ANALYSIS OF FLOODING PROBLEM FOR S.R. 29 WEST OF CHAPARRAL SLOUGH

05090 Glade Co.

Financial Project ID 198356-1-32-04
Work Program Item No. 1119960
S.R. 29 between S.R. 78 and Chaparral Slough

Prepared for:

The Florida Department of Transportation
District One
801 North Broadway
Bartow, FL 33831-12349

Prepared by:

PBS&J, Inc.
5300 W. Cypress Street
Suite 300
Tampa, FL 33607-1066

October 1999

Larry Dadby
10/26/99

TABLE OF CONTENTS

INTRODUCTION

The project is located in Glades County, just east of the City of Labelle. It is a two lane rural highway constructed in the late 1940's. See Appendix D for the original drainage map, dated 1947 and a drainage map for SR 78 dated 1956 which includes this section of roadway. As noted on the original map, the section of roadway between Lone Pine Creek Bridge and 600 ft west of Chaparral Slough Bridge (between Stations 366+00 and 426+00) is flat, with a profile elevation of 35.4. This section of roadway has flooded twice since sometime in the early 1970's, see Appendix B for flooding correspondence. See Appendix A for photographs of a flooding event on March 20, 1998 and a near flood event on February 18, 1998.

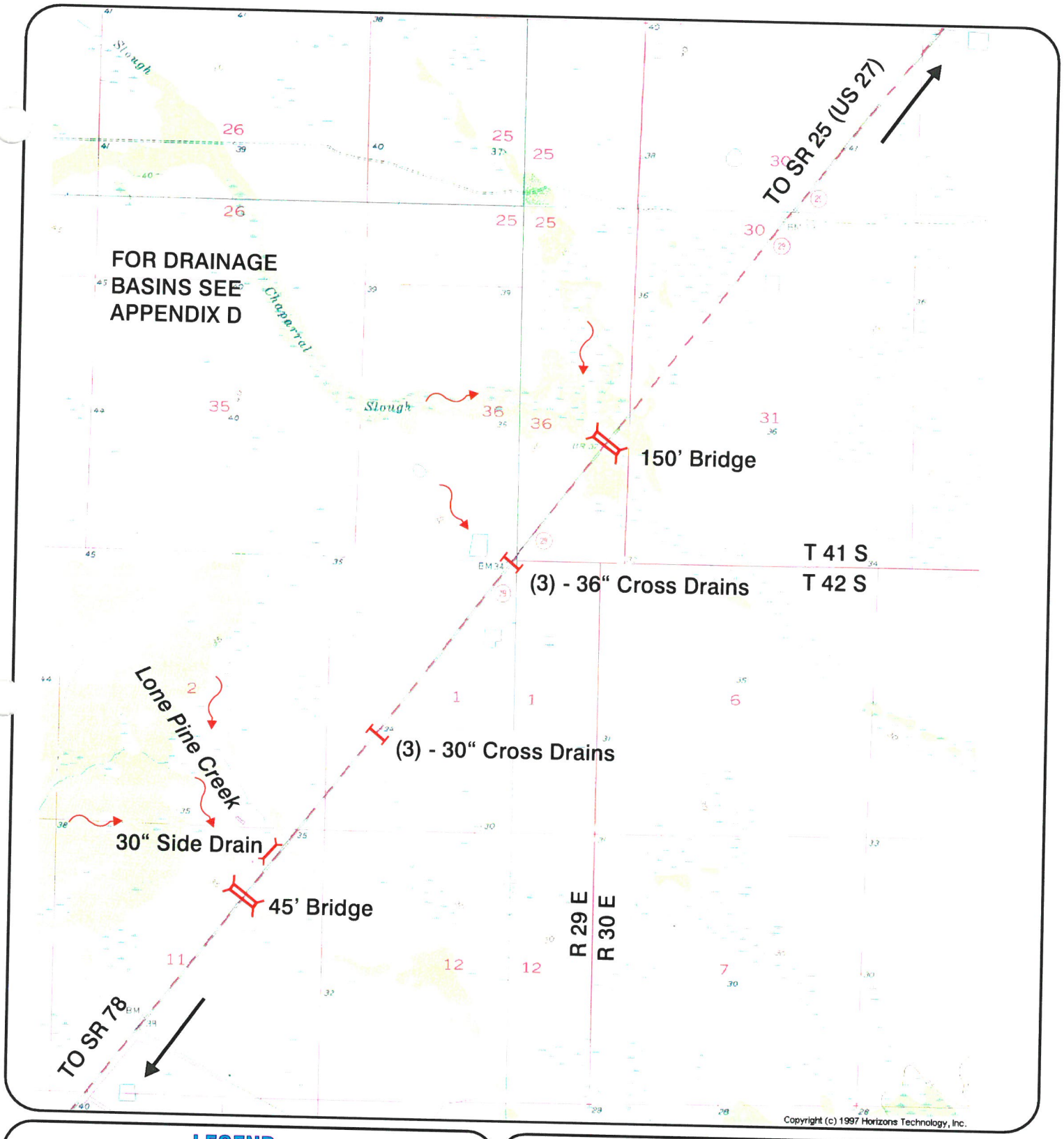
The intent of this engineering analysis is to determine the cause of the flooding and provide recommendations regarding the most cost effective remedy.

