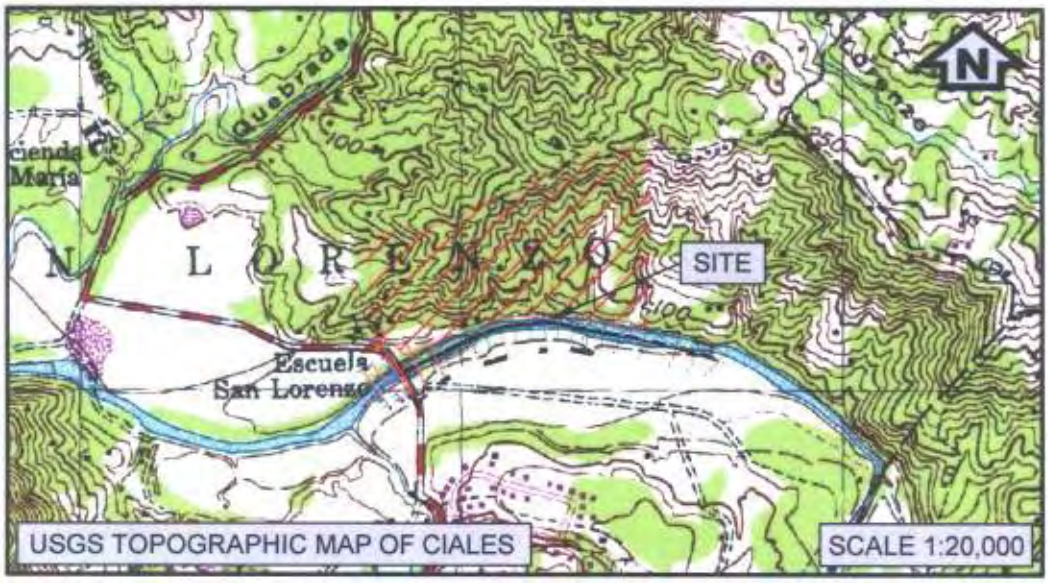
SEDIMENTATION STUDY
FOR A MATERIAL EXTRACTION ACTIVITY
IN THE RÍO GRANDE DE MANATÍ
MOROVIS, PUERTO RICO

PREPARED FOR:

MR. MORGAN GINÉS



PREPARED BY:

MENAR HYDROSYSTEMS ENGINEERING, P.S.C.
PO BOX 20000 PMB 347 CANOVANAS PR 00729
TEL 787-750-0754
FAX 787-750-1592
E-MAIL MENAR@PRTC.NET

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Menar Hydrosystems Engineering, PSC
October 2007

I. INTRODUCTION

General

Mr. Morgan Ginés is currently in the process of submitting a permit for a material extraction activity in a reach of the Río Grande de Manatí. The project is located near the State Road PR-567, at San Lorenzo Ward of the Municipality of Morovis. The proposed extraction activity will be held in a reach of approximately 0.50 kilometers. Figure 1 shows the studied reach length of approximately 0.96 kilometers.

This report summarizes the results of the sedimentation analysis performed to determine the impact of the proposed extraction activity on the existing equilibrium sediment transport rate in the channel bed during the 100-year flood event.

Authorization

Mr. Morgan Ginés, authorized this study through an agreement with Mr. Miguel Menar Figueroa, MSCE, PE, representative of Menar Hydrosystems Engineering, P.S.C.

Scope of Work

The scope of work for the scouring study includes the following tasks.

- Site visit to determine the river bed channel conditions.
- Sediment transport modeling of existing condition.
- Sediment transport modeling of proposed condition.
- Analyze resulting channel bed elevation change according to the proposed material extraction at the river channel.
- Recommend maximum level of material extraction within the river channel according to the impact on the equilibrium sediment transport rate. This will be addressed for the 100-year flood event.

II. SEDIMENTATION ANALYSIS

The sedimentation analysis employed the HEC-6, Version 4.1, developed by the Hydrologic Engineering Center, US Army Corps of Engineers, on October 1993. This computer application was created for the simulation and computations of scour and deposition in rivers and reservoirs. Hydrologic and hydraulic data required in the HEC-6 analysis was obtained from different sources to be explained bellow.

Hydrologic Data

The peak flow discharge for the 100-year frequency event was obtained from the Flood Insurance Study (FIS) report for Río Grande de Manatí, published by FEMA on March 16, 1982, to be effective until April 19, 2005 [FIS No. 72000CV001A, FEMA, 2005]. The peak flow discharge for Río Grande de Manatí at a gage in Ciales (nearest point to the reach under study), is 470 cms (16,598 cfs). Additional hydrologic data required in

HEC-6 is the water surface elevation for the downstream boundary; the water temperature; and the duration of the event. Table 1 show the values used for each of these variables.

Table 1. Hydrologic Data.

Variable	Value
100-year Water Discharge, ft^3/s	16,598
Starting WSEL, ft	203.9
Temperature, degrees Fahrenheit	60
Event Duration, days	1

Hydraulic Data

A hydraulic model was performed using the River Analysis System (HEC-RAS), Version 3.1.3, developed by the U.S. Army Corps of Engineers [USACE, 2005]. The geometry for the hydraulic model was conceptualized as one (1) reach. The hydraulic model was developed to simulate the existing scenario based on the current field data as submitted by Mr. Eric Martínez Arbona, PLS. Twenty six (26) cross sections were field surveyed along the stream from a point downstream the proposed extraction reach to a point upstream from it. Copy of this data is included in Appendix C. From those sections, only sixteen (16) were used in the hydraulic modeling. Figure 2 shows a plan of the cross sections used in the hydraulic analysis.

The Manning's roughness coefficient values used in the HEC-RAS hydraulic model for the main channel and floodplain were 0.04 and 0.06, respectively. Contraction and expansion coefficients of 0.1 and 0.3 respectively were used for gradual transitions, and 0.2 and 0.4 for abrupt transitions.

The HEC-RAS hydraulic model was performed to determine the 100-year water surface elevations along the analyzed stream. Once determined the water levels for the existing condition, the sedimentation analysis was performed using the hydrologic data and reproducing the existing computed water levels. HEC-RAS input and output data (geometry: Existing) is included in Appendix A.

The Manning's roughness coefficients values in the HEC-6 model were determined through the calibration process using the computed flood levels. The values used for the existing and proposed conditions ranged from 0.03 to 0.04 in the main channel and from 0.06 to 0.08 in the floodplain. Contraction and expansion coefficients of 0.1 and 0.3 respectively were used for gradual transitions, and 0.2 and 0.4 for abrupt transitions.

All levels were reproduced within 0.1 ft tolerance. Most of the sections resulted within the subcritical flow regime, except for sections 17 and 18. In these sections the flow was supercritical. In HEC-6, the supercritical levels are approximated by normal depth. That is, sediment transport occurring in supercritical reaches is simplified. In other words, HEC-6 will not compute supercritical flow. Therefore, the water surface

elevations resulting from the hydraulic model (HEC-RAS) for sections 17 and 18 will not be reproduced with HEC-6.

Sediment Data

The sedimentation model requires the input of a sediment load data, and the gradation of the material in the streambed. Also, it requires the transport capacity relationship and the weight assigned to the hydraulic properties at each cross section.

Since an initial sediment load data is not available an initial run was performed assuming zero initial load. From this run a sediment load data was computed based on the existing particle size gradation. This load data was used as input for the existing condition model run. The gradation material was taken from a field sample data taken at a location downstream the analyzed reach. The transport capacity relation to be used to compute the sediment load for the given water discharge was the Toffaleti's transport function. In the case of the weighting factors the scheme 1 suggested in the HEC-6 manual was used. It is the recommended for most stable channel beds.

Sediment Transport Function

Toffaleti presented a procedure to compute sediment load based on the following simplifications: (a) channel width with sediment discharge is equal to that of a rectangular channel width B and depth R, with R being the hydraulic radius of the channel; (b) the total depth of flow is divided in three zones. These zones are upper, middle, and lower. The sediment discharge per unit width for each zone is computed

and, eventually all are added to obtain the total bed material load in a given streambed. Detailed explanation and all the equations are presented in Yang [1996].

Sedimentation Analysis Results

As mentioned earlier, the sedimentation analysis was performed applying the HEC-6 computer program. For the existing condition model the elevation of bottom of dredged channel for sections 5 to 14 was permitted up to 3.28 ft of dredging (1.0 meter). That means, the channel invert elevation of those sections was left as existing but it was permitted a maximum degradation of 3.28 ft upon the sediment transport computations. All other sections were left as existing.

According to the modeling results a maximum of 6.90 ft of scour was resulting in section 8 and a deposition of 3.90 ft was resulting in section 5. Computed bed changes and water levels at each section are shown in Table 2. Figure 3 shows the channel bed elevation for the existing condition. Detailed HEC-6 model is included in Appendix B.

Table 2. Sedimentation analysis results for the **existing condition model:** 100-year discharge.

River Sta.	Q Total (ft^3/s)	Bed Change (ft)	W.S. Elev (ft)	Thalweg (ft)	Transport Rate (tons/day)
0.1	16,598	0	203.94	195.44	11,749
0.2	16,598	0	205.74	195.05	11,749
0.3	16,598	0	205.97	196.72	11,749
0.4	16,598	0	208.86	194.39	11,749

Table 2. Sedimentation analysis results for the **existing condition model:** 100-year discharge (continued).

River Sta.	Q Total (ft3/s)	Bed Change (ft)	W.S. Elev (ft)	Thalweg (ft)	Transport Rate (tons/day)
0.5	16,598	0	208.78	197.24	11,749
0.6	16,598	0	209.93	197.18	11,749
5	16,598	3.90	210.80	200.75	11,750
6	16,598	-0.59	210.91	196.26	17,819
8	16,598	-6.90	216.42	189.95	17,013
10	16,598	-4.73	220.77	192.12	8,956
12	16,598	-2.79	222.84	194.06	4,513
14	16,598	-1.95	225.11	194.90	1,880
16	16,598	0	224.35	196.85	0
17	16,598	0	227.61	196.85	0
18	16,598	0	244.25	229.66	0
20	16,598	0	251.59	239.50	0

This model was established as the base model for comparison with the proposed model. It should be noted that most of the available material is sand and gravel, and the sediment load is variable through the reach.

For the simulation of the proposed condition the existing condition model was modified to lower the channel invert elevations of sections 5 to 14 a total of 3.28 ft (1.0 meter). In this way, the proposed extraction activity was assumed to be completed and a new

run was performed. This run resulted in a maximum degradation of 6.87 ft in section 8 and a maximum deposition of 4.44 ft in section 5. It should be noted that the rate of sediment transport is decreased for sections downstream from section 5, compared to the existing condition. It is the expected behavior because of the proposed extraction. That is, there is a lower concentration of sediments to be transported.

Computed bed changes and water levels at each section are shown in Table 3. Figure 3 shows the channel bed elevation for the proposed condition. Detailed HEC-6 model is included in Appendix B.

Table 3. Sedimentation analysis results for the **proposed condition model:** 100-year discharge.

River Sta.	Q Total (ft^3/s)	Bed Change (ft)	W.S. Elev (ft)	Thalweg (ft)	Transport Rate (tons/day)
0.1	16,598	0	203.94	195.44	10,892
0.2	16,598	0	205.74	195.05	10,892
0.3	16,598	0	205.97	196.72	10,892
0.4	16,598	0	208.86	194.39	10,892
0.5	16,598	0	208.78	197.24	10,892
0.6	16,598	0	209.93	197.18	10,892
5	16,598	4.44	210.88	198.01	10,892
6	16,598	-0.40	210.95	193.17	17,794
8	16,598	-6.87	214.61	186.70	17,249
10	16,598	-4.74	219.02	188.83	9,235

Table 3. Sedimentation analysis results for the **proposed condition model:** 100-year discharge (continued).

River Sta.	Q Total (ft3/s)	Bed Change (ft)	W.S. Elev (ft)	Thalweg (ft)	Transport Rate (tons/day)
12	16,598	-2.60	221.15	190.97	4,788
14	16,598	-2.43	223.31	191.14	2,338
16	16,598	0	222.06	196.85	0
17	16,598	0	227.69	196.85	0
18	16,598	0	244.22	229.66	0
20	16,598	0	251.60	239.50	0

It should be mentioned, that the water surface elevations for the proposed condition increase from the existing a maximum of 0.04 ft (0.01 meter).

III. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on field observations and, the sedimentation analysis performed herein.

Hydraulics

The water surface elevations for the proposed condition are increased a maximum of 0.1 ft (0.03 meter) from the existing condition. That increase is within the 0.30 meter permitted by the Planning Regulation #13.

Sedimentation

Proposed Channel Bed Profile. The proposed extraction should begin at section 0.6 lowering gradually from 0 to 3.28 ft at section 5. In the same way, but in the contrary, the extraction should be reduced from 3.28 ft at section 14 to 0 ft at section 16. In total, the length of the extraction reach will be approximately 0.50 kilometers. In addition, the extraction activity should not be lowered more than 3.28 ft (1.0 meter) below the existing thalweg of sections 0.5 to 14. A minimum distance of 100 meters should be left between the extraction activity and any existing hydraulic structure along the reach, as is the existing bridge of the State Road PR-567 over the river, located between sections 0.3 and 0.4 of the studied reach.

Shape of Extraction Section. The section for extraction should be trapezoidal in shape with lateral sides with maximum slope 3:1 (H:V).

IV. GENERAL COMMENTS

Study Limitations

The results of this study are based on free flow conditions (***no debris***) through the riverbed along the studied reach. The accumulation of debris in any point of the reach might produce scour depths higher than the presented in this report. This analysis is based on the Field Study certified by Mr. Eric Martínez Arbona, PLS. Inaccuracies in this data may total or partially invalidate the results and conclusions contained in this study.

V. CERTIFICATION

I certify that the hydrologic-hydraulic study presented herein was performed by me and the information is true, correct, and complete as per my knowledge. I know and accept the consequences of including and submitting incomplete, unfinished or false information in this document. To state this, I sign the present certification in *Carolina, Puerto Rico*, on October 30, 2007.

Miguel Menar Figueroa, MSCE, PE
PE License #13051

Colegio de Ingenieros y
Agrimensores de Puerto Rico

Ingeniero Licenciado
Miembro de Propiedad
13051 P.E.

