BRIDGE HYDRAULICS REPORT

for

SR 29 Crossing at Turkey Branch

Bridge No. 050031

State Project No. 05090-1511
Work Program No. 1110874
Glades County

Prepared for the
Florida Department of Transportation
District 1, Bartow

Prepared by:
JMI Engineers, Inc.
April 19, 1996

Engineer of Record: ______________________
David F. Snyder, P.E.
4/23/96

EXECUTIVE SUMMARY

The proposed project involves the widening of the existing bridge at Turkey Branch on SR 29, Glades County, Florida (Bridge No. 050031). Turkey Branch is a Class III water body according to the F.A.C., Ch. 62-302. The Federal Emergency Management Agency has not classified this stream as a Regulatory Floodway, therefore a "No-Rise" certification will not be necessary.

The existing bridge is a Category 1 structure. It is being widened to bring it up to current roadway geometric standards. The proposed widening will provide two - 3.60 meter (11.81 feet) travel lanes with a 3.00 meter (9.84 foot) shoulder for both directions of SR29 traffic. The recommended structure will be a Category 1 structure.

Hydraulically, the existing structure is capable of conveying the design flood without overtopping however, the 0.61 meters (2 feet) of vertical clearance is not provided. The proposed widening has minimal effects on these hydraulic characteristics of the bridge. A design variance has been applied for from District One to cover this deviation from FDOT hydraulic design criteria (see Appendix G).

Any impacts to the wetlands and environment due to the replacement of this bridge will be temporary. Maintenance of traffic will be handled by a shift and slight lane width reduction for SR 29 traffic and will remain on the existing bridge structure. No temporary detour road or bridge will be required for this bridge widening. Additional Right of Way will not be needed.

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INTRODUCTION

The Florida Department of Transportation proposes the widening and resurfacing of existing bridge number 050031. This bridge is located in Glades County on State Road 29 between the towns of LaBelle and Palmdale, 0.8 kilometers (0.5 miles) south of County Road 74. It crosses Turkey Branch which is designated a Class III water body according to Chapter 62-302.600, F.A.C..

SR 29 is being widened and resurfaced at this location due to a need for improved public safety at the bridge site. There has been no record of hydraulic problems at this site.

PRELIMINARY INFORMATION

General Site Location

The proposed project includes the widening and resurfacing of bridge number 050031 on State Road 29 in Glades County, Florida. The bridge crosses Turkey Branch and is located in Section 16, Township 41 South, Range 30 East. Figure 1 is a location map which shows the location of the proposed project.

State Road 29 is a two-lane, two-way rural road. The posted speed limit at the project location is 55 miles/hour. SR 29 is classified as both an evacuation and emergency access route for Glades County by the Glades County Emergency Management Agency.

Site Description and Drainage Basin Characteristics

Figure 2 is a copy of the Future Land Use Map provided by Glades County. It shows the drainage area for bridge number 050031 is classified as agricultural/open space and wetlands.

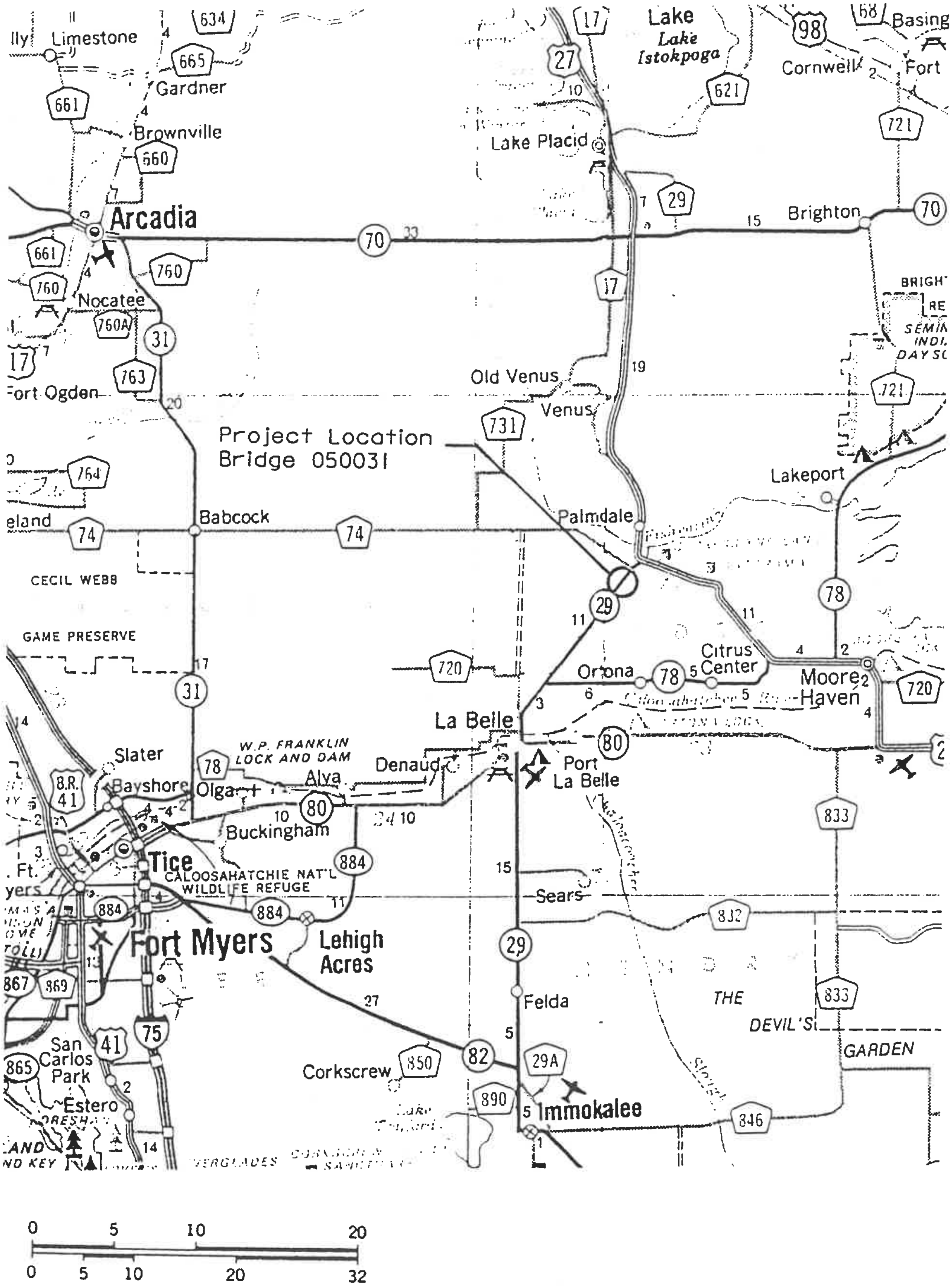

Figure 1. Project Location Map

Federal Emergency Management Agency

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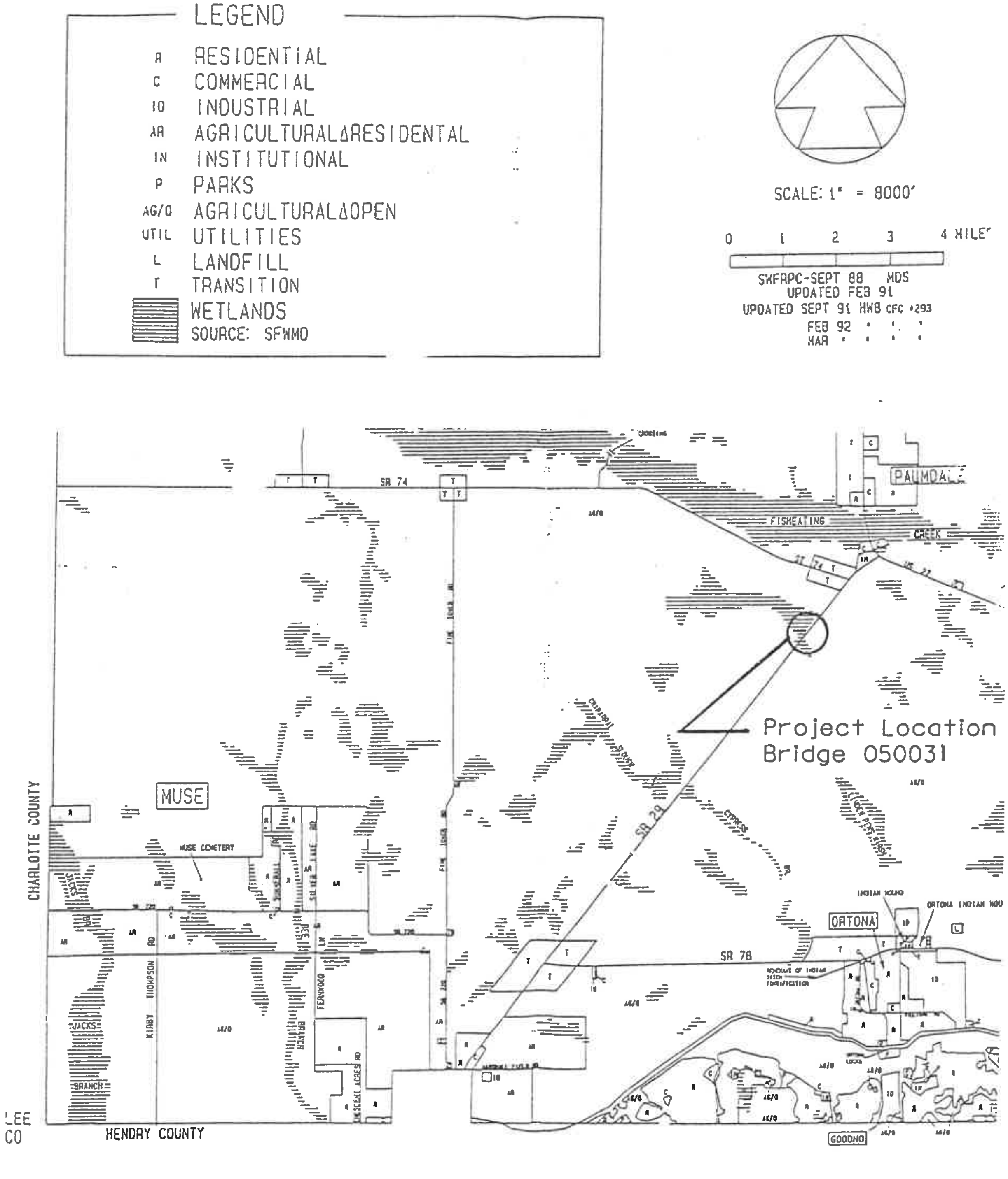

Figure 2. Glades County Future Land use Map - 2010

SW Florida Regional Planning Council

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There two buildings belonging to Lykes Brothers Ranch located within the drainage basin, southwest of the existing bridge.

Turkey Branch is not considered a navigable waterway. There is a large amount of wetland area located within the drainage basin, however it is not in the form of well defined ponds or lakes. The creek is located within the Fisheating Creek Wildlife Management Area and is not directly being used as a source of domestic water supply.

Environmental constraints include the wetland areas delineated on both sides of the bridge. It is necessary that the proposed construction is minimized in these wetland areas.

Turkey Branch is located within the upper northwest fringe of the Florida Everglades, 21 kilometers (13 miles) west of Lake Okeechobee. The topography of the area consist of wetlands (swamp) and low lying undeveloped woodlands surrounded by relatively flat grasslands and open range. The contributing drainage area to Bridge No. 050031 is about 906 hectares (3.50 square miles) and lies on the northwest side of SR 29 (See Figure 3). The drainage boundaries were delineated using the United States Geological Survey (USGS) Quadrangle map for LaBelle, Florida, FEMA Flood Insurance Rate Maps for Community #120095, Panel 200B (Figure 4), aerial photographs of Sections 15-22 (Figure 5), and a visit to the site.

The slope of the terrain is mild and drains to the southeast. A review of the USGS Quadrangle maps and survey data indicate a slope of about 0.0004 feet per foot (2.25 feet per mile). Figure 3 is a map of the area surrounding bridge number 050031 with the drainage basin for Turkey Branch delineated. Figure 5 shows an aerial view of the bridge location and a portion of the drainage basin. The drainage basin is bounded by SR29 on the east and CR74 on the north.

There is one main channel, Turkey Branch, which drains the basin into Bridge No. 050031. This channel is well defined upstream of Bridge 050031. The runoff is conveyed under the bridge and continues a southeasterly flow via Turkey Branch until it empties into Linden Pens Marsh approximately 5 miles downstream.

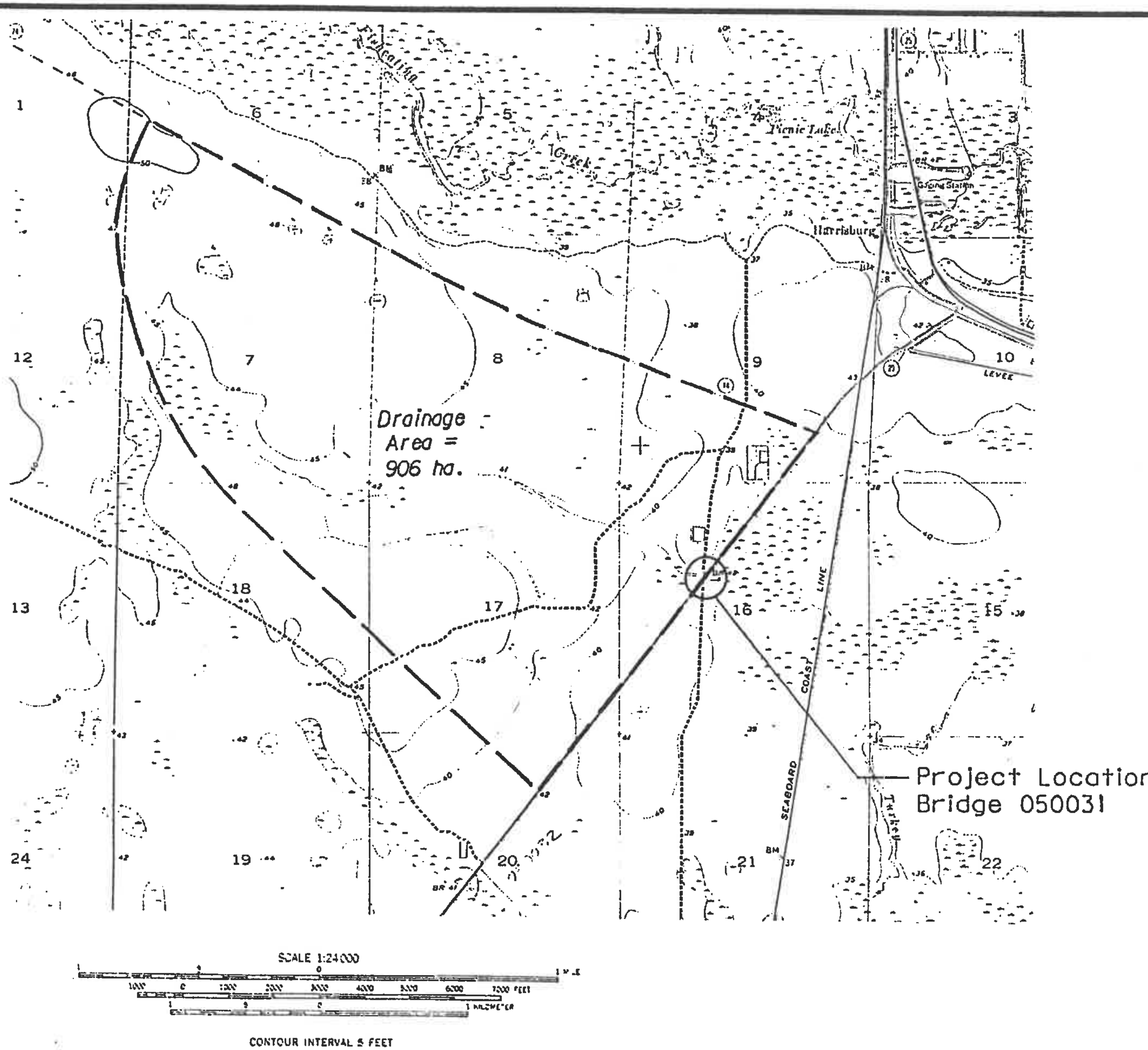

Figure 3. Drainage Basin Map
USGS Quadrangle Map

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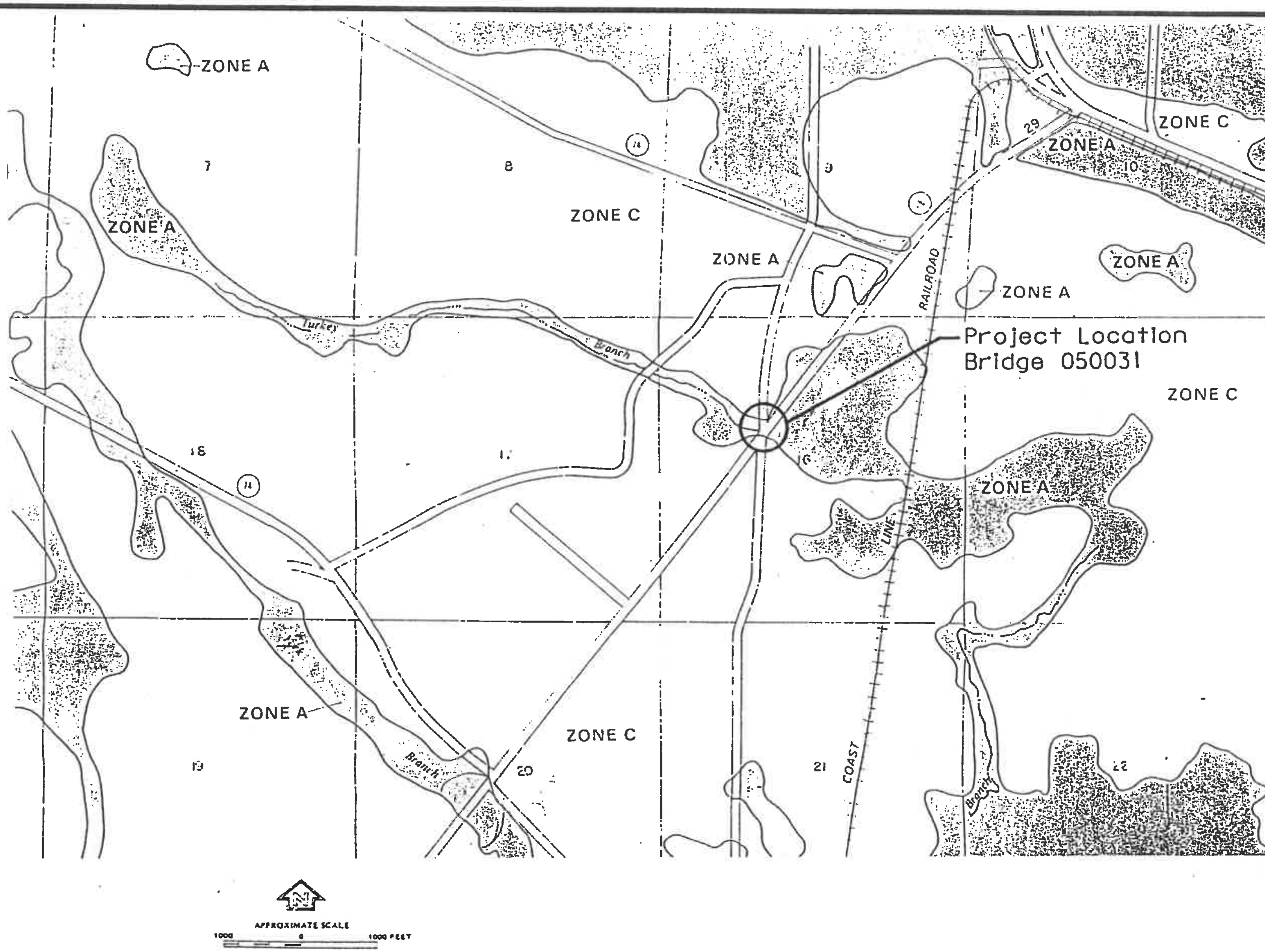

Figure 4. Flood Insurance Rate Map
Federal Emergency Management Agency

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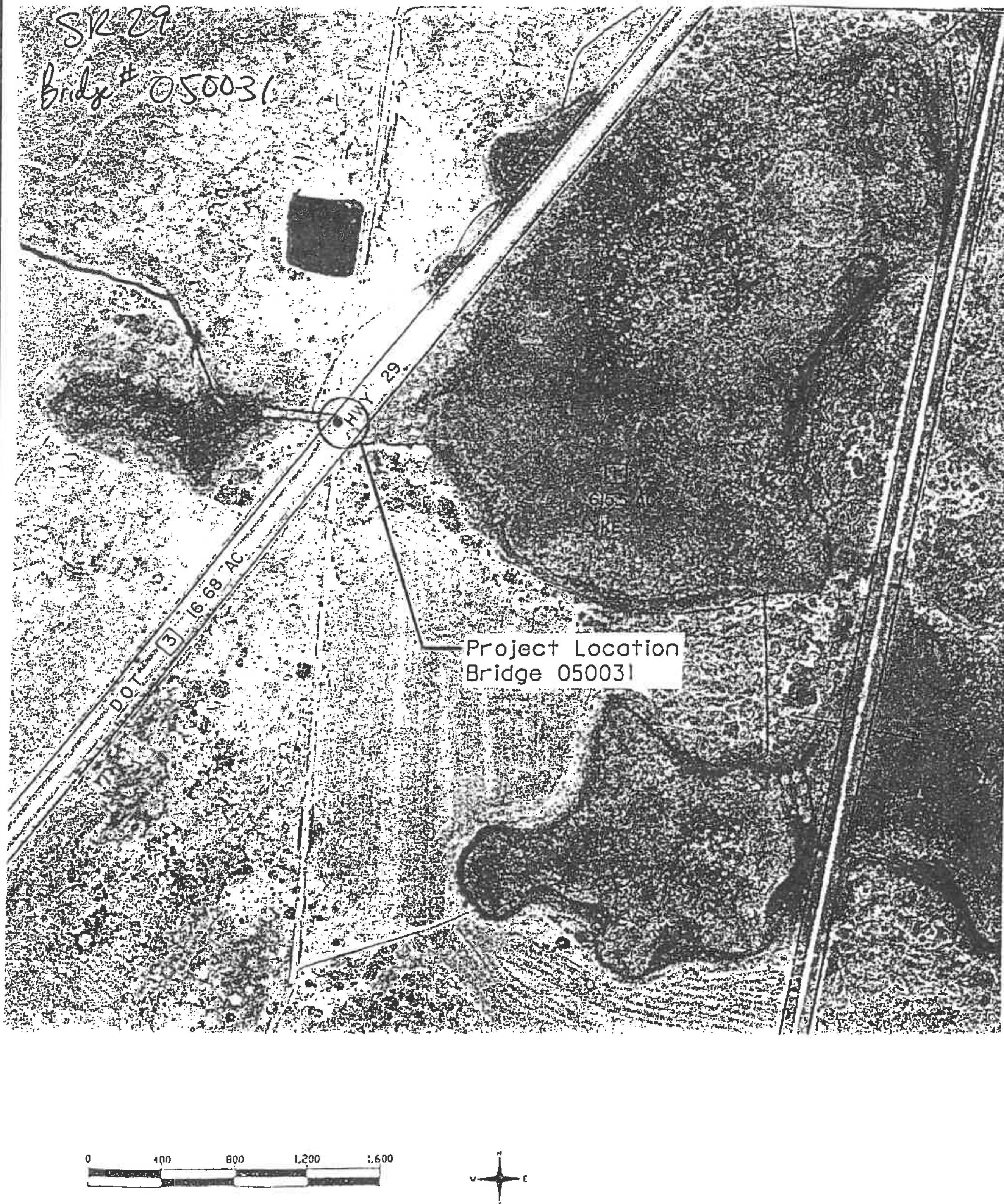

Figure 5. Aerial Photograph of Project Site

Hamrich Aerial Survey

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Channel Stability

A Level One Stream Stability Analysis (HEC-20) was performed for Turkey Branch. Aerial maps, quad maps, Bridge Inspection Reports, and a visit to the site were all utilized for this analysis. Documentation of the site visit and this analysis is provided in Appendix A along with several photographs. It appears from the aerial view, the quadrangle map, and the site visit that the channel has been excavated. However, documentation of this was not available.

Based on the qualitative assessments resulting from this analysis, it can be concluded that the overall stability of Turkey Branch is moderate to high and is resistant to minor changes in the channel and watershed. There is no need for a more detailed analysis.

Potential Water Stages

The existing bridge is located within Flood Zone A as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Glades County. Flood Zone A designates an area of maximum flooding with no given base flood elevations, see Flood Map, Figure 4. According to the FIRM, Turkey Branch is not a Regulatory Floodway and a "no rise" certification will not be necessary.

Potential water stages can be evaluated by studying historical water stages on Turkey Branch at the SR 29 bridge location. There is no gaging station present at this site and limited historic flood information is available for the area.

Bridge 050031 is maintained by the Florida Department of Transportation (FDOT) Maintenance Office in LaBelle, Florida. They have no records of this bridge ever overtopping. FDOT Maintenance has periodically tried to clean the vegetation out of the channels at the bridges along SR 29 with little success. The Glades County Schools, Transportation Director was also contacted to determine if SR 29 had ever been impassable for school buses, however, this has never occurred. Glades County Emergency management concurred with these statements. Documentation of conversations has been provided in Appendix G.

Historical flooding occurred this past summer and water levels appear to have been relatively high at this bridge site. The survey crew recorded a water surface elevation at the downstream side of the bridge of 11.547 meters (37.88 feet) on November 21, 1995. It is assumed that water levels have come down to within normal limits in the creek and appear within limits of normal flow conditions for this time of year. The water surface elevation during the site visit, February 28, 1996, was approximately at elevation 11.37 meters (37.31 feet) or about 0.90 meters (3.0 feet) below the low member. However, little flow was noted in the channel at the time of our site visit. There was no measurable velocity.

Turkey Branch drains an area of wetland west of SR 29 and empties into a large marsh southeast of SR 29. Since it does not have a direct confluence with a major stream or river, there is little, if any, potential for backwater from other water bodies.

Existing Crossings

The existing 9.144 meter (30 foot) bridge was built in 1948. It consists of two, 4.6 meter (15 foot) cast in place reinforced concrete spans. The superstructure is supported by cast in place concrete piers and founded on concrete pile end bents and one intermediate bent. The low member elevation of the bridge is 12.271 meters (40.26 feet NGVD). There is no grade on the bridge and scuppers exist to provide deck drainage. The deck width is 10.698 meters (35.1 feet) out to out. The typical section, shown in Figure 6, consist of two - 3.69 meter (12 foot) travel lanes and a 1.26 meter (4.15 foot) paved shoulder on each side. A metal guardrail is provided on each side of the bridge. The average daily traffic (ADT) for this location is 1,806 according a 1991 traffic survey. The projected future ADT for 2018 is 2,933.

Historically, the existing structure appears to have been hydraulically adequate. There is no record of the bridge deck or approach roadway overtopping. There is no evidence of debris at the existing structure.

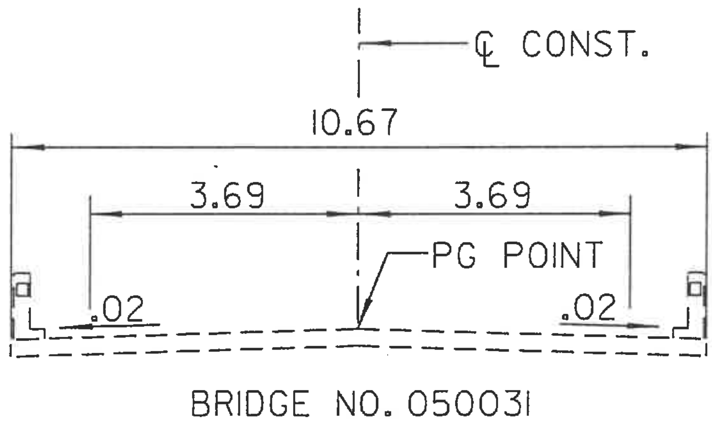

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FIGURE 6
EXISTING BRIDGE
TYPICAL SECTION

FINAL DESIGN DATA

Design Flood

The design flood for this bridge was selected based upon the importance of this route to the highway system. The 50 year storm has been selected as the design flood due to the use of SR 29 as an evacuation and emergency access route and the projected ADT of 2,933 (Florida Department of Transportation Drainage Manual, Vol.1, Section 4.3.2). The existing bridge and proposed improvements will be analyzed for this storm event to insure current FDOT hydraulic criteria is being met. FDOT design criteria includes a stream velocity between 0.61 and 0.91 meters per second (2-3 feet per second), a 0.61 meter (2 foot) vertical clearance and less than 0.30 meters (1 foot) increase in water surface elevation at the approach to the bridge (backwater).

The structure will also be analyzed for the Base Flood (100 year frequency) and the 500 year (greatest) flood event.

Hydrologic Analysis

The hydraulic analysis of the SR 29 bridge over Turkey Branch involves only freshwater flow from the drainage basin located to the west of the bridge. The flow in the stream is perennial, but flashy; flowing most of the year, but responding to precipitation by rapid changes in stage and discharge.

There is very little flow in Turkey Branch and it has been noted by local residents that as the stage of the creek rises, there is usually very little increase in flow.

The South Florida Water Management District (SFWMD) did not have any information on this particular bridge crossing. However, they did have a rate of runoff for the entire Caloosahatchee River basin. For a 25 year design event, the SFWMD has determined the discharge rate to be 30.1 CSM (cfs/mi^2). See documentation in Appendix B. Also, gage data for Fisheating Creek indicate a flow rate of 45 CSM for a drainage basin just north of the basin for Bridge 050031.

Regional regression equations were developed by the USGS and FHWA for this particular region of Florida. However, direct application of these equations yield extremely high flows for this area. In comparison of other drainage basins in this region of south Florida, a flow rate between 30 and 45 cfsm (cfs per square mile) should be expected for the 25 year storm event. For this reason, the standard error of the USGS equations were taken into account in order to replicate the existing condition at Bridge 050031. Refer to Appendix B for documentation and analysis.

Peak Basin Discharge				
	USGS Regression Equations, Region A		FHWA Regression Equations, Zone 1	
Storm (yr.)	Flow (m^3/m)	Flow (cfs)	Flow (m^3/m)	Flow (cfs)
2	**94**	55	**207**	122
50	**446**	263	**840**	495
100	**517**	305	**977**	575
500	**691**	407	**N/A**	N/A

Table 1. Peak Basin Discharge

The resistance to flow, Manning's "n" coefficients, in the main channel and the flood plain have been calculated using procedures and equations found in the Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, FHWA-TS-84-204. Very high amounts of vegetation and a negligible effect of obstructions in the main channel are factors which effect the resistance to flow. A Manning's Roughness Coefficient of 0.08 was used to account for this resistance to flow in the main channel of Turkey Branch (calculations provided in Appendix B).

The Manning's Roughness Coefficients for the flood plain were computed without using the vegetation-density method. Since the roughness is not uniformly distributed across the flood plain it has been subdivided into two sections. These sections include an area of marsh and area of pasture. The computed "n" value for the pasture section is 0.08 and 0.04 for the section with trees (calculations and photographs provided in Appendix B). For WSPRO purposes, composite n-values have been calculated for each cross section.

Hydraulic Analysis

FHWA's Bridge Waterways Analysis Model (WSPRO) was used to create a hydraulic model of Turkey Branch at the crossing of SR 29.

Cross section data is required to describe the physical system of the stream. The location of the cross sections used in the WSPRO analysis was determined from a review of the USGS Quadrangle map, the FIRM, aerial photographs and a visit to the site. Refer to Figure 7.

The five cross sections used in the WSPRO analysis are as follows. Plots of these cross sections are provided in Appendix D.

- SURV1 - Section located approximately 30 meters (100 feet) downstream of the existing bridge.
- SURV2 - Exit Section located one bridge length, 9.14 meters (30 feet), from the downstream face of the bridge.
- SURV3 - Full Valley Section located at downstream face of bridge. This cross section does not reflect the roadway embankment.
- BRDG - Section located at the downstream face of the bridge, including all geometric information about the bridge.
- SURV4 - Approach Section located one bridge length, 9.14 meters (30 feet), from the upstream face of the bridge.
- SURV5 - Reference Section located approximately 30 meters (100 feet) upstream of existing bridge. This section has been included for backwater comparisons.

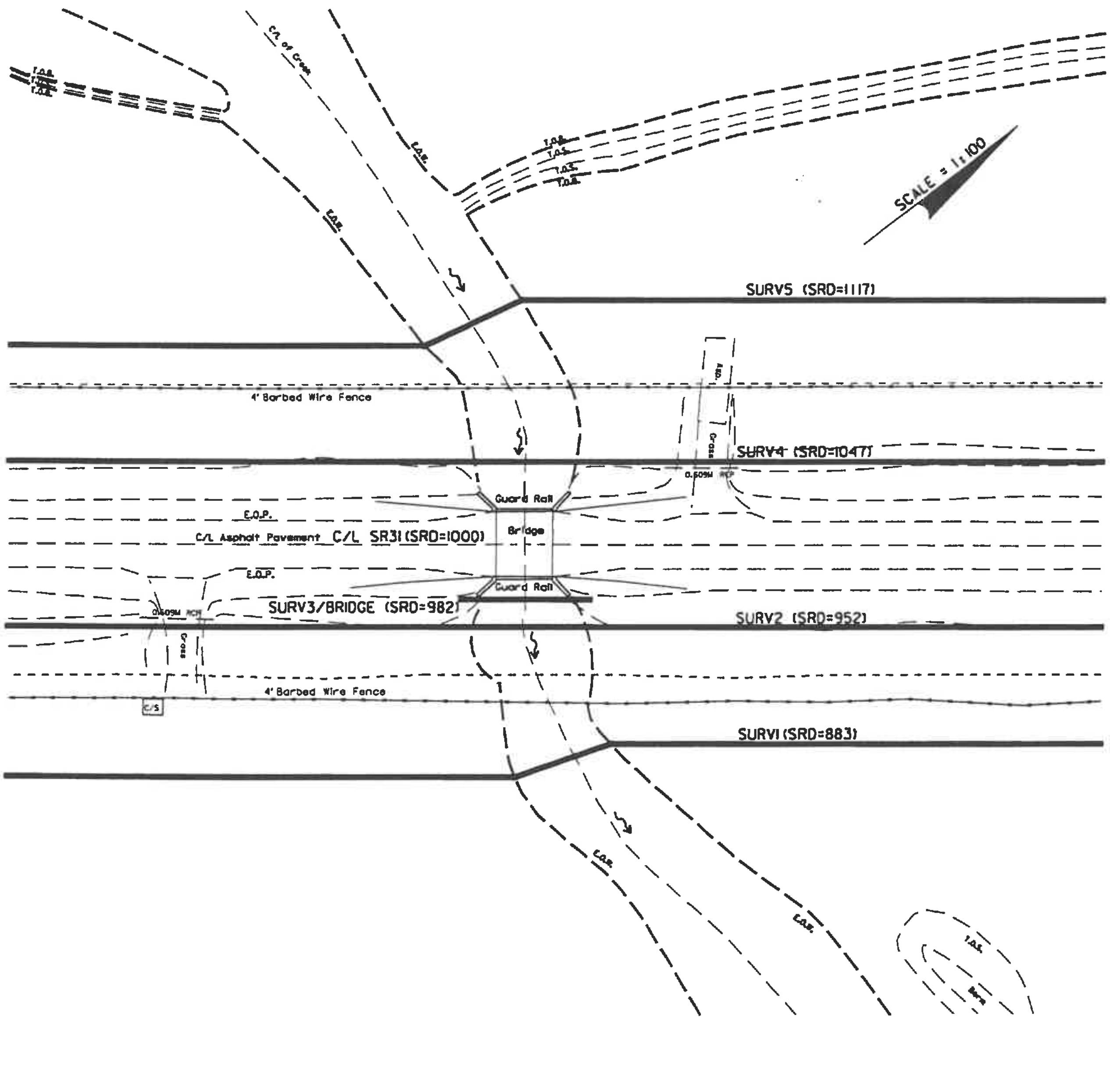

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FIGURE 7
SURVEY CROSS SECTIONS USED FOR WSPRO ANALYSIS

SURV2 has been used as a template for the EXIT section located one bridge length downstream from the bridge. SURV3 and SURV4 are representative of the Full Valley and Approach sections, respectively. The actual location of the Approach varies from the existing bridge to the widened bridge, therefore SURV4 has also been used as a template for the Approach cross section. The exit and approach sections have been coded in one bridge length from the bridge as required by WSPRO and the flow length (FL) option has been utilized to more accurately describe the flow pattern in the channel between cross sections.

The WSPRO analysis was modeled using the slope-conveyance method. This method was used instead of using a starting water surface elevation for several reasons. There is no gaging station located on Turkey Branch and there is no definitive tailwater information available for this location since the discharge area contains a vast flood plain. In order to converge the water surface profiles at the EXIT section, a cross section must be known a distance of several miles downstream. Since the slope on Turkey Branch is very small, it was assumed that this stream flows at normal depth. Therefore, the slope-conveyance method (SK card) was used to determine the initial water surface elevation and compute the water surface profiles. A slope of 0.04% (2.25 feet per mile) representative of the channels and surrounding terrain was used in the WSPRO model.

A flow of 46 cmm (27 cfs) was estimated at the time of the February 28, 1996 site visit. A WSPRO analysis confirmed the measured water surface elevation, flow area, and a minimal velocity. This flow is approximately half that produced during a 2 year storm event. The water surface elevation on November 21, 1995 was surveyed to be 11.547 meters (37.88 feet). This measurement followed a season of heavy rains and flooding. According to WSPRO, this water surface elevation correlates to that produced by a 2 year storm, 11.531 meters (37.83 feet). Based on these results, the historical data and the hydrologic information available for this area, this water surface model is an accurate representation of the flows through Bridge 050031.

The following tables provide a summary of the results computed by WSPRO. Input and output from the WSPRO runs are provided in Appendix D.

50 YEAR STORM EVENT				
Bridge Configuration	Velocity at Bridge (m/sec)/(ft/sec)	WSEL at Bridge (m)/(ft)	WSEL at REFE (m)/(ft)	Increase in WSEL
No Bridge	**0.16**/0.52	**11.91**/39.06	**11.93**/39.13	**0/0**
Existing Bridge	**0.52**/1.71	**11.90**/39.04	**11.95**/39.22	**0.03**/0.09
Widened Bridge	**0.52**/1.71	**11.90**/39.04	**11.96**/39.24	**0.03**/0.11

Table 2. Design Storm: Comparison of Existing to Widened Bridge

100 YEAR STORM EVENT				
Bridge Configuration	Velocity at Bridge (m/sec)/(ft/sec)	WSEL at Bridge (m)/(ft)	WSEL at REFE (m)/(ft)	Increase in WSEL
No Bridge	**0.15**/0.49	**11.93**/39.14	**11.95**/39.22	**0/0**
Existing Bridge	**0.59**/1.95	**11.93**/39.13	**12.00**/39.36	**0.04**/0.14
Widened Bridge	**0.59**/1.95	**11.93**/39.13	**12.00**/39.38	**0.05**/0.16

Table 3. Base Flood Event: Comparison of Existing to Widened Bridge

500 YEAR STORM EVENT				
Bridge Configuration	Velocity at Bridge (m/sec)/(ft/sec)	WSEL at Bridge (m)/(ft)	WSEL at REFE (m)/(ft)	Increase in WSEL
No Bridge	**0.14**/0.46	**11.98**/39.30	**12.01**/39.39	**0/0**
Existing Bridge	**0.77**/2.53	**11.98**/39.29	**12.08**/39.63	**0.07**/0.24
Widened Bridge	**0.77**/2.53	**11.98**/39.29	**12.09**/39.66	**0.08**/0.27

Table 4. Greatest Flood Event: Comparison of Existing to Widened Bridge

The WSPRO analysis indicates that the existing and widened bridge both meet the requirements established by the FDOT, with one exception. The low member of the existing and widened bridge is at elevation 12.271 meters (40.26 feet). The water surface elevation at the existing and widened bridge during the 50 year design flood reaches 11.899 meters (39.04 feet). This allows only 0.372 meters (1.22 feet) of free board during the design storm. The FDOT criteria requires 0.61 meters (2 feet) of vertical clearance during the design storm (FDOT Drainage Manual, Vol.1, Ch.4.6.1). However, a variance for this requirement has been applied for from the District, see documentation in Appendix G. The velocity and backwater requirements have also been met at both bridges. Since these hydraulic criteria have been satisfied by the widened bridge and the existing structure has a sufficiency rating of 85.3, it appears to be more economical to widen the bridge rather than replace the existing structure. A final recommendation for either widening or replacement of this existing bridge will be based on a structural inspection of the actual physical condition of Bridge 050031, specifically the substructure units built in 1948. Existing structure documentation is provided in Appendix C.

Recommended Structure

The hydraulic analysis of the widened widening of Bridge Number 050031 confirms that the structure will be hydraulically capable of conveying the 50 year design storm in Turkey Branch. There is no need for channel modifications or water training devices at this site with the widened bridge design. The widened structure does not provide the required 0.61 meters (2 feet) of free board as recommended by the FDOT, however there is a vertical clearance of 0.372 meters (1.22 feet) provided during the 50 year design storm. There does not appear to be a problem with debris at this bridge location and the provided clearance appears to be adequate for this structure.

Proposed improvements will include the widening of the existing bridge structure 1.741 meters (5.71 feet) on each side providing the standard 3.0 meter (10 foot) paved shoulder with New Jersey barrier bridge railing, see Figure 8. The substructure units will be extended to support the widening of the superstructure. The 45° wingwalls will be replaced at their proper locations. Replacement alternatives were not analyzed since this is a widening project and the existing superstructure will be matched in the widened bridge section. A variance for the freeboard requirement has been applied for from the District Design Engineer (see Appendix G).

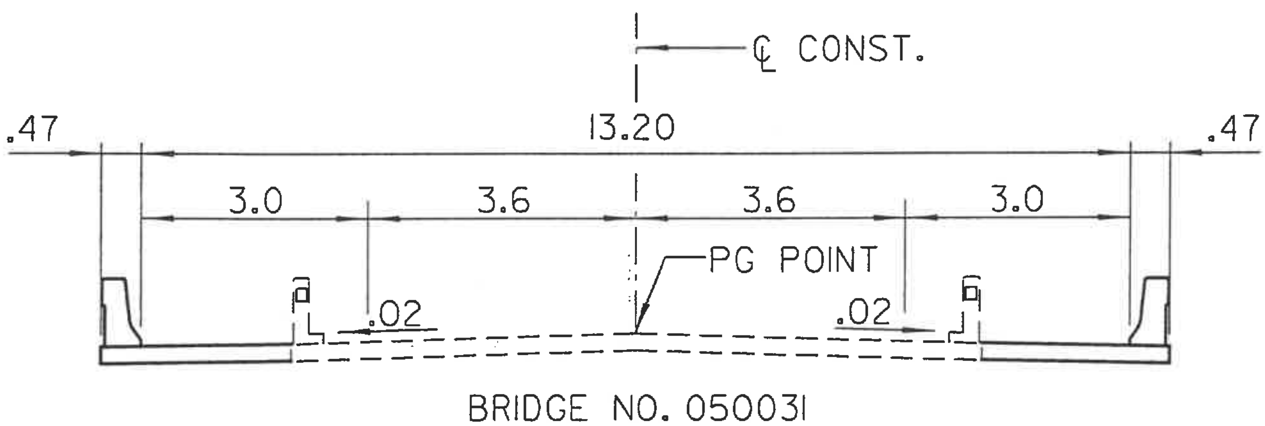

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FIGURE 8
PROPOSED BRIDGE
TYPICAL SECTION

Scour Analysis

The Bridge Inspection Reports indicate that the substructure and piles are in very good condition with no problems noted. The waterway measurements taken in May of 1994 show less than 0.76 meters (2.5 feet) of bed elevation change at the abutments and intermediate bents over the past 2 years. Based on this and historical bed elevation records, long term aggradation or degradation is not anticipated. The above mentioned reports have been provided in Appendix C.

The underwater investigation indicates that the material at the bottom of the channel is mud. The Glades County Soil survey reports the soil type at the bridge to be Okeelanta Muck. It is classified as nearly level and very poorly drained. The median diameter of the soil was determined to be 0.13 mm and has been used to evaluate potential scour at the existing and proposed structures. This information is provided in Appendix B.

Scour calculations for the existing and proposed bridges are provided in Appendix E. The results can be seen in the following table. Long term degradation, contraction, pier and abutment scour have all been estimated using the techniques found in FHWA's Evaluating Scour at Bridges, HEC-18.

There have not been any scour problems observed at this bridge site, as stated in the inspection reports and observed in the most recent field investigation and survey used in this analysis. However, contraction scour estimates, based on HEC-18 equations, disagree with these observations. The hydraulic variables used in the scour equations are based on output from the WSPRO model of Turkey Branch, which is less than ideal for this hydraulic situation. The values calculated for contraction scour are considered to be excessive. Minimal contraction scour is anticipated.

Due to large amounts of vegetation in the stream, it appears that a clear-water scour condition is present at this bridge. The critical velocity was checked to confirm that this is true and the corresponding contraction scour equations were used. There are not specific equations for local clear-water scour, therefore pier scour depths were increased 10 percent since maximum local clear-water scour is about 10 percent greater than the equilibrium local live-bed pier scour (HEC-18, page 16).

Estimated Scour Depths and Elevations					
	Bridge Configuration	Channel Bottom Elevation	Contraction Scour	Local Pier Scour	Scoured Elevation of Channel Bottom
100 Year Storm	Existing Bridge	10.12/33.2	1.45/4.75	0.73/2.39	7.94/26.06
	Widened Bridge	10.12/33.2	1.44/4.73	0.73/2.39	7.95/26.08
500 Year Storm	Existing Bridge	10.12/33.2	2.12/6.94	0.80/2.64	7.20/23.62
	Widened Bridge	10.12/33.2	2.11/6.92	0.82/2.69	7.19/23.59

Table 5. 100 Year & 500 Year Scour Predictions

Widening the bridge does not significantly change the scour values. Since there are no existing scour problems at this site and the estimated values appear to be minimal, no countermeasures are being recommended for the widened bridge. The channel bed appears to be moderately to highly stable. Excavation of the channel bottom would be necessary in order to place riprap protection at the piles and abutments, thereby removing the stabilized bed.

Economic Analysis

The estimated cost of the proposed widening to existing bridge number 050031 is $38,850, as shown in Appendix F. The bridge will be increased to the new standard width of 14.140 meters (46 feet 4½ inch) from the existing width of 10.668 meters (35 feet), an increase in bridge area of 31.75 square meters (342 square feet). Based on the above cost, the proposed improvements to the bridge structure would cost approximately $114.00 per square foot.

Since the existing bridge is considered hydraulically adequate, with the exception of the 0.61 meter (2 feet) freeboard, there is no need for comparison with other hydraulic alternatives, i.e.

complete bridge replacement. This would not be an economically feasible option from a hydraulic point of view.

The estimated unit cost for this bridge widening is based on the sum of costs for driven piles, reinforced concrete substructure and reinforced concrete flat slab superstructure to match the existing. A more detailed explanation of the economic analysis can be found in Appendix F.

Deck Drainage

The bridge deck will have a slope of 0.03 %. Recent FDOT studies by the various District Drainage Departments concluded that scuppers will no longer be allowed on bridges less than 121.92 meters (400 feet) in length. Bridge stormwater drainage will sheet flow off the bridge into existing roadside drainage ditches. Calculations for deck drainage are located in Appendix H.

Permits

The permits required for this project have not been applied for yet. Biological Research Associates will be delineating the wetland area in the spring of 1996 when the flood waters recede. At that time, they will be responsible for applying to the required agencies in order to receive the necessary permits for this bridge widening project.

Maintenance of Traffic

Maintenance of traffic will be handled by shifting traffic to one side of the existing bridge and widening to one side of the existing structure at a time. A temporary construction barrier wall will be placed at the curb line and the existing traffic railing removed. The bridge will be widened behind the temporary construction barrier. When one side of the bridge has been widened, traffic will be shifted to the newly constructed section and the procedure repeated at the other side of the bridge. Very little impact will be placed on the approach roadway, wetlands and/or right-of-way via this maintenance of traffic scenario.

REFERENCES

Aerial Photograph, Sections 1, 2, 11, & 12, Township 42S, Range 29E, Hamrick Aerial Surveys, April 1993

Bridge Inspection Report, Bridge No. 050031, SR 29 over Turkey Branch, April 4, 1994

Evaluating Scour at Bridges, Hydraulic Engineering Circular 18

Federal Emergency Management Agency, Flood Insurance Rate Map, Community Number 120095, Panels 0170B, 260B and 0280B

Florida Administrative Code, Chapter 17-3

Florida Department of Transportation Drainage Manual, Vols. 1-3

Glades County Future Land Use Map, Southwest Florida Regional Planning Council, March 1992

Glades County Soil Survey, U.S.Department of Agriculture, Soil Conservation Service, April 1989

Guide for the Selection of Manning's Roughness Coefficients for Natural Channels and Flood Plains

Stream Stability at Highway Structures, Hydraulic Engineering Circular 20

Stream Stability and Scour at Highway Structures, Publication No. FHWA HI-91-011

USGS Quadrangle Map for LaBelle Quadrangle, Florida, 7.5 Minute Series (Topographic), 1958

Appendix A

Site Reconnaissance

Figure A-1: Bridge No. 050031, Downstream Elevation

Figure A-2: Bridge No. 050031, Upstream Elevation

Figure A-3: Turkey Branch, View Downstream from SR29 Bridge

Figure A-4: Turkey Branch, View Upstream of SR 29 Bridge

SITE FIELD REVIEW

Evidence of scour at structure:

1) Abutment Tilting/Moving in	( ) Yes	(√) No	
2) Slopes Washing in/Sloughing	( ) Yes	(√) No	
3) Scour Holes Near Abutments/Bents	(√) Yes	( ) No	See Comment 8.
4) Bed Deposits Downstream	( ) Yes	(√) No	
5) Bridge Railing Sagging	( ) Yes	(√) No	
6) Debris	( ) Yes	(√) No	

7) High-Water Mark ( ) Yes (√) No ( ) from top of low member

8) Other There appears to be min. Scour around wingwalls due to runoff from roadway.

Feasibility of Adding Riprap or Other Scour Countermeasures: ( ) Yes (√) No

ABUTMENTS

a. Type: (√) Bridge ( ) Bridge Culvert

( ) Spill-Through (√) Vertical Wall (√) Wing Walls ( ) Sheet Piles

b. Foundation	Dimensions (L,W,D) (ft)	Embedment (ft)	Current Scour Exposure (ft)
( ) Spread Footing			
( ) Pile Cap			
(√) Piles			None
( ) Drilled Shafts			

Source of Data: (√) Field Review ( ) Design Plans
(√) As-built Plans ( ) Pile Driving Records
(√) Inspection Reports ( ) Other

c. Location from Bank (Looking Downstream)	Left (ft)	Right (ft)
( ) Set Back		
( ) At Bank		
(√) In Channel		

d. Protection:

1) Countermeasures ( ) Sand-Cement ( ) Rubble ( ) Commercial Block
(√) None ( ) Grouted ( ) Sheet Piles ( ) Other

2) Condition	Good	Fair	Poor
Left	( )	( )	( )
Right	( )	( )	( )

e. Other:

Reviewers: Paula Coulliette
Jerry Washington

SITE FIELD REVIEW

PIER

a. Type (Typical or Worst Pier):

( ) Concrete Wall (√) Pile Bent ( ) Column

b. Shape: (√) Square ( ) Rounded ( ) Sharp Nose

c. Width: (1) feet Length: ( ) feet Diameter: ( ) feet

d. Foundation (Worst Pier)	Dimensions (L,W,D) (ft)	Embedment (ft)	Scour Exposure (ft)
( ) Spread Footing			
( ) Pile Cap			
(√) Piles			None
( ) Drilled Shafts			

Source of Data:
- (√) Field Review
- (√) As-built Plans
- (√) Inspection Reports
- ( ) Design Plans
- ( ) Pile Driving Records
- ( ) Other

e. Protection:

1) Countermeasures ( ) Sand-Cement ( ) Rubble ( ) Commercial Block
(√) None ( ) Grouted ( ) Sheet Piles ( ) Other

2) Condition ( ) Good ( ) Fair ( ) Poor

CHANNEL LATERAL STABILITY

a. Bends: ( ) None

1) Bridge Location (√) Upstream of Bend (√) Downstream of Bend ( ) In Bend

2) Channel Migration ( ) Yes (√) No

3) Countermeasures ( ) Yes ( ) No Type: Unknown

b. Bank Condition:	Upstream	Downstream
1) Eroding	( )	( )
2) Stable	(√)	(√)
3) Vegetated	(√)	(√)
4) Sheet Piles	( )	( )

5) Countermeasures ( ) Yes (√) No

c. Angle of Attack Flood Flow (0) Normal Flow (0)

d. Point Bar Under Bridge ( ) Yes (√) No

e. Islands or Bars:

1) Upstream ( ) Yes (√) No

2) Downstream ( ) Yes (√) No

f. Other:

Reviewers: Paula Coulliette
Jerry Washington

SITE FIELD REVIEW			
CHANNEL VERTICAL STABILITY			
a. Exposed Footing:	( ) Yes	(√) No	( ) Unknown
b. Exposed Piles	( ) Yes	(√) No	( ) Unknown
c. Contraction Scour (Encroachment)			
1) Overbank Flow: Left	(√) Yes	( ) No	( ) feet
(Looking Downstream) Right	(√) Yes	( ) No	( ) feet
2) Relief Bridge:	( ) Yes	(√) No	
3) Roadway Overtopping (At Structure)	( ) Yes ( ) Unknown	(√) No ( ) Possible	( ) Partial
4) Bridge Overtopping (Low Member)	( ) Yes ( ) Unknown	( ) No (√) Possible	( ) Partial
d. Long Term:			
1) Aggradation	( ) Yes	(√) No	( )Unknown
2) Degradation	( ) Yes	(√) No	( )Unknown
e. Bed Material:			
(√) Sand	( ) Sandy Loam		
( ) Clay	( ) Sandy Clay Loam		
( ) Muck	( ) Clayey Fine Sand		
( ) Shell	( ) Marl		
( ) Coated with Organic Matter	( ) Limestone		
( ) Other			
GEOMORPHOLOGY			
a. Alluvial Fan	( ) Yes	( ) No	
b. Dam or Reservoir	( ) Yes	(√) No	
c. River Form	(√) Straight ( ) Braided	( ) Meandering ( ) Manmade	
d. Instream Mining/Dredging	( ) Yes	(√) No	
e. Headcuts or Nickpoints	( ) Yes	(√) No	
f. Diversions	( ) Yes	(√) No	
g. Channel Straightening	( ) Yes	( ) No **Possible**	
h. Stream Size: (√) Small (<100 feet) ( ) Medium (100-500 feet) ( ) Large (>500)			
i. Flow Characteristics: ( ) Intermittent (√) Perennial ( ) Tidal			
j. Other:			

Reviewers: Paula Coulliette
Jerry Washington

SITE FIELD REVIEW				
OTHER CONSIDERATIONS				
a. Sediment Transport (During High Flow):				
1)	( ) Live Bed Condition	(√) Clear Water Condition		( ) Unknown
2) Armored Bed		( ) Yes	(√) No	( ) Partial
b. Watershed	(√) Agricultural	( ) Forested	(√) Swamp	( ) Urban
c. Tidal Influence	( ) Yes	(√) No	( ) Unknown	( ) Possible
d. Tidal Features	( ) Bay	( ) Estuary	( ) Inlet	( ) Barrier Island
1) Normal Range	( ) feet	( ) Tidal Gage	( ) Tide Table	( ) Field Observation
2) Observed Surface Velocity	(0) ft/sec			
3) Seiching (wind set up)		( ) Yes	(√) No	( ) Possible
4) Distance to coast	( ) miles-shortest distance		( ) miles along thalweg	
5) Traffic:	( ) Ship	( ) Recreation		( ) Commercial
	( ) Barge	(√) Snakes & Alligators		( ) None
e. Tributaries:				
( ) Upstream	( ) Downstream		(√) No Factor	
Distance to confluence of next stream or water body:			( ) upstream	
			( ) feet downstream	
f. Observed Stream Velocity	(0) ft/sec			
g. Estimated Manning's n:		Channel (0.10)	Overbank (0.11)	
ADDITIONAL COMMENTS				
a. Photographs:	(√) Upstream Face		(√) Upstream Channel	
	(√) Downstream Face		(√) Downstream Channel	
	( ) East Abutment		( ) West Abutment	
b. Remarks:				

Reviewers: Paula Coulliette
Jerry Washington

JMI ENGINEERS

Project: ______________________ Page No. : ____ of ____

Designed by : ______________ Date : ______________

Job No. : ______________________ Checked by ______________ Note No. ______________

195+68.199 Elev. 41.81 feet

Inst. height = 5.55'

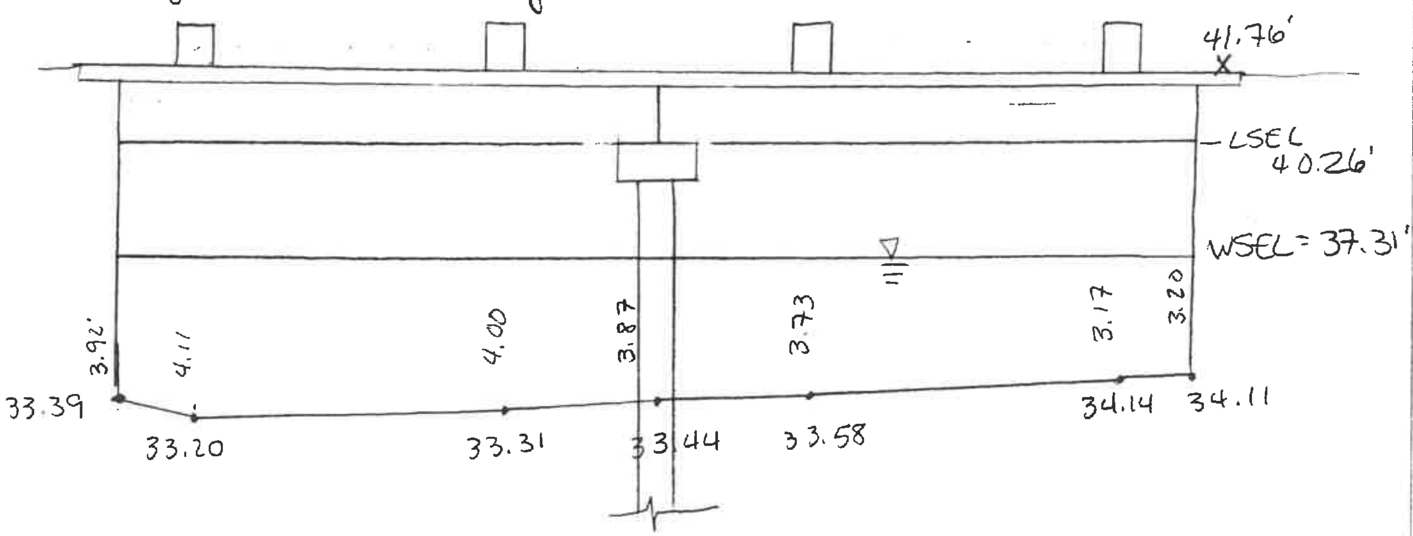
Measured height = 5.[illegible] TOP OF CURB
SE Corner of Bridge

X TOP OF CURB, Elev. 41.76'

Depth of Structure = 1.45'

LSEL = 40.31' (Comparison Only)

Length of Opening = 28', Depth to WS = 4.45', WSEL = 37.31'



Area ≈ 105 ft^2 @ WSEL 37.31'

Assume V = 0.113 ft/sec | V = 1 ft/sec

Q = 11.865 cfs | Q = 105 cfs

JMI ENGINEERS

Project:

Job No.:

Page No.: of

Designed by: Date:

Checked by: Note No.:

WSEL = ~~37.88 feet~~ 11.547 m Date: 11/21/95

Alex Goterez (from field book)

Genesis Group

Appendix B

Hydrology

Discharge Calculations

The FDOT Drainage Manual, Vol.1, Ch.4.7.1 states that a frequency analysis of observed (gage) data shall be used when available. If this information is unavailable, regional or local regression equations, the rational equation or Talbot's Equation is to be used to determine the freshwater flow conditions.

