Appendix F

FISH AND WILDLIFE COORDINATION ACT REPORTS

U.S. Fish and Wildlife Service

Florida Fish and Wildlife Conservation Commission

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

October 20, 2005

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Carpenter:

This letter constitutes the Final Supplement to the previous Final Fish and Wildlife Coordination Act (FWCA) Report on the Tamiami Trail (TT) portion of the Modified Water Deliveries (MWD) to the Everglades National Park (ENP) Project (Service 2003). This letter is provided in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute a biological opinion as described under section 7 of the ESA. The U.S. Army Corps of Engineers (Corps) has submitted a biological assessment and effects determination for this project as required by the ESA. The Corps and Fish and Wildlife Service (Service) staff are working diligently to complete consultation. Additionally, after consultation is completed, if modifications are made to the selected plan or if additional information involving potential impacts to listed species becomes available, reinitiation of consultation may be necessary.

To summarize briefly the conclusions found in this letter, the Service concurs with the Corps' preferred alternative (Alternative 14, 2 miles west and 1 mile east bridge alternative) and looks forward to the implementation of this alternative with consideration towards all of the recommendations set forth in the Final FWCA Report as well as the supplements. The Service strongly supports the TT portion of the MWD Project and commends the Corps for selecting a plan that will facilitate the restoration of ecologic function and hydrologic conditions in ENP.

INTRODUCTION

This Final Second Supplemental FWCA Report was prepared by the Service to further analyze and evaluate additional alternatives considered for the MWD to ENP TT Project. The overall goal for the TT portion of the MWD Project is to maximize hydrologic and ecologic restoration through modifications to the existing U.S. Highway 41 roadway. This goal will allow for more natural flow conditions in a manner that is compatible with the restoration requirements of the 1989 ENP Protection and Expansion Act. It is also desirable to ensure compatibility with ongoing restoration projects such as the C–111 Project and future components of the Comprehensive Everglades Restoration Plan (CERP).

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Since the submittal of the Final GRR/SEIS and as a result of public and agency review of the report, the Corps determined that the Recommended Plan did not contain all the features necessary for implementation and thus retracted the report for further review and modification. The following items needed to be reconsidered: (1) concerns for public safety on TT due to high water impacts to the roadbed; (2) the escalating worldwide and regional cost of construction materials; and (3) because of higher construction costs and shifting fiscal constraints, it became evident that a new cost/benefit analysis would be necessary. Since the Final GRR/SEIS would be amended to reflect consideration of the above-mentioned items, the Service issued a draft supplement to the Final FWCA Report.

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ADDITIONAL ALTERNATIVES

Five additional alternatives were designed and evaluated by the interagency subteam for this iteration of the Revised GRR/SEIS. The previous and additional alternatives are listed in Table 1 along with the total length of bridging and the number of bridges for each. A brief description and figure are included for each of the new alternatives considered and the same information can be found for the previous alternatives in the First Supplemental FWCA Report (Service 2005).

3-Mile Bridge, Alternative 12

Alternative 12 (Figure 1) would create a conveyance opening through TT by removing up to 3 miles of the existing highway and embankment in the western portion of the project area. A bridge would be constructed over the opening to replace the removed section of road and

maintain motor vehicle traffic. The bridge would begin approximately 1,500 feet west of the Airboat Association of Florida and proceed west approximately 3 miles, ending approximately 1/2 mile east of (before) the Osceola Camp. Access roadways would be provided for the Jefferson Pilot site, Everglades Safari and the S-12 Telemetry Tower.

2-Mile Bridge, Alternative 13

Alternative 13 (Figure 2) would create a conveyance opening through TT by removing up to 2 miles of the existing highway and embankment in the western portion of the project area. A bridge would be constructed over the opening to replace the removed section of road and maintain motor vehicle traffic. The bridge would start approximately 1,300 feet west of the S-12 Telemetry Tower and proceed west approximately 2 miles, ending approximately 1/2 mile east of (before) the Osceola Camp. Access roadways would be provided for Everglades Safari and the Jefferson Pilot site.

2-Mile Bridge West and 1-Mile Bridge East, Alternative 14

As with Alternative 13, Alternative 14 (Figure 3) sites a bridge of up to 2 miles long in the western portion of the project area; however, Alternative 14 also sites a bridge of up to 1 mile long in the eastern portion of the project area.

Alternative 14 would create two conveyance openings through TT by removing up to 3 miles (cumulative) of the existing highway and embankment. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic. The opening and bridge for the eastern bridge would start approximately 1 mile west of S-334 and proceed west approximately 1 mile, ending approximately 3,000 feet east of (before) Radio One. As with Alternative 13, the bridge would start approximately 1,200 feet west of the S-12 Telemetry Tower and proceed west approximately 2 miles, ending approximately 2,640 feet east of (before) the Osceola Camp. Access roadways from the western bridge would be provided for Everglades Safari and the Jefferson Pilot site; no access roadways are necessary for the eastern bridge.

1.3-Mile Bridge West and 0.7-Mile Bridge East, Alternative 15

Alternative 15 (Figure 4) sites a bridge with a length of up to 0.7 mile in the eastern portion of the project area and a bridge of up to 1.3 miles long in the western potion of the project area. The bridges are sited in similar locations to the bridges in Alternative 14.

Alternative 15 would create two conveyance openings through TT by removing up to 2 miles (cumulative) of the existing highway and embankment. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening for the eastern bridge would start approximately 1 mile west of S-334 and proceed west approximately 0.7 mile, ending approximately 4,500 feet east of (before) Radio One. The opening for the eastern bridge would begin approximately 1,300 feet west of

Everglades Safari and proceed west approximately 1.3 miles, ending approximately 4,500 feet east of (before) the Osceola Camp. An access roadway from the western bridge would be provided for the Jefferson Pilot site.

Three 3,000-foot Bridges, Alternative 16

Alternative 16 (Figure 5) would create three conveyance openings, each with a length of up to 3,000 feet (total of 9,000 feet), through the TT in the eastern, central, and western portions of the project area. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening for the eastern bridge would start approximately 1 mile west of S-334 and proceed west approximately 3,000 feet, ending approximately 6,000 feet east of (before) Radio One. The opening for the central bridge would start approximately 1,300 feet west of S-335A and proceed west approximately 3,000 feet, ending immediately east of (before) the Airboat Association of Florida. The opening and bridge for the western bridge would start approximately 2,000 feet west of the Jefferson Pilot Communication Site and proceed west approximately 3,000 feet, ending approximately 4,500 feet east of (before) the Osceola Camp. No access roadways are necessary for any of the bridges.

FISH AND WILDLIFE RESOURCE CONCERNS AND EFFECTS

Ecological Benefits Analysis

Representatives from six agencies (District, ENP, Service, Corps, Florida Fish and Wildlife Conservation Commission, and Florida Department of Environmental Protection) participated in the TT Modification Benefits Workshop held on July 6 and 7, 2005, in Jacksonville, Florida. This team evaluated the new alternatives using the same method employed at the previous workshop held on May 23 and 26, 2005. The team used the same performance measures (PM) except with the addition of two new hydrologic based PMs. A list of these PMs and associated scores for each alternative can be found in Table 2. For a more detailed description of the PMs please see the Benefits Analysis Procedures section of the Revised GRR/SEIS.

Different metrics utilized by each PM made it necessary to normalize the different PMs into a 0-1 index. The normalization method used was "percent of maximum", in which the maximum output achieved in each category by any of the alternatives was assigned a "1", and the output values for other alternatives for that same resource category were scaled as a percentage of that maximum (between 0 and 1). An index value of 1 would thus be assigned to an alternative that provides the maximum output value for the habitat unit categories, while a value of 0.5 would equate to the output value for an alternative that only provides 50 percent of the maximum output provided by the "largest" alternative (a hypothetical "largest" alternative in terms of delivering the maximum output of every habitat type). While other normalization techniques exist (*e.g.*, percent of range, percent of total, unit vector), the percent of maximum is the most widely used technique and is usually the default method. Thus, a combined, normalized metric was calculated to perform the Cost Effectiveness/Incremental Cost Analysis on all outputs provided by the TT alternatives.

As an example of normalization, consider PM 1.A, average annual flow volumes. The goal is the Natural System Model flow volume of 895 (acre-feet x 1,000), the flow that was established for each alternative was 683 (acre-feet x 1,000). The goal represents the maximum desired condition regarding the metric, the PM measured. The normalization score for these alternatives resulted from dividing the goal by the alternative score and coming up with an index score. For the PM, the index score was the same for all alternatives and was 0.763. The no-action condition for the PM was 493 (acre-feet x 1,000), and the index for the no-action condition was calculated as 0.551. The basic methodology behind these calculations were held constant for each PM, with minor revisions to PM 1.B in which the lower the score, the better had to be inversed, and PM 2.B (Table 2) where the PM was already an index reflecting a ratio. Index scores were calculated for all alternatives and for the no-action condition.

Habitat units (HU) were calculated by multiplying the indices by the acreages that were impacted by the PMs (PM 1.B and PM 2.B affected 6,848 acres, while the rest of the PMs affected the full 63,195 acres). Each of the PMs were determined to be of equal importance, and were therefore, all given a weight of "1" to be used to combine the HUs associated with each PM. Since all of the HUs occupied the same geographic area, an average of all the PMs was warranted. The averaging of the HUs was a two-part process. It was first necessary to find the total HUs of the upper section of the study area (only two PMs affected this area, 6,848 acres), and then the total HUs of the lower section of the study area (rest of PMs affected entire study area), and add these together to determine the total (HU) lift for the entire study area. Construction costs (Rough Order Magnitude), average annual HUs, and average annual costs per alternative are depicted in Table 3.

CONCLUSIONS AND RECOMMENDATIONS

Although the current Tentatively Selected Plan (2 miles west and 1 mile east bridge) will result in a reduction of average annual benefits by 4,303 HUs from the previously selected plan (4-miles Bridge Central) and by 23,392 HUs from the environmentally-preferred plan (10.7-miles Causeway), the Service still believes it will provide a significant improvement for fish and wildlife resources and take a crucial first step towards restoration of the system. The U.S. Department of Interior (DOI) understands that only limited improvements can be made to TT under the current funding levels of the MWD Project. DOI also understands that the Water Resources Development Act (WRDA) 2000 Water Conservation Area (WCA) 3 Decomp (Phase 1) also provides a separate authority for modifications to TT. The primary purpose of this CERP project is to remove many of the barriers to natural overland flow in WCA-3A and WCA-3B, including L-67 A and C levee and Canal, L-29 levee and Canal as well as TT.

Through careful planning, the combined effect of the authority of the MWD Project and WRDA 2000 will allow for a unique opportunity to implement a level of restoration for the central and southern Everglades currently impacted by TT that would not be possible under separate authority when implemented independently.

At this time, no additional information is available that would lead the Service to assume anymore impacts to threatened and endangered species by the new alternatives other than that already covered in the Final FWCA Report (Service 2003) and the previous supplement (Service 2005) to the Final FWCA Report. All recommendations for implementation of the selected plan from the Final FWCA Report, as well as, either supplement to that report should still be considered still valid and adhered to whenever possible. In addition to the recommendations stated in previous reports, the Service would also like the Corps to consider the following:

1. Should the need arise to shorten any length of the two spans as currently designed (*e.g.*, budget shortfall) the eastern span (1-mile) should be shortened first up to 0.5 mile prior to any shortening of the western bridge (2-miles). The reason for this is that the previous two interagency workshops, as well as, the original GRR and Final FWCA Reports all conclude that a single-bridge span of the longest length possible located on the western portion of the project area will allow for the greatest environmental benefits gained.

2. In order to achieve the maximum amount of overland sheetflow from WCA-3B to North East Shark Slough (NESS), the weirs in L-29 should be placed in-line with the bridge segments. This is a project consideration that could provide a significant increase in ecological benefits.

Thank you for this opportunity to provide recommendations on this important restoration project which will result in the conservation and recovery of south Florida's threatened and endangered species. If you have any questions regarding this letter, please feel free to contact me or Kevin Palmer at 772-562-3909.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Dennis Duke, Jon Moulding, Tambour Eller)
DEP, Tallahassee, Florida (Greg Knecht, Inger Hansen)
District, West Palm Beach, Florida (Paul Linton)
DOI, Miami, Florida (Rock Salt)
DOI, Washington, DC (Don Jodrey)
ENP, Homestead, Florida (Dan Kimball, Bruce Boler)
EPA, Jacksonville, Florida (Eric Hughes)
FWC, Vero Beach, Florida (Joe Walsh, Tim Towles)
NOAA Fisheries, Miami, Florida (Audra Livergood)
Service, Jacksonville, Florida (Miles Meyer)
Miccosukee Tribe of Indians, Miami, Florida (Billy Cypress)

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U.S. Army Corps of Engineers. 2003. General Re-evaluation Report and Supplemental Environmental Impact Statement for the TT portion of the Modified Water Deliveries to Everglades National Park. U.S. Army Corps of Engineers; Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2003. Final Fish and Wildlife Coordination Act Report – Modified Water Deliveries to Everglades National Park: TT Project. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2005. Draft Supplemental Fish and Wildlife Coordination Act Report – Modified Water Deliveries to Everglades National Park: TT Project. Fish and Wildlife Service; Vero Beach, Florida.

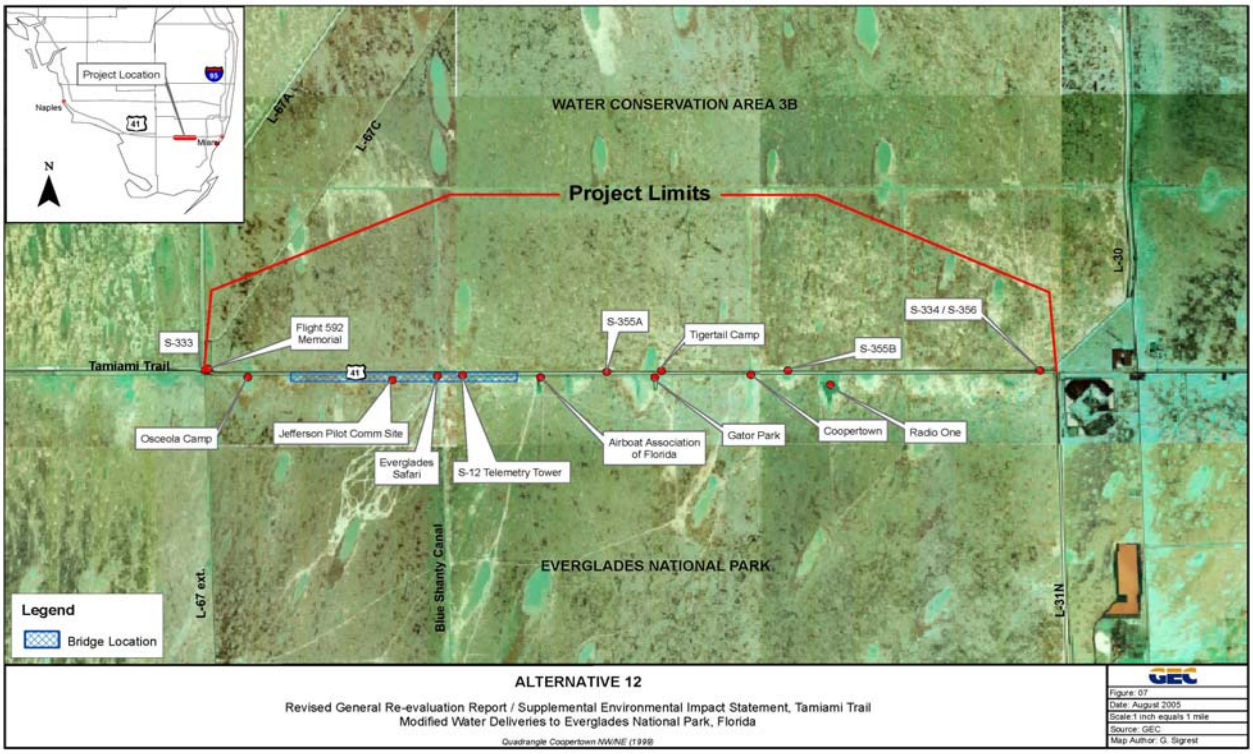

Figure 1. 3-Mile Bridge Alternative.

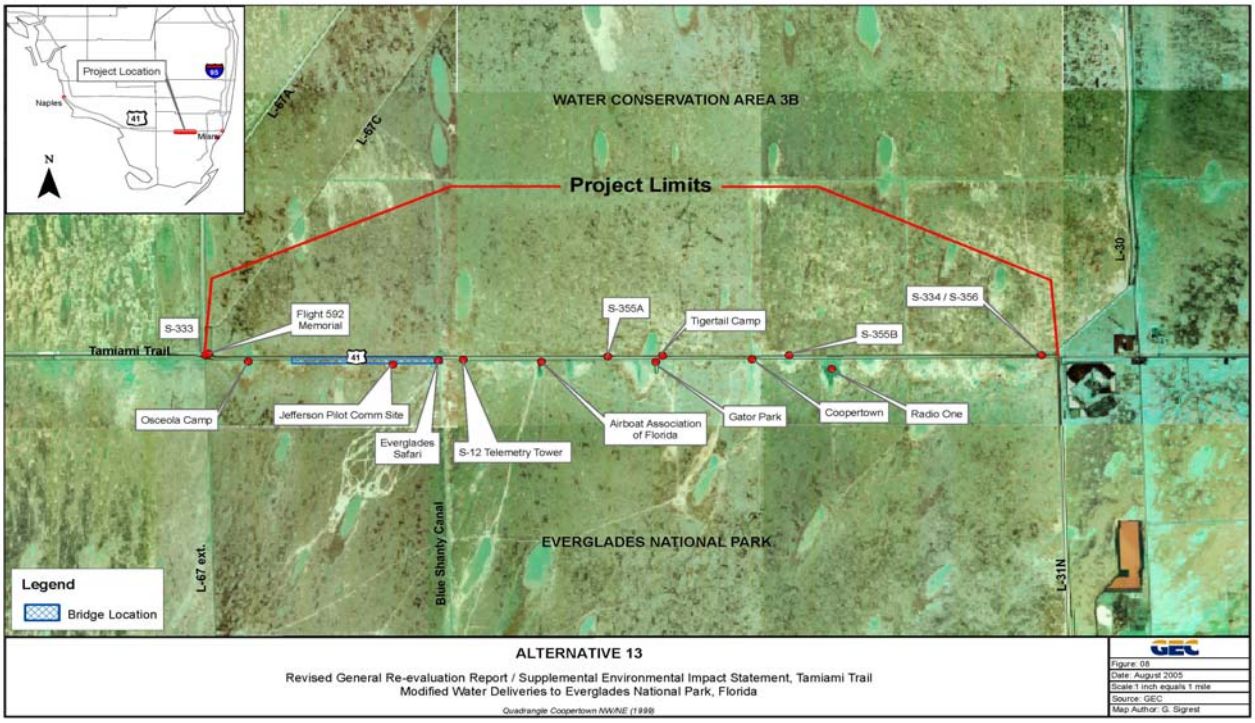

Figure 2. 2-Mile Bridge Alternative.

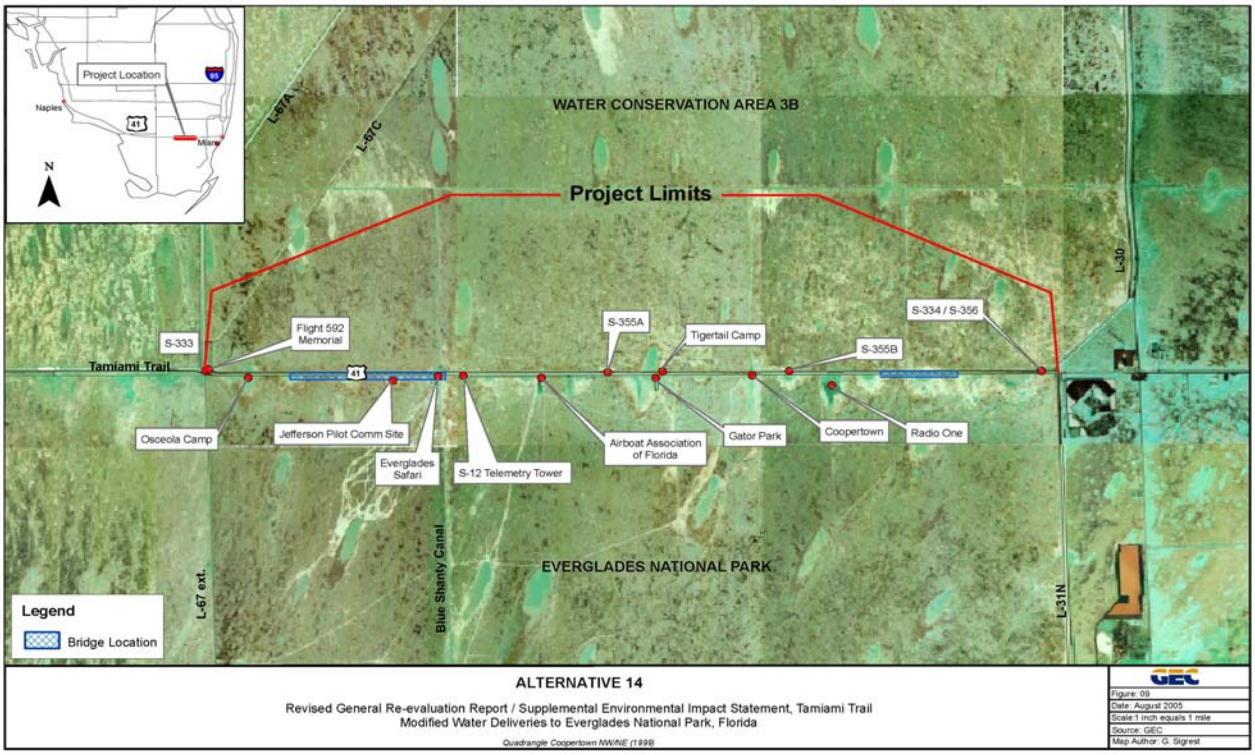

Figure 3. 2-Mile Bridge West and 1-Mile Bridge East Alternative.

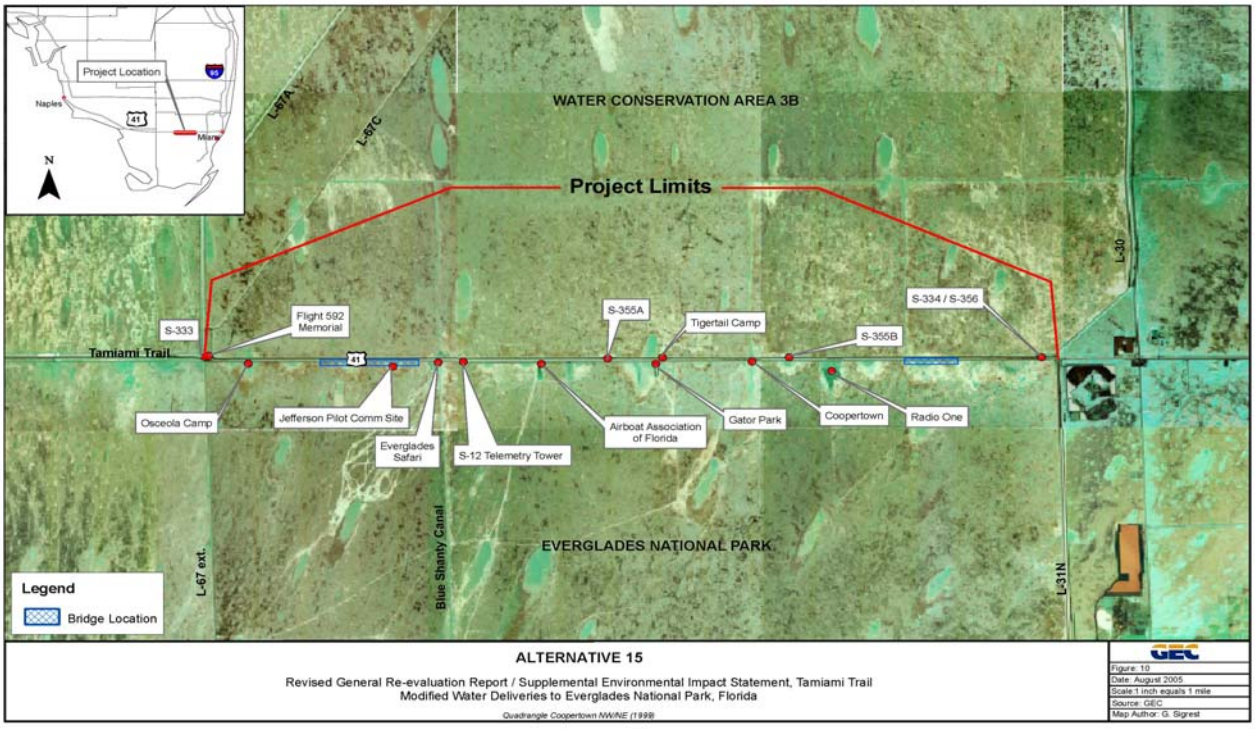

Figure 4. 1.3-Mile Bridge West and 0.7-Mile Bridge East Alternative.

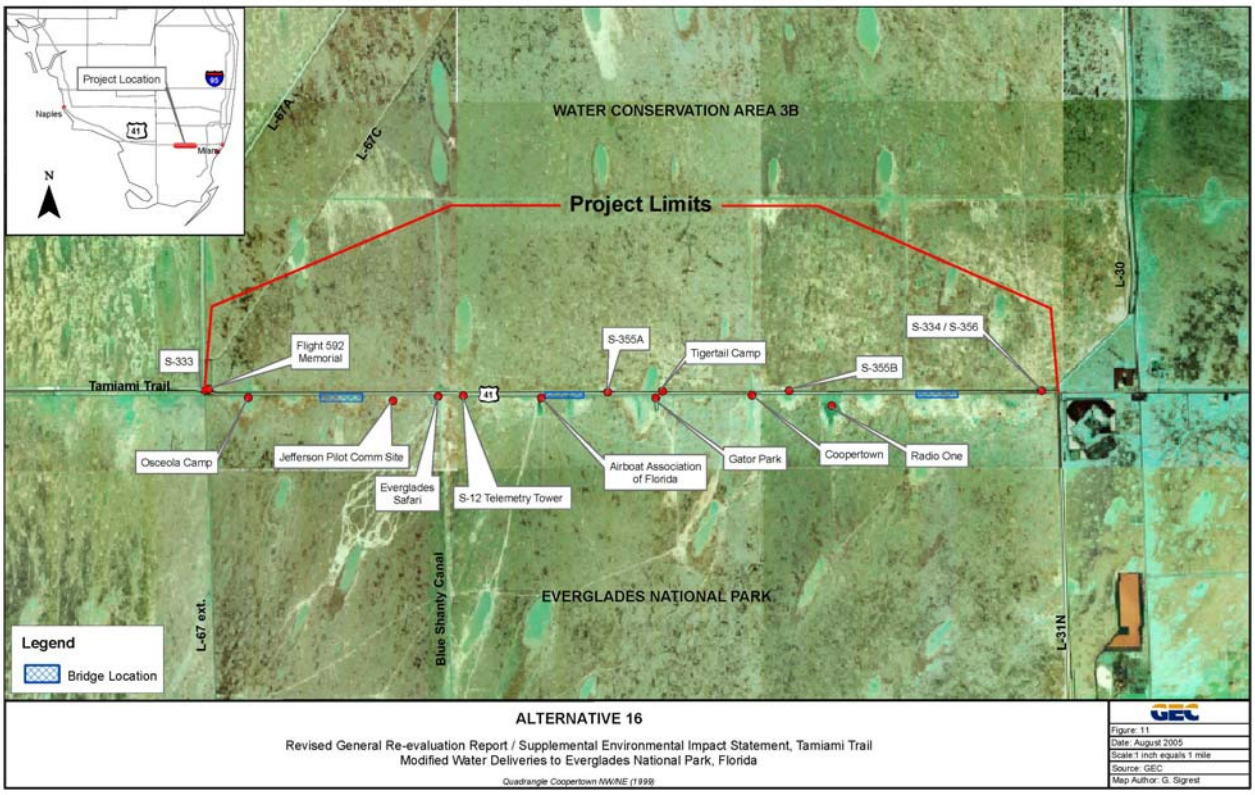

Figure 5. Three 3,000-foot Bridges Alternative.

Table 1. Alternatives considered for the Revised GRR/SEIS. Previous alternatives were evaluated in the Draft Supplemental FWCA Report (Service 2005). Additional alternatives are evaluated within this document.

Alternative number	Alternative Name	Total Length	Number of Bridges
Previous Alternatives			
n/a	No-Action (Future Without Project)	0	0
Alternative 9	3,000-foot Bridge	3,000 feet	1
Alternative 10	4-mile Bridge Central	4 miles	1
Alternative 11	4-mile Bridge East	4 miles	1
Alternative 17	10.7-Mile Bridge	10.7 miles	1
Additional Alternatives			
Alternative 12	3-Mile Bridge Central	3 miles	1
Alternative 13	2-Mile Bridge Central	2 miles	1
Alternative 14	2-Mile West and 1-Mile East Bridge	3 miles	2
Alternative 15	1.3-Mile West and 0.7-Mile East Bridge	2 miles	2
Alternative 16	Three 3,000-foot Bridges	1.7 miles	3

Table 2. Raw values for PMs.

Objectives and Performance Measures	Units	No Action	3,000-ft	2-mi W, 1-mi E	1.3-mi W, 0.7-mi E	Three-3,000-ft	2-mi	3-mi	4-mi Central	4-mi East	10.7-mi Causeway
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Restoration											
1. Restore water deliveries to ENP											
A. Flow Volumes, x 1000 acre ft	acre-ft	493	683	683	683	683	683	683	683	683	683
B. Proportion of area within 1 mile of Tamiami Trail with average velocity (<0.1 f/s)	%	97.3	94.0	95.7	95.6	95.6	95.2	96.8	98.6	98.5	99.9
C. Connectivity of L-29 Canal and NESS, percent of total length*	%	0	8	34	25	25	21	30	39	39	100
D. Distribution of flows, east to west*	%	0	57	59	61	70	51	57	46	23	100
2. Restore ridge and slough processes											
A. Reverse filling in of sloughs	0-7	0	1	4	3	2	3	4	5	5	7
B. Difference between average velocity in marsh and average velocity at road	ratio	0.014	0.137	0.455	0.345	0.238	0.455	0.500	0.556	0.556	1.00
C. Enhance flows form L-29 Canal into deep sloughs of NESS	%	0	11	39	27	23	30	37	45	34	91
3. Restore Vegetative Communities											
A. Shift to open water, spikerush marsh and slough communities in NESS	0-7	0	1	5	3	4	4	5	6	4	7
B. Risk of ridge and tree island peat burning in NESS	0-7	2	5	6	6	6	6	6	6	6	7
C. Invasion of exotic woody plant species	0-7	2	4	5	4	4	4	5	6	6	7
4. Restore Fish and Wildlife Resources											
A. Abundance of fishes in ENP marshes	0-7	0	1	4	3	3	3	4	5	5	7
B. Conditions for wading bird foraging and nesting	0-7	0	1	4	3	3	3	4	5	4	7
C. Reduction in wildlife mortality	#/yr	0	148	783	522	455	522	783	1044	1044	2737

* New or revised performance measures added since previous supplemental FWCA Report.

Table 3. Construction costs (Rough Order Magnitude), average annual HUs, and average annual costs per alternative.

	3,000-ft	2-mi W, 1-mi E	1.3-mi W, .7-mi E	Three-3,000-ft	2-mi	3-mi	4-mi Central	4-mi East	10.7-mi Causeway
Construction Costs (ROM)	68.3 M	127.9 M	104.1 M	101.8 M	99.3 M	119.5M	141.4 M	139.2 M	278.0 M
Average Annual HUs	12,453	28,371	22,185	22,246	22,422	27,973	32,674	28,549	51,763
Average Annual Costs	4.9 M	9.1 M	7.4 M	7.3 M	7.1 M	8.5 M	10.1 M	9.9 M	19.9 M

bcc:Reading
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 10, 2005

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

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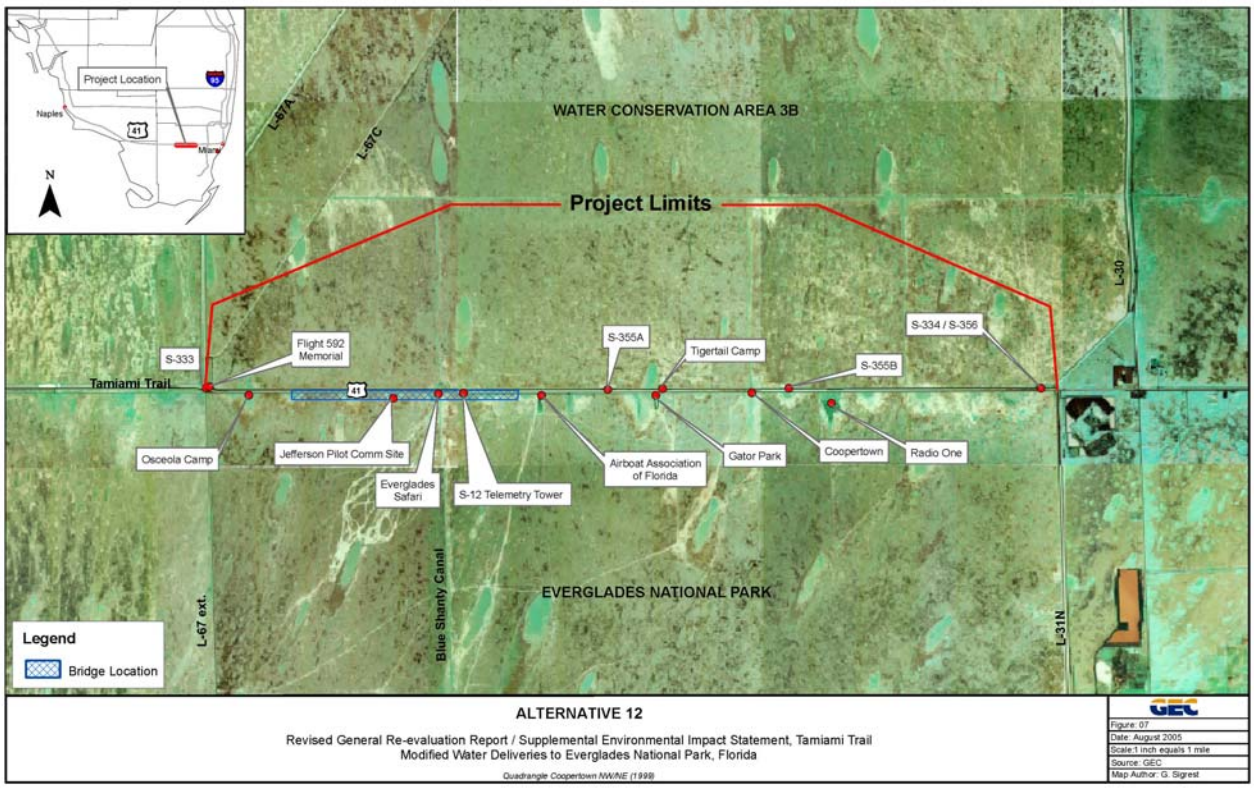

Figure 1. 3-mile Bridge Alternative.

2-Mile Bridge, Alternative 13

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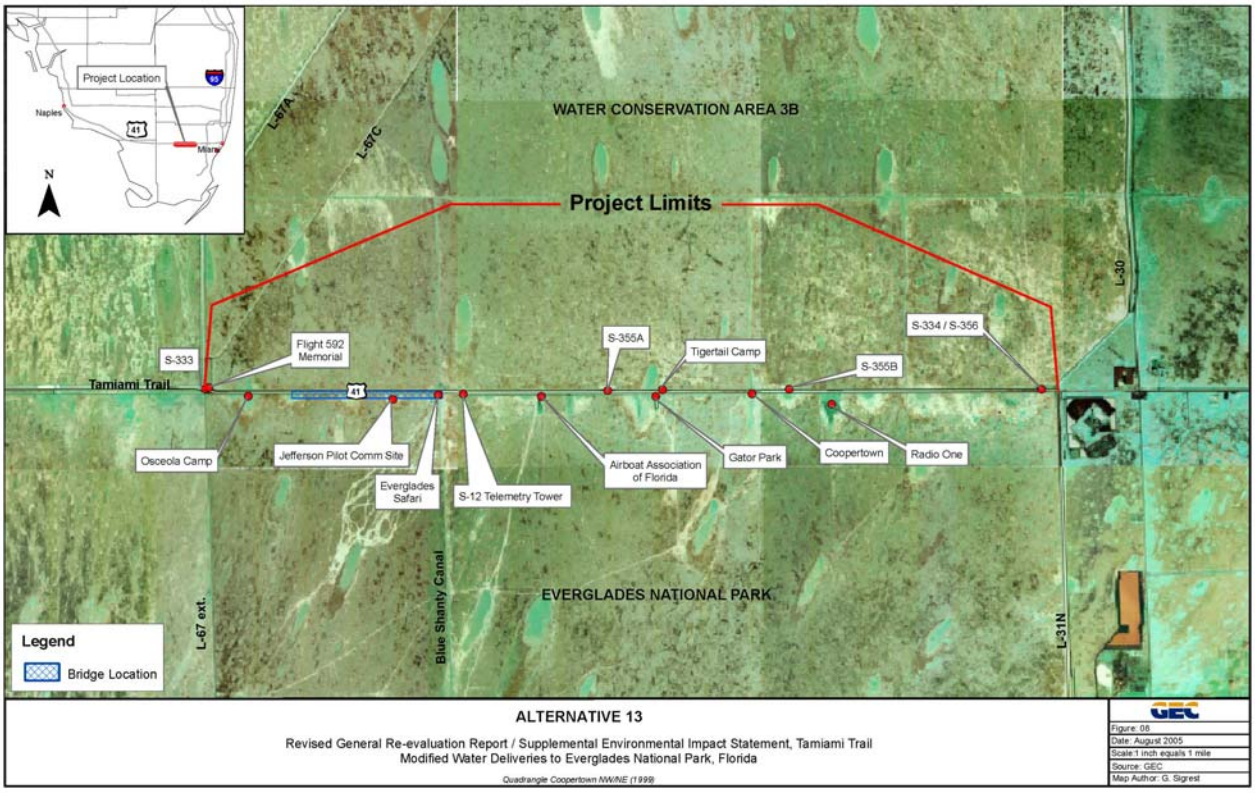


Figure 2. 2-mile Bridge Alternative.

2-Mile Bridge West and 1-Mile Bridge East, Alternative 14

As with Alternative 13, Alternative 14 (Figure 3) sites a bridge of up to two miles long in the western portion of the project area; however, Alternative 14 also sites a bridge of up to one mile long in the eastern portion of the project area.

Alternative 14 would create two conveyance openings through TT by removing up to three miles (cumulative) of the existing highway and embankment. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic. The opening and bridge for the eastern bridge would start approximately one mile west of S-334 and proceed west approximately one mile, ending approximately 3,000 feet east of (before) Radio One. As with Alternative 13, the bridge would start approximately 1,200 feet west of the S-12 Telemetry Tower and proceed west approximately two miles, ending approximately 2,640 feet east of (before) the Osceola Camp. Access roadways from the western bridge would be provided for Everglades Safari and the Jefferson Pilot site; no access roadways are necessary for the eastern bridge.