Ing. Miguel Menar Figueroa

Colegiación expira 31/08/2008

Estado Libre Asociado de Puerto Rico
Departamento de Estado
Secretaría Auxiliar de Juntas Examinadoras

certificamos que,
Miguel Menar Figueroa
esta autorizado a ejercer como
Ingeniero Licenciado
en Puerto Rico

Licencia Núm. **13051**
Expedición: **18-junio-2002**
Expiración: **17-junio-2007**

Secretario Auxiliar

Presidente de la Junta

VI. REFERENCES

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FIGURES

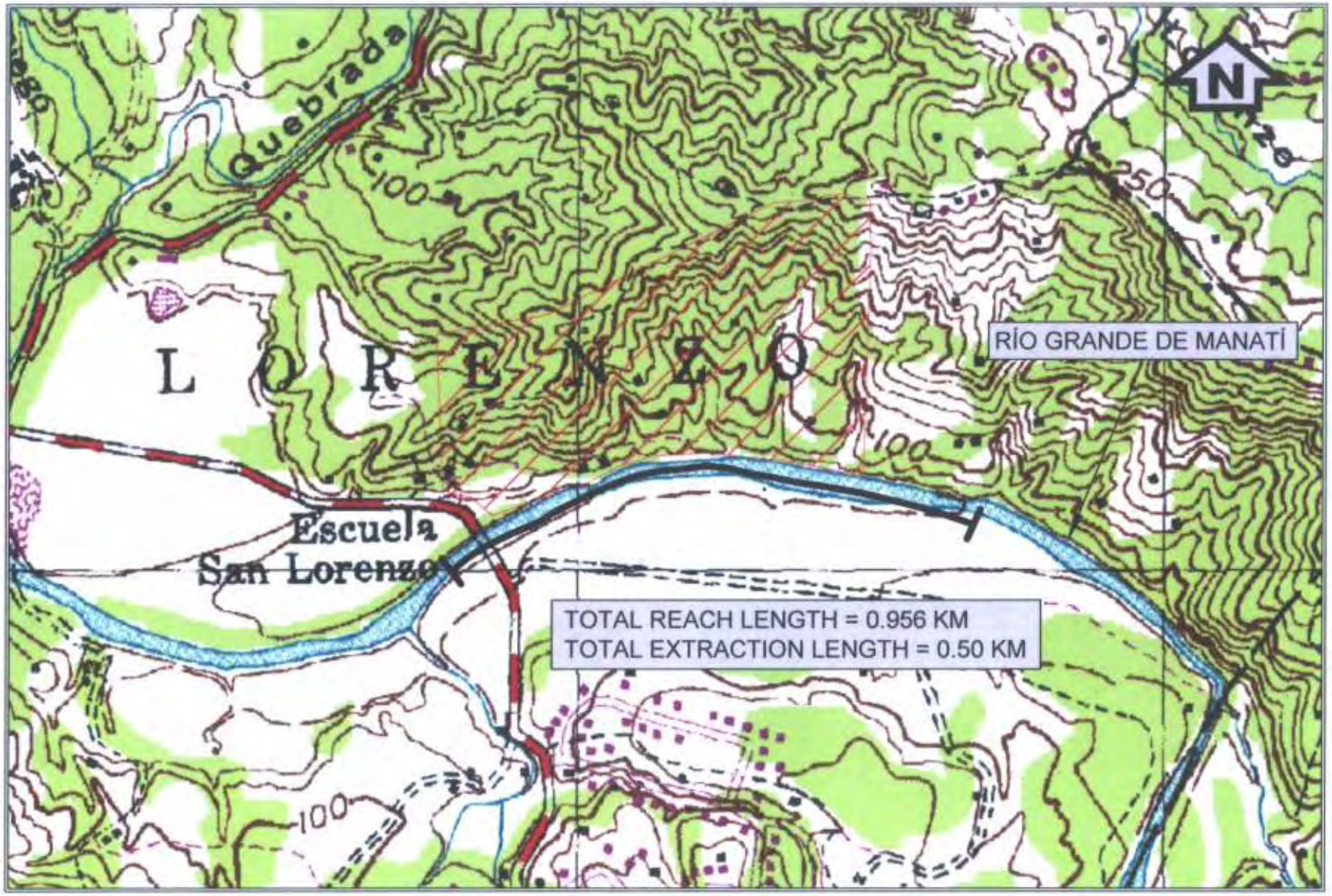

Figure 1. Project location on the USGS topograghic map of Ciales (scale 1:10,000).

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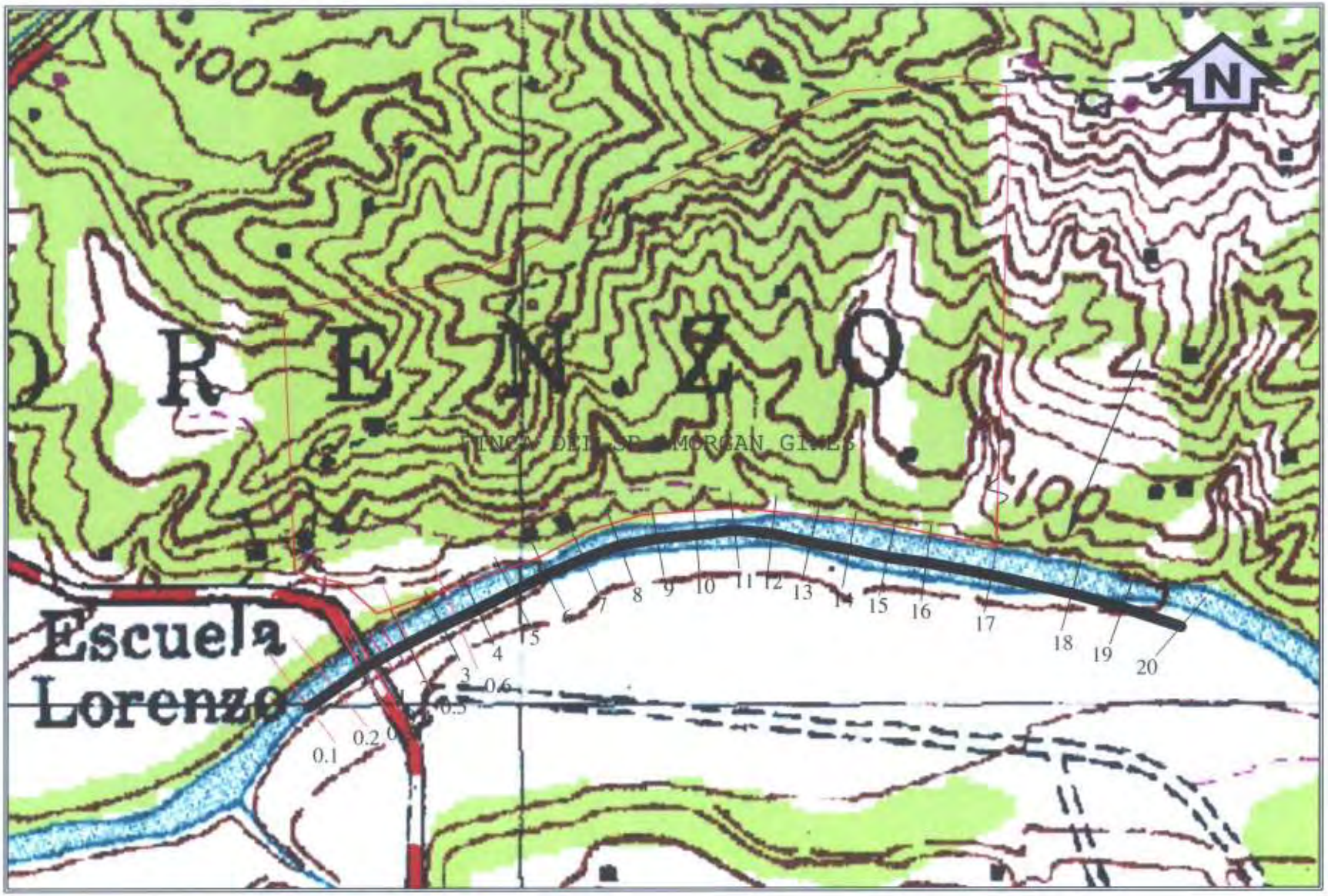

Figure 2. Cross sections location plan (scale 1:10,000).

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APPENDIXES

APPENDIX A

HEC-RAS MODEL

FILENAME: MGINES.PRJ

GEOMETRY: EXISTING

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Hydraulic Analysis: Rio Grande de Manati
Project File : MGines.prj
Run Date and Time: 10/26/2007 5:43:14 PM

Project in English units

PLAN DATA

Plan Title: Existing
Plan File : C:\PROJ\Gines\Ras\MGines.p02

Geometry Title: Existing
Geometry File : C:\PROJ\Gines\Ras\MGines.g02

Flow Title : Existing
Flow File : C:\PROJ\Gines\Ras\MGines.f02

Plan Summary Information:

Number of: Cross Sections	=	16	Multiple Openings	=	0
Culverts	=	0	Inline Structures	=	0
Bridges	=	1	Lateral Structures	=	0

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

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

FLOW DATA

Flow Title: Existing
Flow File : C:\PROJ\Gines\Ras\MGines.f02

Flow Data (cfs)

River	Reach	RS	100-YR
Rio Grande de MaM.Ginés		20	16597.89

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Rio Grande de MaM.Ginés		100-YR	Critical	Critical

GEOMETRY DATA

Geometry Title: Existing
Geometry File : C:\PROJ\Gines\Ras\MGines.g02

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 20

INPUT
Description: XS-20
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	262.467	46.26	255.906	88.845	249.344	105.217	252.625	167.454	246.063
180.545	242.782	206.759	239.501	210.039	242.782	262.467	242.782	306.266	252.339
352.69	262.467								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	105.217	.04	306.266	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105.217	306.266	329.593	385.892 484.318	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	105.217		F

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	254.63	Element	Left OB	Channel	Right OB	
Vel Head (ft)	3.13	Wt. n-Val.		0.040		
W.S. Elev (ft)	251.49	Reach Len. (ft)	329.59	385.89	484.32	
Crit W.S. (ft)	251.49	Flow Area (sq ft)		1168.60		
E.G. Slope (ft/ft)	0.012941	Area (sq ft)	26.55	1168.60		
Q Total (cfs)	16597.89	Flow (cfs)		16597.89		
Top Width (ft)	211.15	Top Width (ft)	24.69	186.46		
Vel Total (ft/s)	14.20	Avg. Vel. (ft/s)		14.20		
Max Chl Dpth (ft)	11.99	Hydr. Depth (ft)		6.27		
Conv. Total (cfs)	145905.5	Conv. (cfs)		145905.5		
Length Wtd. (ft)	385.89	Wetted Per. (ft)		189.65		
Min Ch El (ft)	239.50	Shear (lb/sq ft)		4.98		
Alpha	1.00	Stream Power (lb/ft s)		70.70		
Frctn Loss (ft)	4.74	Cum Volume (acre-ft)	0.16	95.46	1.92	
C & E Loss (ft)	0.11	Cum SA (acres)	0.16	9.42	0.59	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m), between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 18

INPUT
Description: XS-18
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	252.625	23.294	246.063	52.789	242.782	90.453	236.22	118.307	229.659
160.892	236.22	169.127	243.012	188.747	259.186	262.467	269.029		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	52.789	.04	169.127	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
52.789	169.127	595.866	278.297 288.255	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	248.59	Element	Left OB	Channel	Right OB

Vel Head (ft)	5.43	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	243.17	Reach Len. (ft)	595.87	278.30	288.26
Crit W.S. (ft)	244.18	Flow Area (sq ft)	0.67	887.72	0.01
E.G. Slope (ft/ft)	0.017692	Area (sq ft)	0.67	887.72	0.01
Q Total (cfs)	16597.89	Flow (cfs)	0.73	16597.15	0.01
Top Width (ft)	119.99	Top Width (ft)	3.46	116.34	0.19
Vel Total (ft/s)	18.68	Avg. Vel. (ft/s)	1.09	18.70	0.50
Max Chl Dpth (ft)	13.51	Hydr. Depth (ft)	0.19	7.63	0.08
Conv. Total (cfs)	124784.7	Conv. (cfs)	5.5	124779.2	0.1
Length Wtd. (ft)	278.30	Wetted Per. (ft)	3.48	120.61	0.24
Min Ch El (ft)	229.66	Shear (lb/sq ft)	0.21	8.13	0.07
Alpha	1.00	Stream Power (lb/ft s)	0.23	151.99	0.03
Frctn Loss (ft)	5.80	Cum Volume (acre-ft)	0.06	86.35	1.92
C & E Loss (ft)	0.23	Cum SA (acres)	0.05	8.08	0.59

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 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: Rio Grande de Ma
REACH: M.Ginés RS: 17

INPUT
Description: XS-17
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-544.619	262.467	0	239.501	29.528	229.659	95.604	229.659	144.652	196.85
181.037	229.669	199.213	246.063	262.467	278.871				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-544.619	.06	95.604	.04	181.037	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.604	181.037	202.034	224.288 231.955	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	237.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	22.79	Wt. n-Val.		0.040	
W.S. Elev (ft)	215.09	Reach Len. (ft)	202.03	224.29	231.96
Crit W.S. (ft)	221.99	Flow Area (sq ft)		433.23	
E.G. Slope (ft/ft)	0.076296	Area (sq ft)		433.23	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	47.50	Top Width (ft)		47.50	
Vel Total (ft/s)	38.31	Avg. Vel. (ft/s)		38.31	
Max Chl Dpth (ft)	18.24	Hydr. Depth (ft)		9.12	
Conv. Total (cfs)	60089.9	Conv. (cfs)		60089.9	
Length Wtd. (ft)	224.29	Wetted Per. (ft)		60.05	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		34.37	
Alpha	1.00	Stream Power (lb/ft s)		1316.61	
Frctn Loss (ft)	8.97	Cum Volume (acre-ft)	0.06	82.13	1.92
C & E Loss (ft)	1.74	Cum SA (acres)	0.03	7.56	0.59

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: Rio Grande de Ma
REACH: M.Ginés RS: 16

INPUT
Description: XS-16
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-635.367	262.467	0	232.94	20.768	229.659	86.778	229.659	101.312	196.85
136.877	213.255	169.685	229.685	202.395	246.063	262.467	262.467		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-635.367	.06	86.778	.04	169.685	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.778	169.685	304.757	262.211 256.365	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	228.83	Element	Left OB	Channel	Right OB	
Vel Head (ft)	4.49	Wt. n-Val.		0.040		
W.S. Elev (ft)	224.34	Reach Len. (ft)	304.76	262.21	256.37	
Crit W.S. (ft)	221.99	Flow Area (sq ft)		976.01		
E.G. Slope (ft/ft)	0.009250	Area (sq ft)		976.01		
Q Total (cfs)	16597.89	Flow (cfs)		16597.89		
Top Width (ft)	69.88	Top Width (ft)		69.88		
Vel Total (ft/s)	17.01	Avg. Vel. (ft/s)		17.01		
Max Chl Dpth (ft)	27.49	Hydr. Depth (ft)		13.97		
Conv. Total (cfs)	172574.5	Conv. (cfs)		172574.5		
Length Wtd. (ft)	262.21	Wetted Per. (ft)		93.99		
Min Ch El (ft)	196.85	Shear (lb/sq ft)		6.00		
Alpha	1.00	Stream Power (lb/ft s)		101.98		
Frctn Loss (ft)	1.18	Cum Volume (acre-ft)	0.06	78.50	1.92	
C & E Loss (ft)	0.82	Cum SA (acres)	0.03	7.26	0.59	

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: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 14