The USGS and FHWA have developed regional regression equations for the area of Bridge No. 050031. These equations are found in Vol. 2, Chapter 5 of the Drainage Manual. Both equations were used and the results were compared. The USGS equations are preferred because they are based on more specific data.

USGS Regression Equations for Region A were used for this analysis of Turkey Branch. These equations provide conservative, yet comparable discharge rates.

The FHWA equations are shown for comparison purposes only.

The following assumptions were made to evaluate the variables required by the regression equations:

1. The drainage area is 2,240 acres or 3.50 square miles.
2. The slope of the main channel is 0.0004 feet per foot (2.25 feet per mile) and was determined from the USGS Quadrangle Map.
3. The percentage of lake or storage area in the basin has been estimated at 24.9 acres or 1.11 % of the total drainage area. This is based on the enclosed depressional areas on the USGS Quadrangle Map. It was assumed that during a flood event, these areas plus 10% will act as lake areas. (See Memorandum of Meeting, February 29, 1996, Appendix G).

RegionA

USGS Regression Equations

Peak Runoff Equation	CFS	% error	Adjusted	CMM	CFSM
Q_2 = 93.4*(DA)^0.756*(SL)^0.268*(LK+3)^-0.803 =	**96**	42.6	**55**	94	6.8
Q_{10} = 274*(DA)^0.708*(SL)^0.248*(LK+3)^-0.738 =	**287**	44.2	**160**	272	19.8
Q_{25} = 395*(DA)^0.696*(SL)^0.240*(LK+3)^-0.717 =	**417**	47.3	**220**	373	27.2
Q_{50} = 496*(DA)^0.69*(SL)^0.234*(LK+3)^-0.705 =	**525**	50.0	**263**	446	32.5
Q_{100} = 609*(DA)^0.685*(SL)^0.227*(LK+3)^-0.695 =	**647**	52.9	**305**	517	37.7
Q_{500} = 985*(DA)^0.668*(SL)^0.196*(LK+3)^-0.687 =	**1010**	59.7	**407**	691	50.4

Q_t	= Peak runoff rate for return period of t-years, in cfs.	
DA	= Drainage area, in sq. mi.	3.50
SL	= Channel slope, in ft/mile	2.25
LK	= Lake area, in percent of total	1.11

Basin Characteristics	Range of Applicability
Drainage Area	1,170 acres to 3,066 miles^2
Slope	0.15 to 0.24 ft/miles
Lake Area	0 to 28.16%

Reference: FDOT Drainage Manual, Table 5-12

Note: Wetland storage area, 529 acres, has been subtracted from the total drainage area. Drainage manual, 5.8.2.

Zone 1

FHWA Regression Equations

Peak Runoff Equations	CFS	CMM	CFSM
Q_{10} = 0.0214*(A^0.44)*(R^1.164)*(DH^0.785)	**297**	505	36.8
Q_2 = 0.41*Q_{10}=	**122**	207	15.1
Q_{50} = 1.46*(Q_{10}^1.023)=	**495**	840	61.2
Q_{100} = 1.64*(Q_{10}^1.029)=	**575**	977	71.2

Q_t =	Peak runoff rate for t-year flood, in cfs	
A =	Drainage Area, in miles^2	3.5
R =	Iso-erodent factor, from Figure 17-1	400
DH =	Difference in elevation from the most distance point in the watershed to the design point, in ft.	13

Limitation: Drainage Area should be less than 50 square miles.

Reference: FDOT Drainage Manual, Table 5-15

JMI ENGINEERS	Project: SR29-050031 Turkey Branch Job No. 9523-01	Page No. ____ of ____ Designed by: PNC Date: 3/96 Checked by: ______ Note No. ______

Drainage Area = 2,240 acres (measured from Quad map)
97,574,400 ft²

3.50 mi²

Lake Area = Lake area + (depressional areas)1.1
(See Memorandum of Meeting 2/29/96)

Lake Area = 161,215 ft²
+ 72,850 ft²
234,065 ft²

Depressional Area = (769,767 ft²)1.1
= 846,746 ft²

Total LK:

$$\frac{(234,065 + 846,746)\ ft^2}{90,082,080\ ft^2} = \frac{1,080,811\ ft^2}{97,574,400\ ft^2}$$

= 0.0111

1.11 %

JMI ENGINEERS	Project: SR29	Page No.: of
	050031	Designed by: Date:
	Job No.: 7523	Checked by: Note No.:

Turkey Branch

Length of Creek =

$$18.75\text{ in} \times 24{,}000 \times \frac{\text{ft}}{12\text{ in}} = 37{,}500\text{ ft}$$

$$37{,}500\text{ ft} \times \frac{\text{mi}}{5280\text{ ft}} = 7.10\text{ mile}$$

10% Channel Length = 3,750 ft El. 30 ft

85% Channel Length = 31,875 ft El. 42 ft

Slope between 10-85% of Channel:

$$\frac{42-30}{31875-3750} = 0.00043\text{ ft/ft}$$

$$= 2.25\text{ ft/mile}$$

Slope between contour extremes:

$$\frac{45-30}{35{,}000} = 0.00043\text{ ft/ft}$$

Table 5-12
USGS REGRESSION EQUATIONS FOR
NATURAL FLOW CONDITIONS IN FLORIDA:
REGION A

Peak Runoff Equation	R^2	Standard Error in %
$Q_2 = 93.4\ DA^{0.756}\ SL^{0.268}\ (LK + 3)^{-0.803}$	0.868	42.6
$Q_5 = 192\ DA^{0.722}\ SL^{0.255}\ (LK + 3)^{-0.759}$	0.858	42.4
$Q_{10} = 274\ DA^{0.708}\ SL^{0.248}\ (LK + 3)^{-0.738}$	0.843	44.2
$Q_{25} = 395\ DA^{0.696}\ SL^{0.240}\ (LK + 3)^{-0.717}$	0.821	47.3
$Q_{50} = 496\ DA^{0.690}\ SL^{0.234}\ (LK + 3)^{-0.705}$	0.803	50.0
$Q_{100} = 609\ DA^{0.685}\ SL^{0.227}\ (LK + 3)^{-0.695}$	0.784	52.9
$Q_{200} = 779\ DA^{0.674}\ SL^{0.205}\ (LK + 3)^{-0.694}$	0.763	55.8
$Q_{500} = 985\ DA^{0.668}\ SL^{0.196}\ (LK + 3)^{-0.687}$	0.738	59.7

Q_T = Peak runoff rate for return period of T-years, in cfs

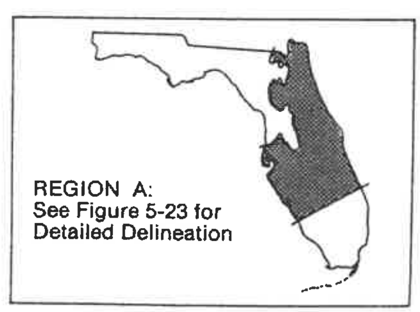
DA = Drainage area, in miles²

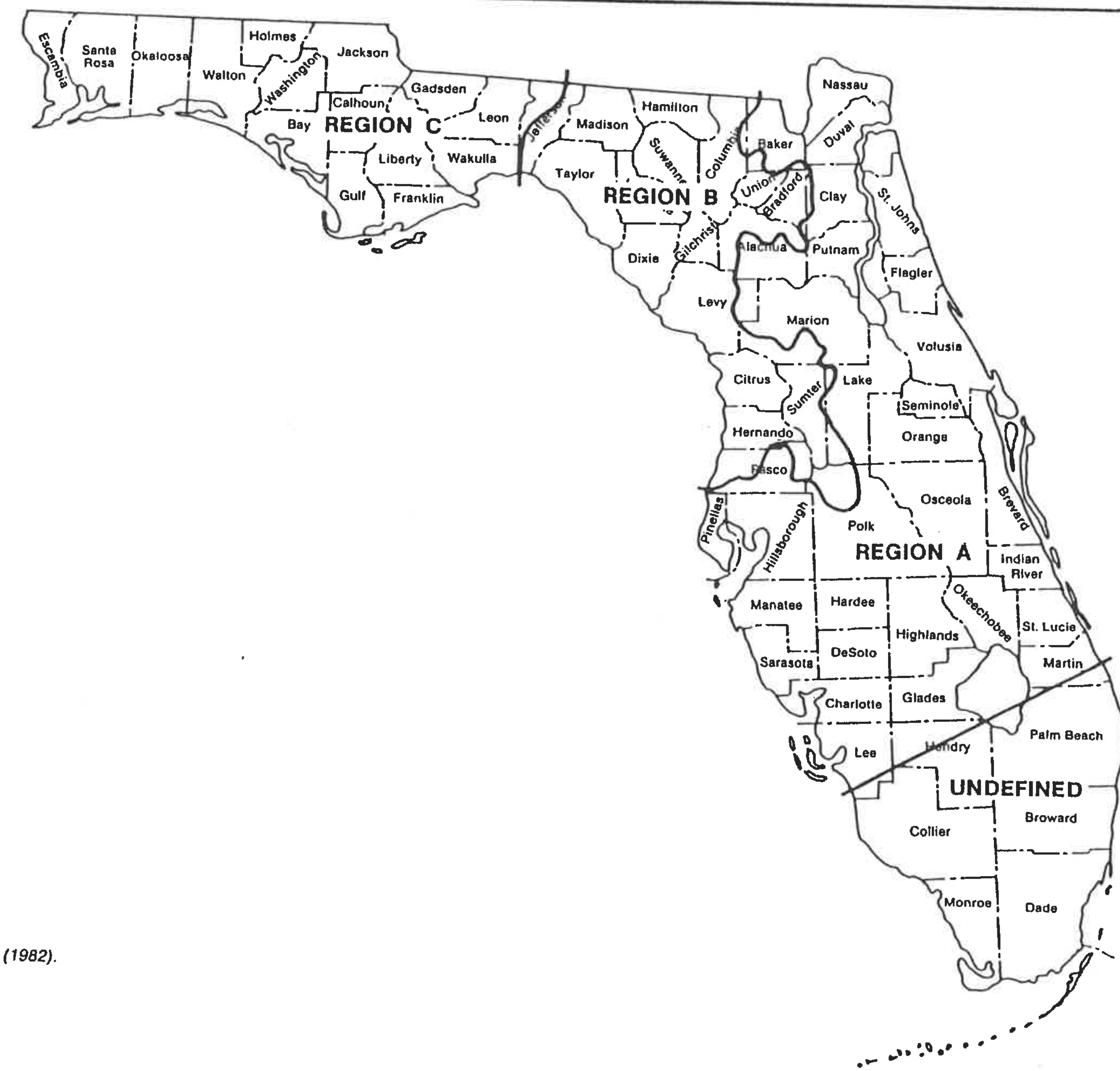
SL = Channel slope between points at 10 and 85 percent of total channel length, in ft/mile (minimum = 0.9)

LK = Lake area, in percent of total

Basin Characteristic	Range of Applicability
Drainage area	1,170 acres to 3,066 miles²
Slope	0.15 to 24.2 ft/miles
Lake area	0 to 28.16 %

Reference: Bridges (1982).





Reference: Bridges (1982).

FIGURE 5-23
Regions for USGS Regression Equations for Natural Flow Conditions

Table 5-15
FHWA REGRESSION EQUATIONS FOR
NATURAL FLOW CONDITIONS IN FLORIDA

Zone	Equation
1	$Q_{10} = 0.0214\ A^{0.440}\ R^{1.164}\ DH^{0.785}$
2	$Q_{10} = 11.890\ A^{0.573}\ R^{0.443}\ DH^{0.295}$

Q_{10} = Peak runoff rate for 10-year flood, in cfs

A = Drainage area, in miles^2

R = Iso-erodent factor, from Figure 17-1

DH = Difference in elevation from the most distant point in the watershed to the design point, in ft

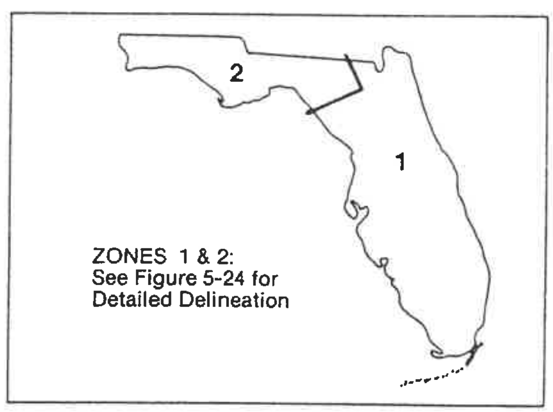
$Q_2 = 0.41\ Q_{10}$ = 2-year peak runoff rate, in cfs

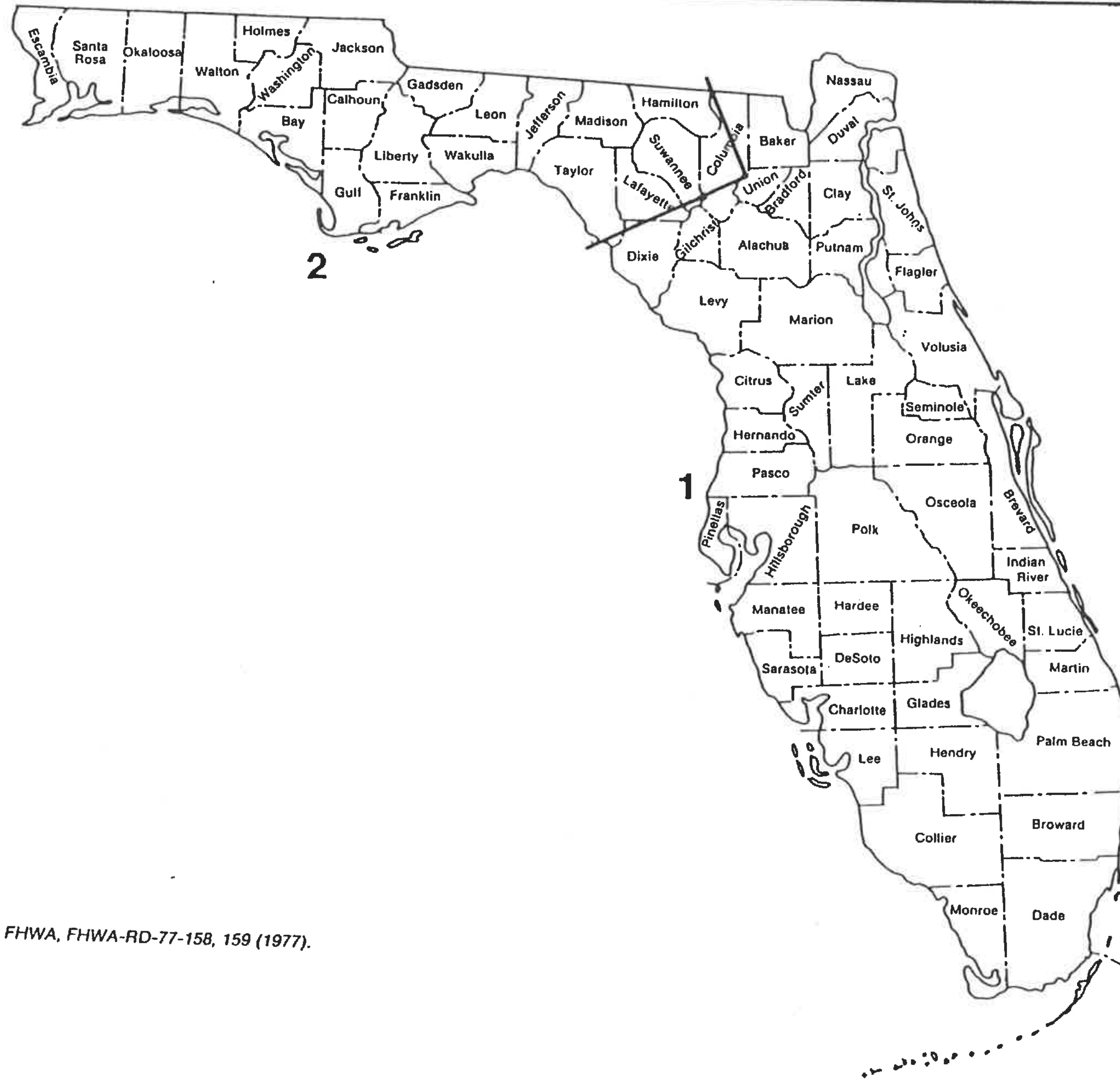
$Q_{50} = 1.46\ Q_{10}^{1.023}$ = 50-year peak runoff rate, in cfs

$Q_{100} = 1.64\ Q_{10}^{1.029}$ = 100-year peak runoff rate, in cfs

Limitation: Drainage area (A) should be less than 50 square miles.

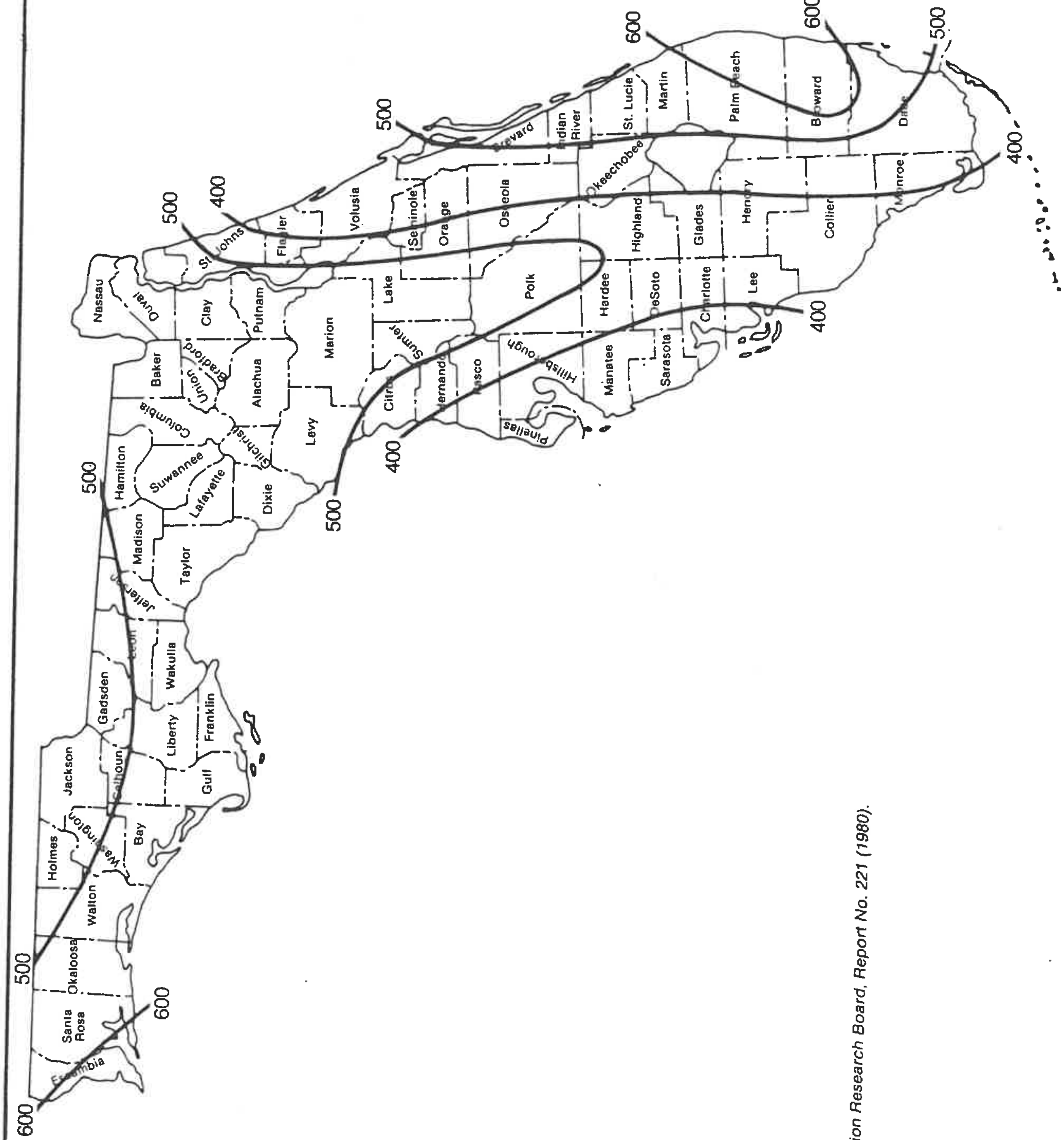
Reference: USDOT, FHWA, FHWA-RD-77-158,159 (1977).





Reference: USDOT, FHWA, FHWA-RD-77-158, 159 (1977).

FIGURE 5-24
Zones for FHWA Regression Equations for Natural Flow Conditions



Reference: Transportation Research Board, Report No. 221 (1980).

FIGURE 17-1
USLE Rainfall Factor (R) Values for Florida

SFWMD, Permit Application Manual, Vol. IV
Appendix 2

Appendix 2 have received this treatment since publication of earlier versions of Appendix 2.

The new values in Appendix 2 come from many sources, some as described above, a few from basin studies, and others from estimates by the District, local governments, permit applicants, etc. The best available sources were used, but new studies were not conducted.

The end result of the above is a series of values which generally ignore basin size. They range from less than one half inch per day to as much as 12 inches per day. These of course range from a large flat basin to a steeper basin. It is unlikely that there is really that much disparity in south Florida waterways or the discharges to them. It is also likely that the smaller basins should have higher unit area discharges. Therefore, Appendix 2 should be used as follows:

Case 1: If the immediate receiving water is a natural stream, overland sheetflow area, secondary or tertiary man made ditch, swale or other conveyance with undefined capacity; then the post-development instantaneous peak discharge rate should equal the pre-development rate for the appropate design storm event such that new adverse water quantity impacts are not created.

Case 2: If the immediate receiving water is a primary waterway with allowable discharge capacity listed in Appendix 2, then the allowable instantaneous peak discharge rate is the lesser of either the listed value or the value calculated by using the appropriate formula below:

For a 25 year/3 day design storm: $Q = 53A^{0.64}$

For a 25 year/1 day design storm: $Q = 46A^{0.64}$

For a 10 year/3 day design storm: $Q = 30A^{0.64}$

where: Q = allowable discharge (cubic feet/second)

A = contributing area (square miles)

Note: These two cases do not apply to the C-51 Basin. Use the subbasin discharge coefficients for that basin.

The above formulas were derived from the experience gained in many years of issuing permits and reviewing applicants submissions. They generally fit an average basin with an SCS curve number of 65. If an applicant believes either the formula or the listed value are inappropriate, the District will consider other submitted information. It is acknowledged that such conditions as; downstream flow attenuation areas, steep slopes, reduced soil storage and other such factors may make pre-development/post-development values more appropriate. The important factors are:

1) That waterway capacity not be unused,
2) That new adverse impacts are not created,
3) That historic drainage rights are preserved and,
4) Recognition is given to contributing drainage area size when possible.

ORANGE RIVER (Lee County)

The allowable discharge rate is 55 CSM. This value is from the Lee County Surface Water Management Plan (December 1992). The design storm is a 25 year event. See Figure 105.

MULLOCK CREEK (Lee County)

The allowable discharge rate is 69 CSM. This value is from the Lee County Surface Water Management Plan (December 1992). The design storm is a 25 year event. See Figure 105.

ESTERO RIVER (Lee County)

The allowable discharge rate is 42 CSM. This value is from the Lee County Surface Water Management Plan (December 1992). The design storm is a 25 year event. See Figure 105.

HALFWAY CREEK (Lee County)

The allowable discharge rate is 60 CSM. This value is from the Lee County Surface Water Management Plan (December 1992). The design storm is a 25 year event. See Figure 105.

SPRING CREEK (Lee County)

The allowable discharge rate is 81 CSM. This value is from the Lee County Surface Water Management Plan (December 1992). The design storm is a 25 year event. See Figure 105.

C-19 BASIN (Glades County)

The allowable discharge for this conveyance is 57.8 CSM. The design storm is a 25 year event. See Figure 106.

CALOOSAHATCHEE RIVER (Glades, Hendry and Lee Counties)

The allowable discharge rate is 30.1 CSM for areas within this basin that are not discussed someplace else within this appendix. This rate is based upon Corps of Engineers design criteria. The design storm is a 25 year event. See Figure 124.

IMPERIAL RIVER (Lee County)

The allowable discharge rate is 59 CSM for areas west of Bonita Grande Drive. Areas east of Bonita Grande Drive are allowed 25 CSM. These values are from the Lee County Surface Water Management Plan (June 1991). The design storm is a 25 year event. See Figures 105 and 108.

TEN MILE CANAL (Lee County)

The allowable discharge rate for the majority of the basin is 64 CSM. This rate is based on the Needles report. Approximately 2,033 acres of this basin drains through the Harper Bothers Farm (SWM Permit #36-00736-S). The allowable discharge, for this area, has been determined, by previous permit action, to be 43 CSM. The design storm is a 25 year event. See Figures 105, 107 and 109.

HENDRY CREEK (Lee County)

The allowable discharge rate is 102 CSM upstream of the Lakes Park weir. Other areas within the basin should be allowed 131 CSM. These values are from the Lee County SurfaceWater Management Plan (June 1991). The design storm is a 25 year event. See Figures 105 and 110.

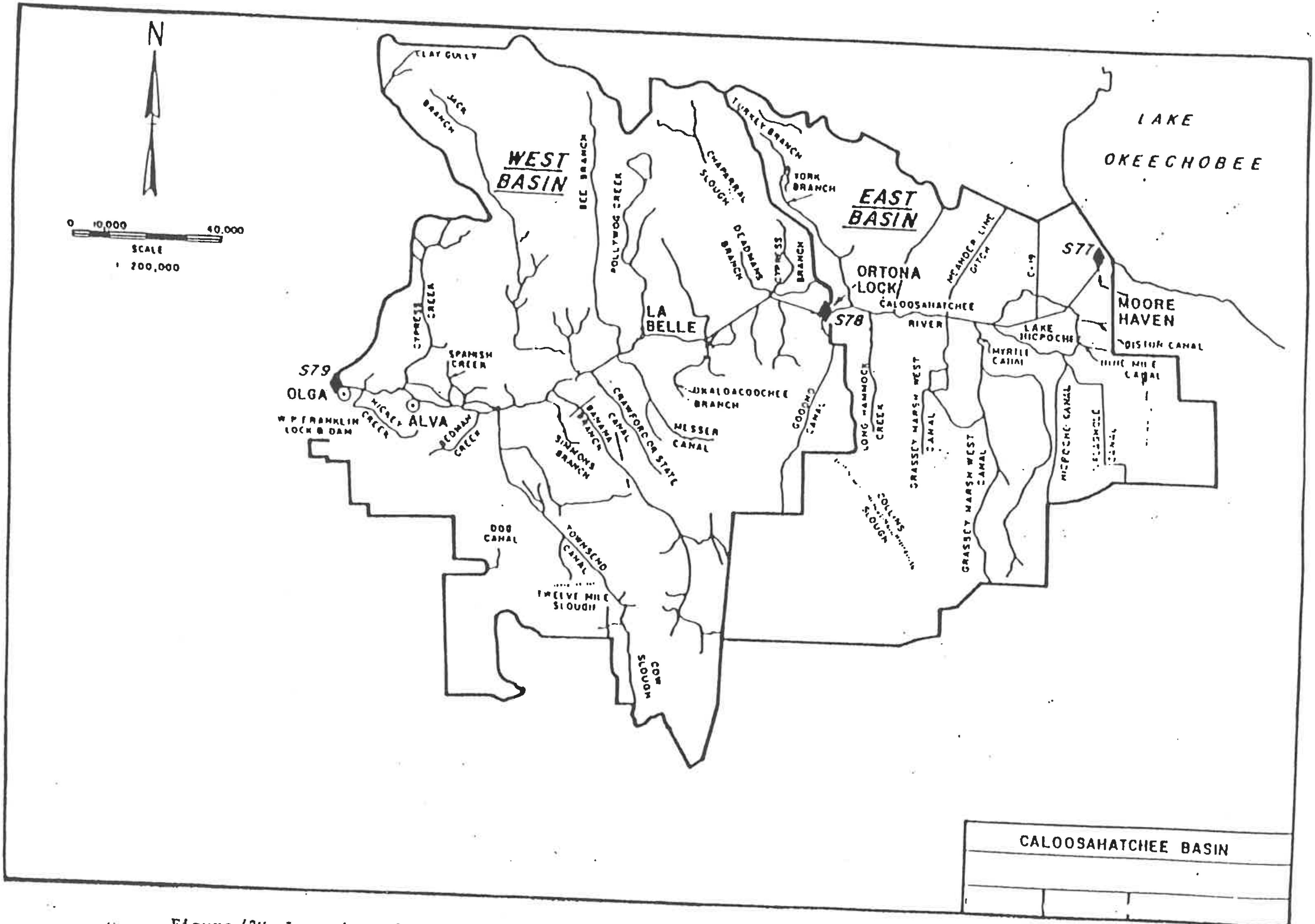


Figure /24 Location of Caloosahatchee Basin ...

United States Department of the Interior

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION
224 West Central Parkway, Suite 1006
Altamonte Springs, Florida 32714
(407) 865-7575

DATE: 2-22-96

TO: Paula Coulliette

FROM: Howard George

SPECIAL NOTE:

SUBJECT: Fisheating Creek 02256500

No. of Pages ~~4~~ 5
(including this page)
If all pages not received, please call: 407-865-7575

Sent by: Sandy

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ORLANDO 02/22/96

STATION NUMBER 02256500 FISHEATING CREEK AT PALMDALE, FLA. STREAM SOURCE AGENCY USGS
LATITUDE 265556 LONGITUDE 0811854 DRAINAGE AREA 311.00 DATUM 27.19 STATE 12 COUNTY 043
PROVISIONAL DATA SUBJECT TO REVISION

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1994 TO SEPTEMBER 1995
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1960	130	116	379	154	312	189	25	5.2	---	---	---
2	1760	132	103	337	143	264	177	23	5.2	---	---	---
3	1590	137	99	298	130	223	152	21	6.2	---	---	---
4	1430	140	91	264	124	188	132	20	6.6	---	---	---
5	1290	143	89	237	120	159	115	25	11	---	---	---
6	1170	143	93	208	113	137	135	36	24	---	---	---
7	1060	137	98	196	104	118	194	37	33	---	---	---
8	966	124	104	207	97	116	244	32	31	---	---	---
9	877	109	108	194	89	147	268	29	27	---	---	---
10	796	95	108	181	81	148	275	31	23	---	---	---
11	728	86	110	168	75	143	318	33	20	---	---	---
12	718	76	124	156	71	133	348	32	17	---	---	---
13	846	69	128	152	70	123	331	28	23	---	---	---
14	900	65	129	202	86	121	292	24	---	---	---	---
15	840	74	123	297	106	120	246	20	---	---	---	---
16	716	152	115	310	118	116	205	18	---	---	---	---
17	588	170	108	308	120	119	166	16	---	---	---	---
18	495	173	101	298	122	176	134	14	---	---	---	---
	431	187	94	332	146	391	105	12	---	---	---	---
	381	255	86	397	225	556	84	11	---	---	---	---
21	340	380	164	405	320	797	70	11	---	---	---	---
	300	410	285	380	325	970	60	9.8	---	---	---	---
	262	379	357	349	301	901	51	9.9	---	---	---	---
24	229	335	419	315	279	755	42	10	---	---	---	---
25	199	290	549	281	317	625	36	9.7	---	---	---	---
26	172	250	655	251	378	522	33	9.1	---	---	---	---
27	155	215	644	222	375	439	30	8.4	---	---	---	---
	145	186	595	195	343	372	29	7.5	---	---	---	---
	131	161	537	174	---	315	30	6.7	---	---	---	---
30	124	138	479	171	---	262	28	6.0	---	---	---	---
31	135	---	426	166	---	216	---	5.6	---	---	---	---
TOTAL	21734	5341	7237	8030	4932	9984	4519	580.7	---	---	---	---
MEAN	701	178	233	259	176	322	151	18.7	---	---	---	---
MAX	1960	410	655	405	378	970	348	37	---	---	---	---
MIN	124	65	86	152	70	116	28	5.6	---	---	---	---
CFSM	2.25	.57	.75	.83	.57	1.04	.48	.06	---	---	---	---
IN.	2.60	.64	.87	.96	.59	1.19	.54	.07	---	---	---	---

CAL YR 1994 TOTAL 114558.4 MEAN 314 MAX 2650 MIN 2.7 CFSM 1.01 IN. 13.70

Period of Record

Table 6.--A comparison of station, regional, and weighted T-year flood estimates--Continued

[Discharge-frequency relationships for each gaging station are presented as follows: Top line--log-Pearson Type III analysis; Middle line--regression equations; Bottom line--weighted or best estimate of T-year flood]

Map No.	Station number and name	Years of record: Systematic	Years of record: Historic	Drainage area mi²	Slope ft/mi	Lake area in percent	2	5	10	25	50	100	200	500
	Region A													
50	2256500 Fisheating Creek at Palmdale	47	--	311	1.33	0.15	3,290	6,740	9,730	14,300	18,300	22,800	27,800	35,400
							3,080	5,450	7,340	10,100	12,400	14,900	17,800	21,900
							3,270	6,600	9,420	13,700	17,400	21,400	26,100	32,800
51	2261500 Myrtle-Mary Jane Canal near Narcoossee	17	--	111	.29	28.16	267	534	760	1,100	1,400	1,730	2,090	2,640
							202	412	592	868	1,100	1,370	1,680	2,110
							253	503	712	1,030	1,300	1,600	1,950	2,440
52	2262900 Boggy Creek near Taft	19	--	83.6	2.04	8.79	453	969	1,430	2,150	2,800	3,530	4,360	5,630
							443	865	1,220	1,740	2,180	2,670	3,210	4,000
							451	946	1,380	2,030	2,620	3,250	3,980	5,040
53	2263500 St. Cloud Canal at S-59 near St. Cloud	18	--	308	.31	22.78	456	1,070	1,660	2,640	3,540	4,600	5,830	7,760
							508	994	1,400	2,020	2,550	3,150	3,800	4,760
							465	1,050	1,590	2,450	3,230	4,090	5,110	6,590
54	2263800 Shingle Creek at Airport, near Kissimmee	20	--	89.2	1.78	6.72	511	980	1,370	1,940	2,430	2,970	3,570	4,430
							523	1,010	1,420	2,020	2,530	3,100	3,730	4,640
							513	986	1,380	1,960	2,460	3,010	3,620	4,490
55	2264000 Cypress Creek at Vineland	33	--	30.3	.41	27.55	30	87	149	261	372	509	675	946
							77	164	240	356	457	571	708	899
							33	95	160	276	386	521	681	936
56	2265000 South Port Canal at S-61 near St. Cloud	16	--	620	.29	19.42	789	2,260	3,870	6,830	9,810	13,500	18,200	25,800
							965	1,830	2,550	3,640	4,560	5,600	6,710	8,350
							821	2,150	3,450	5,640	7,770	10,100	13,100	17,200
57	2266300 Reedy Creek near Vineland	17	19	75	3.60	9.92	355	662	913	1,280	1,590	1,920	2,290	2,830
							441	862	1,210	1,730	2,170	2,650	3,150	3,900
							370	703	983	1,400	1,740	2,130	2,540	3,160

takes into account gage + Reg. based on years of gage data

best answer

check ranges

take log Pearson / D.a = cfsm for Q_T

100 year/62 year good data!

(6)

STATION 02256500 FISHEATING CREEK AT PALMDALE, FLA.

62 years

AGENCY: USGS
STATE: 12
COUNTY: 043
DISTRICT: 12

STATION LOCATOR
LAT. LONG.
265556 0811854

DRAINAGE AREA: 311.00 SQ MI
CONTRIBUTING
DRAINAGE AREA: SQ MI
GAGE DATUM: 27.19 (NGVD)
BASE DISCHARGE: 1500.00 CFS

WATER YEAR	DATE	PEAK DISCHARGE (CFS)	DISCHARGE CODES	GAGE HEIGHT (FT)	GAGE HT CODES	HIGHEST SINCE	MAX GAGE HEIGHT (FT)	DATE	GAGE HT CODES	NUMBER OF PARTIAL PEAKS
1932	09/13/32	5570.00 - 5		8.26						0
1933	09/06/33	6460.00		8.60						0
1934	08/09/34	920.00					6.30	09/22/34 (33.49)		0
1935	09/07/35	1480.00		6.42						0
1936	06/16/36	5800.00 - 5		8.10						0
1937	07/01/37	3010.00		6.98						0
1938	08/01/38	1730.00		6.30						0
1939	10/17/38	3230.00		7.14						0
1940	09/12/40	3090.00		6.92						0
1941	04/10/41	2790.00					6.85	07/15/41 (34.04)		0
1942	02/26/42	3260.00		7.04						0
1943	09/15/43	2240.00		6.74						0
1944	10/05/43	3620.00		7.30						0
1945	09/17/45	8980.00 - 20		9.18						0
1946	10/13/45	2500.00		6.62						0
1947	09/19/47	16400.00 - 100-200		11.06						0
1948	09/24/48	14500.00 - 100		10.52						0
1949	08/29/49	5300.00		7.86						0
1950	10/01/49	4500.00		7.60						0
1951	09/05/51	1430.00		6.42						0
1952	10/03/51	31400.00 - 500+		12.44						0
1953	08/30/53	6200.00					7.77	10/21/52 (34.96)		0
1954	10/10/53	7520.00 - 10		8.53						0
1955	08/01/55	644.00		6.07						0
1956	09/09/56	258.00		5.11						0
1957	08/25/57	3800.00 - 2+		6.70						0
1958	08/13/58	3230.00 - 2+		6.48						0
1959	05/20/59	6220.00		7.16						0
1960	09/13/60	7250.00 - 10		8.19						0
1961	10/11/60	2350.00		6.70						0
1962	09/23/62	6420.00		7.39						0
1963	09/24/63	1680.00		5.87						0
1964	09/15/64	3870.00 - 2+		6.76						0
1965	09/02/65	1600.00		5.84						0
1966	10/03/65	3470.00		6.66						0
1967	10/04/66	1520.00		5.76						0
1968	06/11/68	3650.00		6.74						0
1969	06/22/69	2100.00		6.05						0
1970	03/27/70	7460.00 - 10		7.79						0
1971	09/17/71	2440.00		6.20						0
1972	06/22/72	2630.00		6.28						0
1973	08/09/73	1700.00		5.86						0
1974	07/03/74	8390.00 - 20		8.02						0
1975	08/24/75	1260.00		5.88						0
1976	08/02/76	3910.00		6.77						0
1977	09/10/77	1010.00		5.32						0

Fishcreek Cr

1978	08/25/78	1910.00	5.96			
1979	09/17/79	4270.00	7.49			0
1980	09/10/80	290.00	4.78	7.60	09/06/79	0
1981	09/13/81	830.00	5.80			0
1982	06/26/82	7040.00 - 10	7.83			0
1983	02/15/83	3650.00	6.59			0
1984	03/15/84	6870.00 - 8	7.78			0
	07/07/84	2390.00	6.29			0
	07/24/84	5820.00	7.50			2
1985	09/06/85	1500.00	6.05			
1986	09/12/86	3680.00	6.84			0
	07/02/86	1870.00	6.14			1
1987	09/17/87	700.00	5.44			
1988	10/15/87	3230.00	7.28			0
1989	08/19/89	1100.00	5.92			0
1990	08/18/90	1950.00	6.61			0
	08/09/90	1520.00	6.30			1
1991	08/07/91	1530.00	6.12			
1992	06/29/92	4670.00	7.82			0
1993	09/10/93	1200.00	6.02			0
1994	09/23/94	2690.00	7.15			0
	10/21/93	1600.00	6.36			1

68

Manning's N Value's for Cow Log Branch using Cowen's equation

$$n = (n_0 + n_1 + n_2 + n_3 + n_4)\, m_5$$

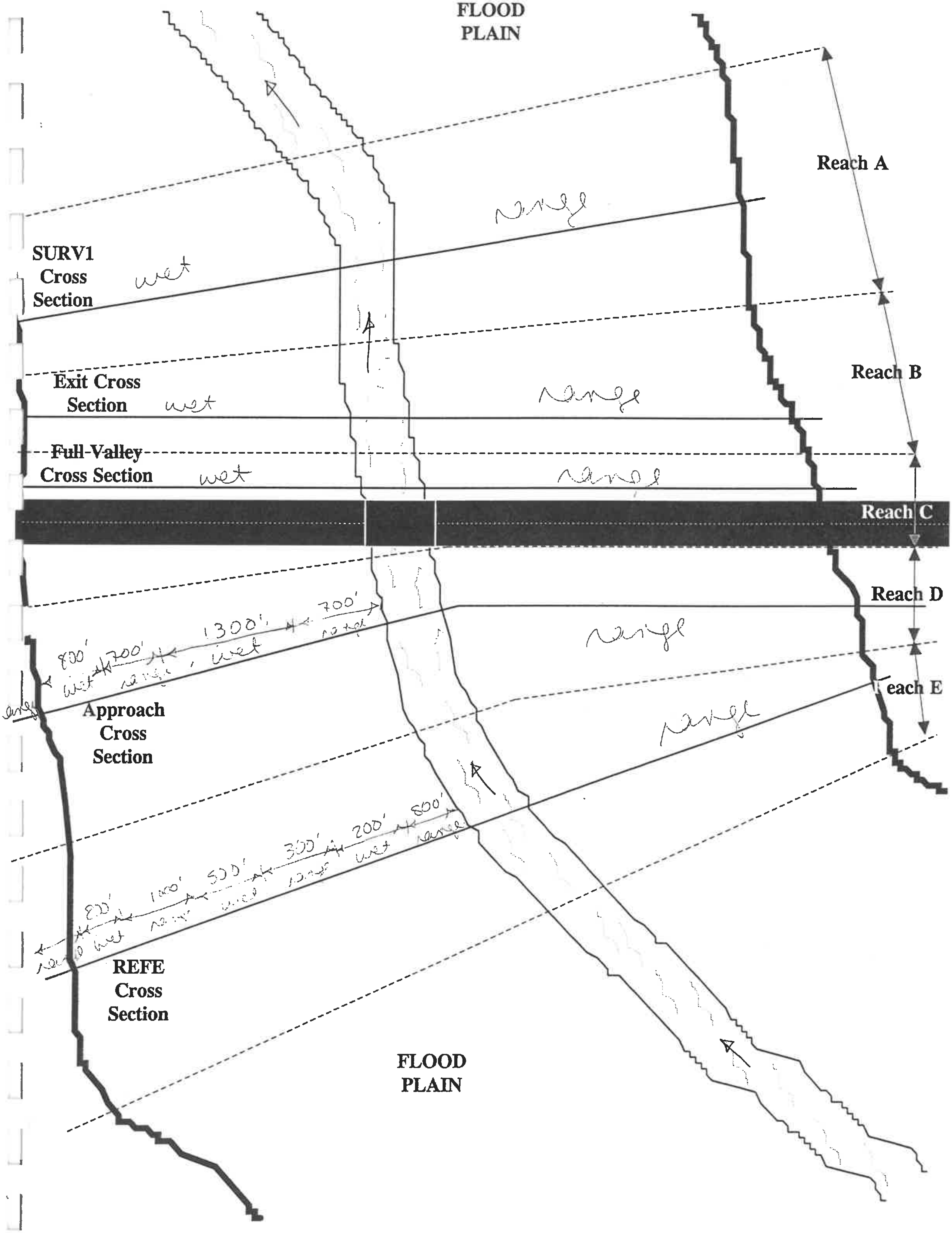
Material Involved	n_0	Main Channel	Flood Plain Marsh Area	Flood Plain Pasture Area
Earth	0.020			
Rock Cut	0.025			
Fine Gravel	0.024			
Coarse Gravel	0.028			
	Enter value:	0.012	0.012	0.02
Degree of Irregularity	n_1			
Smooth	0.000			
Minor	0.001 - 0.005			
Moderate	0.006 - 0.010			
Severe	0.011 - 0.020			
	Enter value:	0.005	0.01	0.001
Variations of Channel Cross Section	n_2			
Gradual	0.000			
Alternating Occasionally	0.001 - 0.005			
Alternating Frequently	0.010 - 0.015			
	Enter value:	0.005	0	0
Relative Effect of Obstructions	n_3			
Negligible	0.000 - 0.004			
Minor	0.005 - 0.015			
Appreciable	0.020 - 0.030			
Severe	0.040 - 0.050			
	Enter value:	0.004	0.004	0.005
Vegetation	n_4			
Low	0.002-0.010			
Medium	0.010-0.025			
High	0.025-0.050			
Very High	0.050-0.100			
	Enter value:	0.05	0.05	0.011
Degree of Meandering	m_5			
Minor	1.000			
Appreciable	1.150			
Severe	1.300			
	Enter value:	1	1	1
	n =	0.08	0.08	0.04

Table 7-5
COEFFICIENTS FOR COMPUTING MANNING'S n VALUES
FOR NATURAL OR EXCAVATED CHANNELS USING COWAN'S EQUATION[a]

Channel Conditions			Values[b]
Material Involved	Earth	n_0	0.020
	Rock Cut		0.025
	Fine Gravel		0.024
	Coarse Gravel		0.028
Degree of Irregularity	Smooth	n_1	0.000
	Minor		0.005
	Moderate		0.010
	Severe		0.020
Variations of Channel Cross Section	Gradual	n_2	0.000
	Alternating Occasionally		0.005
	Alternating Frequently		0.010-0.015
Relative Effect of Obstructions	Negligible	n_3	0.000
	Minor		0.010-0.015
	Appreciable		0.020-0.030
	Severe		0.040-0.060
Vegetation	Low	n_4	0.005-0.010
	Medium		0.010-0.025
	High		0.025-0.050
	Very High		0.050-0.100
Degree of Meandering	Minor	m_5	1.000
	Appreciable		1.150
	Severe		1.300

[a] Cowan's equation is presented as Equation 7-2.

[b] From Chow (1959), Table 5-5, page 109.



FLOOD PLAIN
Reach A
SURV1 Cross Section
Reach B
Exit Cross Section
Full-Valley Cross Section
Reach C
Reach D
Approach Cross Section
Reach E
REFE Cross Section
FLOOD PLAIN

JMI ENGINEERS	Project: SR29 050031 Job No.: 9523	Page No. ___ of ___ Designed by: ___ Date: 2/96 Checked by: ___ Note No.: ___

Range = 0.06

Wetlands = 0.08

Composite N-value

APPR $\frac{(1100)(0.08) + (2785)(0.06)}{3885} = 0.07$

REFE $\frac{(1500)(0.08) + (2382)(0.06)}{3882} = 0.07$

SOIL SURVEY OF GLADES COUNTY, FLORIDA — SHEET NUMBER 29

16 FLORIDANA FINE SAND, DEPRESSIONAL

This soil is nearly level and very poorly drained. It is in wet depressions. This soil is ponded or much of the year. Floridana soils range from 3 to 40 acres in size. Slopes are less than 2 percent.

Typically the upper part of the surface layer is black muck about 4 inches thick. The lower part of the surface layer is black fine sand to a depth of 19 inches. The subsurface layer is light brownish gray fine sand to a depth of 25 inches. The subsoil layer is gray fine sandy loam to a depth of 45 inches. The substratum is gray fine sand and extends to 80 inches.

17 OKEELANTA MUCK

This soil is nearly level and very poorly drained. It is in depressions, marshes, and swampy areas. Large areas of this soil have been drained for the production of sugarcane. Areas of Okeelanta soil range from 10 to 100 acres in size. Slopes are generally less than one percent.

Typically, the okeelanta soils have a surface layer of black muck inches thick. Below this is very dark gray mucky fine sand to a depth of 50 inches, then grayish brown fine sand to a depth of 80 inches or more.

19 TERRA CEIA MUCK

This soil is nearly level and very poorly drained. It is in marsh and swampy areas. Areas of Terra Ceia soil range from 25 to 300 acres in size. Slopes are generally less than one percent.

Typically the organic layer is black muck to a depth of 80 inches. Included with this soil in mapping are small areas of Lauderhill, Okeelanta, and Pahokee soils. The substratum of the included soils and below 52 inches in the Terra Ceia soils occasionally consist of a mixture of shell fragments, limestone, sand, and clay materials. The percentage of these included soils range from 0-22 percent of the mapped areas in 80 percent of the areas mapped Terra Ceia. In the remaining 20 percent the included soils might be more or less than the range given.

FLORIDA **DEPARTMENT OF TRANSPORTATION**

LAWTON CHILES
GOVERNOR

BEN G. WATTS
SECRETARY

RECEIVED
DEC 29 1995
GENESIS GROUP, INC.

DATE: December 28, 1995

TO: John Previte, Project Manager

FROM: Brian W. Jory, P.E., Asst. District Geotechnical Engineer
By: Michael A. Enot

COPIES TO: Art deLaski/Genesis, Ruben Ohanian/Genesis, File

SUBJECT: Budget Item Number: 1110874
State Job Number: 05090-1511
County: Glades
Description: SR 29 at Bridge No. 050031, 050032, 050035 And 050941

RE: Particle Size Distribution Curves and Environmental Classification

---

In response to your request dated November 13, 1995, we have performed two (2) Standard Penetration Tests (SPT) , obtained a water sample of the surface water and a grab sample of the existing soil at each corresponding bridge location. Based on our preliminary investigation, we have developed grain size curves representative of the upper material in the existing waterway and provided an environmental classification for each corresponding bridge location. A summary of our results are provided below:

<u>Bridge No. 050031</u>

We are submitting two (2) grain size distribution curves for this bridge. At the time we conducted our site reconnaissance the water was approximately 1.64 m (5.4 ft) deep. Based on the depth of water, freeboard and location of the boring site the top 2.1 m (6.9 ft) of the borings performed at the subject bridge location is above the existing channel bottom and was not considered in the particle size distribution curve. The first curve is representative of the surficial layer present on the channel bottom. The second curve is representative of insitu material present from the existing channel bottom to a depth of 9.3 m (30.51 ft). The grain size curves for representative soil sample are presented in Appendix "A" and may be used to estimate the corresponding D50 values for scour analysis.