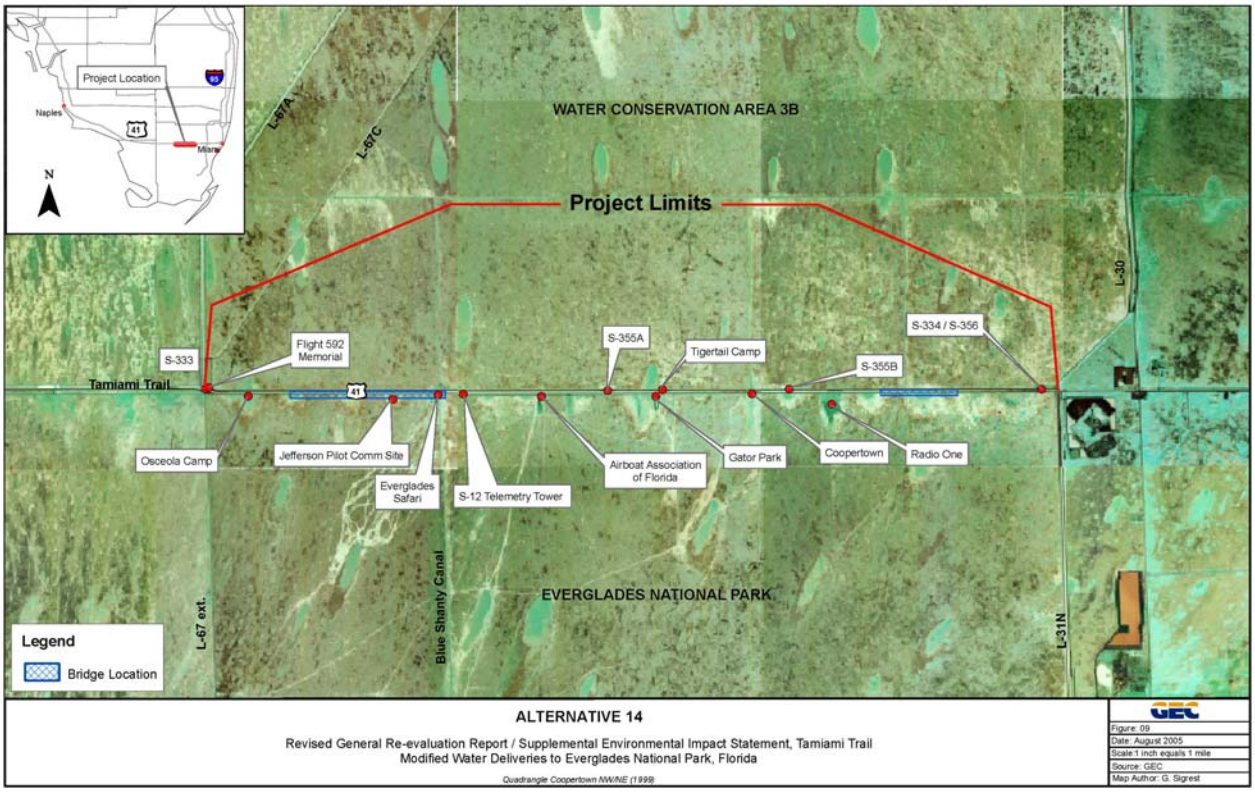


Figure 3. 2-mile Bridge West and 1-mile Bridge East Alternative.

1.3-Mile Bridge West and 0.7-Mile Bridge East, Alternative 15

Alternative 15 (Figure 4) sites a bridge with a length of up to 0.7 mile in the eastern portion of the project area and a bridge of up to 1.3 miles long in the western potion of the project area. The bridges are sited in similar locations to the bridges in Alternative 14.

Alternative 15 would create two conveyance openings through TT by removing up to two miles (cumulative) of the existing highway and embankment. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening for the eastern bridge would start approximately one mile west of S-334 and proceed west approximately 0.7 mile, ending approximately 4,500 feet east of (before) Radio One. The opening for the eastern bridge would begin approximately 1,300 feet west of Everglades Safari and proceed west approximately 1.3 miles, ending approximately 4,500 feet east of (before) the Osceola Camp. An access roadway from the western bridge would be provided for the Jefferson Pilot site.

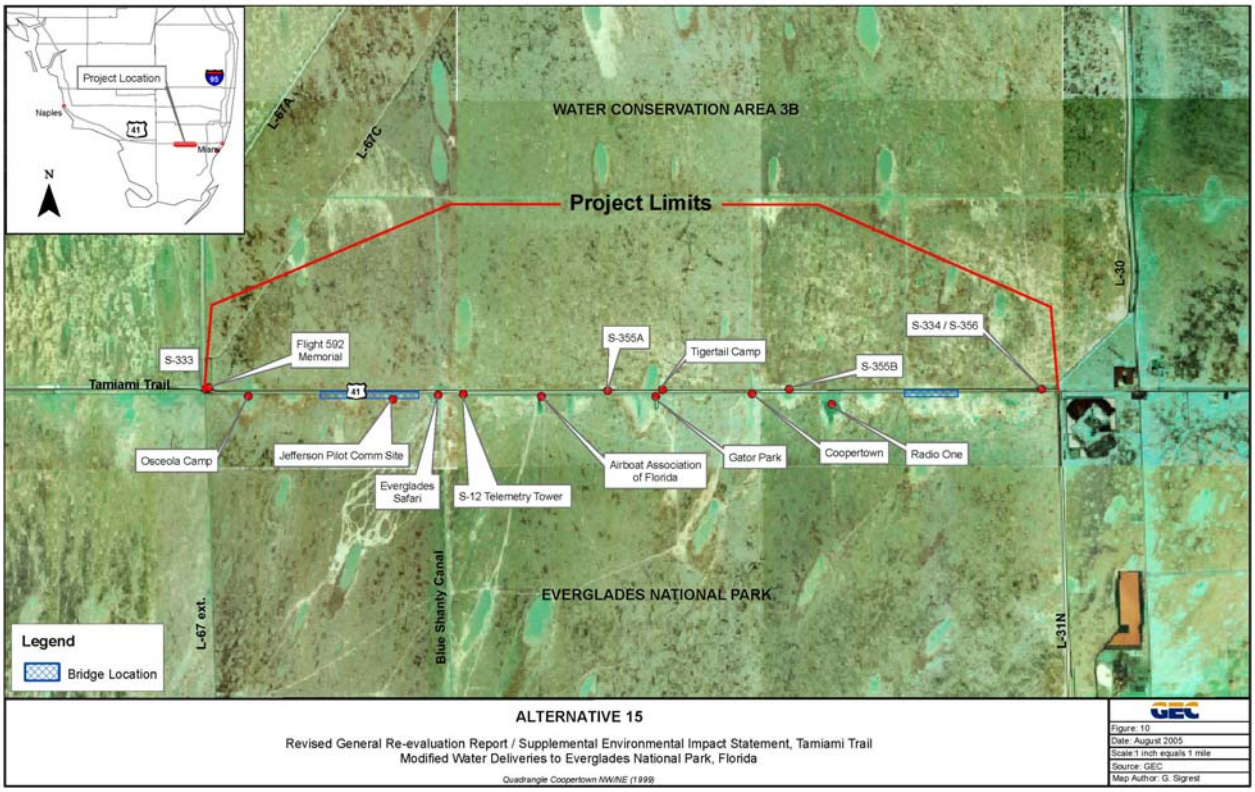


Figure 4. 1.3-Mile Bridge West and 0.7-Mile Bridge East Alternative.

Three 3,000-ft Bridges, Alternative 16

Alternative 16 (Figure 5) would create three conveyance openings, each with a length of up to 3,000 feet (total of 9,000 feet), through the TT in the eastern, central, and western portions of the project area. One bridge would be constructed over each opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening for the eastern bridge would start approximately one mile west of S-334 and proceed west approximately 3,000 feet, ending approximately 6,000 feet east of (before) Radio One. The opening for the central bridge would start approximately 1,300 feet west of S-335A and proceed west approximately 3,000 feet, ending immediately east of (before) the Airboat Association of Florida. The opening and bridge for the western bridge would start approximately 2,000 feet west of the Jefferson Pilot Communication Site and proceed west approximately 3,000 feet, ending approximately 4,500 feet east of (before) the Osceola Camp. No access roadways are necessary for any of the bridges.

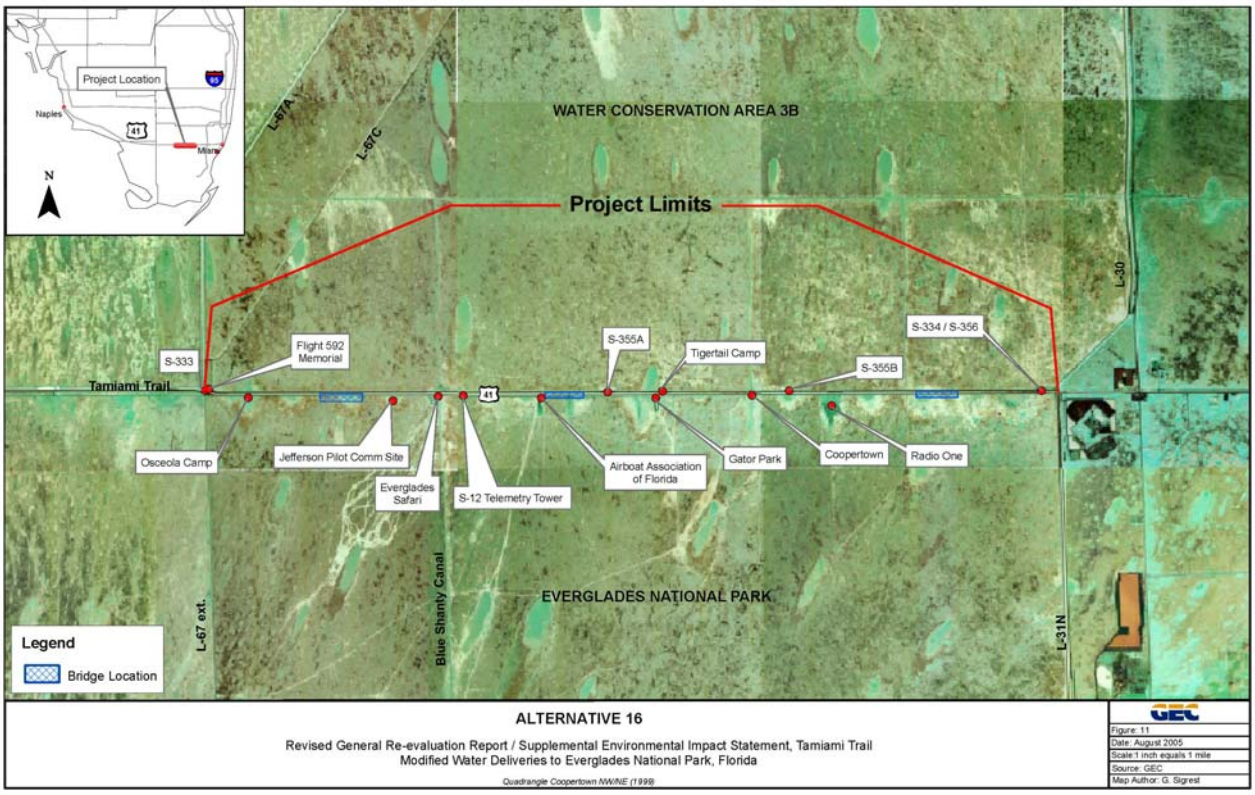


Figure 5. Three 3,000-ft Bridges Alternative.

FISH AND WILDLIFE RESOURCE CONCERNS AND EFFECTS

Ecological Benefits Analysis

Representatives from six agencies (SFWMD, ENP, Service, Corps, Florida Fish and Wildlife Conservation Commission, and Florida Department of Environmental Protection) participated in the TT Modification Benefits Workshop held on July 6-7, 2005, in Jacksonville, Florida. This team evaluated the new alternatives using the same method employed at the previous workshop held on May 23-26, 2005. The team used the same performance measures (PMs) except with the addition of two new hydrologic based PMs. A list of these PMs and associated scores for each alternative can be found in Table 2. For a more detailed description of the PMs please see the Benefits Analysis Procedures section of the Revised GRR/SEIS.

The different metrics made it necessary to normalize the different PM's into a 0-1 index. The normalization method used was "percent of maximum", in which the maximum output achieved in each category by any of the alternatives was assigned a "1", and the output values for other alternatives for that same resource category were scaled as a percentage of that maximum (between 0 and 1).

Table 2. Raw values for performance measures.

Objectives and Performance Measures	Units	No Action	3,000-ft	2-mi W, 1-mi E	1.3-mi W, .7-mi E	Three-3,000-ft	2-mi	3-mi	4-mi Central	4-mi East	10.7-mi Causeway
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Restoration											
1. Restore water deliveries to ENP											
A. Flow Volumes, x 1000 acre ft	acre-ft	493	683	683	683	683	683	683	683	683	683
B. Proportion of area within 1 mile of Tamiami Trail with average velocity (<0.1 f/s)	%	97.3	94.0	95.7	95.6	95.6	95.2	96.8	98.6	98.5	99.9
C. Connectivity of L-29 Canal and NESS, percent of total length*	%	0	8	34	25	25	21	30	39	39	100
D. Distribution of flows, east to west*	%	0	57	59	61	70	51	57	46	23	100
2. Restore ridge and slough processes											
A. Reverse filling in of sloughs	0-7	0	1	4	3	2	3	4	5	5	7
B. Difference between average velocity in marsh and average velocity at road	ratio	0.014	0.137	0.455	0.345	0.238	0.455	0.500	0.556	0.556	1.00
C. Enhance flows form L-29 Canal into deep sloughs of NESS	%	0	11	39	27	23	30	37	45	34	91
3. Restore Vegetative Communities											
A. Shift to open water, spikerush marsh and slough communities in NESS	0-7	0	1	5	3	4	4	5	6	4	7
B. Risk of ridge and tree island peat burning in NESS	0-7	2	5	6	6	6	6	6	6	6	7
C. Invasion of exotic woody plant species	0-7	2	4	5	4	4	4	5	6	6	7
4. Restore Fish and Wildlife Resources											
A. Abundance of fishes in ENP marshes	0-7	0	1	4	3	3	3	4	5	5	7
B. Conditions for wading bird foraging and nesting	0-7	0	1	4	3	3	3	4	5	4	7
C. Reduction in wildlife mortality	#/yr	0	148	783	522	455	522	783	1044	1044	2737

* New or revised performance measures added since previous supplemental FWCA Report.

An index value of 1 would thus be assigned to an alternative that provides the maximum output value for the habitat unit categories, while a value of 0.5 would equate to the output value for an alternative that only provides 50 percent of the maximum output provided by the "largest" alternative (a hypothetical "largest" alternative in terms of delivering the maximum output of every habitat type). While other normalization techniques exist (e.g., percent of range, percent of total, unit vector), the percent of maximum is the most widely used technique and is usually the default method. Thus, a combined, normalized metric was calculated to perform the Cost Effectiveness/Incremental Cost Analysis on all outputs provided by the TT alternatives.

As an example of normalization, consider Performance Measure 1.A, average annual flow volumes. The goal is the NSM flow volume of 895 (ac-ft x 1,000), the flow that was established for each alternative was 683 (ac-ft x 1,000). The goal represents the maximum desired condition regarding the metric the PM measured. The normalization score for these alternatives resulted from dividing the goal by the alternative score and coming up with an index score. For the PM, the index score was the same for all alternatives and was 0.763. The no-action condition for the PM was 493 (ac-ft x 1,000), and the index for the no-action condition was calculated as 0.551. The basic methodology behind these calculations were held constant for each PM, with minor revisions to PM 1.B in which the lower the score the better had to be inversed, and PM 2.B (Table 2) where the PM was already an index reflecting a ratio. Index scores were calculated for all alternatives and for the no action condition.

Habitat units were calculated by multiplying the indices by the acreages that were impacted by the PMs (PM 1.B and 2.B affected 6,848 acres, while the rest of the PMs affected the full 63,195 acres). Each of the PMs were determined to be of equal importance, and were therefore all given a weight of "1" to be used to combine the habitat units associated with each PM. Since all of the habitat units occupied the same geographic area, an average of all the PMs was warranted. The averaging of the habitat units was a two-part process. It was first necessary to find the total habitat units of the upper section of the study area (only two PMs affected this area, 6,848 acres), and then the total habitat units of the lower section of the study area (rest of PMs affected entire study area), and add these together to determine the total (HU) lift for the entire study area. Construction costs (Rough Order Magnitude), average annual HUs, and average annual costs per alternative are depicted in Table 3.

CONCLUSIONS AND RECOMMENDATIONS

Although the current tentatively selected plan (2-mi west and 1-mi east bridge) will result in a reduction of average annual benefits by 4,303 HUs from the previously selected plan (4-mi. Bridge Central) and by 23,392 HUs from the environmentally preferred plan (10.7-mi Causeway), the Service still believes it will provide a significant improvement for fish and wildlife resources and take a crucial first step towards restoration of the system. The Department understands that only limited improvements can be made to TT under the current funding levels of the MWD Project. The Department also understands that the Water Resources Development Act (WRDA) 2000 WCA-3 Decomp (Phase 1) also provides a separate authority for modifications to TT. The primary purpose of this CERP project is to remove many of the barriers to natural overland flow in WCA-3A and WCA-3B, including L-67 A and C levee and Canal, L-29 levee and Canal as well as TT. Through careful planning,

Table 3. Construction costs (Rough Order Magnitude), average annual He's, and average annual costs per alternative.

	3,000-ft	2-mi W, 1-mi E	1.3-mi W, .7-mi E	Three-3,000-ft	2-mi	3-mi	4-mi Central	4-mi East	10.7-mi Causeway
Construction Costs (ROM)	68.3 M	127.9 M	104.1 M	101.8 M	99.3 M	119.5M	141.4 M	139.2 M	278.0 M
Average Annual HUs	12,453	28,371	22,185	22,246	22,422	27,973	32,674	28,549	51,763
Average Annual Costs	4.9 M	9.1 M	7.4 M	7.3 M	7.1 M	8.5 M	10.1 M	9.9 M	19.9 M

the combined effect of the authority of the MWD Project and WRDA 2000 will allow for a unique opportunity to implement a level of restoration for the central and southern Everglades currently impacted by TT that would not be possible under separate authority when implemented independently.

At this time, no additional information is available that would lead the Service to assume anymore impacts to threatened and endangered species by the new alternatives other than that already covered in the Final FWCA Report (Service 2003) and the previous supplement (Service 2005) to the Final Report. All recommendations for implementation of the selected plan from the Final FWCA Report, as well as, either supplement to that report should be considered still valid and adhered to whenever possible. In addition to the recommendations stated in previous reports, the Service would also like the Corps to consider the following:

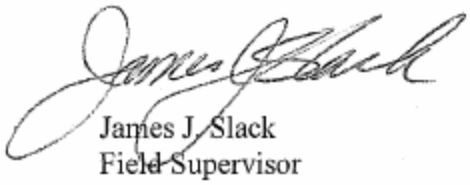
1. Should the need arise to shorten any length of the two spans as currently designed (e.g., budget shortfall) the eastern span (1-mi) should be shortened first up to 0.5 mile prior to any shortening of the western bridge (2-mi). The reason for this is that the previous two interagency workshops, as well as, the original GRR and Final FWCA Report all conclude that the longer a bridge span is the more ecological benefits will be achieved.

2. In order to achieve the maximum amount of overland sheetflow from WCA-3B to NESS, the weirs in L-29 should be placed in-line with the bridge segments. This is more of a future restoration project consideration but one that could provide a significant increase in ecological benefits.

Thank you for this opportunity to provide recommendations on this important restoration project which will result in the conservation and recovery of South Florida's threatened and endangered species.

Please feel free to contact me or Fish and Wildlife Biologist Kevin Palmer at (772) 562-3909 if you have any questions regarding this letter.

Sincerely yours,



James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
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DOI, Miami, Florida (Rock Salt)
DOI, Washington, DC (Don Jodrey)
ENP, Homestead, Florida (Dan Kimball, Bruce Boler)
EPA, Jacksonville, Florida (Eric Hughes)
FWC, Vero Beach, Florida (Joe Walsh, Tim Towles)
NOAA Fisheries, Miami, Florida (Audra Livergood)
Service, Jacksonville, Florida (Miles Meyer)
Miccosukee Tribe of Indians, Miami, Florida (Billy Cypress)

LITERATURE CITED

U.S. Army Corps of Engineers. 2003. General Re-evaluation Report and Supplemental Environmental Impact Statement for the TT portion of the Modified Water Deliveries to Everglades National Park. U.S. Army Corps of Engineers; Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2003. Final Fish and Wildlife Coordination Act Report – Modified Water Deliveries to Everglades National Park: TT Project. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2005. Draft Supplemental Fish and Wildlife Coordination Act Report – Modified Water Deliveries to Everglades National Park: TT Project. Fish and Wildlife Service; Vero Beach, Florida.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

June 21, 2005

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Carpenter:

The enclosed document is a Draft Supplemental Fish and Wildlife Coordination Act (FWCA) Report on the Tamiami Trail portion of the Modified Water Deliveries to the Everglades National Park Project for your review. This report is provided in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The Fish and Wildlife Service (Service) and the U.S. Army Corps of Engineers (Corps) have enjoyed extensive cooperation over several years to plan this project. In the spirit of that cooperation, the Service is supporting the Corps' selected plan as the preferred alternative.

This letter does not constitute a biological opinion as described under section 7 of the ESA. The Corps has not yet submitted a biological assessment or effect determination for this project as required by the ESA. Additionally, after consultation is concluded, if modifications are made to the selected plan or if additional information involving potential impacts to listed species becomes available, reinitiation of consultation may be necessary.

By copy of this letter, the Service is soliciting comments within 45 days from the Florida Fish and Wildlife Conservation Commission and the National Marine Fisheries Service. Comments by those two agencies will be included as an appendix to our final report, which will then constitute the Secretary of the Interior's recommendations for the Tamiami Trail portion of the Modified Water Deliveries to the Everglades National Park Project in accordance with section 2(b) of the FWCA. The Final FWCA Report will be incorporated in the Corps' final Project Implementation Report/Environmental Assessment for public review and comment in accordance with the provisions of the National Environmental Policy Act.

If you or your staff has any questions regarding the findings and recommendations contained in this draft report, please contact me or Kevin Palmer at 772-562-3909, extension 280. The cooperation of your staff is greatly appreciated.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure
Corps, Jacksonville, Florida (Dennis Duke, Jon Moulding, Tambour Eller)
DEP, Tallahassee, Florida (Greg Knecht, Inger Hansen)
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NOAA Fisheries, Miami, Florida (Audra Livergood)
Service, Jacksonville, Florida (Miles Meyer)
Miccosukee Tribe of Indians, Miami, Florida (Billy Cypress)

DRAFT SUPPLEMENTAL

FISH AND WILDLIFE COORDINATION ACT REPORT

MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK: TAMIAMI TRAIL PROJECT

MIAMI-DADE COUNTY, FLORIDA

Prepared for:
U.S. Army Corps of Engineers
Planning Division
Environmental Branch
Jacksonville District
Post Office Box 4970
Jacksonville, Florida 32232-0019

By:
Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

June 21, 2005

EXECUTIVE SUMMARY

This Draft Supplemental Fish and Wildlife Coordination Act (FWCA) Report was prepared by the Fish and Wildlife Service (Service) to further analyze and evaluate the suite of alternatives considered for the Modified Water Deliveries (MWD) to Everglades National Park (ENP): Tamiami Trail (TT) Project. The overall goal for the TT portion of the MWD Project is to maximize hydrologic and ecologic restoration through modifications to the existing U.S. Highway 41 roadway. This goal will allow for more natural flow conditions in a manner that is compatible with the restoration requirements of the 1989 ENP Protection and Expansion Act. It is also desirable to ensure compatibility with ongoing restoration projects, such as the C–111 Project and future components of the Comprehensive Everglades Restoration Plan (CERP).

The Service issued a Final FWCA Report on the TT portion of the MWD Project on August 27, 2003, (Service 2003). The U.S. Army Corps of Engineers (Corps) subsequently issued a Final General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS) in December 2003 (Corps 2003). The Corps' (2003) report recommended Alternative 7a, which included a 3,000-foot conveyance opening and bridge, no additional water quality features, and would establish an escrow fund to assist with maintenance of the remainder of the 10.7-mile length section of TT until future CERP projects determine whether additional changes would be made to TT. The Service similarly concluded (Service 2003) that Alternative 7a (3,000-foot Bridge without water quality treatment) was an environmentally acceptable plan, however, Alternative 5a (10.7-mile Causeway) was identified as the environmentally preferred plan.

Since the submittal of the Final GRR/SEIS and as a result of public and agency review of the report, the Corps determined that the Recommended Plan did not contain all features necessary for implementation and thus retracted the report for further review and modification. The following items needed to be reconsidered: (1) concerns for public safety on TT, due to high water impacts to the roadbed; (2) the escalating worldwide and regional cost of construction materials; and (3) because of higher construction costs and shifting fiscal constraints it became evident that a new cost/benefit analysis would be necessary. Since the Final GRR/SEIS will be amended to reflect consideration of the above mentioned items, we are issuing this supplement to the Final FWCA Report.

The purpose of this Draft Supplemental FWCA Report is to provide the Corps with the recommendations of the Department of the Interior (Department) and supporting documentation leading to the selection of a federally Recommended Plan and Record of Decision for the TT Project to be released as a revised GRR/SEIS for public review and comment in October 2005. The method used for the selection of the Department's Recommended Plan included an extension of the evaluation of environmental and other project objectives which was part of the Final FWCA Report. This evaluation was made in the context of constraints imposed by highway safety, wetland losses, and funding limitations.

Based on an evaluation of the stated environmental objectives (see Table 1) of the project, inclusive of several new as well as previously analyzed hydrological and ecological performance measures, the Department concludes that Alternative 12 (10.7-mile Causeway), with full removal of the existing TT, is the Environmentally Preferred Alternative. It is the position of the Department that this plan is the most consistent of all alternatives with the intent and stated goals of the 1989 ENP Expansion and Protection Act [Public Law 101-229].

Evaluations of Alternative 12 (Environmentally Preferred Alternative) in the context of the fiscal constraints placed on the project reveals that construction costs for Alternative 12 exceed the currently available funding. Therefore, the Department removed Alternative 12 from further consideration due to fiscal constraints. Should additional funding be made available, the Department would amend the decision on the current Department's Recommended Plan to reconsider plans that clearly exhibit superior performance for the environmental objectives.

Based on evaluations included in this report, the Final FWCA Report (Service 2003), and in consideration of the relative costs for construction, Alternative 10 (4-mile Bridge Central) was selected as the Department's Recommended Plan. This decision was also made in recognition of future modifications to TT, anticipated as a result of the implementation of projects associated with the CERP.

The Service strongly supports the TT portion of the MWD Project and commends the Corps for selecting a plan that will facilitate the restoration of ecologic function and hydrologic conditions in ENP. The Service concurs with the Corps' preferred alternative (Alternative 10) which in addition to mitigating concerns for road safety also accomplishes the goals and objectives set forth by the Department for the project.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

LIST OF ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

CERP	Comprehensive Everglades Restoration Plan
Corps	U.S. Army Corps of Engineers
CSSS	Cape Sable Seaside Sparrow
Decomp	Decompartmentalization and Sheetflow Enhancement Project (CERP project)
Department	Department of the Interior
District	South Florida Water Management District
ENP	Everglades National Park
FDOT	Florida Department of Transportation
FWC	Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
GRR	General Reevaluation Report
IOP	Interim Operational Plan
MWD	Modified Water Deliveries
NEPA	National Environmental Policy Act
NESS	North East Shark River Slough
NGVD	National Geodetic Vertical Datum
NPS	National Park Service
PGL	Profile Grade Line
PL	Public Law
PM	Performance Measure
RPA	Reasonable and Prudent Alternative
SEIS	Supplemental Environmental Impact Statement
Service	Fish and Wildlife Service
TT	Tamiami Trail
US 41	U.S. Highway 41
WCA	Water Conservation Area
WRDA	Water Resources Development Act

I. INTRODUCTION

The overall goal for the Tamiami Trail (TT) portion of the Modified Water Deliveries (MWD) Project is to maximize hydrologic and ecologic restoration through modifications to the existing U.S. Highway 41 (US 41) roadway to allow for more natural flow conditions in a manner that is compatible with the restoration requirements of the 1989 Everglades National Park (ENP) Protection and Expansion Act. It is also desirable to ensure compatibility with ongoing restoration projects, such as the C–111 Project and future components of the Comprehensive Everglades Restoration Plan (CERP). To facilitate the development of the Environmental Impact Statement for this project, alternative plans were evaluated based on the environmental objectives listed below. These project objectives are those in which the Department of the Interior (Department) believes will potentially provide significant environmental enhancement consistent with the project authorizing legislation or other statutory requirements.

1. Minimize adverse effects to federally listed species.
2. Meet the Reasonable and Prudent Alternatives (RPA) for the Cape Sable seaside sparrow (CSSS) (*Ammodramus maritimus mirabilis*) as specified in the Fish and Wildlife Service's (Service) 1999 Biological Opinion and the 2002 Amended Biological Opinion.
3. Minimize adverse effects to State-listed endangered or threatened species of special concern consistent with State statutes.
4. Allow for restoration consistent with the 1989 ENP Protection and Expansion Act (Public Law [PL] 101-229).
5. Enhance and restore ecological function.
6. Minimize permanent loss of wetlands in ENP and Water Conservation Area (WCA) 3B.

Additionally, several other project objectives were identified that the Department considers to have the potential to maximize the overall benefits of the project but do not contribute significantly or in some cases immediately (*i.e.*, maximizing compatibility with future restoration actions) to environmental enhancement or restoration. These include:

1. Ensure no reduction in authorized flood control benefits.
2. Maximize compatibility with future restoration actions.
3. Minimize impacts associated with construction.
4. Minimize adverse socio-economic effects.
5. Minimize recreational effects.

The Service issued the Final FWCA Report (Service 2003) on August 27, 2003. The Corps subsequently issued a Final General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS) in December 2003 (Corps 2003). The Corps' (2003) report recommended Alternative 7a, which included a 3,000-foot conveyance opening and bridge, no

additional water quality features, and would establish an escrow fund to assist with maintenance of the remaining 10.7-mile section of TT until future CERP projects determine whether additional changes would be made to TT. The Service similarly concluded (Service 2003) that Alternative 7a (3,000-foot bridge without water quality treatment) was an environmentally acceptable plan, however, Alternative 5a (10.7-mile Causeway) was identified as the environmentally preferred plan.

Since the submittal of the Final GRR/SEIS and as a result of public and agency review of the report, the Corps has determined that the Recommended Plan did not contain all features necessary for implementation and thus retracted the report for further review and modification. The following items needed to be reconsidered: (1) concerns for public safety on TT, due to high water impacts to the roadbed; (2) the escalating worldwide and regional cost of construction materials; and (3) because of higher construction costs and shifting fiscal constraints it became evident that a new cost/benefit analysis would be necessary. Since the GRR/SEIS will be amended to reflect consideration of the above mentioned items, the Service is issuing this supplemental to the Final FWCA Report.

This supplemental to the Final FWCA Report provides additional information to the report for the Secretary of Interior as required by section 2(b) of the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*), which establishes fish and wildlife conservation as a co-equal purpose or objective of federally funded or permitted water resource development projects. The FWCA allows for reports and recommendations from the Service and the State agency exercising administration over wildlife resources, the Florida Fish and Wildlife Conservation Commission (FWC), to be integrated into Corps reports seeking congressional authorization for a Federal action. The FWCA also grants authority to the Corps to include fish and wildlife conservation measures within these projects.

II. MODIFICATIONS AND ADDITIONS TO THE ORIGINAL GRR/SEIS

A. Alternatives considered

Four of the nine original project alternatives and one additional project alternative were evaluated as part of the revised GRR/SEIS. The original alternatives include the No-Action Plan, the 3,000-foot Bridge (originally Alternative 7), the 10.7-mile Causeway (Alternative 5), and the 4-mile Bridge structure (Alternative 6). An additional alternative was included which would utilize the same 4-mile structure as above but place it in the eastern portion of TT project area. Some minor differences exist between the original alternatives and those reevaluated (*i.e.*, name changes) so a written description and figure are included for each.

Unless otherwise noted, for all action alternatives the bridge typical section would satisfy current Florida Department of Transportation (FDOT) standards and be uniform throughout its entire length. The section is expected to include two 12-foot wide travel lanes, two eight-foot wide shoulders, and safety barriers. The lower limit of the bridge superstructure would be based on vertical clearance requirements for exposure and maintenance considerations. This elevation is expected to be 13.5-feet National Geodetic Vertical Datum (NGVD) 1929, based on a 7.5-foot water control elevation plus 6 feet. Additionally, the maintenance of traffic and construction

sequence for the bridge and roadway would be based on the best balance of traffic safety, environmental impacts, and construction cost and duration. Access facilities, such as ramps to the bridge or elevated road, would be provided for existing business and residential communities.

Future Without Project Condition (No-Action Plan Alternative)

The construction of bridges or other appurtenances to facilitate the passage of water from the L-29 Canal under the TT to North East Shark River Slough (NESS) would not take place (Figure 1). The road would remain in its existing configuration. The MWD flows would be conveyed from the L-29 Canal to ENP through the existing series of culverts under the TT. Although this alternative fails to meet the planning goals, objectives, and requirements, its evaluation is required by Section 1502.14 of the Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) of 1970.

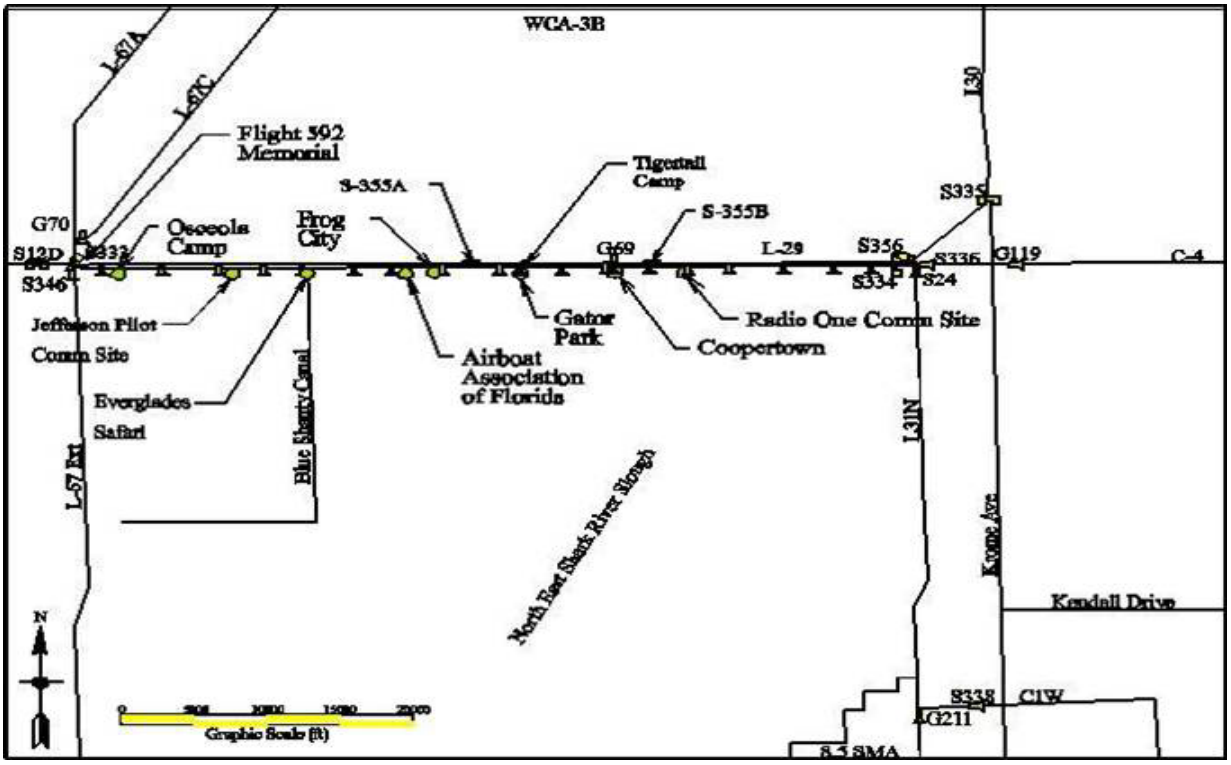

Figure 1. No-Action Plan Alternative.

3,000-foot Bridge Alternative

Alternative 9 (Figure 2) is similar to Alternative 7 from the GRR (Corps 2003), but with a higher roadway centerline elevation and a roadway cross section that meets current FDOT standards. This alternative would involve creating an approximately 3,000-foot wide conveyance channel through TT by removing a 3,000-foot length of the highway and embankment. A bridge would be constructed over the opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening and bridge would be located between the Blue Shanty Canal and the Airboat Association of Florida site.

Approximately 10 miles of remaining highway embankment would be reconstructed to raise the Profile Grade Line (PGL) (crown elevation) to the minimum required based on the Design High Water and the roadway cross section geometry. The PGL elevation is expected to be 12.7 feet. The existing roadway, both asphalt and base material, would be reused to the extent practical in accordance with roadway construction practice. In order to meet FDOT criteria, the roadway width would increase, and additional highway right-of-way would be required. This would necessitate an encroachment, south into ENP. The width of the encroachment would vary from 3 to 22 feet.

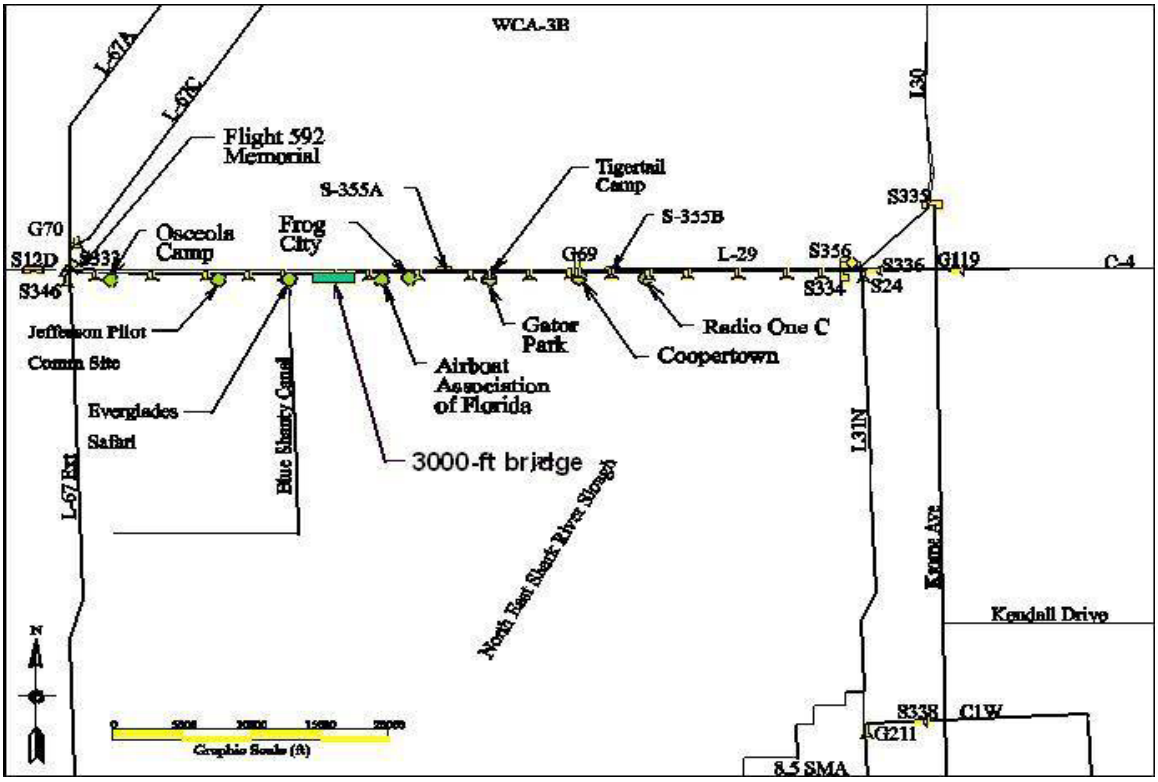

Figure 2. 3,000-foot Bridge Alternative.

4-mile Bridge Alternative (Central Location)

Alternative 10 (Figure 3) is a variation of Alternative 6 that was previously analyzed in the GRR (Corps 2003). It contains the same bridge, but with a higher roadway centerline evaluation and a roadway cross section that meets current FDOT standards.

