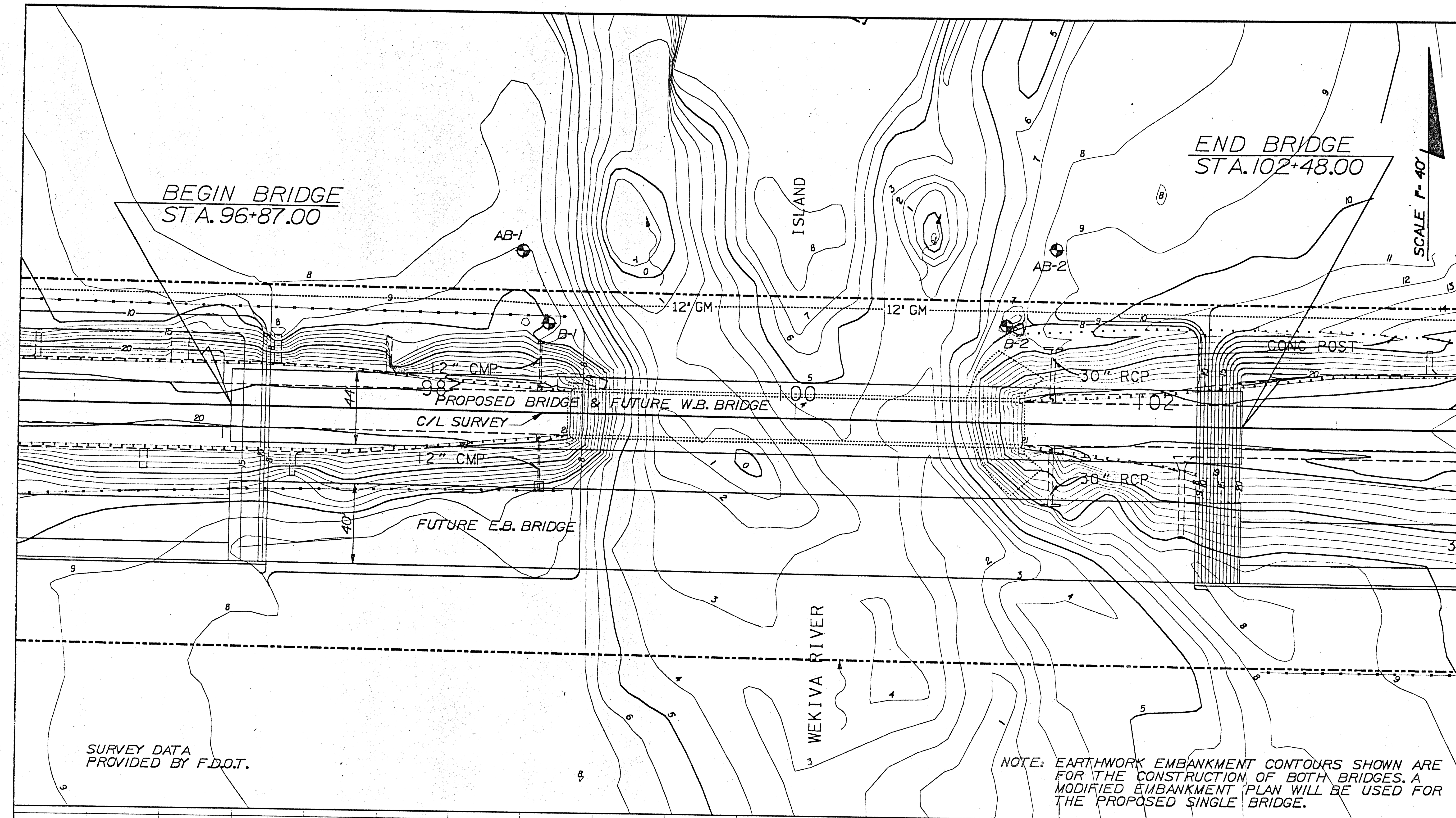
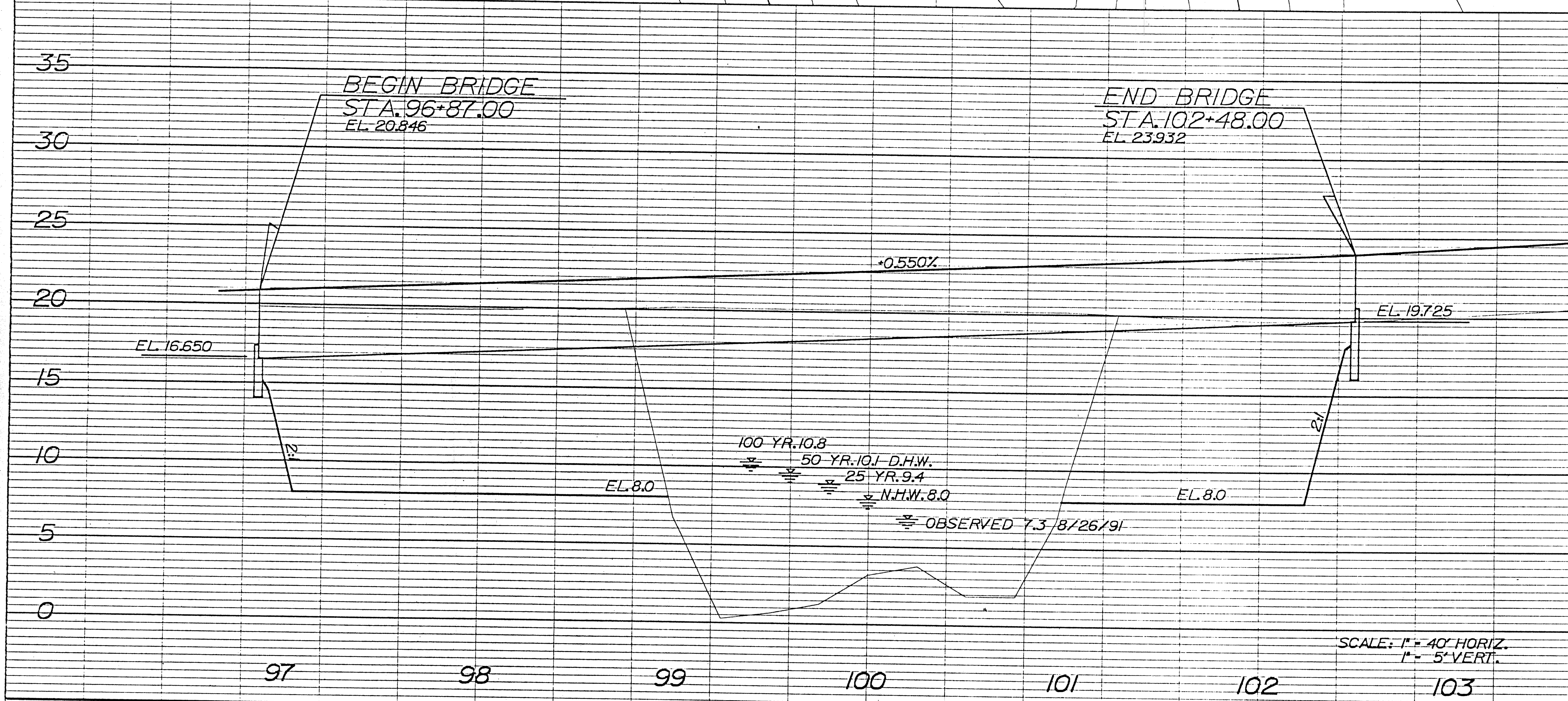
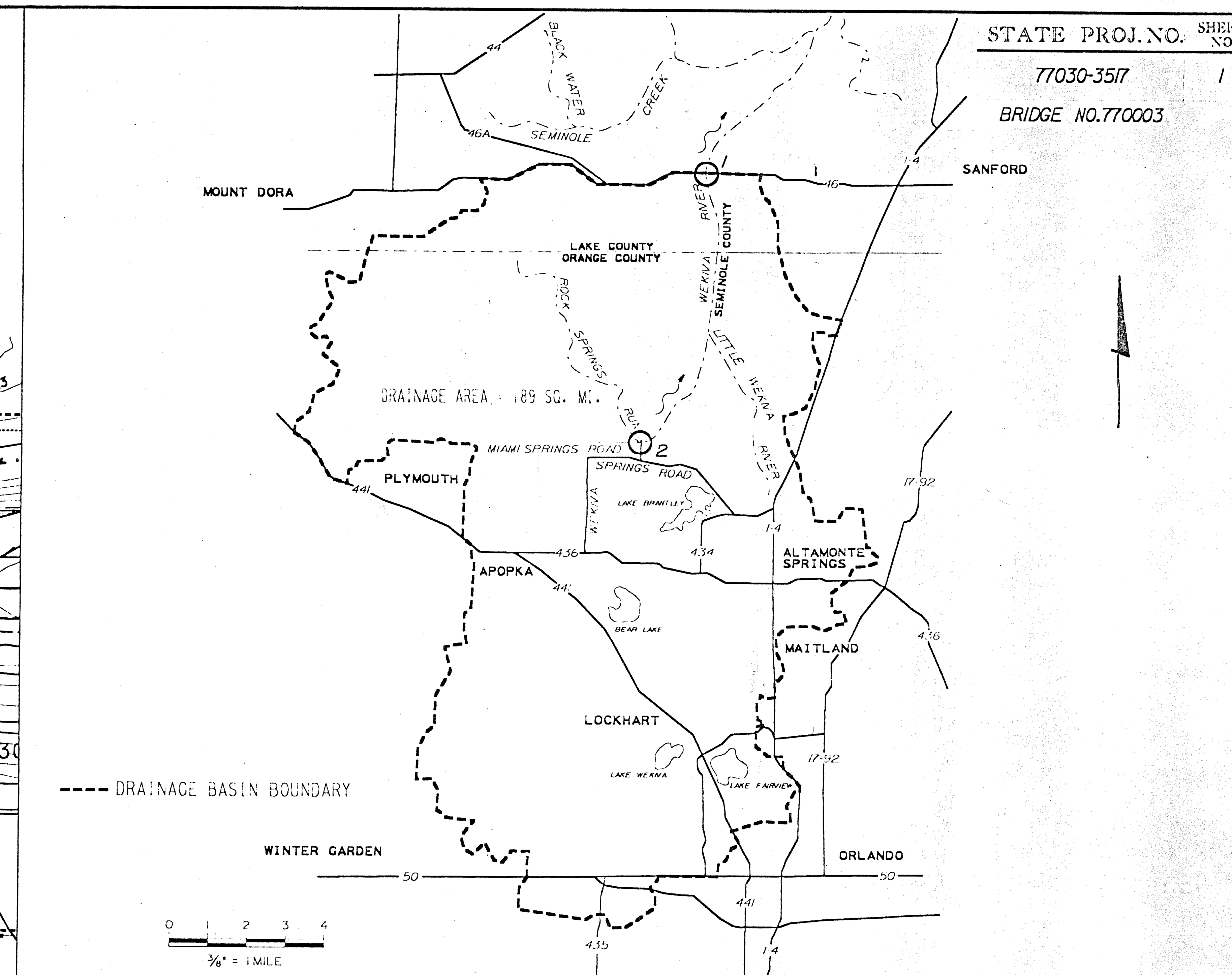
STATE PROJ. NO.	SHEET NO.
77030-3517	1

BRIDGE NO. 770003







EXISTING STRUCTURES	(1)	(2)	(3)	(4)	ASSUMED CONFIGURATION
(REFERENCE)					
FOUNDATION	CONC. PILES	CONC. PILES			CONC. PILES
OVERALL LENGTH	252'	150'			561'
SPAN LENGTH	7 @ 36.0'	5 @ 30.0'			11 @ 51.0'
TYPE CONSTRUCTION	STRUC. STEEL	CONCRETE			PRESTR. BEAMS
AREA OF OPENING @ H.W.	1549 S.F.				1942 S.F. @ DHW
ROADWAY WIDTH	24.0'	20' ±			44' W.B. 40' E.B.
ELEV. LOW MEMBER	17.6				16.65

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 anticipated 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 exceeded 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) 8.0 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 (FT.)	11.05 *	10.1	10.8	12.3
DISCHARGE (CFS)	2060 *	1790	1980	2420
AVERAGE VELOCITY (FPS)	1.3 **	0.86	0.81	0.75
EXCEEDANCE PROB. (%)	0.8 **	2	1	0.2
FREQUENCY (YR.)	125 **	50	100	500

HYDRAULIC RECOMMENDATIONS

1. BEGIN BRIDGE STATION 96+87.00 END BRIDGE STATION 102+48.00 SKEW ANGLE 0
2. CHANNEL SECTION: ℄ STATION 100+31 BOTTOM WIDTH 160 FT. AVG. ELEV. 3 FT. AVG. SIDE SLOPE 3:1
3. LIMITS OF CHANNEL EXCAVATION: RT. N/A LT. N/A
4. CLEARANCE: NAVIGATION: HORIZ. 48'-0" MIN. VERT. 9.792' MIN. ABOVE EL. 8.0' DRIFT: HORIZ. 48'-0" MIN. VERT. 7.692' MIN. ABOVE EL. 10.1
5. SCOUR PREDICTION: SCOUR ELEVATIONS (WORST CASE): 50 YR = 2.0 FT NGVD. 100 YR = -2.0 FT NGVD. 500 YR = -2.0 FT NGVD.
6. SLOPE PROTECTION: RUBBLE RIP-RAP SLOPE AND MAINTENANCE BERM
7. DECK DRAINAGE: RUNOFF WILL BE COLLECTED IN SCUPPERS AND CONVEYED TO INLETS PRIOR TO ITS DISCHARGE INTO THE RET/DET SEDIMENT BASIN. MAX. ALLOWABLE SPREAD WILL BE 10 FEET.
8. OTHER: BOTH 44' W.B. & 40' E.B. BRIDGES ARE SHOWN. THE 44' W.B. SHALL BE BUILT FIRST AND SHALL BE 2-WAY UNTIL THE FUTURE 40' E.B. BRIDGE IS CONSTRUCTED.

REMARKS: *DATA FROM USGS STATION 02235000 AT WEKIVA RIVER-S.R 46: MAX. DISCHARGE OBSERVED SEPT. 17, 1945: MAX. GAGE HEIGHT OBSERVED SEPT. 12, 1960
** CALCULATED VALUES

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
10-11-93	WLS	REVISED NOTE 7,8 & GRADE PER FDOT COMMENTS	11/14/94	CAD	REV. PROP. BRIDGE LENGTHS & HYDRAULIC RECOMMENDATIONS PER FDOT AND SJRWMD	2-6-95	WLS	CORRECTED SCOUR ELEVATIONS			

	NAME	DATE		NAME	DATE
DESIGNED BY	CAH	2-28-92	DRAWN BY	SMP	2-28-92
CHECKED BY	WLS	4-03-92	CHECKED BY	CAH	4-03-92

SUPERVISED BY: WILL L. STEWART P.E.

FLORIDA DEPARTMENT OF TRANSPORTATION

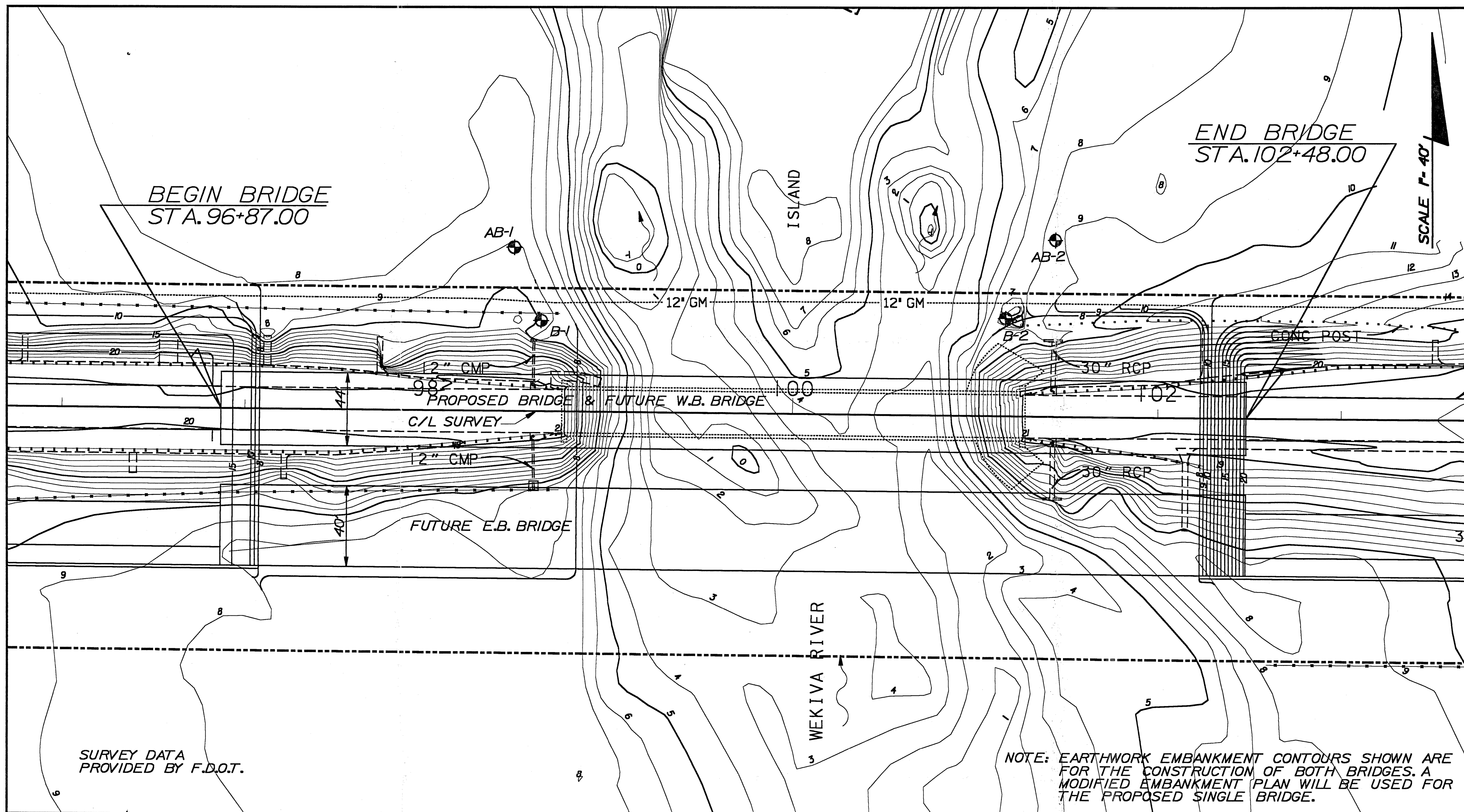
APPROVED BY :

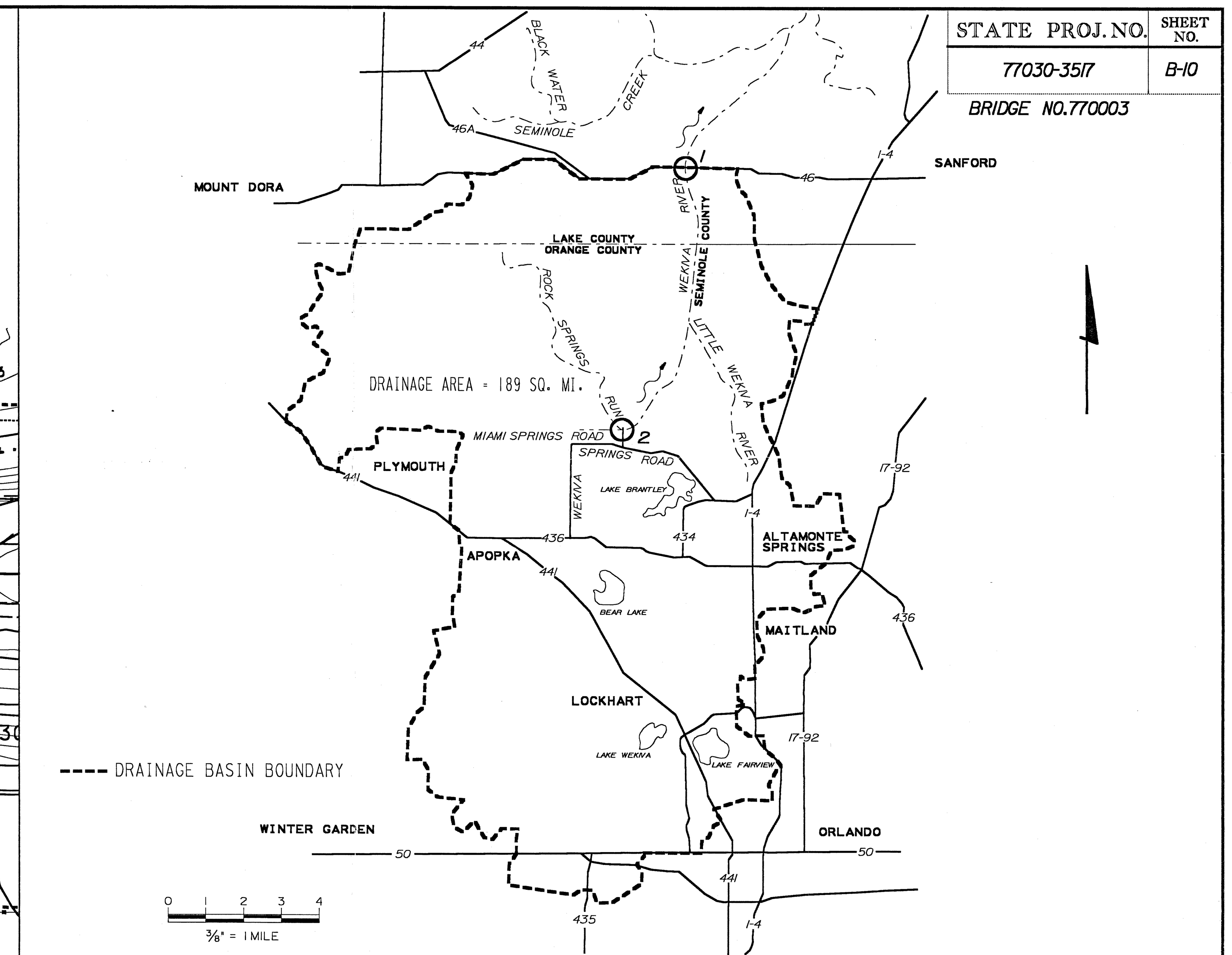
DATE :

S.R. 46 - WEKIVA RIVER

BRIDGE HYDRAULIC RECOMMENDATIONS

PRINTED FEB 07 1995





(REFERENCE)	EXISTING STRUCTURES (1)	(2)	(3)	(4)	ASSUMED CONFIGURATION
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Greatest Flood: The most severe flood which can be predicted where overtopping is not practicable.

WATER SURFACE ELEVATIONS: N.H.W.(Non-Tidal) 8.0 M.H.W. N/A M.L.W. N/A

FLOOD DATA:	MAX. EVENT OF RECORD	DESIGN FLOOD	BASE FLOOD	☐ OVERTOPPING FLOOD ☒ GREATEST FLOOD
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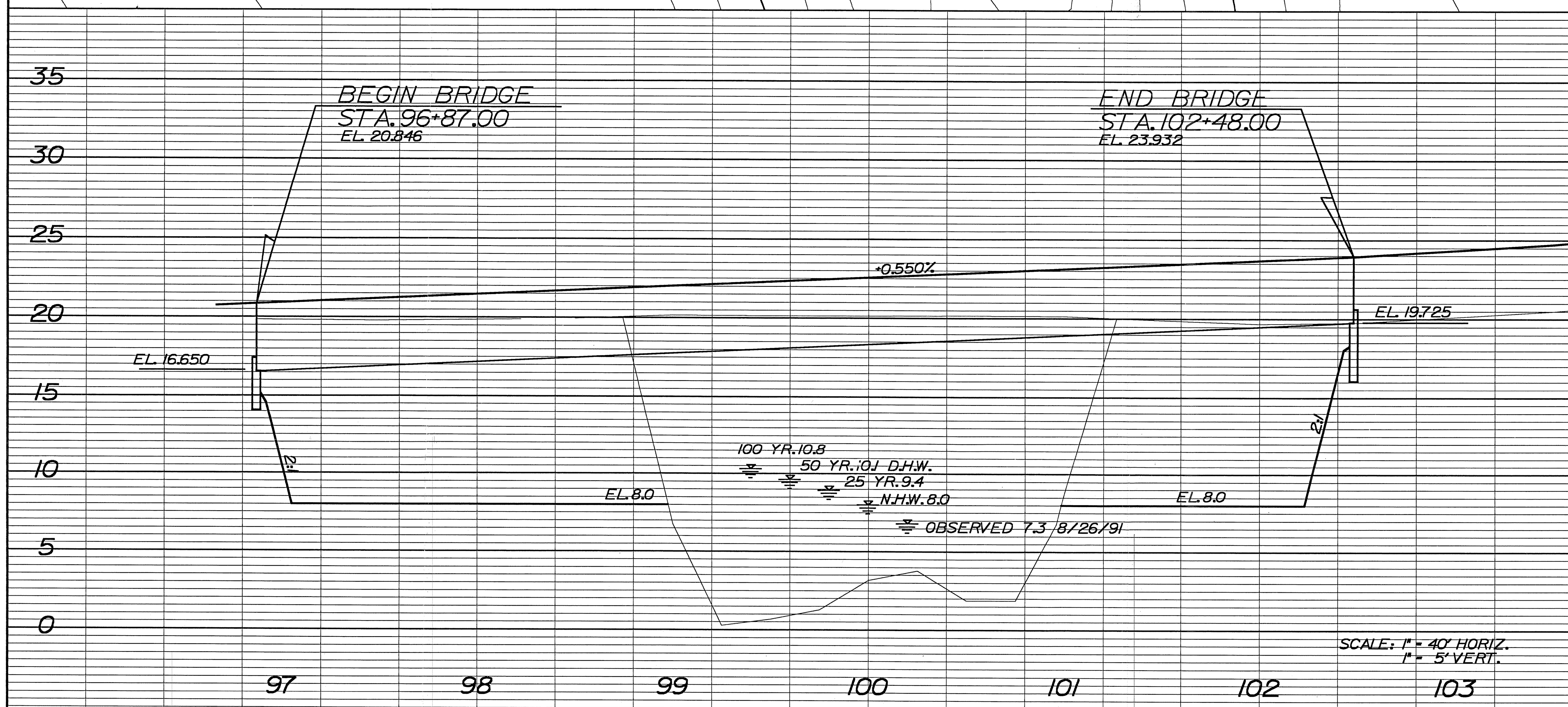
REMARKS: *DATA FROM USGS STATION 02235000 AT WEKIVA RIVER-S.R 46: MAX. DISCHARGE OBSERVED SEPT. 17, 1945: MAX. GAGE HEIGHT OBSERVED SEPT. 12, 1960
** CALCULATED VALUES

Will Stewart 12/2/94



REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
10-11-93	WLS	REVISED NOTE 7,8 & GRADE PER FDOT COMMENTS	11/14/94	CAD	REV. PROP. BRIDGE LENGTHS & HYDRAULIC RECOMMENDATIONS PER FDOT AND SJRWMD						

	NAME	DATE		NAME	DATE
DESIGNED BY	CAH	2-28-92	DRAWN BY	SMP	2-28-92
CHECKED BY	WLS	4-03-92	CHECKED BY	CAH	4-03-92
SUPERVISED BY :	WILL L. STEWART P.E.				

FLORIDA DEPARTMENT OF TRANSPORTATION

APPROVED BY :

DATE :

S.R. 46 - WEKIVA RIVER

BRIDGE HYDRAULIC RECOMMENDATIONS

CADE DT05PBH.001
DT05.TBL

bowyer-singleton & associates Incorporated

Engineering
Planning
Surveying

520 South Magnolia Avenue P.O. Box 2769
Orlando, Florida 32802-2769 (407) 843-5120
Facsimile (407) 659-8664

LETTER OF TRANSMITTAL

HAND DELIVERED

To: Florida Department of Transportation	Date: 12-05-94 Job No.: D21 J5
719 South Woodland Boulevard	Attention: Pat Muench
DeLand, Florida 32720	Re: SR 46 Wekiva River Bridge Replacement
	State Project No. 77030-3517

GENTLEMEN:

WE ARE SENDING YOU [x] Enclosed [ ] Under separate cover via ____________ the following items:
[ ] Shop Drawings [ ] Prints [ ] Plans [ ] Samples [ ] Specifications
[ ] Copy of Letter [ ] Change Order [ ]

Copies	Date	Description
3		Bridge Hydraulics Report with Bridge Hydraulics Recommendation Sheet
1		Bridge Hydraulics Recommendation Sheet

THESE ARE TRANSMITTED as checked below:

[ ] For Approval
[x] For Your Use
[x] As Requested
[ ] For Review and Comment
[ ] FOR BIDS DUE ____________ 19 ____

[ ] Approved as Submitted
[ ] Approved as Noted
[ ] Returned for Corrections
[ ]

[ ] Resubmit _____ Copies for Approval
[ ] Submit _____ Copies for Distribution
[ ] Return _____ Corrected Prints

[ ] PRINTS RETURNED AFTER LOAN TO US

REMARKS ____________

Please keep one copy and distribute two copies to Structures with the BHRS for insertion in the Bridge Plans.

Copies: File, NLF, WLS

Signed: Cynthia A. DiMauro
Cynthia A. DiMauro, P.E.

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

Dec 7 16

WLS

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT

Henry Dean, Executive Director
John R. Wehle, Assistant Executive Director
Charles T. Myers III, Deputy Assistant Executive Director

POST OFFICE BOX 1429 PALATKA, FLORIDA 32178-1429
TELEPHONE 904/329-4500 SUNCOM 904/860-4500
TDD 904/329-4450 TDD SUNCOM 860-4450
FAX (EXECUTIVE/LEGAL) 329-4125 (PERMITTING) 329-4315 (ADMINISTRATION/FINANCE) 329-4508

FIELD STATION

618 E. South Street, Orlando, Florida 32801, 407/897-4300, TDD 407/897-5960
7775 Baymeadows Way, Suite 102, Jacksonville, Florida 32256, 904/730-6270, TDD 904/730-7900
PERMITTING: 305 East Drive, Melbourne, Florida 32904, 407/984-4940, TDD 407/722-5368
OPERATIONS: 2133 N. Wickham Road, Melbourne, Florida 32935-8109, 407/254-1762, TDD 407/253-1203

December 1, 1994

HAND DELIVERED

Ms. Cynthia A. DiMauro, P.E.
Bowyer, Singleton and Associates, Inc.
520 South Magnolia Avenue
Orlando FL 32801

Re: SR 46 Wekiva River Bridge Replacement;
Application Number 4-117-0377AG
(Please reference the above number on any submittal)

Dear Ms. DiMauro:

The staff has reviewed your response to the District's request for additional information. Although most of the technical issues have been resolved, such as mitigation there are a few remaining details that must be provide to sufficiently review the possible impacts the project may have on the surrounding area. This information is again being requested pursuant to the authority vested in the St. Johns River Water Management District under subsection 373.413(2), Florida Statutes (F.S.), and sections 40C-4.101 and 40C-4.301, Florida Administrative Code (F.A.C.).

In order to expedite the review of your application, please use the application number referenced above on all correspondence, and submit three (3) copies of all requested information unless otherwise indicated by a specific information request.

1. Pursuant to staff's telephone conversation with you on December 1, 1994, it appears that the downstream invert elevation of the outfall pipe as shown on the routing computations, from node 10 to node 20, is inconsistent with plan sheet 14 for S-8. Submit any revised plans or calculations. [40C-4.301(1)(a); (2)(a)., F.A.C.] Fixed

2. Pursuant to staff's telephone conversation with you on December 1, 1994, it is noted that the bridge plan, profile, and cross-sections for the proposed project have not yet been furnished. Please submit all necessary construction plans for the proposed redesigned bridge and the temporary bridge. [40C-4.301(1)(a); (2)(a)., F.A.C.] We will furnish plans

3. Pursuant to staff's telephone conversation with you on December 1, 1994, it is noted that the response to item #4 of the District's previous letter requesting additional information (RAI) dated March 18, 1994, is inadequate. The response received by the District on November 1, 1994, indicates that "the contractor will be responsible for submitting the appropriate documentation to the SJRWMD for approval". Please be advised that this project is located within the Water Quality Protection Zone of the Wekiva River Hydrologic Basin. A detailed erosion, sediment and turbidity control plan must be submitted to the District for review by the applicant as part of the surface water management permit application. Please submit the required erosion, sediment and turbidity control plan for your proposed project. The proposed plan must be in accordance with section 18.2 and 18.3 of the MSSW Applicant's Handbook. Also, please be advised that page B-2 of the Bridge Plans" referenced in your submittal as containing plans for sediment and erosion containment during construction of the new 561 foot bridge has not yet been furnished to the District. Please provide this information in addition to drawing details of piling and fill sediment and erosion containment methods for construction of the new 561 foot and temporary bridge crossings, and the demolition of the old and temporary bridge crossings. [40C-4.301(1)(a)6, 9., 10.; (2)(a)4., 6., 7., 8.,; 40C-41.063(3)(c), F.A.C., 11.3.3 MSSW A.H.]

4. Please provide additional details on the phasing of the work that will occur with emphasis on time tables for each phase of construction that is proposed. We are concerned that a contractor working to "FDOT standard specifications" as noted on the plans may leave cleared areas exposed for a durations sufficient to cause erosion. The discussion of the phasing time table should include details on methods to vegetate exposed surfaces (ie.; temporary road side banks, or spoil stockpiles) within 14 days of construction which leaves surface areas exposed. In addition, the surface area of erodible earth exposed by clearing and grubbing operations, or by excavation and filling operations, as allowed by FDOT Standard specification, is excessive for this project. [40C-4.301(1)(a)6.,9.10.;(2)(a)4.,6.,7.,8., F.A.C.]

FDOT

5. Notation on the construction plans received by the District on November 1, 1994, and November 3, 1994, indicate that the construction plans are preliminary. Please submit all final construction plans for the proposed project. [40C-4.301(1)(a); (2)(a).; 40C-1.181(2), F.A.C.] will submit new plan with no preliminary

FDOT

6. The plan view drawings illustrate a turbidity curtain extending across the entire channel of the Wekiva River during Phase D of construction. Please propose alternative methods (see question 3) as placement of the curtain in this manner is not an effective method of turbidity control in a flowing water body and, in addition will be adverse to recreational

use (ie.; canoeing) of the river, and to wildlife movements within the channel. It is noted that the FDOT Details indicate that turbidity barriers should be utilized parallel to the current in a flowing water body, not perpendicular to the flow. [40C-4.301(1)(a)1.,10.;(2)(a)7.,8., F.A.C.]

7. Please provide a plan view drawing that illustrates an additional line of sediment and erosion control measures between the restored wetland areas and the toe of slope of the new road (after Phase D of construction) to prevent the discharge of sediments to these restored (and new) wetland areas. [40C-4.301(1)(a)9., 10.; (2)(a)6.,7.,8., F.A.C.]

8. Please revise the plan view drawing (sheet 23), and the cross section drawings (sheets 41 to 43) of the mitigation area to show the proposed distribution of the species to be planted within the 1.25 acre area. Since species such as hackberry have different hydric tolerances as compared to laurel oak, it would be helpful to know where certain species are proposed to be planted. In addition, please propose some native ground cover species planted in this area to replace the exotic grass that currently exists. [40C-4.301(1)(a)9.,10.;(2)(a)7., F.A.C.]

If the applicant desires to dispute the necessity for any information requested on an application form or in a letter requesting additional information, pursuant to section 40C-1.605(5), F.A.C., he or she may request an administrative hearing in accordance with section 120.57, F.S. Any petition for administrative hearing must comply with sections 40C-1.511 and 40C-1.521, F.A.C., must be filed within fourteen (14) days of receipt of the request for additional information, and must be filed with the District Clerk, in Palatka.

Please be advised, pursuant to section 40C-1.605(5), Florida Administrative Code, any application which has not been technically completed within sixty (60) days from the date of receipt of a request for additional information by the District, will be prepared for an Intent to Deny at the next timely Governing Board meeting. If you require more than the allotted sixty (60) days, please indicate this to the staff.

In addition, no construction (includes land clearing) shall begin on the proposed project until a permit is issued by the St. Johns River Water Management District. This is pursuant to subsection 40C-4.041(1), F.A.C., which states in relevant part, "unless expressly exempt by sections 373.406 and 403.813, F.S., or sections 40C-4.051 or 40C-44.051, F.A.C., a surface water management permit must be obtained from the District prior to the construction, alteration, operation, maintenance, removal or abandonment of any dam, impoundment, reservoir, appurtenant work or works...."

If you have any questions, please do not hesitate to call me at 407/897-4300.

Sincerely,

Rod Pakzadian, Engineer
Department of Resource Management

Lance D. Hart, Lead Environmental Specialist
Department of Resource Management

RP/LDH:rc

cc: Pat Frost, Glenn Lowe, Joan Budzynski, P.E., Cammie Dewey, P.E., PDS-RAIL

Mr. Mark Robinson, P.E.
Mr. Richard Fowler
Florida Department of Transportation
Environmental Management Office
719 South Woodland Boulevard
DeLand, Fl 32720

Mr George Lovett, General Council
Florida Department of Transportation
719 South Woodland Boulevard
DeLand, Fl 32720

Foley and Lardner
Ms. Martha H. Formella
111 North Orange Avenue, Suite 1800
Orlando Fl 32801

ST. JOHNS RIVER

WATER MANAGEMENT DISTRICT

Henry Dean, Executive Director
John R. Wehle, Assistant Executive Director
Charles T. Myers III, Deputy Assistant Executive Director

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OPERATIONS: 2133 N. Wickham Road, Melbourne, Florida 32935-8109, 407/254-1762, TDD 407/253-1203

December 1, 1994

HAND DELIVERED

Post-it™ Fax Note 7671	Date 12-1	# of pages ▸ 8
To Mark Robinson	From Will Stewart	
Co./Dept. FDOT	Co. BSA	
Phone #	Phone #	
Fax # 904 736-5302	Fax #	

Meeting is at 10:30AM, 12-05-9[?] in the Volusia Conference R[?]

Mr. Richard Fowler
Florida Department of Transportation
719 S. Woodland Boulevard
DeLand FL 32720

Re: State Road 46 Wekiva River Bridge Replacement;
Application Number 12-117-0094A
(Please reference the above number on any submittal)

Dear Mr. Fowler:

The St. Johns River Water Management District received the response to the District's request for additional information on November 1, 1994 and November 3, 1994. This information reflects a redesign of the project with the lengthening of the bridge. Although most of the technical issues, such as mitigation have been resolved, there are a few remaining details that must be provided. Therefore, the following additional information is required. This information is requested pursuant to the authority vested in the St. Johns River Water Management District under chapters 373 and 403, Florida Statutes (F.S.), and chapters 17-301, 62-302, 62-4, and 62-312, Florida Administrative Code (F.A.C.). To expedite the review of your application, please use the application number referenced above on all correspondence and provide four copies of all submittals.

1. Since the work is to occur in an Outstanding Florida Water, we do not feel that adequate turbidity and erosion control measures are provided by simply requiring the contractor to submit appropriate documentation to the District if additional measures are needed. Of particular concern is what containment devises will be utilized during construction of the pilings of the proposed and temporary bridge, and during demolition of the pilings of the existing bridge and removal of the pilings for the temporary bridge. At a minimum, the plans need to show construction specific measures of containing sediments (ie.; coffer dams around the pilings), with notes to the contractor that these measures be left in place until sediments have settled out of the water column. Please revise the construction plan drawings accordingly. [62-312.060; 62-302, F.A.C.]

BSA will provide detail like the one they did on Tomoka Project

possibly limit options, discuss w/structures.

Please provide additional details on the phasing of the work that will occur with emphasis on time tables for each phase of construction that is proposed. We are concerned that a contractor working to "FDOT standard specifications" as noted on the plans may leave cleared areas exposed for a durations sufficient to cause erosion. The discussion of the phasing time table should include details on methods to vegetate exposed surfaces (ie.; temporary road side banks, or spoil stockpiles) within 14 days of construction which leaves surface areas exposed. In addition, the surface area of erodible earth exposed by clearing and grubbing operations or by excavation and filling operations, as allowed by FDOT Standard specifications, is excessive for this project. [62-312.060; 62-302, F.A.C.] 104-6.3 p. 105

Brian will Provide note & Time table in plan

3. The plan view drawings illustrate a turbidity curtain extending across the entire channel of the Wekiva River during Phase D of construction. Please propose alternative methods (see question 1) as placement of the curtain in this manner is not an effective method of turbidity control in a flowing water body and , in addition will be adverse to recreational use (ie.; canoeing) of the river, and to wildlife movements within the channel. It is noted that the FDOT Standard Details indicate that turbidity barriers should be utilized parallel to the current in a flowing water body, not perpendicular to the flow. [62-312.060, F.A.C.] Redraw dbl-flty t-barrier around each bent exist, temp & proposed.

4. Please provide a plan view drawing that illustrates an additional line of sediment and erosion control measures between the restored wetland areas and the toe of slope of the new road to prevent the discharge of sediments to these restored (and new) wetland areas. [62-312.060; 62-302, F.A.C.] ? Erosion Mat possibly

5. Please provide additional detail drawings of the replacement and the temporary bridge structures. Specifically:

   a. the cross section drawings (sheets 12 and 13 of 29) illustrate the replacement bridge and the temporary bridge platform, but does not illustrate the configuration of the pilings. At a minimum, provide a separate typical cross section drawing of both the replacement and temporary bridge structures illustrating road platforms and pilings. ok / Show on Sht 12 & 13

   b. A detail profile drawing of the replacement bridge is provided. A profile drawing of the temporary bridge of equal detail, however, is not provided. Please provide a detailed profile drawing of the temporary bridge. See Sht. #6

Please remember to: illustrate, and/or provide notes on these drawings regarding measures to control turbidity during construction and demolition/removal of the pilings; illustrate normal water level flow directions; and, illustrate existing/proposed topography. [62-312.060, F.A.C.]

6. The hatching for the restored wetland area on sheet 23 of 29; labelled Planting Scheme for the west side of the river, either does not cover the entire area to be replanted, or the limits of construction are not correctly illustrated (see MSSW construction plans). Please clarify and revise this drawing accordingly. [62-312.060; 62-312.300, F.A.C.] Fix graphics

7. Please revise the plan view drawing (sheet 26 of 29), and the cross section drawings (sheets 27 to 29 of 290 of the mitigation area to show the proposed distribution of the species to be planted within the 1.25 acre area. Since species such as hackberry have different hydric tolerances as compared to laurel oak, it would be helpful to know where certain species are proposed to be planted. In addition, please propose some native ground cover species planted in this area to replace the exotic grass that currently exists. [62-312.300, F.A.C.] Fix drawing.

8. The replacement and temporary bridge structures have been lengthened and the value in item 9e. of the application form (page 2 of 4) reflects the new replacement bridge length. Please revise this item to include the value of the temporary bridge, similar to the values shown in parenthesis for the fill associated with the temporary road. [62-312.060, F.A.C.]

9. We have received the letter from you indicating that Bowyer-Singleton and Associates, Inc. has been retained to provide engineering and environmental responses for this project. However, since the application form is the legal document associated with this project, it is still necessary for you to complete item 14 on page 4 of 4 and have it notarized. Please do so and submit a minimum of two copies with the original signatures and seals. [62-312.900; 62-312.060, F.A.C.] Richard Fowler

If the applicant desires to dispute the necessity for any information requested on an application form or in a letter requesting additional information, pursuant to section 40C-1.605(5), F.A.C., he or she may request an administrative hearing in accordance with section 120.57, F.S. Any petition for administrative hearing must comply with sections 40C-1.511 and 40C-1.521, F.A.C., must be filed within fourteen (14) days of receipt of the request for additional information, and must be filed with the District Clerk, in Palatka.

Please be advised that as described in subsection 40C-1.605(5), F.A.C., any application which has not been technically completed within sixty (60) days from the date of receipt of a request for additional information by the District, will be prepared for an Intent to Deny at the next timely Governing Board meeting. If you require more than the allotted sixty (60) days, please indicate this to the staff.

bowyer-singleton & associates
INCORPORATED

Bridge Hydraulics Report

State Road 46
Wekiva River Bridge Replacement

State Project No. 77030-3517
W.P.I. No. 5117641

Prepared for
The Florida Department of Transportation
District Five

March 2, 1992
(Revised November 1994)

520 South Magnolia Avenue ▪ Orlando, Florida ▪ 32801 ▪ (407) 843-5120

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Executive Summary

This Bridge Hydraulics Report was prepared for the proposed State Road 46 highway bridge crossing over the Wekiva River at the Seminole and Lake County lines. This work was performed due to the proposed widening of State Road 46 from its present two-lane configuration to a four-lane divided configuration The Florida Department of Transportation (FDOT) has responded to the Florida Department of Environmental Protection's (FDEP) request to increase the bridge length. The project has been redesigned to increase the length of the bridge from the previously proposed 124.4 meters (408 feet) (Bridge Hydraulics Report prepared by Bowyer-Singleton & Associates, Inc. dated March 2, 1992) to 171.0 meters (561 feet). This represents an increase of 46.6 meters (153 feet) over the originally proposed structure, and an increase of 94.2 meters (309 feet) over the existing 76.8 meter (252 foot) bridge structure. In response to a concern expressed by regulatory agencies, the bridge is being lengthened on the Lake County side. The revision substantially increases the portion of the wetland corridor that is available for the safe passage of wildlife. Removing existing roadway fill and returning this area to the natural grade of the adjacent floodplain will provide a wildlife crossing 39.6 meters (130 feet) wide on the east side of the bridge and 57.9 meters (190 feet) wide on the west side of the bridge.

The proposed dual 171.0 meter (561 foot) bridges will replace the existing 75.8 meter (252 foot) structure. The existing two-lane, low level structure (Bridge No. 770003), was constructed in 1939. The local area in the watershed upstream of the structure location is predominantly residential development; however, limited urbanization is expected to increase.

The magnitudes of the 50-year (design storm) and 100-year (base flood) were obtained from the United States Geological Service (USGS) using Log-Pearson Type III distribution of annual peaks recorded at Gaging Station 02235000. The drainage basin area has been determined to be 489.5 square kilometers (189 square miles), which develops design and base flows of 50.7 and 56.1 centimeters (1,790 cfs and 1980 cfs), respectively. The actual flows may vary from these values due to the large size of the basin.

Water-surface profiles were computed using the WSPRO HY-7 computer program developed by the USGS for the Federal Highway Administration. Upon review of the existing and proposed conditions, the proposed 171.0 meter (561 foot) structure is hydraulically equivalent and adequate to replace the existing 76.8 meter (252 foot) structure.

There is no history of scour at the existing bridge location. The low velocities, muck deposits, and dense vegetation around the channel indicate that the potential for scour damage at this location is low. Rubble riprap will provide erosion protection along the embankments and the pilings will be driven deeper to protect against scour damage.

I. Preliminary Information

A. General Site Location

State Road 46 is an existing two-lane roadway classified as Federal Aid Primary. It has been proposed by the Florida Department of Transportation (FDOT) to improve the existing two-lane roadway to a four-lane divided section.

An existing 76.8 meter (252-foot) bridge is located in the Southeast 1/4 of Section 21, Township 19 South, Range 29 East, at the Seminole/Lake County line. The structure provides a crossing to carry State Road 46 over the Wekiva River. The crossing is located approximately 8.4 kilometers (5.2 miles) west of Interstate 4 (I-4) and 14.3 kilometers (8.9 miles) west of Sanford, Florida. A location map is included in Appendix A.

The topography of the basin is quite varied. Elevations range from 39.6 meters (130 feet) above mean sea level near the Seminole/Orange County line to less than 1.5 meters (5.0 feet) at the Wekiva River's confluence with the St. Johns River. A good portion of the river traverses a large, flat wetland area. The remainder of the basin consists of rolling, hilly land interspersed with lakes and sinkholes. The surface sands have a high permeability rate which encourages rapid infiltration and limits surface runoff.

The drainage basin for the Wekiva River and its tributaries, as delineated by the USGS, comprises 489.5 square kilometers (189 square miles). There are a large number of land-locked lakes and wetland areas located within the basin. The Wekiva River flows north to its confluence with the St. Johns River approximately 10.9 kilometers (6.8 miles) downstream of the State Road 46 crossing.

B. Potential Site Problems

Much of the land surrounding the project site is undeveloped wooded areas, recreation preserves, wetlands and agricultural land. Residential developments are located to the east on Longwood Markham Road and Lake Markham Road. Portions of the basin located east of the Wekiva River toward I-4 are experiencing an increase in commercial and residential development.

The existing encroachment is located within the 100-year flood plain, Zone A-5, as determined by the FEMA Flood Insurance Rate Maps. Seminole County Panel 120289 0010 B, May 5, 1981; and Lake County Panel 120421 0275 B, April 1982, are included in Appendix B. A Flood Plain Information (FPI) report for the Wekiva River was prepared by the U.S. Army Corps of Engineers (USACOE), Jacksonville

District, in September 1974. The FPI report included 100-year and Standard Project Flood profiles for the Wekiva River.

It was determined by representatives of the Federal Insurance Administration (FIA) and USACOE that floodways would not be determined for the Wekiva River. The Wekiva River has relatively little development along its banks and the flood profiles were taken from previous USACOE reports which did not include determination of floodways.

There are several nearby publicly-owned recreation preserves and parks used for swimming, canoeing, picnicking, camping, nature and wildlife studies. The river is an important recreational resource with a highly desirable riverine habitat and diverse ecological communities. The Wekiva River is not a FEMA regulated floodway.

Development within the basin is primarily served by central water systems. The Wekiva River is not used for a domestic water supply.

The Wekiva River has been designated by the State as a "Wild and Scenic River" and as an "Outstanding Florida Water". The Wekiva River Protection Act was approved by the 1988 session of the Florida Legislature to protect the river's natural resources and rural character.

The proposed bridge within the Wekiva River flood plain will constitute fill within wetlands. This impact will require mitigation for lost wetland function and lost flood storage. Erosion and sediment control during construction will be an important issue to the regulatory agencies. St. Johns River Water Management District (SJRWMD) will require a detailed Erosion Control Plan for construction.