INPUT
Description: XS-14
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-711.942	262.467	0	232.94	14.6	229.659	99.541	229.659	115.715	196.85
177.953	213.255	205.282	229.747	232.316	246.063	262.467	249.344		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-711.942	.06	99.541	.04	205.282	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
99.541	205.282	763.78	265.82 274.114	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	226.83	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.76	Wt. n-Val.		0.040		
W.S. Elev (ft)	225.07	Reach Len. (ft)	763.78	265.82	274.11	
Crit W.S. (ft)		Flow Area (sq ft)		1557.44		
E.G. Slope (ft/ft)	0.002659	Area (sq ft)		1557.44		
Q Total (cfs)	16597.89	Flow (cfs)		16597.89		
Top Width (ft)	95.72	Top Width (ft)		95.72		
Vel Total (ft/s)	10.66	Avg. Vel. (ft/s)		10.66		
Max Chl Dpth (ft)	28.22	Hydr. Depth (ft)		16.27		
Conv. Total (cfs)	321881.2	Conv. (cfs)		321881.2		
Length Wtd. (ft)	265.82	Wetted Per. (ft)		118.68		
Min Ch El (ft)	196.85	Shear (lb/sq ft)		2.18		
Alpha	1.00	Stream Power (lb/ft s)		23.22		
Frctn Loss (ft)	0.93	Cum Volume (acre-ft)	0.06	70.88	1.92	
C & E Loss (ft)	0.12	Cum SA (acres)	0.03	6.76	0.59	

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 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: Rio Grande de Ma

REACH: M.Ginés RS: 12

INPUT
Description: XS-12
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	246.063	100	246.063	130.774	196.85	185.991	213.255	196.194	246.063
262.467	262.467								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	100	.04	196.194	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100	196.194	231.43	259.423 628.084	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	225.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.93	Wt. n-Val.		0.040	
W.S. Elev (ft)	222.85	Reach Len. (ft)	231.43	259.42	628.08
Crit W.S. (ft)		Flow Area (sq ft)		1208.71	
E.G. Slope (ft/ft)	0.004816	Area (sq ft)		1208.71	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	74.46	Top Width (ft)		74.46	
Vel Total (ft/s)	13.73	Avg. Vel. (ft/s)		13.73	
Max Chl Dpth (ft)	26.00	Hydr. Depth (ft)		16.23	
Conv. Total (cfs)	239163.7	Conv. (cfs)		239163.7	
Length Wtd. (ft)	259.42	Wetted Per. (ft)		98.32	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		3.70	
Alpha	1.00	Stream Power (lb/ft s)		50.76	
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)	0.06	62.44	1.92
C & E Loss (ft)	0.06	Cum SA (acres)	0.03	6.24	0.59

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 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: Rio Grande de Ma
REACH: M.Ginés RS: 10

INPUT
Description: XS-10
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	246.063	93.471	246.063	93.504	246.063	111.483	196.85	174.672	213.255
183.235	246.063	262.467	262.467						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	93.471	.04	183.235	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
93.471	183.235	726.706	262.129 295.866	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	224.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.49	Wt. n-Val.		0.040	
W.S. Elev (ft)	220.79	Reach Len. (ft)	726.71	262.13	295.87
Crit W.S. (ft)	217.25	Flow Area (sq ft)		1106.50	
E.G. Slope (ft/ft)	0.006486	Area (sq ft)		1106.50	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	73.90	Top Width (ft)		73.90	
Vel Total (ft/s)	15.00	Avg. Vel. (ft/s)		15.00	
Max Chl Dpth (ft)	23.94	Hydr. Depth (ft)		14.97	
Conv. Total (cfs)	206090.4	Conv. (cfs)		206090.4	
Length Wtd. (ft)	262.13	Wetted Per. (ft)		98.56	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		4.55	
Alpha	1.00	Stream Power (lb/ft s)		68.19	
Frctn Loss (ft)	2.33	Cum Volume (acre-ft)	0.06	55.54	1.92
C & E Loss (ft)	0.20	Cum SA (acres)	0.03	5.80	0.59

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: Rio Grande de Ma
REACH: M.Ginés RS: 8

INPUT
Description: XS-8
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-742.782	262.467	0	229.659	97.999	229.659	128.478	196.85	191.339	213.255
201.017	229.633	210.728	246.063	262.467	262.467				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-742.782	.06	97.999	.04	201.017	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
97.999	201.017	197.047	262.29 279.987	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	221.76	Element			
Vel Head (ft)	5.45	Wt. n-Val.		0.040	
W.S. Elev (ft)	216.31	Reach Len. (ft)	197.05	262.29	279.99
Crit W.S. (ft)	216.31	Flow Area (sq ft)		886.21	
E.G. Slope (ft/ft)	0.012958	Area (sq ft)		886.21	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	82.74	Top Width (ft)		82.74	
Vel Total (ft/s)	18.73	Avg. Vel. (ft/s)		18.73	
Max Chl Dpth (ft)	19.46	Hydr. Depth (ft)		10.71	
Conv. Total (cfs)	145810.4	Conv. (cfs)		145810.4	
Length Wtd. (ft)	262.29	Wetted Per. (ft)		95.07	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		7.54	
Alpha	1.00	Stream Power (lb/ft s)		141.23	
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	0.06	49.55	1.92
C & E Loss (ft)	1.37	Cum SA (acres)	0.03	5.32	0.59

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 6

INPUT
Description: XS-6
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-656.168	262.467	-36.877	229.659	0	213.255	3.543	213.255	53.51	196.85
178.248	196.85	201.772	213.255	228.773	229.659	254.232	246.063	262.467	249.344
279.856	262.467								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-656.168	.06	-36.877	.04	228.773	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.877	228.773	119.259	131.348 139.009	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	211.75	Element			
Vel Head (ft)	0.89	Wt. n-Val.		0.040	

W.S. Elev (ft)	210.86	Reach Len. (ft)	119.26	131.35	139.01
Crit W.S. (ft)	204.65	Flow Area (sq ft)		2187.23	
E.G. Slope (ft/ft)	0.001652	Area (sq ft)		2187.23	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	187.50	Top Width (ft)		187.50	
Vel Total (ft/s)	7.59	Avg. Vel. (ft/s)		7.59	
Max Chl Dpth (ft)	14.01	Hydr. Depth (ft)		11.67	
Conv. Total (cfs)	408328.7	Conv. (cfs)		408328.7	
Length Wtd. (ft)	131.35	Wetted Per. (ft)		194.14	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		1.16	
Alpha	1.00	Stream Power (lb/ft s)		8.82	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.06	40.29	1.92
C & E Loss (ft)	0.05	Cum SA (acres)	0.03	4.51	0.59

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 5

INPUT
Description: XS-5
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-609.285	262.467	-10.4	229.659	0	223.097	15.518	213.255	54.626	196.85
200.098	196.85	228.314	213.255	254.79	229.659	262.467	236.22	281.398	246.063
320.866	262.467								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-609.285	.06	-10.4	.04	254.79	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-10.4	254.79	704.068	221.811	212.73	.1 .3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	211.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.		0.040	
W.S. Elev (ft)	210.79	Reach Len. (ft)	704.07	221.81	212.73
Crit W.S. (ft)		Flow Area (sq ft)		2425.77	
E.G. Slope (ft/ft)	0.001293	Area (sq ft)		2425.77	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	202.66	Top Width (ft)		202.66	
Vel Total (ft/s)	6.84	Avg. Vel. (ft/s)		6.84	
Max Chl Dpth (ft)	13.94	Hydr. Depth (ft)		11.97	
Conv. Total (cfs)	461610.6	Conv. (cfs)		461610.6	
Length Wtd. (ft)	221.81	Wetted Per. (ft)		209.22	
Min Ch El (ft)	196.85	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		6.40	
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	0.06	33.34	1.92
C & E Loss (ft)	0.04	Cum SA (acres)	0.03	3.92	0.59

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: Rio Grande de Ma
REACH: M.Ginés RS: 0.6

INPUT
Description: XS-0.6 (F)
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	213.78	67.461	211.877	90.433	210.171	104.36	200.951	138.432	197.178
202.041	200.066	298.563	204.888	321.581	207.907	344.682	211.647	351.654	212.205
402.428	212.205								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	67.461	.04	344.682	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
67.461	344.682	173.72	178.084	185.564	.1 .3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	211.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.11	Wt. n-Val.		0.040	
W.S. Elev (ft)	209.94	Reach Len. (ft)	173.72	178.08	185.56
Crit W.S. (ft)		Flow Area (sq ft)		1965.18	
E.G. Slope (ft/ft)	0.003251	Area (sq ft)		1965.18	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	243.33	Top Width (ft)		243.33	
Vel Total (ft/s)	8.45	Avg. Vel. (ft/s)		8.45	
Max Chl Dpth (ft)	12.76	Hydr. Depth (ft)		8.08	
Conv. Total (cfs)	291112.3	Conv. (cfs)		291112.3	
Length Wtd. (ft)	178.08	Wetted Per. (ft)		246.78	
Min Ch El (ft)	197.18	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		13.65	
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	0.06	22.16	1.92
C & E Loss (ft)	0.05	Cum SA (acres)	0.03	2.79	0.59

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 0.5

INPUT
Description: XS-0.5 (E)
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	213.025	54.57	212.303	86.263	210.794	112.221	208.268	119.862	202.625
122.408	201.476	159.442	197.244	217.772	199.377	287.349	201.148	301.07	208.071
329.606	211.549	395.495	211.549						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	86.263	.04	329.606	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.263	329.606	129.331	143.865	165.387	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	210.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.58	Wt. n-Val.		0.040	
W.S. Elev (ft)	208.74	Reach Len. (ft)	129.33	143.87	165.39
Crit W.S. (ft)		Flow Area (sq ft)		1647.94	
E.G. Slope (ft/ft)	0.004516	Area (sq ft)		1647.94	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	199.24	Top Width (ft)		199.24	
Vel Total (ft/s)	10.07	Avg. Vel. (ft/s)		10.07	
Max Chl Dpth (ft)	11.50	Hydr. Depth (ft)		8.27	
Conv. Total (cfs)	246983.2	Conv. (cfs)		246983.2	
Length Wtd. (ft)	143.87	Wetted Per. (ft)		203.36	
Min Ch El (ft)	197.24	Shear (lb/sq ft)		2.28	
Alpha	1.00	Stream Power (lb/ft s)		23.01	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	0.06	14.77	1.92
C & E Loss (ft)	0.23	Cum SA (acres)	0.03	1.88	0.59

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 0.4

INPUT
Description: XS-0.4 (D)
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	218.438	3.478	218.438	34.951	218.406	59.206	218.57	122.047	197.769
131.119	194.652	149.475	194.455	157.756	194.39	171.906	197.343	199.98	197.671
216.844	198.392	229.738	198.95	246.07	198.031	270.699	197.999	283.547	201.903
295.548	204.823	302.552	205.151	329.354	205.512	350.866	207.513	374.895	217.126
390.098	216.995								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	59.206	.04	374.895	.06

