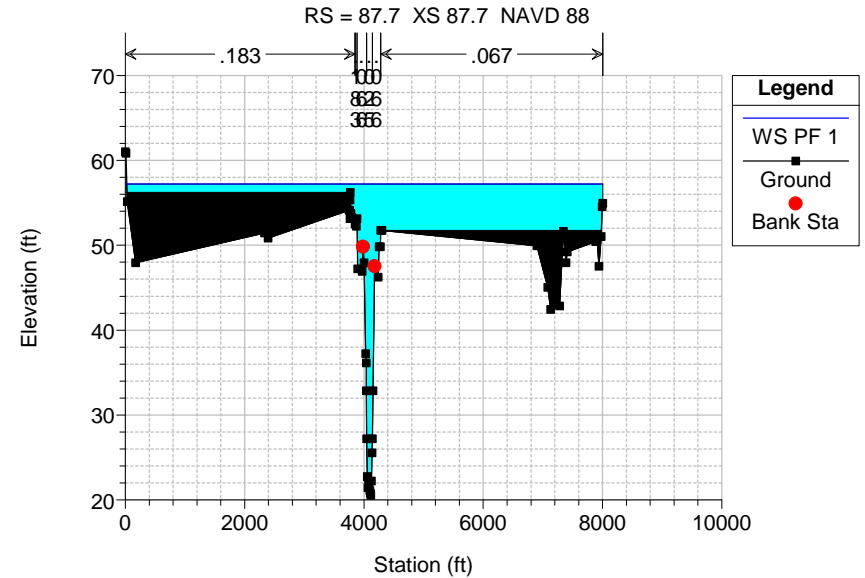
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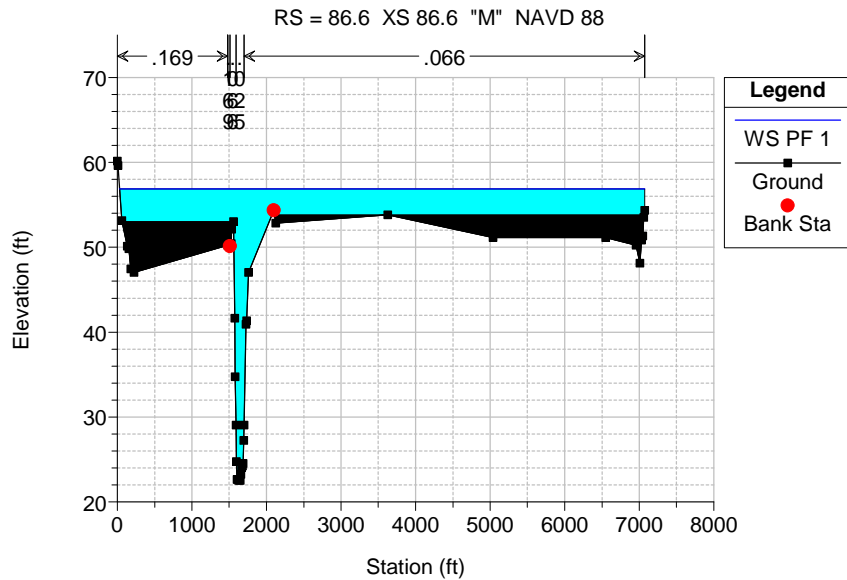
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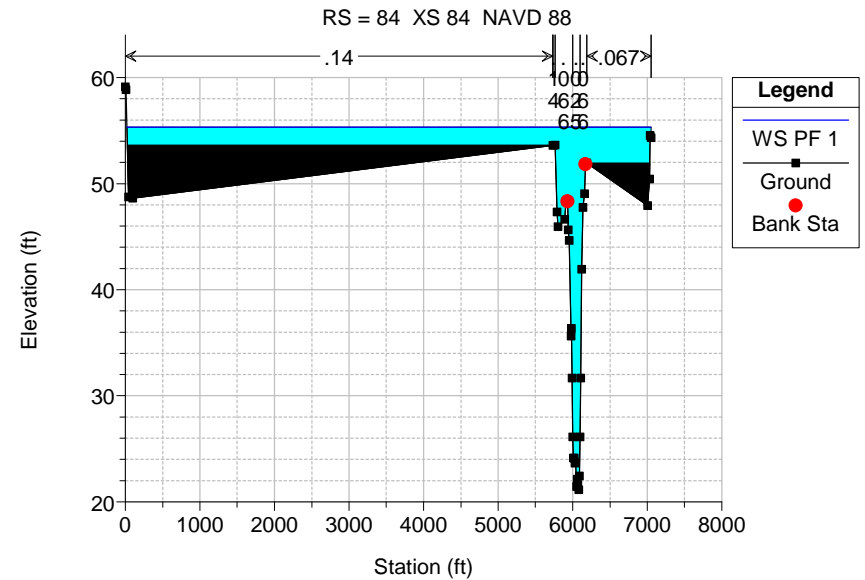
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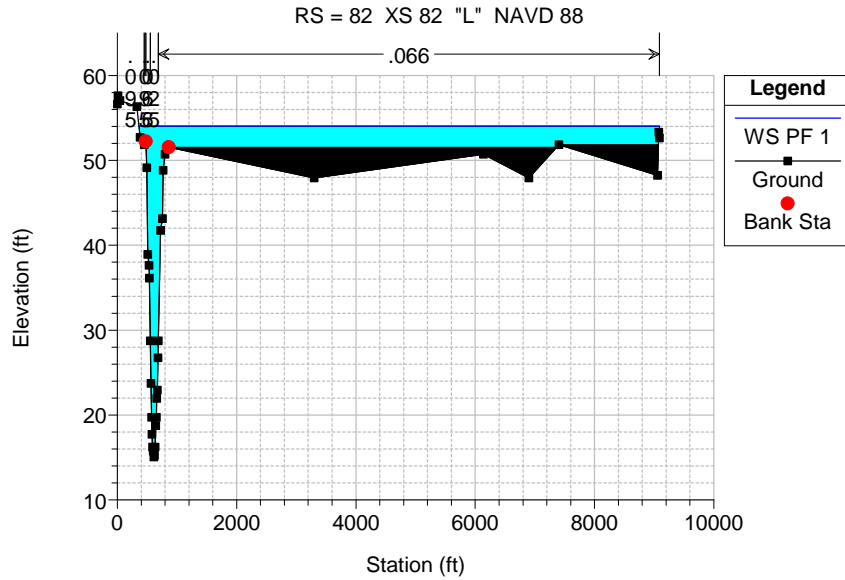
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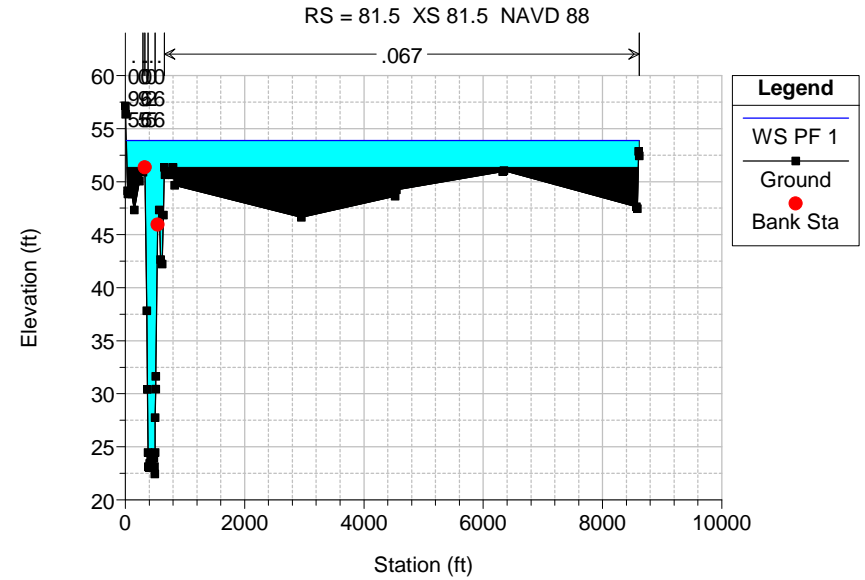
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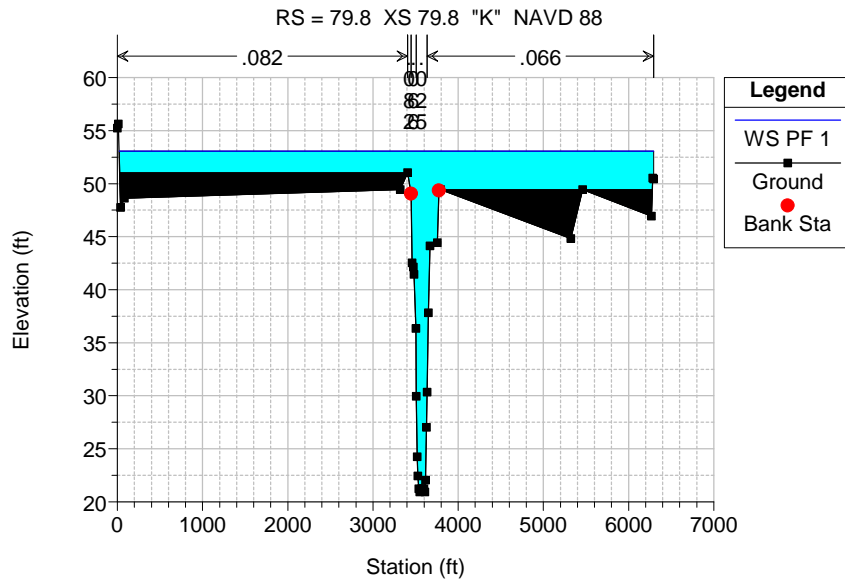
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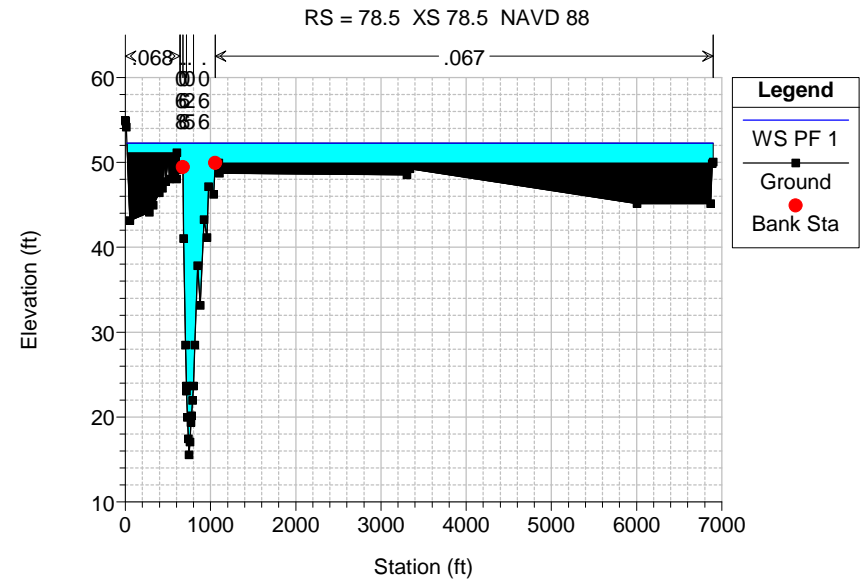
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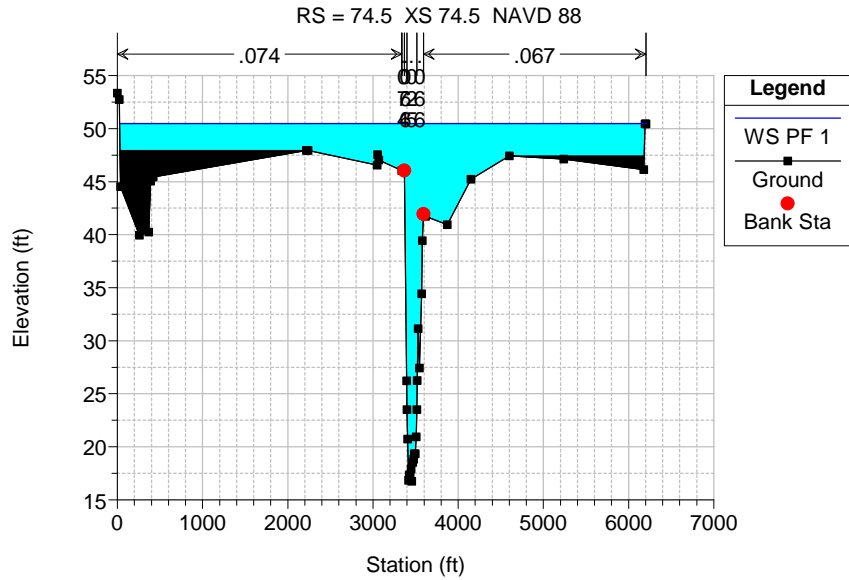
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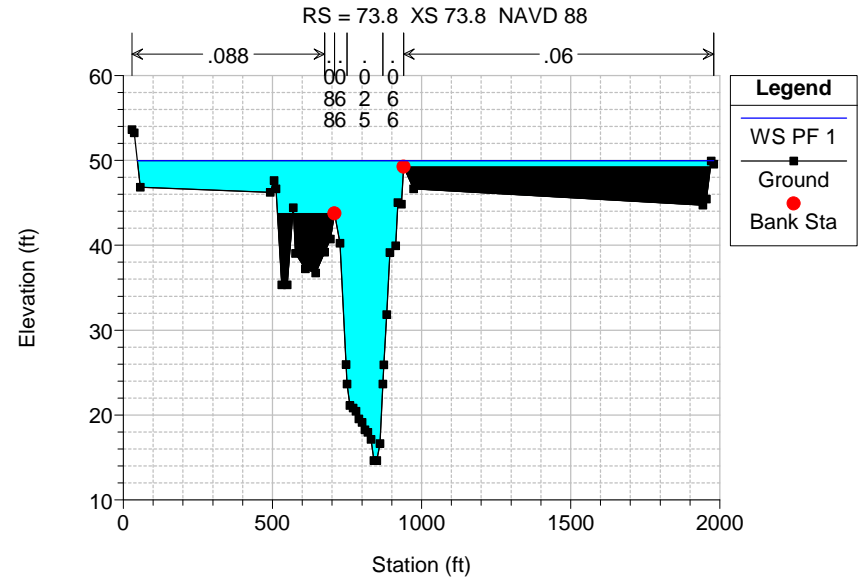
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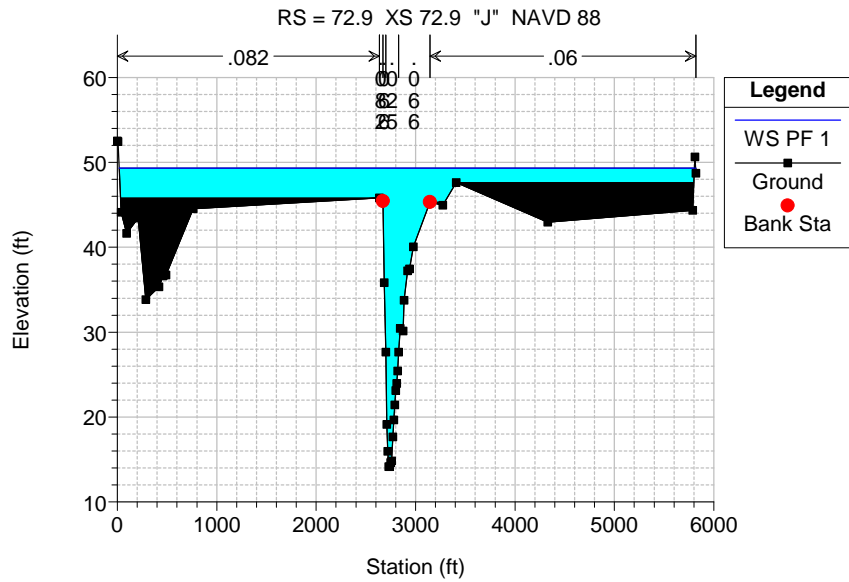
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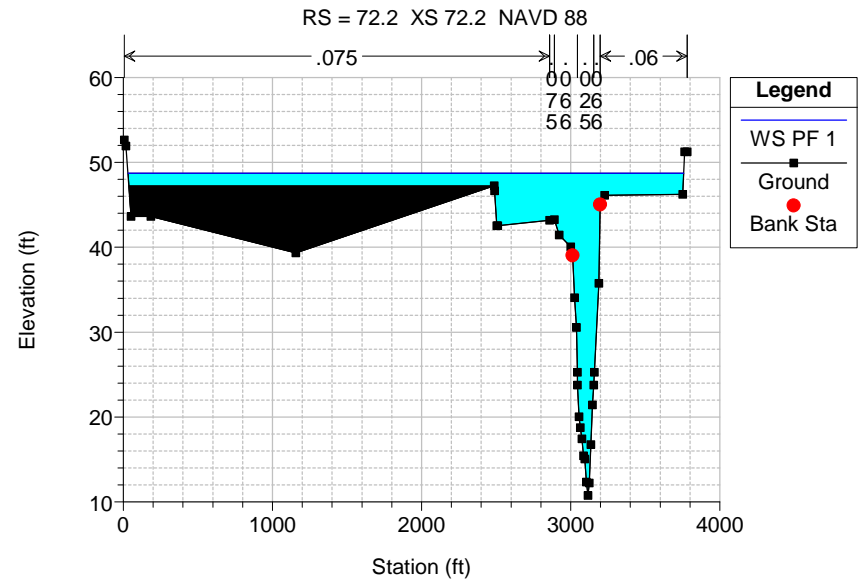
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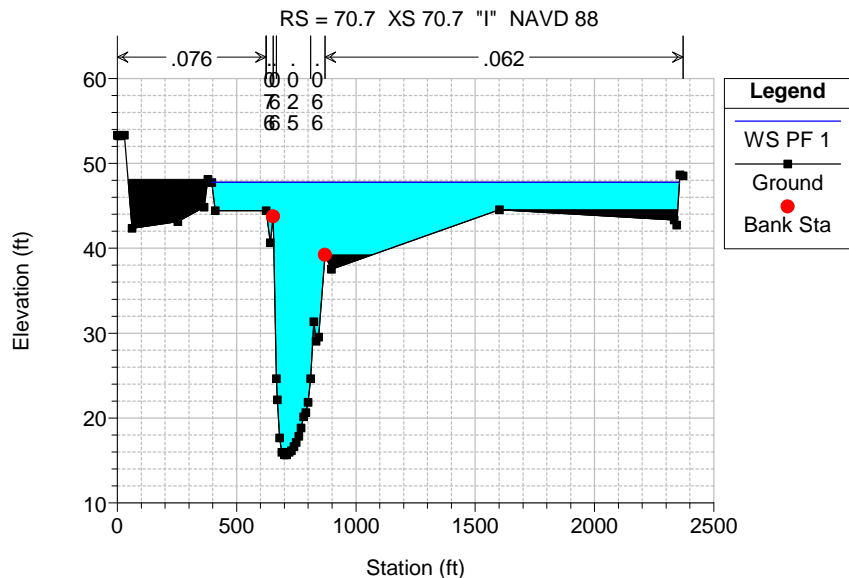
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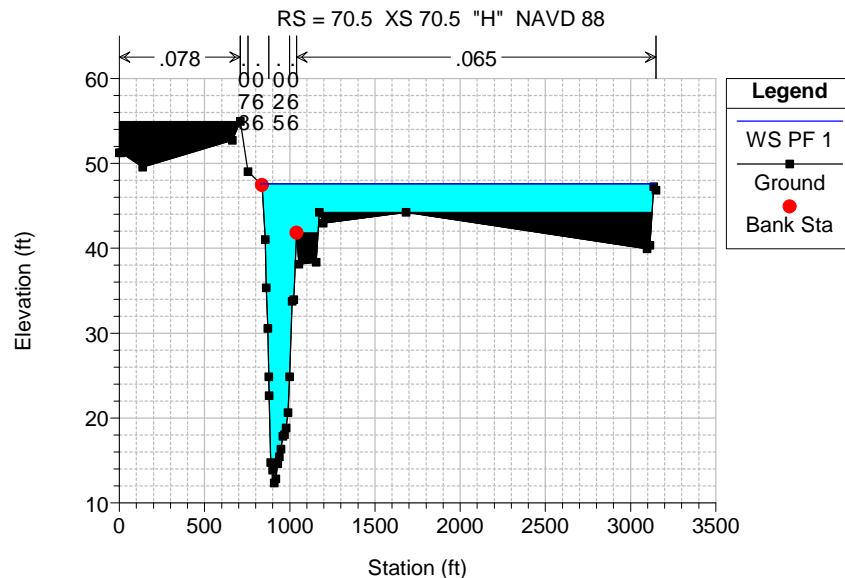
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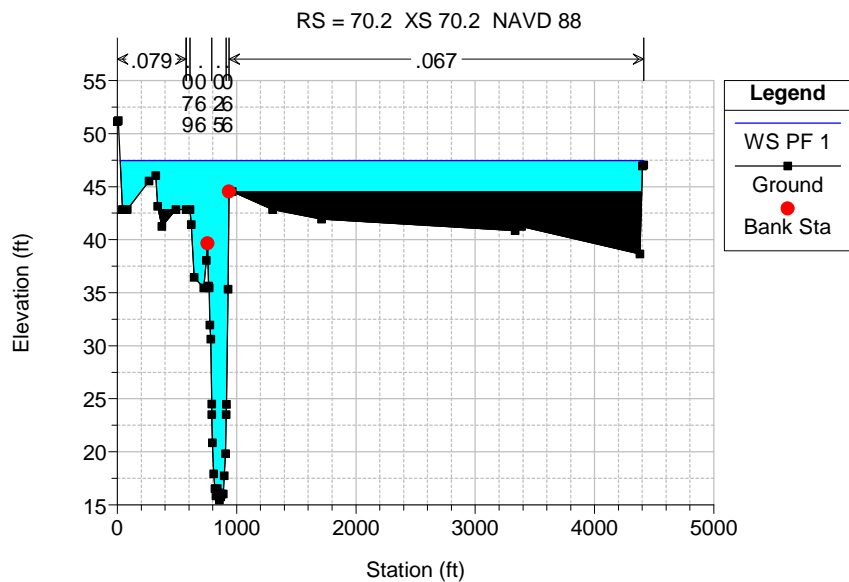
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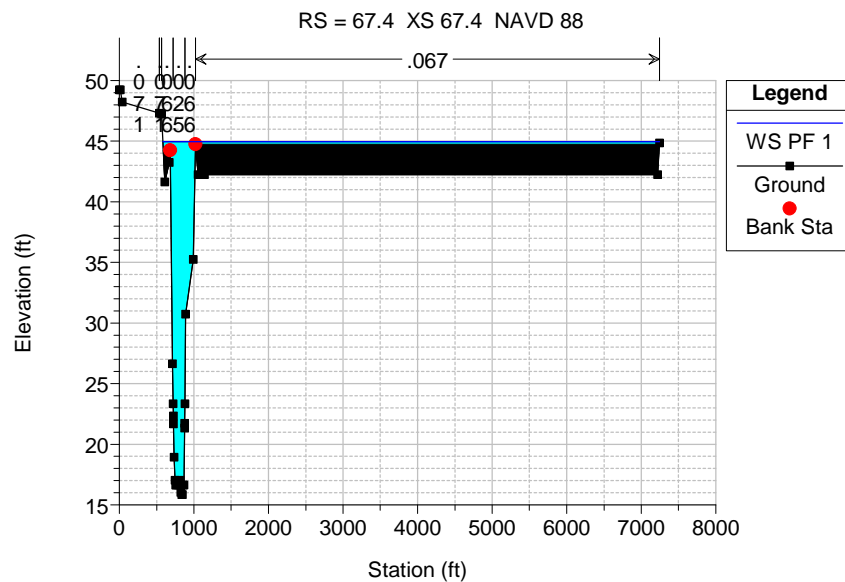
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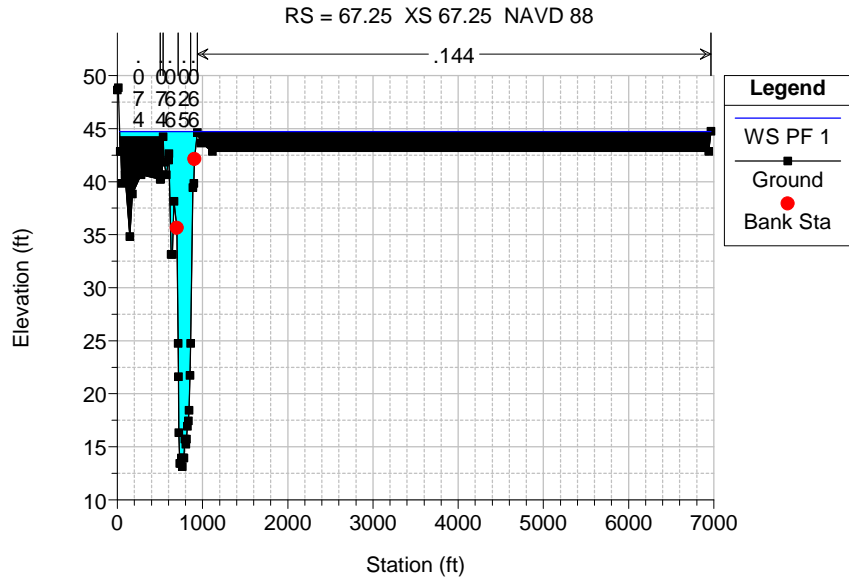
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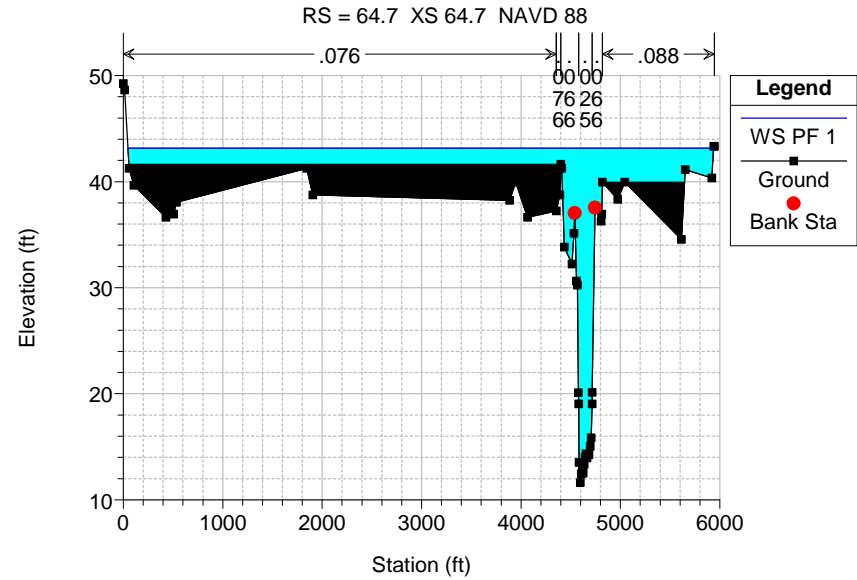
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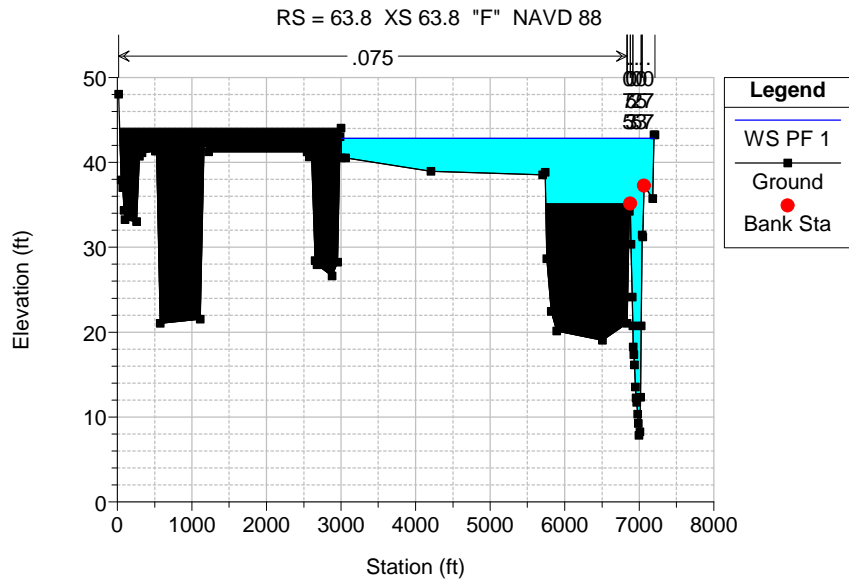
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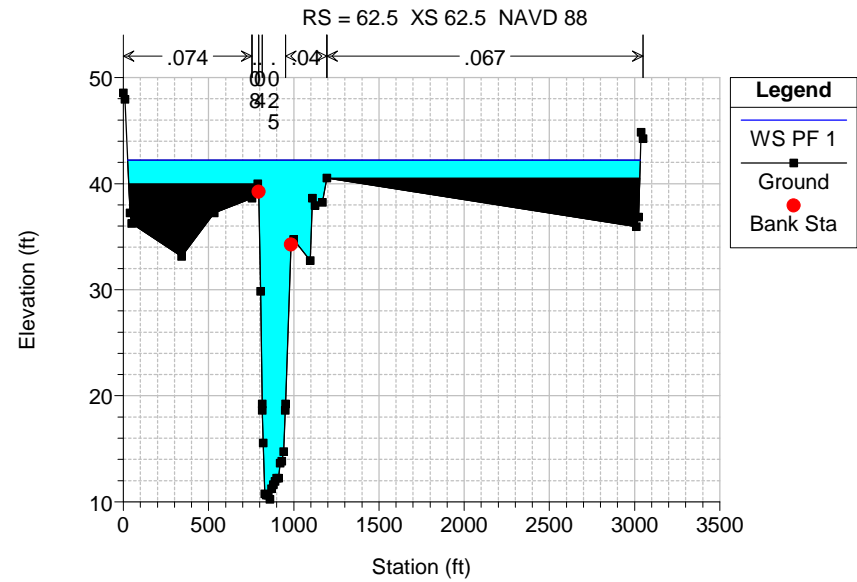
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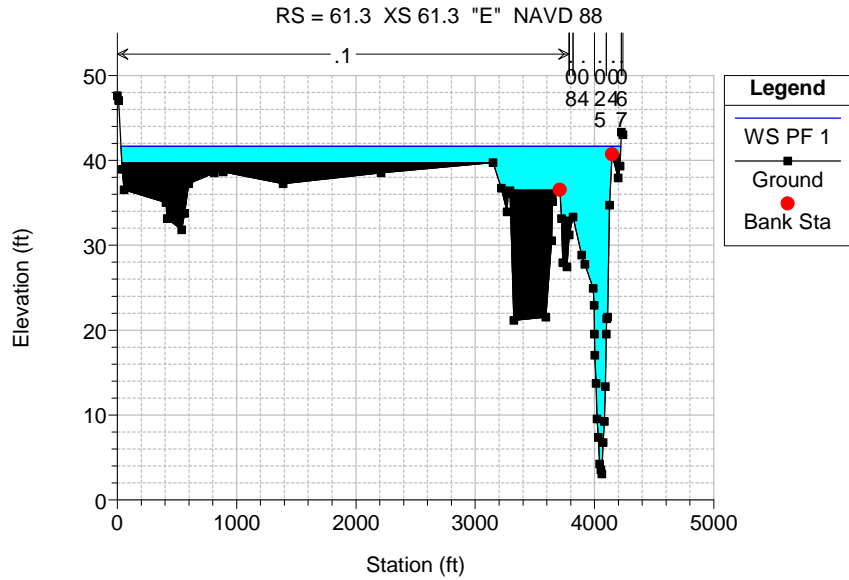
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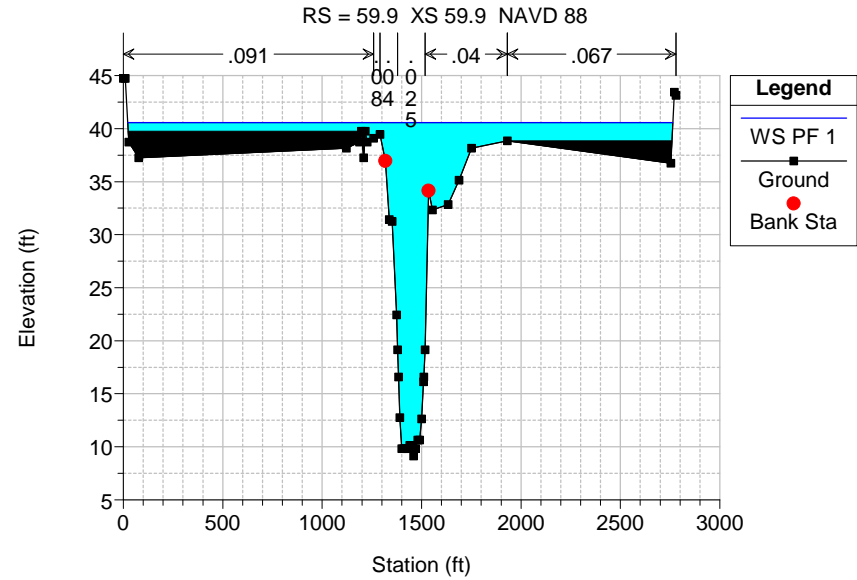
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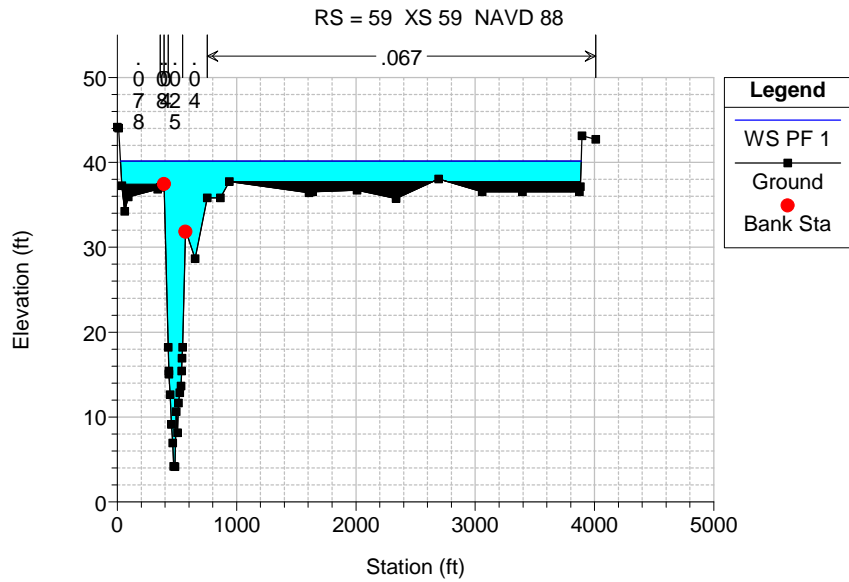
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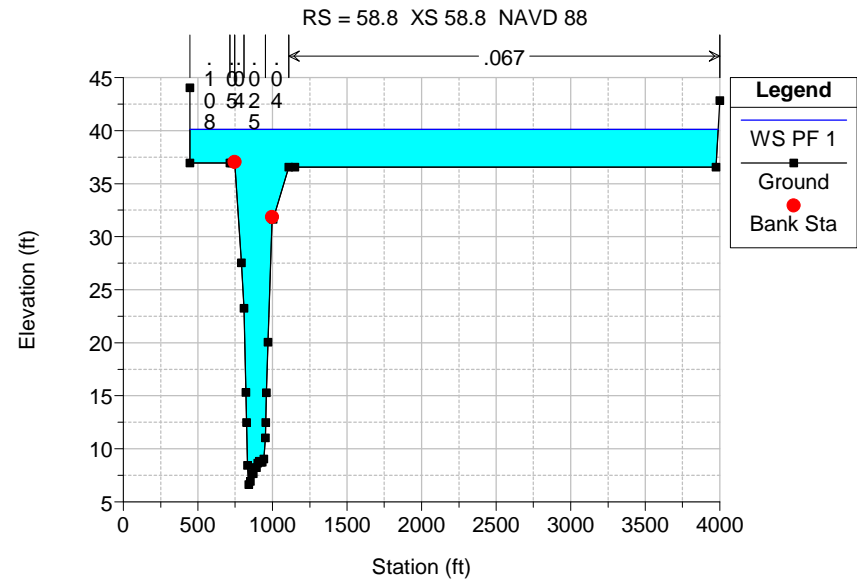
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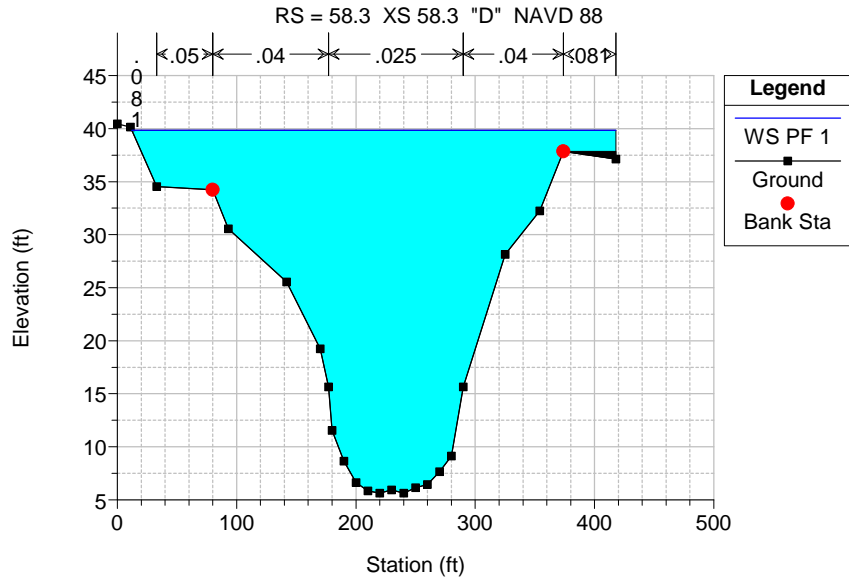
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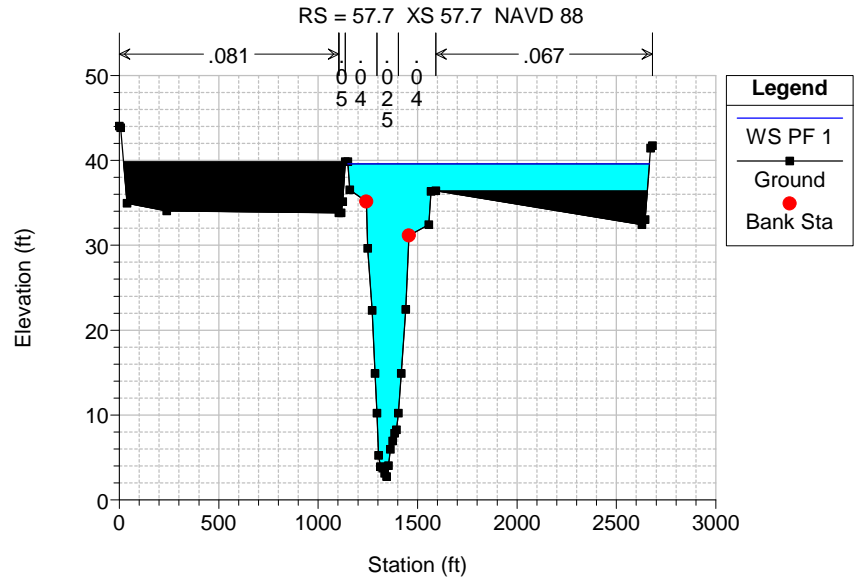
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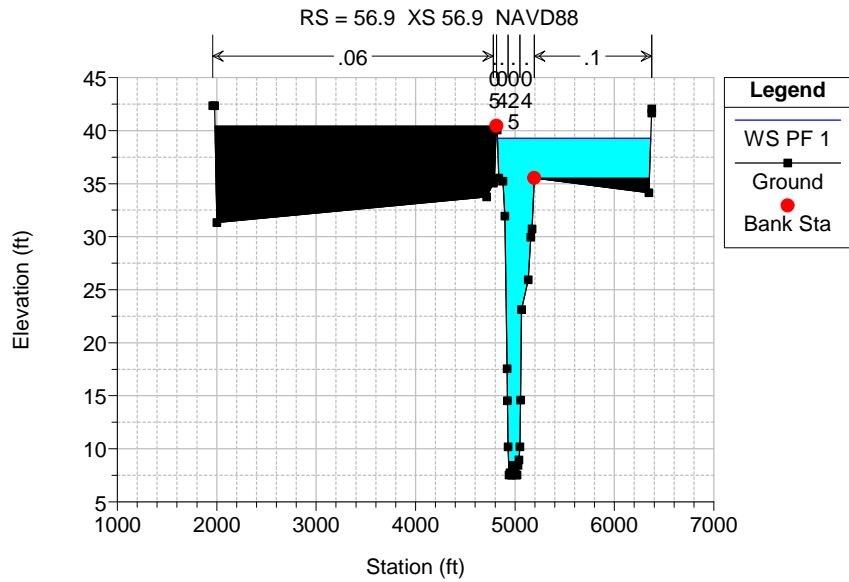
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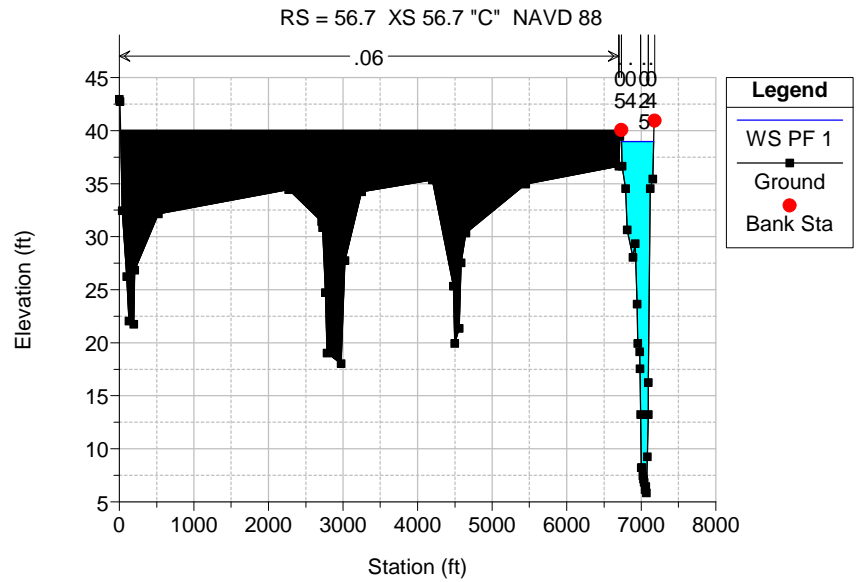
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Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011