C. Channel Stability

The Wekiva River has a mild slope of 0.18 meter per mile (0.6 feet per mile) and is classified as a "Locally Braided Stream". The channel bed has slowly aggraded due to sediment deposition and, therefore, the slope of the channel has increased slightly to a graded state. As the channel steepened, the velocity increased forming multiple channels causing the channel to widen with interspersed islands. A fairly large island exists immediately downstream of the existing bridge. Aerial maps of the site are included in Appendix C.

The Wekiva River is considered mature because of its width, relatively flat slope and shallow depths. The slope and energy of the river are sufficient to transport the material delivered to it and is considered stable.

The existing embankments both upstream and downstream of State Road 46 are stabilized by vegetation and tree root systems. Noticeable erosion has taken place along the embankments of the bridge. A hole in the riprap slope of the right abutment was noted in the field review. A timber bulkhead has been installed on the left embankment to protect the side slope. Photographs of the existing structure are included in Appendix D.

There is no history of scour at this location. The existing piers have been modified with a concrete jacket around the perimeter of each pier. This modification was made more likely for structural stability rather than scour protection. Due to the low velocities and protection provided by dense vegetation found in the channel, scour damage is not considered to be a problem at this site.

D. Potential Water Stages

The FPI report on the Wekiva River for Seminole, Orange and Lake Counties describes floods which occurred on the Wekiva River in 1945, 1947, 1953, 1956, 1960 and 1964. The highest stage of record, 3.3 meters (10.8 feet) NGVD, was produced by the September 1960 flood and the highest discharge of record, 58.3 centimeters (2,060 cfs), was produced by the September 1945 flood.

Information on historical floods was obtained from stream gage data records maintained by the USGS for the State Road 46 - Wekiva River Station 02235000. Newspaper files and historical documents were searched and local residents were interviewed for information concerning past floods in preparation of the FPI report. Information on flood damages along the Wekiva River is not available.

The flood plain along the Wekiva River is subject to overflow by floods from the St. Johns River. Flooding from the St. Johns River will produce more severe flood stages on the lower Wekiva River than flooding from the Wekiva River itself. The simultaneous occurrence of a flood crest on the St. Johns River with one on the Wekiva River, which would increase flooding even more, is very remote. Critical flooding from the St. Johns River would extend up the Wekiva River about four miles for the 100-year flood. The bridge crossing of State Road 46 is located approximately 6.4 kilometers (6.8 miles) above the confluence of the Wekiva River with the St. Johns River and, therefore, the backwater effect is negligible. FEMA flood profiles for the Wekiva River are included in Appendix E.

There are no flood control works completed or planned by the USACOE or SJRWMD in the study area. There are no other known controls within miles of the existing bridge crossing at State Road 46. The Wekiva River is continuously fed by natural springs and includes a large groundwater inflow. The Wekiva River is not affected by tidal waters.

In Chapter 40C-8.031, F.A.C., the SJRWMD has established the following minimum surface water levels and flows, and minimum groundwater levels for the Wekiva River at State Road 46:

Wekiva River Minimum Surface Water Levels and Flows (English Units)				
	Level (Feet NGVD)	*Flow (CFS)*	*Duration (Days)*	*Frequency (Years)*
Minimum Infrequent High	9.2	900	≥7	≤7
Minimum Frequent High	8.2	440	≥30	≤3
Minimum Average	7.6	204	≥180	≥1.7
Minimum Frequent Low	7.2	190	≤90	≥3
Phase 1 Restriction	7.0	180	N/A	N/A
Phase 2 Restriction	6.9	170	N/A	N/A
Phase 3 Restriction	6.7	150	N/A	N/A
Phase 4 Restriction	6.5	120	N/A	N/A
Minimum Infrequent Low	6.1	70	≥7	≥100

Wekiva River Minimum Groundwater Levels and Spring Flows		
	Head (Feet NGVD)	*Discharge (CFS)*
Messant Spring	33.53	15.00
Seminole Spring	33.60	24.00
Rock Spring	31.19	56.00
Wekiva Spring	24.06	63.00
Miami Spring	28.89	4.50
Sanlando Spring	28.55	22.00
Starbuck Spring	30.94	12.00

Wekiva River Minimum Surface Water Levels and Flows (Metric Units)				
	Level (Meters NGVD)	*Flow (CMS)*	*Duration (Days)*	*Frequency (Years)*
Minimum Infrequent High	2.80	25.49	≥7	≤7
Minimum Frequent High	2.50	12.46	≥30	≤3
Minimum Average	2.32	5.78	≥180	≥1.7
Minimum Frequent Low	2.19	5.38	≤90	≥3
Phase 1 Restriction	2.13	5.10	N/A	N/A
Phase 2 Restriction	2.10	4.81	N/A	N/A
Phase 3 Restriction	2.04	4.25	N/A	N/A
Phase 4 Restriction	1.98	3.40	N/A	N/A
Minimum Infrequent Low	1.86	1.98	≥7	≥100

Wekiva River Minimum Groundwater Levels and Spring Flows		
	Head (Meters NGVD)	*Discharge (CMS)*
Messant Spring	10.22	0.42
Seminole Spring	10.24	0.70
Rock Spring	9.51	1.59
Wekiva Spring	7.33	1.78
Miami Spring	8.81	1.37
Sanlando Spring	8.70	0.62
Starbuck Spring	9.43	0.34

E. Clearances

The minimum low member elevation of the bridge structure is 5.1 meters (16.65 feet). The 50-year flood elevation is 3.1 meters (10.1 feet) which provides a 50-year drift clearance of 2.0 meters (6.55 feet). The Wekiva River is not considered to be a navigable waterway by the Coast Guard. A field review from upstream of the structure was attempted, however, shallow water depths prevented access to the site via boat or canoe.

II. Final Design Data

A. Inventory of Existing Crossings

There are no structures located immediately upstream or downstream of the Wekiva River in the vicinity of State Road 46. An abandoned CSX Railroad trestle is located approximately 2.6 kilometers (1.6 miles) upstream of State Road 46. The railroad tracks, timbers and pilings have all been removed. The remaining earth embankments do not encroach into the channel of the river.

The first upstream crossing of the Wekiva River is at Miami Springs Drive. This structure is a five-span concrete bridge approximately 45.7 meters (150 feet) in length constructed in 1959. The bridge embankments are severely eroded, however, Miami Springs Drive has been closed to all traffic. The first crossing downstream is approximately 25.7 kilometers (16 miles) at the State Road 44 bridge over the St. Johns River near DeLand, Florida. This structure is a multi-span bascule bridge dated 1955. These structures and the old railroad crossing have no significant effects on the water-surface profile computations for the State Road 46 crossing. Photographs of the referenced bridges are included in Appendix F.

B. Selection of Design Flood

The design flood for the replacement bridge at State Road 46 and the Wekiva River is the 50-year return frequency in accordance with the FDOT Drainage Design Manual, Chapter 9, relating to bridges on high use or essential highways. Consideration of debris clearance below the low member will be gaged against the 100-year frequency. The 500-year Greatest Flood frequency will be reviewed for overtopping.

C. Hydrologic Analysis

The existing structure is hydraulically adequate to pass the 500-year storm flow without overtopping; however, a replacement structure is recommended to meet current FDOT and AASHTO standards. The existing seven-span concrete structure was constructed in 1939 and does not meet current strength or width requirements. The existing bridge roadway width curb-to-curb is 7.3 meters (24.0 feet) with a design load rating of H-15. A FDOT Bridge Inspection Report dated February 2, 1990 noted drainage deficiencies due to clogged scuppers. A moderate accumulation of sand and debris has built up in both gutter areas. The existing inlet throats are constricted with asphalt from resurfacing of the roadway approaches. A copy of the report and Structure Inventory and Assessment are included in Appendix G.

The only available flood records from USGS records and the FPI report were summarized previously in Section D. The USGS maintains a water-stage recorder stream gage on the Wekiva River at the downstream side of the State Road 46 bridge. The gage has been in operation since October 1931, however, discharge measurements were only recorded to September 1935. Discharge and gage height measurements were recorded from October 1935 to the current year. The maximum gage height of record is 1.9 meters (6.09 feet) on September 12, 1960. The gage datum is 1.5 meters (4.96 feet) NGVD of 1929 (Maximum Stage = 3.4 meters (11.05 feet)). The maximum discharge observed for the period of record is 58.3 cubic meters per second (cms) (2,060 cfs) on September 17, 1945. The USGS Water Resources Data is included in Appendix H.

The drainage basin determined by the USGS is reported to be 489.5 square kilometers (189 square miles). The SJRWMD Division of Geographic Information Systems (GIS) has prepared a drainage map of the Upper Wekiva River Basin which has a calculated drainage area of approximately 455.8 square kilometers (176 square miles). This area was delineated along the natural ridge or the top of man-made features on USGS 7.5 minute quadrangle maps. The SJRWMD map of the Upper Wekiva River Basin is included in Appendix I.

There are no expected changes in the Wekiva River Basin. Although a large majority of the land along the river's banks are in private ownership, any development is regulated by state, regional and local governments to control any potential negative impacts to the area. The Wekiva River Protection Act mandates County Growth Management Policies to preserve the rural character and to protect the natural resources of the basin.

D. Hydraulic Analysis

A water-surface profile computation model, WSPRO HY-7, developed by USGS for the Federal Highway Administration (FHWA) was used to analyze flow through the State Road 46 bridge crossing over the Wekiva River. Water-surface profiles were computed for the existing 76.8 meter (252-foot) bridge and the proposed dual

171.0 meter (561 foot) bridges. The computer input and output is included in Appendix J. Tables I and II summarize the existing and proposed conditions.

Profile and cross section data upstream, downstream and of the existing State Road 46 crossing were provided by FDOT. Using one-foot contour aerials, the FDOT survey cross section coordinates were extended beyond the flood plain limits to include at least one ground point higher than any computed water-surface elevation. Channel cross section data were input 76.2 meters (250 feet) north downstream and 152.4 meters (500 feet) south upstream from the State Road 46 existing centerline. The cross section plan and profiles are included in Appendix K.

Flood frequency information was obtained from the USGS stream gage data recorded over a long period. The USACOE, in cooperation with the NOAA Weather Service, has made comprehensive studies and investigations based on past records of storms and floods. Relative water-surface elevations for the 100-year and Standard Project Flood were determined by the USACOE for the Wekiva River in the 1974 FPI report. The 10-, 50- and 500-year flood profiles for the FEMA Flood Insurance Study were determined by plotting the 100-year and Standard Project Flood (250-year) elevations at various locations along the Wekiva River on probability paper. The line produced by these points was extended to determine the 10-, 50- and 500-year elevations.

Table I						
Summary of Water-Surface Elevations For Wekiva River at State Road 46 (English Units)						
Condition	*Storm Event Frequency (Years)*	*Flow Q (CFS)*	*WSEL Sta. 30+00 Bridge*	*Sta. 25+00 500 Feet Upstream*	*Sta. 27+50 250 Feet Upstream*	*Sta. 32+50 250 Feet Downstream*
Existing	Design (50)	1790	10.11	10.27	10.22	10.10
252 Foot Bridge	Base (100)	1980	10.81	10.97	10.92	10.80
Proposed Dual	Design (50)	1790	10.12	10.28	10.23	10.10
561 Foot Bridge	Base (100)	1980	10.82	10.97	10.92	10.80

Note: WSEL = Water-Surface Elevation, Foot NGVD.

Summary of Water-Surface Elevations For Wekiva River at State Road 46 (Metric Units)						
Condition	*Storm Event Frequency (Years)*	*Flow Q (CMS)*	*WSEL Sta. 30+00 Bridge*	*Sta. 25+00 500 Feet Upstream*	*Sta. 27+50 250 Feet Upstream*	*Sta. 32+50 250 Feet Downstream*
Existing	Design (50)	50.7	3.08	3.13	3.12	3.08
76.8 Meter Bridge	Base (100)	56.1	3.29	3.34	3.22	3.29
Proposed Dual	Design (50)	50.7	3.08	3.13	3.12	3.08
171.0 Meter Bridge	Base (100)	56.1	3.30	3.34	3.33	3.29

Note: WSEL = Water-Surface Elevation, Meters NGVD.

Table II (English Units)					
Comparison of Conditions For Existing and Proposed Bridges					
Existing 252 Foot Bridge					
	Average Velocity (FPS)				
Storm Event	*Approach*	*Bridge*	*Vertical Clearance (Feet)*	*Headwater (Feet)*	*Flow (CFS)*
10	1.10	1.26	9.04	8.36	1330
25	1.12	1.26	7.98	9.42	1595
50	1.13	1.27	7.29	10.11	1790
100	1.14	1.28	6.59	10.81	1980
500	1.16	1.30	5.10	12.30	2420
Proposed 561 Foot Dual Bridges					
	Average Velocity (FPS)				
Storm Event	*Approach*	*Bridge*	*Vertical* Clearance (Feet)*	*Headwater (Feet)*	*Flow (CFS)*
10	1.02	1.14	8.29	8.36	1330
25	0.86	0.93	7.22	9.43	1595
50	0.81	0.86	6.53	10.12	1790
100	0.77	0.81	5.83	10.82	1980
500	0.72	0.75	4.34	12.31	2420

*Minimum vertical clearance calculated used low member elevation of 16.65 feet NGVD.

Table II (Metric Units)					
Comparison of Conditions For Existing and Proposed Bridges					
Existing 76.8 Meter Bridge					
	Average Velocity (MPS)				
Storm Event	*Approach*	*Bridge*	*Vertical Clearance (Meters)*	*Headwater (Meters)*	*Flow (CMS)*
10	0.335	0.384	2.755	2.548	37.66
25	0.341	0.384	2.432	2.871	45.17
50	0.344	0.387	2.222	3.082	50.69
100	0.347	0.390	2.009	3.295	56.07
500	0.354	0.396	1.554	3.749	68.53
Proposed 171.0 Meter Dual Bridges					
	Average Velocity (MPS)				
Storm Event	*Approach*	*Bridge*	*Vertical* Clearance (Meters)*	*Headwater (Meters)*	*Flow (CMS)*
10	0.311	0.347	2.527	2.548	37.66
25	0.262	0.283	2.201	2.874	45.17
50	0.247	0.262	1.990	3.085	50.69
100	0.235	0.247	1.777	3.298	56.07
500	0.219	0.229	1.323	3.752	68.53

*Minimum vertical clearance calculated used low member elevation of 5.07 meters NGVD.

Corresponding peak discharges for the selected recurrence intervals were provided from the USGS using the Log-Pearson Type III distribution of annual peaks (1936-90) recorded at the water-stage stream gage at State Road 46. The flood frequency data is included in Appendix L.

Roughness coefficients (Manning's "n") for the WSPRO calculations were estimated from field reconnaissance using Chow's Open Channel Hydraulics as a reference, see Appendix M.

The proposed dual bridges were treated as an extra-wide bridge for the WSPRO calculations since the flow is essentially continuous through the two structures. The distance between the structures is too short to permit any significant expansion or contraction of the flow.

Upon review of the existing and proposed conditions in Table I, the proposed structure is hydraulically equivalent and adequate to replace the existing structure.

An evaluation of the structure that provides a 0.3 meter (1 foot) rise in backwater over the existing condition for the base flood was not performed due to restrictive environmental issues and a flat gradient of the river.

E. Scour

Hydraulic variables for performing the various scour computations were determined from the WSPRO output, see Appendix O. Scour calculations were based on procedures outlined in Evaluating Scour at Bridges (Hydraulic Circular No. 18, April 1993). The procedures outline the methods and equations for calculating pier, contraction and abutment scour at a bridge. The channel is relatively stable vertically at present, based on an evaluation of the 1938 original bridge plans and present river bed profiles. The forested areas of the watershed adjacent to the Wekiva River are government-owned and regulated to prevent development or change of the land use. Therefore, future aggradation or degradation of the channel due to changes in sediment delivery from the watershed are minimal. Based on these observations, and due to the lack of other possible impacts to the river reach, it is determined that the channel will be relatively stable at the bridge crossing.

The scour analysis of the proposed dual 171.0 meter (408 foot) structures indicates the potential for scour damage at the crossing is less than for the existing structure. The existing 76.8 meter (252 foot) bridge creates a maximum velocity of 0.45 meters per second (1.48 feet per second) for the 100-year storm event. The proposed bridges will only create a maximum velocity of 0.31 meters per second (1.02 feet per second) for the same storm event. The proposed piers have a

45.7 centimeter (18 inch) width, whereas the existing piers have an effective width of 0.6 meters (2 feet) due to the concrete jackets. The decrease in pier width and the larger channel opening causes less turbulence and a decrease in the velocities and scour potential.

The channel bottom has muck deposits as determined by the geotechnical investigation at depths ranging from about 0.6 to 3.0 meters (2 to 10 feet) below ground surface. A stratum of sandy muck deposits as shown in the geotechnical investigation report indicate scour is not a historical problem. The standard abutment protection provided is sufficient to prevent scour damage. Pertinent sections of the Geotechnical Investigation Report are included in Appendix N. Scour calculations are included in Appendix O.

F. Inter-Agency Coordination

Pre-application meetings were held with the SJRWMD to discuss the environmental concerns regarding the bridge replacement at State Road 46. The primary concerns are due to the protected status of the Wekiva River. A Riparian Habitat Regulation Zone (RHRZ) extends 167.6 meters (550 feet) from the edge of the river which is afforded the same protection as wetlands adjacent to the river. Therefore, mitigation for upland and wetland impacts will be the same.

SJRWMD indicated that spanning the wetland and RHRZ would not substantially lower the impact acreage, however, attention to wildlife crossings should be addressed by providing additional spans to the bridge. The proposed 171.0 meter (561 foot) bridges provide a wildlife crossing 39.6 meters (130 feet) wide on the east side of the bridge and 57.9 meters (190 feet) wide on the west side of the bridge. Removing existing roadway fill and returning this area to the natural grade of the adjacent floodplain will substantially increase the portion of the wetland corridor that is available for the safe passage of wildlife.

The new design of the project has not altered the acreage permanently impacting the wetlands. The FDOT proposes to create wetlands resulting from the removal of the existing roadway fill and provide a bridge over an increased portion of the Wekiva River floodplain. This mitigation area will serve a two-fold purpose; as a functional wetland for fish and wildlife, and as a wildlife corridor for the safe passage of small and large mammals underneath State Road 46.

Another component of the mitigation plan is to provide water quality treatment for stormwater runoff, which at the present time, discharges directly into the Wekiva River via bridge scuppers and wetlands adjacent to the river. A water quality system composed of a triple 3.65 meter (12 foot) by 2.7 meter (9 foot) concrete box culvert with three feet of sand filter underlain by 15.2 centimeter (6 inch) PVC perforated pipes is proposed to provide off-line stormwater treatment of runoff from the bridge deck and approach slabs. A baffle extending down over the outfall pipes will be contained in all proposed roadway gutter inlets to provide skimming of debris and oils. Additional treatment is provided on the Seminole County (east) side of the bridge by use of ditch blocks. Limited right-of-way on the Lake County (west) side has precluded the retrofit of a ditch system with blocks.

In addition, a 0.5 hectares (1.25 acre) parcel which is located adjacent to the floodplain wetlands will be purchased by the FDOT. An existing ditch which transects the parcel will be blocked to provide enhancement to down-gradient seepage wetlands. This parcel will be planted with transitional wetland species to provide additional enhancement.

G. Recommendations

The hydraulic analysis conducted for the waterway crossing of State Road 46 utilized state-of-the-art hydraulic models and a thorough engineering analysis of all reasonably obtainable data. While these engineering models are extensive and provide detailed solutions not available when the existing bridge was selected, they are not absolute or faultless.

The computer programs used to determine the flows and water-surface elevations depend on the user's judgements and assumptions. This data was generated using highly variable factors determined by a study of the watershed. Many factors can contribute to change in the calculated values, particularly channelization, urbanization and land use.

A bridge typical section composed of two 3.7 meter (12 foot) travel lanes and two 3.0 meter (10 foot) shoulders (13.4 meters or 44 foot total width) is proposed to be built to the south with 19.5 meters (64 feet) center to center. A future second bridge composed of two 3.7 meter (12 foot) travel lanes, one 1.8 meter (6 foot) and one 3.0 meter (10 foot) shoulder (12.2 meters or 40 foot total width) will be built with its centerline the same as the existing bridge. Calculations in this report are for the ultimate dual bridge design with a divided four-lane roadway. The current plan is to construct the future westbound bridge in place of the existing bridge. A temporary detour bridge will be constructed to the south to maintain traffic. The future eastbound bridge will be constructed at a later date. Construction should be carried out with a minimal impact to traffic and without interruption of emergency services. The Bridge Hydraulics Recommendation Sheet is included following this text.

Bridge deck drainage will be collected via a piped system and conveyed to shoulder gutter inlets prior to its discharge into the triple 3.65 meter (12 foot) by 2.7 meter (9 foot) sediment basin for water quality treatment. Since the maximum allowable spread for the 10-year frequency per FDOT is 3.0 meters (10 feet), scuppers will be used to collect the bridge deck drainage from the last three spans. The scuppers drain to a 35.6 centimeter (14 inch) fiberglass collection pipe suspended from the bridge deck which drains to the roadway stormsewer system.

REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Seminole County, Unincorporated Areas, Florida, revised December 5, 1989.

2. ------, Flood Insurance Study, Lake County, Unincorporated Areas, Florida, October 1, 1981.

3. Florida Department of Water Resources, St. Johns River Water Management District, Aerial Photography with Elevation Contours, Scale 1:2,400, Contour Interval One Foot, January 1985.

4. ------, St. Johns River Water Management District, Technical Publication SJ 89-5, Water Quality Assessment of the Floridan Aquifer in the Wekiva River Basin of Orange, Lake and Seminole Counties, 1989.

5. Orange County Planning Department, Wekiva River, Small Area Study, October 1988.

6. State of Florida, Department of Transportation, Drainage Manual, Drainage Design, Office Tallahassee, Florida, 1987, revised 1988.

7. ------, Evaluating and Designing for Scour at Bridges, Draft Guidelines, September 1, 1991.

8. U.S. Army Corps of Engineers, Jacksonville District, Flood Plain Information - Wekiva River, Seminole, Orange, and Lake Counties, Florida, dated September 1974.

9. U.S. Department of Transportation, Federal Highway Administration, Highways in the River Environment, Hydraulic and Environmental Design Considerations (HEDC), Training and Design Manual, May 1975.

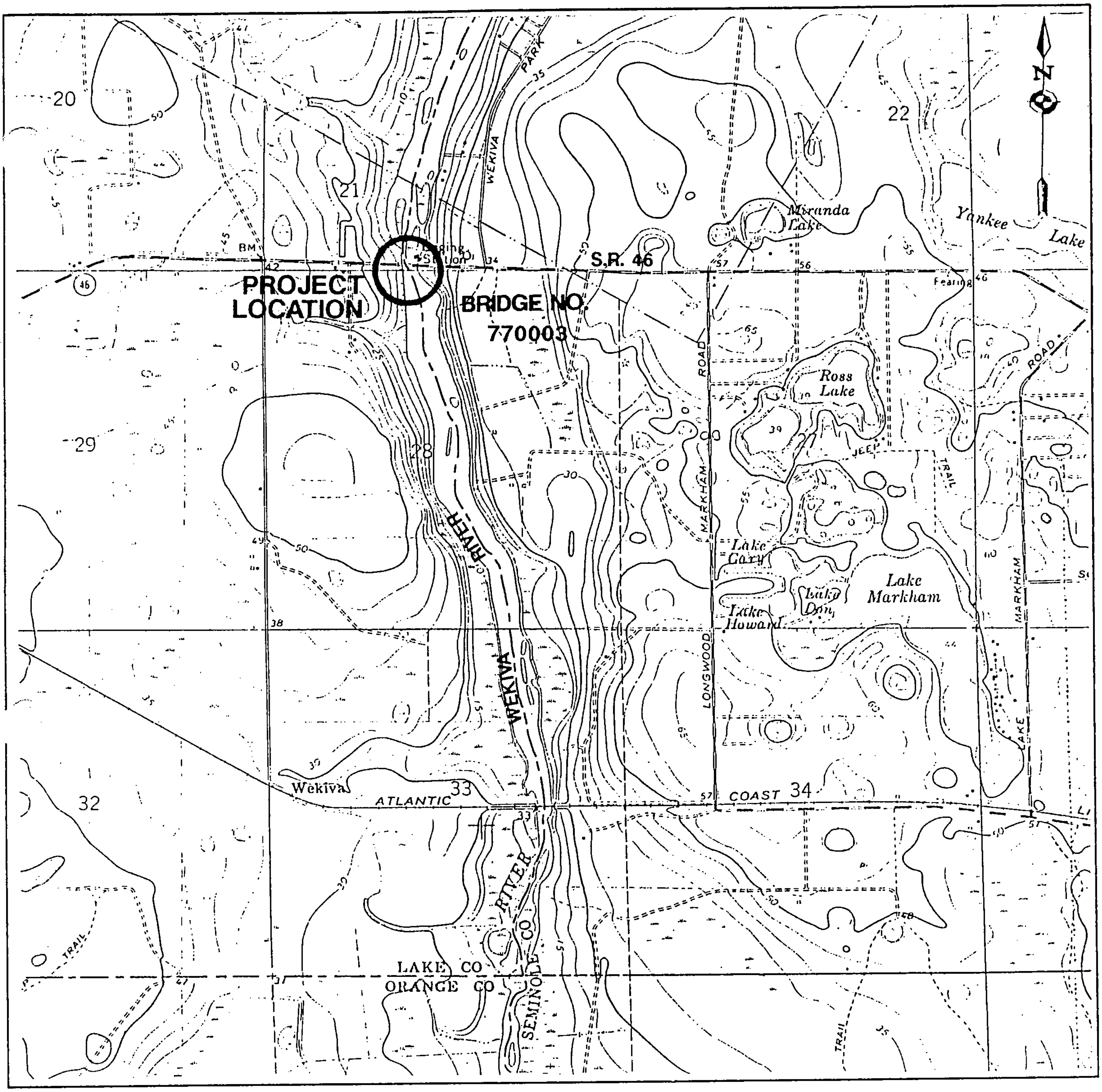
10. ------, Hydraulic Engineering Circular No. 18 - Evaluating Scour at Bridges, (Draft), September 1990.

11. ------, Hydraulic Engineering Circular No. 20 - Stream Stability at Highway Structures, (Draft), September 1990.

12. ------, Hydraulic Engineering Circular No. 16 - Addendum to Highways in the River Environment, Hydraulic and Environmental Design Considerations, July 1980.

13. ------, WSPRO Bridge Waterways Analysis Model (HY-7), March 1990.

14. U.S. Geological Survey, Quadrangle Maps, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval Five Feet: Sanford SW, Florida, 1965, photo-revised 1970; Sanford, Florida, 1965, photo-revised 1980.



SCALE 1:24000

SANFORD SW QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)

bowyer-singleton & associates

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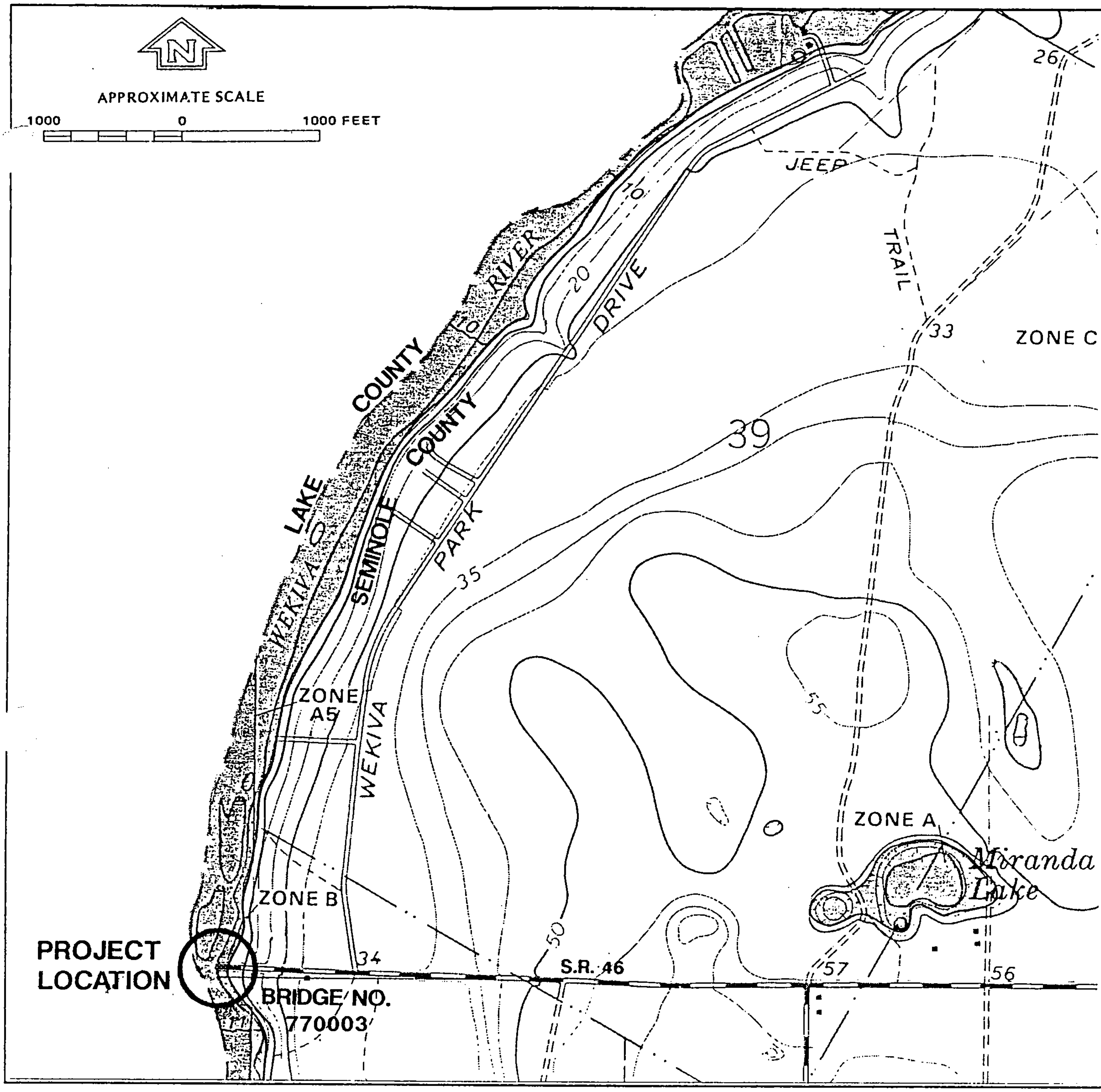
CONSULTING ENGINEERING - LAND SURVEYING
520 S. MAGNOLIA AVENUE - ORLANDO FLORIDA 32801
407/843-5120

LOCATION MAP



COMMUNITY-PANEL NUMBER
120289 0010 B

EFFECTIVE DATE:
MAY 5, 1981

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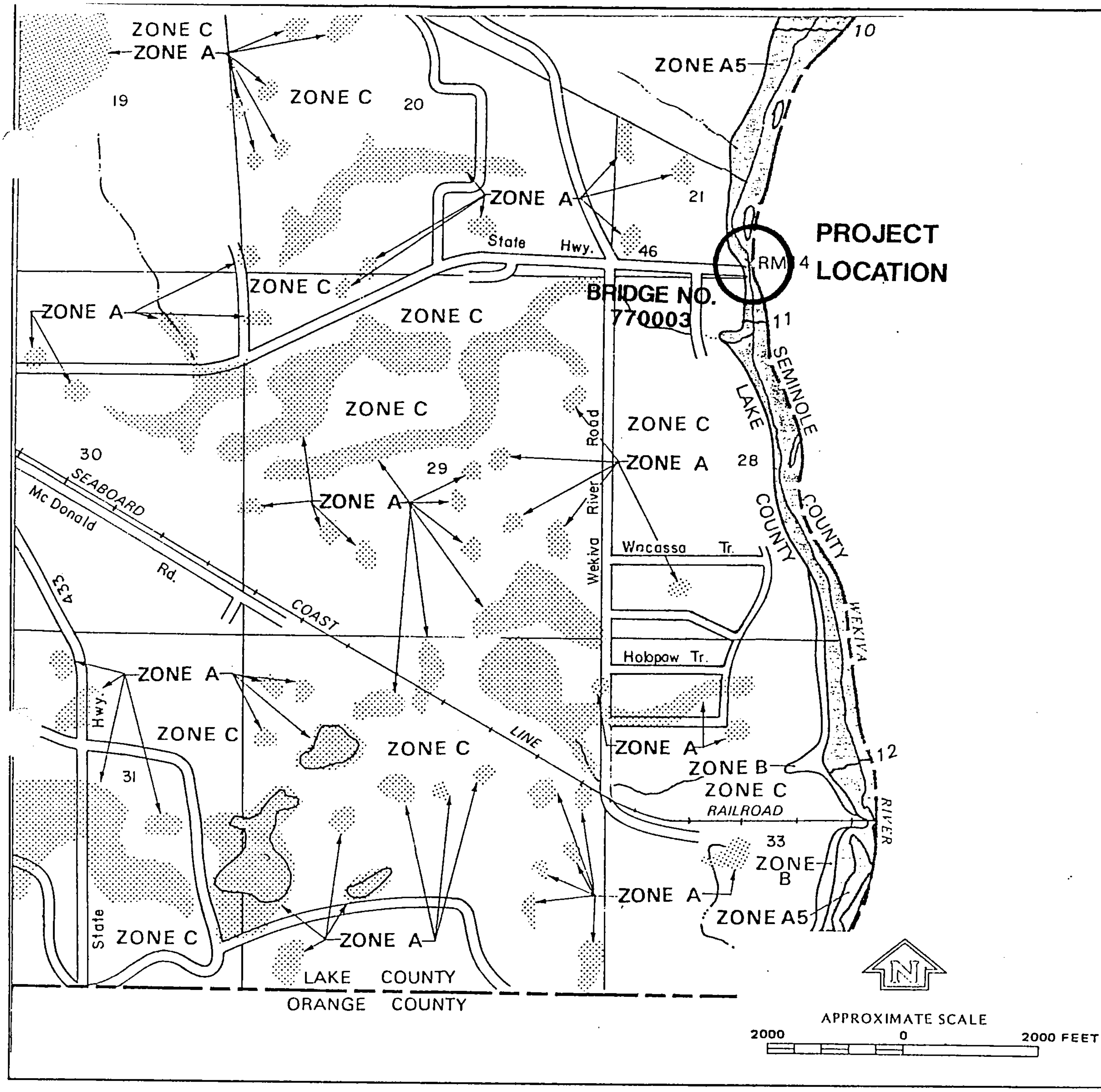
407/843-5120

SEMINOLE COUNTY,
FLORIDA
(UNINCORPORATED AREAS)

FIRM
FLOOD INSURANCE RATE MAP



COMMUNITY-PANEL NUMBER
120421 0275 B

EFFECTIVE DATE:
APRIL 1, 1982

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520 S. MAGNOLIA AVENUE - ORLANDO FLORIDA 32801
407/843-5120

LAKE COUNTY,
FLORIDA
(UNINCORPORATED AREAS)

FIRM
FLOOD INSURANCE RATE MAP

STATE ROAD 46-WEKIVA RIVER

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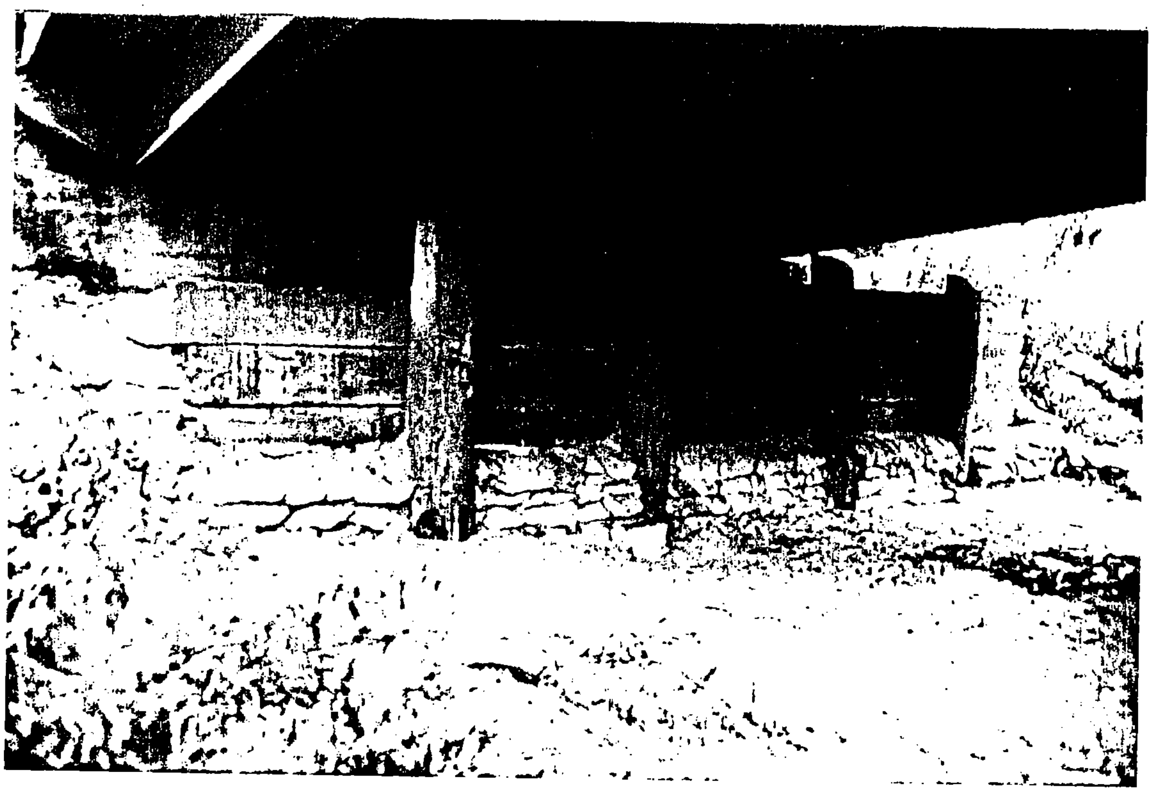
INCORPORATED
CONSULTING ENGINEERING : PLANNING : LAND SURVEYING
520 SOUTH MAGNOLIA AVENUE : ORLANDO, FLORIDA 32801
(407) 843-5120

AERIAL PHOTOGRAPH

RIGHT EMBANKMENT WITH RIPRAP SLOPE



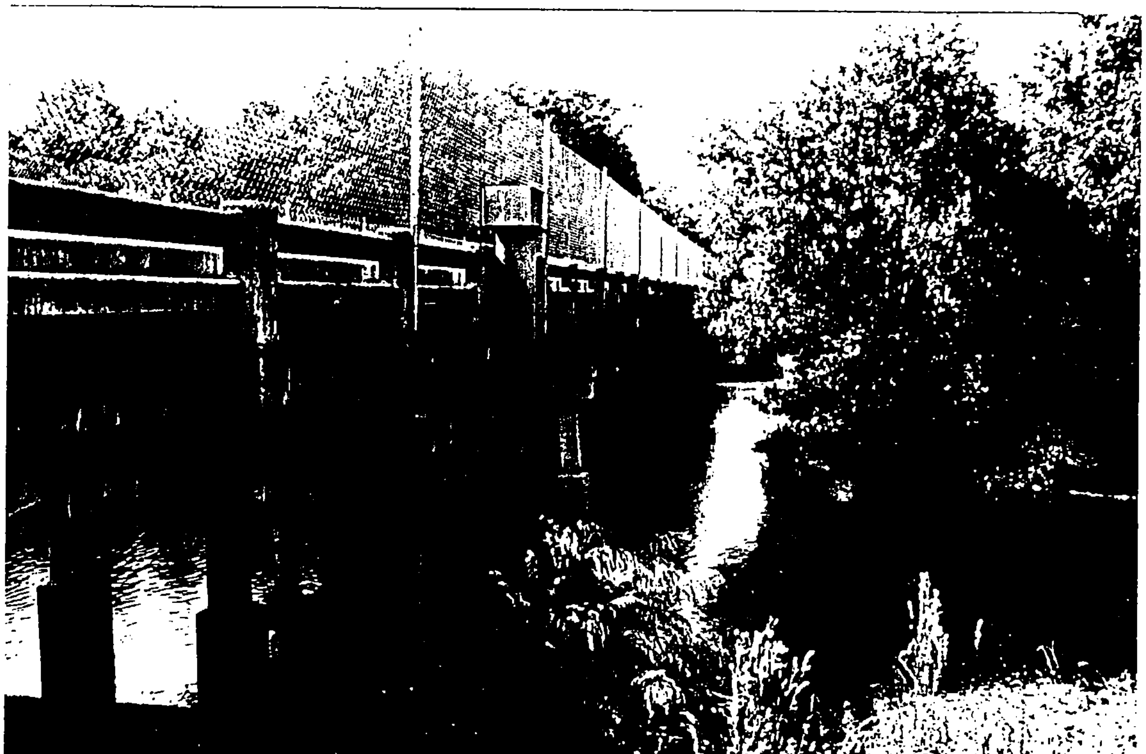
LEFT EMBANKMENT WITH ABUTMENT WALL

bowyer-singleton & associates INCORPORATED

S.R.46 AT WEKIVA RIVER

BRIDGE NO. 770003

UPSTREAM FACE OF BRIDGE



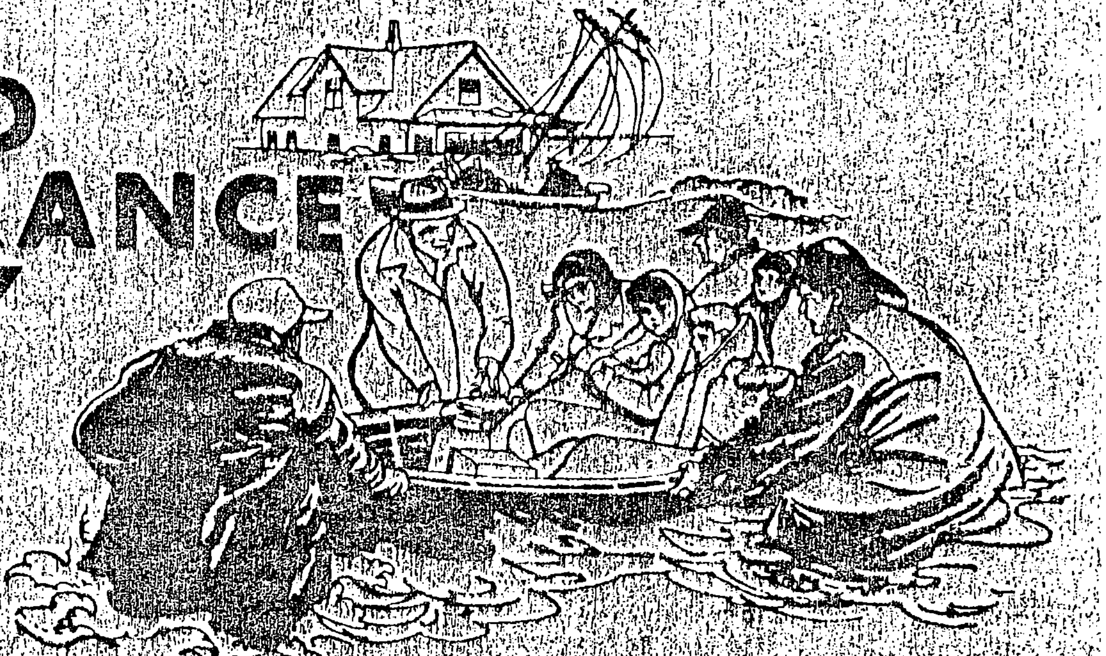
DOWNSTREAM FACE OF BRIDGE WITH USGS GAGE STATION

S.R. 46 AT WEKIVA RIVER

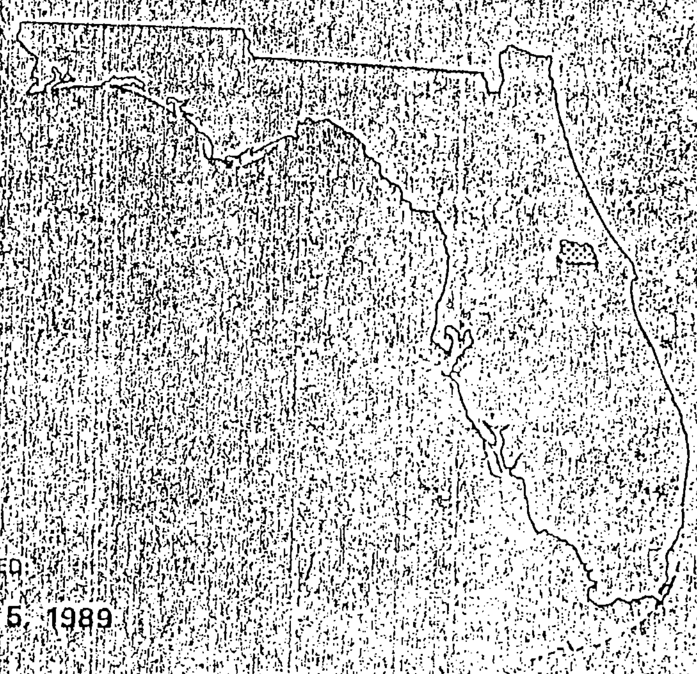
BRIDGE NO. 770003

bowyer-singleton&associates INCORPORATED

FLOOD INSURANCE STUDY



SEMINOLE COUNTY, FLORIDA
UNINCORPORATED AREAS



REVISED:

DECEMBER 5, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 120289

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
ST JOHNS RIVER							
REACH 1	0055, 0065, 0070, 0080, 0090, 0095, 0180, 0185, 0195, 0260	N/A	N/A	1.8	020	A4	VARIES
WEKIVA RIVER							
REACH 1	0010, 0020, 0105, 0110	−2.4	−0.7	1.5	025	A5	VARIES
BANANA LAKE							
REACH 1	0040	−1.0	N/A	N/A	010	A2	50.
GOLF COURSE LAKE							
REACH 1	0040	−7.0	N/A	N/A	070	A14	48
SAWYER LAKE							
REACH 1	0020, 0040	−4.2	N/A	N/A	040	A8	48

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

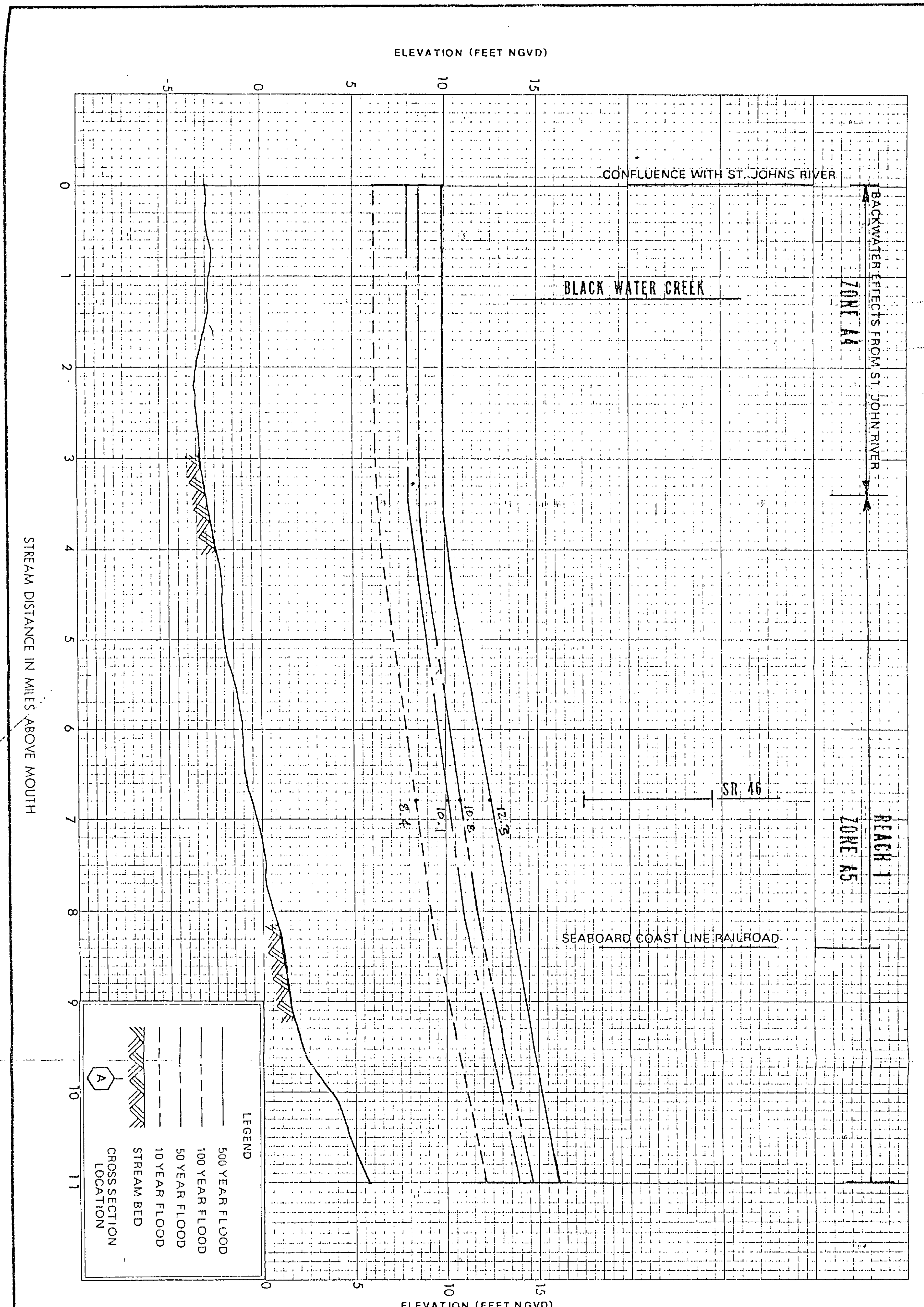
SEMINOLE COUNTY, FL

(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

ST JOHNS RIVER—WEKIVA RIVER—

REVISED: 12/5/89



FEDERAL EMERGENCY MANAGEMENT AGENCY

SEMINOLE COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD PROFILES

WEKIVA RIVER

03P

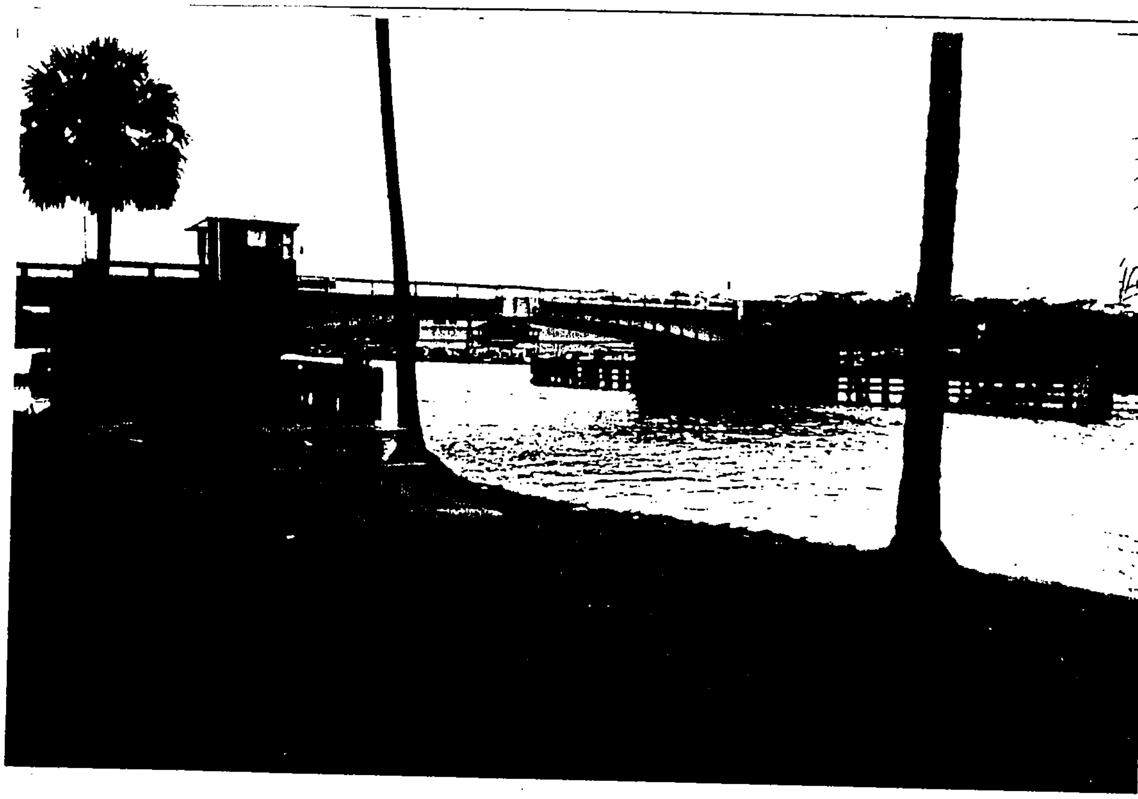
DOWNSTREAM VIEW OF BRIDGE

TOP VIEW OF BRIDGE

MIAMI SPRINGS DRIVE

AT WEKIVA RIVER

bowyer-singleton&associates INCORPORATED



DOWNSTREAM VIEW OF BRIDGE

DOWNSTREAM VIEW OF BRIDGE WITH GAGE

Cindy H.