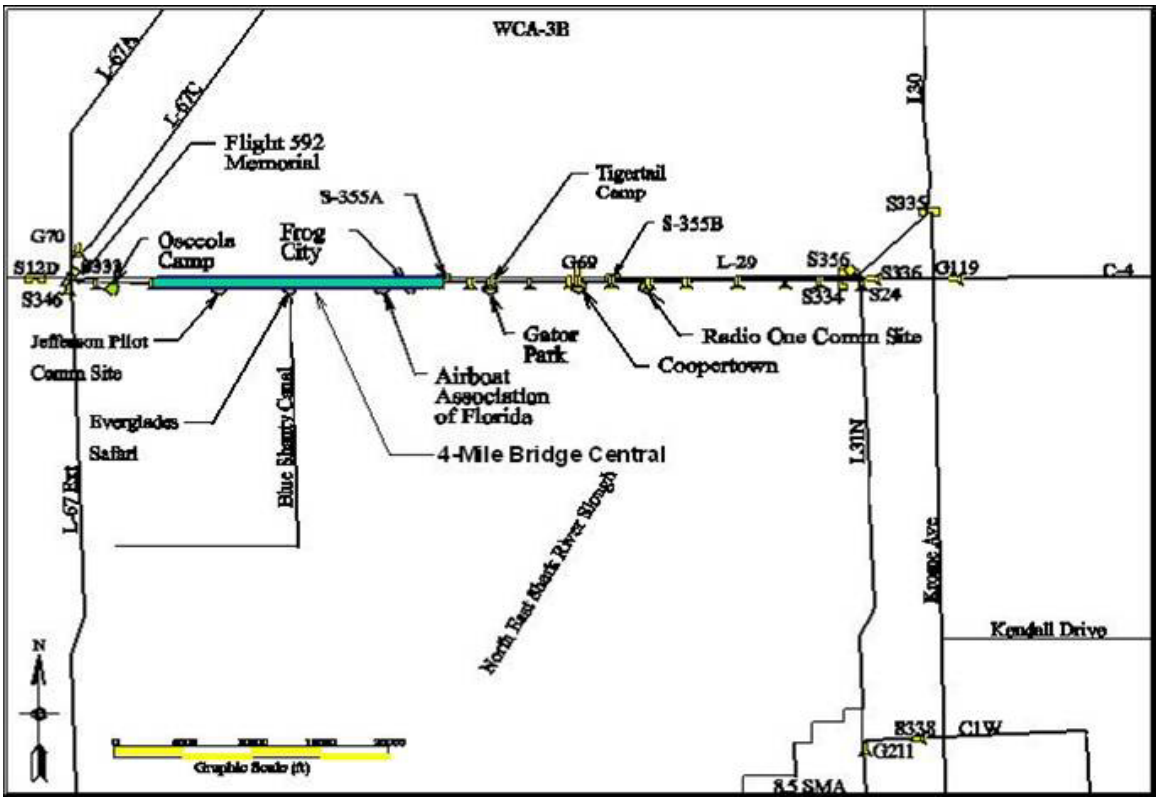

Figure 3. 4-mile Bridge Central Alternative.

Alternative 10 would involve creating an approximately 4-mile wide conveyance channel through TT by removing a 4-mile length of the highway and embankment. A bridge would be constructed over the opening to replace the removed section of road and maintain motor vehicle traffic across the opening. The opening and bridge would start approximately 0.5 mile east of Osceola Camp and proceed east approximately 4 miles, ending west of (before) Tigertail Camp.

Approximately 7 miles of remaining highway embankment would be reconstructed to raise the PGL (crown elevation) to the minimum required based on the Design High Water and the roadway cross section geometry. The PGL elevation is expected to be 12.7 feet. The existing roadway, both asphalt and base material, would be reused to the extent practical in accordance with roadway construction practice. In order to meet FDOT criteria, the roadway width would increase, and additional highway right-of-way would be required. This would necessitate an encroachment, south into ENP. The width of the encroachment would vary from 3 to 22 feet.

4-mile Bridge Alternative (East Location)

Alternative 11 (Figure 4) is a new alternative that was not previously analyzed in the GRR (Corps 2003). This alternative would involve creating an approximately 4-mile wide conveyance channel through TT by removing a 4-mile length of the highway and embankment.

A bridge would be constructed over the opening to replace the removed section of road and

maintain motor vehicle traffic across the opening. The opening and bridge would start approximately 200 to 300-feet west of S-334 and proceed west approximately 4 miles, ending east of (before) Coopertown.

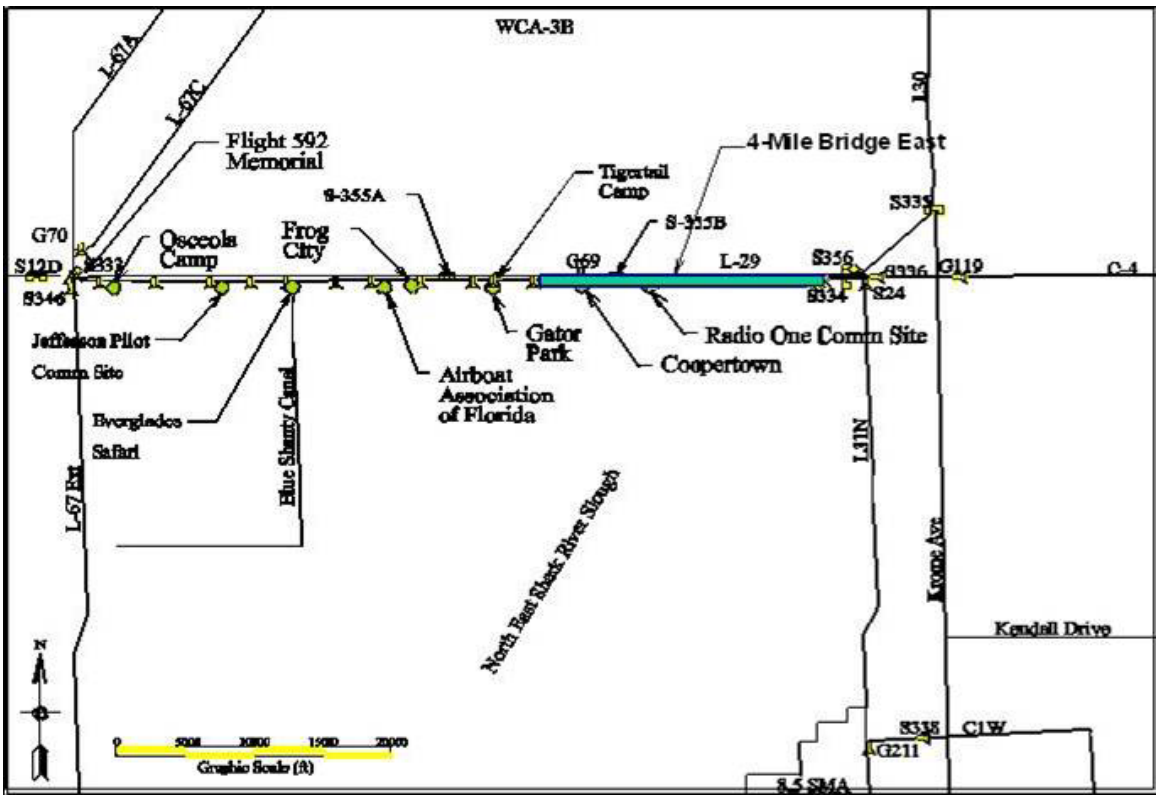

Figure 4. 4-mile Bridge East Alternative.

Approximately 7 miles of remaining highway embankment would be reconstructed to raise the PGL (crown elevation) to the minimum required based on the Design High Water and the roadway cross section geometry. The PGL elevation is expected to be 12.7 feet. The existing roadway, both asphalt and base material, would be reused to the extent practical in accordance with roadway construction practice. In order to meet FDOT criteria, the roadway width would increase, and additional highway right-of-way would be required. This would necessitate an encroachment, south into ENP. The width of the encroachment would vary from 3 to 22 feet.

10.7-mile Bridge Alternative

Alternative 12 (Figure 5) is similar to Alternative 5 that was analyzed in the GRR (Corps 2003). This plan would involve creating an approximately 10-mile wide conveyance channel through TT by removing a 10-mile length of the highway and embankment. A bridge would be constructed over the opening to replace the removed section of road and maintain motor vehicle

traffic across the opening. The opening and bridge would start approximately 200 to 300 feet east of S-333 and proceed east approximately 10 miles, ending approximately 200 to 300 feet

west of S-334.

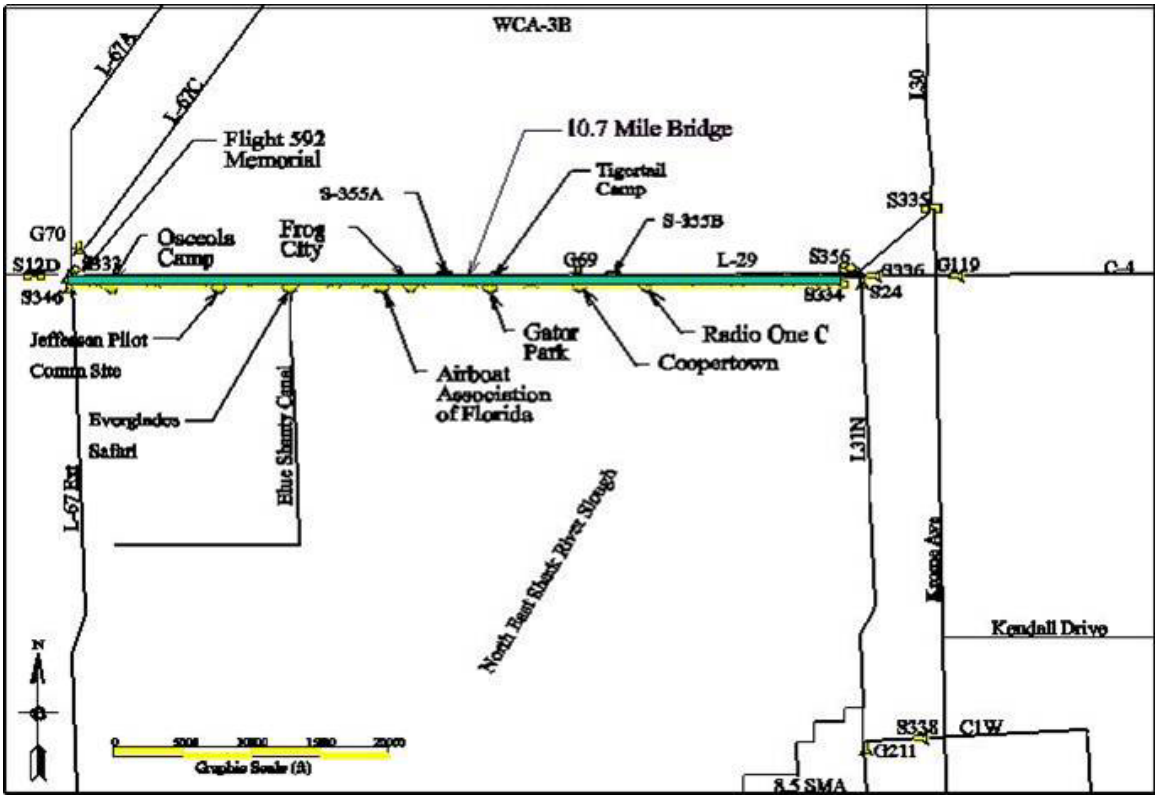

Figure 5. 10.7-mile Bridge Alternative.

The maintenance of traffic and construction sequence for the bridge and roadway would be based on the best balance of traffic safety, environmental impacts, and construction cost and duration. Staging areas for construction equipment and materials may be located at business sites along the corridor. Staging and other functions may also require use of the existing shoulder for temporary periods. Additional staging areas may be necessary near the eastern end of the corridor.

A connecting road would provide temporary access to the Airboat Association of Florida site. A connecting road from the west would provide temporary access to the Osceola Camp. In addition, turning lanes may be needed at these locations. Access facilities, such as ramps to the bridge, would be provided for existing business and residential communities.

B. Design High Water Stage in L-29 Canal

Recent modeling done as part of the Conveyance and Seepage portion of MWD has shown that high water stages in the L-29 Canal could reach higher levels than originally predicted. The Corps (2003) report used a design high water constraint of 9.3 feet, whereas recent modeling has predicted stages as high as 9.7 feet and possibly higher during extreme events. This increase has raised concerns over public safety on TT and the possible detrimental effects the higher water levels could have on the roadbed. In order to mitigate the effects of increased stages and maintain FDOT standards it was determined that the road must be raised and the shoulders

widened. As a result of these adjustments, construction costs and additional project footprint impacts needed to be reassessed.

C. Supplemental Ecological Benefits Analysis

In addition to the previous environmental benefits analysis conducted by the Department in the Final FWCA Report (Service 2003), ENP completed a Draft TT Alternative Optimization Report (National Park Service [NPS] 2005, see the Appendix), at the request of the Corps. This report incorporates expansive and in-depth scientific analyses of 4 of the 5 Alternatives currently being considered (10.7-mile Bridge, 4-mile Bridge [central], 3,000-foot Bridge, and No-Action Plan) to determine the comparative benefits of each in meeting the hydrologic and ecological restoration objectives of the TT component of the MWD Project. Although the 4-mile Bridge East, (Alternative 11), was not specifically addressed in the report, ENP did provide some historical data that supports a western bridge placement in the TT.

Some concern was raised by the interagency team (Corps, South Florida Water Management District [District], Florida Department of Environmental Protection, Service, FWC, and ENP) assigned to review the ENP report (NPS 2005) regarding the validity of the comparisons and assumptions expressed in the report. For the alternative comparisons using model SFWMM output, the 10.7-mile and 4-mile Bridge alternatives were assumed to have similar flow characteristics, as unconstrained L-29 Canal stages are assumed in both alternatives. Conversely, the only model run for the 3,000-foot Bridge alternative available at the time the report was compiled assumed an L-29 Canal stage constraint of 9.3 feet. More recent modeling of the 3,000-foot Bridge alternative with an unconstrained L-29 Canal stage predicted similar flow characteristics as the 3,000-foot Bridge alternative modeled for the report; therefore, ENP believes comparisons between the 4-mile and 10.7-mile Bridges and the 3,000-foot Bridge alternative in the report are valid. Regardless of the perceived discrepancies in the comparisons made between the alternatives in the report, the resulting alternative rankings are the same as previously reported (Corps 2003; Service 2003).

A second concern with the benefits report stems from an assumption made by ENP that the associated levee (L-29) paralleling the length of the bridge alternative is removed along with the roadbed. Removal of the L-29 levee, in full or in part, is not authorized under the MWD Project and thus inclusion of any benefits gained from such a structural modification should not be claimed. Removal of the L-29 levee is, however, authorized under CERP, and the Service agrees with ENP, as stated in the Final FWCA Report (Service 2003), that full restoration of natural flows to ENP, more specifically NESS may only be accomplished through the implementation of MWD Project features coupled with the restoration of CERP.

The interagency team, in an attempt to reconcile concerns with the benefits report, recalculated potential benefits (Table 1) for those performance measures that were dependent only on bridge length and not removal of the L-29 levee. In doing these recalculations the team assumed similar

flows for the 3,000-foot Bridge alternative as was used for the 4-mile and 10.7-mile Bridge alternatives. This exercise (discussed in Section III.A) resulted in similar alternative rankings as both the ENP report (NPS 2005) and the analysis undertaken by the Department in the Final

FWCA Report (Service 2003). The rankings previously reported were based on environmental and other project alternatives and resulted in the 10.7-mile Causeway ranking first (most desirable), next was the 4-mile Bridge alternative, followed by the 2.7-mile Bridge alternative, and lastly the 3,000-foot Bridge alternative.

The interagency team agreed that it was important to calculate the incremental benefits achievable by future implementation of other restoration projects in conjunction with TT modifications. It was decided that both sets of benefits should be presented simultaneously to decision makers so that a well informed decision could be made. This secondary benefits analysis is currently underway and will be included in the Final Supplemental FWCA Report. Although, not separated, the ENP report (NPS 2005) captures both the immediate and incremental benefits.

III. FISH AND WILDLIFE RESOURCE CONCERNS AND EFECTS

A. Ecological Benefits Analysis

Even with the concerns listed above, the ENP report (NPS 2005) still contained the greatest amount of information and detailed analysis potentially applicable to the comparison of TT modification alternatives. The interagency team used the report's findings as the team's baseline and focused on ways to make adjustments and correct some of its invalid assumptions, and produce predictions that allowed valid comparisons among alternatives, while staying within the policy and legal constraints of the project.

The team went through the following sequence of steps: (1) screen performance measures (PM) that could not be used for the purpose of this evaluation; (2) apply the same flows for the 3,000-foot Bridge alternative that were used for the 4-mile and 10.7-mile Bridge alternatives; (3) estimate values for the 4-mile Bridge East alternative by extrapolation from the values for the 4-mile Bridge (central) alternative; (4) assign numerical scoring from the quantitative and qualitative raw values; (5) estimate rate of change; and (6) estimate the acreage in NESS where the changes would occur. A subteam then worked with the scores, rates of change, and area to: (1) normalize the scores; (2) multiply by area to produce habitat units; (3) factor in the rate of change; (4) calculate the habitat unit benefit for each alternative as the difference between the with-alternative condition and future without project condition; and (5) calculate the average annual benefit for a 50-year period of analysis.

Screen PMs

The team considered the 33 PMs displayed in the ENP report (NPS 2005), removing the following from further consideration in the revised GRR because of the concerns discussed above.

The following 11 PMs were removed because the differences they showed among alternatives resulted from different upstream operations of structures rather than bridge lengths.

1. Restore historic distribution of flows to ENP (percent of flows west of L-67 Extension);
2. Restore historic flow volumes to ENP;
3. Restore historic overland flows from WCA-3A to WCA-3B;
4. Restore historic overland flow volumes to NESS;
5. Restore historic sheet flow conditions to NESS;
6. Eliminate discontinuity I water levels above and below TT;
7. Reduce water depths in WCA-3A;
8. Reduction in minimum flow and level (dry season depths) violations in NESS;
9. Reduction in minimum flow and level (dry season depths) violations in mid-NESS;
10. Improve alligator nesting numbers and distribution; and
11. Reduce concentration of total phosphorus discharges to ENP from L-67A Canal.

The following five PMs's were removed because they depended on removing L-29 Canal adjacent to bridge rather than bridge length.

1. Reconnect historic slough habitats between WCA-3B and NESS;
2. Increase physical connectivity of marshes between WCA-3B and ENP;
3. Shift to open water, spikerush marsh and slough communities in NESS;
4. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs; and
5. Increase extent of slough vegetation communities.

Four PMs were removed by combining with others; they were too similar to PMs that were retained.

1. Two fire PMs were merged into one: (a) reduce risk of ridge and tree island peat burning in NESS; and (b) reduce risk of ridge and tree island peat burning in Rocky Glades (net reduction of one); and

2. Four water quality PMs were merged into one: (a) reduce injurious effect of organic forms of carbon, nitrogen, and phosphorus; (b) increase dissolved oxygen; (c) reduce specific conductance and sulfate concentration; and (d) increase nutrient cycling and uptake by biota (net reduction of three).

One new PM was developed for deep sloughs reconnected-important for dry years. The remaining PMs address five important characteristics of ENP: (1) hydrology; (2) ridge and slough processes; (3) vegetation; (4) wildlife; and (5) water quality. These PMs reflect

differences among alternative bridge lengths, and are not dependent on removing the L-29 levee or on different upstream operations.

Consistency of Models for Alternatives

The team recognized that the 3,000-foot Bridge alternative was assessed with lower flow volumes than were used for the other, larger alternatives. The team reassessed and re-estimated some PM values for the 3,000-foot Bridge alternative with the same Combined Structural and Operational Plan West Bookend alternative flows that were used for the other TT alternatives. The West Bookend was also used for all of the alternatives in the Depth-averaged Hydrodynamic Model RMA-2 modeling of surface water velocities and flow directions.

The ENP report (NPS 2005) did not quantify the predictions for the 4-mile Bridge East alternative in the same manner as for the 4-mile Bridge Central alternative or the other alternatives. The team initially assumed that many of the predictions for the central location would apply to the eastern location. The PM values were then adjusted as necessary based on known differences such as topography, vegetation, and wildlife resources.

PM's Raw Values

Table 1. Raw values for PMs used in the benefits analysis.

Objectives and Performance Measures	Units	Tamiami Trail Alternatives					
		Goal	No-Action Plan	3,000 foot	4-mile East	4-mile West Central	10.7-mile Causeway
Tamiami Trail Roadbase Constraint			const.	unconst.	unconst.	unconst.	unconst.
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999							
Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiamai Trail	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes
2. Restoration							
1. Restore Water Deliveries to ENP							
A. Provide average annual NSM flow volumes	ac-ft. x1000	895	493	683	683	683	683
B. Reduce high flow velocity (0.1 f/s) discharge associated with structures on Tamiami Trail	Acres impacted	0	187	411	147	98	8
C. Distribution of flows from L-29 Canal into NESS	ft	55,366	0	3000	20,338	20338	55,366
2. Restore Ridge and Slough Processes							
A. Reverse filling in of sloughs	0-7	7	2	2	4	4	6
B. Minimize differencebetween average velocity at road and average marsh velocity	ratio	1	no bridge(L)	7.3 (L)	1.8 (H)	1.8 (H)	1 (H)
C. Enhance flows from L-29 Canal into deep sloughs of NESS	# sloughs	4	0	0	2	1	4
3. Restore Vegetative Communities							
A. Shift to open water, spikerush marsh and slough communities in NESS	H-L	High	Low	Low	Moderate	High	High
B. Reduce risk of ridge and tree island peat burning in NESS	H-L	High	Low	High	High	High	High
C. Minimize invasion of exotic woody plant species	H-L	High	Low	Moderate	Moderate	Moderate	Moderate
4. Restore Fish and Wildlife Resources							
A. Total abundance of fishes in ENP marshes	H-L	High	Low	Low	Moderate	Moderate	High
B. Improve conditions for wading bird foraging and nesting	H-L	High	Low	Low	Moderate	Moderate	Moderate
C. Reduction in wildlife mortality (shown as % reduction compared to no action)	%	100	0	5	<37	37	<100
5. Water Quality Impacts							
A. Construct bridge with stormwater treatment system	H-L	High	Low	Moderate	Moderate	Moderate	Moderate
B. Construct bridge without stormwater treatment system	H-L	High	Low	Low	Low	Low	Low
C. Reduce erosion - less sediment and TSS transport	H-L	High	Low	Low	Low	Low	Low

Quantitative Scores

The quantitative and qualitative values for the PMs were in many different units that were hard

to combine or compare to each other. Units included percent, feet, acres, acre-feet, feet per second, and high-moderate-low. The team converted these wide-ranging values to unit-less quantitative scores.

The qualitative values of low, moderate, and high were initially converted to scores of 2, 4, and 6, respectively, on a 0 to 7 scale. The target was assigned a score of 7. Most alternatives could not fully achieve the target. If a set of alternatives contained the same low, moderate, and high values for a PM, but the professional judgment of the team was that there was sufficient evidence that the alternatives would not be the same, and then the performance measure score for one alternative would be adjusted up or down 1 unit, as appropriate.

The quantitative numeric values were divided by the target or goal of the PM, and then multiplied by 7 so that they would be easily compared to the scores for the qualitative measures. The scores for the PMs are presented in Table 2. The scores for the PMs for each alternative were added together to produce an index of the quality of restoration of the alternative. The sum of the un-weighted scores is presented in Table 2.

The changes produced by each alternative would occur over the same acreage of NESS. The area for analysis and comparison is defined by L-67 Extension on the west, TT on the north, and the
L-31N and the 8.5 square-mile area western boundary on the east. There is no firmly defined boundary on the south; the differences between alternatives and the without project condition gradually decrease as one moves south. For this study, the southern limit is defined by the team as an east-west line connecting the end of the L-67 Extension to 8.5 square-mile area. The total study area is 63,159 acres.

The team prepared a simple description of the changes in conditions through time. The performance measures values and scores represent the ultimate, or end-point, of changes due to the alternatives, and the team recognized that the restoration of the entire area would not occur immediately after construction is complete. For the alternatives, the team estimated that 30 percent of the end-point would be achieved in the first year. Most of this represents the hydrological changes such as depth, velocity, and hydroperiod. The team further estimated that an additional 6 years, for a total of 7 years, for the full extent of changes to occur. The herbaceous vegetation may take this long to fully respond to the hydrological changes. Fish and wildlife populations require a few seasons to respond to the changed hydrology and vegetation. Although not fully predictable, there is a good likelihood that a wet or dry year will occur during this period, further emphasizing the importance of incorporating events such as scouring some of the sediments and vegetation that have accumulated in the sloughs during high water events or connecting deep sloughs to the L-29 Canal to maintain water during the lowest flow periods. The without project condition is proposed to remain the same throughout the period of analysis, the same as existing conditions. The period of analysis is 50 years, from 2010 to 2060.

Habitat Units and Benefits

Habitat units (HU) are the product of a quality or index times an area. For TT, the sum of the

scores was normalized by dividing each total score by 98, the largest score and the restoration target. This produces a number between 0 and 1 for each alternative and for the without project condition. The HU value for an alternative is a product of the normalized (0-1) performance measure score and the acres of change (63,195), adjusted by the rate of increase of PM scores to account for the gradually increasing performance in the first few years. Benefits are the gain in habitat units due to implementing an alternative. Benefits are defined as the difference of the HUs for an alternative minus the HUs for the without project condition. Table 3 depicts cost and average annual HUs.

Table 2. Numerical scores assigned to the PM's raw output.

Objectives and Performance Measures	Units	Tamiami Trail Alternatives					
		Goal	No-Action Plan	3,000 foot	4-mile East	4-mile West Central	10.7-mile Causway
Tamiami Trail Roadbase Constraint			const.	unconst.	unconst.	unconst.	unconst.
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999							
Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiamai Trail	Yes/No	Yes	Yes	Yes	Yes	Yes	Yes
2. Restoration							
1. Restore Water Deliveries to ENP							
A. Provide average annual NSM flow volumes	0-7	7	1	6	6	6	6
B. Reduce high flow velocity (0.1 f/s) discharge associated with structures on Tamiami Trail	0-7	7	4	1	5	6	7
C. Distribution of flows from L-29 Canal into NESS	0-7	7	0	1	3	3	7
2. Restore Ridge and Slough Processes							
A. Reverse filling in of sloughs	0-7	7	2	2	4	4	6
B. Minimize differencebetween average velocity at road and average marsh velocity	0-7	7	1	2	6	6	7
C. Enhance flows from L-29 Canal into deep sloughs of NESS	0-7	7	0	1	2	4	7
3. Restore Vegetative Communities							
A. Shift to open water, spikerush marsh and slough communities in NESS	0-7	7	0	2	4	6	7
B. Reduce risk of ridge and tree island peat burning in NESS	0-7	7	2	5	6	6	7
C. Minimize invasion of exotic woody plant species	0-7	7	2	4	4	4	4
4. Restore Fish and Wildlife Resources							
A. Total abundance of fishes in ENP marshes	0-7	7	1	3	4	4	6
B. Improve conditions for wading bird foraging and nesting	0-7	7	1	3	4	5	6
C. Reduction in wildlife mortality (shown as % reduction compared to no action)	0-7	7	0	1	3	4	6
5. Water Quality Impacts							
A. Construct bridge with stormwater treatment system	0-7	7	3	4	4	4	4
B. Construct bridge without stormwater treatment system	0-7	7	3	3	1	1	0
C. Reduce erosion - less sediment and TSS transport	0-7	7	1	1	2	2	2
Sum with stormwater treatment		**98**	**18**	**36**	**57**	**64**	**82**

Table 3. Average annual HUs and costs for each alternative.

	Future Without	3,000-foot Bridge	4-mile Bridge Central	4-mile Bridge East	10.7 mile Causeway
Average annual benefits	0	10,904	27,867	23,626	38,772
Average annual costs	0	$4,817,309	$9,264,886	$9,323,755	$18,255,563

B. Federally Listed Threatened and Endangered Species

Endangered Cape Sable Seaside Sparrow

The general intent of the MWD Project is to reroute large volumes of water that currently flows through WCA-3A and into Western Shark River Slough via the S-12 structures, instead redirect overland flows from WCA-3A into WCA-3B and then from WCA-3B into NESS via a 4-mile bridge in the TT (US 41) to be located between the L-67 Extension and the L-30/L-31N.

According to the most recent 2002 Amended Biological Opinion on the Interim Operational Plan (IOP) for the protection of the CSSS (Service 2002a), the earlier February 19, 1999, Biological Opinion was amended to include IOP as a second RPA option with qualifications. The IOP is to be implemented in combination with all the original RPA components of the February 19, 1999, Biological Opinion, excluding component Number 6 that required the MWD Project to be fully functional by 2003.

Since March 1, 2000, the Corps has been responsible for preventing water levels at NP-205 from exceeding 6 feet (NGVD) for a minimum of 60 consecutive days between March 1 and July 15, to allow two nesting cycles in approximately 40 percent of the CSSS habitat in Subpopulation A (Western Shark River Slough). The Corps is also responsible for implementing actions that would produce hydroperiods and water levels in eastern ENP (specifically CSSS Subpopulations C, E, and F) equal to or greater than those produced by implementing Test 7, Phase II as described in the Final Environmental Assessment for Test 7 (Corps 1995). Therefore, since March 1, 2002, the Corps is also responsible for providing at least 60 percent of all regulatory water releases crossing TT are to enter ENP east of the L-67 Extension. However, when water levels in eastern ENP (as measured at G-3273) exceed 6.8 feet, discharges to ENP east of the L-67 Extension are not permitted. When the 6.8-foot stage at G-3273 is reached, up to 100 percent of the regulatory and rainfall components are released west of the L-67 Extension and enter ENP via the S-12 structures (A-D).

In reanalyzing the original MWD-TT alternatives with respect to their ability to meet the RPAs for the CSSS as described above, the Department maintains that the 10.7-mile Causeway, with full removal of the existing TT roadway (US 41) and the L-29 levee, is the Environmentally Preferred Alternative. The 10.7-mile Causeway would not only provide the maximum ecological benefit to the western subpopulation of the CSSS and adjacent marl prairies in ENP, but the 10.7-mile Causeway would also provide relief to the compartmentalized ponding of water in southern WCA-3A while reestablishing slough-like characteristics in NESS and to a lesser extent WCA-3B. It is the position of the Department that the Environmentally Preferred Alternative is the most consistent of all the alternatives with the intent and stated goals of the 1989 ENP Expansion and Protection Act [PL 101-229].

However, it has been determined by the Corps' Engineering staff through computer modeling and best professional judgment, that all the alternatives considered are capable of passing sufficient flow through their respective bridge configurations to satisfy the RPA for the CSSS if they are able to convey volumes of water equal to the sum of the inflows into the L-29 Canal.

Endangered Wood Stork Colonies

As discussed in the original Final FWCA Report for TT (Service 2003), the Primary Zone is the

most critical area surrounding a wood stork (*Mycteria americana*) colony (normally between 1,000 and 1,500-foot circumference). As such, construction activities must be managed according to the Service's *Draft Supplemental Habitat Management Guidelines for the Wood Stork in the South Florida Ecological Services Consultation Area* (Guidelines) (Service 2002b). For the application of the Guidelines to the TT Project, a distance of 1,000 feet was chosen due to the visual barrier of the pond apple forest between the colonies and the roadway, as well as the fact that the wood stork colonies appear to have become somewhat acclimated to highway traffic noise. The Secondary Zone extends outward from the Primary Zone 1,000 to 2,000 feet, or to a radius of 2,500 feet from the outer edge of the colony. Restrictions in this zone are needed to minimize disturbances that might impact the Primary Zone, and to protect essential areas located outside the Primary Zone. For the application of the Guidelines to the TT Project, a distance of 1,000 feet from the Primary Zone, extending in all directions, was chosen for both colonies for the reasons described above for the Primary Zone. All of the Guidelines, restrictions, and recommendations identified in the original Final FWCA Report (Service 2003) for the Tamiami East and West wood stork colonies are valid and still apply and are incorporated here by reference.

Endangered Everglade Snail Kite

Based on Everglade snail kite (*Rostrhamus sociabilis plumbeus*) nesting data from 2000 to 2004, the closest nest to TT that has been recorded to date is approximately 150 meters from the road (2000), and in 2004, there was nesting approximately 550 meters away. Because the closest known snail kite nest site is located a good distance from TT, the Service does not recommend, at this time, that any specific precautions for construction impacts be put in place regarding additional snail kite conservation. The Service and FWC will continue to monitor snail kite nesting in subsequent nesting seasons in the project area, and will immediately notify the Corps if new information would warrant a change in this determination.

State-Listed Threatened and Endangered Species, and Species of Special Concern

In a letter dated October 18, 2000, the FWC has identified six avian species of special concern which may nest or otherwise be found in the vicinity of TT between the S-334 and the L-67s: tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), limpkin (*Aramus guarauna*), roseate spoonbill (*Ajaia ajaja*), and white ibis (*Eudocimus albus*). In addition, the snail kite and wood stork, both listed by the FWC as endangered, are also known to occur in the area. The American alligator (*Alligator mississippiensis*) (listed as a species of special concern) and the Everglades mink (*Mustela vison*) (listed as threatened) also are found along the TT corridor.

A small wading bird colony (Frog City Wading Bird Colony) is situated in WCA-3B close to the L-29 levee approximately 1/4 mile west of the Tiger Tail Miccosukee Indian Camp. This small willow head supports nesting by tricolored herons and great egrets. These migratory birds are

also protected under the provisions of the Migratory Bird Treaty Act. As such, they are protected species under the jurisdiction of the Service. All of the Guidelines, restrictions, and recommendations identified in the original Final FWCA Report (Service 2003) for the Frog City

Wading Bird Colony are valid and still apply and are incorporated here by reference.

C. Wildlife Mortality and Connectivity

Since the submission of the Final FWCA Report, the Service has completed a more in depth study of the wildlife mortality along the TT corridor (Service 2004). In 2002, the Service initiated a survey of wildlife mortality due to vehicle collisions (road-kill) along the TT in the area that will be affected by the TT portion of the MWD Project and future restoration projects such as the WCA-3 Decompartmentalization and Sheetflow Enhancement Project (Decomp) of the CERP. The goal of this road mortality study was to estimate monthly vertebrate mortality for 1 year along the eastern approximately 10.7-miles of the TT (US 41), between the L-67 Extension Canal and the L-31N Canal. This roadway will eventually be modified to provide safe wildlife passage and increase water flow into ENP by both the MWD and Decomp projects. This assessment provides information that may aid in identifying locations, design characteristics, and construction measures that improve the benefits to fish and wildlife resources.

Four transects, each 0.5-mile in length were identified along TT between the S-333 structure where the L-67 crosses the TT and the L-31N Canal along the eastern edge of ENP (Figure 6). These sites were selected because they capture a range of the hydrologic and habitat conditions that occur across the length of the TT that is proposed for modification under the MWD and Decomp, Part 1, projects. Transects were measured using a vehicle odometer, and endpoints of transects were located to correspond to recognizable landmarks.

Between July 2002 and September 2003, surveys were conducted once per month. During each survey, observers walked slowly along each transect and located, identified, and recorded every road-killed vertebrate that they could find along the road right-of-way. Items that could not be identified and were in relatively good condition were collected and taken to the Service's South Florida Ecological Services Office for further investigation and identification. Remains were identified to the lowest taxon possible. For alligators and some snakes, approximate size class of the individual was also recorded when there were sufficient remains to estimate size. Once identified and recorded, remains were removed from the roadway (usually tossed into adjacent dense vegetation) to ensure that they would not be counted on the following survey. Taxonomic diversity was represented as the number of different taxonomic groups represented in road-kill over a certain period. Because the ability to distinguish species was limited, this index is not a traditional representation of species diversity.

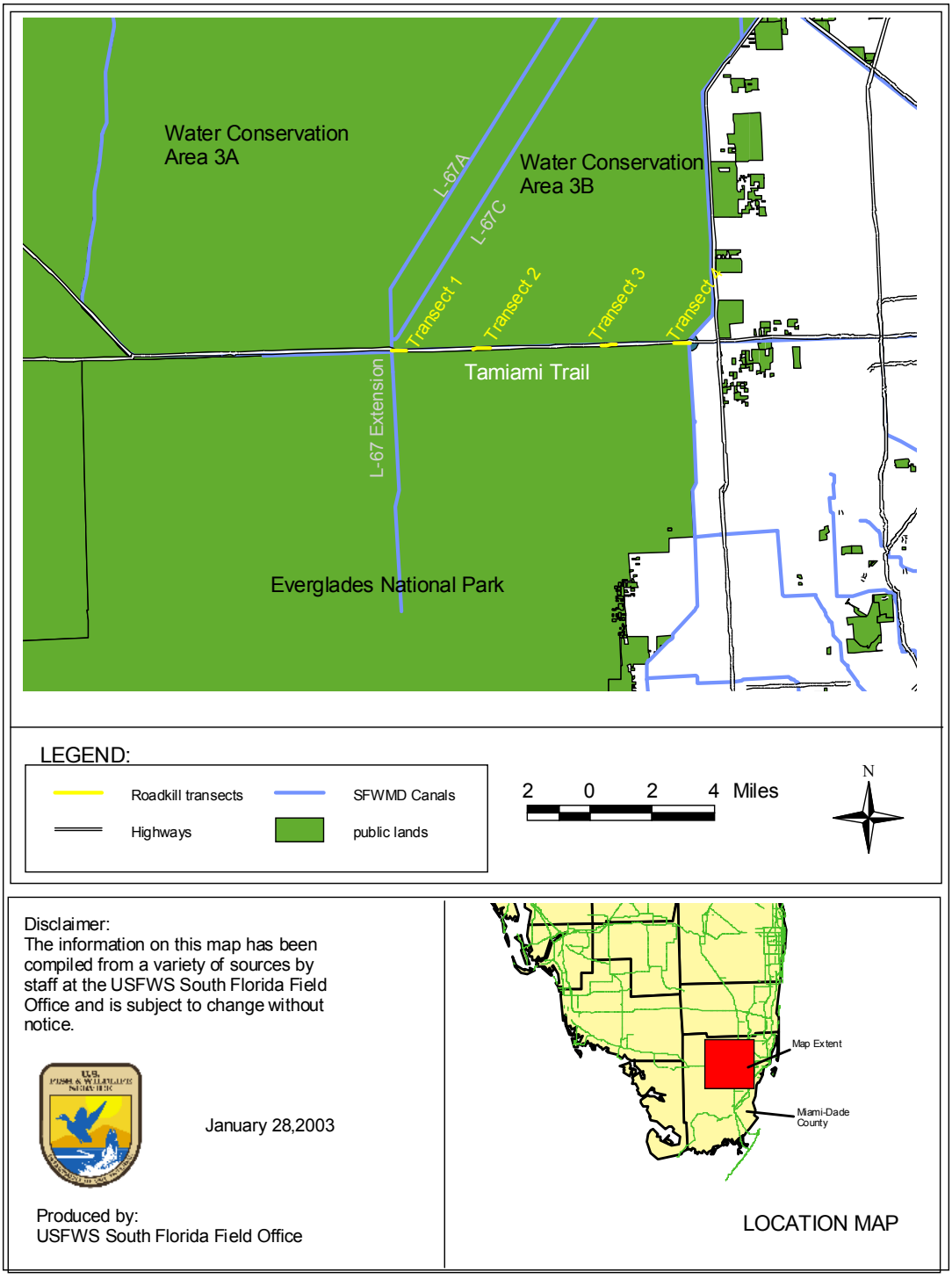

Figure 6. Road mortality study area.

A total of 14 visits were conducted from July 2002 through August 2003, including the initial visit to remove road-kill that had accumulated prior to the initiation of the study. Sampling was planned to occur at 1-month intervals, but deviations from this schedule occurred due to weather, logistical, and personnel limitations. During the course of the study, the actual interval between successive visits ranged from 22 to 42 days.