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

```
      59.206 374.895           31.89   41.47  39.895            .2       .4

CROSS SECTION OUTPUT  Profile #100-YR

  E.G. Elev (ft)            209.65    Element                Left OB    Channel   Right OB
  Vel Head (ft)               0.82    Wt. n-Val.                        0.040
  W.S. Elev (ft)            208.83    Reach Len. (ft)           4.59      4.59      4.59
  Crit W.S. (ft)            204.13    Flow Area (sq ft)                2282.20
  E.G. Slope (ft/ft)       0.002220   Area (sq ft)                     2282.20
  Q Total (cfs)            16597.89   Flow (cfs)                      16597.89
  Top Width (ft)             265.52    Top Width (ft)                   265.52
  Vel Total (ft/s)             7.27    Avg. Vel. (ft/s)                   7.27
  Max Chl Dpth (ft)           14.44    Hydr. Depth (ft)                   8.60
  Conv. Total (cfs)        352251.9    Conv. (cfs)                     352251.9
  Length Wtd. (ft)            4.59    Wetted Per. (ft)                 269.47
  Min Ch El (ft)            194.39    Shear (lb/sq ft)                   1.17
  Alpha                       1.00    Stream Power (lb/ft s)             8.54
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)      0.06     8.28      1.92
  C & E Loss (ft)             0.00    Cum SA (acres)            0.03     1.11      0.59


BRIDGE


RIVER: Rio Grande de Ma
REACH: M.Ginés            RS: 0.35

INPUT
Description: Existing Bridge
Distance from Upstream XS =   4.593
Deck/Roadway Width        =  36.877
Weir Coefficient          =   4.71
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  59.219  218.57 213.648 374.902 217.126 212.205

Upstream Bridge Cross Section Data
Station Elevation Data    num=      21
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 218.438    3.478 218.438   34.951 218.406   59.206   218.57 122.047 197.769
 131.119 194.652 149.475 194.455 157.756  194.39 171.906 197.343  199.98 197.671
 216.844 198.392 229.738  198.95  246.07 198.031 270.699 197.999 283.547 201.903
 295.548 204.823 302.552 205.151 329.354 205.512 350.866 207.513 374.895 217.126
 390.098 216.995

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  59.206     .04 374.895     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
        59.206 374.895            .2       .4

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  57.808 218.143 213.222 373.556 216.207 211.286

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 218.012   27.362 218.176   57.805 218.143 125.666 206.004 149.049 201.804
 177.503 196.719 194.173   197.9 216.089 197.736 236.634 197.769 248.117 197.638
 266.972 197.408  278.57 199.606 280.135  198.95 289.695 202.231 294.583  202.69
 348.097 211.798 373.556 216.207 389.245  216.24 606.339 229.659

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  57.805     .04 373.556     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
        57.805 373.556            .2       .4

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 = 3

Pier Data
Pier Station Upstream= 149.475 Downstream= 149.049
Upstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856
Downstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856

Pier Data
Pier Station Upstream= 216.732 Downstream= 216.306
Upstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856
Downstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856

Pier Data
Pier Station Upstream= 283.99 Downstream= 283.563
Upstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856
Downstream num= 2
Width Elev Width Elev
3.281 227.198 3.281 249.856

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #100-YR

			Inside BR US	Inside BR DS
E.G. US. (ft)	209.65	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	208.83	E.G. Elev (ft)	209.64	209.19
Q Total (cfs)	16597.89	W.S. Elev (ft)	208.81	206.86
Q Bridge (cfs)	16597.89	Crit W.S. (ft)	204.15	205.89
Q Weir (cfs)		Max Chl Dpth (ft)	14.42	10.14
Weir Sta Lft (ft)		Vel Total (ft/s)	7.28	12.25
Weir Sta Rgt (ft)		Flow Area (sq ft)	2278.39	1354.87
Weir Submerg		Froude # Chl	0.44	0.83
Weir Max Depth (ft)		Specif Force (cu ft)	15789.17	11865.46
Min El Weir Flow (ft)	217.01	Hydr Depth (ft)	8.58	6.83
Min El Prs (ft)	213.58	W.P. Total (ft)	269.38	200.44
Delta EG (ft)	0.62	Conv. Total (cfs)	351346.1	179932.0
Delta WS (ft)	2.94	Top Width (ft)	265.44	198.23
BR Open Area (sq ft)	2585.79	Frctn Loss (ft)	0.14	0.00
BR Open Vel (ft/s)	12.25	C & E Loss (ft)	0.30	0.16
Coef of Q		Shear Total (lb/sq ft)	1.18	3.59
Br Sel Method	Energy only	Power Total (lb/ft s)	8.58	43.99

Warning: Pier drag coefficient of 2.0 assumed for Class B flow.
Warning: For the final momentum answer at the bridge, the upstream energy was computed lower than the downstream energy. This is not physically possible, the momentum answer has been disregarded.
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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Rio Grande de Ma

REACH: M.Ginès RS: 0.3

INPUT
Description: XS-0.3 (C)
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	218.012	27.362	218.176	57.805	218.143	125.666	206.004	149.049	201.804
177.503	196.719	194.173	197.9	216.089	197.736	236.634	197.769	248.117	197.638
266.972	197.408	278.57	199.606	280.135	198.95	289.695	202.231	294.583	202.69
348.097	211.798	373.556	216.207	389.245	216.24	606.339	229.659		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	57.805	.04	373.556	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
57.805	373.556	85.078	111.199 193.832	.2	.4

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	209.03	Element			
Vel Head (ft)	3.14	Wt. n-Val.		0.040	
W.S. Elev (ft)	205.89	Reach Len. (ft)	85.08	111.20	193.83
Crit W.S. (ft)	205.89	Flow Area (sq ft)		1167.07	
E.G. Slope (ft/ft)	0.012947	Area (sq ft)		1167.07	
Q Total (cfs)	16597.89	Flow (cfs)		16597.89	
Top Width (ft)	187.06	Top Width (ft)		187.06	
Vel Total (ft/s)	14.22	Avg. Vel. (ft/s)		14.22	
Max Chl Dpth (ft)	9.17	Hydr. Depth (ft)		6.24	
Conv. Total (cfs)	145872.1	Conv. (cfs)		145872.1	
Length Wtd. (ft)	116.66	Wetted Per. (ft)		189.10	
Min Ch El (ft)	196.72	Shear (lb/sq ft)		4.99	
Alpha	1.00	Stream Power (lb/ft s)		70.95	
Frctn Loss (ft)	0.86	Cum Volume (acre-ft)	0.06	6.50	1.92
C & E Loss (ft)	0.67	Cum SA (acres)	0.03	0.89	0.59

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginès RS: 0.2

INPUT
Description: XS-0.2 (B)
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	211.352	16.119	211.352	55.003	211.253	101.076	207.579	116.109	201.437
118.579	200.427	136.673	197.08	175.633	195.046	228.865	197.539	258.333	198.885
285.154	201.476	393.097	201.476	681.155	229.659				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	116.109	.04	285.154	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116.109	285.154	119.665	109.315 73.064	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	207.19	Element			
Vel Head (ft)	1.47	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	205.72	Reach Len. (ft)	119.67	109.32	73.06
Crit W.S. (ft)	204.21	Flow Area (sq ft)	22.47	1386.16	550.50
E.G. Slope (ft/ft)	0.004710	Area (sq ft)	22.47	1386.16	550.50
Q Total (cfs)	16597.89	Flow (cfs)	60.30	14326.67	2210.92
Top Width (ft)	330.88	Top Width (ft)	10.49	169.05	151.34