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

*Not included in this report.

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

RECEIVED
NOV 21 1991
BOWYER - SINGLETON

REPORT IDENTIFICATION

Bridge No.: 770003-S Bridge Name: Wekiva River

Field Inspection Date: Above Water 2-2-90, Under Water

Name of Inspector/Diver	Initials	Engineering Registration Number	Inspector Certification Number
Dannie J. Collins, E-I (Senior Inspector in Charge)	DJC		00158
R. W. Stuckey, E-I			00181
(Senior Diving Inspection /Diver)			

Reviewing Bridge Inspection Supervisor: Name Michael Snyder Initials MS

Confirming Registered Professional Engineer: P.E. Number 20234

Name Yingyong Sujjavanich Signature Y. Sujjavanich

B. COMPREHENSIVE REPORT OF DEFICIENCIES

3.5 Drainage System - A moderate accumulation of sand and debris has built up in both gutter areas. Most of the scuppers are clogged.

C. EVALUATION OF PREVIOUS CORRECTIVE ACTION

4.7 The guardrail has been repaired.

NOTE: The east approach-roadway bridge transition has been leveled with asphalt.

Bridge No. 770003-S
Insp. Date 2-2-90

A. CONDENSED INSPECTION REPORT
FIXED SPANS

.0 SUBSTRUCTURE COMPONENT			2.0 SUPERSTRUCTURE COMPONENT			3.0 DECK COMPONENT		
ELE. NO.	ELEMENT TITLE	NCR **	ELE. NO.	ELEMENT TITLE	NCR **	ELE. NO.	ELEMENT TITLE	NCR **
1.1	Piling/Shafts	7	2.1	Bearings	7	3.1	Deck (Top)/Surfacing	7
1.2	Footings/Caissons	N	2.2	Beams/Stringers/Box & Plate Girders/Flat Slabs	7	3.2	Deck (Underside)	7
1.3	Columns / Wall Piers	N	2.3	Floor Beams	N	3.3	Joints (Expansion)	7
1.4	Caps (Bent & Pier)	7	2.4	Main Girders	N	3.4	Joints (Construction)	N
1.5	Bracing/Struts/Web Walls	N	2.5	Diaphragms/Sway Bracing	7	3.5	Drainage System *	6
1.6	Abutments/End Bents	7	2.6	Lateral Bracing	N	3.6	Curbs/Medians/Sidewalks	7
1.7	Slope Protection	7	2.7	Upper Cords	N	3.7	Handrails/Barriers/Parapets	7
1.8	Overall Rating	7	2.8	Lower Cords	N	3.8	Overall Rating	7
			2.9	Verticals	N			
			2.10	Diagonals	N			
			2.11	Portals	N			
			2.12	Overall Rating	7			

4.0 APPROACH ROADWAY - MAJOR FEATURE			5.0 CHANNEL - MAJOR FEATURE			6.0 NON-STRUCTURAL FEATURES		
ELE. NO.	ELEMENT TITLE	NCR **	ELE. NO.	ELEMENT TITLE	NCR **	ELE. NO.	ELEMENT TITLE	NCR **
4.1	Approach Slabs	7	5.1	Fender System	N	6.1	Lighting Standards	N
4.2	Retaining Wall / Approach Slopes / Embankments	7	5.2	Navigation Lights and Aids	N	6.2	Signs	N
4.3	Approach Slab - Bridge Deck Transition	7	5.3	Embankments / Slopes / Bulk Heads	7	6.3	Striping (roadway, Reflective)	7
4.4	Shoulders	7	5.4	Degradation/Aggregation	8	6.4	Reflectors	8
4.5	Roadway - Approach Slab Transition	7	5.5	Alignment	8	6.5	Utility Attachments	N
4.6	Drainage	7	5.6	Freeboard 10±	N	6.6	Fishing Walks	N
4.7	Guardrails	7	5.7	Obstruction	8	6.7	Attenuators	N
4.8	Overall Rating	7	5.8	Overall Rating	8			

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

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

D. REQUIRED MAINTENANCE, REPAIR AND REHABILITATION

Bridge No. 770C03-S
Section No. 77030

Insp. Date 2-2-90
M.P.0.024

1. Maintenance by State Forces -

   3.5 Drainage System - Remove sand and debris from gutter areas and unclog scuppers as necessary.

2. Repair - None.

3. Rehabilitation - None.

NOTE: Future rehabilitation should include widening and strengthening to meet current A.A.S.H.T.O. standards. A replacement structure should be considered.

PLEASE SCHEDULE STATE FORCE WORK FOR COMPLETION BY FEBRUARY 1990, AND SUBMIT A CORRECTIVE ACTION REPORT UPON COMPLETION. SHOULD YOU BE UNABLE TO SCHEDULE THE WORK WITHIN THIS TIME FRAME, PLEASE ADVISE UPON RECEIPT OF THIS REPORT.

STRUCTURE INVENTORY AND APPRAISAL

~~63.7 SUFFICIENCY RATING (FUNC OBS)~~ ~~09/04/90~~

IDENTIFICATION			CLASSIFICATION		
(1) STATE	FLORIDA		(24) HIGHWAY SYSTEM	FA PRIMARY, RURAL	
(2) HIGHWAY DISTRICT	05		(25) ADMINISTRATIVE	STATE	
(3) COUNTY 117 (4) CITY/TOWN	0000-1920		(26) FUNCTIONAL CLASS	MINOR ARTERIAL RURAL	
(5) INVENTORY ROUTE	131000460				
(6) FEATURE INTERSECTED WEKIVA RIVER	S				

STRUCTURE DATA

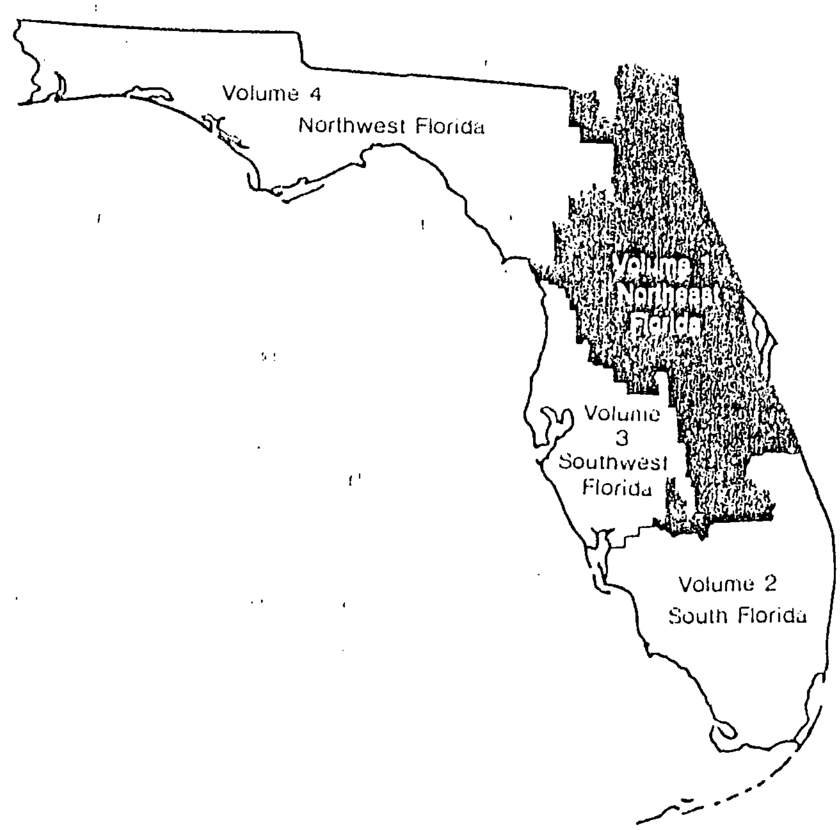
(7) FACILITY CARRIED	SR 46			(42) TYPE SERVICE	HIGHWAY / WATERWAY
(8) STRUCTURE NUMBER	770003	(27) YEAR BUILT	3900	(43) STRUCTURE TYPE MAIN	STEEL / STR/MB GR
(9) LOCATION 5.2 W OF SR 400		(28) LANES ON STR 02 UNDER	00	(44) STRUCTURE TYPE APP	OTHER / OTHER
(10) VERT CLEARANCE	99 FT 99 IN	(29) ADT ON STR	007378	(45) NO OF SPANS MAIN	007
(11) MILEPOINT	0.00	(30) YEAR OF ADT	1989	(46) NO OF APPROACH SPANS	0000
(12) ROAD SECTION NO	00000	(31) DESIGN LOAD	H-15	(47) TOTAL HORIZ CLEARANCE	24.0 FT
(13) DEFENSE BRIDGE LETTER		(32) APP RDWY WDTH W/SHLD	24 FT	(48) MAX SPAN LENGTH	0036 FT
(14) DEFENSE MILEPOINT	0.00	(33) BRIDGE MEDIAN	NONE	(49) STRUCTURE LENGTH	000252 FT
(15) DEFENSE SECTION LENGTH	0.0	(34) SKEW	00	(50) SIDEWALK LEFT 0.0 FT RIGHT	0.0 FT
(16) LATITUDE 28D 48.9" (17) LONGITUDE 081D 25.1"		(35) STRUCTURE FLARED	NO	(51) BRIDGE RDWY WIDTH CURB TO CURB	24.0 FT
(18) PHYSICAL VULNERABILITY	3	(36) TRAFFIC SAFETY FTRS.	1111	(52) DECK WIDTH OUT TO OUT	29.2 FT
(19) BYPASS DETOUR LENGTH	11 MI	(37) HISTORICAL SIGNIFICANCE	5	(53) VERT CLEARANCE OVER DECK	99 FT 99 IN
(20) TOLL	ON FREE ROAD	(38) NAV CONTROL	NC	(54) MIN VERT UNDERCLEARANCE	00 FT 00 IN
(21) CUSTODIAN	S H DEPT	(39) NAV VERT CLEARANCE	000 FT	(55) MIN LAT UNDERCLEARANCE RIGHT	99.9 FT
(22) OWNER	S H DEPT	(40) NAV HORIZ CLEARANCE	0000 FT	(56) MIN LAT UNDERCLEARANCE LEFT	0.0 FT
(23) FEDERAL-AID PROJECT NUMBER		(41) OPEN OR CLOSED	OPEN	(57) WEARING SURFACE	CONCRETE

CONDITION	RATING	PROPOSED IMPROVEMENTS	
(58) DECK	7	(73) YEAR NEEDED	93 ~~1999~~
(59) SUPERSTRUCTURE	7	(74) TYPE OF SERVICE	HIGHWAY
(60) SUBSTRUCTURE	7	(75) TYPE OF WORK	311
(61) CHANNEL & CHANNEL PROTECTION	8	(76) IMPROVEMENT LENGTH	000252 FT
(62) CULVERT & RETAINING WALLS	N	(77) DESIGN LOADING	HS-20
(63) ESTIMATED REMAINING LIFE	08 YRS	(78) ROADWAY WIDTH	0044 FT
(64) OPERATING RATING	246 HS 251	(79) NUMBER OF LANES	02
(65) APPROACH ROADWAY ALIGNMENT	7	(80) ADT 010000 (81) YEAR	1999
(66) INVENTORY RATING	228 HS 16T	(82) PROPOSED RDWY IMPROVEMENT YEAR	1999
		(83) APPROACH IMPROVEMENT	NOT APP

APPRAISAL	RATING		
(67) STRUCTURE CONDITION	4	(84) COST OF IMPROVEMENTS	978000 ~~$1,020,000~~
(68) DECK GEOMETRY	2	(85) P E COST	9000 ~~$127,000~~
(69) UNDERCLEARANCE VERTICAL & LATERAL	N	(86) DEMOLITION COST	110,000 ~~$51,000~~
(70) SAFE LOAD CAPACITY	5	(87) SUBSTRUCTURE COST	133,000 ~~$357,000~~
(71) WATERWAY ADEQUACY	8	(88) SUPERSTRUCTURE COST	430000 ~~$485,000~~
(72) APPROACH ROADWAY ALIGNMENT	8	(89)	
		(90) DATE OF LAST INSPECTION	02/02/90

Water Resources Data Florida Water Year 1990

Volume 1A. Northeast Florida Surface Water



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT FL-90-1A
Prepared in cooperation with the State of Florida
and with other agencies

ST. JOHNS RIVER BASIN ABOVE OKLAWAHA RIVER

02235000 WEKIVA RIVER NEAR SANFORD, FL

LOCATION.--Lat 28°48'54", long 81°25'10", in SE¼ sec.21, T.19 S., R.29 E., Seminole County, Hydrologic Unit 03080101, near right bank at downstream side of bridge on State Highway 46, 4.5 mi downstream from Little Wekiva River, 6.7 mi upstream from mouth, and 8.9 mi west of Sanford.

DRAINAGE AREA.--189 mi^2.

PERIOD OF RECORD.--October 1931 to September 1935 (discharge measurements only), October 1935 to current year.

GAGE.--Water-stage recorder. Datum of gage is 4.96 ft above National Geodetic Vertical Datum of 1929. Prior to Jan. 19, 1960, nonrecording gage at same site and datum.

REMARKS.--Records fair. Flow includes large ground-water inflow.

AVERAGE DISCHARGE.--55 years, 285 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 2,060 ft^3/s, Sept. 17, 1945; maximum gage height, 6.09 ft, Sept. 12, 1960; minimum discharge observed, 105 ft^3/s, June 5-13, 1939; minimum gage height, 1.75 ft, Mar. 13-16,18,19, 1974.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 329 ft^3/s, Feb. 24, gage height, 2.46 ft; minimum daily discharge, 180 ft^3/s, June 21; minimum gage height, 1.90 ft, June 21, July 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	234	218	237	223	240	225	201	195	190	236	269
2	264	233	218	235	221	234	218	199	190	188	235	266
3	263	231	217	233	220	230	221	197	188	187	242	272
4	259	231	217	230	220	227	215	196	197	190	244	265
5	256	231	219	244	218	225	212	194	194	190	242	257
6	254	230	217	251	216	222	212	193	188	189	238	256
7	253	228	217	246	215	221	211	194	186	189	236	255
8	252	228	225	245	216	219	209	193	204	188	237	255
9	248	225	254	243	216	218	208	192	202	187	234	253
10	245	227	250	240	219	217	208	196	209	186	237	250
11	245	226	237	238	259	217	210	195	223	182	256	246
12	245	227	231	237	260	215	211	191	216	184	262	246
13	246	226	227	233	239	214	206	192	190	204	258	246
14	246	224	226	232	232	212	208	193	192	227	264	244
15	243	225	225	232	229	210	208	189	189	241	270	241
16	242	229	224	229	224	210	208	191	187	232	273	239
17	240	228	224	230	221	208	207	190	184	224	273	238
18	240	226	234	231	221	210	208	188	186	219	273	236
19	237	225	244	232	219	210	204	193	184	220	273	232
20	235	224	247	231	217	208	205	199	183	211	270	231
21	233	220	257	231	220	207	203	192	180	214	269	233
22	234	221	253	230	219	207	206	189	186	212	274	232
23	234	224	285	226	255	207	212	194	193	216	278	231
24	234	228	292	226	321	206	208	194	199	214	272	227
25	234	223	271	226	305	205	205	192	198	214	267	226
26	234	224	259	225	273	205	204	192	199	226	262	226
27	238	222	253	224	256	205	204	191	207	234	268	225
28	238	221	248	225	246	203	202	190	202	232	271	226
29	234	220	246	224	---	205	205	188	193	239	266	233
30	234	219	243	222	---	220	205	186	189	237	268	238
31	232	---	240	221	---	227	---	185	---	234	264	---
TOTAL	7562	6780	7419	7209	6600	6664	6268	5969	5842	6500	8012	7294
MEAN	244	226	239	233	236	215	209	193	195	210	258	243
MAX	270	234	292	251	321	240	225	201	223	241	278	272
MIN	232	219	217	221	215	203	202	185	180	182	234	225

CAL YR 1989 TOTAL 85921 MEAN 235 MAX 427 MIN 199
WTR YR 1990 TOTAL 82119 MEAN 225 MAX 321 MIN 180

ST. JOHNS RIVER

ST. JOHNS RIVER BASIN ABOVE OKLAWAHA RIVER

02236000 ST. JOHNS RIVER NEAR DE LAND, FL
(National stream-quality accounting network station)

LOCATION.--Lat 29°00'29", long 81°22'58", in land grant 38, T.17 S., R.28 E., Lake County, Hydrologic Unit 03080101, near left bank on downstream side of Francis P. Whitehair Bridge on State Highway 44, 5 mi west of De Land, and 142 mi upstream from mouth.

DRAINAGE AREA.--3,066 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1933 to current year. Monthly discharge only prior to February 1934, published in WSP 1304.

REVISED RECORDS.--WDR FL-75-1: Drainage area.

GAGE.--Water-stage recorder and electromagnetic current meter recorder. Datum of gage is 0.09 ft below National Geodetic Vertical Datum of 1929. Prior to May 28, 1936, nonrecording gage at site of former Crows Bluff Bridge about 1,000 ft downstream and May 28, 1936 to July 21, 1970, water-stage recorder at site 0.4 mi downstream at datum 1.11 ft lower. Oct. 1, 1959 to Sept. 30, 1975, and Oct. 1, 1984 to Mar. 21, 1986, water-stage recorder for Lake Monroe near Sanford (station 02234499) used as auxiliary gage for this station.

REMARKS.--Records poor. Flow occasionally reversed as a result of tide and wind effect.

AVERAGE DISCHARGE.--57 years, 3,043 ft^3/s, 13.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 17,100 ft^3/s, Oct. 15, 1953; maximum gage height, 6.06 ft, present datum, Oct. 11,12, 1953; maximum daily reverse flow, 3,030 ft^3/s, Aug. 23, 1957; minimum gage height since at least May 28, 1936, -0.58 ft, present datum, Apr. 2, 1945.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 3,980 ft^3/s, Nov. 7; maximum gage height, 2.27 ft, Oct. 31; maximum daily reverse flow, 214 ft^3/s, July 28; minimum gage height, -0.02 ft, July 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2110	2340	2090	2590	2070	1380	1400	1800	476	2020	1580	1190
2	2130	2700	2340	2700	2110	1520	1590	1870	336	1950	1830	543
3	2010	2650	1950	2890	2050	1330	836	1780	660	1680	1830	437
4	2300	2640	2230	3030	2250	1360	714	1520	959	1030	1190	487
5	2100	2850	2620	2560	1440	1210	1670	1270	1470	793	1200	496
6	2030	2930	2650	2220	1720	1020	1930	1130	1460	893	1280	204
7	2230	3980	2730	2320	1730	1000	1830	649	1140	1610	1330	519
8	2290	3370	2790	2510	1770	945	1660	473	1290	1730	1370	1150
9	1870	3250	2320	2350	1930	987	1730	650	1760	1410	1180	1500
10	1430	3180	1800	2350	1990	1430	1730	825	1800	1280	917	1570
11	755	3380	2130	2240	1850	1570	1610	825	2130	1400	1360	1210
12	889	3420	2320	2220	1530	1590	1130	842	1760	1350	1460	989
13	1080	3450	1840	1730	2070	1860	1530	1350	1100	1710	1580	569
14	1580	3310	2020	1800	2180	2170	1460	1290	415	2240	1610	344
15	1850	3550	2340	2270	2330	2230	1680	1350	889	2280	1500	586
16	1990	3520	2330	2500	2510	2220	1590	1230	986	2380	1630	1010
17	2160	3240	2150	2660	2340	2250	1820	1050	432	2280	1790	1250
18	2340	3310	1900	2730	2240	1850	1480	878	69	2050	1580	719
19	2140	3200	1950	2750	2070	2040	492	820	293	1730	1310	181
20	1600	3290	1650	2760	1120	1540	636	762	1040	1600	999	289
21	2370	3290	1910	2710	732	1470	769	878	1340	1460	972	708
22	2610	3580	1850	2680	1120	1530	1400	1050	1500	1500	311	1060
23	2460	3480	796	2720	1660	1460	1450	877	1590	1430	948	1200
24	2070	3190	891	2660	1360	1560	1520	412	2000	1370	1260	590
25	1620	3100	2240	2660	1910	1530	1570	58	1860	1220	1210	601
26	1550	3090	2750	1980	1800	1580	1730	.00	1820	1030	1480	1300
27	1370	3060	3000	2170	1330	1070	2030	119	1830	126	1430	1510
28	887	2970	3200	2260	1340	661	2160	237	1810	-214	1460	1440
29	483	2780	3290	2310	---	835	1830	297	1720	-180	1550	1370
30	1160	1920	3230	2300	---	1360	1620	483	1750	-25	1400	889
31	1790	---	2770	2020	---	1540	---	691	---	546	1320	---
TOTAL	55254	94020	70077	75650	50552	46098	44597	27567.00	37785	41679	41867	25921
MEAN	1782	3134	2261	2440	1805	1487	1487	889	1259	1344	1351	864
MAX	2610	3980	3290	3030	2510	2250	2160	1870	2130	2380	1830	1570
MIN	483	1920	796	1730	732	661	492	.00	69	-214	311	181
CFSM	[illegible]	1.02	.74	.80	.59	.49	.48	.29	.41	.44	.44	.28
IN.	[illegible]	1.14	.85	.92	.61	.56	.54	.33	.46	.51	.51	.31

CAL YR 1989 TOTAL 658478 MEAN 1804 MAX 4220 MIN -786 CFSM .59 IN. 7.99
WTR YR 1990 TOTAL 611067.00 MEAN 1674 MAX 3980 MIN -214 CFSM .55 IN. 7.41

NOTE.--Negative figures indicate reverse flow.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DRAINAGE AREAS OF SELECTED SURFACE-WATER SITES IN FLORIDA

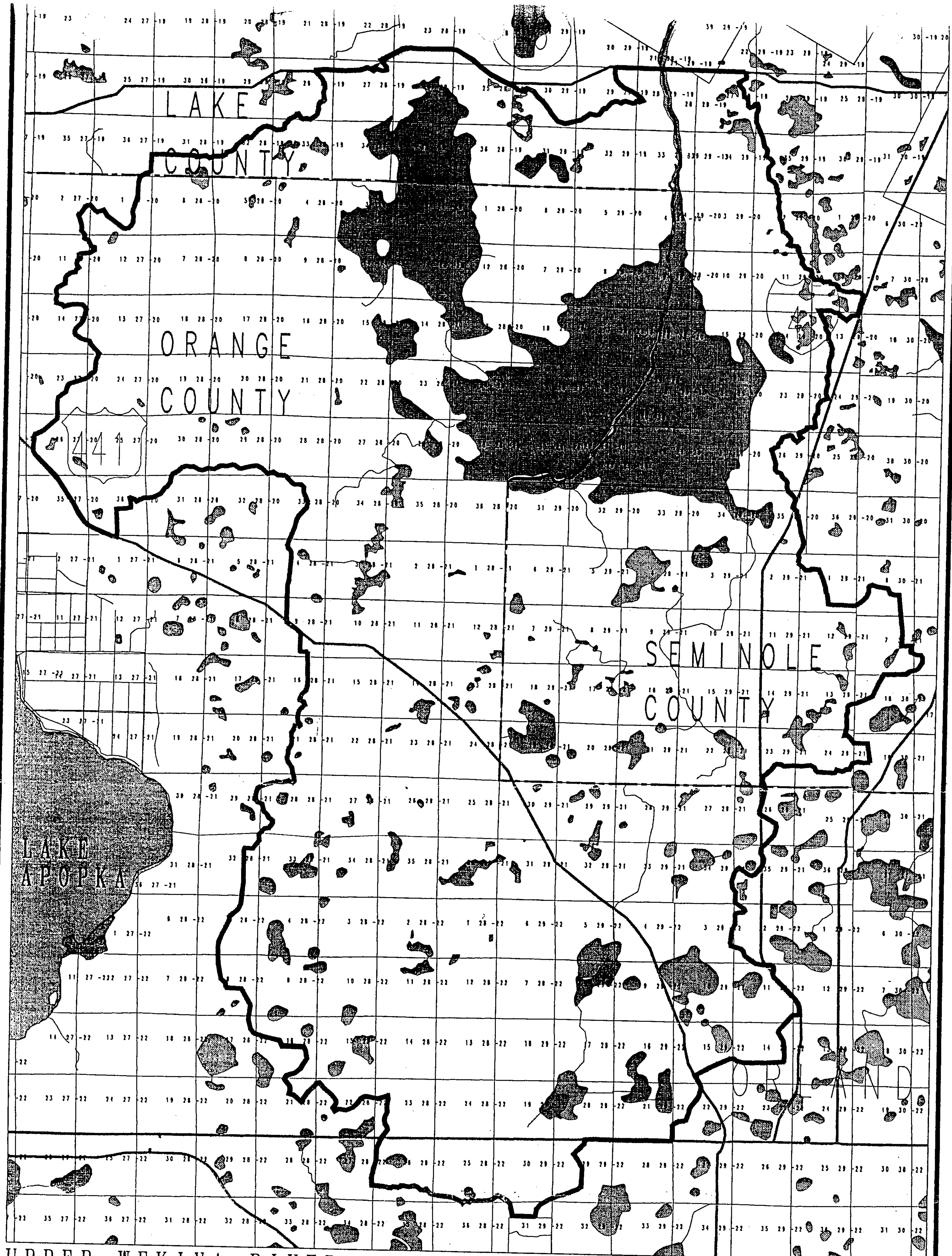
OPEN-FILE REPORT 80-957

Prepared in cooperation with
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

80-957 DRAINAGE AREAS OF SELECTED SURFACE-WATER SITES IN FLORIDA 957

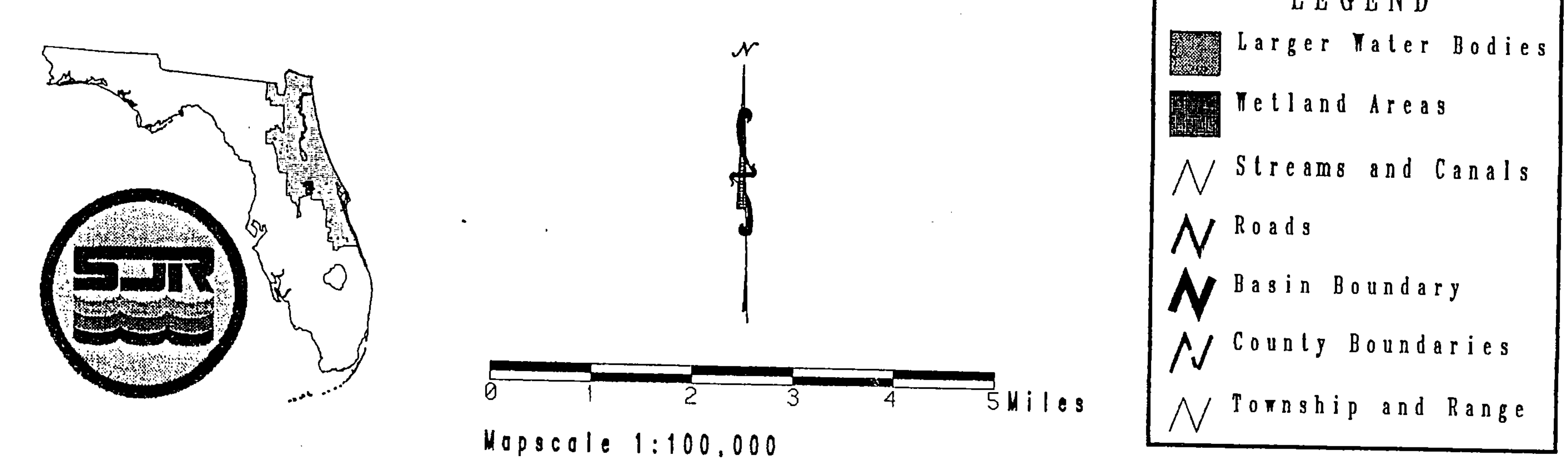
DRAINAGE AREAS FOR SELECTED STREAM SITES IN FLORIDA
ST. JOHNS RIVER
ST. JOHNS RIVER BASIN ABOVE OKLAWAHA RIVER

SITE NUMBER	NAME AND LOCATION	SITE TYPE	DRAINAGE AREA SQ.MI.	DRAINAGE AREA QUALIFIER	LAT DG/MI/SD	LONG DG/MI/SD	QUADRANGLE NAME	CNTY CODE
	HOWELL CREEK AT MOUTH	SW	53.0		28/42/03	81/15/08	CASSELBERRY	
02234384	SOLDIER CREEK NR LONGWOOD	SW	21.2		28/43/07	81/18/32	CASSELBERRY	117
02234400	GEE CREEK NR LONGWOOD	SW	12.8		28/42/13	81/17/27	CASSELBERRY	117
	GEE CREEK AT MOUTH	SW	13.5		28/42/55	81/17/25	CASSELBERRY	
	SOLDIER CREEK AT MOUTH	SW	36.8		28/42/58	81/17/23	CASSELBERRY	
02234435	ST JOHNS RIVER AT ST HWY 46 NR SANFORD	SW	2,445		28/47/09	81/10/50	OSTEEN	117
02234440	ST JOHNS RIVER ABOVE LAKE MONROE NR SANFORD	SW	2,456		28/48/08	81/12/41	OSTEEN	117
02234500	ST JOHNS RIVER NR SANFORD	SW	2,582		28/50/13	81/19/28	SANFORD	117
02234635	WEKIVA RIVER NR APOPKA	SW	58.3		28/42/48	81/26/44	FOREST CITY	095
02234815	LAKE WEKIVA OUTLET NR MAITLAND	CN	13.4		28/36/10	81/25/38	ORLANDO WEST	095
02234945	LITTLE WEKIVA RIVER AT FOREST CITY	SW	73.8		28/39/42	81/24/37	FOREST CITY	117
02234947	LITTLE WEKIVA RIVER AT STATE HIGHWAY 436 AT FOR	SW	73.9		28/39/46	81/24/38	FOREST CITY	117
02234988	CRANES ROOST AT ALTAMONTE SPRINGS	OT	2.89		28/39/57	81/23/18	FOREST CITY	117
02234990	LITTLE WEKIVA RIVER NR ALTAMONTE SPRINGS	SW	90.7		28/41/13	81/23/50	FOREST CITY	117
	LITTLE WEKIVA-RIVER AT MOUTH	SW	102		28/45/20	81/24/59	SANFORD SW	
02235000	WEKIVA RIVER NR SANFORD	SW	189		28/46/54	81/25/10	SANFORD SW	117
02235155	BLACK WATER CREEK NR ALTOONA	SW	32.5		28/57/37	81/34/48	PAISLEY	069
02235200	BLACK WATER CREEK NR CASSIA	SW	126		28/52/37	81/29/21	PINE LAKES	069
	BLACK WATER CREEK AT MOUTH	SW	196		28/52/05	81/22/53	SANFORD SW	
	WEKIVA RIVER AT MOUTH	SW	396		28/52/36	81/22/01	ORANGE CITY	
02236000	ST JOHNS RIVER NR DELAND	SW	3,066		29/00/29	81/22/58	LAKE WOODRUFF	069
02236010	ST JOHNS RIVER AT ST FRANCIS LANDING NR DE LAND	SW	3,072		29/02/14	81/25/05	LAKE WOODRUFF	069
02236120	DEEP CREEK NR BARBERVILLE	SW	35.4		29/09/47	81/23/27	PIERSON	127
02236125	ST JOHNS RIVER AT ASTOR	SW	3,330		29/10/00	81/31/20	ASTOR	069
02236157	PRICE CREEK NR PIERSON	SW	6.21	NONCONTR	29/16/41	81/28/36	SEVILLE	127
	ST JOHNS RIVER ABOVE OKLAWAHA RIVER	SW	3,753		29/28/10	81/41/10		



UPPER WEKIVA RIVER BASIN

Basin Area = 176.17 Sq. Mi.



EXISTING 252-FOOT BRIDGE

WSPRO INPUT & OUTPUT

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T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS      FILE:SR46E
T2        EXISTING 252-FOOT BRIDGE                   REVISED:10/12/94
T3
*
* ---------------------------------------------------------------
J1        0.1 , 0.05 , 0.05 , 1.0
*
*         Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
J3        5    6     3      17     13    14    16   28
*
*         10 yr   25 yr   50 yr   100 yr   500 yr
WS        8.3     9.4     10.1    10.8     12.3
Q         1330    1595    1790    1980     2420
* ---------------------------------------------------------------
XS   32+50 0
GR        0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
GR        668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
GR        900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
GR        1300,21.6
N         0.08     0.035     0.08     0.035     0.08
SA             586       682        825        947
*
XS   30+25 225
GR        0,23.1  200,20  248,19  250,19.8  440,19.7  461,18.1  475,19.5
GR        500,18.9  520,19  525,12.2   550,18   600,17.7  608,16.8
GR        615,17.6  675,1.9  700,1.9  728,2.8  750,5.2  775,5  825,2.8
GR        900,17.8  925,17  950,19.4  975,19.1  1000,20.2  1300,23.3
N         0.08   0.035   0.08
SA            615      900
*
*          BRIDGE SECTION
*
BR   30+00 250     17.4
GR        628,17.4   628,15.4  633,15  645,10  650,7.3  675,0.7
GR        725,1.7  750,3.6   775,4.3   800,2.4   825,2.4   874,17.4
GR        628,17.4
*
*        BRTYPE    BRWDTH    EMBSS    EMBELV
CD          3        34.3       3        20.5
*
PW 1      2,14  6,14  6,10.5  15.4,10.5  15.4,14
*
N         0.025   0.035   0.025
SA            648      847
*
*         APPROACH SECTION
*
AS   29+75 275
GR        0,24.3  220,20  300,19.5  313,19  400,19.3  500,19.8  550,17.8
GR        575,17.8  622,15.5   652,5  675,1.5  700,1  725,-0.6  775,3.8
GR        800,3.4  825,1.8  878,15.2  892,15  900,17.8  910,16  925,19.7
GR        965,19  975,19.8  1000,19.6  1058,20  1300,23.53
N         0.08    0.035    0.08
SA             643       855
*
*
XS   28+68 382
GR        43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
GR        796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
GR        1055,9  1125,11  1169,13  1181,14  1300,19.8
N         0.08   0.035   0.08
SA            636      982
*
XS   27+50 500
GR        122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
GR        600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
GR        1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
GR        1240,16.8  1300,19.1  1325,20
N         0.08   0.035   0.08
SA            652     1035
*
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XS    25+00 750
GR          45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
GR          354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
GR          800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
GR          1164,8  1184,9  1200,10  1270,15
N           0.08   0.035   0.08
SA              575       1164
*
EX
ER
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
P060188              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          *** RUN DATE & TIME: 10-13-94  08:21

  T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS      FILE:SR46E
  T2        EXISTING 252-FOOT BRIDGE                   REVISED:10/12/94
  T3
  * ---------------------------------------------------------------
  J1        0.1 , 0.05 , 0.05 , 1.0

J1 RECORD PARAMETERS:
DELTAY =  .10   YTOL =  .05   QTOL =  .05   FNTEST = 1.00   IHFNOJ = -1

  *
  *         Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
  J3        5    6     3      17     13    14   16   28
  *
  *         10 yr   25 yr   50 yr   100 yr   500 yr
  WS        8.3     9.4     10.1    10.8     12.3
  Q         1330    1595    1790    1980     2420
*** Q-DATA FOR SEC-ID, ISEQ =           1
  * ---------------------------------------------------------------

          *** RUN DATE & TIME: 10-13-94  08:21

*** START PROCESSING CROSS SECTION - "32+50"
  XS   32+50 0
  GR        0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
  GR        668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
  GR        900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
  GR        1300,21.6
  N         0.08     0.035     0.08     0.035     0.08
  SA             586       682        825        947
  *

*** FINISH PROCESSING CROSS SECTION - "32+50"
*** CROSS SECTION "32+50" WRITTEN TO DISK, RECORD NO. =  1

--- DATA SUMMARY FOR SECID "32+50" AT SRD =       0.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  20):
       X       Y          X       Y          X        Y          X        Y
      .0   18.80      100.0   13.40      200.0   10.00      400.0    7.20
   520.0    8.00      586.0    7.00      650.0    2.50      668.0    2.20
   682.0    6.80      720.0    7.90      825.0    7.90      850.0    2.70
   878.0    5.60      900.0    5.00      947.0    7.70     1000.0    8.00
  1040.0    8.30     1120.0   12.10     1190.0   18.70     1300.0   21.60

 X-Y MAX-MIN POINTS:
     XMIN       Y          X     YMIN      XMAX       Y          X    YMAX
       .0   18.80      668.0     2.20    1300.0   21.60     1300.0   21.60

SUBAREA BREAKPOINTS (NSA =  5):
       586.    682.    825.    947.

ROUGHNESS COEFFICIENTS (NSA =  5):
       .080    .035    .080    .035    .080
*** START PROCESSING CROSS SECTION - "30+25"
  XS   30+25 225
  GR        0,23.1  200,20  248,19  250,19.8  440,19.7  461,18.1  475,19.5
  GR        500,18.9  520,19  525,12.2   550,18   600,17.7  608,16.8
  GR        615,17.6  675,1.9  700,1.9  728,2.8  750,5.2  775,5  825,2.8
  GR        900,17.8  925,17  950,19.4  975,19.1  1000,20.2  1300,23.3
  N         0.08   0.035   0.08
  SA            615      900
  *
```

```
  *         BRIDGE SECTION
  *

*** FINISH PROCESSING CROSS SECTION - "30+25"
*** CROSS SECTION "30+25" WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "30+25" AT SRD =     225.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  26):
        X      Y           X      Y            X      Y            X      Y
       .0  23.10       200.0  20.00        248.0  19.00        250.0  19.80
    440.0  19.70       461.0  18.10        475.0  19.50        500.0  18.90
    520.0  19.00       525.0  12.20        550.0  18.00        600.0  17.70
    608.0  16.80       615.0  17.60        675.0   1.90        700.0   1.90
    728.0   2.80       750.0   5.20        775.0   5.00        825.0   2.80
    900.0  17.80       925.0  17.00        950.0  19.40        975.0  19.10
   1000.0  20.20      1300.0  23.30

 X-Y MAX-MIN POINTS:
     XMIN      Y           X   YMIN      XMAX      Y           X   YMAX
       .0  23.10       675.0   1.90    1300.0  23.30      1300.0  23.30

SUBAREA BREAKPOINTS (NSA =  3):
       615.    900.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080
*** START PROCESSING CROSS SECTION - "30+00"
  BR   30+00 250    17.4
  GR         628,17.4   628,15.4  633,15   645,10   650,7.3  675,0.7
  GR         725,1.7  750,3.6   775,4.3   800,2.4   825,2.4   874,17.4
  GR         628,17.4
  *
  *         BRTYPE    BRWDTH    EMBSS    EMBELV
  CD           3        34.3       3       20.5
  *
  PW 1      2,14  6,14  6,10.5  15.4,10.5  15.4,14
  *
  N         0.025   0.035   0.025
  SA            648      847
  *
  *         APPROACH SECTION
  *

*** FINISH PROCESSING CROSS SECTION - "30+00"
*** CROSS SECTION "30+00" WRITTEN TO DISK, RECORD NO. =  3

--- DATA SUMMARY FOR SECID "30+00" AT SRD =     250.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  13):
        X      Y           X      Y            X      Y            X      Y
    628.0  17.40       628.0  15.40        633.0  15.00        645.0  10.00
    650.0   7.30       675.0    .70        725.0   1.70        750.0   3.60
    775.0   4.30       800.0   2.40        825.0   2.40        874.0  17.40
    628.0  17.40

 X-Y MAX-MIN POINTS:
     XMIN      Y           X   YMIN      XMAX      Y           X   YMAX
    628.0  17.40       675.0    .70     874.0  17.40       628.0  17.40

SUBAREA BREAKPOINTS (NSA =  3):
       648.    847.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025    .035    .025
```

```
BRIDGE PARAMETERS:
 BRTYPE  BRWDTH     LSEL  USERCD  EMBSS    EMBELV  ABSLPL  ABSLPR
    3     34.3     17.40 *******  3.00     20.50 ******* *******

PIER DATA:  NPW =  5    PPCD = 1.
     PELV  PWDTH       PELV  PWDTH       PELV  PWDTH       PELV  PWDTH
      2.00  14.0        6.00  14.0        6.00  10.5       15.40  10.5
     15.40  14.0

*** START PROCESSING CROSS SECTION - "29+75"
  AS   29+75 275
  GR          0,24.3  220,20  300,19.5  313,19  400,19.3  500,19.8  550,17.8
  GR          575,17.8  622,15.5   652,5  675,1.5  700,1  725,-0.6  775,3.8
  GR          800,3.4  825,1.8  878,15.2  892,15  900,17.8  910,16  925,19.7
  GR          965,19  975,19.8  1000,19.6  1058,20  1300,23.53
  N           0.08    0.035    0.08
  SA               643       855
  *
  *

*** FINISH PROCESSING CROSS SECTION - "29+75"
*** CROSS SECTION "29+75" WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "29+75" AT SRD =     275.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  26):
       X        Y          X       Y           X        Y          X        Y
       .0    24.30      220.0   20.00       300.0    19.50      313.0    19.00
    400.0    19.30      500.0   19.80       550.0    17.80      575.0    17.80
    622.0    15.50      652.0    5.00       675.0     1.50      700.0     1.00
    725.0     -.60      775.0    3.80       800.0     3.40      825.0     1.80
    878.0    15.20      892.0   15.00       900.0    17.80      910.0    16.00
    925.0    19.70      965.0   19.00       975.0    19.80     1000.0    19.60
   1058.0    20.00     1300.0   23.53

 X-Y MAX-MIN POINTS:
     XMIN       Y          X     YMIN      XMAX        Y            X     YMAX
       .0   24.30      725.0     -.60    1300.0    23.53           .0    24.30

SUBAREA BREAKPOINTS (NSA =  3):
        643.    855.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

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

*** START PROCESSING CROSS SECTION - "28+68"
  XS   28+68 382
  GR          43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
  GR          796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
  GR          1055,9  1125,11  1169,13  1181,14  1300,19.8
  N           0.08   0.035   0.08
  SA               636      982
  *

*** FINISH PROCESSING CROSS SECTION - "28+68"
*** CROSS SECTION "28+68" WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "28+68" AT SRD =     382.  ERR-CODE =       0

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

```
X-Y COORDINATE PAIRS  (NGP =  21):
       X       Y          X       Y          X       Y          X       Y
     43.0   21.00      147.0   17.00      238.0   12.00      290.0   10.00
    418.0    8.00      500.0    7.60      636.0    7.00      672.0    4.00
    796.0    4.00      812.0    3.00      822.0    2.00      854.0    2.00
    874.0    4.00      950.0    5.00      982.0    8.00     1000.0    8.30
   1055.0    9.00     1125.0   11.00     1169.0   13.00     1181.0   14.00
   1300.0   19.80

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
     43.0   21.00      822.0    2.00     1300.0   19.80       43.0   21.00

SUBAREA BREAKPOINTS (NSA =  3):
        636.    982.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080     .035     .080

*** START PROCESSING CROSS SECTION - "27+50"
  XS   27+50 500
  GR         122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
  GR         600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
  GR         1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
  GR         1240,16.8  1300,19.1  1325,20
  N          0.08   0.035   0.08
  SA             652     1035
  *
 *** FINISH PROCESSING CROSS SECTION - "27+50"
*** CROSS SECTION "27+50" WRITTEN TO DISK, RECORD NO. =  6

--- DATA SUMMARY FOR SECID "27+50" AT SRD =     500.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  21):
       X       Y          X       Y          X       Y          X       Y
    122.0   20.00      230.0   15.00      332.0   10.00      400.0    8.50
    500.0    7.70      562.0    7.80      600.0    7.10      652.0    7.50
    745.0    3.40      800.0    2.00      900.0    2.40      955.0    5.00
   1000.0    6.70     1050.0    7.80     1130.0    8.30     1163.0   10.00
   1200.0   12.00     1225.0   15.00     1240.0   16.80     1300.0   19.10
   1325.0   20.00

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
    122.0   20.00      800.0    2.00     1325.0   20.00      122.0   20.00

SUBAREA BREAKPOINTS (NSA =  3):
        652.   1035.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080     .035     .080
*** START PROCESSING CROSS SECTION - "25+00"
  XS   25+00 750
  GR         45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
  GR         354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
  GR         800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
  GR         1164,8  1184,9  1200,10  1270,15
  N          0.08   0.035   0.08
  SA             575      1164
  *
  EX
 *** FINISH PROCESSING CROSS SECTION - "25+00"
*** CROSS SECTION "25+00" WRITTEN TO DISK, RECORD NO. =  7

--- DATA SUMMARY FOR SECID "25+00" AT SRD =     750.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS (NGP = 26):

X	Y	X	Y	X	Y	X	Y
45.0	20.00	70.0	19.00	98.0	18.00	118.0	17.00
148.0	16.00	178.0	15.00	211.0	14.00	268.0	13.00
354.0	12.00	388.0	11.00	432.0	10.00	500.0	8.90
575.0	8.00	600.0	8.00	700.0	7.50	800.0	7.10
837.0	7.00	888.0	6.00	960.0	5.00	1000.0	5.50
1046.0	6.00	1127.0	7.00	1164.0	8.00	1184.0	9.00
1200.0	10.00	1270.0	15.00				

X-Y MAX-MIN POINTS:

XMIN	Y	X	YMIN	XMAX	Y	X	YMAX
45.0	20.00	960.0	5.00	1270.0	15.00	45.0	20.00

SUBAREA BREAKPOINTS (NSA = 3):
575. 1164.

ROUGHNESS COEFFICIENTS (NSA = 3):
.080 .035 .080

```
+++ BEGINNING PROFILE CALCULATIONS --   5

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

 32+50:XS   ******  321.    1024.    .05 *****    8.35    5.48    1330.    8.30
        0. ****** 1040.   75182.   1.72 ***** *******      .25     1.30

 30+25:FV     225.  650.     885.    .04    .05    8.39 *******   1330.    8.35
      225.    225.  853.  100263.   1.00    .00    -.01     .13     1.50
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "29+75"     KRATIO =   1.65

 29+75:AS      50.  642.    1210.    .02    .01    8.42 *******   1330.    8.40
      275.     50.  851.  165489.   1.00    .00     .03     .08     1.10
         <<<<<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

 30+00:BR     225.  648.    1053.    .02    .04    8.38    3.67    1330.    8.36
      250.    225.  844.  136331.   1.00    .00     .01     .10     1.26

      TYPE PPCD FLOW      C     P/A    LSEL   BLEN   XLAB   XRAB
        3.   1.   1.  1.000   .077   17.40 ****** ****** ******

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

 29+75:AS      16.  642.    1204.    .02    .00    8.39    2.82    1330.    8.37
      275.     18.  851.  164285.   1.00    .01    -.03     .08     1.10

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .060   .000  168977.   651.   847.    8.37

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

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

 28+68:XS     107.   391.   1681.    .01    .01    8.44 *******   1330.    8.42
      382.    107.  1010. 166730.   1.23    .00     .04     .09      .79

 27+50:XS     118.   403.   1884.    .01    .01    8.48 *******   1330.    8.47
      500.    118.  1133. 190177.   1.23    .00     .04     .09      .71

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"     KRATIO =    .35

 25+00:XS     250.   531.   1063.    .02    .04    8.55 *******   1330.    8.52
      750.    250.  1174.  65658.   1.02    .01     .02     .17     1.25


10 YEAR          FIRST USER DEFINED TABLE.

   XSID:CODE        Q     SRD    WSEL      AREA     VEL     FR#        K   XSTW
   32+50:XS     1330.      0.    8.30     1024.    1.30     .25   75182.   719.
   30+25:FV     1330.    225.    8.35      885.    1.50     .13  100263.   202.
   30+00:BR     1330.    250.    8.36     1053.    1.26     .10  136331.   196.
   29+75:AS     1330.    275.    8.37     1204.    1.10     .08  164285.   209.
   28+68:XS     1330.    382.    8.42     1681.     .79     .09  166730.   619.
   27+50:XS     1330.    500.    8.47     1884.     .71     .09  190177.   730.
   25+00:XS     1330.    750.    8.52     1063.    1.25     .17   65658.   643.
```

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

32+50:XS   ******   243.    1871.   .03 *****    9.43    5.77   1595.    9.40
      0. ******   1063.  135139.  2.23 ***** *******     .15     .85

30+25:FV     225.   646.    1113.   .03   .03    9.48 *******   1595.    9.45
    225.     225.   858.  142303.  1.00   .00     .02     .11    1.43
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "29+75"     KRATIO =  1.54

29+75:AS      50.   639.    1444.   .02   .00    9.52 *******   1595.    9.50
    275.      50.   855.  218767.  1.00   .00     .03     .08    1.10
          <<<<<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

30+00:BR     225.   646.    1265.   .02   .02    9.45    3.90   1595.    9.42
    250.     225.   848.  183184.  1.00   .00     .00     .09    1.26

     TYPE PPCD FLOW      C    P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  1.000   .073   17.40 ****** ****** ******

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

29+75:AS      16.   639.    1430.   .02   .00    9.45    3.06   1595.    9.44
    275.      17.   855.  215298.  1.00   .01     .00     .08    1.12

       M(G)   M(K)        KQ   XLKQ   XRKQ    OTEL
       .066   .000   219129.   648.   849.    9.43

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

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

28+68:XS     107.   323.    2413.   .01   .01    9.50 *******   1595.    9.49
    382.     107.  1072.  251097.  1.46   .00     .04     .08     .66

27+50:XS     118.   353.    2698.   .01   .00    9.54 *******   1595.    9.54
    500.     118.  1154.  285243.  1.45   .00     .04     .07     .59

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "25+00"     KRATIO =   .51

25+00:XS     250.   458.    1798.   .01   .02    9.60 *******   1595.    9.59
    750.     250.  1193.  145023.  1.11   .00     .04     .11     .89
```

25 YEAR   FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1595.	0.	9.40	1871.	.85	.15	135139.	820.
30+25:FV	1595.	225.	9.45	1113.	1.43	.11	142303.	212.
30+00:BR	1595.	250.	9.42	1265.	1.26	.09	183184.	202.
29+75:AS	1595.	275.	9.44	1430.	1.12	.08	215298.	216.
28+68:XS	1595.	382.	9.49	2413.	.66	.08	251097.	749.
27+50:XS	1595.	500.	9.54	2698.	.59	.07	285243.	801.
25+00:XS	1595.	750.	9.59	1798.	.89	.11	145023.	736.