In all, 991 road-killed vertebrates were documented during the course of the study, including the initial road-clearing period. Of the total items recorded, over one third of the total (335 of the 991) items were recorded on the initial road-clearing visit. The remaining 656 items represent a minimum estimate of the actual number of organisms road-killed on survey transects over the 13-month period from the date the initial road-clearing sample occurred until the end of the study.

A key component of the wildlife mortality study, and one used as a performance measure for the TT portion of MWD, is the average annual road mortality per mile along the trail. The most recent intensive study reports an average of 261.6 mortalities per year per mile. This number represents an 83 percent increase from the 148 mortalities per year per mile as reported in the Final FWCA Report (Service 2003). This translates into 2,779 individual mortalities avoided if the 10.7-mile Causeway was in place, 1,046 individuals if a 4-mile bridge was in place, and 147 individuals if a 3,000-foot bridge was selected. These results further support the need for a wider bridge configuration on the TT.

Another interesting result from the study is that the different transects also had different amounts of road-kill. Only approximately 10 percent of all the road-killed items reported occurred on Transect 1, while nearly 47 percent occurred on Transect 3. Transect 2 had the second lowest total, with approximately 19 percent of the total, and Transect 4 as the second highest, with 24 percent of the total. These results should be used by the Corps to determine the exact location of the wildlife underpasses on the eastern side of the study area as outlined in (Section IV) of this report, and further detailed in the Final FWCA Report (Service 2003).

D. Project Footprint Impacts

The importance of avoiding direct wetland functional losses by keeping any new construction entirely within the footprint of the existing disturbed corridor as much as possible, is well understood and was identified as a concern during the original alternative formulation process. However, it has been decades since the last major engineering effort took place to update the TT (US 41) to current FDOT standards.

As a result, encroachment into ENP to the south is required to meet the current minimum design criteria of the FDOT. The encroachments stem from an increase of the centerline elevation of TT to mitigate the effects of increased stages in the L-29 Canal and increased shoulder widths on the south side of the roadway. The additional height of the roadway will necessitate side slope encroachment. The size of the encroachment will be directly related to the elevation difference between the proposed and existing roadway surfaces. Issues of constructability may also require

encroachment into ENP. These additional space requirements that would give the contractor adequate space to construct the project and meet minimum maintenance of traffic requirements maybe temporary in nature, but permanent encroachment is a possibility.

A conceptual design was developed for screening level analysis. This concept allowed for the centerline of the existing roadway to shift south approximately 12 feet. The shift was considered a maximum and was introduced to comply with minimum design criteria and for constructability requirements.

Currently, there are long, narrow, and discontinuous vegetative communities (~20-feet wide) with invasive exotic species lining both sides of the TT roadway. The dominant exotic species of vegetation was identified as Brazilian pepper (*Schinus terebinthifolius*). This particular invasive exotic species dominates the TT shoulder vegetation composition along the entire 10.7-mile project length for an average width between 10 to 30 feet. This fringe of exotic vegetation does provide habitat primarily for passerine birds, however, the habitat quality is considered low for this area of the Everglades and there is an abundance of disturbed exotic vegetation east and west of the project area. The exotic vegetated fringes also act as a wildlife corridor for east-west movement parallel to the roadway. However, with the additional length of the tentatively selected bridge span increasing from 3,000 feet to 4 miles, the new bridge configuration will better serve a dual function; to allow conveyance of water from upstream (WCA-3B) to downstream (NESS), as well as allow wildlife movement underneath the bridge and thus reducing the occurrence of wildlife mortality from vehicular collisions.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Environmentally Preferred Alternative: Department's Recommended Plan-Alternative 12

The Department concludes that Alternative 12 (10.7-mile Causeway) best meets the stated environmental objectives when compared to the other proposed alternatives. The Department's final position is that Alternative 12 is the environmentally preferred alternative as evidenced by the following:

1. Alternative 12 provides the highest degree of unrestricted flow across the entire 10.7-mile project corridor between WCA-3B and ENP.
2. Alternative 12 provides for the maximum wetland functional gain. All other alternatives result in some loss of wetland function compared to this alternative.
3. Alternative 12 provides for an overall net gain in wetland acres due to implementation.
4. Alternative 12 re-establishes full and permanent connectivity between the central and southern Everglades, providing benefits for the restoration of marsh flow regimes, enabling full wildlife movement, providing the greatest potential to restore the ridge and slough landscape, and providing the highest potential for eliminating wildlife mortality.

5. Alternative 12 does not require any retrofitting of project features, and therefore, has the highest potential for compatibility with future CERP features.
6. Alternative 12 maintains sufficient recreational opportunities, and provides for significant vistas and appreciation of America's Everglades for the benefit of the public.

While the Department maintains that Alternative 12 provides the best performance in meeting the environmental objectives of the project, the Department also recognizes that fiscal constraints prevent the NPS from providing full financial support for implementation. However, the Department also maintains that should additional funding be made available to the project, implementation of Alternative 12 should be reconsidered.

B. Environmentally Acceptable Alternative: Corps' Recommended Plan-Alternative 10

The Corps has tentatively identified Alternative 10 (4-mile Bridge Central) as the Recommended Plan. It is the position of the Department that Alternative 10 is environmentally acceptable, performing sufficiently well for all project objectives and within the limits imposed by the project constraints as evidenced by the following:

1. Meets the FDOT standards for road safety by providing necessary mitigation to offset the adverse impacts to road safety associated with the projected high water following implementation of the MWD Project.
2. Provides acceptable performance for all project objectives for the funds expended. The estimated construction costs are also within the capability of the limited funding available from the NPS.
3. While the Department has concerns that the current configuration of Alternative 10 provides only 37 percent of the potential connectivity between WCA-3B and NESS, the Department anticipates that additional connectivity can be provided through future CERP related modifications, such as future removal of the levee paralleling the L-29 Canal.
4. Reduces wildlife mortality by 570 individuals, or 37 percent.
5. Reduces flow velocities and impacts downstream.
6. Model simulations only increases flow velocity at the road by 0.008 feet/s over average marsh velocities.
7. Provides the opportunity for reconnection of 37 percent of sloughs.*
8. Eliminates pattern of scour and deposition at culverts and weirs.*
9. Reduces encroachment of sawgrass (*Cladium jamaicense*) and wet prairie vegetation into ENP and WCA-3B sloughs.*
10. Creates a substantial shift toward open water, spikerush (*Eleocharis palustris*) marsh and slough communities in WCA-3B and NESS.*
11. Provides a moderate level of improvement to aquatic fish communities.*

12. Provides a moderate improvement in conditions for wading bird foraging and nesting.*

13. Provides a moderate level of improvement for alligator nesting numbers and distribution.*

* Additional performance measures not previously assessed in Service (2003) (ENP Report, see Appendix).

C. Department's Recommendations for Implementation of the Selected Plan

MWD and CERP Modifications to TT

The Department understands that only limited improvements can be made to TT under the current funding levels of the MWD Project. The Department also understands that the Water Resources Development Act (WRDA) 2000 WCA-3 Decomp (Phase 1) also provides a separate authority for modifications to TT. The primary purpose of this CERP project is to remove many of the barriers to natural overland flow in WCA-3A and WCA-3B, including L-67 A and C levee and Canal, L-29 levee and Canal as well as TT. Through careful planning, the combined effect of the authority of the MWD Project and WRDA 2000 will allow for a unique opportunity to implement a level of restoration for the central and southern Everglades currently impacted by TT that would not be possible under separate authority when implemented independently.

In recognition of these facts, the Department envisions that the modifications to TT will occur in two phases. The first phase of modifications will occur using the funding from the NPS and other sources to construct the Alternative 10 features, assuming the Recommended Plan is retained in the Final SEIS/GRR and Record of Decision. The second phase of TT modifications will occur using the separate authority of the WRDA 2000. While the Department recognizes that these features will be identified through a separate public forum consistent with NEPA, the Department also encourages the Corps and the District to consider the information compiled as part of the MWD alternatives analysis.

Threatened and Endangered Species

1. The Service recommends that the Construction Restrictions for wood storks and migratory birds outlined in Chapter 4 of the Final FWCA Report (Service 2003) be integrated into the detailed design and specifications and construction documents during implementation of this project. These construction restrictions are designed to avoid adverse effects to State- and federally listed species and other species of migratory waterbirds.
2. The Service, FWC, ENP, and Corps jointly develop and implement a wood stork monitoring plan to assess wood stork behavior (roosting, nest building, breeding, nesting, and fledging of young) during and after project implementation.
3. As previously recommended in a Planning Aid Letter, dated March 1, 2001, the Service recommends the Corps prepare a Biological Assessment and effect determination consistent with the provisions of the Endangered Species Act for the listed species identified in Chapter 4 of the Final FWCA Report (Service 2003) and reiterated herein.

Mitigation for Wetland Functional Losses

1. While the Department recognizes that the TT Project is designed to restore flows to NESS, it is also recognized that construction of US 41 and the L-29 Borrow Canal has eliminated approximately 530 acres of historic Everglades' wetland habitat. Therefore, in order to maximize the wetland restoration potential of this project, it is recommended that a wetland functional enhancement plan be developed to offset wetland losses attributable to direct construction activities associated with Alternative 10. In this regard, Chapter 3 of the Final FWCA Report (Service 2003) provides specific, detailed wetland functional assessments of eight potential wetland restoration sites in ENP that may be suitable sites for enhancement.
2. The Department finds that Alternative 12 (10.7-mile Causeway) restores wetland function to the fullest extent through removal of US 41, and thus maximizes wetland restoration both in the TT corridor and in NESS.

Recreation

The Department recommends that if any of the three boat ramps in the project area (Service 2003, Chapter 5) are impacted by project implementation, the Corps should consult with the FWC and District to establish a replacement boat ramp at the discretion of the FWC. This recommendation is consistent with the current agreement between the FWC and District.

Wildlife mortality/Connectivity Features

1. The Department recommends that those wildlife features (bridge across the L-29 Canal and wildlife underpass) located to the east of the S-334 structure be included in the detailed design and construction of the TT Project. Wildlife connectivity is particularly lacking along the eastern periphery of the Everglades at this location, because the intersection of the L-30 Canal and the L-29 Canal form a barrier to north-south wildlife movement. These features would not require retrofitting as part of CERP implementation. However, these features will significantly improve safe wildlife passage should CERP water levels increase in WCA-3B and ENP, causing the displacement of terrestrial species of wildlife.
2. The remaining wildlife features presented in the Final FWCA Report (Service 2003) would likely require retrofitting during CERP implementation. The Department recommends that the Corps consider these features for all alternatives (other than Alternative 12) in detailed design and specifications as integral components of the selected plan.

V. LITERATURE CITED

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VI. APPENDIX

Appendix. Draft Tamiami Trail Alternative Optimization Report (Everglades National Park)

Modified Water Deliveries to Everglades National Park

DRAFT Tamiami Trail Alternative Optimization Report

Prepared by:
Everglades National Park
South Florida Natural Resources Center

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Executive Summary

Purpose of Report

At the request of the U.S. Army Corps of Engineers (Corps), the National Park Service (NPS) has reevaluated Tamiami Trail structural components of the Modified Water Deliveries (MWD) for Everglades National Park (ENP) Project. The NPS has prepared this report in support of the Corps Revised General Reevaluation Report (RGRR) and Supplemental Environmental Impact Statement (SEIS). Subsequent to the completion of the 1992 MWD General Design Memorandum (GDM) and Congressional approval of the Comprehensive Everglades Restoration Plan (CERP) in 2000, additional scientific and engineering investigations associated with the CERP led to revisions in ecosystem restoration and highway design and operation requirements for the Modified Water Deliveries Project. These revisions have resulted in the need to reevaluate the Tamiami Trail Components of the MWD Project for consistency with the revised ecosystem restoration targets.

Major Findings and Conclusions

This report incorporates expansive and in-depth scientific analyses of four alternatives—10.7-Mile Bridge, 4-Mile Bridge, 3,000-ft. Bridge, and No Action (no bridge)—to determine the comparative benefits of each in meeting the hydrologic and ecological restoration objectives of the Tamiami Trail component of the MWD Project. The analyses in this report focus on two penultimate questions pertaining to the Tamiami Trail and its relationship with restoration of water flows and ecological conditions in ENP. First, what is the effect of high water levels on the north side of Tamiami Trail in the L-29 Canal (constrained v. unconstrained canal levels)? Second, what is the effect of bridge length on hydrologic and ecological connectivity?

The NPS analyses of effects of higher water depths indicate: an unconstrained L-29 Canal as depicted in the 10.7-Mile and 4-Mile Bridge alternatives is critical to restoring historic flow volumes, distributions, and water depth in ENP, particularly in Northeast Shark Slough (NESS). In addition, having an unconstrained L-29 Canal provides for the reconnection of historic slough habitats, reduces the pattern of scour and deposition at culverts in the road, restores sediment flow and transport needed for ridge and slough building, reverses filling in of sloughs, reduces the risk of fires, increases the extent of slough vegetation, restores myriad fish and wildlife resources, and improves water quality.

The NPS evaluation of the effect of bridge length indicates: increasing the length of the bridge from 3,000 ft. to 4 miles results in substantial ecological and hydrologic benefits to Water Conservation Area (WCA)-3B and ENP. Expansion of the bridge from 4 miles to 10.7 miles provides even greater benefits. The benefits of these two alternatives over the 3,000-ft. Bridge and No Action alternatives include: (1) substantially improving the distribution and timing of flows from WCA-3B to NESS, (2) reconnecting 100% (10.7-Mile Bridge) and 37% (4-Mile Bridge) of the historic slough habitats between WCA-3B and NESS, (3) substantial improvements in conditions for fish and wildlife

resources, (4) greater reduction in invasion of exotic species, and (5) greater reduction in wildlife mortality.

Based on the performance of the environmental project objectives and performance measures, the NPS concludes that the 10.7-mile Bridge Alternative exhibits superior performance in meeting the stated environmental objectives compared to the other proposed alternatives. While the NPS identifies the 10.7-Mile Bridge alternative as the environmentally preferred plan, the NPS identifies the 4-Mile Bridge Alternative as the recommended plan. It is the position of the NPS that the 4-Mile Bridge alternative provides substantial hydrologic and ecological benefits in a cost-effective manner.

Background

The study area (Figure ES.1), historically a mosaic of sawgrass prairies and emergent marshes interspersed with tree islands, is the very heart of the Everglades "River of Grass." ENP lies within the study area to the south of Tamiami Trail; these national trust lands are natural areas consisting of sawgrass prairie interspersed with hardwood hammock tree islands. Immediately to the north of Tamiami Trail lies WCA-3B, a similar habitat to that in NESS. Except for levees surrounding WCA-3B and several north-south ditches excavated in its interior by agricultural interests in the early 1900's, the area is undeveloped and is managed by the Florida Fish and Wildlife Commission as a Wildlife Management Area.

Prior to the construction of the Central & Southern Florida (C&SF) Project features, water deliveries to Shark Slough occurred through unimpeded sheet flow and 70% of the natural overland flows entered NESS. Following the completion of project features, much of the water was re-directed to western Shark Slough and the percent discharge to NESS dropped to 25%. This reduction in flows to NESS has had adverse impacts on many ecological aspects of both WCA-3B and NESS, including loss of peat-forming, open water slough habitats, increase in damaging fires with subsequent loss of soils (subsidence) in many areas, increase in exotic species, and reduction in populations of fish and invertebrates, as well as wading birds.

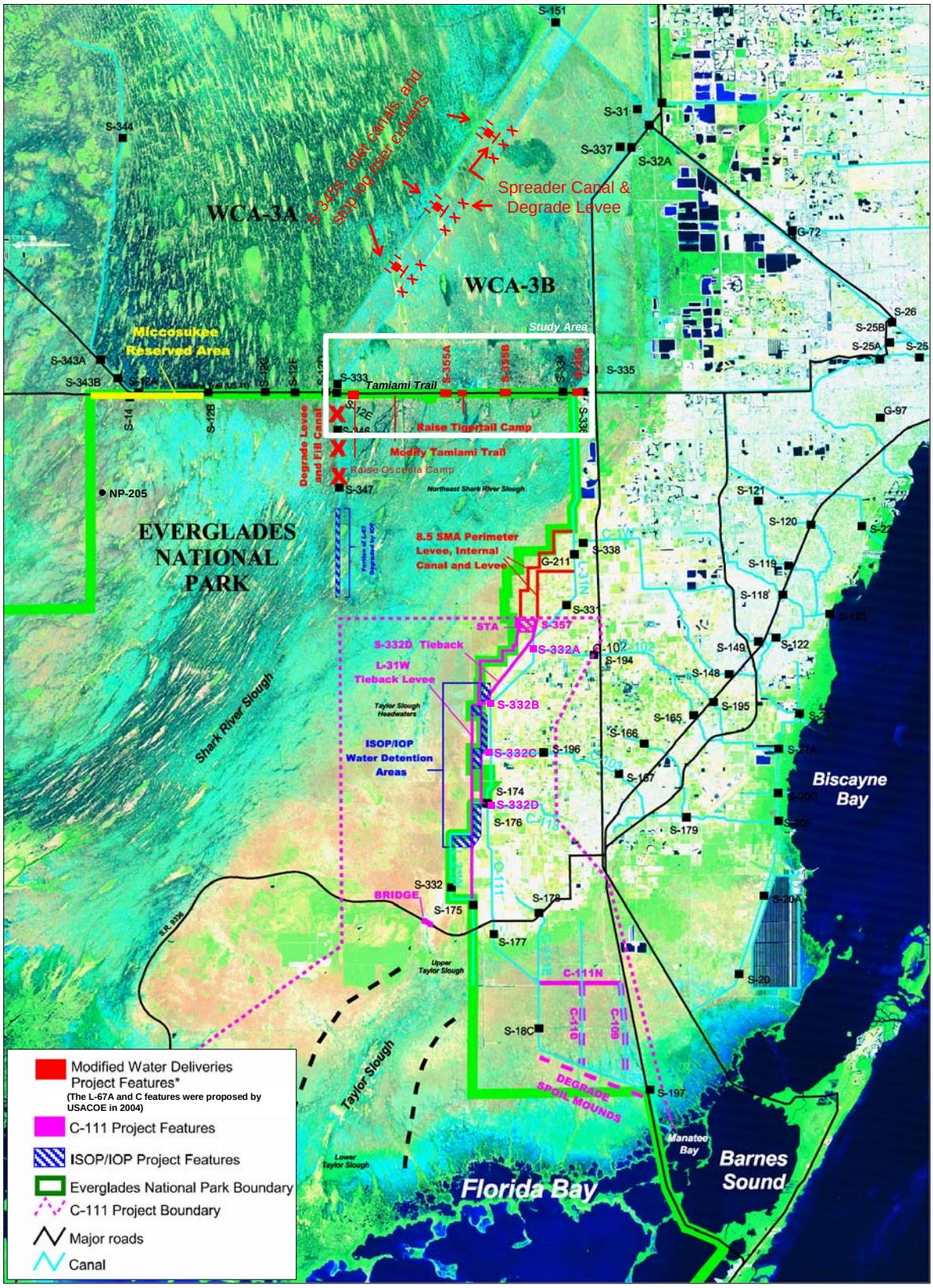

Figure ES.1. Feature map and study area.

Purpose of Tamiami Trail Component of MDW Project

The overall goal of the Tamiami Trail component of the MWD Project is to construct the needed modifications to the existing roadway to allow for the restoration of more natural conditions in a manner consistent with the 1989 Everglades National Park Protection and Expansion Act, while maintaining Tamiami Trail as a transportation corridor. According to the Act, the purpose of the project is to construct modifications to the C&SF Project "to improve delivery of water to ENP and, to the extent practicable, restore the natural hydrological conditions within the park." Based on a request from the Corps, the NPS has re-evaluated four alternatives and determined that the 10.7-Mile Bridge is the environmentally preferred alternative. From the standpoint of maximizing environmental benefits in a cost-effective manner, the NPS has identified the 4-Mile Bridge alternative as our recommended plan.

National Park Service Goals for Tamiami Trail Component of MDW Project

NPS expects the authorized Tamiami Trail alternative will be consistent with ENP enabling legislation and ENP Strategic Plan, ENP Protection and Expansion Act of 1989 (and modifications to C&SF Project), and CERP. To this end, NPS expects that the Tamiami Trail alternative will allow for overland flows from WCA-3B to NESS at volumes, velocities, and distribution patterns necessary to substantially restore ecological and hydrological functions in WCA-3 and Everglades National Park. Historically, the ridge and slough landscape encompassed much of what is now WCA-3A, WCA-3B and east and west Shark Slough, with the majority of the flows (70% or approximately 1.3 million ac-feet/per year) passing from WCA-3A, through WCA-3B to NESS. The construction of the L-67A and L-67C canals and levees as well as the Tamimai Trail levee and canal (L-29) eliminated this surface water connection, resulting in adverse impacts to WCA-3A, WCA-3B and NESS, i.e., the historic ridge and slough landscape. Impounding WCA-3A and WCA-3B has also eliminated their historic connection to NESS, causing similar losses of tree islands and slough habitats in NESS. Adjacent land uses, drainage systems (canals and levees), and water management practices associated with these barriers to sheetflow have further exacerbated these impacts. It is the goal of the NPS that a Tamiami Trail alternative reconnecting WCA-3B to NESS will restore historic flow patterns between these areas, substantially reducing the deleterious effects of external stressors and restoring many of the natural wetland functions that have been lost or degraded. According to evaluations in this report, "substantial" improvements in ecological and hydrological conditions require flow volumes from WCA-3A to WCA-3B then to NESS at levels modeled in the 4-Mile Bridge alternative (903,000 ac-ft/per year). The NPS goal is that 100% of CERP flows should flow from WCA-3A to WCA-3B or approximately 920,000 ac-ft. per year.

Tamiami Trail Project Component Environmental Objectives and Performance Measures

The overall goal of the Tamiami Trail Project is to identify modifications to the existing roadway that will allow for the restoration of more natural conditions in adjacent marshes. The NPS expects the authorized Tamiami Trail alternative will be consistent with ENP enabling legislation and ENP Strategic Plan, ENP Protection and Expansion Act of 1989 (and modifications to C&SF Project), and CERP. To this end, NPS expects that the Tamiami Trail alternative will allow for overland flows from WCA-3B to NESS at volumes, velocities, and distribution patterns necessary to substantially

improve hydrological and ecological conditions in WCA-3 and ENP. In this report, the NPS re-evaluates four alternatives for the Tamiami Trail project based on their potential environmental benefits and detriments to park resources.

In this reevaluation, the NPS has divided the two environmental objectives—(A) meet the Reasonable and Prudent Alternative (RPA) for the Cape Sable Seaside Sparrow as specified in the U.S. Fish and Wildlife Biological Opinion of February 1999, and amended the BO in 2002, and (B) allow for restoration consistent with the 1989 ENP Protection and Expansion Act—into two hydrological and four ecological project objectives. The two hydrological objectives are:

1. Restore water deliveries to ENP, and
2. Restore historic water depths and hydroperiods in ENP.

The four ecological objectives are:

1. Restore ridge and slough processes,
2. Restore vegetative communities,
3. Restore fish and wildlife resources, and
4. Improve water quality in ENP.

These six objectives are further divided into 30 performance measures that were identified by scientists as critical ecological indicators of park health.

Analytical Approach and Summary of Alternative Performance

For the purpose of reevaluating the Tamiami Trail alternatives based on NPS expectations, updated 2X2 (SFWMD Model v5.4) modeling was conducted only for the 4-Mile Bridge (unconstrained L-29 canal, west-central location for the bridge), 3,000-ft Bridge (9.3 ft. DHW constraint in the L-29 canal) and No Action (7.5 ft. DHW L-29 canal constraint) alternatives. The analysis focused on the hydrologic and ecological significance of two critical questions:

1. What is the importance of high water levels on the north side of Tamiami Trail in the L-29 canal (constrained v. unconstrained canal levels)?
2. What is the effect of bridge length on hydrologic and ecological connectivity?

Previous modeling using RMA-2 Model was used for re-evaluation, as well. For the 2X2 modeling evaluations, the 10.7-Mile and 4-Mile bridge alternatives were assumed to have similar flow characteristics, as unconstrained L-29 canal stages are assumed in both alternatives. More recent modeling of the 3,000-ft. Bridge alternative with an unconstrained L-29 canal stage (not available for the ecological evaluations) predicted similar flow characteristics as the 3,000-ft alternative modeled for this report; therefore, NPS believes comparisons between the more expansive bridge alternatives and the 3,000-ft Bridge alternative in this report are valid. This report provides objective characterization of the hydrological and ecological responses of four alternatives based on the most up-to-date scientific information. The results of the analysis of the Tamiami Trail alternatives are presented in Figure ES.2. The performance of the four alternatives is based on the assumption that the associated levee paralleling the length of the bridge alternative is removed along with the roadbed.

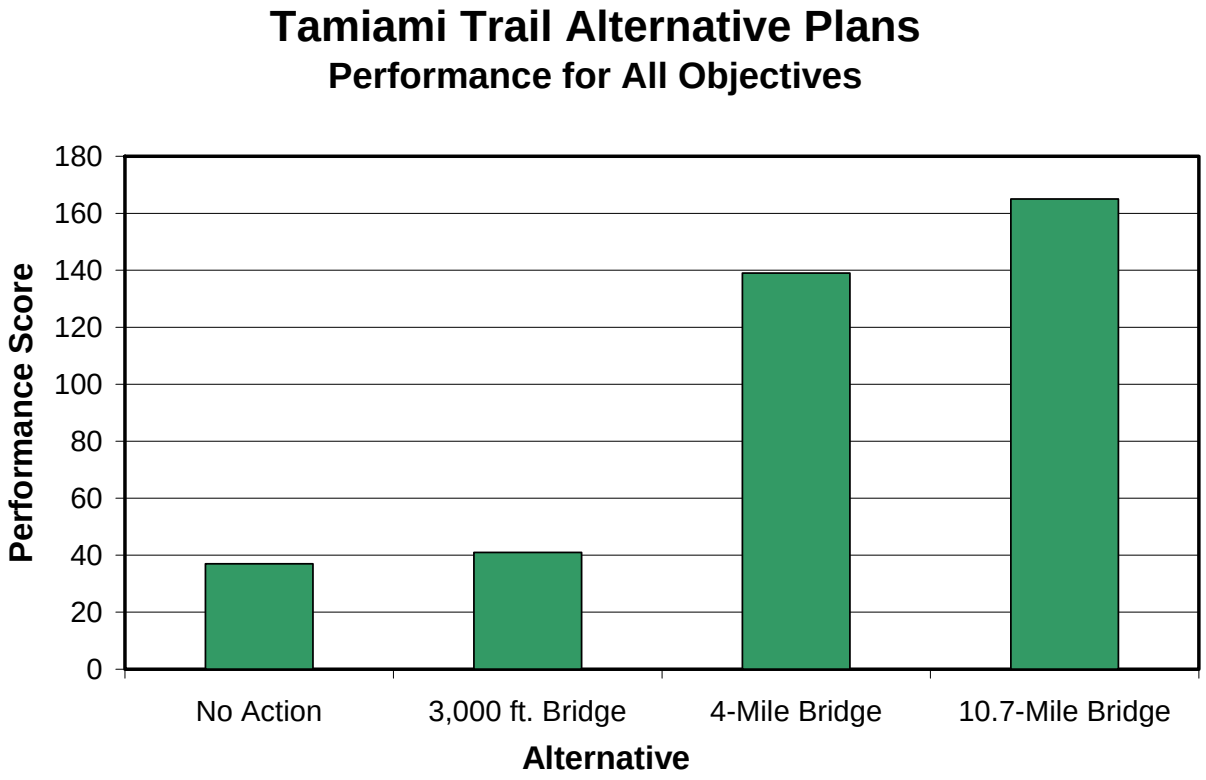

Figure ES.2. Summary of Alternative Performance.

Environmentally Preferred Alternative: 10.7-Mile Bridge—Alternative 4

Based on the performance of the environmental project objectives and performance measures (refer to Table 6.1), the NPS concludes that the 10.7-mile Bridge Alternative exhibits superior performance in meeting the stated environmental objectives compared to the other proposed alternatives. While the NPS maintains that the 10.7-Mile Bridge Alternative provides the best performance in meeting the environmental objectives of the project, we recognize there are fiscal constraints associated with this alternative. The NPS position is that the 10.7-Mile Bridge Alternative is the environmentally preferred alternative as evidenced by the following:

- Provides the highest ratio of overland flows to NESS from WCA-3B.
- Performs equally as well as the 4-Mile Bridge in providing NSM flow volumes to NESS and ENP.
- Provides the highest degree of unrestricted flow across the entire 10.7-mile project corridor between WCA-3B and ENP, providing nearly 69% of historic (NSM) flow volumes to NESS.
- Substantially shifts the historic flow distributions (30/70 W/E) back to the east side of the L-67A canal—from the present 78/22 W/E split to 44/56.
- Provides the highest level of physical connectivity between WCA-3B and NESS with the highest reduction in wetland impacts compared to the other alternatives.

- Reduces damaging high water levels in WCA-3A
- Reduces and nearly eliminates wildlife mortality by 1,584 individuals, or a 100 percent reduction
- Has no increase in average velocity at the road over marsh velocity
- Eliminates the discontinuity in water levels above and below Tamiami Trail
- Eliminates the pattern of scour and deposition at culverts and weirs, restoring sediment flow and transport needed for ridge building in all sloughs
- Significantly reduces the risk of ridge and tree island peat burning fires in NESS and in the Rocky Glades
- Substantially reduces encroachment of sawgrass and wet prairie vegetation into sloughs, and provides a significant shift toward open water, spikerush marsh and slough communities in NESS
- Provides the highest level of improvement to aquatic fish communities
- Has the highest reduction in the risk for invasion of exotic aquatic species
- Provides the greatest improvement in conditions for wading bird foraging and nesting
- Provides the highest level of improvement for alligator nesting numbers and distribution
- Provides the highest level of water quality improvement to ENP by (1) reducing the concentration of TP discharged to ENP, (2) reducing the injurious effects of TOC, TON, and TOP, (3) increasing levels of dissolved oxygen in ENP, (4) reducing effects of high sulfate concentrations, and (5) increasing nutrient cycling and uptake by biota

The NPS Recommended Plan: 4-Mile Bridge—Alternative 3

While the NPS identifies the 10.7-Mile Bridge Alternative as the environmentally preferred plan, the NPS identifies the 4-Mile Bridge Alternative as the recommended plan. It is the position of the NPS that the 4-Mile Bridge Alternative has substantial hydrologic and ecological benefits, and is a reasonable alternative given budgetary constraints. The essential characteristics of Alternative 3 are:

- Provides the same high ratio of overland flows to NESS from WCA-3B 44/56 (W to E), as in the 10.7-Mile Causeway alternative.
- Provides 69% of historic flow volumes to NESS (same as 10.7 Mile Bridge).
- Substantially shifts the historic flow distributions (30/70 W/E) back to the east side of the L-67A Canal—from the present 22/78 W/E split to 44/56 (same as 10.7 Mile Bridge).
- Meets the Florida Department of Transportation (FDOT) concern for road safety by providing necessary mitigation to offset the adverse impacts to road safety associated with the projected high water following implementation of the MWD Project.
- Provides an acceptable level of performance for all project objectives for the funds expended. The estimated construction costs are also within the capability of the limited funding available from the NPS.
- Although NPS has concerns that the current configuration of Alternative 3 provides only 37 percent of the potential connectivity between WCA-3B and NESS, NPS anticipates that additional connectivity can be provided through future CERP-related modifications, such as removal of levees.
- Reduces damaging high water levels in WCA-3A
- Reduces wildlife mortality—a reduction of 570 individuals, or a 37% reduction
- Reduces flow velocities and impacts to only 437.5 acres of wetlands
- Increases average velocity at the road by 0.008 ft/s over marsh velocity
- Reduces discontinuity in water levels above and below Tamiami Trail

- Provides the opportunity for reconnection of 37% of sloughs (4 large sloughs)
- Eliminates pattern of scour and deposition at culverts and weirs
- Restores sediment flow and transport needed for ridge building in 37% of area
- Reverses infilling in 37% of sloughs
- Significantly reduces risk of ridge and tree island peat burning fires in NESS and in the Rocky Glades
- Restores vegetative communities in 37% of sloughs
- Reduces encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs
- Creates a substantial shift toward open water, spikerush marsh and slough communities in WCA-3B and NESS
- Provides a moderate level of improvement to aquatic fish communities
- Provides a moderate reduction in the risk for invasion of exotic aquatic species
- Provides a moderate improvement in conditions for wading bird foraging and nesting
- Provides a high to moderate level of improvement for alligator nesting numbers and distribution
- Provides high to moderate level of water quality improvement to ENP by (1) reducing the concentration of TP discharged to ENP, (2) reducing the injurious effects of TOC, TON, and TOP, (3) increasing levels of dissolved oxygen in ENP, (4) reducing effects of high sulfate concentrations, and (5) increasing nutrient cycling and uptake by biota

Alternatives Eliminated Based on Poor Environmental Performance and/or Human Safety Concerns—3,000-ft Bridge and No Action alternatives

3,000-ft Bridge—Alternative 2

- Has a poor distribution of flows to ENP—55/45 (W to E)
- Provides much less flow volumes to ENP, compared to the 4-Mile Bridge alternative-666,000 ac-ft/per year, compared to 949,000.
- Provides only 61,000 ac-ft/per year of flows through WCA-3B to NESS, compared to 531,000 in alternatives 3 and 4.
- Provides only 11% of flows to NESS from WCA-3, compared to 56% in alternatives 3 and 4.
- Increases MFL violations in NESS and Mid-NESS from “1-in-12” years to “1-in-6” years for NESS and “1-in-7.2” years for Mid-NESS.
- Continued discontinuity in water levels above and below Tamiami Trail
- North-south connectivity is only 5.4% of the 10.7-mile project length.
- Wildlife mortality remains a concern with a reduction of only 84 individuals, or a 5.3% reduction.
- Increases flow velocity in 1649.3 acres, compared to only 437.5 for Alternative 3 and 165.7 for Alternative 4.
- Increases average velocity at the road by 0.027 ft/s over marsh velocity;
- Opportunity to reconnect only 2% of sloughs (1 small slough)
- Continued pattern of scour and deposition at culverts and/or weirs
- Continued lack of sediment flow and transport needed for ridge building (and tree island formation)
- Continued filling in of sloughs

- Slightly reduced risk of ridge and tree island peat burning fires in NESS and Rocky Glades
- Continued high water levels in southern WCA-3A, with large open water areas and reduced sawgrass ridge vegetation
- Slight reduction of sawgrass and wet prairie vegetation into sloughs in ENP and eastern WCA-3B
- Reduced but continued encroachment of sawgrass and wet prairie vegetation into sloughs
- Provides low level of improvement to aquatic fish communities
- Provides low reduction in the risk for invasion of exotic aquatic species
- Provides low improvement in conditions for wading bird foraging and nesting
- Provides low level of improvement for alligator nesting numbers and distribution
- Only minimally improves water quality conditions in ENP.

No Action—Alternative 1

- Has a poor distribution of flows to ENP—48/52 (W to E)
- Provides much less flow volumes to ENP, compared to the 4-Mile Bridge alternative-790,000 ac-ft/per year, compared to 949,000.
- Provides only 104,000 ac-ft/per year of flows through WCA-3B to NESS, compared to 531,000 in alternatives 3 and 4.
- Provides only 13% of flows to NESS from WCA-3, compared to 56% in Alternatives 3 and 4.
- Increases minimum flows and levels (MFL) violations in NESS and Mid-NESS from “1-in-12” years to “1-in-6” years for NESS and “1-in-7.2” years for Mid-NESS.
- Continued discontinuity in water levels above and below Tamiami Trail
- Wildlife mortality remains a concern with no reduction in mortalities.
- Flow velocities at the trail are not reduced.
- Opportunity to reconnect 0% of sloughs.
- Continued pattern of scour and deposition at culverts and/or weirs
- Continued lack of sediment flow and transport needed for ridge building (and tree island formation)
- Continued filling in of sloughs
- Slight reduced risk of ridge and tree island peat burning fires in NESS and Rocky Glades
- Continued high water levels in southern WCA-3A, with large open water areas and reduced sawgrass ridge vegetation
- Slight reduction of sawgrass and wet prairie vegetation into sloughs in ENP and eastern WCA-3B
- Reduced but continued encroachment of sawgrass and wet prairie vegetation into sloughs
- Provides low level of improvement to aquatic fish communities
- Provides low reduction in the risk for invasion of exotic aquatic species
- Provides low improvement in conditions for wading bird foraging and nesting
- Provides low level of improvement for alligator nesting numbers and distribution
- Only minimally improves water quality conditions in ENP.

NPS Recommendations for Implementation of the Recommended Plan

NPS Recommendations for Restoring Water Deliveries to ENP

The NPS goal is that structural changes to the Tamiami Trail will provide substantial improvements in the restoration of overland flows from WCA-3 to Everglades National Park, particularly to NESS. Without modifications to the road, it will not be physically possible to move significant quantities of water into the historical flow-way without resulting in water levels that the Florida Department of Transportation has documented as damaging to the road. The NPS recommendation is that the structural changes ensure that water deliveries to ENP mimic historic flow distributions by providing at least 55% of total overland flows to NESS from WCA-3B (the NPS goal is 70%, historic flow percent to NESS). In addition, the NPS recommends the use of passive weirs in L-67A and L-29 in combination with a 4-Mile Bridge (and parallel levee along L-29 removed) to provide a significant increase in overland flow volumes from WCA-3A through WCA-3B to NESS. These volumes should be substantial enough to restore historic water depths and hydroperiods in ENP, restore ridge and slough processes, restore vegetative communities, and substantially improve fish and wildlife resources. A CERP-level flow volume of 920,000 ac-ft/per year from WCA-3A to WCA-3B and then to NESS is needed to substantially improve hydrological and ecological conditions in ENP.

NPS Recommendations for Location of the 4-Mile Bridge

The NPS recommends that the 4-Mile Bridge be located along the Tamiami Trail corridor based on the following siting criteria:

1. Enhance ecological connectivity
2. Facilitate hydraulic passage of flows
3. Avoid or minimize adverse effects on state and federally listed species
4. Minimize wildlife mortality
5. Maintain CERP compatibility, and
6. Reduce seepage losses east of L-30 and L-31N

1. <u>Enhance ecological connectivity</u>

   A 4-Mile Bridge location in a west-central location of the Tamiami Trail provides more ecological benefits than an eastern location. These benefits include greater reconnection between historic ridge and slough habitats between WCA-3B and NESS, as the eastern area of WCA-3B and NESS has undergone significant subsidence and loss of historic ridge and slough flow patterns. In addition, since the west-central location is less degraded, i.e., maintains the corrugated features associated with a ridge and slough system (Figure ES.3), these locations will be more effective in restoring sediment flow and transport needed for ridge and slough building, reverse filling in of sloughs, restore more vegetative communities, and improve fish and wildlife resources.