In addition to the grain size distribution, we performed a series of corrosion tests on the water and soil obtained form the subject bridge site. Based on test results the water appeared to be more corrosive. The results of the corrosion series on the water sample are as follows:

Corrosion Series Test Results

pH:	5.5
Resistivity:	10,000
Chlorides:	40
Sulfates:	<2

Environmental Classification

Substructure:	Concrete	Moderately Aggressive
	Steel	Extremely Aggressive
Superstructure:	Slightly Aggressive	
Location:	Inland	

Bridge No. 050032

We are submitting three (3) grain size distribution curves for this bridge. Based on the depth of water, freeboard and location of the boring site the top 2.0 m (6.6 ft) of the borings performed at the subject bridge location is above the existing channel bottom and was not considered in the particle size distribution curves. The first curve is representative of the surficial layer present on the channel bottom. The second curve is representative of the insitu material present from the existing channel bottom to a depth of 1.6 m (5.25 ft) and the material present 3.1 m (10.17 ft) to 6.9 m (22.64 ft) beneath the existing ground surface. The third curve is representative of the insitu material lying directly beneth the above strata from 1.6 m (5.25 ft) to 3.1 m (10.17 ft) beneath the existing ground surface and on underlying strata present from 6.9 m (22.64 ft) to 9.9 m, (32.48 ft) beneath the existing ground surface. The grain size curves for these representative soil samples are presented in Appendix "B" and may be used to estimate the corresponding D50 values for scour analysis.

In addition to the grain size distribution, we performed a series of corrosion tests on the water and soil obtained from the subject bridge site. Based on test results, the water appeared to be more corrosive. The results of corrosion series tests on the water sample are as follows:

Corrosion Series Test Results

pH:	4.7
Resistivity:	10,000 +
Chlorides:	40
Sulfates:	<2

Environmental Classification

Substructure:	**Extremely Aggressive**
Superstructure:	**Slightly Aggressive**
Location:	**Inland**

Bridge No. 050035

We are submitting two (2) grain size distribution curves for this structure. Based on our site reconnaissance the water was approximately 1.83 m (6.0 ft) deep. Based on the depth of water, freeboard and location of the boring site the top 2.4 m (8 ft) of the borings performed at the subject bridge location is above the existing channel bottom and was not considered in the particle size distribution curves. The first curve is representative of the surficial layer present on the channel bottom. The second curve is representative of the insitu material present from the existing channel bottom to a depth of 3.5 m (11.48 ft) and the material present 4.6 m (15.09 ft) to 8.0 m (26.25 ft) beneath the existing ground surface. In addition to the material covered by the curves above there exists a clay layer from 3.5 m (11.48 ft) to 4.6 m (15.09 ft) in which seventy-five (75) percent passes the number 200 sieve.

Based on my telephone conversation of December 26, 1995 at approximately 11:00 a.m. with Mr. Ruben O'Hanian, a hydrometer is being run on a representative sample and the results of this test will be forwarded to you upon completion. The grain size curves for the representative soil samples are presented in Appendix "C" and may be used to estimate the corresponding D50 values of each strata for scour analysis.

In addition to the grain size distribution, we performed a series of corrosion tests on the water and soil obtained from the subject bridge site. Based on test results, the water appear to be more corrosive. The results of the corrosion series tests on the water samle are as follows:

<u>Corrosion Series Test Results</u>

pH:	5.0
Resistivity:	10,000 +
Chlorides:	60
Sulfates:	2

Environmental Classififcation

Substructure:	Extremely Aggressive
Superstructure:	Slightly Aggressive
Location:	Inland

<u>Bridge No. 050941</u>

We are submitting two (2) grain size distribution curves for this structure. Based on the depth of water, freeboard and location of the boring site the top 2.0 m (6.56 ft) of the borings performed at the subject bridge location is above the existing channel bottom and was not considered in the particle size distribution curves. The first curve is representative of the surficial layer of the channel bottom. The second curve is representative of the upper 7.0 m (22.96 ft) beneath the existing channel bottom. The grain size of these rperesentative soil samples are presented in Appendix "D" and may be used to obtain D50 values of the corresponding strata for scour analysis.

In addition to the grain size distribution, we performed a series of corrosion tests on the water and soil obtained from the subject bridge site. Based on test results the water appeared to be comre corrosive. The results of corrosion series tests on the water sample are as follows:

<u>Corrosion Series Test Results</u>

pH:	5.9
Resistivity:	8970
Chlorides:	40
Sulfates:	<2

Environmental Classifications

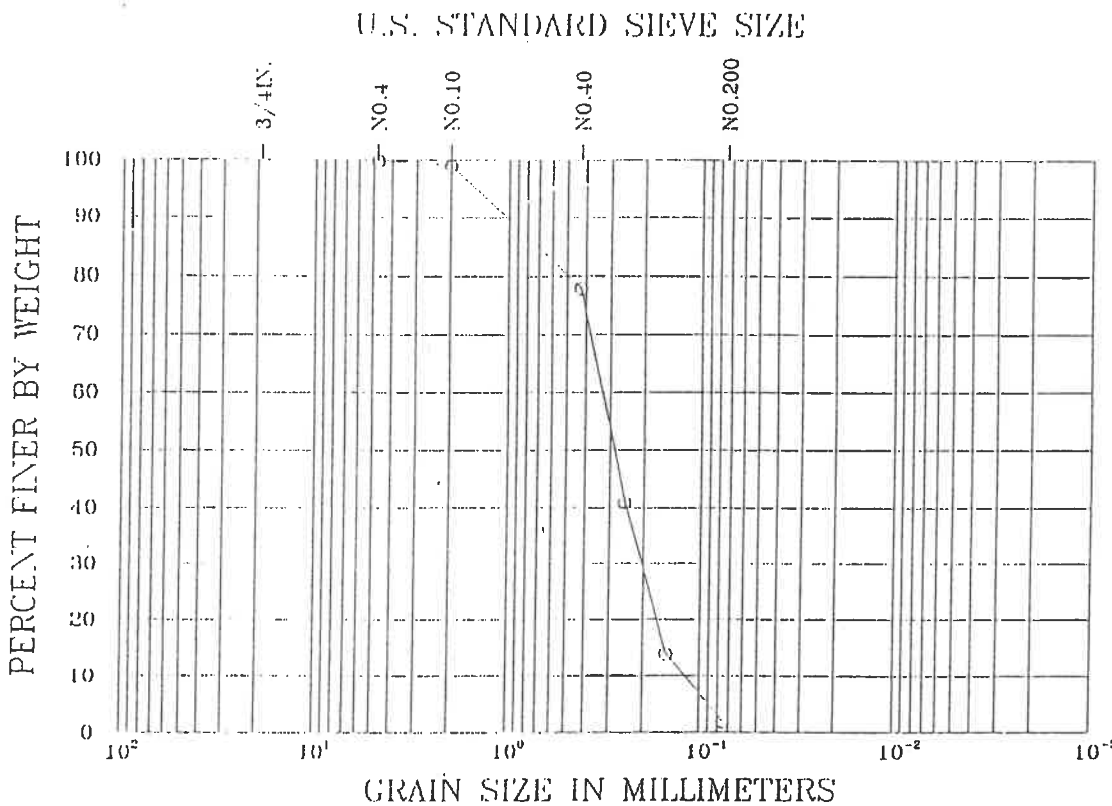
Substructure:	Concrete - Moderately Aggressive
	Steel - Extremely Aggressive
Superstructure:	Slightly Aggressive
Location:	Inland

The results contained in this letter are based on the information obtained from our preliminary analysis. We should receive a copy of all the final test results and associated borings by January 4, 1995 and will begin evaluating the data and prepare a preliminary geotechnical structures report. This report will not consider scour. When scour analyses have been performed, please forward the information to this office so that we can being our Phase I report for the BDR. We will be completing the report based on the priority list received from you on November 15, 1995.

If you have any questions, please contact this office.

BWJ/MAE/skw
Attachaments

APPENDIX A - GRAIN SIZE DISTRIBUTION CURVES
BRIDGE NO. 050031



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

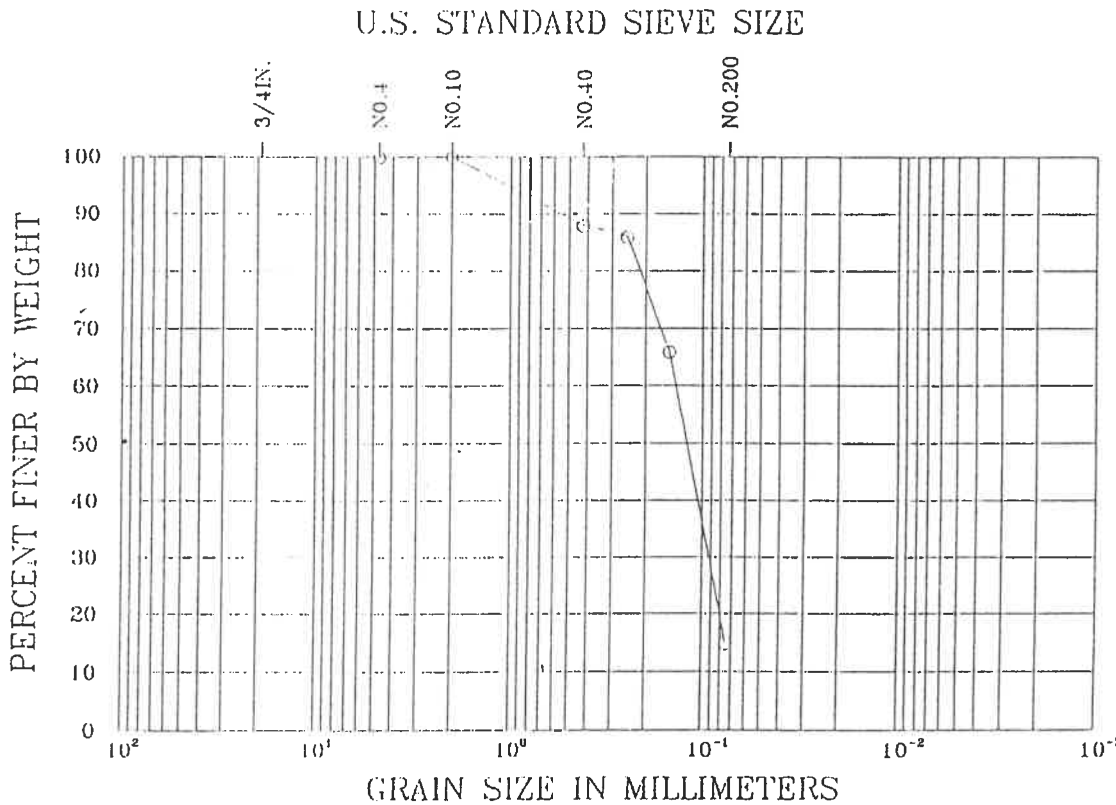
LOCATION: NORTHEAST QUADRANT
SAMPLE DEPTH: GRAB SAMPLE

-o-

SOIL CLASSIFICATION: A-3, SP

STATE PROJECT # 05090-1511
BRIDGE # 050031

REPRESENTATIVE OF SURFICIAL MATERIAL



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

LOCATION: STATION 195+54 11m LT OF C.L.
SAMPLE DEPTH: 8.69m

-⊖-

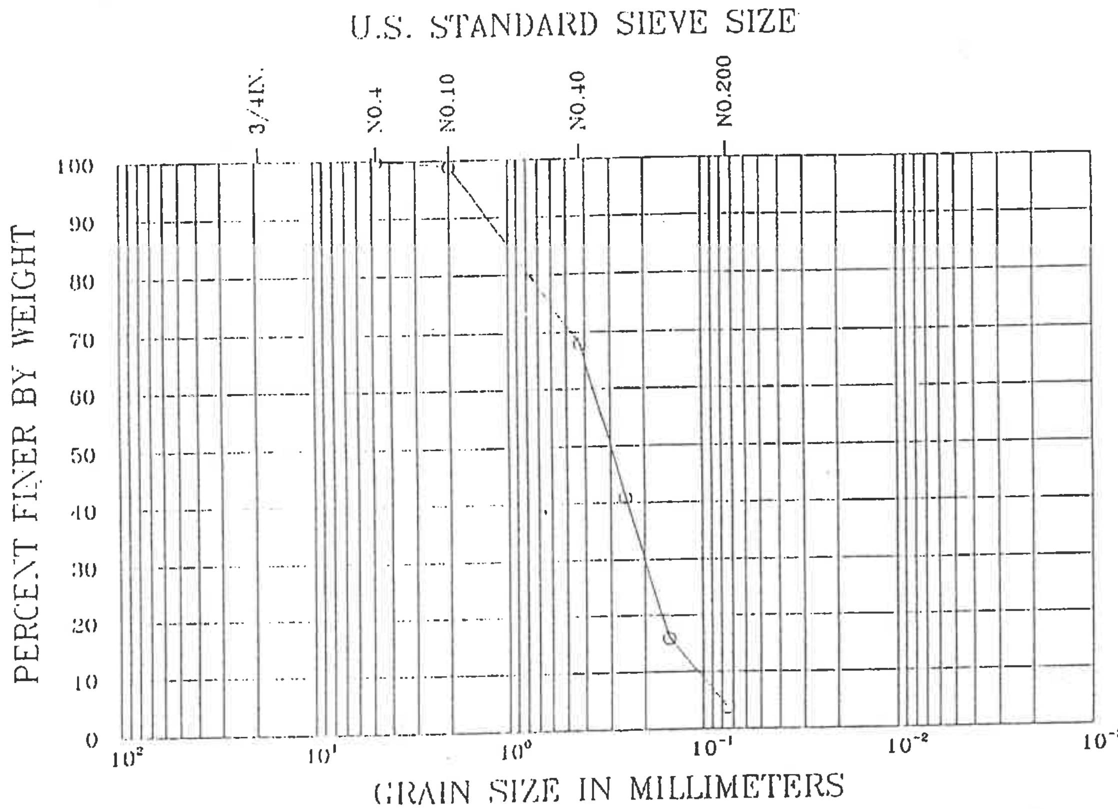
SOIL CLASSIFICATION: A-2-4, SC

STATE PROJECT # 05090-1511
BRIDGE # 050031

THIS CURVE REPRESENTS MATERIAL
0.0 m TO 9.3m BENEATH CHANNEL BOTTOM

CURVE 2

APPENDIX B - GRAIN SIZE DISTRIBUTION CURVES
BRIDGE NO. 050032



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

LOCATION: SOUTHWEST QUADRANT
SAMPLE DEPTH: GRAB SAMPLE

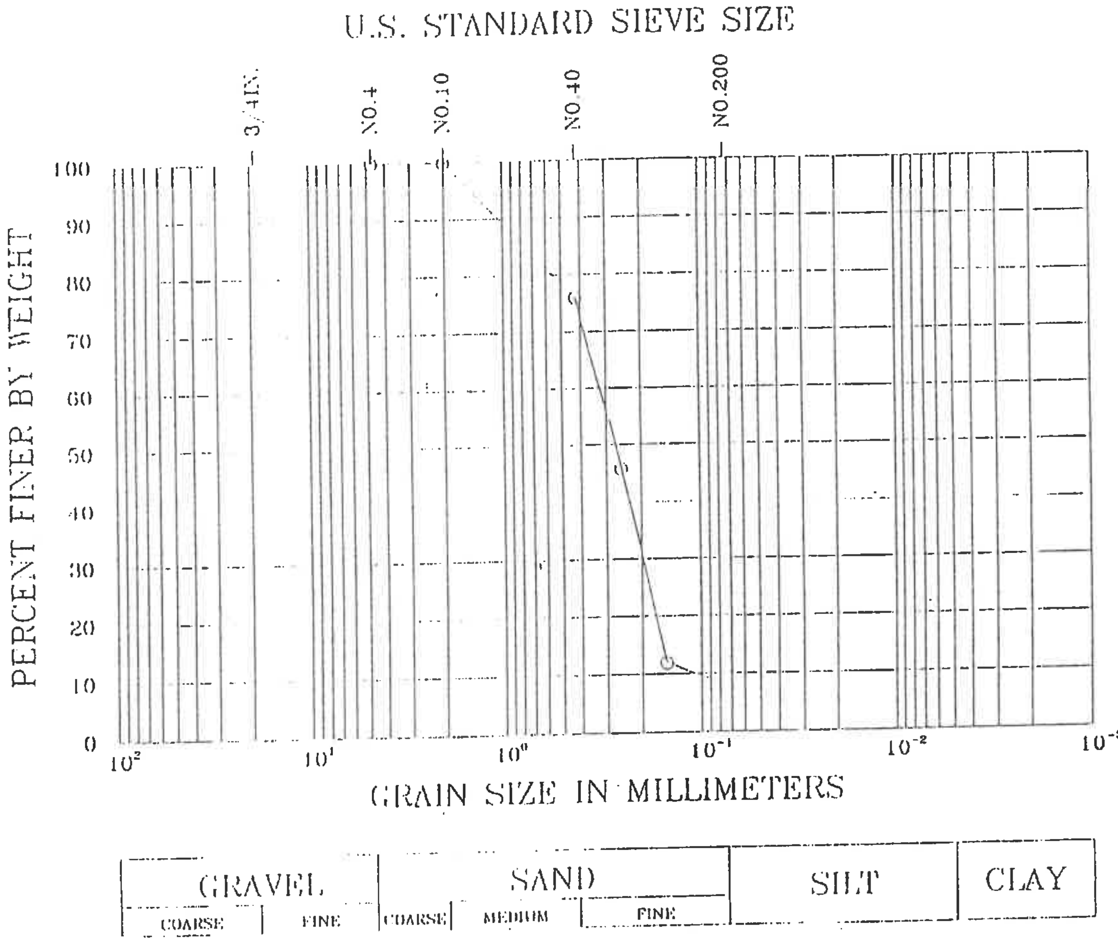
-e-

SOIL CLASSIFICATION: A-3, SP

REPRESENTATIVE OF SURFICIAL MATERIAL

STATE PROJECT # 05090-1511
BRIDGE # 050032

CURVE 1



LOCATION: STATION 170+46 11m RT OF C.L.
SAMPLE DEPTH: 6.4 m

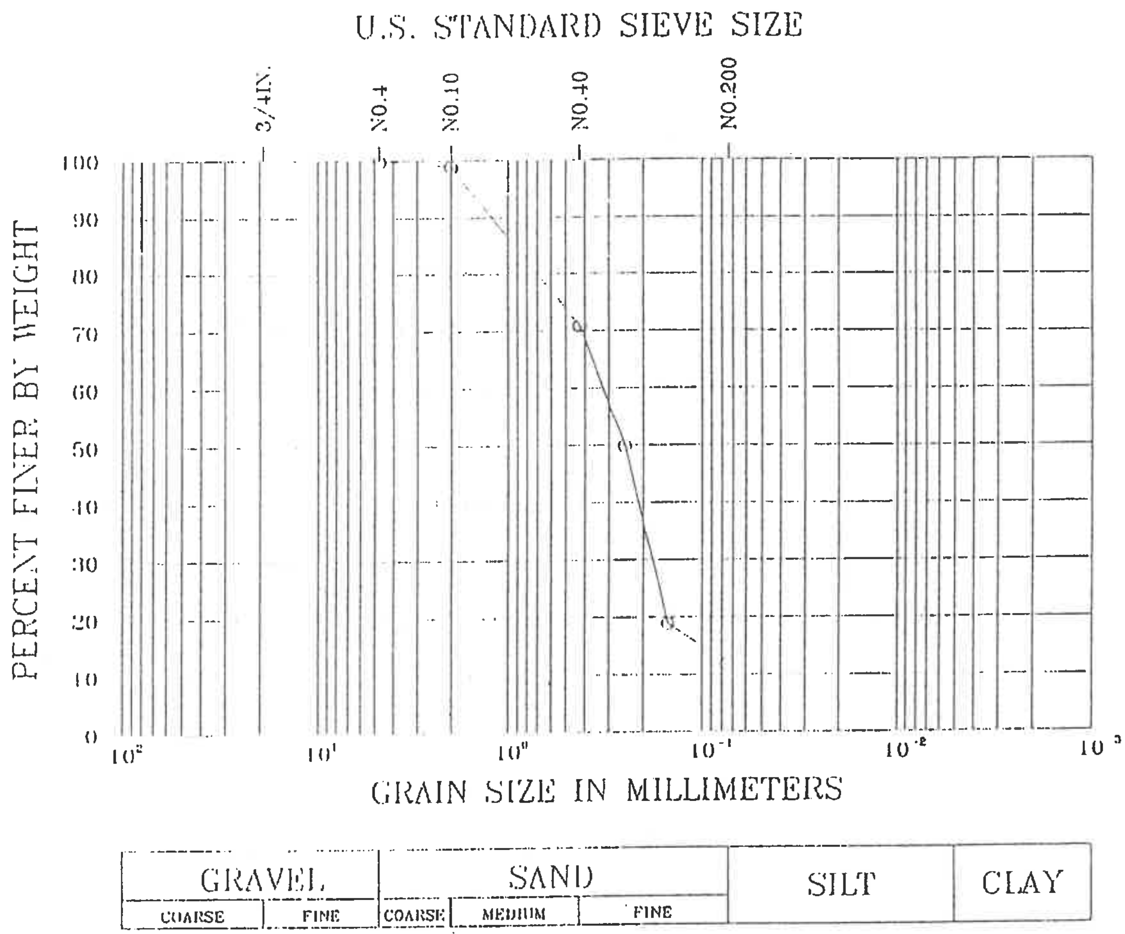
-0-

SOIL CLASSIFICATION: A-2-4, SP-SC

THIS CURVE REPRESENTS MATERIAL
0.0 m to 1.6 m and 3.1 m to 6.9 m
BENEATH CHANNEL BOTTOM

STATE PROJECT # 05090-1511
BRIDGE # 050032

CURVE 2



LOCATION: STATION 170+46 11m RT OF C.L.
SAMPLE DEPTH: 24.7 m

-⊙-

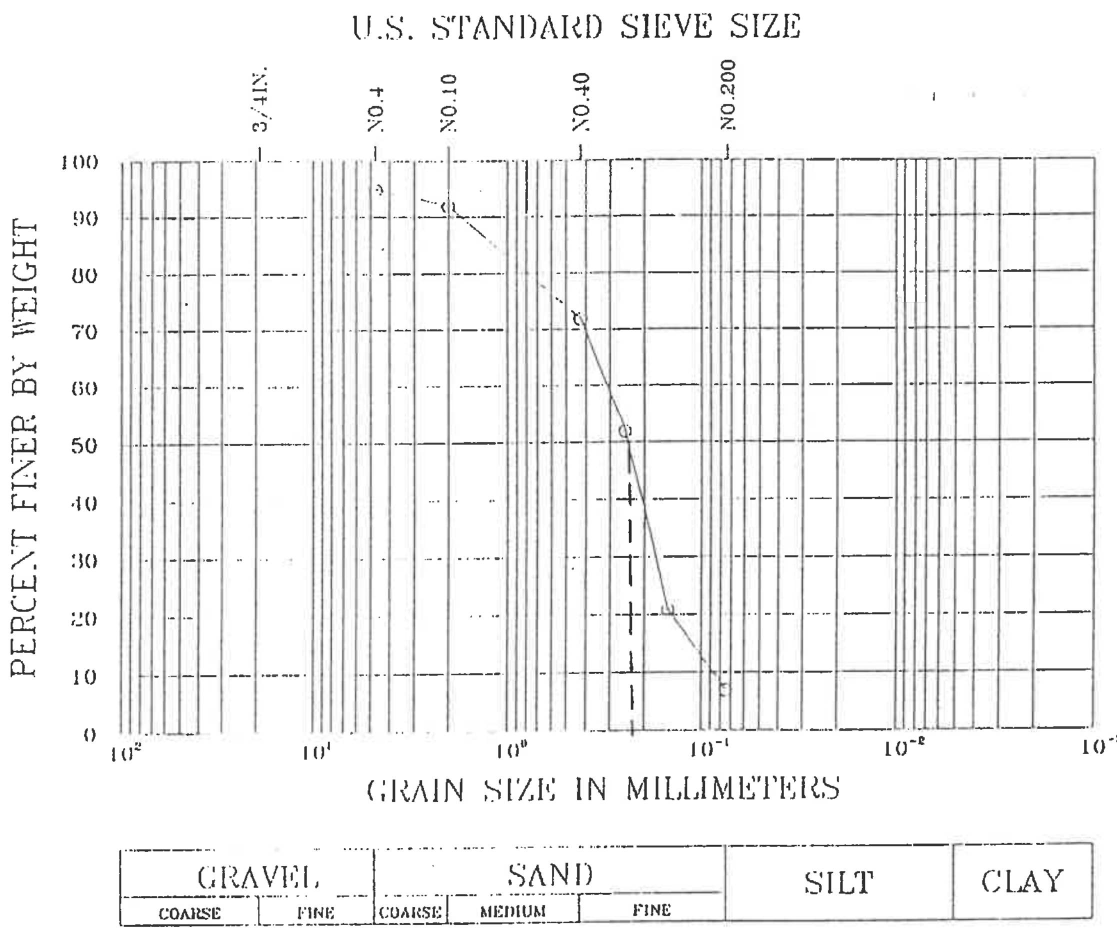
SOIL CLASSIFICATION: A-2-4, SM-SC

STATE PROJECT # 05090-1511
BRIDGE # 050032

THIS CURVE REPRESENTS MATERIAL
1.6 m to 3.1 m and 6.9 m to 9.9 m
BENEATH CHANNEL BOTTOM

CURVE 3

APPENDIX C - GRAIN SIZE DISTRIBUTION CURVES
BRIDGE NO. 050035



LOCATION: NORTHEAST QUADRANT
SAMPLE DEPTH: GRAB SAMPLE

-⊖-

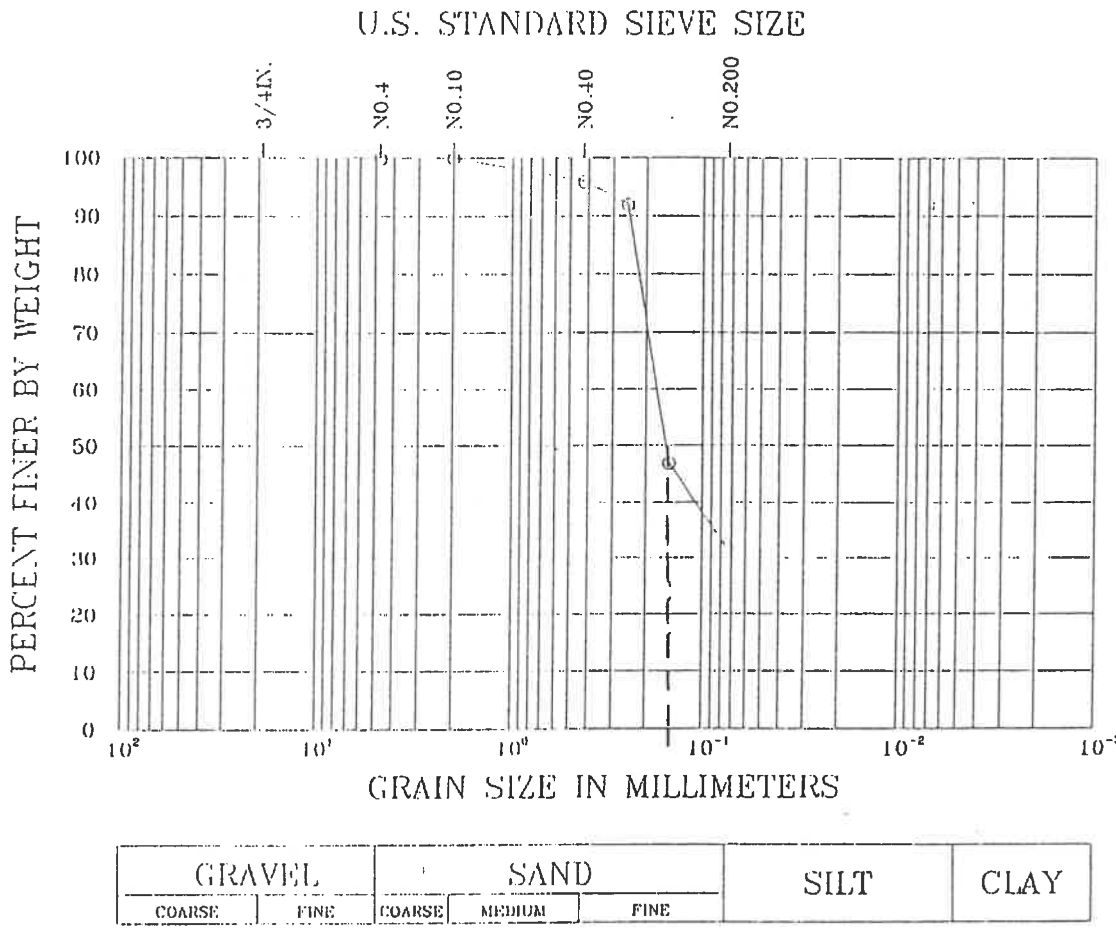
SOIL CLASSIFICATION: A-3, SP-SM

STATE PROJECT # 05090-1511
BRIDGE # 050035

REPRESENTATIVE OF SURFICIAL MATERIAL

CURVE 1

D_{50} = 0.23 mm surficial Layer



LOCATION: STATION 95+39 10m LT OF C.L.
SAMPLE DEPTH: 10.21 m

-θ-

SOIL CLASSIFICATION: A-2-4, SC

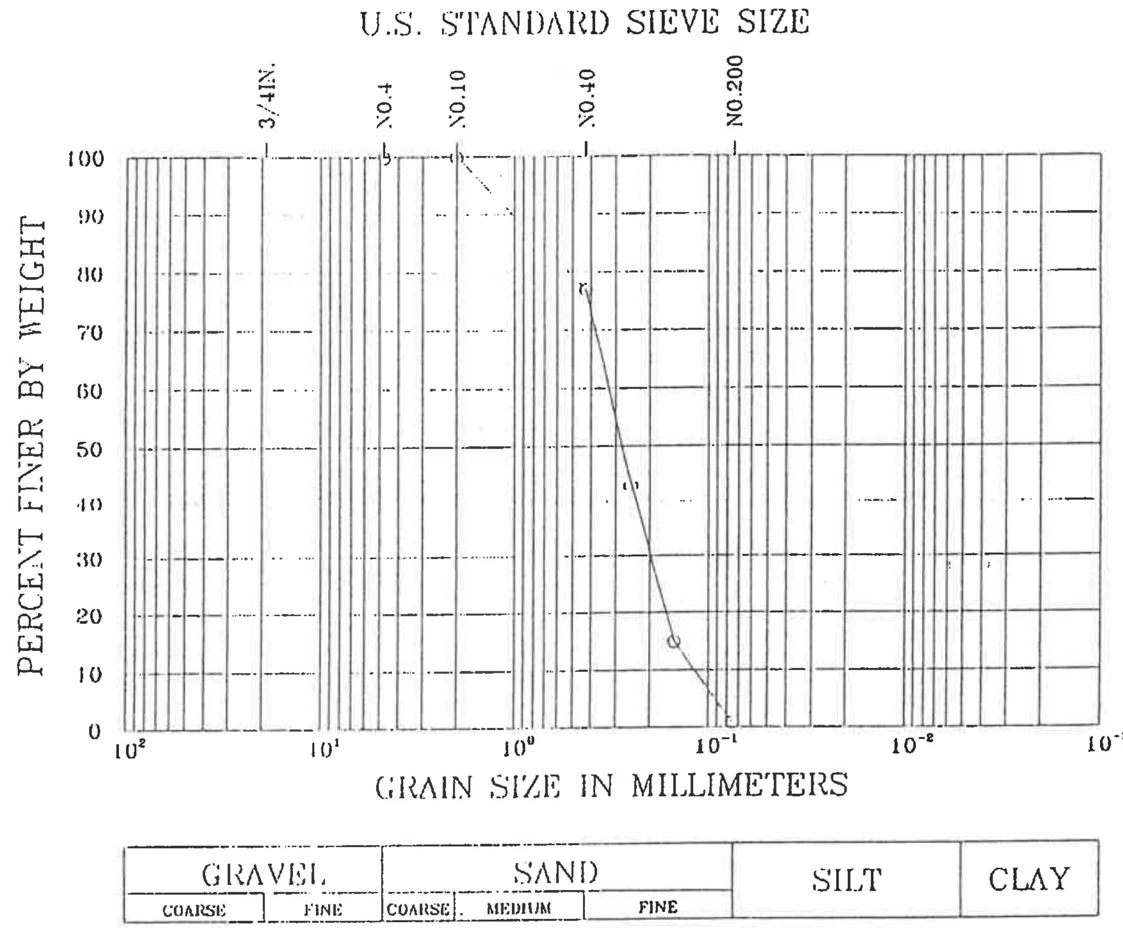
STATE PROJECT # 05090-1511
BRIDGE # 050035

THIS CURVE REPRESENTS MATERIAL
0.0 m to 3.5 m and 4.6 m to 8.0 m
BENEATH CHANNEL BOTTOM

CURVE 2

D_{50} = 0.16 (from 0 - 11.48 feet)

APPENDIX D - GRAIN SIZE DISTRIBUTION CURVES
BRIDGE NO. 050941



LOCATION: SOUTHEAST QUADRANT
SAMPLE DEPTH: GRAB SAMPLE

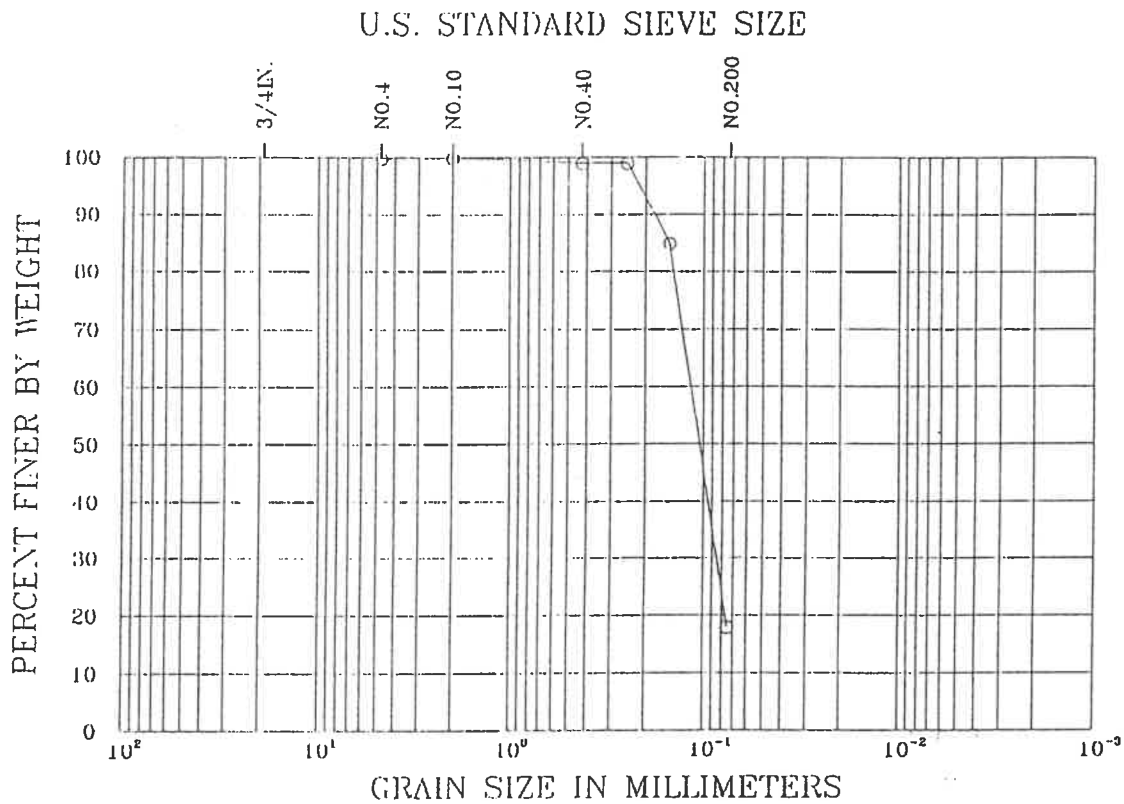
-o-

SOIL CLASSIFICATION: A-3, SP

REPRESENTATIVE OF SURFICIAL MATERIAL

STATE PROJECT # 05090-1511
BRIDGE # 050941

CURVE 1



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

LOCATION: STATION 49+27 12m RT OF C.L.
SAMPLE DEPTH: 8.7 m

-o-

SOIL CLASSIFICATION: A-2-4, SC

STATE PROJECT # 05090-1511
BRIDGE # 050941

THIS CURVE REPRESENTS MATERIAL
0.0 m TO 7.0 m BENEATH CHANNEL BOTTOM

CURVE 2

Appendix C

Existing Structure Documentation

NATIONAL BRIDGE INVENTORY - - - - - - - STRUCTURE INVENTORY AND APPRAISAL 01/24/96

```
********** IDENTIFICATION **********************
(1) STATE NAME - FLORIDA                     CODE   124
(8) STRUCTURE NUMBER                   #          050031
(5) INVENTORY ROUTE (ON/UNDER) - ON      =   131000290
(2) STATE HIGHWAY DEPARTMENT DISTRICT                 01
(3) COUNTY CODE     043    (4) PLACE CODE        00000
(6) FEATURES INTERSECTED - TURKEY BRANCH
(7) FACILITY CARRIED      - SR 29
(9) LOCATION              - 0.5 MILES SOUTH OF C-74
(11) MILEPOINT                                   010.941
(16) LATITUDE  26 D 54.4' (17) LONGITUDE  081 D 19.4'
(98) BORDER BRIDGE STATE CODE   000    % SHARE   00 %
(99) BORDER BRIDGE STRUCTURE NO.      #

********** STRUCTURE TYPE AND MATERIAL *********
(43) STRUCTURE TYPE MAIN:  MATERIAL - CONCRETE
       TYPE - SLAB                              CODE 101
(44) STRUCTURE TYPE APPR:  MATERIAL - OTHER
       TYPE - OTHER                             CODE 000
(45) NUMBER OF SPANS IN MAIN UNIT                    002
(46) NUMBER OF APPROACH SPANS                       0000
(107) DECK STRUCTURE TYPE - CAST IN PLACE CONC  CODE 1
(108) WEARING SURFACE / PROTECTIVE SYSTEM:
  A) TYPE OF WEARING SURFACE - BITUMINOUS      CODE 6
  B) TYPE OF MEMBRANE        - NONE            CODE 0
  C) TYPE OF DECK PROTECTION - NONE            CODE 0

********** AGE AND SERVICE *********************
(27) YEAR BUILT                                     1948
(106) YEAR RECONSTRUCTED                            0000
(42) TYPE OF SERVICE:  ON - HIGHWAY
       UNDER - WATERWAY                          CODE 15
(28) LANES:  ON STRUCTURE  02   UNDER STRUCTURE   00
(29) AVERAGE DAILY TRAFFIC                        001806
(30) YEAR OF ADT    1991    (109) TRUCK ADT        10 %
(19) BYPASS, DETOUR LENGTH                         15 MI

********** GEOMETRIC DATA **********************
(48) LENGTH OF MAXIMUM SPAN                      0015 FT
(49) STRUCTURE LENGTH                          000030 FT
(50) CURB OR SIDEWALK:   LEFT 00.0 FT    RIGHT 00.0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB          032.4 FT
(52) DECK WIDTH OUT TO OUT                      035.1 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)         040 FT
(33) BRIDGE MEDIAN - NO MEDIAN                    CODE 0
(34) SKEW     00 DEG      (35) STRUCTURE FLARED       NO
(10) INVENTORY ROUTE MIN VERT CLEAR          99 FT 99 IN
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR           32.4 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY         99 FT 99 IN
(54) MIN VERT UNDERCLEAR REF - NOT A HI      00 FT 00 IN
(55) MIN LAT UNDERCLEAR RT  REF - NOT A HI       99.9 FT
(56) MIN LAT UNDERCLEAR LT                       00.0 FT

********** NAVIGATION DATA *********************
(38) NAVIGATION CONTROL - BRIDGE HAS NO NA       CODE 0
(111) PIER PROTECTION - NAVIGATION PROTECTI      CODE 1
(39) NAVIGATION VERTICAL CLEARANCE                000 FT
(116) VERT-LIFT BRIDGE NAV MIN VERT CLEAR         000 FT
(40) NAVIGATION HORIZONTAL CLEARANCE             0000 FT
******************************* BOTTOM OF DATA ***********
```

```
***********************************************
SUFFICIENCY RATING =  085.3
STATUS = NO SIGNIFICANT DEFICIENCY

********** CLASSIFICATION ***************** CODE
(112) NBIS BRIDGE LENGTH                              YES
(104) HIGHWAY SYSTEM     - STRUCTURE IS NOT ON NHS     0
(26) FUNCTIONAL CLASS    - RURAL MINOR ARTERIAL       06
(100) DEFENSE HIGHWAY    - NOT A DEFENSE HIGHWAY       0
(101) PARALLEL STRUCTURE   - NONE EXISTS               N
(102) DIRECTION OF TRAFFIC - TWO WAY TRAFFIC           2
(103) TEMPORARY STRUCTURE  - NOT APPLICABLE            N
(110) DESIGNATED NATIONAL NETWORK - NOT PART OF N      0
(20) TOLL       - ON FREE ROAD                         3
(21) MAINTAIN  - STATE HIGHWAY AGENCY                 01
(22) OWNER     - STATE HIGHWAY AGENCY                 01
(37) HISTORICAL SIGNIFICANCE - NOT ELIGIBLE FOR        5

********** CONDITION ********************** CODE
(58) DECK                                              7
(59) SUPERSTRUCTURE                                    8
(60) SUBSTRUCTURE                                      6
(61) CHANNEL & CHANNEL PROTECTION                      8
(62) CULVERTS                                          N

********** LOAD RATING AND POSTING ******** CODE
(31) DESIGN LOAD        -                  H 15        2
(64) OPERATING RATING -               HS-20 TRU      246
(66) INVENTORY RATING -               HS-20 TRU      228
(70) BRIDGE POSTING   - EQ OR GT LEGAL LOAD NO P       5
(41) STRUCTURE OPEN, POSTED OR CLOSED -                A
       DESCRIPTION - OPEN, NO RESTRICTION

********** APPRAISAL ********************** CODE
(67) STRUCTURAL EVALUATION                             6
(68) DECK GEOMETRY                                     5
(69) UNDERCLEARANCES, VERTICAL & HORIZONTAL            N
(71) WATERWAY ADEQUACY                                 8
(72) APPROACH ROADWAY ALIGNMENT                        8
(36) TRAFFIC SAFETY FEATURES                        1111
(113) SCOUR CRITICAL BRIDGES                           6

********** PROPOSED IMPROVEMENTS ***************
(75) TYPE OF WORK - NO IMPROVEMENT PLANNED  CODE  000
(76) LENGTH OF STRUCTURE IMPROVEMENT         000000 FT
(94) BRIDGE IMPROVEMENT COST             $       ,000
(95) ROADWAY IMPROVEMENT COST            $       ,000
(96) TOTAL PROJECT COST                  $       ,000
(97) YEAR OF IMPROVEMENT COST ESTIMATE             20
(114) FUTURE ADT                               002933
(115) YEAR OF FUTURE ADT                         2018

********** INSPECTIONS ***********************
(90) INSPECTION DATE  94/05   (91) FREQUENCY   24 MO
(92) CRITICAL FEATURE INSPECTION:      (93) CFI DATE
  A) FRACTURE CRIT DETAIL -  NO   __ MO   A)
  B) UNDERWATER INSP      -  YES  24 MO   B)   94 11
  C) OTHER SPECIAL INSP   -  NO   __ MO   C)
************************************ BOTTOM OF DATA ***********
```

RECEIVED
MAY 15 1995

I. INSPECTION REPORTS

BRIDGE NUMBER 050031

BRIDGE NAME Turkey Branch M.P. 10.941

DOCUMENT LOG	
Type Inspection Report or Document	Date Published
Built in 1948	
Bridge Inspection Report	02-05-70
Divers Inspection Report	06-30-72
Bridge Inspection Report	02-14-73
Bridge Inspection Report	03-07-75
Bridge Inspection Report	12-20-76
Bridge Inspection Report	10-31-78
Bridge Inspection Report	08-26-80
Corrective Action Report	12-23-80
Bridge Inspection Report	06-15-82
Bridge Inspection Report	09-06-83
Bridge Inspection Report	06-11-85
Bridge Inspection Report	04-13-87
Bridge Inspection Report	12-21-88
Bridge Inspection Report	09/05/90
Bridge Inspection Report	08-25-92
Bridge Inspection Report	05/10/94

FLORIDA DEPARTMENT OF TRANSPORTATION

Form 850-010-14-a
Replaces 571-26
MAINTENANCE
04/91

BRIDGE INSPECTION REPORT

CONTENTS OF REPORT

A. Condensed Inspection Report

B. Comprehensive Report of Deficiencies

* C. Evaluation of Previous Corrective Action

D. Required Maintenance Repair and Rehabilitation

* E. Methods, Quantities and Costs of Contract Corrective Action

* F. Field Preparation

* G. Fracture Critical Inspections

* H. Scour Evaluation

* I. Load Rating Analysis

* J. BMIS Report

* This section is not included in this report.

REPORT IDENTIFICATION

Bridge No.: 050031 Bridge Name: Turkey Branch

Location: 0.5 miles South of CR 74

Section No. 05090
US R.
S.R. 29
M.P. 10.941
RD. SYS. 901

NO	YES	
[X]	[ ]	This bridge contains fracture critical components?
[X]	[ ]	This bridge is scour critical?
[X]	[ ]	This report identifies deficiencies which require prompt corrective action?

Type of inspection: [X] Routine [ ] Interim [ ] Special

Field Inspection Date: Above Water 05/10/94 Under Water:

Name of Inspector/Diver	Initials	Engineering Registration Number	Certified Bridge Inspection No.
R.W. Seichko, E-II (Senior Inspector In Charge)	RWS		00199
C.A. Faxon, SHEO			T0006
R.S. Raiola, E-II (Senior Diving Inspector/Diver)			00038
M.I. Werner, E-I			00262

Reviewing Bridge Inspection Supervisor

Name: R.W. Nelson, E-III 00031 Initials: RWN

PE or CBI Number:

Confirming Registered Professional Engineer

Name: C.D. Oliver, P.E. Number: 23475

Signature C. D. Oliver

STATE OF FLORIDA DEPARTMENT OF TRANSPORTA[illegible]

FORM 850-010-08-a
REPLACES 571-30
MAINTENANCE
04/91

CONDENSED INSPECTION REPORT FIXED SPANS

BRIDGE NUMBER 050031

INSPECTION DATE 05/10/94

DECK COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G1.00 (58)	Deck Overall Rating	7
G1.01	Deck(Top)/Surfacing	7
G1.02	Deck(Underside)	7
G1.03	Expansion Joints	N
G1.04	Construction Joints	N
G1.05	Drainage System	8
G1.06	Curbs/Medians/Sidewalks	N
G1.07	Handrails/Barriers/Parapets	8

SUPERSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G2.00 (59)	Superstructure Overall Rating	8
G2.01	Bearings	N
G2.02	Beams/Stringers/Box& Plate Girders/Flat Slabs/Arches	8
G2.03	Floor Beams	N
G2.04	Main Girders	N
G2.05	Diaphragms/Sway Bracing	N
G2.06	Lateral Bracing	N
G2.07	Upper Chords	N
G2.08	Lower Chords	N
G2.09	Verticals	N
G2.10	Diagonals	N
G2.11	Portals	N
G2.12	Fracture Critical Members	N

SUBSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G3.00 (60)	Substructure Overall Rating	6
G3.01	Piling/Shafts	6
G3.02	Footings/Caissons	N
G3.03	Columns/Wall Piers	N
G3.04	Intermediate Caps (Bent & Pier)	6
G3.05	Bracing/Struts/Web Walls	N
G3.06	Abutements/End Bents	6
G3.07	Slope Protection/Slope	7

APPROACH ROADWAY MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G4.00	Approach Roadway Overall Rating	8
G4.01	Approach Slabs	N
G4.02	Retaining Walls/Approach Slopes/Embankments/Shoulder	8
G4.03	Roadway-Bridge Transition	N
G4.04	Guardrails	8
G4.05	Roadway Alignment	8

CHANNEL-MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G5.00 (61)	Channel and Channel Protection Overall Rating	8
G5.01	Fender System	N
G5.02	Navigation Lights and Aids	N
G5.03	Embankments/Slopes/Bulkheads	8
G5.04	Degradation/Aggregation	8
G5.05	Alignment	8
G5.06	Flow	7

NON-STRUCTURAL FEATURES

BMIS NO.	ELEMENT TITLE	NCR **
G6.01	Lighting Systems	N
G6.02	Signs	N
G6.03	Striping (Roadway Reflective)	3
G6.04	Reflectors	4
G6.05	Utility Attachements	N
G6.06	Fishing Walks	N
G6.07	Attenuators	N
G6.08	Traffic Control and Monitoring Systems	N
G6.09	Deck Cleanness	3
G6.10	Superstructure Cleanness	3
G6.11	Substructure Cleanness	3
G6.12	Fences and Glare Screens	N

* - Deficiencies exist in this element that warrant written and/or sketched descriptions that are provided in section B of this report.

** - NCR is an abbreviation for Numerical Condition Rating, the definitions of which can be found on the back of this page.

Bridge No.: 050031

County Section No.: 05090

State Road No.: 29

US Road No.:

Location: 0.5 miles South of CR 74

Inspection Date: 05/10/94

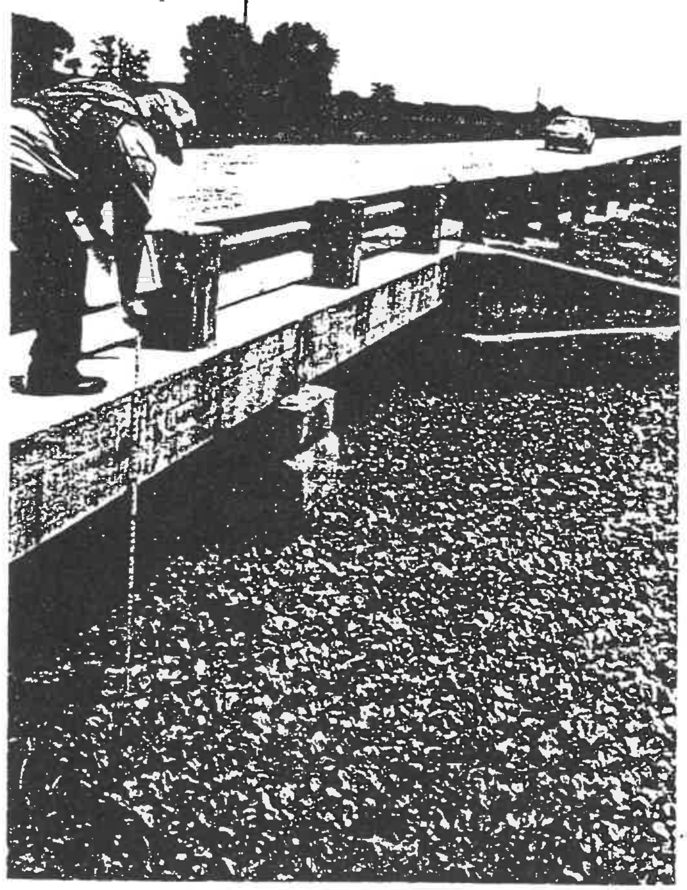
Inspector: R.W. Seichko, E-II

Mile Post No.: 10.941

B. COMPREHENSIVE REPORT OF DEFICIENCIES

Note: Due to the present water level (2'freeboard)and heavy vegetation growth ,the above water inspection team was unable to inspect the underside of this structure.The structural ratings in this report was taken from 1990 inspection. See the photo on page 4.

5-4-94 19



Water depth 5'+
22" Freeboard

Bridge Number: 050031

Inspection Date: 05/04/94

Waterway Measurements

	LEFT Dist.	Bent No.	RIGHT Dist.	Bent No.
Distance from Top of bridgerail to water at time of inspection:			3.10	2

Distance from Top of bridgerail to mudline

"-" Sign Denotes Degradation

	Left				Right			
Bent No.	Original	Previous	Present	Difference	Original	Previous	Present	Difference
Abut.1		9.5	7.9	1.6		9.8	8.0	1.8
Bent 2		9.2	8.6	0.6		9.5	8.1	1.4
Abut.3		9.4	7.7	1.7		9.8	7.3	2.5
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0
				0				0

Remarks:

Bridge No.:	050031	Location:	0.5 miles South of CR 74
County Section No.:	05090	Inspection Date:	05/10/94
State Road No.:	29	Inspector:	R.W. Seichko, E-II
US Road No.:		Mile Post No.:	10.941

D. Required Maintenance Repair and Rehabilitation

STATE FORCES

No Recommendations

COMMENTS:

BRIDGE INSPECTION REPORT

CONTENTS OF REPORT

A. Condensed Inspection Report
B. Comprehensive Report of Deficiencies
C. Evaluation of Previous Corrective Action
D. Required Maintenance Repair and Rehabilitation
* E. Methods, Quantities and Costs of Contract Corrective Action
* F. Field Preparation
* G. Fracture Critical Inspections
* H. Scour Evaluation
* I. Load Rating Analysis
J. BMIS Report

* This section is not included in this report.

REPORT IDENTIFICATION

Bridge No.: 050031 Bridge Name: Turkey Branch

Location: 0.5 miles South of C-74

NO	YES		
[X]	[ ]	This bridge contains fracture critical components.	Section No. 05090
[X]	[ ]	This bridge is scour critical.	S.R. 29
[X]	[ ]	This report identifies deficiencies which require prompt corrective action.	M.P. 10.941

Type of Inspection: [X] Routine [ ] Interim [ ] Special ____

Field Inspection Date: Above Water 8/25/92 Under Water ____

Name of Inspector/Diver	Initials	Engineering Registration Number	Certified Bridge Inspector No.
J.E. Denton, E-II (Senior Inspector in Charge)	JED		00168
Y.M. Aaron, ET-IV			
(Senior Diving Inspector/Diver)			

Reviewing Bridge Inspection Supervisor

Name R.W. Nelson, E-III 00031 (PE or CBI Number) Initials RWN

Confirming Registered Professional Engineer

Name C.D. Oliver P.E. Number 23475

Signature C. D. Oliver

BRIDGE NUMBER 050031

INSPECTION DATE 8/25/92

DECK COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G1.00 (58)	Deck Overall Rating	N
G1.01	Deck (Top)/Surfacing	7
G1.02	Deck (Underside)	N
G1.03	Expansion Joints	N
G1.04	Construction Joints	N
G1.05	Drainage System	8
G1.06	Curbs/Medians/Sidewalks	N
G1.07	Handrails/Barriers/Parapets	8

SUPERSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G2.00 (59)	Superstructure Overall Rating	8
G2.01	Bearings	N
G2.02	Beams/Stringers/Box & Plate Girders/Flat Slabs/Arches	8
G2.03	Floor Beams	N
G2.04	Main Girders	N
G2.05	Diaphragms/Sway Bracing	N
G2.06	Lateral Bracing	N
G2.07	Upper Chords	N
G2.08	Lower Chords	N
G2.09	Verticals	N
G2.10	Diagonals	N
G2.11	Portals	N
G2.12	Fracture Critical Members	N

SUBSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G3.00 (60)	Substructure Overall Rating	6
G3.01	Piling/Shafts	6
G3.02	Footings/Caissons	N
G3.03	Columns/Wall Piers	N
G3.04	Intermediate Caps (Bent & Pier)	6
G3.05	Bracing/Struts/Web Walls	N
G3.06	Abutments/End Bents	6
G3.07	Slope Protection/Slope	N

NON-STRUCTURAL FEATURES

BMIS. NO.	ELEMENT TITLE	NCR **
G6.01	Lighting Systems	N
G6.02	Signs	N
G6.03	Striping (Roadway Reflective)	3
G6.04	Reflectors	4
G6.05	Utility Attachments	N
G6.06	Fishing Walks	N
G6.07	Attenuators	N
G6.08	Traffic Control and Monitoring Systems	N
G6.09	Deck Cleanness	3
G6.10	Superstructure Cleanness	3
G6.11	Substructure Cleanness	3
G6.12	Fences and Glare Screens	N

APPROACH ROADWAY MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G4.00	Approach Roadway Overall Rating	8
G4.01	Asphalt Overlay Approach Slabs	N
G4.02	Retaining Walls/Approach Slopes/Embankments/Shoulder	8
G4.03	Roadway-Bridge Transition	8
G4.04	Guardrails	8
G4.05	Roadway Alignment	8

CHANNEL- MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G5.00 (61)	Channel and Channel Protection Overall Rating	8
G5.01	Fender System	N
G5.02	Navigation Lights & Aids	N
G5.03	Embankments/Slopes/Bulkheads	8
G5.04	Degradation/Aggregation	8
G5.05	Alignment	8
G5.06	Flow	8

* - Deficiencies exist in this element that warrant written and/or sketched descriptions that are provided in Section 3 of this report.