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

32+50:XS   ******   197.    2467.   .02 *****   10.12    5.91   1790.   10.10
        0. ******  1078.  184097.  2.36 ***** *******     .12     .73

30+25:FV     225.   643.    1264.   .03    .02   10.18 *******   1790.   10.15
      225.   225.   862.  172437.  1.00    .01     .03     .10    1.42
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "29+75"      KRATIO =   1.49

29+75:AS      50.   637.    1597.   .02    .00   10.22 *******   1790.   10.20
      275.    50.   858.  257670.  1.01    .00     .03     .07    1.12
         <<<<<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

30+00:BR     225.   645.    1405.   .03    .02   10.14    4.07   1790.   10.11
      250.   225.   850.  217637.  1.00    .00     .00     .09    1.27

     TYPE PPCD FLOW      C    P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  1.000   .071   17.40 ****** ****** ******

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

29+75:AS      16.   637.    1580.   .02    .00   10.14    3.21   1790.   10.12
      275.    17.   858.  253277.  1.01    .00     .00     .07    1.13

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .070   .000  255577.   646.   851.   10.12

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

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

28+68:XS     107.   285.    2951.   .01    .00   10.18 *******   1790.   10.17
      382.   107.  1096.  315999.  1.58    .00     .03     .07     .61

27+50:XS     118.   327.    3264.   .01    .00   10.23 *******   1790.   10.22
      500.   118.  1167.  357642.  1.54    .00     .04     .06     .55

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "25+00"      KRATIO =    .59

25+00:XS     250.   420.    2322.   .01    .01   10.28 *******   1790.   10.27
      750.   250.  1204.  210417.  1.16    .00     .04     .08     .77
```

50 YEAR   FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1790.	0.	10.10	2467.	.73	.12	184097.	881.
30+25:FV	1790.	225.	10.15	1264.	1.42	.10	172437.	218.
30+00:BR	1790.	250.	10.11	1405.	1.27	.09	217637.	205.
29+75:AS	1790.	275.	10.12	1580.	1.13	.07	253277.	221.
28+68:XS	1790.	382.	10.17	2951.	.61	.07	315999.	811.
27+50:XS	1790.	500.	10.22	3264.	.55	.06	357642.	840.
25+00:XS	1790.	750.	10.27	2322.	.77	.08	210417.	784.

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

32+50:XS  ******   176.    3096.    .02 *****   10.82    6.06   1980.   10.80
        0. ******  1093.  241951.  2.40 ***** *******     .09     .64

30+25:FV    225.   641.    1419.    .03    .02  10.88 *******   1980.   10.85
      225.  225.   865.  205180.  1.00    .01     .04     .10    1.40
       <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "29+75"      KRATIO =   1.46

29+75:AS     50.   635.    1753.    .02    .00  10.92 *******   1980.   10.90
      275.   50.   861.  299167.  1.01    .00     .04     .07    1.13
       <<<<<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

30+00:BR    225.   643.    1549.    .03    .01  10.83    4.23   1980.   10.81
      250.  225.   852.  254921.  1.00    .00     .00     .08    1.28

     TYPE PPCD FLOW      C     P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  1.000   .069   17.40 ****** ****** ******

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

29+75:AS     16.   635.    1734.    .02    .00  10.84    3.36   1980.   10.82
      275.   17.   861.  294089.  1.01    .00     .00     .07    1.14

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .072   .000  294816.   644.   853.    10.82

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

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

28+68:XS    107.   267.    3528.    .01    .00  10.87 *******   1980.   10.87
      382.  107.  1120.  390017.  1.67    .00     .03     .06     .56

27+50:XS    118.   313.    3855.    .01    .00  10.92 *******   1980.   10.92
      500.  118.  1180.  439164.  1.61    .00     .05     .05     .51

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"      KRATIO =    .65

25+00:XS    250.   389.    2879.    .01    .01  10.98 *******   1980.   10.97
      750.  250.  1214.  286921.  1.20    .00     .04     .07     .69


100 YEAR          FIRST USER DEFINED TABLE.

   XSID:CODE         Q     SRD    WSEL     AREA      VEL     FR#        K    XSTW
  32+50:XS       1980.      0.   10.80    3096.      .64     .09  241951.    916.
  30+25:FV       1980.    225.   10.85    1419.     1.40     .10  205180.    224.
  30+00:BR       1980.    250.   10.81    1549.     1.28     .08  254921.    209.
  29+75:AS       1980.    275.   10.82    1734.     1.14     .07  294089.    225.
  28+68:XS       1980.    382.   10.87    3528.      .56     .06  390017.    853.
  27+50:XS       1980.    500.   10.92    3855.      .51     .05  439164.    867.
  25+00:XS       1980.    750.   10.97    2879.      .69     .07  286921.    824.
```

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

32+50:XS   ******   132.    4527.    .01 *****    12.31     6.30   2420.    12.30
        0. ******  1122.  391850.   2.40 ***** *******       .07     .53

30+25:FV     225.   525.    1765.    .03    .01   12.38 *******   2420.    12.35
      225.   225.   873.  284119.   1.00    .01     .05      .09    1.37
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS      50.   631.    2100.    .02    .00   12.42 *******   2420.    12.40
      275.    50.   867.  396651.   1.03    .00     .04      .07    1.15
          <<<<<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

30+00:BR     225.   639.    1868.    .03    .01   12.32     4.50   2420.    12.30
      250.   225.   857.  343836.   1.00    .00     .00      .08    1.30

      TYPE PPCD FLOW       C     P/A     LSEL    BLEN    XLAB    XRAB
        3.   1.   1.   1.000    .065    17.40 ****** ****** ******

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

29+75:AS      16.   631.    2078.    .02    .00   12.33     3.75   2420.    12.31
      275.    16.   867.  390246.   1.03    .00     .00      .07    1.16

        M(G)   M(K)       KQ    XLKQ   XRKQ    OTEL
        .076   .001  389880.   640.   857.    12.31

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

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                  "28+68"     KRATIO =  1.48

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

28+68:XS     107.   232.    4854.    .01    .00   12.36 *******   2420.    12.36
      382.   107.  1155.  576002.   1.81    .00     .03      .05     .50

27+50:XS     118.   283.    5189.    .01    .00   12.41 *******   2420.    12.41
      500.   118.  1203.  641207.   1.72    .00     .05      .05     .47

25+00:XS     250.   315.    4166.    .01    .00   12.46 *******   2420.    12.46
      750.   250.  1234.  484719.   1.30    .00     .05      .05     .58


500 YEAR          FIRST USER DEFINED TABLE.

    XSID:CODE       Q     SRD    WSEL     AREA      VEL      FR#        K    XSTW
   32+50:XS     2420.      0.   12.30    4527.      .53      .07  391850.    990.
   30+25:FV     2420.    225.   12.35    1765.     1.37      .09  284119.    238.
   30+00:BR     2420.    250.   12.30    1868.     1.30      .08  343836.    218.
   29+75:AS     2420.    275.   12.31    2078.     1.16      .07  390246.    235.
   28+68:XS     2420.    382.   12.36    4854.      .50      .05  576002.    923.
   27+50:XS     2420.    500.   12.41    5189.      .47      .05  641207.    920.
   25+00:XS     2420.    750.   12.46    4166.      .58      .05  484719.    920.
  ER

1  NORMAL  END  OF  WSPRO  EXECUTION.
```

PROPOSED 561-FOOT DUAL BRIDGES

WSPRO INPUT & OUTPUT

```
T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS      FILE:SR46PROR
T2        PROPOSED 561-FOOT DUAL BRIDGES             REVISED:10/12/94
T3
*
* ------------------------------------------------------------------
J1        0.1 , 0.05 , 0.05 , 1.0
*
*         Q    SRD    WSEL    AREA    VEL    FR#    K    XSTW
J3        5    6      3       17      13     14     16   28
*
*         10 yr    25 yr    50 yr    100 yr    500 yr
WS        8.3      9.4      10.1     10.8      12.3
Q         1330     1595     1790     1980      2420
* ------------------------------------------------------------------
XS    32+50 0
GR         0,18.8    100,13.4    200,10    400,7.2    520,8    586,7    650,2.5
GR         668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
GR         900,5    947,7.7    1000,8.0    1040,8.3    1120,12.1    1190,18.7
GR         1300,21.6
N          0.08     0.035     0.08     0.035     0.08
SA              586        682         825         947
*
XS    30+25 225
GR         437,16.65  439,16.65  442,15   456,8    648,8    675,1.9
GR         700,1.9   725,2.8   775,5   800,3.6   825,2.8   848,8
GR         972,8    993,18.5    996,19.725  998,19.725
N          0.025     0.035     0.025
SA             648        848
*
*         PROPOSED BRIDGE SECTION
*
BR    30+00 250     16.65
GR         437,20.846  437,16.65    439,16.65    442,15   456,8
GR         648,8    675,0.8    725,1.8    750,3.7    775,4.3    800,2.4
GR         825,2.4    847,8    972,8    993,18.5    996,19.725   998,19.725
GR         998,23.932  437,20.846
*
*         BRTYPE    BRWDTH    EMBSS    EMBELV
CD          3         104       2       20.846
*
PW 1      2,12
*
N         0.025   0.035   0.025
SA            648      847
*
*         APPROACH SECTION
*
AS    29+75 275
GR         437,16.65  439,16.65   442,15  456,8  643,8  675,1.5
GR         700,1    725,-0.6    750,2.3    775,3.8    800,3.4    825,1.8
GR         855,8  972,8  993,18.5  996,19.725  998,19.725
N          0.025     0.035     0.025
SA              643        855
*
*
XS    28+68 382
GR         43,21   147,17   238,12   290,10   418,8   500,7.6   636,7    672,4
GR         796,4   812,3    822,2    854,2    874,4   950,5   982,8   1000,8.3
GR         1055,9   1125,11   1169,13   1181,14   1300,19.8
N          0.08    0.035    0.08
SA             636       982
*
XS    27+50 500
GR         122,20    230,15    332,10    400,8.5    500,7.7    562,7.8
GR         600,7.1   652,7.5   745,3.4    800,2     900,2.4    955,5
GR         1000,6.7   1050,7.8   1130,8.3   1163,10   1200,12   1225,15
GR         1240,16.8   1300,19.1   1325,20
N          0.08    0.035    0.08
SA             652      1035
*
```

```
XS    25+00 750
GR          45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
GR          354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
GR          800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
GR          1164,8  1184,9  1200,10  1270,15
N           0.08   0.035   0.08
SA              575      1164
*
EX
ER
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WSPRO           FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
P060188              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          *** RUN DATE & TIME: 10-12-94  15:52

  T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS      FILE:SR46PRO
  T2        PROPOSED 561-FOOT DUAL BRIDGES             REVISED:10/12/94
  T3
  * ---------------------------------------------------------------------
  J1        0.1 , 0.05 , 0.05 , 1.0

 J1 RECORD PARAMETERS:
 DELTAY =  .10   YTOL =  .05   QTOL =  .05   FNTEST = 1.00   IHFNOJ = -1

  *
  *         Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
  J3        5    6     3      17     13    14   16   28
  *
  *         10 yr   25 yr   50 yr   100 yr   500 yr
  WS        8.3     9.4     10.1    10.8     12.3
  Q         1330    1595    1790    1980     2420
*** Q-DATA FOR SEC-ID, ISEQ =          1
  * ---------------------------------------------------------------------

*** START PROCESSING CROSS SECTION - "32+50"
  XS   32+50 0
  GR        0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
  GR        668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
  GR        900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
  GR        1300,21.6
  N         0.08     0.035     0.08     0.035     0.08
  SA             586       682        825        947
  *

*** FINISH PROCESSING CROSS SECTION - "32+50"
*** CROSS SECTION "32+50" WRITTEN TO DISK, RECORD NO. =  1

--- DATA SUMMARY FOR SECID "32+50" AT SRD =      0.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  20):
       X       Y          X       Y           X       Y          X       Y
      .0   18.80      100.0   13.40       200.0   10.00      400.0    7.20
   520.0    8.00      586.0    7.00       650.0    2.50      668.0    2.20
   682.0    6.80      720.0    7.90       825.0    7.90      850.0    2.70
   878.0    5.60      900.0    5.00       947.0    7.70     1000.0    8.00
  1040.0    8.30     1120.0   12.10      1190.0   18.70     1300.0   21.60

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
      .0   18.80      668.0    2.20     1300.0   21.60     1300.0   21.60

SUBAREA BREAKPOINTS (NSA =  5):
       586.    682.    825.    947.

ROUGHNESS COEFFICIENTS (NSA =  5):
        .080    .035    .080    .035    .080

*** START PROCESSING CROSS SECTION - "30+25"
  XS   30+25 225
  GR        437,16.65  439,16.65  442,15   456,8   648,8   675,1.9
  GR        700,1.9   725,2.8   775,5   800,3.6   825,2.8   848,8
  GR        972,8   993,18.5   996,19.725  998,19.725
  N         0.025    0.035    0.025
  SA            648        848
  *
  *        PROPOSED BRIDGE SECTION
  *
```

```
*** FINISH PROCESSING CROSS SECTION - "30+25"
*** CROSS SECTION "30+25" WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "30+25" AT SRD =     225.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  16):
       X       Y          X       Y          X       Y          X       Y
    437.0   16.65      439.0   16.65      442.0   15.00      456.0    8.00
    648.0    8.00      675.0    1.90      700.0    1.90      725.0    2.80
    775.0    5.00      800.0    3.60      825.0    2.80      848.0    8.00
    972.0    8.00      993.0   18.50      996.0   19.73      998.0   19.73

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
    437.0   16.65      675.0    1.90      998.0   19.73      996.0   19.73

SUBAREA BREAKPOINTS (NSA =  3):
        648.    848.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025     .035     .025

*** START PROCESSING CROSS SECTION - "30+00"
  BR    30+00 250     16.65
  GR          437,20.846  437,16.65   439,16.65   442,15  456,8
  GR          648,8   675,0.8   725,1.8   750,3.7   775,4.3   800,2.4
  GR          825,2.4   847,8   972,8   993,18.5   996,19.725  998,19.725
  GR          998,23.932  437,20.846
  *
  *         BRTYPE    BRWDTH    EMBSS    EMBELV
  CD           3        104       2       20.846
  *
  PW 1        2,12
  *
  N          0.025   0.035   0.025
  SA              648      847
  *
  *         APPROACH SECTION
  *
 *** FINISH PROCESSING CROSS SECTION - "30+00"
*** CROSS SECTION "30+00" WRITTEN TO DISK, RECORD NO. =  3

--- DATA SUMMARY FOR SECID "30+00" AT SRD =     250.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  19):
       X       Y          X       Y          X       Y          X       Y
    437.0   20.85      437.0   16.65      439.0   16.65      442.0   15.00
    456.0    8.00      648.0    8.00      675.0     .80      725.0    1.80
    750.0    3.70      775.0    4.30      800.0    2.40      825.0    2.40
    847.0    8.00      972.0    8.00      993.0   18.50      996.0   19.73
    998.0   19.73      998.0   23.93      437.0   20.85

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
    437.0   20.85      675.0     .80      998.0   19.73      998.0   23.93

SUBAREA BREAKPOINTS (NSA =  3):
        648.    847.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025     .035     .025

BRIDGE PARAMETERS:
 BRTYPE  BRWDTH     LSEL  USERCD  EMBSS    EMBELV  ABSLPL  ABSLPR
    3     104.0    16.65 *******   2.00     20.85 ******* *******
```

```
PIER DATA:  NPW =  1    PPCD = 1.
     PELV  PWDTH      PELV  PWDTH      PELV  PWDTH      PELV  PWDTH
      2.00  12.0

*** START PROCESSING CROSS SECTION - "29+75"
  AS   29+75 275
  GR         437,16.65  439,16.65   442,15  456,8  643,8  675,1.5
  GR         700,1   725,-0.6   750,2.3   775,3.8   800,3.4   825,1.8
  GR         855,8  972,8  993,18.5  996,19.725  998,19.725
  N          0.025    0.035    0.025
  SA              643       855
  *
  *

*** FINISH PROCESSING CROSS SECTION - "29+75"
*** CROSS SECTION "29+75" WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "29+75" AT SRD =     275.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  17):
       X        Y          X        Y          X        Y          X        Y
    437.0    16.65      439.0    16.65      442.0    15.00      456.0     8.00
    643.0     8.00      675.0     1.50      700.0     1.00      725.0     -.60
    750.0     2.30      775.0     3.80      800.0     3.40      825.0     1.80
    855.0     8.00      972.0     8.00      993.0    18.50      996.0    19.73
    998.0    19.73

 X-Y MAX-MIN POINTS:
     XMIN        Y          X     YMIN       XMAX        Y          X     YMAX
    437.0    16.65      725.0     -.60      998.0    19.73      996.0    19.73

SUBAREA BREAKPOINTS (NSA =  3):
       643.   855.

ROUGHNESS COEFFICIENTS (NSA =  3):
        .025    .035    .025

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

*** START PROCESSING CROSS SECTION - "28+68"
  XS   28+68 382
  GR         43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
  GR         796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
  GR         1055,9  1125,11  1169,13  1181,14  1300,19.8
  N          0.08   0.035   0.08
  SA              636      982
  *

*** FINISH PROCESSING CROSS SECTION - "28+68"
*** CROSS SECTION "28+68" WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "28+68" AT SRD =     382.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  21):
       X        Y          X        Y          X        Y          X        Y
     43.0    21.00      147.0    17.00      238.0    12.00      290.0    10.00
    418.0     8.00      500.0     7.60      636.0     7.00      672.0     4.00
    796.0     4.00      812.0     3.00      822.0     2.00      854.0     2.00
    874.0     4.00      950.0     5.00      982.0     8.00     1000.0     8.30
   1055.0     9.00     1125.0    11.00     1169.0    13.00     1181.0    14.00
   1300.0    19.80
```

```
X-Y MAX-MIN POINTS:
     XMIN        Y          X    YMIN      XMAX        Y          X    YMAX
     43.0    21.00      822.0    2.00    1300.0    19.80       43.0   21.00

SUBAREA BREAKPOINTS (NSA =  3):
        636.    982.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "27+50"
  XS   27+50 500
  GR          122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
  GR          600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
  GR          1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
  GR          1240,16.8  1300,19.1  1325,20
  N           0.08   0.035   0.08
  SA              652     1035
  *

*** FINISH PROCESSING CROSS SECTION - "27+50"
*** CROSS SECTION "27+50" WRITTEN TO DISK, RECORD NO. =  6

--- DATA SUMMARY FOR SECID "27+50" AT SRD =     500.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  21):
       X        Y          X        Y          X        Y          X        Y
    122.0    20.00      230.0    15.00      332.0    10.00      400.0     8.50
    500.0     7.70      562.0     7.80      600.0     7.10      652.0     7.50
    745.0     3.40      800.0     2.00      900.0     2.40      955.0     5.00
   1000.0     6.70     1050.0     7.80     1130.0     8.30     1163.0    10.00
   1200.0    12.00     1225.0    15.00     1240.0    16.80     1300.0    19.10
   1325.0    20.00

 X-Y MAX-MIN POINTS:
     XMIN        Y          X    YMIN      XMAX        Y          X    YMAX
    122.0    20.00      800.0    2.00    1325.0    20.00      122.0   20.00

SUBAREA BREAKPOINTS (NSA =  3):
        652.    1035.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "25+00"
  XS   25+00 750
  GR          45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
  GR          354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
  GR          800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
  GR          1164,8  1184,9  1200,10  1270,15
  N           0.08   0.035   0.08
  SA              575      1164
  *
  EX

*** FINISH PROCESSING CROSS SECTION - "25+00"
*** CROSS SECTION "25+00" WRITTEN TO DISK, RECORD NO. =  7

--- DATA SUMMARY FOR SECID "25+00" AT SRD =     750.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS (NGP = 26):

X	Y	X	Y	X	Y	X	Y
45.0	20.00	70.0	19.00	98.0	18.00	118.0	17.00
148.0	16.00	178.0	15.00	211.0	14.00	268.0	13.00
354.0	12.00	388.0	11.00	432.0	10.00	500.0	8.90
575.0	8.00	600.0	8.00	700.0	7.50	800.0	7.10
837.0	7.00	888.0	6.00	960.0	5.00	1000.0	5.50
1046.0	6.00	1127.0	7.00	1164.0	8.00	1184.0	9.00
1200.0	10.00	1270.0	15.00				

X-Y MAX-MIN POINTS:

XMIN	Y	X	YMIN	XMAX	Y	X	YMAX
45.0	20.00	960.0	5.00	1270.0	15.00	45.0	20.00

SUBAREA BREAKPOINTS (NSA = 3):
575. 1164.

ROUGHNESS COEFFICIENTS (NSA = 3):
.080 .035 .080

```
+++ BEGINNING PROFILE CALCULATIONS --   5

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

 32+50:XS   ******   321.   1024.   .05 *****    8.35    5.48   1330.    8.30
       0. ******  1040.  75182.  1.72 ***** *******     .25    1.30

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "30+25"     KRATIO =   1.49

 30+25:FV     225.   455.   1034.   .03    .05    8.38 *******   1330.    8.35
      225.    225.   973.  111774.  1.15    .00    -.01     .17    1.29
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "29+75"     KRATIO =   1.47

 29+75:AS      50.   455.   1315.   .02    .00    8.42 *******   1330.    8.40
      275.     50.   973.  163819.  1.13    .00     .03     .12    1.01
          <<<<<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

 30+00:BR     225.   455.   1169.   .02    .04    8.38    3.74   1330.    8.36
      250.    225.   973.  138905.  1.01    .00     .01     .13    1.14

     TYPE PPCD FLOW      C     P/A     LSEL   BLEN   XLAB   XRAB
       3.   1.   1.   .997   .066    16.65 ****** ****** ******

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

 29+75:AS     -54.   455.   1305.   .02    .00    8.40    2.97   1330.    8.38
      275.     31.   973.  162538.  1.13    .01    -.02     .12    1.02

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  163798.   458.   975.    8.38

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

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

 28+68:XS     107.   390.   1685.   .01    .01    8.44 *******   1330.    8.43
      382.    107.  1010.  167185.  1.23    .00     .04     .09     .79

 27+50:XS     118.   403.   1889.   .01    .01    8.49 *******   1330.    8.48
      500.    118.  1133.  190687.  1.23    .00     .04     .09     .70

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"     KRATIO =    .35

 25+00:XS     250.   531.   1067.   .02    .04    8.55 *******   1330.    8.53
      750.    250.  1175.   66057.  1.02    .01     .02     .17    1.25
```

10 YEAR FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1330.	0.	8.30	1024.	1.30	.25	75182.	719.
30+25:FV	1330.	225.	8.35	1034.	1.29	.17	111774.	517.
30+00:BR	1330.	250.	8.36	1169.	1.14	.13	138905.	517.
29+75:AS	1330.	275.	8.38	1305.	1.02	.12	162538.	518.
28+68:XS	1330.	382.	8.43	1685.	.79	.09	167185.	620.
27+50:XS	1330.	500.	8.48	1889.	.70	.09	190687.	731.
25+00:XS	1330.	750.	8.53	1067.	1.25	.17	66057.	644.

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

32+50:XS    ******    243.     1871.    .03 *****     9.43     5.77    1595.     9.40
        0. ******    1063.   135139.   2.23 ***** *******       .15      .85

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "30+25"      KRATIO =   1.41

30+25:FV      225.    453.     1606.    .02     .02     9.47 *******   1595.     9.45
      225.    225.    975.   189964.   1.15     .00      .02      .11      .99
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS       50.    453.     1887.    .01     .00     9.51 *******   1595.     9.50
      275.     50.    975.   250970.   1.15     .00      .04      .08      .85
         <<<<<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

30+00:BR      225.    453.     1724.    .01     .02     9.44     3.97    1595.     9.43
      250.    225.    975.   218366.   1.00     .00      .00      .09      .93

     TYPE PPCD FLOW       C     P/A     LSEL    BLEN    XLAB    XRAB
       3.   1.   1.   1.000    .052    16.65 ****** ****** ******

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

29+75:AS      -54.    453.     1855.    .01     .00     9.45     3.17    1595.     9.44
      275.     33.    975.   245402.   1.16     .01      .00      .09      .86

       M(G)    M(K)         KQ    XLKQ    XRKQ     OTEL
       .000    .000  245444.    455.    977.      9.44

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

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

28+68:XS      107.    323.     2416.    .01     .00     9.50 *******   1595.     9.49
      382.    107.   1072.   251494.   1.46     .00      .04      .08      .66

27+50:XS      118.    353.     2702.    .01     .00     9.55 *******   1595.     9.54
      500.    118.   1154.   285688.   1.45     .00      .04      .07      .59

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "25+00"      KRATIO =    .51

25+00:XS      250.    457.     1801.    .01     .02     9.60 *******   1595.     9.59
      750.    250.   1193.   145416.   1.11     .00      .04      .10      .89
```

25 YEAR FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1595.	0.	9.40	1871.	.85	.15	135139.	820.
30+25:FV	1595.	225.	9.45	1606.	.99	.11	189964.	522.
30+00:BR	1595.	250.	9.43	1724.	.93	.09	218366.	522.
29+75:AS	1595.	275.	9.44	1855.	.86	.09	245402.	522.
28+68:XS	1595.	382.	9.49	2416.	.66	.08	251494.	749.
27+50:XS	1595.	500.	9.54	2702.	.59	.07	285688.	801.
25+00:XS	1595.	750.	9.59	1801.	.89	.10	145416.	736.

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

32+50:XS   ******   197.    2467.    .02 *****   10.12    5.91    1790.   10.10
        0. ******  1078.  184097.   2.36 ***** *******     .12      .73

30+25:FV     225.   452.    1972.    .01    .02   10.16 *******   1790.   10.15
      225.   225.   976.  255433.   1.09    .00     .03     .09      .91
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS      50.   452.    2253.    .01    .00   10.21 *******   1790.   10.20
      275.    50.   976.  321518.   1.11    .00     .04     .07      .79
          <<<<<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

30+00:BR     225.   452.    2085.    .01    .01   10.13    4.15    1790.   10.12
      250.   225.   976.  284769.   1.00    .00     .00     .08      .86

     TYPE PPCD FLOW       C     P/A     LSEL    BLEN    XLAB    XRAB
       3.    1.   1.  1.000    .047    16.65 ****** ****** ******

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

29+75:AS     -54.   452.    2215.    .01    .00   10.14    3.37    1790.   10.13
      275.    39.   976.  313790.   1.12    .00     .00     .07      .81

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  313942.   454.   978.    10.13

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

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

28+68:XS     107.   285.    2955.    .01    .00   10.19 *******   1790.   10.18
      382.   107.  1096.  316493.   1.58    .00     .04     .07      .61

27+50:XS     118.   327.    3268.    .01    .00   10.24 *******   1790.   10.23
      500.   118.  1167.  358188.   1.54    .00     .04     .06      .55

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"     KRATIO =    .59

25+00:XS     250.   420.    2326.    .01    .01   10.29 *******   1790.   10.28
      750.   250.  1204.  210919.   1.16    .00     .04     .08      .77
```

50 YEAR FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1790.	0.	10.10	2467.	.73	.12	184097.	881.
30+25:FV	1790.	225.	10.15	1972.	.91	.09	255433.	525.
30+00:BR	1790.	250.	10.12	2085.	.86	.08	284769.	524.
29+75:AS	1790.	275.	10.13	2215.	.81	.07	313790.	525.
28+68:XS	1790.	382.	10.18	2955.	.61	.07	316493.	811.
27+50:XS	1790.	500.	10.23	3268.	.55	.06	358188.	840.
25+00:XS	1790.	750.	10.28	2326.	.77	.08	210919.	784.

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

32+50:XS  ******   176.    3096.   .02 *****   10.82    6.06   1980.   10.80
       0. ******  1093.  241951.  2.40 ***** *******     .09     .64

30+25:FV    225.   450.    2340.   .01    .01  10.86 *******   1980.   10.85
     225.   225.   978.  331449.  1.05    .00    .04     .07     .85
       <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS     50.   450.    2621.   .01    .00  10.91 *******   1980.   10.90
     275.    50.   978.  402274.  1.07    .00    .05     .06     .76
       <<<<<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

30+00:BR    225.   450.    2450.   .01    .01  10.83    4.28   1980.   10.82
     250.   225.   978.  361779.  1.00    .00    .00     .07     .81

     TYPE PPCD FLOW      C     P/A     LSEL    BLEN    XLAB    XRAB
       3.   1.   1.  1.000    .043    16.65 ****** ****** ******

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

29+75:AS    -54.   450.    2579.   .01    .00  10.83    3.52   1980.   10.82
     275.    41.   978.  392590.  1.08    .00    .00     .06     .77

      M(G)   M(K)      KQ   XLKQ   XRKQ    OTEL
      .000   .000 392907.   453.   980.   10.82

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

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

28+68:XS    107.   267.    3531.   .01    .00  10.88 *******   1980.   10.87
     382.   107.  1120.  390431.  1.67    .00    .05     .06     .56

27+50:XS    118.   313.    3858.   .01    .00  10.93 *******   1980.   10.92
     500.   118.  1180.  439619.  1.61    .00    .05     .05     .51

===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                               "25+00"     KRATIO =    .65

25+00:XS    250.   389.    2882.   .01    .01  10.98 *******   1980.   10.97
     750.   250.  1214.  287355.  1.20    .00    .04     .07     .69
```

100 YEAR   FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1980.	0.	10.80	3096.	.64	.09	241951.	916.
30+25:FV	1980.	225.	10.85	2340.	.85	.07	331449.	527.
30+00:BR	1980.	250.	10.82	2450.	.81	.07	361779.	527.
29+75:AS	1980.	275.	10.82	2579.	.77	.06	392590.	527.
28+68:XS	1980.	382.	10.87	3531.	.56	.06	390431.	853.
27+50:XS	1980.	500.	10.92	3858.	.51	.05	439619.	867.
25+00:XS	1980.	750.	10.97	2882.	.69	.07	287355.	824.

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

 32+50:XS  ******   132.    4527.   .01 *****  12.31    6.30   2420.   12.30
       0. ******   1122.  391850.  2.40 ***** *******    .07     .53

 30+25:FV    225.   447.    3136.   .01   .01  12.36 *******   2420.   12.35
     225.    225.   981.  526475.  1.01   .00    .04     .06     .77
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 29+75:AS     50.   447.    3417.   .01   .00  12.41 *******   2420.   12.40
     275.     50.   981.  606558.  1.03   .00    .05     .05     .71
         <<<<<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

 30+00:BR    225.   447.    3241.   .01   .01  12.32    4.56   2420.   12.31
     250.    225.   981.  559223.  1.00   .00    .00     .05     .75

      TYPE PPCD FLOW      C    P/A    LSEL   BLEN   XLAB   XRAB
        3.   1.   1.  1.000   .038   16.65 ****** ****** ******

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

 29+75:AS    -54.   447.    3370.   .01   .00  12.32    3.87   2420.   12.31
     275.     26.   981.  593336.  1.03   .00    .00     .05     .72

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  594200.   450.   983.   12.31

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

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

 28+68:XS    107.   231.    4858.   .01   .00  12.37 *******   2420.   12.36
     382.    107.  1155.  576626.  1.81   .00    .05     .05     .50

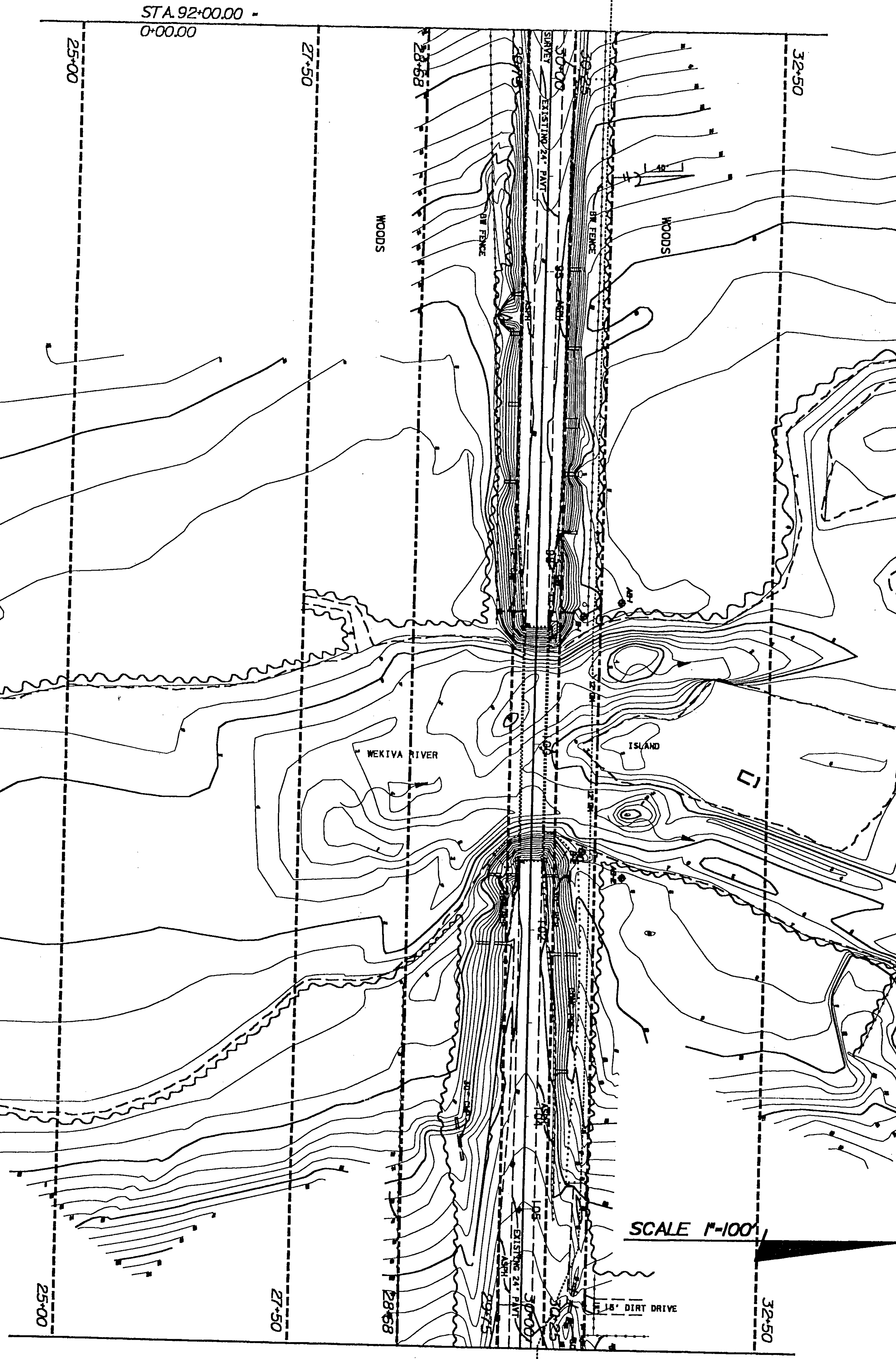
 27+50:XS    118.   283.    5193.   .01   .00  12.42 *******   2420.   12.41
     500.    118.  1203.  641880.  1.72   .00    .05     .05     .47

 25+00:XS    250.   314.    4170.   .01   .00  12.47 *******   2420.   12.46
     750.    250.  1234.  485385.  1.30   .00    .05     .05     .58

500 YEAR         FIRST USER DEFINED TABLE.

   XSID:CODE       Q     SRD    WSEL     AREA      VEL      FR#        K    XSTW
   32+50:XS    2420.      0.   12.30    4527.      .53      .07  391850.    990.
   30+25:FV    2420.    225.   12.35    3136.      .77      .06  526475.    533.
   30+00:BR    2420.    250.   12.31    3241.      .75      .05  559223.    533.
   29+75:AS    2420.    275.   12.31    3370.      .72      .05  593336.    533.
   28+68:XS    2420.    382.   12.36    4858.      .50      .05  576626.    924.
   27+50:XS    2420.    500.   12.41    5193.      .47      .05  641880.    921.
   25+00:XS    2420.    750.   12.46    4170.      .58      .05  485385.    920.
 ER

1  NORMAL  END  OF  WSPRO  EXECUTION.
```



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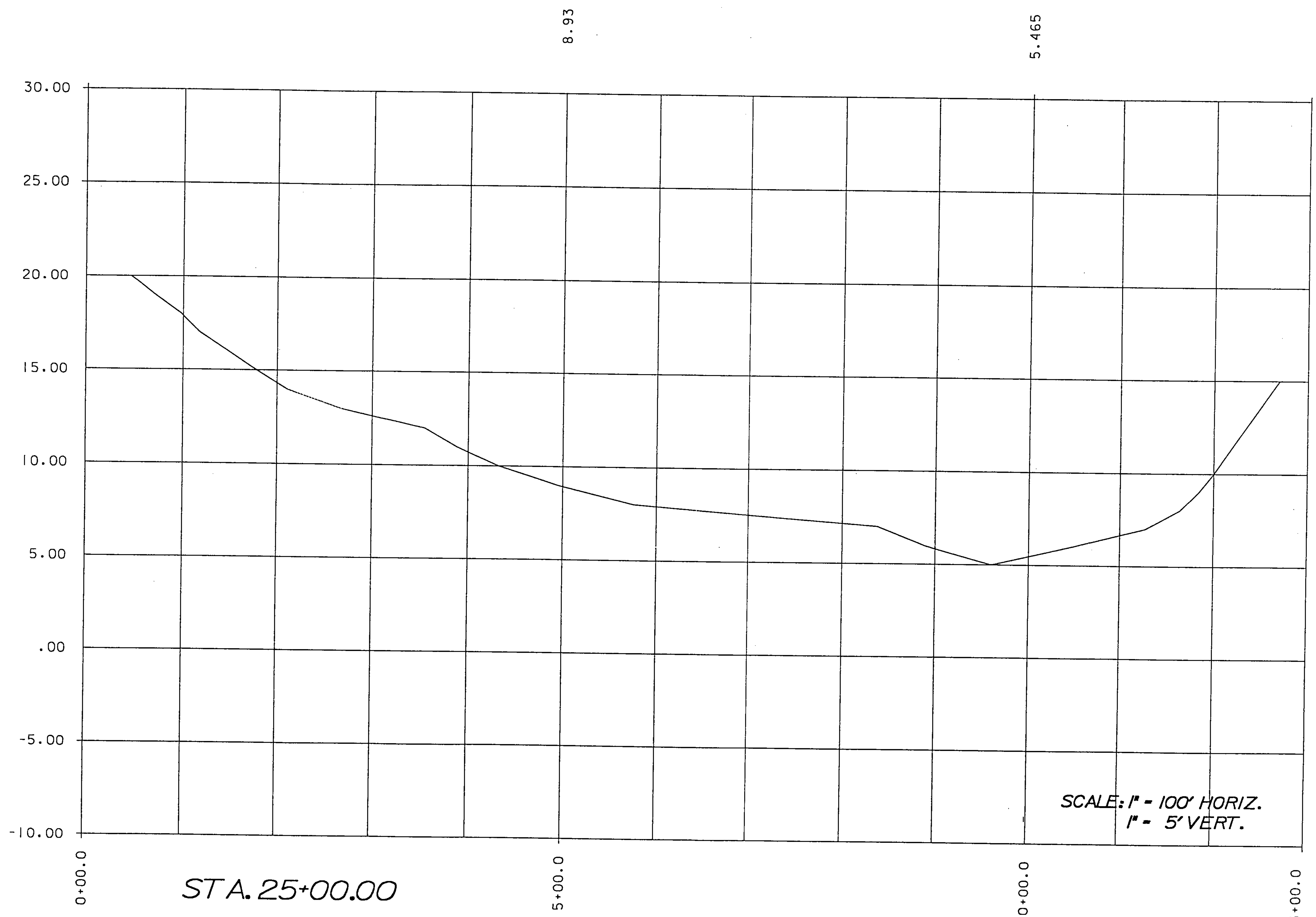
(407) 843-5120

PLAN VIEW WITH CROSS SECTION LOCATIONS
SR 46 - WEKIVA RIVER

CADE DT05PPL001



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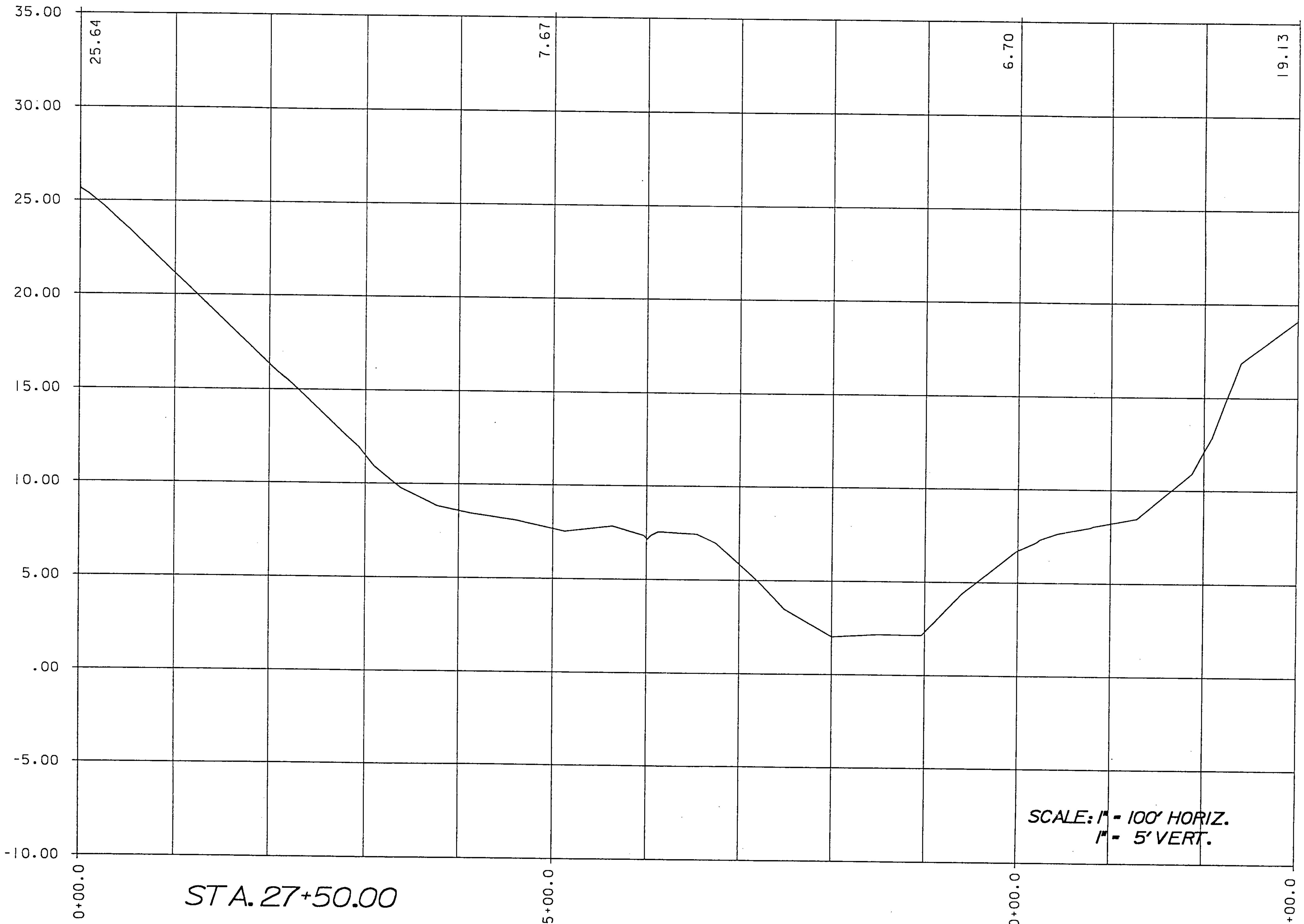
CROSS - SECTION PROFILE
OF THE WEKIVA RIVER
EXISTING CONDITIONS

CADE DT05PPL001



CROSS - SECTION PROFILE OF THE WEKIVA RIVER EXISTING CONDITIONS

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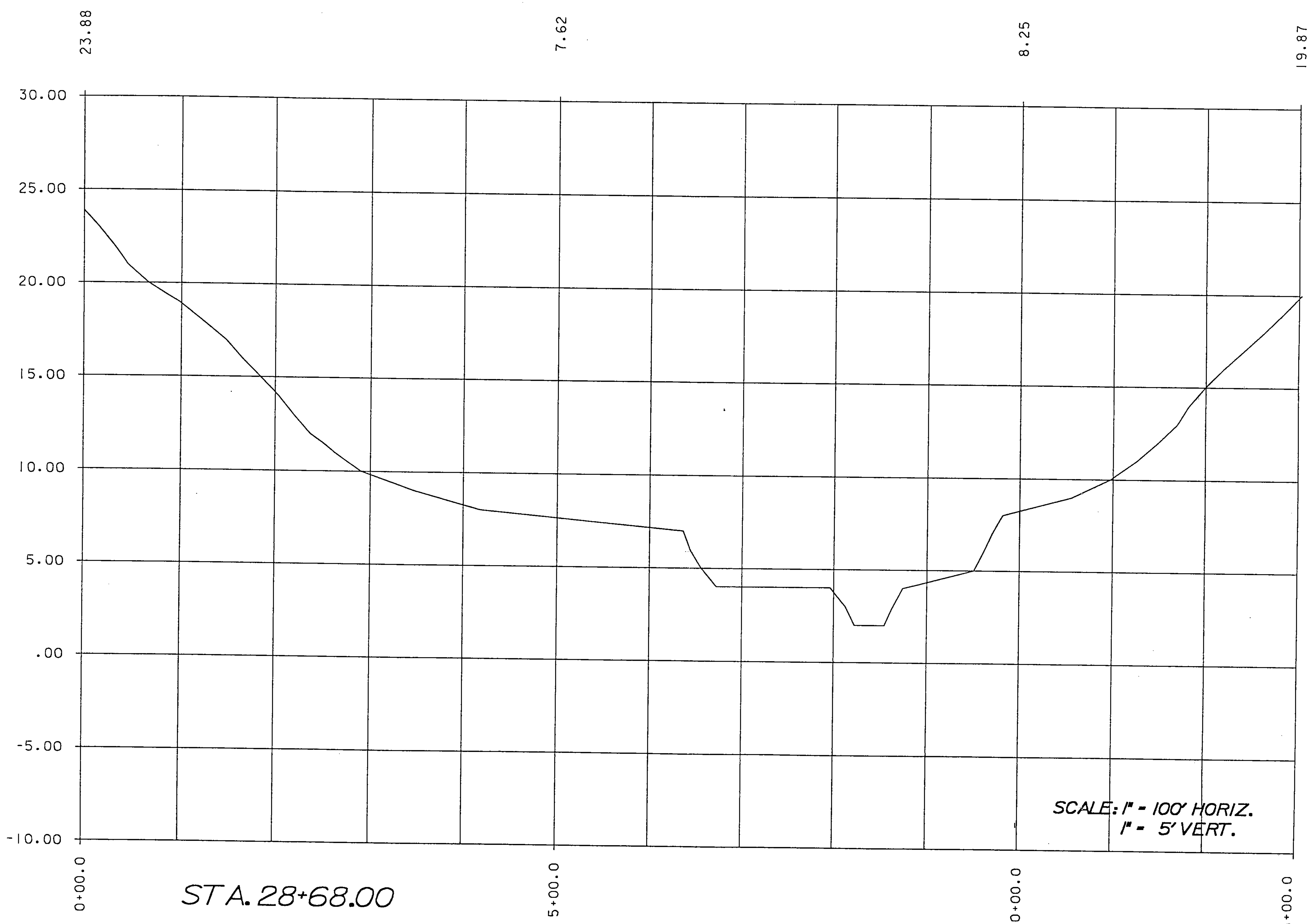