Vel Total (ft/s)	8.47	Avg. Vel. (ft/s)	2.68	10.34	4.02
Max Chl Dpth (ft)	10.68	Hydr. Depth (ft)	2.14	8.20	3.64

Conv. Total (cfs)	241848.4	Conv. (cfs)	878.6	208754.4	32215.4
Length Wtd. (ft)	105.82	Wetted Per. (ft)	11.33	169.82	151.55
Min Ch El (ft)	195.05	Shear (lb/sq ft)	0.58	2.40	1.07
Alpha	1.31	Stream Power (lb/ft s)	1.56	24.81	4.29
Frctn Loss (ft)	0.69	Cum Volume (acre-ft)	0.03	3.25	0.69
C & E Loss (ft)	0.10	Cum SA (acres)	0.02	0.44	0.26

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: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: Rio Grande de Ma
REACH: M.Ginés RS: 0.1

INPUT
Description: XS-0.1 (A)
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	206.07	57.32	208.563	69.347	207.677	76.476	201.978	78.579	200.295
88.081	196.588	148.563	195.44	184.045	196.85	205.161	198.786	243.871	197.933
254.928	201.969	385.755	201.969	700.059	229.659				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	76.476	.04	254.928	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
76.476	254.928	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	206.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.47	Wt. n-Val.	0.060	0.040	0.060
W.S. Elev (ft)	203.92	Reach Len. (ft)			
Crit W.S. (ft)	203.92	Flow Area (sq ft)	2.36	1200.03	276.93
E.G. Slope (ft/ft)	0.009785	Area (sq ft)	2.36	1200.03	276.93
Q Total (cfs)	16597.89	Flow (cfs)	4.81	15585.82	1007.26
Top Width (ft)	333.86	Top Width (ft)	2.43	178.45	152.98
Vel Total (ft/s)	11.22	Avg. Vel. (ft/s)	2.04	12.99	3.64
Max Chl Dpth (ft)	8.48	Hydr. Depth (ft)	0.97	6.72	1.81
Conv. Total (cfs)	167795.7	Conv. (cfs)	48.6	157564.2	10182.8
Length Wtd. (ft)		Wetted Per. (ft)	3.11	180.59	153.06
Min Ch El (ft)	195.44	Shear (lb/sq ft)	0.46	4.06	1.11
Alpha	1.26	Stream Power (lb/ft s)	0.94	52.72	4.02
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Rio Grande de Ma

Reach	River Sta.	n1	n2	n3
M.Ginés	20	.06	.04	.06
M.Ginés	18	.06	.04	.06
M.Ginés	17	.06	.04	.06
M.Ginés	16	.06	.04	.06
M.Ginés	14	.06	.04	.06
M.Ginés	12	.06	.04	.06
M.Ginés	10	.06	.04	.06
M.Ginés	8	.06	.04	.06
M.Ginés	6	.06	.04	.06
M.Ginés	5	.06	.04	.06
M.Ginés	0.6	.06	.04	.06
M.Ginés	0.5	.06	.04	.06
M.Ginés	0.4	.06	.04	.06
M.Ginés	0.35	Bridge		
M.Ginés	0.3	.06	.04	.06
M.Ginés	0.2	.06	.04	.06
M.Ginés	0.1	.06	.04	.06

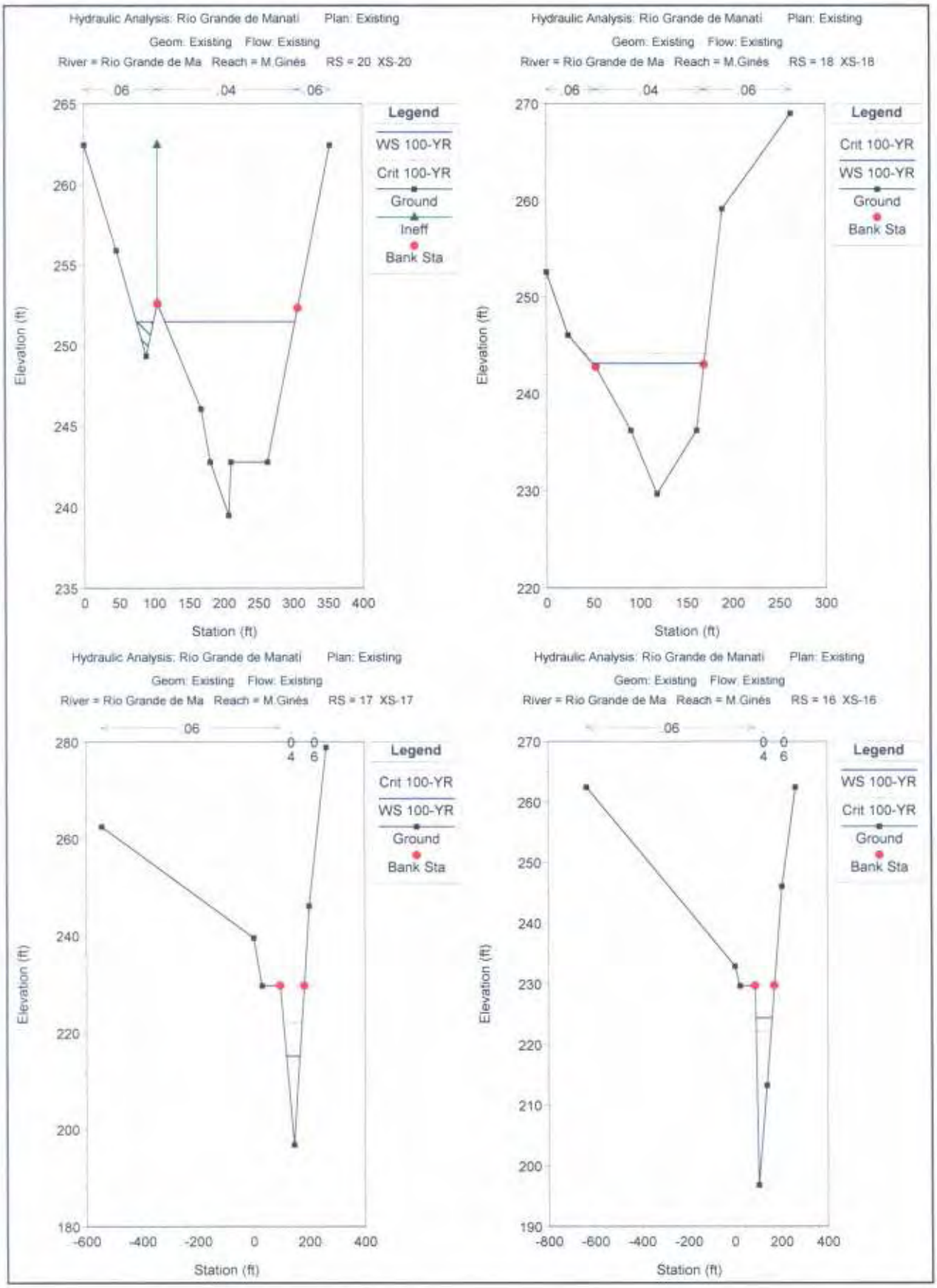
SUMMARY OF REACH LENGTHS

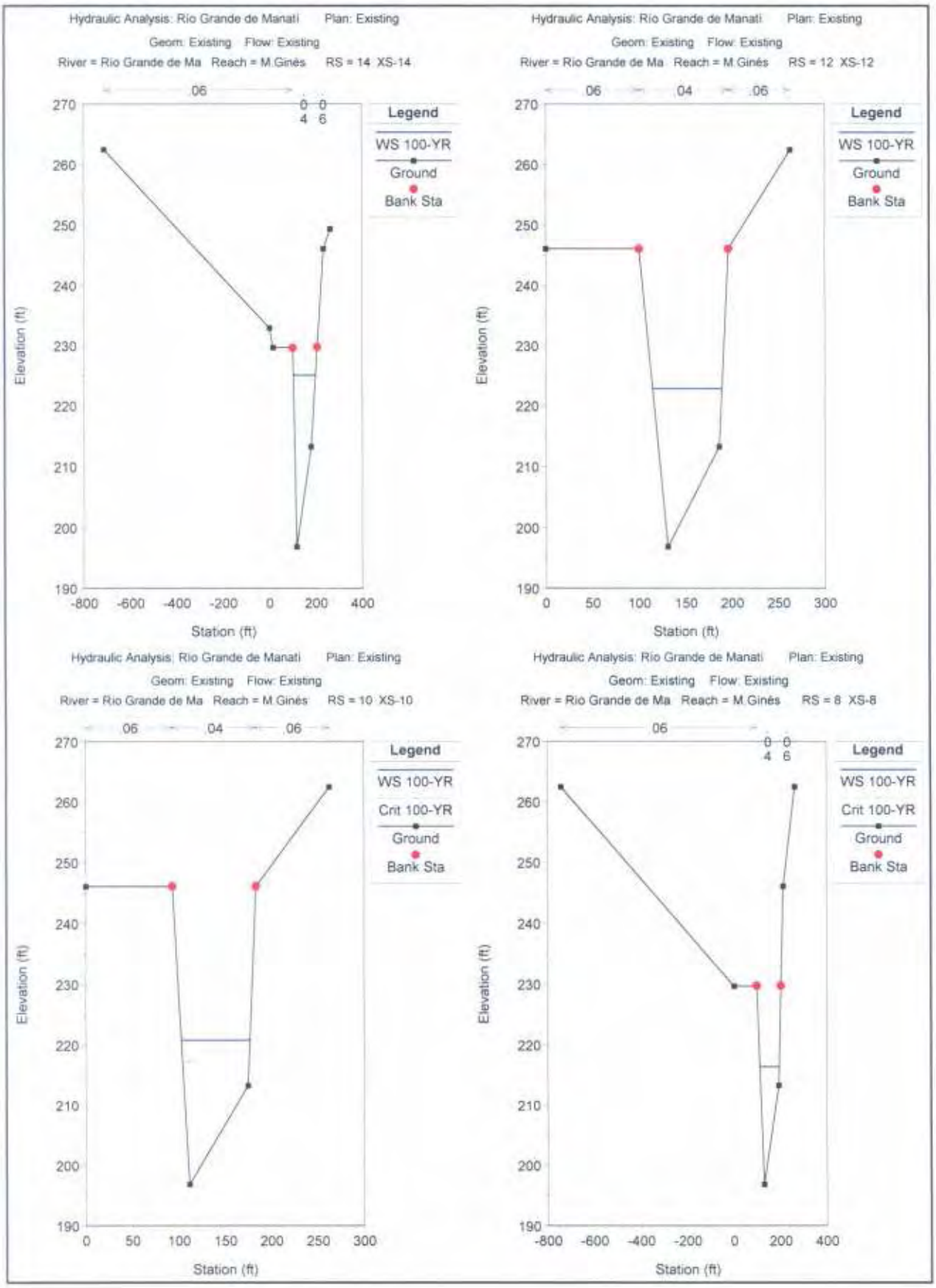
River: Rio Grande de Ma

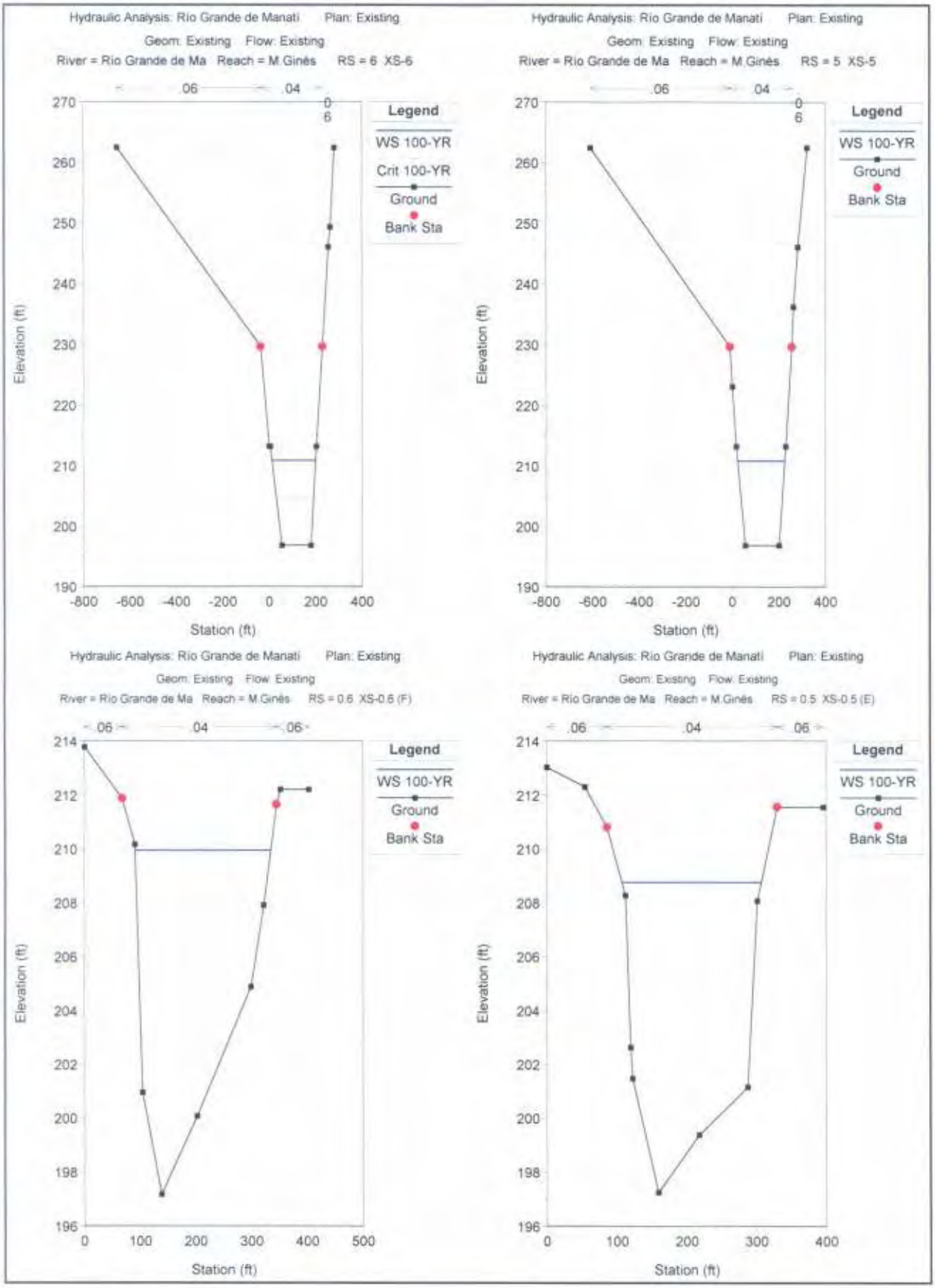
Reach	River Sta.	Left	Channel	Right
M.Ginés	20	329.593	385.892	484.318
M.Ginés	18	595.866	278.297	288.255
M.Ginés	17	202.034	224.288	231.955
M.Ginés	16	304.757	262.211	256.365
M.Ginés	14	763.78	265.82	274.114
M.Ginés	12	231.43	259.423	628.084
M.Ginés	10	726.706	262.129	295.866
M.Ginés	8	197.047	262.29	279.987
M.Ginés	6	119.259	131.348	139.009
M.Ginés	5	704.068	221.811	212.73
M.Ginés	0.6	173.72	178.084	185.564
M.Ginés	0.5	129.331	143.865	165.387
M.Ginés	0.4	31.89	41.47	39.895
M.Ginés	0.35	Bridge		
M.Ginés	0.3	85.078	111.199	193.832
M.Ginés	0.2	119.665	109.315	73.064
M.Ginés	0.1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Rio Grande de Ma

Reach	River Sta.	Contr.	Expan.
M.Ginés	20	.1	.3
M.Ginés	18	.1	.3
M.Ginés	17	.1	.3
M.Ginés	16	.1	.3
M.Ginés	14	.1	.3
M.Ginés	12	.1	.3
M.Ginés	10	.1	.3
M.Ginés	8	.1	.3
M.Ginés	6	.1	.3
M.Ginés	5	.1	.3
M.Ginés	0.6	.1	.3
M.Ginés	0.5	.1	.3
M.Ginés	0.4	.2	.4
M.Ginés	0.35	Bridge	
M.Ginés	0.3	.2	.4
M.Ginés	0.2	.1	.3
M.Ginés	0.1	.1	.3


Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 20 XS-20
Legend
WS 100-YR
Crit 100-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 18 XS-18
Legend
Crit 100-YR
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 17 XS-17
Legend
Crit 100-YR
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 16 XS-16
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 14 XS-14
Legend
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 12 XS-12
Legend
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 10 XS-10
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 8 XS-8
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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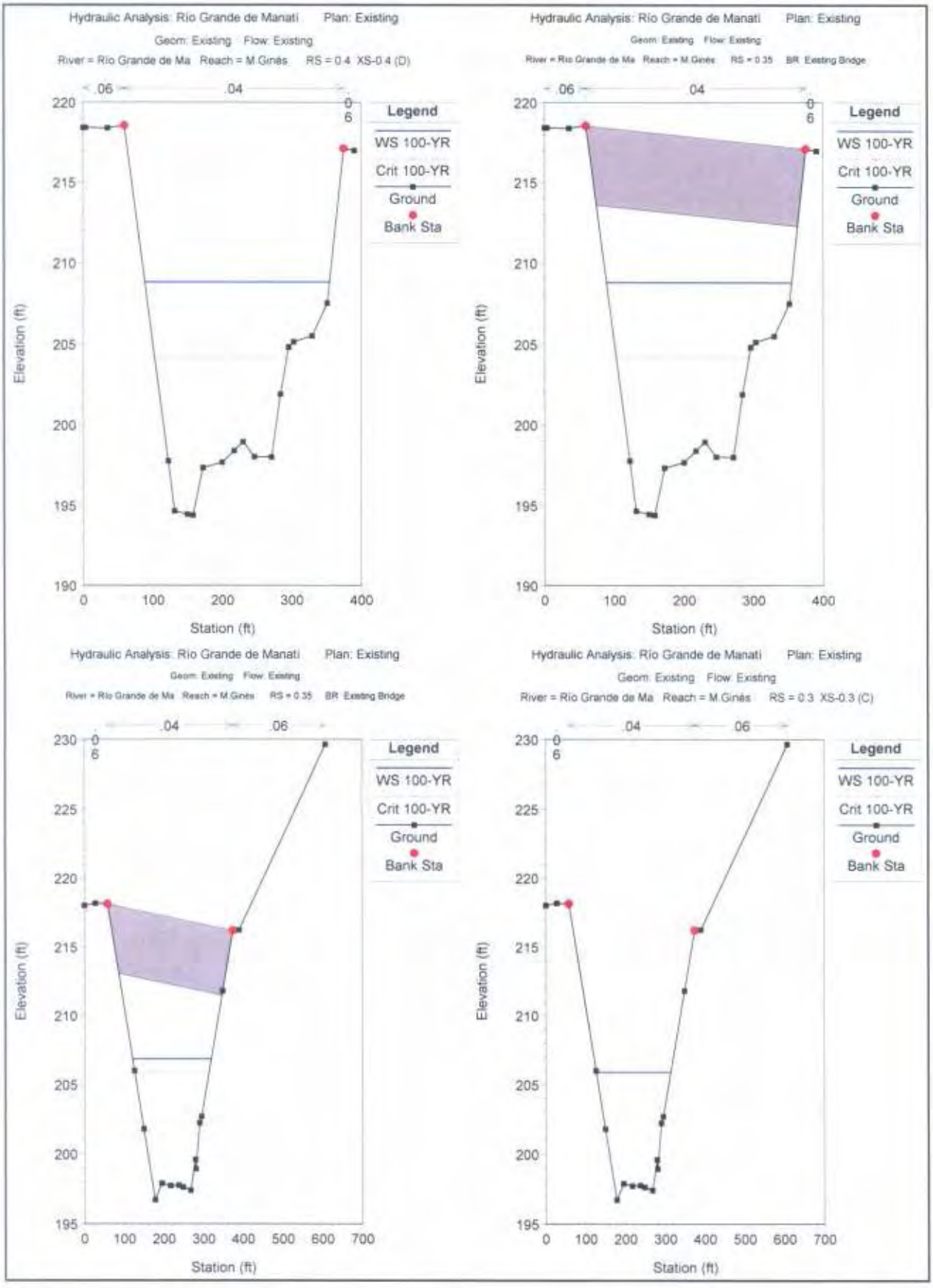
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 6 XS-6
.06 .04
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 5 XS-5
.06 .04
Legend
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.6 XS-0.6 (F)
.06 .04 .06
Legend
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.5 XS-0.5 (E)
.06 .04 .06
Legend
WS 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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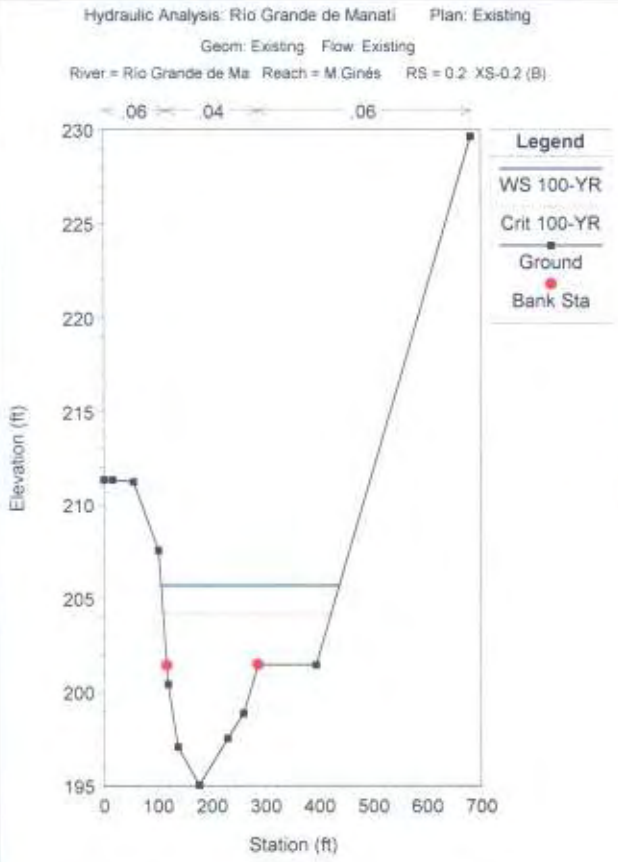
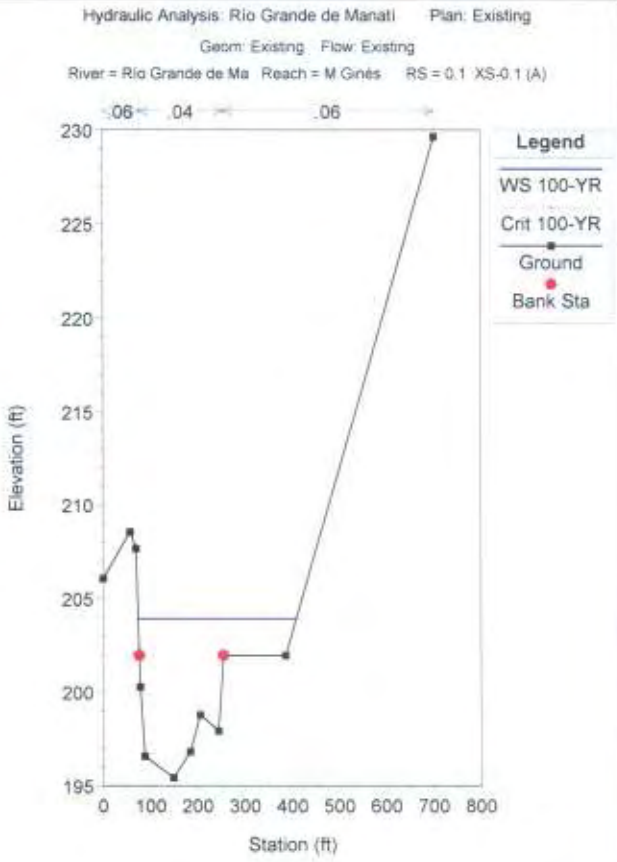
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.4 XS-0.4 (D)
.06
.04
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.35 BR Existing Bridge
.06
.04
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.35 BR Existing Bridge
.04
.06
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.3 XS-0.3 (C)
.04
.06
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.2 XS-0.2 (B)
.06 .04 .06
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
230
225
220
215
210
205
200
195
0 100 200 300 400 500 600 700


Hydraulic Analysis: Rio Grande de Manati Plan: Existing
Geom: Existing Flow: Existing
River = Rio Grande de Ma Reach = M.Ginés RS = 0.1 XS-0.1 (A)
.06 .04 .06
Legend
WS 100-YR
Crit 100-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
230
225
220
215
210
205
200
195
0 100 200 300 400 500 600 700 800

HEC-RAS Plan: Existing River: Rio Grande de Ma Reach: M Ginés Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Length Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft)	(ft/s)	(sq ft)	(ft)	
M.Ginés	0.1	100-YR	16597.89	195.44	203.92	203.92	206.39	0.009785		12.99	1479.31	333.86	0.88
M.Ginés	0.2	100-YR	16597.89	195.05	205.72	204.21	207.19	0.004710	109.32	10.34	1959.13	330.88	0.64
M.Ginés	0.3	100-YR	16597.89	196.72	205.89	205.89	209.03	0.012947	111.20	14.22	1167.07	187.06	1.00
M.Ginés	0.35		Bridge										
M.Ginés	0.4	100-YR	16597.89	194.39	208.83	204.13	209.65	0.002220	4.59	7.27	2282.20	265.52	0.44
M.Ginés	0.5	100-YR	16597.89	197.24	208.74		210.32	0.004516	143.87	10.07	1647.94	199.24	0.62
M.Ginés	0.6	100-YR	16597.89	197.18	209.94		211.04	0.003251	178.08	8.45	1965.18	243.33	0.52
M.Ginés	5	100-YR	16597.89	196.85	210.79		211.51	0.001293	221.81	6.84	2425.77	202.66	0.35
M.Ginés	6	100-YR	16597.89	196.85	210.86	204.65	211.75	0.001652	131.35	7.59	2187.23	187.50	0.39
M.Ginés	8	100-YR	16597.89	196.85	216.31	216.31	221.76	0.012958	262.29	18.73	886.21	82.74	1.01
M.Ginés	10	100-YR	16597.89	196.85	220.79	217.25	224.28	0.006486	262.13	15.00	1106.50	73.90	0.68
M.Ginés	12	100-YR	16597.89	196.85	222.85		225.78	0.004816	259.42	13.73	1208.71	74.46	0.60
M.Ginés	14	100-YR	16597.89	196.85	225.07		226.83	0.002659	265.82	10.66	1557.44	95.72	0.47
M.Ginés	16	100-YR	16597.89	196.85	224.34	221.99	228.83	0.009250	262.21	17.01	976.01	69.88	0.80
M.Ginés	17	100-YR	16597.89	196.85	215.09	221.99	237.88	0.076296	224.29	38.31	433.23	47.50	2.24
M.Ginés	18	100-YR	16597.89	229.66	243.17	244.18	248.59	0.017692	278.30	18.70	888.40	119.99	1.19
M.Ginés	20	100-YR	16597.89	239.50	251.49	251.49	254.63	0.012941	385.89	14.20	1168.60	211.15	1.00

APPENDIX B
HEC-6 MODEL

FILENAME: GINEXIS.DAT