** - NCR is an abbreviation for Numerical Condition Rating, the definitions of which can be found on the back of this page.

BRIDGE NUMBER: 050031

INSPECTION DATE: 8/25/92

B. COMPREHENSIVE REPORT OF DEFICIENCIES

NOTE; Enviroment is moderately aggressive

Cracks and Spall definitions, Page 1

ELEMENT NO.'S

NOTE: Due to the present water level (1' freeboard) the above water inspection team was unable to inspect the underneath of this structure. The structural ratings in this report was taken from the last inspection report.

BRIDGE NUMBER 050031

INSPECTION DATE 8/25/92

Waterway Measurements

	LEFT	RIGHT
Distance from top of bridgerail to water at time of inspection:	Bent No.	Bent No.

"+" Sign denotes aggregation
"-" Sign denotes degradation

Distance from top of bridgerail to mudline:

	LEFT				RIGHT			
Bent No.	Original	Previous	Present	Difference	Original	Previous	Present	Difference
Abut.1		10.0	9.5	+0.5		10.8	9.8	+1.0
Bent 2		10.8	9.2	+1.6		10.4	9.5	+0.9
Bent 3		9.7	9.4	+0.3		10.4	9.8	+0.6

BRIDGE NUMBER: 050031

INSPECTION DATE: 8/25/92

C. EVALUATION OF PREVIOUS CORRECTIVE ACTION

MENT NO.'S

revious corrective action requested.

I

V

DATE: 02/16/93

FIXED AND MOVEABLE
UNDERWATER BRIDGE INSPECTION REPORT

BRIDGE NO.	LOCAL NAME	S.R. NO.	TOPSIDE INSP.	DIVER INSP. ~~PSR/KSK~~/MIW/AMB
050031	TURKEY BRANCH	29	JED	

FIXED SPAN COMPONENTS

G3.00 (C0)	Substructure Overall Rating	8
G3.01	Piling / Shafts	8
G3.02	Footings/Caissons	N
G3.03	Columns/Wall Piers	
G3.04	Intermediate Caps (Bent & Pier)	
G3.05	Bracing/Struts/Web Walls	
G3.06	Abutments/End Bents	
G3.07	Slope Protection/ Slopes	N

CHANNEL - MAJOR FEATURE

G5.00 (C1)	Channel & Channel Protection Overall	N
G5.01	Fender System	
G6.06	Fishing Walks	
G5.03	Embankments/ Slopes/Bulkheads	
G5.04	Degradation/ Aggregation	
G5.05	Alignment	
G5.06	Flow	
	Obstruction	N

MOVEABLE SPAN ELEMENTS

G13.01	Piling/Shafts	N
G13.02	Footings/Caissons	
G13.03	Caps(Bent, Pier)	
G13.04	Columns/Piers(Wall/ Pivot/Rest/Bascule	
G9.07	Submarine Cable	
G13.00	Substructure Overall Rating	N

WATER/SCOUR CONDITIONS

SCOUR CRITICAL: NO TIDAL: NO
TYPE:
1. GENERAL
2. LOCAL
3. AGGREGATION/DEGRADATION

WATER TYPE: 2
1. FRESH/CLEAR
2. FRESH/TANNIC
3. SALT
4. BRACKISH
5. STAGNANT

(K9)WATER QUALITY: 0
0. NO DATA AVAILABLE
1. GOOD
2. FAIR
3. POOR
N. NOT APPLICABLE

K(10)WATER DEPTH:
AVERAGE 4 FT.
MAXIMUM 5 FT.

(K11)BOTTOM MATERIAL: 1
1. MUD
2. SAND
3. MARINE GROWTH/CORAL
4. ROCK
5. GRAVEL
6. OTHER

ITEMS INSPECTED: MAN HOURS: 2

CONCRETE PILES 1 THRU 5 OF BENT 2.

COMMENTS:

UNDERWATER INSPECTION OF CONCRETE PILES FOUND THEM TO BE FREE OF SIGNIFICANT CRACKS AND SPALLS. CONCRETE PILES EXHIBIT MODERATE TO HEAVY LOSS OF MATRIX.

RECOMMENDATIONS:

Bridge Inspection Report

CONTENTS OF REPORT

A. Condensed Inspection Report

B. Comprehensive Report of Deficiencies

*C. Evaluation of Previous Corrective Action

D. Required Maintenance Repair and Rehabilitation

* E. Method, Quantities and Cost of Contract Corrective Action

*These items are not included in this report.

STATE OF FLORIDA

DEPARTMENT OF TRANSPORTATION

BRIDGE INSPECTION DISTRICT 1/7

REPORT IDENTIFICATION

Bridge No. 050031 Bridge Name: Turkey Branch

Sec No. 05090 S.R. 29 M.P. 10.941

Field Inspection Date: Above Water 9-5-90 Under Water

Name of Inspector/Diver	Initials	Engineering Registration	Inspector Certification
G.A. Dionne, E-II (Senior Inspector in Charge)	GAD		00142
B.L. Miller, E-I			00225
R.S. Raiola, E-II (Senior Diving Inspector/Diver)			00038
K.S. King, ET-III			
M.I. Werner, ET-III			

Reviewing Bridge Inspection Supervisor: G.D. Burke, E-III Initials GDB

Confirming Registered Professional Engineer: C. D. OLIVER P.E. Number 23475

Signature C. D. Oliver

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

CONDENSED INSPECTION REPORT
FIXED SPANS

FORM 850-010-08-s
REPLACES 571-30
MAINTENANCE
01/90

BRIDGE NUMBER 050031

SUBSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G24	Gunite Piling/Shafts	6
G25	Footings/Caissons	N
G26	Columns/Wall Piers	N
G27	Intermediate Caps (Bent & Pier) Gunite	6
G28	Bracing/Struts/Web Walls	N
G29	Gunite Abutments/End Bents	6
G30	Slope Protection/Slope	N
G23	Substructure Overall Rating	6

SUPERSTRUCTURE COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G10	Bearings	N
G11	Beams/Stringers/Box & Plate Girders/Flat Slabs/Arches	8
G12	Floor Beams	N
G13	Main Girders	N
G14	Diaphragms/Sway Bracing	N
G15	Lateral Bracing	N
G16	Upper Chords	N
G17	Lower Chords	N
G18	Verticals	N
G19	Diagonals	N
G20	Portals	N
G21	Fracture Critical Members	N
G9	Superstructure Overall rating	8

DECK COMPONENT

BMIS NO.	ELEMENT TITLE	NCR **
G2	Deck (Top)/Surfacing	7
G3	Deck (Underside)	N
G4	Expansion Joints	N
G5	Construction Joints	N
G6	Drainage System	8
G7	Curbs/Medians/Sidewalks	N
G8	Handrails/Barriers/Parapets	8
G1	Deck Overall Rating	8

APPROACH ROADWAY MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G31	Asphalt Overlay Approach Slabs	N
G32	Retaining Wall/Approach Slopes/Embankments	8
G33	Roadway Bridge Transition	8
G34	Guardrails	8
	Approach Roadway Overall Rating	8

CHANNEL- MAJOR FEATURE

BMIS NO.	ELEMENT TITLE	NCR **
G36	Fender System	N
G37	Navigation Lights & Aids	N
G38	Embankments/Slopes Bulkheads	8
G39	Degradation/Aggregation	8
G40	Alignment	8
G41	Flow	*6
G35	Channel and Channel Protection Overall Rating	7

*Deficiencies exist in this element that warrant written and/or sketched descriptions that are provided in Section B of this report.
**NCR is an abbreviation for Numerical Condition Rating, the definitions of which can be found on the back of this page.

CONDENSED INSPECTION REPORT
NON-STRUCTURAL FEATURES, PAINTING SYSTEM

BRIDGE NUMBER 050031

NON-STRUCTURAL FEATURES			PAINTING SYSTEM			PAINTING SYSTEM		
BMIS NO.	ELEMENT TITLE	NCR **	BMIS NO	ELEMENT TITLE	NCR **	BMIS NO.	ELEMENT TITLE	NCR **
G42	Lighting Systems	N		Deck Painting System	N		Substructure Painting System	N
G43	Signs	N	G22	Superstructure Painting System	N		Equipment Painting System Movable Bridge	N
G44	Striping (Roadway Reflective)	3		Beams/Stringers/Box and Plate Girders/Arches	N		Painting System Overall Rating	N
G45	Reflectors	4		Floor Beams	N			
G46	Utility Attachments	N		Main Girders	N			
G47	Fishing Walks	N		Diaphrams/Sway Braacing	N			
G48	Attenuators	n		Lateral Bracing	N			
G49	Traffic Control and Monitoring Systems	N		Upper Chords	N			
G50	Deck Cleanness	3		Lower Chords	N			
G51	Superstructure Cleanness	3		Verticals	N			
G52	Substructure Cleanness	3		Diagonals	N			
G53	Fences and Glare Screens	N		Portals	N			

* - Deficiencies exist in this element that warrant written and/or sketched descriptions that are provided in Section 8 of this report.
** - NCR is an abbreviation for Numerical Condition Rating, the definitions of which can be found on this page and the back of this page.

NUMERICAL CONDITION RATING DEFINITIONS FOR PAINTING SYSTEM

EXCLUSIVE CODES	DESCRIPTION
N	NOT APPLICABLE
4	GOOD CONDITION - the paint system is well bonded to the steel with no blisters and peels. Little corrosion and/or some fading may present; however, the paint system still protects the steel.
3	FAIR CONDITION - Some spot painting should be scheduled to ensure that limited paint system failure does not damage the structural steel.
2	MARGINAL CONDITION - Corrosion exists where the paint has peeled, blistered or failed in fairly large areas. Schedule paint contract to recoat the structure.
1	POOR CONDITION - Corrosion exists to the degree that extensive structural damage is occurring and immediate repair and painting is required.

BRIDGE NUMBER: 050031

INSPECTION DATE: 9-5-90

B. COMPREHENSIVE REPORT OF DEFICIENCIES

NOTE; Environment is moderately aggressive

Cracks and Spall definitions, Page 5

ELEMENT NO.'S

Channel - Major Feature

Flow

Due to the present water level the above water inspection team was unable to inspect the underneath of this structure. The structural ratings in this report are taken from the last inspection report. The divers have been requested to inspect the underneath part of this structure. If any changes are noted they will be added to this report at a later date.

BRIDGE NUMBER 050031

INSPECTION DATE 9-5-90

Waterway Measurements

Depth of Water at time of inspection :	LEFT Bent No.	LEFT Depth	RIGHT Bent No.	RIGHT Depth

Distance from top of bridgerail to mudline:

"+" Sign denotes aggregation
"-" Sign denotes degradation

	LEFT				RIGHT			
Bent No.	Orignal	Previous	Present	Difference	Orignal	Previous	Present	Difference
Abut. 1		10.0'	10.0'	0		10.2'	10.8'	-0.6'
Bent 2		10.2'	10.8'	-0.6'		10.6'	10.4'	+0.2'
Abut. 3		10.2'	9.7'	+0.5'		10.2'	10.4'	-0.2'

S.R. No.	29
SECTION No.	05090
MILE POST:	10.941
BRIDGE No.	050031
DATE INSPECTION:	9-5-90
BRIDGE NAME:	Turkey Branch
INSPECTORS:	G.A. Dionne, E-II
	B.L. Miller, E-I

D. REQUIRED MAINTENANCE REPAIR AND REHABILITATION

Maintenance - State Forces

ELEMENT NO.'S

None Required

BRT 98/99 W.P.I. 1110874

BRIDGE INSPECTION REPORT

CONTENTS OF REPORT

*This item is not included in this report.

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

REPORT IDENTIFICATION

Bridge No.: 050031 Bridge Name: S.R. 29 over Turkey Branch
Sec. No. 05090 S.R. 29 M.P. 10.941

Field Inspection Date: Above Water 12-21-88, Under Water N/A

Name of Inspector/Diver		Initials	Engineering Registration Number	Inspector Certification Number
R. W. Nelson, E-II	(Senior Inspector in Charge)	RWN		00031
M. H. Betz, ET-IV				00162
	(Senior Diving Inspector/Diver)			

Reviewing Bridge Inspection Supervisor: Name R. W. Nelson, E-II Initials RWN

Confirming Registered Professional Engineer: P.E. Number 23475

Name C. D. Oliver, Jr. Signature C. D. Oliver

Bridge No. 050031
12-21-88

A. CONDENSED INSPECTION REPORT
FIXED SPANS

ELE. NO.	1.0 SUBSTRUCTURE COMPONENT ELEMENT TITLE	NCR **	ELE. NO.	2.0 SUPERSTRUCTURE COMPONENT ELEMENT TITLE	NCR **	ELE. NO.	3.0 DECK COMPONENT ELEMENT TITLE	NCR **
1.1	Piling/Shafts	*6	2.1	Bearings	N	3.1	Deck (Top)/Surfacing	N
1.2	Footings/Caissons	N	2.2	Beams/Stringers/Box & Plate Girders/Flat Slabs	8	3.2	Deck (Underside)	N
1.3	Columns / Wall Piers	N	2.3	Floor Beams	N	3.3	Joints (Expansion)	N
1.4	Caps (Bent & Pier)	*6	2.4	Main Girders	N	3.4	Joints (Construction)	N
1.5	Bracing/Struts/Web Walls	N	2.5	Diaphragms/Sway Bracing	N	3.5	Drainage System	8
1.6	Abutments/End Bents	6	2.6	Lateral Bracing	N	3.6	Curbs/Medians/Sidewalks	N
1.7	Slope Protection	N	2.7	Upper Cords	N	3.7	Handrails/Barriers/Parapets	8
1.8	Overall Rating	6	2.8	Lower Cords	N	3.8	Overall Rating	8
			2.9	Verticals	N			
			2.10	Diagonals	N			
			2.11	Portals	N			
			2.12	Overall Rating	8			

ELE. NO.	4.0 APPROACH ROADWAY - MAJOR FEATURE ELEMENT TITLE	NCR **	ELE. NO.	5.0 CHANNEL - MAJOR FEATURE ELEMENT TITLE	NCR **	ELE. NO.	6.0 NON-STRUCTURAL FEATURES ELEMENT TITLE	NCR **
4.1	Approach Slabs	N	5.1	Fender System	N	6.1	Lighting Standards	N
4.2	Retaining Wall / Approach Slopes / Embankments	8	5.2	Navigation Lights and Aids	N	6.2	Signs	N
4.3	Approach Slab - Bridge Deck Transition	8	5.3	Embankments / Slopes / Bulk Heads	8	6.3	Striping (roadway, Reflective)	3
4.4	Shoulders	8	5.4	Degradation/Aggregation	8	6.4	Reflectors	4
4.5	Roadway - Approach Slab Transition	8	5.5	Alignment	8	6.5	Utility Attachments	N
4.6	Drainage	8	5.6	Freeboard	7	6.6	Fishing Walks	N
4.7	Guardrails	8	5.7	Obstruction	7	6.7	Attenuators	N
4.8	Overall Rating	8	5.8	Overall Rating	8			

* - Deficiencies exist in this element that warrant written and/or sketched descriptions that are provided in Section B of this report.

** - NCR is an acronym for Numerical Condition Rating, the definitions of which can be found on the back of this page.

NUMBER 050031
ION DATE 12-21-

8-9-89
DATE OF INSP.
8-2-89

UNDERWATER BRIDGE INSPECTION REPORT

LOCAL NAME	S.R. NO.	TOPSIDE INSP.	DIVER INSP.
Turkey Branch	29		R.R. BARTHOLD R. PADRINO

ggressive.

page 4 .

ent		Channel-Major Feature			Movable Span Elements		
tle	NCR	Elem. No.	Element Title	(NCR)	Elem. No.	Element Title	NCR
	(8)	5.1	Fender System	( )	8.20	Sub Cable	( )
F oters	(N)	5.3	Embankments/Slopes Bulkheads	( )	1.1	Piling/Shafts	( )
all Piers	( )	5.4	Degrad./Aggreg.	( )	8.71	Footings/ Caissons	( )
uts/	( )	5.7	Obstruction	( )	8.72	Columns/Piers	( )
/ nd	( )		Timber Decay	( )	8.74	Brace/Struts Web Walls	( )
		5.8	Overall Rating	( )			
ction	( )					Fender	( )
cay	(N)					Degrad/Aggreg.	( )
ating	(8)					Overall Rating	( )

Piles "A thru E" of bent 2.

NO CRACKING OR SPALLING OF THE PILES VISIBLE TO THE DIVERS BELOW THE WATER LINE.

CRACK WIDTH (CW) DIMENSION RANGES AND CLASSES

CLASS		WIDTH RANGE
(I)	1	0 < CW < 1/64", 0.4mm
(II)	2	1/64", 0.4mm ≥ CW < 1/32", 0.8mm
(III)	3	1/32", 0.8mm ≥ CW < 1/16", 1.6mm
(IV)	4	1/16", 1.6mm ≥ CW < 1/8", 3.2mm
(V)	5	CW ≥ 1/8", 3.2mm

SCALE DEPTH (SCD) DIMENSION RANGES AND CLASSES

CLASS		DEPTH RANGES
(I)	1	0 < SCD ≤ 1/4", 6.4mm
(II)	2	1/4", 6.4mm > SCD ≤ 1/2", 12.7mm
(III)	3	1/2", 12.7mm > SCD ≤ 1", 25.4mm
(IV)	4	SCD > 1", 25.4mm

SPALL DEPTH (SPD) AND WIDTH (SPW) DIMENSION RANGES & CLASSES

CLASS		DEPTH RANGES		WIDTH RANGE
(I)	1	0 < SPD ≤ 1", 25.4mm	&	0 < SPW ≤ 6", 15.25cm
(II)	2	SPD > 1", 25.4mm	&	SPW > 6", 15.25cm

BRIDGE NO. 050031

INSPECTION DATE 12-21-88

C. EVALUATION OF PREVIOUS CORRECTIVE ACTION

The missing nuts and bolts on the guardrail splice have been replaced.

WATERWAY MEASUREMENTS

Bridge No. 050031
12-21-88

"+" denotes aggregation
"-" denotes degradation

istance from top of bridgerail to waterline. _____
istance from top of bridgerail to mudline. _____

	LEFT			RIGHT			
ENT NO.	Previous	Present	Difference	Previous	Present	Difference	
butment 1	10.2'	10.0'	+.2'	10.2'	10.2'	N/C	
Bent 2	10.'4	10.2'	+.2'	10.5'	10.6'	-.1'	
butment 3	10.2'	10.2'	N/C	10.2'	10.2'	N/C	

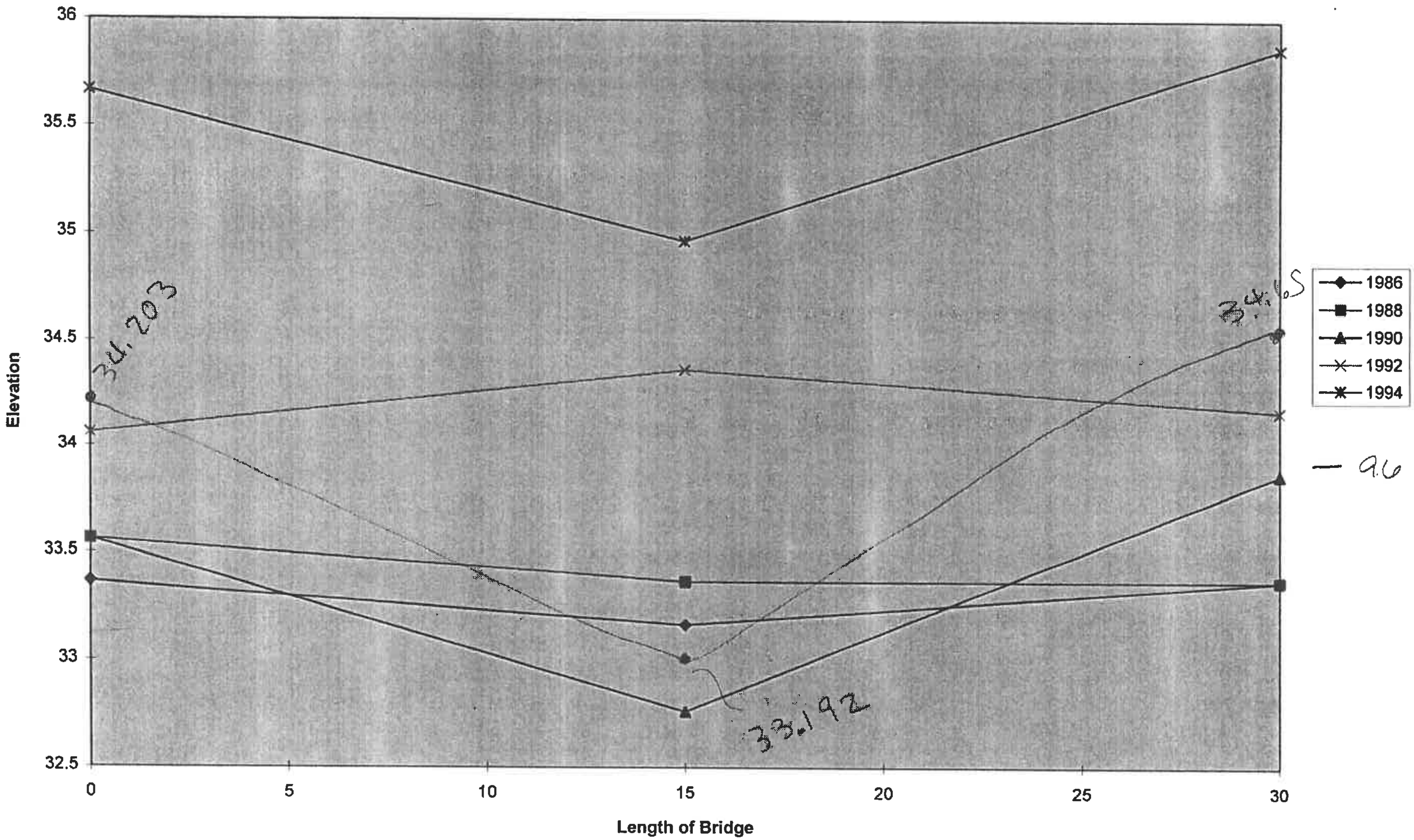
S.R. No. 29
Section No. 05090
Mile Post 10.941
Bridge No. 050031
Date Inspected 12-21-88
Bridge Name Turkey Branch
Inspectors: R. W. Nelson, E-II
M. H. Betz, ET-IV

D. REQUIRED MAINTENANCE REPAIR AND REHABILITATION

No Maintenance Required

This structure is a candidate for replacement under the BRT Program 94-95, WPI #1110874.

Long Term Bed Elevation Changes
Left Side of Bridge



SR 29 - Turkey Branch
Bridge No. 050031

Appendix D

WSPRO Analysis

LOCATION OF CROSS SECTIONS USED IN WSPRO

EXISTING BRIDGE

Station CL of Existing Bridge	1000 ft
Width of Existing Bridge	35 ft
Length of Existing Bridge	30 ft
Station of **EXIT** Section: 1000 - 30 - 35/2 =	**952**
Station of **FULLV** Section: 1000 - 35/2 =	**982**
Station of **APPR** Section: 1000+30+35/2 =	**1047**

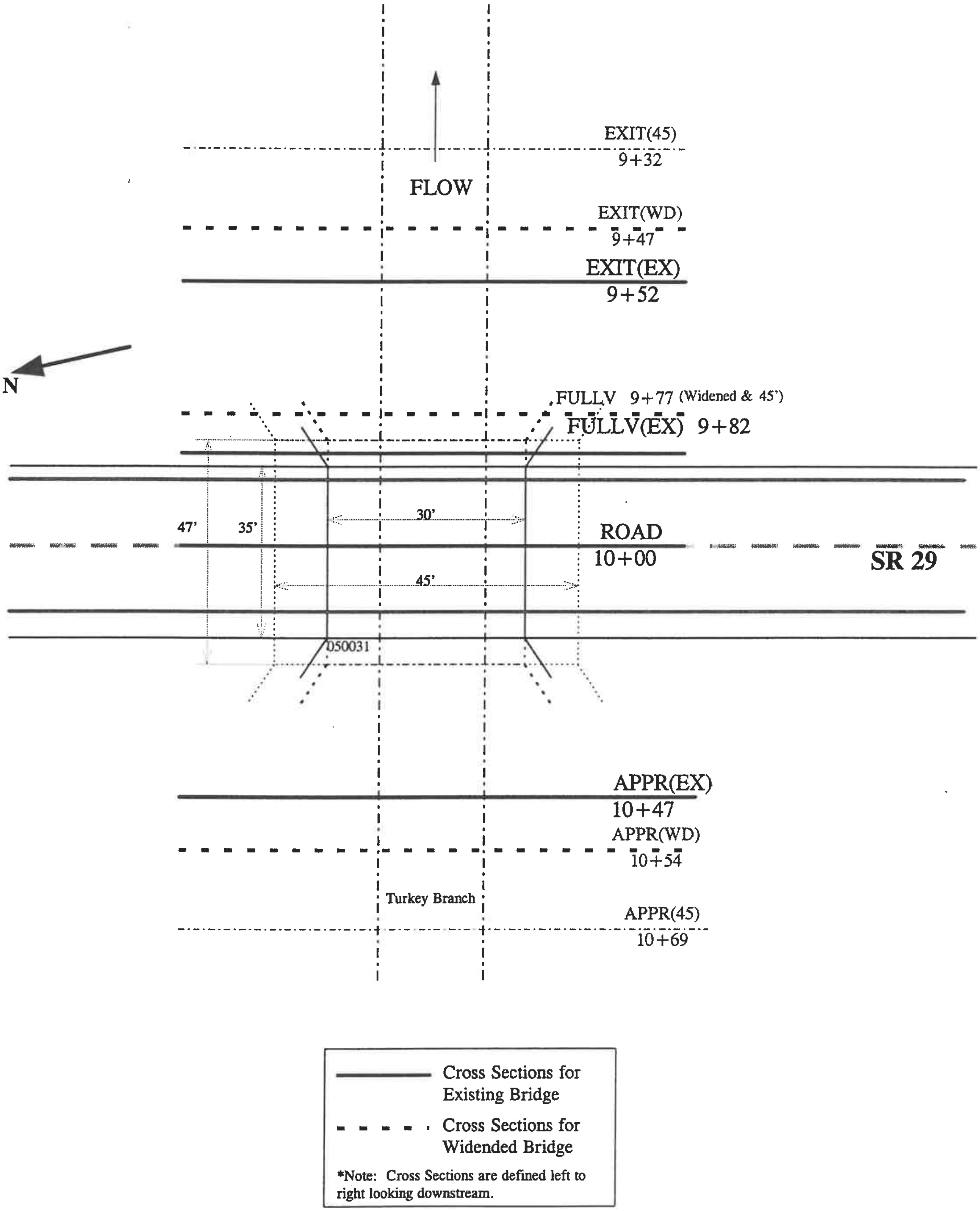
WIDENED BRIDGE

Station CL of Widened Bridge	1000 ft
Width of Widened Bridge	47 ft
Length of Widened Bridge	30 ft
Station of **EXIT** Section: 1000 - 30 - 47/2 =	**947**
Station of **FULLV** Section: 1000 - 47/2 =	**977**
Station of **APPR** Section: 1000+30+47/2 =	**1054**

45 FOOT ALTERNATE BRIDGE

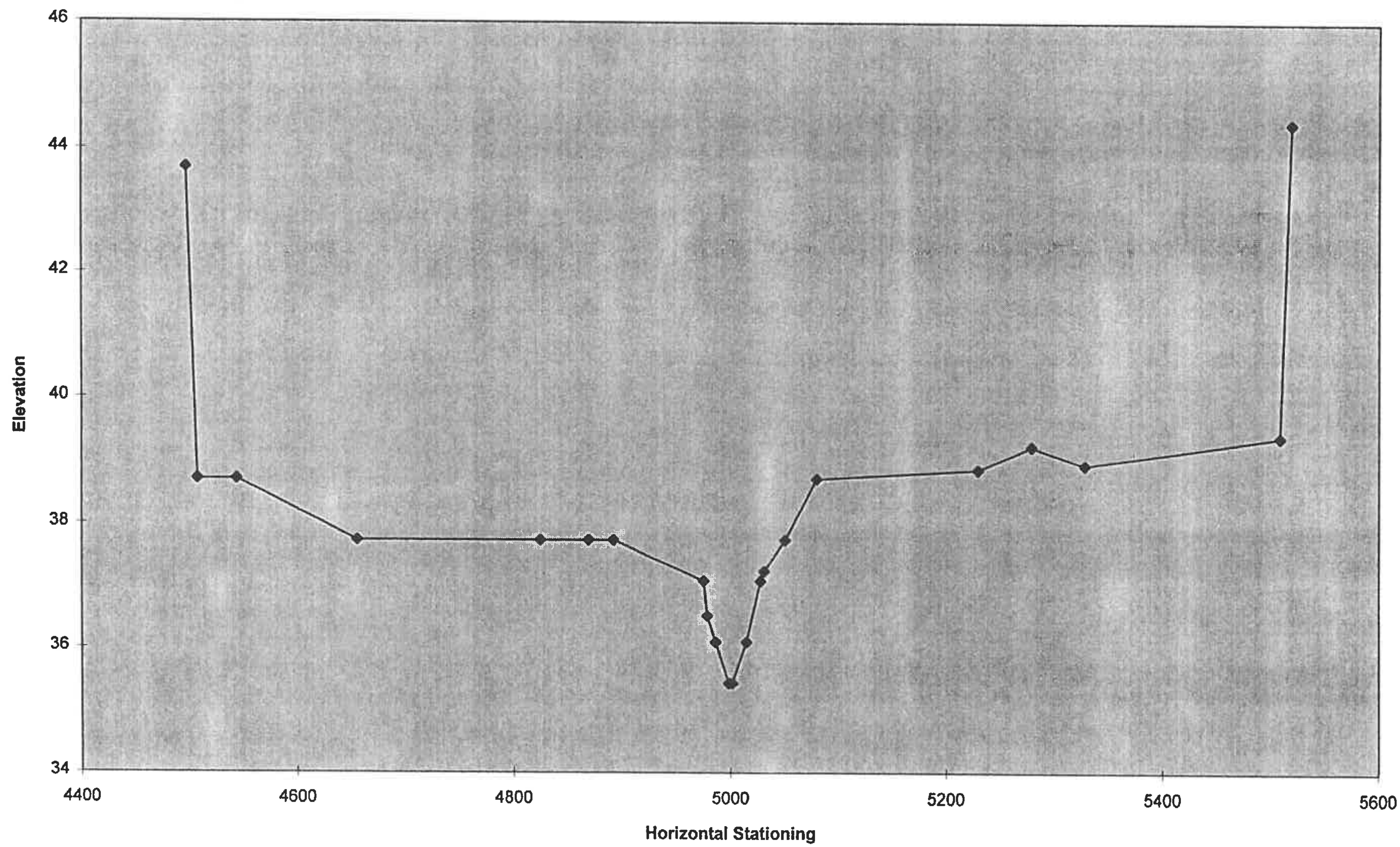
Station CL of 45' Bridge	1000 ft
Width of 45' Bridge	47 ft
Length of Bridge	45 ft
Station of **EXIT** Section: 1000 - 45 - 47/2 =	**932**
Station of **FULLV** Section: 1000 - 47/2 =	**977**
Station of **APPR** Section: 1000+45+47/2 =	**1069**

GENERAL LOCATION OF CROSS SECTIONS USED IN WSPRO

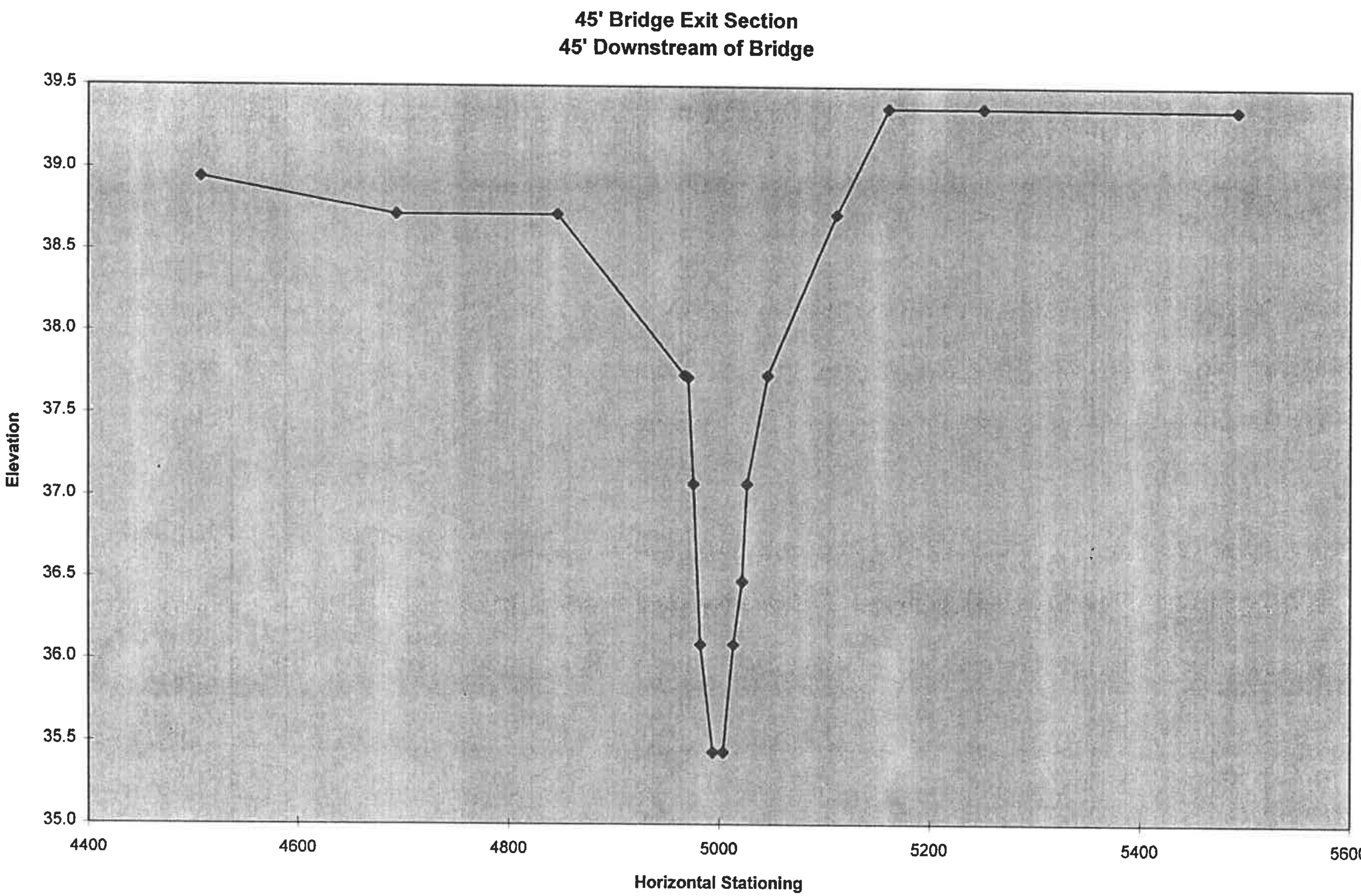


SR29 - Turkey Branch
Bridge No. 050031

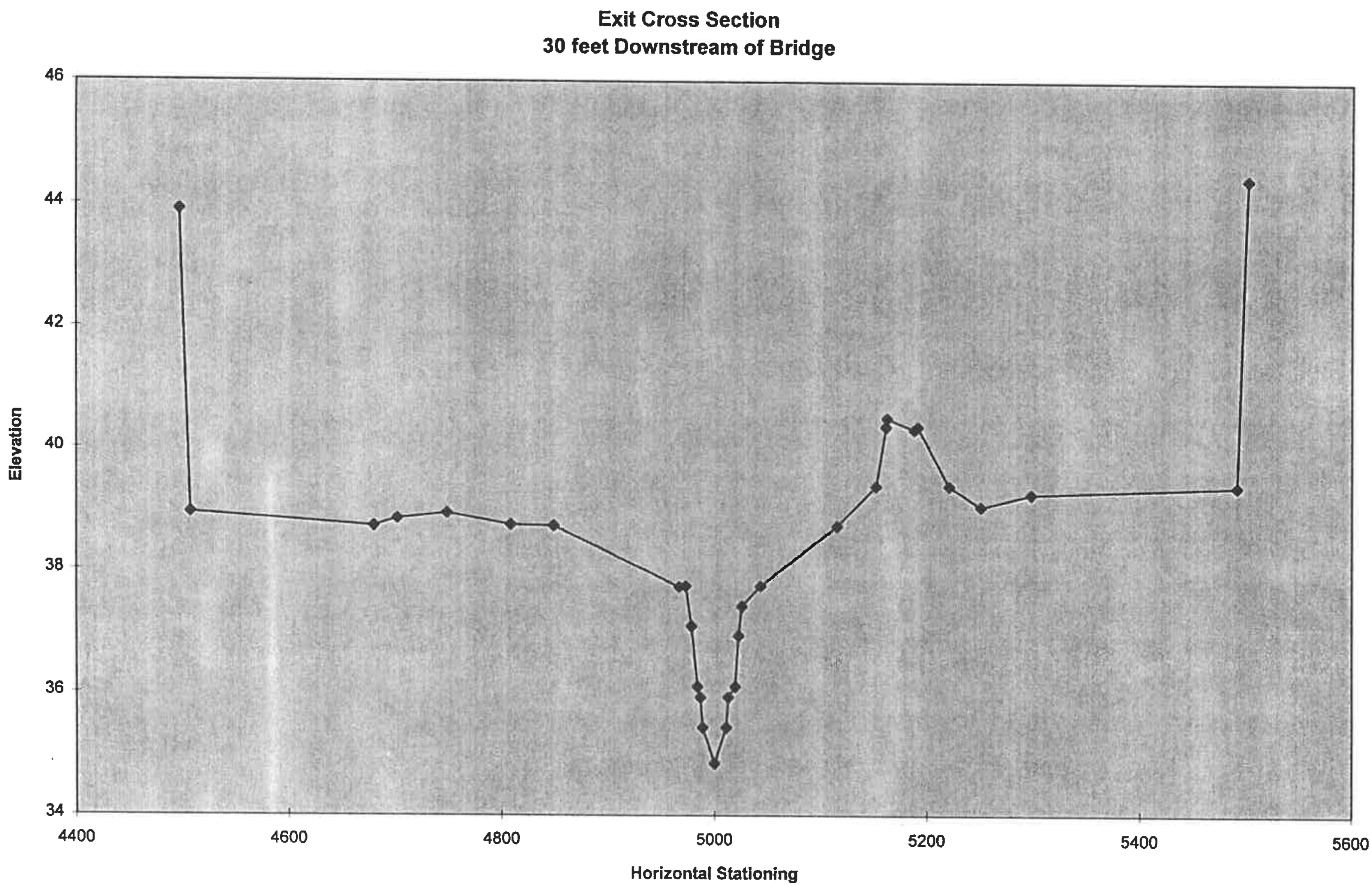
Survey Cross Section 1
100 feet Downstream of Bridge