STA. 28+68.00

CROSS - SECTION PROFILE
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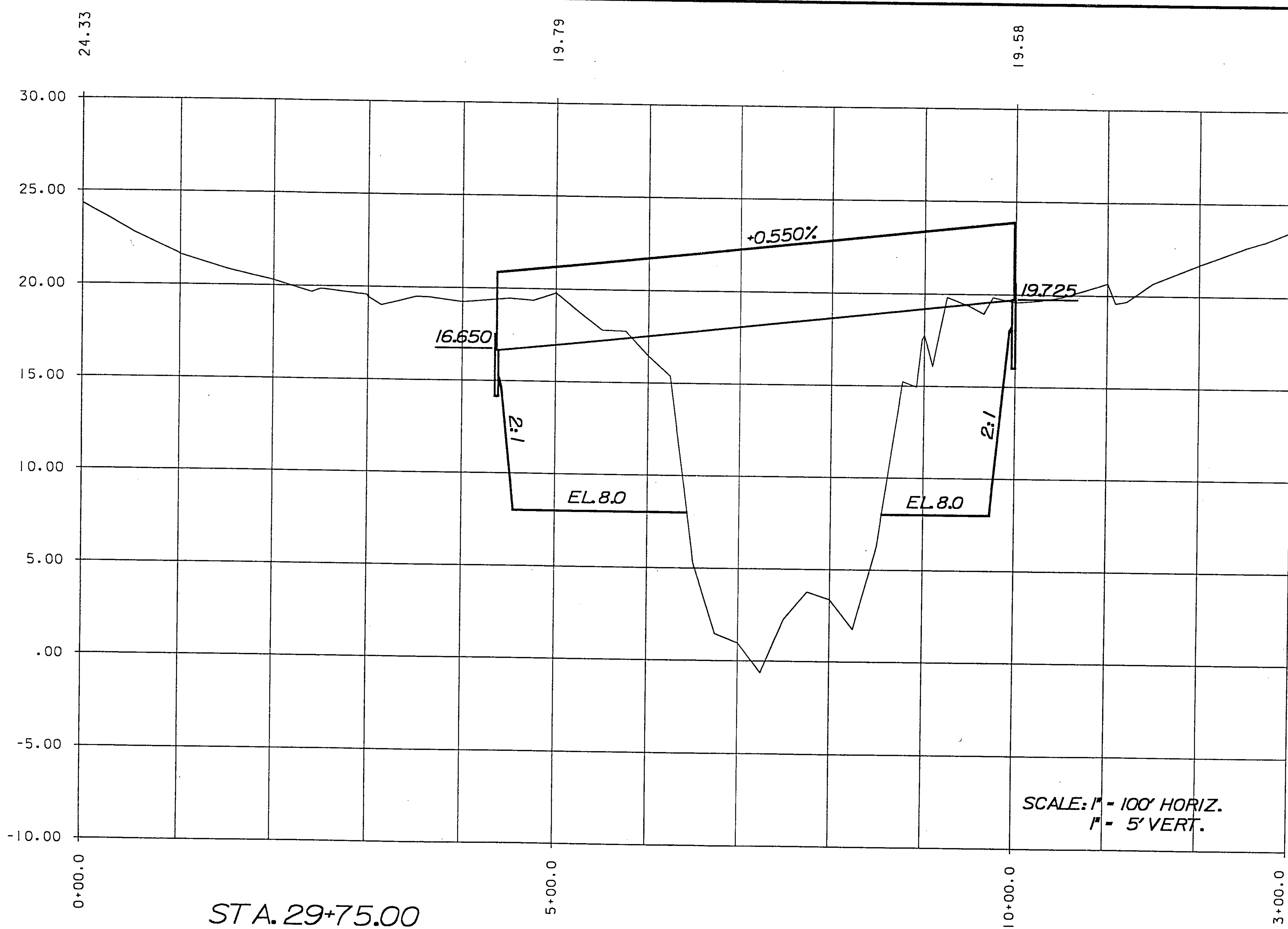

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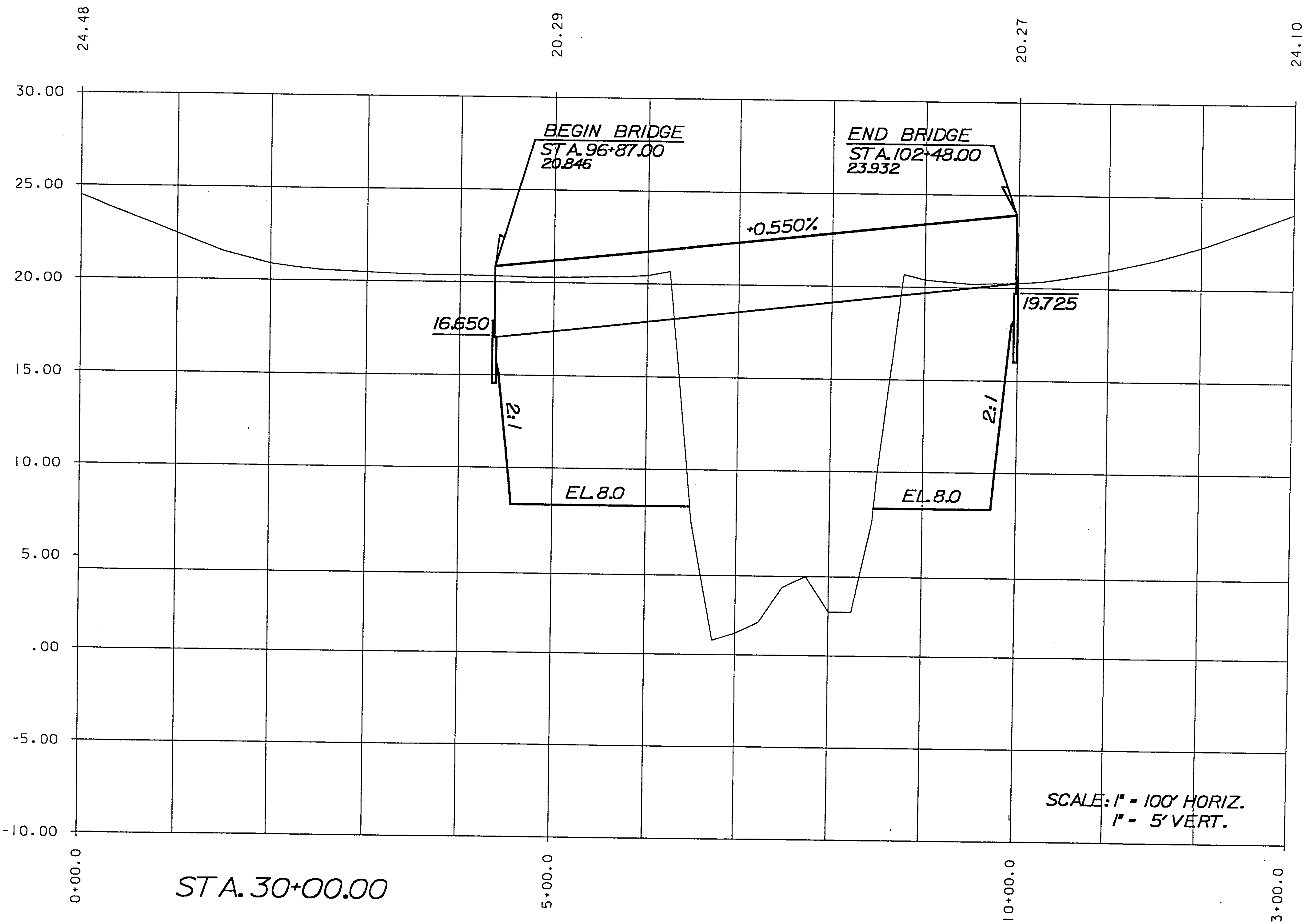

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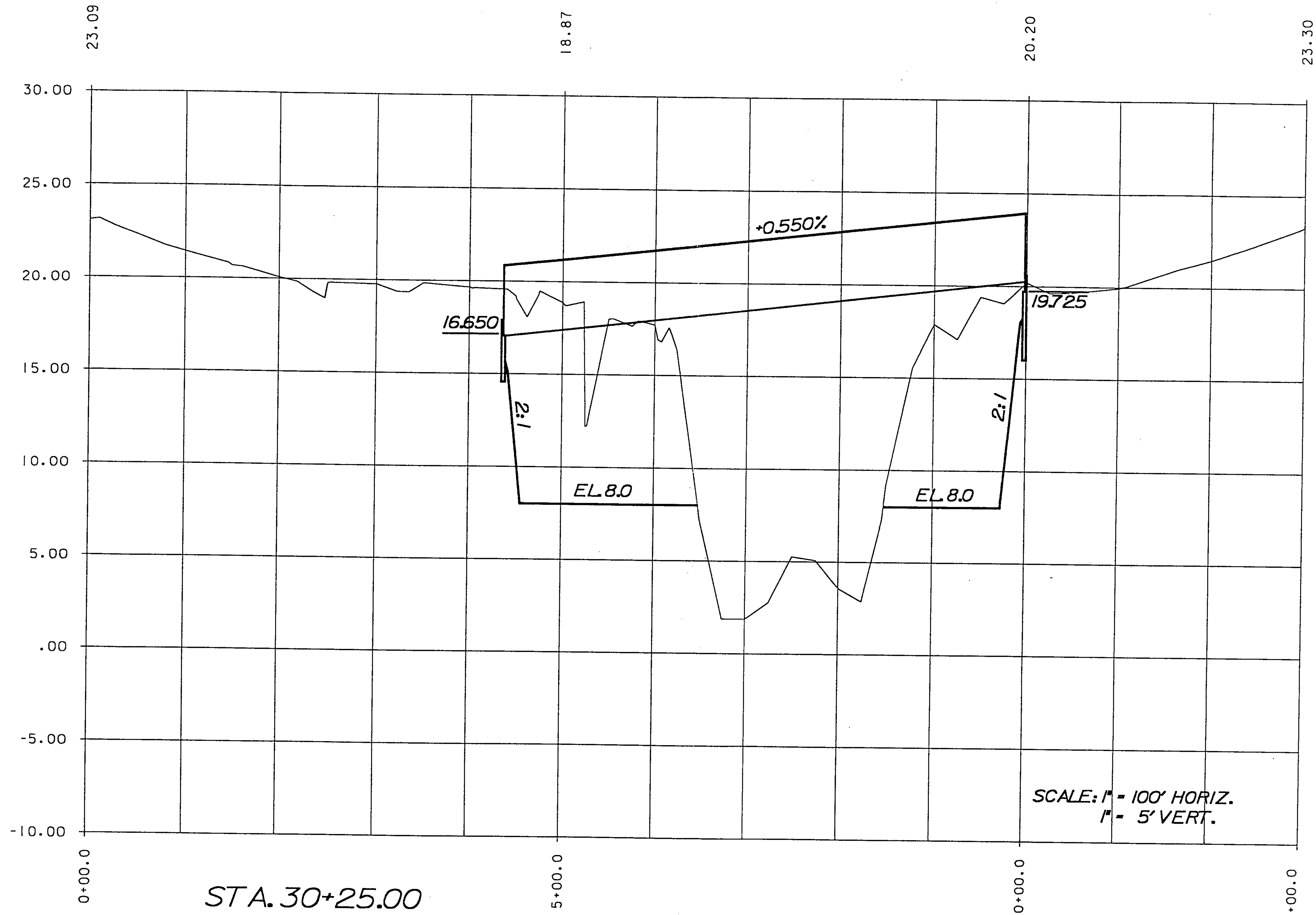

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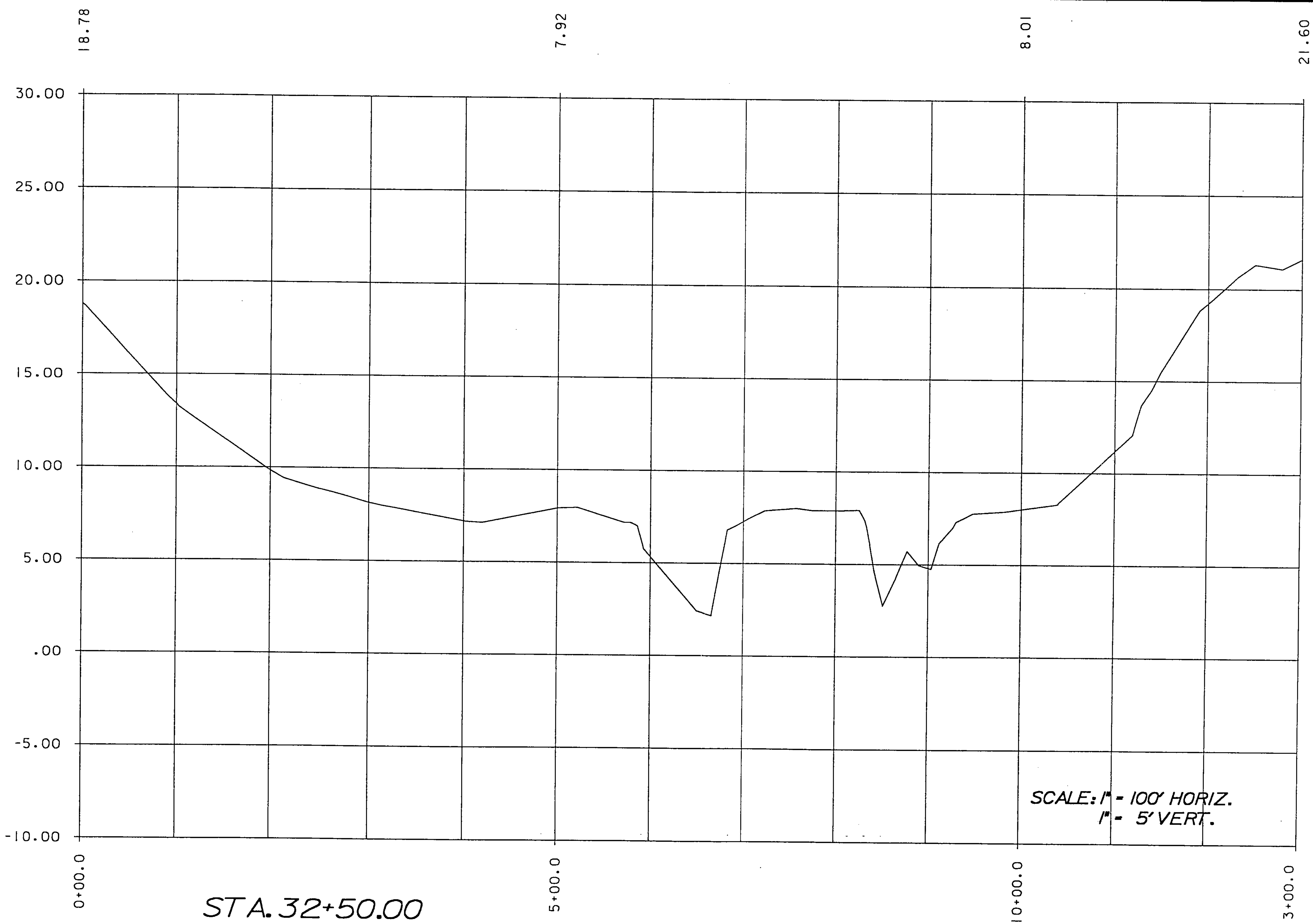

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Cindy

United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
227 N. BRONOUGH STREET, SUITE 3015
TALLAHASSEE, FLORIDA 32301

RECEIVED
NOV ... 1991
BOWYER - SINGLETON

November 25, 1991

Ms. Cindy Hillman
Bowyer-Singleton and Associates
520 South Magnolia Avenue
Orlando, Florida 32801

Dear Ms. Hillman:

Your telephone request November 22, 1991 was for flood frequency information for the Wekiva River at State Highway 46, Seminole County. In response to your request, the following information is enclosed:

1. Site description for 02235000 Wekiva River near Sanford gaging station.
2. List of annual peaks (1936-1990) for Wekiva River near Sanford.
3. Log-Pearson type III distribution of annual peaks (1936-90) for Wekiva River near Sanford.

If you have any questions about the enclosed material or need additional information, please feel free to contact me.

Sincerely,

Wayne C. Bridges

Wayne C. Bridges
Hydrologist

Enclosure

cc: Subdistrict Chief, WRD, Altamonte Springs
Marvin Franklin, WRD, Tallahassee

ST. JOHNS RIVER

ST. JOHNS RIVER BASIN ABOVE OKLAWAHA RIVER

02235000 WEKIVA RIVER NEAR SANFORD, FL

LOCATION.--Lat 28°48'54", long 81°25'10", in SE¼ sec.21, T.19 S., R.29 E., Seminole County, Hydrologic Unit 03080101, near right bank at downstream side of bridge on State Highway 46, 4.5 mi downstream from Little Wekiva River, 6.7 mi upstream from mouth, and 8.9 mi west of Sanford.

DRAINAGE AREA.--189 mi^2.

PERIOD OF RECORD.--October 1931 to September 1935 (discharge measurements only), October 1935 to current year.

GAGE.--Water-stage recorder. Datum of gage is 4.96 ft above National Geodetic Vertical Datum of 1929. Prior to Jan. 19, 1960, nonrecording gage at same site and datum.

REMARKS.--Records fair. Flow includes large ground-water inflow.

AVERAGE DISCHARGE.--55 years, 285 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 2,060 ft^3/s, Sept. 17, 1945; maximum gage height, 6.09 ft, Sept. 12, 1960; minimum discharge observed, 105 ft^3/s, June 5-13, 1939; minimum gage height, 1.75 ft, Mar. 13-16,18,19, 1974.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 329 ft^3/s, Feb. 24, gage height, 2.46 ft; minimum daily discharge, 180 ft^3/s, June 21; minimum gage height, 1.90 ft, June 21, July 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	234	219	237	223	240	225	201	195	190	236	269
2	264	233	218	235	221	234	218	199	190	188	235	266
3	263	231	217	233	220	230	221	197	188	187	242	272
4	259	231	217	230	220	227	215	196	197	190	244	265
5	256	231	219	244	218	225	212	194	194	190	242	257
6	254	230	217	251	216	222	212	193	188	189	238	256
7	253	228	217	246	215	221	211	194	186	189	236	255
8	252	228	225	245	216	219	209	193	204	188	237	255
9	248	225	254	243	216	218	208	192	202	187	234	253
10	245	227	250	240	219	217	208	186	209	186	237	250
11	245	226	237	238	259	217	210	195	223	182	256	246
12	245	227	231	237	260	215	211	191	216	184	262	246
13	246	226	227	233	239	214	206	192	199	204	258	246
14	246	224	226	232	232	212	208	193	192	227	264	244
15	243	225	225	232	229	210	206	189	189	241	270	241
16	242	229	224	229	224	210	208	191	187	232	273	239
17	240	228	224	230	221	208	207	190	184	224	273	238
18	240	226	234	231	221	210	208	188	186	219	273	236
19	237	225	244	232	219	210	204	193	184	220	273	232
20	235	224	247	231	217	208	205	199	183	211	270	231
21	233	220	257	231	220	207	203	192	180	214	269	233
22	234	221	253	230	219	207	206	189	186	212	274	232
23	234	224	285	226	255	207	212	194	193	216	278	231
24	234	228	292	226	321	206	208	194	199	214	272	227
25	234	223	271	226	305	205	205	192	198	214	267	226
26	234	224	259	225	273	205	204	192	199	226	262	226
27	238	222	253	224	256	205	204	191	207	234	268	225
28	238	221	246	225	246	203	202	190	202	232	271	226
29	234	220	246	224	---	205	205	188	193	239	266	233
30	234	219	243	222	---	220	205	186	189	237	268	238
31	232	---	240	221	---	227	---	185	---	234	264	---
TOTAL	7562	6780	7419	7209	6600	6664	6268	5969	5842	6500	8012	7294
MEAN	244	226	239	233	236	215	209	193	195	210	258	243
MAX	270	234	292	251	321	240	225	201	223	241	278	272
MIN	232	219	217	221	215	203	202	185	180	182	234	225

CAL YR 1989 TOTAL 85921 MEAN 235 MAX 427 MIN 199
WTR YR 1990 TOTAL 82119 MEAN 225 MAX 321 MIN 180

WATSTORE PEAK FLOW FILE RETRIEVAL PGM. J980 - RUN DATE : 22 NOV 91 10.53.48
PROGRAM LAST REVISED : 3 OCT 83 18.25.23

*** EXPLANATION OF PEAK DATA CODES *****

DISCHARGE QUALIFICATION CODES:

1...DISCHARGE IS A MAXIMUM DAILY AVERAGE
2...DISCHARGE IS AN ESTIMATE
3...DISCHARGE AFFECTED BY DAM FAILURE
4...DISCHARGE LESS THAN INDICATED VALUE, WHICH IS MINIMUM RECORDABLE DISCHARGE AT THIS SITE
5...DISCHARGE AFFECTED TO UNKNOWN DEGREE BY REGULATION OR DIVERSION
6...DISCHARGE AFFECTED BY REGULATION OR DIVERSION
7...DISCHARGE IS AN HISTORIC PEAK
8...DISCHARGE ACTUALLY GREATER THAN INDICATED VALUE
9...DISCHARGE DUE TO SNOWMELT, HURRICANE, ICE-JAM OR DEBRIS DAM BREAKUP
A...YEAR OF OCCURRENCE IS UNKNOWN OR NOT EXACT
B...MONTH OR DAY OF OCCURRENCE IS UNKNOWN OR NOT EXACT
C...ALL OR PART OF THE RECORD AFFECTED BY URBANIZATION, MINING, AGRICULTURAL CHANGES, CHANNELIZATION, OR OTHER
D...BASE DISCHARGE CHANGED DURING THIS YEAR
E...ONLY ANNUAL MAXIMUM PEAK AVAILABLE FOR THIS YEAR

GAGE HEIGHT QUALIFICATION CODES:

1...GAGE HEIGHT AFFECTED BY BACKWATER
2...GAGE HEIGHT NOT THE MAXIMUM FOR THE YEAR
3...GAGE HEIGHT AT DIFFERENT SITE AND/OR DATUM
4...GAGE HEIGHT BELOW MINIMUM RECORDABLE ELEVATION
5...GAGE HEIGHT IS AN ESTIMATE
6...GAGE DATUM CHANGED DURING THIS YEAR

*** NOTES *****

BASE DISCHARGE (IF REPORTED) MAY NOT BE EFFECTIVE FOR ENTIRE PERIOD OF RECORD; CURRENT VALUE USED.

GAGE DATUM (IF REPORTED) MAY NOT BE EFFECTIVE FOR ENTIRE PERIOD OF RECORD; CURRENT VALUE USED.

..IEVAL SPECIFICATIONS FOR REQUEST NUMBER 01 ARE AS FOLLOWS:
M CARD: M 01
PEAK FLOW RETRIEVAL NUMBER 01 IS FOR ALL WATER YEARS
THE FOLLOWING HAVE BEEN REQUESTED:
.....LONG FORMAT PRINTOUT
.....STANDARD RECORD FORMAT

L 12 12
*** PR087 CARD IGNORED BY PGM. J980 - PROBABLY USED BY PREPROCESSOR

NUMBER OF SITES RETRIEVED: 1
NUMBER OF RECORDS RETRIEVED: 55

STATION 02235000 WEKIVA RIVER NR SANFORD, FLA.

AGENCY: USGS
STATE: 12
COUNTY: 117
DISTRICT: 12

STATION LOCATOR
LAT. LONG.
284854 0812510

DRAINAGE AREA: 189.00 SQ MI
CONTRIBUTING DRAINAGE AREA: SQ MI
GAGE DATUM: 4.86 (NGVD)
BASE DISCHARGE: 550.00 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
1936	06/05/36	912.00		4.36						0
1937	10/12/36	642.00		4.16						0
1938	10/02/37	673.00		3.98						0
1939	09/27/39	711.00					3.90	06/18/39		0
1940	04/09/40	484.00		3.45						0
1941	07/27/41	927.00		3.84						0
1942	11/15/41	605.00					3.78	09/07/42		0
1943	08/22/43	884.00		4.28						0
1944	08/06/44	604.00		3.90						0
1945	09/17/45	2060.00		5.60						0
1946	07/29/46	890.00		4.52						0
1947	09/23/47	1130.00		4.82						0
1948	01/25/48	671.00		4.19						0
1949	08/29/49	929.00		4.54						0
1950	09/07/50	1130.00		4.78						0
1951	10/19/50	1610.00		5.40						0
1952	10/03/51	551.00		4.00						0
1953	08/29/53	1100.00	1							0
1954	10/09/53	640.00		4.10						0
1955	10/10/54	952.00		4.60						0
1956	01/24/56	347.00		3.50						0
1957	05/19/57	748.00					4.20	10/16/56		0
1958	03/03/58	920.00		3.62						0
1959	03/20/59	1280.00		4.18						0
1960	03/18/60	1950.00					6.09	09/12/60		0
1961	02/04/61	757.00		3.83						0
1962	09/22/62	707.00		3.67						0
1963	09/27/63	1060.00		4.07						0
1964	09/13/64	1650.00		5.27						0
1965	08/22/65	592.00			2		3.42	07/15/65		0
1966	09/22/66	1150.00			2		4.46	06/15/66		0
1967	08/15/67	743.00		3.82						0
1968	07/06/68	970.00		4.37						0
1969	08/16/69	1170.00		4.04						0
1970	12/11/69	1150.00		4.10			4.10	10/05/69		0
1971	02/09/71	972.00					4.26	07/31/71		0
1972	04/01/72	804.00		3.78						0
1973	09/16/73	755.00					3.63	08/07/73		0
1974	07/08/74	1160.00		4.20						0
1975	07/14/75	345.00		4.72						0
1976	10/09/75	661.00		3.66						0
1977	09/04/77	572.00		3.14						0
1978	07/21/78	935.00		3.75						0
1979	03/08/79	820.00		3.53						0
1980	04/07/80	462.00	1				3.25	10/01/79		0
1981	02/09/81	260.00	1				2.14	03/31/81		0

1982	09/27/82	729.00	1		3.39	09/27/82	0
1983	04/24/83	740.00	1		3.22	04/24/83	0
1984	08/02/84	570.00	1		3.03	07/31/84	0
1985	09/21/85	755.00	1		3.42	09/21/85	0
1986	01/16/86	942.00	1		3.67	01/11/86	0
1987	11/25/86	476.00		4.02	2.78	11/25/86	0
1988	09/09/88	757.00		3.39			0
1989	11/25/88	476.00		2.79			0
1990	02/24/90	329.00		2.46			0

PGM J407 VER 3.7
(REV 11/3/31)

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
FOLLOWING WRC GUIDELINES BULL. 17-B.

SJWMD UPPER ST. JOHNS BASIN
RUN-DATE 3/ 7/91 AT 1346 SEC 1.0015

OPTIONS IN EFFECT -- PLOT ECPL LGPT NODE PRIS NORS EXPP CLIM

STATION - 02235000 /USGS WEKIVA RIVER NR SANFORD, FLA. 1935-1990 02235000 /USGS

I N P U T   D A T A   S U M M A R Y

-- YEARS OF RECORD -- SYSTEMATIC	HISTORIC	HISTORIC PEAKS	GENERALIZED SKEW	STD. ERROR OF GENERAL. SKEW	SKEW OPTION	GAGE BASE DISCHARGE	USER-SET OUTLIER CRITERIA HIGH OUTLIER	LOW OUTLIER
55	0	0	-0.097	--	WRC WEIGHTED	0.0	--	--

********* NOTICE -- PRELIMINARY MACHINE COMPUTATIONS. *********
********* USER RESPONSIBLE FOR ASSESSMENT AND INTERPRETATION. *********

WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION. 240.5
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 2341.3

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE DISCHARGE	FLOOD BASE EXCEEDANCE PROBABILITY	LOGARITHMIC MEAN	LOGARITHMIC STANDARD DEVIATION	LOGARITHMIC SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.8931	0.1826	-0.180
W R C ESTIMATE	0.0	1.0000	2.8931	0.1826	-0.159

ANNUAL FREQUENCY CURVE ORDINATES -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	W R C ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR W R C ESTIMATES LOWER	UPPER
0.9950	243.7	2[illegible]	231.4	196.2	297.[illegible]
0.9900	28[illegible]	271.2	265.5	225.1	333.3
0.9500	3[illegible]	3[illegible].4	376.2	325.2	432.1
0.9000	433.1	432.7	446.3	392.5	50[illegible]
0.8000	5[illegible]	551.1	54[illegible]	4[illegible].9	[illegible]34.5
0.5000	79[illegible]	791.7	792.5	71[illegible]	[illegible]69.1
0.2000	111[illegible]	1117.[illegible]	1134.6	100[illegible]	1289.2
[10] 0.1000	13[illegible] [1330]	13[illegible].2	1347.8	1166.1	1531.9
[25] 0.0400	15[illegible] [1595]	15[illegible]	1639.5	139[illegible].4	1[illegible]
[50] 0.0200	17[illegible] [1790]	1779.1	184[illegible]	15[illegible]	2132.3
[100] 0.0100	1[illegible] [1980]	1[illegible].7	2[illegible]1.[illegible]	1[illegible].3	2[illegible]1.5
[200] 0.0050	21[illegible] [2170]	2[illegible]	[illegible].2	1[illegible].7	2[illegible]
[500] 0.0020	24[illegible] [2420]	239[illegible]	[illegible].1	2025.7	3[illegible].5

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(REV 11/5/81)

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
FOLLOWING WRC GUIDELINES BULL. 17-B.

SJWMD UPPER ST. JOHNS BASIN
RUN-DATE 3/ 7/91 AT 1548 SEQ 1.0015

STATION - 02235000 7USGS WEKIVA RIVER NR SANFORD, FLA. 1936-1980 02235000 7USGS

********* NOTICE -- PRELIMINARY MACHINE COMPUTATIONS. *********
********* USER RESPONSIBLE FOR ASSESSMENT AND INTERPRETATION. *********

INPUT DATA LISTING

WATER YEAR	DISCHARGE	CODES
1936	912.0	
1937	642.0	
1938	673.0	
1939	711.0	
1940	[illegible]	
1941	927.0	
1942	605.0	
1943	884.0	
1944	604.0	
1945	2060.0	
1946	890.0	
1947	1130.0	
1948	671.0	
1949	929.0	
1950	1130.0	
1951	1610.0	
1952	551.0	
1953	1100.0	
1954	640.0	
1955	952.0	
1956	942.0	
1957	748.0	
1958	920.0	
1959	1230.0	
1960	1950.0	
1961	757.0	
1962	727.0	
1963	1060.0	
1964	1650.0	
1965	592.0	
1966	1150.0	
1967	743.0	
1968	970.0	
1969	1170.0	
1970	1150.0	
1971	972.0	
1972	804.0	
1973	755.0	
1974	1160.0	
1975	935.0	

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	W R C ESTIMATE
1945	2060.0	0.0179	0.0179
1960	1950.0	0.0357	0.0357
1964	1650.0	0.0536	0.0536
1951	1610.0	0.0714	0.0714
1959	1230.0	0.0893	0.0893
1969	1170.0	0.1071	0.1071
1974	1160.0	0.1250	0.1250
1966	1150.0	0.1429	0.1429
1970	1150.0	0.1607	0.1607
1947	1130.0	0.1786	0.1786
1950	1130.0	0.1964	0.1964
1953	1100.0	0.2143	0.2143
1963	1060.0	0.2321	0.2321
1971	972.0	0.2500	0.2500
1968	970.0	0.2679	0.2679
1955	952.0	0.2857	0.2857
1956	942.0	0.3036	0.3036
1975	935.0	0.3214	0.3214
1949	929.0	0.3393	0.3393
1941	927.0	0.3571	0.3571
1958	920.0	0.3750	0.3750
1936	912.0	0.3929	0.3929
1946	890.0	0.4107	0.4107
1943	884.0	0.4286	0.4286
1979	820.0	0.4464	0.4464
1972	804.0	0.4643	0.4643
1961	757.0	0.4821	0.4821
[illegible]	757.0	0.5000	0.5000
1973	755.0	0.5179	0.5179
[illegible]	753.0	0.5357	0.5357
1957	748.0	0.5536	0.5536
1967	743.0	0.5714	0.5714
[illegible]	740.0	0.5893	0.5893
[illegible]	729.0	0.6071	0.6071
1939	711.0	0.6250	0.6250
[illegible]	707.0	0.6429	0.6429
1938	673.0	0.6607	0.6607
1948	671.0	0.6786	0.6786
[illegible]	661.0	0.6964	0.6964
1937	642.0	0.7143	0.7143

-- CONTINUED --

PGM J407 VER 3.7
(REV 11/5/81)

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
FOLLOWING WRC GUIDELINES BULL. 17-B.

SJWMD UPPER ST. JOHNS BASIN
RUN-DATE 5/ 7/91 AT 13-6 SEC 1.0015

STATION - 02235000 /USGS WEKIVA RIVER NR SANFORD, FLA. 1936-1990 02235000 /USGS

********* NOTICE -- PRELIMINARY MACHINE COMPUTATIONS. *********
********* USER RESPONSIBLE FOR ASSESSMENT AND INTERPRETATION. *********

INPUT DATA LISTING

WATER YEAR	DISCHARGE	CODES
1976	[illegible]	
1977	573.0	
1978	[illegible]	
1979	[illegible]	
1980	[illegible]	
1981	260.0	
1982	[illegible]	
1983	[illegible]	
1984	570.0	
1985	[illegible]	
1986	[illegible]	
1987	[illegible]	
1988	[illegible]	
1989	[illegible]	
1990	329.0	

-- CONTINUED --

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	W R C ESTIMATE
1954	640.0	0.7321	0.7321
1942	605.0	0.7500	0.7500
1944	604.0	0.7679	0.7679
1965	592.0	0.7857	0.7857
1977	573.0	0.8036	0.8036
1984	570.0	0.8214	0.8214
1952	551.0	0.8393	0.8393
1940	484.0	0.8571	0.8571
1957	476.0	0.8750	0.8750
1959	476.0	0.8929	0.8929
1960	462.0	0.9107	0.9107
1956	347.0	0.9286	0.9286
1975	345.0	0.9464	0.9464
1990	329.0	0.9643	0.9643
1981	260.0	0.9821	0.9821

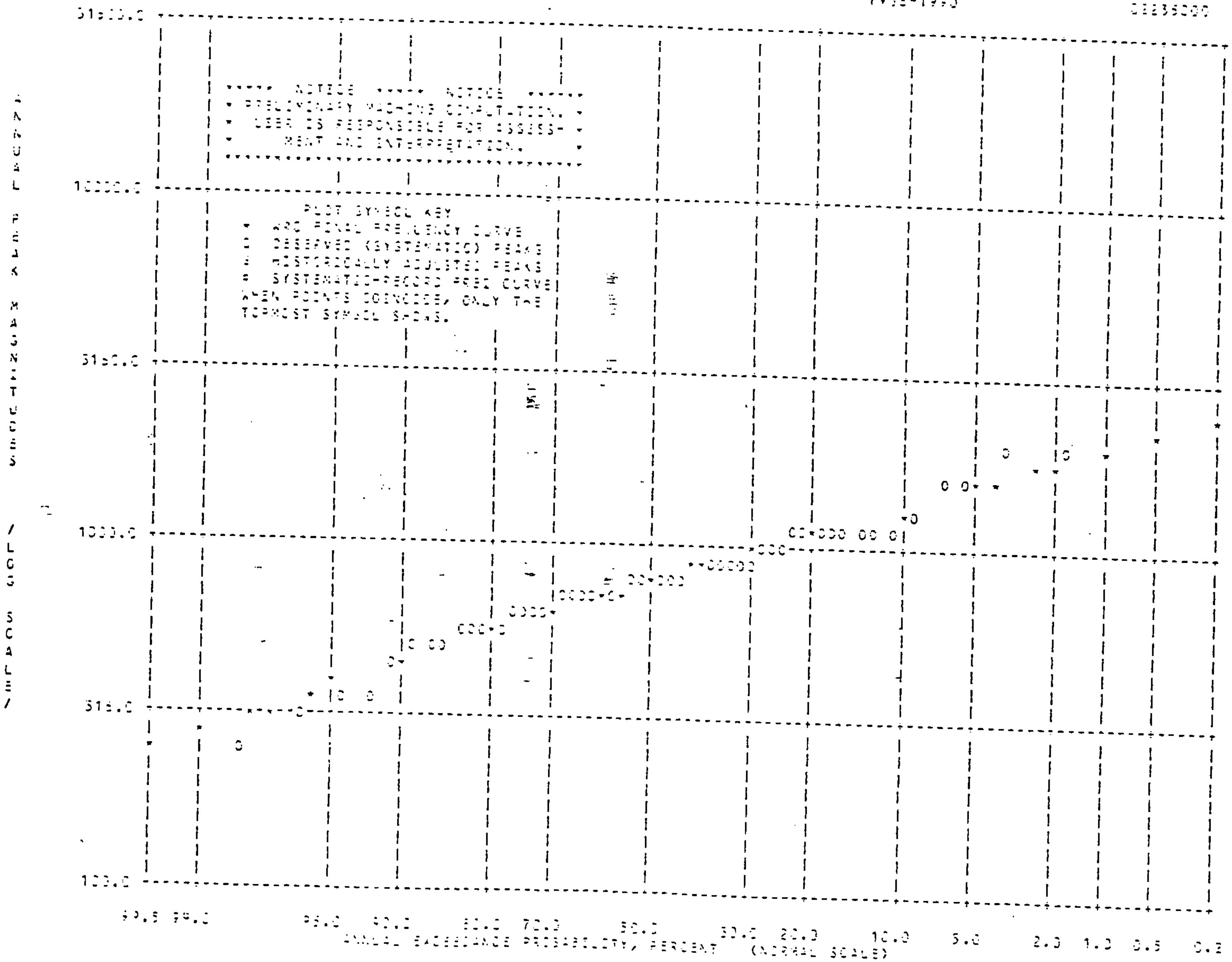
PGM J407 VER 3.7
(REV 11/5/81)

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
FOLLOWING WRC GUIDELINES BULL. 17-B.

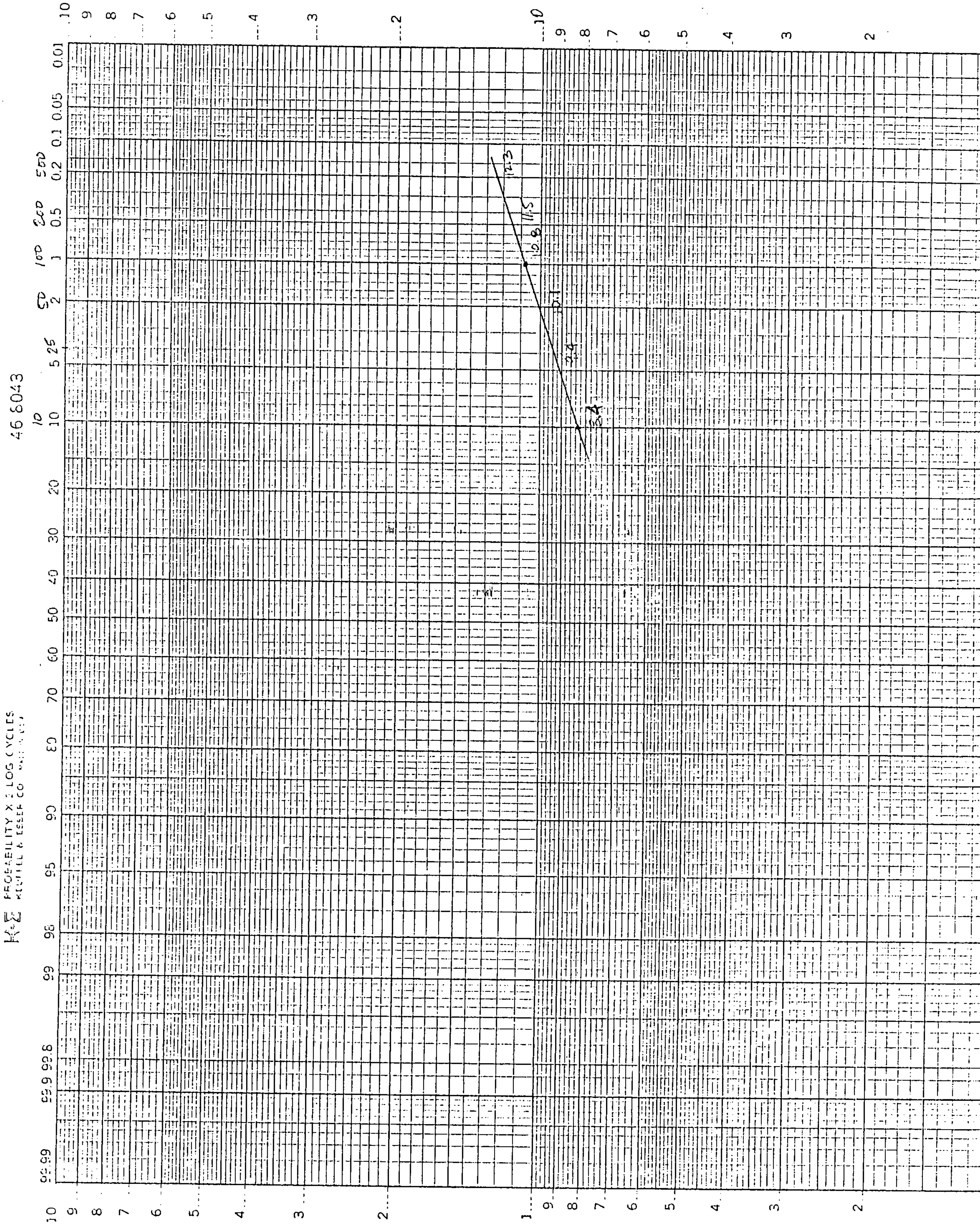
SJRWMD UPPER ST. JOHNS BASIN
RUN-DATE 2/ 7/91 AT 1346 SEQ 1.0015

STATION - 02235000 /USGS WEKIVA RIVER NR SANFORD, FLA.

1936-1990 02235000 /USGS



WSEL - S.R. 46 AT WEKIVA RIVER



OPEN-CHANNEL HYDRAULICS

VEN TE CHOW, Ph.D.

Professor of Hydraulic Engineering
University of Illinois

McGRAW-HILL BOOK COMPANY

New York Toronto London

1959

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
B. LINED OR BUILT-UP CHANNELS			
B-1. Metal			
a. Smooth steel surface			
1. Unpainted	0.011	0.012	0.014
2. Painted	0.012	0.013	0.017
b. Corrugated	0.021	0.025	0.030
B-2. Nonmetal			
a. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
b. Wood			
1. Planed, untreated	0.010	0.012	0.014
2. Planed, creosoted	0.011	0.012	0.015
3. Unplaned	0.011	0.013	0.015
4. Plank with battens	0.012	0.015	0.018
5. Lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. Trowel finish	0.011	0.013	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	0.020
4. Unfinished	0.014	0.017	0.020
5. Gunite, good section	0.016	0.019	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. On irregular excavated rock	0.022	0.027	
d. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
e. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. Glazed	0.011	0.013	0.015
2. In cement mortar	0.012	0.015	0.018
g. Masonry			
1. Cemented rubble	0.017	0.025	0.030
2. Dry rubble	0.023	0.032	0.035
h. Dressed ashlar	0.013	0.015	0.017
i. Asphalt			
1. Smooth	0.013	0.013	
2. Rough	0.016	0.016	
j. Vegetal lining	0.030	.....	0.500

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040 *
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120 *
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100 *

Geotechnical and
Environmental Consultants, Inc.

January 10, 1992

DRAFT

Bowyer-Singleton & Associates, Inc.
520 S. Magnolia Avenue
Orlando, Florida 32801

Attention: Mr. Will Stewart, P.E.

Subject: Report of Geotechnical Investigation
S.R. 46 BRIDGE AT WEKIVA RIVER
Districtwide Miscellaneous Drainage Design
Contract No. 92-D1
State Project No. 77030-1517
W.P.I. No. 5117641
GEC Project No. 158G

Dear Mr. Stewart:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to present this report of our geotechnical investigation for the above-referenced project. This study was performed in general accordance with our Proposal No. 231G dated November 6, 1991. The purposes of this study were to evaluate soil and groundwater conditions at the bridge site and to use the information obtained to develop soil parameters needed for scour analysis and preliminary driven prestressed concrete pile foundation design.

SITE AND PROJECT DESCRIPTION

The S.R. 46 bridge over the Wekiva River is presently a 2 lane multi-span structure located on the boundary of Seminole and Lake Counties. The top of deck is approximate elevation +20 feet NGVD and the toe of the embankment is about +9 feet NGVD. The river water surface is between approximately +7 and +8 feet NGVD according to topographic information supplied by Bowyer-Singleton & Associates, Inc. (BSA). The site is located within the St. Johns River Water Management District and the Wekiva River Drainage Basin.

We understand that a hydraulics report is presently being prepared by BSA for this bridge and that future plans include widening or replacement of the existing structure.

6220 S. Orange Blossom Trail, Suite 400B, Orlando, Florida 32809 • 407/240-0669, FAX 407/240-0795

CENTRAL FLORIDA GEOLOGY

Central Florida geologic conditions can generally be described in terms of three basic sedimentary layers. The near-surface layer is primarily composed of sands containing varying amounts of silt and clay. These sands are underlain by a layer of clay, clayey sand, phosphate and limestone which is locally referred to as the Hawthorn formation. The third layer underlies the Hawthorn formation and is composed of limestone. The thickness of these three strata varies throughout Central Florida. In general, the surficial sands typically extend to depths of 40 to 70 feet while the Hawthorn formation ranges from nearly absent in some locations to thicknesses greater than 100 feet.

The groundwater hydrogeology of Central Florida can be described in terms of the nature and relationship of the three basic geologic strata. The near-surface sand stratum is fairly permeable and comprises the water table (unconfined) aquifer. The limestone formation, known as the Floridan aquifer, is highly permeable due to the presence of large interconnected channels and cavities throughout the rock. The Floridan aquifer is the primary source of drinking water in Central Florida. These two permeable strata are separated by the relatively low permeability clays of the Hawthorn formation. The amount of groundwater flow between the two aquifer systems is dependent on the thickness and consistency of the Hawthorn clay confining beds which, as previously stated, varies widely throughout Central Florida.

The geology and hydrogeology described above can be conducive to collapses of the ground surface resulting in circular depressions known as "sinkholes." Sinkholes usually occur in Central Florida due to the downward movement of the near surface sands through openings in the Hawthorn formation into the limestone cavities. This process can be likened to the movement of sand through an hourglass. Sinkholes are most likely to occur in areas where the Hawthorn formation is thin or absent, allowing free downward movement of sands into the limestone. Groundwater also flows freely from the surficial aquifer into the Floridan aquifer when the Hawthorn formation is thin or breached, and this phenomenon is called recharge. Therefore, high recharge areas are typically prone to sinkhole activity. Conversely, low recharge areas are not prone to sinkhole activity.

The project site is classified by the Florida Department of Natural Resources as a "very poor recharge area, Artesian flow". Therefore, this site has a low risk for sinkhole activity compared to the background risk of the Central Florida area. In addition, SJRWMD potentiometric maps of the Floridan aquifer in this area indicate a potentiometric elevation of about +10 to +20 feet NGVD. Based on this information, artesian flow can be anticipated in areas where the confining layer is breached.

SUBSURFACE EXPLORATION

For this study, GEC performed 2 Standard Penetration Test (SPT) borings to depths ranging from 63 to 69 feet below ground surface. We also performed 2 machine auger borings to depths ranging from 16 to 22 feet below ground surface. The SPT borings were located as close to the bridge structure as possible given site constraints. The SPT boring locations are shown on the "Report of SPT Borings for Structures" sheet in the Appendix.

Our field crew performed Standard Penetration Tests continuously in the SPT borings at 3 foot intervals until hard rock was encountered. Double barrel NX rock cores were then obtained on 5 foot runs with a Standard Penetration Test performed between each run. A GEC engineer supervised the drilling operation and examined and visually classified each sample. Representative portions of each sample were packaged and sealed for transportation to our laboratory for further examination and visual classification. Water levels were measured in the boreholes at the time of our field exploration to evaluate the depth to groundwater. All boreholes were grouted immediately upon completion. A brief description of the SPT boring procedure is included in the Appendix.

The machine auger borings were performed by hydraulically turning a four inch wide continuous flight into the ground in 5 foot increments. Additional flights were added until hard material was encountered. The auger flights were then retrieved in 5 foot increments and visually examined by an engineer. Samples of representative strata were obtained for further examination and testing in our laboratory.

GENERAL SUBSURFACE CONDITIONS

The SPT and auger borings encountered soil and rock conditions which can be summarized as follows:

DEPTH (FT)	SOIL OR ROCK DESCRIPTION	N-VALUE (BPF)
0 to 15	Loose to medium dense sand and shell (SP)	3 to 27
15 to 40	Stiff to very hard sandy clay (CH)	10 to 69/8"
40 to 69	Soft to very hard fossiliferous limestone	50/0" to 50/5"

We note that borings B-1 and AB-1 encountered a stratum of sandy muck (PT) at depths ranging from about 2 to 10 feet below ground surface.

Groundwater levels were encountered at depths ranging from about 1 to 3 feet below ground surface, depending on topography at the borehole location. Groundwater levels will fluctuate with the water level in the Wekiva River and, therefore, may be different at other times.

LABORATORY TESTING

Soil classification tests were performed on representative soil strata encountered in the borings.

These tests included grain size analyses, percent fines, moisture content, Atterberg Limits, and organic content. The results of the laboratory tests are shown on Tables 1 through 4 in the Appendix. The grain size graphs are also included in the Appendix.

ANALYSIS AND RECOMMENDATIONS

The following analysis and recommendations are based on the project characteristics previously described, the data obtained during our field exploration, and our experience with similar subsurface conditions and design projects. We note that the following pile analysis is preliminary in nature and should not be used for final bridge foundation design. A more detailed geotechnical study with additional SPT borings should be performed to provide final foundation design recommendations.