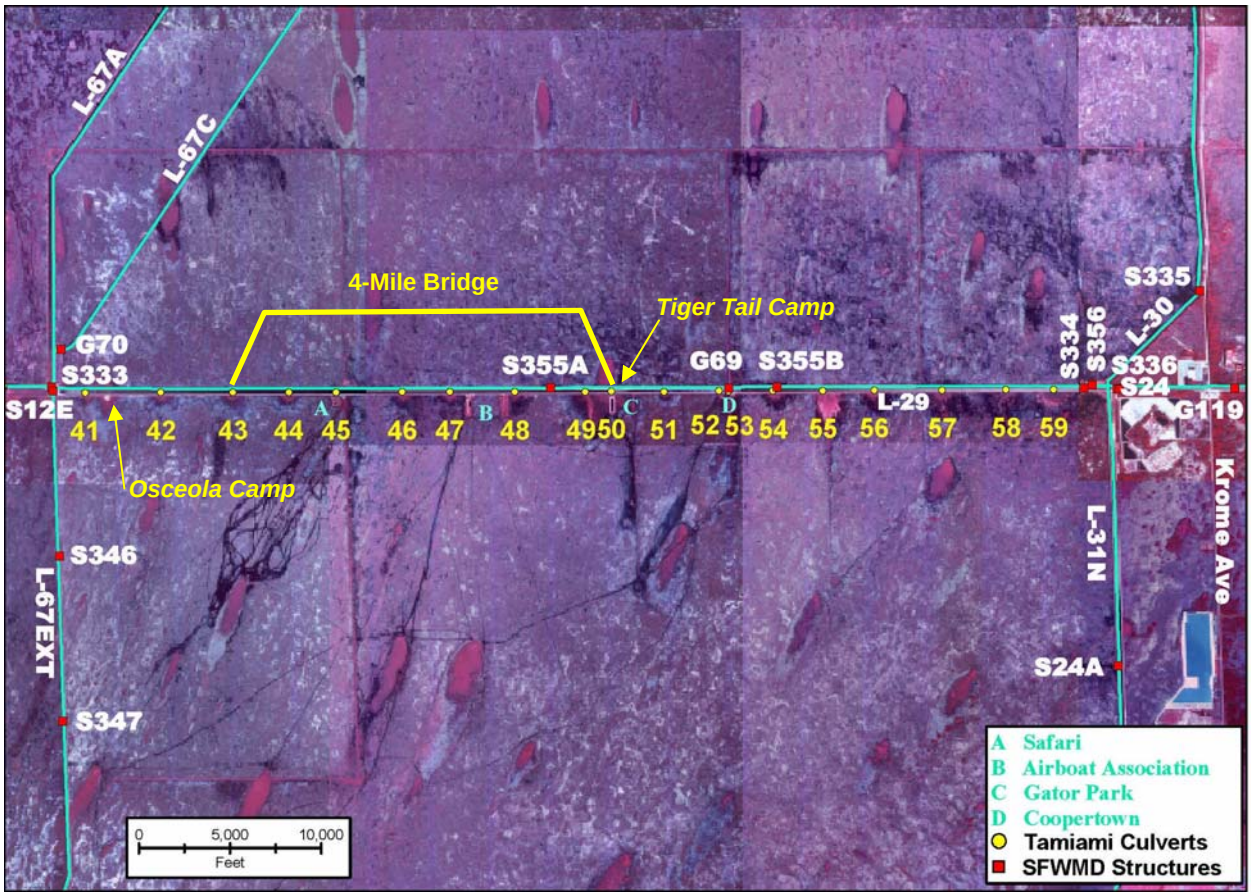

Figure ES.3. Proposed location of the 4-Mile Bridge alternative.

2. Facilitate Hydraulic Passage of Flows

As evidenced in Table ES.1, the majority of historic flows (51%) passed through culverts 43-50 in the west-central location of the trail; whereas, only 37% passed through the culverts 51-59 on the eastern end of the trail (Table ES.1). This is because the land elevation is lowest in this area and there is still evidence of slough corrugation, allowing some flows even during the dry seasons. Obviously, the reason the airboat enterprises are located more in the west-central location is due to the fact that there are flows through this area, even during the dry season (Figure ES.3). The NPS recommends that the 4-Mile Bridge be located to optimize the hydrological and ecological benefits of this historic flow path. Moreover, the Corps completed a Value Engineering Study in 2001 that evaluated conveyance and seepage features for the MWD project. In this VE report, the Corps recommends passive weirs for the L-67A canal, filling in of the L-67C canal, and the addition of three passive weirs in the L-29 canal to facilitate the passage of flows to NESS. The Corps recommends that two of the weirs be located to the west of S-355A and B in a west-central location of L-29—similar to that proposed by NPS for the 4-Mile Bridge alternative. The other weir would be located to the east of the S-355s. This recommendation by the Corps is consistent with the NPS recommendation designed to maximize flows through WCA-3B to NESS.

Table ES.1. Average Seasonal Culvert Flow for a dry-average and wet year

	Average Seasonal Flow (cfs)	
Year	**Culverts 43-50**	**Culverts 51-59**
Dry-Average Year		
1943 Wet Season	47.19	11.41
1943 Dry Season	30.3	13.23
Wet Year		
1947 Wet Season	555.85	331.9
1947 Dry Season	576.02	508.25

3. Avoid or Minimize Adverse Effects on State and Federally Listed Species

   The U.S. FWS has identified the potential eastern location as having potential impacts to a colony of wood stork (*Mycteria Americana*) in that area. Based on this information, a more western location would be preferable due to concern for this endangered species.

4. Minimize Wildlife Mortality

   There is no significant difference in the performance of different bridge locations in meeting the siting criterion of meeting wildlife mortality.

5. Maintain CERP Compatibility

   The west-central location would be more consistent with future CERP objectives compared to the proposed eastern location, as these sites would be more effective in reconnecting historic sloughs between WCA-3B and NESS. The reconnection of these historic sloughs will allow for the increase in flow volumes to NESS associated with future CERP objectives without the increased seepage problems associated with a bridge on the eastern side of the trail.

6. Reduce Seepage Losses east of L-30 and L-31N

   Aquifer properties vary along Tamiami Trail and as a result hydraulic control structures breaching the L-29 levee may have different influences on surface waters, depending on where they are located. In highly transmissive areas, surface waters will only minimally converge towards a breach, since they easily pass under the levee. The most transmissive area of Tamiami Trail is along its eastern-most section where L-30 and L-31N meet. This high transmissivity means increased flow volumes from WCA-3B to NESS may be compromised by similar increases in seepage to the east. Flow convergence may be much greater to the west, since the levee is a more significant barrier, therefore, a larger fraction of surface waters will flow through a western breach than an eastern one. Because of this change in aquifer transmissivity, a 4-mile bridge in the western part of WCA-3B will influence the hydrologic balance over a wider extent than the same bridge in the eastern part.

The NPS has determined that a west-central location of the 4-Mile Bridge starting just west of the Tiger Tail Camp would provide the most ecological and hydrological benefits to WCA-3 and ENP

(Figure ES.3). It would restore or enhance hydrological and ecological conditions in WCA-3 and ENP, facilitate the hydraulic passage of flows between WCA-3B and NESS, avoid impacts to threatened and endangered species, be most compatible with future CERP objectives, and would avoid complications associated with seepage issues to the east of the park. This location would also allow for restoration of flows into areas that are deeper on either side of the trail so that flow volumes will be maximized. Allowing for increased flow volumes from WCA-3 to NESS will reduce the flows through WCA-3A, reducing damaging high water levels in WCA-3A and reducing impacts to the CSSS.

This goal is most attainable for the section of the ridge and slough landscape south of Tamiami Trail, east of S-333 and west of S-355A (Figure ES.3). This is the section of ridge and slough landscape in NESS that is least degraded and therefore most feasible to restore. 100% restoration of this section would require water depths greater than 2 ft for 80-100% of the time in the sloughs and less than 25% of the time on the ridges. Flow velocities should be maximized in the sloughs over large reaches. Reconnection of this flow section would provide for reconnection of approximately 40% of the historic slough habitats between WCA-3B and NESS, and, given the proper upstream conditions, could provide the flow patterns required to restore the ecological functions that are supported by the ridge and slough landscape in this region of the Everglades.

Segmentation of the 4-Mile Bridge

From an ecological perspective, the more segments in the bridge, the greater the loss of ecological connectivity between WCA-3B and NESS. From a hydrologic perspective, multi-bridge locations could optimize the hydraulic connectivity between WCA-3B and NESS, if the bridge spans could be strategically placed to straddle the major sloughs. In evaluating these options, the NPS has determined that a single 4-mile bridge span between the Tiger Tail Camp and the Osceola Camp (Figure ES.3) would provide the greatest ecological and hydrological benefits, while reducing costs associated with providing access to establishments along U.S. 41.

NPS Conclusions

The NPS recommends implementation of the 4-Mile Bridge Alternative based on its performance in providing substantial ecological and hydrological improvements in a cost-effective manner. The alternative exhibiting the best performance for the environmental objectives, the 10.7-Mile Bridge Alternative (Environmentally Preferred Alternative) has a construction cost of approximately 230 million dollars. This level of funding exceeds the current amount available from the NPS. It is the opinion of the NPS that any alternative exceeding the current level of funding is beyond the capability of the NPS and should be eliminated from further consideration.

Should additional funding be made available from other sources, NPS reserves the option to amend this position in order to support the 10.7-Mile Bridge alternative that exhibited superior performance for the environmental objectives.

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Table of Contents

Acronyms

Biological Opinion	BO
Cape Sable Seaside Sparrow	CSSS
Central and Southern Florida Project	C&SF
Combined Structural and Operations Plan	CSOP
Comprehensive Everglades Restoration Plan	CERP
Department of Environmental Resource Management	DERM
Department of Environmental Protection	DEP
Department of the Interior	DOI
Design High Water	DHW
Environmental Impact Statement	EIS
Endangered Species Act	ESA
Everglades National Park	ENP
Everglades Rain Driven Operations	ERDO
Fish and Wildlife Coordination Act Report	FWCAR
Florida Department of Environmental Protection	FDEP
Florida Department of Transportation	FDOT
Functional Units	FU
General Design Memorandum	GDM
General Reevaluation Report	GRR
Interim Operational Plan	IOP
Minimum Flow Level	MFL
Modified Water Deliveries	MWD
National Environmental Policy Act	NEPA
National Geodetic Vertical Datum	NGVD
National Park Service	NPS
Natural Systems Model	NSM
Northeast Shark Slough	NESS
Operations & Maintenance	O&M
Outstanding Florida Waters	OFW
Performance Measures	PMs
Project Delivery Team	PDT
Record of Decision	ROD
Resource Management Assessment	RMA
Revised General Reevaluation Report	RGRR
South Florida Water Management District	SFWMD
South Florida Water Management Model	SFWMM
Summary of Findings	SOF
Supplemental Environmental Impact Statement	SEIS
U.S. Army Corps of engineers	CORPS
U.S. Fish and Wildlife Service	FWS
Value Engineering	VE
Water Conservation Area	WCA
Water Resources Development Act	WRDA

1. Purpose of Report

At the request of the U.S. Army Corps of Engineers (Corps), the National Park Service (NPS) has reevaluated Tamiami Trail structural components of the Modified Water Deliveries (MWD) to Everglades National Park (ENP) Project. NPS has prepared this report in support of the Corps Revised General Reevaluation Report (RGRR) and Supplemental Environmental Impact Statement (SEIS). Subsequent to the completion of the 1992 MWD General Design Memorandum (GDM) and Congressional approval of the Comprehensive Everglades Restoration Plan (CERP) in 2000, additional scientific and engineering investigations associated with the CERP led to revisions in ecosystem restoration and highway design requirements. These revisions have resulted in the need to reevaluate the MWD Project components for consistency with the revised ecosystem restoration targets and highway design specifications. This report incorporates expansive and in-depth scientific analyses of four alternatives—10.7-Mile Bridge, 4-Mile Bridge, 3,000-ft. Bridge, and No Action (no bridge)—to determine the comparative benefits of each in meeting the hydrologic and ecological restoration objectives of the Tamiami Trail component of the Modified Water Deliveries to Everglades National Park Project. The analyses in this report focus on two penultimate questions pertaining to the Tamiami Trail and its relationship with restoration of water flows and ecological conditions in ENP. First, what is the effect of high water levels on the north side of Tamiami Trail in the L-29 Canal (constrained v. unconstrained canal levels)? Second, what is the effect of bridge length on hydrologic and ecological connectivity?

As part of the project formulation process for the Combined Structural and Operations Plan (CSOP) for the combined MWD and C-111 projects, the CSOP Project Delivery Team (PDT) is working to refine alternative structural and operational plans to optimize MWD and C-111 project benefits. The CSOP PDT agreed that alternative evaluation would begin with the comparison of two alternative models: one designed to maximize environmental benefits, while at least meeting other authorized objectives (4-Mile Bridge/Environmental alternative) and one designed to maximize other authorized project objectives, while meeting the minimum environmental objectives (3,000-ft Bridge/non-Environmental alternative). These two alternatives are included within the set of alternatives analyzed in this report. The Environmental Alternative with a 4-mile bridge is similar to an alternative in the Tamiami Trail General Reevaluation Report (GRR)/Supplemental Environmental Impact Statement (SEIS); however, there is no constraint on water levels in the L-29 canal. The Non-Environmental Alternative is similar to the 3,000-ft Bridge alternative in the Tamiami Trail GRR/SEIS with an L-29 design high water (DHW) level constraint of 9.3 ft. The No Action base planning condition (9.0 ft DHW level L-29 constraint) is the baseline from which restoration benefits are measured against and is included in this evaluation. Although the No Action Alternative has a 9.0 ft. L-29 constraint, the Florida Department of Transportation insists that current operations should not allow water levels to exceed 7.5 ft. in the L-29 Canal, as this will cause degradation of the roadbed and create a safety hazard for passengers in motorized vehicles. The 10.7-Mile Bridge, the environmentally preferred alternative in the GRR, is also included in this evaluation. It is assumed that many of the flow characteristics of this alternative would be similar to the 4-Mile Bridge alternative. This report uses updated hydrological modeling in conjunction with updated Performance Measures (PMs) and in-depth ecological evaluations to provide more detailed analyses of the following four alternatives to the Tamiami Trail project features: (1) No Action (9.0/7.5 ft L-29 constraint), (2) 3,000 ft bridge (9.3 ft L-29 constraint), and (3) 4 mile bridge (no L-29 constraint), and (4) 10.7 mile bridge (no L-29 constraint).

Section 1 of this report describes the purpose of this report, including an explanation of the alternatives that will be evaluated and their attributes. Section 2 describes the purposes and objectives of the MWD project. Section 3 describes the purpose and objectives of the Tamiami Trail component of the MWD Project. Contained within this section is an explanation of all authorizing documents, a general

description of the original 1992 design, and responsibilities for and decisions made by each of the agencies having a role in project development and implementation. Section 4 identifies NPS restoration expectations based on the most recent Resource Management Assessment (RMA)-2, SEDFLOW, and South Florida Water Management District (SFWMD) model version 5.4 outputs in conjunction with the most up-to-date ecological research in this region of the Everglades. Section 5 provides descriptions and graphical representations of the four alternatives evaluated in the report. Section 6 includes the hydrological and ecological analyses of the four alternatives. Contained within this portion of the document are graphs and tables representing PMs used to compare alternatives. Section 7 contains NPS conclusions and recommendations.

2. Purpose of Modified Water Deliveries Project

Following severe ecological impacts in ENP from droughts in the early 1960's, Congress passed the River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act of 1970 (PL 91-282), which established a Minimum Water Delivery to ENP. The delivery schedule called for an allocation of 260,000 acre-feet annually from Water Conservation Area (WCA)-3A via the S-12 structures into Shark Slough to ENP in accordance with a monthly schedule based on water stages in WCA-3A. While the Minimum Delivery Schedule did serve the intended purpose of providing drought protection to ENP, it became apparent during wet years that this method of water deliveries to ENP was both unnatural and oftentimes damaging to ENP resources. Excessive amounts of water were still released during flood conditions and the minimum deliveries quantities were insufficient in meeting ENP needs during low water conditions.

As a result of continued damage to ENP resources, the Supplemental Appropriations Act of 1984 (Public Law 98-181) authorized the Secretary of the Army to conduct an experimental program for delivering water to ENP to protect and enhance the unique natural resources of the park. This authorization permitted modification to the schedule of water deliveries from the Central and Southern Florida (C&SF) Project to ENP. However, direct compliance with the language and intent of PL 98-181 was not possible within the timeframe mandated by the Act.

The authorization to continue the experimental water deliveries program was subsequently extended by Congress for several years. A General Plan was prepared to develop a strategy for implementation of the authorization and was approved by the Assistant Secretary of the Army (Civil Works) in 1985. The General Plan recommended the preparation of a General Design Memorandum (GDM) and Environmental Impact Statement (EIS), addressing a modified water deliveries plan necessary to improve water deliveries to ENP.

On 13 December 1989, the ENP Park Protection and Expansion Act became law (P. L. 101–229). This Act added Northeast Shark Slough (NESS) to ENP. It also authorized the Secretary of the Army, in consultation with the Secretary of the Interior, to design and construct modifications to the C&SF Project. The purpose of these modifications was to 1) improve delivery of water into ENP and, 2) to the extent practicable, restore the natural hydrologic conditions within ENP. The Secretary of the Army was to base the modifications upon the findings of the Secretary of the Army's experimental program for delivering water to ENP, which Congress originally had authorized in 1983 (P. L. 98–181). This Act directed the Secretary of the Army to set forth the proposed modifications to the C&SF Project in a GDM entitled "Modified Water Deliveries to Everglades National Park."

3. Tamiami Trail Project

3.1. Background

Tamiami Trail (U.S. Highway 41) lies in the area of the eastern Everglades and is located in southwest Miami-Dade County. The project area (Figure 3.1) includes approximately 11 miles of the eastern portion of U.S. 41 between the S-334 structure on the east and the S-333 structure on the west. U.S. 41 is directly proximal to the L-29 canal and levee to the north and ENP to the south.

The study area, historically a mosaic of sawgrass prairies and emergent marshes interspersed with tree islands, lies at the headwaters of NESS. ENP lands within the study area to the south of Tamiami Trail are natural areas consisting of sawgrass prairie interspersed with hardwood hammock tree islands. Immediately to the north of Tamiami Trail lies WCA-3B, a similar habitat as in NESS. Except for levees surrounding WCA-3B and several north-south ditches excavated in its interior by agricultural interests in the early 1900's, the area is undeveloped and is managed by the Florida Fish and Wildlife Commission as a Wildlife Management Area.

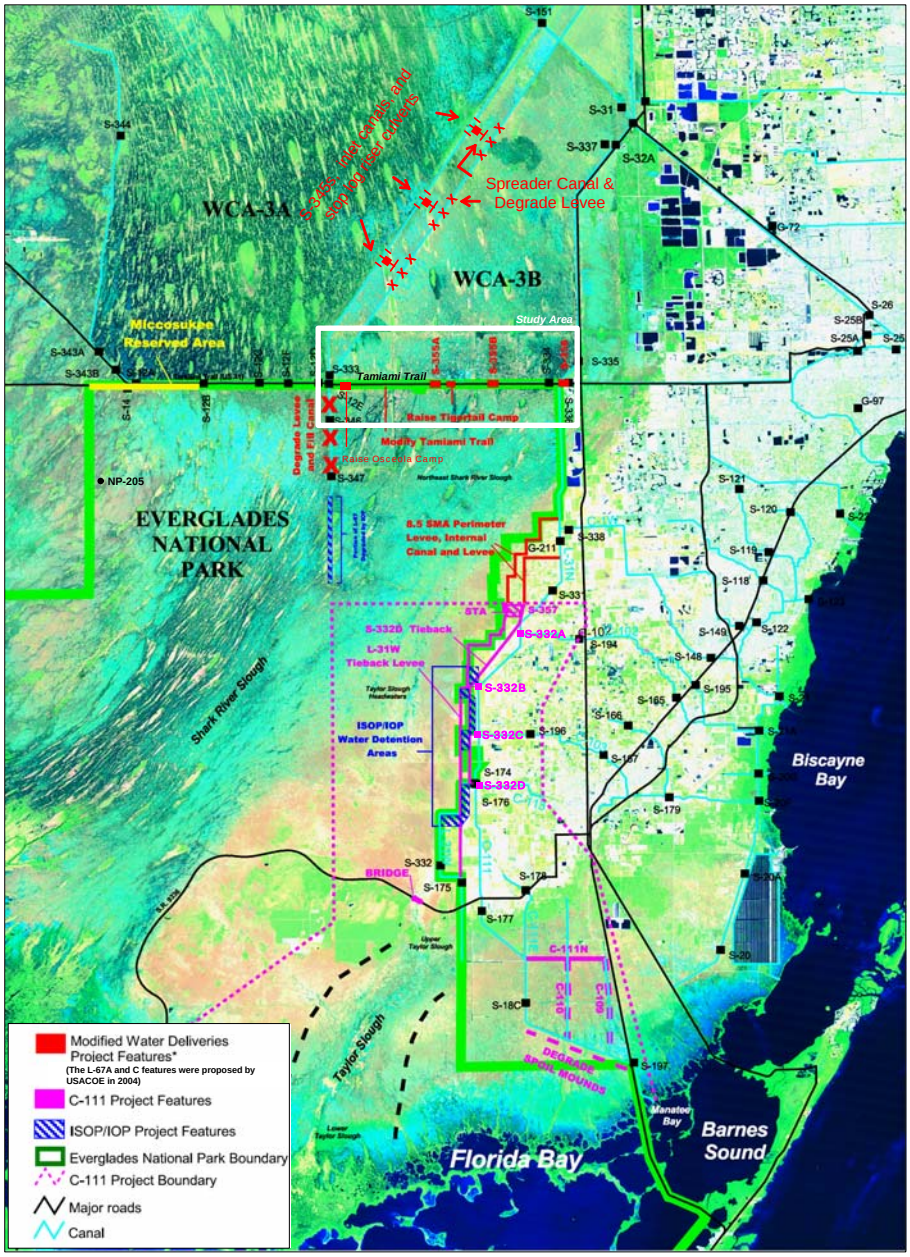


Figure 3.1. Feature map and project area.

Prior to the construction of the C&SF features, water deliveries to Shark Slough occurred through unimpeded sheet flow and 70% of the water deliveries were made to NESS. Following the completion of project features, much of the water was directed to western Shark Slough and the percent discharge to NESS dropped to 25%. This reduction in flows to NESS has had adverse impacts on many ecological aspects of both WCA-3B and NESS, including loss of peat-forming, open water slough habitats, increase in damaging fires with subsequent loss of soils (subsidence) in many areas, increase in exotics, and reduction in populations of fish and invertebrates, as well as wading birds.

3.1.1. Need for Revisions to the Tamiami Trail Component of the 1992 GDM

The Tamiami Trail provides a vital transportation link from Miami-Dade County west to Monroe County and Collier County, Florida. The existing link is important for both commerce and emergency evacuations (e.g., hurricane evacuation). The existing roadway of Tamiami Trail is subject to high traffic loads as well as periodic high water events. Under the 1992 GDM, increased flows from WCA-3B to NESS were assumed to pass through the existing culverts beneath the road and only a small portion of the main roadway along Tamiami Trail was identified for elevation. However, the 1992 GDM also identified modifications to Tamiami Trail as necessary for raising the water stages in the L-29 canal.

The NPS examined projected water level increases that would occur in the L-29 canal under a range of flow events, reviewing measured water levels for the L-29 canal that has been recorded along the Northeast Shark Slough flow section beginning in October 1939. The NPS used this historical water level data along with modeled data provided by the Corps to evaluate the range of possible water levels that would result from implementing the future restoration projects. Figure 3.2 is a frequency analysis of water levels in the L-29 canal that compares historic water levels (stages) with the predicted stages after CERP implementation (D13R simulation, in blue). The historic data has been broken into two time periods to reflect the conditions before (in red) and after (in green) the closure of the WCAs in 1963. The return frequency on the X-axis equates to the return interval for specific events (i.e. 2 indicates a "1-in-2" year event, 10 indicates a "1-in-10" year event, etc.), with wet years occurring on the left side of the graph, and dry years occurring on the right side. If we use the 1-in-2 year event as an example, the post-WCA period (1963 –1996) shows that average L-29 canal stages are maintained at approximately 7.5 ft. In contrast, the pre-WCA period (1940-1963) had average L-29 canal stages approximately 0.5 ft higher, and the CERP plan (D13R simulation, in blue), would predict average stages that are approximately 0.8 ft higher than post-WCA historic conditions.

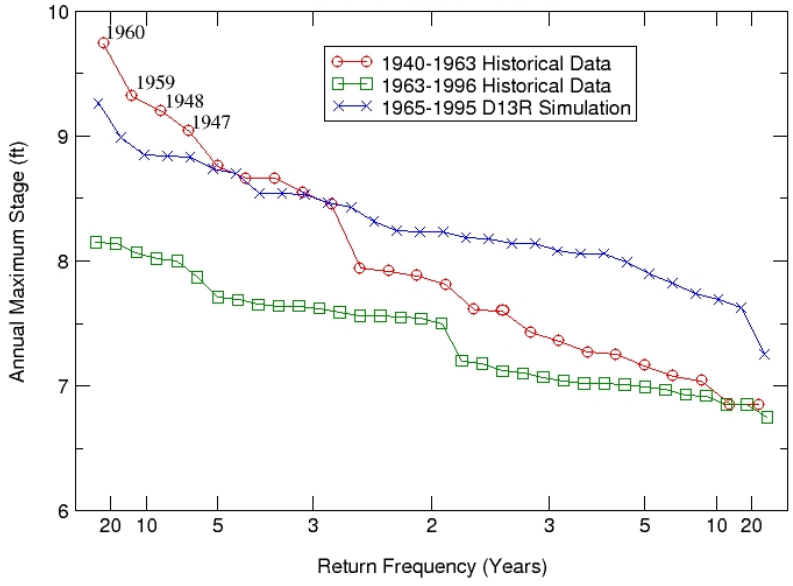


Figure 3.2. Frequency analysis of annual peak stages (water levels) in the L-29 canal adjacent to Northeast Shark Slough.

The important part of the graph for Tamiami Trail design purposes is the higher water level events that are represented on the left side of the graph. Since the WCA's were compartmentalized in 1963, water levels in the L-29 canal have been effectively controlled at approximately 7.5 ft (or just over 8.0 ft in wet years).

This control of L-29 water level greatly limits flows into NESS, because higher L-29 stages are needed to push water into the downstream marshes. If the L-29 constraint is 9.3 ft, which is the design high water (DHW) that Tamiami Trail would be constructed to in the 3,000-ft. bridge alternative, the historic water level data shows that this 9.3 ft limit is still a significant constraint, since a number of high flow events exceeded this stage in the pre-WCA period (1959, 1960). The frequency analysis indicates that the 9.3 ft constraint would limit peak water levels to the equivalent of approximately a 1-in-10 year event (based on the pre-WCA period), which is a relatively common event for the south Florida area. In contrast, FDOT would normally design a two-lane primary road to accommodate a "1-in-50" or even a "1-in-100" year event, which would call for a substantial increase in the elevation of Tamiami Trail, if the L-29 canal stages were not controlled (FDOT correspondence March, 2004).

We can also determine the appropriate peak stage for designing the road elevation of Tamiami Trail by examining two additional finer-scale modeling simulations included in the 2003 GRR/SEIS for Tamiami Trail. In the first case, the Corps used the MODBRANCH model to simulate the CERP D13R alternative, and the predicted "1-in-10" year stage in the L-29 canal was estimated at 9.55 ft. In the second case the Corps used the RMA-2 model with a simulated flow rate of 5,500 cubic feet per second (CFS) (equal to approximately a 1-in-15 year flood event), and the predicted stage was 9.58 ft. By comparison, the above graphic shows that the annual peak stage of 9.74 ft in 1960 is approximately equivalent to a "1-in-20" year event. Since the established goal for CERP is "to achieve unconstrained or passive flow between WCA-3A and 3B and NESS", the NPS is recommending an increase in the design high water to 9.7 feet (representing slightly over a "1-in-20" year event). This higher design stage should be acknowledged in our discussions as a representative target for our restoration goals for Tamiami Trail. This approach would represent a minimally constrained L-29 DHW that would achieve significant flow restoration benefits without over-designing the roadway. This increase of 0.5 ft in the DHW limit for the L-29 canal translates to an increase of an additional 0.5 feet in the roadway elevation for Tamiami Trail (raising the remainder of the roadway from 12.0 to 12.5 ft).

The direct benefits of increasing the Tamiami Trail design high water to 9.7 ft is the ability of future restoration projects to accommodate larger flow events, and thereby provide greater relief to the WCA's during flooding events, while passing larger flows to the Shark Slough marshes and downstream estuaries. Figure 3.3 shows the return frequency of annual peak flows into the NESS flow-section for the period prior to WCA compartmentalization (1940-1963, in red) and the annual flows predicted from CERP implementation (SFWMM D13R, in blue). The L-29 canal constraint of 9.3 ft has the effect of limiting inflows into Northeast Shark Slough to approximately 4000 cfs. This represents an annual peak flow of less than a "1-in-10" year event, based on the historic data from the pre-WCA period. Using a return interval of "1-in-20" years, a comparable flow target would translate to approximately 6,200 cfs, which would represent a minimally constrained restoration goal.

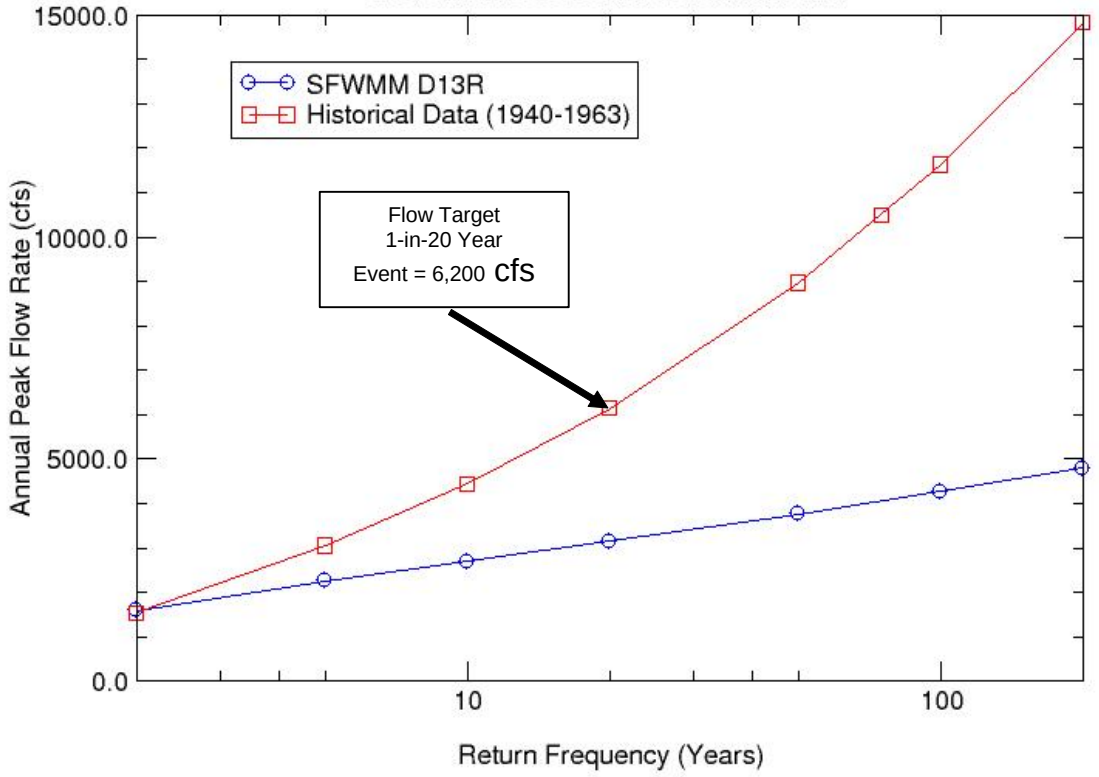


Figure 3.3. Frequency analysis of annual peak flows for the Northeast Shark Slough flow-section.

When Alternative 7A (3,000-ft bridge with 9.3 DHW constraint) was selected as the recommended plan for the implementation in the GRR/SEIS, the Corps also recognized the need for consistency with the modifications to Tamiami Trail that were proposed under the WCA-3 Decompartmentalization Phase I project within CERP. Therefore, the draft 2003 GRR/SEIS for the Tamiami Trail component of the MWD project specified the construction of the 3000-ft. Bridge only, and not the elevation of the roadway. In lieu of raising the remainder of the road alignment, as specified in Alternative 7A, the Corps recommended an alternative mechanism involving the transfer of funds to the Florida Department of Transportation (FDOT) in an amount equivalent to construction costs for elevating the remainder of the roadway. These funds would be provided to FDOT through a real estate agreement, and used at the discretion of FDOT, to mitigate for any roadway damage during peak design flows until the WCA-3 Decompartmentalization features in CERP were identified and constructed (2003 GRR/SEIS).

When FDOT commented on the draft GRR/SEIS in March 2004, the agency stated they could not accept the legal responsibility associated with this alternative mechanism proposed by the Corps as this would constitute a transfer of responsibility (liability) for the Tamiami Trail, as modified by the GRR/SEIS. As a result of this opinion, the Corps was required, as part of the MWD project, to elevate the remaining portions of the roadway not modified by the 3000-ft. Bridge as specified in Alternative 7A. Furthermore, FDOT restated their Agency's position that required the finished elevation of the roadway to be built to 12 feet, or 0.5 feet higher than the elevation specified in Alternative 7A. Based on these requirements, the Corps modified the design of Alternative 7A to include the raising of the full roadway elevation to 12 feet. This modification to the design of the Tamiami Trail component of the MWD project resulted in an increase in cost of more than $34 million (the 2003 GRR/SEIS revised estimate was $20.2 million, while the revised estimate following the FDOT requirements was $54.5 million).

The March 2004 FDOT letter also reiterated their position regarding FDOT design standards related to the 9.3 ft DHW for Alternative 7A. FDOT emphasized that the water levels resulting from the implementation of the MWD project must be operated below the 9.3 ft DHW elevation and could only be exceeded for a duration of less than 24 hours during a heavy rainfall event. Since the Corps had assumed that the water level in the L-29 canal could equal or even exceed the 9.3 ft DHW more often than the FDOT requirements, modifications had to be made to the conveyance features of the MWD project to accommodate this new constraint. Based on the position of FDOT, the Corps modified the structural design for the features that would convey water from WCA-3A into WCA-3B. The Corps proposed replacing the more passive, weir-type structures originally considered with gated culverts. These structural features would provide the necessary control of water levels in order to provide the assurance that the DHW criteria of 9.3 ft would not be exceeded for a duration of more than 24 hours as required by FDOT regulations. The NPS raised concerns that this more stringent constraint on water levels in the L-29 canal could jeopardize the restoration performance of the MWD project.

As additional scientific and engineering data have become available and incorporated into hydrologic models, it has been recognized that the original plan is not the most optimal solution for providing the increased conveyance capacity and connectivity required to meet the goals and objectives of the MWD Project. Based on the MWD Project's proposed modifications to the upstream conveyance features within the WCA-3 as well as the increased conveyance requirements associated with CERP implementation, the quantity of water ultimately discharged under Tamiami Trail will be increased substantially over the quantities originally anticipated in 1992. Additionally, these increased flows required for restoration of NESS specifically, and ENP in general, will result in higher water levels in the Tamiami Canal (L-29), immediately north of the roadway. The resulting high-water condition will periodically saturate the roadway sub-base and under extreme conditions may overtop the roadway in some locations. FDOT has advised the Corps that the roadway sub-base clearance should be two feet above the Design High Water (DHW) level of 9.7 ft. as a minimum to prevent damages to the road surface.

The objective of the 2003 GRR/SEIS for Tamiami Trail was to identify a technical solution for the modification of the roadway compatible with the expected hydraulic conveyance of CERP and the ENP Protection and Expansion Act of 1989. Components of CERP were designed with the assumption that the features to be constructed under MWD authority would be in place prior to the start of CERP-related construction. An investment in the MWD project ensures that the features that are a precursor to CERP are constructed and operated in a manner that allows the CERP program to improve the health of the south Florida ecosystem, improve water quality, enhance water supply, and otherwise achieve and maintain the benefits to the natural system and human environment described in the CERP plan.

3.1.2. Need for Changes to Conveyance Features between Water Conservation Area 3A, Water Conservation Area 3B and Northeast Shark Slough and Seepage Control

Significant progress, subsequent to the completion of the 1992 GDM, has been made in the collection and analysis of additional hydrological and biological data from Everglades' research resulting in more effective scientific modeling and analysis. New information regarding shifts in vegetation composition and dominance, hydropatterns, the importance of flow and connectivity, and transportation and assimilation of nutrients in south Florida ecosystems has been obtained. These scientific and engineering advancements have allowed for a greater understanding of the restoration requirements of the ecosystem and have also necessitated the need for the reevaluation of the structural and operational features of existing projects such as the MWD Project. Initially, the structures identified in the 1992 GDM for restoring the hydrologic connection between WCA-3A, WCA-3B, and NESS were reanalyzed through detailed hydrologic modeling that occurred in an inter-agency evaluation process over an approximately

one-year period during 1999 and 2000. As a result of this process, the Corps completed a Value Engineering (VE) Study in January 2001 that recommended replacing the original 1992 design conveyance features in the L-67A levee (S-345s and S-349s) and constructing three additional weirs in the L-29 levee to augment the flow of the existing L-29 conveyance structures, S-355A and S-355B. The VE Study also recommended eliminating the L-67C canal and levee. No final plan for the conveyance and seepage control features of the project has been identified. The Corps is currently reexamining these features in the context of potential revised modifications to Tamiami trail as part of the CSOP EIS.

3.2. Tamiami Trail Project Goals and Objectives

The overall goal of the Tamiami Trail Project is to identify modifications to the existing roadway that will allow for the restoration of more natural conditions in adjacent marshes in a manner compatible with the restoration requirements of the 1989 ENP Protection and Expansion Act. It is also desirable to ensure compatibility with ongoing restoration projects, such as the C–111 Project and future components of the CERP. Recognizing this overall goal, several objectives have been identified for the Tamiami Trail Project.

DOI, in conjunction with the Corps and other agencies and stakeholders developed objectives for the Tamiami Trail Project. An alternative must meet a specified level of performance for these objectives in order to be consistent with existing, relevant legal authorities. The required project objectives, and other desirable project outcomes, are described below:

3.2.1. Project Objectives

- Ensure no adverse effects to federally-listed endangered or threatened species consistent with the Endanger Species Act (ESA).
- Meet the Reasonable and Prudent Alternative requirements for the endangered Cape Sable Seaside Sparrow (CSSS) as specified in the U.S. Fish and Wildlife Service (FWS) Biological Opinion (BO) of 2/99.
- Ensure no adverse effects to state listed endangered or threatened species consistent with State statutes.
- Allow for restoration consistent with the 1989 ENP Protection and Expansion Act.
- Meet all FDOT requirements.
- Consult with FDOT
- Provide water quality treatment needed for FDEP water quality certification.
- Consult with FDEP
- Meet Outstanding Florida Water (OFW) water quality standards
- Meet Miami-Dade County Department of Environmental Resource Management (DERM) Water Quality Design Criteria
- Ensure no reduction in authorized flood control benefits

3.2.2. Other Objectives (Desirable outcomes from project implementation)

- Increase wetland Functional Units (FUs)
- Increase linear footage of North/South Connectivity
- Increase linear footage of animal under crossings (both aquatic and terrestrial)
- Increase acres of exotic vegetation removed
- Maximize compatibility with future CERP actions.
- Increase linear footage of levees and canals incapable of CERP designated degradation

- Identify project features requiring retrofit
- Improve ability to accommodate additional capacity required by CERP project features not included in the current South Florida Water Management Model (SFWMM) D13R simulation
- Maximize consistency with other MWD project components.
- Minimize impacts associated with construction.
- Minimize duration of construction
- Minimize coincidence of construction and nesting season
- Decrease turbidity
- Minimize adverse socio-economic impacts
- Minimize impacts to recreational facilities
- Identify costs associated with alternatives
- Minimize permanent loss of wetlands
- Minimize acres of wetlands lost

3.3. Agency Responsibilities

3.3.1. Corps of Engineers' Responsibilities and Decisions for Identification of Alternative Design

As described above, the 1989 ENP Protection and Expansion Act authorized and directed the Corps (through the Secretary of the Army) to design and construct modifications to the C&SF Project. The purpose of the modifications is to improve the delivery of water into ENP and, to the extent practicable, take steps to restore ENP natural hydrological conditions. In order to meet the requirements of the 1989 Act, the Corps has determined that modifications must now be made to the Tamiami Trail to ensure that the components of the MWD Project can be operated in a manner that is consistent with the MWD project purpose.