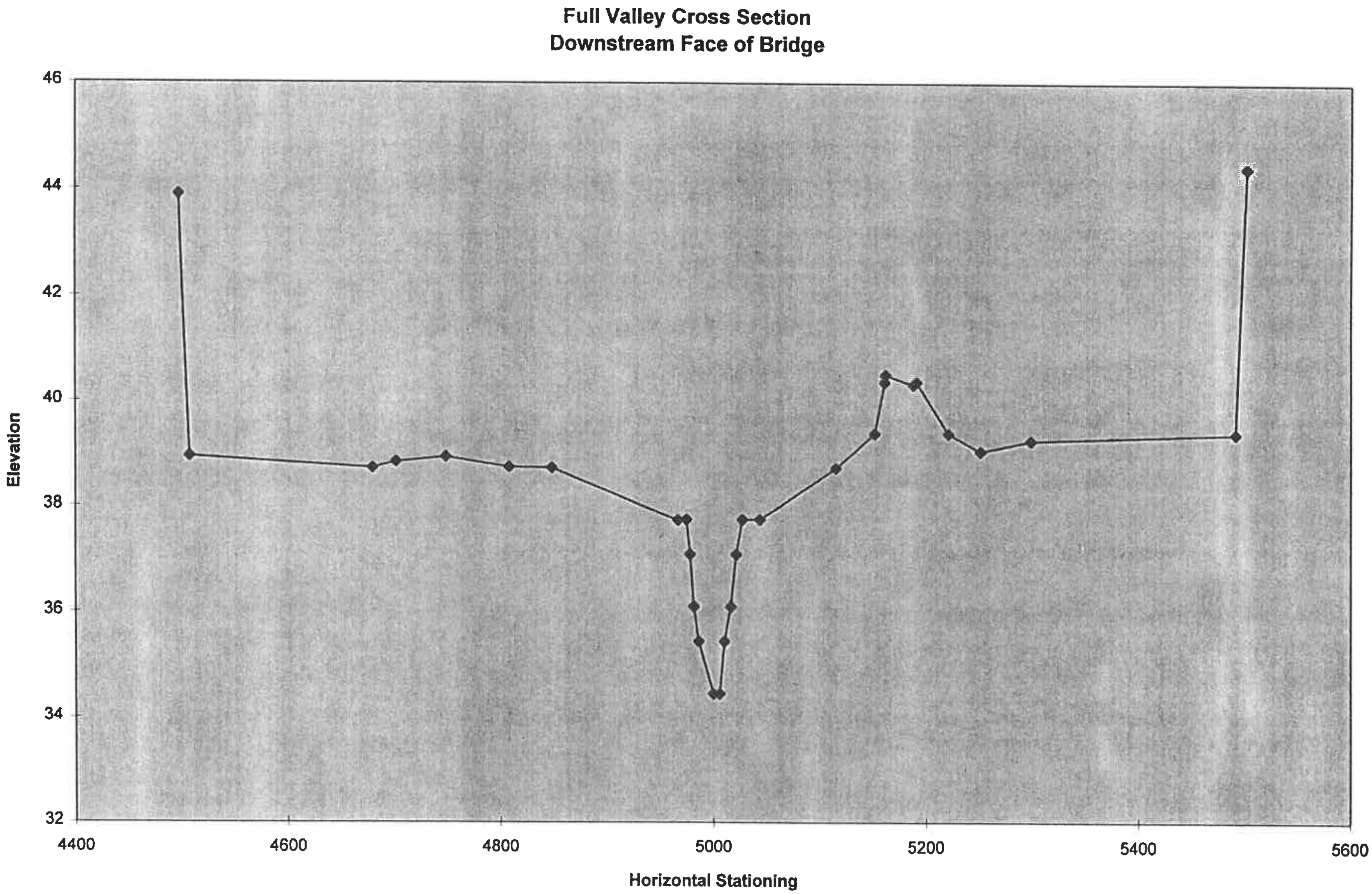
SR 29 - Turkey Branch
Bridge No. 050031



SR 29 - Turkey Branch
Bridge No. 050031

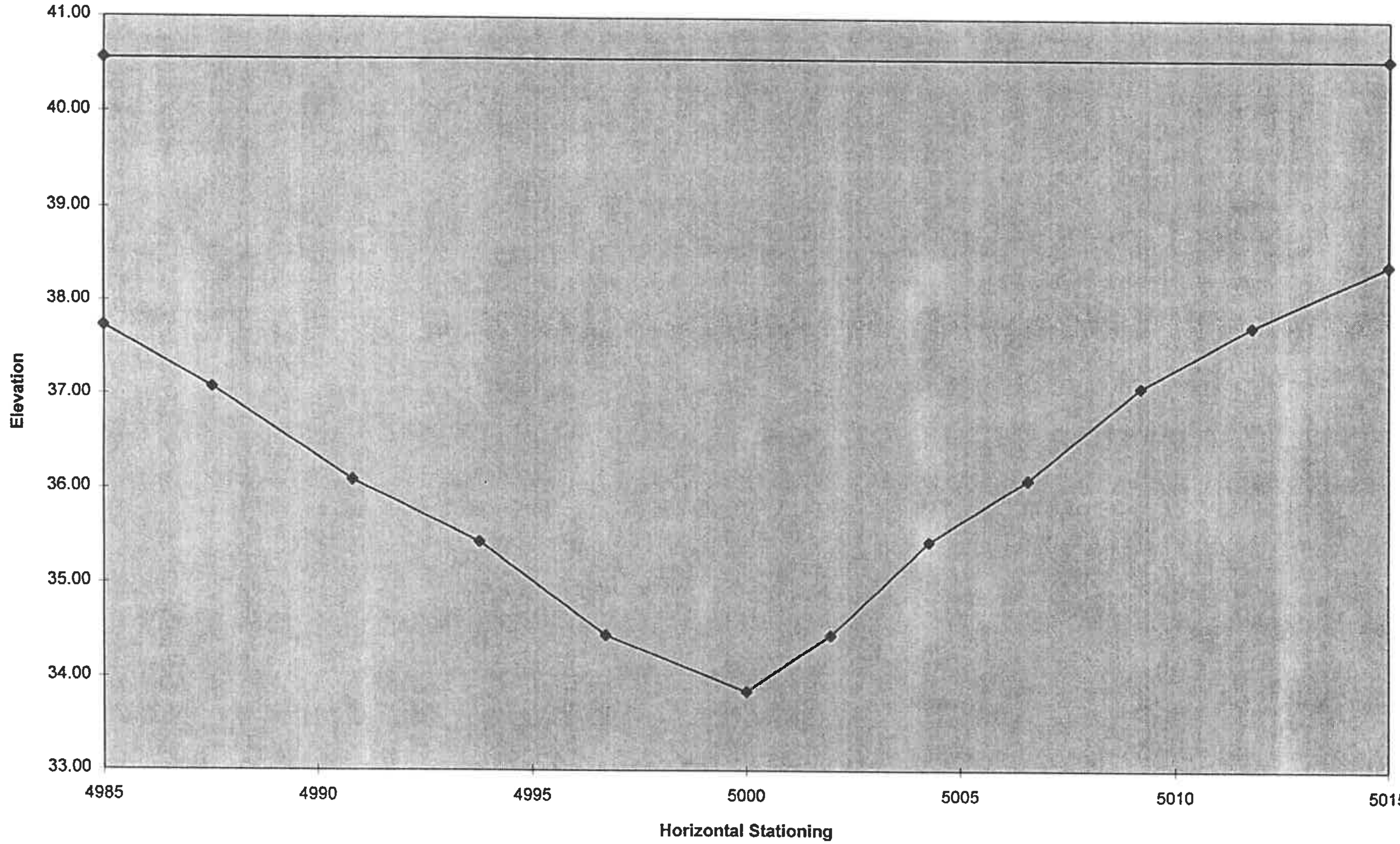


SR 29 - Turkey Branch
Bridge No. 050031



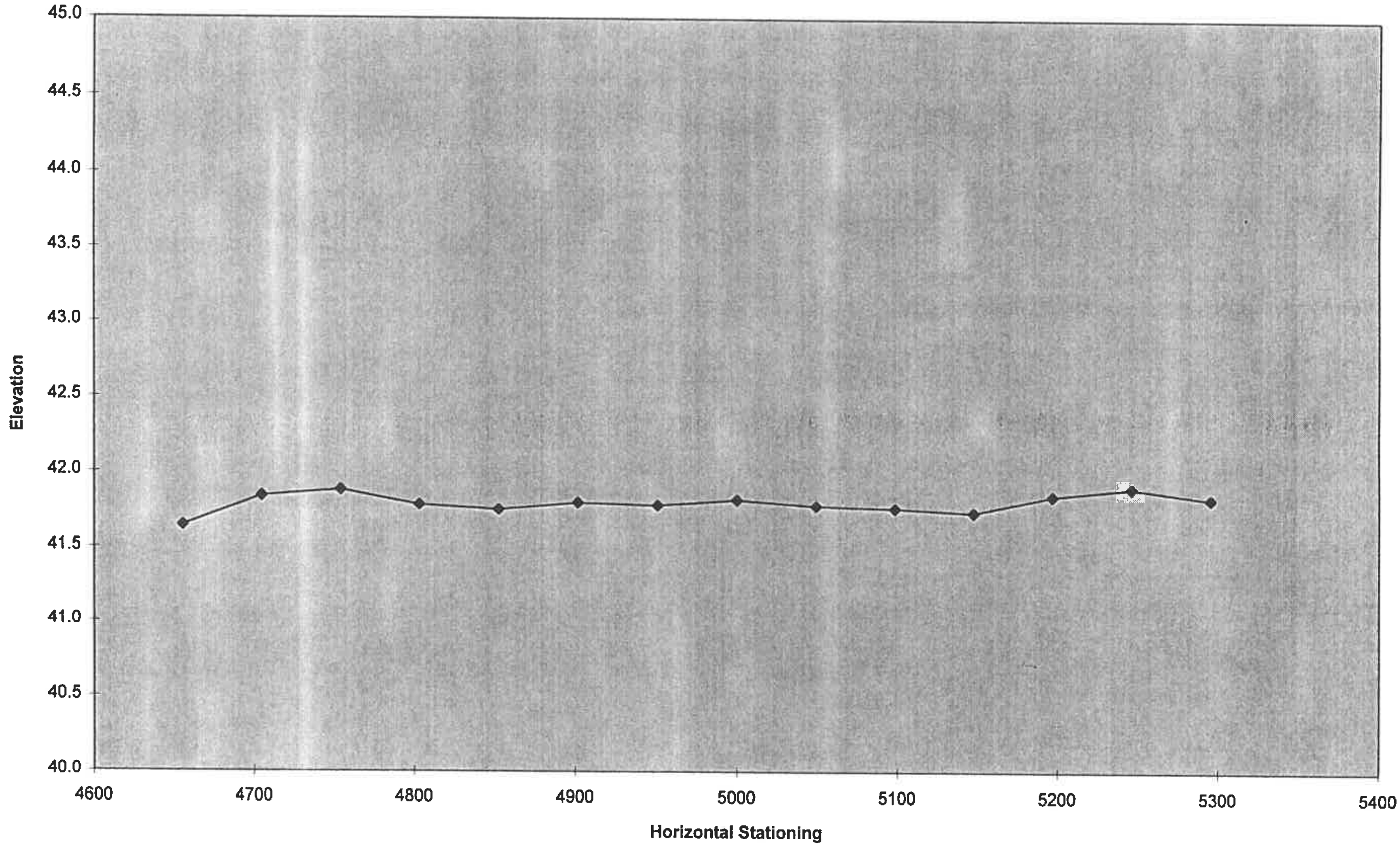
SR 29 - Turkey Branch
Bridge No. 050031

Bridge Cross Section
at Downstream Face of Bridge



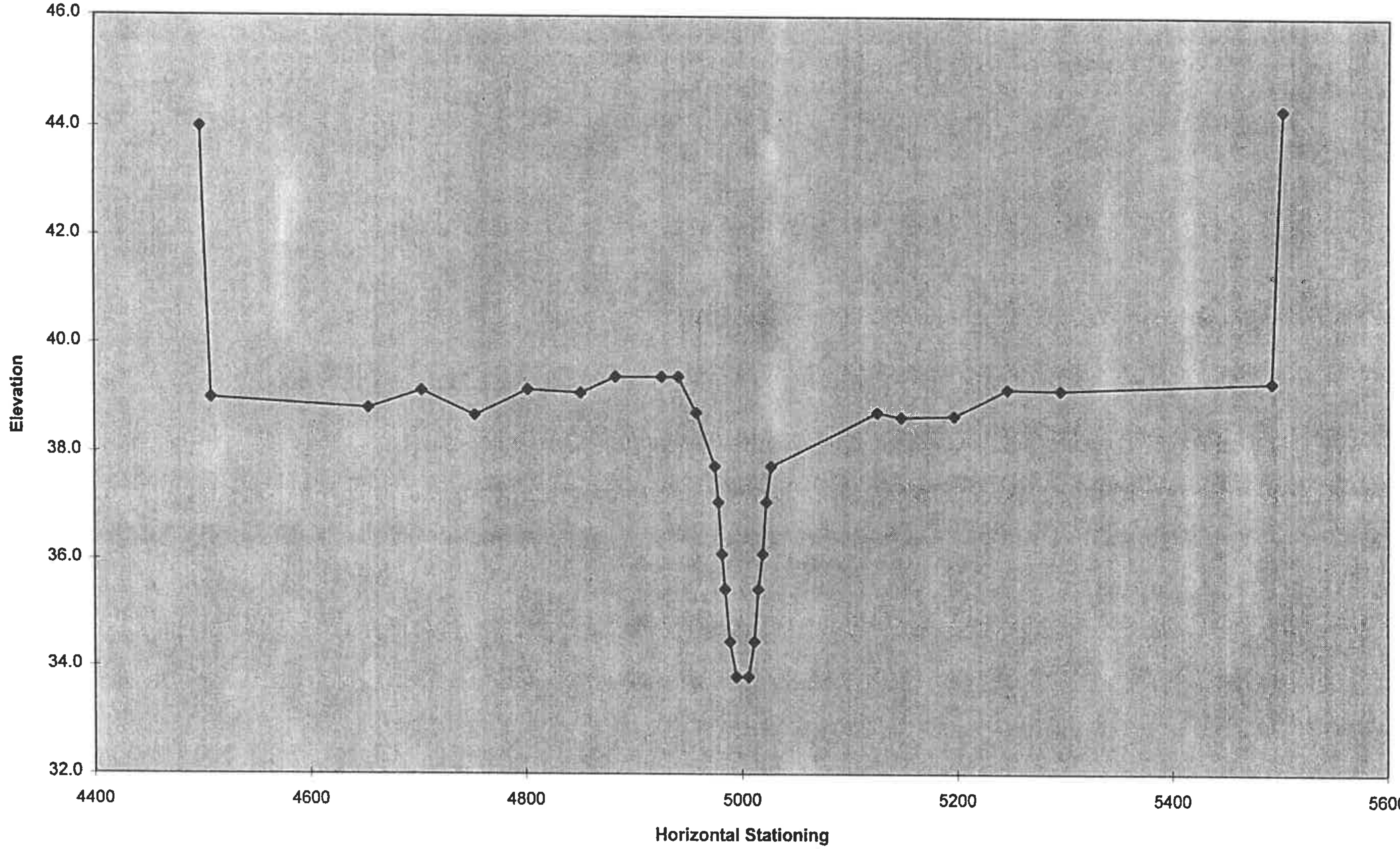
SR 29 - Turkey Branch
Bridge No. 050031

Survey Cross Section CL SR 29



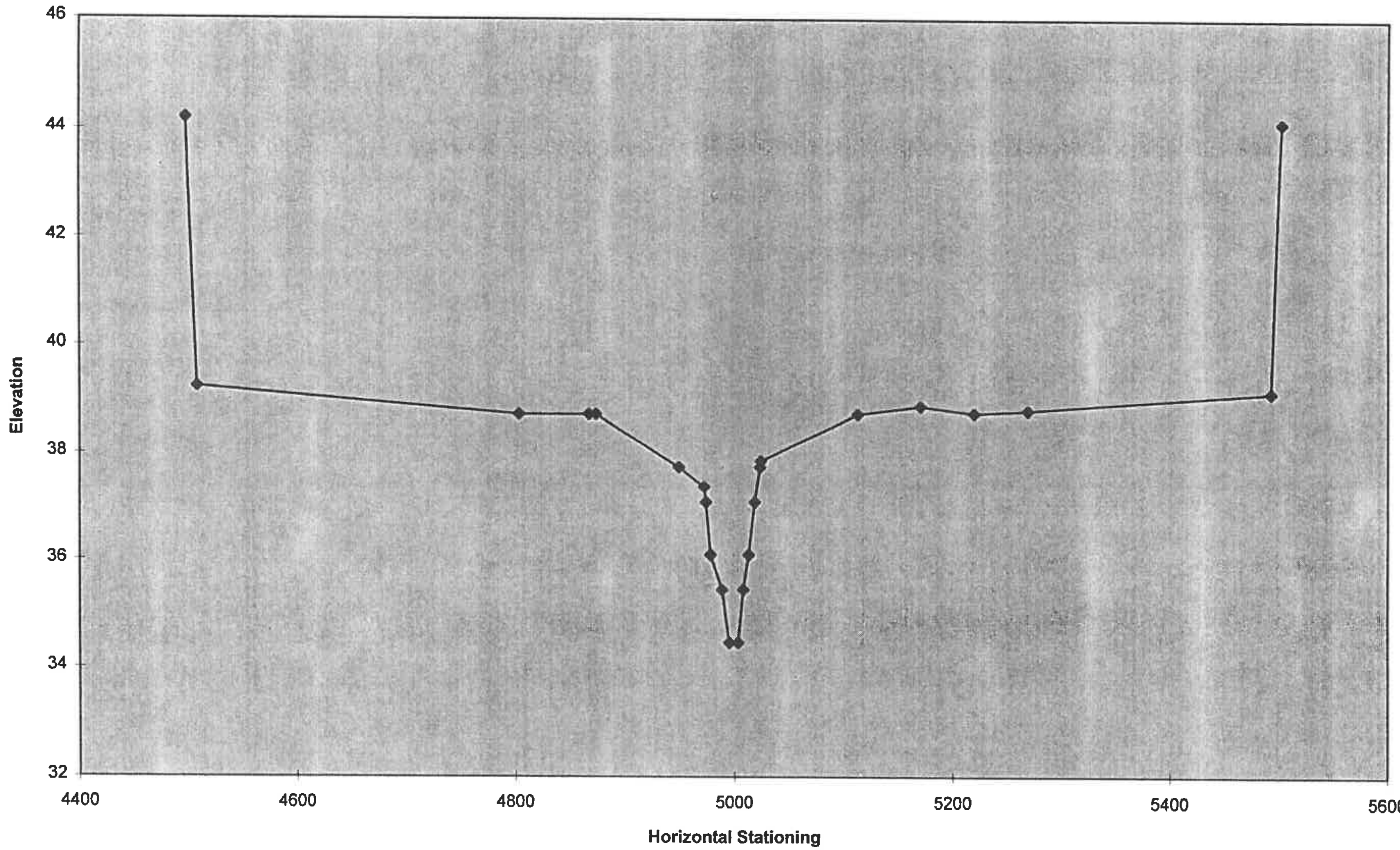
SR 29 - Turkey Branch
Bridge No. 050031

Approach Cross Section
30 feet Upstream of Bridge

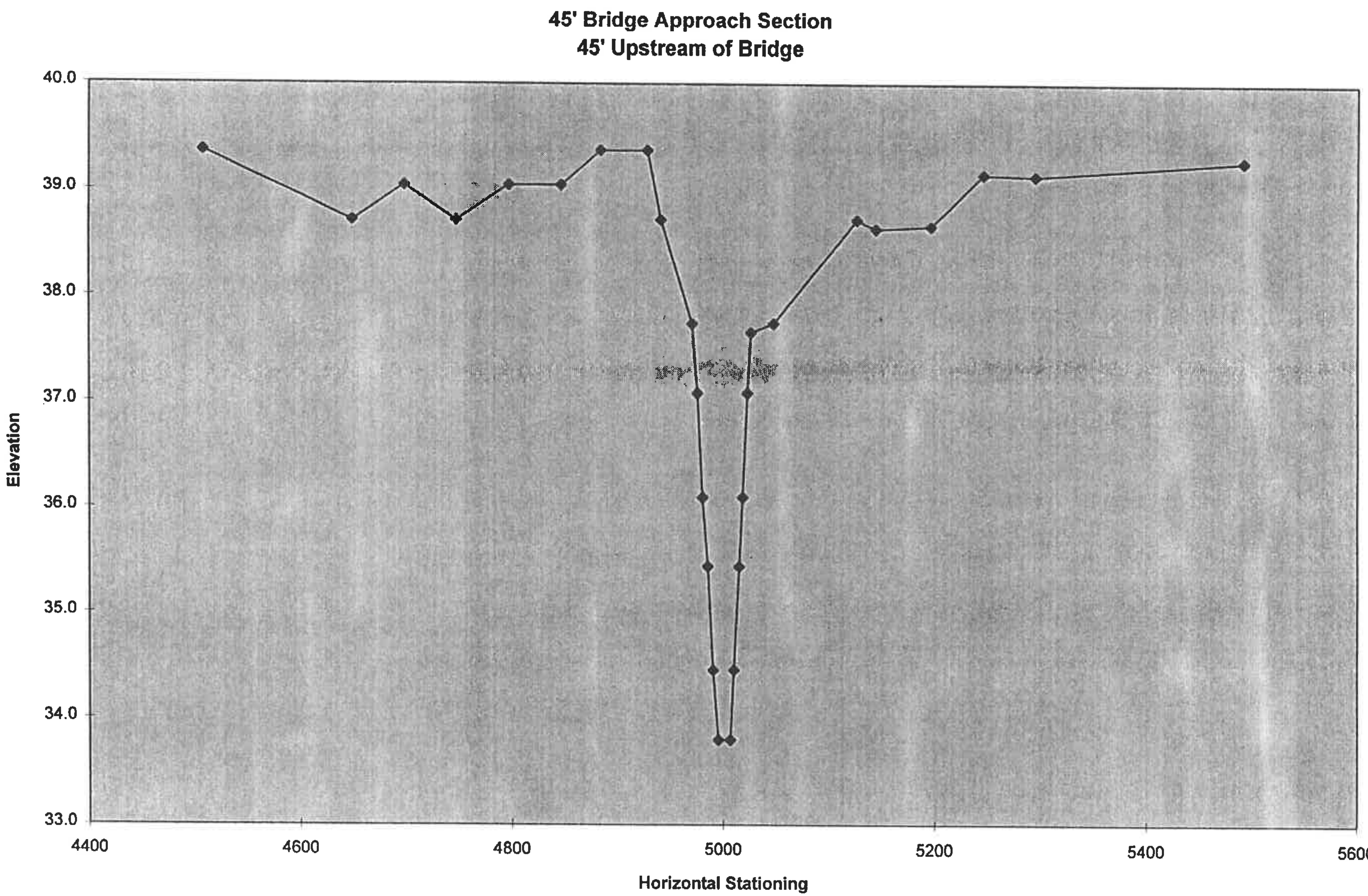


SR 29 - Turkey Branch
Bridge No. 050031

Reference Cross Section
100 feet Upstream of Bridge



SR 29 - Turkey Branch
Bridge No. 050031

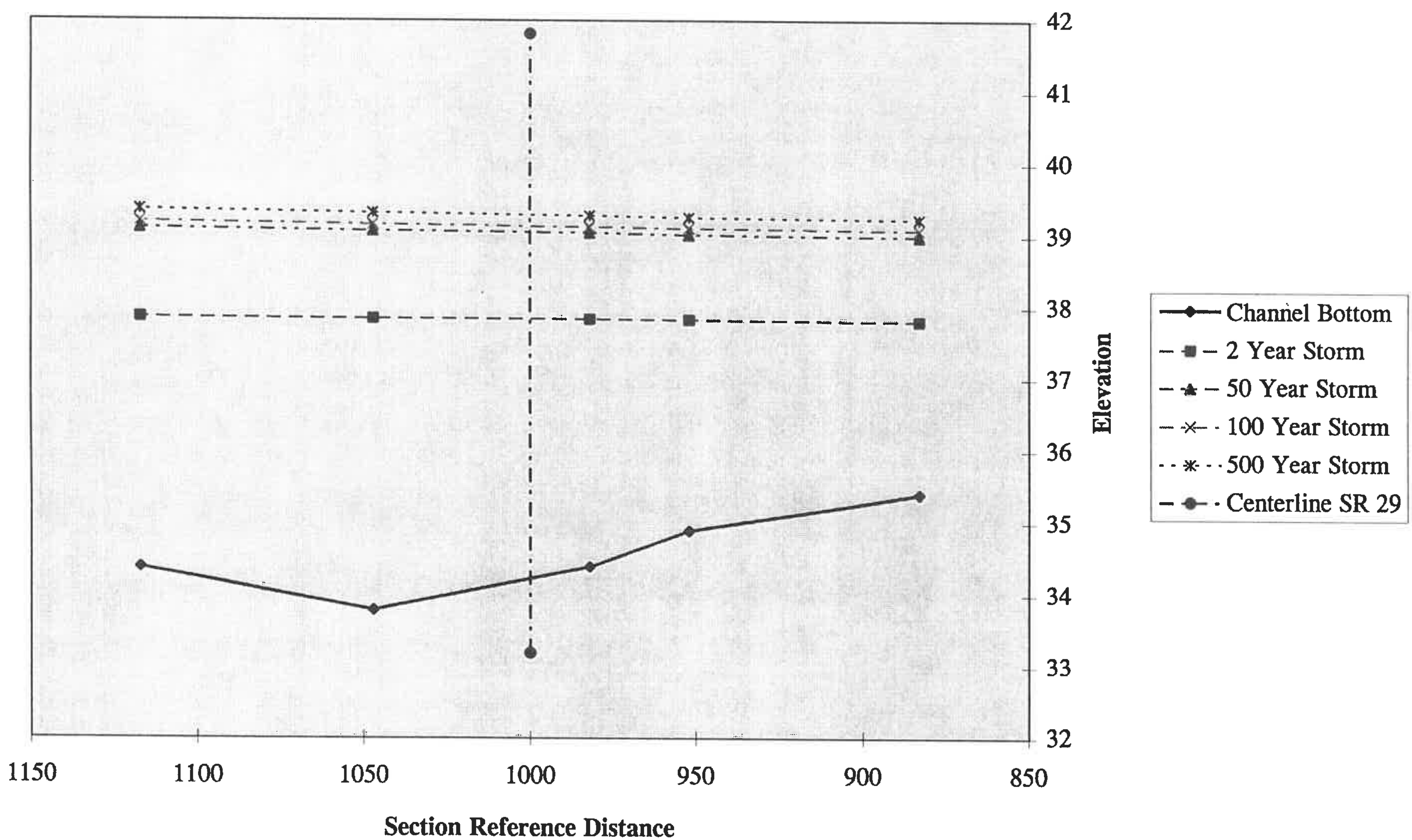


SR 29 - Turkey Branch
Bridge No. 050031

SR 29 - Turkey Branch

OPEN CHANNEL ANALYSIS

Water Surface Profiles



SR 29 - Turkey Branch
Bridge No. 050031

No Bridge

```
WSPRO        FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

           *** RUN DATE & TIME: 03-05-96  13:19

   T1          SR 29 - OPEN CHANNEL ANALYSIS
   T2          TURKEY BRANCH @ BR#050031 (BR31OPEN.DAT)
   *
   J3          5  6  3  17  13  14  16  28
   *
   *           2 YEAR  50 YEAR  100 YEAR  500 YEAR
   Q             55      263       305      407
 *** Q-DATA FOR SEC-ID, ISEQ =             1
   *
   *           SLOPE FROM QUAD MAP
   SK          0.0004  0.0004  0.0004  0.0004
   *
   *           SURVEY CROSS SECTION LOCATED 100' DOWNSTREAM OF BRIDGE

 *** START PROCESSING CROSS SECTION - "SURV1"
   XS    SURV1  883
   GR            725,45.0   750,40.0  4508,38.7  4544,38.7
   GR          4824,37.7  4869,37.7  4892,37.7  4975,37.1  4979,37.0
   GR          4986,36.1  4998,35.4  5002,35.4  5015,36.1  5028,37.1
   GR          5031,37.2  5051,37.7  5080,38.7  5230,38.9  5279,39.2
   GR          5328,38.9  5509,39.4  6250,40.0  6275,45.0
   N           0.08  0.08  0.06
   SA            4979    5031
   *
   *
   *           SURVEY X-SCT LOCATED 30' DOWNSTREAM OF BRIDGE

 *** FINISH PROCESSING CROSS SECTION - "SURV1"
 *** CROSS SECTION "SURV1" WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "SURV1" AT SRD =     883.  ERR-CODE =      0

      SKEW      IHFNO     VSLOPE        EK         CK
        .0         0. *********        .50        .00

 X-Y COORDINATE PAIRS   (NGP =  23):
        X        Y            X        Y            X        Y            X        Y
     725.0    45.00       750.0    40.00       4508.0    38.70       4544.0    38.70
    4824.0    37.70      4869.0    37.70       4892.0    37.70       4975.0    37.10
    4979.0    37.00      4986.0    36.10       4998.0    35.40       5002.0    35.40
    5015.0    36.10      5028.0    37.10       5031.0    37.20       5051.0    37.70
    5080.0    38.70      5230.0    38.90       5279.0    39.20       5328.0    38.90
    5509.0    39.40      6250.0    40.00       6275.0    45.00

  X-Y MAX-MIN POINTS:
     XMIN       Y           X      YMIN       XMAX        Y           X      YMAX
    725.0    45.00      4998.0    35.40     6275.0    45.00       725.0    45.00

 SUBAREA BREAKPOINTS (NSA =  3):
        4979.   5031.

 ROUGHNESS COEFFICIENTS (NSA =  3):
          .080     .080     .060

 *** START PROCESSING CROSS SECTION - "EXIT "
```

```
  XS   EXIT   952
  GR          740,45.0   750,40.0  4508,38.9
  GR         4680,38.7  4702,38.8  4749,38.9  4808,38.7
  GR         4849,38.7  4973,37.7  4979,37.1  4984,36.1  4987,35.9  4989,35.4
  GR         5000,34.9  5011,35.4  5013,35.9  5020,36.1  5023,36.9  5026,37.4
  GR         5044,37.7  5115,38.7  5152,39.4
  GR         5221,39.4  5299,39.2  5492,39.4  6250,40.0  6260,45.0
  N          0.08   0.08  0.06
  SA            4973     5026
  FL         82    4986    66    5027    49
  *
  *
  *
  *          SURVEY X-SCT LOCATED @ DOWNSTREAM FACE OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "EXIT "
*** CROSS SECTION "EXIT " WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "EXIT " AT SRD =    952.  ERR-CODE =      0

     SKEW      IHFNO    VSLOPE         EK         CK
       .0         0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  27):
       X       Y           X       Y           X       Y           X       Y
     740.0   45.00       750.0   40.00      4508.0   38.90      4680.0   38.70
    4702.0   38.80      4749.0   38.90      4808.0   38.70      4849.0   38.70
    4973.0   37.70      4979.0   37.10      4984.0   36.10      4987.0   35.90
    4989.0   35.40      5000.0   34.90      5011.0   35.40      5013.0   35.90
    5020.0   36.10      5023.0   36.90      5026.0   37.40      5044.0   37.70
    5115.0   38.70      5152.0   39.40      5221.0   39.40      5299.0   39.20
    5492.0   39.40      6250.0   40.00      6260.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y           X    YMIN       XMAX        Y           X    YMAX
     740.0   45.00      5000.0   34.90      6260.0   45.00       740.0   45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4973.   5026.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080     .080     .060

FLOW LENGTH DATA (NFL = 3):
            FLEN       XSTA       FLEN       XSTA       FLEN
             82.      4986.        66.      5027.        49.

*** START PROCESSING CROSS SECTION - "FULLV"
  XS   FULLV   982
  GR          740,45.0   750,40.0
  GR         4508,38.9  4680,38.7  4702,38.8  4749,38.9  4808,38.7
  GR         4849,38.7  4967,37.7  4975,37.7  4978,37.1  4982,36.1  4986,35.4
  GR         5000,34.4  5006,34.4  5010,35.4  5016,36.1  5022,37.1  5028,37.7
  GR         5044,37.7  5115,38.7  5152,39.4
  GR         5221,39.4  5299,39.2  5492,39.4
  GR         6250,40.0  6260,45.0
  N          0.08   0.08  0.06
  SA            4975    5028
  *
  *
```

```
 *
 *         SURVEY X-SCT LOCATED 30' UPSTREAM OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "FULLV"
*** CROSS SECTION "FULLV" WRITTEN TO DISK, RECORD NO. =  3

--- DATA SUMMARY FOR SECID "FULLV" AT SRD =    982.  ERR-CODE =       0

     SKEW      IHFNO     VSLOPE          EK         CK
       .0         0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  27):
       X        Y             X        Y             X        Y             X        Y
   740.0    45.00         750.0    40.00        4508.0    38.90        4680.0    38.70
  4702.0    38.80        4749.0    38.90        4808.0    38.70        4849.0    38.70
  4967.0    37.70        4975.0    37.70        4978.0    37.10        4982.0    36.10
  4986.0    35.40        5000.0    34.40        5006.0    34.40        5010.0    35.40
  5016.0    36.10        5022.0    37.10        5028.0    37.70        5044.0    37.70
  5115.0    38.70        5152.0    39.40        5221.0    39.40        5299.0    39.20
  5492.0    39.40        6250.0    40.00        6260.0    45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y             X     YMIN         XMAX        Y             X     YMAX
    740.0    45.00        5000.0    34.40       6260.0    45.00         740.0    45.00

SUBAREA BREAKPOINTS (NSA =  3):
      4975.   5028.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .080    .060

*** START PROCESSING CROSS SECTION - "APPR "
  XS   APPR    1047
  GR         1090,45.0  1100,40.0  4508,39.0
  GR         4654,38.8  4703,39.1  4753,38.7  4802,39.1
  GR         4851,39.1  4884,39.4
  GR         4926,39.4  4942,39.4  4958,38.7
  GR         4975,37.7  4978,37.1  4982,36.1  4985,35.4
  GR         4989,34.4  4995,33.8  5006,33.8  5011,34.4
  GR         5015,35.4  5019,36.1  5022,37.1  5027,37.7
  GR         5125,38.7  5148,38.6  5197,38.7  5246,39.1
  GR         5295,39.1  5492,39.3  6450,40.0  6460,45.0
  N          0.07  0.08  0.06
  SA         4975  5027
  *
  *
  *          SURVEY X-SCT LOCATED 100' UPSTREAM OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "APPR "
*** CROSS SECTION "APPR " WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "APPR " AT SRD =   1047.  ERR-CODE =       0

     SKEW      IHFNO     VSLOPE          EK         CK
       .0         0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  32):
       X        Y             X        Y             X        Y             X        Y
  1090.0    45.00        1100.0    40.00        4508.0    39.00        4654.0    38.80
  4703.0    39.10        4753.0    38.70        4802.0    39.10        4851.0    39.10
```

```
   4884.0   39.40     4926.0   39.40     4942.0   39.40     4958.0   38.70
   4975.0   37.70     4978.0   37.10     4982.0   36.10     4985.0   35.40
   4989.0   34.40     4995.0   33.80     5006.0   33.80     5011.0   34.40
   5015.0   35.40     5019.0   36.10     5022.0   37.10     5027.0   37.70
   5125.0   38.70     5148.0   38.60     5197.0   38.70     5246.0   39.10
   5295.0   39.10     5492.0   39.30     6450.0   40.00     6460.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN       Y          X     YMIN       XMAX       Y          X     YMAX
   1090.0   45.00     4995.0   33.80     6460.0   45.00     1090.0   45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4975.   5027.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .070    .080    .060

*** START PROCESSING CROSS SECTION - "REFE "
  XS   REFE    1117
  GR         1090,45.0  1100,40.0
  GR         4508,39.2  4803,38.7  4867,38.7
  GR         4874,38.7  4949,37.7  4972,37.4  4974,37.1
  GR         4978,36.1  4989,35.4  4995,34.4  5003,34.4
  GR         5008,35.4  5013,36.1  5019,37.1  5024,37.7
  GR         5025,37.8  5113,38.7  5171,38.9  5220,38.7
  GR         5269,38.8  5492,39.1  6450,40.0  6460,45.0
  N          0.07   0.08   0.06
  SA         4972   5025
  FL         82   4986   66   5027   49
  *
  EX

*** FINISH PROCESSING CROSS SECTION - "REFE "
*** CROSS SECTION "REFE " WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "REFE " AT SRD =   1117.  ERR-CODE =      0

      SKEW      IHFNO    VSLOPE        EK        CK
        .0         0. *********       .50       .00

X-Y COORDINATE PAIRS  (NGP =  25):
         X        Y          X        Y          X        Y          X        Y
   1090.0   45.00     1100.0   40.00     4508.0   39.20     4803.0   38.70
   4867.0   38.70     4874.0   38.70     4949.0   37.70     4972.0   37.40
   4974.0   37.10     4978.0   36.10     4989.0   35.40     4995.0   34.40
   5003.0   34.40     5008.0   35.40     5013.0   36.10     5019.0   37.10
   5024.0   37.70     5025.0   37.80     5113.0   38.70     5171.0   38.90
   5220.0   38.70     5269.0   38.80     5492.0   39.10     6450.0   40.00
   6460.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN       Y          X     YMIN       XMAX       Y          X     YMAX
   1090.0   45.00     4995.0   34.40     6460.0   45.00     1090.0   45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4972.   5025.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .070    .080    .060
```

```
 FLOW LENGTH DATA (NFL = 3):
            FLEN       XSTA       FLEN       XSTA       FLEN
             82.      4986.        66.      5027.        49.


 +++ BEGINNING PROFILE CALCULATIONS --    4

***********************************2 YEAR STORM*******************************

  XSID:CODE    SRDL     LEW      AREA    VHD     HF     EGL    CRWS        Q     WSEL
        SRD    FLEN     REW         K   ALPH     HO     ERR     FR#      VEL

 SURV1:XS    ******   4792.      142.    .00  *****   37.82   36.20      55.   37.81
       883.  ******   5054.     2749.   1.59  ***** *******     .12      .39

 EXIT :XS       69.   4956.      108.    .00    .03   37.84 *******      55.   37.84
       952.     67.   5054.     2945.   1.08    .00     .00     .09      .51

 FULLV:XS       30.   4949.      117.    .00    .01   37.85 *******      55.   37.85
       982.     30.   5055.     3409.   1.08    .00     .00     .08      .47

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "APPR "     KRATIO =  1.42

 APPR :XS       65.   4972.      139.    .00    .01   37.87 *******      55.   37.86
      1047.     65.   5043.     4832.   1.02    .00     .00     .05      .40

 REFE :XS       70.   4936.      120.    .00    .01   37.88 *******      55.   37.88
      1117.     69.   5032.     3439.   1.10    .00     .00     .08      .46

   FIRST USER DEFINED TABLE.

     XSID:CODE         Q    SRD     WSEL      AREA      VEL      FR#        K    XSTW
    SURV1:XS         55.   883.    37.81      142.      .39      .12    2749.    262.
    EXIT :XS         55.   952.    37.84      108.      .51      .09    2945.     98.
    FULLV:XS         55.   982.    37.85      117.      .47      .08    3409.    105.
    APPR :XS         55.  1047.    37.86      139.      .40      .05    4832.     71.
    REFE :XS         55.  1117.    37.88      120.      .46      .08    3439.     97.


***********************************50 YEAR STORM******************************

  XSID:CODE    SRDL     LEW      AREA    VHD     HF     EGL    CRWS        Q     WSEL
        SRD    FLEN     REW         K   ALPH     HO     ERR     FR#      VEL

 SURV1:XS    ******   3634.      835.    .00  *****   39.01   37.02     263.   39.00
       883.  ******   5365.    13143.   2.73  ***** *******     .13      .31

 EXIT :XS       69.   4048.      471.    .01    .04   39.05 *******     263.   39.03
       952.     67.   5133.     9989.   2.47    .00     .00     .24      .56

 FULLV:XS       30.   3975.      505.    .01    .02   39.07 *******     263.   39.06
       982.     30.   5134.    10817.   2.63    .00     .00     .23      .52

 APPR :XS       65.   4198.      414.    .01    .04   39.10 *******     263.   39.09
      1047.     65.   5245.    11838.   2.01    .00     .00     .23      .64
```

```
REFE :XS      70.  4549.     540.   .01    .03    39.14 *******    263.    39.13
     1117.    68.  5524.   11848.  2.34    .00      .00     .18      .49
```

FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
SURV1:XS	263.	883.	39.00	835.	.31	.13	13143.	1666.
EXIT :XS	263.	952.	39.03	471.	.56	.24	9989.	1085.
FULLV:XS	263.	982.	39.06	505.	.52	.23	10817.	1159.
APPR :XS	263.	1047.	39.09	414.	.64	.23	11838.	896.
REFE :XS	263.	1117.	39.13	540.	.49	.18	11848.	974.

```
**************************************100 YEAR STORM********************************

 XSID:CODE   SRDL    LEW      AREA   VHD     HF     EGL    CRWS       Q     WSEL
      SRD    FLEN    REW         K  ALPH     HO     ERR     FR#     VEL

SURV1:XS   ******  3387.     990.   .00  *****   39.09   37.15     305.    39.09
      883. ******  5396.   15249.  2.73  ***** *******     .13      .31

EXIT :XS      69.  3755.     577.   .01    .04   39.13 *******     305.    39.12
      952.    67.  5137.   11346.  2.79    .00     .00     .24      .53

FULLV:XS      30.  3681.     617.   .01    .02   39.15 *******     305.    39.14
      982.    30.  5138.   12275.  2.95    .00     .00     .23      .49

APPR :XS      65.  3899.     517.   .01    .04   39.19 *******     305.    39.18
     1047.    65.  5372.   12696.  2.69    .00     .00     .28      .59

REFE :XS      70.  4412.     639.   .01    .04   39.23 *******     305.    39.22
     1117.    68.  5622.   13340.  2.50    .00     .00     .18      .48
```

FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
SURV1:XS	305.	883.	39.09	990.	.31	.13	15249.	1972.
EXIT :XS	305.	952.	39.12	577.	.53	.24	11346.	1382.
FULLV:XS	305.	982.	39.14	617.	.49	.23	12275.	1457.
APPR :XS	305.	1047.	39.18	517.	.59	.28	12696.	1386.
REFE :XS	305.	1117.	39.22	639.	.48	.18	13340.	1211.

```
**************************************500 YEAR STORM********************************

 XSID:CODE   SRDL    LEW      AREA   VHD     HF     EGL    CRWS       Q     WSEL
      SRD    FLEN    REW         K  ALPH     HO     ERR     FR#     VEL

SURV1:XS   ******  2948.    1331.   .00  *****   39.24   37.49     407.    39.24
      883. ******  5451.   20332.  2.55  ***** *******     .12      .31

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                               "EXIT "      KRATIO =    .68

EXIT :XS      69.  3234.     832.   .01    .04   39.29 *******     407.    39.27
      952.    70.  5369.   13866.  3.49    .00     .00     .25      .49
```

```
FULLV:XS       30.  3152.    891.   .01    .02   39.31 *******   407.   39.30
      982.     30.  5392.  14984.  3.72    .00     .00     .24    .46

)PPR :XS       65.  3351.    799.   .01    .04   39.35 *******   407.   39.34
     1047.     65.  5546.  16190.  3.53    .00     .00     .28    .51

REFE :XS       70.  3707.    912.   .01    .04   39.40 *******   407.   39.39
     1117.     66.  5798.  16814.  2.99    .00     .00     .21    .45
```

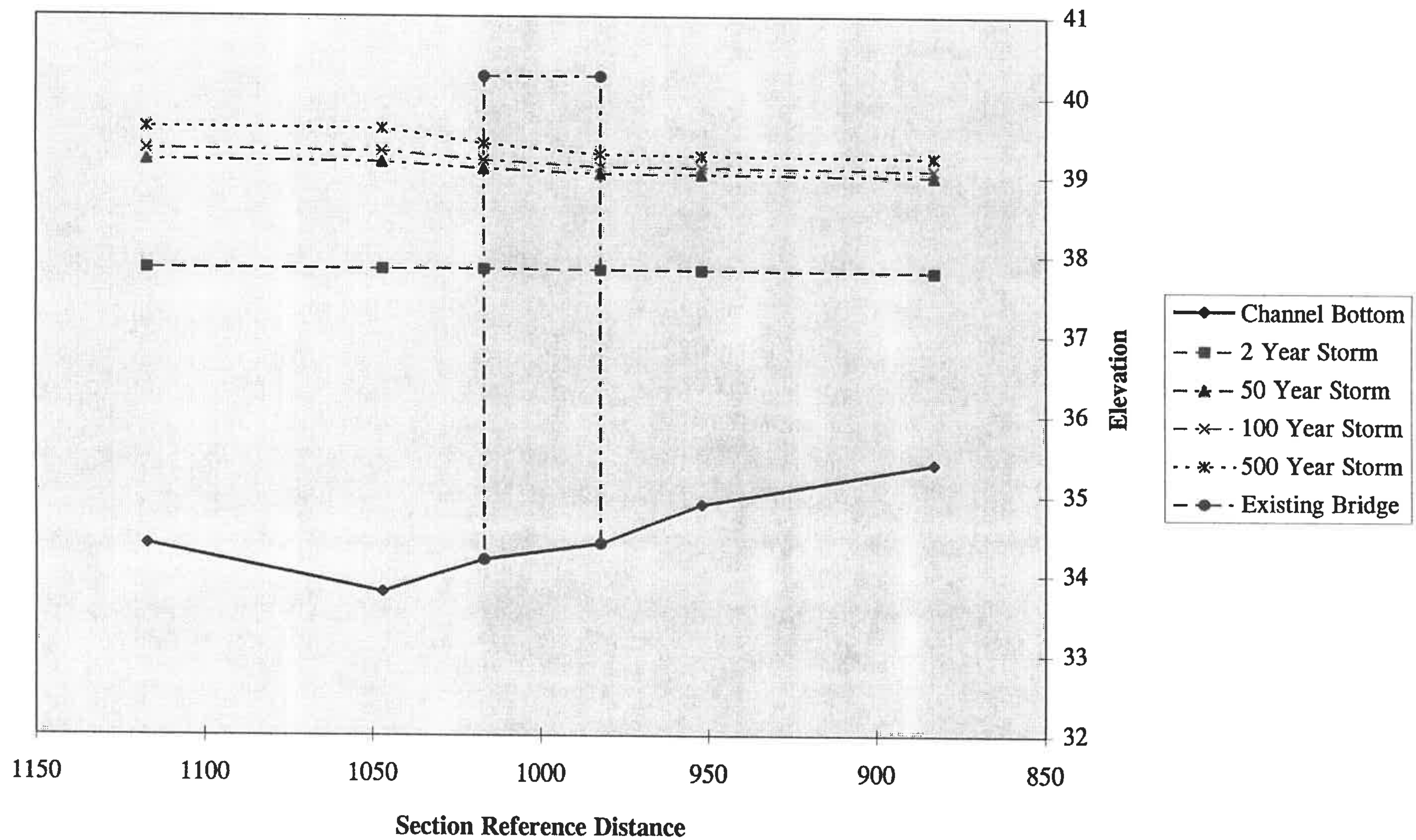
FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
SURV1:XS	407.	883.	39.24	1331.	.31	.12	20332.	2503.
EXIT :XS	407.	952.	39.27	832.	.49	.25	13866.	2011.
FULLV:XS	407.	982.	39.30	891.	.46	.24	14984.	2126.
APPR :XS	407.	1047.	39.34	799.	.51	.28	16190.	2129.
REFE :XS	407.	1117.	39.39	912.	.45	.21	16814.	2091.

SR 29 - Turkey Branch

EXISTING BRIDGE ANALYSIS

Water Surface Profiles



SR 29 - Turkey Branch
Bridge No. 050031

Existing Bridge

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

            *** RUN DATE & TIME: 03-05-96  13:53

   T1         SR 29 - EXISTING BRIDGE ANALYSIS
   T2         TURKEY BRANCH @ BR#050031 (BR31EXBR.DAT)
   *
   J3         5  6  3  17  13  14  16  28
   *
   *          EXISTING   2 YEAR  50 YEAR  100 YEAR  500 YEAR
   Q             27        55       263       305       407
 *** Q-DATA FOR SEC-ID, ISEQ =               1
   *
   *          SLOPE FROM QUAD MAP
   SK         0.0004  0.0004  0.0004  0.0004   0.0004
   *
   *          SURVEY CROSS SECTION LOCATED 100' DOWNSTREAM OF BRIDGE

 *** START PROCESSING CROSS SECTION - "SURV1"
   XS    SURV1  883
   GR          740,45.0   750,40.0  4508,38.7  4544,38.7
   GR         4824,37.7  4869,37.7  4892,37.7  4975,37.1  4979,36.5
   GR         4986,36.1  4998,35.4  5002,35.4  5015,36.1  5028,37.1
   GR         5031,37.2  5051,37.7  5080,38.7  5230,38.9  5279,39.2
   GR         5328,38.9  5509,39.4  6250,40.0  6260,45.0
   N          0.08     0.08     0.06
   SA              4979     5031
   *
   *
   *          SURVEY X-SCT LOCATED 30' DOWNSTREAM OF BRIDGE

 *** FINISH PROCESSING CROSS SECTION - "SURV1"
 *** CROSS SECTION "SURV1" WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "SURV1" AT SRD =    883.  ERR-CODE =      0

      SKEW     IHFNO    VSLOPE         EK        CK
        .0        0. *********        .50       .00

X-Y COORDINATE PAIRS  (NGP =  23):
        X       Y             X       Y            X       Y            X       Y
    740.0   45.00         750.0   40.00       4508.0   38.70       4544.0   38.70
   4824.0   37.70        4869.0   37.70       4892.0   37.70       4975.0   37.10
   4979.0   36.50        4986.0   36.10       4998.0   35.40       5002.0   35.40
   5015.0   36.10        5028.0   37.10       5031.0   37.20       5051.0   37.70
   5080.0   38.70        5230.0   38.90       5279.0   39.20       5328.0   38.90
   5509.0   39.40        6250.0   40.00       6260.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN       Y             X    YMIN         XMAX       Y            X    YMAX
    740.0   45.00        4998.0   35.40       6260.0   45.00        740.0   45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4979.   5031.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .080    .060

*** START PROCESSING CROSS SECTION - "EXIT "
```

```
XS    EXIT    952
GR          740,45.0   750,40.0   4508,38.9
GR         4680,38.7  4702,38.8  4749,38.9  4808,38.7
GR         4849,38.7  4973,37.7  4979,37.1  4984,36.1  4987,35.9  4989,35.4
GR         5000,34.9  5011,35.4  5013,35.9  5020,36.1  5023,36.9  5026,37.4
GR         5044,37.7  5115,38.7  5152,39.4
GR         5221,39.4  5299,39.2  5492,39.4  6250,40.0  6260,45.0
N          0.08      0.08      0.06
SA              4973      5026
FL         82   4986    66   5027    49
*
*
*
*          SURVEY X-SCT LOCATED @ DOWNSTREAM FACE OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "EXIT "
*** CROSS SECTION "EXIT " WRITTEN TO DISK, RECORD NO. =   2

--- DATA SUMMARY FOR SECID "EXIT " AT SRD =     952.  ERR-CODE =       0

     SKEW      IHFNO     VSLOPE         EK         CK
       .0         0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  27):
       X        Y             X        Y             X        Y             X        Y
    740.0    45.00        750.0    40.00       4508.0    38.90       4680.0    38.70
   4702.0    38.80       4749.0    38.90       4808.0    38.70       4849.0    38.70
   4973.0    37.70       4979.0    37.10       4984.0    36.10       4987.0    35.90
   4989.0    35.40       5000.0    34.90       5011.0    35.40       5013.0    35.90
   5020.0    36.10       5023.0    36.90       5026.0    37.40       5044.0    37.70
   5115.0    38.70       5152.0    39.40       5221.0    39.40       5299.0    39.20
   5492.0    39.40       6250.0    40.00       6260.0    45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y             X     YMIN         XMAX        Y             X     YMAX
    740.0    45.00       5000.0    34.90       6260.0    45.00        740.0    45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4973.   5026.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .080    .060

FLOW LENGTH DATA (NFL = 3):
           FLEN       XSTA       FLEN       XSTA       FLEN
            82.      4986.        66.      5027.        49.

*** START PROCESSING CROSS SECTION - "FULLV"
XS    FULLV    982
GR          740,45.0   750,40.0
GR         4508,38.9  4680,38.7  4702,38.8  4749,38.9  4808,38.7
GR         4849,38.7  4967,37.7  4975,37.7  4978,37.1  4982,36.1  4986,35.4
GR         5000,34.4  5006,34.4  5010,35.4  5016,36.1  5022,37.1  5028,37.7
GR         5044,37.7  5115,38.7  5152,39.4
GR         5221,39.4  5299,39.2  5492,39.4
GR         6250,40.0  6260,45.0
N          0.08      0.08      0.06
SA              4975      5028
*
*
```

```
*** FINISH PROCESSING CROSS SECTION - "FULLV"
*** CROSS SECTION "FULLV" WRITTEN TO DISK, RECORD NO. =  3

 -- DATA SUMMARY FOR SECID "FULLV" AT SRD =    982.  ERR-CODE =       0

     SKEW     IHFNO    VSLOPE          EK         CK
       .0        0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  27):
        X       Y          X       Y          X       Y          X       Y
    740.0   45.00      750.0   40.00     4508.0   38.90     4680.0   38.70
   4702.0   38.80     4749.0   38.90     4808.0   38.70     4849.0   38.70
   4967.0   37.70     4975.0   37.70     4978.0   37.10     4982.0   36.10
   4986.0   35.40     5000.0   34.40     5006.0   34.40     5010.0   35.40
   5016.0   36.10     5022.0   37.10     5028.0   37.70     5044.0   37.70
   5115.0   38.70     5152.0   39.40     5221.0   39.40     5299.0   39.20
   5492.0   39.40     6250.0   40.00     6260.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
    740.0   45.00     5000.0   34.40     6260.0   45.00      740.0   45.00

SUBAREA BREAKPOINTS (NSA =  3):
       4975.   5028.

ROUGHNESS COEFFICIENTS (NSA =  3):
          .080    .080    .060

*** START PROCESSING CROSS SECTION - "BRDGE"
  BR   BRDGE    982  40.26
  GR        4986,40.26  4986,33.39  4988,33.2  4996,33.31
  GR        5000,33.44  5004,33.58  5012,34.14  5014,34.11
  GR        5014,40.26  4986,40.26
  CD        4  35.1  6.0  41.8  45
  PW 1      33.2,1.0  38.26,1.0  38.26,2.0  40.26,2.0
  N         0.08
  *
  *
  *         CENTERLINE SR 29 ELEVATIONS

*** FINISH PROCESSING CROSS SECTION - "BRDGE"
*** CROSS SECTION "BRDGE" WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "BRDGE" AT SRD =    982.  ERR-CODE =       0

     SKEW     IHFNO    VSLOPE          EK         CK
       .0        0. *********        .50        .00

X-Y COORDINATE PAIRS  (NGP =  10):
        X       Y          X       Y          X       Y          X       Y
   4986.0   40.26     4986.0   33.39     4988.0   33.20     4996.0   33.31
   5000.0   33.44     5004.0   33.58     5012.0   34.14     5014.0   34.11
   5014.0   40.26     4986.0   40.26

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
   4986.0   40.26     4988.0   33.20     5014.0   34.11     4986.0   40.26

ROUGHNESS COEFFICIENTS (NSA =  1):
```

```
        .080

BRIDGE PARAMETERS:
 BRTYPE  BRWDTH     LSEL  USERCD   EMBSS   EMBELV  WWANGL
    4      35.1    40.26 *******   6.00    41.80   45.00

PIER DATA:  NPW =  4    PPCD = 1.
     PELV  PWDTH        PELV  PWDTH        PELV  PWDTH        PELV  PWDTH
     33.20   1.0        38.26   1.0        38.26   2.0        40.26   2.0

*** START PROCESSING CROSS SECTION - "ROAD "
  XR   ROAD   1000  40.0
  GR         4656,41.6  4705,41.8  4754,41.9  4803,41.8  4852,41.7
  GR         4902,41.8  4951,41.8  5000,41.8  5049,41.8  5098,41.8
  GR         5148,41.7  5197,41.8  5246,41.9  5295,41.8
  N           0.012
  *
  *
  *          SURVEY X-SCT LOCATED 30' UPSTREAM OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "ROAD "
*** CROSS SECTION "ROAD " WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "ROAD " AT SRD =   1000.  ERR-CODE =      0

     SKEW     IHFNO    VSLOPE        EK         CK
       .0        0. *********       .50        .00

X-Y COORDINATE PAIRS  (NGP =  14):
       X       Y          X       Y          X       Y          X       Y
   4656.0   41.60    4705.0   41.80    4754.0   41.90    4803.0   41.80
   4852.0   41.70    4902.0   41.80    4951.0   41.80    5000.0   41.80
   5049.0   41.80    5098.0   41.80    5148.0   41.70    5197.0   41.80
   5246.0   41.90    5295.0   41.80

 X-Y MAX-MIN POINTS:
     XMIN       Y         X    YMIN      XMAX       Y         X    YMAX
   4656.0   41.60    4656.0   41.60    5295.0   41.80    4754.0   41.90

ROUGHNESS COEFFICIENTS (NSA =  1):
         .012

ROAD GRADE DATA:  IPAVE  RDWID  USERCF
                  *****   40.0 *******

BRIDGE PROJECTION DATA:  XREFLT  XREFRT  FDSTLT  FDSTRT
                        ******* ******* ******* *******

*** START PROCESSING CROSS SECTION - "APPR "
  AS   APPR    1047
  GR         1090,45.0  1100,40.0  4508,39.0
  GR         4654,38.8  4703,39.1  4753,38.7  4802,39.1
  GR         4851,39.1  4884,39.4
  GR         4926,39.4  4942,39.4  4958,38.7
  GR         4975,37.7  4978,37.1  4982,36.1  4985,35.4
  GR         4989,34.4  4995,33.8  5006,33.8  5011,34.4
  GR         5015,35.4  5019,36.1  5022,37.1  5027,37.7
  GR         5125,38.7  5148,38.6  5197,38.7  5246,39.1
  GR         5295,39.1  5492,39.3  6450,40.0  6460,45.0
  N          0.07      0.08      0.06
```

```
  SA              4975     5027
  BP         4986  5016
  *
  *
  *          SURVEY X-SCT LOCATED 100' UPSTREAM OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "APPR "
*** CROSS SECTION "APPR " WRITTEN TO DISK, RECORD NO. =   6

--- DATA SUMMARY FOR SECID "APPR " AT SRD =    1047.   ERR-CODE =       0

     SKEW      IHFNO     VSLOPE          EK          CK
       .0         0.  *********         .50         .00

X-Y COORDINATE PAIRS   (NGP =   32):
       X        Y          X        Y          X        Y          X        Y
   1090.0    45.00     1100.0    40.00     4508.0    39.00     4654.0    38.80
   4703.0    39.10     4753.0    38.70     4802.0    39.10     4851.0    39.10
   4884.0    39.40     4926.0    39.40     4942.0    39.40     4958.0    38.70
   4975.0    37.70     4978.0    37.10     4982.0    36.10     4985.0    35.40
   4989.0    34.40     4995.0    33.80     5006.0    33.80     5011.0    34.40
   5015.0    35.40     5019.0    36.10     5022.0    37.10     5027.0    37.70
   5125.0    38.70     5148.0    38.60     5197.0    38.70     5246.0    39.10
   5295.0    39.10     5492.0    39.30     6450.0    40.00     6460.0    45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y          X     YMIN       XMAX        Y          X     YMAX
   1090.0    45.00     4995.0    33.80     6460.0    45.00     1090.0    45.00

SUBAREA BREAKPOINTS (NSA =   3):
       4975.   5027.

ROUGHNESS COEFFICIENTS (NSA =   3):
         .070    .080    .060

BRIDGE PROJECTION DATA:   XREFLT   XREFRT   FDSTLT   FDSTRT
                           4986.    5016. ******* *******

*** START PROCESSING CROSS SECTION - "REFE "
  XS   REFE    1117
  GR         1090,45.0  1100,40.0  4508,39.2  4803,38.7  4867,38.7
  GR         4874,38.7  4949,37.7  4972,37.4  4974,37.1
  GR         4978,36.1  4989,35.4  4995,34.4  5003,34.4
  GR         5008,35.4  5013,36.1  5019,37.1  5024,37.7
  GR         5025,37.8  5113,38.7  5171,38.9  5220,38.7
  GR         5269,38.8  5492,39.1  6450,40.0  6460,45.0
  N          0.07      0.08      0.06
  SA              4972       5025
  FL         82   4986   66   5027   49
  *
  HP 1 APPR 39.19    1  39.19

*** FINISH PROCESSING CROSS SECTION - "REFE "
*** CROSS SECTION "REFE " WRITTEN TO DISK, RECORD NO. =  7

--- DATA SUMMARY FOR SECID "REFE " AT SRD =    1117.   ERR-CODE =       0

     SKEW      IHFNO     VSLOPE          EK          CK
       .0         0.  *********         .50         .00
```

X-Y COORDINATE PAIRS (NGP = 25):

X	Y	X	Y	X	Y	X	Y
1090.0	45.00	1100.0	40.00	4508.0	39.20	4803.0	38.70
4867.0	38.70	4874.0	38.70	4949.0	37.70	4972.0	37.40
4974.0	37.10	4978.0	36.10	4989.0	35.40	4995.0	34.40
5003.0	34.40	5008.0	35.40	5013.0	36.10	5019.0	37.10
5024.0	37.70	5025.0	37.80	5113.0	38.70	5171.0	38.90
5220.0	38.70	5269.0	38.80	5492.0	39.10	6450.0	40.00
6460.0	45.00						

X-Y MAX-MIN POINTS:

XMIN	Y	X	YMIN	XMAX	Y	X	YMAX
1090.0	45.00	4995.0	34.40	6460.0	45.00	1090.0	45.00

SUBAREA BREAKPOINTS (NSA = 3):
4972. 5025.

ROUGHNESS COEFFICIENTS (NSA = 3):
.070 .080 .060

FLOW LENGTH DATA (NFL = 3):

FLEN	XSTA	FLEN	XSTA	FLEN
82.	4986.	66.	5027.	49.

*************************************50 YEAR STORM********************************

CROSS-SECTION PROPERTIES: ISEQ = 6; SECID = APPR ; SRD = 1047.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	169.	1076.	1029.	1029.				388.
	2	206.	9515.	52.	53.				2329.
	3	159.	2292.	357.	357.				600.
39.19		533.	12883.	1437.	1438.	2.77	3860.	5384.	1109.

VELOCITY DISTRIBUTION: ISEQ = 6; SECID = APPR ; SRD = 1047.

WSEL	LEW	REW	AREA	K	Q	VEL
39.19	3860.5	5383.6	533.4	12883.	263.	.49

X STA.	3860.5		4734.7		4980.8		4985.7		4988.7		4991.2
A(I)		122.5		58.6		16.4		12.9		12.4	
V(I)		.11		.22		.80		1.02		1.06	
X STA.	4991.2		4993.6		4995.7		4997.9		5000.1		5002.3
A(I)		12.0		11.6		11.6		11.8		11.8	
V(I)		1.10		1.13		1.14		1.11		1.11	
X STA.	5002.3		5004.4		5006.5		5008.9		5011.3		5014.3
A(I)		11.5		11.5		12.0		12.1		13.1	
V(I)		1.14		1.15		1.10		1.09		1.01	
X STA.	5014.3		5018.9		5035.0		5051.0		5072.3		5383.6
A(I)		15.9		28.6		21.2		24.2		101.5	
V(I)		.82		.46		.62		.54		.13	

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = BRDGE; SRD = 982.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	154.	7199.	28.	39.				2046.
39.04		154.	7199.	28.	39.	1.00	4986.	5014.	2046.

VELOCITY DISTRIBUTION: ISEQ = 4; SECID = BRDGE; SRD = 982.

WSEL	LEW	REW	AREA	K	Q	VEL
39.04	4986.0	5014.0	153.8	7199.	263.	1.71

X STA.	4986.0		4989.4		4990.5		4991.6		4992.6		4993.7
A(I)		19.8		6.3		6.2		6.3		6.3	
V(I)		.67		2.10		2.14		2.10		2.10	

X STA.	4993.7		4994.8		4995.9		4997.0		4998.1		4999.3
A(I)		6.2		6.2		6.3		6.4		6.4	
V(I)		2.11		2.12		2.08		2.04		2.06	

X STA.	4999.3		5000.4		5001.6		5002.7		5003.9		5005.1
A(I)		6.4		6.4		6.4		6.3		6.4	
V(I)		2.04		2.06		2.05		2.08		2.06	

X STA.	5005.1		5006.3		5007.5		5008.8		5010.1		5014.0
A(I)		6.4		6.6		6.5		6.7		19.3	
V(I)		2.05		1.99		2.01		1.98		.68	

************************************100 YEAR STORM******************************

CROSS-SECTION PROPERTIES: ISEQ = 6; SECID = APPR ; SRD = 1047.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	347.	2760.	1524.	1524.				941.
	2	213.	10081.	52.	53.				2453.
	3	218.	3094.	506.	506.				813.
39.33		779.	15935.	2082.	2083.	3.49	3383.	5533.	1447.

VELOCITY DISTRIBUTION: ISEQ = 6; SECID = APPR ; SRD = 1047.

WSEL	LEW	REW	AREA	K	Q	VEL
39.33	3383.4	5533.1	779.1	15935.	305.	.39

X STA.	3383.4		4482.7		4648.6		4824.7		4982.4		4987.0
A(I)		177.3		68.2		69.2		50.6		18.1	
V(I)		.09		.22		.22		.30		.84	

X STA.	4987.0		4990.2		4993.0		4995.6		4998.2		5000.8
A(I)		15.4		14.5		14.1		14.2		14.2	
V(I)		.99		1.05		1.08		1.08		1.08	

X STA.	5000.8		5003.3		5005.9		5008.5		5011.5		5015.2
A(I)		14.1		14.1		14.4		14.8		16.2	
V(I)		1.08		1.08		1.06		1.03		.94	

```
 X STA.       5015.2      5022.5      5040.5      5059.2      5083.9      5533.1
   A(I)              22.9        29.7        26.2        29.0       142.0
   V(I)               .67         .51         .58         .53         .11


     CROSS-SECTION PROPERTIES:   ISEQ =   4;  SECID = BRDGE;   SRD =      982.

      WSEL   SA#      AREA         K   TOPW   WETP  ALPH    LEW    REW      QCR
               1      156.     7374.    28.    39.                         2096.
     39.13            156.     7374.    28.    39.  1.00  4986.  5014.    2096.


     VELOCITY DISTRIBUTION:   ISEQ =  4;  SECID = BRDGE;  SRD =      982.

          WSEL     LEW     REW    AREA        K       Q     VEL
         39.13  4986.0  5014.0   156.3    7374.    305.    1.95

 X STA.       4986.0      4989.5      4990.5      4991.6      4992.7      4993.7
   A(I)              20.4         6.1         6.3         6.4         6.4
   V(I)               .75        2.50        2.44        2.39        2.39

 X STA.       4993.7      4994.8      4995.9      4997.0      4998.2      4999.3
   A(I)               6.3         6.3         6.4         6.5         6.5
   V(I)              2.41        2.42        2.37        2.33        2.34

 X STA.       4999.3      5000.4      5001.6      5002.7      5003.9      5005.1
   A(I)               6.5         6.4         6.5         6.5         6.5
   V(I)              2.35        2.37        2.35        2.34        2.36

 X STA.       5005.1      5006.3      5007.5      5008.8      5010.0      5014.0
   A(I)               6.5         6.7         6.6         6.5        19.9
   V(I)              2.34        2.28        2.30        2.34         .76


*********************************500 YEAR STORM*******************************

     CROSS-SECTION PROPERTIES:   ISEQ =   6;  SECID = APPR ;  SRD =     1047.

      WSEL   SA#      AREA         K   TOPW   WETP  ALPH    LEW    REW      QCR
               1      922.     9977.  2546.  2546.                         3150.
               2      228.    11253.    52.    53.                         2709.
               3      414.     6166.   889.   889.                         1601.
     39.61           1564.    27396.  3487.  3488.  3.56  2429.  5916.    3148.


     VELOCITY DISTRIBUTION:   ISEQ =   6;  SECID = APPR ;  SRD =     1047.

          WSEL     LEW     REW    AREA        K       Q     VEL
         39.61  2429.1  5916.3  1563.9   27396.    407.     .26

 X STA.       2429.1      3932.3      4164.7      4346.2      4503.3      4624.2
   A(I)             331.5       110.4        97.3        91.9        83.0
   V(I)               .06         .18         .21         .22         .25
```

```
 X STA.      4624.2      4742.8      4967.1      4984.9      4990.3      4994.6
  A(I)             82.5        112.3        43.2        26.0        23.9
  V(I)              .25          .18         .47         .78         .85

 X STA.      4994.6      4998.7      5002.8      5006.7      5011.2      5017.5
  A(I)             23.7         23.7        23.1        24.4        27.6
  V(I)              .86          .86         .88         .83         .74

 X STA.      5017.5      5036.8      5059.6      5091.4      5147.6      5916.3
  A(I)             43.7         38.7        44.9        58.0       253.8
  V(I)              .47          .53         .45         .35         .08


   CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = BRDGE;  SRD =     982.

     WSEL   SA#     AREA        K   TOPW   WETP  ALPH    LEW    REW     QCR
              1     161.    7687.    28.    39.                         2187.
   39.29            161.    7687.    28.    39.  1.00  4986.  5014.    2187.


   VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = BRDGE;  SRD =     982.