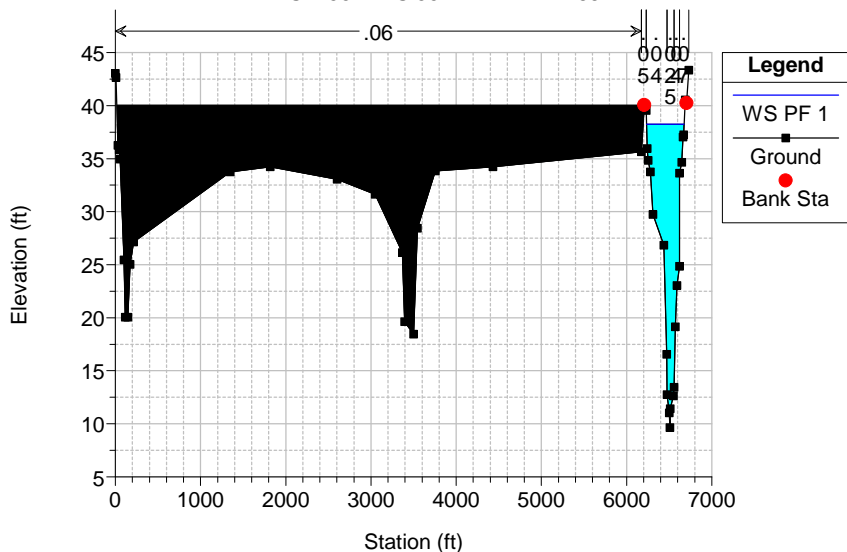


Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



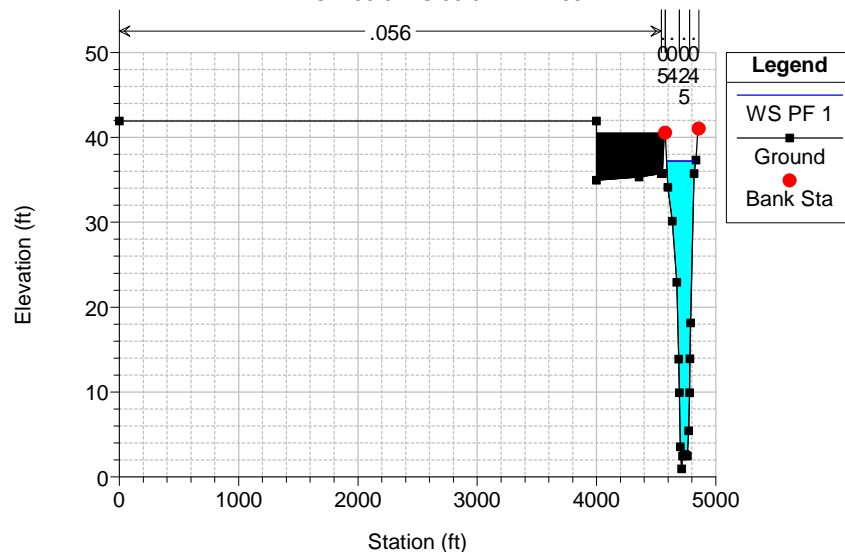
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RS = 56.1 XS 56.1 "B" NAVD 88



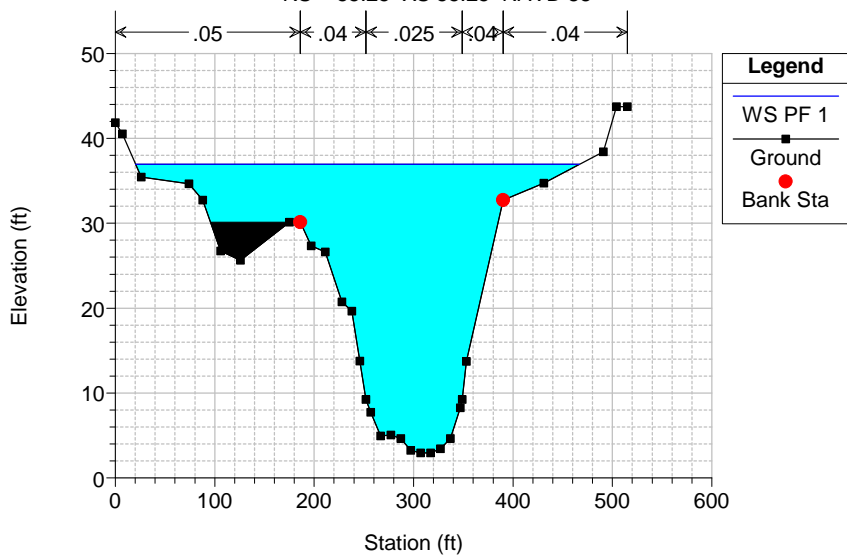
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RS = 55.5 XS 55.5 NAVD 88



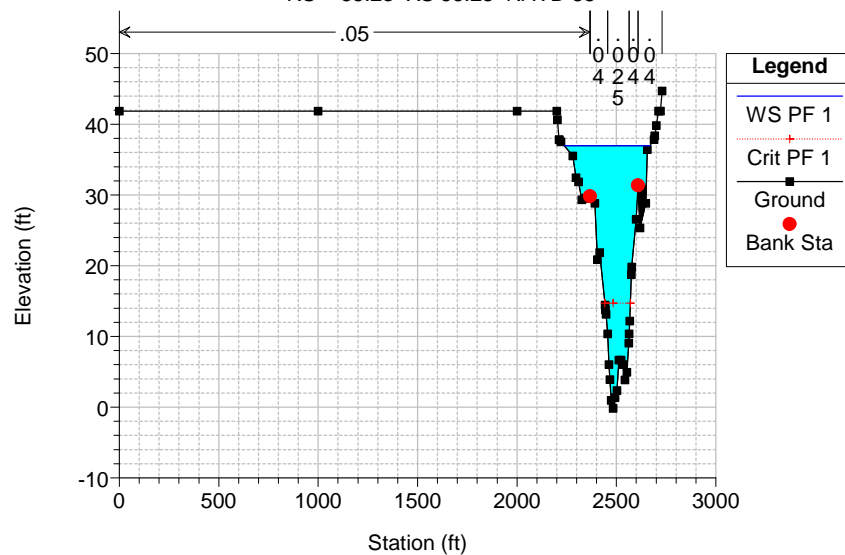
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RS = 55.25 XS 55.25 NAVD 88



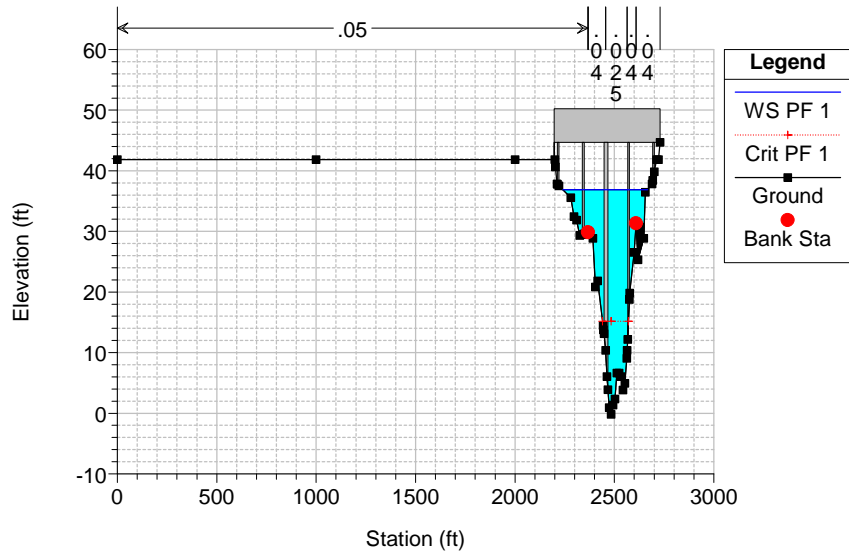
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RS = 55.23 XS 55.23 NAVD 88



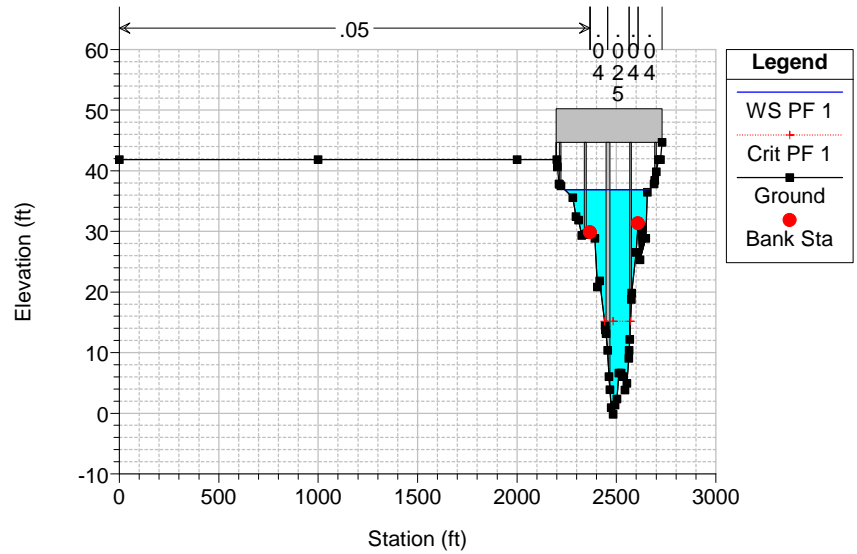
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RS = 55.215 BR B & M



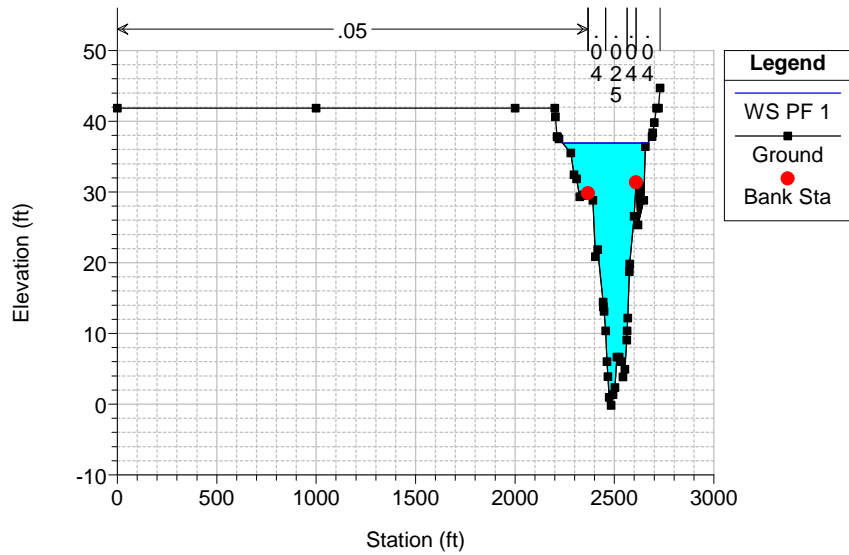
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RS = 55.215 BR B & M



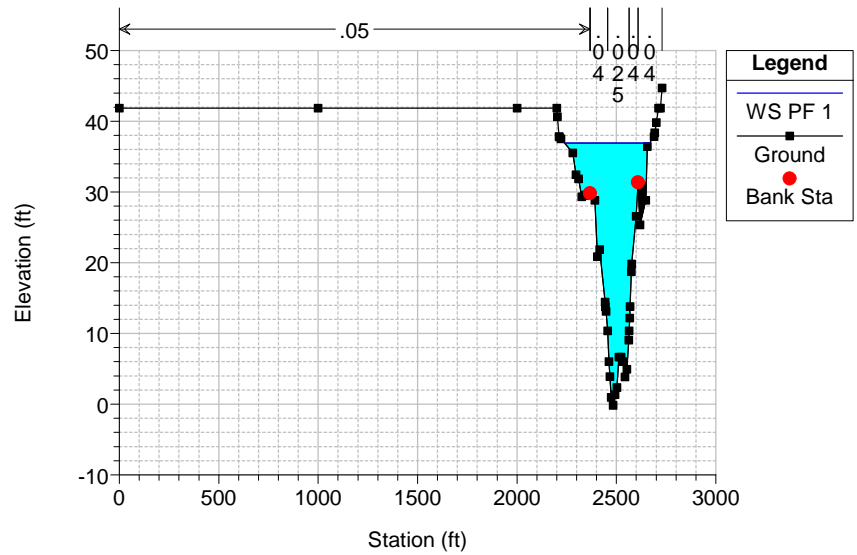
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RS = 55.21 XS 55.21 NAVD 88

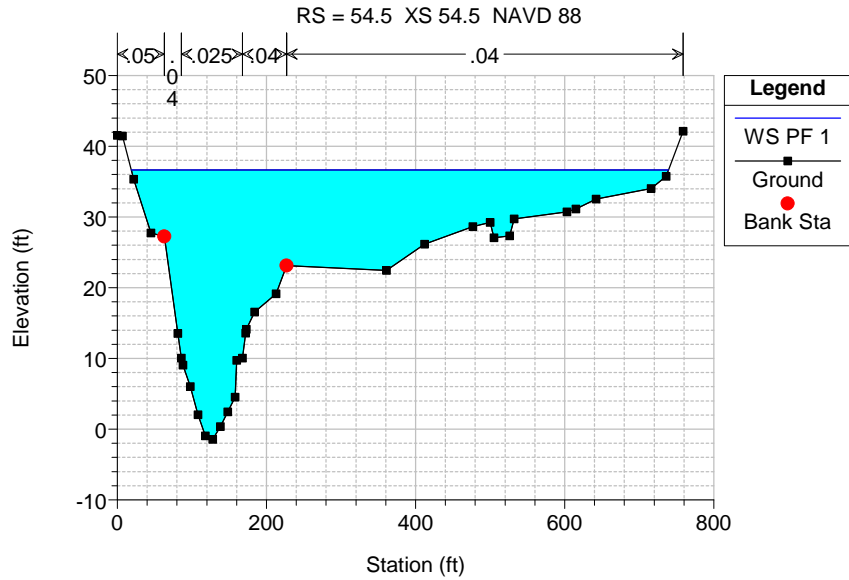


Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011

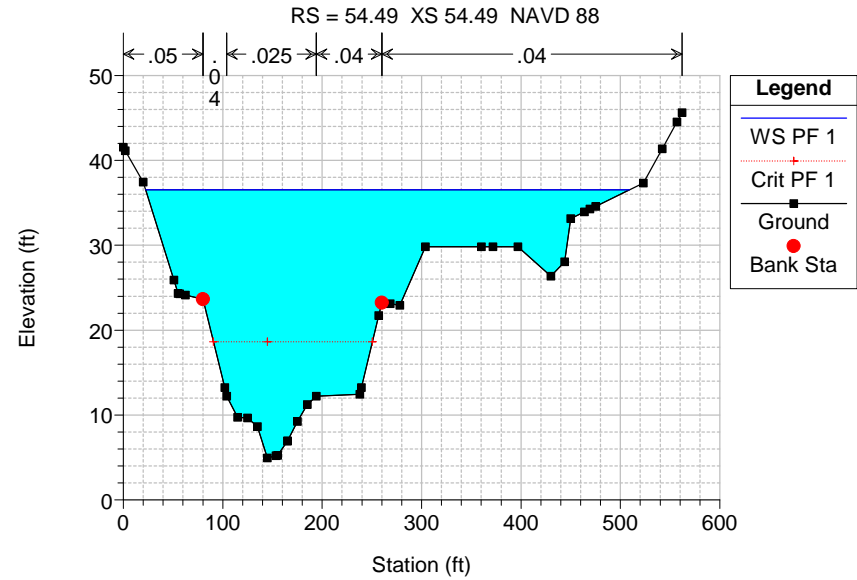
RS = 55.2 XS 55.2 NAVD 88



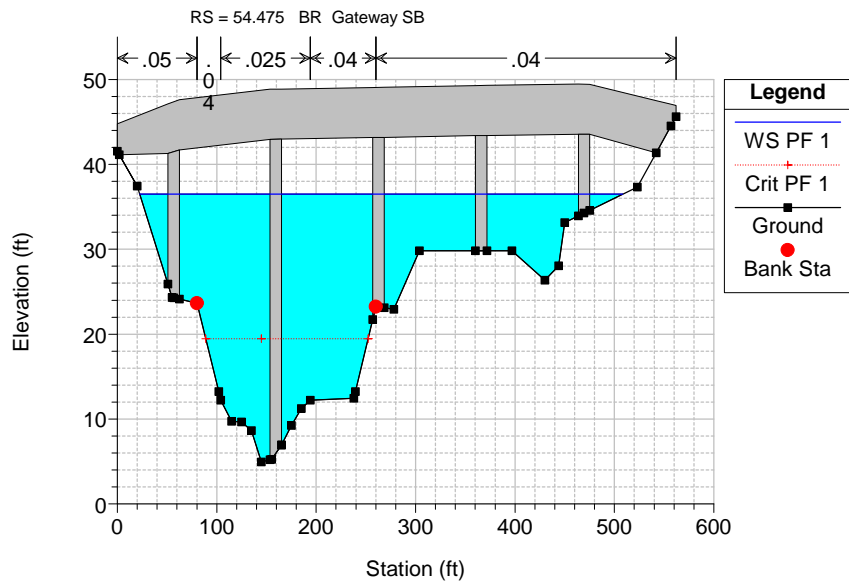
Lower Rio Grande 2003 Model - NAVD 88 Plan: Lower RG - Existing 2003 - NAVD88 5/19/2011