Scour Analysis

Grain size analyses were performed on representative strata encountered in the borings for use in scour analysis. The D_{50} values for the strata encountered are summarized on Tables 1 through 4. Due to highly variable subsurface conditions, the D_{50} value ranges from less than 0.075 millimeters to as high as 5.6 millimeters. The results of the D_{50} analysis were provided to BSA for use in evaluating scour at the bridge site.

Preliminary Pile Foundation Analysis

The results of the SPT borings were input to the computer program SPT91 developed by the Florida Department of Transportation (FDOT) for use in driven concrete pile capacity analyses. An 18 inch square precast concrete pile was analyzed for this project. The results of the static analysis indicate that an 18 inch pile can support an allowable compressive capacity of 100 tons for a driven length of 35 to 40 feet. This corresponds to a pile tip elevation of about -30 feet NGVD. The computer output from SPT91 is included in the Appendix.

An evaluation of the driveability of an 18 inch pile to achieve a design load of 100 tons was performed using the computer program GRLWEAP. The pile driving hammer used in our calculations was a Delmag D46-32 with a rated hammer energy of 107 kip feet. The results of the WEAP analysis indicate that an 18 inch pile can be driven to the estimated tip elevation without exceeding typical allowable pile stresses of 1.2 ksi in tension and 2.8 ksi in compression. The results of the WEAP analysis are included in the Appendix.

CLOSURE

Geotechnical and Environmental Consultants, Inc. (GEC) appreciates the opportunity to be of service to you on this project. If you should have any questions concerning the contents of this report, or if we may be of further assistance, please do not hesitate to contact us.

Very truly yours,

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS, INC.

DRAFT

Mark C. Canty, P.E.
Project Engineer

Gary L. Kuhns, P.E.
Senior Geotechnical Engineer

MCC/GLK/sas
Encls.

AUGER BORING LOG

BORING NO. AB-1 STAT 98+47, 90' LT, EL 9.0

LOGGED BY: M.C.C.

DATE DRILLED: 12-6-91

PROJECT NO.: 158G

DEPTH (FT.)	SOIL DESCRIPTION	GW
0	DARK BROWN TO BLACK SANDY MUCK (PT)	2'
3.5	GRAY FINE SAND, TRACE SILT (SP-SM)	
5.5	DARK BROWN SANDY MUCK (PT)	
8	GRAY SANDY SHELL SOME SILT AND PHOSOPHATE (SP-SM)	
19	DARK GRAY GREEN SANDY CLAY, SOME PHOSOPHATE (CH)	
20	DARK GRAY GREEN CLAY, TRACE SAND (CH)	
22	BORING COMPLETED AT 22' COULD NOT PENETRATE DEEPER GROUTED HOLE	

BORING NO. AB-2 STAT 101+43, 97' LT, EL

LOGGED BY: M.C.C.

DATE DRILLED: 12-6-91

GROUND WATER LEVEL

DEPTH (FT.)	SOIL DESCRIPTION	G\
0	DARK BROWN SANDY MUCK, TRACE SHELL (PT)	1
5.5	GRAY SANDY SHELL, TRACE SILT AND PHOSOPHATE (SP-SM)	
10	DARK GRAY GREEN SANDY SHELL, SOME CLAY AND PHOSOPHATE (SP-SC)	
12	DARK GRAY GREEN CLAYEY FINE SAND TRACE SHELL AND PHOSOPHATE (SC)	
14	DARK GRAY GREEN SANDY CLAY (CH)	
16	BORING COMPLETED AT 16' COULD NOT PENETRATE DEEPER GROUTED HOLE	

Geotechnical and Environmental Consultants, Inc.
6220 S. Orange Blossom Trail, Suite 400B
Orlando, Florida 32809 407/240-0669, FAX 407/240-0795

TABLE 1

S.R. 46 BRIDGE AT WEKIVA RIVER

LABORATORY TEST RESULTS

GEC PROJECT NO. 158G

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	USCS	AASHTO	-200	MC	OC	LL	PI	D50(MM)
B-1	1	Fine sand, some shell	SP	A-3	2.8	--	--	--	--	0.68
B-1	4	Sandy muck	Pt	A-8	59.5	132.7	39.8	--	--	<0.075
B-1	7	Sandy muck	Pt	A-8	23.9	108.0	11.5	--	--	0.14
B-1	10	Sandy shell, trace silt	SP	A-3	3.6	--	--	--	--	0.56
B-1	13	Sandy shell, some clay	SP-SC	A-2-4	11.9	32.4	--	--	--	0.18
B-1	16	Sandy shell, trace clay	SP-SC	A-3	9.7	23.1	--	--	--	0.31
B-1	22	Clay, trace sand	CH	A-7-5	95.7	50.8	--	104	71	<0.075
B-1	25	Clay, trace sand	CH	A-7-5	97.2	94.2	16.0	248	153	<0.075
B-1	28	Sandy clay	CH	A-7-5	52.0	71.6	--	192	142	<0.075
B-1	31	Sandy clay	CH	A-7-6	68.2	46.3	--	69	40	<0.075
B-1	37	Gravelly sand, some clay	GP	A-2-7	4.7	23.2	--	78	44	5.6
B-1	40	Sandy clay	CH	A-2-5	72.2	44.7	--	88	54	<0.075

TABLE 2
S.R. 46 BRIDGE AT WEKIVA RIVER
LABORATORY TEST RESULTS
GEC PROJECT NO. 158G

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	USCS	AASHTO	-200	MC	OC	LL	PI	D50(MM)
B-2	1	Sandy shell, trace silt	SP	A-3	3.6	--	--	--	--	0.85
B-2	4	Fine sand, trace silt	SP	A-3	3.4	--	--	--	--	0.26
B-2	7	Sandy shell, some silt	SP-SM	A-2-4	10.7	--	--	--	--	0.47
B-2	10	Sandy shell, trace silt	SP	A-3	6.5	--	--	--	--	0.68
B-2	13	Sandy shell, some silt	SM	A-2-4	12.2	--	--	--	--	0.65
B-2	16	Sandy clay	CH	A-7-5	64.0	38.6	--	95	63	<0.075
B-2	19	Clay, trace sand	CH	A-7-5	--	110.5	--	285	209	<0.075
B-2	22	Sandy clay	CH	A-7-5	64.0	69.1	--	159	107	<0.075
B-2	25	Clayey sand	SC-CH	A-7-6	48.9	38.6	--	61	36	0.084
B-2	28	Silty sand	SM	A-2-4	34.9	23.5	--	26	2	0.18
B-2	31	Clayey sand, some gravel	SC	A-7-6	36.2	21.4	--	56	27	0.70

TABLE 3
S.R. 46 BRIDGE AT WEKIVA RIVER
LABORATORY TEST RESULTS
GEC PROJECT NO. 158G

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	USCS	AASHTO	-200	MC	OC	LL	PI	D50(MM)
AB-1	0-3	Sandy muck	Pt	A-8	39.2	142.7	26.5	--	--	0.16
AB-1	3-5	Fine sand, trace silt	SP-SM	A-3	7.0	--	--	--	--	0.16
AB-1	5-7.5	Sandy muck	Pt	A-8	10.8	54.0	5.4	--	--	0.17
AB-1	7.5-8	Sandy shell, some silt	SP-SM	A-2-4	10.7	--	--	--	--	0.30
AB-1	9-10	Sandy shell, some silt	SP-SM	A-2-4	11.9	--	--	--	--	0.67
AB-1	10-12	Sandy shell, some silt	SM	A-2-4	15.3	--	--	--	--	0.78
AB-1	12-13	Sandy shell, some silt	SP-SM	A-2-4	11.9	--	--	--	--	0.56
AB-1	19-20	Sandy clay	CH	A-7-6	70.3	26.3	--	50	26	<0.075
AB-1	20-22	Clay, trace sand	CH	A-7-6	95.8	34.7	--	70	41	<0.075

TABLE 4
S.R. 46 BRIDGE AT WEKIVA RIVER
LABORATORY TEST RESULTS
GEC PROJECT NO. 158G

BORING NO.	SAMPLE DEPTH (FT)	SOIL DESCRIPTION	USCS	AASHTO	-200	MC	OC	LL	PI	D50(MM)
AB-2	0-5	Sandy muck, track shell	Pt	A-8	14.9	163.9	11.5	--	--	0.20
AB-2	5-6	Sandy shell, trace silt	SP-SM	A-2-4	7.7	--	--	--	--	0.28
AB-2	6-10	Sandy shell, trace silt	SP-SM	A-2-4	7.0	--	--	--	--	0.15
AB-2	13-14	Clayey sand, trace shell	SC	A-2-7	21.0	29.7	--	67	44	0.24
AB-2	14-16	Sandy Clay	CH	A-7-5	73.3	38.7	--	89	55	<0.075

SR 46 WEKIVA RIVER
BRIDGE SCOUR ANALYSIS
File: tmp\wekiva\scour\totals.xls

BY: CAD
DATE: 11/18/94

SUMMARY OF SCOUR RESULTS

STORM FREQUENCY	Q cfs	CONTRACTION SCOUR DEPTH	ABUTMENT SCOUR				PIER SCOUR		ABUTMENT SCOUR		PIER SCOUR ELEVATION
			LEFT		RIGHT				LEFT ELEVATION	RIGHT ELEVATION	
			DEPTH	WIDTH	DEPTH	WIDTH	DEPTH	WIDTH			
50 YEAR	1790	0 m	1.04 m	2.92 m	1.04 m	2.92 m	0.66 m	4.11 m			
		0 ft	3.42 ft	9.58 ft	3.42 ft	9.58 ft	2.18 ft	13.5 ft	4.58 ft NGVD	4.58 ft NGVD	-13.0 ft NGVD
100 YEAR	1980	0 m	1.36 m	3.82 m	1.36 m	3.82 m	0.64 m	3.99 m			
		0 ft	4.47 ft	12.52 ft	4.47 ft	12.52 ft	2.10 ft	13.1 ft	3.53 ft NGVD	3.53 ft NGVD	-12.6 ft NGVD
500 YEAR	2420	0 m	1.89 m	5.30 m	1.89 m	5.30 m	0.62 m	3.87 m			
		0 ft	6.21 ft	17.38 ft	6.21 ft	17.38 ft	2.04 ft	12.7 ft	1.79 ft NGVD	1.79 ft NGVD	-12.20 ft NGVD

NOTES:
Abutment Scour Hole Width = 2.8 x Depth.
Top Width of Pier Scour Hole = 2(2.75 x Depth) + a, where a = 1.5 ft.
Long-Term Degradation/Aggradation = 0.
Total Scour = Contraction Scour + Long Term + Abutment or Pier Scour.

50 YEAR SCOUR ANALYSIS

50 YEAR

Table 1: Hydraulic Variables from WSPRO for Estimation of Contraction Scour

		Remarks
Q (cfs)	1790	Total discharge input to WSPRO, 50-Year
Kc (Approach)	249932	Conveyance of main channel of approach section.
Ktotal (Approach)	313989	Total conveyance of approach section.
W1 (Approach) (ft)	212	Top width of flow (TOPW), assumed to represent active live-bed width of approach.
Ac (Approach) (sf)	1560	Main channel area of approach section.
TOPW (Approach) (ft)	212	Top width of main channel of approach section.
WETP (Approach) (ft)	214	Wetted perimeter of main channel of approach section.
Kc (Bridge)	218334	Conveyance of main channel through bridge.
Ktotal (Bridge)	284600	Total conveyance through bridge.
W2 (Bridge) (ft)	184	Difference between subarea break points defining channel banks at the bridge less pier widths in section.
Sf (ft/ft)	0.0001	Average unconstricted energy slope. Defined as the head loss (HF) divided by the distance between cross sections.

Table 2: Hydraulic Variables from WSPRO for Estimation of Pier Scour

		Remarks
Area (sf)	78.9	Area of conveyance tube with maximum velocity.
V1 (fps)	1.14	Maximum velocity in conveyance tube at bridge.
Top Width (ft)	8.6	Difference between right and left end stations.
Y1 (ft)	9.17	Mean depth, area divided by top width.

50 YEAR

Table 3: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Left Abutment.

		Remarks
Q (cfs)	1790	Total discharge input to WSPRO, 50-Year
qtube (cfs)	89.5	Discharge per equal conveyance tube, Q/20.
Atube #1 (sf) (Bridge X-section)	146.5	Area of conveyance tube #1, adjacent to left abutment.
Vabut (ft/s) (Bridge X-section)	0.61	Mean velocity of conveyance tube #1, adjacent to left abutment.
TOPWtube #1 (ft) (Bridge X-section)	71.2	Difference between left and right station of conveyance tube #1.
y1 (ft) (Bridge X-section)	2.06	Average depth of conveyance tube #1, Atube/TOPWtube
Ae (left abut) (sf)	545	Area of approach section conveyance tubes which are obstructed by left abutment.
a' (ft)	219.25	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	2.49	Ae\a'

Table 4: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Right Abutment.

		Remarks
Q (cfs)	1790	Total discharge input to WSPRO, 50-Year
qtube (cfs)	89.5	Discharge per equal conveyance tube, Q/20.
Atube #20 (sf) (Bridge X-section)	147.6	Area of conveyance tube #20, adjacent to right abutment.
Vabut (ft/s) (Bridge X-section)	0.61	Mean velocity of conveyance tube #20, adjacent to right abutment.
TOPWtube #1 (ft) (Bridge X-section)	71.7	Difference between left and right station of conveyance tube #20.
y1 (ft) (Bridge X-section)	2.06	Average depth of conveyance tube #20, Atube/TOPWtube
Ae (left abut) (sf)	389	Area of approach section conveyance tubes which are obstructed by left abutment.
a' (ft)	148.2	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	2.62	Ae\a'

Computation of Contraction Scour for Main Channel

50 YEAR:

Determine if the flow in the main channel is transporting bed material (live-bed scour) or is not (clear-water scour). To determine if the flow upstream of the bridge is transporting bed material, calculate the critical velocity for beginning of motion Vc and compare it with the mean velocity of the flow in the main channel. If the critical velocity of the bed material is larger than the mean velocity (Vc > V), then clear-water contraction scour will exist. If the critical velocity is less than the mean velocity (Vc < V), then live-bed contraction scour will exist.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Calculate the critical velocity, Vc, use Laursen's equation with Ss = 2.65:

$$V_c = 10.95\ y1^{0.167}\ D50^{0.33} =$$

The average depth, y1, is equal to the hydraulic radius of the main channel at the approach section, therefore:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{1560}{214} = 7.29 \text{ ft}$$

D50 = 0.2 mm = 0.0007 ft

Vc = 1.39 fps

Calculate the mean velocity, V, of the flow in the main channel:

$$Q_{avg} = Q\ \frac{\text{Kc (Approach)}}{\text{Ktotal (Approach)}} = 1790\ \frac{249932}{313989} = 1424.8 \text{ cfs}$$

$$V = \frac{Q_{avg}}{A_c} = \frac{1424.8}{1560} = 0.91 \text{ fps}$$

Ac = 1560 sf, Main channel area of approach section

Vc > V, therefore, Clear-Water Contraction Scour Occurs in the Main Channel

Computation of Contraction Scour for Main Channel

50 YEAR:

Clear-water contraction scour will occur in the main channel. Clear-water scour occurs when there is no movement of the bed material in the flow upstream of the crossing, but the acceleration of the flow and vortices created by the piles ands abutments causes the material in the crossing to move. The subsequent calculations are based on the discharge and depth of flow passing under the bridge in the main channel.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Clear-Water Contraction Scour:

y2 = [Q^2/(120 Dm^.67 W^2)]^.43

D50 =	0.2 mm	=	0.0007 ft	
Dm =	1.25(D50)	=	0.0009 ft	Effective mean diameter of bed material.
Q =			1424.8 cfs	
W =			184 ft	

y2 = 5.64 ft

Depth of Flow in the Main Channel at the Approach Section, y1:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{1560}{214} = 7.29 \text{ ft}$$

Depth of Clear-Water Contraction Scour in Main Channel, ys:

ys =y2 - y1 = -1.65 ft

No Contraction Scour, ys = 0, Scour Undefined

Computation of Local Scour at Piers

50 YEAR:

Only one computation for pier (pile) scour is calculated because it is assumed that any pier (pile) under the bridge could potentially be subject to the maximum flow depths and velocities derived from the WSPRO hydraulic model.

All hydraulic parameters which are needed for this computation are listed in Table 2.

The Froude Number for the pier scour computation is based on the hydraulic characteristics of the conveyance tube with the maximum velocity.

Fr1 = V1/(g y1)^0.5 =

V1 = 1.14 ft/s
y1 = 9.17 ft
g = 32.2 ft/s^2 acceleration of gravity

Fr1 = 0.07

Correction Factor K1 for Pier Nose Shape

Shape of Pier Nose	K1
Square Nose	1.1
Round Nose	1
Circular Cylinder	1
Sharp Nose	0.9
Group of Cylinders	1

Correction Factor K2 for Angle of Attack of Flow

Angle	L/a=4	L/a=8	L/a=12
0	1	1	1
15	1.5	2	2.5
30	2	2.75	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5
Angle = skew angle of flow L = length, a = width of pier			

Correction Factor K3 for Bed Condition

Bed Condition	Dune Height, H ft	K3
Clear-Water Scour	N/A	1.1
Plane Bed and Antidune Flow	N/A	1.1
Small Dunes	10 > H < 2	1.1
Medium Dunes	30 > H > 10	1.1-1.2
Large Dunes	H > 30	1.3

For a square nose pile aligned with the flow in a plane bed:

K1 = 1.1 K2 = 1 K3 = 1.1 a = 1.5 ft

Computation of Local Scour at Piers (continued)

50 YEAR:

Using the Colorado State University (CSU) Equation:

$$ys/y1 = 2\ K1\ K2\ K3\ (a/y1)^{.65}\ Fr1^{.43}$$

Depth of Pier Scour, ys:

ys = 2.18 ft

Top Width of Scour Holes, W:

W = 2 (2.75ys) + a = 13.5 ft

Computation of Local Scour at Abutments

50 YEAR:
LEFT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 3.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{219.3 \text{ ft}}{2.49 \text{ ft}}$ 88 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.07

Vabut =	0.61	ft/s	mean velocity adjacent to abutment end
g =	32.2	ft/s^2	acceleration of gravity
y1 =	2.06	ft	average depth of flow at abutment end

ys/y1 = 1.66 ft

Depth of Abutment Scour, ys:

ys = 3.42 ft

Computation of Local Scour at Abutments

50 YEAR:
RIGHT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 4.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{148.2 \text{ ft}}{2.62 \text{ ft}}$ 57 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.07

Vabut =	0.61 ft/s	mean velocity adjacent to abutment end
g =	32.2 ft/s^2	acceleration of gravity
y1 =	2.06 ft	average depth of flow at abutment end

ys/y1 = 1.66 ft

Depth of Abutment Scour, ys:

ys = 3.42 ft

100 YEAR SCOUR ANALYSIS

100 YEAR

Table 1: Hydraulic Variables from WSPRO for Estimation of Contraction Scour

		Remarks
Q (cfs)	1980	Total discharge input to WSPRO, 100-Year
Kc (Approach)	290206	Conveyance of main channel of approach section.
Ktotal (Approach)	392554	Total conveyance of approach section.
W1 (Approach) (ft)	212	Top width of flow (TOPW), assumed to represent active live-bed width of approach.
Ac (Approach) (sf)	1706	Main channel area of approach section.
TOPW (Approach) (ft)	212	Top width of main channel of approach section.
WETP (Approach) (ft)	214	Wetted perimeter of main channel of approach section.
Kc (Bridge)	255642	Conveyance of main channel through bridge.
Ktotal (Bridge)	362350	Total conveyance through bridge.
W2 (Bridge) (ft)	184	Difference between subarea break points defining channel banks at the bridge less pier widths in section.
Sf (ft/ft)	0.0001	Average unconstricted energy slope. Defined as the head loss (HF) divided by the distance between cross sections.

Table 2: Hydraulic Variables from WSPRO for Estimation of Pier Scour

		Remarks
Area (sf)	94.7	Area of conveyance tube with maximum velocity.
V1 (fps)	1.05	Maximum velocity in conveyance tube at bridge.
Top Width (ft)	9.5	Difference between right and left end stations.
Y1 (ft)	9.97	Mean depth, area divided by top width.

100 YEAR

Table 3: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Left Abutment.

		Remarks
Q (cfs)	1980	Total discharge input to WSPRO, 100-Year
qtube (cfs)	99.0	Discharge per equal conveyance tube, Q/20.
Atube #1 (sf) (Bridge X-section)	156.6	Area of conveyance tube #1, adjacent to left abutment.
Vabut (ft/s) (Bridge X-section)	0.63	Mean velocity of conveyance tube #1, adjacent to left abutment.
TOPWtube #1 (ft) (Bridge X-section)	58.3	Difference between left and right station of conveyance tube #1.
y1 (ft) (Bridge X-section)	2.69	Average depth of conveyance tube #1, Atube/TOPWtube
Ae (left abut) (sf)	590	Area of approach section conveyance tubes which are obstructed by left abutment.
a' (ft)	200	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	2.95	Ae/a'

Table 4: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Right Abutment.

		Remarks
Q (cfs)	1980	Total discharge input to WSPRO, 100-Year
qtube (cfs)	99.0	Discharge per equal conveyance tube, Q/20.
Atube #20 (sf) (Bridge X-section)	157.7	Area of conveyance tube #20, adjacent to right abutment.
Vabut (ft/s) (Bridge X-section)	0.65	Mean velocity of conveyance tube #20, adjacent to right abutment.
TOPWtube #1 (ft) (Bridge X-section)	58.7	Difference between left and right station of conveyance tube #20.
y1 (ft) (Bridge X-section)	2.69	Average depth of conveyance tube #20, Atube/TOPWtube
Ae (right abut) (sf)	417	Area of approach section conveyance tubes which are obstructed by right abutment.
a' (ft)	136	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	3.06	Ae/a'

Computation of Contraction Scour for Main Channel

100 YEAR:

Determine if the flow in the main channel is transporting bed material (live-bed scour) or is not (clear-water scour). To determine if the flow upstream of the bridge is transporting bed material, calculate the critical velocity for beginning of motion Vc and compare it with the mean velocity of the flow in the main channel. If the critical velocity of the bed material is larger than the mean velocity (Vc > V), then clear-water contraction scour will exist. If the critical velocity is less than the mean velocity (Vc< V), then live-bed contraction scour will exist.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Calculate the critical velocity, Vc, use Laursen's equation with Ss = 2.65:

$$Vc = 10.95\ y1^{0.167}\ D50^{0.33} =$$

The average depth, y1, is equal to the hydraulic radius of the main channel at the approach section, therefore:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{1706}{214} = 7.97\ \text{ft}$$

D50 = 0.2 mm = 0.0007 ft

Vc = 1.41 fps

Calculate the mean velocity, V, of the flow in the main channel:

$$Qavg = Q\frac{\text{Kc (Approach)}}{\text{Ktotal (Approach)}} = 1980\ \frac{290206}{392554} = 1463.8\ \text{cfs}$$

$$V = \frac{Qavg}{Ac} = \frac{1463.8}{1706} = 0.86\ \text{fps}$$

Ac = 1706 sf, Main channel area of approach section

Vc > V, therefore, Clear-Water Contraction Scour Occurs in the Main Channel

Computation of Contraction Scour for Main Channel

100 YEAR:

Clear-water contraction scour will occur in the main channel. Clear-water scour occurs when there is no movement of the bed material in the flow upstream of the crossing, but the acceleration of the flow and vortices created by the piles ands abutments causes the material in the crossing to move. The subsequent calculations are based on the discharge and depth of flow passing under the bridge in the main channel.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Clear-Water Contraction Scour:

y2 = [Q^2/(120 Dm^.67 W^2)]^.43

D50 =	0.2 mm	=	0.0007 ft	
Dm =	1.25(D50)	=	0.0009 ft	Effective mean diameter of bed material.
Q =			1463.8 cfs	
W =			184 ft	

y2 = 5.77 ft

Depth of Flow in the Main Channel at the Approach Section, y1:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{1706}{214} = 7.97 \text{ ft}$$

Depth of Clear-Water Contraction Scour in Main Channel, ys:

ys = y2 - y1 = -2.20 ft

No Contraction Scour, ys = 0, Scour Undefined

Computation of Local Scour at Piers

100 YEAR:

Only one computation for pier (pile) scour is calculated because it is assumed that any pier (pile) under the bridge could potentially be subject to the maximum flow depths and velocities derived from the WSPRO hydraulic model.

All hydraulic parameters which are needed for this computation are listed in Table 2.

The Froude Number for the pier scour computation is based on the hydraulic characteristics of the conveyance tube with the maximum velocity.

$Fr1 = V1/(g\ y1)^{0.5} =$

V1 = 1.05 ft/s
y1 = 9.97 ft
g = 32.2 ft/s^2 acceleration of gravity

Fr1 = 0.06

Correction Factor K1 for Pier Nose Shape

Shape of Pier Nose	K1
Square Nose	1.1
Round Nose	1
Circular Cylinder	1
Sharp Nose	0.9
Group of Cylinders	1

Correction Factor K2 for Angle of Attack of Flow

Angle	L/a=4	L/a=8	L/a=12
0	1	1	1
15	1.5	2	2.5
30	2	2.75	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5
Angle = skew angle of flow L = length, a = width of pier			

Correction Factor K3 for Bed Condition

Bed Condition	Dune Height, H ft	K3
Clear-Water Scour	N/A	1.1
Plane Bed and Antidune Flow	N/A	1.1
Small Dunes	10 > H < 2	1.1
Medium Dunes	30 > H > 10	1.1-1.2
Large Dunes	H > 30	1.3

For a square nose pile aligned with the flow in a plane bed:

K1 = 1.1 K2 = 1 K3 = 1.1 a = 1.5 ft

Computation of Local Scour at Piers (continued)

100 YEAR:

Using the Colorado State University (CSU) Equation:

$$ys/y1 = 2\ K1\ K2\ K3\ (a/y1)^{.65}\ Fr1^{.43}$$

Depth of Pier Scour, ys:

ys = 2.1 ft

Top Width of Scour Holes, W:

W = 2 (2.75ys) + a = 13.1 ft

Computation of Local Scour at Abutments

100 YEAR:
LEFT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 3.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{200 \text{ ft}}{2.95 \text{ ft}}$ 68 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.07

Vabut =	0.63 ft/s	mean velocity adjacent to abutment end
g =	32.2 ft/s^2	acceleration of gravity
y1 =	2.69 ft	average depth of flow at abutment end

ys/y1 = 1.66 ft

Depth of Abutment Scour, ys:

ys = 4.47 ft

Computation of Local Scour at Abutments

100 YEAR:
RIGHT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 4.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{136 \text{ ft}}{3.06 \text{ ft}}$ 44 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.07

Vabut =	0.65 ft/s	mean velocity adjacent to abutment end
g =	32.2 ft/s^2	acceleration of gravity
y1 =	2.69 ft	average depth of flow at abutment end

ys/y1 = 1.66 ft

Depth of Abutment Scour, ys:

ys = 4.47 ft

500 YEAR SCOUR ANALYSIS

SR 46 WEKIVA RIVER
BRIDGE SCOUR ANALYSIS
File: tmp\wekiva\scour\500yr\var.xls

BY: CAD
DATE: 11/18/94

500 YEAR

Table 1: Hydraulic Variables from WSPRO for Estimation of Contraction Scour

		Remarks
Q (cfs)	2420	Total discharge input to WSPRO, 500-Year
Kc (Approach)	385178	Conveyance of main channel of approach section.
Ktotal (Approach)	593164	Total conveyance of approach section.
W1 (Approach) (ft)	212	Top width of flow (TOPW), assumed to represent active live-bed width of approach.
Ac (Approach) (sf)	2022	Main channel area of approach section.
TOPW (Approach) (ft)	212	Top width of main channel of approach section.
WETP (Approach) (ft)	214	Wetted perimeter of main channel of approach section.
Kc (Bridge)	342688	Conveyance of main channel through bridge.
Ktotal (Bridge)	559512	Total conveyance through bridge.
W2 (Bridge) (ft)	184	Difference between subarea break points defining channel banks at the bridge less pier widths in section.
Sf (ft/ft)	0.0001	Average unconstricted energy slope. Defined as the head loss (HF) divided by the distance between cross sections.

Table 2: Hydraulic Variables from WSPRO for Estimation of Pier Scour

		Remarks
Area (sf)	131.2	Area of conveyance tube with maximum velocity.
V1 (fps)	0.92	Maximum velocity in conveyance tube at bridge.
Top Width (ft)	11.5	Difference between right and left end stations.
Y1 (ft)	11.41	Mean depth, area divided by top width.

500 YEAR

Table 3: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Left Abutment.

		Remarks
Q (cfs)	2420	Total discharge input to WSPRO, 500-Year
qtube (cfs)	121.0	Discharge per equal conveyance tube, Q/20.
Atube #1 (sf) (Bridge X-section)	191.8	Area of conveyance tube #1, adjacent to left abutment.
Vabut (ft/s) (Bridge X-section)	0.63	Mean velocity of conveyance tube #1, adjacent to left abutment.
TOPWtube #1 (ft) (Bridge X-section)	48.8	Difference between left and right station of conveyance tube #1.
y1 (ft) (Bridge X-section)	3.93	Average depth of conveyance tube #1, Atube/TOPWtube
Ae (left abut) (sf)	672	Area of approach section conveyance tubes which are obstructed by left abutment.
a' (ft)	160	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	4.19	Ae/a'

Table 4: Hydraulic Variables from WSPRO for Estimation of Abutment Scour Using HIRE Equation for Right Abutment.

		Remarks
Q (cfs)	2420	Total discharge input to WSPRO, 500-Year
qtube (cfs)	121.0	Discharge per equal conveyance tube, Q/20.
Atube #20 (sf) (Bridge X-section)	192.2	Area of conveyance tube #20, adjacent to right abutment.
Vabut (ft/s) (Bridge X-section)	0.63	Mean velocity of conveyance tube #20, adjacent to right abutment.
TOPWtube #1 (ft) (Bridge X-section)	48.9	Difference between left and right station of conveyance tube #20.
y1 (ft) (Bridge X-section)	3.93	Average depth of conveyance tube #20, Atube/TOPWtube
Ae (right abut) (sf)	499	Area of approach section conveyance tubes which are obstructed by right abutment.
a' (ft)	118	Length of abutment projected into flow, determined by adding top widths of obstructed conveyance tubes.
ya (ft)	4.24	Ae/a'

Computation of Contraction Scour for Main Channel

500 YEAR:

Determine if the flow in the main channel is transporting bed material (live-bed scour) or is not (clear-water scour). To determine if the flow upstream of the bridge is transporting bed material, calculate the critical velocity for beginning of motion Vc and compare it with the mean velocity of the flow in the main channel. If the critical velocity of the bed material is larger than the mean velocity (Vc > V), then clear-water contraction scour will exist. If the critical velocity is less than the mean velocity (Vc< V), then live-bed contraction scour will exist.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Calculate the critical velocity, Vc, use Laursen's equation with Ss = 2.65:

$$Vc = 10.95\ y1^{0.167}\ D50^{0.33} =$$

The average depth, y1, is equal to the hydraulic radius of the main channel at the approach section, therefore:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{2022}{214} = 9.45 \text{ ft}$$

D50 = 0.2 mm = 0.0007 ft

Vc = 1.45 fps

Calculate the mean velocity, V, of the flow in the main channel:

$$Qavg = Q\ \frac{\text{Kc (Approach)}}{\text{Ktotal (Approach)}} = 2420\ \frac{385178}{593164} = 1571.5 \text{ cfs}$$

$$V = \frac{Qavg}{Ac} = \frac{1571.5}{2022} = 0.78 \text{ fps}$$

Ac = 2022 sf, Main channel area of approach section

Vc > V, therefore, Clear-Water Contraction Scour Occurs in the Main Channel

Computation of Contraction Scour for Main Channel

500 YEAR:

Clear-water contraction scour will occur in the main channel. Clear-water scour occurs when there is no movement of the bed material in the flow upstream of the crossing, but the acceleration of the flow and vortices created by the piles ands abutments causes the material in the crossing to move. The subsequent calculations are based on the discharge and depth of flow passing under the bridge in the main channel.

All hydraulic parameters which are needed for this computation are listed in Table 1.

Clear-Water Contraction Scour:

y2 = [Q^2/(120 Dm^.67 W^2)]^.43

$$y_2 = \left[\frac{Q^2}{120\, D_m^{.67}\, W^2} \right]^{.43}$$

D50 =	0.2 mm	=	0.0007 ft	
Dm =	1.25(D50)	=	0.0009 ft	Effective mean diameter of bed material.
Q =			1571.5 cfs	
W =			184 ft	

y2 = 6.14 ft

Depth of Flow in the Main Channel at the Approach Section, y1:

$$y1 = \frac{\text{Ac (approach)}}{\text{WETP (Approach)}} = \frac{2022}{214} = 9.45 \text{ ft}$$

Depth of Clear-Water Contraction Scour in Main Channel, ys:

ys = y2 - y1 = -3.31 ft

No Contraction Scour, ys = 0, Scour Undefined

Computation of Local Scour at Piers

500 YEAR:

Only one computation for pier (pile) scour is calculated because it is assumed that any pier (pile) under the bridge could potentially be subject to the maximum flow depths and velocities derived from the WSPRO hydraulic model.

All hydraulic parameters which are needed for this computation are listed in Table 2.

The Froude Number for the pier scour computation is based on the hydraulic characteristics of the conveyance tube with the maximum velocity.

Fr1 = V1/(g y1)^0.5 =

V1 = 0.92 ft/s
y1 = 11.41 ft
g = 32.2 ft/s^2 acceleration of gravity

Fr1 = 0.05

Correction Factor K1 for Pier Nose Shape

Shape of Pier Nose	K1
Square Nose	1.1
Round Nose	1
Circular Cylinder	1
Sharp Nose	0.9
Group of Cylinders	1

Correction Factor K2 for Angle of Attack of Flow

Angle	L/a=4	L/a=8	L/a=12
0	1	1	1
15	1.5	2	2.5
30	2	2.75	3.5
45	2.3	3.3	4.3
90	2.5	3.9	5
Angle = skew angle of flow L = length, a = width of pier			

Correction Factor K3 for Bed Condition

Bed Condition	Dune Height, H ft	K3
Clear-Water Scour	N/A	1.1
Plane Bed and Antidune Flow	N/A	1.1
Small Dunes	10 > H < 2	1.1
Medium Dunes	30 > H > 10	1.1-1.2
Large Dunes	H > 30	1.3

For a square nose pile aligned with the flow in a plane bed:

K1 = 1.1 K2 = 1 K3 = 1.1 a = 1.5 ft

Computation of Local Scour at Piers (continued)

500 YEAR:

Using the Colorado State University (CSU) Equation:

ys/y1 = 2 K1 K2 K3 (a/y1)^.65 Fr1^.43

Depth of Pier Scour, ys:

ys = 2.04 ft

Top Width of Scour Holes, W:

W = 2 (2.75ys) + a = 12.7 ft

Computation of Local Scour at Abutments

500 YEAR:
LEFT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 3.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{160 \text{ ft}}{4.19 \text{ ft}}$ 38 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.06

Vabut =	0.63 ft/s	mean velocity adjacent to abutment end
g =	32.2 ft/s^2	acceleration of gravity
y1 =	3.93 ft	average depth of flow at abutment end

ys/y1 = 1.58 ft

Depth of Abutment Scour, ys:

ys = 6.21 ft

Computation of Local Scour at Abutments

500 YEAR:
RIGHT ABUTMENT:

The bridge has spill-through abutments which are set perpendicular to the flow.

The HIRE equation is applicable when the ratio of projected abutment length (a') to the flow depth (ya) is greater than 25.

All hydraulic parameters which are needed for this computation are listed in Table 4.

Using HIRE Equation:

Check: $\frac{a'}{ya} > 25$, $\frac{118 \text{ ft}}{4.24 \text{ ft}}$ 28 > 25

ys/y1 = 4 Fr1^0.33

Fr1 = Vabut/(g y1)^0.5 0.06

Vabut =	0.63 ft/s	mean velocity adjacent to abutment end
g =	32.2 ft/s^2	acceleration of gravity
y1 =	3.93 ft	average depth of flow at abutment end

ys/y1 = 1.58 ft

Depth of Abutment Scour, ys:

ys = 6.21 ft

EXISTING 252-FOOT BRIDGE

WSPRO INPUT & OUTPUT

WITH SCOUR OUTPUT DATA

```
T1       SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS     FILE:SR46ES
T2       EXISTING 252-FOOT BRIDGE                  REVISED:10/12/94
T3       SCOUR OUTPUT DATA
*
* ---------------------------------------------------------------
J1       0.1 , 0.05 , 0.05 , 1.0
*
*         Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
J3        5    6     3      17     13    14   16   28
*
*        10 yr    25 yr    50 yr    100 yr    500 yr
WS       8.3      9.4      10.1     10.8      12.3
Q        1330     1595     1790     1980      2420
* ---------------------------------------------------------------
XS   32+50 0
GR        0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
GR        668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
GR        900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
GR        1300,21.6
N         0.08     0.035     0.08     0.035     0.08
SA             586       682        825        947
*
XS   30+25 225
GR        0,23.1  200,20  248,19  250,19.8  440,19.7  461,18.1  475,19.5
GR        500,18.9  520,19  525,12.2   550,18   600,17.7  608,16.8
GR        615,17.6  675,1.9  700,1.9  728,2.8  750,5.2  775,5  825,2.8
GR        900,17.8  925,17  950,19.4  975,19.1  1000,20.2  1300,23.3
N         0.08   0.035   0.08
SA            615      900
*
*         BRIDGE SECTION
*
BR   30+00 250     17.4
GR        628,17.4   628,15.4  633,15  645,10  650,7.3  675,0.7
GR        725,1.7  750,3.6   775,4.3   800,2.4   825,2.4   874,17.4
GR        628,17.4
*
*        BRTYPE    BRWDTH    EMBSS    EMBELV
CD          3        34.3       3       20.5
*
PW 1     2,14  6,14  6,10.5  15.4,10.5  15.4,14
*
N        0.025   0.035   0.025
SA           648      847
*
*        APPROACH SECTION
*
AS   29+75 275
GR        0,24.3  220,20  300,19.5  313,19  400,19.3  500,19.8  550,17.8
GR        575,17.8  622,15.5   652,5  675,1.5  700,1  725,-0.6  775,3.8
GR        800,3.4  825,1.8  878,15.2  892,15  900,17.8  910,16  925,19.7
GR        965,19  975,19.8  1000,19.6  1058,20  1300,23.53
N         0.08    0.035    0.08
SA            643       855
*
*
XS   28+68 382
GR        43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
GR        796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
GR        1055,9  1125,11  1169,13  1181,14  1300,19.8
N         0.08   0.035   0.08
SA            636      982
*
XS   27+50 500
GR        122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
GR        600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
GR        1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
GR        1240,16.8  1300,19.1  1325,20
N         0.08   0.035   0.08
SA            652     1035
*
```

```
XS    25+00 750
GR          45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
GR          354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
GR          800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
GR          1164,8  1184,9  1200,10  1270,15
N           0.08   0.035   0.08
SA              575      1164
*
HP 2 30+00      10.11    *    *    1790
HP 2 30+00      10.81    *    *    1980
HP 2 30+00      12.30    *    *    2420
*
HP 1 29+75      10.12    1    10.12
HP 1 29+75      10.82    1    10.82
HP 1 29+75      12.31    1    12.31
*
ER
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WSPRO        FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
P060188          MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

          *** RUN DATE & TIME: 10-13-94  10:09

  T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS     FILE:SR46ES
  T2        EXISTING 252-FOOT BRIDGE                  REVISED:10/12/94
  T3        SCOUR OUTPUT DATA
  * -----------------------------------------------------------------
  J1        0.1 , 0.05 , 0.05 , 1.0

 J1 RECORD PARAMETERS:
 DELTAY =  .10   YTOL =  .05   QTOL =  .05   FNTEST = 1.00   IHFNOJ = -1

  *
  *          Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
  J3         5    6     3      17     13    14   16   28
  *
  *         10 yr    25 yr   50 yr   100 yr   500 yr
  WS        8.3      9.4     10.1    10.8     12.3
  Q         1330     1595    1790    1980     2420
 *** Q-DATA FOR SEC-ID, ISEQ =          1
  * -----------------------------------------------------------------
*** START PROCESSING CROSS SECTION - "32+50"
  XS   32+50 0
  GR         0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
  GR         668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
  GR         900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
  GR         1300,21.6
  N          0.08     0.035     0.08     0.035     0.08
  SA              586       682        825        947
  *

 *** FINISH PROCESSING CROSS SECTION - "32+50"
 *** CROSS SECTION "32+50" WRITTEN TO DISK, RECORD NO. =  1

 --- DATA SUMMARY FOR SECID "32+50" AT SRD =       0.  ERR-CODE =      0

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

 X-Y COORDINATE PAIRS  (NGP =  20):
       X       Y           X       Y           X       Y           X       Y
      .0   18.80       100.0   13.40       200.0   10.00       400.0    7.20
   520.0    8.00       586.0    7.00       650.0    2.50       668.0    2.20
   682.0    6.80       720.0    7.90       825.0    7.90       850.0    2.70
   878.0    5.60       900.0    5.00       947.0    7.70      1000.0    8.00
  1040.0    8.30      1120.0   12.10      1190.0   18.70      1300.0   21.60

  X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X    YMAX
      .0   18.80       668.0    2.20      1300.0   21.60      1300.0   21.60

 SUBAREA BREAKPOINTS (NSA =  5):
        586.    682.    825.    947.

 ROUGHNESS COEFFICIENTS (NSA =  5):
         .080     .035     .080     .035     .080

*** START PROCESSING CROSS SECTION - "30+25"
  XS   30+25 225
  GR         0,23.1  200,20  248,19  250,19.8  440,19.7  461,18.1  475,19.5
  GR         500,18.9  520,19  525,12.2   550,18   600,17.7  608,16.8
  GR         615,17.6  675,1.9  700,1.9  728,2.8  750,5.2  775,5  825,2.8
  GR         900,17.8  925,17  950,19.4  975,19.1  1000,20.2  1300,23.3
  N          0.08   0.035   0.08
  SA             615      900
  *
  *          BRIDGE SECTION
  *
```

```
*** FINISH PROCESSING CROSS SECTION - "30+25"
*** CROSS SECTION "30+25" WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "30+25" AT SRD =      225.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  26):
        X       Y           X       Y           X       Y           X       Y
       .0   23.10       200.0   20.00       248.0   19.00       250.0   19.80
    440.0   19.70       461.0   18.10       475.0   19.50       500.0   18.90
    520.0   19.00       525.0   12.20       550.0   18.00       600.0   17.70
    608.0   16.80       615.0   17.60       675.0    1.90       700.0    1.90
    728.0    2.80       750.0    5.20       775.0    5.00       825.0    2.80
    900.0   17.80       925.0   17.00       950.0   19.40       975.0   19.10
   1000.0   20.20      1300.0   23.30

 X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X    YMAX
       .0   23.10       675.0    1.90      1300.0   23.30      1300.0   23.30

SUBAREA BREAKPOINTS (NSA =  3):
       615.    900.

ROUGHNESS COEFFICIENTS (NSA =  3):
        .080     .035     .080

*** START PROCESSING CROSS SECTION - "30+00"
  BR   30+00 250     17.4
  GR         628,17.4   628,15.4  633,15  645,10  650,7.3  675,0.7
  GR         725,1.7  750,3.6   775,4.3   800,2.4   825,2.4   874,17.4
  GR         628,17.4
  *
  *         BRTYPE    BRWDTH    EMBSS    EMBELV
  CD           3        34.3       3       20.5
  *
  PW 1      2,14  6,14  6,10.5  15.4,10.5  15.4,14
  *
  N         0.025   0.035   0.025
  SA            648      847
  *
  *         APPROACH SECTION
  *

*** FINISH PROCESSING CROSS SECTION - "30+00"
*** CROSS SECTION "30+00" WRITTEN TO DISK, RECORD NO. =  3

--- DATA SUMMARY FOR SECID "30+00" AT SRD =      250.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  13):
        X       Y           X       Y           X       Y           X       Y
    628.0   17.40       628.0   15.40       633.0   15.00       645.0   10.00
    650.0    7.30       675.0     .70       725.0    1.70       750.0    3.60
    775.0    4.30       800.0    2.40       825.0    2.40       874.0   17.40
    628.0   17.40

 X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X    YMAX
    628.0   17.40       675.0     .70       874.0   17.40       628.0   17.40

SUBAREA BREAKPOINTS (NSA =  3):
       648.    847.

ROUGHNESS COEFFICIENTS (NSA =  3):
        .025     .035     .025
```

```
BRIDGE PARAMETERS:
  BRTYPE  BRWDTH     LSEL  USERCD  EMBSS    EMBELV  ABSLPL  ABSLPR
    3      34.3     17.40 *******  3.00     20.50 ******* *******

 PIER DATA:  NPW =  5    PPCD = 1.
      PELV  PWDTH       PELV  PWDTH       PELV  PWDTH       PELV  PWDTH
       2.00  14.0        6.00  14.0        6.00  10.5       15.40  10.5
      15.40  14.0

*** START PROCESSING CROSS SECTION - "29+75"
   AS    29+75 275
   GR         0,24.3  220,20  300,19.5  313,19  400,19.3  500,19.8  550,17.8
   GR         575,17.8  622,15.5   652,5  675,1.5  700,1  725,-0.6  775,3.8
   GR         800,3.4  825,1.8  878,15.2  892,15  900,17.8  910,16  925,19.7
   GR         965,19  975,19.8  1000,19.6  1058,20  1300,23.53
   N          0.08    0.035    0.08
   SA              643       855
   *
   *

 *** FINISH PROCESSING CROSS SECTION - "29+75"
 *** CROSS SECTION "29+75" WRITTEN TO DISK, RECORD NO. =  4

 --- DATA SUMMARY FOR SECID "29+75" AT SRD =    275.  ERR-CODE =      0

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

 X-Y COORDINATE PAIRS  (NGP =  26):
         X       Y         X       Y          X       Y          X       Y
        .0   24.30     220.0   20.00      300.0   19.50      313.0   19.00
     400.0   19.30     500.0   19.80      550.0   17.80      575.0   17.80
     622.0   15.50     652.0    5.00      675.0    1.50      700.0    1.00
     725.0    -.60     775.0    3.80      800.0    3.40      825.0    1.80
     878.0   15.20     892.0   15.00      900.0   17.80      910.0   16.00
     925.0   19.70     965.0   19.00      975.0   19.80     1000.0   19.60
    1058.0   20.00    1300.0   23.53

  X-Y MAX-MIN POINTS:
      XMIN       Y         X    YMIN       XMAX       Y          X    YMAX
        .0   24.30     725.0    -.60     1300.0   23.53         .0   24.30

 SUBAREA BREAKPOINTS (NSA =  3):
        643.    855.

 ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

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

 *** START PROCESSING CROSS SECTION - "28+68"
   XS    28+68 382
   GR         43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
   GR         796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
   GR         1055,9  1125,11  1169,13  1181,14  1300,19.8
   N          0.08   0.035   0.08
   SA             636      982
   *

 *** FINISH PROCESSING CROSS SECTION - "28+68"
 *** CROSS SECTION "28+68" WRITTEN TO DISK, RECORD NO. =  5

 --- DATA SUMMARY FOR SECID "28+68" AT SRD =    382.  ERR-CODE =      0

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

```
X-Y COORDINATE PAIRS  (NGP =  21):
       X        Y           X       Y           X       Y           X        Y
     43.0    21.00       147.0   17.00       238.0   12.00       290.0    10.00
    418.0     8.00       500.0    7.60       636.0    7.00       672.0     4.00
    796.0     4.00       812.0    3.00       822.0    2.00       854.0     2.00
    874.0     4.00       950.0    5.00       982.0    8.00      1000.0     8.30
   1055.0     9.00      1125.0   11.00      1169.0   13.00      1181.0    14.00
   1300.0    19.80

 X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X     YMAX
     43.0    21.00       822.0    2.00      1300.0   19.80        43.0    21.00

SUBAREA BREAKPOINTS (NSA =  3):
        636.   982.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "27+50"
  XS   27+50 500
  GR         122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
  GR         600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
  GR         1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
  GR         1240,16.8  1300,19.1  1325,20
  N          0.08   0.035   0.08
  SA              652     1035
  *

*** FINISH PROCESSING CROSS SECTION - "27+50"
*** CROSS SECTION "27+50" WRITTEN TO DISK, RECORD NO. =  6

--- DATA SUMMARY FOR SECID "27+50" AT SRD =     500.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  21):
       X        Y           X       Y           X       Y           X        Y
    122.0    20.00       230.0   15.00       332.0   10.00       400.0     8.50
    500.0     7.70       562.0    7.80       600.0    7.10       652.0     7.50
    745.0     3.40       800.0    2.00       900.0    2.40       955.0     5.00
   1000.0     6.70      1050.0    7.80      1130.0    8.30      1163.0    10.00
   1200.0    12.00      1225.0   15.00      1240.0   16.80      1300.0    19.10
   1325.0    20.00

 X-Y MAX-MIN POINTS:
     XMIN       Y           X    YMIN        XMAX       Y           X     YMAX
    122.0    20.00       800.0    2.00      1325.0   20.00       122.0    20.00

SUBAREA BREAKPOINTS (NSA =  3):
        652.   1035.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "25+00"
  XS   25+00 750
  GR         45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
  GR         354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
  GR         800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
  GR         1164,8  1184,9  1200,10  1270,15
  N          0.08   0.035   0.08
  SA              575     1164
  *
  HP 2 30+00      10.11     *     *     1790

*** FINISH PROCESSING CROSS SECTION - "25+00"
*** CROSS SECTION "25+00" WRITTEN TO DISK, RECORD NO. =  7

--- DATA SUMMARY FOR SECID "25+00" AT SRD =     750.  ERR-CODE =      0
```

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

 X-Y COORDINATE PAIRS  (NGP =  26):
         X       Y          X       Y          X       Y          X       Y
      45.0   20.00       70.0   19.00       98.0   18.00      118.0   17.00
     148.0   16.00      178.0   15.00      211.0   14.00      268.0   13.00
     354.0   12.00      388.0   11.00      432.0   10.00      500.0    8.90
     575.0    8.00      600.0    8.00      700.0    7.50      800.0    7.10
     837.0    7.00      888.0    6.00      960.0    5.00     1000.0    5.50
    1046.0    6.00     1127.0    7.00     1164.0    8.00     1184.0    9.00
    1200.0   10.00     1270.0   15.00

  X-Y MAX-MIN POINTS:
      XMIN       Y          X    YMIN       XMAX       Y          X    YMAX
      45.0   20.00      960.0    5.00     1270.0   15.00       45.0   20.00

 SUBAREA BREAKPOINTS (NSA =  3):
        575.   1164.

 ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

 50 YEAR
    VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

         WSEL     LEW     REW    AREA        K         Q     VEL
        10.11   644.7   850.2  1404.9  217496.     1790.    1.27

 X STA.       644.7       668.4       675.8       682.1       688.7       695.3
   A(I)             104.0        63.7        58.8        60.2        60.6
   V(I)               .86        1.40        1.52        1.49        1.48

 X STA.       695.3       702.2       709.3       716.6       724.0       731.4
   A(I)              61.7        62.1        62.7        63.1        60.9
   V(I)              1.45        1.44        1.43        1.42        1.47

 X STA.       731.4       739.6       749.8       762.0       775.5       787.2
   A(I)              62.4        70.6        77.4        80.3        74.1
   V(I)              1.43        1.27        1.16        1.11        1.21

 X STA.       787.2       797.0       805.7       814.2       822.8       850.2
   A(I)              69.2        66.7        66.1        66.1       114.0
   V(I)              1.29        1.34        1.35        1.35         .79
1
   HP 2 30+00      10.81      *     *     1980


100 YEAR
    VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

         WSEL     LEW     REW    AREA        K         Q     VEL
        10.81   643.1   852.5  1550.1  255084.     1980.    1.28

 X STA.       643.1       667.5       675.2       681.9       688.6       695.5
   A(I)             113.8        69.8        67.6        66.7        67.1
   V(I)               .87        1.42        1.46        1.48        1.47

 X STA.       695.5       702.5       709.8       717.3       724.8       732.6
   A(I)              67.0        69.3        70.0        69.4        68.8
   V(I)              1.48        1.43        1.41        1.43        1.44

 X STA.       732.6       741.2       751.9       763.8       777.0       788.3
   A(I)              70.3        79.8        83.4        87.6        80.1
   V(I)              1.41        1.24        1.19        1.13        1.24

 X STA.       788.3       798.0       806.6       815.4       823.9       852.5
   A(I)              76.5        72.8        73.4        72.0       124.6
   V(I)              1.29        1.36        1.35        1.38         .79
```

HP 2 30+00 12.30 * * 2420

500 YEAR

VELOCITY DISTRIBUTION: ISEQ = 3; SECID = 30+00; SRD = 250.