        WSEL     LEW     REW    AREA       K       Q    VEL
       39.29  4986.0  5014.0   160.8   7687.    407.   2.53

 X STA.      4986.0      4989.5      4990.6      4991.6      4992.7      4993.8
  A(I)             21.2          6.5         6.4         6.3         6.5
  V(I)              .96         3.14        3.18        3.22        3.11

 X STA.      4993.8      4994.8      4995.9      4997.0      4998.2      4999.3
  A(I)              6.5          6.6         6.6         6.7         6.6
  V(I)             3.14         3.10        3.10        3.04        3.06

 X STA.      4999.3      5000.4      5001.6      5002.8      5003.9      5005.1
  A(I)              6.7          6.7         6.7         6.6         6.7
  V(I)             3.04         3.06        3.04        3.09        3.06

 X STA.      5005.1      5006.3      5007.5      5008.7      5010.0      5014.0
  A(I)              6.7          6.7         6.8         6.9        20.6
  V(I)             3.04         3.04        2.99        2.94         .99


 +++ BEGINNING PROFILE CALCULATIONS --    5

*********************************EXISTING CONDITION***************************

 XSID:CODE   SRDL    LEW     AREA    VHD     HF     EGL    CRWS      Q    WSEL
       SRD   FLEN    REW        K   ALPH     HO     ERR     FR#    VEL

 SURV1:XS  ******   4948.     68.    .00  *****   37.30   35.97     27.   37.30
      883. ******   5035.   1350.   1.10  ***** *******     .08    .40

 EXIT :XS     69.   4977.     74.    .00    .02   37.32 *******     27.   37.32
      952.    67.   5026.   1831.   1.00    .00     .00     .05    .36
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```
 FULLV:FV       30.  4977.       85.    .00    .01   37.33 *******     27.   37.33
      982.      30.  5024.     2305.   1.00    .00     .00      .04     .32
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "APPR "      KRATIO =   1.56

 APPR :AS       65.  4977.      110.    .00    .01   37.33 *******     27.   37.33
     1047.      65.  5024.     3593.   1.00    .00     .00      .03     .24
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

  XSID:CODE    SRDL     LEW      AREA    VHD     HF     EGL     CRWS      Q    WSEL
        SRD    FLEN     REW         K   ALPH     HO     ERR      FR#    VEL

 BRDGE:BR       30.  4986.      106.    .00    .00   37.33   33.79     27.   37.33
      982.      30.  5014.     4106.   1.15    .00     .00      .02     .26

      TYPE PPCD FLOW       C     P/A     LSEL   BLEN    XLAB   XRAB
        4.   1.   1.    .932    .039    40.26 ****** ****** ******

     XSID:CODE     SRD    FLEN     HF   VHD      EGL     ERR       Q    WSEL
    ROAD :RG     1000.         <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

  XSID:CODE    SRDL     LEW      AREA    VHD     HF     EGL     CRWS      Q    WSEL
        SRD    FLEN     REW         K   ALPH     HO     ERR      FR#    VEL

 APPR :AS       30.  4977.      110.    .00    .00   37.33   34.29     27.   37.33
     1047.      30.  5024.     3586.   1.00    .00     .00      .03     .24

        M(G)    M(K)        KQ   XLKQ   XRKQ     OTEL
        .406    .001     3590.  4987.  5015.    37.33

                        <<<<<END OF BRIDGE COMPUTATIONS>>>>>

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "REFE "      KRATIO =    .62

  XSID:CODE    SRDL     LEW      AREA    VHD     HF     EGL     CRWS      Q    WSEL
        SRD    FLEN     REW         K   ALPH     HO     ERR      FR#    VEL

 REFE :XS       70.  4972.       83.    .00    .01   37.34 *******     27.   37.34
     1117.      68.  5021.     2215.   1.00    .00     .00      .04     .32


  FIRST USER DEFINED TABLE.

     XSID:CODE        Q     SRD    WSEL      AREA      VEL      FR#        K   XSTW
    SURV1:XS        27.    883.   37.30       68.      .40      .08    1350.    87.
    EXIT :XS        27.    952.   37.32       74.      .36      .05    1831.    49.
    FULLV:FV        27.    982.   37.33       85.      .32      .04    2305.    47.
    BRDGE:BR        27.    982.   37.33      106.      .26      .02    4106.    28.
    ROAD :RG         0.   1000.*****************      1.00*************************
    APPR :AS        27.   1047.   37.33      110.      .24      .03    3586.    47.
    REFE :XS        27.   1117.   37.34       83.      .32      .04    2215.    49.
```

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************************************2 YEAR STORM************************************

 XSID:CODE    SRDL     LEW       AREA    VHD      HF       EGL      CRWS         Q     WSEL
       SRD    FLEN     REW          K   ALPH      HO       ERR       FR#       VEL

SURV1:XS    ******   4798.       140.    .00   *****     37.80     36.20       55.    37.79
      883.  ******   5054.      2749.   1.58   *****   *******       .12       .39

EXIT :XS       69.   4958.       107.    .00     .03     37.83   *******       55.    37.82
      952.     67.   5053.      2889.   1.07     .00       .00       .09       .52

FULLV:FV       30.   4952.       115.    .00     .01     37.83   *******       55.    37.83
      982.     30.   5053.      3351.   1.07     .00       .00       .08       .48
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "APPR "      KRATIO =  1.42

APPR :AS       65.   4973.       137.    .00     .01     37.85   *******       55.    37.84
     1047.     65.   5041.      4773.   1.01     .00       .00       .05       .40
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW       AREA    VHD      HF       EGL      CRWS         Q     WSEL
       SRD    FLEN     REW          K   ALPH      HO       ERR       FR#       VEL

BRDGE:BR       30.   4986.       120.    .00     .01     37.83     34.03       55.    37.83
      982.     30.   5014.      4962.   1.14     .00       .00       .04       .46

     TYPE PPCD FLOW      C     P/A     LSEL    BLEN    XLAB    XRAB
       4.   1.   1.   .935    .039    40.26  ******  ******  ******

     XSID:CODE    SRD     FLEN     HF    VHD      EGL      ERR        Q     WSEL
    ROAD :RG    1000.          <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE    SRDL     LEW       AREA    VHD      HF       EGL      CRWS         Q     WSEL
       SRD    FLEN     REW          K   ALPH      HO       ERR       FR#       VEL

APPR :AS       30.   4973.       137.    .00     .00     37.84     34.55       55.    37.84
     1047.     30.   5041.      4761.   1.01     .01       .00       .05       .40

        M(G)    M(K)        KQ    XLKQ    XRKQ     OTEL
        .592    .035     4608.   4987.   5015.    37.84

                    <<<<<END OF BRIDGE COMPUTATIONS>>>>>

 XSID:CODE    SRDL     LEW       AREA    VHD      HF       EGL      CRWS         Q     WSEL
       SRD    FLEN     REW          K   ALPH      HO       ERR       FR#       VEL

REFE :XS       70.   4937.       118.    .00     .01     37.86   *******       55.    37.85
     1117.     69.   5030.      3370.   1.09     .00       .00       .08       .47


  FIRST USER DEFINED TABLE.

   XSID:CODE        Q     SRD     WSEL       AREA      VEL      FR#         K    XSTW
   SURV1:XS        55.    883.    37.79      140.      .39      .12     2749.    256.
   EXIT :XS        55.    952.    37.82      107.      .52      .09     2889.     95.
   FULLV:FV        55.    982.    37.83      115.      .48      .08     3351.    102.
```

```
   BRDGE:BR        55.   982.   37.83       120.      .46      .04    4962.     28.
   ROAD :RG         0.   1000.*****************     1.00*************************
   APPR :AS        55.   1047.  37.84       137.      .40      .05    4761.     68.
   REFE :XS        55.   1117.  37.85       118.      .47      .08    3370.     93.


***********************************50 YEAR STORM*******************************

 XSID:CODE    SRDL     LEW        AREA    VHD      HF      EGL     CRWS       Q     WSEL
       SRD    FLEN     REW           K   ALPH      HO      ERR      FR#      VEL

SURV1:XS    ******   3652.        828.    .00  *****    39.00    36.98     263.    39.00
      883.  ******   5363.      13141.   2.75  ***** *******       .13      .32

EXIT :XS       69.   4068.        465.    .01     .04   39.04  *******     263.    39.03
      952.     67.   5132.       9907.   2.45     .00     .00      .24      .57

FULLV:FV       30.   3994.        498.    .01     .02   39.06  *******     263.    39.05
      982.     30.   5134.      10736.   2.61     .00     .00      .23      .53
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       65.   4215.        410.    .01     .04   39.10  *******     263.    39.09
     1047.     65.   5244.      11772.   2.00     .00     .00      .23      .64
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW        AREA    VHD      HF      EGL     CRWS       Q     WSEL
       SRD    FLEN     REW           K   ALPH      HO      ERR      FR#      VEL

BRDGE:BR       30.   4986.        154.    .06     .03   39.10    34.99     263.    39.04
      982.     30.   5014.       7197.   1.24     .03     .00      .14     1.71

     TYPE PPCD FLOW      C      P/A     LSEL    BLEN    XLAB    XRAB
       4.   1.   1.   .899    .043    40.26  ******  ******  ******

   XSID:CODE     SRD    FLEN     HF    VHD      EGL      ERR       Q     WSEL
  ROAD :RG     1000.         <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE    SRDL     LEW        AREA    VHD      HF      EGL     CRWS       Q     WSEL
       SRD    FLEN     REW           K   ALPH      HO      ERR      FR#      VEL

APPR :AS       30.   3851.        537.    .01     .04   39.20    35.57     263.    39.19
     1047.     54.   5386.      12930.   2.78     .07     .00      .24      .49

      M(G)    M(K)       KQ   XLKQ   XRKQ     OTEL
      .973    .427    7428.  4990.  5018.    39.18

                     <<<<<END OF BRIDGE COMPUTATIONS>>>>>

 XSID:CODE    SRDL     LEW        AREA    VHD      HF      EGL     CRWS       Q     WSEL
       SRD    FLEN     REW           K   ALPH      HO      ERR      FR#      VEL

REFE :XS       70.   4404.        641.    .01     .03   39.23  *******     263.    39.22
     1117.     68.   5625.      13360.   2.52     .00     .00      .16      .41


 FIRST USER DEFINED TABLE.
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```
   XSID:CODE       Q     SRD     WSEL       AREA       VEL       FR#         K    XSTW
  SURV1:XS      263.    883.    39.00       828.       .32       .13    13141.  1644.
  EXIT :XS      263.    952.    39.03       465.       .57       .24     9907.  1065.
  FULLV:FV      263.    982.    39.05       498.       .53       .23    10736.  1139.
  BRDGE:BR      263.    982.    39.04       154.      1.71       .14     7197.    28.
  ROAD :RG        0.   1000.*****************       1.00*************************
  APPR :AS      263.   1047.    39.19       537.       .49       .24    12930.  1450.
  REFE :XS      263.   1117.    39.22       641.       .41       .16    13360.  1221.


**********************************100 YEAR STORM*******************************

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K   ALPH     HO      ERR      FR#      VEL

SURV1:XS    ******   3402.      983.    .00  *****    39.09    37.10     305.    39.08
      883.  ******   5394.    15248.   2.76  ***** *******       .13      .31

EXIT :XS       69.   3771.      570.    .01    .04    39.13  *******     305.    39.12
      952.     67.   5137.    11263.   2.77    .00      .00      .24      .54

FULLV:FV       30.   3696.      611.    .01    .02    39.15  *******     305.    39.14
      982.     30.   5138.    12193.   2.94    .00      .00      .23      .50
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       65.   3912.      512.    .01    .04    39.19  *******     305.    39.17
     1047.     65.   5369.    12635.   2.67    .00      .00      .28      .60
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

             <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K   ALPH     HO      ERR      FR#      VEL

BRDGE:BR       30.   4986.      156.    .08    .03    39.20    35.15     305.    39.13
      982.     30.   5014.     7367.   1.27    .04      .00      .16     1.95

     TYPE PPCD FLOW      C     P/A     LSEL    BLEN    XLAB    XRAB
       4.   1.   1.   .887    .043    40.26 ****** ****** ******

    XSID:CODE     SRD    FLEN     HF    VHD       EGL      ERR        Q     WSEL
   ROAD :RG     1000.          <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K   ALPH     HO      ERR      FR#      VEL

APPR :AS       30.   3385.      778.    .01    .05    39.34    35.70     305.    39.33
     1047.     65.   5532.    15923.   3.49    .09     -.01      .21      .39

       M(G)   M(K)       KQ   XLKQ   XRKQ     OTEL
       .981   .508    7914.  4989.  5017.    39.32

                      <<<<<END OF BRIDGE COMPUTATIONS>>>>>

 XSID:CODE    SRDL     LEW      AREA    VHD     HF      EGL     CRWS        Q     WSEL
       SRD    FLEN     REW         K   ALPH     HO      ERR      FR#      VEL

REFE :XS       70.   3834.      852.    .01    .02    39.36  *******     305.    39.36
     1117.     66.   5767.    15969.   2.95    .00      .00      .16      .36
```

FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
SURV1:XS	305.	883.	39.08	983.	.31	.13	15248.	1954.
EXIT :XS	305.	952.	39.12	570.	.54	.24	11263.	1366.
FULLV:FV	305.	982.	39.14	611.	.50	.23	12193.	1442.
BRDGE:BR	305.	982.	39.13	156.	1.95	.16	7367.	28.
ROAD :RG	0.	1000.********	********	********	1.00******	******	******	******
APPR :AS	305.	1047.	39.33	778.	.39	.21	15923.	2080.
REFE :XS	305.	1117.	39.36	852.	.36	.16	15969.	1932.

```
**********************************500 YEAR STORM*******************************

 XSID:CODE   SRDL    LEW     AREA    VHD    HF     EGL    CRWS      Q     WSEL
       SRD   FLEN    REW        K   ALPH    HO     ERR     FR#    VEL

SURV1:XS   ******  2958.    1325.    .00 *****   39.24   37.45    407.   39.24
      883. ******  5450.   20332.   2.59 ***** *******     .12     .31

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "EXIT "      KRATIO =    .68

EXIT :XS       69.  3245.     825.    .01    .04   39.28 *******    407.   39.27
      952.     70.  5366.   13801.   3.48    .00     .00     .25     .49

FULLV:FV       30.  3163.     884.    .01    .02   39.31 *******    407.   39.29
      982.     30.  5390.   14912.   3.71    .00     .00     .24     .46
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       65.  3360.     793.    .01    .04   39.35 *******    407.   39.34
     1047.     65.  5542.   16118.   3.52    .00     .00     .28     .51
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

           <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE   SRDL    LEW     AREA    VHD    HF     EGL    CRWS      Q     WSEL
       SRD   FLEN    REW        K   ALPH    HO     ERR     FR#    VEL

BRDGE:BR       30.  4986.     161.    .13    .05   39.41   35.47    407.   39.29
      982.     30.  5014.    7678.   1.26    .08     .00     .21    2.53

     TYPE PPCD FLOW      C     P/A    LSEL   BLEN   XLAB   XRAB
       4.   1.   1.   .891   .044   40.26 ****** ****** ******

    XSID:CODE    SRD    FLEN    HF    VHD     EGL     ERR        Q    WSEL
   ROAD :RG     1000.         <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE   SRDL    LEW     AREA    VHD    HF     EGL    CRWS      Q     WSEL
       SRD   FLEN    REW        K   ALPH    HO     ERR     FR#    VEL

APPR :AS       30.  2426.    1567.    .00    .07   39.61   36.05    407.   39.61
     1047.     86.  5917.   27448.   3.56    .14     .01     .13     .26

      M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
      .987   .676    8780.  4987.  5015.   39.61
```

<<<<<END OF BRIDGE COMPUTATIONS>>>>>

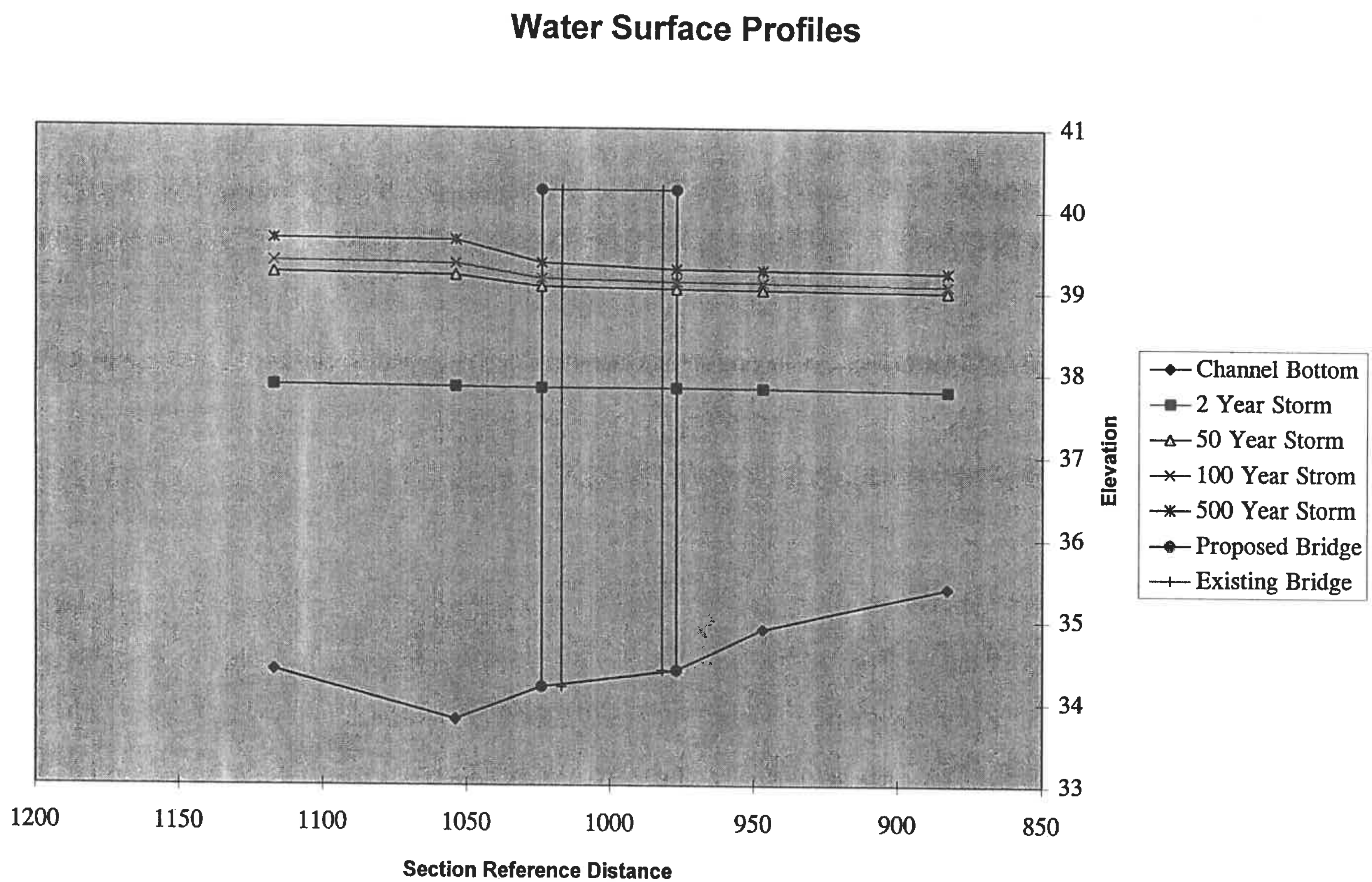
XSID:CODE SRD	SRDL FLEN	LEW REW	AREA K	VHD ALPH	HF HO	EGL ERR	CRWS FR#	Q VEL	WSEL
REFE :XS	70.	2683.	1569.	.00	.01	39.63	*******	407.	39.63
1117.	67.	6055.	27002.	2.82	.00	.00	.11	.26	

FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
SURV1:XS	407.	883.	39.24	1325.	.31	.12	20332.	2491.
EXIT :XS	407.	952.	39.27	825.	.49	.25	13801.	1995.
FULLV:FV	407.	982.	39.29	884.	.46	.24	14912.	2111.
BRDGE:BR	407.	982.	39.29	161.	2.53	.21	7678.	28.
ROAD :RG	0.	1000.	*****************		1.00	************************		
APPR :AS	407.	1047.	39.61	1567.	.26	.13	27448.	3491.
REFE :XS	407.	1117.	39.63	1569.	.26	.11	27002.	3372.

SR 29 - Turkey Branch

WIDENED BRIDGE ANALYSIS



SR 29 Turkey Branch
Bridge No. 050031

Proposed Bridge

```
WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
 P060188            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

              *** RUN DATE & TIME: 03-05-96  13:53

   T1          SR 29 - WIDENED BRIDGE ANALYSIS
   T2          TURKEY BRANCH @ BR#050031 (BR31WD.DAT)
   *
   J3          5  6  3  17  13  14  16  28
   *
   *           EXISTING   2 YEAR  50 YEAR  100 YEAR  500 YEAR
   Q              27        55      263       305       407
 *** Q-DATA FOR SEC-ID, ISEQ =            1
   *
   *           SLOPE FROM QUAD MAP
   SK          0.0004  0.0004  0.0004  0.0004   0.0004
   *
   *           SURVEY CROSS SECTION LOCATED 100' DOWNSTREAM OF BRIDGE

 *** START PROCESSING CROSS SECTION - "SURV1"
   XS    SURV1  883
   GR           740,45.0   750,40.0  4508,38.7  4544,38.7
   GR          4824,37.7  4869,37.7  4892,37.7  4975,37.1  4979,36.5
   GR          4986,36.1  4998,35.4  5002,35.4  5015,36.1  5028,37.1
   GR          5031,37.2  5051,37.7  5080,38.7  5230,38.9  5279,39.2
   GR          5328,38.9  5509,39.4  6250,40.0  6260,45.0
   N           0.08     0.08     0.06
   SA               4979     5031
   *
   *
   *           SURVEY X-SCT LOCATED 30' DOWNSTREAM OF BRIDGE

 *** FINISH PROCESSING CROSS SECTION - "SURV1"
 *** CROSS SECTION "SURV1" WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "SURV1" AT SRD =    883.  ERR-CODE =      0

      SKEW     IHFNO    VSLOPE        EK        CK
        .0        0. *********       .50       .00

 X-Y COORDINATE PAIRS  (NGP =  23):
         X       Y             X       Y             X       Y             X       Y
     740.0   45.00         750.0   40.00        4508.0   38.70        4544.0   38.70
    4824.0   37.70        4869.0   37.70        4892.0   37.70        4975.0   37.10
    4979.0   36.50        4986.0   36.10        4998.0   35.40        5002.0   35.40
    5015.0   36.10        5028.0   37.10        5031.0   37.20        5051.0   37.70
    5080.0   38.70        5230.0   38.90        5279.0   39.20        5328.0   38.90
    5509.0   39.40        6250.0   40.00        6260.0   45.00

  X-Y MAX-MIN POINTS:
      XMIN       Y             X    YMIN        XMAX       Y             X    YMAX
     740.0   45.00        4998.0   35.40        6260.0   45.00         740.0   45.00

 SUBAREA BREAKPOINTS (NSA =  3):
        4979.   5031.

 ROUGHNESS COEFFICIENTS (NSA =  3):
          .080    .080    .060

 *** START PROCESSING CROSS SECTION - "SURV2"
```

```
  XT   SURV2   952
  GR         740,45.0   750,40.0  4508,38.9
  GR        4680,38.7  4702,38.8  4749,38.9  4808,38.7
  GR        4849,38.7  4973,37.7  4979,37.1  4984,36.1  4987,35.9  4989,35.4
  GR        5000,34.9  5011,35.4  5013,35.9  5020,36.1  5023,36.9  5026,37.4
  GR        5044,37.7  5115,38.7  5152,39.4
  GR        5221,39.4  5299,39.2  5492,39.4  6250,40.0  6260,45.0
  *
  *

*** FINISH PROCESSING CROSS SECTION - "SURV2"
*** TEMPLATE CROSS SECTION "SURV2" SAVED INTERNALLY.

*** START PROCESSING CROSS SECTION - "EXIT "
  XS   EXIT     947  *  *  *  0.0004
  GT
  N         0.08      0.08      0.06
  SA             4973      5026
  FL        82   4986   66   5027   49
  *
  *
  *
  *         SURVEY X-SCT LOCATED @ DOWNSTREAM FACE OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "EXIT "
*** CROSS SECTION "EXIT " WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "EXIT " AT SRD =    947.  ERR-CODE =      0

     SKEW      IHFNO     VSLOPE        EK         CK
       .0         0.      .0004        .50        .00

X-Y COORDINATE PAIRS  (NGP =  27):
       X        Y            X        Y           X        Y           X        Y
    740.0    45.00       750.0    40.00      4508.0    38.90      4680.0    38.70
   4702.0    38.80      4749.0    38.90      4808.0    38.70      4849.0    38.70
   4973.0    37.70      4979.0    37.10      4984.0    36.10      4987.0    35.90
   4989.0    35.40      5000.0    34.90      5011.0    35.40      5013.0    35.90
   5020.0    36.10      5023.0    36.90      5026.0    37.40      5044.0    37.70
   5115.0    38.70      5152.0    39.40      5221.0    39.40      5299.0    39.20
   5492.0    39.40      6250.0    40.00      6260.0    45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y            X     YMIN       XMAX        Y           X     YMAX
    740.0    45.00      5000.0    34.90      6260.0    45.00       740.0    45.00

SUBAREA BREAKPOINTS (NSA =  3):
      4973.   5026.

ROUGHNESS COEFFICIENTS (NSA =  3):
        .080    .080    .060

FLOW LENGTH DATA (NFL = 3):
           FLEN       XSTA       FLEN       XSTA       FLEN
            82.      4986.        66.      5027.        49.
```

```
        TURKEY BRANCH @ BR#050031 (BR31WD.DAT)
           *** RUN DATE & TIME: 03-05-96  13:53

 *** START PROCESSING CROSS SECTION - "SURV3"
   XT   SURV3   982
   GR          740,45.0   750,40.0
   GR         4508,38.9  4680,38.7  4702,38.8  4749,38.9  4808,38.7
   GR         4849,38.7  4967,37.7  4975,37.7  4978,37.1  4982,36.1  4986,35.4
   GR         5000,34.4  5006,34.4  5010,35.4  5016,36.1  5022,37.1  5028,37.7
   GR         5044,37.7  5115,38.7  5152,39.4
   GR         5221,39.4  5299,39.2  5492,39.4
   GR         6250,40.0  6260,45.0
   *
   *

 *** FINISH PROCESSING CROSS SECTION - "SURV3"
 *** TEMPLATE CROSS SECTION "SURV3" SAVED INTERNALLY.

 *** START PROCESSING CROSS SECTION - "FULLV"
   XS   FULLV   977  *  *  *  0.0004
   GT
   N          0.08    0.08    0.06
   SA             4975    5028
   FL         33  4986  38  5027  44
   *
   *

 *** FINISH PROCESSING CROSS SECTION - "FULLV"
 *** CROSS SECTION "FULLV" WRITTEN TO DISK, RECORD NO. =  3

 --- DATA SUMMARY FOR SECID "FULLV" AT SRD =    977.  ERR-CODE =      0

     SKEW     IHFNO    VSLOPE       EK       CK
       .0        0.     .0004      .50      .00

 X-Y COORDINATE PAIRS  (NGP =  27):
        X       Y           X       Y           X       Y           X       Y
    740.0   45.00       750.0   40.00      4508.0   38.90      4680.0   38.70
   4702.0   38.80      4749.0   38.90      4808.0   38.70      4849.0   38.70
   4967.0   37.70      4975.0   37.70      4978.0   37.10      4982.0   36.10
   4986.0   35.40      5000.0   34.40      5006.0   34.40      5010.0   35.40
   5016.0   36.10      5022.0   37.10      5028.0   37.70      5044.0   37.70
   5115.0   38.70      5152.0   39.40      5221.0   39.40      5299.0   39.20
   5492.0   39.40      6250.0   40.00      6260.0   45.00

  X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X    YMAX
    740.0   45.00      5000.0   34.40      6260.0   45.00       740.0   45.00

 SUBAREA BREAKPOINTS (NSA =  3):
       4975.   5028.

 ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .080    .060

 FLOW LENGTH DATA (NFL = 3):
          FLEN      XSTA      FLEN      XSTA      FLEN
           33.     4986.       38.     5027.       44.

 *** START PROCESSING CROSS SECTION - "BRDGE"
```

```
  BR   BRDGE    977  40.26
  GR        4986,40.26  4986,33.39  4988,33.2  4996,33.31
  GR        5000,33.44  5004,33.58  5012,34.14  5014,34.11
  GR        5014,40.26  4986,40.26
  CD        4  47.1  6.0  41.8  45
  PW 1      33.2,1.0  38.26,1.0  38.26,2.0  40.26,2.0
  N         0.08
  *
  *
  *         CENTERLINE SR 29 ELEVATIONS

*** FINISH PROCESSING CROSS SECTION - "BRDGE"
*** CROSS SECTION "BRDGE" WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "BRDGE" AT SRD =    977.  ERR-CODE =       0

     SKEW     IHFNO     VSLOPE        EK        CK
       .0        0.     .0004        .50       .00

X-Y COORDINATE PAIRS  (NGP =  10):
       X       Y           X       Y           X       Y           X       Y
   4986.0   40.26    4986.0   33.39    4988.0   33.20    4996.0   33.31
   5000.0   33.44    5004.0   33.58    5012.0   34.14    5014.0   34.11
   5014.0   40.26    4986.0   40.26

 X-Y MAX-MIN POINTS:
     XMIN       Y           X     YMIN      XMAX       Y           X     YMAX
   4986.0   40.26    4988.0   33.20    5014.0   34.11    4986.0   40.26

ROUGHNESS COEFFICIENTS (NSA =  1):
         .080

BRIDGE PARAMETERS:
 BRTYPE  BRWDTH     LSEL  USERCD  EMBSS   EMBELV  WWANGL
    4     47.1    40.26 *******   6.00    41.80   45.00

PIER DATA:  NPW =  4    PPCD = 1.
     PELV  PWDTH       PELV  PWDTH       PELV  PWDTH       PELV  PWDTH
     33.20   1.0       38.26   1.0       38.26   2.0       40.26   2.0

*** START PROCESSING CROSS SECTION - "ROAD "
  XR   ROAD   1000  40.0
  GR        4656,41.6  4705,41.8  4754,41.9  4803,41.8  4852,41.7
  GR        4902,41.8  4951,41.8  5000,41.8  5049,41.8  5098,41.8
  GR        5148,41.7  5197,41.8  5246,41.9  5295,41.8
  N          0.012
  *
  *
  *         SURVEY X-SCT LOCATED 30' UPSTREAM OF BRIDGE

*** FINISH PROCESSING CROSS SECTION - "ROAD "
*** CROSS SECTION "ROAD " WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "ROAD " AT SRD =   1000.  ERR-CODE =       0

     SKEW     IHFNO     VSLOPE        EK        CK
       .0        0.     .0004        .50       .00

X-Y COORDINATE PAIRS  (NGP =  14):
       X       Y           X       Y           X       Y           X       Y
```

```
   4656.0   41.60    4705.0   41.80    4754.0   41.90    4803.0   41.80
   4852.0   41.70    4902.0   41.80    4951.0   41.80    5000.0   41.80
   5049.0   41.80    5098.0   41.80    5148.0   41.70    5197.0   41.80
   5246.0   41.90    5295.0   41.80

 X-Y MAX-MIN POINTS:
     XMIN       Y          X     YMIN       XMAX       Y          X     YMAX
   4656.0   41.60    4656.0   41.60    5295.0   41.80    4754.0   41.90

 ROUGHNESS COEFFICIENTS (NSA =  1):
         .012

 ROAD GRADE DATA:  IPAVE  RDWID  USERCF
                   *****   40.0 *******

 BRIDGE PROJECTION DATA:  XREFLT  XREFRT  FDSTLT  FDSTRT
                         ******* ******* ******* *******

 *** START PROCESSING CROSS SECTION - "SURV4"
   XT   SURV4    1047
   GR        1090,45.0  1100,40.0  4508,39.0
   GR        4654,38.8  4703,39.1  4753,38.7  4802,39.1
   GR        4851,39.1  4884,39.4
   GR        4926,39.4  4942,39.4  4958,38.7
   GR        4975,37.7  4978,37.1  4982,36.1  4985,35.4
   GR        4989,34.4  4995,33.8  5006,33.8  5011,34.4
   GR        5015,35.4  5019,36.1  5022,37.1  5027,37.7
   GR        5125,38.7  5148,38.6  5197,38.7  5246,39.1
   GR        5295,39.1  5492,39.3  6450,40.0  6460,45.0
   *
   *
   *

 *** FINISH PROCESSING CROSS SECTION - "SURV4"
 *** TEMPLATE CROSS SECTION "SURV4" SAVED INTERNALLY.

 *** START PROCESSING CROSS SECTION - "APPR "
   AS   APPR   1054
   GT
   N         0.07     0.08     0.06
   SA             4975     5027
   BP        4986  5016
   FL        109  4986  98  5027  98
   *
   *
   *         SURVEY X-SCT LOCATED 100' UPSTREAM OF BRIDGE

 *** FINISH PROCESSING CROSS SECTION - "APPR "
 *** CROSS SECTION "APPR " WRITTEN TO DISK, RECORD NO. =  6

 --- DATA SUMMARY FOR SECID "APPR " AT SRD =   1054.  ERR-CODE =       0

      SKEW     IHFNO    VSLOPE       EK        CK
        .0        0.    .0004       .50       .00

 X-Y COORDINATE PAIRS  (NGP =  32):
       X        Y          X        Y          X        Y          X        Y
   1090.0   45.00    1100.0   40.00    4508.0   39.00    4654.0   38.80
   4703.0   39.10    4753.0   38.70    4802.0   39.10    4851.0   39.10
   4884.0   39.40    4926.0   39.40    4942.0   39.40    4958.0   38.70
```

```
   4975.0   37.70    4978.0   37.10    4982.0   36.10    4985.0   35.40
   4989.0   34.40    4995.0   33.80    5006.0   33.80    5011.0   34.40
   5015.0   35.40    5019.0   36.10    5022.0   37.10    5027.0   37.70
   5125.0   38.70    5148.0   38.60    5197.0   38.70    5246.0   39.10
   5295.0   39.10    5492.0   39.30    6450.0   40.00    6460.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y          X     YMIN      XMAX       Y          X     YMAX
   1090.0   45.00    4995.0   33.80    6460.0   45.00    1090.0   45.00

 SUBAREA BREAKPOINTS (NSA =  3):
       4975.   5027.

 ROUGHNESS COEFFICIENTS (NSA =  3):
         .070    .080    .060

 FLOW LENGTH DATA (NFL = 3):
           FLEN       XSTA       FLEN       XSTA       FLEN
           109.      4986.        98.      5027.        98.

 BRIDGE PROJECTION DATA:  XREFLT  XREFRT  FDSTLT  FDSTRT
                           4986.   5016. ******* *******

 *** START PROCESSING CROSS SECTION - "REFE "
   XS   REFE    1117
   GR        1090,45.0  1100,40.0  4508,39.2  4803,38.7  4867,38.7
   GR        4874,38.7  4949,37.7  4972,37.4  4974,37.1
   GR        4978,36.1  4989,35.4  4995,34.4  5003,34.4
   GR        5008,35.4  5013,36.1  5019,37.1  5024,37.7
   GR        5025,37.8  5113,38.7  5171,38.9  5220,38.7
   GR        5269,38.8  5492,39.1  6450,40.0  6460,45.0
   N         0.07      0.08      0.06
   SA             4972       5025
   FL        82   4986   66   5027   49
   *
   HP 1 APPR 39.21   1  39.21

 *** FINISH PROCESSING CROSS SECTION - "REFE "
 *** CROSS SECTION "REFE " WRITTEN TO DISK, RECORD NO. =  7

 --- DATA SUMMARY FOR SECID "REFE " AT SRD =   1117.  ERR-CODE =       0

      SKEW     IHFNO    VSLOPE       EK        CK
        .0        0.     .0004       .50       .00

 X-Y COORDINATE PAIRS  (NGP =  25):
         X       Y          X       Y          X       Y          X       Y
   1090.0   45.00    1100.0   40.00    4508.0   39.20    4803.0   38.70
   4867.0   38.70    4874.0   38.70    4949.0   37.70    4972.0   37.40
   4974.0   37.10    4978.0   36.10    4989.0   35.40    4995.0   34.40
   5003.0   34.40    5008.0   35.40    5013.0   36.10    5019.0   37.10
   5024.0   37.70    5025.0   37.80    5113.0   38.70    5171.0   38.90
   5220.0   38.70    5269.0   38.80    5492.0   39.10    6450.0   40.00
   6460.0   45.00

 X-Y MAX-MIN POINTS:
     XMIN        Y          X     YMIN      XMAX       Y          X     YMAX
   1090.0   45.00    4995.0   34.40    6460.0   45.00    1090.0   45.00

 SUBAREA BREAKPOINTS (NSA =  3):
```

```
       4972.   5025.

 ROUGHNESS COEFFICIENTS (NSA =  3):
         .070    .080    .060

 FLOW LENGTH DATA (NFL = 3):
          FLEN       XSTA       FLEN       XSTA       FLEN
           82.      4986.        66.      5027.        49.


***********************************50 YEAR STORM*******************************

    CROSS-SECTION PROPERTIES:  ISEQ =  6;  SECID = APPR ;  SRD =    1054.

     WSEL  SA#      AREA        K   TOPW   WETP  ALPH    LEW    REW      QCR
             1      187.     1229.  1090.  1090.                          440.
             2      207.     9583.    52.    53.                         2344.
             3      165.     2371.   374.   374.                          621.
    39.21           559.    13184.  1515.  1516.  2.87  3802.  5401.    1136.


    VELOCITY DISTRIBUTION:  ISEQ =  6;  SECID = APPR ;  SRD =    1054.

         WSEL      LEW     REW     AREA        K        Q    VEL
        39.21  3801.9  5400.6    558.8   13184.     263.    .47

 X STA.     3801.9     4674.0     4979.1     4985.0     4988.2     4990.8
  A(I)          124.9       69.9       18.5       13.5       12.6
  V(I)            .11        .19        .71        .97       1.04

 X STA.     4990.8     4993.2     4995.5     4997.7     4999.9     5002.2
  A(I)           12.2       11.9       12.2       12.0       12.0
  V(I)           1.08       1.10       1.08       1.09       1.09

 X STA.     5002.2     5004.3     5006.5     5008.8     5011.3     5014.5
  A(I)           11.8       11.8       11.9       12.3       13.8
  V(I)           1.11       1.12       1.10       1.07        .95

 X STA.     5014.5     5019.1     5035.6     5051.9     5073.0     5400.6
  A(I)           16.2       29.0       21.8       24.1      106.3
  V(I)            .81        .45        .60        .55        .12


    CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = BRDGE;  SRD =     977.

     WSEL  SA#      AREA        K   TOPW   WETP  ALPH    LEW    REW      QCR
             1      154.     7199.    28.    39.                         2046.
    39.04           154.     7199.    28.    39.  1.00  4986.  5014.    2046.


    VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = BRDGE;  SRD =     977.

         WSEL      LEW     REW     AREA        K        Q    VEL
        39.04  4986.0  5014.0    153.8    7199.     263.   1.71

 X STA.     4986.0     4989.4     4990.5     4991.6     4992.6     4993.7
  A(I)           19.8        6.3        6.2        6.3        6.3
```

V(I)		.67	2.10	2.14	2.10	2.10

X STA.	4993.7	4994.8	4995.9	4997.0	4998.1	4999.3
A(I)		6.2	6.2	6.3	6.4	6.4
V(I)		2.11	2.12	2.08	2.04	2.06
X STA.	4999.3	5000.4	5001.6	5002.7	5003.9	5005.1
A(I)		6.4	6.4	6.4	6.3	6.4
V(I)		2.04	2.06	2.05	2.08	2.06
X STA.	5005.1	5006.3	5007.5	5008.8	5010.1	5014.0
A(I)		6.4	6.6	6.5	6.7	19.3
V(I)		2.05	1.99	2.01	1.98	.68

**********************************100 YEAR STORM*******************************

CROSS-SECTION PROPERTIES: ISEQ = 6; SECID = APPR ; SRD = 1054.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	374.	3042.	1585.	1585.				1032.
	2	214.	10152.	52.	53.				2469.
	3	227.	3209.	530.	530.				844.
39.35		816.	16403.	2167.	2168.	3.56	3325.	5557.	1505.

VELOCITY DISTRIBUTION: ISEQ = 6; SECID = APPR ; SRD = 1054.

WSEL	LEW	REW	AREA	K	Q	VEL
39.35	3324.7	5556.6	815.7	16403.	305.	.37

X STA.	3324.7	4450.6	4626.8	4766.9	4980.6	4986.2
A(I)		186.0	70.3	64.4	66.1	20.0
V(I)		.08	.22	.24	.23	.76
X STA.	4986.2	4989.6	4992.5	4995.3	4997.9	5000.5
A(I)		15.9	14.9	14.9	14.5	14.5
V(I)		.96	1.03	1.02	1.05	1.05
X STA.	5000.5	5003.1	5005.8	5008.4	5011.4	5015.3
A(I)		14.6	14.6	14.4	15.1	16.9
V(I)		1.05	1.05	1.06	1.01	.90
X STA.	5015.3	5023.3	5041.0	5060.1	5085.2	5556.6
A(I)		24.4	29.0	26.9	29.7	148.6
V(I)		.63	.53	.57	.51	.10

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = BRDGE; SRD = 977.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	156.	7374.	28.	39.				2096.
39.13		156.	7374.	28.	39.	1.00	4986.	5014.	2096.

VELOCITY DISTRIBUTION: ISEQ = 4; SECID = BRDGE; SRD = 977.

WSEL	LEW	REW	AREA	K	Q	VEL
39.13	4986.0	5014.0	156.3	7374.	305.	1.95

X STA.	4986.0		4989.5		4990.5		4991.6		4992.7		4993.7
A(I)		20.4		6.1		6.3		6.4		6.4	
V(I)		.75		2.50		2.44		2.39		2.39	
X STA.	4993.7		4994.8		4995.9		4997.0		4998.2		4999.3
A(I)		6.3		6.3		6.4		6.5		6.5	
V(I)		2.41		2.42		2.37		2.33		2.34	
X STA.	4999.3		5000.4		5001.6		5002.7		5003.9		5005.1
A(I)		6.5		6.4		6.5		6.5		6.5	
V(I)		2.35		2.37		2.35		2.34		2.36	
X STA.	5005.1		5006.3		5007.5		5008.8		5010.0		5014.0
A(I)		6.5		6.7		6.6		6.5		19.9	
V(I)		2.34		2.28		2.30		2.34		.76	

**********************************500 YEAR STORM*******************************

CROSS-SECTION PROPERTIES: ISEQ = 6; SECID = APPR ; SRD = 1054.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	993.	11015.	2639.	2639.				3456.
	2	229.	11370.	52.	53.				2734.
	3	438.	6608.	926.	926.				1711.
39.64		1661.	28993.	3617.	3618.	3.48	2336.	5953.	3420.

VELOCITY DISTRIBUTION: ISEQ = 6; SECID = APPR ; SRD = 1054.

WSEL	LEW	REW	AREA	K	Q	VEL
39.64	2336.4	5953.5	1660.5	28993.	407.	.25

X STA.	2336.4		3883.1		4117.4		4302.2		4464.3		4596.7
A(I)		351.0		114.4		101.6		97.3		89.4	
V(I)		.06		.18		.20		.21		.23	
X STA.	4596.7		4711.4		4843.8		4982.6		4989.1		4993.7
A(I)		84.2		90.6		85.3		29.1		25.3	
V(I)		.24		.22		.24		.70		.81	
X STA.	4993.7		4998.0		5002.3		5006.5		5011.2		5017.7
A(I)		25.0		25.1		24.5		25.4		29.0	
V(I)		.81		.81		.83		.80		.70	
X STA.	5017.7		5038.2		5062.3		5097.0		5155.0		5953.5
A(I)		46.1		41.0		48.6		60.1		267.6	
V(I)		.44		.50		.42		.34		.08	

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = BRDGE; SRD = 977.

```
      WSEL   SA#      AREA         K   TOPW    WETP  ALPH     LEW     REW      QCR
               1      161.     7668.    28.     39.                           2181.
    39.28             161.     7668.    28.     39.  1.00   4986.   5014.     2181.


   VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = BRDGE;  SRD =     977.

          WSEL     LEW      REW     AREA         K         Q     VEL
         39.28  4986.0   5014.0    160.5     7668.      407.    2.54

 X STA.      4986.0     4989.5     4990.5     4991.6     4992.7     4993.8
  A(I)             21.1        6.3        6.6        6.3        6.5
  V(I)              .96       3.26       3.08       3.22       3.12

 X STA.      4993.8     4994.8     4995.9     4997.0     4998.2     4999.3
  A(I)              6.5        6.6        6.6        6.7        6.6
  V(I)             3.14       3.11       3.10       3.05       3.07

 X STA.      4999.3     5000.4     5001.6     5002.8     5003.9     5005.1
  A(I)              6.7        6.6        6.7        6.6        6.6
  V(I)             3.04       3.06       3.05       3.09       3.06

 X STA.      5005.1     5006.3     5007.5     5008.7     5010.0     5014.0
  A(I)              6.7        6.7        6.8        6.9       20.5
  V(I)             3.04       3.05       3.00       2.94        .99


 ++ BEGINNING PROFILE CALCULATIONS --   5

*******************************EXISTING CONDITION*****************************

 XSID:CODE    SRDL     LEW     AREA    VHD     HF     EGL    CRWS       Q    WSEL
       SRD    FLEN     REW        K   ALPH     HO     ERR     FR#     VEL

SURV1:XS    ******   4948.      68.    .00  *****   37.30   35.97     27.   37.30
      883.  ******   5035.    1350.   1.10  ***** *******     .08     .40

EXIT :XS       64.   4977.      75.    .00    .02   37.32 *******     27.   37.32
      947.     67.   5026.    1834.   1.00    .00     .00     .05     .36

FULLV:FV       30.   4977.      85.    .00    .01   37.33 *******     27.   37.33
      977.     38.   5024.    2311.   1.00    .00     .00     .04     .32
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                               "APPR "     KRATIO =  1.56

APPR :AS       77.   4977.     111.    .00    .01   37.34 *******     27.   37.34
     1054.     99.   5024.    3596.   1.00    .00     .00     .03     .24
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW     AREA    VHD     HF     EGL    CRWS       Q    WSEL
       SRD    FLEN     REW        K   ALPH     HO     ERR     FR#     VEL
```

```
 BRDGE:BR      30.  4986.      106.   .00    .00   37.33   33.79     27.   37.33
      977.     30.  5014.     4106.  1.15    .00     .00     .02     .26

      TYPE PPCD FLOW       C     P/A    LSEL   BLEN   XLAB   XRAB
        4.   1.   1.    .932    .039   40.26 ****** ****** ******

     XSID:CODE     SRD    FLEN     HF   VHD      EGL      ERR        Q     WSEL
    ROAD :RG     1000.          <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

  XSID:CODE    SRDL    LEW      AREA   VHD     HF      EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH     HO      ERR     FR#      VEL

 APPR :AS      30.  4977.      110.   .00    .00   37.33   34.29     27.   37.33
      1054.    30.  5024.     3582.  1.00    .00    -.01     .03     .24

        M(G)    M(K)        KQ   XLKQ   XRKQ     OTEL
        .406    .001     3593.  4987.  5015.    37.33

                         <<<<<END OF BRIDGE COMPUTATIONS>>>>>

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "REFE "     KRATIO =    .62

  XSID:CODE    SRDL    LEW      AREA   VHD     HF      EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH     HO      ERR     FR#      VEL

 REFE :XS      63.  4972.       83.   .00    .01   37.34 *******     27.   37.34
      1117.    68.  5021.     2216.  1.00    .00     .00     .04     .32


   FIRST USER DEFINED TABLE.

     XSID:CODE         Q     SRD    WSEL       AREA       VEL      FR#        K    XSTW
    SURV1:XS         27.    883.   37.30        68.       .40      .08    1350.     87.
    EXIT :XS         27.    947.   37.32        75.       .36      .05    1834.     49.
    FULLV:FV         27.    977.   37.33        85.       .32      .04    2311.     47.
    BRDGE:BR         27.    977.   37.33       106.       .26      .02    4106.     28.
    ROAD :RG          0.   1000.*****************      1.00*************************
    APPR :AS         27.   1054.   37.33       110.       .24      .03    3582.     47.
    REFE :XS         27.   1117.   37.34        83.       .32      .04    2216.     49.


**********************************2 YEAR STORM**********************************

  XSID:CODE    SRDL    LEW      AREA   VHD     HF      EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH     HO      ERR     FR#      VEL

 SURV1:XS   ******  4798.      140.   .00 *****   37.80   36.20     55.   37.79
       883. ******  5054.     2749.  1.58 ***** *******     .12     .39

 EXIT :XS      64.  4958.      107.   .00    .03   37.83 *******     55.   37.82
       947.    67.  5053.     2894.  1.08    .00     .00     .09     .52

 FULLV:FV      30.  4951.      116.   .00    .01   37.84 *******     55.   37.83
       977.    38.  5054.     3364.  1.07    .00     .00     .08     .48
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "APPR "     KRATIO =   1.42
```

```
 APPR :AS       77.   4972.       138.    .00     .02    37.86 *******       55.    37.85
     1054.      99.   5042.      4792.   1.02     .00      .00     .05       .40
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

  XSID:CODE    SRDL     LEW      AREA    VHD      HF      EGL     CRWS         Q     WSEL
        SRD    FLEN     REW         K   ALPH      HO      ERR      FR#       VEL

 BRDGE:BR       30.   4986.       120.    .00     .01    37.83    34.03      55.    37.83
      977.      30.   5014.      4962.   1.14     .00     -.01      .04       .46

     TYPE PPCD FLOW       C     P/A     LSEL    BLEN    XLAB    XRAB
       4.   1.   1.    .935    .039    40.26 ****** ****** ******

    XSID:CODE     SRD    FLEN     HF    VHD      EGL      ERR        Q     WSEL
   ROAD :RG     1000.         <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

  XSID:CODE    SRDL     LEW      AREA    VHD      HF      EGL     CRWS         Q     WSEL
        SRD    FLEN     REW         K   ALPH      HO      ERR      FR#       VEL

 APPR :AS       30.   4973.       137.    .00     .00    37.84    34.55      55.    37.84
     1054.      30.   5041.      4756.   1.01     .01     -.01      .05       .40

       M(G)    M(K)        KQ    XLKQ    XRKQ     OTEL
       .596    .036     4620.   4987.   5015.    37.84

                        <<<<<END OF BRIDGE COMPUTATIONS>>>>>

  XSID:CODE    SRDL     LEW      AREA    VHD      HF      EGL     CRWS         Q     WSEL
        SRD    FLEN     REW         K   ALPH      HO      ERR      FR#       VEL

 REFE :XS       63.   4937.       118.    .00     .01    37.86 *******       55.    37.86
     1117.      69.   5030.      3374.   1.09     .00      .00      .08       .47


  FIRST USER DEFINED TABLE.

   XSID:CODE           Q     SRD     WSEL       AREA       VEL      FR#          K    XSTW
   SURV1:XS          55.    883.    37.79       140.       .39      .12      2749.    256.
   EXIT :XS          55.    947.    37.82       107.       .52      .09      2894.     95.
   FULLV:FV          55.    977.    37.83       116.       .48      .08      3364.    103.
   BRDGE:BR          55.    977.    37.83       120.       .46      .04      4962.     28.
   ROAD :RG           0.   1000.*****************        1.00*************************
   APPR :AS          55.   1054.    37.84       137.       .40      .05      4756.     68.
   REFE :XS          55.   1117.    37.86       118.       .47      .08      3374.     93.


**********************************50 YEAR STORM**********************************

  XSID:CODE    SRDL     LEW      AREA    VHD      HF      EGL     CRWS         Q     WSEL
        SRD    FLEN     REW         K   ALPH      HO      ERR      FR#       VEL

 SURV1:XS    ******   3652.       828.    .00  *****    39.00    36.98      263.    39.00
      883.   ******   5363.     13141.   2.75  ***** *******      .13       .32

 EXIT :XS       64.   4061.       467.    .01     .04    39.04 *******      263.    39.03
      947.      67.   5132.      9934.   2.46     .00      .00      .24       .56
```

```
FULLV:FV        30.   3971.      506.    .01     .02    39.07 *******     263.    39.06
      977.      38.   5134.    10834.   2.64     .00      .00      .23      .52
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS        77.   4150.      428.    .01     .05    39.12 *******     263.    39.11
     1054.      99.   5300.    11702.   2.22     .00      .00      .25      .62
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE   SRDL     LEW      AREA    VHD      HF      EGL     CRWS        Q     WSEL
       SRD   FLEN     REW         K   ALPH      HO      ERR      FR#      VEL

BRDGE:BR        30.   4986.      154.    .06     .03    39.10    34.99     263.    39.04
      977.      30.   5014.     7197.   1.26     .03      .00      .14     1.71

     TYPE PPCD FLOW       C      P/A     LSEL   BLEN   XLAB   XRAB
       4.   1.   1.    .892     .043    40.26 ****** ****** ******

    XSID:CODE     SRD    FLEN     HF    VHD      EGL      ERR        Q    WSEL
   ROAD :RG     1000.        <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE   SRDL     LEW      AREA    VHD      HF      EGL     CRWS        Q     WSEL
       SRD   FLEN     REW         K   ALPH      HO      ERR      FR#      VEL

APPR :AS        30.   3799.      560.    .01     .04    39.22    35.57     263.    39.21
     1054.      57.   5401.    13200.   2.88     .08      .00      .23      .47

      M(G)    M(K)        KQ    XLKQ   XRKQ     OTEL
      .976    .430     7530.   4990.  5018.    39.20

                  <<<<<END OF BRIDGE COMPUTATIONS>>>>>

 XSID:CODE   SRDL     LEW      AREA    VHD      HF      EGL     CRWS        Q     WSEL
       SRD   FLEN     REW         K   ALPH      HO      ERR      FR#      VEL

REFE :XS        63.   4331.      663.    .01     .03    39.25 *******     263.    39.24
     1117.      67.   5643.    13565.   2.60     .00      .00      .16      .40

  FIRST USER DEFINED TABLE.

   XSID:CODE          Q     SRD     WSEL       AREA       VEL       FR#          K    XSTW
   SURV1:XS        263.    883.    39.00       828.       .32       .13     13141.   1644.
   EXIT :XS        263.    947.    39.03       467.       .56       .24      9934.   1071.
   FULLV:FV        263.    977.    39.06       506.       .52       .23     10834.   1162.
   BRDGE:BR        263.    977.    39.04       154.      1.71       .14      7197.     28.
   ROAD :RG          0.   1000.*****************       1.00*************************
   APPR :AS        263.   1054.    39.21       560.       .47       .23     13200.   1519.
   REFE :XS        263.   1117.    39.24       663.       .40       .16     13565.   1312.


*********************************100 YEAR STORM*********************************

 XSID:CODE   SRDL     LEW      AREA    VHD      HF      EGL     CRWS        Q     WSEL
       SRD   FLEN     REW         K   ALPH      HO      ERR      FR#      VEL

SURV1:XS    ******   3402.      983.    .00  *****    39.09    37.10     305.    39.08
```

```
     883. ******  5394.   15248.  2.76 ***** *******      .13      .31

 EXIT :XS      64.  3765.     573.   .01   .04   39.13 *******     305.   39.12
     947.     67.  5137.   11297.  2.78   .00     .00     .24      .53

 FULLV:FV      30.  3673.     621.   .01   .03   39.15 *******     305.   39.14
     977.     38.  5138.   12324.  2.96   .00     .00     .23      .49
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 APPR :AS      77.  3842.     541.   .01   .06   39.21 *******     305.   39.20
    1054.    100.  5389.   12975.  2.80   .00     .00     .27      .56
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

  XSID:CODE    SRDL    LEW      AREA   VHD    HF     EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH    HO     ERR     FR#      VEL

 BRDGE:BR      30.  4986.     156.   .08   .03   39.20   35.15     305.   39.13
     977.     30.  5014.    7366.  1.29   .04     .00     .17     1.95

     TYPE PPCD FLOW       C     P/A    LSEL   BLEN   XLAB   XRAB
       4.   1.   1.    .881    .043   40.26 ****** ****** ******

    XSID:CODE     SRD    FLEN     HF    VHD      EGL     ERR         Q    WSEL
   ROAD :RG    1000.          <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

  XSID:CODE    SRDL    LEW      AREA   VHD    HF     EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH    HO     ERR     FR#      VEL

 APPR :AS      30.  3319.     819.   .01   .05   39.36   35.70     305.   39.35
    1054.     67.  5559.   16451.  3.57   .11    -.01     .20      .37

      M(G)    M(K)        KQ   XLKQ   XRKQ     OTEL
      .982    .520     7985.  4989.  5017.    39.34

                      <<<<<END OF BRIDGE COMPUTATIONS>>>>>

  XSID:CODE    SRDL    LEW      AREA   VHD    HF     EGL    CRWS        Q    WSEL
        SRD    FLEN    REW         K  ALPH    HO     ERR     FR#      VEL

 REFE :XS      63.  3748.     892.   .01   .02   39.38 *******     305.   39.38
    1117.     66.  5788.   16537.  2.98   .00     .00     .16      .34

  FIRST USER DEFINED TABLE.

    XSID:CODE        Q     SRD     WSEL       AREA       VEL       FR#         K    XSTW
   SURV1:XS       305.    883.    39.08       983.       .31       .13    15248.   1954.
   EXIT :XS       305.    947.    39.12       573.       .53       .24    11297.   1372.
   FULLV:FV       305.    977.    39.14       621.       .49       .23    12324.   1466.
   BRDGE:BR       305.    977.    39.13       156.      1.95       .17     7366.     28.
   ROAD :RG         0.   1000.*****************        1.00************************
   APPR :AS       305.   1054.    39.35       819.       .37       .20    16451.   2175.
   REFE :XS       305.   1117.    39.38       892.       .34       .16    16537.   2041.


**********************************500 YEAR STORM********************************
```

```
 XSID:CODE   SRDL     LEW       AREA    VHD     HF      EGL      CRWS        Q     WSEL
       SRD   FLEN     REW          K   ALPH     HO      ERR       FR#      VEL

SURV1:XS    ******   2958.     1325.    .00 *****   39.24    37.45      407.    39.24
      883. ******   5450.    20332.   2.59 ***** *******      .12       .31

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "EXIT "      KRATIO =    .68

EXIT :XS        64.  3238.       829.    .01    .04   39.28 *******     407.    39.27
      947.      70.  5368.     13838.   3.49    .00     .00      .25       .49

FULLV:FV        30.  3134.       902.    .01    .03   39.31 *******     407.    39.30
      977.      37.  5398.     15108.   3.74    .00     .00      .24       .45
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS        77.  3272.       850.    .01    .07   39.38 *******     407.    39.37
     1054.     101.  5578.     16845.   3.61    .00     .00      .26       .48
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

           <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE   SRDL     LEW       AREA    VHD     HF      EGL      CRWS        Q     WSEL
       SRD   FLEN     REW          K   ALPH     HO      ERR       FR#      VEL

BRDGE:BR        30.  4986.       161.    .13    .05   39.41    35.47      407.    39.28
      977.      30.  5014.      7677.   1.27    .08     .00      .21      2.53

     TYPE PPCD FLOW       C    P/A     LSEL    BLEN    XLAB    XRAB
       4.   1.   1.    .887   .044    40.26 ****** ****** ******

    XSID:CODE     SRD    FLEN     HF    VHD      EGL      ERR        Q     WSEL
   ROAD :RG     1000.          <<<<<EMBANKMENT IS NOT OVERTOPPED>>>>>

 XSID:CODE   SRDL     LEW       AREA    VHD     HF      EGL      CRWS        Q     WSEL
       SRD   FLEN     REW          K   ALPH     HO      ERR       FR#      VEL

APPR :AS        30.  2323.      1675.    .00    .07   39.65    36.06      407.    39.64
     1054.      89.  5959.     29240.   3.47    .17     .01      .12       .24

       M(G)    M(K)        KQ    XLKQ    XRKQ     OTEL
       .988    .692     8882.   4987.   5015.    39.64

                   <<<<<END OF BRIDGE COMPUTATIONS>>>>>

 XSID:CODE   SRDL     LEW       AREA    VHD     HF      EGL      CRWS        Q     WSEL
       SRD   FLEN     REW          K   ALPH     HO      ERR       FR#      VEL

REFE :XS        63.  2550.      1677.    .00    .01   39.66 *******     407.    39.66
     1117.      67.  6088.     28802.   2.76    .00     .00      .10       .24

 FIRST USER DEFINED TABLE.

  XSID:CODE         Q     SRD     WSEL      AREA      VEL      FR#         K    XSTW
  SURV1:XS        407.    883.    39.24     1325.      .31      .12    20332.   2491.
  EXIT :XS        407.    947.    39.27      829.      .49      .25    13838.   2004.
  FULLV:FV        407.    977.    39.30      902.      .45      .24    15108.   2151.
  BRDGE:BR        407.    977.    39.28      161.     2.53      .21     7677.     28.
  ROAD :RG          0.   1000.*****************     1.00************************
```

APPR :AS	407.	1054.	39.64	1675.	.24	.12	29240.	3637.
REFE :XS	407.	1117.	39.66	1677.	.24	.10	28802.	3538.