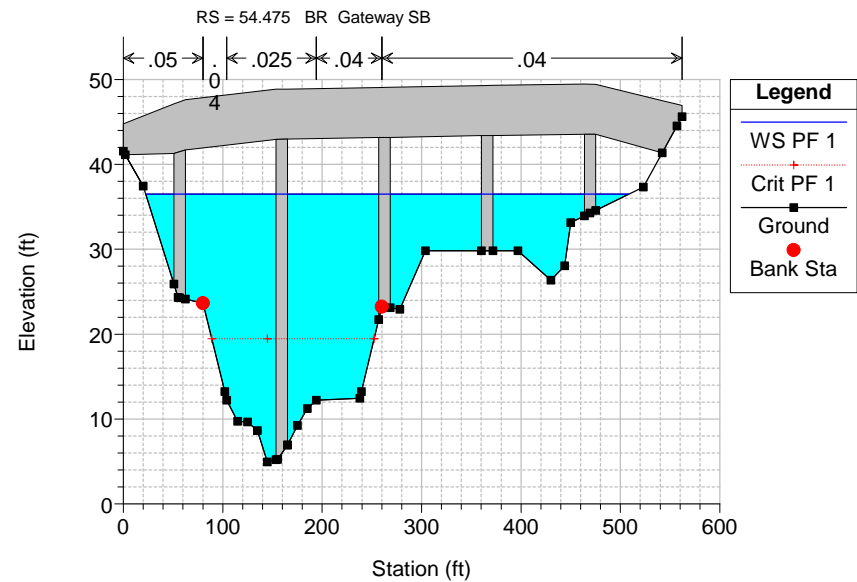
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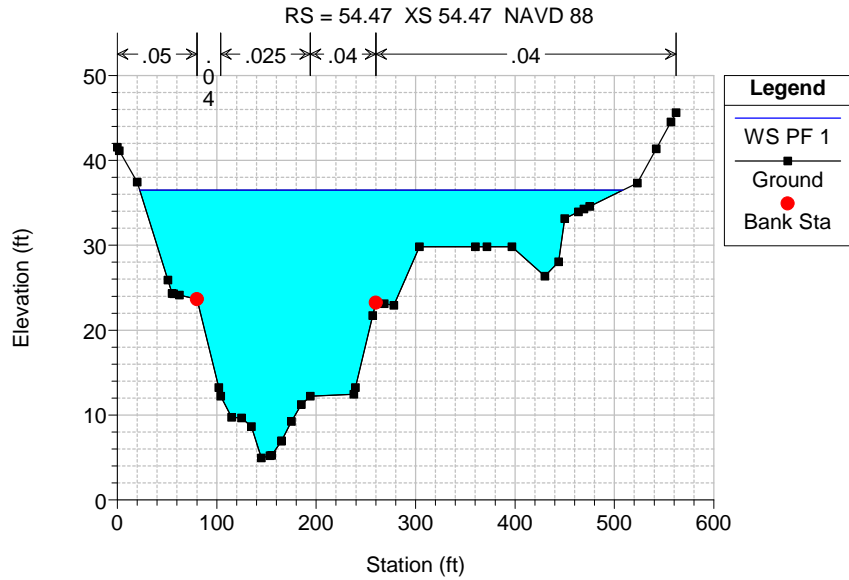
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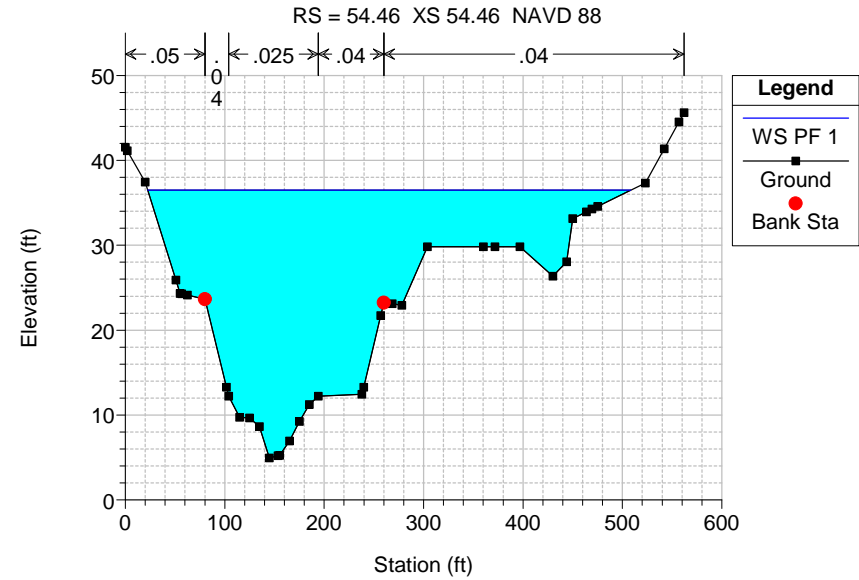
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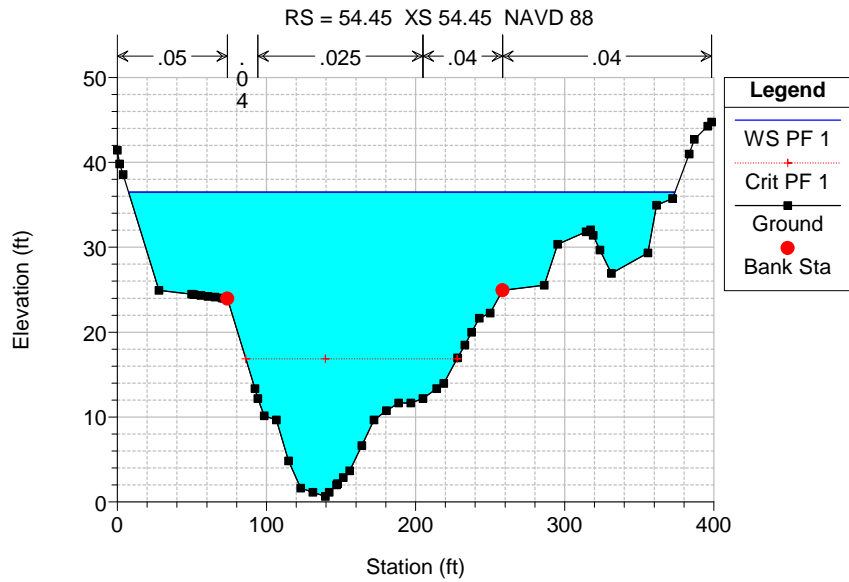
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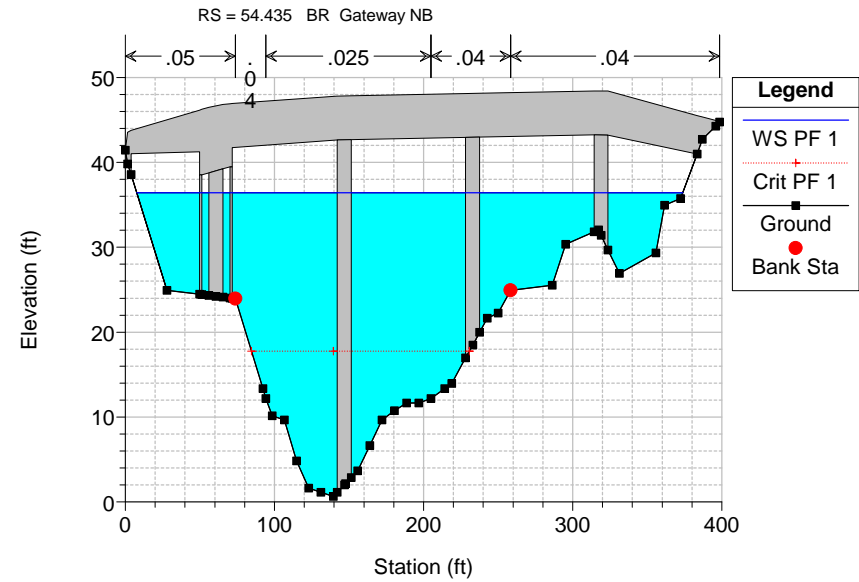
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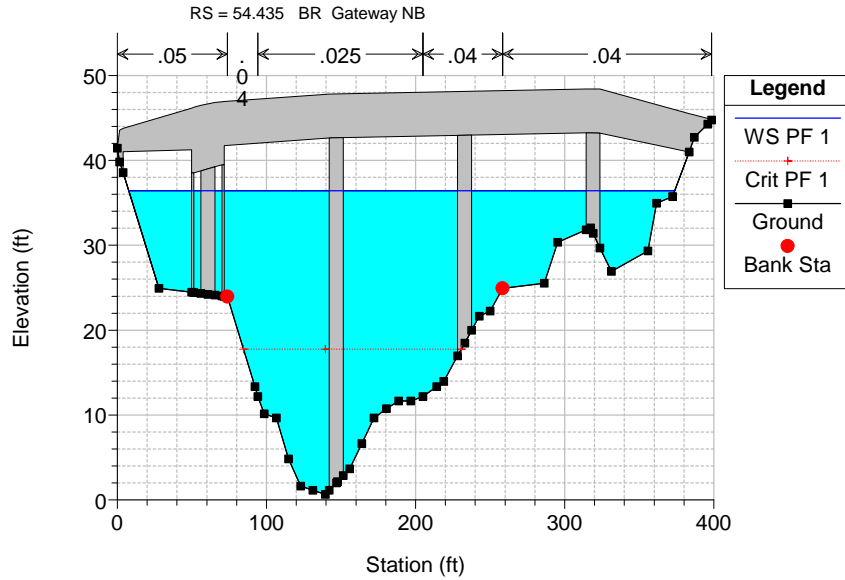
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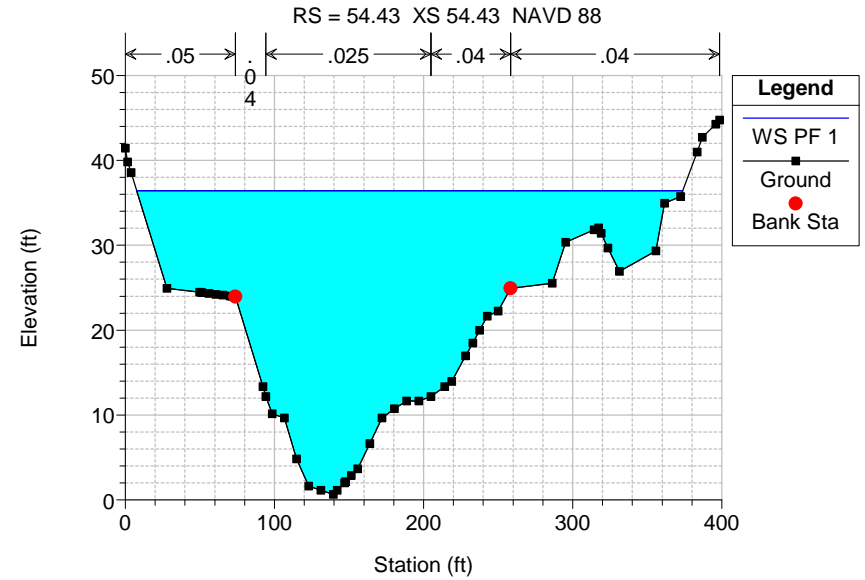
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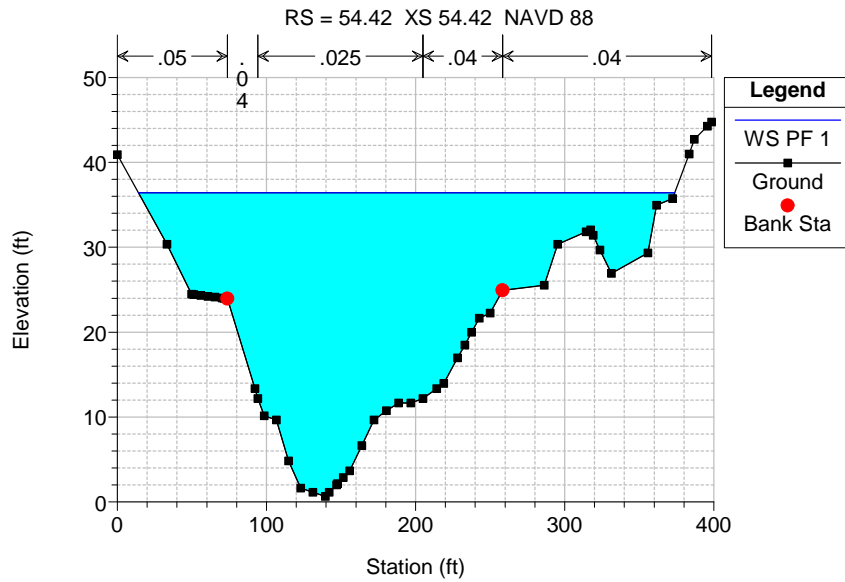
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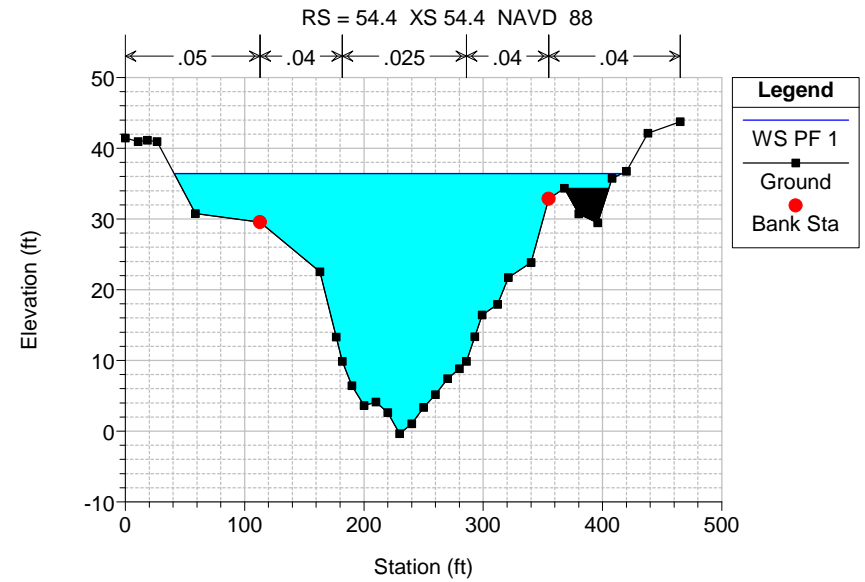
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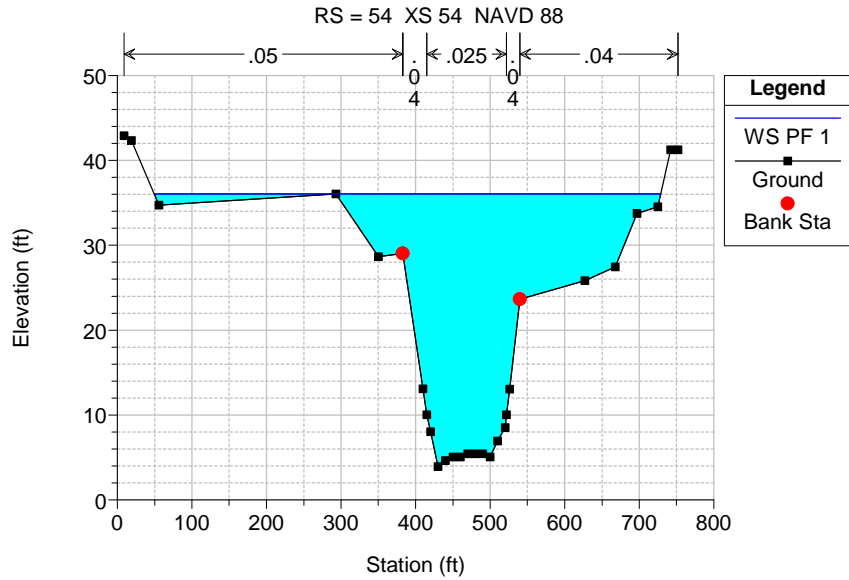
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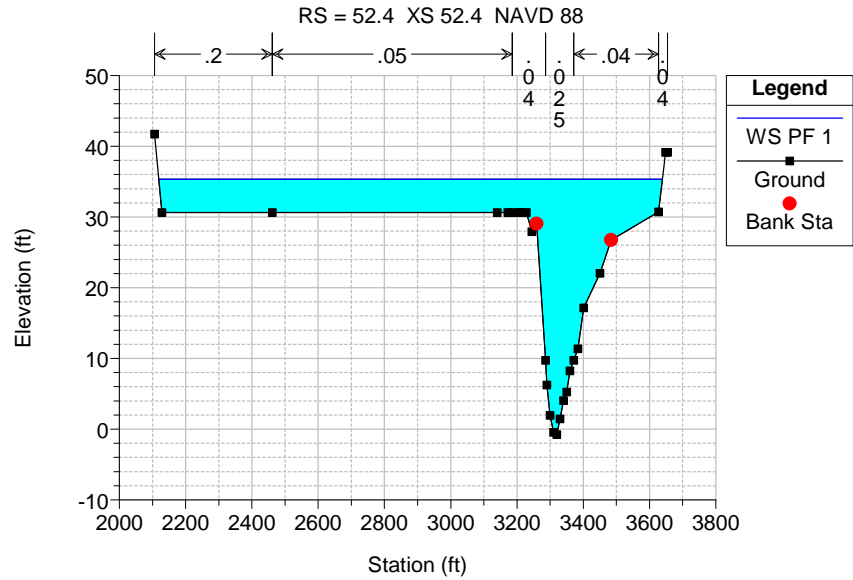
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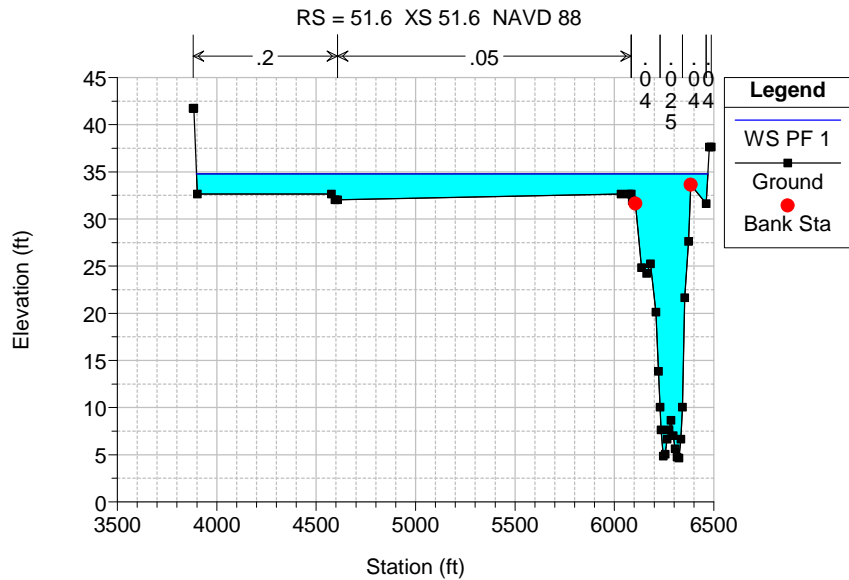
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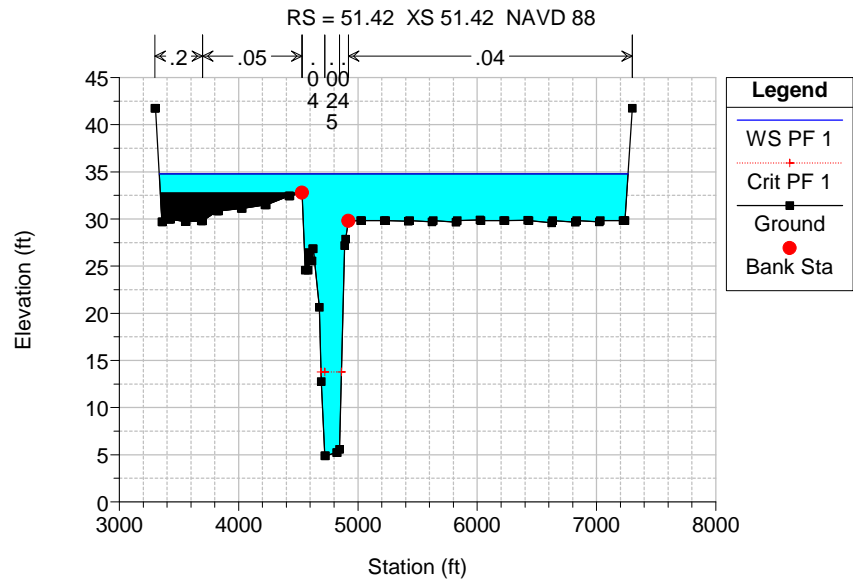
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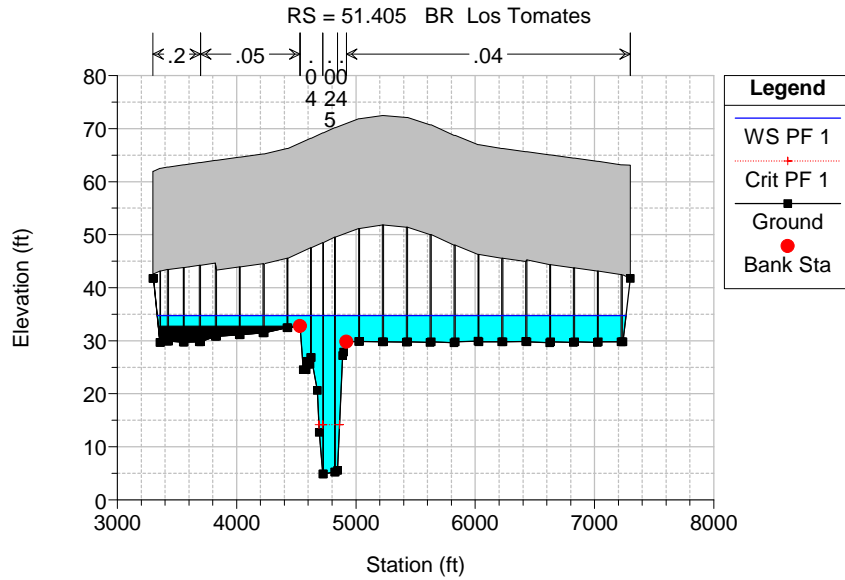
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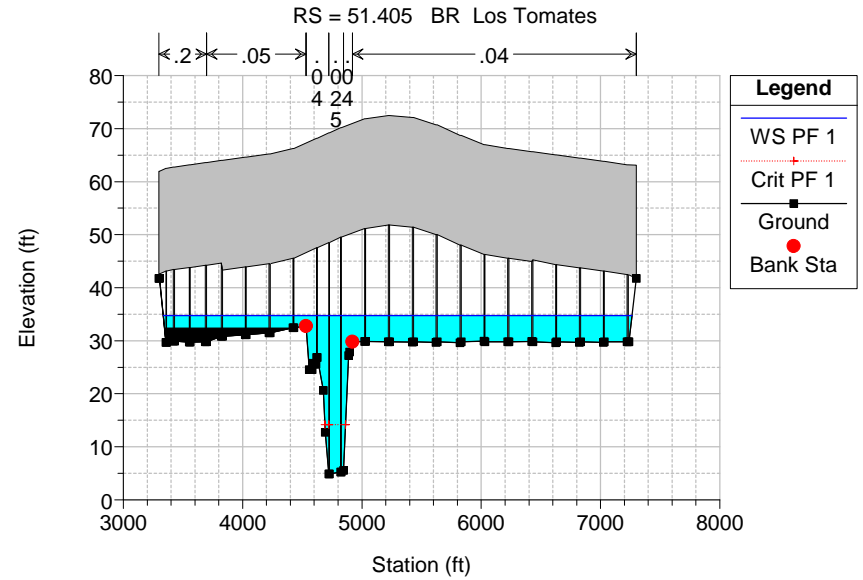
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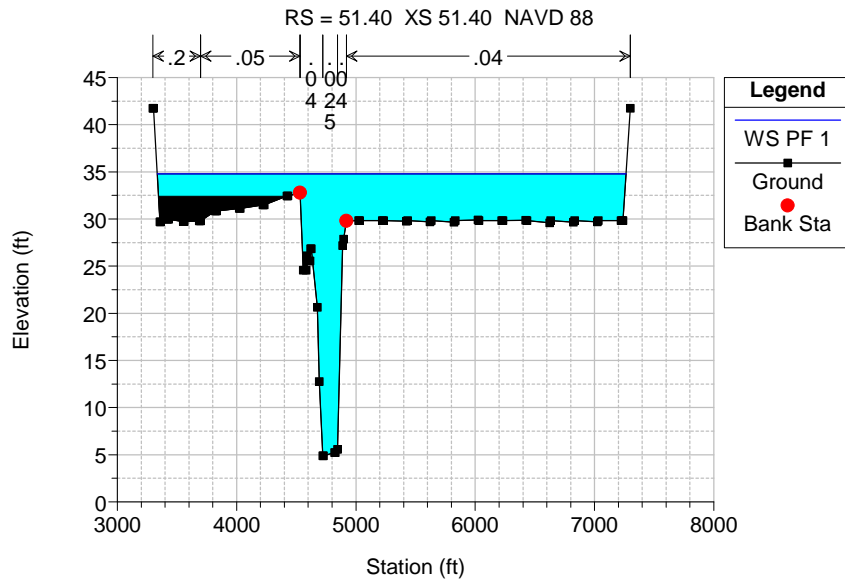
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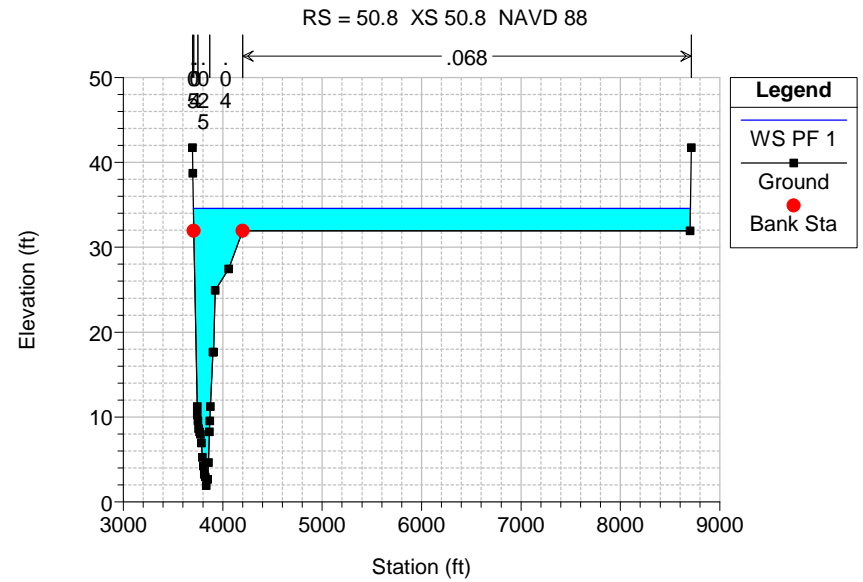
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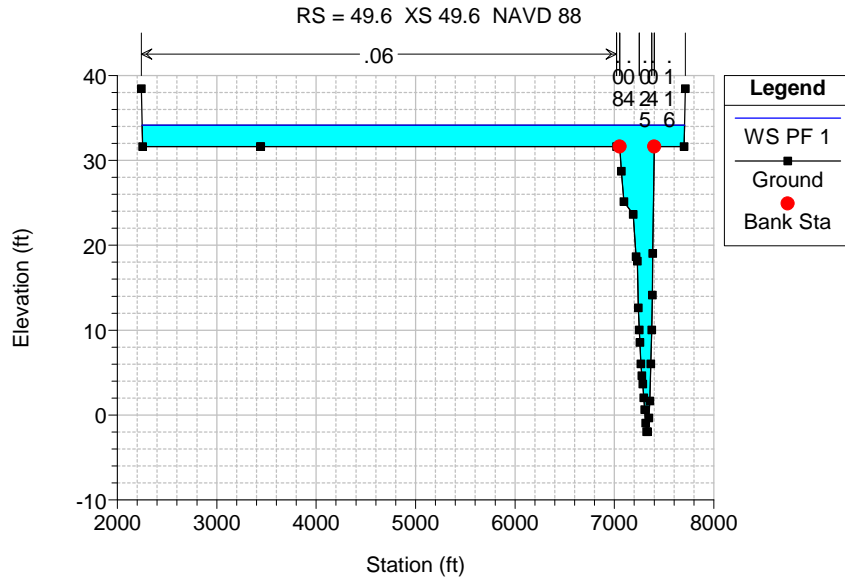
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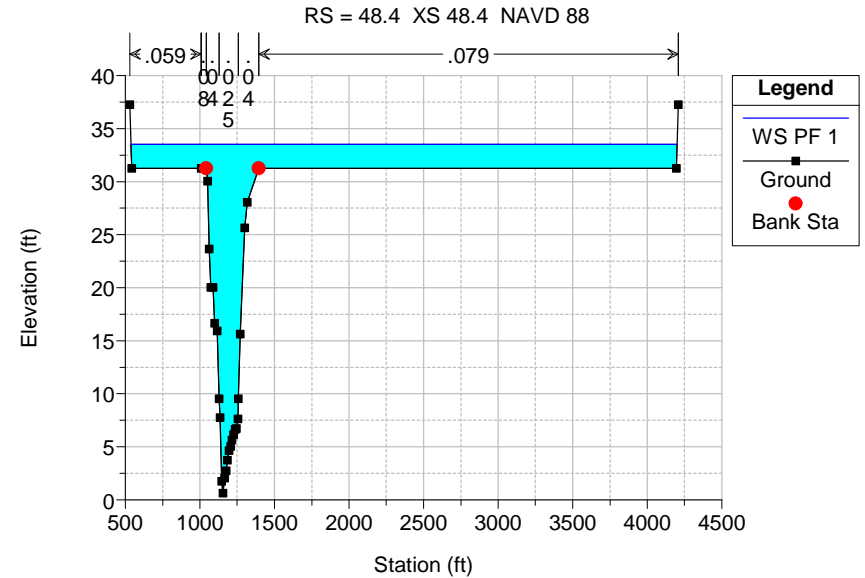
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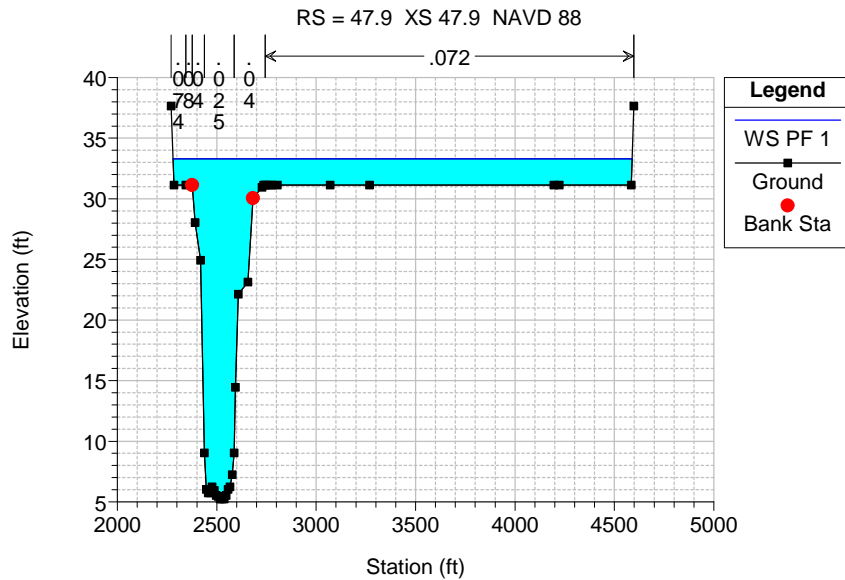
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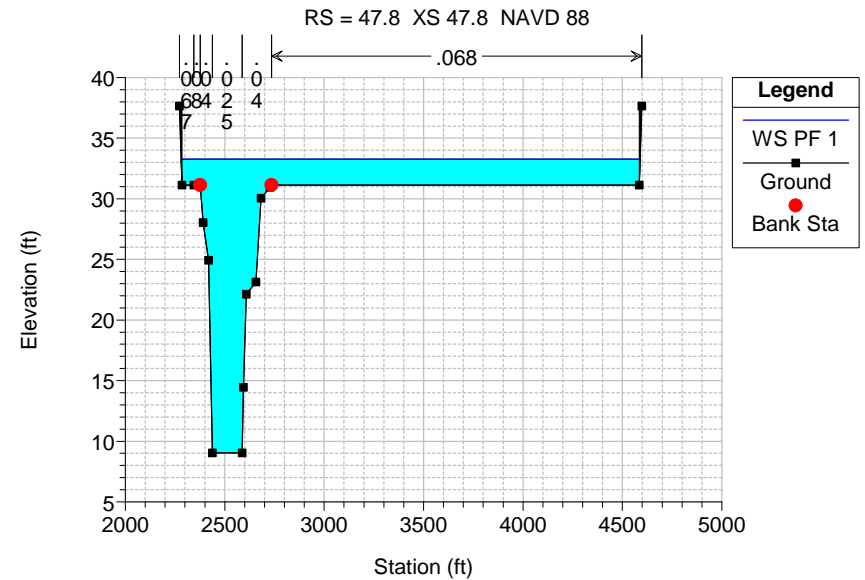
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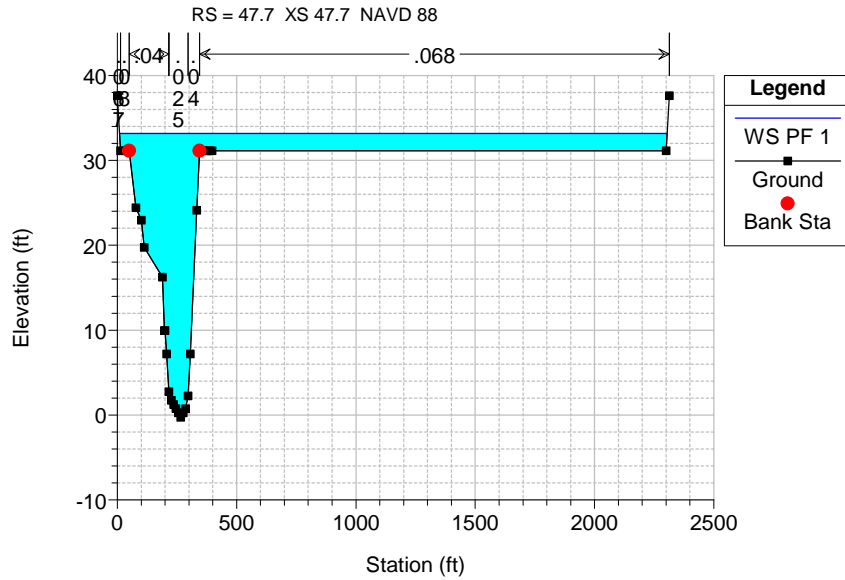
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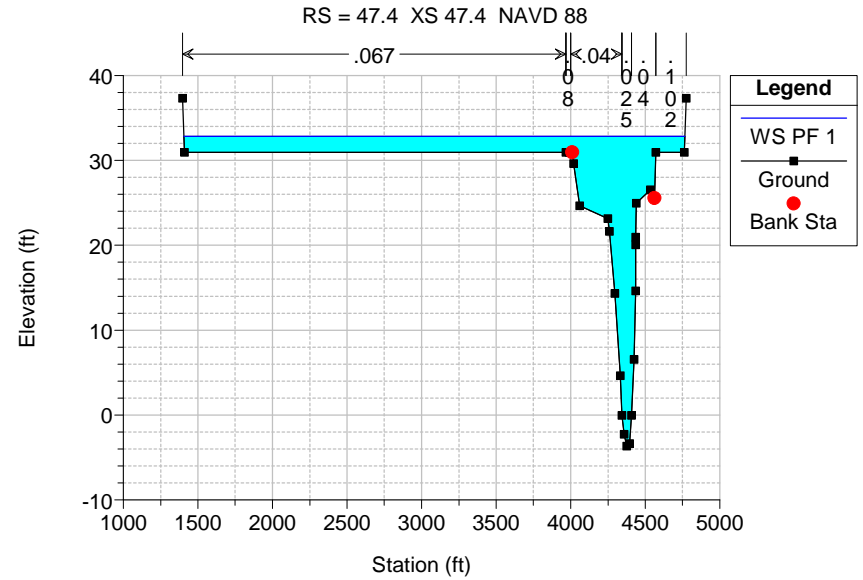
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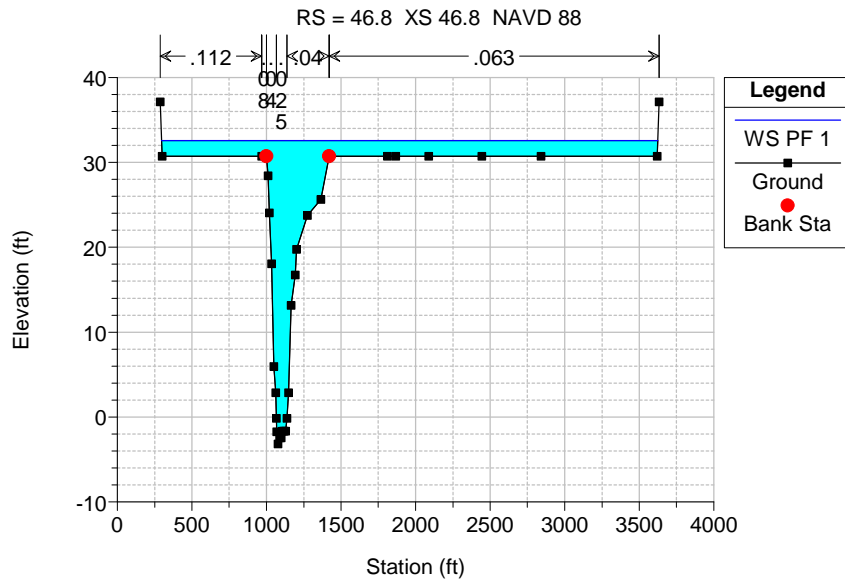
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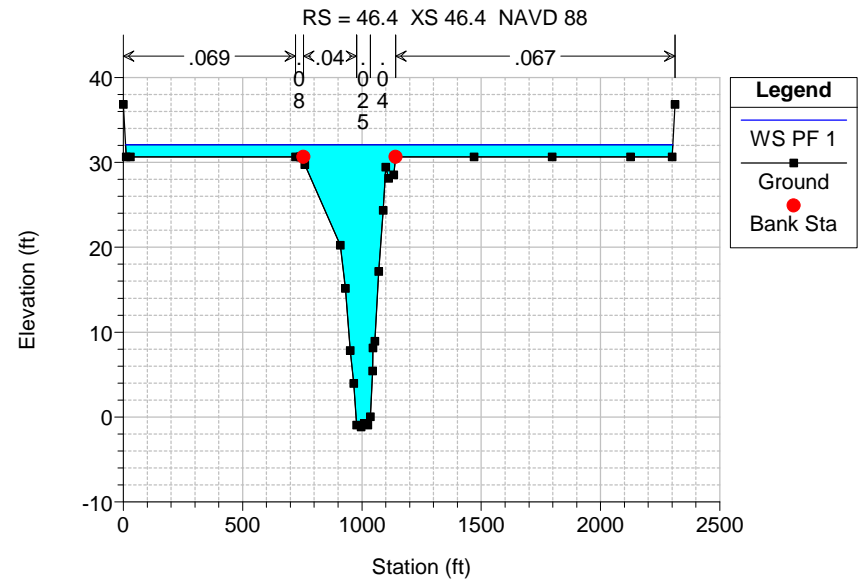
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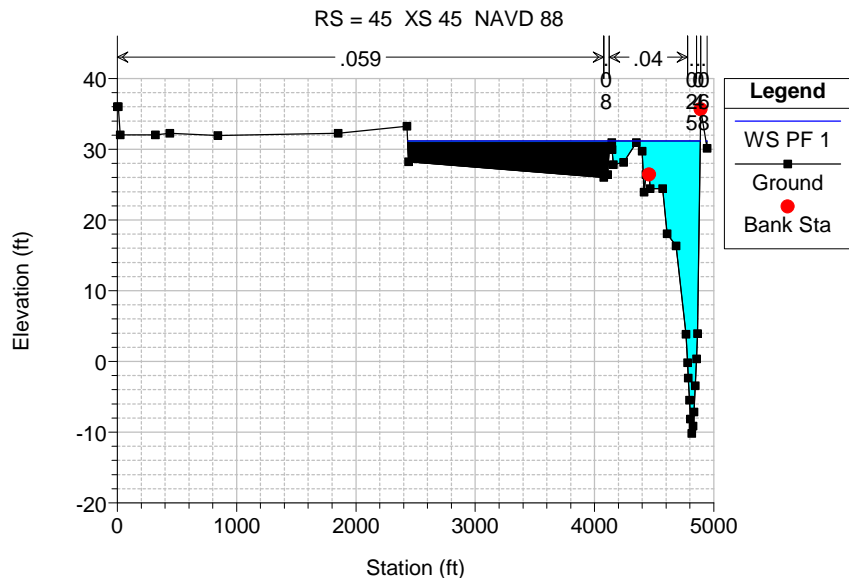
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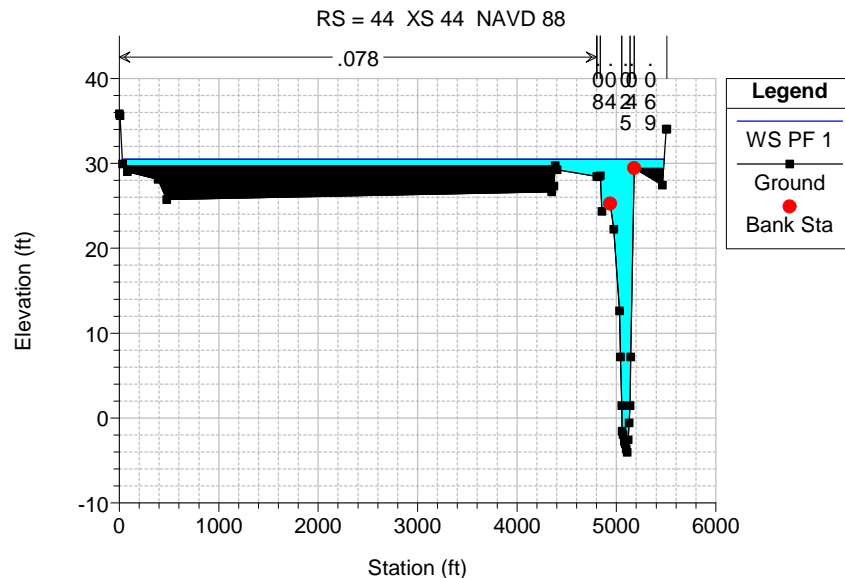
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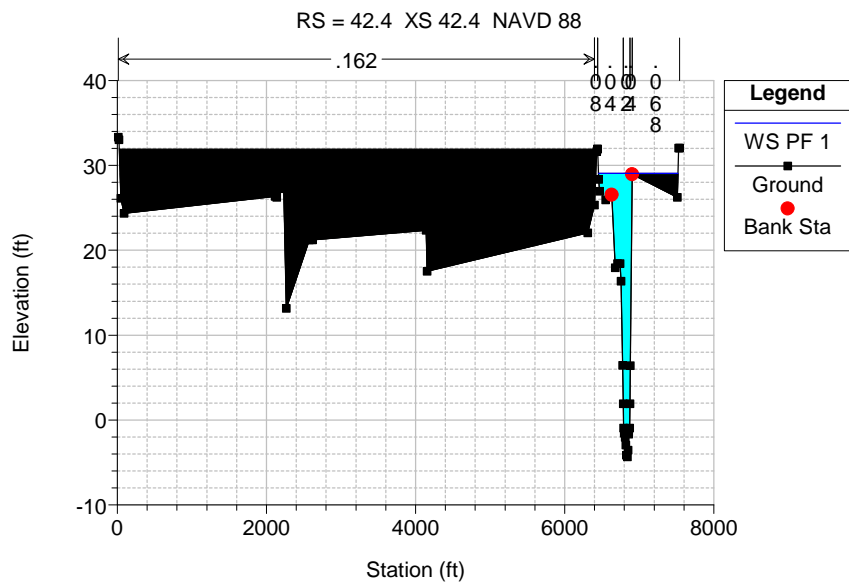
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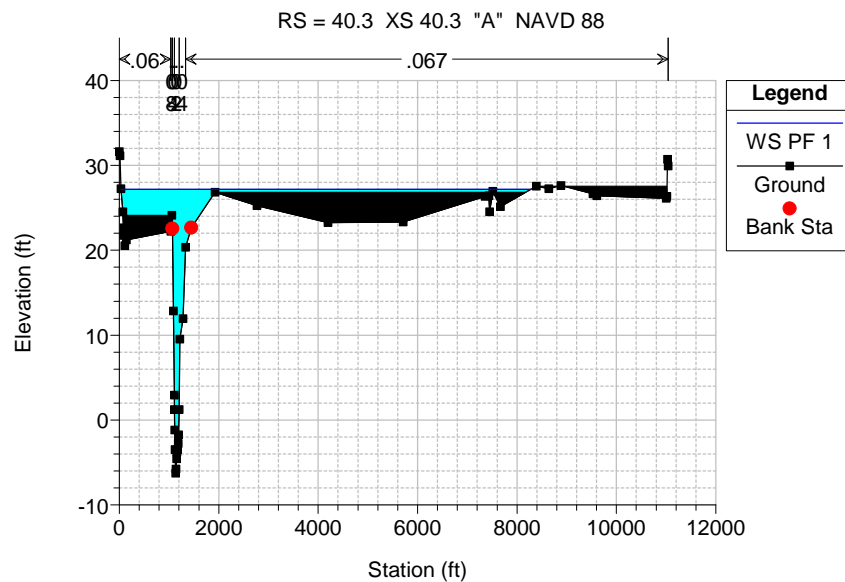
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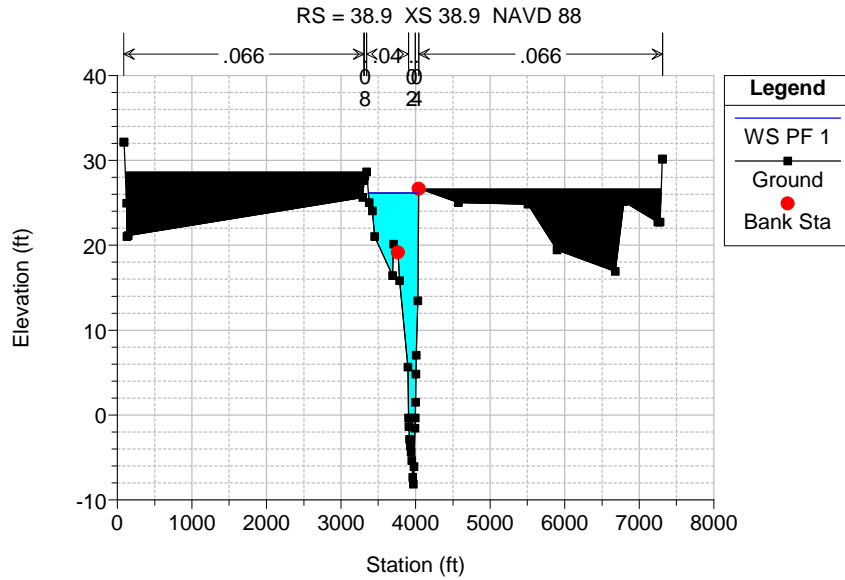
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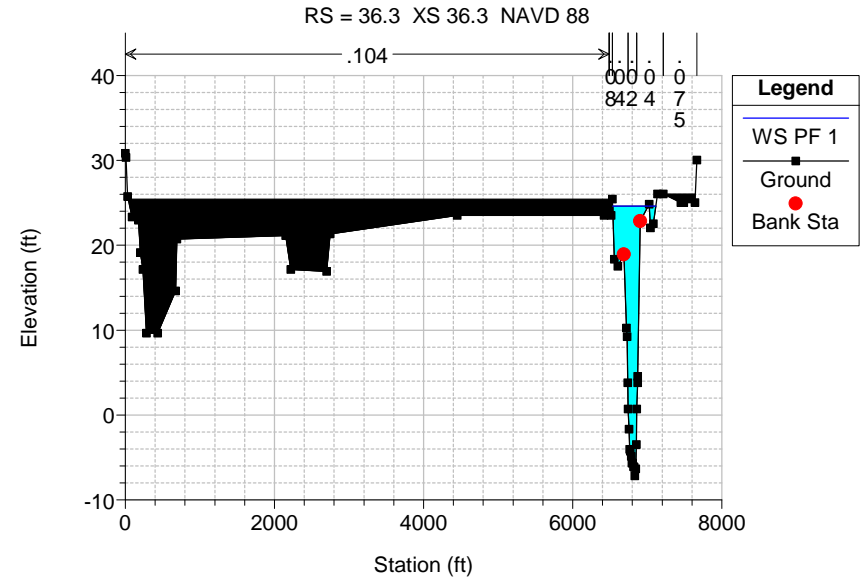
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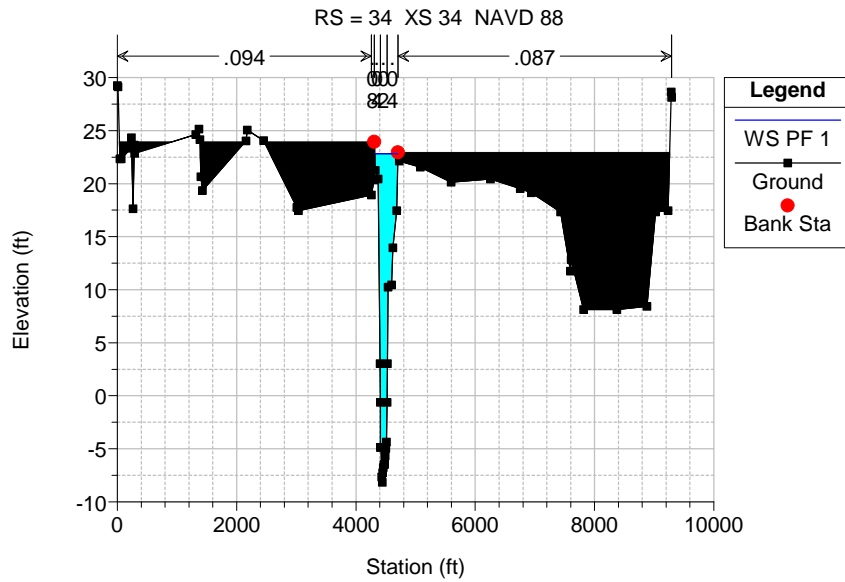
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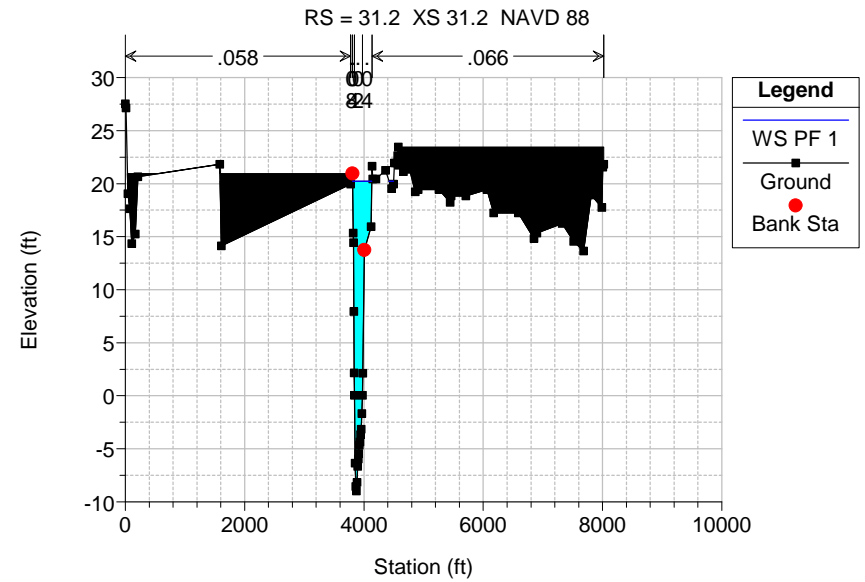
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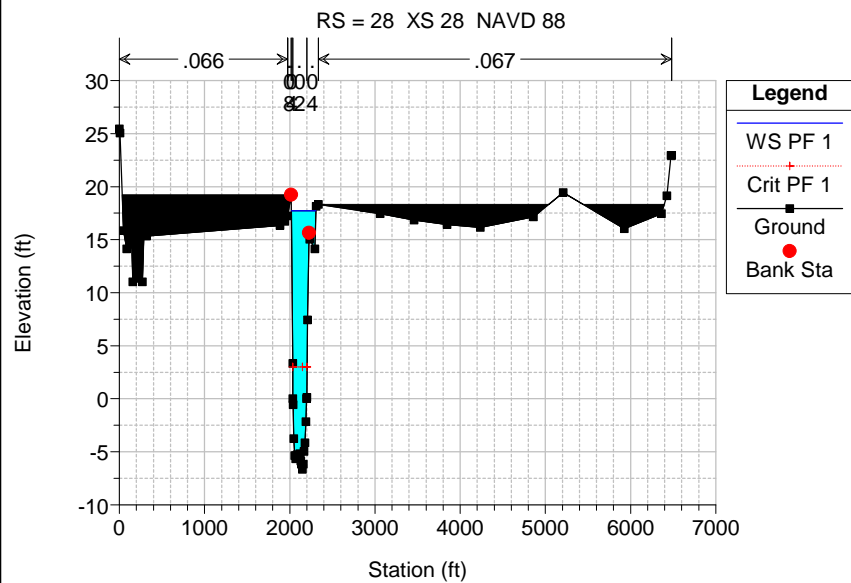


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Appendix D

Gateway International Bridge Memorandum

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TO: Frank Duran (IBWC)
FROM: Andy Gong, P.E. (Tetra Tech)
SUBJECT: IBWC U.S. Levee Embankment Protection – Gateway International Bridge
Cc: Ike Pace, P.E. (Tetra Tech)
DATE: March 30, 2011

PROJECT LOCATION

The Gateway International Bridge connects Brownsville, Texas to Matamoros, Tamaulipas, Mexico. The bridge currently includes a southbound span and a northbound span (Figure 1). The southbound (upstream) span crosses the Rio Grande at River Mile 54.475; the northbound span crosses the Rio Grande at River Mile 54.435.

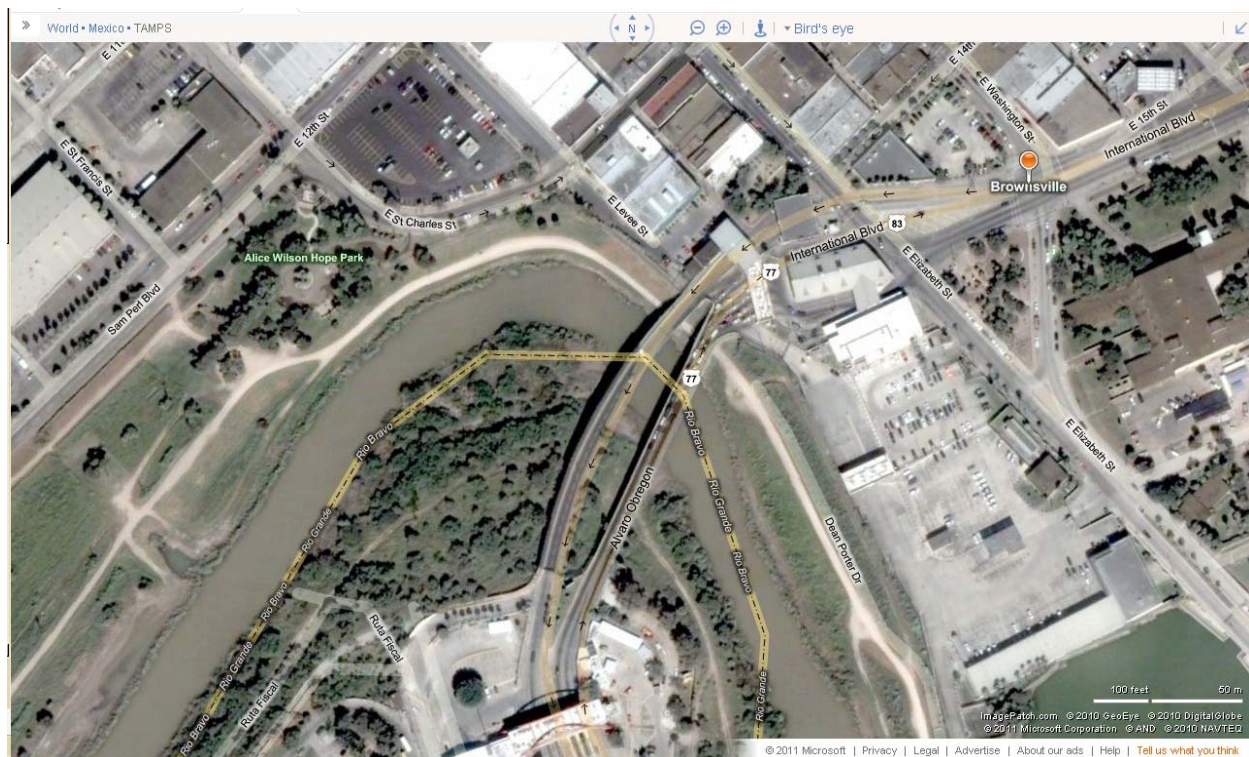


Figure 1. Gateway International Bridge Crossing of the Rio Grande (flow from left to right)

The IBWC is responsible for operation and maintenance of the U.S. levee along the left bank of the Rio Grande. Since the Rio Grande serves as the U.S. – Mexico border, the U.S. Department of Homeland Security (DHS) constructed a border security fence that is located in the access road along the crown of the levee (Figure 2). The fence obstructs access to the top of levee embankment, so access by the IBWC for flood fighting may be limited. The location of the levee embankment along the outside of the bend makes the embankment particularly subject to scour and erosion. To reduce the need for access to the levee during flood events, the IBWC is considering construction of an erosion protection along the

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riverward slope of the levee embankment. This technical memorandum summarizes existing hydraulic conditions and the risk of the embankment to erosion. Additionally, the results of analyses of revetment alternatives are presented.

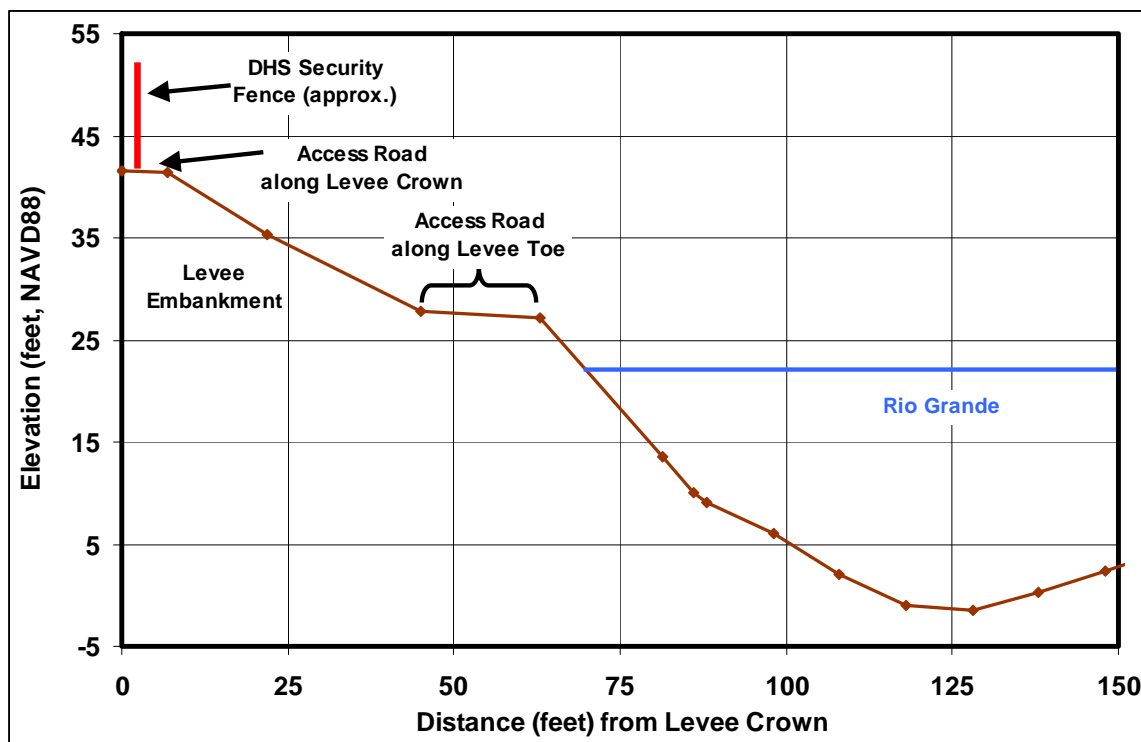


Figure 2. U.S. Levee Embankment, Access Roads, and DHS Security Fence

EXISTING CONDITIONS

The IBWC provided a hydraulic model of the Rio Grande that was used to quantify existing hydraulic conditions. The model includes 11 cross sections in the vicinity of the bridge (Table 1). The model includes a flow profile associated with the design flood, which for the reach adjacent to the Gateway International Bridge is 20,000 cfs. For this design flood, the HEC-RAS model was used to calculate the water surface elevation, channel velocity, and the top width of the water surface in the channel. These hydraulic parameters were used with an estimate of the radius of curvature of the bend to estimate the increased velocity along the outside of the bend – the area where embankment protection is under consideration. The resulting velocity was compared to erosion thresholds to identify whether there is need for embankment protection.