EXISTING DRAINAGE PATTERNS

Drainage is generally toward the south and consists of shallow sloughs, marshes, and wetlands. Because the terrain is so flat, flow is at low velocity and the difference between flood stages and normal wet season water levels is only a few feet. There is significant storage within the basins. Drainage structures within and near the flooding area consist of a 45' bridge at Lone Pine Creek, a 150' bridge at Chaparral Slough, (3) - 30" cross drain pipes at approximately Sta. 354+00, (3) – 36" cross drain pipes at approximately Sta. 392+00, and a 30" side drain pipe under a drive approximately 700 ft northeast of Lone Pine Creek Bridge. All structures except the side drain and (3) - 36" pipe were constructed on the original project. Time of construction and reason for the (3) - 36" pipes are unknown.

The original roadway project provided a large R/W ditch on the northwest side of SR 29 between Lone Pine Creek Bridge and a slough approximately 1500 ft northeast of the bridge. It connected the slough, which drains a 2618 acre basin (see original project drainage map), with Lone Pine Creek Bridge. The old plans show the R/W ditch begins at station 315+70.50 and ends at approximately 325+00. The ditch has a 20 ft bottom width and a 0.15% profile grade (Elv 28.65 @ Sta 316+00 to Elv 30.00 @ Sta 325+00).

During flood conditions, a large area northwest of SR 29 stores runoff and rises to elevation 35.4 before overtopping occurs. There is a slight gradient on the pool due to its movement toward the southwest.



LEGEND

FLORIDA DEPARTMENT OF TRANSPORTATION

S.R. 29
STUDY
West of Chaparral Slough
Glades County, Florida

EXISTING DRAINAGE PATTERNS

FIGURE 1

COREL \ DRAINAGE \ 9 GLADES COUNTY \ REPORT \ FIG_1.CDR \ 10-25-99

POTENTIAL CAUSES OF FLOODING

A review of the area drainage was performed using the following sources:

Two field reviews. (August 26, 1999 and September 7, 1999)
Drainage maps for SR 29, Project 05090-1 (date 1947) and SR 78, Project 05040- (date 1956)
USGS Quadrangle maps
Photographs of flood events.
Interviews with Talbert Melton (FDOT Maintenance - Labelle), George Vialas (Engineer for Lykes Bros.), Joseph Phillips (FDOT SWAO Drainage Engineer)
District One Flood Inventory, 1996
Bridge Hydraulic Report for Lone Pine Creek Bridge, by JMI Engineers, March 7, 1996
Aerial reconnaissance, August 29, 1999

Potential causes and their evaluations are listed below:

- The flow capacity of Chaparral Slough Bridge could be significantly reduced by partial blockage resulting from accumulation of Water Hyacinths. This could cause diversion of flow to the southwest and overload the pipes and Lone Pine Creek bridge. *A review of the photograph taken at Chaparral Slough bridge during flooding conditions on February 18, 1998 shows low velocities through the bridge, thus significant head losses would not be possible.*

- The large R/W ditch northeast of Lone Pine Creek Bridge is restricted by a 30" side drain pipe under a driveway, approximately 700 ft from the bridge. This restriction could be contributing to the flooding problem in two ways. It could increase the head losses, which will cause immediate and direct impacts to flood stages and/or it could indirectly raise flood stages by raising the seasonal high waters, thus reducing available storage. *This could be a significant problem, depending on the ratio between the flow carried in the R/W ditch and that carried overland in shallow depth flow. It is obvious that the 30" pipe violates the design intent of the R/W ditch, since its capacity is so much less than the ditch.*