Before the Corps can implement any proposed modifications to the C&SF Project, those modifications must be evaluated and disclosed under the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.). Due to its responsibilities for designing and constructing modifications to the C&SF Project, the Corps has assumed the role of lead agency for the analysis of proposed modifications to the Tamiami Trail under the NEPA. In this role, the Corps determined the proposed modifications potentially would have a significant effect on the human environment and the NEPA analysis would have to be documented in a SEIS.

As the lead agency, the Corps has the ultimate responsibility for the content of the SEIS. However, the SEIS is supposed to use the environmental analyses and recommendations of cooperating agencies with jurisdiction by law or special expertise to the maximum extent possible, consistent with the Corps own responsibilities as lead agency (Section 1501.6(a)(2)). If the lead agency leaves out a significant issue or ignores the advice and expertise of a cooperating agency, the EIS may be found later to be inadequate (CEQ 1981). This report contains some of the results of the FWS and ENP primary environmental analyses and recommendations regarding hydrological and ecological effects of the alternatives on ENP and fish and wildlife resources in the study area.

As discussed previously, the Corps released a GDM, Final EIS, and Record of Decision (ROD) on the MWD Project in 1992. Since the project was authorized in 1989 and the design approved in 1992, various concerns about the discharge capacity and elevation of the Tamiami Trail have arisen necessitating reconsideration of the Tamiami Trail component of the MWD Project. Much of the concern with the 1992 GDM design stemmed from new information resulting from the extensive hydrologic modeling

done in conjunction with the development of the conceptual plan for the CERP. This regional-based modeling enabled a more accurate characterization of the restoration requirements of the ecosystem.

Upon completion of a revised supplemental NEPA analysis, the Corps will issue a ROD after full consideration of all viewpoints. The ROD will identify the alternative selected by the Corps for implementation.

3.3.2. Department of the Interior Responsibilities

Authority for the involvement of the DOI in the SEIS originates from various laws, agreements, and regulations. Each of these laws, agreements, and regulations are described below.

3.3.2.1. 1989 ENP Protection and Expansion Act and Interagency Agreement for Project Implementation

The 1989 ENP Protection and Expansion Act authorized the Secretary of the Army, in consultation with the Secretary of the Interior, to design and construct modifications to the C&SF Project. Consultation with the Secretary of Interior is needed because the specific purpose of the MWD Project is to benefit ENP ecological resources, including federally listed threatened and endangered species. Since the MWD Project is dependent on the Tamiami Trail Project to be completely functional, NPS is providing this report to represent our position and recommendations on the Tamiami Trail Project.

3.3.2.2. The Endangered Species Act

The ESA of 1973 (16 U.S.C. 1531 *et seq*.) specifically requires consultation and coordination between the Corps and the FWS. The ESA requires federal agencies to consult with the FWS and National Marine Fisheries Service regarding any effects that a federal action may have on federally listed threatened or endangered species or those proposed for listing as threatened or endangered. Section 7(a)(2) states that each federal agency shall, in consultation with the Secretary of the Interior, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a federally listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available (FWS 1998). This section of the ESA sets out the consultation process, which is further implemented by regulation (50 CFR §402).

The FWS has determined several species listed as threatened or endangered occur or potentially occur in the study area. They include the snail kite (*Rostrhamus sociabilis*), wood stork (*Mycteria americana*), Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Florida panther (*Felis concolor coryi*), and Eastern indigo snake (*Drymarchon corais couperi*).

3.3.2.3. Fish and Wildlife Coordination Act

The FWCAR mandates coordination with the Corps regarding fish and wildlife resources. The purpose of the FWCAR is to recognize the contribution of these resources to the nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that the conservation of fish and wildlife receives equal consideration and be coordinated with other features of water-resources development programs. The Secretary of the Interior, through the FWS, is authorized to assist and cooperate with federal, state and public or private agencies and organizations in the conservation and rehabilitation of fish and wildlife resources. The FWCAR provides that whenever the waters of any stream or other body of water are proposed to be impounded, diverted, the channel deepened or otherwise controlled or modified, the Corps shall consult with the FWS and the agency

administering the fish and wildlife resources of the state (Corps 1998). The consultation shall consider conservation of wildlife resources with the view of preventing loss of and damages to such resources as well as providing for development and improvement in connection with such water resources development (Corps 1998).

Any reports and recommendations of these fish and wildlife agencies shall be included in authorization documents for construction or for modification of projects. The Corps shall give full consideration to the reports and recommendations of these fish and wildlife agencies and include such justifiable means and measures for wildlife mitigation or enhancement as the Corps finds should be adopted to obtain maximum overall project benefits (Corps 1998). The NPS is also providing this report to the FWS to represent our position and recommendations for the Tamiami Trail Report.

4. National Park Service Goals

4.1. Introduction

NPS expects the authorized Tamiami Trail alternative will be consistent with ENP enabling legislation and ENP Strategic Plan, ENP Protection and Expansion Act of 1989 (and modifications to C&SF Project), and CERP. To this end, NPS expects that the Tamiami Trail alternative will allow for overland flows from WCA-3B to NESS at volumes, velocities, and distribution patterns necessary to substantially improve hydrological and ecological conditions in WCA-3 and ENP. Historically, the ridge and slough landscape encompassed much of what is now WCA-3A, WCA-3B and east and west Shark Slough, with the majority of the flows (70% or approximately 1.3 million ac-ft/per year) passing from WCA-3A, through WCA-3B to NESS. The construction of the L-67A and L-67C canals and levees as well as the Tamimai Trail levee and canal (L-29) eliminated this surface water connection, resulting in adverse impacts to WCA-3A, WCA-3B and NESS (historic ridge and slough landscape). Impounding WCA-3A and WCA-3B has also eliminated their historic connection to NESS, causing similar losses of tree islands and slough habitats in NESS. Adjacent land uses, drainage systems (canals and levees), and water management practices associated with these barriers to sheetflow have further exacerbated these impacts. It is the expectation of NPS that a Tamiami Trail alternative reconnecting WCA-3 to NESS will restore historic flow patterns between these areas, substantially reducing the deleterious effects of external stressors and restoring many of the natural wetland functions that have been lost or degraded. The justification for raising the Tamiami Trail roadbed and bridging the trail must be based on the scientific understanding that substantial overland flows from WCA-3B to NESS are required to restore the many ecological attributes of both WCA-3B and ENP.

4.2. Overarching Goals/Objectives of the National Park Service

ENP was authorized by Congress in 1934. A fundamental purpose for the park's establishment was provided in the enabling legislation: "The said area or areas shall be permanently reserved as a wilderness, and no development of the project or plan for the entertainment of visitors shall be undertaken which will interfere with the preservation intact of the unique flora and fauna and the essential primitive natural conditions now prevailing in this area." In order to fulfill this purpose, ENP has developed a “Strategic Plan” for protection and preservation of these resources as captured in the following bullets:

> *Everglades NP Goal I*: ENP is restored and protected in ways that allow natural processes, functions, cycles, and biota to be reestablished and maintained in perpetuity and with archeological and historical resources appropriately preserved.

> *Everglades NP Goal II*: Hydrological conditions within ENP and the south Florida ecosystem are characteristic of the natural ecosystem prior to Euro-American intervention, including water quality, quantity, distribution, and timing.
>
> *South Florida National Parks Goal I*: Natural and cultural resources and associated values within the South Florida national parks are protected, restored, and maintained in good condition and managed within the broad context of the south Florida ecosystem.

From the original 460,000 acres held at the time of the park's establishment in 1947, boundary changes expanded the park to 1.4 million acres by 1958. The ENP Protection and Expansion Act of 1989 added 109,506 acres to the East Everglades portion of the park, and brought the NESS within the park boundary. The addition of this major flow-way has provided the cornerstone to long-range planning objectives to restore more natural hydrologic conditions and revitalize wildlife habitat and ecosystem health. The act authorized modifications to the C&SF Project to achieve more natural timing, distribution and volumes of flows to the park through WCA-3A and WCA-3B, and included flood protection provisions for adjacent agricultural and residential areas.

4.3. Connecting NPS Overarching Objectives with the C&SF Project

While the ENP enabling legislation established the high standard of protection and preservation by which projects affecting the park's resources must be evaluated, the ENP Protection and Expansion Act of 1989 established the nexus between these standards and the C&SF project. In the ENP Protection and Expansion Act of 1989, the President and Congress recognized:

- "The Everglades National Park is a nationally and internationally significant resource and the park has been adversely affected and continues to be adversely affected by external factors which have altered the ecosystem including the natural hydrologic conditions within the park."

- "Wildlife resources and their associated habitats have been adversely impacted by the alteration of natural hydrologic conditions within the park, which has contributed to an overall decline in fishery resources and a 90 percent population loss of wading birds."

- "The existing boundary of Everglades National Park excludes the contiguous lands and waters of the Northeast Shark Slough that are vital to long-term protection of the park and restoration of natural hydrologic conditions within the park."

- "Incorporation of the Northeast Shark Slough and the East Everglades within the park will limit further losses suffered by the park due to habitat destruction outside the present park boundaries and will preserve valuable ecological resources for use and enjoyment by future generations."

Thus, the ENP Protection and Expansion Act of 1989 (1989 Act) authorized the Secretary of the Army, in consultation with the Secretary of the Interior to "construct modifications to the C&SF Project to improve water deliveries to the park and shall, to the extent practicable, take steps to restore the natural hydrologic conditions within the park." This legislation was enacted in order to increase the level of protection of the natural values of ENP and to enhance and restore the ecological values, natural hydrologic conditions, and public enjoyment of the area by adding the NESS and the East Everglades to ENP. An investment in the MWD project supports the intent of the Everglades Expansion Act of 1989 of protecting and restoring ENP for the enjoyment of the public.

Following the passage of the 1989 Act, the Corps completed the GDM for the MWD Project. The 1992 GDM identified the goal of the project to restore natural hydrologic conditions in the park and explicitly identified the hydrologic objectives of improved timing, volume, and distribution of water to ENP to meet this goal. Inherent to the attainment of these goals and objectives are the assumptions published in the 1992 GDM (1992 GDM, pgs. 24-26, Section 44, Objectives) for identification and implementation of the structural features of the MWD Project:

1. **Timing**: Restoring the natural hydrologic condition will result in wide natural variations in water availability from year to year, including the extremes of natural floods and droughts, as well as natural variations in depth and volume within the normal annual wet and dry seasons. The Corps recognized in 1992 that restoration would require modifications to the system that would alter the time when water would be delivered to ENP. The Corps 1992 GDM states that changing the water delivery schedule so that it fluctuates in consonance with the meteorological conditions, including providing for long term and annual variations in hydrologic conditions in the Everglades, would meet this objective.

2. **Location**: The natural hydrologic condition should reflect the historic condition of water flow through Shark Slough, including flow in WCA-3A, WCA-3B, NESS, and ENP. The Corps recognized the importance of restoring flow in the conservations areas as a necessary predicate for restoring flows to ENP. The Corps 1992 GDM states that restoration of WCA-3B as a functioning component of the Everglades hydrologic system and water deliveries to NESS, the center of the historic Shark Slough, would meet this objective.

3. **Volume**: The natural hydrologic condition should allow the system to fluctuate, as it did historically, in response to local rainfall, upstream water contributions, and other natural factors in the Everglades hydrologic system. The Corps recognized the importance of restoring the necessary quantities of water to ENP to assure that ENP is managed to maintain the natural abundance, diversity, and ecological integrity of native plants and animals. The Corps 1992 GDM states the flows through the area need to be adjusted to minimize the effects of too much or too little water.

The 1992 GDM states that the goal of restoring natural hydrologic conditions in NESS **"**will be met in terms of all three of its dimensions: location, timing and volume." Importantly, "**The historic path of Shark Slough will be restored by bringing WCA-3B and NESS back into the flow-way between WCA-3A and Everglades National Park (NPS emphasis)**."

The 1992 GDM concludes in its final plan that "Conveyance of water from WCA-3A to WCA-3B would restore the historic flow patterns in the Everglades Basin. By so doing, 100,000 acres of prime Everglades' habitat would be brought back as a fully functional component of the Everglades system. The surface water component added to direct rainfall effects in WCA-3B would recreate the hydrologic dynamics in the system that has been almost totally lost since the area was impounded. The additional volume would create a fluctuating water level with seasonally deeper water in the center of the historic slough in WCA-3B, and would restore the historic short hydroperiod in the marshes along the eastern edge. This would build up the food resource base of small fishes and macroinvertebrates for harvesting by wading birds during the dry season recession. The increased water levels and secondary productivity combined with the topographical heterogeneity of the area would create a seasonal diversity of feeding habitats. This would greatly increase the opportunities for wading birds to forage sites under a wide range of water conditions. Ecological restoration of WCA-3B is believed to be the key to restoring long-term trends in successful nesting by wood storks and other wading birds in the park because it historically played such an important role in sustaining the large nesting colonies during the dry season. Increased

water depths would also benefit the apple snail, a food resource for a wide array of animals, and the essential food source for the snail kite. Regional snail kite populations, therefore, would be expected to increase as the kites repopulate the area."

The 1992 GDM also states that "hydrologic restoration of WCA-3B is also essential to restoring natural water conditions in the park. Diversion of flood waters from WCA-3A into detention in WCA-3B would decrease the volume of and, in some cases, the need for regulatory water releases into the park from WCA-3A."

DOI is strongly supportive of each of the aforementioned conclusions in the 1992 GDM.

4.4. Confluence of Three Major Restoration Objectives- ENP enabling legislation, ENP Protection and Expansion Act (C&SF Project), and Comprehensive Everglades Restoration Plan (CERP)

In 2000, the $8 billion CERP was approved, adding unprecedented focus on restoration objectives for ENP and the south Florida region. CERP provides a framework and guide to restore, protect, and preserve the water resources of south Florida, including the Everglades, while providing for other water related needs of the region, including water supply and flood protection. Components of CERP were designed with the assumption that the features to be constructed under MWD authority would be in place prior to the start of CERP-related construction. An investment in the MWD project ensures that the features that are a precursor to CERP are constructed and operated so that the CERP program can improve upon the health of the south Florida ecosystem, improve water quality, enhance water supply, and achieve and maintain the benefits to the natural system and human environment described in the CERP plan.

Under the "Initial Authorization Projects", CERP states that "Restoration of the Everglades demands immediate attention and action. We believe that it is vital to our overall success to take aggressive significant steps to start construction of restoration features as soon as possible. In this regard, we have selected an initial package of projects that we believe will provide immediate and substantial ecosystem restoration benefits. The initial authorization of projects includes a set of features that will provide, in the short-term, system-wide water quantity, quality, and flow distribution benefits to the ecosystem. The need for Water Resources Development Act (WRDA) 2000 authorization of these features involves two factors: (1) the ability to improve coordination with ongoing projects such as the MWD Project which will improve flows to ENP; and (2) taking advantage of the benefits of federal investments already undertaken (e.g., the purchase over 50,000 acres of land in the Everglades Agricultural Area)."

The NPS expects the MWD restoration objectives to be consistent with CERP restoration objectives for restoration of the historic ridge and slough system that encompasses WCA-3 and NESS. As identified in CERP, the ridge and slough system is the "heart of the Everglades"— the most ecologically productive, yet most adversely impacted habitat in the Everglades. Degradation of the ridge and slough system has resulted from changes in land use, drainage, and water management practices in south Florida. The effects from these regional impacts include compartmentalization and reduced spatial extent of the natural system, loss of organic soils, altered water depth, distribution and flow patterns, altered water chemistry, and the introduction of exotic species. NPS expects the final Tamiami Trail alternative will significantly reduce the deleterious effects of each of these external factors on the ridge and slough system. These stressors, and the ecological effects resulting from the stressors, are as follows:

- Urban and Agricultural Expansion - Drainage of wetlands and the subsequent conversion of slough habitat into agricultural and urban uses have reduced the total spatial extent of the ridge and slough system in the main Everglades from 490,000 ha in the pre-drainage system to 365,000

ha in the current system (Davis et al. 1994). The biological and physical effects from this 26% loss in spatial extent include: (a) a substantial reduction in habitat options for wildlife, and (b) a reduction in the system-wide levels of primary and secondary production.

- Influences from Industrial and Agricultural Practices - Increased loads of Phosphorus (P) and Mercury (Hg), originating as bi-products from an array of agricultural and urban industrial practices, were identified in the CERP as the two alterations in water quality which have been demonstrated or hypothesized, respectively, to have had the greatest ecological significance in the slough systems. Increased phosphorus loading in a low-nutrient system has, (a) caused a substantial expansion of "nutrient-loving" plants (monocultures of cattail) into other communities, (b) contributed to shifts in the species composition in periphyton mats from communities dominated by green algae/diatoms to communities dominated by blue-green algae, and (c) contributed to reductions or alterations in primary and secondary production patterns.

- Water Management Practices - Reduced spatial extent, the introduction and spread of degraded water, reduced water storage capacity, compartmentalization, and the introduction and spread of exotic species have had part or all of their origins in water management practices. Major objectives of water management have included water supply and flood control, which have been achieved by means of a complex system of structural and operational modifications to the natural system. These modifications have (a) contributed to the substantial reduction in spatial extent (b) provided a network of canals and levees which have accelerated the spread of degraded water and exotic species (c) greatly reduced the water storage capacity within the remaining natural system (d) altered sheet flow velocities and directions, and (e) created an unnatural mosaic of impounded and over-drained marshes in the WCAs (Science subgroup 1993; Davis and Ogden 1994; Light and Dineen 1994; Fennema et al. 1994). The combined effects from reduced water storage capacity, altered sheet flow patterns and compartmentalization have, paradoxically, included both a reduction in the duration of annual and multi-year hydroperiods and an increase in the frequency of unnatural high water events.

- Societal influences on the species composition of regional floras/faunas - The introduction, both intended and unintended, of large numbers of non-native species of plants and animals has resulted in substantial alterations to the Everglades sloughs. The most blatant examples affecting the sloughs are: (a) the invasions by Melaleuca, and the conversion of extensive marshes into woody swamps (Bodle et al. 1994; Laroche and Ferriter; 1992), and (b) the spread by 15-20 species of introduced fishes throughout much of the region of the ridge and slough systems (Courtenay 1994; Robertson and Frederick 1994). Although the ecological consequences of these fish invasions have been largely unmeasured, it must be assumed that their presence has substantially altered the characteristics of marsh fish communities.

- Ecological Impacts - The principal, broad-scale ecological responses from the combined affects of the above four major ecological stressors acting on the ridge and slough systems have been, (a) a substantial alteration and degradation in the natural patterns of plant community composition and structure, and (b) substantial changes in the distribution of flora and fauna, and reductions in abundance of many native animals that are dependant on aquatic habitats and food chains.

4.5. NPS Hydrological and Ecological Objectives and Performance Measures for Tamiami Trail Project

ENP was authorized in recognition of the desire to preserve and protect the unique flora and fauna within the area. Subsequent legislation was passed to assure protection of the resources within the park, largely

in response to the potential threats from activities external to the park boundaries. This concern for the protection of the park resources was so acute that Congress passed the ENP Protection and Expansion Act of 1989. This Act allowed for the expansion of the park boundaries to include much of the remaining wetlands in the Shark Slough and also directed the Corps to modify the structural features of the C&SF Project to restore historical hydrological conditions, to the extent practicable, within the park. Based on the authorities provided by the park enabling legislation and the park expansion act, it is the expectation of ENP that the restoration of historical hydrological conditions as authorized by the expansion act will provide significant improvements to the park resources consistent with the purposes and objectives of the MWD Project as stated in the Corps 1992 GDM. It is also the expectation of ENP that the features implemented will be consistent with the purposes of CERP so that subsequent features implemented with the CERP authority will augment benefits of the MWD Project.

Therefore, ENP expects that the Tamiami Trail alternative to meet the objectives of the MWD Project and to be implemented in a manner consistent with the objectives of the CERP Decompartmentalization (DECOMP) Project. DECOMP project objectives include: (1) remove or reduce the effects of landscape discontinuities that are caused by roads, levees, canals, drainage ditches, and spoil banks by removing barriers to sheetflow, (2) improve sheetflow, hydropatterns, and hydroperiods within WCA-3 and ENP, focusing on areas east of S-333, (3) in as much as practical, create opportunities for passive management of WCA-3 and ENP, (4) increase the capacity of water deliveries to ENP in accordance with CERP restoration goals, (5) promote more natural hydrologic recession rates throughout the ridge and slough, marl prairie, and rocky glades landscapes, (6) reduce the pathways for the occurrence and dispersal of invasive species, (7) restore, maintain, and sustain the ridge and slough topography, (8) integrate project objectives and features with other related projects (i.e., MWD Project, CSOP, Water Preserve Area Feasibility Study, Rainfall Driven Operations, and C-111 Project), (9) restore and recover existing populations of migratory birds and their habitat, (10) maintain the spatial extent and function of wetland resources in WCA-3A, WCA-3B, and ENP, (11) increase fish and wildlife connectivity, including terrestrial species, (12) increase the spatial extent and restore vegetative composition, habitat function, and productivity of tree islands, and (13) restore peat soils, depth and topography. As can be identified in the following table of ENP expectations for the Tamiami Trail project, ENP expectations are both similar and consistent with the DECOMP project objectives.

Table 3.1 NPS Project Objectives and Performance Measures for Tamiami Trail Project

NPS Objectives and Performance Measures
1. Meet the Reasonable and Prudent Alternative (RPA) for the CSSS as specified in the FWS BO of Feb. 1999 and reiterated with an amended BO in 2002
2. Allow for restoration consistent with 1989 ENP Protection and Expansion Act ***2A. Restore water deliveries to ENP*** A. Restore historic distribution of flows to ENP B. Restore historic flow volumes to ENP C. Restore historic overland flow volumes to NESS D. Restore historic sheetflow conditions to NESS E. Reduce high flow discharges associated with structures in Tamiami Trail
2B. Restore historic water depths and hydroperiods in ENP A. NESS Stage Requirement: Eliminate discontinuity in water levels above and below Tamiami Trail B. Reduction in MFL violations in NESS (dry-season depths)

NPS Objectives and Performance Measures
C. Reduction in MFL violations in mid-NESS (dry-season depths)
2C. Enhance and restore ecological functions in ENP Restore ridge and slough processes A. Reconnect historic slough habitats between WCA-3B and NESS B. Increase physical connectivity of marshes between WCA-3B and ENP C. Reduce pattern of scour and deposition at culverts and weirs D. Restore sediment flow and transport needed for R & S building in all sloughs E. Reverse filling in of sloughs F. Minimize difference between average velocity at the road and average velocity in the marsh. Restore vegetative communities A. Shift to open water, spikerush marsh and slough communities in NESS B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs C. Reduce risk of ridge and tree island peat burning in NESS D. Reduce risk of ridge and tree island peat burning fires in Rocky Glades E. Increase extent of slough vegetation communities F. Potential for invasion of exotic plant species Restore fish and wildlife resources A. Improve characteristics of freshwater aquatic communities - Increase total abundance of fishes in ENP marshes, including Shark Slough and Taylor Slough (compared to no action alternative) - Potential for invasion of exotic aquatic species B. Improve conditions for wading bird foraging and nesting C. Improve alligator nesting numbers and distribution D. Reduction in wildlife mortality (shown as % reduction compared to no action) Improve water quality in ENP A. Reduce concentration of TP discharges to ENP from L-67A Canal B. Reduce injurious effects of organic forms of nutrients--TOC, TON, and TOP C. Increase dissolved oxygen to support health of aquatic species D. Reduce specific conductance and sulfate concentrations E. Reduced erosion--less sediment and TSS transport F. Increase in nutrient cycling, uptake by biota

4.5.1. *Meet the Reasonable and Prudent Alternative requirements for the endangered Cape Sable Seaside Sparrow as specified by the U.S. Fish and Wildlife Service*

The FWS issued a Final BO for the MWD Project, the C-111 Project, and the Experimental Program of Water Deliveries to ENP in February 1999. The FWS found that the hydrological impacts associated with the Experimental Program, if allowed to continue, would likely jeopardize the continued existence of the CSSS and adversely modify its critical habitat. The FWS also determined that other endangered species (American Crocodile, Wood Stork, Eastern Indigo Snake, and Snail Kite) within the area affected by the

Experimental Program or the proposed projects would either be unaffected or the incidental take associated with the species is anticipated and managed through reasonable and prudent measures associated with project implementation. The BO also included a reasonable and prudent alternative that, when implemented, would result in improved conditions for the sparrow and, in the opinion of the FWS, would preclude jeopardy of the CSSS.

In response to the FWS BO, the Corps completed an EIS of an Interim Operational Plan (IOP) that specified structural and operational modifications to the C&SF Project and also requested the FWS adopt the recommended plan included in the EIS as a second reasonable and prudent alternative. In March 2002, the FWS amended the 1999 BO and concluded that compliance with either the 1999 BO conditions or the water management actions recommended in the IOP EIS will comply with the ESA. In general, the water management recommendations include reducing water discharges to western Shark Slough and increasing discharges to NESS to improve nesting success and protection of the critical habitat of the CSSS. Therefore, it is the expectation of the NPS that an acceptable alternative for the modifications to Tamiami Trail would include the following hydrologic criteria (FWS 1999 and 2002 BO) to create conditions that would be in compliance with the Endangered Species Act:

1. Water level conditions at NP-205 between March 15 and July 15 are below 6.0 ft-NGVD. This would provide water level conditions needed to complete two nesting cycles in approximately 40 percent of the habitat.

2. Hydroperiods and water levels in eastern ENP are equal to or greater than those that would have resulted from the implementation of Test 7 Phase II. The NPS assumes that these criteria would be met if hydrologic conditions in the area as defined by the IOP are equaled or exceeded.

3. Sixty percent of all regulatory (or supplemental) water releases enter ENP east of the L-67 extension. The NPS assumes this criterion is moot since all alternatives evaluated for the Tamiami Trail modifications assumed Environmental Rain Driven Operations (ERDO)-derived discharges which do not include a regulatory component.

All other criteria stated in the 1999 BO either have been satisfied through the implementation of IOP or would be satisfied through the implementation of the operations associated with CSOP, as the later project assumes completion of the MWD Project, including the Tamiami Trail modifications.

4.5.2. Allow for Restoration Consistent with the 1989 ENP Expansion Act: including (1) restoring water deliveries to ENP, (2) restoring water depths to NESS, and, (3) enhancing and restoring ecological functions

4.5.2.1. Restore Water Deliveries to ENP

The Everglades has at the core of its identity the slow movement of water across the vast, low gradient, wetland landscape. Marjory Stoneman Douglas eloquently immortalized this identity in her descriptions of the “River of Grass” (Douglas 1947). Drainage and compartmentalization efforts during the 20th century for flood control and water supply purposes interrupted this flow, as well as altering water levels, distribution, and seasonal timing. Water flows are closely linked to water levels, and their alterations have caused severe environmental damage in WCA-3 and ENP.

Before the impoundment of WCA-3A and WCA-3B, the original flow pattern followed the natural gradient-based flow-way through the central Everglades into Shark Slough (Figure 4.1A). Extensive flooding occurred east of the protective levee system in the low-lying wetland areas. A strong surface

water connection formed across the Rocky Glades that linked Shark Slough with Taylor Slough. The impoundment of the WCA-3 created a pool of persistent deep water north of Tamiami Trail, which altered flows into Shark Slough. Flow patterns have been shifted westward away from the historic flow-way, into western Shark Slough. The eastern canal and levee systems have greatly reduced flooding east of the protective levee system, but they have over-drained ENP (through groundwater seepage). In addition, the surface water connection across the Rocky Glades that linked Shark Slough with Taylor Slough has been lost (Figure 4.1B).

Therefore, it is the expectation of the NPS that an acceptable alternative for the modifications to Tamiami Trail would create conditions that would comply with the 1989 Everglades Protection and Expansion Act, including substantial improvements in the following areas,: (1) restore historic distribution of flows to ENP, (2) restore historic flow volumes to ENP, (3) restore historic overland flow volumes to NESS, (4) restore historic sheetflow conditions in NESS, and (5) reduce high flow discharges associated with structures in Tamiami Trail.

Pre-WCA Flow Patterns
(November 1959)

Post-WCA Flow Patterns
(November 1994)

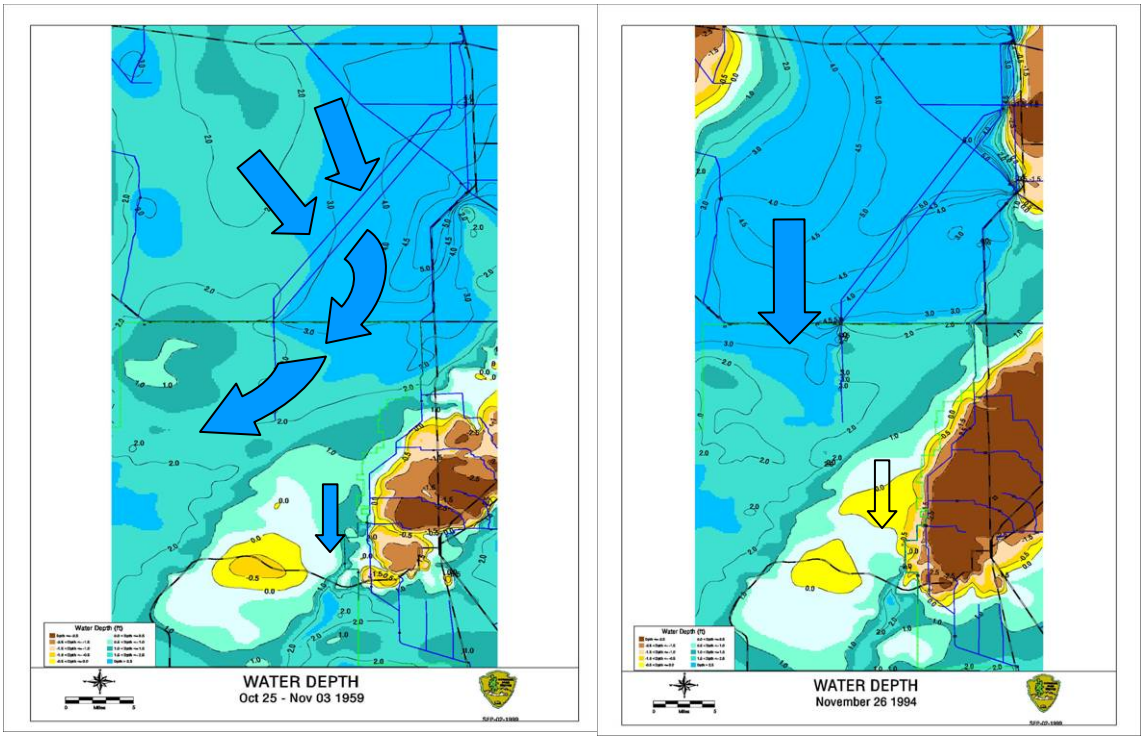


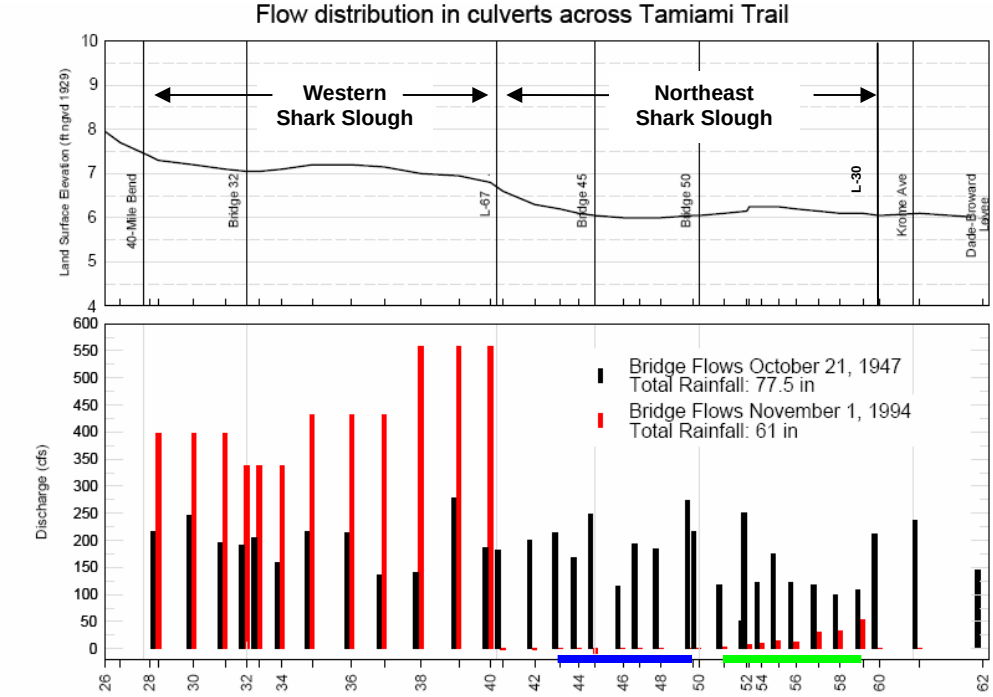
Figure 4.1 A and B. Pre- and post-WCA-3 flow patterns and water depths across Rocky Glades.

4.5.2.1.1. *Restore historic distribution of flows to ENP*

The NPS goal is to restore the historic flow distribution from WCA-3 to ENP—70% overland flows to NESS and 30% overland flows to western Shark Slough. The existing distribution of flow to ENP is 22/78 (East to West). This distribution has resulted in artificially high water depths and durations in WCA-3A and western Shark Slough and too low water depths and durations in WCA-3B and NESS,

resulting in substantial adverse impacts from high water conditions in WCA-3A and western Shark Slough and adverse low water (too dry) conditions in WCA-3B and NESS.

In addition, it is the NPS expectation that flow patterns across the trail into NESS will reconnect historic sloughs and mimic historic flow patterns. As depicted in the actual measurement of flows through culverts in Tamiami Trail from 1947 data (Figure 4.1, recreated from Parker, et al., 1955), the majority of flows from WCA-3B to NESS are between culverts 43-50 (51%) in the Tamiami Trail or just west of the present location of the Tiger Tail Camp on Tamiami Trail. The proposed eastern location has only 37% of flows. Also depicted in the upper section of this figure, the land elevation is lowest in the area between culverts 43-50 (west-central part of 10.7-Mile section) and this corresponds to where Parker measured the highest flows to NESS in 1947. The NPS expectation is that the final selected bridge will be located to optimize historic flow conditions as depicted in the Parker report.



Western Flow Section (blue line)

	Bridges 43 - 50 (cfs)	NESS (cfs)	WESS (cfs)	Brdg 43-50 / NESS	Brdg 43-50 / SRS total	NESS / SRS total
Oct 21, 1947	1613	3157	2383	51.1%	29.1%	57.0%
Nov 1, 1994	-9.6	153.1	5460	0.0%	0.0%	2.7%

Eastern Flow Section (green line)

	Bridges 51 - 59 (cfs)	NESS (cfs)	WESS (cfs)	Brdg 51-59 / NESS	Brdg 51-59 / SRS tot	NESS / SRS tot
October 21, 1947	1162	3157	2383	36.8%	21.0%	57.0%
November 1, 1994	166.8	153.1	5460	100.0%	100.0%	2.7%

Figure 4.1 Flow Distribution across Tamiami Trail culverts. Blue and green lines represent the theoretical placement of a western and eastern four mile bridge.

4.5.2.1.2. *Restore historic flow volumes to ENP*

The NPS goal is the selected alternative will substantially improve total overland flows to ENP. According to the latest NSM model, total overland flow volumes to ENP should be approximately 1.7 million ac-ft/per year. Increasing volumes of flows toward NSM levels will improve slough vegetation and Loxahatchee peat-forming conditions—a minimum of 2.0 ft. deep, 365 day hydroperiod is required to sustain peat-forming conditions—and result in improved hydroperiods in the Rocky Glades, Taylor Slough headwaters, and Taylor Slough. Other benefits of these increased volumes include: (1) increase in sediment transport (needed for supporting tree island formation and maintenance), (2) reduction in the prevalence of abnormal vegetation (including elimination of non-native species), (3) increase in wildlife species movements and genetic diversity, (4) improvement in water depths and durations needed to support various aquatic species and wading birds, (5) increase in the uniformity of marsh flow velocities, improving physical conditions for maintenance of native flora and fauna, and (6) reductions in hypersaline events in coastal estuaries.

4.5.2.1.3. *Restore historic overland flow volumes to NESS*

The NPS goal is that NSM-level overland flow volumes will once again flow from WCA-3B to NESS. Based on Natural Systems Model (NSM) predictions, this volume is approximately 1.3 million ac-ft/per year. Historically, this volume was needed to provide for the ridge and slough processes in NESS that supported many ecological functions and also kept water in the sloughs all year, providing refugia for many species during the dry season. In addition, these volumes provided critical freshwater flows to the estuaries to support the spawning of many coastal estuarine species. The NPS expectation is flow volumes from WCA-3A to WCA-3B should meet CERP levels or approximately 920,000 ac-ft/per year.

4.5.2.1.4. *Restore historic sheetflow conditions to NESS*

The NPS goal is that increased sheetflow across Tamiami Trail will provide greater marsh connectivity between WCA-3 and ENP, primarily through the restoration of sheetflow from WCA-3B to NESS. One measure of sheetflow is the percent of overland flow from WCA-3B to NESS. The NSM goal is historic overland flow patterns, whereby 70% of overland flow volumes to ENP are from WCA-3B. Increased sheetflow/marsh connectivity will serve to (1) eliminate the unnatural effects of impoundment of water especially in WCA-3A, (2) reduce the damaging occurrences of peat fires in WCA-3B that result from excessive dry-down events, (3) reduce wetland impacts from excessive flow velocities near the trail, (4) reduce pollutant loading associated with canal discharges, (5) improve conditions for the restoration and maintenance of periphyton communities in ENP, (6) improve recession rates in ENP, providing water depths and durations necessary to sustain aquatic communities, (7) increase ridge and slough processes, including sediment transport, (8) improve aquatic species movements between WCA-3 and ENP, and (9) generally improve conditions for fish and invertebrates, as well as wading birds in WCA-3 and ENP.

4.5.2.1.5. *Reduce high flow discharges associated with structures in Tamiami Trail*

The NPS goal is that the bridging of Tamiami Trail will provide for significant hydrological and ecological improvements to WCA-3 and ENP, but will also be accomplished with as few impacts as possible to the wetlands adjacent to Tamiami Trail. The ENP expectation is that the selected alternative will not increase wetland impacts over 437.5 acres. This level of wetland impacts was identified for the 4-Mile Bridge alternative in the previous RMA-2 modeling for the GRR/SEIS.

4.5.2.2. Restore Water Depths and Hydroperiods in ENP

The NPS goal is that the selected alternative will (1) eliminate the discontinuity in water levels north and south of Tamiami Trail, and (2) reduce minimum flow & levels (MFL) violations (dry-down events where water levels are below the ground surface for extended periods of time) in NESS and mid-NESS (dry-season depths). In addition, ENP expects increased hydroperiods in NESS will once again support the formation of peat-forming sloughs, the most species-rich habitats of the ridge and slough landscape. Similarly, the reduction in the number and extent of dry-down events due to increased hydroperiods will improve ecological conditions for numerous flora and fauna in ENP, including fish and invertebrates, alligators, and wading birds. Barriers to sheetflow have resulted in reduction of water depths in ENP and caused filling-in of sloughs with sawgrass, reducing biodiversity and contributing to the loss of wading bird foraging habitat. It is clear that the ridge and slough landscape is degrading and that most severe degradation is geographically associated with major linear structures that inhibit flow, such as roads and levees. Increased water depths in WCA-3B and NESS would also benefit the apple snail, a food source for a wide array of animals, and the essential food source for the endangered snail kite. Regional snail kite populations, therefore, would be expected to increase as the snail kites repopulate the area. Increased flows and water depths in NESS will also benefit the CSSS by reducing flows and depths in western Shark Slough.