For the design flow of 20,000 cfs, Table 1 summarizes pertinent hydraulic parameters calculated using the HEC-RAS model. The radius of curvature of the bend was estimated using aerial photography to be between 550 and 575 feet.

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Table 1. Hydraulic Parameters Calculated Using IBWC HEC-RAS Model of the Rio Grande

Section ID	Description	Minimum Channel Elevation ¹ (feet)	Water Surface Elevation ¹ (feet)	Hydraulic Depth of Main Channel (feet)	Channel Top Width (feet)	Depth-Averaged Channel Velocity (feet/sec.)
55.2		-0.16	36.88	22.9	241.0	3.5
54.5		-1.46	36.61	26.0	164.0	3.2
54.49		4.94	36.51	24.6	180.0	3.9
54.475	U/S side of S/B span	4.94	36.47	24.4	165.4	4.2
54.475	D/S side of S/B span	4.94	36.46	24.3	165.4	4.2
54.47		4.94	36.47	24.6	180.0	3.9
54.46		4.94	36.47	24.6	180.0	3.9
54.45		0.64	36.46	25.2	184.5	3.9
54.435	U/S side of N/B span	0.64	36.39	25.0	165.7	4.4
54.435	D/S side of S/B span	0.64	36.39	25.0	165.7	4.4
54.43		0.64	36.41	25.2	241.0	3.9

¹ Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88)

The depth-averaged channel velocities in Table 1 are averaged across the entire channel section (defined by the bank stations in the HEC-RAS model). Since the concern is the velocities acting along the riverward embankment of the levee, evenly spaced “slices” were cut through the cross section of the channel and the HEC-RAS model calculated the depth averaged velocity within each slice. The minimum and maximum velocities along the left bank are presented in Table 2. The maximum velocities are taken from the toe of the left bank (i.e., the greatest depth); the minimums are taken from the top of the bank as defined by the bank station in the HEC-RAS model.

While the maximum and minimum velocities shown in Table 2 illustrate the variability associated with flow depth; this variability does not account for the greater flow velocity along the outside of a bend compared to the center of the channel. The U.S. Army Corps of Engineers (USACE) Engineer Manual EM 1110-2-1601 *Hydraulic Design of Flood Channels* (1994) provides the following equation to calculate flow velocity along the outside of a bend to facilitate the design of riprap:

$$\frac{V_{ss}}{V_{AVG}} = 1.74 - 0.52 * LOG(R_c/W) \quad \text{(Equation 1)}$$

Where:

- V_{ss} = characteristic velocity for side-slopes, depth-averaged velocity at 20% of the slope length up from the toe
- V_{AVG} = main channel average velocity at the upstream end of the bend
- R_c = centerline radius of the bend
- W = main channel water surface width

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Table 2. Maximum and Minimum Velocities Calculated Using the HEC-RAS Model along the Left Bank of the Rio Grande

Section ID	Description	Depth-Averaged Channel Velocity (feet/sec.)	Maximum Velocity (feet/sec.)	Minimum Velocity (feet/sec.)
55.2		3.5	4.5	1.3
54.5		3.2	4.4	1.2
54.49		3.9	5.3	1.9
54.475	U/S side of S/B span	4.2	6.2	2.2
54.475	D/S side of S/B span	4.2	6.2	2.2
54.47		3.9	5.3	1.9
54.46		3.9	5.3	1.9
54.45		3.9	5.2	1.7
54.435	U/S side of N/B span	4.4	6.4	2.1
54.435	D/S side of S/B span	4.4	6.4	2.1
54.43		3.9	5.3	1.7

Applying Equation 1 with main channel average velocity at the upstream end of the bend (Section ID 54.5), a radius of curvature between 550 and 575 feet, a main channel average velocity at the upstream end of the bend of 3.2 feet per second, and a main channel water surface width of 165 to 180 feet, the characteristic velocity for side-slopes is between 4.7 and 4.8 feet per second.

The resulting characteristic velocity for side-slopes as well as the maximum velocities computed using the HEC-RAS model show that the riverward slope of the embankment is close to the maximum permissible velocity to prevent erosion of 5 feet per second for various grass covers (USACE 1994; USDA 1954). Additionally, the duration of major flood flows in the Rio Grande can be several weeks, providing sufficient time to fully saturate surface soils and decrease resistance to erosive forces. Therefore, under the existing conditions in which access during a flood is limited, the addition of erosion protection to the riverward slope of the levee embankment is prudent.

As shown in Figure 1, it is noteworthy that there is a zone of vegetation that has established along the left edge of water. This vegetation does not extend up the bank, and characteristics of the vegetation that would affect flow velocity (i.e., height, flexibility, density, root structure) are unknown. While this vegetation may inhibit erosion, given the risk of erosion and the limited access, an erosion protection revetment would be more reliable than assuming the vegetation would prevent erosion.

Given the channel alignment near the Gateway International Bridge (i.e. a bend in the channel with small radius of curvature), scour along the bank is a concern and a likely cause of failure along the bank. The maximum potential bend scour was calculated using data developed by Thorne and Abt (1992). The safe design curve through the data (Equation 2) is intended to be conservative – it represents an upper limit for scour. It is important to note that this equation addresses local scour; if general bed degradation is expected, it would need to be quantified and added to the local scour. No general bed degradation beyond the bend scour is expected in the vicinity of the Gateway International Bridge.

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$$\frac{d_{SC}}{d_{BAR}} = 1.07 - 0.44 * \log[(R_c / W_{BAR}) - 2] \quad (\text{Equation 2})$$

Where:

- d_{SC} = maximum depth of scour in the bend
- d_{BAR} = mean water depth at upstream crossing
- R_c = centerline radius of the bend
- W_{BAR} = main channel water surface width at upstream crossing

Applying Equation 2 with the hydraulic characteristics of the upstream crossing (i.e., Section ID 54.5) and a radius of curvature of 550 to 575 feet, the maximum scour depth in the bend is 26 to 27 feet. The R_c / W_{BAR} ratios of 3.3 and 3.4 are between 2 and 22, so the use of this equation is appropriate.

Maynord (1996) developed an alternate equation to estimate potential bend scour:

$$\frac{d_{MAX}}{d_{BAR}} = 1.8 - 0.051 \left(\frac{R_c}{W_{BAR}} \right) + 0.0084 \left(\frac{W_{BAR}}{d_{BAR}} \right) \quad (\text{Equation 3})$$

All variables are as defined for Equation 1 and Equation 2. Application of Equation 3 yields maximum water depths of 43 to 44 feet. Existing flow depths in the bend during the design flood are between 31 and 36 feet, indicating that the toe depth of a riprap revetment should be 7 to 13 feet. Using a factor of safety of 1.19 as recommended by Maynord (1996) to more closely resemble the safe design curve, the maximum bend scour depths are 16 to 21 feet. These results indicate the conservatism of the Thorne and Abt (1992) safe design curve.

Based on engineering judgment and the results of both equations, the ultimate bend scour assumed for this location is 21 feet. An analysis of the thalweg profile between approximately RM 52 to RM 67 indicates that at least 5 feet of bend scour exists at the bend at the Gateway International Bridge. Thus, future potential for bend scour is estimated to be 16 feet.

ALTERNATIVE ANALYSIS

An analysis was performed to determine alternatives that would mitigate erosion as a result of the flow velocity as well as to provide a depth of protection based on the expected scour depth. Loose rock revetment was assumed as the erosion protection for several of the alternatives. Future design phases should consider other options for sloped revetment such as concrete slope paving, armorflex, and soil cement.

Using the flow velocities in Table 2 and the USACE sizing methodology (USACE 1994), the recommended rock gradation includes a D_{100} of 9.0 inches, a D_{50} of 6.0 inches, and thickness of 9 inches. For constructability, a thickness of 12 inches is recommended. These rock dimensions apply to all 4 alternatives presented below. For each alternative the extent of the revetment should extend from downstream of the Gateway Independence Bridge upstream to the point where the security fence no longer impacts maintenance and operation of the levee. The top of the revetment should extend to the top of levee.

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ALTERNATIVE 1 – RIPRAP REVETMENT OF UPPER BANK ONLY

One alternative means of embankment protection is the construction of a riprap revetment along the upper bank (i.e., between the access road along the toe and the access road along the crown). This is illustrated in Figure 3.

This alternative would provide embankment protection along the upper bank and reduce the potential for vegetation growth along the bank. This addresses the short-term condition but does not address the long-term condition in which the existing bank below the lower access road could begin to scour. Toe scour is probably the most frequent cause of failure of riprap revetments (USACE 1994). As the lower bank is eroded, the progressive erosion of the embankment will undermine the lower access road along the levee toe and the upper bank riprap revetment. This upper bank revetment would then fail and not provide any protection to the embankment.

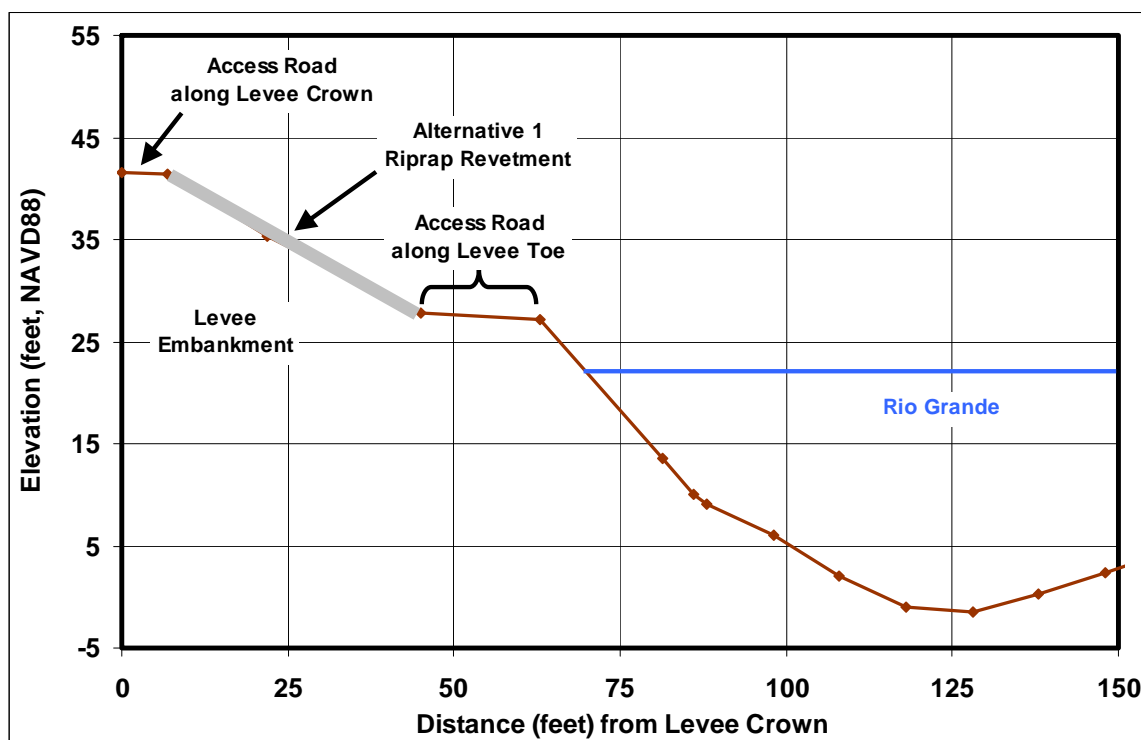


Figure 3. Alternative 1 Embankment Protection – Riprap Revetment on Upper Bank Only

ALTERNATIVE 2 – RIPRAP REVETMENT OF ENTIRE BANK

A second alternative is to construct a riprap revetment along the entire height of the bank from the upper access road down to a depth that will not be impacted by potential maximum scour. This alternative is illustrated in Figure 4. The advantage of this method is that it will fully cover the maximum potential scour depth with a uniform thickness of riprap revetment. The disadvantage of this alternative is that construction would require dewatering and substantial excavation, which will increase the cost of construction and potentially require environmental mitigation.

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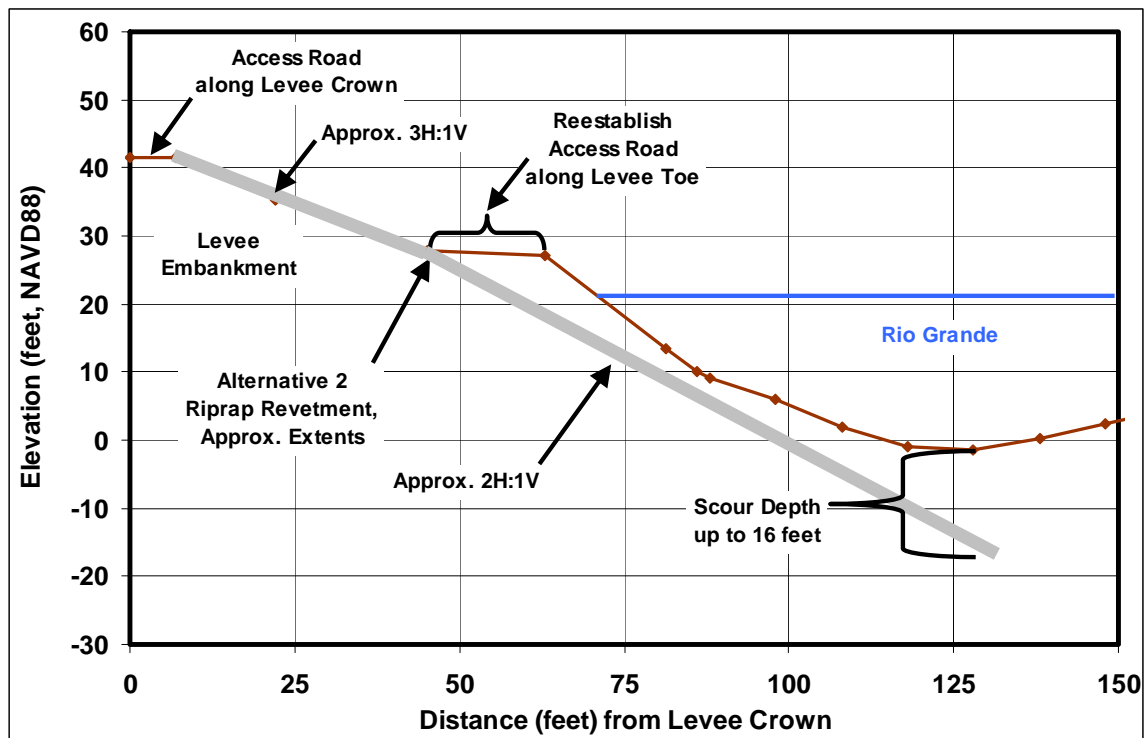


Figure 4. Embankment Protection – Riprap Revetment of Entire Bank (16 feet)

ALTERNATIVE 3 – LAUNCHABLE ROCK

A third alternative is for toe protection to be provided using launchable stone. As scour occurs underneath placed launchable stone, the stone is undermined and rolls/slides down the slope, stopping further scour at the toe of the bank. A trench is excavated, filled with stone, and buried such that toe scour is used as a substitute for mechanical excavation and placement. It is important to note that this alternative provides toe protection only, not the more robust full bank protection recommended in Alternative 2, as well as protection for the upper bank as described in Alternative 1.

Design guidance for trench-fill revetments is available in the *Hydraulic Design of Flood Control Channels* (USACE 1994). Providing an adequate volume of stone is critical because some material is lost downstream in the launching process – the greater the expected scour depth, the greater the percentage of stone lost. The height of the stone section in the trench-fill controls the rate at which rock is released during the launching process. In cases where impinging flow is expected to induce rapid scouring, the height of the stone section should be 2.5 to 3.0 times the desired thickness of the revetment. Widely graded riprap is recommended to reduce rock void and prevent leaching of bank material.

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The required volume of stone was calculated using the USACE (1994) methodology as presented in Equation 4:

$$Vol = F_s * T * L_L \quad \text{(Equation 4)}$$

Where:

- Vol = until volume of stone required cover an area one foot in width and spanning the launch length to the desired thickness
- F_s = safety factor (for vertical launch distances greater than 15 feet, safety factor is 1.5 for dry placement and 1.75 for placement underwater)
- T = thickness of stone layer after launching
- L_L = launch length, distance over which launched stone is to cover (for the recommended slope of 2H:1V, this distance equals $\sqrt{5}$ times the scour depth)

The available space to construct the trench is limited due to the depth of the channel; therefore, this alternative can provide only sufficient revetment for the toe (i.e. the expected bend scour depth of 16 feet). Applying Equation 4 with a F_s of 1.5, a T of 1 foot, and L_L of 36 feet (16 feet * $\sqrt{5}$), the required volume of stone is 54 cubic feet per foot of revetment. Using the recommended 2.5 to 3.0 times the desired thickness of stone layer, the height of the trench-fill should be approximately 2.5 to 3.0 feet. To achieve this required volume of stone, the distance the trench-fill needs to penetrate into the bank is approximately 18 to 22 feet (Figure 5).

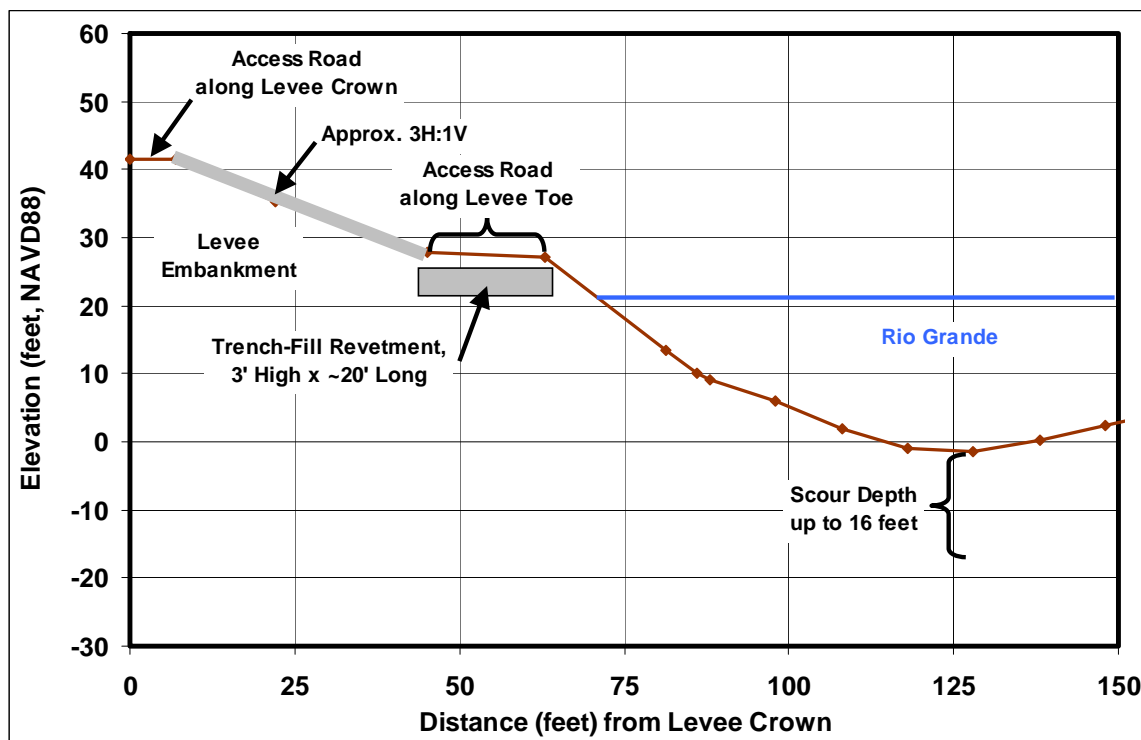


Figure 5. Embankment Protection – Trench-Fill Placement of Launching Stone

ALTERNATIVE 4 – SHEETPILE

The fourth alternative uses sheetpile rather than rock to provide protection for future scour. Riprap revetment is provided along the existing channel slope, under the lower access road, and along the upper bank. As shown in Figure 6, the sheetpile would be left at an additional height during construction to facilitate the placement of rock along the existing channel bank (the additional height will be cut to ground elevation at the end of construction). The depth of sheetpile required to protect against bend scour is 16 feet so approximately an additional 32 feet of embedment is required below the scour depth for stability.

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(Figure 6). Future design phases would need to determine if sheetpile or king piles are required for stability.

To protect the bank between the top of the sheetpile and the existing lower access road along the levee toe, a new riprap revetment would be constructed. This revetment cannot reduce existing conveyance and can be no steeper than 2H:1V so a new 16-foot wide access road would need to be overbuilt on the levee toe and protected in place.

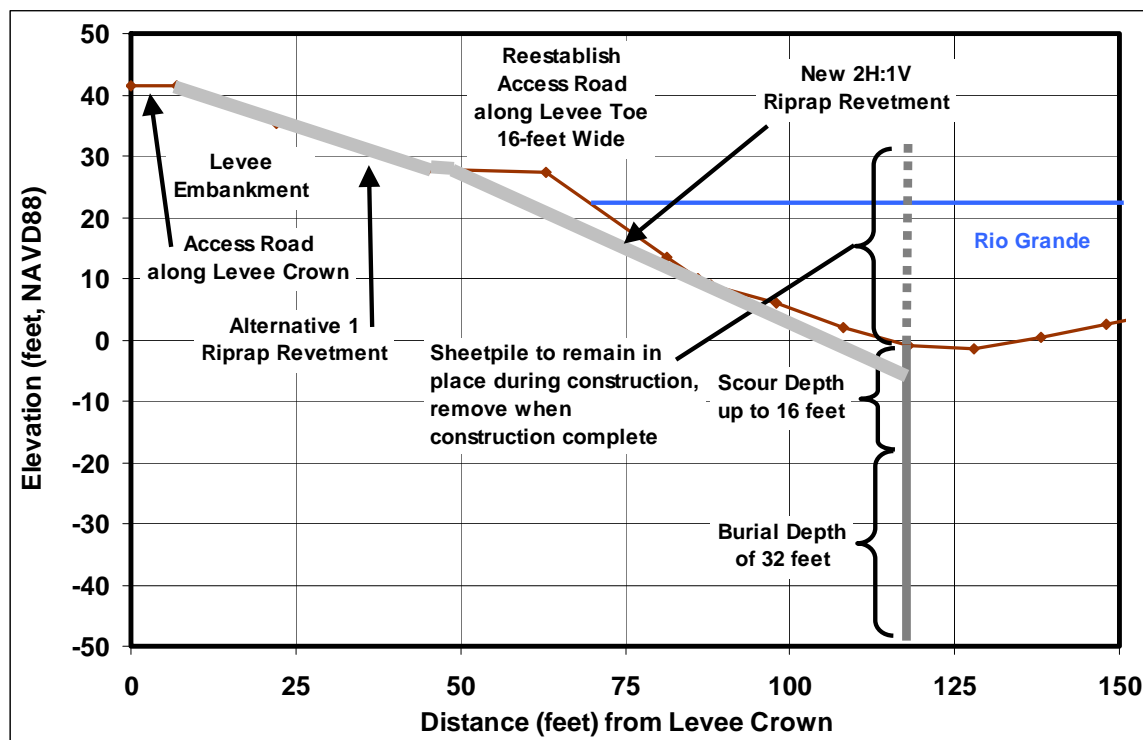


Figure 6. Embankment Protection – Riprap Upper Bank with Sheetpile for Future Scour

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DESIGN RECOMMENDATIONS

Each of these alternatives would require an environmental assessment and further investigation of construction feasibility to determine the design constraints. The alternatives presented have the following major advantages and disadvantages that should be considered as part of the design selection.

Alternative 1: Riprap Revetment Upper Bank Only

- + Least environmental impacts
- + Addresses short-term maintenance concerns on the upper bank
- + No dewatering operations needed
- Does not provide protection due to scour

Alternative 2: Riprap Revetment of Entire Bank

- + Provides protection for future scour and addresses maintenance concerns along the entire bank
- Most environmental impacts
- Diversion of river and dewatering must be considered

Alternative 3: Launchable Rock Protection

- + Addresses short-term maintenance concerns on the upper bank
- + Likely no dewatering operations needed
- + Provides for scour protection at the toe
- Full bank protection is not provided

Alternative 4: Sheet Pile Protection

- + Provides protection for future scour and addresses maintenance concerns along the entire bank
- Dewatering must be considered (likely no river diversion required)
- + Less environmental impacts as compared to Alternative 2

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Appendix E

Survey Control Data

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DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -LINE TABLE								
LINE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END STATION	END NORTHING	END EASTING	LENGTH	BEARING
L1	1270+ 72.00	16520062.06	1275912.87	1276+70.76	1276+70.76	1276434.27	598.76	N60- 33' 02.85"E
L2	1276+ 70.76	16520356.44	1276434.27	1277+92.58	1277+92.58	1276541.5	121.82	N61- 40' 25.06"E
L3	1279+05.95	16520416.64	1276650.67	1279+86.88	1279+86.88	1276723.53	80.93	S64- 11' 45.58"E
L4	1279+86.88	16520381.42	1276723.53	1283+01.94	1283+01.94	1277004.65	315.07	S63" 09' 20.13"E
L5	1283+01.94	16520239.14	1277004.65	1288+20.88	1288+20.88	1277469.44	518.93	S63" 35' 40.51"E
L6	1288+20.88	16520008.36	1277469.44	1302+67.84	1302+67.84	1278763.3	1446.96	S63" 24' 16.29"E
L7	1302+67.84	16519360.58	1278763.3	1304+72.98	1304+72.98	1278947.27	205.15	S63" 44' 34.67"E
L8	1304+72.98	16519269.82	1278947.27	1308+91.29	1308+91.29	1279321.8	418.31	S63" 32' 54.43"E
L9	1308+91.29	16519083.48	1279321.8	1313+07.02	1313+07.02	1279692.55	415.73	S63" 06' 12.28"E
L10	1313+07.02	16518895.42	1279692.55	1314+09.76	1314+09.76	1279783.45	102.74	S62" 13' 43.73"E
L11	1316+89.80	16518658.72	1279985.78	1318+27.29	1318+27.29	1280058.07	137.49	S31- 43' 26.13"E
L12	1318+27.29	16518541.77	1280058.07	1319+30.77	1319+30.77	1280109.36	103.48	S29- 42' 44.63"E
L13	1319+30.77	16518451.9	1280109.36	1320+00.80	1320+00.80	1280141.24	70.03	S2T 04' 45.66"E
L14	1323+27.98	16518071.45	1280183.41	1324+49.50	1324+49.50	1280158.2	121.52	S11- 58' 28.65"W
L16	1328+54.63	16517561.94	1280054.81	1329+62.75	1329+62.75	1280000.58	108.12	S30- 06' 04.87"W
L17	1329+62.75	16517468.4	1280000.58	1336+92.02	1336+92.02	1279614.42	729.28	S31- 58' 21.44"W
L18	1336+92.02	16516849.75	1279614.42	1338+99.28	1338+99.28	1279505.93	207.26	S31- 33' 55.42"W
L19	1338+99.28	16516673.16	1279505.93	1344+97.38	1344+97.38	1279190.86	598.1	S31- 47' 15.68"W
L20	1352+ 73.40	16515447.31	1279264.91	1353+50.58	1353+50.58	1279318.11	77.18	S43" 34' 19.78"E
L21	1353+50.58	16515391.39	1279318.11	1361+ 78.89	1361+78.89	1279909.3	828.31	S45- 32' 20.99"E
L22	1361+ 78.89	16514811.22	1279909.3	1362+81.26	1362+81.26	1279983.9	102.37	S46- 46' 43.25"E
L23	1363+59.69	16514702.73	1280051.45	1364+87.24	1364+87.24	1280174.06	127.54	S74- 00' 49.11"E
L24	1364+87.24	16514667.61	1280174.06	1368+98.01	1368+98.01	1280571.04	410.77	S75- 06' 27.47"E
L25	1368+98.01	16514562.04	1280571.04	1370+40.97	1370+40.97	1280709.92	142.97	S76- 16' 35.19"E
L26	1370+80.03	16514523.41	1280748.59	1372+08.21	1372+08.21	1280876.78	128.18	S89- 50' 13.53"E
L27	1372+08.21	16514523.04	1280876.78	1378+21.48	1378+21.48	1281489.9	613.28	N88- 43' 31.38"E
L28	1378+21.48	16514536.69	1281489.9	1379+14.81	1379+14.81	1281583.22	93.33	S89- 04' 15.94"E
L29	1380+81.32	16514456.93	1281722.53	1389+02.61	1389+02.61	1282161.19	821.29	S32" 17' 01.71"E
L30	1389+02.61	16513762.6	1282161.19	1394+11.78	1394+11.78	1282428.74	509.17	S31- 41' 58.03"E
L31	1394+11.78	16513329.39	1282428.74	1394+55.71	1394+55.71	1282461.88	43.94	S48- 58' 32.76"E
L32	1394+55.71	16513300.55	1282461.88	1395+08.77	1395+08.77	1282514.88	53.06	S8T 23' 40.01"E
L33	1395+08.77	16513298.14	1282514.88	1396+12.71	1396+12.71	1282618.64	103.94	N86- 35' 06.52"E
L34	1396+12.71	16513304.33	1282618.64	1413+57.95	1413+57.95	1284359.57	1745.24	N85- 58' 28.23"E
L35	1414+86.49	16513449.51	1284485.85	1416+01.79	1416+01.79	1284596.51	115.3	N73- 40' 43.13"E
L36	1417+14.72	16513493.94	1284708.19	1418+26.18	1418+26.18	1284819.38	111.46	S85- 58' 30.87"E
L37	1418+26.18	16513486.12	1284819.38	1420+27.88	1420+27.88	1285020.12	201.7	S84- 24' 31.17"E
L38	1420+27.88	16513466.47	1285020.12	1425+37.49	1425+37.49	1285526.57	509.61	S83" 36' 33.09"E
L39	1428+59.56	16513311.29	1285830.94	1435+33.77	1435+33.77	1286417.98	674.21	S60- 32' 34.20"E
L40	1435+33.77	16512979.74	1286417.98	1446+87.16	1446+87.16	1287422.23	1153.39	S60- 32' 18.88"E
L41	1448+75.16	16512255.14	1287505.51	1449+84.06	1449+84.06	1287496.5	108.89	S4- 44' 43.07"W
L42	1449+84.06	16512146.62	1287496.5	1464+01.50	1464+01.50	1287323.05	1417.45	ST 01' 44.07"W
L44	1468+95.12	16510580.5	1287739.22	1472+81.84	1472+81.84	1288121.62	386.72	S81' 26' 06.58"E
L45	1472+81.84	16510522.91	1288121.62	1477+39.64	1477+39.64	1288570.42	457.8	S78' 36' 52.61"E

DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -LINE TABLE								
LINE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END STATION	END NORTHING	END EASTING	LENGTH	BEARING
L46	1478+47.99	16510432.35	1288678.06	1480+03.83	1480+03.83	1288830.95	155.85	N78' 48' 41.29"E
L47	1480+03.83	16510462.59	1288830.95	1481+36.15	1481+36.15	1288958.38	132.32	N74' 22' 32.26"E
L48	1483+91.37	16510535.03	1289210.23	1485+72.02	1485+72.02	1289390.86	180.65	N88' 59' 54.50"E
L49	1485+ 72.02	16510538.18	1289390.86	1489+38.08	1489+38.08	1289756.9	366.05	N89' 37' 46.79"E
L50	1489+38.08	16510540.55	1289756.9	1490+32.79	1490+32.79	1289851.61	94.71	N89' 11' 52.20"E
L51	1490+32.79	16510541.88	1289851.61	1492+43.27	1492+43.27	1290062.09	210.48	S89' 46' 00.20"E
L52	1496+06.04	16510380.07	1290372.08	1497+02.00	1497+02.00	1290427.61	95.96	S35' 21' 19.73"E
L53	1497+02.00	16510301.8	1290427.61	1497+99.44	1497+99.44	1290485.65	97.44	S36' 33' 40.24"E
L54	1497+99.44	16510223.54	1290485.65	1498+94.62	1498+94.62	1290538.53	95.18	S33' 44' 58.22"E
L55	1498+94.62	16510144.4	1290538.53	1499+92.56	1499+92.56	1290595.38	97.94	S35' 29' 07.86"E
L56	1499+92.56	16510064.65	1290595.38	1500+87.22	1500+87.22	1290647.84	94.66	S33' 39' 10.68"E
L57	1500+87.22	16509985.85	1290647.84	1501 +83.40	1501+83.40	1290706.05	96.19	S3T 14' 39.62"E
L58	1501+83.40	16509909.28	1290706.05	1502+75.76	1502+ 75.76	1290760.19	92.35	S35' 53' 16.72"E
L59	1502+75.76	16509834.46	1290760.19	1503+73.20	1503+73.20	1290817.49	97.45	S36' 01' 02.75"E
L60	1503+ 73.20	16509755.64	1290817.49	1506+56.84	1506+56.84	1290982.81	283.64	S35' 39' 03.61"E
L61	1506+56.84	16509525.16	1290982.81	1507+52.51	1507+52.51	1291037.4	95.67	S34' 47' 53.74"E
L62	1507+52.51	16509446.61	1291037.4	1508+48.12	1508+48.12	1291093.37	95.62	S35' 49' 23.28"E
L63	1508+48.12	16509369.08	1291093.37	1509+42.96	1509+42.96	1291147.28	94.83	S34' 38' 54.45"E
L64	1509+42.96	16509291.06	1291147.28	1511+32.94	1511+32.94	1291249.77	189.99	S32' 38' 44.05"E
L65	1511+32.94	16509131.09	1291249.77	1512+29.34	1512+29.34	1291301.09	96.39	S32' 10' 02.30"E
L66	1512+29.34	16509049.49	1291301.09	1521+ 73.59	1521+73.59	1291811.4	944.25	S32' 42' 49.89"E
L67	1521+ 73.59	16508255.02	1291811.4	1525+43.10	1525+43.10	1292011.33	369.51	S32' 45' 23.59"E
L68	1529+69.84	16507535.32	1292090.27	1531+11.86	1531+11.86	1292063.41	142.02	S10' 54' 19.80"W
L69	1531+11.86	16507395.87	1292063.41	1533+21.65	1533+21.65	1292018.38	209.78	S12' 23' 37.62"W
L70	1533+21.65	16507190.98	1292018.38	1534+22.63	1534+22.63	1291998.88	100.99	S11' 07' 58.63"W
L71	1539+70.47	16506656.86	1292249.56	1540+58.27	1540+58.27	1292332.59	87.8	S71' 02' 12.12"E
L72	1540+58.27	16506628.33	1292332.59	1541+67.99	1541+67.99	1292438.92	109.72	S75' 44' 00.59"E
L73	1541+67.99	16506601.29	1292438.92	1546+07.00	1546+07.00	1292861.36	439.01	S74' 12' 15.85"E
L74	1546+07.00	16506481.79	1292861.36	1549+10.12	1549+10.12	1293151.6	303.12	S73' 14' 16.36"E
L75	1549+10.12	16506394.37	1293151.6	1552+21.64	1552+21.64	1293451.55	311.52	S74' 20' 26.14"E
L76	1552+21.64	16506310.29	1293451.55	1559+63.08	1559+63.08	1294154.75	741.44	S71' 31' 05.82"E
L77	1562+14.17	16505934.39	1294358.59	1563+15.65	1563+15.65	1294422.71	101.48	S39' 11' 21.22"E
L78	1563+15.65	16505855.74	1294422.71	1566+35.52	1566+35.52	1294619.1	319.88	S3T 52' 36.39"E
L79	1566+35.52	16505603.25	1294619.1	1574+12.71	1574+12.71	1295088.56	777.19	S3T 09' 36.03"E
L80	1574+12.71	16504983.86	1295088.56	1575+29.50	1575+29.50	1295162.8	116.79	S39' 28' 18.98"E
L81	1578+53.42	16504709.88	1295424.73	1579+72.10	1579+72.10	1295536.54	118.68	S70' 24' 14.35"E
L82	1579+72.10	16504670.08	1295536.54	1589+64.71	1589+64.71	1296465.26	992.62	S69' 19' 48.82"E
L83	1589+64.71	16504319.7	1296465.26	1591+85.22	1591+85.22	1296672.31	220.5	S69' 52' 48.68"E
L84	1591+85.22	16504243.85	1296672.31	1592+50.54	1592+50.54	1296731.76	65.32	S65' 31' 40.82"E
L85	1593+54.61	16504165.34	1296822.05	1594+78.17	1594+ 78.17	1296923.42	123.56	S55' 07' 20.19"E
L86	1594+78.17	16504094.69	1296923.42	1606+07.77	1606+07.77	1297831.44	1129.6	S53' 29' 56.03"E
L87	1606+07.77	16503422.76	1297831.44	1610+20.52	1610+20.52	1298166.79	412.75	S54' 20' 10.14"E
L88	1610+20.52	16503182.11	1298166.79	1611+32.78	1611+32.78	1298259.75	112.26	S55' 54' 21.31"E

DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -LINE TABLE								
LINE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END STATION	END NORTHING	END EASTING	LENGTH	BEARING
L89	1611+32.78	16503119.19	1298259.75	1612+31.70	1612+31.70	1298339.94	98.92	S54' 09' 16.65"E
L90	1612+31.70	16503061.26	1298339.94	1617+55.08	1617+55.08	1298780.53	523.38	S5T 19' 58.77"E
L91	1619+73.64	16502698.3	1298982.31	1625+98.16	1625+98.16	1299595.75	624.52	S79' 11' 14.58"E
L91	1619+ 73.64	16502698.3	1298982.31	1625+98.16	1625+98.16	1299595.75	624.52	S79" 11' 14.58"E
L92	1625+98.16	16502581.14	1299595.75	1630+40.57	1630+40.57	1300030.85	442.41	S79" 34' 25.52"E
L93	1630+40.57	16502501.08	1300030.85	1633+34.51	1633+34.51	1300319.14	293.95	S78" 44' 23.56"E
L94	1633+34.51	16502443.68	1300319.14	1639+95.48	1639+95.48	1300968.42	660.97	S79" 12' 34.35"E
L95	1644+91.75	16502046.89	1301365.92	1648+96.02	1648+96.02	1301579.06	404.27	S31" 49' 08.18"E
L96	1651+25.88	16501489.87	1301660.35	1652+29.80	1652+29.80	1301678.16	103.93	S9" 52' 10.45"E
L97	1652+29.80	16501387.48	1301678.16	1653+34.95	1653+34.95	1301693.82	105.15	S8" 33' 55.01 "E
L98	1653+34.95	16501283.51	1301693.82	1654+36.05	1654+36.05	1301702.63	101.1	S4" 59' 45.64"E
L99	1657+37.00	16500890.73	1301647.55	1658+59.24	1658+59.24	1301593.28	122.24	S26" 21' 18.25"W
L100	1658+59.24	16500781.19	1301593.28	1666+21.63	1666+21.63	1301222.67	762.39	S29" 05' 08.13"W
L1 01	1666+21.63	16500114.94	1301222.67	1673+99.92	1673+99.92	1300850.95	778.28	S28" 31' 49.35"W
L102	1676+38.04	16499200.91	1300835.96	1680+91.13	1680+91.13	1300998.93	453.09	S21" 04' 53.06"E
L103	1683+28.44	16498601.14	1301150.13	1683+75.95	1683+ 75.95	1301191.25	47.52	S59" 55' 43.57"E
L104	1685+00.82	16498547.92	1301310.88	1686+13.65	1686+13.65	1301423.61	112.83	N8T 33' 07.40"E
L105	1686+13.65	16498552.74	1301423.61	1697+40.95	1697+40.95	1302546.92	1127.31	N85" 10' 18.19"E
L106	1704+26.69	16498343.8	1303120.43	1710+23.28	1710+23.28	1303412.8	596.59	S29" 20' 44.36"E
L107	1710+23.28	16497823.77	1303412.8	1713+56.45	1713+56.45	1303573.31	333.17	S28" 48' 00.83"E
L108	1713+56.45	16497531.8	1303573.31	1714+07.52	1714+07.52	1303600.67	51.07	S32" 23' 30.04"E
L109	1714+07.52	16497488.68	1303600.67	1723+25.23	1723+25.23	1304053.48	917.72	S29" 33' 55.67"E
L110	1725+12.49	16496644.69	1304215.99	1726+78.25	1726+ 78.25	1304361	165.76	N61" 01' 31.91"E
L111	1726+ 78.25	16496724.99	1304361	1727+29.38	1727+29.38	1304407.31	51.13	N64" 56' 10.28"E
L112	1727+29.38	16496746.65	1304407.31	1727+81.90	1727+81.90	1304456.52	52.52	N69" 31' 34.69"E
L113	1727+81.90	16496765.02	1304456.52	1730+51.39	1730+51.39	1304716.94	269.49	N75" 05' 38.94"E
L114	1732+59.53	16496778.21	1304906.7	1732+99.06	1732+99.06	1304933.23	39.53	S42" 08' 21.12"E
L115	1732+99.06	16496748.9	1304933.23	1733+50.04	1733+50.04	1304965.67	50.98	S39" 31' 59.86"E
L116	1733+50.04	16496709.58	1304965.67	1734+48.71	1734+48.71	1305023.59	98.67	S35" 56' 39.77"E
L117	1734+48.71	16496629.7	1305023.59	1735+51.58	1735+51.58	1305086.83	102.87	S3T 55' 50.24"E
L118	1735+51.58	16496548.56	1305086.83	1736+64.26	1736+64.26	1305157.51	112.68	S38" 51' 07.18"E
L119	1737+93.03	16496404.99	1305269.19	1738+53.89	1738+53.89	1305330.02	60.87	S88" 02' 11.06"E
L120	1739+91.83	16496313.31	1305416.94	1741+64.81	1741+64.81	1305417.62	172.99	SO" 13' 31.93"E
L121	1741+64.81	16496140.32	1305417.62	1744+88.10	1744+88.10	1305428.79	323.28	S1" 58' 50.07"E
L122	1745+84.96	16495740.62	1305379.6	1746+93.97	1746+93.97	1305278.96	109.01	S6T 23' 18.69"W
L123	1747+96.99	16495614.75	1305234.26	1751+57.13	1751+57.13	1305304.93	360.13	S11" 19' 00.65"E
L124	1751+57.13	16495261.62	1305304.93	1753+61.94	1753+61.94	1305352.25	204.81	S13" 21' 33.42"E
L125	1753+61.94	16495062.36	1305352.25	1762+90.66	1762+90.66	1305548.3	928.73	S12" 11' 12.02"E
L126	1766+60.90	16493812.1	1305451.88	1768+13.04	1768+13.04	1305346.89	152.13	S43" 38' 14.64"W
L127	1768+13.04	16493702	1305346.89	1769+17.94	1769+17.94	1305270.04	104.9	S4T 06' 16.46"W
L128	1769+17.94	16493630.6	1305270.04	1773+24.29	1773+24.29	1304977.76	406.35	S45" 59' 44.45"W
L129	1773+24.29	16493348.3	1304977.76	1777+56.63	1777+56.63	1304670.21	432.35	S45" 20' 38.88"W
L130	1778+77.24	16492935.78	1304669.32	1785+79.24	1785+ 79.24	1305160.48	701.99	S44" 24' 01.95"E

DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -LINE TABLE								
LINE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END STATION	END NORTHING	END EASTING	LENGTH	BEARING
L131	1785+ 79.24	16492434.23	1305160.48	1790+00.05	1790+00.05	1305453.36	420.81	S44" 06' 18.15"E
L132	1792+14.65	16492068.52	1305649.52	1795+77.18	1795+77.18	1306006.54	362.53	N80" 00' 14.12"E
L133	1798+38.39	16492244.81	1306238.07	1799+21.80	1799+21.80	1306299.88	83.41	N4T 49' 05.64"E
L134	1799+21.80	16492300.82	1306299.88	1800+31.07	1800+31.07	1306374.82	109.26	N43" 18' 21.54"E
L135	1800+31.07	16492380.33	1306374.82	1801+17.78	1801+17.78	1306430.93	86.71	N40" 19' 13.51"E
L136	1803+18.83	16492546.53	1306600.97	1805+79.61	1805+ 79.61	1306856.71	260.78	N78" 43' 09.48"E
L137	1808+34.14	16492607.12	1307109.99	1815+58.62	1815+58.62	1307829.15	724.48	S83" 03' 04.42"E
L138	1815+58.62	16492519.47	1307829.15	1817+65.76	1817+65.76	1308032.03	207.14	S78" 21' 51.22"E
L139	1817+65.76	16492477.69	1308032.03	1819+07.55	1819+07.55	1308170.55	141.79	S7T 39' 51.61 "E
L140	1822+30.35	16492348.13	1308477.16	1825+78.06	1825+78.06	1308795.92	347.71	S66- 27' 18.38"E
L141	1825+78.06	16492209.23	1308795.92	1828+85.65	1828+85.65	1309076.47	307.59	S65- 47' 36.65"E
L142	1828+85.65	16492083.11	1309076.47	1833+10.08	1833+10.08	1309463.63	424.43	S65- 48' 38.81"E
L143	1835+96.23	16491773.71	1309715.39	1838+24.27	1838+24.27	1309907.97	228.05	S5T 36' 47.29"E
L144	1838+24.27	16491651.56	1309907.97	1838+88.29	1838+88.29	1309962.68	64.02	S58- 43' 14.05"E
L145	1841+39.28	16491462.59	1310158.67	1849+15.68	1849+15.68	1310701.32	776.41	S44- 20' 25.0TE
L146	1850+67.08	16490781.77	1310784.31	1854+81.27	1854+81.27	1310943.48	414.19	S22- 36' 00.51"E
L147	1854+81.27	16490399.38	1310943.48	1855+88.09	1855+88.09	1310986.4	106.82	S23" 41' 26.79"E
L148	1855+88.09	16490301.57	1310986.4	1860+30.58	1860+30.58	1311159.63	442.49	S23" 02' 47.85"E
L149	1862+44.63	16489684.65	1311179.92	1863+71.93	1863+ 71.93	1311153.47	127.3	S11" 59' 37.37"W
L150	1863+71.93	16489560.13	1311153.47	1865+09.12	1865+09.12	1311247.32	137.2	S43" 09' 53.32"E
L151	1865+09.12	16489460.06	1311247.32	1866+07.76	1866+07.76	1311319.33	98.63	S46" 53' 17.95"E
L152	1866+49.27	16489379.3	1311357.39	1869+32.58	1869+32.58	1311639.84	283.31	N85" 32' 18.99"E
L153	1869+32.58	16489401.34	1311639.84	1875+03.28	1875+03.28	1312209.09	570.7	N85- 55' 15.16"E
L154	1875+03.28	16489441.94	1312209.09	1876+98.06	1876+98.06	1312403.38	194.78	N85" 55' 48.68"E
L155	1879+06.60	16489538.83	1312590.1	1880+68.76	1880+68.76	1312706.96	162.16	N46- 06' 07.73"E
L156	1880+68.76	16489651.27	1312706.96	1886+97.41	1886+97.41	1313151.75	628.65	N45" 02' 08.33"E
L157	1887+76.46	16490095.11	1313222.82	1889+25.10	1889+25.10	1313326.78	148.64	S44" 22' 44.00"E
L158	1889+25.10	16489988.87	1313326.78	1889+64.60	1889+64.60	1313356.21	39.5	N48- 10' 06.00"E
L159	1889+64.60	16490015.22	1313356.21	1891+ 79.21	1891+ 79.21	1313559.23	214.61	N71" 04' 46.00"E
L160	1894+17.10	16490042.89	1313782.83	1897+82.36	1897+82.36	1314064.31	365.26	S50- 24' 42.01"E
L161	1897+82.36	16489810.12	1314064.31	1899+01.54	1899+01.54	1314125.77	119.18	S31" 02' 41.59"E
L162	1899+01.54	16489708.01	1314125.77	1902+32.06	1902+32.06	1314267.89	330.52	S25- 27' 59.91"E
L163	1903+45.75	16489301.44	1314301.63	1904+31.93	1904+31.93	1314315.38	86.18	S9" 10' 54.10"E
L164	1904+31.93	16489216.36	1314315.38	1904+85.12	1904+85.12	1314326.06	53.18	S11" 34' 46.69"E

DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -CURVE TABLE

CURVE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END. STATION	END. NORTHING	END. EASTING	LENGTH	RADIUS	DELTA	TANGENT LENGTH
C1	1277+92.58	16520414.24	1276541.5	1279+05.95	16520416.64	1276650.67	113.370'	120	54° 07' 49"	61.32'
C2	1314+09.76	16518847.55	1279783.45	1316+89.80	16518658.72	1279985.78	280.048'	526	30° 30' 18"	143.43'
C3	1320+00.80	16518389.55	1280141.24	1323+27.98	16518071.45	1280183.41	327.178'	480	39° 03' 14"	170.23'
C4	1327+70.81	16517639.59	1280085.53	1328+54.63	16517561.94	1280054.81	83.819'	282	17° 01' 48"	42.22'
C5	1344+97.38	16516164.77	1279190.86	1352+73.40	16515447.31	1279264.91	776.014'	590	75° 21' 35"	455.67'
C6	1362+81.26	16514741.11	1279983.9	1363+59.69	16514702.73	1280051.45	78.431'	165	27° 14' 06"	39.97'
C7	1370+40.97	16514528.12	1280709.92	1370+80.03	16514523.41	1280748.59	39.052'	165	13° 33' 38"	19.62'
C8	1379+14.81	16514535.17	1281583.22	1380+81.32	16514456.93	1281722.53	166.509'	168	56° 47' 14"	90.81 '
C9	1413+57.95	16513426.85	1284359.57	1414+86.49	16513449.51	1284485.85	128.547'	599	12° 17' 45"	64.52'
C10	1416+01.79	16513481.91	1284596.51	1417+14.72	16513493.94	1284708.19	112.924'	318	20° 20' 46"	57.06'
C11	1425+37.49	16513409.74	1285526.57	1428+59.56	16513311.29	1285830.94	322.067'	800	23° 03' 59"	163.24'
C12	1446+87.16	16512412.46	1287422.23	1448+75.16	16512255.14	1287505.51	188.004'	165	65° 17' 02"	105.69'
C13	1464+01.50	16510739.83	1287323.05	1465+69.51	16510620.55	1287416.08	168.008'	107	89° 57' 50"	106.93'
C14	1477+39.64	16510432.53	1288570.42	1478+47.99	16510432.35	1288678.06	108.347'	275	22° 34' 26"	54.89'
C15	1481 +36.15	16510498.23	1288958.38	1483+91.37	16510535.03	1289210.23	255.217'	1000	14° 37' 22"	128.31'
C16	1492+43.27	16510541.02	1290062.09	1496+06.04	16510380.07	1290372.08	362.768'	382	54° 24' 40"	196.37'
C17	1525+43.10	16507944.27	1292011.33	1529+69.84	16507535.32	1292090.27	426.746'	560	43° 39' 43"	224.34'
C18	1534+22.63	16507091.89	1291998.88	1539+70.47	16506656.86	1292249.56	547.838'	382	82° 10' 11"	333.06'
C19	1559+63.08	16506075.25	1294154.75	1562+14.17	16505934.39	1294358.59	251.091'	445	32° 19' 45"	128.99'
C20	1575+29.50	16504893.71	1295162.8	1578+53.42	16504709.88	1295424.73	323.920'	600	30° 55' 55"	166.01'
C21	1592+50.54	16504216.79	1296731.76	1593+54.61	16504165.34	1296822.05	104.065'	573	10° 24' 21"	52.18'
C22	1617+55.08	16502778.76	1298780.53	1619+73.64	16502698.3	1298982.31	218.560'	573	21° 51' 16"	110.62'
C23	1639+95.48	16502319.93	1300968.42	1644+91.75	16502046.89	1301365.92	496.273'	600	47° 23' 26"	263.32'
C24	1648+96.02	16501703.37	1301579.06	1651+25.88	16501489.87	1301660.35	229.853'	600	21° 56' 58"	116.35'
C25	1654+36.05	16501182.79	1301702.63	1657+37.00	16500890.73	1301647.55	300.949'	550	31° 21' 04"	154.34'
C26	1673+99.92	16499431.17	1300850.95	1676+38.04	16499200.91	1300835.96	238.119'	275	49° 36' 42"	127.10'
C27	1680+91.13	16498778.14	1300998.93	1683+28.44	16498601.14	1301150.13	237.305'	350	38° 50' 51"	123.42'
C28	1683+75.95	16498577.33	1301191.25	1685+00.82	16498547.92	1301310.88	124.865'	220	32° 31' 09"	64.16'
C29	1697+40.95	16498647.63	1302546.92	1704+26.69	16498343.8	1303120.43	685.732'	600	65° 28' 57"	385.80'
C30	1723+25.23	16496690.46	1304053.48	1725+12.49	16496644.69	1304215.99	187.258'	120	89° 24' 32"	118.77'
C31	1730+51.39	16496834.34	1304716.94	1732+59.53	16496778.21	1304906.7	208.142'	190	62° 46' 00"	115.90'
C32	1736+64.26	16496460.81	1305157.51	1737+93.03	16496404.99	1305269.19	128.764'	150	49° 11' 04"	68.65'
C33	1738+53.89	16496402.91	1305330.02	1739+91.83	16496313.31	1305416.94	137.933'	90	87° 48' 39"	86.63'
C34	1746+93.97	16495698.71	1305278.96	1747+96.99	16495614.75	1305234.26	103.025'	75	78° 42' 19"	61.50'
C35	1762+90.66	16494154.56	1305548.3	1766+60.90	16493812.1	1305451.88	370.239'	380	55° 49' 27"	201.30'
C36	1777+56.63	16493044.43	1304670.21	1778+77.24	16492935.78	1304669.32	120.608'	77	89° 44' 41"	76.66'
C37	1790+00.05	16492132.06	1305453.36	1792+14.65	16492068.52	1305649.52	214.606'	220	55° 53' 28"	116.71'
C38	1795+77.18	16492131.44	1306006.54	1798+38.39	16492244.81	1306238.07	261.212'	465	32° 11' 08"	134.15'
C39	1801+17.78	16492446.44	1306430.93	1803+18.83	16492546.53	1306600.97	201.056'	300	38° 23' 56"	104.47'
C40	1805+79.61	16492597.54	1306856.71	1808+34.14	16492607.12	1307109.99	254.531 '	800	18° 13' 46"	128.35'

DONNA PUMP TO BROWNSVILLE LEVEE REHABILITATION -CURVE TABLE

CURVE NO.	BEG. STATION	BEG. NORTHING	BEG. EASTING	END. STATION	END. NORTHING	END. EASTING	LENGTH	RADIUS	DELTA	TANGENT LENGTH
C41	1819+07.55	16492447.4	1308170.55	1822+30.35	16492348.13	1308477.16	322.803'	1650	11° 12' 33"	161.92'
C42	1833+10.08	16491909.2	1309463.63	1835+96.23	16491773.71	1309715.39	286.152'	2000	8° 11' 52"	143.32'
C44	1849+15.68	16490907.31	1310701.32	1850+67.08	16490781.77	1310784.31	151.395'	399	21° 44' 25"	76.62'
C45	1860+30.58	16489894.4	1311159.63	1862+44.63	16489684.65	1311179.92	214.049'	350	35° 02' 25"	110.49'
C46	1866+07.76	16489392.65	1311319.33	1866+49.27	16489379.3	1311357.39	41.515'	50	47° 34' 23"	22.04'
C47	1876+98.06	16489455.76	1312403.38	1879+06.60	16489538.83	1312590.1	208.539'	300	39° 49' 41 "	108.68'
C48	1886+97.41	16490095.52	1313151.75	1887+76.46	16490095.11	1313222.82	79.051'	50	90° 35' 08"	50.51'
C49	1891+79.21	16490084.81	1313559.23	1894+17.10	16490042.89	1313782.83	237.896'	230.72	59° 04' 40"	130.74'
C50	1902+32.06	16489409.61	1314267.89	1903+45.75	16489301.44	1314301.63	113.690'	400	16° 17' 06"	57.23'

Appendix F

Engineer's Estimate of Probably Cost Backup

REMOVED BY USIBWC

Appendix G

Geotechnical Evaluation Report

For Existing Placed Fill

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EVALUATION OF PLACED FILL

FOR

**THE LOWER RIO GRANDE FLOOD CONTROL PROJECT
LEVEE SYSTEM – FROM DONNA PUMP TO BROWNSVILLE LEVEE REACH
HIDALGO COUNTY AND CAMERON COUNTY, TEXAS**



Raba-Kistner Consultants, Inc.

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TBPE Firm F-3257

Project No. AMA08-115-01
April 14, 2011

Mr. Andy Gong, P.E.
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

**RE: Evaluation of Placed Fill
Summary Report
The Lower Rio Grande Flood Control Project
Levee System – From Donna Pump to Brownsville Levee Reach
Hidalgo County and Cameron County, Texas
Tetra Tech, Inc., Job No. 100-SWW-T27062**

Dear Mr. Gong:

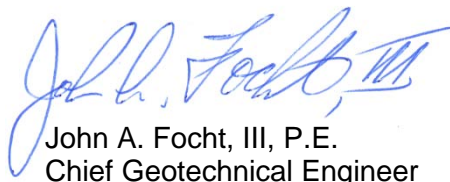
Raba-Kistner Consultants, Inc., (R-K), is pleased to submit our summary report for the field testing and engineering evaluation of the Lower Rio Grande Flood Control Project Levee System. This summary report specifically addresses the levee segment from the Donna Pump to the Brownsville Levee Reach. These services were performed in accordance with the scope of work pursuant to the executed Subconsultant Professional Services Agreement between Tetra Tech, Inc., (CLIENT), and **R-K** dated February 3, 2011 for the above-referenced Tetra Tech, Inc. Job with the United States International Boundary and Water Commission (USIBWC).

The purpose of this study was to evaluate the existing fill placed by the USIBWC's levee "in-house" field crews on portions (sub-reaches) of the Donna Pump to the Brownsville Levee Reach of the Lower Rio Grande Flood Control Project levee system, and to determine whether the placement activities to date have resulted in fill that meets the intent of the specifications for the fill placement work.

We appreciate the opportunity to be of professional service to you on this project, and look forward to working with you throughout the remaining phases of the project. If you should have any comments or questions, please call.


Very truly yours,

RABA-KISTNER CONSULTANTS, INC.


John A. Focht, III, P.E.
Chief Geotechnical Engineer



4/14/11


Chris L. Schultz, P.E., PMP
Senior Vice President

JAF/CLS/IA/mem

Attachments

Copies Submitted: Above (4)

**EVALUATION OF PLACED FILL
THE LOWER RIO GRANDE FLOOD CONTROL PROJECT LEVEE SYSTEM
FROM DONNA PUMP TO BROWNSVILLE LEVEE REACH
HIDALGO COUNTY AND CAMERON COUNTY, TEXAS**

SUMMARY REPORT

for

**U.S. SECTION OF THE INTERNATIONAL BOUNDARY AND WATER COMMISSION
(USIBWC)**

Prepared for

TETRA TECH, INC.
Irvine, California

Prepared by

RABA-KISTNER CONSULTANTS, INC.
San Antonio, Texas

**PROJECT NO. AMA 08-115-01
April 14, 2011**

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ATTACHMENTS

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INTRODUCTION

Raba-Kistner Consultants, Inc., (R-K), has completed the authorized field testing and engineering analyses of the Donna Pump to the Brownsville Levee Reach segment of the Lower Rio Grande Flood Control Project (LRGFCP) levee system related to fill placement activities. This summary report briefly describes the procedures utilized during this study and presents our findings

PROJECT BACKGROUND

The United States Section of the International Boundary and Water Commission (USIBWC) has recently conducted hydraulic, aerial, geophysical, and exploratory geotechnical studies of the LRGFCP to assess the ability of the associated levees to safely contain flood flows in the Rio Grande River. From these studies, the USIBWC has determined that certain reaches of the levees require rehabilitation improvements in order to meet the Federal Emergency Management Agency (FEMA) requirements for the safe containment of 100-year flood flows.

The LRGFCP extends from the Town of Peñitas, Texas, at its upstream end, to 28 miles above the Gulf of Mexico, a distance of about 158 river miles. The LRGFCP has two diversion dams, Anzalduas Dam and Retamal Dam, approximately 17 and 57 river miles below Peñitas, which divert portions of the flood flows into the Main Floodway and the Mexico Floodway, respectively. The LRGFCP was constructed to provide flood protection to urban, suburban, and irrigated lands in the Rio Grande delta in both the United States and Mexico. Each country designed and constructed the portion of the project located in its territory.

The Donna Pump to Brownsville Levee Reach has a distance of approximately 64.5 miles, with 48.5 miles within Cameron County and 16 miles within Hidalgo County, Texas. The levees are being raised approximately 1 to 3 feet in the areas identified as deficient in a Hydraulic Study conducted by the USIBWC for the LRGFCP in 2003.

For the purposes of this study, the Donna Pump to Brownsville Levee Reach has been divided into 5 sub-reaches. These sub-reaches have been defined as follows:

- Sub-reach #1: Begins at the Donna Pump and continues to the Hidalgo/Cameron County Line for approximately 15.99 miles.
- Sub-reach #2: Begins at the Hidalgo/Cameron County Line and continues approximately 12 miles downriver.
- Sub-reach #3: Extends from the end of the Sub-reach #2 and continues approximately 12 miles downriver.
- Sub-reach #4: Extends from the end of the Sub-reach #3 and continues approximately 12 miles downriver.
- Sub-reach #5: Extends from the end of the Sub-reach #4 and continues approximately 12.51 miles downriver.

PROJECT DESCRIPTION

We understand that fill material was placed by the USIBWC's "in-house" field crews on portions of the Donna Pump to the Brownsville Levee Reach in order to increase the levee height and restore the levee crest to an appropriate elevation. The scope of this study consisted of continuously proofrolling the levee crest using a heavy pneumatic tire compaction equipment to observe the presence of weak, pumping, and/or yielding areas; and conducting in-place nuclear moisture-density tests to evaluate the level of compaction of the in place fill material. The purpose of these observations and tests was to determine if the work performed to date by the USIBWC's field personnel met standard USIBWC construction practices.

LIMITATIONS

This summary report has been prepared in accordance with accepted Geotechnical Engineering practices in the region of South Texas for the use of Tetra Tech, Inc., (CLIENT) and its representatives for design purposes. This summary report may not contain sufficient information for purposes of other parties or other uses.

The opinions and recommendations submitted in this summary report are based on the data obtained from in place nuclear moisture-density tests performed on fill material and caliche flexible base material along the subject levee reach, visual observations of proofrolling activities over the levee crest, laboratory optimum moisture-density tests ("Proctor curves") for both fill and caliche flexible base material samples, our previous experience with the site and subsurface conditions obtained while performing a geotechnical engineering study of the subject levee reach, and our understanding of the project information provided to us by others. If the project information described in this summary report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

This summary report may not reflect the actual variations of the subsurface conditions along the levee. This is particularly true with regard to existing soil moisture contents that are likely to be highly variable based on precipitation events and exposure to the elements, and to the plasticity characteristics and the fines content of the fill materials placed. The nature and extent of variations along the subject levee reach may not become evident until construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our current study does not include an environmental assessment of the air, soil, rock, or water conditions either on or adjacent to the site. No environmental opinions are presented in this summary report.

FIELD EXPLORATION

Representatives of **R-K** made visual observations of the existing levee conditions in conjunction with the in-place nuclear moisture density testing activities at selected locations in the field. We also conducted visual observations of the effects of proofrolling in the vicinity of the nuclear

moisture-density tests. Photographs were made of the distresses noted during the proofrolling activities. The approximate locations of the nuclear moisture-density tests are presented with the field density data in Appendix A, and fall within the boundaries described in the Scope of Work document attached to the Subconsultant Professional Services Agreement for this study.

IN PLACE NUCLEAR MOISTURE-DENSITY TESTS

In place nuclear moisture-density tests were performed within the five designated sub-reaches comprised within the Donna Pump to the Brownsville Levee Reach of the LRGFCP levee system using a nuclear density gage with a maximum 12-inch deep probe. The tests were performed in general accordance with ASTM D 698 procedures, performing density testing both before and after proofrolling operations. The nuclear density gauge apparatus measures both the in-place density and moisture content of the soils in accordance with the cited ASTM test standard. A total of 403 in-place density tests were performed at 197 locations within the five designated sub-reaches of the Donna Pump to the Brownsville Levee Reach. One hundred three of these tests were performed on the in-place caliche flexible base surface layer. Two hundred ninety nine of the tests were performed on the upper layer of in-place fill material. One test was conducted as a backscatter density test on a segment of asphalt-paved section over the levee crest. The location of each in place density test was estimated using a Garmin GPS device, with the positions recorded as latitude and longitude based on the WGS84 map projection.

In order to perform the nuclear moisture-density tests on the upper layer of in-place fill material on the levee crest, the surface layer of caliche flexible base material was removed to allow the nuclear gauge to be in direct contact with the fill material beneath. Similarly, in order to perform the nuclear moisture-density tests on the upper layer of in-place fill material on the levee slope, the surface layer of topsoil material with grass were removed to allow the nuclear gauge to be in direct contact with the underlying fill material. The test areas were restored to their original condition following the completion of the field tests.

The results of the in place density testing and GPS coordinates of each test are presented in Appendix A of this report. Calculations were performed using the corresponding average maximum laboratory dry density ("Proctor") value of material samples collected within each sub-reach to determine the in-place percent compaction.

As described later in this report, multiple samples of the in-place caliche flexible base material and the underlying upper layer of fill material were collected in the field for Laboratory Atterberg Limits, sieve analyses, and moisture-density relationship (Proctor) determination of the various materials encountered along the levee alignment. The determination of the appropriate moisture-density relationship (Proctor) value to use in calculating the in-place compaction at the nuclear moisture-density test locations was based on visual observations of the in-place caliche base and fill materials tested in the field and the classification of the samples tested in the laboratory. It should be noted that Sub-Reach 1 exhibited the greatest variability in terms of the different types of materials comprising the upper layer of fill observed along the levee alignment.

The average calculated compaction percentages are summarized in the table presented on the following page:

Sub-Reach	Material Tested	Compaction (%)		
		Minimum	Maximum	Average
Sub-Reach 1	Fill Material (Sub-Reach 1 – Fill 1)	81.5	97.6	91.3
	Fill Material (Sub-Reach 1 – Fill 2)	90.4	95.6	93.0
	Fill Material (Sub-Reach 1 – Fill 3)	76.7	110.4	92.3
	Caliche Flexible Base Material	82.5	102.1	92.6
Sub-Reach 2	Fill Material (Sub-Reach 2 – Fill)	63.4	116.9	91.0
	Caliche Flexible Base Material	82.2	97.0	92.3
Sub-Reach 3	Fill Material (Sub-Reach 3 – Fill)	69.5	107.7	91.3
	Caliche Flexible Base Material	82.6	93.9	88.1
Sub-Reach 4	Fill Material (Sub-Reach 4 – Fill)	62.3	104.0	86.8
	Caliche Flexible Base Material	82.6	96.7	90.2
Sub-Reach 5	Fill Material (Sub-Reach 5 – Fill)	72.0	112.4	89.1
	Caliche Flexible Base Material	92.6	98.3	95.0

In general, the data indicates variability in the average percent compaction both within each sub-reach and from sub-reach to sub-reach; however, the average in-place fill compaction test results do not conform with a minimum compaction of 95% of ASTM D 698 (Standard Proctor Compaction Method). Similarly, with the exception of sub-reach 5, the levee sub-reaches exhibited average in-place caliche test results that do not conform to a minimum compaction of 95% of ASTM D 698.

Several of the tests conducted on the upper layer of in-place fill on the levee crest were performed both before and after the proofrolling operations to assess the gain in the fill compaction. The results did not indicate a consistent gain in the fill compaction after the proofrolling operations. The fact that the proofrolling operations were performed over the in-place caliche flexible base surface layer may have limited the densification effectiveness of the tire compactor over the upper layer of in-place fill material on the levee crest.

Please refer to Appendix A of this report for the detailed in-place nuclear moisture-density test results obtained for this study.

ATTERBERG LIMITS, SIEVE ANALYSES, AND MOISTURE-DENSITY (PROCTOR) TESTS

Laboratory Atterberg Limits, sieve analyses, and moisture-density relationship (Proctor) tests were conducted on samples of the in-place caliche flexible base material and the underlying upper layer of placed fill material. Several of the fill material samples exhibited plasticity index values below 20 percent. Of particular concern are two samples of fill material from Sub-Reach #1 that exhibited plasticity indices of 4 and non-plastic, respectively. These two material samples consist of silty-clayey sands and silty sands that are typically not suitable for levee construction due to the high permeability and erodability that characterize these soil types. Several samples of caliche flexible base material exhibited plasticity index values greater than 12 percent. These results do not conform to the maximum flexible base material plasticity index characteristics recommended by the Texas Department of Transportation for road construction. Please refer to Appendix B of this report for the detailed laboratory test results.

PROOFROLLING

The crest of the levee was proofrolled using a pneumatically tired Caterpillar PS-130 compactor. The Caterpillar PS-130 compactor used during our field operations had a weight of about 27,550 lb., and a tire inflation pressure of about 50 psi. The intent of the proofrolling operations was to identify weak, pumping, yielding, and/or inadequately compacted areas of the levee. The proofrolling was intended to provide a near-continuous indication of the condition of the upper one foot of caliche surface and the underlying fill, and to provide a visual check on the results of the in place density tests. It is important to note that since the proofrolling was performed over the existing surface layer of caliche flexible base material, it was not possible to clearly identify pumping of the fill material. It is our judgment that the upper layer of caliche flexible base resulted in a "bridging" effect that prevented the observation of pumping of the underlying fill; however, indications of rutting, saturated and/or soft fill, washouts, and/or depressed areas were noted on several locations. Please refer to Appendix C for a summary of our proofrolling observations. Selected photographs of the impact of the proofrolling operations on the caliche over the levee crest are presented in Appendix D.

OBSERVATIONS

The results of the in place density tests show that significant portions of the fill are in a relatively loose state. Our review of the data suggests that this is likely due to a combination of effects; some of the low compaction results probably occurred because the compaction efforts made by the field construction crew failed to achieve the minimum acceptable fill compaction. In addition, the effects of weather may also have contributed to some of the low in place densities, particularly where the placed materials are relatively thin. The visual observations of the condition of the levee and the impact of the pneumatic compactor are consistent with these findings.

CONCLUSIONS

The recent fill placement repairs to the existing levee embankments did not appear to be compacted to the standard densities required for USIBWC levee construction. The relatively loose condition of the fill has resulted in washouts and erosion on portions of the subject levee reach. We were not able to identify any significant sections of the subject levee segment where fill materials were placed at higher compactive efforts. In consideration of the relatively low in-place fill densities, surficial sloughs (shallow slope failures) and erosion of the in place fill materials are a serious risk to the levee embankments during a design flood event.

RECOMMENDATIONS

The following factors are anticipated to impact the levee performance in the areas where the recent fill activities have been performed:

- Several of the density test and proofrolling observations indicate that significant portions of the levee materials are not compacted to the specified density, which has already resulted in washouts and erosion on portions of the subject levee.

- None of the density test results performed on the slopes met the specified compaction requirements, likely indicating no good compactive effort was performed on the slopes.
- Some of the levee embankment materials are granular in nature and do not conform to standard recommendations for levee embankment materials.

Although some areas are anticipated to include properly compacted, properly selected materials, we did not encounter areas where both criteria were consistently met. Further, the apparent lack of compaction on the slopes in all tested area adds additional concern. Consequently, we recommend that the fill materials placed in these areas be removed to a depth of 18 in. below the top of the caliche or the entire depth of fill, whichever is shallower. The exposed top of levee subgrade should then be compacted to 95 percent of the maximum density as determined by ASTM D 1557 at optimum to plus 2 percent of optimum until permanently covered.

On the basis of our testing, some of the materials appear to be reusable as fill materials for the levee embankment. However, the existing caliche base should be segregated, and only those materials that can be classified as CL soils under the USCS may be reutilized for the levee embankment. Due to the variable nature of these materials, we recommend that they be stockpiled in relatively small piles so that testing can be performed to determine their suitability for reuse. Materials acceptable for reuse should have a maximum Liquid Limit of 50, and a Plasticity Index ranging from 20 to 30.

The reusable materials or other import materials should then be placed in compacted lifts up to the design elevation of the levee. Embankment fill should be placed in loose lifts not exceeding 8 in. in thickness and compacted to at least 95 percent of maximum density as determined by ASTM D 1557. The moisture content of the fill should be maintained within the range of optimum to 2 percentage points above the optimum moisture content.

* * * * *

The following Appendices are attached and complete this revised summary report:

In Place Density Test Results	Appendix A
Atterberg Limits, Sieve Analyses, and Moisture-Density Relationship (Proctor) Test Results	Appendix B
Summary of Proofrolling Observations	Appendix C
Selected Photographs of Levee Conditions	Appendix D

Appendix H

Geotechnical Report Addendum

Upper Brownsville Levee

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TRANSMITTAL COVER PAGE

DATE: June 1, 2011

TO: Mr. Andy Gong, P.E.

Tetra Tech, Inc.

- ☒ MAIL
☐ DELIVERY
☐ OVERNIGHT COURIER
☐ PICK UP

FROM: Chris L. Schultz, P.E., PMP, Senior Vice President

SUBJECT: Geotechnical Addendum – Subreach 4.
 The Lower Rio Grande Flood Control Project
 Levee System – From Donna Pump to
 Brownsville Levee Reach
 Hidalgo County and Cameron County, Texas

PROJECT NO. AMA08-115-06

DESCRIPTION

- | | | |
|-------------------------------------|-------------------|---|
| <input type="checkbox"/> | Report | <u></u> |
| <input type="checkbox"/> | Proposal/Contract | <u></u> |
| <input type="checkbox"/> | Drawings | <u></u> |
| <input type="checkbox"/> | Copy of | <u></u> |
| <input checked="" type="checkbox"/> | Other | <u>Geotechnical Addendum – Subreach 4, dated June 1, 2011 – 4 originals</u> |

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GEOTECHNICAL ADDENDUM – SUBREACH 4

FOR

**THE LOWER RIO GRANDE FLOOD CONTROL PROJECT
LEVEE SYSTEM – FROM DONNA PUMP TO BROWNSVILLE LEVEE REACH
HIDALGO COUNTY AND CAMERON COUNTY, TEXAS**



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 TBPE Firm F-3257

Project No. AMA08-115-06
 June 1, 2011

Mr. Andy Gong, P.E.
 Tetra Tech, Inc.
 17885 Von Karman Avenue, Suite 500
 Irvine, California 92614

**RE: Geotechnical Addendum – Subreach 4
 The Lower Rio Grande Flood Control Project
 Levee System – From Donna Pump to Brownsville Levee Reach
 Hidalgo County and Cameron County, Texas
 Tetra Tech, Inc., Job No. 100-SWW-T27062**

Dear Mr. Gong:


Raba-Kistner Consultants, Inc., (R-K), is pleased to submit our geotechnical addendum to our original Technical Memorandum (**R-K** Report No. AMA08-115-00, dated July 24, 2009) for the above referenced project. Specifically, this addendum addresses additional analyses prepared for the final design of the levee system identified as Subreach 4 of the Donna Pump to Brownsville Levee, from Stations 1270+72 to 1904+85.

The analysis prepared for our original Technical Memorandum was reviewed based on the updated survey and levee geometry data provided by Tetra Tech. On the basis of our review of the new data, it was determined that the levee geometry and landside conditions warranted additional analysis to evaluate seepage and slope stability conditions in this subreach. Additionally, **R-K** was asked to provide input on the existing structures along this subreach, and to provide additional construction recommendations related to the placement of the embankment fill materials and the toe drain recommended for this subreach. This report should not be utilized separately from the referenced, original Technical Memorandum. These services were performed in accordance with the scope of work pursuant to the executed Subconsultant Professional Services Agreement between Tetra Tech, Inc., (CLIENT), and **R-K** dated February 3, 2011 for the above-referenced Tetra Tech, Inc. Job with the United States International Boundary and Water Commission (USIBWC).

We appreciate the opportunity to be of professional service to you on this project, and look forward to working with you throughout the remaining phases of the project. If you should have any comments or questions, please call.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.


 John A. Focht, III, P.E.
 Chief Geotechnical Engineer


 Chris L. Schultz, P.E., PMP
 Senior Vice President
 June 1, 2011



JAF/CLS/mem
 Attachments
 Copies Submitted: Above (4)

**GEOTECHNICAL ADDENDUM – SUBREACH 4
THE LOWER RIO GRANDE FLOOD CONTROL PROJECT LEVEE SYSTEM
FROM DONNA PUMP TO BROWNSVILLE LEVEE REACH
HIDALGO COUNTY AND CAMERON COUNTY, TEXAS**

for

**U.S. SECTION OF THE INTERNATIONAL BOUNDARY AND WATER COMMISSION
(USIBWC)**

Prepared for

TETRA TECH, INC.
Irvine, California

Prepared by

RABA-KISTNER CONSULTANTS, INC.
San Antonio, Texas

**PROJECT NO. AMA08-115-06
June 1, 2011**

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June 1, 2011

INTRODUCTION

Raba-Kistner Consultants, Inc., (R-K) has completed its review of our original Technical Memorandum (**R-K** Report No. AMA08-115-00, dated July 24, 2009) for Subreach 4 of the Donna Pump to Brownsville Levee, from 1270+72 to 1904+85.

The analysis prepared for our original Technical Memorandum was reviewed based on the updated survey and levee geometry data provided by Tetra Tech. On the basis of our review of the new data, it was determined that the levee geometry and landside conditions warranted additional analysis to evaluate seepage and slope stability conditions in this subreach. Additionally, **R-K** was asked to provide input on the existing structures, many of which have been abandoned, along this subreach, and to provide additional construction recommendations related to the placement of the embankment fill materials and the toe drain recommended for this subreach. This report should not be utilized separately from the referenced, original Technical Memorandum. These services were performed in accordance with the scope of work pursuant to the executed Subconsultant Professional Services Agreement between Tetra Tech, Inc., (CLIENT), and **R-K** dated February 3, 2011 for the above-referenced Tetra Tech, Inc. Job with the United States International Boundary and Water Commission (USIBWC).

LIMITATIONS

This geotechnical addendum has been prepared in accordance with accepted Geotechnical Engineering practices in the region of South Texas for the use of Tetra Tech, Inc., (CLIENT) and its representatives for design purposes. This addendum may not contain sufficient information for purposes of other parties or other uses.

The recommendations submitted in this summary report are based on the data obtained in completion of the original Technical Memorandum, and should not be utilized separately from the Technical Memorandum. All other recommendations and limitations remain as stated in that report.

SELECTION OF CROSS-SECTIONS FOR ANALYSIS

In selecting the levee sections for analysis, we analyzed the conditions from both a geotechnical and geometric perspective. A brief description of each analysis is presented in the following subsections. This approach is intended to identify possible circumstances where a poor soil condition and moderate geometry, or poor geometry and moderate soil conditions represent the critical case with respect to underseepage.

Following our selection of cross-sections to analyze, cross-sections at Sta. 1717+00 through 1746+00 were discussed as potentially more critical. In particular, these are areas which have the potential for steady state seepage problems to develop at any time since the Rio Grande's normal level is higher than the water levels within the Brownsville PUB Water Treatment Plant No.2 reservoirs. In order to assess this risk, **R-K** visited this area on April 28, 2011. During the site visit, **R-K's** representatives did not observe areas of soft ground or other evidence of through seepage, underseepage, or piping.

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FIRST ANALYSIS - CRITICAL SEEPAGE SECTIONS

We sorted the boring logs presented in **R-K** Project No. AMA08-115-00 dated July 24, 2009 into three categories: 1) sands shallower than 20 ft; 2) sands between 20 ft and 30 ft; and 3) sands below 30 ft. Within these groups, the boring logs were then resorted from highest permeability of the topmost seepage layer to the lowest. Using the most critical section from a seepage perspective identified from this process, we then identified the corresponding levee/structure geometry and then sorted the subgroupings with similar topmost permeability from thinnest blanket to thickest blanket in order to develop the analysis section. Our evaluation identified the cross-section at Station 1342+00 as the most critical to evaluate.

SECOND ANALYSIS - CRITICAL GEOMETRIC SECTIONS

We sorted the available structure cross sections for Subreach 4 from greatest differential elevation (levee crest to landside and riverside toe) to least differential elevation. Please note that there are some structures for which no drawings were provided by USIBWC. We then looked at the specific soil profiles corresponding to each these sections and identified the riverside and landside blanket thickness on each. We then sorted the subgroups from thinnest blanket to thickest blanket in order to develop the analysis section. Our evaluation again identified the cross-section at Station 1342+00 as the most critical to evaluate.