- The water elevation observed on August 26, 1999 at Chaparral Slough was approximately 1 ft below the bottom slab of the bridge. This is estimated to be

elevation 34.0, which is the same elevation of the highwater shown on the old drainage map. Since no significant rainfall had occurred within several days it suggest the seasonal high water stages downstream of Chaparral Slough Bridge may have been raised through land alterations. This would raise flood elevations for two reasons, bridge hydraulics and the loss of storage. *No land alterations south of the bridge were observed during aerial reconnaissance.*

- Chaparral Slough may overtop its western basin boundary during flood stages and increase flow to the (3)–30", (3)–36", and Lone Pine Creek Bridge above that anticipated in the original design. This diversion of flow could be natural or caused by land alteration. *Survey efforts and comprehensive modeling will be required to determine if this is occurring, however it is not warranted at this time. It is obvious that the discharge to the pipes and Lone Pine Creek Bridge exceed their capacity, regardless of source.*

- The location of the (3)-30" pipes offers a more efficient path for removal of flood waters than either Lone Pine Creek or Chaparral Slough. This is apparent from the photographs of flooding. It is obvious that the tailwater stages at this site are 2' to 3' below upstream stages. Low velocities at the bridge, observed during flood events, indicate losses through the bridges are low. If the headwaters are near 35.5, as shown in the photograph, then the tailwaters at the bridges are much closer to the 35.5 than at the pipes. An examination of the USGS Quadrangle map adds further support to the hypothesis that tailwater stages are lower at the pipes than at the two bridges. Based on these facts, the original design may not have been the most hydraulically effective. *Clearly, the most certain remedy for the flood condition is a significant enlargement of the (3)-30" pipes, however such alteration can have far reaching impacts. The increased discharge rate downstream would require concurrence of property owners and the Water Management District.*

RECOMMENDATIONS

Improvements should be implemented in a two step process as follows:

- Replace the 30" side drain pipe in the R/W ditch at approximately Sta 320+22 with 40 ft of double 72" pipes at approximately elevation 28.8. This will provide capacity

which conforms to the original design intent at a relatively economical expense, especially if FDOT Maintenance employees perform the work. This improvement will reduce flood levels in two ways; (1) it will reduce head losses through the side drain and (2) it will draw down water levels more rapidly which, in turn, will increase storage available, and thus will lower flood stages. Benefits provided by this action are unknown without a significant surveying and modeling effort since they depend on the ditch conveyance as compared to overland conveyance. It is more cost effective to invest in the pipe than in the study to predict their benefits.

- Step two is to be implemented if the side drain enlargement does not reduce flooding to an acceptable level. It requires replacement of the (3)-30" cross drain pipes with a box culvert. This modification will involve design, permitting, and possible acquisition of flood rights from downstream property owners.

If Step Two cannot be implemented, two options are available, both of which are significantly more expensive:

- Option One requires raising the roadway grade for approximately 2 miles, extending cross drains, and adding 48" cross drains uniformly spaced along the raised segment. Weirs with crest elevations to match existing roadway elevation (35.4) will be affixed to the 48" cross drains to serve as control structures to match existing conditions, i.e. restricted pipe flow up to 35.4 and a large capacity increase above 35.4. This modification can be designed to provide stage-discharge characteristics similar to existing overtopping conditions, thus maintaining existing flow conditions. There are significant construction cost attached to this option.

- Option Two will provide a raised berm along the northwest R/W line at elevation 35.4 with openings equivalent to existing pipes. Several 48" cross drains will be provided under the roadway to carry the large berm overtopping flow and distribute it along the southeast R\W line in a manner similar to what happens during existing roadway overtopping. Construction cost will be less than Option One, however it will require a R\W strip along the northwest side in order to provide sufficient width to construct the berm and ditches (one on either side of the berm). Option Two will be more economical than option one because R/W acquisition will involve undeveloped property in one ownership.

APPENDIX A

PHOTOGRAPHS OF FLOODING

LOOKING NORTHEAST ALONG S.R. 29 AT CHAPARRAL SLOUGH BRIDGE

LOOKING SOUTH ALONG S.R. 29 AT (3) 30" RCP APPROXIMATELY STA. 354+00

LOOKING SOUTHWEST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

LOOKING SOUTHWEST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

LOOKING NORTHEAST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

LOOKING NORTHEAST ALONG S.R. 29 BETWEEN LONE PINE CREEK AND CHAPARRAL SLOUGH

APPENDIX B

FLOODING CORRESPONDENCE

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 10:29 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Talbert Melton

Subject: Flooding on SR29

I asked Mr. Melton specifically about June 1995 when Ken Howard recalls there was a need for barricades on a portion of SR 29 where water was coming onto the roadway. He does not remember ever having to take barricades out there. He said that the water frequently comes up and will quickly runoff the roadway. At times they have gone out and driven fluorescent painted stakes at the edge of the pavement, however they have not had to drive stakes in a while.