*A*ssociated with the improved water depths and hydroperiods in the restoration of ridge and slough habitats, is the improvement in the timing of water deliveries to ENP. The NPS expectation is that the timing of deliveries of waters to ENP will once again fluctuate in consonance with natural climatic changes. A more natural flow regime based on climatological conditions will reduce the deleterious effects of pulsed flows associated with regulatory discharges. The target is to mimic the NSM (shape of curve) for hydroperiods. Expected benefits of these more natural flow patterns include: improve natural recession rates in the dry season supporting larger populations of fish and invertebrates and wading birds in NESS, Rocky Glades, Taylor Slough headwaters, and Taylor Slough, as well as eliminate damaging dry season pulses south of S-175 and S-18C; reduction in dry-down events that result in damaging fires and loss of peat soils, and improved recession rates needed to support healthy aquatic communities, as well as, wading birds.

4.5.2.2.1. *Eliminate discontinuity in water levels above and below Tamiami Trail*

The NPS goal is that water depths and hydroperiods north and south of Tamiami Trail will once again be consistent with the historic gradient between southern WCA-3B and NESS, whereby water levels differed from north to south in inches rather than feet. The loss of this continuity in water depths has resulted in substantial loss in the number and average size of fish species in both WCA-3B and NESS (Trexler, Appendix F). In addition, the more gradual gradient between WCA-3B and NESS should enhance movements of aquatic and upland species, reduce vectors for the introduction of exotic, invasive species, and provide for greater genetic diversity for the numerous species that traditionally moved between WCA-3 and ENP.

4.5.2.2.2. *Reduce Minimum Flow & Levels Violations in NESS and mid-NESS (dry-season depths)*

The NPS goal is that flows to NESS during the dry season will mimic historical flow patterns, whereby water depths and hydroperiods in the sloughs will once again support fish and invertebrate populations as well as the myriad wading bird populations that prey on them. Currently, NESS does not receive enough water during the wet season to support traditional open-water slough habitats, and flows are cut off too soon after the wet season to provide foraging areas (refugia) for many aquatic species during the dry season. The extremely dry conditions in NESS have resulted in abnormal fire events that have destroyed

the peat that is the foundation of the ridge and slough system. The peat fires and subsequent loss of peat soils have caused subsidence in many areas of NESS and WCA-3B. These extreme dry conditions have resulted in MFL violations in NESS and mid-NESS. The NPS expectation is that the selected alternative will eliminate all MFL violations in NESS (the threshold is 1-in-10 year dry-down event to become a MFL violation).

4.5.2.3. Enhance and Restore Ecological Functions in Everglades National Park

ENP alone among our hemisphere's national parks holds three international designations: The International Biosphere Reserve, World Heritage Site, and Wetland of International Significance. Despite these designations, many of the habitats and indigenous species are declining at a prodigious rate. Numbers of wading birds nesting in colonies in the southern Everglades have over 90% since the 1930's - from 265,000 to 18,500.

The loss of ecological functions in the park can be traced to man's attempt to either drain the Everglades for development or manage the system for urban and agricultural uses. Human manipulation of water deliveries have caused numerous ecological problems in the park, including loss of habitat for many species (alligators, fish, invertebrates, wading birds, etc.), introduction of exotic species that out-compete native species, drying out of sloughs, resulting in loss of peat-forming conditions, subsidence due to increased occurrence of wildfires, and loss of breeding and foraging areas for many species.

Given present trends, the endangered wood stork may no longer nest in south Florida by the year 2010. The wood stork has declined from 6,000 nesting birds to just 500 since the 1960's. Only seasonally drying wetlands (mostly in drying sloughs) concentrate enough fish to provide the 440 pounds per pair required during each breeding season. When natural wetlands cycles are upset by human water management, wood storks fail to nest successfully.

Native trees, such as mangroves and cypress, are being replaced rapidly by exotic (non-native) species. Florida largemouth bass share their nesting beds with tilapia and oscars, fish imported from Africa and South America. As the Everglades yield to human introduced plants and fish, native species diminish.

The NPS expectation is that improved water deliveries to ENP will result in substantial enhancement and restoration of ecological functions in ENP, including improvements in the following four broad categories: 1) the restoration of ridge and slough processes, 2) restoration of vegetative communities, 3) restoration of fish and wildlife resources, and 4) improvements to water quality. Specific quantitative and qualitative expectations for ecological indicators of restoration within each of these broad categories are explained in the sections to follow.

4.5.2.3.1. *Restore Ridge and Slough Processes*

Restoration of the ridge and slough landscape in ENP is critical to providing suitable habitat for many species, including many threatened and endangered species. Recovery of more natural flow patterns (velocities, volumes, hydroperiods, depths, timing) between WCA-3B and NESS will allow for the reconnection of slough habitats, increase the physical connectivity of sloughs (marshes), reduce the patterns of scour and deposition at culverts and weirs, restore the sediment flow and transport needed for ridge and slough building, reverse filling in of sloughs, and minimize the difference between average velocity at the road and average velocity in the adjacent marshes. In addition, the duration of uninterrupted surface flooding, and in water depths, should result in improvements in pre-drainage rates of accretion for peat soils. Conversely, unnatural rates of loss of organic soil due to oxidation and excessive fires should be curtailed. Furthermore, ENP expects that restoration of ridge and slough processes will provide substantial improvements to the native vegetative communities, including: (1)

cause a shift to open water, spikerush marsh and slough communities in NESS, (2) reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs, (3) reduce the risk of ridge and tree island peat-burning fires in NESS and the Rocky Glades, (4) increase the extent of slough vegetation communities, and (5) reduce the potential for invasion of exotic species.

A. Reconnect historic slough habitats between WCA-3B and NESS

The NPS goal is that the selected alternative will provide flow patterns between WCA-3B and ENP adequate to substantially restore slough habitats in NESS. The ridge and slough landscape evolved over thousands of years under a natural flow regime that was characterized by steady sheetflow. The system was hydrated naturally by rainfall and the flow of water from Lake Okeechobee. Drainage of the system for agriculture and urban development has led to oxidation of peat soils, particularly in the eastern areas of ENP and WCA-3 and in the Everglades Agricultural Area south of Lake Okeechobee (Figure 4.2; Stober et al. 2001). In the southern Everglades, post-drainage lowering of water levels, oxidation of the ridges and blockage of the slough channels caused water velocities to be reduced. Reduction of sediment transport capacity accompanied the reduction in velocity below the critical levels needed for sediment transport and sloughs began filling in with sediment and emergent vegetation. In Northern WCA-3A, impoundment has led to decreased sheetflow, decreased hydroperiods and decreased depths in the northern end of WCA-3A. As a result of over-drainage, major peat burning fires in the 1950s resulted in the destruction of hammocks and the loss of tree island tails (Robertson 1953). This drainage was followed by prolonged periods of excessively high water, which hindered the re-establishment of woody vegetation. In southern and eastern WCA-3 impounded water has caused increased depths, longer hydroperiods and loss of sheetflow. As a result, southern WCA-3A has shifted from a ridge and slough landscape to a deeper water, more lacustrine landscape (Science Coordination Team 2003).

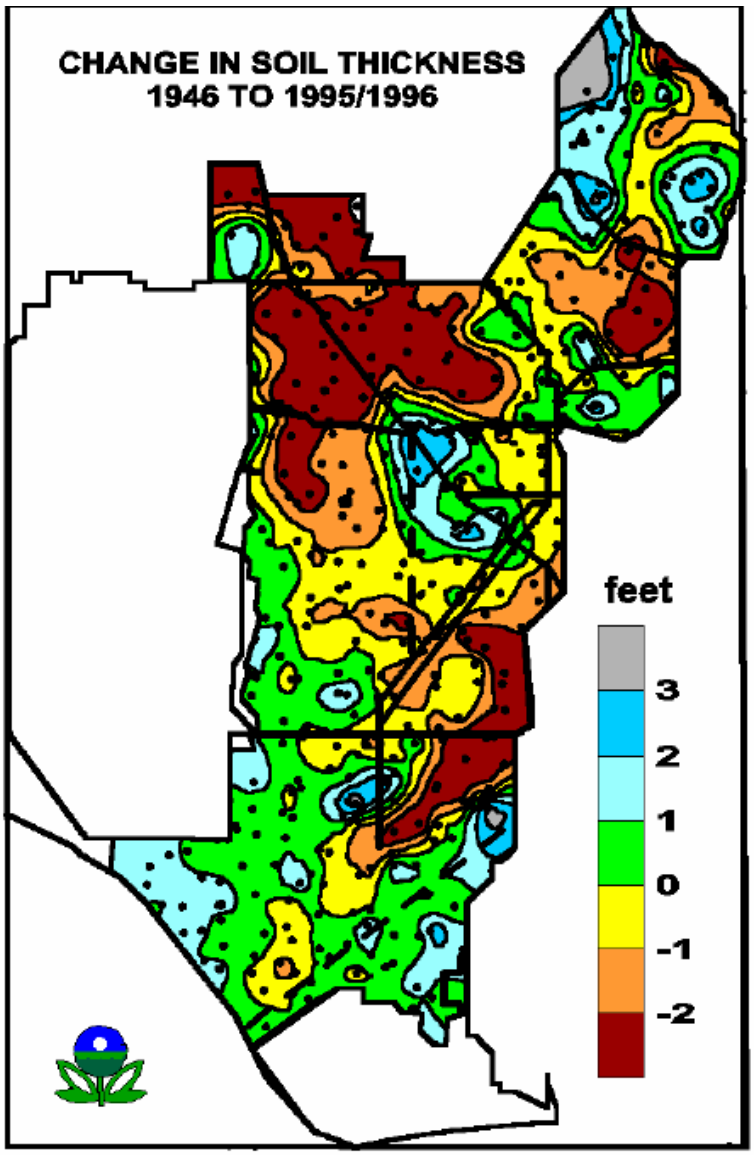


Figure 4.2. Spatial plot of soil subsidence and accretion from 1946 to 1995/1996 (after Stober et al, 2001)

WCA-3B is subject to unnatural drainage from the L-30 canal. Historically WCA-3B was the center of the slough (King 1917; Davis 1943). Today most of WCA-3B is over-drained with shorter hydroperiods, less sheetflow and shallower depths. Whereas sawgrass extent has declined in southern WCA-3A as it has become wetter, sawgrass has expanded greatly into areas that historically were sloughs in WCA-3B (Barnes and Tarboton 2002). Soil subsidence has occurred in WCA-3B and NESS due to the decreased hydroperiods and increased duration of drydowns (Figure 4.2). In central Shark Slough in ENP, decreased hydroperiods and water depths have led to a transition of sloughs to spike-rush-maidencane flats. While sawgrass is invading wet prairies in some places, it is dying back in other places and being replaced by woody plants in some locations (Ross 2001).

The spatial extent of the ridge and slough system has also been affected by water management. Figure 4.3 shows that the historical ridge and slough system was centered in the vicinity of the current L-67

extension and extended to Whitewater Bay. Currently, there is no habitat in ENP or WCA-3B that fits Davis' description of slough (Clark 2003). Water is released from WCA-3A to ENP according to a regulation schedule that decouples the flow from the natural variability of rainfall and runoff. By comparing the historical discharges of water across Tamiami Trail to current discharges it is apparent that water deliveries to ENP have been unnaturally shifted to the west (Figure 4.4). This has resulted in unnatural flooding in the western marl prairies and impacts to the western habitat of the endangered CSSS.

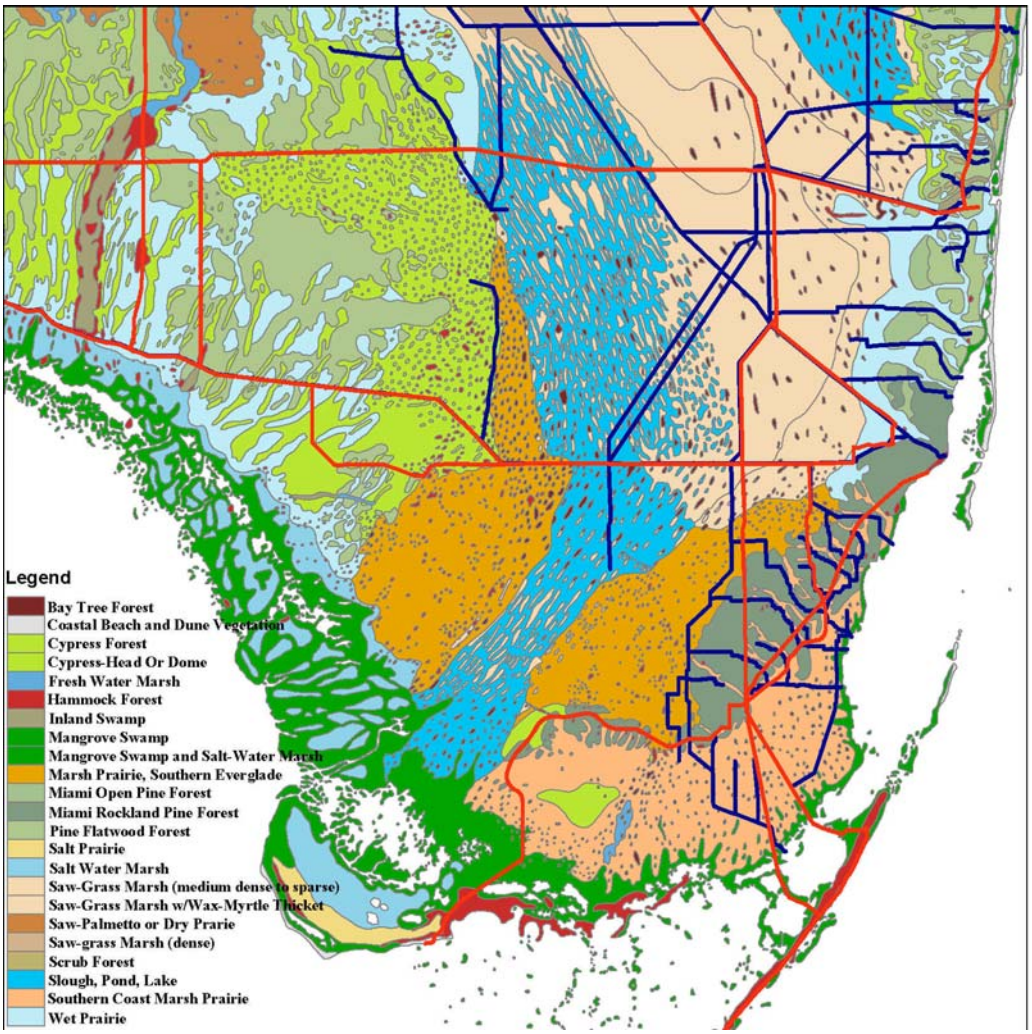


Figure 4.3. 1943 vegetation map with current canal alignment. The location of the slough, pond, lake classification was centered along the current alignment of the L-67 extension.

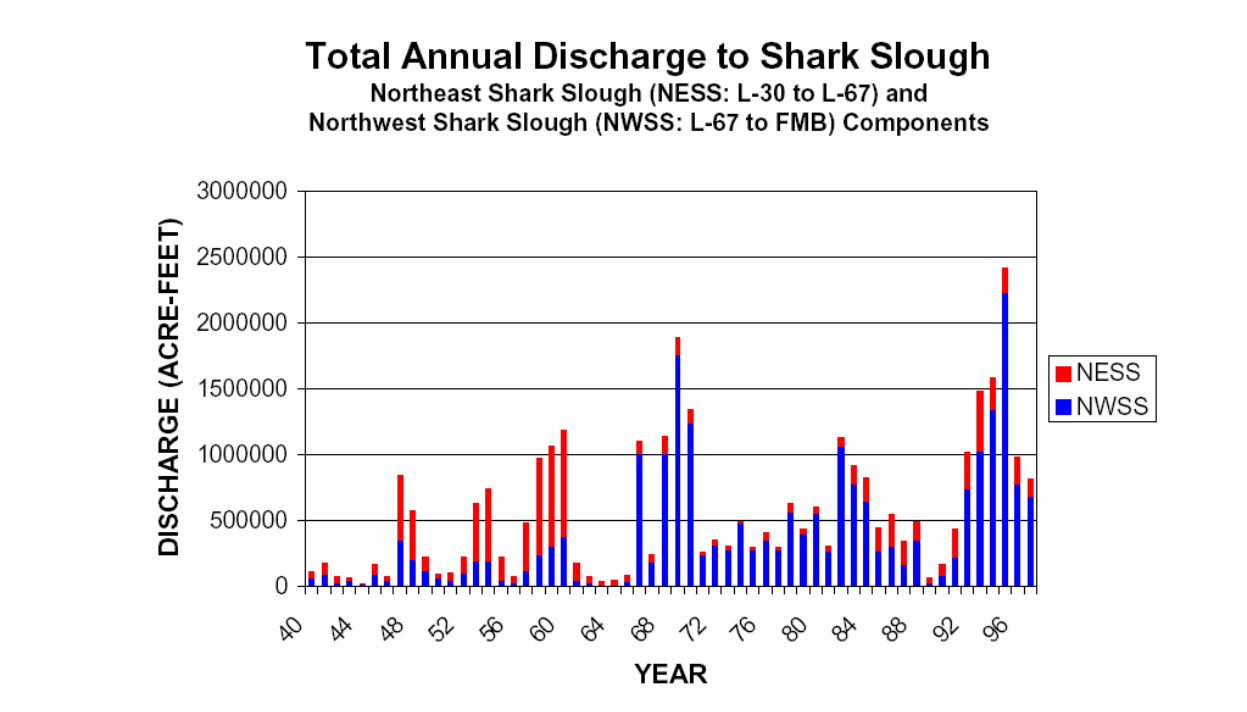


Figure 4.4. Total annual discharge to NESS and northwest Shark Slough for the period of record, 1940-1997.

The Tamiami Trail project is required to restore natural flow patterns to the extent practicable, realizing that portions of the historical slough are outside of the project footprint and that the project is constrained by the commitment to maintain the base level of flood damage reduction provided by water control structures in L-31N. Additional constraints that have been identified include the loss of soil in WCA-3B and eastern NESS. Given these constraints, it is the expectation of ENP that the selected alternative will not be able to provide restoration to 100% of the ridge and slough habitat, but should provide 100% restoration to a portion of that habitat. This 100% restoration means providing water depths, hydroperiods and flow velocities within these habitats at a level that will support slough vegetation and open water and restore the historical ridge building and slough scouring processes. This goal is most attainable for the section of the ridge and slough landscape south of Tamiami Trail, east of S-333 and west of S-355A. This is the section of ridge and slough landscape in NESS that is least degraded and therefore most feasible to restore. 100% restoration of this section would require water depths greater than 2 ft for 80-100% of the time in the sloughs and less than 25% of the time on the ridges. Flow velocities should be maximized in the sloughs over large reaches. Re-connection of this flow section would provide for reconnection of approximately 40% of the historic slough habitats between WCA-3B and NESS, and, given the proper upstream conditions, could provide the flow patterns required to restore the ecological functions that are supported by the ridge and slough landscape in this region of the Everglades.

B. Increase physical connectivity of marshes between WCA-3B and ENP

The King report identifies a pre-drainage Everglades in which extensive, deep, well-connected sloughs (between WCA-3B and NESS) carried water flows of sufficient velocities to scour organic and marl sediments from the bottom. These sloughs were open and, for the most part free of vegetation all year. There were sharp banks separating the sawgrass ridges and the sloughs and organic material was sequestered in the sawgrass ridges to form deep muck soils. King's report supports the supposition that water flow was important in maintaining the open sloughs. Contemporaneous accounts (Simpson 1920)

reported that marl was carried by "streams" and deposited along the borders of the Everglades. The formation of ridges concentrates flow and reduces the resistance to flow by increasing flow depth (Wende and Nanson 1998). Flow concentration and decreased resistance to flow caused an increase in flow velocity and sediment transport capacity. Under this hypothesis, ridge formation allowed for deeper, concentrated flows which would provide the momentum needed to move the bed sediments, keeping the sloughs clear. Because of the shallow topographic gradient and the vegetative resistance to flow in the Everglades, the sloughs were needed in order to provide the momentum for sediment transport, which in turn provided open channels for flow. In this way, the system maintained a dynamic equilibrium over thousands of years, maximizing the capacity for sediment transport in this low-energy system. The ENP expectation is that the linear feet of connectivity between WCA-3B and NESS will be at a minimum of 20,338.56 ft. This physical connectivity is needed in conjunction with adequate flow volumes, distributions and timing of flows to restore the ridge and slough systems in NESS.

C. Reduce pattern of scour and deposition at culverts and weirs

The NPS goal is that re-established flows between WCA-3B and NESS will be of sufficient breadth (expanse due to bridge length) to prevent the pattern of scour and deposition at weirs and culverts that results from high flow velocities through narrow structures (RMA-2 model results). These adverse impacts include erosion, abnormal sediment transport, increased conductivity, reduced light penetration, and overall poorer water quality. Smaller structures also create conditions for invasion of exotic species. The NPS expectation is optimize natural marsh velocities and reduce and/or minimize impacts to adjacent wetlands.

D. Restore sediment flow and transport needed for Ridge & Slough building in all sloughs

The NPS goal is that the selected alternative will substantially improve sediment flow and transport needed for ridge and slough building in NESS. In the pre-drainage Everglades, water flow and sediment and nutrient transport were important factors in building sawgrass ridges, tree island tails and keeping sloughs open and flowing. A detailed l917 report (King 1917) describes the flow patterns, vegetation, soils and soil characteristics of property located along Tamiami Trail. This report and others indicates that at this period of time, deep expanses of open flowing water created a system of sawgrass ridges and open sloughs through transport of organic soils in shallow sloughs (Wright 1912; Baldwin and Hawker 1915). Since the deeper sloughs were known to be wet most of the time, it was believed that the buildup of marls in these sloughs and the southern transverse glades occurred as a result of marl deposition and the transport of muck soils through deep sloughs during periods of high water (King 1917). Figures 4.5, 4.6, and 4.7 show photographs from a 1917 survey (King 1917) documenting the broad expanses of sloughs in the area south of Tamiami Trail. The spatial extent of these sloughs was mapped in two separate areas (Figure 4.8). The eastern area shown in the central basin (Figure 4.5) was referred to as the "Central Slough Basin" (Blue Shanty area) which was in "the heart of the slough drainage area" and contained "sloughs of major importance", with channels averaging a mile or more in width and water that reached a foot or more in depth in mid-February (King 1917). Outside of the sloughs were sawgrass ridges with a thin layer of water, indicating approximately a foot of relief between the slough bottom and the sawgrass ridge top. While floating vegetation and seeds collected along the sides of the sawgrass ridge, the slough bottoms had a few inches of litter, a few inches of "muck" and calcareous marl subsoil**.** The absence of a thick organic layer suggests that most of the organic material was transported through the sloughs, rather than settling to the bottom.

Figure 4.5. Photographic view of Central Slough Basin, taken in February 1917 at Section 6, Range 38 E, Township 54 South (King 1917).

Figure 4.6. Photographic view of Western portion of Central Basin taken during February 1917, in Section 24 on its Western boundary, Range 37 E, Township 54 South, looking west (King, 1917). Note the stream-like character of the slough.

Figure 4.7. Photographic view of "Shark River Headwater" and "lake like" conditions, taken late February 1917 at or near Section 20, Range 37 E, Township 54 South.

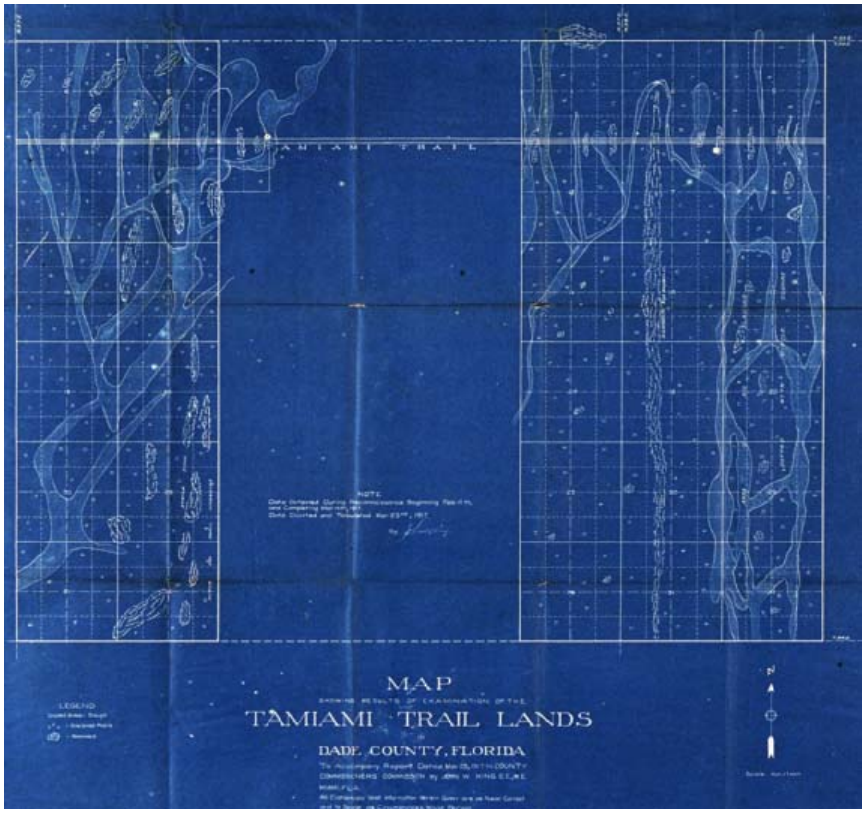


Figure 4.8 (King map) Map of Tamiami Trail Lands mapped by King in 1917. Shaded areas outlined in solid white are sloughs; textured areas outlined in irregular lines are hammocks. The remainder is sawgrass prairie.

E. Reverse filling in of sloughs

Figure 4.9. Periphyton sweaters

The NPS goal is that the selected alternative will reverse the current trend of filling in of sloughs in WCA-3B and NESS. In the current Everglades ridge and slough landscape, water velocities are reduced by vegetation and levees. In ENP, sloughs are filling in with sawgrass, spikerush and other emergent vegetation (Ross et al. 2001). The effect of this vegetation is to reduce the velocity of the water (Childers et al. 2005; Bazante et al. 2004). When water moves from vegetated to non-vegetated areas, velocity increases (Childers et al. 2005). This effect occurs only when sloughs are connected, providing an outlet for the increased flow. In this case, velocity should be increased along the length of the flow path and velocity is at a maximum at the center of the slough. Maximum velocities occur as the length of the pathway through the non-vegetated areas increases. Today, since sloughs are not connected in many areas, conservation of mass causes velocities to decrease as water deepens in the center of sloughs (Bazante et al. 2004). Local velocity increases cannot be sustained downstream unless there are well-connected open flow-ways. The King map (Figure 4.8) shows the distribution of sloughs south of Tamiami Trail in 1917. It is evident from these pictures and the surveyor's description, that the sloughs were extensive and well-connected. Today, this area has been described as comprised of directional sawgrass with open water sloughs that have been partly filled in with sparse sawgrass and other species. Increased vegetation density along with increased periphyton benthic mats and "sweaters" on submerged stems has caused increased flow resistance (Barnes and Tarboton 2002, Figure 4.9). In order to provide increased velocities in ENP, sloughs must be deepened and reconnected. Figure 4.10 depicts a theoretical map with the western edge of the central slough basin map placed in the gap between the two areas mapped by King. It is evident from this figure that the Tamiami Trail road and levee have disrupted sloughs that were continuous over lengths of greater than 20 miles. These quarter mile to one mile wide sloughs were the major conduits of flow in the Everglades. Reconnection of these sloughs is an essential component of flow restoration. The higher velocities and higher water depths in these sloughs will remove organic sediments and restore the marl and rocky bottoms. Sediment scoured from sloughs will feed ridge and tree island elongation, re-corrugating the ridge and slough landscape.

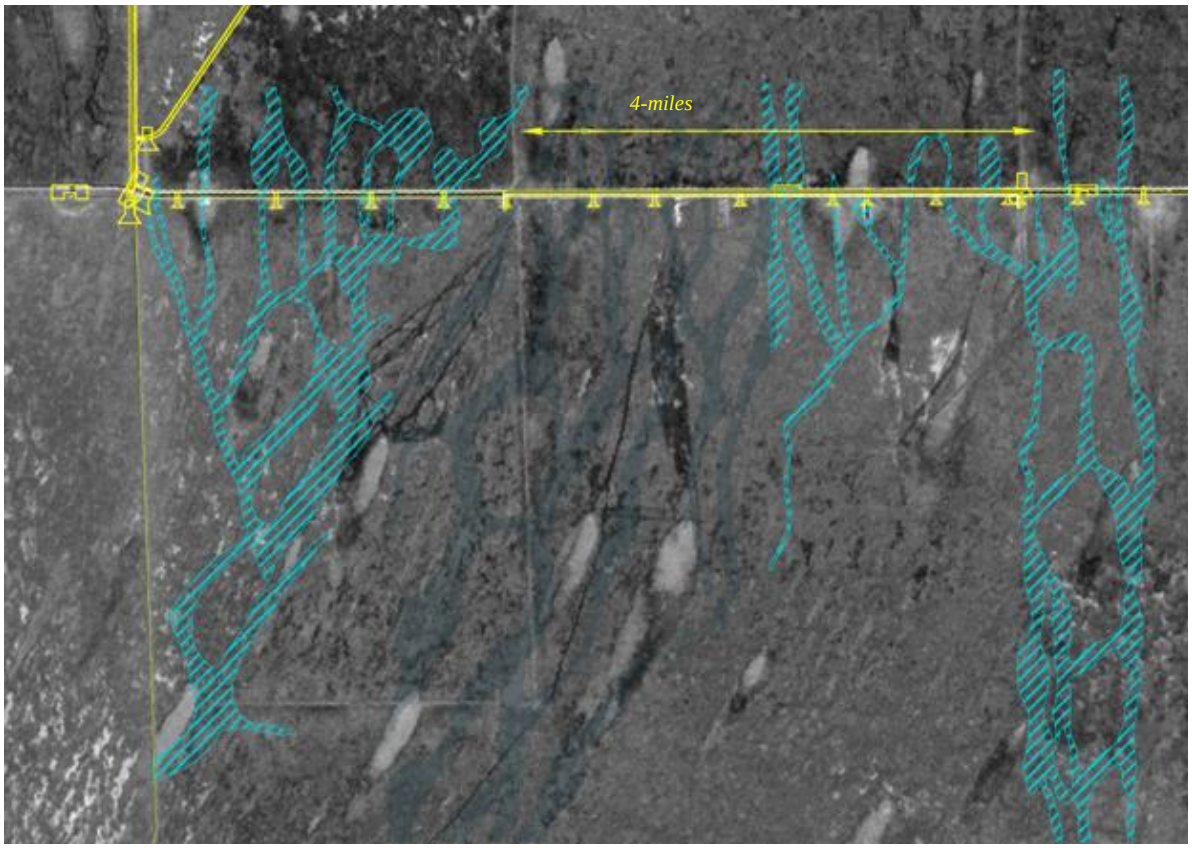


Figure 4.10. 1917 King Survey (blue hatched). Theoretical sloughs (blue shade) have been placed in the gap between the two areas mapped by King.

F. Minimize difference between average velocity at the road and average velocity in the marsh.

The NPS expectation is that flow velocities through structures in the trail will match flow velocities in the adjacent marshes upstream and downstream of the trail.

4.5.2.3.2. *Restore Vegetative Communities*

Alterations in hydrology resulting from water management activities have reduced the quantity of water entering NESS, disrupted the historic pattern of sheetflow entering the northern part of the slough within the park and reduced hydroperiods and flow velocities in most areas of the slough. The resulting impacts on the vegetation of this area of the park have included a loss of deepwater slough communities dominated by *Nymphaea* (white water lily), a reduction in the extent of all slough vegetation, an expansion of sawgrass, marl prairie and exotic vegetation, and the development of semicircles of disturbed vegetation downstream from the mouth of each of the culverts under the Tamiami Trail.

In order to undo the undesirable post-drainage changes described above, ENP expects successful hydrologic restoration to produce the following alterations in vegetation communities:

A. Shift to open water, spikerush marsh and other slough communities in NESS
B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs
C. Reduce risk of peat-burning fires in NESS and the Rocky Glades

D. Increase area of slough vegetation communities
E. Restore deepwater slough vegetative communities (e.g., *Nymphaea*)
F. Reduce potential for invasion of exotic plant species
G. Reduction in area of disturbed vegetation associated with concentrated flow zones along Tamiami Trail

An explanation of each of these alternations follows:

A. Shift to open water, spikerush marsh and slough communities in NESS

In NESS, a reduction in the hydroperiod, water depth and flow has apparently led to replacement of the slough vegetation by sawgrass and other wet prairie species (Committee on Restoration of the Greater Everglades Ecosystem 2003). The evidence for this replacement consists of visual evidence of pattern blurring from aerial photographs and satellite images (Committee on Restoration of the Greater Everglades Ecosystem 2003). A lack of detailed studies of historical vegetation change in Shark Slough vegetation makes it impossible to quantify this conversion either for Shark Slough in its entirety or for different areas of the slough. It is generally assumed that increased hydroperiods, flows and water depths will result in the restoration of the historic abundance of slough vegetation and the retreat of sawgrass and wet prairie vegetation that has invaded former sloughs. It is the ENP expectation that the selected alternative will provide flow patterns to support the restoration of slough communities in NESS.

B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs

Historically, the deepwater, long-hydroperiod areas of Shark Slough supported a community dominated by white water lilies (*Nymphaea odorata*) bladderwort (*Utricularia* spp.) and pickerel weed (*Pontederia cordata*) (Olmstead 1983). Ross et al. (2001) found that the wettest sites in Shark Slough are currently occupied by spikerush (*Eleocharis cellulosa*) stands and that deepwater slough vegetation is too rare to be mapped. Water lily-dominated slough communities in Shark Slough are currently restricted to artificially deepened areas such as canals. In the central Everglades, deepwater slough communities dominated by *Nymphaea* began replacing the emergent wet prairies in locations where water depths regularly exceed 2.5 ft (Goodrick 1984). Other studies have found that *Nymphaea* is characteristic where year-round water depths range from 1.0 - 3.3 ft (Cohen et al. 1984) or 0.8 - 3.3 ft (Herdendorf et al. 1986). Presumably, restoration that results in annual water depths in excess of 2.5 ft will result in the recovery of deep-slough vegetation. It is the ENP expectation that the selected alternative should provide annual water depths greater than 2.5 ft in NESS to restore deep-slough vegetation and prevent encroachment of sawgrass and wet prairie vegetation.

C. Reduce risk of ridge and tree island peat burning in NESS and the Rocky Glades

Impoundment of WCA-3A has led to decreased sheetflow, decreased hydroperiods and decreased depths in the northern end of WCA-3A. As a result of over-drainage, major peat burning fires in the 1950s resulted in the destruction of hammocks and the loss of tree island tails (Robertson 1953). This drainage was followed by prolonged periods of excessively high water, which hindered the re-establishment of woody vegetation. In southern and eastern WCA-3 impounded water has caused increased depths, longer hydroperiods and loss of sheetflow. As a result, southern WCA-3A has shifted from a ridge and slough landscape to a deeper water, more lacustrine landscape (Science Coordination Team 2003).

During periods of extreme dryness, peat fires have severely damaged areas of Shark Slough. By removing substrate and lowering the surface elevation, peat fires have long-lasting impacts on the landscape. When a peat fires burns through a tree island, the loss of substrate can lower the elevation sufficiently to prevent tree island vegetation from recovering. Following such a peat fire, complex tree

islands can be replaced by willowheads. Peat fires in sawgrass-dominated areas often result in the replacement of sawgrass with slough vegetation such as maidencane (*Panicum hemitomon* Schult.). Sawgrass may eventually recover in these areas, but recovery is very slow and occurs primarily by rhizome expansion, since maidencane inhibits sawgrass seedling establishment (Lowe 1986). Although peat fires must have occurred prior to water management, it is assumed that they became more frequent following drainage and efforts at fire supression. Simmons describes peat fires burning away hummocks of pine in the rocky glades during the 1930s (Simmons and Ogden 1998). He attributes the destructive peat fires to a combination of drainage and the accumulation of fuel resulting from suppression of wet season fires. Hydrologic alterations that result in shorter periods when the substrate surface is dry (water depth of 0 ft or less) will decrease the likelihood of peat-burning fires. It is the NPS expectation that the selected alternative will improve hydroperiods and eliminate or substantially reduce dry-down events in NESS where the groundwater is below 0 ft. This will significantly reduce the risk of peat-burning fires in NESS and the Rocky Glades.

D. Increase area of slough vegetation communities

The spatial extent of the ridge and slough system has also been affected by water management. Figure 4.3 shows that the historical ridge and slough system was centered in the vicinity of the current L-67 extension and extended to Whitewater Bay. Currently, there is no habitat in ENP or WCA-3B that fits Davis' description of slough (Clark 2003). Water is released from WCA-3A to ENP according to a regulation schedule that decouples the flow from the natural variability of rainfall and runoff. By comparing the historical discharges of water across Tamiami Trail to current discharges, it is apparent that water deliveries to ENP have been unnaturally shifted to the west (refer to Figure 4.4). This has resulted in unnatural flooding in the western marl prairies and impacts to the western habitat of the endangered CSSS.

In NESS, a reduction in the hydroperiod, water depth and flow has apparently led to replacement of the slough vegetation by sawgrass and other wet prairie species (Committee on Restoration of the Greater Everglades Ecosystem 2003). The evidence for this replacement consists of visual evidence of pattern blurring from aerial photographs and satellite images (Committee on Restoration of the Greater Everglades Ecosystem 2003). A lack of detailed studies of historical vegetation change in Shark Slough vegetation makes it impossible to quantify this conversion either for Shark Slough in its entirety or for different areas of the slough. It is generally assumed that increased hydroperiods, flows and water depths will result in the restoration of the historic abundance of slough vegetation and the retreat of sawgrass and wet prairie vegetation that has invaded former sloughs. The ENP expectation is to restore annual water depths of greater than 2.5 ft. in order to restore slough habitats to areas characterized historically as slough habitats in NESS.

E. Decrease potential for invasion of exotic species

NPS expectations for exotic plants are to 1) reduce the populations of exotic plants to a low level and maintain them there, and 2) decrease the potential for invasion of exotic plant species into the park. The drying of park habitats to the east has been associated with rapid establishment and spread of a large number of exotic plant species. ENP has a vigorous exotic plant management program which targets such exotic plant species as Melaleuca (*Melaleuca quinquenervia)*, Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*) and Old World climbing fern (*Lygodium microphyllum*). Because the East Everglades Acquisition Lands support a large fraction of park exotic plant populations, particularly for Melaleuca (*Melaleuca quinquenervia)* and Australian pine (*Casuarina equisetifolia*), significant exotic plant control efforts are focused on the part of the park downstream from likely bridge sites for the Tamiami Trail.

A number of studies have been conducted that demonstrate a link between hydroperiod and exotic plant establishment and survival. Australian pine, which typically invades short-hydroperiod prairies, is intolerant of flood conditions. Melaleuca recruitment at longer hydroperiods is limited by a shortening the period of viability of seeds in waterlogged soils (Sena, Gomes and Kozlowski 1980). Studies of Melaleuca saplings, however, found that they adapt to hypoxic, aquatic conditions, leading to increased growth under longer, fluctuating hydroperiods, even with periods of submersion (Lockhart et al. 1999). Brazilian pepper thrives in hammocks, bayheads and other shrub communities, typically in slightly elevated areas with increased nutrient availability. It occurs in short hydroperiod prairies, but it rarely thrives there. Prolonged submergence reduces the survival of Brazilian pepper seedlings (Ewel et al. 1982), which excludes it from establishing in long hydroperiod areas.

Increased water flow, depth and hydroperiod resulting from the elevation of a section of Highway 41 is expected to reduce the amount of effort required to control Melaleuca, Australian Pine, and Brazilian pepper in areas downstream of the elevated bridge. Wetter conditions will not significantly impact established plants, but recruitment of these three exotic plant species is expected to be reduced. Depending on the plant species involved, reduced recruitment in wetter soils is expected to result from more rapid loss of seed viability, reduced germination rates, lower survival of seedlings and slower growth.