DESIGN PERMEABILITY

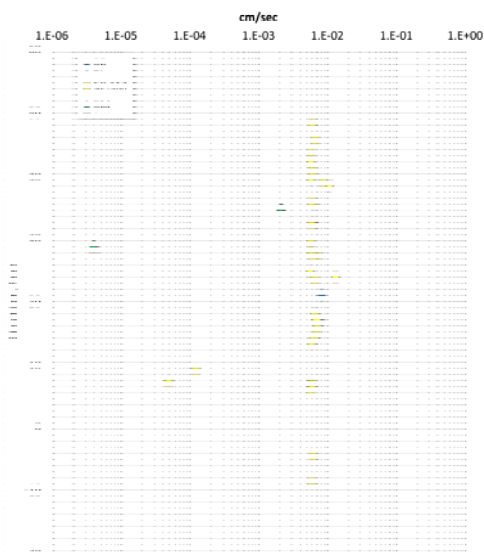
Based on the USACE EM 1110-2-1901 *Seepage Analysis and Control for Dams*, indirect methods for determining hydraulic conductivity were employed for this study.

For uniform, loose clean sands classified as SP (poorly graded sand) using the Unified Soil Classification System, the Hazen¹ equation is suggested for use. We have also used the Hazen equation to estimate poorly graded sands with some silt (SP-SM) as well as the limited number of gravel samples (GP, GP-GM, GW and GW-GM.) The following graph presents the results calculated using the Hazen equation plotted against the sample elevation.

¹ Hazen, Allen, "Discussion of 'Dams on Sand Foundations' by A.C. Koenig", Trans. American Society of Civil Engineers, Vol. 73, p. 199, 1911.

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Permeability Values Calculated Using Hazen's Equation



Since the silty sands (SM) at this site contained significant quantities of silt, we chose a design horizontal permeability of 10^{-4} centimeters per second for these soils based on the silt fraction as well as prior area experience with similar soils. Similarly, we chose a design horizontal permeability of $1 \cdot 10^{-6}$ cm/sec for the lean clays. The following table summarizes the assumed horizontal permeability values used in our analyses.

Material	Horizontal Saturated Design Permeability*, cm/sec
Poorly Graded Sands (SP)	1.00E-02
Poorly Graded Silty Sands (SM)	1.00E-04
Lean Clays (CL)	1.00E-06
Gravel (Drainage Blanket)	1.00E+00
Clay FILL (CL and CH)	1.00E-06

*Vertical permeability was estimated to be 20% of horizontal permeability

The selection of the design permeabilities was based on the discussions presented above, as well as the relative density of the materials based on SPT values and the plasticity of the materials. The boring logs were reviewed and the classification of the various strata into one of the above materials was based predominately on the gradation and percentage of fine grained materials encountered in our borings.

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DESIGN BLANKET PERMEABILITY

The selection of the design permeability values for the surficial “blanket” soils were developed using a combination of guidance from USACE DIVR 1110-1-400, prior area experience, and engineering judgment. The following table contains the design values used for both the flood and land sides of the levees.

Material	Design Permeability cm/sec	
	Flood Side	Land Side
Poorly graded Silty Sands (SM)	1.0E-4	1.0E-4
Poorly Graded Sands with Silt (SP-SM)	1.0E-2	1.0E-2
Clays (CL and CH)	2.0E-5	3.0E-5

DESIGN SHEAR STRENGTH

The selection of the design shear strength values was based on several parameters including but not limited to the soil classification testing (PI and gradation), the moisture contents, the results of the SPT testing, and our experience with similar soils.

For granular soils, the following table summarizes the range in angle of internal friction values based on the results of our field and laboratory testing.

Material	SPT Blow Count Range	Angle of Internal Friction, degrees
		Inferred Range
Poorly Graded Sands (SP), Poorly Graded Sand with Silt (SP-SM)	8 – 50+	30 - 43
Poorly Graded Silty Sands (SM), Sandy Silt (ML)	3 - 50+	30 - 35

For cohesive soils, the following table summarizes the range of undrained shear strength values based on the results of our field and laboratory testing.

Material	SPT Blow Count Range	Undrained Shear Strength, psf
		Inferred Range
Lean Clays (CL)	2 - 30	250 – 3,750
Fat Clays (CH)	3 - 36	375 - 4,500

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The boring logs were reviewed and the classification of the various strata into one of the above materials was based predominately on the soil classification and the SPT test results. The design shear strength parameters for this study were selected based on the resistance to driving while performing the SPT test, prior area experience, and professional judgment. The following tables summarize the design values used in our analyses.

End of Construction Condition

Material	Total Unit Weight	Total Stress	
		Cohesion, psf	Angle of Internal Friction degrees
Poorly Graded Sands with Silt (SP-SM)	117	0	33
Poorly Graded Silty Sands (SM)	117	0	32
Clays (CL and CH)	120	400	0
Gravel (Drainage Blanket)	125	0	35
Clay FILL (CL and CH)	120	400	0

Steady State Condition

Material	Total Unit Weight	Effective Stress	
		Cohesion, psf	Angle of Internal Friction degrees
Poorly Graded Sands with Silt (SP-SM))	117	0	33
Poorly Graded Silty Sands (SM)	117	0	32
Clays (CL and CH)	120	200	24
Gravel (Drainage Blanket)	125	0	35
Clay FILL (CL and CH)	120	200	24

Rapid Drawdown Condition

The rapid drawdown analyses utilized the design soil parameters from both the end of construction and steady state conditions. The computer program SLOPE/W evaluates the sliding resistance under both conditions, and uses the lower of the two calculated values for that portion of the assumed sliding surface. This comparison is performed for every soil "slice" within a given trial surface, and it is possible for both end of construction and steady state soil parameters to be utilized within the calculated critical failure surface. This type of analysis is often referred to as a multi-stage rapid drawdown analysis.

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Summary

A review of the above indicates that for our analyses, the lower range of strength values for a given soil type was typically selected based on the above parameters in lieu of average values based on statistical analyses. The use of the lower range of strength values for design purposes was considered appropriate as levees must be designed for local, not average, soil conditions, as discussed in detail in the Risk section of the original Technical Memorandum. The exception was the lower range of blow counts recorded for some of the granular strata.

A number of SPT blow counts at depth for this material were less than 5, suggesting these materials are weaker than we have assumed for design. However, published correlations² between SPT and relative density would imply that for an angle of internal friction of 32 degrees, the soil's relative density would be less than 30 percent. Based on the observed condition of the overlying soils during field exploration and sampling, we do not believe that in situ relative densities lower than 30 percent are likely, and consider the minimum likely angle of internal friction in granular soils to be 32 degrees at this site.

LEEVE SEEPAGE ANALYSIS

We performed a steady-state seepage analysis of proposed slope geometries using SEEP/W, a commercially available engineering program produced by Geo-Slope International which utilizes finite element analyses to evaluate ground water seepage. Our analyses included a slope geometry of 3:1 slopes on the riverside and 2.5:1 slopes on the landside, with a maximum height of 9.8 ft on the riverside and 8.8 ft on the landside. Additionally, we have assumed a levee crest width of 18.75 ft.

The lateral boundaries of the model on the land side were located at a distance from the levee profile following the guidelines established in USACE DIVR 1110-1-400³. The full hydrostatic pressure associated with the design 100 year storm was assumed to act on the boundary on the flood side model boundary, while a hydrostatic pressure associated with the groundwater at the ground surface was assumed to act on the land side model boundary. Potential seepage face conditions were assumed at the landside ground surface and along the landside slope of the levee. The bottom boundary of our model was assumed to be 50 ft below the crest. No flow conditions were assumed at the bottom boundary. The analyses were performed assuming that the hydraulic properties of the soils exhibited a horizontal permeability that was five times greater than the vertical permeability.

Conditions exceeding the maximum allowable seepage exit gradient of 0.5 were observed in the vicinity of the levee toe for Subreach No. 4. Additionally, the phreatic surface was exiting above the landside toe. These analyses indicate the need to lengthen the seepage flow paths, provide pressure relief, and/or intercept the seepage with one or more drainage layers. The analyses performed assumed that clay fill materials would be utilized for all newly placed levee embankment materials. The results of these analyses are provided in Appendix A.

² "Penetration Tests and Bearing Capacity of Cohesionless Soils", Meyerhof, G.G., JSMFD, ASCE, Vol. 82, SM 1, pp. 1-19.

³ USACE DIVR 1110-1-400, "Landside Seepage Berms for Mississippi River", December 12, 1998.

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Various seepage control measures were considered in the analysis performed for the original technical memorandum, including the installation of toe drains on the land side toe, seepage cutoff barriers and active relief wells. Based on the analyses performed in the original Technical Memorandum, a toe drain was selected.

TOE DRAIN

For Subreach 4, a toe drain constructed into the land side toe will be required to reduce exit gradients below acceptable values over a majority of the reach. Information on the toe drain is provided in a subsequent section of this report. It should be noted that the purpose of the toe drain is to improve levee stability and to reduce the exit gradients, not to cut off or control the quantity of seepage. Consequently, the use of a toe drain may cause some incremental flooding on the landside area of the levee if it is not collected and removed. Estimates of the amount of seepage to be executed during steady state conditions are on the order of 2 gallons/day per foot of levee. Due to the low anticipated flow, a universal collection system does not appear to be warranted at this time. **R-K** recommends that the flow conditions within the toe drain be monitored during future flood events to determine if a collection system is warranted along all or isolated points of the levee.

The toe drains should extend 1.5 ft. up (measured from vertical) the landside face. Additionally, the drain should penetrate the subgrade at the landside toe for a minimum of 1.5 ft. The toe drain width extends horizontally a minimum of 3 ft. The temporary cut slopes for the sides of the toe drain should extend no steeper than 1:1 (horizontal:vertical). The toe drain should be constructed with gravel meeting the gradation requirements of ASTM D 448 coarse concrete aggregate Size No. 57, 67 or 357. The gravel must be entirely wrapped with a geotextile fabric (Mirafi 160N or equivalent). The geotextile fabric should be buried 6 in. beneath the exposed surfaces of the gravel to prevent damage.

It is our understanding that physical constraints will prevent construction of the toe drain detail as described above at the following areas:

- Station 1483+00 to 1485+00
- Station 1733+00 to 1780+30
- Station 1801+40 to 1904+85

R-K has reviewed the subsurface profiles for each of these reaches and determined that there is a sufficient blanket thickness to eliminate the toe drain in these areas, assuming that the subsurface conditions encountered in our borings are consistent with conditions between boring locations. Due to the potential variability of the soils, if the toe drain is eliminated we recommend that each of these areas be inspected following flood events to determine if isolated seepage conditions exist which require future remedial measures.

LEVEE SLOPE STABILITY ANALYSIS

We performed end of construction, steady-state, and multi-stage rapid drawdown slope stability analyses of proposed slope geometries using SLOPE/W, a commercially available engineering program produced by Geo-Slope International which evaluates slope stability. Our analyses was

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June 1, 2011

based on the Spencer method, and included a slope declination of 3:1 (horizontal:vertical) for the riverside of the levee and 2.5:1 for the land side of the levee, with a uniform traffic surcharge load of 300 psf applied to the crest of the levee.

MINIMUM FACTOR OF SAFETY

For a given slope configuration, the forces that “drive” slope failure (including gravity and external loading conditions) are compared to the slope’s resistance to failure, which is a function of dewatering controls and internal shear strength (cohesion and internal angle of friction) of both the foundation soils and the fill soils utilized for construction of the levees.

For levee projects, the USACE has specified minimum safety factors against slope failure with respect to loading conditions. The minimum acceptable factors of safety for levees, provided in Table 6-1b on Page 6-5 of EM 1110-2-1913, are listed in the following table.

Condition	Required Factor of Safety
End of Construction	1.3
Sudden (“Rapid”) Drawdown	1.0 to 1.2*
Long Term (Steady Seepage)	1.4

* Sudden drawdown analysis. FS = 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown. FS = 1.2 applies to pool level, likely to persist for long periods prior to drawdown. For this project, 1.0 is considered applicable.

We consider a significant slope failure to involve a volume of slope material that is large enough to substantially impair the serviceability or operation of the levee or that could imperil human life. Shallow, sloughing slope failures that involve a relatively small volume of material or that can be repaired locally without substantially impacting the levee operations are considered to be minor slope failures and do not control the conclusions of our stability analyses.

RESULTS OF ANALYSES

The results of these analyses indicate that the slopes of the levee are not of primary concern. The following table contains a summary of the results from our slope stability analyses for loading conditions and slope configuration discussed above. A graphical presentation of the most critical failure surfaces from our SLOPE/W analyses can be found at the end of this Geotechnical Memorandum in Appendix A.

Computed Factors of Safety

End of Construction- Flood Side	End of Construction- Land Side	Steady State at Flood Stage – Flood Side	Steady State at Flood Stage – Land Side	Sudden Drawdown – Flood Side
1.8	1.7	3.2	2.1	1.8

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June 1, 2011

Based on the results of our analyses, the factors of safety computed for flood side and land side slopes of 3:1 (horizontal: vertical) and 2.5:1, respectively, or flatter meet the USACE requirements for minimum safety factors for the assumed flood event based off of the improved levee configurations.

SETTLEMENT

In general, the on-site soils are overconsolidated as evidenced by the geologic history of the area and the pre-consolidation pressures observed as part of the laboratory one-dimensional consolidation tests performed for the original geotechnical study. That is, the native soils have experienced a stress history greater than the overburden pressures that will be imposed by the planned improvements.

For our original study, settlement estimates were prepared for four case conditions based on the underlying subsurface soil conditions. The method used for estimating settlement was based on NAVFAC DM-7.1, which references Osterberg's stress distribution theory for earthen embankments. We also used a commercially available computer program, Settle3D.

On the basis of our review of the conditions encountered along Subreach 4, Case 1 conditions as described in our original report should be assumed. For Case 1 conditions, maximum estimated settlements of 3-1/4 in. were calculated. It is our understanding that the new levee construction will include a 4 in. overbuild to account for settlements. Additionally, the design includes a 3 ft. freeboard. Consequently, settlements are considered to be a low risk for this levee segment. The original report should be reviewed for more detail on the settlement calculations.

STRUCTURE REVIEW

DRAINAGE STRUCTURES

Multiple drainage structures that penetrate the levee are located in Subreach 4. These are quite old and some of them have been abandoned and/or removed. Although a detailed seepage and slope stability analysis of these structures was not included in the study scope, **R-K** was asked to review the as-built drawings to determine if obvious concerns existed with regard to the as built conditions. Please note that the structural drawings provided do not include all of the potential drainage structures that may be present in Subreach 4.

In general, it appears that most if not all of the structures were constructed over 50 years ago. Although some structures were "buried", immediately identifiable seepage or stability concerns were not observed other than the common use of seepage collars, which is discussed further below. On the basis of the age of the structures and our understanding that significant seepage or stability problems have not been observed to date, **R-K** recommends that all of the structures be observed during and immediately following flood events to determine if remediation measures and/or additional analyses are required in the future. Alternatively, **R-K** can evaluate the structures for seepage and uplift.

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As referenced above and in conversations with the USIBWC, our review of the as built drawings indicate that seepage collars were utilized as a seepage control measure for a significant majority, if not all of the structures within Subreach 4. It is our understanding that the US Army Corps of Engineers does not accept seepage collars as an acceptable seepage control measure. **R-K** recommends that the USIBWC evaluate this situation and determine 1) if additional structures are present; and 2) if the existing structures should be removed and/or replaced.

ROADWAY CONDITIONS

It is our understanding that several roads utilized by the Border Patrol run perpendicular to and over the levee along this reach. The preferred recommendation would be that these roads be closed. However, if these roads are allowed and the practice is continued, it is anticipated that the recommended toe drain would be subjected to damage from traffic loading conditions. In those areas where roadways are allowed, the toe drain can be removed provided no continuous span exceeds 30 ft. along the reach. If greater than 30 ft. of toe drain is removed from any levee section, **R-K** should be contacted to evaluate this condition based on the levee geometry and subsurface conditions at the individual locations.

It is also our understanding that rutting conditions were observed at several of these crossings. **R-K** recommends that the levee faces in these areas be repaired. Provided the rutting is less than 24 in. in depth, the repairs can be made by excavating the rutted areas and recompacting soils on the existing slope.

CONCLUSIONS

The results of our original and current analysis indicate settlements and slope stability are considered to be low risk for the proposed reconstructed levee. However, as discussed above, underseepage is considered to be a risk as calculated exit gradients exceed the maximum allowable exist gradient of 0.5. Consequently, **R-K** recommends a toe drain be embedded into the landside toe to reduce exit gradients to acceptable values, with the exception of isolated reaches where physical constraints will prevent construction of the toe drain. Provided the geotechnical recommendations presented herein are incorporated into the design and construction, the reconstructed levees will satisfy 44CFR65.10 criteria from a geotechnical perspective.

CONSTRUCTION RECOMMENDATIONS

GENERAL CONSTRUCTION CONSIDERATIONS

If clay is utilized as an engineered fill, it is important for the clay and existing clays to develop some mechanical bond. Typically, the existing embankment face is excavated so that a series of keys and benches are cut into the slope face. The keys and benches reduce the risk of formation of a preferential failure surface at the old/new fill interface. Bench heights should be limited to 3.5 ft. or less.

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In all areas of the levee, including the levee faces, the upper 6 in. of material is anticipated to be topsoil and should be removed prior to new embankment construction. The remaining levee embankment materials can be stockpiled and reutilized as fill if they meet the requirements of the Clay Fill Levee Materials presented in a subsequent section of this report.

Additionally, it is our understanding that the caliche base and an additional 6 in. of levee embankment materials will be removed prior to new levee construction. In those areas where prior fill has been placed, the results of the proofrolling and compaction testing indicate an additional 6 in. of materials should be removed.

TOE DRAIN

For Subreach 4, a toe drain constructed into the land side toe will be required to reduce exit gradients below acceptable values. As referenced above, the purpose of the toe drain is to improve levee stability and to reduce the exit gradients, not to cut off or control the quantity of seepage. Consequently, the use of a toe drain may cause some incremental flooding on the landside area of the levee if it is not collected and removed. Estimates of the amount of seepage to be executed during steady state conditions are on the order of 2 gallons/day per foot of levee. Due to the low anticipated flow, a universal collection system does not appear to be warranted at this time. **R-K** recommends that the flow conditions within the toe drain be monitored during flood events to determine if a collection system is warranted along all or isolated points of the levee.

The toe drains should extend 1.5 ft. up (measured from vertical) the landside face. Additionally, the drain should penetrate the subgrade at the landside toe for a minimum of 1.5 ft. The toe drain width extends horizontally a minimum of 3 ft. The toe drain should be constructed with gravel meeting the gradation requirements of ASTM D 448 coarse concrete aggregate Size No. 57, 67 or 357. The gravel must be entirely wrapped with a geotextile fabric (Mirafi 160N or equivalent). The geotextile fabric should be buried 6 in. beneath the exposed surfaces of the gravel to prevent damage.

It is our understanding that physical constraints will prevent construction of the toe drain detail as described above at the following areas:

- Station 1483+00 to 1485+00
- Station 1733+00 to 1780+30
- Station 1801+40 to 1904+85

R-K has reviewed the subsurface profiles for each of these reaches and determined that there is a sufficient blanket thickness to eliminate the toe drain in these areas, assuming that the subsurface conditions encountered in our borings are consistent with conditions between boring locations. Due to the potential variability of the soils, if the toe drain is eliminated we recommend that each of these areas be inspected following flood events to determine if isolated seepage conditions exist which require future remedial measures.

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CLAY FILL LEVEE MATERIALS

Low to moderate plasticity clay soils may be used to protect the existing embankment soils from the effects of erosion as well as limit seepage through the embankment. The clay soils should be clean and free of trash, organics, hazardous compounds, asbestos or other deleterious materials. The clay soils should be rated as Grade 1 (non-dispersive) when tested in accordance with ASTM D 6572 ("Crumb Test") and either ND1 or ND2 as evaluated using ASTM D 4647 ("Pin Hole Test"). The materials should be classified as CL, CL-ML and/or SC in accordance with the Unified Soil Classification System (USCS). Soils classified as ML, MH, SM, SP, or gravels should not be permitted. These materials should have a Plasticity Index in the range of 20 to 30, with a maximum Liquid Limit of 45.

The surface of the previous lift should be scarified just prior to fill placement. The clays should be compacted in relatively thin, horizontal lifts with a maximum loose lift thickness of 8 inches. The project site is in a semi-arid to desert environment, and hot, dry conditions are expected in late spring through early fall; and low humidity conditions are expected during the majority of the year. The soils must be maintained in a moist condition at all times and properly compacted in a timely, workmanlike manner. The soil should be compacted to at least 95 percent of optimum density as determined by ASTM D1557 at a moisture content that is at optimum to plus two percent of optimum moisture. Once placed, the compacted materials should be maintained in a moist condition until the next lift is placed. The compacted mixture should be protected from freezing. Any soil materials that are damaged, disturbed, or dessicated after placement should be removed and replaced with like materials. Some degree of dessication cracking should be anticipated for clay fill materials.

Samples of the fill soils should be taken at a minimum rate of one set per 10,000 square feet of compacted fill with a minimum of one test per lift, and checked for plasticity and crumb test grade. Samples should be taken every 50,000 square feet and checked for non-dispersivity by the pin hole test. Any materials that do not meet the recommended crumb test and pin hole test criteria outlined above should be removed and replaced with suitable soils.

VEGETATIVE COVER FOR CLAY LEVEES

The recommendations presented in Sections 3-1 and 3-2 of the USACE ETL 1110-2-571 titled "Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams," should be incorporated into the design. Additionally, **R-K** recommends that sod and/or vegetative cover not be constructed over the exposed faces of the proposed toe drain.

CRUSHED ROCK BASE

Crushed rock base should meet the gradation and plasticity requirements of TxDOT Item 247 Type A or C, Grade 3. Blending of 2 or more sources is allowed to achieve the following physical characteristics.

Type A or C, Grade 3:

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Grading Requirements	
U.S. Standard Sieve Size	Percent Retained
2 ½ inch	0
1 ¾ inch	0-10
No. 4	45-75
No. 40	50-85
Max Liquid Limit	40
Max Plasticity Index	12

Base course should be placed in lifts with a maximum thickness of 8 inches and compacted to a minimum of 95 percent of the maximum density at a moisture content within the range of 2 percentage points below to 2 percentage points above the optimum moisture content as determined by ASTM D 698.

* * * * *

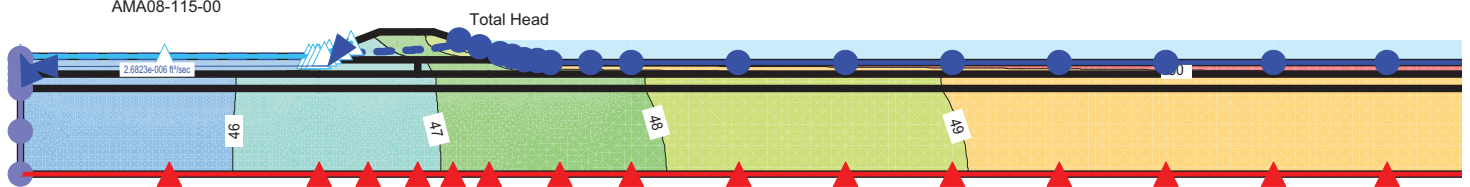
The following Appendices are attached and complete this revised supplemental report:

Slope Stability and Seepage AnalysesAppendix A

APPENDIX A

SLOPE STABILITY AND SEEPAGE
ANALYSES

Steady State Seepage
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



Steady State Seepage

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 232
Last Edited By:
Date: 4/19/2011
Time: 9:03:52 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 9:04:01 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
 Include Air Flow: No
Control
 Apply Runoff: Yes
Convergence
 Convergence Type: Gauss Point K
 Convergence Settings
 Maximum Number of Iterations: 500
 Tolerance: 0.01
 Maximum Change in K: 0.1
 Rate of Change in K: 1.02
 Minimum Change in K: 0.0001
Equation Solver: Parallel Direct

Steady State Seepage

Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec

Duration: 0 sec

Ending Time: 0 sec

Materials

(SP-SM) to El 33.8 ft

Model: Saturated Only

Hydraulic

K-Sat: 0.00033 ft/sec

Volumetric Water Content: 0.3 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

FILL: (CH) and (CL)

Model: Saturated Only

Hydraulic

K-Sat: 3.3e-008 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

Toe Drain

Model: Saturated Only

Hydraulic

K-Sat: 0.033 ft/sec

Volumetric Water Content: 0.3 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

(CH) Landside Blanket

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-007 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

(SM) below El 33.8 ft

Model: Saturated Only

Hydraulic

Steady State Seepage

K-Sat: 3.3e-006 ft/sec

Volumetric Water Content: 0.3 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

(CH) Riverside Blanket

Model: Saturated Only

Hydraulic

K-Sat: 6.6e-007 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

Boundary Conditions

Zero Flow (Q=0)

Type: Total Flux (Q) 0

Potential Seepage Face

Review: true

Type: Total Flux (Q) 0

100-yr (El. 50.8 ft)

Type: Head (H) 50.8

LS Total Head (45 ft)

Type: Head (H) 45

Flux Sections

Flux Section 1

Coordinates

Coordinate: (-24.281412, 51.268085) ft

Coordinate: (-31.396545, 41.8328) ft

Coordinate: (-137.24703, 41.626565) ft

Coordinate: (-139.05159, 46.009074) ft

Regions

	Material	Points	Area (ft ²)
Region 1	(CH) Landside Blanket	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) Riverside Blanket	13,17,18,14	125

Steady State Seepage

Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500
Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) Riverside Blanket	31,32,28,25	315
Region 12	(CH) Landside Blanket	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5
Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) Riverside Blanket	32,38,39,28	630
Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) Riverside Blanket	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) Riverside Blanket	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) Riverside Blanket	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) Landside Blanket	33,57,55,34	121.83828
Region 30	Toe Drain	57,53,12,21,55	3.56172
Region 31	Toe Drain	12,21,56,58	3.1719465

Lines

	Start Point	End Point	Hydraulic Boundary
Line 1	13	14	
Line 2	14	22	
Line 3	22	21	
Line 4	23	15	
Line 5	15	14	
Line 6	22	23	
Line 7	24	16	Zero Flow (Q=0)
Line 8	16	15	
Line 9	23	24	
Line 10	13	17	
Line 11	17	18	
Line 12	18	14	
Line 13	15	19	
Line 14	19	18	
Line 15	16	20	Zero Flow (Q=0)
Line 16	20	19	
Line 17	18	25	

Steady State Seepage

Line 18	25	26	
Line 19	26	19	
Line 20	20	27	Zero Flow (Q=0)
Line 21	27	26	
Line 22	26	29	
Line 23	29	30	
Line 24	30	27	Zero Flow (Q=0)
Line 25	25	28	
Line 26	28	29	
Line 27	31	32	100-yr (El. 50.8 ft)
Line 28	32	28	
Line 29	25	31	
Line 30	22	35	
Line 31	35	34	LS Total Head (45 ft)
Line 32	36	23	
Line 33	35	36	LS Total Head (45 ft)
Line 34	37	24	Zero Flow (Q=0)
Line 35	36	37	LS Total Head (45 ft)
Line 36	32	38	100-yr (El. 50.8 ft)
Line 37	38	39	
Line 38	39	28	
Line 39	29	40	
Line 40	40	39	
Line 41	30	41	Zero Flow (Q=0)
Line 42	41	40	
Line 43	38	42	100-yr (El. 50.8 ft)
Line 44	42	43	
Line 45	43	39	
Line 46	40	44	
Line 47	44	43	
Line 48	41	45	Zero Flow (Q=0)
Line 49	45	44	
Line 50	42	46	100-yr (El. 50.8 ft)
Line 51	46	47	100-yr (El. 50.8 ft)
Line 52	47	43	
Line 53	44	48	
Line 54	48	47	100-yr (El. 50.8 ft)
Line 55	45	49	Zero Flow (Q=0)
Line 56	49	48	100-yr (El. 50.8 ft)
Line 57	7	13	
Line 58	7	6	
Line 59	6	5	
Line 60	5	4	
Line 61	4	3	
Line 62	7	50	
Line 63	2	17	
Line 64	3	2	100-yr (El. 50.8 ft)
Line 65	2	1	100-yr (El. 50.8 ft)

Steady State Seepage

Line 66	1	31	100-yr (El. 50.8 ft)
Line 67	50	54	
Line 68	54	3	100-yr (El. 50.8 ft)
Line 69	21	55	
Line 70	55	34	
Line 71	21	56	
Line 72	56	13	
Line 73	57	55	
Line 74	56	58	
Line 75	56	59	
Line 76	59	11	
Line 77	11	10	
Line 78	10	9	
Line 79	9	8	
Line 80	8	7	
Line 81	58	52	Potential Seepage Face
Line 82	52	51	
Line 83	51	7	
Line 84	33	57	Potential Seepage Face
Line 85	34	33	LS Total Head (45 ft)
Line 86	57	53	Potential Seepage Face
Line 87	53	12	Potential Seepage Face
Line 88	12	21	
Line 89	58	12	Potential Seepage Face

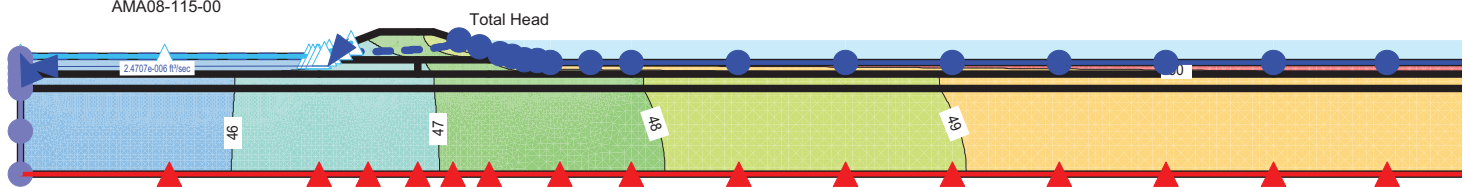
Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48
Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8

Steady State Seepage

Point 21	-34.5	43.8
Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8
Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8
Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Steady State Seepage No Toe Drain
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



Steady State Seepage No Toe Drain

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 238
Last Edited By:
Date: 4/19/2011
Time: 10:03:32 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:14:40 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady State Seepage No Toe Drain

Kind: SEEP/W
Method: Steady-State
Settings
 Include Air Flow: No
Control
 Apply Runoff: Yes
Convergence
 Convergence Type: Gauss Point K
 Convergence Settings
 Maximum Number of Iterations: 500
 Tolerance: 0.01
 Maximum Change in K: 0.1
 Rate of Change in K: 1.02
 Minimum Change in K: 0.0001
Equation Solver: Parallel Direct

Steady State Seepage No Toe Drain

Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec

Duration: 0 sec

Ending Time: 0 sec

Materials

(SP-SM) to El 33.8 ft

Model: Saturated Only

Hydraulic

K-Sat: 0.00033 ft/sec

Volumetric Water Content: 0.3 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

FILL: (CH) and (CL)

Model: Saturated Only

Hydraulic

K-Sat: 3.3e-008 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

(CH) LS Blanket

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-007 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

(SM) below El 33.8 ft

Model: Saturated Only

Hydraulic

K-Sat: 3.3e-006 ft/sec

Volumetric Water Content: 0.3 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

(CH) RS Blanket

Model: Saturated Only

Hydraulic

Steady State Seepage No Toe Drain

K-Sat: 6.6e-007 ft/sec

Volumetric Water Content: 0.4 ft³/ft³

Mv: 0 /psf

K-Ratio: 0.2

K-Direction: 0 °

Boundary Conditions

Zero Flow (Q=0)

Type: Total Flux (Q) 0

Potential Seepage Face

Review: true

Type: Total Flux (Q) 0

100-yr (El. 50.8 ft)

Type: Head (H) 50.8

LS Total Head (45 ft)

Type: Head (H) 45

Flux Sections

Flux Section 1

Coordinates

Coordinate: (-24.281412, 51.268085) ft

Coordinate: (-31.396545, 41.8328) ft

Coordinate: (-137.24703, 41.626565) ft

Coordinate: (-139.05159, 46.009074) ft

Regions

	Material	Points	Area (ft ²)
Region 1	(CH) LS Blanket	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500
Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket	31,32,28,25	315
Region 12	(CH) LS Blanket	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5

Steady State Seepage No Toe Drain

Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) RS Blanket	32,38,39,28	630
Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) RS Blanket	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) RS Blanket	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) RS Blanket	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) LS Blanket	33,57,55,34	121.83828
Region 30	(CH) LS Blanket	57,53,12,21,55	3.56172
Region 31	FILL: (CH) and (CL)	12,21,56,58	3.1719465

Lines

	Start Point	End Point	Hydraulic Boundary
Line 1	13	14	
Line 2	14	22	
Line 3	22	21	
Line 4	23	15	
Line 5	15	14	
Line 6	22	23	
Line 7	24	16	Zero Flow (Q=0)
Line 8	16	15	
Line 9	23	24	
Line 10	13	17	
Line 11	17	18	
Line 12	18	14	
Line 13	15	19	
Line 14	19	18	
Line 15	16	20	Zero Flow (Q=0)
Line 16	20	19	
Line 17	18	25	
Line 18	25	26	
Line 19	26	19	
Line 20	20	27	Zero Flow (Q=0)
Line 21	27	26	
Line 22	26	29	
Line 23	29	30	
Line 24	30	27	Zero Flow (Q=0)
Line 25	25	28	
Line 26	28	29	

Steady State Seepage No Toe Drain

Line 27	31	32	100-yr (El. 50.8 ft)
Line 28	32	28	
Line 29	25	31	
Line 30	22	35	
Line 31	35	34	LS Total Head (45 ft)
Line 32	36	23	
Line 33	35	36	LS Total Head (45 ft)
Line 34	37	24	Zero Flow (Q=0)
Line 35	36	37	LS Total Head (45 ft)
Line 36	32	38	100-yr (El. 50.8 ft)
Line 37	38	39	
Line 38	39	28	
Line 39	29	40	
Line 40	40	39	
Line 41	30	41	Zero Flow (Q=0)
Line 42	41	40	
Line 43	38	42	100-yr (El. 50.8 ft)
Line 44	42	43	
Line 45	43	39	
Line 46	40	44	
Line 47	44	43	
Line 48	41	45	Zero Flow (Q=0)
Line 49	45	44	
Line 50	42	46	100-yr (El. 50.8 ft)
Line 51	46	47	100-yr (El. 50.8 ft)
Line 52	47	43	
Line 53	44	48	
Line 54	48	47	100-yr (El. 50.8 ft)
Line 55	45	49	Zero Flow (Q=0)
Line 56	49	48	100-yr (El. 50.8 ft)
Line 57	7	13	
Line 58	7	6	
Line 59	6	5	
Line 60	5	4	
Line 61	4	3	
Line 62	7	50	
Line 63	2	17	
Line 64	3	2	100-yr (El. 50.8 ft)
Line 65	2	1	100-yr (El. 50.8 ft)
Line 66	1	31	100-yr (El. 50.8 ft)
Line 67	50	54	
Line 68	54	3	100-yr (El. 50.8 ft)
Line 69	21	55	
Line 70	55	34	
Line 71	21	56	
Line 72	56	13	
Line 73	57	55	
Line 74	56	58	

Steady State Seepage No Toe Drain

Line 75	56	59	
Line 76	59	11	
Line 77	11	10	
Line 78	10	9	
Line 79	9	8	
Line 80	8	7	
Line 81	58	52	Potential Seepage Face
Line 82	52	51	
Line 83	51	7	
Line 84	33	57	Potential Seepage Face
Line 85	34	33	LS Total Head (45 ft)
Line 86	57	53	Potential Seepage Face
Line 87	53	12	Potential Seepage Face
Line 88	12	21	
Line 89	58	12	Potential Seepage Face

Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48
Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8
Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8
Point 29	150	33.8

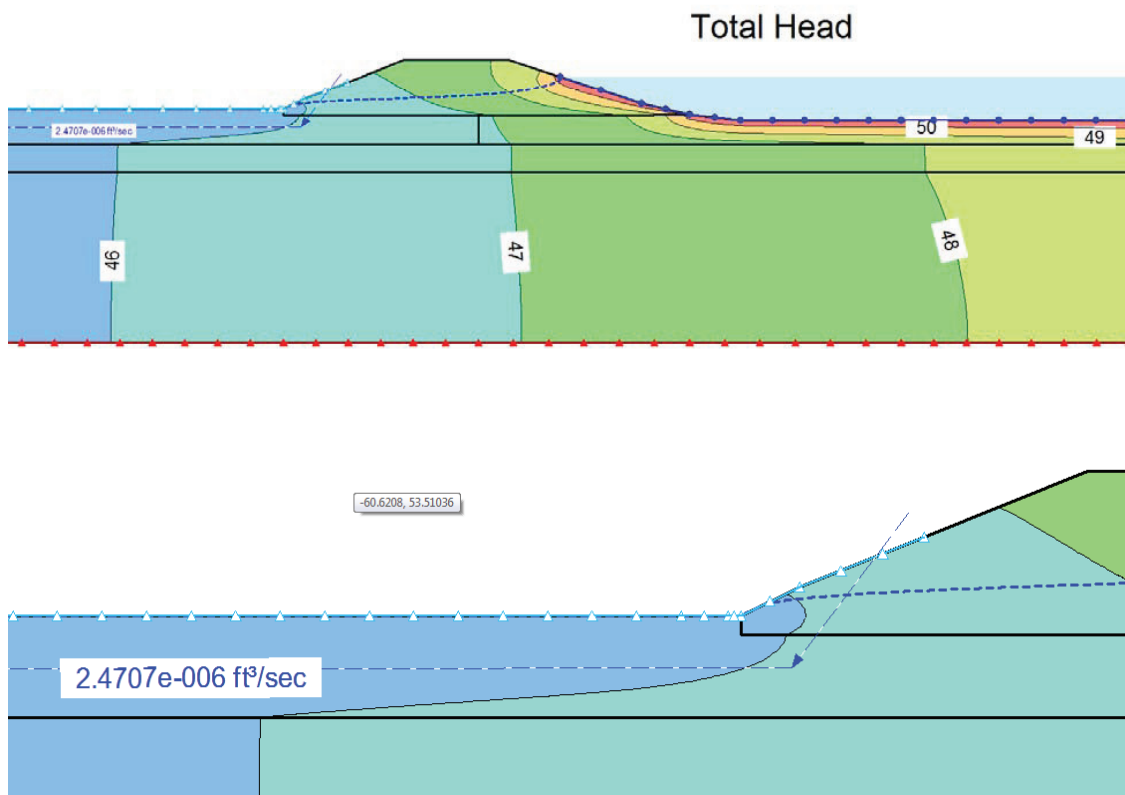
Steady State Seepage No Toe Drain

Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8
Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Donna to Brownsville – Reach 4 – Station 1342+00

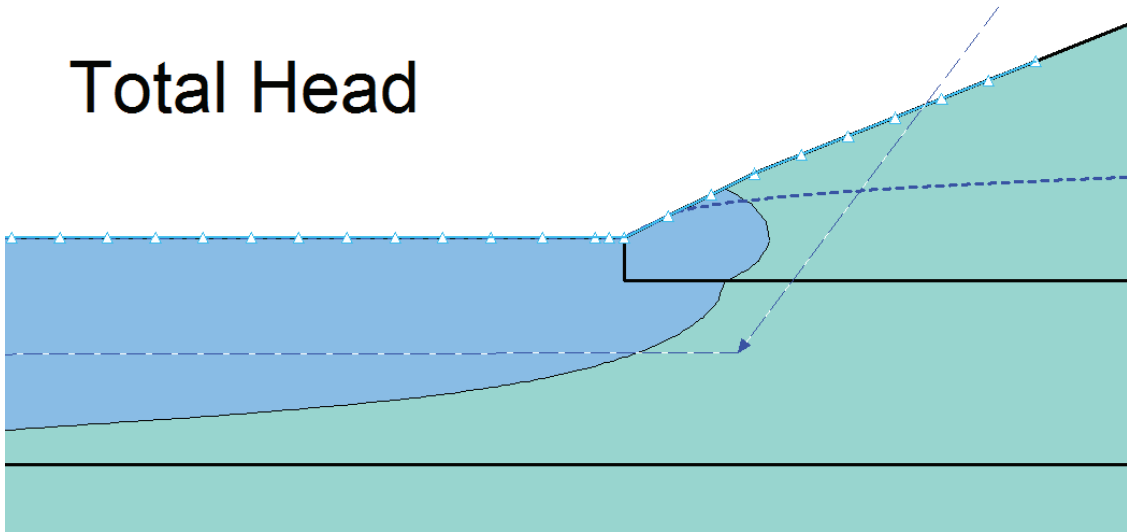
Seepage Results without Toe Drain

Steady State Seepage
Donna to Brownsville Subreach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