He also spoke with field superintendent Robert Crawford who would actually gone out into the field. Mr. Crawford does not remember water over the road or bridges. He did not take barricades out during this event.

The other field superintendent, Wally Thalen, was out of the office but will call when he gets in.

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 11:40 AM **CALL ~~PLACED~~/RECEIVED BY:** Paula

FIRM CALLED: FDOT Maintenance **TELEPHONE #** (941) 674-4027

SPOKE WITH: Wallace Thalen

Subject: Flooding on SR29

The area of flooding during June 1995 was at a 36" cross drain located between bridges 050033 and 050035. It is approximately 0.5 - 0.6 miles south of bridge 050033. This is the area that they have the most problems with. During June the water was up to the edge of pavement. It lacked only a few inches to overtop the road. You could not pull off the highway.

Water flows 'real good' through bridge 050035. It washes sand up on the east side of the highway. He does not remember the water level ever coming up to the bridge.

	Project/Proposal
cc: File, Dave, Art	9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/07/96 **PROJECT NO:** 9523

TIME: 09:23 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Emergency Management **TELEPHONE #** (941) 946-1217

SPOKE WITH: Ken Howard, Director

Subject: Flooding on SR29

I called Mr. Howard about the flooding which occurred around June 23, 1995 (per Art de Laski). He stated that the road was never completely closed during this time. There was an area where the water was over the road, however the road was still passible. A Florida Highway Patrol first noticed the water on the road and notified the EMA, who notified the Glades Co. Road Department who put up barricades and warnings for travelors.

Mr. Howard stated that this area was located about 5 miles south of the intersection of SR 29 and US 27. He said that it was not at a bridge, it was only the roadway. The water receded in about 24 hours.

Mr. Howard stated that all this information was his own personal experience. This past year was unusual due to several tropical storms, hurricanes, etc. and there were a lot of areas flooded which usually don't. In the last 7-10 years, he does not remember SR 29 ever overtopping. The EMA does not have detailed records of flooding and road closures. Since this is a state road, he recommended contacting the FDOT Maintenance.

He mentioned contacting Tommy Greenwood, Director of the Glades County Road Department for possibly more information. (941) 946-0771

Project/Proposal

cc: File, Dave, Art 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 09:11 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. Schools **TELEPHONE #** (941) 946-0323 ext.13

SPOKE WITH: Norman (Sonny) Hughes, Dir. of Transportation

Subject: Flooding on SR 29

Mr. Hughes has been with the Glades Co. School Department for 29 years. Glades Co. School buses travel SR 29 from LaBelle to Palmdale and are not allowed to drive on roads which have water overtopping them. He said that during the period of time he has been with Glades Co., SR 29 has never been blocked for the school buses. He said that there have been other roads which have been blocked but not SR 29.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/23/96 **PROJECT NO:** 9523

TIME: 10:01 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 946-0533

SPOKE WITH: Jerry Harris, Building Director

Subject: Flooding on SR 29

Mr. Harris is the former Glades Co. Emergency Management Director (1978-1995). He also has been the FEMA Flood Program Administrator since 1982. He was born and raised in Clewiston and considers himself a "Sawgrass Mugrat".

Speaking with Mr. Harris about flooding on SR 29, he mentioned that the only location where they have had trouble on this road is at Chaparral Slough. He recalls that the water has come up very high at this location, enough to damage the roadway base, but has not overtopped the roadway.

He said that during heavy rains water will spread out on both sides of SR 29, and sheetflow across the floodplain approximately 200 square miles. He said that all the water in this area is trying to reach the Caloosahatchee River regardless of the direction it travels.

Project/Proposal

cc: FILE, DFS 9523

TELEPHONE CONVERSATION
MEMORANDUM

DATE: 02/26/96 **PROJECT NO:** 9523

TIME: 11:59 AM **CALL PLACED/~~RECEIVED~~ BY:** Paula

FIRM CALLED: Glades Co. **TELEPHONE #** (941) 675-0124

SPOKE WITH: David Whiddon, Former Road Department Superintendent

---

Subject: Flooding on SR29

Mr. Whiddon was with the road department from 1980-93, prior to Tommy Greenwood. He has lived in Glades County all his life, 48 years.

To his knowledge, SR 29 has never overtopped. He stated that the land to the west of SR 29, north of SR 78 approximately 3-4 miles stays wet for most of the year.