```
*************************************************     ***********************************
*  SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS  *     *  U.S. ARMY CORPS OF ENGINEERS   *
*       Version: 4.2    -  May 2004               *     *  HYDROLOGIC ENGINEERING CENTER  *
*  INPUT FILE:  GINEXIS.DAT                       *     *  609 SECOND STREET              *
*  OUTPUT FILE: GINEXIS.OUT                       *     *  DAVIS, CALIFORNIA 95616-4687   *
*  RUN DATE: 29 OCT 07    RUN TIME: 16:54:07      *     *  (530) 756-1104                 *
*************************************************     ***********************************

                     X     X  XXXXXXX   XXXXX          XXXXX
                     X     X  X       X     X        X     X
                     X     X  X       X              X
                     XXXXXXX  XXXX    X        XXXXX  XXXXXX
                     X     X  X       X              X     X
                     X     X  X       X     X        X     X
                     X     X  XXXXXXX   XXXXX          XXXXX

          **********************************************************************
          *  MAXIMUM LIMITS FOR THIS VERSION ARE:                              *
          *       10  Stream Segments (Main Stem + Tributaries)                *
          *      500  Cross Sections                                           *
          *      200  Elevation/Station Points per Cross Section               *
          *       20  Grain Sizes                                              *
          *       20  Control Points                                           *
          **********************************************************************

T1       SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
T2       RIO GRANDE DE MANATI AT MOROVIS, P.R. (FILENAME=GINEXIS.DAT)
T3       OCTOBER 2007  EXISTING RIVER PROFILE CONDITION  100-YR FREQUENCY STORM

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.100
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0700   0.0400   0.0700       1.1000     0.7000

SECTION NO.      0.200
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.2000     0.6000

SECTION NO.      0.300
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.2000     0.6000

SECTION NO.      0.400
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.500
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.600
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      5.000
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      6.000
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      8.000
```

```
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    10.000
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    12.000
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0390   0.0600       1.1000     0.7000

SECTION NO.    14.000
...ELEVATION of Model Bottom =    186.850 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    16.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    17.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    18.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0800   0.0300   0.0800       1.1000     0.7000

SECTION NO.    20.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 16
NO. OF INPUT DATA MESSAGES =   0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK =  16
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK=   1
END OF GEOMETRIC DATA
```

```
T4      SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
T5      RIO GRANDE DE MANATI AT MOROVIS, P.R.
T6      OCTOBER 2007
T7      BED GRADATION FROM FIELD CONDITIONS
T8      ONLY SANDS AND GRAVEL PRESENT

        SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
        RIO GRANDE DE MANATI AT MOROVIS, P.R. (FILENAME=GINEXIS.DAT)
        OCTOBER 2007  EXISTING RIVER PROFILE CONDITION  100-YR FREQUENCY STORM

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT PROPERITES AND PARAMETERS

       SPI      IBG     MNQ      SPGF      ACGR      NFALL     IBSHER
I1     50.        0       1     1.000    32.174          2          1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 SANDS - BOULDERS ARE PRESENT

       MTC      IASA     LASA      SPGS       GSF       BSAE       PSI      UWDLB
I4       1         1       10     2.650     0.667      0.500    30.000     93.000

USING TRANSPORT CAPACITY RELATIONSHIP #  1, TOFFALETI
GRAIN SIZES UTILIZED (mean diameter - mm)
-------------------------------------------------------------------------
    VERY FINE SAND....     0.088  |  VERY FINE GRAVEL..     2.828
    FINE SAND.........     0.177  |  FINE GRAVEL.......     5.657
    MEDIUM SAND.......     0.354  |  MEDIUM GRAVEL.....    11.314
    COARSE SAND.......     0.707  |  COARSE GRAVEL.....    22.627
```

VERY COARSE SAND.. 1.414 | VERY COARSE GRAVEL 45.255

COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

	DBI	DBN	XID	XIN	XIU	UBI	UBN	JSL
IS	0.500	0.500	0.250	0.500	0.250	0.000	1.000	1

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1
LOAD BY GRAIN SIZE CLASS (tons/day)

FLOW	0.00000
VF SAND	0.100000E-19
F SAND	0.100000E-19
M SAND	0.100000E-19
C SAND	0.100000E-19
VC SAND	0.100000E-19
VF GRVL	0.100000E-19
F GRVL	0.100000E-19
M GRVL	0.100000E-19
C GRVL	0.100000E-19
VC GRVL	0.100000E-19
TOTAL	0.100000E-18

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS LEFT SIDE (ft)	THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	(miles)
	0.000						
0.100		700.060	206.070	195.440	229.660	0.000	0.000
	109.320						
0.200		681.150	211.350	195.050	229.660	109.320	0.021
	111.190						
0.300		606.340	218.010	196.720	229.660	220.510	0.042
	41.470						
0.400		390.100	218.440	194.390	216.990	261.980	0.050
	143.860						
0.500		395.500	213.020	197.240	211.550	405.840	0.077
	178.080						
0.600		402.430	213.780	197.180	212.200	583.920	0.111
	221.810						
5.000		568.475	229.660	196.850	229.660	805.730	0.153
	131.350						
6.000		588.025	229.660	196.850	229.660	937.080	0.177
	262.300						
8.000		156.875	229.660	196.850	229.630	1199.380	0.227
	262.140						
10.000		176.115	246.060	196.850	246.060	1461.520	0.277
	259.420						
12.000		179.330	246.060	196.850	246.060	1720.940	0.326
	265.810						
14.000		153.130	229.660	196.850	225.389	1986.750	0.376
	262.200						
16.000		897.840	262.470	196.850	262.470	2248.950	0.426
	224.280						
17.000		807.090	262.470	196.850	278.870	2473.230	0.468
	278.310						
18.000		262.470	252.620	229.660	269.030	2751.540	0.521
	385.890						
20.000		352.690	262.470	239.500	262.470	3137.430	0.594

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size		
0.100	1.000	0.167	0.167	1.000	1.000	VF SAND 0.097	VC SAND 0.131	M GRVL 0.061
						F SAND 0.131	VF GRVL 0.087	C GRVL 0.085
						M SAND 0.131	F GRVL 0.063	VC GRVL 0.057
						C SAND 0.131		
0.200	1.000	0.167	0.167	1.000	1.000	VF SAND 0.097	VC SAND 0.131	M GRVL 0.061
						F SAND 0.131	VF GRVL 0.087	C GRVL 0.085
						M SAND 0.131	F GRVL 0.063	VC GRVL 0.057
						C SAND 0.131		
0.300	1.000	0.167	0.167	1.000	1.000	VF SAND 0.097	VC SAND 0.131	M GRVL 0.061

							F SAND	0.131	VF GRVL	0.087	C GRVL	0.085
							M SAND	0.131	F GRVL	0.063	VC GRVL	0.057
							C SAND	0.131				
0.400	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
0.500	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
0.600	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
5.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
6.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
8.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
10.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
12.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
14.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
16.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
17.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
18.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					
20.000	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061	
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085	
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057	
						C SAND	0.131					

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	V O L U M E (cu.ft)	(cu.yd)
0.100	54.660	693.757	0.000	0.00000	0.00000
0.200	110.255	671.701	0.000	0.00000	0.00000
0.300	76.330	604.922	0.000	0.00000	0.00000
0.400	92.665	407.626	0.000	0.00000	0.00000
0.500	160.970	395.973	0.000	0.00000	0.00000

```
|     0.600 |    199.945 |    432.102 |     0.000 | 0.00000     | 0.00000     |
|     5.000 |    176.580 |    536.136 |    10.000 | 946709.     | 35063.3     |
|     6.000 |    196.825 |    490.088 |    10.000 | 964616.     | 35726.5     |
|     8.000 |    262.220 |    231.961 |    10.000 | 608248.     | 22527.7     |
|    10.000 |    260.780 |    173.425 |    10.000 | 452257.     | 16750.3     |
|    12.000 |    262.615 |    174.381 |    10.000 | 457950.     | 16961.1     |
|    14.000 |    264.005 |    280.796 |    10.000 | 741316.     | 27456.2     |
|    16.000 |    243.240 |    750.101 |     0.000 | 0.00000     | 0.00000     |
|    17.000 |    251.295 |    720.061 |     0.000 | 0.00000     | 0.00000     |
|    18.000 |    332.100 |    356.010 |     0.000 | 0.00000     | 0.00000     |
|    20.000 |    192.945 |    322.617 |     0.000 | 0.00000     | 0.00000     |

NO. OF INPUT DATA MESSAGES=    0
END OF SEDIMENT DATA

================================================================================

$HYD
BEGIN COMPUTATIONS.

================================================================================

TIME STEP #       1
*   AB                                A

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
ACCUMULATED TIME (yrs).....       0.000

--- Downstream Boundary Condition Data for STREAM SEGMENT NO.  1 at Control Point #  1 ---
                          DISCHARGE   TEMPERATURE  WATER SURFACE
                            (cfs)       (deg F)        (ft)
                         16598.000        60.00       203.900

****  DISCHARGE    WATER    ENERGY  VELOCITY   ALPHA     TOP      AVG       AVG VEL (by subsection)
        (CFS)    SURFACE     LINE      HEAD             WIDTH     BED        1       2       3

SECTION NO.       0.100
** CRITICAL WATER SURFACE USED AT SECTION NO.       0.100 AT TIME =      1.000 DAYS.**
**ELOEQ**
****  16598.000   203.942   206.440   2.498    1.263   333.553   197.241   2.034  13.045   3.634
                                                FLOW DISTRIBUTION (%) =    0.028  93.988   5.984
SECTION NO.       0.200
****  16598.000   205.740   207.258   1.518    1.385   331.509   197.488   2.336  10.462   3.494
                                                FLOW DISTRIBUTION (%) =    0.324  87.933  11.743
SECTION NO.       0.300
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.       0.300 TIME =      1.000 DAYS.
TRIAL     TRIAL       COMPUTED     CRITICAL
 NO.        WS           WS           WS
  2.     205.873      205.649
  3.     205.967      205.689      205.917
****  16598.000   205.967   209.032   3.065    1.000   187.981   199.680   0.000  14.044   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       0.400
****  16598.000   208.856   209.674   0.818    1.000   265.627   200.244   0.000   7.256   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       0.500
****  16598.000   208.784   210.330   1.546    1.000   200.736   200.494   0.000   9.975   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       0.600
****  16598.000   209.931   211.046   1.115    1.000   243.138   201.873   0.000   8.472   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       5.000
****  16598.000   210.801   211.524   0.723    1.000   202.793   198.803   0.000   6.822   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       6.000
****  16598.000   210.910   211.736   0.826    1.000   189.196   198.874   0.000   7.289   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.       8.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.       8.000 TIME =      1.000 DAYS.
TRIAL     TRIAL       COMPUTED     CRITICAL
 NO.        WS           WS           WS
  0.     216.330      208.607
  1.     216.424      208.665      216.374
****  16598.000   216.424   221.758   5.334    1.000    82.920   205.619   0.000  18.526   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      10.000
****  16598.000   220.766   224.271   3.505    1.000    73.891   205.809   0.000  15.018   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      12.000
```

```
**** 16598.000   222.844   225.777   2.933    1.000    74.458   206.616   0.000  13.737   0.000
                                               FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      14.000
**** 16598.000   225.114   226.777   1.663    1.000   102.886   209.521   0.000  10.346   0.000
                                               FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      16.000
**** 16598.000   224.346   228.810   4.464    1.000    69.984   210.353   0.000  16.949   0.000
                                               FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      17.000
**** 16598.000   227.610   230.418   2.809    1.000    80.190   212.213   0.000  13.443   0.000
                                               FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      18.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      18.000 TIME =      1.000 DAYS.
TRIAL     TRIAL        COMPUTED      CRITICAL
 NO.        WS           WS            WS
  0.     244.151      228.598
  1.     244.245      228.632       244.195
**** 16598.000   244.245   248.399   4.154    1.017   131.018   235.536   2.136  16.360   1.610
                                               FLOW DISTRIBUTION (%) =    0.124  99.867   0.009
SECTION NO.      20.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      20.000 TIME =      1.000 DAYS.
TRIAL     TRIAL        COMPUTED      CRITICAL
 NO.        WS           WS            WS
  2.     251.495      247.967
  3.     251.589      248.017       251.539
**** 16598.000   251.589   254.602   3.013    1.040   213.676   245.271   1.656  13.944   0.000
                                               FLOW DISTRIBUTION (%) =    0.290  99.710   0.000
```

SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
ACCUMULATED TIME (yrs).... 0.003
FLOW DURATION (days)..... 1.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 / Section No. 20.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	16598.00	0.00	60.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
1.00	20.000	0.00		
TOTAL=	0.100	0.00	5.80**********	

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	0.00	VERY FINE GRAVEL..	0.00
FINE SAND.....	0.00	FINE GRAVEL.....	0.00
MEDIUM SAND.....	0.00	MEDIUM GRAVEL.....	0.00
COARSE SAND.....	0.00	COARSE GRAVEL.....	0.00
VERY COARSE SAND..	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	3076.29	VERY FINE GRAVEL..	18.98
FINE SAND.....	4023.12	FINE GRAVEL.....	1.72
MEDIUM SAND.....	3183.20	MEDIUM GRAVEL.....	0.23
COARSE SAND.....	1238.12	COARSE GRAVEL.....	0.02
VERY COARSE SAND..	206.84	VERY COARSE GRAVEL	0.00
		TOTAL =	11748.54

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 1.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
20.000	0.00	251.59	239.50	16598.	0.
18.000	0.00	244.25	229.66	16598.	0.
17.000	0.00	227.61	196.85	16598.	0.
16.000	0.00	224.35	196.85	16598.	0.
14.000	-1.95	225.11	194.90	16598.	1880.
12.000	-2.79	222.84	194.06	16598.	4513.
10.000	-4.73	220.77	192.12	16598.	8956.
8.000	-6.90	216.42	189.95	16598.	17013.
6.000	-0.59	210.91	196.26	16598.	17819.
5.000	3.90	210.80	200.75	16598.	11750.
0.600	0.00	209.93	197.18	16598.	11749.
0.500	0.00	208.78	197.24	16598.	11749.
0.400	0.00	208.86	194.39	16598.	11749.
0.300	0.00	205.97	196.72	16598.	11749.
0.200	0.00	205.74	195.05	16598.	11749.
0.100	0.00	203.94	195.44	16598.	11749.

$$END

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 1
TOTAL NO. OF WS PROFILES = 1
ITERATIONS IN EXNER EQ = 800

COMPUTATIONS COMPLETED
RUN TIME = 0 HOURS, 0 MINUTES & 0.00 SECONDS

FILENAME: GINPROP.DAT

```
**************************************************     ***********************************
*  SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS  *     *  U.S. ARMY CORPS OF ENGINEERS   *
*       Version: 4.2    -  May 2004               *     *  HYDROLOGIC ENGINEERING CENTER  *
*  INPUT FILE:  GINPROP.DAT                       *     *  609 SECOND STREET              *
*  OUTPUT FILE: GINPROP.OUT                       *     *  DAVIS, CALIFORNIA 95616-4687   *
*  RUN DATE: 29 OCT 07    RUN TIME: 16:57:47      *     *  (530) 756-1104                 *
**************************************************     ***********************************

                    X     X  XXXXXXX   XXXXX           XXXXX
                    X     X  X        X     X        X     X
                    X     X  X        X              X
                    XXXXXXX  XXXX     X        XXXXX  XXXXXX
                    X     X  X        X              X     X
                    X     X  X        X     X        X     X
                    X     X  XXXXXXX   XXXXX           XXXXX