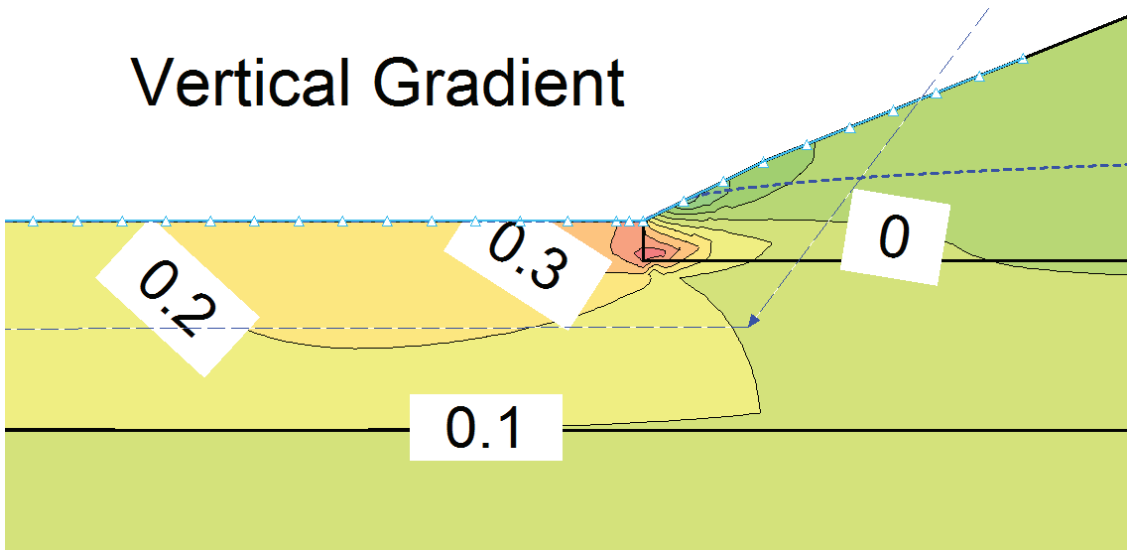
$q = 1.6$ gallons per day

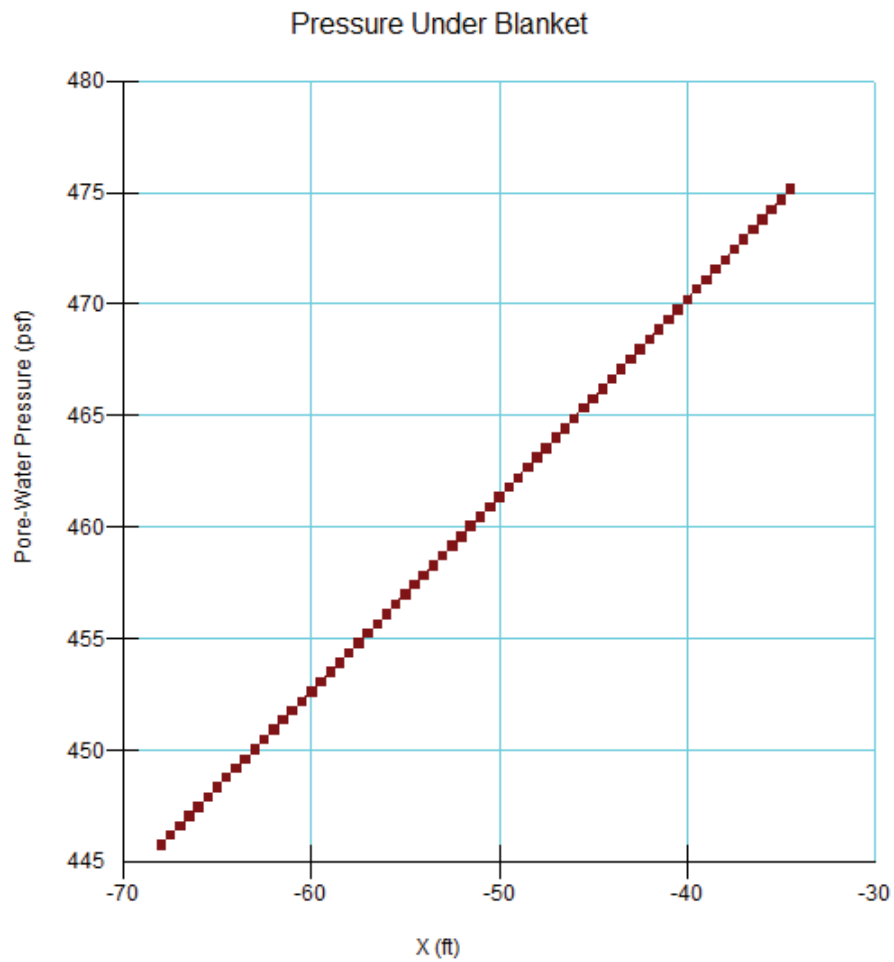
Total Head



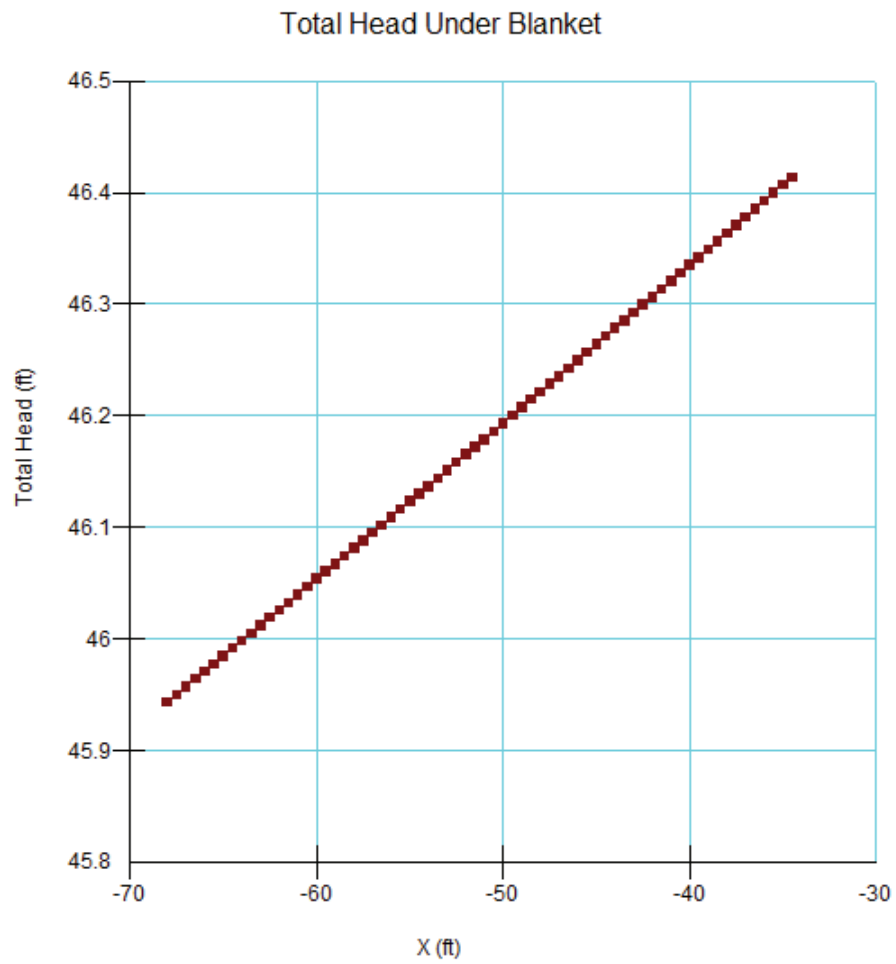
Phreatic surface daylights on Landside Slope

Vertical Gradient





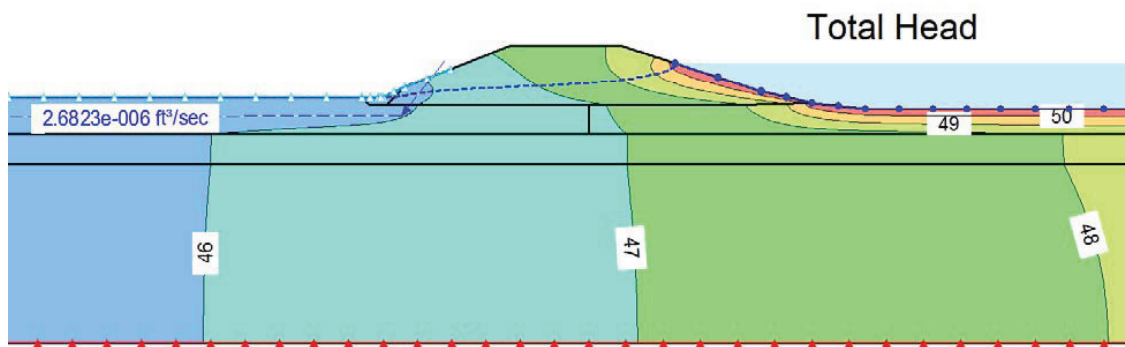
F.S. Heave = $\Sigma V / u = 120 \text{ pcf} \cdot (45 \text{ ft} - 38.8 \text{ ft}) / 475.1 \text{ psf} = 1.6 > 1.2$ Okay



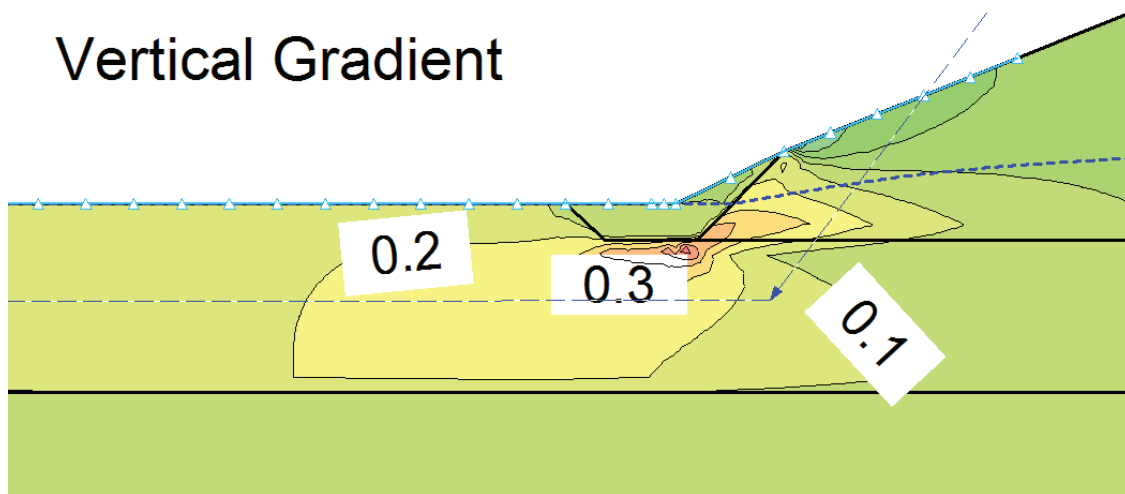
$$i_e = \Delta h / l = (46.4 \text{ ft} - 45 \text{ ft}) / (45 \text{ ft} - 38.8 \text{ ft}) = 0.23 < 0.5 \text{ ft} \quad \text{Okay}$$

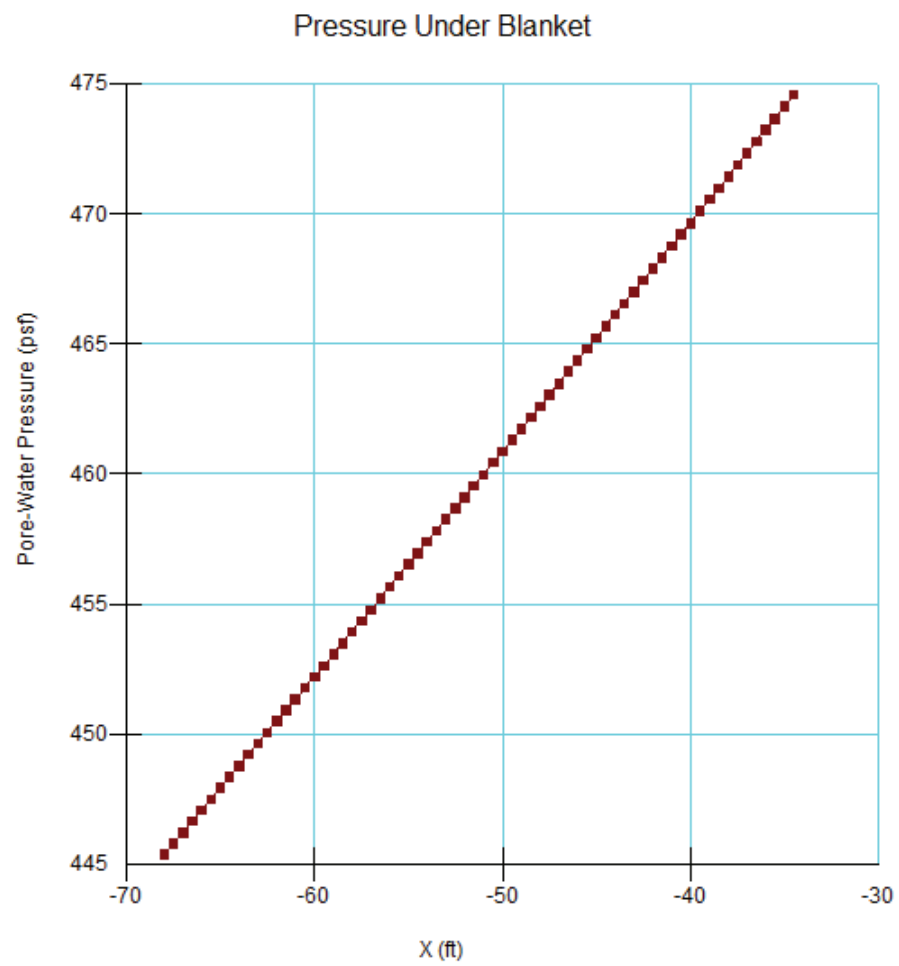
Seepage Analysis with Toe Drain

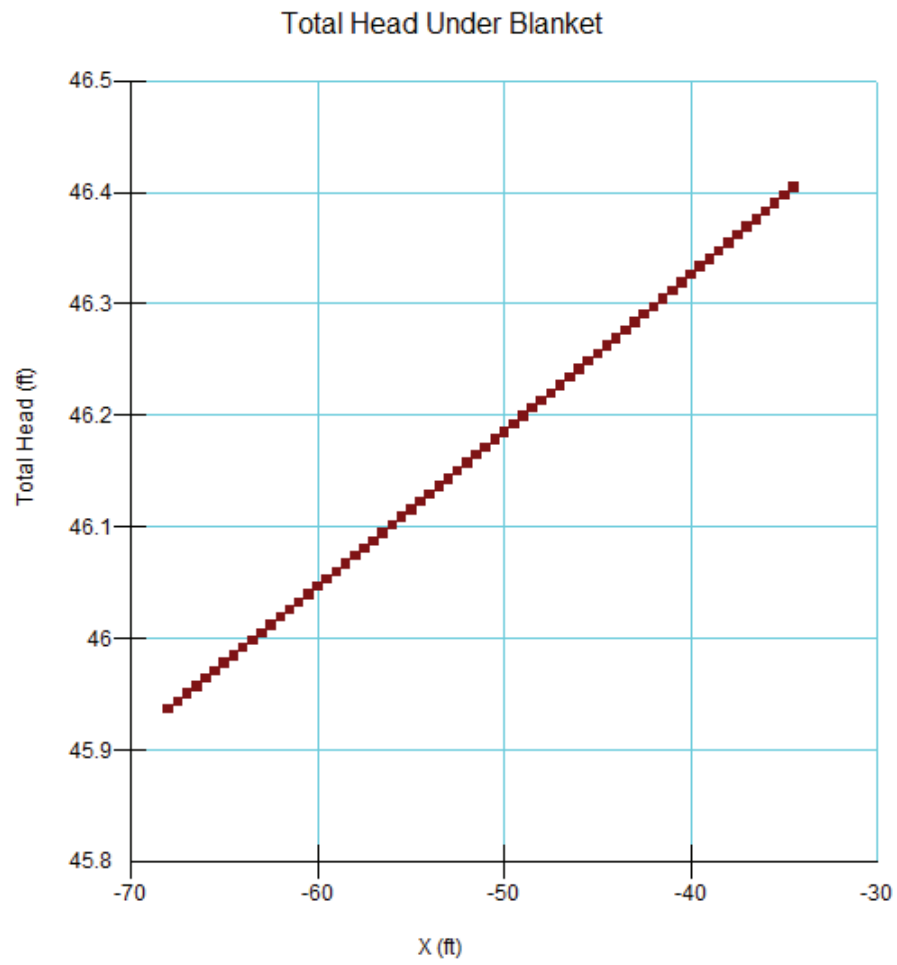
Steady State Seepage
Donna to Brownsville Subreach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



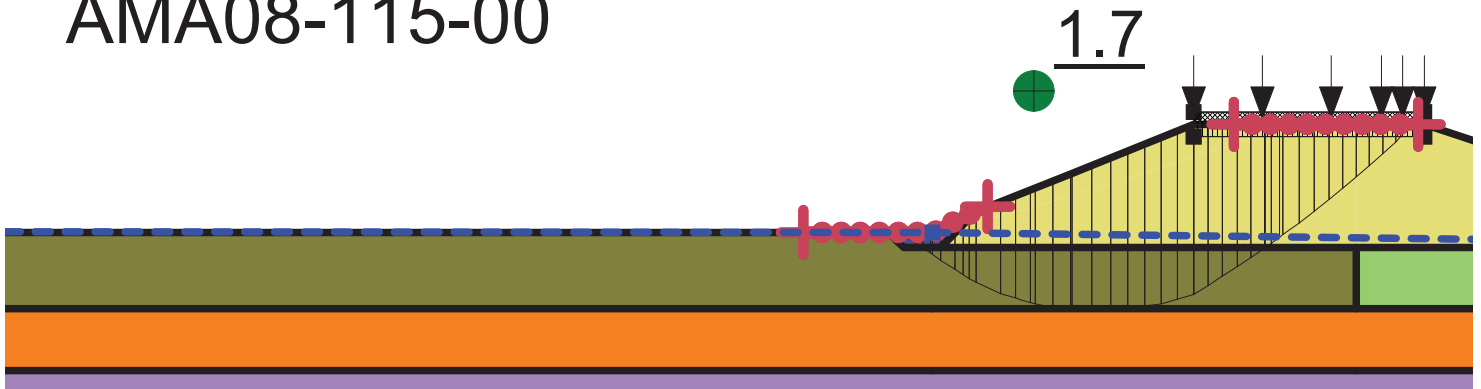
$q = 1.7$ gallons per day







EOC (LS) Entry Exit Refined
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



EOC (LS) Entry Exit Refined

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 240
Last Edited By:
Date: 4/19/2011
Time: 10:21:24 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:23:40 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

EOC (LS) Entry Exit Refined

Kind: SLOPE/W
Parent: Steady State Seepage
Method: Spencer
Settings
 Apply Phreatic Correction: No
 PWP Conditions Source: Piezometric Line
 Use Staged Rapid Drawdown: No
Slip Surface
 Direction of movement: Right to Left
 Use Passive Mode: No
 Slip Surface Option: Entry and Exit
 Critical slip surfaces saved: 1
 Optimize Critical Slip Surface Location: Yes
Tension Crack
 Tension Crack Option: Tension Crack Line
 Percentage Wet: 1

EOC (LS) Entry Exit Refined

Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution

FOS Calculation Option: Constant

Advanced

Number of Slices: 30

Optimization Tolerance: 0.01

Minimum Slip Surface Depth: 0.1 ft

Optimization Maximum Iterations: 20000

Optimization Convergence Tolerance: 1e-007

Starting Optimization Points: 8

Ending Optimization Points: 16

Complete Passes per Insertion: 1

Driving Side Maximum Convex Angle: 5 °

Resisting Side Maximum Convex Angle: 1 °

Materials

(SP-SM) to El 33.8 ft

Model: Mohr-Coulomb

Unit Weight: 117 pcf

Cohesion: 0 psf

Phi: 33 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

Toe Drain

Model: Mohr-Coulomb

Unit Weight: 125 pcf

Cohesion: 0 psf

Phi: 35 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(SM) below El 33.8 ft

Model: Mohr-Coulomb

Unit Weight: 117 pcf

Cohesion: 0 psf

Phi: 32 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

FILL: (CH) and (CL) (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

EOC (LS) Entry Exit Refined

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(CH) LS Blanket (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(CH) RS Blanket (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range

Left-Zone Left Coordinate: (-45, 45) ft

Left-Zone Right Coordinate: (-30, 47.11107) ft

Left-Zone Increment: 10

Right Projection: Range

Right-Zone Left Coordinate: (-10, 53.8) ft

Right-Zone Right Coordinate: (5, 53.8) ft

Right-Zone Increment: 10

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (-139, 45) ft

Right Coordinate: (838, 43) ft

Piezometric Lines

Piezometric Line 1

Coordinates



EOC (LS) Entry Exit Refined

	X (ft)	Y (ft)
	-139	45
	-34.5	45
	37.5	44
	46.5	43
	75	43
	150	43
	300	43
	500	43
	838	43

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 300 pcf

Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	-13.25	54.8
	5.5	54.8

Tension Crack Line

	X (ft)	Y (ft)
	-13.25	52.8
	5.5	52.8

Regions

	Material	Points	Area (ft²)
Region 1	(CH) LS Blanket (undrained)	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket (undrained)	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500
Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket (undrained)	31,32,28,25	315
Region 12	(CH) LS Blanket (undrained)	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5
Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) RS Blanket (undrained)	32,38,39,28	630

EOC (LS) Entry Exit Refined

Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) RS Blanket (undrained)	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) RS Blanket (undrained)	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL) (undrained)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL) (undrained)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) RS Blanket (undrained)	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL) (undrained)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL) (undrained)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) LS Blanket (undrained)	33,57,55,34	121.83828
Region 30	Toe Drain	57,53,12,21,55	3.56172
Region 31	Toe Drain	12,21,56,58	3.1719465

Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48
Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8
Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8

EOC (LS) Entry Exit Refined

Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8
Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.7	(-20.454, 65.946)	19.59834	(3.59205, 53.8)	(-37.2677, 45)
2	711	1.7	(-20.454, 65.946)	26.857	(2.96611, 53.8)	(-37.2636, 45)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-36.27843	44.370025	39.310416	115.81749	53.57083	0
2	Optimized	-34.96725	43.535025	91.414247	413.61986	0	400
3	Optimized	-34.57265	43.28194	107.2068	455.90297	0	400
4	Optimized	-34.15	43.00235	124.35366	517.14536	0	400
5	Optimized	-33.226795	42.39164	161.661	658.43702	0	400
6	Optimized	-	41.798265	197.91034	793.75352	0	400

EOC (LS) Entry Exit Refined

		32.329795					
7	Optimized	-31.76795	41.426595	220.62077	878.54156	0	400
8	Optimized	-31.22945	41.128375	238.75664	870.88982	0	400
9	Optimized	-29.93155	40.520385	275.56923	1019.233	0	400
10	Optimized	-28.325575	39.869615	314.78255	1111.7098	0	400
11	Optimized	-27.108525	39.502565	336.636	1219.0105	0	400
12	Optimized	-26.3253	39.26635	350.68346	1288.0863	0	400
13	Optimized	-25.42545	39.11283	359.49389	1277.4432	0	400
14	Optimized	-23.97515	38.91117	370.82389	1373.0551	0	400
15	Optimized	-23.21105	38.804925	376.78585	1423.4047	0	400
16	Optimized	-22.36004	38.804735	376.06017	1396.8494	0	400
17	Optimized	-20.77399	38.81494	374.05419	1471.695	0	400
18	Optimized	-19.29325	38.82447	372.17489	1541.5319	0	400
19	Optimized	-17.9097	38.92818	364.50369	1528.3045	0	400
20	Optimized	-16.5561	39.126505	350.95157	1568.5076	0	400
21	Optimized	-15.223575	39.411935	331.98786	1532.9344	0	400
22	Optimized	-13.912125	39.78446	307.60643	1550.3916	0	400
23	Optimized	-13.2532	39.97276	295.28883	1403.0007	0	400
24	Optimized	-12.661435	40.35018	271.22114	1634.6898	0	400
25	Optimized	-11.4843	41.10094	223.35437	1552.8228	0	400
26	Optimized	-10.307165	41.8517	175.4876	1470.8842	0	400
27	Optimized	-9.16395	42.60834	127.27899	1367.8796	0	400
28	Optimized	-8.05465	43.37086	78.738695	1285.2705	0	400
29	Optimized	-7.4651695	43.77606	52.943684	1241.4332	0	400
30	Optimized	-7.1854695	43.96832	40.704602	1220.5659	0	400
31	Optimized	-6.6193115	44.372475	14.994291	1158.9964	0	400
32	Optimized	-6.1490115	44.717685	-6.9544509	1121.8549	0	400
33	Optimized	-5.3334	45.31636	-45.018554	1057.439	0	400
34	Optimized	-4.05705	46.28037	-106.27608	938.20588	0	400
35	Optimized	-2.83755	47.22979	-166.58007	836.75024	0	400
36	Optimized	-1.67085	48.17221	-226.39665	716.70616	0	400
37	Optimized	-0.55695	49.107625	-285.73373	617.5154	0	400
38	Optimized	0.5279	50.018645	-343.51876	520.93926	0	400
39	Optimized	1.588575	50.94607	-402.30931	404.10825	0	400

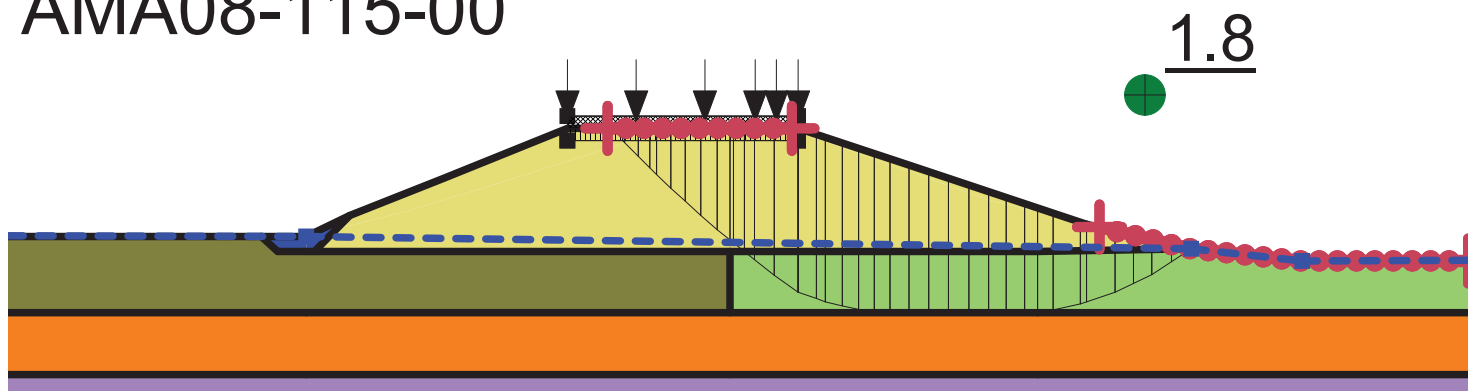
EOC (LS) Entry Exit Refined

40	Optimized	2.654125	51.91429	-463.6538	302.43697	0	400
41	Optimized	3.3894765	52.5992	-507.02408	200.25733	0	400

Slices of Slip Surface: 711

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	711	-36.455715	44.4	37.439787	115.13208	54.400727	0
2	711	-35.468515	43.67909	82.425109	391.36437	0	400
3	711	-34.8946	43.306485	105.6751	429.05672	0	400
4	711	-34.15	42.84726	134.02562	498.23077	0	400
5	711	-33.226795	42.329715	165.52102	606.28125	0	400
6	711	-32.329795	41.86005	194.04968	704.429	0	400
7	711	-31.4675	41.458205	218.38132	792.08005	0	400
8	711	-30.190835	40.92871	250.31388	906.44491	0	400
9	711	-28.7145	40.40269	281.86116	1021.7741	0	400
10	711	-27.238165	39.97117	307.50548	1124.4814	0	400
11	711	-25.6875	39.61686	328.27275	1219.2833	0	400
12	711	-24.0625	39.34513	343.81679	1305.6403	0	400
13	711	-22.4375	39.174705	353.04442	1378.9273	0	400
14	711	-20.8125	39.10364	356.07284	1439.5023	0	400
15	711	-19.325	39.121185	353.68692	1484.3157	0	400
16	711	-17.975	39.212175	346.83812	1515.2778	0	400
17	711	-16.625	39.372015	335.69658	1537.3843	0	400
18	711	-15.275	39.601965	320.17578	1550.4732	0	400
19	711	-13.925	39.90388	300.16303	1554.4157	0	400
20	711	-12.53125	40.29509	274.54932	1802.4569	0	400
21	711	-11.09375	40.78445	242.76621	1717.3717	0	400
22	711	-9.65625	41.36757	205.13408	1621.3032	0	400
23	711	-8.21875	42.051345	161.22131	1513.4506	0	400
24	711	-6.75	42.864655	109.19774	1389.779	0	400
25	711	-5.6298825	43.55497	65.149695	1287.2914	0	400
26	711	-4.721173	44.18946	24.769353	1195.3624	0	400
27	711	-3.4854845	45.14764	-36.092068	1059.0141	0	400
28	711	-2.091291	46.370245	-113.58839	888.49317	0	400
29	711	-0.697097	47.78235	-202.91279	695.59975	0	400
30	711	0.7415265	49.49599	-311.09281	466.13484	0	400
31	711	2.224579	51.625705	-445.26864	184.09813	0	400

EOC (RS) Entry Exit Refined
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



EOC (RS) Entry Exit Refined

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 240
Last Edited By:
Date: 4/19/2011
Time: 10:21:24 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:24:55 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

EOC (RS) Entry Exit Refined

Kind: SLOPE/W
Parent: Steady State Seepage
Method: Spencer
Settings
 Apply Phreatic Correction: No
 PWP Conditions Source: Piezometric Line
 Use Staged Rapid Drawdown: No
Slip Surface
 Direction of movement: Left to Right
 Use Passive Mode: No
 Slip Surface Option: Entry and Exit
 Critical slip surfaces saved: 1
 Optimize Critical Slip Surface Location: Yes
Tension Crack
 Tension Crack Option: Tension Crack Line
 Percentage Wet: 1

EOC (RS) Entry Exit Refined

Tension Crack Fluid Unit Weight: 62.4 pcf

FOS Distribution

FOS Calculation Option: Constant

Advanced

Number of Slices: 30

Optimization Tolerance: 0.01

Minimum Slip Surface Depth: 0.1 ft

Optimization Maximum Iterations: 20000

Optimization Convergence Tolerance: 1e-007

Starting Optimization Points: 8

Ending Optimization Points: 16

Complete Passes per Insertion: 1

Driving Side Maximum Convex Angle: 5 °

Resisting Side Maximum Convex Angle: 1 °

Materials

(SP-SM) to El 33.8 ft

Model: Mohr-Coulomb

Unit Weight: 117 pcf

Cohesion: 0 psf

Phi: 33 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

Toe Drain

Model: Mohr-Coulomb

Unit Weight: 125 pcf

Cohesion: 0 psf

Phi: 35 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(SM) below El 33.8 ft

Model: Mohr-Coulomb

Unit Weight: 117 pcf

Cohesion: 0 psf

Phi: 32 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

FILL: (CH) and (CL) (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

EOC (RS) Entry Exit Refined

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(CH) LS Blanket (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

(CH) RS Blanket (undrained)

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 400 psf

Phi: 0 °

Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range

Left-Zone Left Coordinate: (-10, 53.8) ft

Left-Zone Right Coordinate: (5, 53.8) ft

Left-Zone Increment: 10

Right Projection: Range

Right-Zone Left Coordinate: (30, 45.76471) ft

Right-Zone Right Coordinate: (60, 43) ft

Right-Zone Increment: 20

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (-139, 45) ft

Right Coordinate: (838, 43) ft

Piezometric Lines

Piezometric Line 1

Coordinates



EOC (RS) Entry Exit Refined

	X (ft)	Y (ft)
	-139	45
	-34.5	45
	37.5	44
	46.5	43
	75	43
	150	43
	300	43
	500	43
	838	43

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 300 pcf

Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	-13.25	54.8
	5.5	54.8

Tension Crack Line

	X (ft)	Y (ft)
	-13.25	52.8
	5.5	52.8

Regions

	Material	Points	Area (ft²)
Region 1	(CH) LS Blanket (undrained)	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket (undrained)	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500
Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket (undrained)	31,32,28,25	315
Region 12	(CH) LS Blanket (undrained)	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5
Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) RS Blanket (undrained)	32,38,39,28	630

EOC (RS) Entry Exit Refined

Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) RS Blanket (undrained)	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) RS Blanket (undrained)	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL) (undrained)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL) (undrained)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) RS Blanket (undrained)	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL) (undrained)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL) (undrained)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) LS Blanket (undrained)	33,57,55,34	121.83828
Region 30	Toe Drain	57,53,12,21,55	3.56172
Region 31	Toe Drain	12,21,56,58	3.1719465

Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48
Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8
Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8

EOC (RS) Entry Exit Refined

Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8
Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.8	(19.477, 72.606)	21.82028	(-8.74081, 53.8)	(37.489, 44.0026)
2	292	1.9	(19.477, 72.606)	33.71	(-7.80122, 53.8)	(37.364, 44.032)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-8.666592	52.72522	-504.42206	180.68361	0	400
2	Optimized	-8.046187	52.10012	-465.97515	272.99196	0	400
3	Optimized	-7.02415	51.07035	-402.6028	380.56741	0	400
4	Optimized	-6.27415	50.33	-357.05793	472.07851	0	400
5	Optimized	-5.422125	49.51915	-307.19475	557.39688	0	400
6	Optimized	-4.266375	48.419255	-239.56577	673.15587	0	400
7	Optimized	-3.03065	47.29682	-170.59322	815.64132	0	400

EOC (RS) Entry Exit Refined

8	Optimized	-1.71495	46.151835	-100.2896	937.41991	0	400
9	Optimized	-0.52855	45.1498	-38.789214	1063.3136	0	400
10	Optimized	0.1248339	44.618815	-6.2222427	1120.1777	0	400
11	Optimized	0.6910299	44.158685	21.999015	1169.4477	0	400
12	Optimized	1.548396	43.461925	64.73415	1244.0911	0	400
13	Optimized	2.78245	42.492515	124.15577	1363.4441	0	400
14	Optimized	4.5502	41.163175	205.57543	1521.3998	0	400
15	Optimized	5.49995	40.465155	248.30578	1770.7689	0	400
16	Optimized	6.25	40.21321	263.37825	1485.2471	0	400
17	Optimized	7.37695	39.83466	286.01944	1485.7369	0	400
18	Optimized	8.424975	39.553255	302.6739	1522.8802	0	400
19	Optimized	9.767125	39.24368	320.83143	1507.1258	0	400
20	Optimized	11.0812	39.01737	333.81224	1534.4713	0	400
21	Optimized	12.3672	38.87433	341.62564	1500.9301	0	400
22	Optimized	13.77255	38.802805	344.86784	1502.7874	0	400
23	Optimized	15.34304	38.80279	343.5059	1440.2252	0	400
24	Optimized	16.959315	38.802775	342.10762	1375.8797	0	400
25	Optimized	18.575585	38.80276	340.70935	1311.5342	0	400
26	Optimized	20.19186	38.802745	339.31107	1247.1269	0	400
27	Optimized	21.72905	38.80273	337.98093	1185.9269	0	400
28	Optimized	23.18715	38.802715	336.71216	1127.8376	0	400
29	Optimized	24.4581	38.858825	332.11392	1110.3198	0	400
30	Optimized	25.63975	38.98119	323.45208	1047.6219	0	400
31	Optimized	27.38195	39.286015	302.92056	981.98621	0	400
32	Optimized	28.7422	39.61327	281.31853	932.73995	0	400
33	Optimized	30.1407	40.09435	250.09015	827.19544	0	400
34	Optimized	32.0316	40.84496	201.61596	722.15346	0	400
35	Optimized	33.532	41.56138	155.61153	584.068	0	400
36	Optimized	35.082815	42.43963	99.461762	477.55891	0	400
37	Optimized	36.684395	43.479935	33.158814	289.47739	0	400
38	Optimized	37.48719	44.00139	-0.07583788	195.19808	0	400

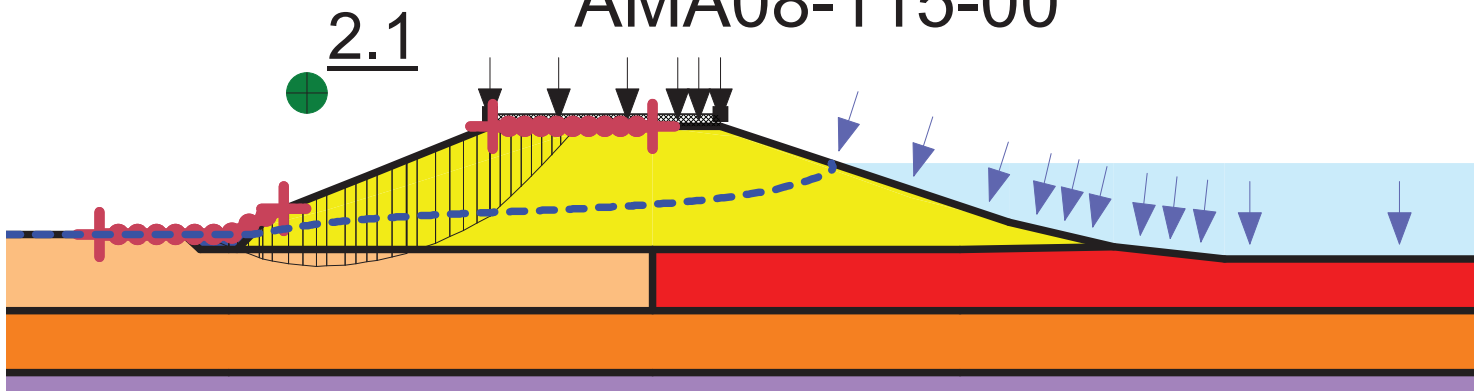
Slices of Slip Surface: 292

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	292	-7.6506125	52.59581	-497.24645	140.29235	0	400
2	292	-6.75	51.461325	-427.25011	290.9577	0	400
3	292	-5.25	49.720655	-319.92124	505.67028	0	400
4	292	-3.75	48.19659	-226.11749	698.15344	0	400
5	292	-2.25	46.8502	-143.40187	872.01911	0	400
6	292	-0.75	45.65461	-70.099836	1029.7696	0	400
7	292	0.4252068	44.80037	-17.811707	1144.6365	0	400
8	292	1.4086308	44.15451	21.637745	1233.0725	0	400
9	292	2.850136	43.298865	73.778119	1352.7712	0	400
10	292	4.616712	42.363695	130.60264	1487.0421	0	400
11	292	6.25	41.6096	176.24314	1289.4329	0	400
12	292	7.75349	41.009955	212.35813	1322.6501	0	400

EOC (RS) Entry Exit Refined

13	292	9.26047	40.49066	243.45486	1345.9576	0	400
14	292	10.76745	40.049365	269.6897	1359.7628	0	400
15	292	12.27443	39.68293	291.2503	1364.2979	0	400
16	292	13.78141	39.388875	308.2915	1359.7999	0	400
17	292	15.34304	39.15977	321.23155	1345.7155	0	400
18	292	16.959315	38.99932	329.84207	1321.4413	0	400
19	292	18.575585	38.91714	333.57372	1287.2529	0	400
20	292	20.19186	38.912645	332.44919	1243.1354	0	400
21	292	21.666665	38.97318	327.39465	1194.4722	0	400
22	292	23	39.08664	319.15989	1142.9309	0	400
23	292	24.333335	39.253765	307.57938	1084.2427	0	400
24	292	25.666665	39.475375	292.59047	1018.4304	0	400
25	292	27	39.752575	274.14005	945.2122	0	400
26	292	28.333335	40.086785	252.1324	864.24926	0	400
27	292	29.692315	40.48853	225.88138	781.77532	0	400
28	292	31.076945	40.962505	195.10703	697.34846	0	400
29	292	32.461575	41.50533	160.03135	603.46988	0	400
30	292	33.846205	42.120685	120.43289	499.57275	0	400
31	292	35.230835	42.813075	76.033514	384.79636	0	400
32	292	36.61997	43.590845	26.293777	257.6805	0	400
33	292	37.34037	44.017275	- 0.93981991	188.11504	0	400

SS (LS) Entry Exit Refined
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



SS (LS) Entry Exit Refined

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 238
Last Edited By:
Date: 4/19/2011
Time: 10:03:32 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:13:07 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SS (LS) Entry Exit Refined