He warned that if the flow was increased through SR 29, this could cause increased flooding at SR 78. He said that the residents on Marshall Field Road get mad every year because of flooding. If we increase the risk of flooding for these residents, he said for us to expect a lawsuit.

He said that during heavy rains, the water already comes up to the edge of pavement on SR 78.

Project/Proposal

cc: File, Dave, Art 9523

APPENDIX C

HYDRAULIC CALCULATIONS

PBS&J

COMP. BY: MDM
CHK. BY: REG
DATE: 9/14/99
SHEET NO:
JOB NO:

SUBJECT: SR 29 - 50yr Flow Rate for Lone Pine Creek

Q_{50yr} = 598 cfs (See BHR for SR29 Crossing for Lone Pine Creek Bridge No. 050035, JMI Engineers March 7, 1996)

Drainage Area = 4833 Ac (From original Drainage Map)

Area blocked by Driveway = 2618 Ac
(Existing 30" cmp side Drain)

$$Q_{50yr\ @\ Ex\ 30"cmp} = \frac{2618\ Ac}{4833\ Ac} \times 598_{cfs} = 324\ cfs$$

Size proposed Side Drain for a velocity of 6 fps for 50yr event.

$$Q = V\ A$$

$$A = \frac{Q}{V} = \frac{324}{6} = 54\ ft^2$$

USE (2) - 72" RCP

$$A = 2 \times \frac{6^2}{4} \times 3.142 = 56.6\ ft^2$$

Peak Basin Discharge				
	USGS Regression Equations, Region A		FHWA Regression Equations, Zone 1	
Storm (yr.)	Flow (m^3/m)	Flow (cfs)	Flow (m^3/m)	Flow (cfs)
2	234	138	514	303
50	1015	598	2138	1258
100	1164	685	2498	1470
500	1485	874	N/A	N/A

Table 1. Peak Basin Discharge

The resistance to flow, Manning's "n" coefficients, in the main channel and the flood plain have been calculated using procedures and equations found in the Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, FHWA-TS-84-204. Very high amounts of vegetation, a severe degree of irregularity, and a negligible effect of obstructions in the main channel are factors which effect the resistance to flow. A Manning's Roughness Coefficient of 0.10 was used to account for this resistance to flow in the main channel of Lone Pine Creek (calculations provided in Appendix B).

The Manning's Roughness Coefficients for the flood plain were computed without using the vegetation-density method. Since the roughness is not uniformly distributed across the flood plain it has been subdivided into two sections. These sections include an area with trees and area of pasture (no trees). The computed "n" value for the pasture section is 0.06 and 0.15 for the section with trees (calculations and photographs provided in Appendix B).

Hydraulic Analysis

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

APPENDIX D

DRAINAGE MAPS


TOTAL 5,409.55 A.
TOTAL 2,456.46 A.
TOTAL 1,272.4 A.
Area by B.R.H.
by A.H.S.
TWP. 41 S. - R. 29 E.
TWP. 42 S. - R. 29 E.
TWP. 41 S. - R. 30 E.
TWP. 42 S. R. 30 E.
TWP. 41 S. R. 29 E.
TWP. 41 S. R. 30 E.
STATE RD. 29 TO PALMDALE FLA.
STATE RD. NO. 29 TO LA BELLE FLA.
24' MARL GRADE TO LA BELLE, FLA.
CHAPARRAL SLOUGH
PALMETTO PRAIRIE
SWAMP
GRASS POND
SLOUGH
DEAD MAN'S BRANCH
POND
PINE (PALMETTO)
AV. 12' WINDING DITCH
H.W. = 28.0
THIS AREA IS IRRIGATED BY CONTROLLED DITCHES
2,221.30 A.
1,270.89 A.
743.80 A.
709.83 A.
1,124.89 A.
621.67 A.
809.92 A.
313.1 A.
44 A.
339.8 A.
534.44 A.
N
SEC. 0504 - S.R. 78
SCALE 1" = 2,000'
NOTE: PI STA. 375+00 BACK END SURVEY = STA. 375+00 AHD. ON JOB ... ALSO END OF 24' MARL RD. BEGIN 17' PAVEMENT.
REFERENCE NO. 05090-1
05040
SR 78
1" = 2000
1 OF 1
SR 29 TO EAST

DRAINAGE MAP

Dist.	State	County	Route	Proj.	Sheet No.
8	Fla.	HENDRY & GLADES	29	S-186(9); S-230	2

Reference No. 05090-1