          **********************************************************************
          *  MAXIMUM LIMITS FOR THIS VERSION ARE:                              *
          *       10  Stream Segments (Main Stem + Tributaries)                *
          *      500  Cross Sections                                           *
          *      200  Elevation/Station Points per Cross Section               *
          *       20  Grain Sizes                                              *
          *       20  Control Points                                           *
          **********************************************************************

T1       SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
T2       RIO GRANDE DE MANATI AT MOROVIS, P.R. (FILENAME=GINPROP.DAT)
T3       OCTOBER 2007  PROPOSED RIVER PROFILE CONDITION  100-YR FREQUENCY STORM

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.100
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0700   0.0400   0.0700       1.1000     0.7000

SECTION NO.      0.200
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.2000     0.6000

SECTION NO.      0.300
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.2000     0.6000

SECTION NO.      0.400
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.500
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      0.600
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      5.000
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      6.000
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.      8.000
```

```
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    10.000
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    12.000
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0390   0.0600       1.1000     0.7000

SECTION NO.    14.000
...ELEVATION of Model Bottom =    183.570 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    16.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    17.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0600   0.0400   0.0600       1.1000     0.7000

SECTION NO.    18.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

N values...  Left   Channel   Right    Contraction    Expansion
           0.0800   0.0300   0.0800       1.1000     0.7000

SECTION NO.    20.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 16
NO. OF INPUT DATA MESSAGES =   0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK =  16
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK=   1
END OF GEOMETRIC DATA
```

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T4      SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
T5      RIO GRANDE DE MANATI AT MOROVIS, P.R.
T6      OCTOBER 2007
T7      BED GRADATION FROM FIELD CONDITIONS
T8      ONLY SANDS AND GRAVEL PRESENT

        SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
        RIO GRANDE DE MANATI AT MOROVIS, P.R. (FILENAME=GINPROP.DAT)
        OCTOBER 2007  PROPOSED RIVER PROFILE CONDITION  100-YR FREQUENCY STORM

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT PROPERITES AND PARAMETERS

       SPI      IBG     MNQ      SPGF      ACGR      NFALL     IBSHER
I1     50.        0       1     1.000    32.174          2          1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 SANDS - BOULDERS ARE PRESENT

       MTC      IASA     LASA      SPGS       GSF       BSAE       PSI      UWDLB
I4       1         1       10     2.650     0.667      0.500    30.000     93.000

USING TRANSPORT CAPACITY RELATIONSHIP #  1, TOFFALETI
GRAIN SIZES UTILIZED (mean diameter - mm)
-------------------------------------------------------------------
    VERY FINE SAND....    0.088  |  VERY FINE GRAVEL..    2.828
    FINE SAND.........    0.177  |  FINE GRAVEL.......    5.657
    MEDIUM SAND.......    0.354  |  MEDIUM GRAVEL.....   11.314
    COARSE SAND.......    0.707  |  COARSE GRAVEL.....   22.627
```

VERY COARSE SAND.. 1.414 | VERY COARSE GRAVEL 45.255

COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

	DBI	DBN	XID	XIN	XIU	UBI	UBN	JSL
IS	0.500	0.500	0.250	0.500	0.250	0.000	1.000	1

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1
LOAD BY GRAIN SIZE CLASS (tons/day)

FLOW	0.00000
VF SAND	0.100000E-19
F SAND	0.100000E-19
M SAND	0.100000E-19
C SAND	0.100000E-19
VC SAND	0.100000E-19
VF GRVL	0.100000E-19
F GRVL	0.100000E-19
M GRVL	0.100000E-19
C GRVL	0.100000E-19
VC GRVL	0.100000E-19
TOTAL	0.100000E-18

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS LEFT SIDE (ft)	THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	(miles)
	0.000						
0.100		700.060	206.070	195.440	229.660	0.000	0.000
	109.320						
0.200		681.150	211.350	195.050	229.660	109.320	0.021
	111.190						
0.300		606.340	218.010	196.720	229.660	220.510	0.042
	41.470						
0.400		390.100	218.440	194.390	216.990	261.980	0.050
	143.860						
0.500		395.500	213.020	197.240	211.550	405.840	0.077
	178.080						
0.600		402.430	213.780	197.180	212.200	583.920	0.111
	221.810						
5.000		568.475	229.660	193.570	229.660	805.730	0.153
	131.350						
6.000		588.025	229.660	193.570	229.660	937.080	0.177
	262.300						
8.000		156.875	229.660	193.570	229.630	1199.380	0.227
	262.140						
10.000		176.115	246.060	193.570	246.060	1461.520	0.277
	259.420						
12.000		179.330	246.060	193.570	246.060	1720.940	0.326
	265.810						
14.000		153.130	229.660	193.570	225.389	1986.750	0.376
	262.200						
16.000		897.840	262.470	196.850	262.470	2248.950	0.426
	224.280						
17.000		807.090	262.470	196.850	278.870	2473.230	0.468
	278.310						
18.000		262.470	252.620	229.660	269.030	2751.540	0.521
	385.890						
20.000		352.690	262.470	239.500	262.470	3137.430	0.594

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size							
0.100	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061		
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085		
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057		
						C SAND	0.131						
0.200	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061		
						F SAND	0.131	VF GRVL	0.087	C GRVL	0.085		
						M SAND	0.131	F GRVL	0.063	VC GRVL	0.057		
						C SAND	0.131						
0.300	1.000	0.167	0.167	1.000	1.000	VF SAND	0.097	VC SAND	0.131	M GRVL	0.061		

						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
0.400	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
0.500	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
0.600	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
5.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
6.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
8.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
10.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
12.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
14.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
16.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
17.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
18.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						
20.000	1.000	0.167	0.167	1.000	1.000	VF	SAND	0.097	VC	SAND	0.131	M	GRVL	0.061
						F	SAND	0.131	VF	GRVL	0.087	C	GRVL	0.085
						M	SAND	0.131	F	GRVL	0.063	VC	GRVL	0.057
						C	SAND	0.131						

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	V O L U M E (cu.ft)	(cu.yd)
0.100	54.660	693.757	0.000	0.00000	0.00000
0.200	110.255	671.701	0.000	0.00000	0.00000
0.300	76.330	604.922	0.000	0.00000	0.00000
0.400	92.665	407.626	0.000	0.00000	0.00000
0.500	160.970	395.973	0.000	0.00000	0.00000

```
|     0.600 |    199.945 |    432.102 |     0.000 | 0.00000     | 0.00000     |
|     5.000 |    176.580 |    536.136 |    10.000 | 946709.     | 35063.3     |
|     6.000 |    196.825 |    490.088 |    10.000 | 964616.     | 35726.5     |
|     8.000 |    262.220 |    231.961 |    10.000 | 608248.     | 22527.7     |
|    10.000 |    260.780 |    173.425 |    10.000 | 452257.     | 16750.3     |
|    12.000 |    262.615 |    174.381 |    10.000 | 457950.     | 16961.1     |
|    14.000 |    264.005 |    280.796 |    10.000 | 741316.     | 27456.2     |
|    16.000 |    243.240 |    750.101 |     0.000 | 0.00000     | 0.00000     |
|    17.000 |    251.295 |    720.061 |     0.000 | 0.00000     | 0.00000     |
|    18.000 |    332.100 |    356.010 |     0.000 | 0.00000     | 0.00000     |
|    20.000 |    192.945 |    322.617 |     0.000 | 0.00000     | 0.00000     |

NO. OF INPUT DATA MESSAGES=    0
END OF SEDIMENT DATA

================================================================================

$HYD
BEGIN COMPUTATIONS.

================================================================================

TIME STEP #       1
*   AB                                A

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
ACCUMULATED TIME (yrs).....       0.000

--- Downstream Boundary Condition Data for STREAM SEGMENT NO.  1 at Control Point #  1 ---
                          DISCHARGE   TEMPERATURE  WATER SURFACE
                            (cfs)       (deg F)        (ft)
                          16598.000       60.00        203.900

****  DISCHARGE    WATER    ENERGY  VELOCITY   ALPHA      TOP      AVG       AVG VEL (by subsection)
        (CFS)    SURFACE     LINE      HEAD              WIDTH      BED        1       2       3

SECTION NO.      0.100
** CRITICAL WATER SURFACE USED AT SECTION NO.      0.100 AT TIME =      1.000 DAYS.**
**ELOEQ**
****  16598.000   203.942   206.440   2.498    1.263   333.553   197.241   2.034  13.045   3.634
                                                FLOW DISTRIBUTION (%) =    0.028  93.988   5.984
SECTION NO.      0.200
****  16598.000   205.740   207.258   1.518    1.385   331.509   197.488   2.336  10.462   3.494
                                                FLOW DISTRIBUTION (%) =    0.324  87.933  11.743
SECTION NO.      0.300
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      0.300 TIME =      1.000 DAYS.
TRIAL     TRIAL       COMPUTED     CRITICAL
 NO.       WS           WS           WS
  2.     205.873      205.649
  3.     205.967      205.689      205.917
****  16598.000   205.967   209.032   3.065    1.000   187.981   199.680   0.000  14.044   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      0.400
****  16598.000   208.856   209.674   0.818    1.000   265.627   200.244   0.000   7.256   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      0.500
****  16598.000   208.784   210.330   1.546    1.000   200.736   200.494   0.000   9.975   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      0.600
****  16598.000   209.931   211.046   1.115    1.000   243.138   201.873   0.000   8.472   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      5.000
****  16598.000   210.883   211.451   0.569    1.000   203.931   197.427   0.000   6.049   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      6.000
****  16598.000   210.954   211.595   0.641    1.000   190.502   197.386   0.000   6.421   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      8.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      8.000 TIME =      1.000 DAYS.
TRIAL     TRIAL       COMPUTED     CRITICAL
 NO.       WS           WS           WS
  0.     214.516      208.268
  1.     214.610      208.328      214.560
****  16598.000   214.610   219.997   5.387    1.000    81.433   203.662   0.000  18.618   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.     10.000
****  16598.000   219.021   222.547   3.526    1.000    73.415   204.012   0.000  15.063   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.     12.000
```

```
**** 16598.000   221.153   224.065   2.912    1.000    73.848   204.733   0.000  13.688   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      14.000
**** 16598.000   223.314   225.093   1.779    1.000    98.228   207.523   0.000  10.701   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      16.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      16.000 TIME =      1.000 DAYS.
TRIAL     TRIAL        COMPUTED      CRITICAL
 NO.        WS            WS            WS
  2.     221.970       221.587
  3.     222.064       221.642       222.014
**** 16598.000   222.064   228.378   6.314    1.000    64.326   209.262   0.000  20.156   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      17.000
**** 16598.000   227.687   230.482   2.795    1.000    80.289   212.271   0.000  13.410   0.000
                                                FLOW DISTRIBUTION (%) =    0.000 100.000   0.000
SECTION NO.      18.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      18.000 TIME =      1.000 DAYS.
TRIAL     TRIAL        COMPUTED      CRITICAL
 NO.        WS            WS            WS
  0.     244.129       228.649
  1.     244.223       228.684       244.173
**** 16598.000   244.223   248.399   4.176    1.016   130.785   235.536   2.123  16.403   1.597
                                                FLOW DISTRIBUTION (%) =    0.120  99.872   0.009
SECTION NO.      20.000
** SUPERCRITICAL **  Using Critical Water Surface + .050 ft.
SECTION NO.      20.000 TIME =      1.000 DAYS.
TRIAL     TRIAL        COMPUTED      CRITICAL
 NO.        WS            WS            WS
  2.     251.502       247.984
  3.     251.596       248.033       251.546
**** 16598.000   251.596   254.602   3.006    1.041   213.849   245.275   1.657  13.929   0.000
                                                FLOW DISTRIBUTION (%) =    0.291  99.709   0.000

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
      ACCUMULATED TIME (yrs).....      0.003
      FLOW DURATION (days).......      1.000

UPSTREAM BOUNDARY CONDITIONS
-------------------------------------------------------------------------
Stream Segment # 1     |   DISCHARGE   | SEDIMENT LOAD | TEMPERATURE
Section No.    20.000  |     (cfs)     |   (tons/day)  |   (deg F)
-------------------------------------------------------------------------
               INFLOW  |     16598.00  |         0.00  |       60.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
            SEDIMENT TRANSPORT ANALYSIS FOR A MATERIAL EXTRACTION ACTIVITY IN THE
            ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT
*******************************************************
    TIME       ENTRY *              SAND               *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *
    1.00      20.000 *      0.00                      *
   TOTAL=      0.100 *      0.00      5.38********** *
*******************************************************

TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
-------------------------------------------------------------------------------
  SEDIMENT INFLOW at the Upstream Boundary:
      GRAIN SIZE      LOAD (tons/day)  |    GRAIN SIZE      LOAD (tons/day)
  ---------------------------------------------------------------------------
    VERY FINE SAND....          0.00   |  VERY FINE GRAVEL..          0.00
    FINE SAND.........          0.00   |  FINE GRAVEL.......          0.00
    MEDIUM SAND.......          0.00   |  MEDIUM GRAVEL.....          0.00
    COARSE SAND.......          0.00   |  COARSE GRAVEL.....          0.00
    VERY COARSE SAND..          0.00   |  VERY COARSE GRAVEL          0.00
                        -------------                       -------------
                                                 TOTAL =          0.00
  SEDIMENT OUTFLOW from the Downstream Boundary
      GRAIN SIZE      LOAD (tons/day)  |    GRAIN SIZE      LOAD (tons/day)
  ---------------------------------------------------------------------------
    VERY FINE SAND....       3017.47   |  VERY FINE GRAVEL..         11.76
    FINE SAND.........       3883.98   |  FINE GRAVEL.......          1.01
    MEDIUM SAND.......       2902.80   |  MEDIUM GRAVEL.....          0.13
    COARSE SAND.......        935.57   |  COARSE GRAVEL.....          0.01
    VERY COARSE SAND..        138.77   |  VERY COARSE GRAVEL          0.00
                        -------------                       -------------
                                                 TOTAL =      10891.50
```

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 1.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
20.000	0.00	251.60	239.50	16598.	0.
18.000	0.00	244.22	229.66	16598.	0.
17.000	0.00	227.69	196.85	16598.	0.
16.000	0.00	222.06	196.85	16598.	0.
14.000	-2.43	223.31	191.14	16598.	2338.
12.000	-2.60	221.15	190.97	16598.	4788.
10.000	-4.74	219.02	188.83	16598.	9235.
8.000	-6.87	214.61	186.70	16598.	17249.
6.000	-0.40	210.95	193.17	16598.	17794.
5.000	4.44	210.88	198.01	16598.	10892.
0.600	0.00	209.93	197.18	16598.	10892.
0.500	0.00	208.78	197.24	16598.	10892.
0.400	0.00	208.86	194.39	16598.	10892.
0.300	0.00	205.97	196.72	16598.	10892.
0.200	0.00	205.74	195.05	16598.	10892.
0.100	0.00	203.94	195.44	16598.	10892.