Kind: SLOPE/W
Parent: Steady State Seepage
Method: Spencer
Settings
 PWP Conditions Source: Parent Analysis
Slip Surface
 Direction of movement: Right to Left
 Use Passive Mode: No
 Slip Surface Option: Entry and Exit
 Critical slip surfaces saved: 1
 Optimize Critical Slip Surface Location: Yes
 Tension Crack
 Tension Crack Option: (none)
FOS Distribution
 FOS Calculation Option: Constant
Advanced

SS (LS) Entry Exit Refined

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 20000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

(SP-SM) to El 33.8 ft

Model: Mohr-Coulomb
Unit Weight: 117 pcf
Cohesion: 0 psf
Phi: 33 °
Phi-B: 0 °

FILL: (CH) and (CL)

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 200 psf
Phi: 24 °
Phi-B: 0 °

Toe Drain

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °

(CH) LS Blanket

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 200 psf
Phi: 24 °
Phi-B: 0 °

(SM) below El 33.8 ft

Model: Mohr-Coulomb
Unit Weight: 117 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

(CH) RS Blanket

Model: [Mohr-Coulomb](#)
Unit Weight: [120 pcf](#)
Cohesion: [200 psf](#)
Phi: [24 °](#)
Phi-B: [0 °](#)

Slip Surface Entry and Exit

Left Projection: [Range](#)
Left-Zone Left Coordinate: [\(-45, 45\) ft](#)
Left-Zone Right Coordinate: [\(-30, 47.11107\) ft](#)
Left-Zone Increment: [10](#)
Right Projection: [Range](#)
Right-Zone Left Coordinate: [\(-13, 53.8\) ft](#)
Right-Zone Right Coordinate: [\(0, 53.8\) ft](#)
Right-Zone Increment: [10](#)
Radius Increments: [10](#)

Slip Surface Limits

Left Coordinate: [\(-139, 45\) ft](#)
Right Coordinate: [\(838, 43\) ft](#)

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): [300 pcf](#)
Direction: [Vertical](#)

Coordinates

	X (ft)	Y (ft)
	-13.25	54.8
	5.5	54.8

Regions

	Material	Points	Area (ft²)
Region 1	(CH) LS Blanket	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500

SS (LS) Entry Exit Refined

Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket	31,32,28,25	315
Region 12	(CH) LS Blanket	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5
Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) RS Blanket	32,38,39,28	630
Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) RS Blanket	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) RS Blanket	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) RS Blanket	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) LS Blanket	33,57,55,34	121.83828
Region 30	Toe Drain	57,53,12,21,55	3.56172
Region 31	Toe Drain	12,21,56,58	3.1719465

Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48
Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8

SS (LS) Entry Exit Refined

Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8
Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8
Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.1	(-26.887, 66.899)	15.89782	(-6.1452, 53.8)	(-36.8228, 45)
2	666	2.2	(-26.887, 66.899)	24.233	(-6.5, 53.8)	(-37.2636, 45)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

SS (LS) Entry Exit Refined

1	Optimized	-36.055995	44.677545	20.121154	55.247068	24.59543	0
2	Optimized	-34.9024	44.19243	50.393276	138.36673	61.599673	0
3	Optimized	-34.5078	44.02715	60.706426	156.67703	67.199342	0
4	Optimized	-34.14265	43.904385	68.367676	207.70246	97.563265	0
5	Optimized	-33.340475	43.62602	106.02056	374.69918	119.62343	200
6	Optimized	-32.450825	43.309585	141.742	483.47325	152.14855	200
7	Optimized	-31.8613	43.0999	162.69948	556.0269	175.12065	200
8	Optimized	-31.3228	42.967175	176.28897	549.22276	166.04082	200
9	Optimized	-30.26685	42.749295	198.1516	641.95528	197.59413	200
10	Optimized	-29.0385	42.56913	216.92408	675.998	204.39288	200
11	Optimized	-27.9061	42.482055	227.7716	746.77986	231.07737	200
12	Optimized	-26.91995	42.453595	233.48459	749.89211	229.91944	200
13	Optimized	-25.75375	42.495455	234.81698	802.83315	252.89709	200
14	Optimized	-24.568125	42.58582	232.67176	800.23363	252.69482	200
15	Optimized	-23.689375	42.712985	226.99547	826.84689	267.07106	200
16	Optimized	-22.8279	42.83765	221.3382	853.03132	281.2479	200
17	Optimized	-21.81895	43.04476	210.74154	828.94375	275.24135	200
18	Optimized	-20.64525	43.336815	195.00765	849.03484	291.19167	200
19	Optimized	-20.0292	43.49294	186.56828	817.07165	280.71819	200
20	Optimized	-19.57075	43.65152	177.59559	819.66094	285.86591	200
21	Optimized	-18.40505	44.05474	154.64	826.23099	299.01157	200
22	Optimized	-17.096175	44.5673	125.54814	783.99094	293.15762	200
23	Optimized	-15.951325	45.08294	96.52648	777.24524	303.07552	200
24	Optimized	-14.846675	45.63581	65.650022	725.41955	293.74832	200
25	Optimized	-13.782225	46.22591	32.895261	707.76246	300.47024	200
26	Optimized	-13.24955	46.52121	16.662035	945.53596	413.56132	200
27	Optimized	-12.823425	46.928795	-6.3877998	749.24046	333.58334	200
28	Optimized	-11.972075	47.743465	-52.187824	680.32996	302.90241	200
29	Optimized	-11.13085	48.56027	-97.927378	603.26556	268.59113	200
30	Optimized	-10.29975	49.379205	-143.77995	534.68383	238.05658	200
31	Optimized	-9.465725	50.218865	-190.99153	454.77229	202.47767	200
32	Optimized	-8.628775	51.079255	-239.76206	383.78259	170.87102	200
33	Optimized	-7.85515	51.903375	-287.03732	302.06416	134.48763	200
34	Optimized	-7.1629745	52.67112	-331.65977	240.46476	107.06181	200

35	Optimized	-6.485577	53.42247	-375.84052	180.17407	80.218662	200
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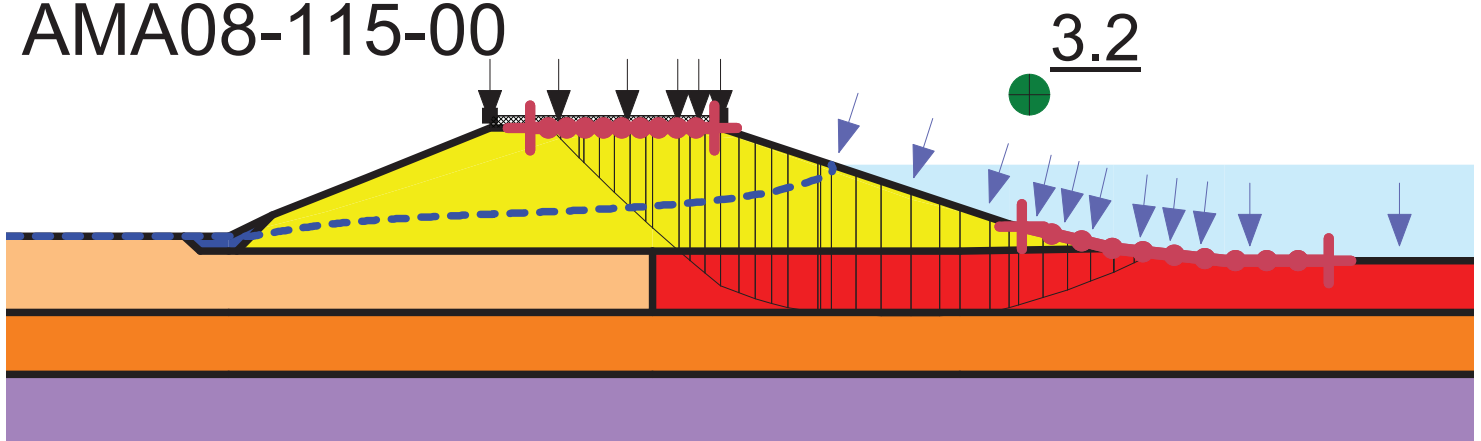
Slices of Slip Surface: 666

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	666	-36.77	44.77947	13.760925	38.358382	17.223325	0
2	666	-35.7828	44.3641	39.680401	106.31001	46.654553	0
3	666	-34.8946	44.03109	60.460609	156.85603	67.4968	0
4	666	-34.356605	43.84646	71.982347	195.72564	86.645988	0
5	666	-34.006605	43.7365	81.583707	295.00879	95.02297	200
6	666	-33.3515	43.54884	112.24446	356.98615	108.96602	200
7	666	-32.4545	43.318795	141.04991	435.32341	131.01901	200
8	666	-31.4675	43.109235	165.17472	513.0391	154.8792	200
9	666	-30.375375	42.925015	185.49352	584.57048	177.68051	200
10	666	-29.268125	42.7898	200.82057	642.76245	196.7652	200
11	666	-28.160875	42.70599	211.75469	692.20939	213.91221	200
12	666	-27.053625	42.673055	218.5363	733.37632	229.22155	200
13	666	-25.958335	42.690045	221.44003	766.3465	242.60799	200
14	666	-24.875	42.755985	220.73609	791.58119	254.15661	200
15	666	-23.791665	42.870925	216.60038	809.71319	264.07083	200
16	666	-22.708335	43.03557	209.08876	820.99798	272.43954	200
17	666	-21.625	43.25097	198.15594	825.51159	279.31673	200
18	666	-20.541665	43.518525	183.8532	823.17915	284.64625	200
19	666	-19.78084	43.73277	172.06658	818.11728	287.6403	200
20	666	-19.035705	43.98019	158.00843	808.56789	289.64773	200
21	666	-17.98376	44.368235	135.93763	790.34079	291.35906	200
22	666	-16.931815	44.813185	110.78256	765.40755	291.45783	200
23	666	-15.879865	45.31856	82.382072	733.55814	289.92226	200
24	666	-14.82792	45.88874	50.515494	694.54166	286.73892	200
25	666	-13.775975	46.529195	14.891777	648.00412	281.87978	200
26	666	-12.770835	47.211325	-22.933648	811.8023	361.43767	200
27	666	-11.8125	47.935815	-63.072799	717.77706	319.57494	200
28	666	-10.854165	48.7398	-107.71133	619.16417	275.66965	200

SS (LS) Entry Exit Refined

29	666	- 9.8958335	49.63446	- 157.67327	515.67883	229.59501	200
30	666	-8.9375	50.63488	- 214.16635	406.99104	181.20409	200
31	666	- 7.9791665	51.76227	- 278.87371	292.75087	130.34109	200
32	666	-7.257063	52.69661	- 333.52644	204.28283	90.952577	200
33	666	-6.757063	53.416195	- 376.32719	140.06195	62.359598	200

SS (RS) Entry Exit Refined
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



SS (RS) Entry Exit Refined

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 238
Last Edited By:
Date: 4/19/2011
Time: 10:03:32 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:14:29 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

SS (RS) Entry Exit Refined

Kind: SLOPE/W
Parent: Steady State Seepage
Method: Spencer
Settings
 PWP Conditions Source: Parent Analysis
Slip Surface
 Direction of movement: Left to Right
 Use Passive Mode: No
 Slip Surface Option: Entry and Exit
 Critical slip surfaces saved: 1
 Optimize Critical Slip Surface Location: Yes
 Tension Crack
 Tension Crack Option: (none)
FOS Distribution
 FOS Calculation Option: Constant
Advanced

SS (RS) Entry Exit Refined

Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 20000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

(SP-SM) to El 33.8 ft

Model: Mohr-Coulomb
Unit Weight: 117 pcf
Cohesion: 0 psf
Phi: 33 °
Phi-B: 0 °

FILL: (CH) and (CL)

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 200 psf
Phi: 24 °
Phi-B: 0 °

Toe Drain

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °

(CH) LS Blanket

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 200 psf
Phi: 24 °
Phi-B: 0 °

(SM) below El 33.8 ft

Model: Mohr-Coulomb
Unit Weight: 117 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

(CH) RS Blanket

Model: [Mohr-Coulomb](#)

Unit Weight: [120 pcf](#)

Cohesion: [200 psf](#)

Phi: [24 °](#)

Phi-B: [0 °](#)

Slip Surface Entry and Exit

Left Projection: [Range](#)

Left-Zone Left Coordinate: [\(-10, 53.8\) ft](#)

Left-Zone Right Coordinate: [\(5, 53.8\) ft](#)

Left-Zone Increment: [10](#)

Right Projection: [Range](#)

Right-Zone Left Coordinate: [\(30, 45.76471\) ft](#)

Right-Zone Right Coordinate: [\(55, 43\) ft](#)

Right-Zone Increment: [10](#)

Radius Increments: [10](#)

Slip Surface Limits

Left Coordinate: [\(-139, 45\) ft](#)

Right Coordinate: [\(838, 43\) ft](#)

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): [300 pcf](#)

Direction: [Vertical](#)

Coordinates

	X (ft)	Y (ft)
	-13.25	54.8
	5.5	54.8

Regions

	Material	Points	Area (ft²)
Region 1	(CH) LS Blanket	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500

SS (RS) Entry Exit Refined

Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket	31,32,28,25	315
Region 12	(CH) LS Blanket	34,55,21,22,35	522.5
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Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
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Region 24	FILL: (CH) and (CL)	7,50,54,3,4,5,6	11.999857
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Region 27	FILL: (CH) and (CL)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL)	58,52,51,7,8,9,10,11,59,56	46.510347
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Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8

SS (RS) Entry Exit Refined

Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8
Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
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Point 41	300	3.8
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Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	3.2	(20.856, 73.591)	23.52445	(-8.32834, 53.8)	(40.7805, 43.6355)
2	171	3.3	(20.856, 73.591)	35.404	(-8.5, 53.8)	(39.8846, 43.7351)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

SS (RS) Entry Exit Refined

1	Optimized	-7.914172	53.37346	-377.2609	235.20883	104.72172	200
2	Optimized	-6.75	52.17453	-299.98314	350.0291	155.84299	200
3	Optimized	-5.8054	51.20173	-237.98571	443.19827	197.32458	200
4	Optimized	-4.985975	50.39162	-186.73973	529.44623	235.72465	200
5	Optimized	-3.736325	49.17222	-110.57764	647.58968	288.3255	200
6	Optimized	-2.482175	47.975405	-37.399976	772.65476	344.00806	200
7	Optimized	-1.223525	46.80118	32.398053	890.41199	382.01242	200
8	Optimized	-0.2971	45.953765	81.152281	992.07781	405.57017	200
9	Optimized	1.0805405	44.74673	148.06343	1117.2799	431.52299	200
10	Optimized	2.5897405	43.424425	222.25147	1254.4798	459.57767	200
11	Optimized	3.638275	42.53165	278.98395	1360.8248	481.66659	200
12	Optimized	4.878025	41.49725	344.47969	1469.5199	500.90016	200
13	Optimized	5.49895	40.97965	377.12019	1695.4877	586.97505	200
14	Optimized	6.25	40.693675	395.61786	1423.1876	457.50351	200
15	Optimized	7.65465	40.15883	430.03507	1431.9037	446.06067	200
16	Optimized	8.981325	39.732485	457.48512	1472.9572	452.11729	200
17	Optimized	10.325375	39.378335	480.35685	1462.8847	437.44958	200
18	Optimized	12.22495	39.0061	504.6393	1471.4791	430.46483	200
19	Optimized	13.551485	38.80547	517.83236	1481.8771	429.22039	200
20	Optimized	14.092685	38.77556	520.1953	1463.5644	612.63104	0
21	Optimized	15.53905	38.69563	526.50838	1436.6867	591.07674	0
22	Optimized	17.54735	38.58465	535.25866	1412.6732	569.79966	0
23	Optimized	19.77575	38.534035	540.4083	1398.233	557.07785	0
24	Optimized	22.1604	38.543535	542.00717	1352.3249	526.22649	0
25	Optimized	24.1604	38.60065	540.24481	1327.4468	511.21494	0
26	Optimized	26.20355	38.72838	534.12411	1272.9087	479.77234	0
27	Optimized	28.20355	39.011535	521.28979	1269.831	333.27204	200
28	Optimized	29.36775	39.31545	508.67712	1205.607	310.29318	200
29	Optimized	30.73565	39.724055	493.24055	1149.9085	292.3674	200
30	Optimized	32.73595	40.34927	473.53383	1038.7779	251.66286	200
31	Optimized	34.677075	41.02162	457.78446	941.04053	215.15947	200
32	Optimized	36.559025	41.7411	447.47073	816.06479	164.10865	200
33	Optimized	37.5109	42.105005	444.7101	745.32538	133.84255	200
34	Optimized	38.33648	42.49075	443.03854	705.24457	116.74164	200
35	Optimized	39.965845	43.253915	447.55157	586.36064	61.80178	200

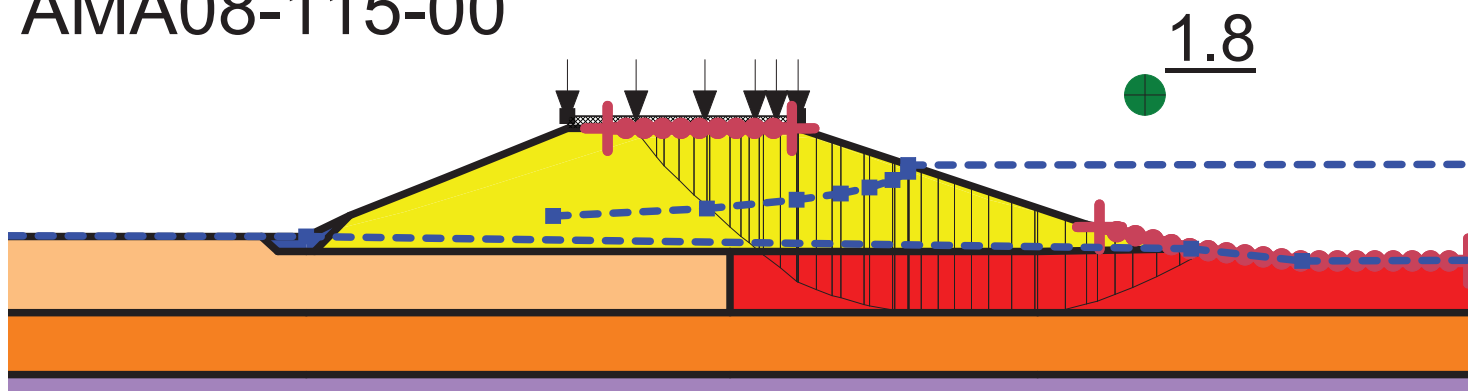
Slices of Slip Surface: 171

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	171	-8.180732	53.342165	-376.11874	203.56116	90.631266	200
2	171	-7.680732	52.63818	-331.26327	273.12191	121.60171	200
3	171	-6.75	51.45662	-256.51494	393.52586	175.209	200

SS (RS) Entry Exit Refined

4	171	-5.25	49.70161	-146.92639	580.03654	258.2489	200
5	171	-3.75	48.156435	-52.140231	752.01335	334.81792	200
6	171	-2.25	46.78439	30.0107	913.435	393.32584	200
7	171	-0.75	45.559825	100.94637	1065.6447	429.51137	200
8	171	0.862959	44.390865	165.93075	1214.7443	466.96186	200
9	171	2.6694385	43.23473	234.0956	1366.9518	504.38006	200
10	171	4.5564795	42.17985	302.02114	1510.7877	538.17757	200
11	171	6.25	41.350465	355.39027	1327.8251	432.95589	200
12	171	7.729452	40.719395	395.94481	1362.1265	430.17182	200
13	171	9.1883565	40.173415	430.99208	1386.6167	425.4715	200
14	171	10.64726	39.699005	461.38488	1402.3543	418.9466	200
15	171	12.106165	39.293185	487.34352	1409.5078	410.57398	200
16	171	13.56507	38.953545	509.06347	1408.3005	400.36612	200
17	171	14.41471	38.77776	520.33372	1404.9828	574.49786	0
18	171	15.34304	38.628095	530.5318	1412.1357	572.52028	0
19	171	16.959315	38.411155	545.53058	1423.9066	570.42408	0
20	171	18.575585	38.269465	555.83957	1426.6751	565.52718	0
21	171	20.19186	38.20212	561.50715	1420.4855	557.82705	0
22	171	22	38.219295	562.05604	1402.1167	545.54176	0
23	171	24	38.34083	556.2918	1368.8165	527.6597	0
24	171	26.20876	38.61501	541.20272	1313.8763	501.7801	0
25	171	28.20876	38.968035	523.3917	1254.8098	325.64834	200
26	171	29.85	39.3594	507.53286	1189.7942	303.7623	200
27	171	31.55	39.85215	489.99245	1118.4543	279.80925	200
28	171	33.25	40.43935	472.17482	1033.2681	249.81483	200
29	171	34.95	41.126145	455.75706	932.71965	212.35743	200
30	171	36.65	41.919035	443.03857	814.67467	165.46305	200
31	171	38.692295	43.03898	440.45828	645.29564	91.19947	200

RD (RS) Entry Exit Refined
Reach 4 Station 1342+00
Raba-Kistner Consultants
AMA08-115-00



RD (RS) Entry Exit Refined

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File Information

Title: Donna to Brownsville
Created By: Glen R. Andersen
Revision Number: 238
Last Edited By:
Date: 4/19/2011
Time: 10:03:32 AM
File Name: Donna Station 1342+00 with toe drain.gsz
Directory: C:\Users\Glen\Documents\Eng\Raba Kistner\Donna to Brownsville\Subreach 4 Station 1342+00\Results\
Last Solved Date: 4/19/2011
Last Solved Time: 10:10:58 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

RD (RS) Entry Exit Refined

Kind: SLOPE/W
Parent: Steady State Seepage
Method: Spencer

Settings

Apply Phreatic Correction: No
PWP Conditions Source: Piezometric Line
Use Staged Rapid Drawdown: Yes

Slip Surface

Direction of movement: Left to Right
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Optimize Critical Slip Surface Location: Yes
Tension Crack
Tension Crack Option: (none)

FOS Distribution

RD (RS) Entry Exit Refined

FOS Calculation Option: **Constant**

Advanced

Number of Slices: **30**

Optimization Tolerance: **0.01**

Minimum Slip Surface Depth: **0.1 ft**

Optimization Maximum Iterations: **20000**

Optimization Convergence Tolerance: **1e-007**

Starting Optimization Points: **8**

Ending Optimization Points: **16**

Complete Passes per Insertion: **1**

Driving Side Maximum Convex Angle: **5 °**

Resisting Side Maximum Convex Angle: **1 °**

Materials

(SP-SM) to El 33.8 ft

Model: **Mohr-Coulomb**

Unit Weight: **117 pcf**

Cohesion: **0 psf**

Phi: **33 °**

Phi-B: **0 °**

Drawdown Total Cohesion: **1 psf**

Drawdown Total Phi: **33 °**

Pore Water Pressure

Piezometric Line: **1**

Piezometric Line After Drawdown: **2**

FILL: (CH) and (CL)

Model: **Mohr-Coulomb**

Unit Weight: **120 pcf**

Cohesion: **200 psf**

Phi: **24 °**

Phi-B: **0 °**

Drawdown Total Cohesion: **400 psf**

Drawdown Total Phi: **0 °**

Pore Water Pressure

Piezometric Line: **1**

Piezometric Line After Drawdown: **2**

Toe Drain

Model: **Mohr-Coulomb**

Unit Weight: **125 pcf**

Cohesion: **0 psf**

Phi: **35 °**

Phi-B: **0 °**

Drawdown Total Cohesion: **1 psf**

Drawdown Total Phi: **35 °**

RD (RS) Entry Exit Refined

Pore Water Pressure

Piezometric Line: 1

Piezometric Line After Drawdown: 2

(CH) LS Blanket

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 200 psf

Phi: 24 °

Phi-B: 0 °

Drawdown Total Cohesion: 400 psf

Drawdown Total Phi: 0 °

Pore Water Pressure

Piezometric Line: 1

Piezometric Line After Drawdown: 2

(SM) below El 33.8 ft

Model: Mohr-Coulomb

Unit Weight: 117 pcf

Cohesion: 0 psf

Phi: 32 °

Phi-B: 0 °

Drawdown Total Cohesion: 1 psf

Drawdown Total Phi: 33 °

Pore Water Pressure

Piezometric Line: 1

Piezometric Line After Drawdown: 2

(CH) RS Blanket

Model: Mohr-Coulomb

Unit Weight: 120 pcf

Cohesion: 200 psf

Phi: 24 °

Phi-B: 0 °

Drawdown Total Cohesion: 400 psf

Drawdown Total Phi: 0 °

Pore Water Pressure

Piezometric Line: 1

Piezometric Line After Drawdown: 2

Slip Surface Entry and Exit

Left Projection: Range

Left-Zone Left Coordinate: (-10, 53.8) ft

Left-Zone Right Coordinate: (5, 53.8) ft

Left-Zone Increment: 10

Right Projection: Range

Right-Zone Left Coordinate: (30, 45.76471) ft

RD (RS) Entry Exit Refined

Right-Zone Right Coordinate: (60, 43) ft

Right-Zone Increment: 20

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (-139, 45) ft

Right Coordinate: (838, 43) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-14.4	46.7
	-1.9	47.3
	5.4	48
	9	48.5
	11.3	49
	13.2	49.6
	14.49	50.3
	14.5	50.8
	838	50.8

Piezometric Line 2

Coordinates

	X (ft)	Y (ft)
	-139	45
	-34.5	45
	37.5	44
	46.5	43
	75	43
	150	43
	300	43
	500	43
	838	43

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 300 pcf

Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	-13.25	54.8
	5.5	54.8

Regions

	Material	Points	Area (ft²)
Region 1	(CH) LS Blanket	21,56,13,14,22	172.5
Region 2	(SP-SM) to El 33.8 ft	23,15,14,22	172.5
Region 3	(SM) below El 33.8 ft	24,16,15,23	1035
Region 4	(CH) RS Blanket	13,17,18,14	125
Region 5	(SP-SM) to El 33.8 ft	15,19,18,14	125
Region 6	(SM) below El 33.8 ft	16,20,19,15	750
Region 7	(SP-SM) to El 33.8 ft	18,25,26,19	250
Region 8	(SM) below El 33.8 ft	20,27,26,19	1500
Region 9	(SM) below El 33.8 ft	26,29,30,27	2250
Region 10	(SP-SM) to El 33.8 ft	25,28,29,26	375
Region 11	(CH) RS Blanket	31,32,28,25	315
Region 12	(CH) LS Blanket	34,55,21,22,35	522.5
Region 13	(SP-SM) to El 33.8 ft	36,23,22,35	522.5
Region 14	(SM) below El 33.8 ft	37,24,23,36	3135
Region 15	(CH) RS Blanket	32,38,39,28	630
Region 16	(SP-SM) to El 33.8 ft	29,40,39,28	750
Region 17	(SM) below El 33.8 ft	30,41,40,29	4500
Region 18	(CH) RS Blanket	38,42,43,39	840
Region 19	(SP-SM) to El 33.8 ft	40,44,43,39	1000
Region 20	(SM) below El 33.8 ft	41,45,44,40	6000
Region 21	(CH) RS Blanket	42,46,47,43	1419.6
Region 22	(SP-SM) to El 33.8 ft	44,48,47,43	1690
Region 23	(SM) below El 33.8 ft	45,49,48,44	10140
Region 24	FILL: (CH) and (CL)	7,50,54,3,4,5,6	11.999857
Region 25	FILL: (CH) and (CL)	2,17,13,7,6,5,4,3	195.3
Region 26	(CH) RS Blanket	17,2,1,31,25,18	225.75
Region 27	FILL: (CH) and (CL)	56,59,11,10,9,8,7,13	204.54038
Region 28	FILL: (CH) and (CL)	58,52,51,7,8,9,10,11,59,56	46.510347
Region 29	(CH) LS Blanket	33,57,55,34	121.83828
Region 30	Toe Drain	57,53,12,21,55	3.56172
Region 31	Toe Drain	12,21,56,58	3.1719465

Points

	X (ft)	Y (ft)
Point 1	46.5	43
Point 2	37.5	44
Point 3	29	46
Point 4	21	48

RD (RS) Entry Exit Refined

Point 5	7	53
Point 6	5.5	53.1
Point 7	0	53.8
Point 8	-6	53.1
Point 9	-7.5	53
Point 10	-20	49
Point 11	-26.5	47
Point 12	-34.5	45
Point 13	0	43.8
Point 14	0	38.8
Point 15	0	33.8
Point 16	0	3.8
Point 17	25	43.8
Point 18	25	38.8
Point 19	25	33.8
Point 20	25	3.8
Point 21	-34.5	43.8
Point 22	-34.5	38.8
Point 23	-34.5	33.8
Point 24	-34.5	3.8
Point 25	75	38.8
Point 26	75	33.8
Point 27	75	3.8
Point 28	150	38.8
Point 29	150	33.8
Point 30	150	3.8
Point 31	75	43
Point 32	150	43
Point 33	-139	45
Point 34	-139	43.8
Point 35	-139	38.8
Point 36	-139	33.8
Point 37	-139	3.8
Point 38	300	43
Point 39	300	38.8
Point 40	300	33.8
Point 41	300	3.8
Point 42	500	43
Point 43	500	38.8
Point 44	500	33.8
Point 45	500	3.8
Point 46	838	43
Point 47	838	38.8
Point 48	838	33.8
Point 49	838	3.8
Point 50	5.5	53.8
Point 51	-13.25	53.8
Point 52	-23.25	49.8

RD (RS) Entry Exit Refined

Point 53	-35.2892	45
Point 54	14.5349	50.80117
Point 55	-36.8	43.8
Point 56	-33.8	43.8
Point 57	-38.1362	45
Point 58	-30.929	46.74099
Point 59	-32.006	45.6235

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.8	(21.101, 72.643)	22.58165	(-7.80618, 53.8)	(38.8264, 43.8526)
2	534	1.8	(21.101, 72.643)	33.834	(-7, 53.8)	(38.8648, 43.8484)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-7.4992085	53.41026	-548.20073	149.05851	66.365126	200
2	Optimized	-6.596119	52.263665	-477.43677	241.55462	107.54705	200
3	Optimized	-5.703	51.129725	-407.44762	333.03101	148.27496	200
4	Optimized	-4.79055	50.169095	-348.30141	490.26902	0	380.81
5	Optimized	-3.55965	49.00201	-276.54236	606.93349	0	392.38
6	Optimized	-2.4221	47.95457	-212.1646	728.93102	0	404.74
7	Optimized	-1.8031545	47.40462	-178.38452	784.39788	0	410.69
8	Optimized	-0.8531545	46.560525	-126.53819	871.34926	0	414.61
9	Optimized	0.43635	45.41477	-56.159641	989.7021	0	419.16
10	Optimized	1.1926305	44.763445	-16.171856	1079.7319	0	423.81
11	Optimized	1.937221	44.149915	21.466606	1143.7528	0	426.31
12	Optimized	2.5379405	43.65493	51.832823	1195.3615	0	428.32
13	Optimized	3.3855	42.977685	93.35803	1278.2896	0	432.21
14	Optimized	4.7285	41.913335	158.61178	1389.8664	0	436.6
15	Optimized	5.45	41.341535	193.66564	1449.8081	0	438.95
16	Optimized	5.50115	41.301	196.14859	1197.5613	0	410.82
17	Optimized	6.25115	41.00804	213.78256	1363.6748	0	423
18	Optimized	7.6417	40.46573	246.4161	1373.2371	0	419.03
19	Optimized	8.6417	40.112735	267.57426	1421.2409	0	420.03
20	Optimized	9.9543	39.736375	289.92091	1414.8527	0	414.95
21	Optimized	11.1043	39.42619	308.28455	1451.8633	0	414.18
22	Optimized	12.25	39.21216	320.64253	1432.5854	0	408.22
23	Optimized	13.29025	39.01783	331.87091	1415.0764	0	402.62

RD (RS) Entry Exit Refined

24	Optimized	13.93525	38.94986	335.55047	1440.766	0	401.5
25	Optimized	14.49025	38.89873	338.25661	1424.8338	0	397.32
26	Optimized	14.49525	38.89827	338.28266	1424.5907	0	395.62
27	Optimized	14.51745	38.89622	338.39499	1423.9125	0	393.95
28	Optimized	15.03405	38.848625	340.91816	1409.2374	0	393.2
29	Optimized	16.21655	38.80245	342.77457	1409.5266	0	394.53
30	Optimized	17.58325	38.802075	341.61118	1354.9426	0	391.84
31	Optimized	18.94995	38.8017	340.44779	1300.2854	0	389.18
32	Optimized	20.31665	38.80132	339.29172	1245.6282	0	386.55
33	Optimized	21.937025	38.800875	337.91521	1180.865	0	383.48
34	Optimized	23.811075	38.80036	336.31974	1106.0004	0	380.02
35	Optimized	24.87405	38.815635	334.44887	1111.2705	0	381.84
36	Optimized	26.12395	38.96979	323.74482	1041.0467	0	378.55
37	Optimized	28.12395	39.331915	299.4155	965.03584	0	376.61
38	Optimized	29.4295	39.664995	277.50229	873.13788	0	372.1
39	Optimized	30.583275	40.0491	252.53063	835.89447	0	371.69
40	Optimized	32.031825	40.598165	217.01367	720.40947	0	366.82
41	Optimized	33.70115	41.325255	170.19646	608.50233	0	363.52
42	Optimized	35.59125	42.23036	112.08048	422.66385	138.28063	200
43	Optimized	37.01815	42.929025	67.245955	272.4529	0	281.22
44	Optimized	38.16319	43.51388	25.73542	159.65629	0	253.27

Slices of Slip Surface: 534

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	534	-6.747196	53.43352	-550.3058	128.3534	57.146615	200
2	534	-6.247196	52.7276	-506.68913	191.75433	85.374526	200
3	534	-5.3166665	51.533045	-432.95428	304.10444	135.39602	200
4	534	-3.95	49.924465	-333.76148	476.32249	0	380.41
5	534	-2.5833335	48.50065	-246.10325	646.85938	0	396.55
6	534	-1.6357525	47.59049	-190.12526	758.46932	0	407.78
7	534	-0.6857525	46.77318	-139.95101	862.43821	0	414.35
8	534	0.584663	45.749665	-77.186474	995.76807	0	420.79
9	534	1.753989	44.896	-24.930954	1109.5779	0	426.4
10	534	2.8768925	44.144175	21.010403	1211.9761	0	431.54
11	534	4.4075665	43.236635	76.315342	1339.3522	0	438.02
12	534	5.45	42.64718	112.19668	1423.4926	0	442.36
13	534	6.25	42.254575	135.99628	1182.8472	0	411.98
14	534	8	41.46784	183.57517	1233.8833	0	410.04
15	534	9.575	40.83924	221.42994	1270.2075	0	407.45
16	534	10.725	40.44557	245.00201	1288.7394	0	404.77
17	534	12.25	40.002685	271.3134	1303.7124	0	400.07

RD (RS) Entry Exit Refined

18	534	13.845	39.603445	294.84251	1311.1599	0	393.41
19	534	14.49025	39.46175	303.13524	1311.5711	0	389.97
20	534	14.49525	39.460755	303.18854	1311.557	0	388.37
21	534	14.51745	39.45635	303.42872	1311.5507	0	386.84
22	534	15.34436	39.31309	311.66515	1307.3344	0	386.9
23	534	16.961515	39.0737	325.2035	1293.7854	0	386.89
24	534	18.57691	38.913675	333.78418	1270.2565	0	386.4
25	534	20.192305	38.831545	337.51099	1236.7131	0	385.45
26	534	21.666665	38.821005	336.89034	1197.7323	0	384.18
27	534	23	38.86965	332.69934	1154.9003	0	382.66
28	534	24.333335	38.97114	325.21217	1104.9196	0	380.83
29	534	25.666665	39.12596	314.39871	1047.748	0	378.67
30	534	27	39.334855	300.20294	983.17387	0	376.2
31	534	28.333335	39.598845	282.5781	910.91123	0	373.44
32	534	29.708335	39.931145	260.64756	836.51332	0	370.36
33	534	31.125	40.33732	234.07299	759.52371	0	367.64
34	534	32.541665	40.8117	203.24925	672.84756	0	364.82
35	534	33.958335	41.357395	167.97061	576.14826	0	362.23
36	534	35.375	41.97822	128.00231	464.65954	149.88945	200
37	534	36.791665	42.67886	83.050578	328.45656	109.26178	200
38	534	38.18242	43.449065	29.647051	186.43474	0	261.42

Gong, Andy

From: Chris Schultz [cschultz@rkci.com]
Sent: Tuesday, July 12, 2011 12:36 PM
To: Gong, Andy
Cc: glenandersen10@gmail.com; John A. Focht
Subject: FW: Donna to Brownsville Reach 4 Gap Analysis for Andy Gong

Andy –

Please see Glen's comments below. In summary, for the first and third reach we consider the condition to be marginal but because of the short linear distance the drain can be omitted provided the areas are properly inspected during flood events.

With regard to the middle segment, it too can be eliminated provided the canal is maintained full during flood events.

Chris L. Schultz, P.E., PMP
Senior Vice President
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San Antonio, TX 78249
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<http://www.rkci.com>

TBPE Firm Number 3257

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From: Glen Andersen [<mailto:glenandersen10@gmail.com>]
Sent: Tuesday, July 12, 2011 10:05 AM
To: Chris Schultz; John A. Focht; Monika McCartney
Subject: Donna to Brownsville Reach 4 Gap Analysis for Andy Gong

Hi Chris and John:

I went through each of the gaps in the toe drain detail identified by Andy Gong for Donna to Brownsville Reach 4.

There are only three areas of concern that we should point out, all of the other proposed gap areas should be okay.

- 1) Station 1337+24.32 to 1337+72.67
 - a. In this location there is SP-SM at 15 ft below the levee crest and SM (almost SP-SM) below 20 ft
 - b. Since the gap is only about 48 ft wide, there may not be a problem
 - c. This would be an area of concern during a flood and should merit higher levels of surveillance during a flood event
- 2) Station 1521+90.83 to 1525+96

- a. In this location, the flood protection incorporates the Los Fresnos Canal (and some sort of pump station???)
- b. We did not find any sand to the 50 ft exploration depth.
- c. However, we should recommend that the Canal be maintained full of water during a flood event.

3) Station 1674+02.39 to 1674+31.24

- a. In this location there is ML at 8 ft, SM (almost SP-SM) at 15 ft and SP-SM at 35 ft
- b. Since the gap is only about 29 ft wide, there may not be a problem
- c. This would be an area of concern during a flood and should merit higher levels of surveillance during a flood event

I did not communicate this to Andy.

Let me know if you want me to contact him with this information.

Thanks,

Glen

Glen R. Andersen, Sc.D., P.E.
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Gong, Andy

From: Gong, Andy
Sent: Friday, July 08, 2011 3:25 PM
To: 'Glen Andersen'; 'Chris Schultz'; john.focht@rkci.com
Cc: Pace, Ike
Subject: Donna to Brownsville Reach 4- Toe Drain Gaps

Gentlemen, the following is a table that shows the toe drain gaps for Reach 4. As discussed in previous meeting gaps greater than 50 feet need to be reviewed by RK. I have highlighted in yellow the gaps greater than 50 feet. Please review and let me know if these gaps are acceptable.

End Toe Drain Sta	Begin Toe Drain Sta	Gap Length (ft)	Comment
1278+71.24	1279+50.	78.76	Access Ramps
1293+36.05	1293+86.92	50.87	
1322+36.08	1322+80.82	44.74	
1326+33.32	1326+69.12	35.80	
1337+24.32	1337+72.67	48.35	
1362+56.06	1362+96.75	40.69	
1379+29.55	1398+00.	1,870.45	DHS Wall
1410+59.47	1411+29.54	70.07	DHS Wall
1425+00.	1448+00.	2,300.00	DHS Wall
1465+72.42	1466+35.02	62.60	Golf Course Tee Box
1472+35.49	1473+31.19	95.70	Roadway
1483+00.	1502+00.	1,900.00	Landside Ditch shown on Report as 1483+00 to 1485+00
1509+42.96	1510+37.	94.04	Access Ramp
1521+90.83	1525+96.	405.17	Los Fresnos Canal
1548+74.75	1549+12.05	37.30	
1577+64.36	1578+48.28	83.92	Flor de Mayo Crossing
1615+86.94	1616+32.38	45.44	
1642+46.39	1642+82.36	35.97	
1656+83.51	1657+09.25	25.74	
1674+02.39	1674+31.24	28.85	
1709+15.99	1709+60.4	44.41	
1732+53.95	1780+30.	4,776.05	Report 1733+00 to 1780+30
1795+67.67	1796+20.23	52.56	Access Ramp
1801+40.	1904+85.12	10,345.12	City of Brownsville Homes and Bridges, shown on Report 1801+40 to 1904+85

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