Appendix E

Stream Stability and Scour Analysis

HEC - 20

Level One Stream Stability Analysis

Step 1: Define Stream Characteristics

Stream Characteristics

Turkey Branch is a small stream with an average width ranging from 10 - 15 meters (30 - 50 feet). The bed material is Okeelanta Muck (see Soil Survey Appendix B) and has a low relief valley setting. As shown in Figure 4, the Federal Emergency Management Agency's (FEMA's) Flood Insurance Rate Map (FIRM), the flood plain for this creek is very wide (>10X channel width). Natural levees are not apparent and the stream is incised. Tree cover and vegetation on the channel banks is in the range of 50-90 percent. Turkey Branch is a sinuous, equiwidth channel which is not braided or anabranched.

Step 2: Evaluate Land Use Changes

Land Use Changes

The Future Land Use Map for Glades County, Figure 2, indicates that there will not be any changes in the land use surrounding Turkey Branch.

Step 3: Assess Overall Stability

Overall Stability

Based on the interpretation of observed data and identified stream characteristics, a preliminary assessment of stream stability would indicate Turkey Branch to be stable.

Steps 4 & 5: Evaluate Lateral & Vertical Stability

Vertical and Lateral Stability

Steps 4 & 5: Evaluate Lateral & Vertical Stability

Vertical and Lateral Stability

There is no apparent bank erosion in the vicinity of the SR 29 bridge and Bridge Inspection Reports indicate that there has not been any significant amounts of aggradation or degradation of the channel bottom (see Underwater Bridge Inspection Report, Appendix C). These observations confirm Turkey Branch is a vertically and laterally stable channel.

Step 6: Evaluate Channel Response to Change

Evaluation of the present and historical channel and watershed conditions, it appears that the channel has not changed due to previous impacts and will not be greatly effected by the proposed widening of SR 29.

Conclusion:

Based on the qualitative assessments resulting from a Level One Analysis (HEC-18), it can be concluded that in the vicinity of the SR 29 crossing, Turkey Branch is a stable channel. There is no need for a more detailed analysis.

HEC - 18

Evaluating Scour at Highway Structures

A HEC-18 Scour Analysis was performed on the existing and proposed structures on SR 29 crossing Turkey Branch. The 100 year and 500 year frequency floods were used to estimate the most severe scour conditions at this location.

Water surface profiles were developed for these flood events by FHWA's WSPRO (Appendix D). Water surface elevations and velocities produced by this model were used in the scour calculations.

Four types of scour were estimated for the floods at Bridge No. 050031: aggradation/degradation, contraction, pier and abutment scour. Underwater Inspection Reports, changes in land use, up and downstream controls were evaluated to predict the long term bed elevation change. Contraction, pier and abutment scour values were computed using the method of analysis and equations found in HEC-18. The scour analysis variables used in the equations were taken from the WSPRO output, geotechnical and hydrologic information at the site.

The total scour predictions have been plotted on a cross section of the stream and flood plain at Bridge No. 050031.

Channel Bottom Elevation prior to Storm Event
33.20 feet

Estimated Scour Estimates (English)								
	Contraction		Pier		Abutment		Existing Channel Bottom Scour Elev.	Proposed Channel Bottom Scour Elev.
	Existing	Proposed	Existing	Proposed	Existing	Proposed		
50 Year Storm	3.83	3.81	2.21	2.21	8.61	8.61	**27.16**	**27.18**
100 Year Storm	4.75	4.73	2.39	2.39	8.94	8.94	**26.06**	**26.08**
500 Year Storm	6.94	6.92	2.64	2.69	10.01	9.97	**23.62**	**23.59**

Channel Bottom Elevation prior to Storm Event
10.12 meters

Estimated Scour Estimates (Metric)								
	Contraction		Pier		Abutment		Existing Channel Bottom Scour Elev.	Proposed Channel Bottom Scour Elev.
	Existing	Proposed	Existing	Proposed	Existing	Proposed		
50 Year Storm	1.17	1.16	0.67	0.67	2.62	2.62	8.28	8.28
100 Year Storm	1.45	1.44	0.73	0.73	2.72	2.72	7.94	7.95
500 Year Storm	2.12	2.11	0.80	0.82	3.05	3.04	7.20	7.19

Contraction Scour Conditions at SR29

Case 1.a
The river channel width becomes narrower either due to the bridge abutments projecting into the channel or the bridge being located at a narrowing reach of the river, see Figure E-2.

Determine if flow upstream is transporting bed material:
Check V_c at approach:

$$V_c = 11.52 * y_1^{1/6} * D_{50}^{1/3}$$
$$D_{50} = 0.13 \text{ mm}$$
$$D_{50} = 0.00042651 \text{ ft}$$

If $V_{appr} < V_c$, Clear Water Contraction Scour exists.
If $V_{appr} > V_c$, Live Bed Contraction Scour exists.

Existing Bridge	A_{appr}	$TOPW_{appr}$	y_1	V_{appr}	V_c	Scour Type
50 Year	206	52	3.96	0.49	1.09	**Clear Water**
100 Year	213	52	4.10	0.39	1.10	**Clear Water**
500 Year	228	52	4.38	0.26	1.11	**Clear Water**
Proposed Bridge						
50 Year	207	52	3.98	0.47	1.09	**Clear Water**
100 Year	214	52	4.12	0.37	1.10	**Clear Water**
500 Year	229	52	4.40	0.25	1.11	**Clear Water**

SR 29 - Turkey Branch

SCOUR CALCULATIONS
EXISTING BRIDGE ANALYSIS

HEC-18 SCOUR ANALYSIS

Design Frequency: 50 year
Bridge Configuration: Existing Bridge

Clear Water Contraction Scour:

***** Requires Input***

$y_2 = (Q^2/(120 \cdot D_m^{2/3} * W^2))^{3/7}$

Q=	263 cfs	**Discharge at bridge section
D_{50}=	0.13 mm	**Median grain size at bridge
	0.000426509 ft	
D_m=	0.000533136 ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
W_1=	27 ft	**Bottom width of bridge less pier widths or overbank width, ft
A_{APPR}=	206 ft^2	**Area at approach
$TOPW_{APPR}$=	52 ft	**Topwidth of approach
y_1=	3.96 ft	**Average depth at the bridge before scour, ft
y_2=	7.79 ft	**Depth of flow in the bridge opening, ft
y_s=	3.83 ft	**Contraction scour depth.
	1.17 m	

Local Scour at Piers:

$y_s/y_1 = 2.0 * K_1 * K_2 * K_3 * (a/y_1)^{0.65} * Fr^{0.43}$

		**Select conveyance tube with highest velocity
Area tube=	6.2 ft^2	**Conveyance tube area (from WSPRO)
v_1=	2.14 ft/sec	**Velocity of conveyance tube
top width=	1.1 ft	**Top width of tube
y_1=	5.636 ft	Flow depth directly upstream of the pier: Area tube/top width
Fr=	0.159	Froude's Number: $Fr = v_1/(g*y_1)^{0.5}$
K_1=	1.1	**Correction for pier shape
		$K_1 = 1$ for circular cylinder or group of cylinders
		$K_1 = 1.1$ for square nose
K_2=	1	**Correction for angle of attack of flow (see HEC-18)
K_3=	1.1	**Correction factor for bed condition (see HEC-18)
a=	1 ft	**Width of pier
y_s=	2.01 ft	**Local Scour at Piers**
y_s=	0.61 m	
y_s=	2.21 ft	Correction for Clear Water Scour: $y_s * 1.1$
y_s=	0.67 m	HEC-18, Ch. 2.6, p.16

Abutment Scour

Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	4985.7	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4988.7	Right edge of conveyance tube beyond bridge.
	3	Number of tubes completely obstructed.
#Tubes =	3.10	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	40.77 cfs	Flow in left overbank obstructed by left abut.
A_e =	198.79 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	1125.50 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$$

*** Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	K_1 = 1.0
		Vertical Abutment with Wingwalls	K_1 = 0.82
		Spill-Through Abutment	K_1 = 0.55
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90°$ if embankment points downstream; $\theta > 90°$ if embankment points upstream	
a' =	1125.50 ft	** Length of abutment projected normal to flow.	
A_e =	198.79 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.21 ft/sec	Q_e/A_e	
Q_e =	40.77 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.18 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.09	** Froude Number of approach flow upstrea $V_e/(gy_a)^{0.5}$	
y_s =	3.36 ft	Scour depth.	
	1.02 m		

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.8 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.67 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment.
$TOPW_{tube}$ #1	3.40 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.82 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \approx a'/y_1$		Check for validity of equation.
a' =	1125.50 ft	** Length of abutment projected normal to flow.
y_1 =	5.82 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	193.27	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.67 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	5.82 ft	** Depth of flow at the abutment on the overbank or in the main channel.
Fr_1 =	0.04893	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	8.61 ft	Scour depth.
	2.62 m	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
$Q =$	263 cfs	Total discharge Input to WSPRO
$q_{tube} =$	13.15 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5011.3	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5014.3	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.10	Number of approach section conveyance tubes which are obstructed by right abutment.
$Q_e =$	67.07 cfs	Flow in right overbank obstructed by right abutment.
$A_e =$	192.71 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	369.6 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$ ** *Requires Input*

$K_1 =$	0.82	** Coefficient for abutment shape.
		Vertical Abutment — $K_1 = 1.0$
		Vertical Abutment with Wingwalls — $K_1 = 0.82$
		Spill-Through Abutment — $K_1 = 0.55$
$K_2 =$	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$
$\theta =$	90	$\theta < 90^\circ$ if embankment points downstream; $\theta > 90^\circ$ if embankment points upstream
a' =	369.60 ft	** Length of abutment projected normal to flow.
$A_e =$	192.71 ft^2	** Flow area of the approach cross section obstructed by the embankment.
$V_e =$	0.35 ft/sec	Q_e / A_e
$Q_e =$	67.07 cfs	** Flow obstructed by the abutment and approach embankment.
$y_a =$	0.52 ft	** Average depth of flow on the floodplain.
$Fr_e =$	0.08	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$
$y_s =$	4.15 ft	Scour depth.
	1.26 m	

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.3 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.68 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	3.90 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	4.95 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

L/y_1 ˜ a'/y_1		Check for validity of equation.
a' =	369.60 ft	** Length of abutment projected normal to flow.
y_1 =	4.95 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	74.69	** The ratio for abutment length projection.
		If L/y_1 > 25 Bridge not skewed to flow. Use HIRE eq.
		If L/y_1 < 25 HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** ***Requires Input***
V_{abut} =	0.68 ft/s	** Velocity through bridge adjacent to abutment, ft/s. *V_{abut}* can be determined directly from WSPRO.
y_1 =	4.95 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.054	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	7.549 ft	Scour depth.
	2.301 m	

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	**WIDTH**
Total scour at Piers:	**6.04 ft**	**5.63 ft**
Total Scour at Right Abutment:	**7.55 ft**	**21.14 ft**
Total Scour at Left Abutment:	**8.61 ft**	**24.10 ft**

HEC-18 SCOUR ANALYSIS

Design Frequency: 100 year
Bridge Configuration: Existing Bridge

Clear Water Contraction Scour:

*** Requires Input*

$y_2 = (Q^2/(120 \cdot D_m^{2/3} * W^2))^{3/7}$

Q=	305 cfs	**Discharge at bridge section
D_{50}=	0.13 mm	**Median grain size at bridge
	0.000426509 ft	
D_m=	0.000533136 ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
W_1=	27 ft	**Bottom width of bridge less pier widths or overbank width, ft
A_{APPR}=	213 ft^2	**Area at approach
$TOPW_{APPR}$=	52 ft	**Topwidth of approach
y_1=	4.10 ft	**Average depth at the bridge before scour, ft
y_2=	8.84 ft	**Depth of flow in the bridge opening, ft
y_s=	4.75 ft	**Contraction scour depth.
	1.45 m	

Local Scour at Piers:

$y_s/y_1 = 2.0*K_1*K_2*K_3*(a/y_1)^{0.65}*Fr^{0.43}$

		**Select from WSPRO conveyance tube with highest velocity
Area tube=	6.1 ft^2	**Conveyance tube area (from WSPRO)
v_1=	2.5 ft/sec	**Velocity of conveyance tube
top width=	1 ft	**Top width of tube
y_1=	6.100 ft	Flow depth directly upstream of the pier: Area tube/top width
Fr=	0.178	Froude's Number: $Fr=v_1/(g*y_1)^{0.5}$
K_1=	1.1	**Correction for pier shape
		$K_1=1$ for circular cylinder or group of cylinders
		$K_1=1.1$ for square nose
K_2=	1	**Correction for angle of attack of flow (see HEC-18)
K_3=	1.1	**Correction factor for bed condition (see HEC-18)
a=	1 ft	**Width of pier
y_s=	2.17 ft	**Local Scour at Piers**
y_s=	0.66 m	
y_s=	2.39 ft	Correction for Clear Water Scour: $y_s * 1.1$
y_s=	0.73 m	HEC-18, Ch. 2.6, p.16

Abutment Scour

Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	**REMARKS**
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	4982.4	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4987	Right edge of conveyance tube beyond bridge.
	4	Number of tubes completely obstructed.
#Tubes =	4.78	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	72.93 cfs	Flow in left overbank obstructed by left abutment.
A_e =	379.42 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	1602.6 ft	Length of abutment projected in ** ***Requires Input*** WSPRO output.

Froehlich's Equation

$$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$$

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow.	
		$K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90^\circ$ if embankment points downstream	
		$\theta > 90^\circ$ if embankment points upstream	
a' =	1602.60 ft	** Length of abutment projected normal to flow.	
A_e =	379.42 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.19 ft/sec	Q_e/A_e	$V_e/(gy_a)^{0.5}$
Q_e =	72.93 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.24 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.07	** Froude Number of approach flow upstream of the abutment. =	
y_s =	4.09 ft	Scour depth.	
	1.25 m		

Hydraulic variables for Hire Eq.

	Values	REMARKS
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	20.4 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.75 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	3.50 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.83 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

L/y_1 ~ a'/y_1		Check for validity of equation.
a' =	1602.60 ft	** Length of abutment projected normal to flow.
y_1 =	5.83 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	274.96	** The ratio for a
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\,Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.75 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	5.83 ft	** Depth of flow at the abutment on the overbank or in the main channel.
		** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
Fr_1 =	0.05475	
y_s =	8.94 ft	Scour depth.
	2.72 m	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	**REMARKS**
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5011.5	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5015.2	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.32	Number of approach section conveyance tubes which are obstructed by right abutment.
Q_e =	81.20 cfs	Flow in right overbank obstructed by right abutment.
A_e =	254.98 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	519.1 ft	Length of abutment projected in ** *Requires Input* WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90^\circ$ if embankment points downstream; $\theta > 90^\circ$ if embankment points upstream	
a' =	519.10 ft	** Length of abutment projected normal to flow.	
A_e =	254.98 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.32 ft/sec	Q_e/A_e	$V_e/(gy_a)^{0.5}$
Q_e =	81.20 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.49 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.08	** Froude Number of approach flow upstream of the abutment. =	
y_s =	4.40 ft 1.34 m	Scour depth.	

Hydraulic variables for **Hire Eq.**

	Values	REMARKS
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.9 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.76 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	4.00 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	4.98 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \sim a'/y_1$		Check for validity of equation.
a' =	519.10 ft	** Length of abutment projected normal to flow.
y_1 =	4.98 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	104.34	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** ***Requires Input***
V_{abut} =	0.76 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	4.98 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.060	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	7.866 ft	Scour depth.
	2.398 m	

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	WIDTH
Total scour at Piers:	**7.14 ft**	**6.08 ft**
Total Scour at Right Abutment:	**7.87 ft**	**22.02 ft**
Total Scour at Left Abutment:	**8.94 ft**	**25.03 ft**

HEC-18 SCOUR ANALYSIS

Design Frequency: 500 year
Bridge Configuration: Existing Bridge

Clear Water Contraction Scour:

** *Requires Input*

$y_2 = (Q^2/(120 \cdot D_m^{2/3} * W^2))^{3/7}$

Q=	407	cfs	**Discharge at bridge section
D_{50}=	0.13	mm	**Median grain size at bridge
	0.000426509	ft	
D_m=	0.000533136	ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
W_1=	27	ft	**Bottom width of bridge less pier widths or overbank width, ft
A_{APPR}=	228	ft^2	**Area at approach
$TOPW_{APPR}$=	52	ft	**Topwidth of approach
y_1=	4.38	ft	**Average depth at the bridge before scour, ft
y_2=	11.32	ft	**Depth of flow in the bridge opening, ft
y_s=	6.94	ft	**Contraction scour depth.
	2.12	m	

Local Scour at Piers:

ys/y1=2.0*K1*K2*K3*(a/y1)^0.65*Fr^0.43

			**Select from WSPRO conveyance tube with highest velocity
Area tube=	6.3	ft^2	**Conveyance tube area (from WSPRO)
v_1=	3.22	ft/sec	**Velocity of conveyance tube
top width=	1.1	ft	**Top width of tube
y_1=	5.727	ft	Flow depth directly upstream of the pier: Area tube/top width
Fr=	0.237		Froude's Number: $Fr=v_1/(g*y_1)^{0.5}$
K_1=	1.1		**Correction for pier shape K_1=1 for circular cylinder or group of cylinders K_1=1.1 for square nose
K_2=	1		**Correction for angle of attack of flow (see HEC-18)
K_3=	1.1		**Correction factor for bed condition (see HEC-18)
a=	1	ft	**Width of pier
y_s=	2.40	ft	**Local Scour at Piers**
y_s=	0.73	m	
y_s=	2.64	ft	Correction for Clear Water Scour: y_s * 1.1
y_s=	0.80	m	HEC-18, Ch. 2.6, p.16

Abutment Scour

Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	4984.9	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4990.3	Right edge of conveyance tube beyond bridge.
	8	Number of tubes completely obstructed.
#Tubes =	8.20	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	166.95 cfs	Flow in left overbank obstructed by left abutment.
A_e =	957.30 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	2556.9 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27 K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90^\circ$ if embankment points downstream $\theta > 90^\circ$ if embankment points upstream	
a' =	2556.90 ft	** Length of abutment projected normal to flow.	
A_e =	957.30 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.17 ft/sec	Q_e / A_e	
Q_e =	166.95 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.37 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.05	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$	
y_s =	5.38 ft 1.64 m	Scour depth.	

Hydraulic variables for **Hire Eq.**

	Values	REMARKS
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	21.2 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.96 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	3.50 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	6.06 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

L/y_1 ~ a'/y_1		Check for validity of equation.
a' =	2556.90 ft	** Length of abutment projected normal to flow.
y_1 =	6.06 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	422.13	** The ratio for abutment length projection.
		If L/y_1 > 25 Bridge not skewed to flow. Use HIRE eq.
		If L/y_1 < 25 HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\,Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.96 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	6.06 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.069	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	10.014 ft	Scour depth.
	3.052	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5011.2	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5017.5	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.56	Number of approach section conveyance tubes which are obstructed by right abutment.
Q_e =	113.06 cfs	Flow in right overbank obstructed by right abutment.
A_e =	454.56 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	902.3 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27 K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape. Vertical Abutment $K_1 = 1.0$ Vertical Abutment with Wingwalls $K_1 = 0.82$ Spill-Through Abutment $K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$
θ =	90	$\theta < 90^\circ$ if embankment points downstream $\theta > 90^\circ$ if embankment points upstream
a' =	902.30 ft	** Length of abutment projected normal to flow.
A_e =	454.56 ft^2	** Flow area of the approach cross section obstructed by the embankment.
V_e =	0.25 ft/sec	Q_e/A_e
Q_e =	113.06 cfs	** Flow obstructed by the abutment and approach embankment.
y_a =	0.50 ft	** Average depth of flow on the floodplain.
Fr_e =	0.06	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$
y_s =	4.80 ft 1.46 m	Scour depth.

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	20.6 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.99 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	4.00 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.15 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

L/y_1 ~ a'/y_1		Check for validity of equation.
a' =	902.30 ft	** Length of abutment projected normal to flow.
y_1 =	5.15 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	175.20	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.99 ft/s	** Velocity through bridge adjacent to abutment, ft/s. *V_{abut}* can be determined directly from WSPRO.
y_1 =	5.15 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.077	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	8.835 ft	Scour depth.
	2.693 m	

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	**WIDTH**
Total scour at Piers:	**9.58 ft**	**6.72 ft**
Total Scour at Right Abutment:	**8.83 ft**	**24.74 ft**
Total Scour at Left Abutment:	**10.01 ft**	**28.04 ft**

SR 29 - Turkey Branch

Scour Calculations
Widened Bridge Analysis

HEC-18 SCOUR ANALYSIS

Design Frequency: 50 year
Bridge Configuration: Proposed Bridge

Clear Water Contraction Scour:

*** Requires Input*

$y_2 = (Q^2/(120 * D_m^{2/3} * W^2))^{3/7}$

Q=	263 cfs	**Discharge at bridge section
D_{50}=	0.13 mm	**Median grain size at bridge
	0.000426509 ft	
D_m=	0.000533136 ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
W_1=	27 ft	**Bottom width of bridge less pier widths or overbank width
A_{APPR}=	207 ft^2	**Area at approach
$TOPW_{APPR}$=	52 ft	**Topwidth of approach
y_1=	3.98 ft	**Average depth at the bridge before scour, ft
y_2=	7.79 ft	**Depth of flow in the bridge opening, ft
y_s=	3.81 ft	**Contraction scour depth.
	1.16 m	

Local Scour at Piers:

$y_s/y_1=2.0*K_1*K_2*K_3*(a/y_1)^{0.65}*Fr^{0.43}$

		**Select conveyance tube with highest velocity
Area tube=	6.2 ft^2	**Conveyance tube area (from WSPRO)
v_1=	2.14 ft/sec	**Velocity of conveyance tube
top width=	1.1 ft	**Top width of tube
y_1=	5.636 ft	Flow depth directly upstream of the pier: Area tube/top width
Fr=	0.159	Froude's Number: $Fr=v_1/(g*y_1)^{0.5}$
K_1=	1.1	**Correction for pier shape
		K_1=1 for circular cylinder or group of cylinders
		K_1=1.1 for square nose
K_2=	1	**Correction for angle of attack of flow (see HEC-18)
K_3=	1.1	**Correction factor for bed condition (see HEC-18)
a=	1 ft	**Width of pier
y_s=	2.01 ft	**Local Scour at Piers**
y_s=	0.61 m	
y_s=	2.21 ft	Correction for Clear Water Scour: y_s * 1.1
y_s=	0.67 m	HEC-18, Ch. 2.6, p.16

Abutment Scour

Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	4985.7	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4988.2	Right edge of conveyance tube beyond bridge.
	3	Number of tubes completely obstructed.
#Tubes =	3.12	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	41.03 cfs	Flow in left overbank obstructed by left abut.
A_e =	214.92 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	1184.10 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$

** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90°$ if embankment points downstream; $\theta > 90°$ if embankment points upstream	
a' =	1184.10 ft	** Length of abutment projected normal to flow.	
A_e =	214.92 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.19 ft/sec	Q_e/A_e	
Q_e =	41.03 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.18 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.08	** Froude Number of approach flow upst $V_e/(gy_a)^{0.5}$	
y_s =	3.32 ft	Scour depth.	
	1.01 m		

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.8 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.67 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment.
$TOPW_{tube}$ #1	3.40 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.82 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \approx a'/y_1$		Check for validity of equation.
a' =	1184.10 ft	** Length of abutment projected normal to flow.
y_1 =	5.82 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	203.33	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.67 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	5.82 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.049	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	8.606 ft	Scour depth.
	2.623	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5011.3	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5014.5	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.16	Number of approach section conveyance tubes which are obstructed by right abutment.
Q_e =	67.80 cfs	Flow in right overbank obstructed by right abutment.
A_e =	199.61 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	386.6 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape. Vertical Abutment $K_1 = 1.0$ Vertical Abutment with Wingwalls $K_1 = 0.82$ Spill-Through Abutment $K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$
θ =	90	$\theta < 90°$ if embankment points downstream $\theta > 90°$ if embankment points upstream
a' =	386.60 ft	** Length of abutment projected normal to flow.
A_e =	199.61 ft^2	** Flow area of the approach cross section obstructed by the embankment.
V_e =	0.34 ft/sec	Q_e / A_e
Q_e =	67.80 cfs	** Flow obstructed by the abutment and approach embankment.
y_a =	0.52 ft	** Average depth of flow on the floodplain.
Fr_e =	0.08	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$
y_s =	4.15 ft 1.26 m	Scour depth.

Hydraulic variables for **Hire Eq.**

	Values	REMARKS
Q =	263 cfs	Total discharge Input to WSPRO
q_{tube} =	13.15 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.3 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. (**Bridge X-Sec.**)
V_{tube} =	0.68 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. (**Bridge X-Sec.**)
$TOPW_{tube}$ #1	3.90 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	4.95 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \approx a'/y_1$		Check for validity of equation.
a' =	386.60 ft	** Length of abutment projected normal to flow.
y_1 =	4.95 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	78.12	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

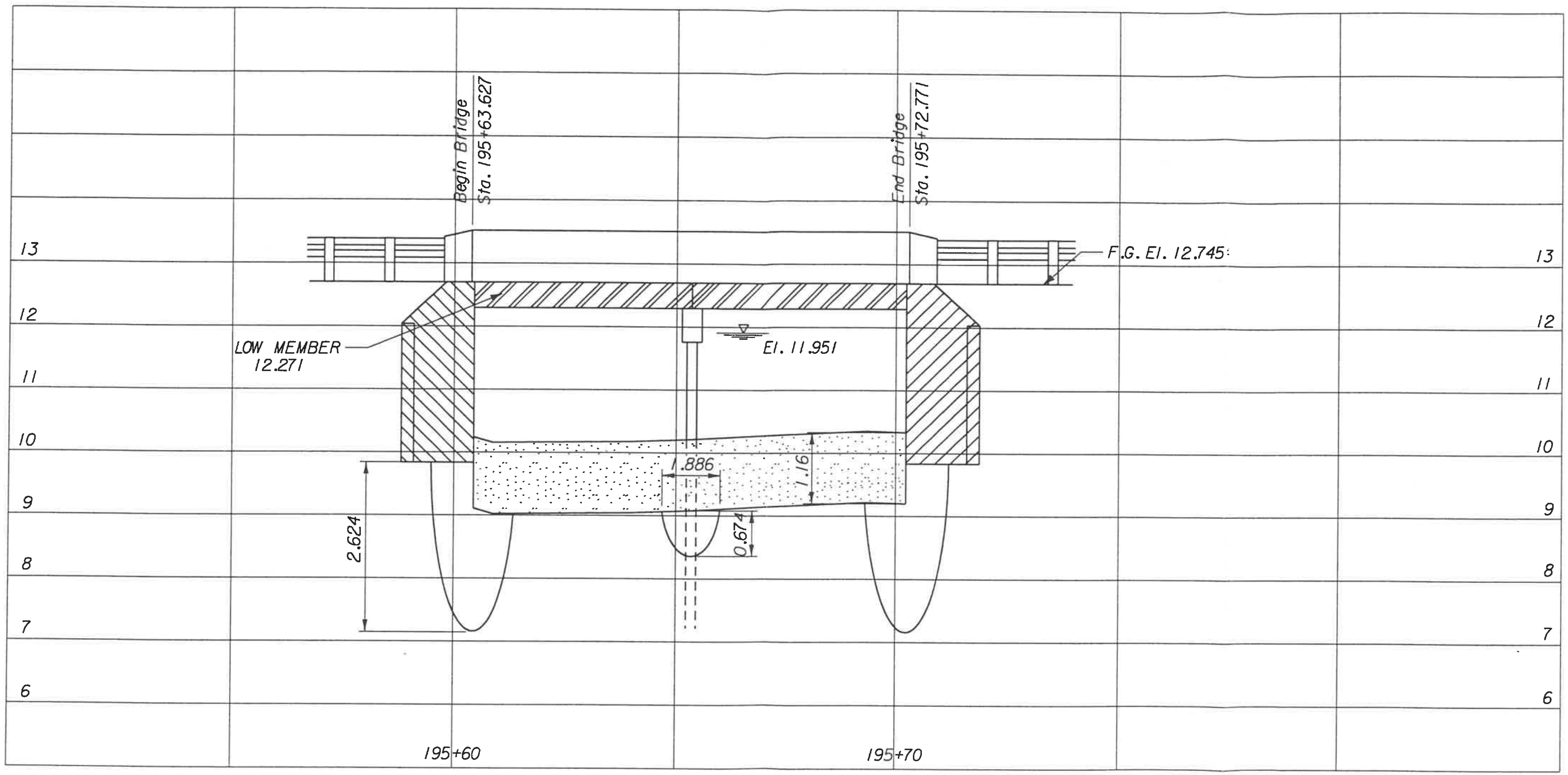
Hire Computation:

$y_s/y_1 = 4\, Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.68 ft/s	** Velocity through bridge adjacent to abutment, ft/s. *V_{abut}* can be determined directly from WSPRO.
y_1 =	4.95 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.054	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	7.549 ft	Scour depth.
	2.301 m	

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	WIDTH
Total scour at Piers:	**6.02 ft**	**5.63 ft**
Total Scour at Right Abutment:	**7.55 ft**	**21.14 ft**
Total Scour at Left Abutment:	**8.61 ft**	**24.10 ft**



50 YEAR STORM SCOUR PROFILE

N.T.S.

PROPOSED BRIDGE OVER TURKEY BRANCH

JMI ENGINEERS

HEC-18 SCOUR ANALYSIS

Design Frequency: 100 year
Bridge Configuration: Proposed Bridge

Clear Water Contraction Scour:

***** Requires Input***

$y_2 = (Q^2/(120 \cdot D_m^{2/3} * W^2))^{3/7}$

$Q=$	305 cfs	**Discharge at bridge section
$D_{50}=$	0.13 mm	**Median grain size at bridge
	0.000426509 ft	
$D_m=$	0.000533136 ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
$W_1=$	27 ft	**Bottom width of bridge less pier widths or overbank width, ft
$A_{APPR}=$	214 ft^2	**Area at approach
$TOPW_{APPR}=$	52 ft	**Topwidth of approach
$y_1=$	4.12 ft	**Average depth at the bridge before scour, ft
$y_2=$	8.84 ft	**Depth of flow in the bridge opening, ft
$y_s=$	4.73 ft	**Contraction scour depth.
	1.44 m	

Local Scour at Piers:

$y_s/y_1=2.0*K_1*K_2*K_3*(a/y_1)^{0.65}*Fr^{0.43}$

		**Select from WSPRO conveyance tube with highest velocity
Area tube=	6.1 ft^2	**Conveyance tube area (from WSPRO)
$v_1=$	2.5 ft/sec	**Velocity of conveyance tube
top width=	1 ft	**Top width of tube
$y_1=$	6.100 ft	Flow depth directly upstream of the pier: Area tube/top width
$Fr=$	0.178	Froude's Number: $Fr=v_1/(g*y_1)^{0.5}$
$K_1=$	1.1	**Correction for pier shape
		$K_1=1$ for circular cylinder or group of cylinders
		$K_1=1.1$ for square nose
$K_2=$	1	**Correction for angle of attack of flow (see HEC-18)
$K_3=$	1.1	**Correction factor for bed condition (see HEC-18)
$a=$	1 ft	**Width of pier
$y_s=$	2.17 ft	**Local Scour at Piers**
$y_s=$	0.66 m	
$y_s=$	2.39 ft	Correction for Clear Water Scour: $y_s * 1.1$
$y_s=$	0.73 m	HEC-18, Ch. 2.6, p.16

Abutment Scour

Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	4986.2	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4980.6	Right edge of conveyance tube beyond bridge.
	4	Number of tubes completely obstructed.
#Tubes =	4.04	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	61.54 cfs	Flow in left overbank obstructed by left abutment.
A_e =	387.60 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	1661.3 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90°$ if embankment points downstream $\theta > 90°$ if embankment points upstream	
a' =	1661.30 ft	** Length of abutment projected normal to flow.	
A_e =	387.60 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.16 ft/sec	Q_e / A_e	
Q_e =	61.54 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.23 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.06	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$	
y_s =	3.70 ft 1.13 m	Scour depth.	

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	20.4 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.75 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	3.50 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.83 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \approx a'/y_1$		Check for validity of equation.
a' =	1661.30 ft	** Length of abutment projected normal to flow.
y_1 =	5.83 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	285.03	** The ratio for abutment length projection.
		If L/y_1 > 25 Bridge not skewed to flow. Use HIRE eq.
		If L/y_1 < 25 HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.75 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	5.83 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.055	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	8.939 ft	Scour depth.
	2.725	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5015.3	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5011.4	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.67	Number of approach section conveyance tubes which are obstructed by right abutment.
Q_e =	86.42 cfs	Flow in right overbank obstructed by right abutment.
A_e =	269.92 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	542.6 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27 K_1 K_2 (a'/y_a)^{0.43} Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.
		Vertical Abutment $K_1 = 1.0$
		Vertical Abutment with Wingwalls $K_1 = 0.82$
		Spill-Through Abutment $K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$
θ =	90	$\theta < 90°$ if embankment points downstream $\theta > 90°$ if embankment points upstream
a' =	542.60 ft	** Length of abutment projected normal to flow.
A_e =	269.92 ft^2	** Flow area of the approach cross section obstructed by the embankment.
V_e =	0.32 ft/sec	Q_e/A_e
Q_e =	86.42 cfs	** Flow obstructed by the abutment and approach embankment.
y_a =	0.50 ft	** Average depth of flow on the floodplain.
Fr_e =	0.08	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$
y_s =	4.51 ft 1.38 m	Scour depth.

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	305 cfs	Total discharge Input to WSPRO
q_{tube} =	15.25 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	19.9 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.76 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	4.00 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	4.98 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \sim a'/y_1$		Check for validity of equation.
a' =	542.60 ft	** Length of abutment projected normal to flow.
y_1 =	4.98 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	109.07	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

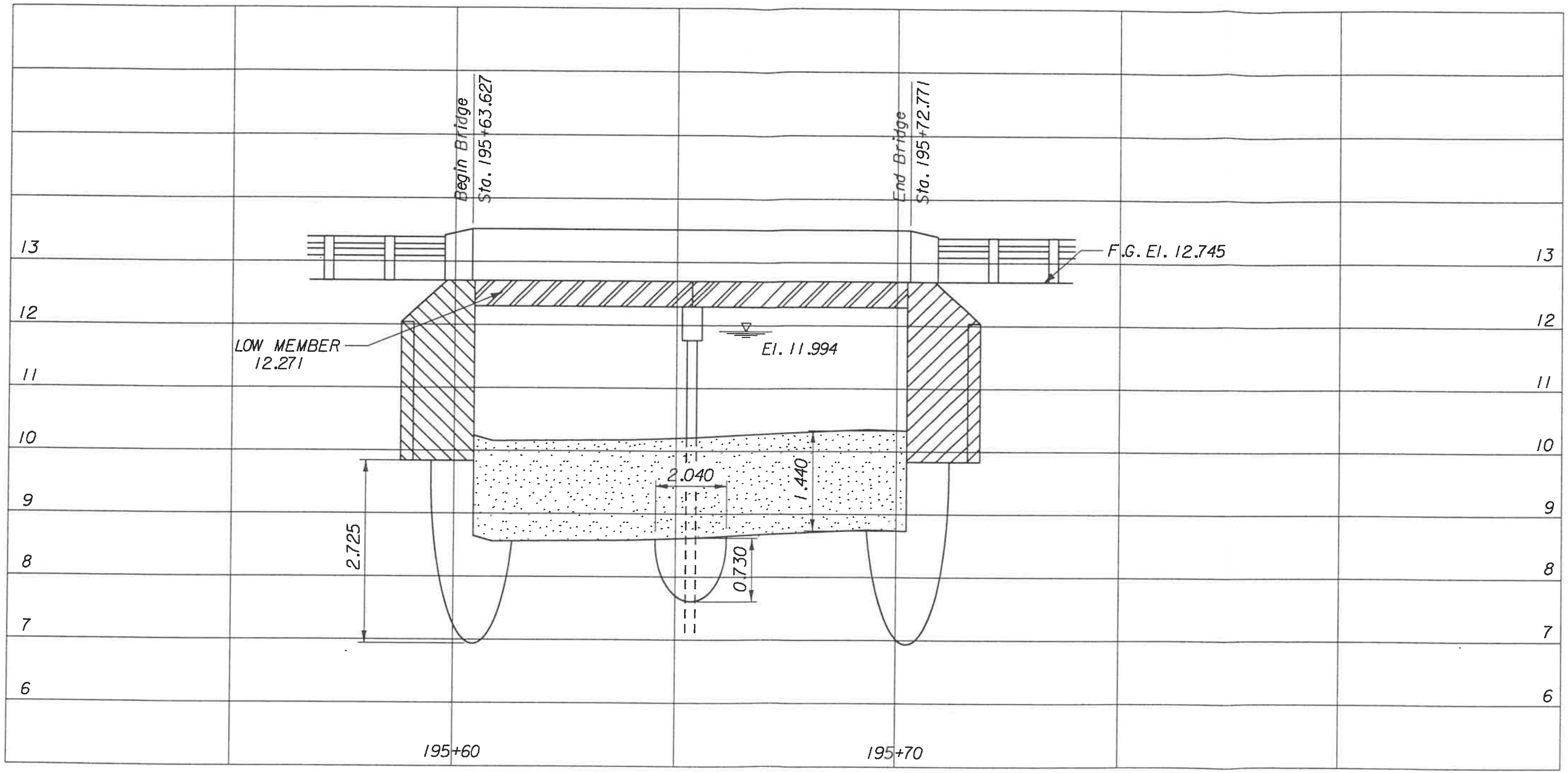
Hire Computation:

$y_s/y_1 = 4\,Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.76 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	4.98 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.060	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	7.866 ft	Scour depth.
	2.398 m	

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	**WIDTH**
Total scour at Piers:	**7.12 ft**	**6.08 ft**
Total Scour at Right Abutment:	**7.87 ft**	**22.02 ft**
Total Scour at Left Abutment:	**8.94 ft**	**25.03 ft**



100 YEAR STORM SCOUR PROFILE

N.T.S.

PROPOSED BRIDGE OVER TURKEY BRANCH

JMI ENGINEERS

HEC-18 SCOUR ANALYSIS

Design Frequency: 500 year
Bridge Configuration: Proposed Bridge

Clear Water Contraction Scour:

***** Requires Input***

$y_2 = (Q^2/(120 \cdot D_m^{2/3} * W^2))^{3/7}$

Q=	407 cfs	**Discharge at bridge section
D_{50}=	0.13 mm	**Median grain size at bridge
	0.000426509 ft	
D_m=	0.000533136 ft	**Effective mean grain size, ft. Taken as 1.25 times the median grain size (D_{50})
W_1=	27 ft	**Bottom width of bridge less pier widths or overbank width, ft
A_{APPR}=	229 ft^2	**Area at approach
$TOPW_{APPR}$=	52 ft	**Topwidth of approach
y_1=	4.40 ft	**Average depth at the bridge before scour, ft
y_2=	11.32 ft	**Depth of flow in the bridge opening, ft
y_s=	6.92 ft	**Contraction scour depth.
	2.11 m	

Local Scour at Piers:

ys/y1=2.0*K1*K2*K3*(a/y1)^0.65*Fr^0.43

		**Select from WSPRO conveyance tube with highest velocity
Area tube=	6.3 ft^2	**Conveyance tube area (from WSPRO)
v_1=	3.26 ft/sec	**Velocity of conveyance tube
top width=	1 ft	**Top width of tube
y_1=	6.300 ft	Flow depth directly upstream of the pier: Area tube/top width
Fr=	0.229	Froude's Number: $Fr=v_1/(g*y_1)^{0.5}$
K_1=	1.1	**Correction for pier shape
		K_1=1 for circular cylinder or group of cylinders
		K_1=1.1 for square nose
K_2=	1	**Correction for angle of attack of flow (see HEC-18)
K_3=	1.1	**Correction factor for bed condition (see HEC-18)
a=	1 ft	**Width of pier
y_s=	2.44 ft	**Local Scour at Piers**
y_s=	0.75 m	
y_s=	2.69 ft	Correction for Clear Water Scour: y_s * 1.1
y_s=	0.82 m	HEC-18, Ch. 2.6, p.16

Abutment Scour
Left Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube.
		Defined as the total discharge divided by 20.
X-sta. 1	4989.1	Left edge of conveyance tube #1.
X-sta. 2	4986	Station of left edge of bridge (edge of obstruction)
X-sta. 3	4982.6	Right edge of conveyance tube beyond bridge.
	8	Number of tubes completely obstructed.
#Tubes =	8.48	Number of approach section conveyance tubes which are obstructed by left abutment.
Q_e =	172.51 cfs	Flow in left overbank obstructed by left abutment.
A_e =	1027.77 ft^2	Left abutment; area of conveyance. Determined from WSPRO output.
a' =	2649.6 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	K_1 = 1.0
		Vertical Abutment with Wingwalls	K_1 = 0.82
		Spill-Through Abutment	K_1 = 0.55
K_2 =	1.00	** Coefficient for angle of embankment to flow.	
		$K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90^\circ$ if embankment points downstream	
		$\theta > 90^\circ$ if embankment points upstream	
a' =	2649.60 ft	** Length of abutment projected normal to flow.	
A_e =	1027.77 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.17 ft/sec	Q_e / A_e	
Q_e =	172.51 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.39 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.05	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$	
y_s =	5.40 ft	Scour depth.	
	1.65 m		

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	21.1 ft^2	Area of conveyance tube #1, adjacent to left abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.96 ft/s	Mean velocity of conveyance tube #1, adjacent to left abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	3.50 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	6.03 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \sim a'/y_1$		Check for validity of equation.
a' =	2649.60 ft	** Length of abutment projected normal to flow.
y_1 =	6.03 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	439.51	** The ratio for abutment length projection.
		If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq.
		If $L/y_1 < 25$ HIRE eq not appropriate.

Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.96 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	6.03 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.069	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	9.975 ft	Scour depth.
	3.040	

Right Abutment:

Hydraulic variables for **Froehlich's Eq.**

	Values	REMARKS
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube. Defined as the total discharge divided by 20.
X-sta. 1	5017.7	Left edge of conveyance tube beyond bridge.
X-sta. 2	5014	Station of right edge of bridge (edge of obstruction)
X-sta. 3	5011.2	Right edge of conveyance tube.
# tubes	5	# of tubes completely obstructed.
#Tubes =	5.43	Number of approach section conveyance tubes which are obstructed by right abutment.
Q_e =	110.52 cfs	Flow in right overbank obstructed by right abutment.
A_e =	475.87 ft^2	Right abutment; area of conveyance. Determined from WSPRO output.
a' =	939.5 ft	Length of abutment projected into flow. Determined from WSPRO output.

Froehlich's Equation

$y_s/y_a = 2.27\, K_1 K_2 (a'/y_a)^{0.43}\, Fr^{0.61} + 1$ ** *Requires Input*

K_1 =	0.82	** Coefficient for abutment shape.	
		Vertical Abutment	$K_1 = 1.0$
		Vertical Abutment with Wingwalls	$K_1 = 0.82$
		Spill-Through Abutment	$K_1 = 0.55$
K_2 =	1.00	** Coefficient for angle of embankment to flow. $K_2 = (\theta/90)^{0.13}$	
θ =	90	$\theta < 90^\circ$ if embankment points downstream $\theta > 90^\circ$ if embankment points upstream	
a' =	939.50 ft	** Length of abutment projected normal to flow.	
A_e =	475.87 ft^2	** Flow area of the approach cross section obstructed by the embankment.	
V_e =	0.23 ft/sec	Q_e/A_e	
Q_e =	110.52 cfs	** Flow obstructed by the abutment and approach embankment.	
y_a =	0.51 ft	** Average depth of flow on the floodplain.	
Fr_e =	0.06	** Froude Number of approach flow upstream of the abutment. = $V_e/(gy_a)^{0.5}$	
y_s =	4.71 ft 1.43 m	Scour depth.	

Hydraulic variables for **Hire Eq.**

	Values	**REMARKS**
Q =	407 cfs	Total discharge Input to WSPRO
q_{tube} =	20.35 cfs	Discharge per equal conveyance tube.
A_{tube} #1 =	20.5 ft^2	Area of conveyance tube #1, adjacent to right abutment. Read directly from WSPRO. **(Bridge X-Sec.)**
V_{tube} =	0.99 ft/s	Mean velocity of conveyance tube #1, adjacent to right abutment. Read from WSPRO. **(Bridge X-Sec.)**
$TOPW_{tube}$ #1	4.00 ft	Difference between left and right station of conveyance tube 1, from WSPRO.
y_1 =	5.13 ft	Average depth of conveyance tube 1. $A_{tube}/TOPW_{tube}$ of conveyance tube 1.

Hire Equation

Check L/y_1 ratio:

$L/y_1 \approx a'/y_1$		Check for validity of equation.
a' =	939.50 ft	** Length of abutment projected normal to flow.
y_1 =	5.13 ft	** $A_{tube}/TOPW_{tube}$ of conveyance tube #1
a' / y_1 =	183.32	** The ratio for abutment length projection. If $L/y_1 > 25$ Bridge not skewed to flow. Use HIRE eq. If $L/y_1 < 25$ HIRE eq not appropriate.

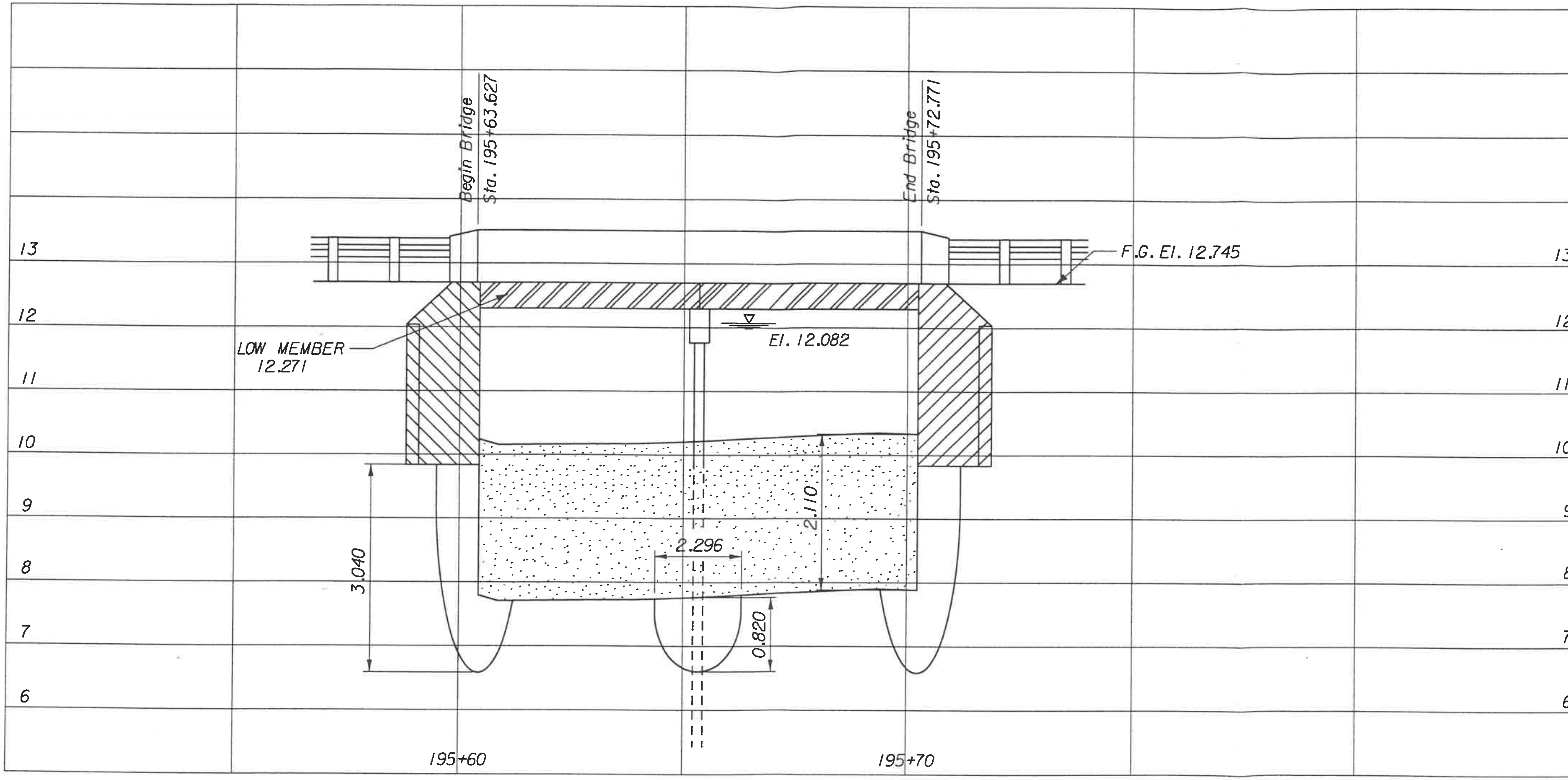
Hire Computation:

$y_s/y_1 = 4\ Fr_1^{0.33}$		** *Requires Input*
V_{abut} =	0.99 ft/s	** Velocity through bridge adjacent to abutment, ft/s. V_{abut} can be determined directly from WSPRO.
y_1 =	5.13 ft	** Depth of flow at the abutment on the overbank or in the main channel
Fr_1 =	0.077	** Froude Number based on the velocity and depth in the bridge opening adjacent to the abutment.
y_s =	8.799 ft 2.682 m	Scour depth.