$$END

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 1
TOTAL NO. OF WS PROFILES = 1
ITERATIONS IN EXNER EQ = 800

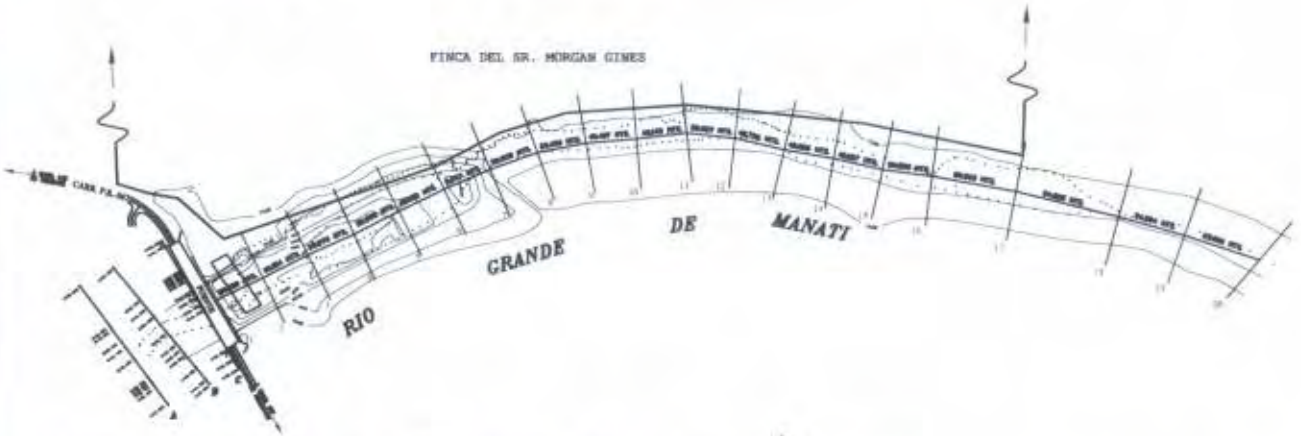
COMPUTATIONS COMPLETED
RUN TIME = 0 HOURS, 0 MINUTES & 0.00 SECONDS

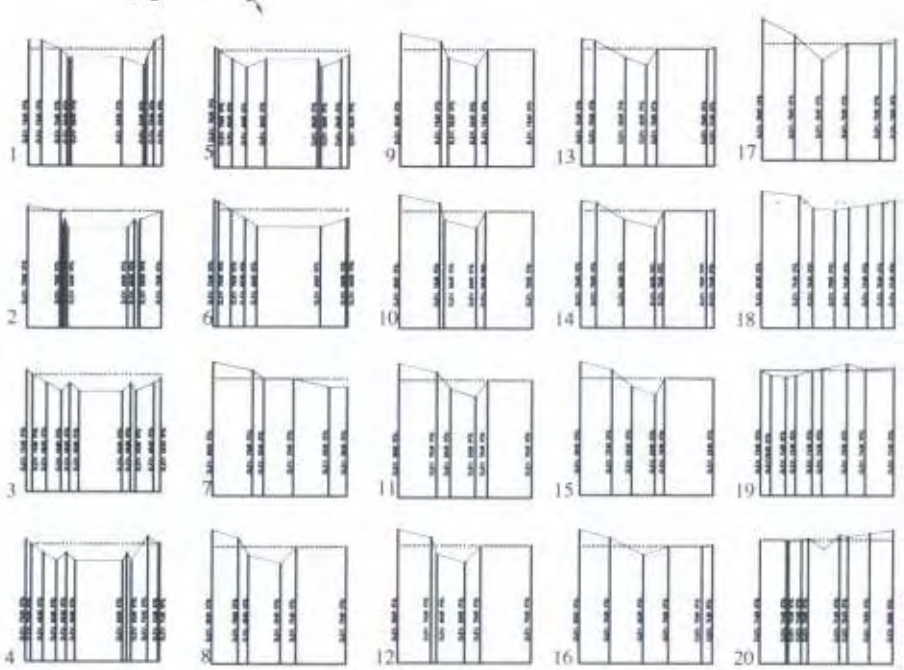
APPENDIX C

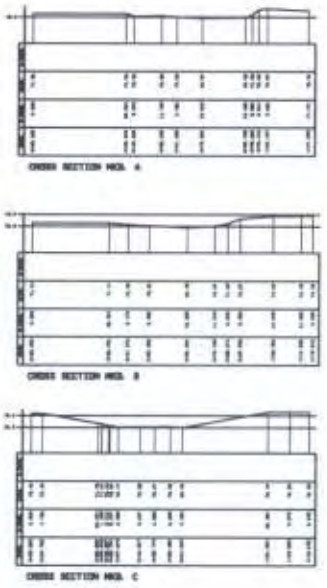
FIELD DATA

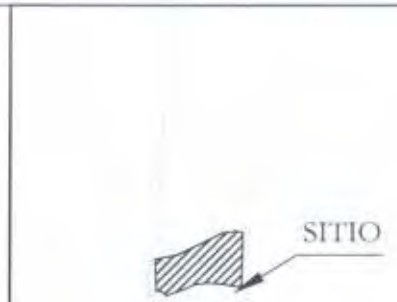
PLANO DE SECCIONES TRANSVERSALES DE SEGMENTO DEL RIO GRANDE DE MANATI EN LA ALTURA DEL KM 2.5 DE LA CARR. 567 DEL BARRIO SAN LORENZO DE MOROVIS, P.R.

ESC. 1:2,000.

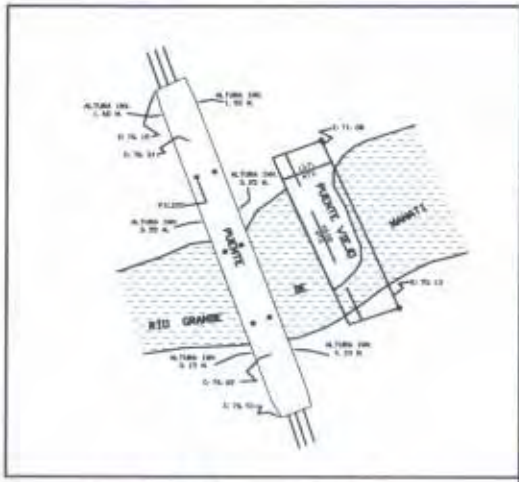








PLANO DE LOCALIZACION ESCALA 1:20,000.



DETALLE DE PUENTE ESCALA 1:500.

LEYENDA :

* RIO
* CARRETERAS
* CONTORNO

ERIC MARTINEZ ARBONA P.L.S.
BOX 3848 VEGA BAJA, PUERTO RICO 00694

SECCIONES TRANSVERSALES
BARRIO SAN LORENZO
MOROVIS PUERTO RICO

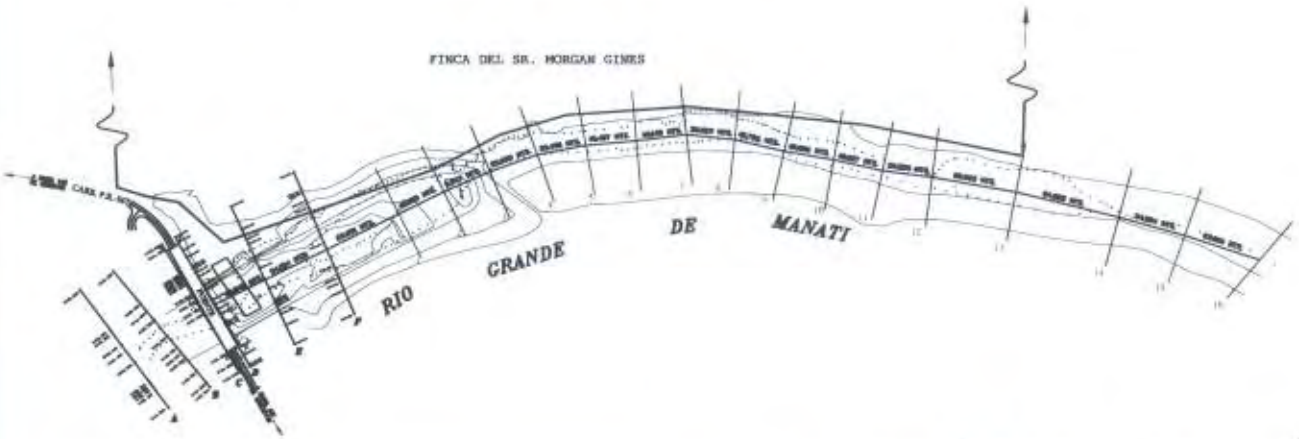
CERTIFICO CORRECTO:
AGRIMENSOR ERIC MARTINEZ ARBONA.
LIC. 7518. FECHA:

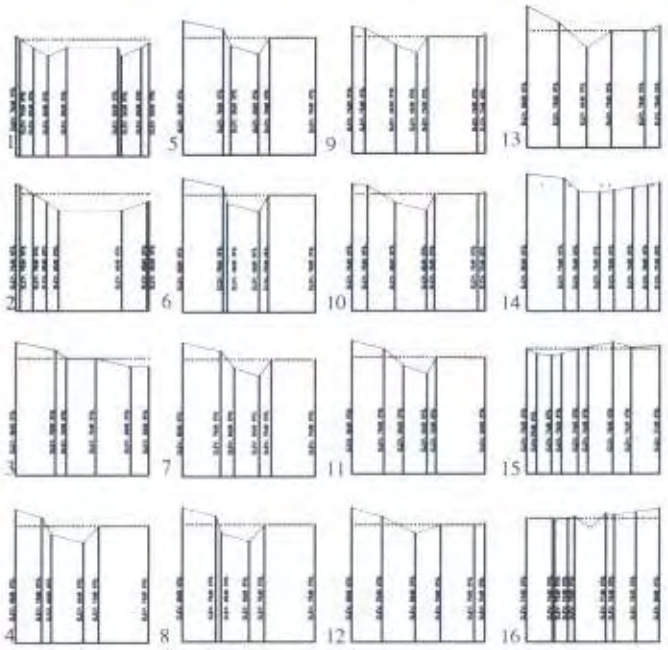
Project
Drawing by
Revised by

1 of 1

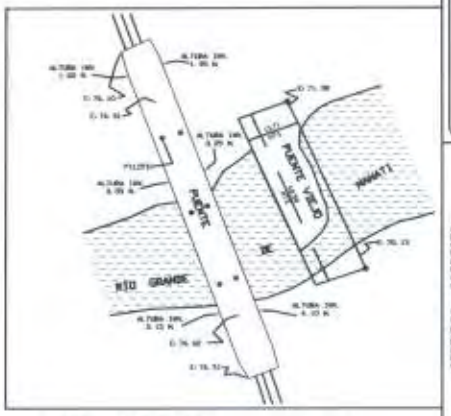
PLANO DE SECCIONES TRANSVERSALES DE
SEGMENTO DEL RIO GRANDE DE MANATI
EN LA ALTURA DEL KM 2.5 DE LA CARR. 567
DEL BARRIO SAN LORENZO DE MOROVIS, P.R.

ESC. 1:2,000.





PLANO DE LOCALIZACION ESCALA 1:20,000.



DETALLE DE PUENTE ESCALA 1:500.

LEYENDA :

- RIO
- CARRETERAS
- CONTORNO

ERIC MARTINEZ ARBONA P.L.S.
BOX 3640 VEGA BAJA, PUERTO RICO 00694

REVISIONS

SECCIONES TRANSVERSALES
BARRIO SAN LORENZO
MOROVIS PUERTO RICO

CERTIFICO CORRECTO:
AGRIMENSOR ERIC MARTINEZ ARBONA.
LIC. 751S. FECHA:

SELLO

Project:
Drawing by:
Revised by:

1 of 1

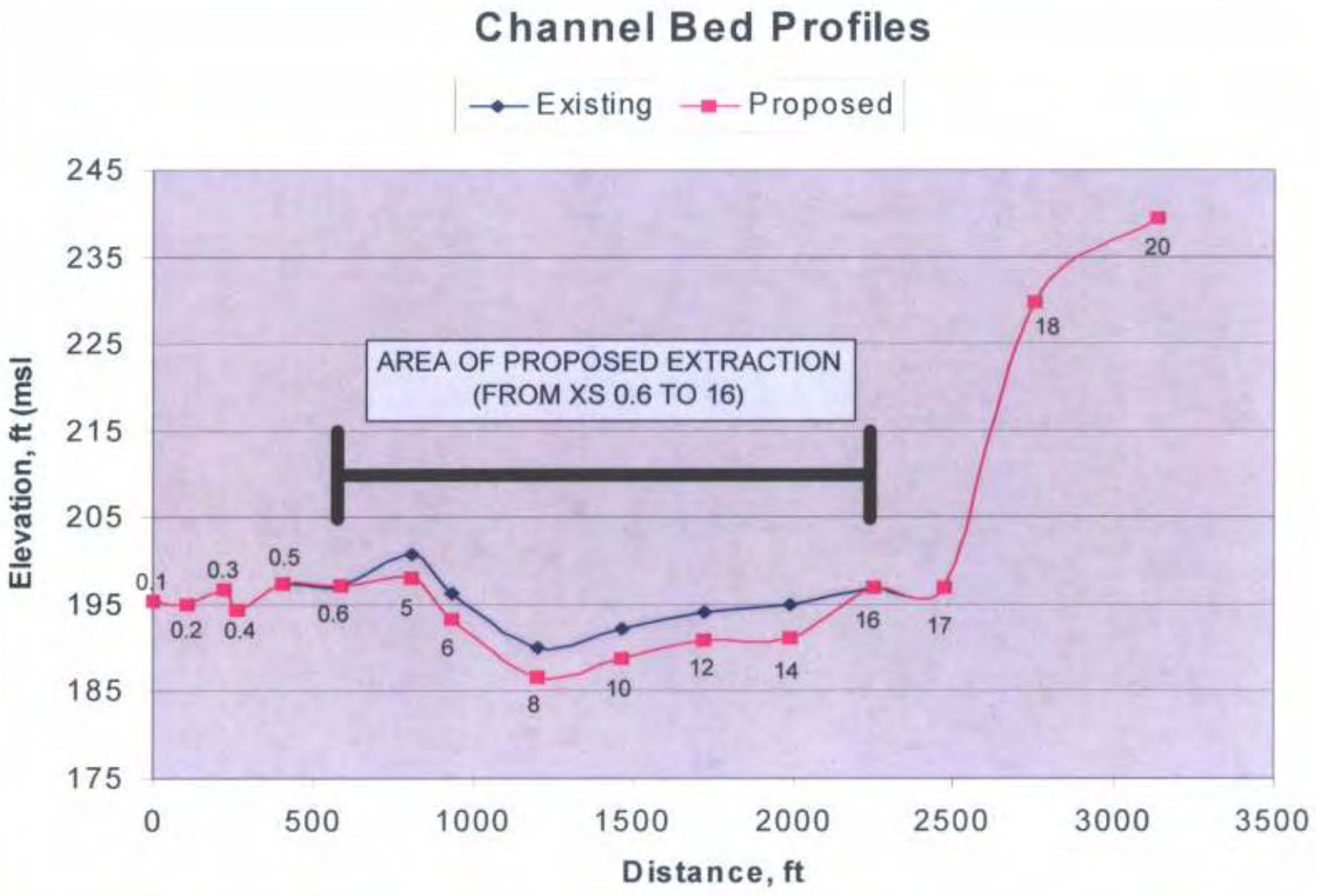


Figure 3. Channel bed profiles for the existing and proposed conditions (scale as shown).

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