WSEL	LEW	REW	AREA	K	Q	VEL
12.30	639.5	857.3	1868.4	343921.	2420.	1.30

X STA.	639.5		665.5		674.2		681.1		688.2		695.7
A(I)		134.2		88.7		79.2		81.4		84.0	
V(I)		.90		1.36		1.53		1.49		1.44	
X STA.	695.7		703.0		710.7		718.4		726.5		734.8
A(I)		81.5		84.4		83.4		85.8		84.6	
V(I)		1.48		1.43		1.45		1.41		1.43	
X STA.	734.8		744.0		754.8		766.7		779.2		790.0
A(I)		87.5		94.7		100.6		101.6		94.2	
V(I)		1.38		1.28		1.20		1.19		1.28	
X STA.	790.0		799.7		808.6		817.3		826.2		857.3
A(I)		91.5		88.5		86.1		88.2		148.2	
V(I)		1.32		1.37		1.40		1.37		.82	

1

*

HP 1 29+75 10.12 1 10.12

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = 29+75; SRD = 275.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	6.	98.	6.	6.				31.
	2	1572.	252983.	212.	214.				24302.
	3	1.	10.	3.	3.				4.
10.12		1579.	253091.	221.	223.	1.01	637.	858.	23892.

1

HP 1 29+75 10.82 1 10.82

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = 29+75; SRD = 275.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	10.	221.	8.	8.				67.
	2	1721.	294013.	212.	214.				27822.
	3	4.	60.	6.	6.				20.
10.82		1735.	294294.	225.	228.	1.01	635.	861.	27138.

1

HP 1 29+75 12.31 1 12.31

CROSS-SECTION PROPERTIES: ISEQ = 4; SECID = 29+75; SRD = 275.

WSEL	SA#	AREA	K	TOPW	WETP	ALPH	LEW	REW	QCR
	1	25.	722.	12.	13.				202.
	2	2037.	389357.	212.	214.				35824.
	3	17.	398.	12.	12.				116.
12.31		2078.	390477.	235.	239.	1.03	631.	867.	34486.

*

ER

1 NORMAL END OF WSPRO EXECUTION.

PROPOSED 561-FOOT DUAL BRIDGES

WSPRO INPUT & OUTPUT

WITH SCOUR OUTPUT DATA

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T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS     FILE:SR46PROS
T2        PROPOSED 561-FOOT DUAL BRIDGES            REVISED:10/18/94
T3        SCOUR ANALYSIS
* ----------------------------------------------------------------
J1        0.1 , 0.05 , 0.05 , 1.0
*
*          Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
J3         5    6     3      17     13    14   16   28
*
*         10 yr    25 yr   50 yr   100 yr   500 yr
WS        8.3      9.4     10.1    10.8     12.3
Q         1330     1595    1790    1980     2420
* ----------------------------------------------------------------
XS   32+50 0
GR         0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
GR         668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
GR         900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
GR         1300,21.6
N          0.08     0.035     0.08     0.035     0.08
SA              586       682        825        947
*
XS   30+25 225
GR         437,16.65  439,16.65  442,15   456,8   648,8   675,1.9
GR         700,1.9   725,2.8   775,5   800,3.6   825,2.8   848,8
GR         972,8   993,18.5   996,19.725  998,19.725
N          0.025    0.035    0.025
SA              648       848
*
*         PROPOSED BRIDGE SECTION
*
BR   30+00 250     16.65
GR         437,20.846  437,16.65   439,16.65   442,15  456,8
GR         648,8   675,0.8   725,1.8   750,3.7   775,4.3   800,2.4
GR         825,2.4   847,8   972,8   993,18.5   996,19.725   998,19.725
GR         998,23.932  437,20.846
*
*         BRTYPE    BRWDTH    EMBSS    EMBELV
CD           3        104       2       20.846
*
PW 1      0.8,1.5  2,1.5  2,3  4,3  4,4.5  5,4.5  5,6  8,6  8,15
PW 1      16.9,15  16.9,0
*
N         0.025  0.035  0.025
SA             648      847
*
*         APPROACH SECTION
*
AS   29+75 275
GR         437,16.65  439,16.65   442,15  456,8  643,8  675,1.5
GR         700,1   725,-0.6   750,2.3   775,3.8   800,3.4   825,1.8
GR         855,8  972,8  993,18.5  996,19.725  998,19.725
N          0.025    0.035    0.025
SA              643       855
*
*
XS   28+68 382
GR         43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
GR         796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
GR         1055,9  1125,11  1169,13  1181,14  1300,19.8
N          0.08   0.035   0.08
SA             636      982
*
XS   27+50 500
GR         122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
GR         600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
GR         1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
GR         1240,16.8  1300,19.1  1325,20
N          0.08   0.035   0.08
SA             652     1035
*
```

```
XS    25+00 750
GR          45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
GR          354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
GR          800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
GR          1164,8  1184,9  1200,10  1270,15
N           0.08   0.035   0.08
SA              575      1164
*
HP 2 30+00    10.12    *    *    1790
HP 2 30+00    10.82    *    *    1980
HP 2 30+00    12.31    *    *    2420
*
HP 2 29+75    10.13    *    *    1790
HP 2 29+75    10.82    *    *    1980
HP 2 29+75    12.31    *    *    2420
*
HP 1 29+75    10.13    1    10.13
HP 1 29+75    10.82    1    10.82
HP 1 29+75    12.31    1    12.31
*
HP 1 30+00    10.12    1    10.12
HP 1 30+00    10.82    1    10.82
HP 1 30+00    12.31    1    12.31
*
EX
ER
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
P060188             MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         *** RUN DATE & TIME: 10-19-94  13:36

  T1        SR 46 AT WEKIVA RIVER BRIDGE ANALYSIS      FILE:SR46PROS
  T2        PROPOSED 561-FOOT DUAL BRIDGES             REVISED:10/18/94
  T3        SCOUR ANALYSIS
  * -----------------------------------------------------------------
  J1        0.1 , 0.05 , 0.05 , 1.0

J1 RECORD PARAMETERS:
DELTAY =  .10   YTOL =  .05   QTOL =  .05   FNTEST = 1.00   IHFNOJ = -1

  *
  *          Q   SRD   WSEL   AREA   VEL   FR#   K   XSTW
  J3         5    6     3      17     13    14   16   28
  *
  *         10 yr    25 yr   50 yr   100 yr   500 yr
  WS        8.3      9.4     10.1    10.8     12.3
  Q         1330     1595    1790    1980     2420
*** Q-DATA FOR SEC-ID, ISEQ =          1
  * -----------------------------------------------------------------

*** START PROCESSING CROSS SECTION - "32+50"
  XS   32+50 0
  GR        0,18.8   100,13.4   200,10   400,7.2   520,8   586,7   650,2.5
  GR        668,2.2   682,6.8   720,7.9   825,7.9   850,2.7   878,5.6
  GR        900,5   947,7.7   1000,8.0   1040,8.3   1120,12.1   1190,18.7
  GR        1300,21.6
  N         0.08      0.035     0.08     0.035     0.08
  SA             586       682        825        947
  *

*** FINISH PROCESSING CROSS SECTION - "32+50"
*** CROSS SECTION "32+50" WRITTEN TO DISK, RECORD NO. =  1

--- DATA SUMMARY FOR SECID "32+50" AT SRD =       0.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  20):
      X       Y          X       Y            X       Y            X       Y
     .0   18.80      100.0   13.40        200.0   10.00        400.0    7.20
  520.0    8.00      586.0    7.00        650.0    2.50        668.0    2.20
  682.0    6.80      720.0    7.90        825.0    7.90        850.0    2.70
  878.0    5.60      900.0    5.00        947.0    7.70       1000.0    8.00
 1040.0    8.30     1120.0   12.10       1190.0   18.70       1300.0   21.60

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN      XMAX        Y            X    YMAX
       .0   18.80      668.0    2.20    1300.0    21.60       1300.0   21.60

SUBAREA BREAKPOINTS (NSA =  5):
       586.    682.    825.    947.

ROUGHNESS COEFFICIENTS (NSA =  5):
        .080    .035    .080    .035    .080

*** START PROCESSING CROSS SECTION - "30+25"
  XS   30+25 225
  GR        437,16.65  439,16.65  442,15   456,8   648,8   675,1.9
  GR        700,1.9   725,2.8   775,5   800,3.6   825,2.8   848,8
  GR        972,8   993,18.5   996,19.725  998,19.725
  N         0.025     0.035     0.025
  SA             648       848
  *
  *        PROPOSED BRIDGE SECTION
  *
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*** FINISH PROCESSING CROSS SECTION - "30+25"
*** CROSS SECTION "30+25" WRITTEN TO DISK, RECORD NO. =  2

--- DATA SUMMARY FOR SECID "30+25" AT SRD =     225.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  16):
          X        Y            X        Y             X        Y             X        Y
      437.0    16.65        439.0    16.65         442.0    15.00         456.0     8.00
      648.0     8.00        675.0     1.90         700.0     1.90         725.0     2.80
      775.0     5.00        800.0     3.60         825.0     2.80         848.0     8.00
      972.0     8.00        993.0    18.50         996.0    19.73         998.0    19.73

 X-Y MAX-MIN POINTS:
       XMIN        Y            X     YMIN          XMAX        Y             X     YMAX
      437.0    16.65        675.0     1.90         998.0    19.73         996.0    19.73

SUBAREA BREAKPOINTS (NSA =  3):
        648.    848.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025     .035     .025


*** START PROCESSING CROSS SECTION - "30+00"
  BR   30+00 250    16.65
  GR          437,20.846  437,16.65   439,16.65   442,15  456,8
  GR          648,8    675,0.8    725,1.8    750,3.7    775,4.3    800,2.4
  GR          825,2.4    847,8    972,8    993,18.5    996,19.725  998,19.725
  GR          998,23.932  437,20.846
  *
  *         BRTYPE    BRWDTH    EMBSS    EMBELV
  CD           3        104       2        20.846
  *
  PW 1       0.8,1.5  2,1.5  2,3  4,3  4,4.5  5,4.5  5,6  8,6  8,15
  PW 1       16.9,15  16.9,0
  *
  N          0.025   0.035   0.025
  SA              648      847
  *
  *          APPROACH SECTION
  *

*** FINISH PROCESSING CROSS SECTION - "30+00"
*** CROSS SECTION "30+00" WRITTEN TO DISK, RECORD NO. =  3

--- DATA SUMMARY FOR SECID "30+00" AT SRD =     250.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  19):
          X        Y            X        Y             X        Y             X        Y
      437.0    20.85        437.0    16.65         439.0    16.65         442.0    15.00
      456.0     8.00        648.0     8.00         675.0      .80         725.0     1.80
      750.0     3.70        775.0     4.30         800.0     2.40         825.0     2.40
      847.0     8.00        972.0     8.00         993.0    18.50         996.0    19.73
      998.0    19.73        998.0    23.93         437.0    20.85

 X-Y MAX-MIN POINTS:
       XMIN        Y            X     YMIN          XMAX        Y             X     YMAX
      437.0    20.85        675.0      .80         998.0    19.73         998.0    23.93

SUBAREA BREAKPOINTS (NSA =  3):
        648.    847.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025     .035     .025
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BRIDGE PARAMETERS:
 BRTYPE  BRWDTH     LSEL  USERCD  EMBSS   EMBELV  ABSLPL  ABSLPR
    3     104.0    16.65 *******  2.00    20.85 ******* *******

PIER DATA:  NPW = 11    PPCD = 1.
     PELV  PWDTH       PELV  PWDTH       PELV  PWDTH       PELV  PWDTH
       .80   1.5        2.00   1.5        2.00   3.0        4.00   3.0
      4.00   4.5        5.00   4.5        5.00   6.0        8.00   6.0
      8.00  15.0       16.90  15.0       16.90    .0

*** START PROCESSING CROSS SECTION - "29+75"
  AS   29+75 275
  GR         437,16.65  439,16.65   442,15  456,8  643,8  675,1.5
  GR         700,1   725,-0.6   750,2.3   775,3.8   800,3.4   825,1.8
  GR         855,8  972,8  993,18.5  996,19.725  998,19.725
  N          0.025    0.035    0.025
  SA              643         855
  *
  *

*** FINISH PROCESSING CROSS SECTION - "29+75"
*** CROSS SECTION "29+75" WRITTEN TO DISK, RECORD NO. =  4

--- DATA SUMMARY FOR SECID "29+75" AT SRD =     275.  ERR-CODE =      0

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

X-Y COORDINATE PAIRS  (NGP =  17):
       X       Y          X       Y           X       Y           X       Y
    437.0   16.65      439.0   16.65       442.0   15.00       456.0    8.00
    643.0    8.00      675.0    1.50       700.0    1.00       725.0    -.60
    750.0    2.30      775.0    3.80       800.0    3.40       825.0    1.80
    855.0    8.00      972.0    8.00       993.0   18.50       996.0   19.73
    998.0   19.73

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN       XMAX       Y           X    YMAX
    437.0   16.65      725.0    -.60      998.0   19.73       996.0   19.73

SUBAREA BREAKPOINTS (NSA =  3):
        643.    855.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .025    .035    .025

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

*** START PROCESSING CROSS SECTION - "28+68"
  XS   28+68 382
  GR         43,21  147,17  238,12  290,10  418,8  500,7.6  636,7   672,4
  GR         796,4  812,3   822,2   854,2   874,4  950,5  982,8  1000,8.3
  GR         1055,9  1125,11  1169,13  1181,14  1300,19.8
  N          0.08   0.035   0.08
  SA             636      982
  *

*** FINISH PROCESSING CROSS SECTION - "28+68"
*** CROSS SECTION "28+68" WRITTEN TO DISK, RECORD NO. =  5

--- DATA SUMMARY FOR SECID "28+68" AT SRD =     382.  ERR-CODE =      0

     SKEW     IHFNO    VSLOPE        EK        CK
       .0        0. *********       .50       .00
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X-Y COORDINATE PAIRS  (NGP =  21):
        X       Y          X       Y           X       Y           X       Y
     43.0   21.00      147.0   17.00       238.0   12.00       290.0   10.00
    418.0    8.00      500.0    7.60       636.0    7.00       672.0    4.00
    796.0    4.00      812.0    3.00       822.0    2.00       854.0    2.00
    874.0    4.00      950.0    5.00       982.0    8.00      1000.0    8.30
   1055.0    9.00     1125.0   11.00      1169.0   13.00      1181.0   14.00
   1300.0   19.80

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN        XMAX       Y           X    YMAX
     43.0   21.00      822.0    2.00      1300.0   19.80        43.0   21.00

SUBAREA BREAKPOINTS (NSA =  3):
        636.    982.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "27+50"
  XS   27+50 500
  GR         122,20   230,15   332,10   400,8.5   500,7.7   562,7.8
  GR         600,7.1  652,7.5  745,3.4   800,2    900,2.4   955,5
  GR         1000,6.7  1050,7.8  1130,8.3  1163,10  1200,12  1225,15
  GR         1240,16.8  1300,19.1  1325,20
  N          0.08   0.035   0.08
  SA             652     1035
  *

*** FINISH PROCESSING CROSS SECTION - "27+50"
*** CROSS SECTION "27+50" WRITTEN TO DISK, RECORD NO. =  6

--- DATA SUMMARY FOR SECID "27+50" AT SRD =     500.  ERR-CODE =       0

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

X-Y COORDINATE PAIRS  (NGP =  21):
        X       Y          X       Y           X       Y           X       Y
    122.0   20.00      230.0   15.00       332.0   10.00       400.0    8.50
    500.0    7.70      562.0    7.80       600.0    7.10       652.0    7.50
    745.0    3.40      800.0    2.00       900.0    2.40       955.0    5.00
   1000.0    6.70     1050.0    7.80      1130.0    8.30      1163.0   10.00
   1200.0   12.00     1225.0   15.00      1240.0   16.80      1300.0   19.10
   1325.0   20.00

 X-Y MAX-MIN POINTS:
     XMIN       Y          X    YMIN        XMAX       Y           X    YMAX
    122.0   20.00      800.0    2.00      1325.0   20.00       122.0   20.00

SUBAREA BREAKPOINTS (NSA =  3):
        652.   1035.

ROUGHNESS COEFFICIENTS (NSA =  3):
         .080    .035    .080

*** START PROCESSING CROSS SECTION - "25+00"
  XS   25+00 750
  GR         45,20  70,19  98,18  118,17  148,16  178,15  211,14  268,13
  GR         354,12  388,11  432,10  500,8.9  575,8  600,8  700,7.5
  GR         800,7.1  837,7  888,6  960,5  1000,5.5  1046,6  1127,7
  GR         1164,8  1184,9  1200,10  1270,15
  N          0.08   0.035   0.08
  SA             575     1164
  *
  HP 2 30+00    10.12    *    *    1790

*** FINISH PROCESSING CROSS SECTION - "25+00"
*** CROSS SECTION "25+00" WRITTEN TO DISK, RECORD NO. =  7

--- DATA SUMMARY FOR SECID "25+00" AT SRD =     750.  ERR-CODE =       0
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```
      SKEW     IHFNO    VSLOPE        EK        CK
        .0        0. *********       .50       .00

 X-Y COORDINATE PAIRS  (NGP =  26):
        X      Y           X      Y           X      Y           X      Y
      45.0  20.00        70.0  19.00        98.0  18.00       118.0  17.00
     148.0  16.00       178.0  15.00       211.0  14.00       268.0  13.00
     354.0  12.00       388.0  11.00       432.0  10.00       500.0   8.90
     575.0   8.00       600.0   8.00       700.0   7.50       800.0   7.10
     837.0   7.00       888.0   6.00       960.0   5.00      1000.0   5.50
    1046.0   6.00      1127.0   7.00      1164.0   8.00      1184.0   9.00
    1200.0  10.00      1270.0  15.00

  X-Y MAX-MIN POINTS:
      XMIN      Y          X    YMIN       XMAX       Y          X    YMAX
      45.0  20.00      960.0    5.00     1270.0   15.00       45.0   20.00

 SUBAREA BREAKPOINTS (NSA =  3):
         575.   1164.

 ROUGHNESS COEFFICIENTS (NSA =  3):
          .080    .035    .080

  50 YEAR        BRIDGE SECTION
     VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

         WSEL     LEW     REW    AREA         K         Q     VEL
        10.12   451.8   976.2  2084.2  284600.    1790.     .86

 X STA.        451.8       523.0       591.9       660.0       673.3       681.9
   A(I)             146.5       146.1       163.5        94.3        78.9
   V(I)               .61         .61         .55         .95        1.13

 X STA.        681.9       690.5       699.3       708.5       718.3       728.1
   A(I)              78.9        78.5        80.5        83.6        81.4
   V(I)              1.14        1.14        1.11        1.07        1.10

 X STA.        728.1       738.9       752.8       769.7       786.0       798.7
   A(I)              83.0        93.8       104.0        99.7        90.6
   V(I)              1.08         .95         .86         .90         .99

 X STA.        798.7       809.9       821.1       834.9       904.5       976.2
   A(I)              86.3        87.0        93.8       166.2       147.6
   V(I)              1.04        1.03         .95         .54         .61
1
   HP 2 30+00    10.82    *    *    1980


100 YEAR         BRIDGE SECTION
     VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

         WSEL     LEW     REW    AREA         K         Q     VEL
        10.82   450.4   977.6  2452.3  362350.    1980.     .81

 X STA.        450.4       508.7       563.3       617.0       664.3       676.1
   A(I)             156.6       153.9       151.5       168.8       102.7
   V(I)               .63         .64         .65         .59         .96

 X STA.        676.1       685.6       695.4       705.8       716.2       727.1
   A(I)              94.7        94.3        99.0        97.5        98.2
   V(I)              1.05        1.05        1.00        1.02        1.01

 X STA.        727.1       739.1       754.5       772.1       789.1       802.3
   A(I)             101.0       114.3       119.7       118.3       106.9
   V(I)               .98         .87         .83         .84         .93

 X STA.        802.3       814.3       826.7       865.0       918.9       977.6
   A(I)             100.4       104.5       160.2       152.2       157.7
   V(I)               .99         .95         .62         .65         .63
1
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```
   HP 2 30+00    12.31    *    *    2420
 500 YEAR          BRIDGE SECTION
      VELOCITY DISTRIBUTION:  ISEQ =  3;  SECID = 30+00;  SRD =      250.

           WSEL     LEW      REW    AREA         K          Q     VEL
          12.31   447.4    980.6  3242.4  559512.    2420.    .75

  X STA.       447.4       496.2       537.3       578.4       619.6       660.8
    A(I)             191.8       177.3       177.0       177.8       199.4
    V(I)               .63         .68         .68         .68         .61

  X STA.       660.8       675.9       687.4       699.5       712.1       725.1
    A(I)             146.5       131.2       134.4       137.2       138.3
    V(I)               .83         .92         .90         .88         .88

  X STA.       725.1       738.9       756.7       776.3       794.1       808.8
    A(I)             138.1       157.3       161.2       156.4       144.6
    V(I)               .88         .77         .75         .77         .84

  X STA.       808.8       823.0       849.8       891.3       931.7       980.6
    A(I)             140.2       188.4       179.2       173.9       192.2
    V(I)               .86         .64         .68         .70         .63
1
   *
   HP 2 29+75    10.13    *    *    1790

  50 YEAR          APPROACH SECTION
      VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

           WSEL     LEW      REW    AREA         K          Q     VEL
          10.13   451.7    976.3  2216.4  313989.    1790.    .81

  X STA.       451.7       530.1       605.1       664.8       677.1       687.0
    A(I)             162.3       159.9       175.1        95.4        87.5
    V(I)               .55         .56         .51         .94        1.02

  X STA.       687.0       696.8       706.0       714.5       722.6       730.3
    A(I)              87.8        84.5        83.6        83.8        80.1
    V(I)              1.02        1.06        1.07        1.07        1.12

  X STA.       730.3       738.7       749.1       762.1       778.1       794.8
    A(I)              81.0        89.4        96.8       106.9       108.3
    V(I)              1.11        1.00         .92         .84         .83

  X STA.       794.8       809.7       821.8       834.4       897.5       976.3
    A(I)             103.0        94.1        95.6       177.9       163.3
    V(I)               .87         .95         .94         .50         .55
1
   HP 2 29+75    10.82    *    *    1980

  100 YEAR         APPROACH SECTION
      VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

           WSEL     LEW      REW    AREA         K          Q     VEL
          10.82   450.4    977.6  2579.3  392554.    1980.    .77

  X STA.       450.4       513.6       572.6       631.4       669.0       680.8
    A(I)             170.4       166.4       165.9       174.2       106.7
    V(I)               .58         .59         .60         .57         .93

  X STA.       680.8       691.4       702.1       711.7       720.9       729.4
    A(I)             101.6       104.4        98.6        99.3        96.4
    V(I)               .97         .95        1.00        1.00        1.03

  X STA.       729.4       738.8       750.5       764.9       782.2       799.1
    A(I)              97.1       106.7       116.1       125.0       122.6
    V(I)              1.02         .93         .85         .79         .81

  X STA.       799.1       814.3       826.9       856.1       913.7       977.6
    A(I)             119.8       109.3       163.9       162.3       172.5
    V(I)               .83         .91         .60         .61         .57
```

```
1
  HP 2 29+75    12.31    *    *    2420

500 YEAR         APPROACH SECTION
     VELOCITY DISTRIBUTION:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

          WSEL      LEW      REW    AREA          K          Q     VEL
         12.31    447.4    980.6  3369.4  593164.     2420.    .72

 X STA.       447.4       498.8       541.7       585.3       629.8       666.5
  A(I)              203.2       184.9       187.8       191.7       214.3
  V(I)                .60         .65         .64         .63         .56

 X STA.       666.5       680.8       693.6       705.9       717.1       727.7
  A(I)              148.0       141.6       139.0       135.4       133.9
  V(I)                .82         .85         .87         .89         .90

 X STA.       727.7       738.9       752.8       769.4       789.1       807.1
  A(I)              133.7       146.5       155.5       170.1       161.1
  V(I)                .90         .83         .78         .71         .75

 X STA.       807.1       822.7       840.9       885.1       929.2       980.6
  A(I)              153.9       164.4       211.6       190.0       202.9
  V(I)                .79         .74         .57         .64         .60
1
  *
  HP 1 29+75    10.13    1    10.13
1

     CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

       WSEL   SA#     AREA         K    TOPW    WETP   ALPH     LEW     REW      QCR
                1     403.   39383.    191.    192.                              3318.
                2    1560.  249932.    212.    214.                             24009.
                3     254.   24674.    121.    122.                              2083.
     10.13           2216.  313989.    525.    527.   1.12    452.    976.   24483.
1
  HP 1 29+75    10.82    1    10.82

CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

       WSEL   SA#     AREA         K    TOPW    WETP   ALPH     LEW     REW      QCR
                1     535.   62912.    193.    193.                              5063.
                2    1706.  290206.    212.    214.                             27464.
                3     338.   39436.    123.    123.                              3183.
     10.82           2579.  392554.    527.    530.   1.08    450.    978.   31176.
1
  HP 1 29+75    12.31    1    12.31

CROSS-SECTION PROPERTIES:  ISEQ =  4;  SECID = 29+75;  SRD =      275.

       WSEL   SA#     AREA         K    TOPW    WETP   ALPH     LEW     REW      QCR
                1     825.  127789.    196.    197.                              9606.
                2    2022.  385178.    212.    214.                             35434.
                3     523.   80198.    126.    127.                              6053.
     12.31           3369.  593164.    533.    537.   1.03    447.    981.   47357.
1
  *
  HP 1 30+00    10.12    1    10.12

CROSS-SECTION PROPERTIES:  ISEQ =  3;  SECID = 30+00;  SRD =      250.

       WSEL   SA#     AREA         K    TOPW    WETP   ALPH     LEW     REW      QCR
                1     412.   40117.    196.    197.                              3382.
                2    1403.  218334.    199.    201.                             21143.
                3     269.   26148.    129.    130.                              2208.
     10.12           2084.  284600.    524.    527.   1.11    452.    976.   22334.
1
  HP 1 30+00    10.82    1    10.82
1
```

```
CROSS-SECTION PROPERTIES:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

      WSEL  SA#     AREA         K   TOPW   WETP  ALPH     LEW     REW      QCR
              1     549.   64589.   198.   198.                            5198.
              2    1542.  255642.   199.   201.                           24369.
              3     360.   42118.   131.   131.                            3398.
     10.82         2452.  362350.   527.   530.  1.07   450.    978.   28969.
1
   HP 1 30+00    12.31    1    12.31
1

     CROSS-SECTION PROPERTIES:  ISEQ =  3;  SECID = 30+00;  SRD =     250.

      WSEL  SA#     AREA         K   TOPW   WETP  ALPH     LEW     REW      QCR
              1     846.  131189.   201.   202.                            9860.
              2    1839.  342688.   199.   201.                           31723.
              3     557.   85635.   134.   135.                            6459.
     12.31         3242.  559512.   533.   537.  1.02   447.    981.   44816.
1
   *
   EX
```

```
+++ BEGINNING PROFILE CALCULATIONS --   5

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

32+50:XS   ******   321.    1024.   .05 *****   8.35   5.48   1330.    8.30
        0. ******  1040.   75182.  1.72 ***** *******    .25    1.30

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "30+25"     KRATIO =  1.49

30+25:FV     225.   455.    1034.   .03    .05   8.38 *******  1330.    8.35
       225.  225.   973.  111774.  1.15    .00   -.01    .17    1.29
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "29+75"     KRATIO =  1.47

29+75:AS      50.   455.    1315.   .02    .00   8.42 *******  1330.    8.40
       275.   50.   973.  163819.  1.13    .00    .03    .12    1.01
         <<<<<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

30+00:BR     225.   455.    1169.   .02    .04   8.38   3.64   1330.    8.36
       250.  225.   973.  138912.  1.00    .00    .01    .13    1.14

    TYPE PPCD FLOW      C     P/A    LSEL   BLEN   XLAB   XRAB
      3.   1.   1.  1.000   .031   16.65 ****** ****** ******

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

29+75:AS     -54.   455.    1305.   .02    .00   8.40   2.97   1330.    8.38
       275.   31.   973.  162538.  1.13    .01   -.02    .12    1.02

      M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
      .000   .000  163798.   458.   975.    8.38

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

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

28+68:XS     107.   390.    1685.   .01    .01   8.44 *******  1330.    8.43
       382.  107.  1010.  167185.  1.23    .00    .04    .09     .79

27+50:XS     118.   403.    1889.   .01    .01   8.49 *******  1330.    8.48
       500.  118.  1133.  190687.  1.23    .00    .04    .09     .70

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                 "25+00"     KRATIO =   .35

25+00:XS     250.   531.    1067.   .02    .04   8.55 *******  1330.    8.53
       750.  250.  1175.   66057.  1.02    .01    .02    .17    1.25
```

10 YEAR FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1330.	0.	8.30	1024.	1.30	.25	75182.	719.
30+25:FV	1330.	225.	8.35	1034.	1.29	.17	111774.	517.
30+00:BR	1330.	250.	8.36	1169.	1.14	.13	138912.	517.
29+75:AS	1330.	275.	8.38	1305.	1.02	.12	162538.	518.
28+68:XS	1330.	382.	8.43	1685.	.79	.09	167185.	620.
27+50:XS	1330.	500.	8.48	1889.	.70	.09	190687.	731.
25+00:XS	1330.	750.	8.53	1067.	1.25	.17	66057.	644.

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

 32+50:XS   ******  243.    1871.   .03 *****   9.43    5.77   1595.    9.40
        0. ****** 1063.  135139.  2.23 ***** *******     .15     .85

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "30+25"     KRATIO =  1.41

 30+25:FV     225.  453.    1606.   .02   .02    9.47 *******   1595.    9.45
      225.    225.  975.  189964.  1.15   .00     .02     .11     .99
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 29+75:AS      50.  453.    1887.   .01   .00    9.51 *******   1595.    9.50
      275.     50.  975.  250970.  1.15   .00     .04     .08     .85
        <<<<<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

 30+00:BR     225.  453.    1724.   .01   .02    9.44    3.87   1595.    9.43
      250.    225.  975.  218367.  1.00   .00     .00     .09     .93

     TYPE PPCD FLOW       C     P/A     LSEL    BLEN   XLAB   XRAB
       3.    1.   1.  1.000    .030   16.65 ****** ****** ******

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

 29+75:AS     -54.  453.    1855.   .01   .00    9.45    3.17   1595.    9.44
      275.     33.  975.  245402.  1.16   .01     .00     .09     .86

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  245444.   455.   977.     9.44

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

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

 28+68:XS     107.  323.    2416.   .01   .00    9.50 *******   1595.    9.49
      382.    107. 1072.  251494.  1.46   .00     .04     .08     .66

 27+50:XS     118.  353.    2702.   .01   .00    9.55 *******   1595.    9.54
      500.    118. 1154.  285688.  1.45   .00     .04     .07     .59

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"     KRATIO =   .51

 25+00:XS     250.  457.    1801.   .01   .02    9.60 *******   1595.    9.59
      750.    250. 1193.  145416.  1.11   .00     .04     .10     .89

25 YEAR          FIRST USER DEFINED TABLE.

    XSID:CODE         Q      SRD     WSEL      AREA      VEL      FR#        K    XSTW
   32+50:XS       1595.      0.     9.40     1871.      .85      .15  135139.    820.
   30+25:FV       1595.    225.     9.45     1606.      .99      .11  189964.    522.
   30+00:BR       1595.    250.     9.43     1724.      .93      .09  218367.    522.
   29+75:AS       1595.    275.     9.44     1855.      .86      .09  245402.    522.
   28+68:XS       1595.    382.     9.49     2416.      .66      .08  251494.    749.
   27+50:XS       1595.    500.     9.54     2702.      .59      .07  285688.    801.
   25+00:XS       1595.    750.     9.59     1801.      .89      .10  145416.    736.
```

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

 32+50:XS  ******   197.    2467.   .02 *****   10.12    5.91   1790.   10.10
        0. ******  1078.  184097.  2.36 ***** *******     .12     .73

 30+25:FV    225.   452.    1972.   .01   .02   10.16 *******   1790.   10.15
      225.   225.   976.  255433.  1.09   .00     .03     .09     .91
       <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

 29+75:AS     50.   452.    2253.   .01   .00   10.21 *******   1790.   10.20
      275.    50.   976.  321518.  1.11   .00     .04     .07     .79
       <<<<<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

 30+00:BR    225.   452.    2085.   .01   .01   10.13    4.05   1790.   10.12
      250.   225.   976.  284769.  1.00   .00     .00     .08     .86

     TYPE PPCD FLOW      C    P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  1.000   .030   16.65 ****** ****** ******

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

 29+75:AS    -54.   452.    2215.   .01   .00   10.14    3.37   1790.   10.13
      275.    39.   976.  313790.  1.12   .00     .00     .07     .81

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  313942.   454.   978.   10.13

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

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

 28+68:XS    107.   285.    2955.   .01   .00   10.19 *******   1790.   10.18
      382.   107.  1096.  316493.  1.58   .00     .04     .07     .61

 27+50:XS    118.   327.    3268.   .01   .00   10.24 *******   1790.   10.23
      500.   118.  1167.  358188.  1.54   .00     .04     .06     .55

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "25+00"     KRATIO =    .59

 25+00:XS    250.   420.    2326.   .01   .01   10.29 *******   1790.   10.28
      750.   250.  1204.  210919.  1.16   .00     .04     .08     .77

50 YEAR          FIRST USER DEFINED TABLE.

    XSID:CODE         Q     SRD    WSEL     AREA      VEL     FR#        K   XSTW
    32+50:XS      1790.      0.   10.10    2467.      .73     .12  184097.   881.
    30+25:FV      1790.    225.   10.15    1972.      .91     .09  255433.   525.
    30+00:BR      1790.    250.   10.12    2085.      .86     .08  284769.   524.
    29+75:AS      1790.    275.   10.13    2215.      .81     .07  313790.   525.
    28+68:XS      1790.    382.   10.18    2955.      .61     .07  316493.   811.
    27+50:XS      1790.    500.   10.23    3268.      .55     .06  358188.   840.
    25+00:XS      1790.    750.   10.28    2326.      .77     .08  210919.   784.
```

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

32+50:XS  ******   176.    3096.    .02 *****    10.82    6.06    1980.    10.80
       0. ******  1093.  241951.   2.40 ***** *******      .09      .64

30+25:FV    225.   450.    2340.    .01    .01   10.86 *******    1980.    10.85
     225.   225.   978.  331449.   1.05    .00     .04     .07      .85
        <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS     50.   450.    2621.    .01    .00   10.91 *******    1980.    10.90
     275.    50.   978.  402274.   1.07    .00     .05     .06      .76
        <<<<<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

30+00:BR    225.   450.    2450.    .01    .01    10.83    4.15    1980.    10.82
     250.   225.   978.  361779.   1.00    .00      .00     .07      .81

     TYPE PPCD FLOW       C     P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.   1.000    .030   16.65 ****** ****** ******

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

29+75:AS    -54.   450.    2579.    .01    .00    10.83    3.52    1980.    10.82
     275.    41.   978.  392590.   1.08    .00      .00     .06      .77

       M(G)   M(K)       KQ   XLKQ   XRKQ    OTEL
       .000   .000  392907.   453.   980.   10.82

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

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

28+68:XS    107.   267.    3531.    .01    .00    10.88 *******    1980.    10.87
     382.   107.  1120.  390431.   1.67    .00      .05     .06      .56

27+50:XS    118.   313.    3858.    .01    .00    10.93 *******    1980.    10.92
     500.   118.  1180.  439619.   1.61    .00      .05     .05      .51

===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                           "25+00"     KRATIO =    .65

25+00:XS    250.   389.    2882.    .01    .01    10.98 *******    1980.    10.97
     750.   250.  1214.  287355.   1.20    .00      .04     .07      .69
```

100 YEAR FIRST USER DEFINED TABLE.

XSID:CODE	Q	SRD	WSEL	AREA	VEL	FR#	K	XSTW
32+50:XS	1980.	0.	10.80	3096.	.64	.09	241951.	916.
30+25:FV	1980.	225.	10.85	2340.	.85	.07	331449.	527.
30+00:BR	1980.	250.	10.82	2450.	.81	.07	361779.	527.
29+75:AS	1980.	275.	10.82	2579.	.77	.06	392590.	527.
28+68:XS	1980.	382.	10.87	3531.	.56	.06	390431.	853.
27+50:XS	1980.	500.	10.92	3858.	.51	.05	439619.	867.
25+00:XS	1980.	750.	10.97	2882.	.69	.07	287355.	824.

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

32+50:XS  ******   132.    4527.    .01 *****    12.31     6.30    2420.   12.30
       0. ******  1122.  391850.   2.40 ***** *******       .07      .53

30+25:FV    225.   447.    3136.    .01    .01   12.36 *******    2420.   12.35
     225.   225.   981.  526475.   1.01    .00     .04      .06      .77
    <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

29+75:AS     50.   447.    3417.    .01    .00   12.41 *******    2420.   12.40
     275.    50.   981.  606558.   1.03    .00     .05      .05      .71
    <<<<<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

30+00:BR    225.   447.    3241.    .01    .01   12.32     4.43    2420.   12.31
     250.   225.   981.  559223.   1.00    .00     .00      .05      .75

     TYPE PPCD FLOW      C     P/A     LSEL    BLEN    XLAB    XRAB
       3.   1.   1.  1.000    .029    16.65 ****** ****** ******

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

29+75:AS    -54.   447.    3370.    .01    .00   12.32     3.87    2420.   12.31
     275.    26.   981.  593336.   1.03    .00     .00      .05      .72

       M(G)   M(K)        KQ   XLKQ   XRKQ     OTEL
       .000   .000  594200.   450.   983.    12.31

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

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

28+68:XS    107.   231.    4858.    .01    .00   12.37 *******    2420.   12.36
     382.   107.  1155.  576626.   1.81    .00     .05      .05      .50

27+50:XS    118.   283.    5193.    .01    .00   12.42 *******    2420.   12.41
     500.   118.  1203.  641880.   1.72    .00     .05      .05      .47

25+00:XS    250.   314.    4170.    .01    .00   12.47 *******    2420.   12.46
     750.   250.  1234.  485385.   1.30    .00     .05      .05      .58

500 YEAR          FIRST USER DEFINED TABLE.

  XSID:CODE       Q     SRD    WSEL     AREA      VEL      FR#        K    XSTW
  32+50:XS    2420.     0.    12.30    4527.      .53      .07  391850.   990.
  30+25:FV    2420.   225.    12.35    3136.      .77      .06  526475.   533.
  30+00:BR    2420.   250.    12.31    3241.      .75      .05  559223.   533.
  29+75:AS    2420.   275.    12.31    3370.      .72      .05  593336.   533.
  28+68:XS    2420.   382.    12.36    4858.      .50      .05  576626.   924.
  27+50:XS    2420.   500.    12.41    5193.      .47      .05  641880.   921.
  25+00:XS    2420.   750.    12.46    4170.      .58      .05  485385.   920.
 ER

1  NORMAL  END  OF  WSPRO  EXECUTION.
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FLORIDA DEPARTMENT OF TRANSPORTATION

LAWTON CHILES
GOVERNOR

BEN G. WATTS
SECRETARY

Environmental Management Office MS 3-501
719 South Woodland Boulevard
DeLand, Florida 32720

January 20, 1994

Mr. Rod Pakzadian
St. Johns River Water Management District
618 East South Street
Orlando, Florida 32801

Subject: Application No.: 4-117-0377AG
SR 46 Wekiva River Bridge
Work Program No.: 5117641
State Project No.: 77030-3517

Dear Mr. Paksadian:

This response to your request for additional information for the referenced project follows the order of the items contained in your letter.

1. District form 40C-41.063(41), "Local Government Notification" was submitted to Mr. Mark Knight, Lake County Department of Planning and Development and to Mr. Richard Thomas, Seminole County Comprehensive Planning Department on October 14, 1993 (see enclosed copies). To date no response has been received.

   Frankly, these gentlemen may be at a loss as to the applicability of this statement. Section 163.3177, F.S. provides that maintenance and improvement of public highways within rights of way dedicated for that purpose are not considered a "development" subject to the specific requirements of local comprehensive plans (also see Sections 163.3164(5) and 380.04(3)(a), F.S.). However, local comprehensive plans must be compatible with the implementation of the State Comprehensive Plan prepared by the Executive Office of the Governor. Each state agency functional plan (i.e., Department of Transportation's [DOT] Work Program) must also be consistent with the State Comprehensive Plan. Section 339.135, F.S., requires that the tentative DOT Work Program be reviewed by the Department of Community Affairs for consistency with the local comprehensive plans. This is done every year prior to the Governor and Legislatures approval of DOT's work program. Projects or project elements which are inconsistent with local comprehensive plans are reported to the Chairman, Florida Transportation Commission by the Secretary, Department of Community Affairs. Therefore, pursuant to Section 339.135, F.S. the Florida Department of Community Affairs has determined that this project is not inconsistent with the local comprehensive plan for the affected area.

2. Plans previously submitted were signed and sealed by Mr. Mark Robinson, P.E., pursuant to Chapter 471, F.S. See front page of construction plans.

3. Construction plans submitted are scaled plans (half scale). There is no District criteria as to the exact size format required, other than the MSSW site and design information checklist request of sheets no larger than 2 ft. by 3 ft. However, the enclosed signed and sealed sets are full size.

4. This questions relates to 40C-42.025(8), which states that stormwater systems requiring a permit under 40C-42.022(1) (construction of new stormwater management facilities) and which serve new construction area with greater than 50% impervious surface must demonstrate pre-post peak discharge for the stated event. This project falls under 40C-42.022(2) - alteration or reconstruction of an existing stormwater management system, therefore, this criteria should not be applicable to this in-kind bridge replacement. Regardless, slight alteration of the roadway in order to provide bridge deck drainage where none currently exists will result in 9.008 square feet of additional impervious surface. However, 6,496 square feet of existing impervious surface will be removed and sodded. This is a net increase of 2,512 $ft.^2$ in impervious area. This equates to 28% of the new impervious surface being a net increase. This does not take into account the additional 20 foot width of bridge deck due to safety shoulders. The runoff coefficient of rainfall over water bodies is one (100% reaches the receiving water) while the coefficient for the shoulders would also be close to one. However, rainfall on to the 19,176 $ft.^2$of bridge, up to 3.75 inches, will be conveyed to the sand filtration box and discharged by filtration over a 57 hour period. Therefore, post development peak rate of discharge will be less than the pre development peak.

5. Typically, in-kind bridge replacements do not provide surface water management systems beyond those in existence prior to the project. This is because the bridge replacement does not provide for an increase in capacity and, therefore, no increase in pollutant loading, no change in points of discharge and no increase in peak rates of discharge. The same situation exists with this particular project with the expectation that stormwater treatment is being provided where possible, due to the class of receiving waters and the policy of trying to provide some degree of improvement when a bridge is replaced in-kind. Pre-post peak attenuation for this facility was not a design criteria during several pre-application meetings and site reviews with District Staff. However, some degree of attenuation is being provided by virtue of a significant volume of stormwater being retained and filtered.

   An interconnected pond routing program has been run utilizing the inlets and filtration box as nodes. See the enclosed run for pre and post peak discharge rates.(PENDING)

6. The existing and proposed water surface profile for the 10 year, 25 year, and 100 year flood events were previously submitted. A summary of the existing and proposed backwater elevation under the 50 year and 100 year event can be found on page 9 of the Bridge Hydraulics Report. The existing stage under a 100 year event is 10.87 feet at 250 feet upstream. The same event under proposed conditions will be 10.92 feet. This is 0.05 feet cf difference. The backwater effect of a traversing work diminishes the further upstream from a constriction. It stands to reason that if backwater criteria permits a 0.1 foot increase in water surface elevation 500 upstream and the WSPRO run indicates a water surface elevation increase of 0.05 feet at 250 feet upstream, then the elevation 500 feet upstream will certainly be less than the allowable 0.1 feet increase. The following table is a summary of water surface elevations contained in the WSPRO run previously submitted.

		10 YR.	25 YR.	50 YR.	100 YR.
Bridge:	Existing	8.36	9.42	10.11	10.81
	Proposed	8.36	9.43	10.12	10.81
250'Upstream:	Existing	8.42	9.48	10.17	10.87
	Proposed	8.50	9.55	10.23	10.92

7. Erosion control measures were depicted on the Traffic Control Plan sheets previously submitted. These measures are now shown on separate sheets (No. 45 and 46) and are labeled as "Erosion Control".

Erosion control measures consists of hay bales backed by silt fences encompassing the boundaries of the construction area, including wrapping around the ends of the detour fill and under the existing bridge and tieing into silt fence on the other side. In addition, staked turbidity barriers will be placed behind the silt fence along the rivers edge; just off the shoreline floating turbidity barriers will encompass the area of work. The floating barriers will not be placed in the center of the channel.

In the "valley" between the existing road and the detour road hay bales backed by silt fence was also called for, at 125 feet spacing. These erosion control devices are standard design items as contained in DOT's Roadway and Traffic Design Standards, January, 1992; copies of these details are enclosed.

As this project is an alteration of an existing facility which is already located within the Water Quality Protection Zone, it is not possible to comply with the criteria that would presume this standard is met (Section 11.3.3(b) 1,2 and 3). For example, as the roadway already traverses the wetlands the only way to maintain undisturbed vegetation 100 feet landward of the abutting wetlands would be the no project alternative. Additionally, a stormwater treatment facility or sedimentation basin would need to be constructed within the wetlands immediately adjacent to the river. This additional wetland impacts would be in contravention of the avoidance/minimization criteria. The no project alternative is not acceptable due to the significant adverse socio-economic impacts that would result from bridge structure failure and closure of the road.

The following is a discussion pursuant to section 18.3 Applicants Handbook.(PENDING)

8. Enclosed are copies of the Standard Design items used in erosion and turbidity controls. These indexes depict construction and installation details of these items. The turbidity curtains float on the surface by use of closed cell solid plastic foam with the curtain extending to the bottom being weighted by ¼" galvanized chain. The curtains shall extend to the bottom by use of additional five foot panels, if necessary. A single five foot panel will only be required at this particular location, however.

   The turbidity barriers do not have a mesh size as they are made of 18 ounce nylon reinforced PVC fabric with 300 psi test strength. The physical requirements of plastic filter fabric used for silt fences are listed in the Departments Standards Specifications section 985 (copy enclosed). The table does not list a mesh size but it does specify that the fabric must have a minimum filtration efficiency of 75%. The contractor is required to provide certified test reports from the manufacturer guaranteeing that the fabric meets these specification requirements. Additionally, the material these manufacturers provide are utilized and accepted throughout the nation for use in erosion control.

9. Runoff from the existing roadway on the Seminole County side will be conveyed to new roadside vegetated swale/ditch with ditch blocks in order to retrofit stormwater treatment. The new bridge and approach slabs runoff will be treated in the proposed sand filtration box. Existing roadway runoff on the Lake County side will receive vegetated sheet flow prior to entering the wetlands. Lack of sufficient right of way at the beginning of the project (Lake County side) precludes retro-fitting of roadside swales and ditch blocks. However, roadway bridge approach runoff will receive the benefit of inlet structures containing trash/oil skimming baffles along with energy dissipators at the end of the replacement flumes.

10. Structure S-11 will be a triple 12' x 9' concrete box culvert 70 feet long (across the roadway) by 40 feet wide (sta. 97+60 to 98+00). These dimensions are as depicted on the plan view. The drainage detail sheet calls for this structure to be constructed at sta.97+80, which is the middle of the CBC. The 2 foot by 2 foot openings are the openings in the internal walls of the triple barrel culvert. These openings allow water to flow from the inflow at the first barrel to the second and third barrels. Inconsistency between the plan view and the detail sheet are not noted.