Total Scour:

Assume that the width of the scour hole is equal to 2.8 * y_s. (HEC-18 Manual)

	DEPTH	**WIDTH**
Total scour at Piers:	**9.61 ft**	**6.85 ft**
Total Scour at Right Abutment:	**8.80 ft**	**24.64 ft**
Total Scour at Left Abutment:	**9.97 ft**	**27.93 ft**

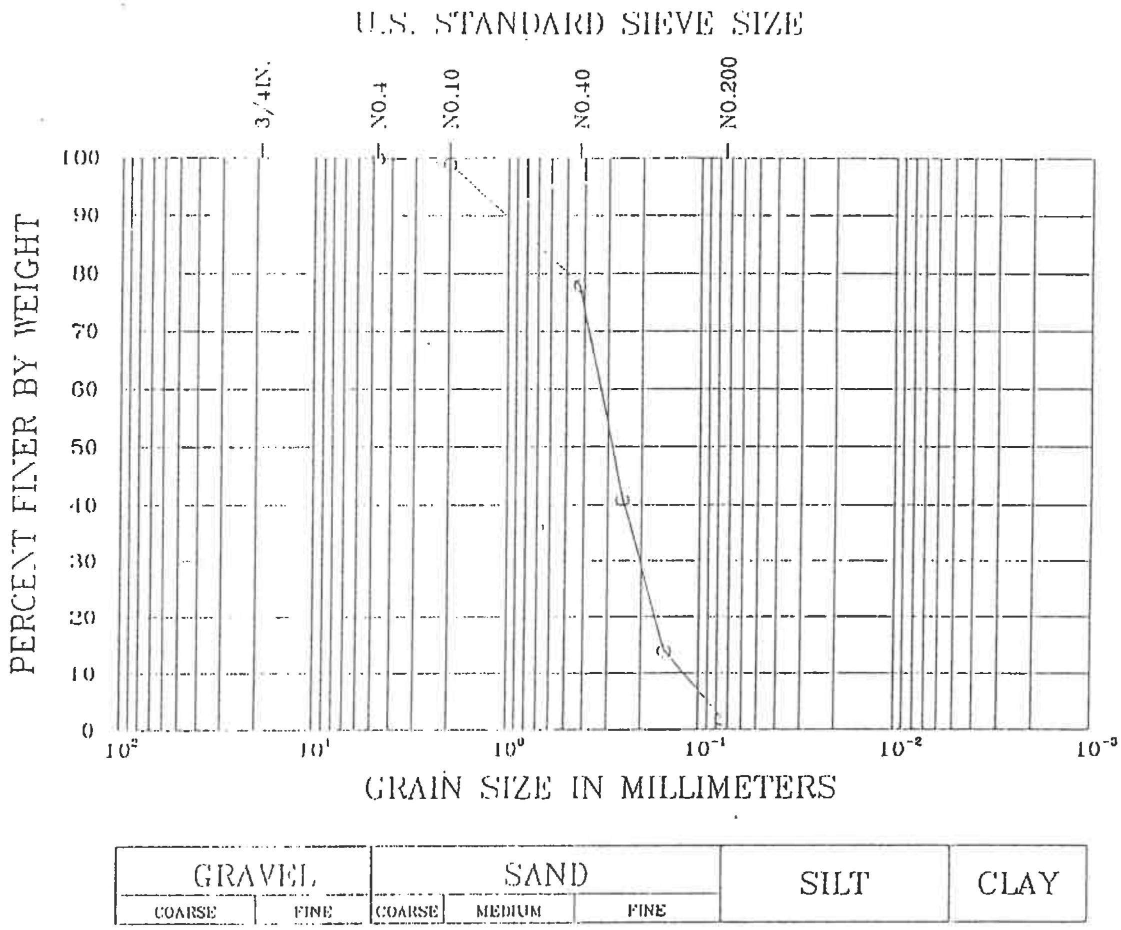


500 YEAR STORM
SCOUR PROFILE
N.T.S.

PROPOSED BRIDGE
OVER
TURKEY BRANCH

JMI ENGINEERS

APPENDIX A - GRAIN SIZE DISTRIBUTION CURVES
BRIDGE NO. 050031



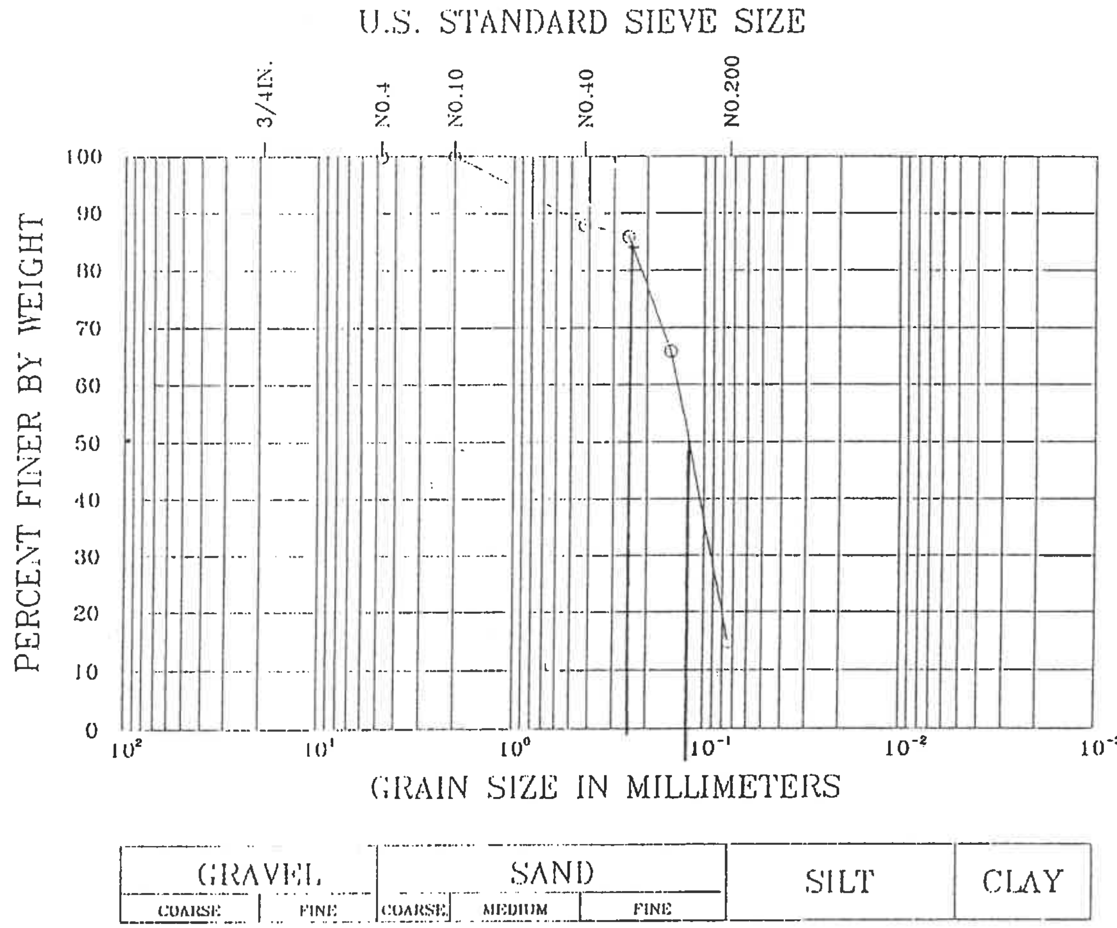
LOCATION: NORTHEAST QUADRANT
SAMPLE DEPTH: GRAB SAMPLE

-0-

SOIL CLASSIFICATION: A-3, SP

REPRESENTATIVE OF SURFICIAL MATERIAL

STATE PROJECT # 05090-1511
BRIDGE # 050031



LOCATION: STATION 195+54 11m LT OF C.L.
SAMPLE DEPTH: 8.69m

SOIL CLASSIFICATION: A-2-4, SC

STATE PROJECT # 05090-1511
BRIDGE # 050031

THIS CURVE REPRESENTS MATERIAL
0.0 m TO 9.3m BENEATH CHANNEL BOTTOM

CURVE 2

d_{50} = 0.13 mm
d_{84} = 0.25 mm

Appendix F

Economic Analysis

An economic analysis was completed for the widening of Bridge No. 050031 on SR 29. Since the existing and widened bridge are both hydraulically adequate it is not necessary to compare any replacement alternatives. The following calculations show how the cost for widening the bridge was determined. A more detailed cost analysis will be included in the Bridge Development Report.

Preliminary Cost Estimate
Bridge No. 050031 Widening

	Quantity	Unit Cost	Total Cost
Concrete (Superstructure)	20 yd^3	\$450 /yd^3	\$9,000
12 ft Additional width 30 ft Length 1.5 ft Depth of structure			
Concrete (Substructure)	10 yd^3	\$525 /yd^3	\$5,133
End Bents - 2 Total (incl. wingwalls) 24 ft Additional Length 3 ft Additional Height 3 ft Additional Width Intermediate Bents - 1 Total 12 ft Length 2 ft Width 2 ft Height			
Reinforcing Steel	7,668 lb	\$0.60 /lb	\$7,300
Superstructure Assume 8% of Concrete Weight 20 yd^3 * 150 lb/ft^3 * 27 ft^3/yd^3 Substructure: Assume 3% of Concrete Weight 10 yd^3 * 150 lb/ft^3 * 27 ft^3/yd^3			
Piles - Driven and Furnished	320 lf	\$45 /lf	\$14,400
4 piles @ 50 ft 4 piles @ 30 ft			
Barrier Wall	60 lf	\$50 /lf	\$3,000

Estimated Cost of Bridge Widening: \$38,833

Appendix G
Correspondence

DATE: October 27, 1995

PROJECT NO: 9523

TIME: 2:00 P.M.

CALL PLACED BY: PAULA

FIRM CALLED: Glades County Emergency Management Agency

TELEPHONE # (813) 946-1217

SPOKE WITH:

Subject: SR 29 as emergency access route or evacuation route

SR 29 is considered both an evacuation and emergency access route for Glades County.

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 01/25/96 **PROJECT NO:** 9523

TIME: 05:09 PM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: FDOT Maintenance, LaBelle, Florida **TELEPHONE #** (941) 674-4027

SPOKE WITH: Talbert Melton

Subject: Flooding problems at Bridge 050031

Mr. Melton did not know of any problems incurred at this bridge location and has no records of it overtopping. He has seen the water very high, as high as the low member. There was a time in 1970 when other parts of SR 29 were overtopped but there was no overtopping at this bridge or its roadway approaches.

		Project/Proposal
cc:	BHR	9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/06/96 **PROJECT NO:** 9523

TIME: 05:04 PM **CALL ~~PLACED~~/RECEIVED BY:** Paula

FIRM CALLED: SFWMD **TELEPHONE #** (941) 278-7396

SPOKE WITH: Clayton Miller

Subject: Deck Drainage

There is not a problem with the additional deck drainage sheet flowing off the bridge into the existing drainage ditches. They are primarily concerned with water quality. We have slowed the runoff by taking off the bridge, over the grassed shoulder and into the existing ditches. He agrees that it is not practical to provide any more treatment than this.

In regards to permitting, he advised us to look into a Noticed General Permit rather than a General Permit.

He will also be faxing the runoff equations developed by the SFWMD. However, they encourage people not to use them because the values they give are too high.

Project/Proposal

cc: File 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 09:23 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Emergency Management **TELEPHONE #** (941) 946-1217

SPOKE WITH: Ken Howard, Director

Subject: Flooding on SR29

I called Mr. Howard about the flooding which occurred around June 23, 1995 (per Art de Laski). He stated that the road was never completely closed during this time. There was an area where the water was over the road, however the road was still passible. A Florida Highway Patrol first noticed the water on the road and notified the EMA, who notified the Glades Co. Road Department who put up barricades and warnings for travelors.

Mr. Howard stated that this area was located about 5 miles south of the intersection of SR 29 and US 27. He said that it was not at a bridge, it was only the roadway. The water receded in about 24 hours.

Mr. Howard stated that all this information was his own personal experience. This past year was unusual due to several tropical storms, hurricanes, etc. and there were a lot of areas flooded which usually don't. In the last 7-10 years, he does not remember SR 29 ever overtopping. The EMA does not have detailed records of flooding and road closures. Since this is a state road, he recommended contacting the FDOT Maintenance.

He mentioned contacting Tommy Greenwood, Director of the Glades County Road Department for possibly more information. (941) 946-0771

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 10:19 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co.Maintenance **TELEPHONE #** (941) 946-0771

SPOKE WITH: Tommy Greenwood

Subject: Flooding on SR29

The County Maintenance Department does not have any information on this road because it is a state road. He does not have any personal recollection of flooding on SR 29 either.

He suggested calling Talbert Melton or Wally Thalen.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 10:29 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Talbert Melton

Subject: Flooding on SR29

I asked Mr. Melton specifically about June 1995 when Ken Howard recalls there was a need for barricades on a portion of SR 29 where water was coming onto the roadway. He does not remember ever having to take barricades out there. He said that the water frequently comes up and will quickly runoff the roadway. At times they have gone out and driven fluorescent painted stakes at the edge of the pavement, however they have not had to drive stakes in a while.

He also spoke with field superintendent Robert Crawford who would actually gone out into the field. Mr. Crawford does not remember water over the road or bridges. He did not take barricades out during this event.

The other field superintendent, Wally Thalen, was out of the office but will call when he gets in.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 11:40 AM **CALL ~~PLACED~~/RECEIVED BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Wallace Thalen

Subject: Flooding on SR29

The area of flooding during June 1995 was at a 36" cross drain located between bridges 050033 and 050035. It is approximately 0.5 - 0.6 miles south of bridge 050033. This is the area that they have the most problems with. During June the water was up to the edge of pavement. It lacked only a few inches to overtop the road. You could not pull off the highway.

Water flows 'real good' through bridge 050035. It washes sand up on the east side of the highway. He does not remember the water level ever coming up to the bridge.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION

DATE:	February 22, 1995	**PROJECT NO:**	9523
TIME:	11:00 AM	**CALL PLACED BY:**	PAULA
FIRM CALLED:	USGS	**TELEPHONE #**	(904) 942-9500 ext. 3058
SPOKE WITH:	Marvin Franklin		

Subject: USGS Quad. Maps, Regression Equations, Gage information

I called Marvin in order to better understand the above subjects. Regarding the quad. Maps, there are several swamp areas within the Lone Pine Creek drainage basin which are completely bordered with inside tick marks. He said that this delineation indicates a depressional area.

Marvin said that any time he is doing work close to a boundary area, he becomes very leery of the USGS equations because the drainage basin might actually act like the bordering area.

He suggested to take out any areas that look like no-contributing areas from the drainage area. His gut feeling about this area is that there are no major flows. He said there could be high water but most likely the flow and velocity area low.

He suggested checking the gage information around this basin and determine a CFSM. If all gage information gives similar CFSM's then this should be used as representative of the area. The Fisheating Creek data provided by the Altamonte Springs office compares the flood flows using the log-Pearson Type III analysis, the regression equations, and a weighted or best estimate which considers both the gage and regression equations. Marvin suggested taking the log-Pearson flow values for each storm event and dividing them by the drainage area to determine the CFSM.

TELEPHONE CONVERSATION

DATE:	February 22, 1996	**PROJECT NO:**	9523
TIME:	03:43 PM	**CALL PLACED BY:**	PAULA
FIRM CALLED:	FDOT Maintenance LaBelle	**TELEPHONE #**	(941) 674-4027
SPOKE WITH:	Receptionist		

Subject: Maintenance crew's tenure with FDOT/LaBelle

Talbert Melton - 40 years with FDOT, first in Ft. Myers, then Bartow. He has been with LaBelle maintenance since 1970, or 26 years.

Robert Crawford - 23 years, 4 months in LaBelle.

Wally Thalen - 31 years in LaBelle.

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 09:11 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Schools **TELEPHONE #** (941) 946-0323 ext.13

SPOKE WITH: Norman (Sonny) Hughes, Dir. of Transportation

Subject: Flooding on SR 29

Mr. Hughes has been with the Glades Co. School Department for 29 years. Glades Co. School buses travel SR 29 from LaBelle to Palmdale and are not allowed to drive on roads which have water overtopping them. He said that during the period of time he has been with Glades Co., SR 29 has never been blocked for the school buses. He said that there have been other roads which have been blocked but not SR 29.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 10:01 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 946-0533

SPOKE WITH: Jerry Harris, Building Director

Subject: Flooding on SR 29

Mr. Harris is the former Glades Co. Emergency Management Director (1978-1995). He also has been the FEMA Flood Program Administrator since 1982. He was born and raised in Clewiston and considers himself a "Sawgrass Mugrat".

Speaking with Mr. Harris about flooding on SR 29, he mentioned that the only location where they have had trouble on this road is at Chaparral Slough. He recalls that the water has come up very high at this location, enough to damage the roadway base, but has not overtopped the roadway.

He said that during heavy rains water will spread out on both sides of SR 29, and sheetflow across the floodplain approximately 200 square miles. He said that all the water in this area is trying to reach the Caloosahatchee River regardless of the direction it travels.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/26/96 **PROJECT NO:** 9523

TIME: 11:59 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 675-0124

SPOKE WITH: David Whiddon, Former Road Department Superintendent

---

Subject: Flooding on SR29

Mr. Whiddon was with the road department from 1980-93, prior to Tommy Greenwood. He has lived in Glades County all his life, 48 years.

To his knowledge, SR 29 has never overtopped. He stated that the land to the west of SR 29, north of SR 78 approximately 3-4 miles stays wet for most of the year.

He warned that if the flow was increased through SR 29, this could cause increased flooding at SR 78. He said that the residents on Marshall Field Road get mad every year because of flooding. If we increase the risk of flooding for these residents, he said for us to expect a lawsuit.

He said that during heavy rains, the water already comes up to the edge of pavement on SR 78.

Project/Proposal

cc: File, Dave, Art 9523

MEMORANDUM OF CONVERSATION

DATE: February 29, 1996 **PROJECT NO:** 9523

TIME: 10:15 AM **INTERVIEWER:** Paula

SPOKE WITH: Milford Thomas, Lykes Brothers Ranch, SR 29

Subject: Flooding along SR29

We spoke to Mr. Thomas as he pulled his cow trailor into the cow pen located alongside Lone Pine Creek at bridge 050035. He said that he has worked in this area for 25 years. He knows that the water has gotten high at this location but the backwater from the creek has never flooded the road or the cow pen. He stated that the water does rise but it doesn't move well at this bridge. There is a marshy area downstream. He stated that the water gets very high at Chapparel Slough.

Project/Proposal

cc: FILE, DFS 9523

MEMORANDUM OF MEETING

DATE: February 29, 1996

TIME: 10:30 am

PROJECT NO.: SR29, 9523-01

ATTENDEES: Art de Laski, Genesis
Chick Savering, Genesis
Catherine Bradley, Genesis
Paula Coulliette, JMI
Jerry Washington, JMI
John Previte, FDOT
Mike Finch, FDOT
Maverick Marshall, FDOT

PLACE: Bridge 050035, SR 29

The purpose of this meeting was to discuss the flows calculated and observed at the proposed widened bridges on SR 29. The USGS equations for Region A were initially used, however, given the comparison between flow rates determined by the SFWMD, gage data, etc. and the regression equations, it appears as though direct application of the regression equations are inappropriate for this location.

The following resolutions were suggested:

> Do not include all of the water storage area as lake area. Maverick suggested that we determine the depressional areas (from quad. map) which retain flood waters. Try to determine the elevation at which there would be no more storage and use this area as lake area.
>
> Maverick also mentioned that we should look at the standard error of the USGS equations and base our flows on the lower end of the values. Check to insure that these values correlate with the known rates of discharge for this area.
>
> There have been numerous observations that the water level at this site will rise, however there is very little movement through the bridges. The survey crew, project managers, and hydraulic engineers working on this project have all noted high water at these locations without significant flow through the bridge. Many residents have also made similar statements.
>
> There was a consensus to use a similar approach when determining flood flow with all of the bridges on this project.

ENGINEERS

DATE: March 7, 1996

TO: Mike Peterson, P.E.
District Design Engineer

FROM: Paula N. Coulliette
JMI Engineers, Inc.

COPIES: Mike Finch, P.E., District Drainage Engineer
Art de Laski, P.E.
David F. Snyder, P.E.

SUBJECT: Design Variation

RE: W.P.I No. 1110874
State Project No. 05010-1511
Glades County

This project proposes the widening of Bridge No. 050031 on SR 29 in Glades County. The structure is being widened to improve public safety and modernize the existing bridge to current FDOT Geometric Standards. Bridge No. 050031 received an efficiency rating of 85.3 with no significant deficiencies (Bridge Inspection, 05/94). An underwater inspection confirmed the same.

During the preparation of the Bridge Hydraulics Report, it became evident that the minimum 2 foot vertical clearance during the design storm is not being met at the existing bridge. Since this is a widening project and the low member elevation is not changing, the 2 foot vertical clearance will not be met by the proposed bridge either. This letter requests that a variance be granted by District One for this design requirement.

The design criteria given in the FDOT Drainage Manual, Vol. 1, Ch. 4, states specifically:

1424 Piedmont Drive East, Suite 100, Tallahassee, FL 32312 — Tel: 904-385-7450 — Fax: 904-385-3545
San Diego, CA Chicago, IL Paris, France Bangkok,Thailand

4.6.1 Vertical Clearance

Minimum vertical clearance requirements are as follows:

1. To allow debris to pass without causing damage, the clearance between the design flood stage and the low member of bridges shall be a minimum of 2 feet. This standard does not apply to culverts and bridge-culverts.

The table below documents the water surface elevations computed by the hydraulic program, WSPRO, used to model the creek.

Estimated Vertical Clearances from WSPRO (in feet)			
Bridge Configuration	Low Member Elevation	Design Water Surface Elevation	Vertical Clearance
Existing Bridge	40.26	39.04	1.22
Proposed Bridge	40.26	39.04	1.22

The existing and proposed bridges both provide some amount of vertical clearance during the design storm. There is no evidence of a debris problem at this bridge.

Since the existing bridge is hydraulically adequate with the exception of the substandard vertical clearance, widening appears to be a viable alternative. In order to provide the required 2 foot of vertical clearance, the low member would have to be raised a minimum of 0.78 feet. Raising the low member would not be feasible without a complete bridge replacement having an approximate cost of $100,000. The cost of widening the bridge is approximately $40,000, or about one-third the cost of the replacement. A final recommendation on widening versus replacement will rest on a structural evaluation of the actual existing condition of the bridge which was built in 1948.

We would appreciate your approval of the design variation for a substandard vertical clearance as soon as possible so that we may continue with the project schedule as planned. Thank you for your assistance in this matter.

Sincerely,

Paula N. Coulliette

Paula N. Coulliette

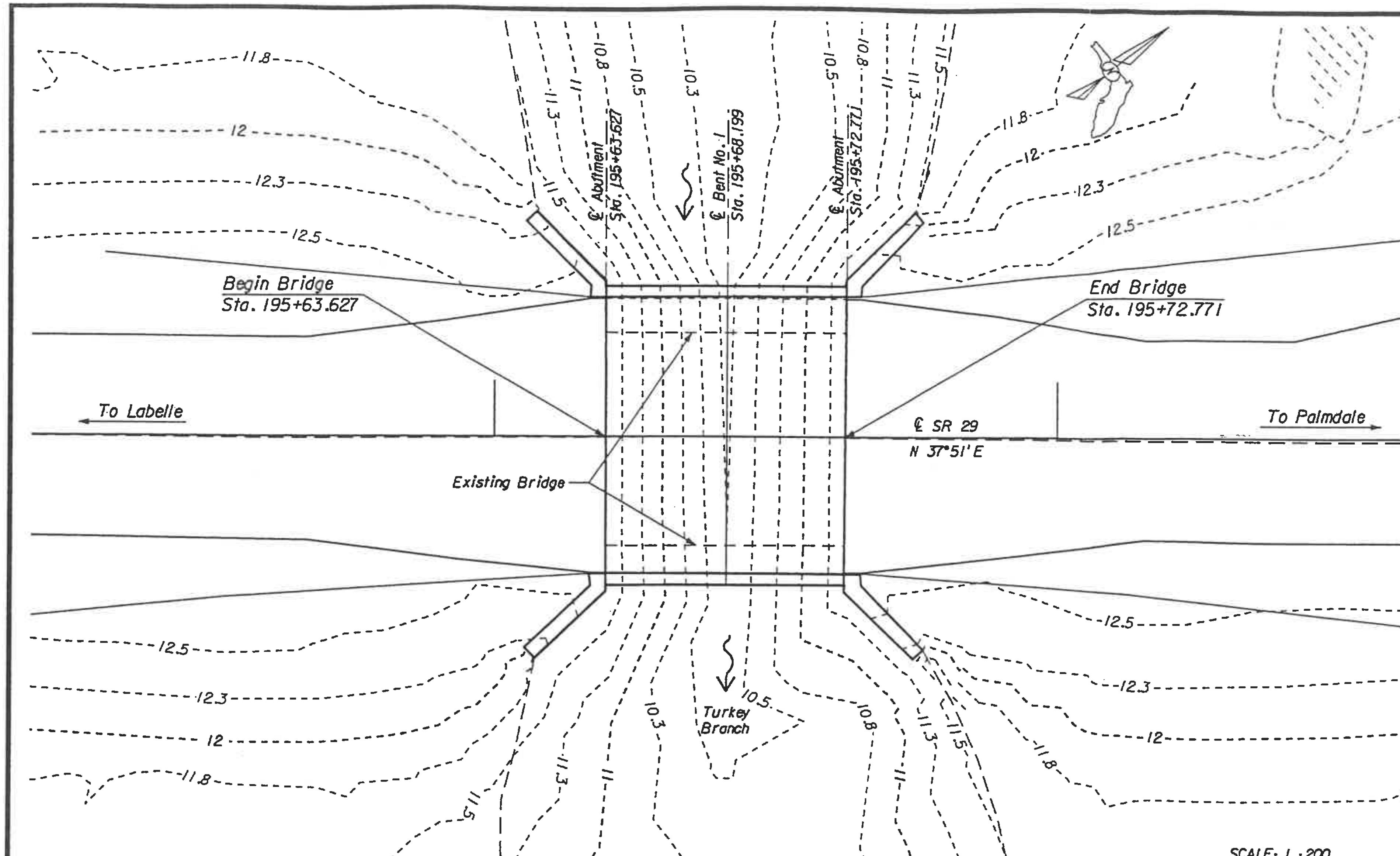
Enclosure

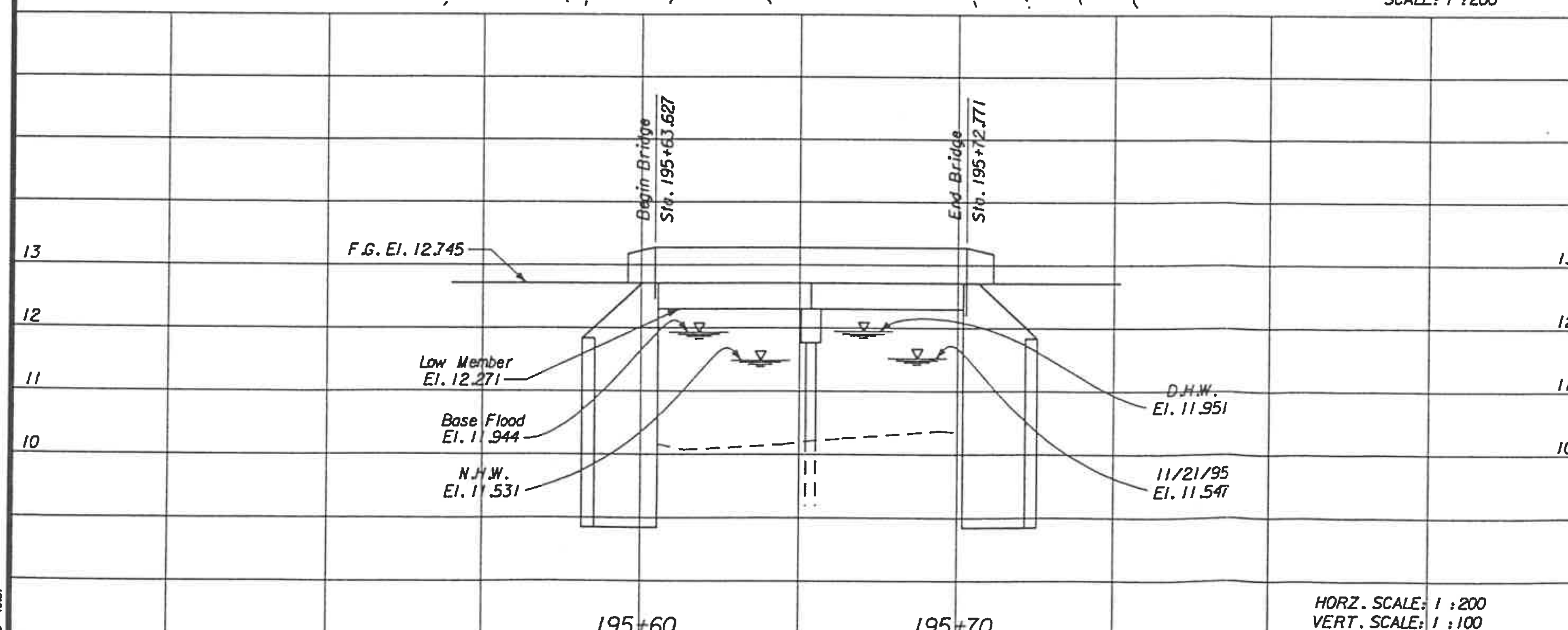
Appendix H

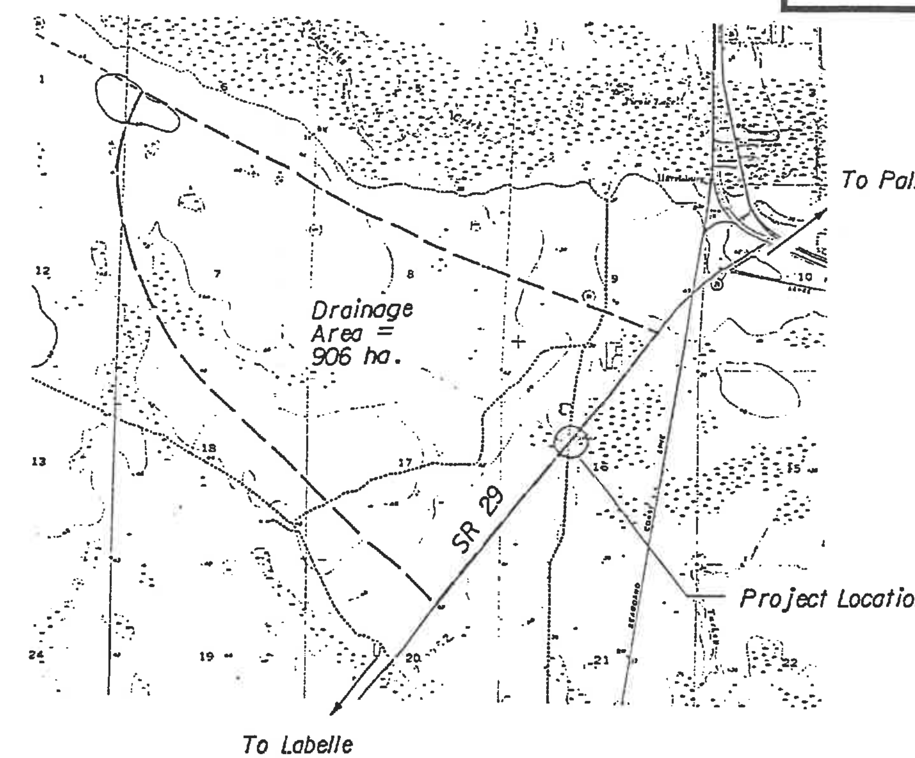
Bridge Hydraulics Recommendation Sheet

& Deck Drainage Calculations

STATE PROJ. NO.	SHEET NO.
05090-1511	
BRIDGE NO. 050031	







EXISTING STRUCTURES

	(1)	(2)	(3)	(4)	ASSUMED CONFIGURATION
(REFERENCE)					
FOUNDATION	0.305 Piles	N/A	N/A	N/A	0.305 Piles
OVERALL LENGTH	9.144				9.144
SPAN LENGTH	4.572				4.572
TYPE CONSTRUCTION	Flat Slab				Flat Slab
AREA OF OPENING @ H.W.	14.307				14.307
ROADWAY WIDTH	10.668				14.356
ELEV. LOW MEMBER	12.271				12.271

HYDRAULIC DESIGN DATA

NOTE: The hydraulic data is shown for informational purposes only to indicate the flood discharges and water surface elevations which may be anticilated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgements and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly antecedent conditions, urbanization, channelization and land use. Users of this data are cautioned against the assumption of precision which cannot be obtained.

DEFINITIONS:
Design Flood: The flood utilized to assure a desired level of hydraulic performance.
Base Flood: The flood having a 1% chance of being exceded in any year. (100 Year Frequency)
Overtopping Flood: The flood which causes flow over the highway, over a watershed divide or thru emergency relief structures.
Greatest Flood: The most severe flood which can be predicted where overtopping is not practicable.

WATER SURFACE ELEVATIONS: N.H.W.(Non-Tidal) 11.531 M.H.W. N/A M.L.W. N/A

FLOOD DATA:	MAX. EVENT OF RECORD	DESIGN FLOOD	BASE FLOOD	☐ OVERTOPPING FLOOD ☒ GREATEST FLOOD
STAGE ELEV. NGVD (M)	Unknown	11.951	11.994	12.082
DISCHARGE (CM/M)	*	447	518	691
AVERAGE VELOCITY (M/S)	*	0.521	0.594	0.771
EXCEEDANCE PROB. (%)	*	2%	1%	0.2%
FREQUENCY (YR.)	*	50	100	500

HYDRAULIC RECOMMENDATIONS

1. BEGIN BRIDGE STATION 195+63.627 END BRIDGE STATION 195+72.771 SKEW ANGLE 0°
2. CHANNEL SECTION: ℄ STATION 195+66.199 BOTTOM WIDTH 8.534 ELEV. 10.119 SIDE SLOPE 0
3. LIMITS OF CHANNEL EXCAVATION: RT. N/A LT. N/A
4. CLEARANCE: NAVAGATION: HORIZ. N/A VERT. N/A ABOVE EL. N/A DRIFT: HORIZ. 3.962 VERT. 0.320 ABOVE EL. 11.951
5. SCOUR PREDICTION: Base Flood: Contraction El. = 8.68m Pier El. = 7.95m; Greatest Flood: Contraction El. = 8.01m Pier El. = 7.19m
6. SLOPE PROTECTION: None
7. DECK DRAINAGE: Runoff will sheet flow off bridge into existing roadway drainage ditches.
8. OTHER:

REMARKS:

REVISIONS											
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

JMI ENGINEERS, INC.
1424 Piedmont Drive East
Tallahassee, Florida 32312
Tel: 904-385-1450 Fax: 904-385-3545

FLORIDA DEPARTMENT OF TRANSPORTATION

BRIDGE HYDRAULIC RECOMMENDATIONS
S.R. 29 BRIDGE

FILE: f:\jmi\seedpl.dgn
DATE: 23-Mar-95 10:37

DECK DRAINAGE CALCULATIONS
SR 29 - BRIDGE NUMBER 050031

625-040-001-b
DRAINAGE MANUAL
CHAPTER 3, STORM DRAINS
October 1, 1992
Page 1-3-6.0

3.9 SPREAD STANDARDS

For sections with design speeds greater than 45 mph, and for sections having full width shoulders 6 feet or greater, or a parking lane, spread resulting from a rainfall intensity of 4.0 inches per hour shall not encroach on the travel lanes.

For sections with design speeds 45 mph and less, and without full width shoulders, spread resulting from a rainfall intensity of 4.0 inches per hour shall not exceed one-half the travel lane adjacent to the gutter.

Gutter Flow Capacity Calculations:

$$Q_g = \frac{0.56}{n} S_x^{5/3} s^{1/2} T^{8/3}$$ (Eq. 12-3, FDOT Drainage Manual, Vol. 2B)

n =	0.016		concrete deck
S_x =	0.02		ft/ft cross slope
s =	0.03%	(0.0003 ft/ft	min. longitudinal slope
T =	10		spread = shoulder width

$$Q_g = \frac{0.56}{0.016} (0.02)^{5/3} (0.0003)^{1/2} (10)^{8/3}$$

Q_g = **0.415 cfs** Bridge deck gutter flow

Deck Drainage

Runoff Quantity from Bridge Deck

Bridge Deck Drainage Area:

$$A = 1/2 \times l \times w$$
$$A = 1/2 \times (30) \times (47.1)$$
$$A = 1059.7 \ ft^2$$
$$A = 0.024 \ ac$$

Assume no contribution from adjacent roadway.

$$Q_b = c\ i\ A$$

c =	0.95 for asphalt pavement
i =	4.0 inches/hour
A =	0.024 ac

$$Q_b = (0.95)(4.0)(0.024)$$

$$\mathbf{Q_b = 0.091 \ cfs}$$

Conclusion:

Flow from bridge deck (Q_b) < Capacity of Gutter Flow (Q_g)
0.0912 < 0.415

Spread resulting from a rainfall intensity of 4.0 inches/hour will not encroach on travel lanes.

Check Spread of Bridge Deck Runoff:

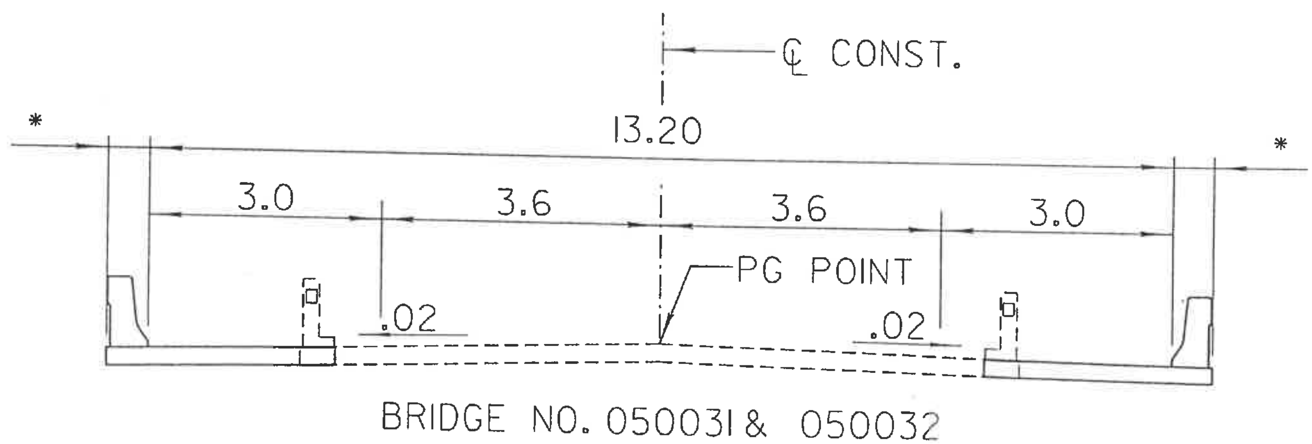
$$0.0912 \quad \frac{0.56}{0.016} \ (0.02)^{5/3} \ (0.0003)^{1/2} \ (T)^{8/3}$$

T = 5.667 ft

T < 10'

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

PROPOSED TYPICAL SECTION



* FOR ADDITIONAL DETAILS SEE STRUCTURES INDEX NO. 700.

COUNTY	ROAD NO.	LENGTH	TERMINI	SECTION	JOB	EST. COST
GLADES	S.R.29		REPAIR @ S.R. 29 OVER TURKEY BRANCH AND YORK BRANCH	05090	1511	(CONSTRUCTION)

FEDERAL AID PROJECT NO.	WPI NO.	APPROVED BY:	CONCURRENCE:	CONCURRENCE:
NA	1110874	CONSULTANT DATE:	DISTRICT DESIGN ENGINEER DATE:	NA FHWA DISTRICT ENGINEER DATE:

FORM 731-02
7-84

3.9 SPREAD STANDARDS

For sections with design speeds greater than 45 mph, and for sections having full width shoulders 6 feet or greater, or a parking lane, spread resulting from a rainfall intensity of 4.0 inches per hour shall not encroach on the travel lanes.

For sections with design speeds 45 mph and less, and without full width shoulders, spread resulting from a rainfall intensity of 4.0 inches per hour shall not exceed one-half the travel lane adjacent to the gutter.

3.10 CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

The design of storm drain systems shall be consistent with the standard construction and maintenance practices of the Department. Standard details for inlets, manholes, junction boxes, end treatments, and other miscellaneous drainage details are provided in the standard index drawings. Specifications are provided in the Standard Specifications for Road and Bridge Construction. In the event standard index drawings are not suitable for a specific project need, a detailed design shall be developed and included in the plans; and, as appropriate, special provisions shall be provided for inclusion with the project specifications. Proper design shall also consider maintenance concerns of adequate physical access for cleaning and repair.

3.10.1 Pipe Size and Length

The minimum pipe size for trunk lines and laterals is 15 inches.

The 15 inch minimum pipe size does not apply to connections from stormwater management facilities. The pipe size for these connections shall be the size required to convey the permitted discharge.

The maximum pipe lengths without maintenance access structures are as follows:

15" pipe	100 feet
18" pipe	300 feet
24" to 36" pipe	400 feet
42" and larger and all box culverts	500 feet

Table 12-1
MANNING'S n VALUES FOR STREET AND PAVEMENT GUTTERS

Type of Gutter or Pavement	Range of Manning's n
Concrete gutter, troweled finish	0.012
Asphalt pavement:	
Smooth texture	0.013
Rough texture	0.016
Concrete gutter with asphalt pavement:	
Smooth	0.013
Rough	0.015
Concrete pavement:	
Float finish	0.014
Broom finish	0.016
For gutters with small slope, where sediment may accumulate, increase above values of n by	0.002

Note: Estimates are by the Federal Highway Administration.

Reference: USDOT, FHWA, HDS-3 (1961).

Cross Sections for WSPRO

Taken from Contour Map provided by Genesis
CL Stream - Horizontal Station 5000
CL SR29 - SRD 1000

EXISTING BRIDGE

SURV1 Section SRD 883

Location: 100 feet downstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
		4498	43.7
-150.0	11.8	4508	38.7
-139.0	11.8	4544	38.7
-105.0	11.5	4656	37.7
-53.5	11.5	4824	37.7
-40.0	11.5	4869	37.7
-33.0	11.5	4892	37.7
-7.5	11.3	4975	37.1
-6.5	11.129	**4979**	**36.5**
-4.2	11.0	4986	36.1
-0.5	10.8	4998	35.4
0.5	10.8	5002	35.4
4.5	11.0	5015	36.1
8.5	11.3	5028	37.1
9.5	11.346	**5031**	**37.2**
15.5	11.5	5051	37.7
24.5	11.8	5080	38.7
70.0	11.844	5230	38.9
85.0	11.956	5279	39.2
100.0	11.865	5328	38.9
155.0	12.0	5509	39.4
		5519	44.4

Exit Section SRD 952

Location: One bridge length (30 feet) downstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
		4498	43.9
-150	11.870	4508	38.9
-97.5	11.8	4680	38.7
-90.8	11.837	4702	38.8
-76.6	11.865	4749	38.9
-58.4	11.805	4808	38.7
-46.1	11.8	4849	38.7
-10.0	11.496	4967	37.7
-8.2	11.5	**4973**	**37.7**
-6.5	11.3	4979	37.1
-4.8	11.0	4984	36.1
-4.0	10.947	4987	35.9
-3.4	10.8	4989	35.4
0	10.624	5000	34.9
3.4	10.8	5011	35.4
4.0	10.947	5013	35.9
6.0	11.0	5020	36.1
7.0	11.254	5023	36.9
8.0	11.4	**5026**	**37.4**
13.4	11.5	5044	37.7
35.2	11.8	5115	38.7
46.4	12.0	5152	39.4
49.2	12.3	5161	40.4
49.5	12.343	5162	40.5
57.4	12.286	5188	40.3
58.4	12.300	5192	40.4
67.4	12.000	5221	39.4
76.6	11.897	5251	39.0
91.0	11.958	5299	39.2
150.0	11.997	5492	39.4
		5502	44.4

FULLV Section SRD 983

Location: Downstream face of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
		4498	43.9
-150	11.870	4508	38.9
-97.5	11.8	4680	38.7
-90.8	11.837	4702	38.8
-76.6	11.865	4749	38.9
-58.4	11.805	4808	38.7
-46.1	11.8	4849	38.7
-10.0	11.496	4967	37.7
-7.6	11.5	**4975**	**37.7**
-6.6	11.3	4978	37.1
-5.5	11.0	4982	36.1
-4.2	10.8	4986	35.4
0.0	10.5	5000	34.4
1.8	10.5	5006	34.4
3.2	10.8	5010	35.4
5.0	11.0	5016	36.1
6.6	11.3	5022	37.1
8.4	11.5	**5028**	**37.7**
13.4	11.5	5044	37.7
35.2	11.8	5115	38.7
46.4	12.0	5152	39.4
49.2	12.3	5161	40.4
49.5	12.343	5162	40.5
57.4	12.286	5188	40.3
58.4	12.300	5192	40.4
67.4	12.000	5221	39.4
76.6	11.897	5251	39.0
91.0	11.958	5299	39.2
150.0	11.997	5492	39.4
		5502	44.4

Bridge Section SRD 983

Location: Downstream face of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
-4.572	12.364	4985	40.56
-4.572	11.5	4985	37.7
-3.8	11.3	4988	37.1
-2.8	11.0	4991	36.1
-1.9	10.8	4994	35.4
-1.0	10.5	4997	34.4
0.0	10.317	5000	33.8
0.6	10.5	5002	34.4
1.3	10.8	5004	35.4
2.0	11.0	5007	36.1
2.8	11.3	5009	37.1
3.6	11.5	5012	37.7
4.572	11.7	5015	38.4
4.572	12.364	5015	40.56
		4985	40.56

Points

Approach Section SRD 1047

Location: One bridge length (30 feet) upstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
		4498	44.0
-150.0	11.885	4508	39.0
-105.4	11.828	4654	38.8
-90.4	11.925	4703	39.1
-75.4	11.786	4753	38.7
-60.4	11.929	4802	39.1
-45.4	11.912	4851	39.1
-35.4	12.0	4884	39.4
-22.5	12.0	4926	39.4
-17.8	12.0	4942	39.4
-12.8	11.8	4958	38.7
-7.6	11.5	**4975**	**37.7**
-6.6	11.3	4978	37.1
-5.6	11.0	4982	36.1
-4.7	10.8	4985	35.4
-3.4	10.5	4989	34.4
-1.6	10.3	4995	33.8
1.8	10.3	5006	33.8
3.4	10.5	5011	34.4
4.6	10.8	5015	35.4
5.8	11.0	5019	36.1
6.8	11.3	5022	37.1
8.2	11.5	**5027**	**37.7**
38.2	11.8	5125	38.7
45.0	11.773	5148	38.6
60.0	11.781	5197	38.7
75.0	11.931	5246	39.1
90.0	11.925	5295	39.1
150.0	11.968	5492	39.3
		5502	44.3

REFE Section SRD 1117

Location: 100 feet upstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
		4498	44.2
-150.0	11.959	4508	39.2
-60.0	11.8	4803	38.7
-40.5	11.8	4867	38.7
-38.5	11.8	4874	38.7
-15.5	11.5	4949	37.7
-8.5	11.389	**4972**	**37.4**
-8.0	11.3	4974	37.1
-6.7	11	4978	36.1
-3.5	10.8	4989	35.4
-1.5	10.5	4995	34.4
1.0	10.5	5003	34.4
2.5	10.8	5008	35.4
4.0	11.0	5013	36.1
5.7	11.3	5019	37.1
7.3	11.5	5024	37.7
7.5	11.536	**5025**	**37.8**
34.5	11.8	5113	38.7
52.0	11.845	5171	38.9
67.0	11.804	5220	38.7
82.0	11.819	5269	38.8
150.0	11.918	5492	39.1
		5502	44.1

ROAD Section SRD 1000

Location: CL SR 29

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
-105.0	12.693	4656	41.6
-90.0	12.753	4705	41.8
-75.0	12.765	4754	41.9
-60.0	12.735	4803	41.8
-45.0	12.725	4852	41.7
-30.0	12.739	**4902**	**41.8**
-15.0	12.734	4951	41.8
0.0	12.745	5000	41.8
15.0	12.733	5049	41.8
30.0	12.728	5098	41.8
45.0	12.719	5148	41.7
60.0	12.753	5197	41.8
75.0	12.769	5246	41.9
90.0	12.747	5295	41.8

45' Exit Section SRD 932

Location: 45 feet downstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
-150.0	11.870	4508	38.9
-93.5	11.8	4693	38.7
-47.0	11.800	4846	38.7
-10.0	11.5	4967	37.7
-9.0	11.496	**4970**	**37.7**
-7.5	11.3	4975	37.1
-5.5	11.0	4982	36.1
-2.0	10.8	4993	35.4
1.0	10.8	5003	35.4
4.0	11.0	5013	36.1
6.5	11.1	**5021**	**36.5**
8.0	11.3	5026	37.1
14.0	11.5	5046	37.7
34.0	11.800	5112	38.7
49.0	12.0	5161	39.4
76.5	12.000	5251	39.4
150.0	11.997	5492	39.4

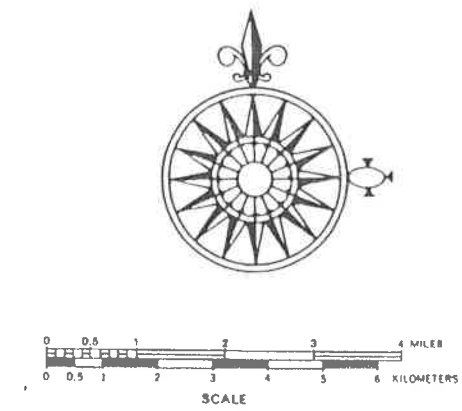
45' Approach Section SRD 1069

Location: 45 feet upstream of bridge.

Offset (in meters from CL stream)	Elevation (in meters)	WSPRO Station (in feet)	Elevation (in feet)
-150.0	12	4508	39.4
-107.0	11.8	4649	38.7
-92.0	11.9	4698	39.0
-77.0	11.8	4747	38.7
-62.0	11.9	4797	39.0
-47.0	11.9	4846	39.0
-35.5	12.000	4884	39.4
-22.0	12	4928	39.4
-18.0	11.8	4941	38.7
-9.0	11.5	**4970**	**37.7**
-7.5	11.3	4975	37.1
-6.0	11.0	4980	36.1
-4.5	10.8	4985	35.4
-3.0	10.5	4990	34.4
-1.5	10.3	4995	33.8
2.0	10.3	5007	33.8
3.0	10.5	5010	34.4
4.5	10.800	5015	35.4
5.5	11.0	5018	36.1
7.0	11.300	5023	37.1
8.0	11.474	**5026**	**37.6**
14.5	11.5	5048	37.7
38.5	11.8	5126	38.7
44.0	11.773	5144	38.6
60.0	11.781	5197	38.7
75.0	11.931	5246	39.1
90.0	11.926	5295	39.1
150.0	11.968	5492	39.3

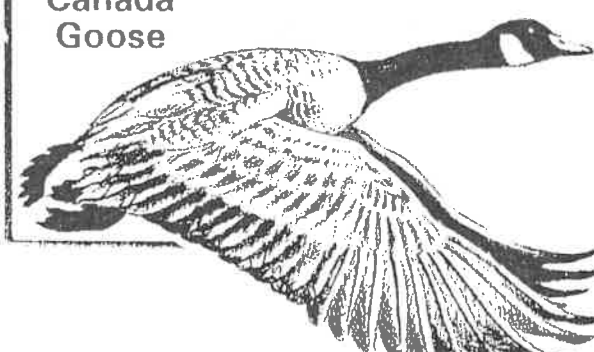
Glades County

Glades County is located in Southeastern Florida and is one of five counties which border Lake Okeechobee. The county was established in 1921 and named after the Everglades. It has only one incorporated town and that is the county seat of Moorehaven. The Moorehaven is famous for being the first town in the U.S. to have a woman for its mayor. Located in the county is a large Seminole Indian Reservation. The principal crops of this county are winter vegetables, cattle and dairying and food processing and shipping are the major types of manufacturing.

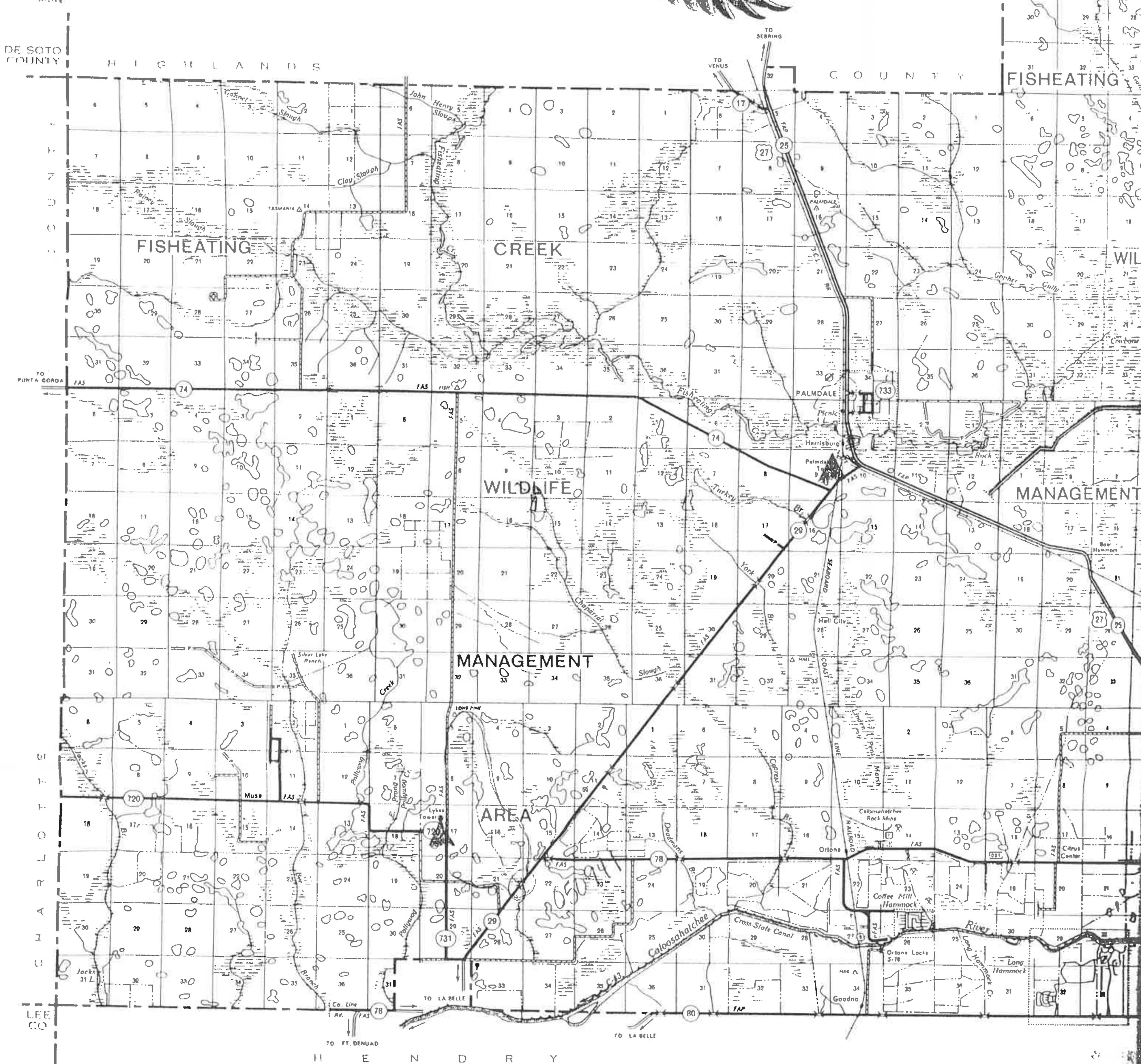


- STATE OR NATIONAL FOREST
- STATE PARK OR RECREATIONAL AREA
- WILDLIFE PRESERVE
- LOOKOUT TOWER
- HISTORICAL SITE

Canada Goose



Except for parrots and vultures—geese and their relatives the swans live longer than any other birds • to 40 years old in captivity • much less in the wild



GLADES COUNTY MAP -