11. The special ditches with ditch blocks are depicted in profile on the plan/profile sheet of this area. Ditch flow lines and ditch block top elevations can only be shown in profile and cross sectional views. For construction purposes, a plan view of a ditch would be superfluous. The typical section of the plans depicts what the cross-sectional view of the roadway looks like in general. Special details such as the occasional ditch block would not been shown as they are not typical of the cross section of the road. Drainage structure sheets show details of structures to be constructed. These sheets do not depict adjacent ground elevations or ditch earthwork, only actual structures.

12. The narrative previously submitted did state that the bridge would have a 49 foot horizontal clearance, while the bridge profile indicates a 48 foot horizontal clearance (sheet B-9). The clearance between piles will be 49.5 feet. The 48 foot clearance on the bridge profile sheet is the horizontal clearance between the pile bent caps. The caps will be 3 feet wide with 18 inch square pile centered on the centerline of the caps. This will leave 0.75 feet of cap overhand on each side of the pile. This results in 1.5 feet less clearance between caps than between piles. Likewise, the bridge profile also indicates 8 spans at 51'0". As the joint between each span will be directly centered on the 18 inch pile, the clearance between piles will be 1.5 feet less than the span lengths, or 49.5 feet. See bridge sheets B-9 and B-15 for details.

13. The inlet structure type the plans call for will have sump weep holes, although the detail sheets did not depict them. As a standard design, weep holes are called for whenever the flow-line of the outfall pipe is above the flow-line of the inlet structure. Weep holes have been added to the detail sheets.

14. Riparian habitat within the project limits was determined based on the width of project to the eastward and westward limits of the RHPZ, which is 50 feet landward of the wetland limits. The project contains 4.35 Ac of Riparian Habitat. The majority of this, 2.56 Ac is the existing roadway and embankment slopes. It is assumed that all 2.56 Ac of road and embankment will be impacted. There is no habitat value of this 2.56 acres. Of the remaining 1.79 acres of riparian habitat within the project limits, 1.62 acres

is forested wetlands and another 0.166 acres is forested uplands. Of the 1.62 Ac of wetlands, 0.805 acres will be impacted. Permanent impacts will account for 0.04 of the 0.805 acres. Incidental fill associated with a replacement flume at sta. 94+00 accounts for 0.01 acres and recontouring of the ditch in the southeast quadrant accounts for the remaining 0.03 acres of permanent impacts.

Forested upland riparian habitat within the project limits amounts to 0.166 acres on the south side of the road. The west side contains 0.066 acres within the temporary construction easement and the existing toe of roadway slope. This area will not be impacted as the detour road transition does not leave the existing asphalt until station 92+44, which is within the wetland component of the riparian habitat.

The southeast quadrant contains 0.099 acres of forested upland riparian habitat. Of this, 0.033 acres will be impacted mostly from recontouring of the ditch to tie into the existing culvert under River Oaks Circle.

15. The new bridge, being an in-kind replacement, will not in itself adversely affect the abundance of food sources and habitat of aquatic and wetland dependent species. There would be a degree of enhancement to these functions by virtue of stormwater treatment that will be provided (particularly, elimination of bridge deck scuppers) and the creation of an additional 0.35 acres of wetland habitat. The wetland creation areas will also function as a crossing under the bridge for wildlife such at the threatened Florida black bear.

The temporary disturbance of riparian habitat, which is not avoidable if the bridge is to be replaced and the road kept open, has been minimized as much a possible. Additionally, the project will now be constructed under a compressed time frame of 240 days.

Numerous site visits have not resulted in evidence of this particular area being noticeably utilized for such functions. No nests have been observed nor burrows or tracks or scat or other evidence of feeding or foraging. Numerous craw-dad mounds were noted, however. The proximity of this area of disturbance, within 80 feet of the existing well traveled road, (10,584 ADT Lake County side 91-92) most likely limits the value of this area in terms of abundance, food sources and habitat when compared to the extensive more remote riparian habitat of this system.

16. The Traffic Control Plans contain construction sequencing for this project. The work will be conducted under four phases. Phase I involves construction of the detour road and bridge and milling and resurfacing of existing portions of SR 46 while maintaining 2-way traffic on SR 46. All erosion control measures will be installed prior to initiating land clearing.

The crane to be utilized for bridge construction will be brought to the waters edge by using the area and fill for the detour. The east side of the river may be too shallow for a barge so timber mats will likely be used to support the crane. A containment system of turbidity barriers and absorbent foam cells will encircle the crane.

The piles for the detour bridge will likely be driven in by a diesel hammer mounted atop the crane. However, should pre-formed pile holes or jetting be necessary, the plans call for a containment system such as containment boxes/collars, casings, culvert pipes, etc. to be utilized in additional to and because turbidity barriers may not be sufficient (see "Special Construction Notes" on page B-2 of the Bridge Plans).

Phase II involves rerouting the traffic to the detour while the roadway work and proposed structures are constructed. Roadway embankment removal will occur following demolition and removal of the existing bridge. Existing bridge piles will be removed entirely. The same note above will apply to extraction of these piles if they cannot be vibrated out.

Phase III will shift westbound traffic on to the new bridge while eastbound remains on the detour. This will allow construction of inlet structures, pipes, and flumes on the southeast side of the road.

Phase IV routes all traffic on to new bridge while the detour is removed, recontoured and re-vegetated. Miscellaneous construction items will be completed at this time.

17. Fill material for the detour will be clean sand, type A-3, which will come from excavation of stormwater facilities for the SR 46 shoulder paving project.

18. Aerial photos at 1"=200' showing property boundaries, RHPZ and wetland limits with areas of impacts are enclosed.

19. (a) All station numbers have been added to plan views with ticks at 20 foot intervals. Cross sectional drawings have the station numbers called out so that they may be correlated with the plan view.

(b) Symbols used on the plans and sketches are called out or labeled. These symbols are a standard design as identified in DOT's Roadway and Traffic Design Standards (copy of sheet enclosed).

(c) Temporary fill, permanent fill, excavation, and upland excavation/wetland creation have been depicted by different hatching. The shading originally used to depict temporary fill could not be removed without necessitating re-creation of the sketches. The shaded areas have been cross-hatched and since various types of shading were not used to differentiate between types of earthwork, (the reason shading is not acceptable for depicting dredge and fill earthwork is that difference in shading and colors may be lost upon reproduction) the sketches should be acceptable.

(d) All proposed grades can be differentiated from existing by the boldness or thickness of the lines. Existing conditions are shown by a thin light line while proposed conditions are indicated by a bold dark line.

(e) The bridge deck profile has been hatched to indicate "fill" although bridge decks are not included in calculations of fill volumes and areas as there is no footprint or displacement associated with bridge decks. Due to the scale necessary to show the 408 foot proposed bridge in its entirety, it is difficult to cross-hatch the 18 inch piles. the four bents of 6 piles each result in 36 square feet of fill within the wetlands. Of course, the seven bents of 4 H piles each within the river to be removed results in a loss of 19.44 square feet for a net increase of 16.5 square feet.

(f) Limits of construction have been called out on the construction plans and the sketches. The construction limits and, therefore, the limits of clearing will be at the toe of slope of the temporary detour. Limiting construction to the detour footprint only reduces impacts from the 1.62 acres of wetlands within the right of way or construction easement to 0.8 acres.

(g) The plan view of the bridge in the construction plans (sheet B-9) does indicate direction of river flow north. This plan view has been added to the dredge/fill sketches.

(h) The limits of the Riparian Habitat Protection Zone were called out as RHPZ with an arrow to the dashed line indicating these limits. The riparian and wetland limits along with erosion controls were depicted on the Traffic Control Plans plan view (sheet 36), as the TCP shows the detour road. These limits are also now shown on the erosion control sheets.

20. The plan view on the construction plans shows existing structures in a dashed line format and proposed structures with solid lines. Details of the sand filtration box are shown in the Drainage Detail section (sheet 15) and is labeled to construct triple 12' x 9' CBC at sta. 97+80. This structure has been added to the dredge/fill sketches plan view and was shown in the cross sectional view at sta. 98+00; "Const." has been added to this view.

21. The locations of existing and proposed structures are depicted in the plan views by dashed lines (existing) and by solid lines (proposed). A profile of the existing road and proposed road grades have been included in the dredge/fill drawings. Additionally, profile grades for the detour road and natural ground below the detour centerline have been included.

22. Enclosed is a copy of the draft geotechnical report for the detour road. The final signed and sealed report has not been submitted to the Department at this date. The report does identify A-8 material (muck) along the detour corridor. Based on the findings of this investigation and the knowledge that this area is to be restored, the geotech consultant is making specific recommendations for placement of the detour fill.

There will be no grubbing within the area of detour fill. Instead, vegetation will be cut at ground level with all sub-surface portions remaining intact. Once any trees and large debris are removed, a stabilizing geotextile will be placed over the prepared area. Two feet of select sand will be placed, without compactive effort, over the geotextile to provide a stable horizontal working surface. Up to 3 feet of sand is acceptable if necessary to provide a level surface. A geogrid will then be placed over the select sand. Embankment fill operations will then begin with fill compaction in accordance with Standard Specifications.

The primary purpose of the system is to provide an acceptable safety factor for slope stability and to mitigate pavement surface settlement. The additional benefit is that it will preserve the natural conditions of the surficial muck thereby aiding restoration of this area.

De-mucking will be necessary, however, for the placement and support for the sand filter box located at sta. 97+80 (±20 ft.). Although this activity does not take place in wetlands, a profile sketch has been included in the revised dredge/fill package. Sheet pile will first be installed from station 95+50 to 98+45 left, and from 96+50 to 98+45 right. The sheet pile will also serve to function as a containment system during de-mucking. There will not be able to be any discharge from the sides or the ends. Should it be necessary to pump out the "pit", the water will be discharged into the valley between the road and the detour. This area will act as a vegetated swale to allow some settlement and percolation.

23. The contractor may have to stock pile excavated material prior to re-using it on the project. A note has been added to the plans calling for any stockpiling to be placed east of River Oaks Circle adjacent to station 110+00 beyond the Clear Recovery Zone. This is within the maintained right of way; no clearing will take place. Silt fence and hay bales will encircle the pile. The slope of this area is toward the road and the existing shallow swale. River Oaks Circle provides a divide to prevent runoff towards the river. Additionally, hay bales and silt fence will be placed in front of the side drain under River Oaks Circle to further prevent any potential turbid discharge from leaving the stockpile area.

24. The detour road will impact 0.8 acres of forested wetlands; 0.5 acres on the west side and 0.3 acres on the east side. See responses to question numbers 14, 15 and 22 for discussion of these impacts. The new bridge and approaches will not themselves, impact wetlands. A small amount of miscellaneous fill associated with the flume at station 94+00 will encroach 5 feet beyond the existing toe of slope. Also, the existing ditch in the southeast quadrant will be reconstructed. The eastern end of the ditch will be filled (sta 105+50 to 106+50) and reconstructed slightly further out. These two areas are within the footprint of the detour, therefore they are not additional impacts.

25. Wetland limits in all four quadrants were established by myself and Mr. Lance Heart, SJRWMD. Hydric soil indicators were heavily used to establish limits as the majority of the tree species within these wetlands are transitional, making demarkation strictly by vegetation more difficult.

26. The plan view of the bridge in the construction plans submitted (sheet B-9) and also now in the dredge/fill drawings show the location of the USGS gauge. The Geological survey as owner, is responsible for removing the gauge and relocating it to the temporary bridge; as is the case with all utilities. Sheet B-2 of the construction plans contains a note which directs the contractor to contact Mr. Richard Graig, U.S.G.S. at least two weeks prior to removal of the bridge. Mr. Graig has indicated that he would only need a couple of days to have the gauge relocated, therefore they would not loose data provided by the gauge.

The gauge is and will be attached directly to a pile; there will be no dredging or filling associated with its relocation. Additionally, any permits that may be required for activities associated with utility relocations is the responsibility of the owner.

27. The replanting scheme has been prepared and is contained in the construction plans and sketches. Six species of trees are proposed to be planted on 8 foot centers within the detour area with the species composition similar to the composition of the prevalent species existing. These will be 18 to 20 foot trees (dependent on commercial availability. The ground cover will be marsh ferns planted on three foot centers.

The created 0.35 acres will be planted with button bush and soft rush. The button bush will be planted in clusters on 15 foot centers. They will line the shoreline and also spaced throughout the remaining area. Button bush provides a fairly high degree of wildlife utilization providing cover for nesting and foot utilization of the seeds.

Soft rush will be planted on three foot centers throughout these two areas.

Hydrology of the creation areas will be influenced by the river. Proposed elevation of 8.0 NGVD is the elevation of the rivers frequent high elevation and should result in seasonal inundation. Other river stages are: 10 year - 8.4; 25 year - 9.4; 50 year - 10.1; and 100 year - 10.8.

River elevations will have less of an affect on the detour plantings as these existing wetlands are not a function of the rivers stage (with the exception of a small area at station 98 which is just below el. 8). The hydrology of these wetlands is due to groundwater seepage. As there will be minimum disturbance to the underlying soil matrix, soil hydrology within the area to be replanted will not be impacted.

Removal of the detour fill will be accomplished during Phase IV, after all traffic has been moved back on to the new bridge and the temporary bridge has been dismantled. As soon as the detour fill has been removed, the south side embankment will receive final dressing and be sodded. All soil stabilization and plantings are scheduled to be accomplished within 240 days of begin construction.

Upland habitat enhancement adjacent to the riparian zone is also proposed. This is a 1.25 acre parcel in the northwest quadrangle which is mostly a cleared pasture area. There is an existing ditch which bisects the parcels and runs in a northerly direction. As this parcel is up-gradient from the seepage wetland, the ditch is intercepting groundwater flow to the wetlands.

The ditch is lined with trees so in order to not disturb them the entire ditch will not be filled. A ditch block at the north end of the parcel is proposed to prevent discharge of intercepted groundwater.

There will be no clearing or grubbing in this parcel so all existing vegetation will remain as is. The remaining open areas are proposed to be planted with hackberry, blackgum, sweetgum, laural oak and wax myrtle. Sweetgum is good at colonizing new areas and the laural oak associates well with it. The fruits of hackberry and wax myrtle are consumed by several species of birds along with the fruit of blackgum, which some mammals also consume. These species are facultative or drier with the exception of laural oak, a facultative-wet species. This designation implies that there is roughly an equal probability of these species occurring in an upland area or a wetland area.

28. These created areas will be planted with wetland species as discussed above.

29. The detour road will occupy a narrow swath of forested wetlands for approximately 8 months. This is an area immediately adjacent to the existing embankment. Impacts to this area have been minimized as much as possible by using 2:1 slopes and by separating the two roads by the minimum distance needed for the crane to operate in between the two bridges.

The high productivity resulting from seasonal inundation of riverine floodplains is a major source of the food and habitat value of forested floodplains to wetland dependent species. While the area to be impacted by this project is a forested wetland, only a small area on the west side becomes seasonally inundated. As can be seen by the detour natural ground profile, the area impacted by detour fill on the east side is above even the 100 year flood event. The 100 year stage (el. 10.8) will inundate wetlands on the west side for above 320 feet back from river. The 10 year stage will inundate about 130 feet of the west side wetlands. The seasonal high of 8.0 barely inundates a small area of the west side wetlands. These wetlands lack typical biological indicators of seasonal high water such as stain lines, snail egg rafts, lichen lines, etc.

With no inundation of the forest floor there is no migration of fish from the river channel into the floodplain to forage on the leaf litter invertebrates. Likewise, without the subsidence of seasonal inundation there is no wash out of these larval insects into the river channel to become a food source. . The high productivity of forested wetlands is dependent upon this hydroperiod.

As these particular wetlands have no hydroperiod, for the most part, their value as a habitat and food source for wetland dependent species is greatly curtailed. This results in much less severe adverse impact to the abundance, food sources, and habitat of aquatic and wetland dependent species due to the disturbance of these wetlands.

Given the expanse of the forested wetlands in the vicinity, the temporary 8 month reduction in functions to a 100 foot wide area immediately adjacent to the existing road would be quantitatively minute. Following completion of the project this area will once again provide these wetland dependent functions.

The new bridge itself will not require any clearing. A small area between station 105+50 and 106+50 will encroach about 20 feet into the tree line due to ditch reconstruction. This will impact some water oak, hackberry, and wax myrtle.

Given the minimal permanent impacts (0.04 Ac) versus the benefits of reducing floodplain encroachment, providing stormwater treatment, creation of herbaceous wetland areas, provisions for wildlife crossing, enhancement of upland areas adjacent to the riparian zone and the safety and welfare of the public provided by the new safer bridge, this project will result in a net benefit to the resources of the District.

30. The concerned property owner's parcel is identified as adjacent property owner number 13 on the plan view the sketches and on the aerial. This parcel is located east of the project limits and will not be impacted by this project.

31. The following response is in reference to the Policy of Consideration of Secondary and Cumulative Impacts.

<u>Cumulative Impacts</u>

This in-kind bridge replacement project is essentially a project to maintain a functional existing infrastructure. Permanent adverse impacts associated with the project are very minor; being limited to incidental fill along the existing tow of slope and to 3/100th of an acre to provide for existing conveyance. Adverse impacts have been avoided where possible and minimized where unavoidable. Additionally, there are numerous beneficial impacts of the project: stormwater treatment, wildlife crossings, wetland creation, reduction of floodplain encroachment, upland riparian enhancement, reduction of sedimentation from erosive slopes, and public safety.

Given the very restrictive regulatory policies in place for this basin, future projects with adverse effects should be very limited such that cumulative unacceptable impacts would not be expected to result. Also, as this is the only functioning roadway crossing of the Wekiva River, similar type projects will not occur.

Mr. Rod Pakzadian
St. Johns River Water Management District
January 20, 1994

Secondary Impacts

Upland habitat within this projects limits consists of dedicated and maintained roadway right of way. Alteration of the roadway will not adversely affect habitat functions that uplands within the project area currently provide. There is currently little to no habitat value being provided by the upland roadway.

The use of the proposed system will not differ from the use of the existing systems and therefore, will have no more adverse impacts than those already existing. A degree of improvement in water quality is expected due to stormwater treatment to be provided along with skimmers for removal of hydrocarbons. Proposed improvements to the existing structure (408 ft. versus 252 ft.) will facilitate movement of the State listed threatened Florida black bear.

There are no plans in the Department of Transportation's work program for any additional phases or expansion of the existing roadway. The only exception is the construction of paved shoulders on SR 46 east of this project. That project is currently under review. However, the safety improvement of paved shoulders should not be construed to be an expansion which would result in additional adverse impacts. Replacement of the existing, in-kind, will not provide for secondary impacts.

Should you have any questions or require additional clarification please do not hesitate to contact me at 904/943-5392 or SUNCOM 373-5392.

Sincerely,

Richard C. Fowler

Richard C. Fowler
Environmental Specialist

RCF:mg
Enclosures

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT

Henry Dean, Executive Director
John R. Wehle, Assistant Executive Director

POST OFFICE BOX 1429 PALATKA, FLORIDA 32178-1429
TELEPHONE 904/329-4500 SUNCOM 904/860-4500
FAX (EXECUTIVE/LEGAL) 329-4125 (PERMITTING) 329-4315 (ADMINISTRATION/FINANCE) 329-4508

FIELD STATIONS

618 E. South Street
Orlando, Florida 32801
407/897-4300

7775 Baymeadows Way
Suite 102
Jacksonville, Florida 32256
904/730-6270

PERMITTING:
305 East Drive
Melbourne, Florida 32904
407/[illegible]

OPERATIONS:
2133 N. Wickham Road
Melbourne, Florida 32935-8109
407/[illegible]

RECEIVED
NOV 10 1993
Fla. Dept. of Transportation
- District Office -
Design Department

November 9, 1993

Certified Mail P 098 307 392

Mr. Mark Robinson, P.E.
Florida Department of Transportation
719 South Woodland Boulevard
DeLand FL 32720

Re: State Road 46 / Wekiva River Bridge Replacement
Application Number 4-117-0377AG
(Please reference the above number on any submittal)

Dear Mr. Robinson:

The St. Johns River Water Management District is in receipt of your Management and Storage of Surface Waters Individual Permit application. Upon preliminary review of the proposed project, the following technical information is required to sufficiently review the possible impacts the project may have on the surrounding area. This information is being requested pursuant to the authority vested in the St. Johns River Water Management District under subsection 373.413(2), Florida Statutes (F.S.), and sections 40C-4.101 and 40C-4.301, Florida Administrative Code (F.A.C.).

In order to expedite the review of your application, please use the application number referenced above on all correspondence, and submit three (3) copies of all requested information unless otherwise indicated by a specific information request.

1. Pursuant to the staff's meeting with you on March 26, 1993, and June 14, 1993, it appears that the project is in the Wekiva River Protection Area. Please submit a completed and executed District Form Number 40C-41.063(4) entitled "Local Government Notification" for this project. Please be advised that the District shall not issue a permit for this project until the form has been received by the District. [40C-41.063(4), F.A.C.]

[illegible]nt to [illegible]al govt. O/H

2. Please be advised that in accordance with Florida State Statutes, all plans, specifications, and reports being filed for public records, shall be signed, sealed, and dated by appropriate registrants holding valid certificates of registration within the State of Florida. Please provide sealed plans pursuant to chapter 471.025(1) F.S. [40C-4.301(1)(a)2.,3.,4.,6.,12.,13.; (2)(a)1.,2.,3.,4., F.A.C.] *Soil Report*

were sealed.

3. It appears that the construction plans submitted to the District on October 6, 1993, are not a full scale set. Please submit a complete full scale set of construction plans. [40C-4.301(1)(a); (2)(a)., F.A.C.]

sent ½ scale. Will send full.

4. Clearly indicate the percentage of impervious area. If the project's impervious area exceeds 50 percent, then please submit calculations for the mean annual storm event for the pre-development and post-development condition. Please be advised that the post-development peak rate of discharge must not exceed the pre-development peak rate of discharge for the 2.3-year, 24-hour storm event. [40C-4.301(1)(a); (2)(a)., F.A.C.] *40C-42.025(8): for new facilities serving new const. areas of 50%+ imperv.*

5. Submit pre-development and post-development condition calculations for the proposed system. Please be advised that the post-development peak rate of discharge must not exceed the pre-development peak rate of discharge for the 25-year, 24-hour storm event. [40C-4.301(1)(a); (2)(a)., F.A.C.]

6. Please be advised that the existing and proposed water surface profile for the 10-year, 25-year, and 100-year, 24-hour storm events have not been submitted. Please demonstrate that the system will not cause a net reduction in flood conveyance capabilities provided by the floodway. Traversing works shall cause no more than a one foot increase in the 100-year flood elevation immediately upstream and no more than one tenth of foot increase in the 100-year flood elevation 500 feet upstream. Please submit all necessary information. [40C-4.301(1)(a); (2)(a)., F.A.C.; 10.5.2, A.H.]

7. Pursuant to staff's telephone conversation with Mr. Ed Pershe on November 9, 1993, please be advised that your project is located within the Wekiva River Water Quality Protection Zone, pursuant to section 11.3.3, of the Applicant's Handbook. Please be advised that the information furnished in the calculations (Page 4) regarding the Water Quality Protection Zone is inconsistent with the requirements of section 11.3.3 of the Applicant's Handbook. Please be advised that the plan must be in conformance with the erosion and sediment control principles set forth in section 18.2, Applicant's Handbook: Management and Storage of Surface Waters, and must be contain the information set forth in section 18.3, Applicant's Handbook. Please delineate and detail on the plans, erosion, sediment, and turbidity control best management practices that will be utilized during and after construction of the project. Include provisions that the delineated measures are the minimum required, with additional controls to be utilized as needed. Please be advised that under no circumstances should silt fence be constructed in live stream or in swales or ditch lines where flows are likely to exceed 1 cubic foot per second (cfs). After a review of the drawings, it appears that additional sediment, erosion and turbidity control measures may be necessary. For instance, there is no indication that a silt fence will be placed between the toe of slope of the fill for the temporary detour road and the channel (i.e., NWL at 8 foot NGVD[?]). The proposed turbidity barrier, based upon its proposed placement out in the channel will not prevent a discharge of sediments to the Wekiva River, which is an Outstanding Florida Water (OFW) body. Additional sediment and erosion control structures should be used when fill is removed for the temporary detour road and under the existing bridge (the 0.35 of an acre area) to prevent the deposition of sediments from slope areas into the Wekiva River, or into restored wetland areas. Please

Done

delineate these additional measures on all appropriate drawings. It may be necessary to prepare an additional set of post-construction (i.e., earthwork) drawings to clearly delineate these structures. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

8. Please provide a construction detail of the proposed silt screens and hay bales, and the turbidity curtain. Provide a cross-sectional drawing of the proposed turbidity curtain in relation to the depths of the river channel. Include a description of the mesh size of both the silt screens and the turbidity curtain. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

9. From the construction plans, it appears that the proposed design is inconsistent with information presented to the District staff at staff's meetings with Mr. Ed Pershe on March 26, 1993, and June 14, 1993. Please be advised that it was staff's understanding that runoff from the proposed roadway would be conveyed to a shallow existing swale with a ditch block, then discharged to the Wekiva River. Please clarify and submit any revised plan and calculations. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

10. It appears that Structure Number 11, as shown on the plan view, is inconsistent with the drainage structure sheet detail S-11. Also, indicate what is the purpose of the two 2-foot by 2-foot openings on S-11. Please submit any revised plans. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

11. It appears that the special ditch sections with ditch blocks for the left and right sides of the of proposed roadway have been designed. Please be advised, however, that these special ditch sections with ditch blocks are not shown on the plan view and are inconsistent with the roadway typical section, and with the drainage structure sheet for S-18 and S-19. Please clarify and submit any revised plans. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

12. The calculations (Page 1) indicate that the horizontal clearance will be increased from 36 feet to 49 feet between piles. However, this is inconsistent with the bridge profile. Clarify and submit any information. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

13. It appears from the detail of the proposed inlet, that runoff will become trapped at the bottom of the sump. Please submit a revised inlet design demonstrating that the recovery of runoff stored within the sump will occur. [40C-4.301(1)(a)6.,9.; (2)(a)4., F.A.C.]

Adding sump.

14. Please revise the application and all supporting drawings to quantify and qualify the Riparian Habitat Protection Zone (RHPZ) that occurs within the proposed project area. Please differentiate between the wetland and upland component of the RHPZ. Include the acreage of RHPZ that will be affected by this project, again differentiating between uplands and wetlands within the RHPZ. [40C-41(3)(e), F.A.C.]

RHPZ functions

15. Please demonstrate that the proposed activities within the Wekiva River Riparian Habitat Protection Zone will not adversely affect aquatic and wetland dependent species. Section 11.3.5(b), A.H.; specifically any construction within the RHPZ is presumed to adversely affect the abundance, flood sources, and habitat of aquatic and wetland dependent species. [40C-41(3)(e)1.,2., F.A.C.]

needed? & structures

16. Please describe in adequate detail, the construction techniques and sequences for the construction of the temporary detour road and the new bridge, including the removal of the 0.35 of an acre of embankment under the proposed bridge and the removal of the temporary detour road. Include a description of the equipment to be used, methods for moving the equipment to and from the proposed site, and special provisions to be used. If equipment is to be brought to the site by a barge or other vessel, provide the draft of the fully loaded vessel and the available water depth. Describe how the new pilings will be constructed and how the old pilings will be removed. [40C-4.301(1)(a); (2)(a), F.A.C.]

17. Please describe and identify the source and type of fill material to be used in the temporary detour road, and in the new approaches. [40C-4.301(1)(a); (2)(a), F.A.C.] *May come from SR46 shldr job w/RR excavation.*

18. Please provide recent aerial photographs at the same scale as plans submitted or at a scale of 1"=200' to 1"=400' (no photocopies please). Suitable aerial photographs usually may be obtained from county or city tax assessor's offices. Include the following information:

Drainage lines

a. the date aerial photograph was taken (flown);
b. the scale;
c. north direction;
d. the boundaries of the property owned and the project area (if not the same);
e. if known, show any wetland jurisdictional lines which have been determined for the property and label these appropriately; and,
f. the limits of the RHPZ.

[40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6.,7.,, F.A.C.]

19. Please revise all application drawings to ensure that the following items are included on each drawing (i.e., plan view, profile and cross-sectional drawings):

See plans

a. Identify all station numbers (on the plan view drawings), and locations represented by cross-sectional drawings.

Called Out b/ end standards

b. A legend that identifies all symbols used on the drawings (i.e., fence lines, wetland limits, property lines....) on all drawings.

See dredge/fill sketches

c. Ensure that all cleared, dredge and fill areas, including temporary fill areas (differentiating between wetlands and uplands) are clearly identified by cross hatching (dredged), hatching (fill), or by some other easily recognized method other than coloring or shading (because of reproduction requirements) on all drawings.

d. Clearly differentiate on the drawings all existing grades and all proposed grades (some of the lines are discontinuous on the drawings; i.e., cross section drawings, and the proposed activities in the ditches on the east side of the river are not clearly delineated). ?

e. Ensure that all proposed piling (as appropriate) and bridge structures are shown as permanent fill on all drawings.

f. Delineate the limits of construction required within existing rights-of-way. (Is it appropriate to presume that construction activities will occur out to the limits of the "temporary construction easement"? Please clarify.) Doing that.

g. Indicate the direction of flow of the river (on plan view drawings). Shown

h. Indicate the limits of the RHPZ. Shown

[40C-4.301(1)(a)9.,10.; (2)(a)1,2.,6.,7., F.A.C.]

20. A plan view drawing has been provided of a"3- 9'X12'X70' Sand Filtration Box." Please clarify whether or not this is an existing or proposed structure in the drawings. Please revise the appropriate profile and cross-sectional drawings to illustrate this structure as it is not shown on either type of drawings. [40C-4.301(1)(a); (2)(a), F.A.C.] Shown on plan/profile & drainage detail. Adding box to profile.

21. Please provide a revised complete profile view drawing of the entire project delineating the location of all existing and proposed structures. It may be advisable to provide a separate profile drawing of the proposed temporary detour road. [40C-4.301(1)(a); (2)(a), F.A.C.] Shown. See TCP Plan/Profile

22. The application and drawings do not indicate any de-mucking activities that may be required in order to construct the temporary detour road. Please provide a geotechnical analysis (signed and sealed by a professional in the field of geology) of the substrate with the proposed temporary detour road corridor, and recommendations for the construction of this road. Please revise the application's narrative, as appropriate, if de-mucking will occur. [40C-4.301(1)(a); (2)(a), F.A.C.]

23. For the fill material that will be removed as a result of this project, and any dredged material for construction of the bridge (temporary and permanent), please show and fully dimension any proposed spoil sites to be located in, or immediately adjacent to, wetlands, or if there is an expectation of a discharge to wetlands. Include retention levees and control structures for retaining or detaining return water if applicable. [40C-4.301(1)(a); (2)(a), F.A.C.]

24. Please describe, and provide the acreage of any areas that will be impacted by clearing activities necessary to construct this project. It appears that forested wetlands will be cleared for the placement of

the temporary bridge which have not been identified and described in the application. Please identify the amount of forested wetlands that will be permanently cleared as a result of the construction of the new bridge. [40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6.,7., F.A.C.]

25. During the pre-application site visit that occurred with District staff, wetland limits were only generally identified within existing rights-of-way. Wetland limits were not established on other properties; i.e., in the southeast and southwest quadrants of the project. Please identify the entity or individual, and their professional association with the project, and the methodology employed to establish the limits of wetlands in these areas. Please be advised that District staff will need to inspect these areas to verify the described limits of wetlands. [40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6.,7., F.A.C.]

26. Please delineate on the drawings (as appropriate) the location of the USGS water level gauge station. Please include a narrative of how the proposed construction of this project will affect this station. Include drawings that detail any replacement structures, if appropriate. The dredge and fill activities associated with the removal and replacement of this structure should be included in the application if it is the Departments intent to relocate the structure. [40C-4.301(1)(a); (2)(a), F.A.C.] B-9

27. It was indicated in the application that details of the re-planting scheme for the temporary impact areas are pending. Please provide these detailed plans for the restoration of these areas, including at a minimum the following:

   a. The Latin and common names of all species to be planted.

   b. The size and proposed planting densities of all species proposed to be planted.

   c. Plan view, cross section, and profile drawings that illustrate the proposed planting scheme, the pre-construction contours, and the post-construction contours.

   d. Provide a geotechnical assessment of the substrate and ground water elevations with in the proposed temporary detour road corridor. (For example, will any de-mucking occur to construct the detour road? Will the fill material for the detour road cause compaction of the underlying indigenous substrate which will inhibit plant growth during the restoration phase? Please qualify and quantify these issues, and provide the details on all appropriate drawings).

   e. The schedule for restoration activities (i.e., regrading, planting, etc.).

   f. The high, normal and low water (ground and surface) elevations.

[40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6.,7., F.A.C.]

✓28. There is no indication in the application whether the 0.30 and 0.05 of an acre areas that will have existing fill removed, will be planted with the appropriate wetland species to stabilize exposed sediments. Please revise the application to include a planting plan for these two areas. [40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6.,7., F.A.C.]

29. Based upon staffs' preliminary review of this application, it appears that there will be a reduction in functions provided by forested wetlands to fish and wildlife as a result of construction of the temporary detour road, and clearing associated with the placement of the new bridge. Please submit a proposed plan to compensate for the loss of these functions. Please submit the details of any plans that are proposed to be used to compensate for the loss of wetland functions. [40C-4.301(1)(a)9.,10.; (2)(a)1.,2.,6., 7., F.A.C.]

Wetland Functions

30. Include a specific response to the concerns of an adjacent property owner (see enclosed letter). Address how this project will, or will not, affect this individual. [40C-4.301(1)(a); (2)(a), F.A.C.]

The following information is requested pursuant to the enclosed **policy** which was approved by the District's Governing Board on September 8, 1993, in response to an order of the Governor and Cabinet sitting as the Florida Land and Water Adjudicatory Commission. This policy applies to all MSSW permit applications which were not complete by November 8, 1993.

31. Please provide reasonable assurance that this project will not have adverse cumulative or secondary impacts to wetland functions, water quality, and aquatic and wetland dependent fish and wildlife listed as endangered, threatened or of special concern, pursuant to the enclosed policy dated September 8, 1993. Please reference the response to the criteria listed in this policy. [40C-4.041(2), F.A.C.]

It appears that, as currently proposed, that construction of the new bridge with the temporary detour road will result in water quality violations for several parameters (i.e., turbidity, dissolved oxygen, etc...). Please be advised that a water quality variance may be required prior to the issuance of a Wetland Resource Management Permit. You are advised to either apply for a water quality variance, or to modify the plans to eliminate any potential for water quality violations. In addition, please be advised that water quality sampling; pre-, during, and post-construction may be required for this project.

If the applicant desires to dispute the necessity for any information requested on an application form or in a letter requesting additional information, pursuant to section 40C-1.605(5), F.A.C., he or she may request an administrative hearing in accordance with section 120.57, F.S. Any petition for administrative hearing must comply with sections 40C-1.511 and 40C-1.521, F.A.C., must be filed within fourteen (14) days of receipt of the request for additional information, and must be filed with the District Clerk, in Palatka.

Please be advised, pursuant to subsection 40C-1.605(5), F.A.C., any application which has not been technically completed within sixty (60) days from the date of receipt of a request for additional information by the

District, will be prepared for an Intent to Deny at the next timely Governing Board meeting. If you require more than the allotted sixty (60) days, please indicate this to the staff.

In addition, no construction shall begin on the proposed project until a permit is issued by the St. Johns River Water Management District. This is pursuant to subsection 40C-4.041(1), F.A.C., which states in relevant part, "unless expressly exempt by sections 373.406 and 403.813, F.S., or sections 40C-4.051 or 40C-44.051, F.A.C., a surface water management permit must be obtained from the District prior to the construction, alteration, operation, maintenance, removal or abandonment of any dam, impoundment, reservoir, appurtenant work or works...."

If you have any questions, please do not hesitate to call this office at 407/897-4335 or 407/897-4331.

Sincerely,

Rod Pakzadian, Engineer
Department of Resource Management

For

Lance Hart, Supervising Environmental Specialist
Department of Resource Management

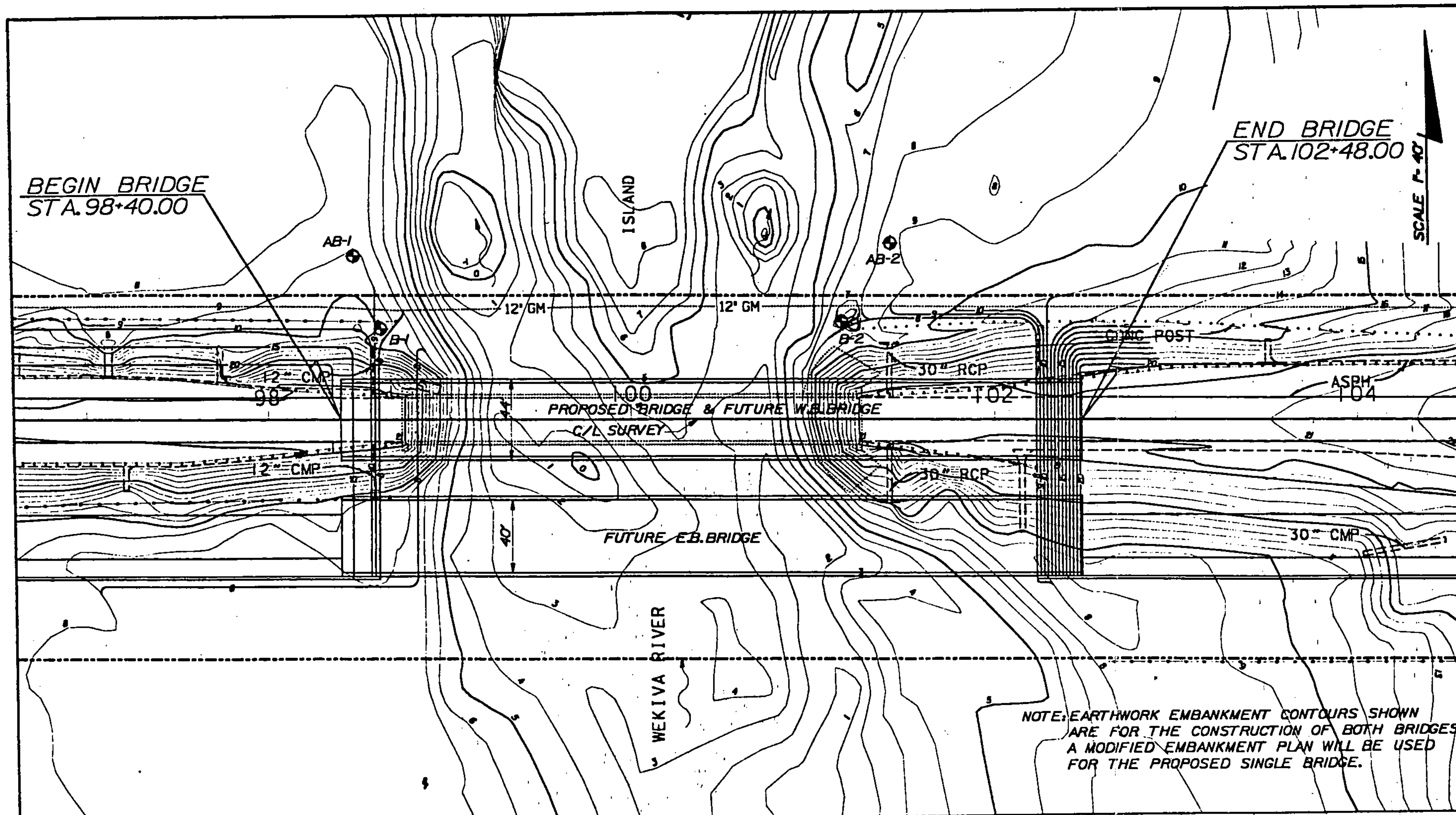
RP:LH:db
Enclosures
cc: PDS-RAIL
Pat Frost
Joan B. Budzynski, P.E.
Cammie Dewey, P.E.

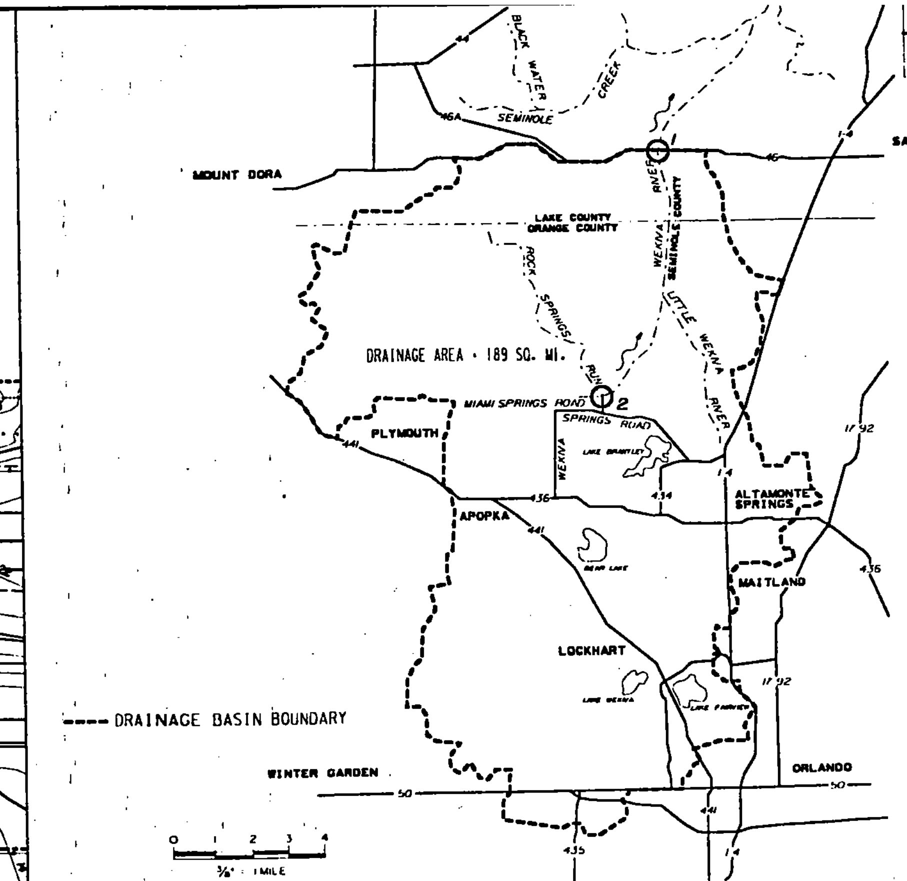
Mr. Richard Fowler
Florida Department of Transportation
Environmental Management Office
719 South Woodland Boulevard
DeLand FL 32720

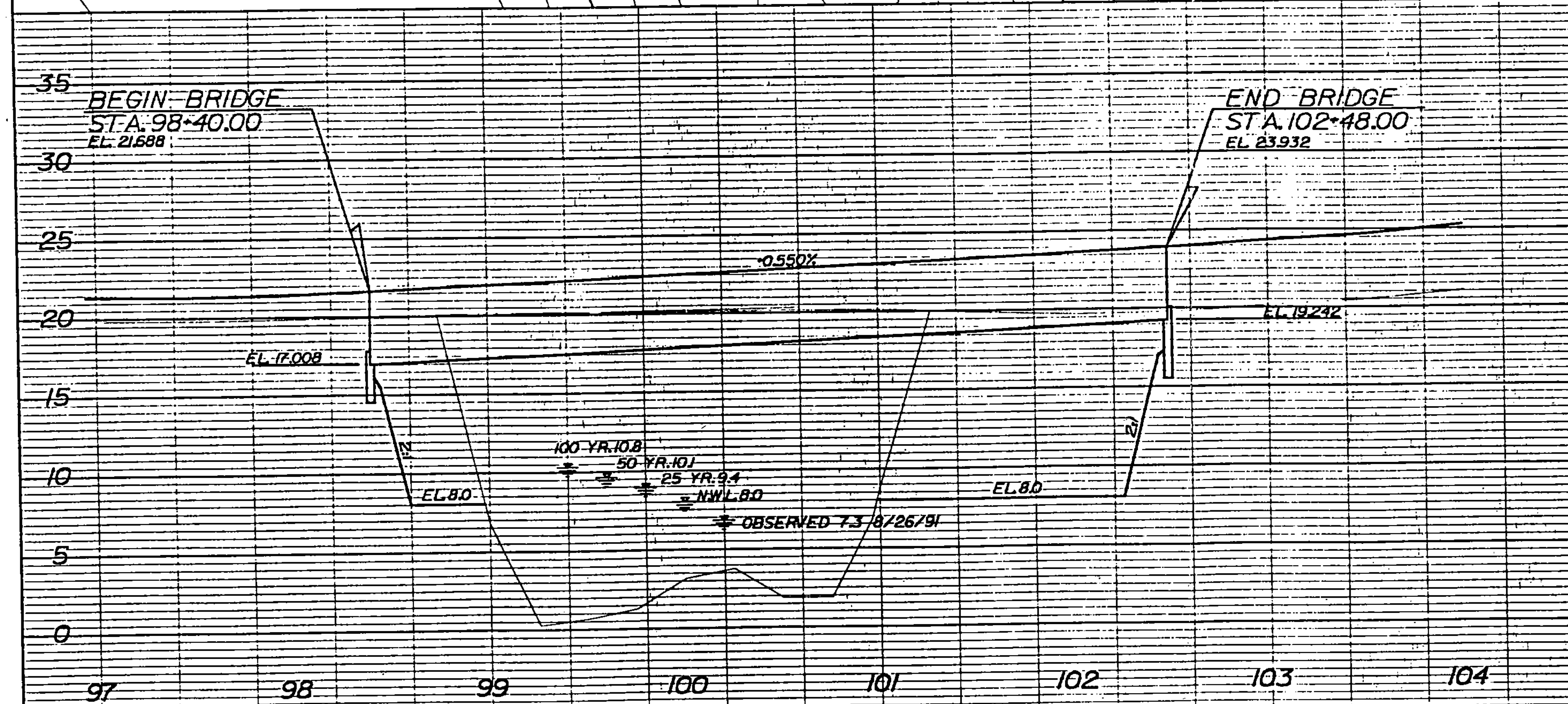
Mr George Lovett, General Counsel
Florida Department of Transportation
719 South Woodland Boulevard
DeLand FL 32720

STATE PROJ. NO. 77030-3517 | SHEET NO. B-10

BRIDGE NO. 770003







(REFERENCE)	EXISTING STRUCTURES (1)	(2)	(3)	(4)	ASSUMED CONFIGURATION
FOUNDATION	CONC. PILES	CONC. PILES			CONC. PILES
OVERALL LENGTH	252'	150'			408'
SPAN LENGTH	7 @ 36.0'	5 @ 30.0'			8 @ 51.0'
TYPE CONSTRUCTION	STRUC. STEEL	CONCRETE			PRESTR. BEAMS
AREA OF OPENING @ H.W.	1549 S.F.				2060 S.F.
ROADWAY WIDTH	24.0'	20'			44' W.B. 40' E.B.
ELEV. LOW MEMBER	17.6				17.482

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 anticipated 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 exceeded 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) 8.0 M.H.W. N/A M.L.W. N/A

☐ OVERTOPPING FLOOD
☒ GREATEST FLOOD

FLOOD DATA:	MAX. EVENT OF RECORD	DESIGN FLOOD	BASE FLOOD	GREATEST FLOOD
STAGE ELEV. NGVD (FT.)	11.05 *	10.1	10.8	12.3
DISCHARGE (CFS)	2060 *	1790	1980	2420
AVERAGE VELOCITY (FPS)	1.3 **	0.96	0.95	0.93
EXCEEDANCE PROB. (%)	0.8 **	2	1	0.2
FREQUENCY (YR.)	125 **	50	100	500

HYDRAULIC RECOMMENDATIONS

1. BEGIN BRIDGE STATION 98+40.00 END BRIDGE STATION 102+48.00 SKEW ANGLE 0
2. CHANNEL SECTION: ℄ STATION 100+31 BOTTOM WIDTH 180 FT. AVG. ELEV. 3 FT. AVG. SIDE SLOPE 3:1
3. LIMITS OF CHANNEL EXCAVATION: RT. N/A LT. N/A
4. CLEARANCE: NAVAGATION: HORIZ. 48' VERT. 9.792' ABOVE EL. 8.0 DRIFT: HORIZ. 51.4 VERT. 7.5 ABOVE EL. 8.0
5. SCOUR PREDICTION: MAXIMUM GENERAL SCOUR ESTIMATED TO BE 0.5 FEET; MAXIMUM LOCAL SCOUR ESTIMATED TO BE 5 FEET; MAXIMUM DEPTH OF SCOUR ESTIMATED TO BE 5 FEET.
6. SLOPE PROTECTION: RUBBLE RIP-RAP 2:1 SLOPE AND MAINTENANCE BERM
7. DECK DRAINAGE: BRIDGE DECK RUNOFF SHALL BE COLLECTED IN SHOULDER GUTTERS AND CONVEYED TO A SAND FILTRATION SYSTEM FOR TREATMENT. SCUPPERS SHALL NOT BE USED. MAX. ALLOWABLE SPREAD IS 10 FEET.
8. OTHER: BOTH 44' W.B., & 40' E.B. BRIDGES ARE SHOWN. THE 44' W.B. SHALL BE BUILT FIRST AND SHALL BE 2-WAY UNTIL THE FUTURE 40' E.B. BRIDGE IS CONSTRUCTED.

REMARKS: * DATA FROM USGS STATION 02235000 AT WEKIVA RIVER-S.R 46; MAX. DISCHARGE OBSERVED SEPT. 17, 1945; MAX. GAGE HEIGHT OBSERVED SEPT. 12, 1960
** CALCULATED VALUES

[signature] 11/01/93

REVISIONS DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
10-11-93	WLS	REVISED NOTE 7,8 & GRADE PER FDOT COMMENTS									

	NAME	DATE		NAME	DATE
DESIGNED BY	CAH	2-28-92	DRAWN BY	SMP	2-28-92
CHECKED BY	WLS	4-03-92	CHECKED BY	CAH	4-03-92

SUPERVISED BY: WILL L. STEWART P.E.

FLORIDA DEPARTMENT OF TRANSPORTATION

APPROVED BY:

DATE:

S.R. 46 - WEKIVA RIVER

BRIDGE HYDRAULIC RECOMMENDATIONS

CADE DTOSPB.DG
DTOS.TB.