Of the major nuisance exotic plants in ENP, Australian pine recruitment will likely be reduced to the greatest extent, as it is the least tolerant of flooding. Conversion of short-hydroperiod prairies to long-hydroperiod marshes will reduce the area susceptible to invasion by Australian pine. Increasing hydroperiod should reduce the potential for establishment of Melaleuca, but is unlikely to result in reduced growth or significantly increased mortality of this species. Brazilian pepper recruitment is expected to decrease as increased water depths and hydroperiods render the wettest of its current habitats too wet for establishment. Increased hydroperiod and water depths are expected to reduce recruitment of Brazilian pepper by rendering the lowest elevation heads (*e.g.*, willow heads) too wet for its establishment.

4.5.2.3.3. *Restore fish and wildlife resources*

The restoration of ridge and slough processes and vegetative communities via improvements in hydrology is expected to lead to changes and improvements in fish and wildlife resources. We examined five aspects of the fish and wildlife resources of ENP in order to analyze the benefits of the different alternatives for raising portions of the Tamiami Trail.

A. Improve characteristics of aquatic communities

With respect to bridging of the Tamiami Trail and associated increases in flow volume and hydroperiod, NPS goals for aquatic community restoration are: 1) minimize the impact of anthropogenic structures on native fish communities across the landscape, 2) increase total biomass of fishes over current conditions in NESS, Taylor Slough and the Rocky Glades, and 3) maintain a low proportion and abundance of exotic aquatic species within all park habitats.

1) Minimize the impact of anthropogenic structures on native fish communities across the landscape. Current marked differences in the native aquatic communities in WCA-3A, WCA-3B and NESS are an unnatural result of the partitioning of the original river of grass by means of levees, canals and roads, including the Tamiami Trail. These community differences are documented in a number of scientific publications (Trexler et al. 2001; McElroy et al. 2003; Chick et al. 2004; Ruetz et al. 2005). Aquatic communities in the Everglades are dynamic because of the marked impact of periodic marsh drying on fish and aquatic macroinvertebrates; therefore, increasing connectivity and

restoring natural hydrology in this area will lead to improvements in the aquatic communities in all three regions. Fish populations will be shifted in space; areas of WCA-3A that currently harbor the largest populations of bass, gar, and other large species will have lower densities because of increased drying, while southern WCA-3B and NESS will harbor more of these fish because of lengthened hydroperiods.

2) Increase abundance of native fishes over current conditions in NESS, Taylor Slough and the Rocky Glades. Where hydroperiod is lengthened as a result of increasing stages and volume across Tamiami Trail, areas of greatest small fish, crayfish, and grass shrimp productivity will be increased. Changes caused by shortening hydroperiod in southern WCA-3A will be realized in the first year this area dries when it would not have dried without the project. In contrast, lengthening hydroperiod in WCA-3B and northern Shark Slough will yield desirable changes in small fish and macroinvertebrate communities over a 5 to 7 year period (Trexler et al. 2005). Deeper slough habitats and increased microtopographic relief expected to result from increased flow is predicted to provide increased concentration of small fish and macroinvertebrates that are consumed by wading birds, potentially improving foraging habitats in areas where maximum flow rates are increased.

Quantitative calculation of the expected benefits of the alternatives regarding increased density of marsh fishes and associated aquatic fauna is based on an empirical relationship of fish abundance to a hydroperiod variable (time since the site was last dried out) that has been determined from field studies at selected long-term sampling sites in the Everglades (Trexler et al. 2003). A modeled index (the total abundance of fish produced in a sample site over the 31-year period of record) allows comparisons of the performance of the alternatives in terms of support for aquatic production in different areas. Modeled predictions were made for a total of 16 sample sites, distributed over WCA-3A, WCA-3B, NESS, and Taylor Slough (Figure 4.11). These predictions indicate that Alternative 2 and CSOP base perform nearly equally with respect to marsh fish production over the entire sample area: that is, no improvement is detected with implementation of a 3,000-ft bridge. Implementation of a 4-mile bridge would provide a substantially higher level of marsh fish production for northern Shark Slough and WCA-3B, and less production in Taylor Slough and WCA-3A. Calculations were not available for the 10.7-mile Bridge.

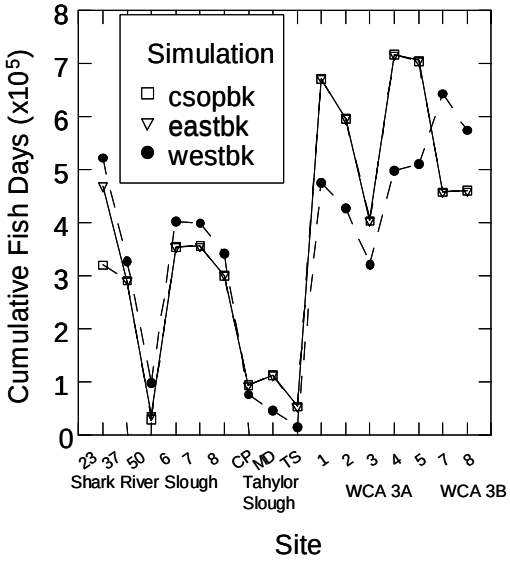


Figure 4.11. Comparison of three alternative management plans through simulations of small fish population dynamics. Cumulative fish days is the sum of fish density on each day simulated (1965 – 2000). Note that the 3,000-ft Bridge model and CSOP model only differed in northeast Shark Slough (site 23).

3) Maintain a low proportion and abundance of exotic aquatic species within all park habitats. For the purposes of the Tamiami trail evaluation, the question to answer is the following: "Will increased sheetflow and connectivity from the north lead to increased spread of non-native fishes into the wetlands of Shark River Slough?" In all parts of the Everglades system (north and south) canals are an unnatural deepwater habitat that tends to harbor and promote the spread of exotic fish. Trexler 2003 and Rehage and Trexler (in prep.) studied the density of non-native and native fishes in marsh with respect to distance from canals in 4 sites north of Shark Slough in ENP, and one site north of the ENP eastern panhandle.

These studies showed that both native and non-native fishes are found at artificially high densities along the canal border, but that these densities drop off very quickly with increasing distance into the marsh. The dominant exotic fish (Mayan ciclid) dropped to undetectable levels at about 50m distance from the canals. These results indicate that those species of exotic fish currently in the deepwater canal system to the north are unlikely to spread into any restored marsh habitats in ENP resulting from increased sheetflow across the Tamiami Trail.

With respect to the spread of exotic fish, a second line of evidence indicates that it is more beneficial for the park to receive water by increasing sheetflow from the north than to receive water via pumping from canals along the eastern boundaries. Because human development is concentrated to the east of the park, the canal systems to the east have a much higher potential for introducing exotic fish to marsh habitats within the park than the L-67 canals. Long-term monitoring studies carried out by park staff have discovered at least 4 species of exotic fish just within the eastern park boundary (Kline 2003) These species were all detected since 1999, and two of them (the jewel ciclid and jaguar ciclid) have spread rapidly throughout the Rocky Glades since first detection. It is worthwhile noting that the long-term monitoring studies included a number of sampling sites toward the northern boundary of the park; however, no exotic species have yet to be detected at the sample sites in that region.

B. Improve conditions for wading bird foraging and nesting

With respect to bridging of the Tamiami Trail and associated increases in flow volume and hydroperiods into northeast Shark Slough, NPS goals for wading birds are to 1) substantially increase total abundance of wading bird populations found in ENP compared to current levels, and 2) to approximate pre-drainage patterns of colony formation, including increasing the percentage of breeding colonies found in and adjacent to the estuarine region, and increasing the frequency of formation of super colonies of wading birds.

There is strong evidence to suggest that several species of wading birds in the Everglades are limited by prey availability, which is linked to hydrologic conditions (Gawlik 2002). For example, wading birds will not start nesting until water levels are below a threshold (Kahl 1964) and they will abandon nests when water levels increase by as little as 2 cm, causing prey to disperse. The primary determinants of prey availability are the characteristics of the prey community (e.g., prey population size, species composition, and energetic value), wading bird species (e.g., body size, bill length, leg length), and physical environment (e.g., microtopography, water depth, and vegetation structure; Figure 4.12; Gawlik 2002). High quality habitat (i.e., habitat with high prey availability) in the Everglades occurs when these three sets of characteristics interact to produce habitat patches with a high density of prey that are of high energetic quality and are vulnerable to being captured by birds. The ENP expectations for wading birds are therefore affected by the availability of high-quality foraging habitat, and by the distribution of this foraging habitat with respect to the location of available nesting habitat.

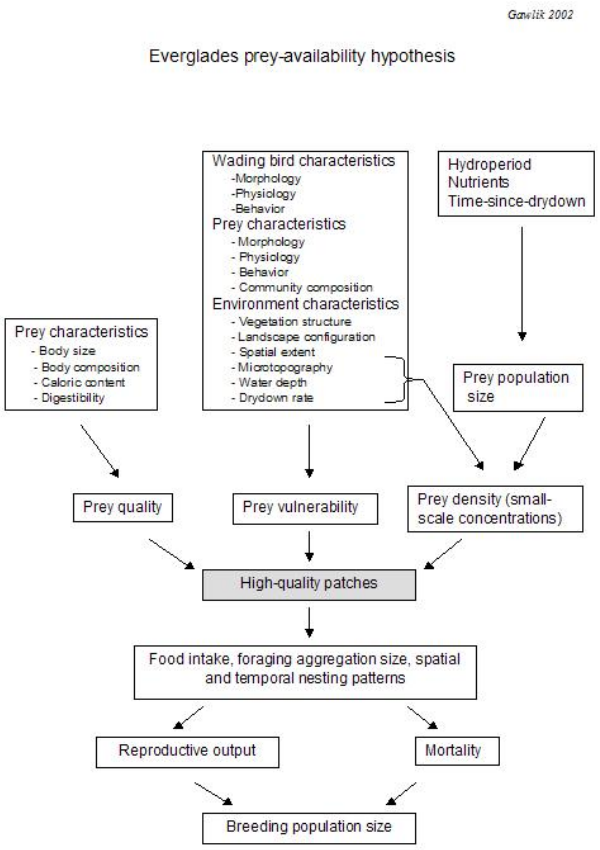


Figure 4.12. Everglades Prey availability hypothesis

We examined three factors that are linked to prey availability and thus to wading bird ecology in the Everglades:

1) Marsh fish abundance, which increases with the length of bridge and associated increases in flow volume and hydroperiod in northern Shark Slough.

   (see previous section on characteristics of aquatic communities.)

2) Increases in flow volume and velocity associated with longer bridge spans are expected to improve microtopography in the ridge and slough system in the long term, and to create and maintain a larger area with open water or sparse vegetation.

   a. Microtopography: For an explanation of the physical processes that improve microtopography in the Ridge and Slough system, see the section on Restore Ridge and Slough Processes. Increased microtopography can increase habitat quality for wading birds by increasing prey density. Small scale differences in microtopography serve as a mechanism to produce habitat patches with a high density of prey, which is critical for wading birds living in an oligotrophic ecosystem noted for its low standing stocks of fish (Turner et al. 1999). As water levels drop during the dry season, aquatic prey animals are concentrated in low places at densities of 20-150 times the wet season average (Carter et al. 1973; Kushlan 1974; Kushlan 1976; Loftus and Eklund 1994; Howard et al. 1995).

More recently, a preliminary analysis of data collected across the Everglades landscape during 2004 showed that wading birds selected habitat patches averaging 125 prey/m^2 whereas random sites in seemingly similar habitat averaged only 31 fish/m^2 (Figure 4.13; Gawlik et al. 2004). One foraging site contained 1695 prey in a single square meter of marsh. The main difference in physical features between the wading bird foraging sites and the nearby random sites was that foraging sites had more microtopographic variation from meter to meter along a 100-m transect (Figure 4.14). The coefficient of variation in relative elevation (water depth) averaged 59% at foraging sites compared to 39% at random sites. Other features such as max, min, and range in water depths within transects did not differ substantially between foraging and random sites (Figure 4.14). As a caution, however, the small sample sizes make these latter two patterns tentative. Additional sampling is currently being done to increase precision of the estimates.

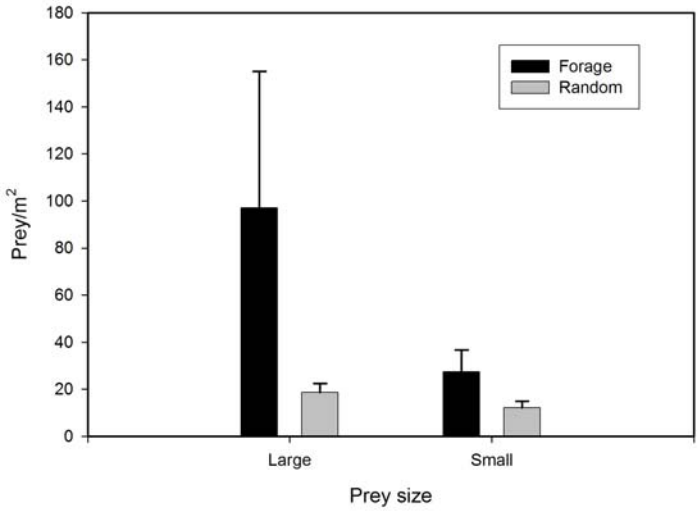


Figure 4.13. Wading Bird foraging habitat and prey availability.

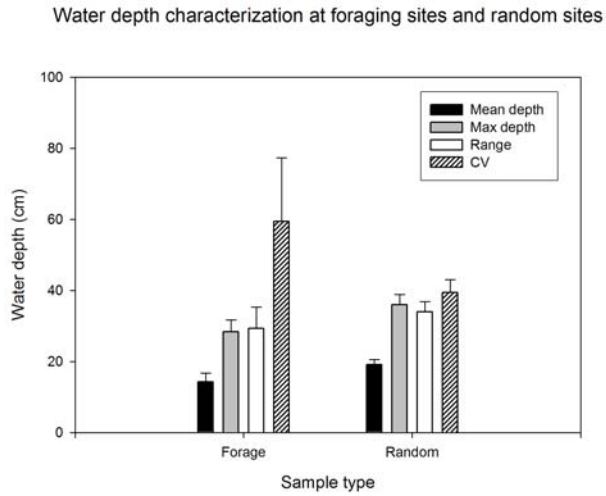


Figure 4.14. Water depth influence on wading bird foraging and prey availability.

Enhanced microtopography can also benefit wading birds by reducing their search time to find prey. At shallow water foraging sites preferred by wading birds, the higher elevation areas are dry and visually obvious so they don't have to be searched for food. This habitat cue effectively reduces the size of the landscape that must be searched to find high quality sites, could greatly increase the foraging efficiency of birds. Reduced search time would be especially advantageous in ecosystems like the Everglades where the location of good foraging sites changes quickly with changing water depths.

b. Vegetative structure: Maintaining sloughs with little emergent vegetation can increase habitat quality for wading birds by making fish more vulnerable to capture. Wading birds forage more successfully in areas with sparse vegetation (Surdick 1998) than dense vegetation, which may explain why densities of some wading bird species are highest where open slough habitat is most abundant (Bancroft et al. 2002). In contrast, wading birds avoid areas with dense sawgrass (Hoffman et al. 1994) like those in northern WCA-3B, where sheet flow has been reduced and sawgrass has replaced submerged slough vegetation.

3) If the bridging of the Tamiami trail is sufficiently wide, and is accompanied by sufficient passive flow from WCA-3A through WCA-3B and into NESS, then;

   a. patterns of annual water recession and ascension should better reflect the natural hydrologic cycle, and should more consistently create the high quality wading bird foraging habitat that occurs on the fringes of drying pools during the dry season and,

   b. persistent pools (very long-hydroperiod habitat) needed for substantial marsh fish production and currently located in southern WCA-3A will be shifted southward into WCA-3B and Shark Slough, creating the potential for high-quality foraging habitat closer to the historical locations of nesting colonies in the estuarine region.

C. Improve alligator nesting numbers and distribution

Alligators are a keystone species in the south Florida wetlands in that they play a major role in influencing the overall health and ecological patterns of the region. In ENP, overall numbers of alligators have substantially declined, and distribution patterns have been greatly altered, as a result of water management practices. Hydrological conditions are known to have direct and indirect effects on alligator population numbers and nesting success. Direct effects include nest flooding caused by high variability in daily discharges from flood control structures. Indirect effects on alligators result from changes in the amount and distribution of the prey base (marsh fishes). Lower water levels in NESS, due to lack of overland flow from the north, have been shown to reduce the number of alligators nesting in ENP. Water management practices, including drainage of peripheral wetlands and increasing salinity in mangrove habitats, have also likely been the cause of a shift in distribution of alligators from these areas to canals and the central slough habitats of the Everglades (Dalrymple; Rice et al. 2004; Slone et al. 2003).

Restoration goals for alligators in ENP include the following:

1. Expansion of the geographic range of breeding age alligators

2. A shift in distribution of alligator nests from the central areas of Shark Slough toward the peripheral marshes

3. Increases in alligator total population numbers and increases in numbers of females nesting per year

4. Reduction in the frequency of excessive nest flooding associated with releases from flood control structures.

Hydrologic conditions that will lead to NPS restoration expectations for alligators include increasing the quantity of water entering NESS from the north, providing an unimpeded flow-way that allows water levels in the slough and peripheral marshes to track natural rainfall patterns, and maintaining a low level of frequency and severity of operational hydrologic events that reverse or highly exaggerate natural hydrologic cycles. Hydrologic conditions that allow for about 2 ft of water at gauge NP-203 during late April and early May result in an increase in the number of nests produced.

D. Reduce wildlife mortality

Wildlife on roads is a serious threat to local populations of wildlife, as well as a hazard to drivers. Increasing numbers of studies have documented road-kill as a significant factor in the overall mortality of several wildlife species (extensive references found in Foster and Humphrey 1995, and the FWS Multi-Species Recovery Plan 1999). The ENP expectation is to reduce wildlife mortality on roads to a minimum number of events per year.

In a study carried out specifically to assist in formulating alternatives for the Everglades, the FWS conducted a survey of animals killed by vehicles from September 2002 through September 2003 along the eastern section of Tamiami Trail (from the junction of the L-67 levee to the junction of L31N levee).

Over 650 road-killed animals were recorded during the survey. The majority of these were snakes, frogs, turtles, alligators, small birds, raccoons and opossums, but rarer species such as the grey fox and river otter, and the endangered wood stork were also recorded. This number translates to about 22 collisions with animals per mile per month along the Tamiami Trail. This estimate must be viewed as a minimum number because many of the smaller carcasses go unrecorded (they decompose or are carried off by scavengers before they can be recorded, or the injured animal moves off the road before dying): by some estimates, the total number is likely to be double the number recorded.

When bridges and other kinds of wildlife underpasses are incorporated into highway design, animals do use them. A study of Florida panthers and other wildlife conducted along I-75 showed that many species, including panthers, bobcats, alligators, deer, raccoons, and wading birds readily use the space under a bridge to move from one side of the road to another (Foster and Humphrey 1995). A bridge incorporated into the Tamiami Trail design will result in a corresponding benefit to wildlife, with the benefit directly proportional to the length of the bridge.

Although it is difficult to predict relative benefits to different wildlife groups (for example birds vs. mammals), crawling, walking, swimming and wading types of animals are likely to receive particular benefits. Endangered species will benefit directly: wood storks have been recorded as road-kill along the eastern half of the Trail. For the Florida panther, the major cause of death is collision with motor vehicles.

4.5.2.3.4. *Improve Water Quality in ENP*

Everglades National Park is part of the State of Florida's "Everglades Protection Area" and water quality within the park is subject to state law requirements for Class III waters (recreation) as set forth in the Everglades Forever Act. One of the surface water classifications under Florida's water quality rules is Outstanding Florida Waters. An Outstanding Florida Water is a water body designated worthy of special protection because of its natural attributes. Most OFWs are areas managed by the state or federal governments as parks, including ENP. This designation protects waters from any deterioration of water quality over that water quality which existed during a one-year baseline period ending March 1, 1979. For the park, the long-term limits designated under the terms of the Settlement Agreement (see below) were designed to afford OFW protection. Further, the Consent Decree entered in United States v. SFWMD provides additional requirements to ensure the improvement of the quality of water entering Shark Slough in the park

The NPS goal is that the preferred alternative will be consistent with applicable state and federal law requirements for water quality conditions in ENP. As a result, ENP expects that the 4-mile Bridge or 10.7-Mile Bridge alternative will substantially reduce canal discharges to the park by providing more overland flow through WCA-3B. Canals have much higher levels of pollutants than do marshes, thus reducing direct canal discharges into the park will improve water quality conditions in the park. This increased overland flow should provide the following specific ecological benefits: (1) reduce the injurious effects of organic forms of nutrients—total organic carbon, total organic nitrogen, and total organic phosphorus—on aquatic communities, (2) increase the levels of dissolved oxygen in park wetlands, contributing to the improved viability of many wetland species, (3) reduce specific conductance and sulfate concentrations, thus reducing the debilitating effects of mercury methylation on aquatic species, (4) reduce canal bed erosion that contributes to the transportation of suspended solids and the loss of photosynthesis needed for the production of dissolved oxygen, and (5) increase nutrient cycling by reducing the aforementioned stressors that prevent nutrient uptake by plants as well as nutrient cycling by soil bacteria.

4.6. Rationale for NPS Selection of Tamiami Trail Project Component Performance Measures

The NPS reevaluation of the Tamiami Trail alternatives is focused on the two major environmental objectives, as explained earlier in this report. The objective—Allow for Restoration Consistent with the 1989 ENP Protection and Expansion Act—is further sub-divided into six objectives and 30 performance measures. These performance measures are identified by scientists as critical ecological indicators of park health. The performance measures are identified in the NPS Expectations section (summarized in Table 3.1) and in the "Hydrological and Ecological Benefits of Alternatives" section (summarized in Table 6.1) under the two primary environmental objectives.

The performance measures are grouped by hydrological indicators (8 PMs) and ecological indicators (22 PMs). Obviously, there is a strong connection between hydrological attributes and ecological responses; however, this grouping was selected based on the analyses conducted by the contributing scientists. Data from the analysis of these performance measures represent a broad array of information provided through numerous sources, and represents the best available scientific information at the time of this final report. Each of the alternatives was evaluated initially for performance in meeting the environmental objectives of the project for the explicit purpose of identifying the environmentally preferred alternative.

5. Alternative Descriptions

For comparison purposes, the 4-Mile Bridge alternative and 10.7-Mile Bridge alternative operate with an unconstrained L-29 Canal stage (DHW of 9.7 ft), the 3,000-ft Bridge alternative has a constraint of 9.3 ft-NGVD for the L-29 Canal, and the No Action alternative has a L-29 Canal constraint of 7.5 ft-NGVD. A CSOP alternative termed "Alternative 3" was modeled with an unconstrained L-29 Canal, instead of the 9.3 ft. constraint used in the 3,000-ft Bridge alternative evaluated in this report; however, these results were not available for the technical evaluations included in this report. ENP staff have evaluated both the 3,000-ft Bridge alternative (9.3) and 3,000-ft Bridge alternative (unconstrained L-29 Canal) an identified only slight differences in their environmental performance. For example, total flows through WCA-3B to NESS were 11% in the 3,000-ft bridge (9.3 ft. L-29 constraint) and 13% in the CSOP 3,000-ft Bridge (unconstrained L-29 canal). Due to these similarities, we believe comparisons between the 4-Mile Bridge alternative and the 3,000-ft Bridge alternative are valid.

The Corps 2003 Final GRR and SEIS for the Tamiami Trail component of the MWD Project evaluated nine alternatives. The alternatives ranged from low cost approaches such as adding four small bridges to the existing road alignment and profile (Alternative 1 with an estimated cost of $14.3 million), to an elevated 10.7 mile bridge which would raise the entire roadway to +17 ft (Alternative 5 with an estimated cost of $142.2 million). Table 5.1 provides a brief description for each of the alternatives as well as the estimated costs for each (2003 GRR/SEIS for the Tamiami Trail Component of the MWD Project).

Table 5.1. 2003 Final GRR and SEIS Tamiami Trail Alternatives

Alternative[1]	Description	Total Cost[2] ($M)
1	Existing alignment and profile with four new bridges	14.3
2	Existing alignment with raised profile and four new bridges	24.4
3	New northern alignment with eight new bridges	68.0
4	New southern roadway with four new bridges	45.2
5	Elevated replacement roadway with full removal of the existing highway	142.2
6 (full[4])	Existing alignment with raised profile and a 4-mi bridge	74.7
7	Existing alignment with raised profile and a 3000-ft bridge	23.0
8	Existing alignment with raised profile and 24 additional box culverts	45.5
9[5]	Existing alignment with raised profile and a 2.7-mi bridge	48.0

[1]Alternatives 2 through 9 were classified as either without water quality features, (A) or with water quality features, (B). This list does not include any alternatives with water quality features as these alternatives were eliminated from further consideration by DOI in the 2003 Final FWCAR over concerns of increased wetland loss due to construction and because FDEP did not require the features for issuance of the associated water quality permits.
[2]Cost figures are for construction only and are provided in FY02 dollars. These figures are from the 2003 GRR, except Alternatives 6*a* (full) and 9*a*, which were from the FWCAR.
[4]Full is the term used in the GRR/FWCAR to denote "full" removal of the existing highway section that would be replaced by the new bridges or culverts.
[5]Alternative 9 was evaluated as part of the FWCAR, but was eliminated in the 2003 GRR.

As stated earlier in this report, the preliminary selected plan identified in the Final 2003 GRR was Alternative 7A (Alt-7A). That plan specified the construction of a 3000 ft bridge in the 10.7 mile NESS section of the Tamiami Trail and raising the remainder of the affected road alignment. When Alt-7A was

selected as a potential plan for implementation, the Corps also recognized the need for consistency with the modifications to Tamiami Trail that were proposed under the WCA-3 Decompartmentalization Phase I project within CERP. Therefore, the 2003 GRR/SEIS for the Tamiami Trail component of the MWD project specified the construction of the 3000 ft bridge only, and not the elevation of the roadway. In lieu of raising the remainder of the road alignment, the Corps recommended an alternative mechanism involving the transfer of funds to the FDOT in an amount equivalent to construction costs for elevating the remainder of the roadway. These funds would be provided to FDOT through a real estate agreement, and used at the discretion of FDOT, to mitigate for any roadway damage during peak design flows until the WCA-3 Decompartmentalization features in CERP were identified and constructed.

Three concerns were raised concerning public review of this potential plan. First, when FDOT commented on the draft 2003 GRR/SEIS in March 2004, the agency stated they could not accept the legal responsibility associated with the real estate agreement proposed by the Corps as this would constitute a transfer of responsibility (liability) for the Tamiami Trail, as modified by the 2003 GRR/SEIS. As a result of this opinion, the Corps was now required, as part of the MWD Project, to elevate the remaining portions of the roadway not modified by the 3000-ft bridge as specified in Alternative 7A.

Second, FDOT restated their agency's position that required the finished elevation of the roadway to be built to 12 ft, or 0.5 ft higher than the elevation specified in the selected plan. This modification was based on the FDOT stating that the DHW in the L-29 canal could not be exceeded within a 24-hour period to ensure the structural integrity of the road. The additional modifications to the Tamiami Trail component of the MWD project required to comply with the FDOT DHW requirements resulted in an increase in cost of the Tamiami trail component of more than $34 million. The Corps and FDOT have recently agreed on the appropriate DHW for L-29 canal for modifications to the Tamiami Trail. According to April 2005 correspondence between the two agencies, the Corps intends on using the 20-year, 24-hour stage of 9.7 ft-NGVD as the DHW for the design of the roadway. It should be noted that this information was not available at the time of the hydrologic modeling, and therefore the development of the assumptions associated with the four alternatives evaluated in this report do not include these the 9.7 ft. constraint. However, this DHW is similar to the DHW assumed for the 4-mile bridge alternative assessed in this report.

Third, the FDOT induced design modifications also resulted in the Corps modifying the design of the MWD conveyance component from more passive weirs to more costly gated culverts. The NPS was concerned with the cost increases and the potential reduction in environmental performance of the MWD Project due to these design changes. This concern also preceded the DHW agreement recently reached between the Corps and FDOT.

Based on the concerns outlined above, the Corps is in the process of reviewing the alternatives for the Tamiami Trail for ways to better comply with FDOT concerns and criteria as well as improve environmental performance and compatibility with future modifications implemented under the CERP authority. The Corps has elected to resolve these concerns through the completion of a revised GRR, scheduled for completion in December 2005. Four alternatives have been selected by the Corps for inclusion in the RGGR. These are the No Action alternative, the 3000-ft bridge (Alternative 7A in the 2003 GRR), the 4-mile bridge (Alternative 6A in the 2003 GRR), and the elevated highway (Alternative 5 in the 2003 GRR). A general description of each alternative follows.

5.1. No Action Alternative—Alternative 1

The purpose of the No Action alternative is to provide a basis of comparison for all other alternatives evaluated in the RGRR as well as this report. In this case, the No Action alternative is used for the

comparison of benefits associated with the remaining alternatives, assuming their implementation will result in superior performance. Therefore, the No Action Alternative includes only the modifications to the Tamiami Trail specified in the original 1992 GDM for the MWD Project. These modifications include the raising of a small segment of the Tamiami Trail in the vicinity of the existing S-334 structure. This assumption was made because, at the time the 1992 GDM was completed, it was believed that the existing culverts under Tamiami Trail would be adequate to convey the flow of water anticipated under the MWD Project. The No Action alternative also assumes that the 1992 GDM conveyance features were also in place; this assumption includes the original S-345 structures, S-349 structures, S-355 structures, and the elimination of the L-67 extension canal and levee. Other major assumptions with this plan include the elimination of the need for the G-3273 constraint for releases of water through S-333 into NESS, the full implementation of the 8.5 Square Mile Area flood mitigation features (Alternative 6D), and water deliveries to ENP in accordance with the rainfall formula. For purposes of the analyses included in this report, it was assumed that the No Action alternative DHW in the L-29 canal upstream of the Tamiami Trail alignment is 7.5 ft-NGVD in order to prevent damage to the existing road surface as mandated by the FDOT. This assumption constrains the quantity of water available for delivery to NESS as the discharges from WCA-3A (through S-333) and WCA-3B (through S-355 A and B) would only occur at times when water levels in the canal do not exceed 24-hour 7.5 ft-NGVD stage criteria associated with this alternative. The remaining major assumptions associated with the No Action Alternative are found in Table 5.2.

Table 5.2: Major structural and operational assumptions associated with Tamiami trail alternatives examined in this report

Alternative Feature	Alternatives			
	Alt 1 (No Action)	**Alt 2 (3000-ft Bridge)**	**Alt 3 (4-mile Bridge)**	**Alt 4 (Elevated Highway)**
DHW Elevation (ft-ngvd)	7.5	9.3	Unconstrained	Unconstrained
Road Elevation (ft-ngvd)	current	11.5	12	17
L-67A Levee features[1]	S-345 A-C	S-345 A-C	Weirs	Weirs
L-29 Levee features	S-355 A/B	S-355 A/B	S-355 A/B plus 3 weirs	S-355 A/B plus 3 weirs

[1]L-67C modifications and L-67A canal features were beyond the resolution capability of the SFWMM hydrologic model and not addressed in this analysis

5.2. 3000-ft Bridge Alternative—Alternative 2

The purpose of the 3000-ft Bridge alternative in this report is to provide consistency with the selected plan identified in the Final 2003 Tamiami Trail GRR. Unlike the No Action alternative, the 3000-ft Bridge alternative attempts to reduce the potential adverse impacts associated with the stage constraint in the adjacent L-29 canal and thereby improve the volume, timing, and distribution of water delivered to NESS in a manner more consistent with the intent of the MWD Project. However, DOI expressed an environmental performance concern with the modifications to the 2003 GRR Recommended Plan. This concern is related to the 9.3 ft. design high water (DHW) of the 3,000-ft bridge alternative. Specifically,

the roadway safety requirements of FDOT prohibit water levels exceeding the DHW for more than 24 hours. Recent analysis of historical Tamiami Trail water level data indicates that the DHW of 9.3 ft will be exceeded for more than 24 hours during flood events exceeding "1-in-10" year events. Since "1-in-10" year flood events are common in this region, DOI believes that a minimum DHW of 9.8 ft ("1-in-20" year flood event) is needed for Tamiami Trail to meet the authorized objectives of the project, CERP goals, and FDOT requirements. FDOT concurs with this analysis.

The 3000-ft Bridge alternative (Alternative 7A in the 2003 GRR) is a raised profile roadway built on the existing alignment with a 3000-ft bridge. The existing Tamiami Trail profile and typical section will be modified (raised in elevation) for approximately 1 mile at the western end of the project and approximately 9.4 miles to the east of the bridge (Figure 5.1). The bridge portion of this alternative is defined as reconstruction of approximately 3,000 ft of the Tamiami Trail alignment as an elevated structure. The existing road embankment coincident with the 3,000-ft bridge would be removed while the existing culverts under Tamiami Trail would be retained. The bridge typical section would have two travel lanes of 12 ft, two shoulders of 8 ft, and outside barriers. This alternative would raise nearly 10.4 miles of the existing highway by approximately 2 ft to a finished elevation of 11.5 ft based on a design high water of 9.3 ft. This would be accomplished by adding a combination of fill material and asphalt surfacing.

Since this alternative also assumes that the amounts of water conveyed from WCA-3A and WCA-3B into the L-29 canal and the Tamiami Trail are reduced to levels that would prevent exceeding the FDOT 24-hour DHW criteria, operations assumed for this alternative restricted the amounts of water capable of being transferred from WCA-3B into NESS. Due to this operational constraint, this alternative it was assumed that much of the water discharged into NESS would originate in WCA-3A rather than in the more historical flow route of WCA-3B. The remaining structural and operational assumptions associated with this alternative can be found in Table 5.2.

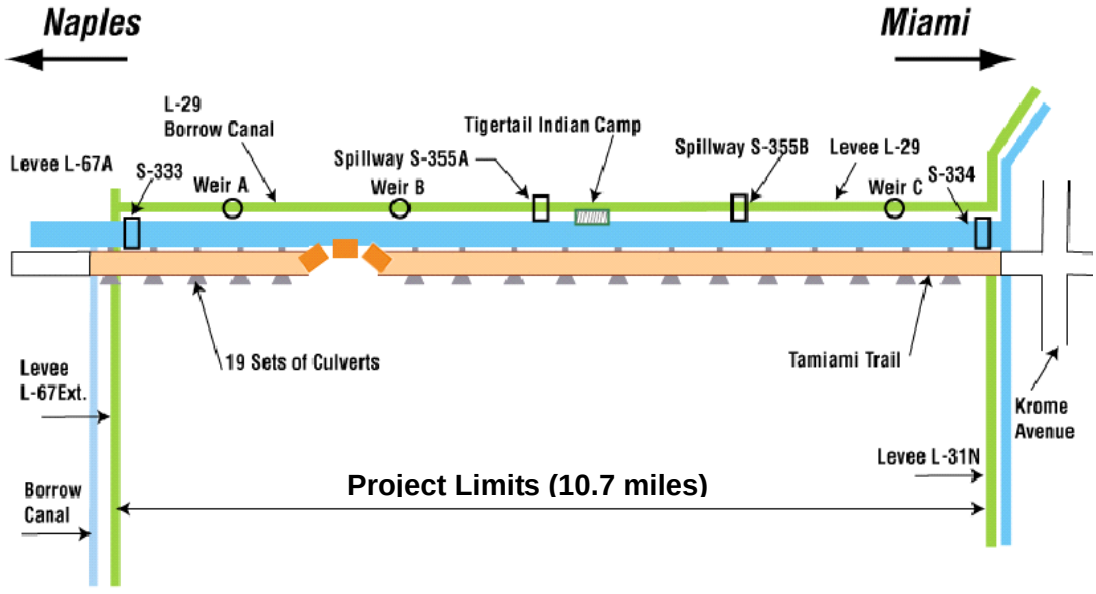


Figure 5.1. Plan view of Alternative 2 (3000-ft Bridge) with full removal of the old Tamiami trail.

5.3. 4-Mile Bridge Alternative—Alternative 3

The purpose of the 4-Mile Bridge alternative is to significantly reduce or eliminate the potential constraint imposed by water levels in the upstream L-29 canal, thereby providing more natural flows to NESS. For purposes of this report, the 4-Mile Bridge alternative assumes unconstrained water levels in the L-29 canal. The 4-Mile Bridge alternative (Alternative 6A in the 2003 GRR) is an intermediate plan between the smaller span 3000-ft Bridge and the 10.7-Mile Bridge alternatives.

Based on the design described in the 2003 GRR, the existing Tamiami Trail profile and typical section will be modified (raised) for approximately 3 miles at the western end of the project and approximately 4 miles at the eastern end of the project. This alternative will built along the existing alignment, with a raised profile and a 4-mile bridge structure. The bridge design is similar to the 10.7-Mile bridge. While placement of the 4-mile span is an important design consideration, it was not considered in the evaluations included in this report. However, the NPS does provide recommendations on the placement in the bridge span in Section 7. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Canal. Eight box culverts will be strategically placed in areas where the natural slough crosses Tamiami Trail to enhance the natural, historic sheet flow. In the previous Alternative 6A partial plan, the existing Tamiami Trail embankment would need to be breached at four evenly spaced locations along the 4-mile bridge totaling about 1,500 ft in length. The 2003 FWCAR recommended a modification to this plan, referred to as Alternative 6A full plan, which would remove the embankment over the full four-mile bridge length as depicted in Figure 5.2. The NPS assumes that the 4-Mile Bridge alternative that will be considered in the Corps proposed RGRR will also adopt the design proposed in the 2003 FWCAR. The structural and operational assumptions associated with the alternative are found in Table 5.2.

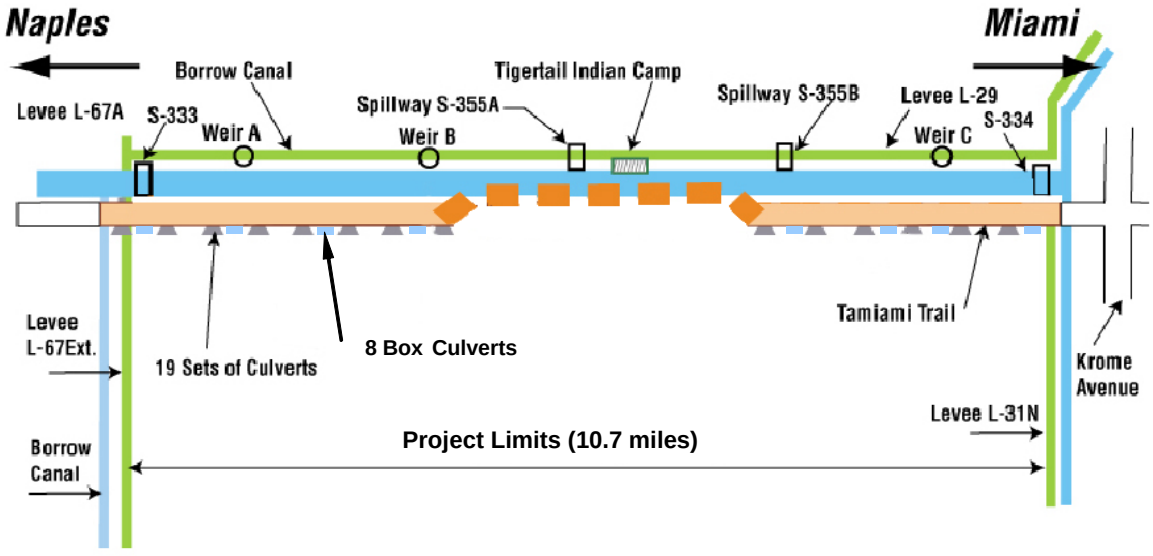


Figure 5.2. Plan view of Alternative 3 (4-Mile Bridge Alternative) with full removal of the old Tamiami Trail.

5.4. Elevated Highway Alternative (10.7-Mile Bridge)—Alternative 4

The purpose of the 10.7-Mile Bridge alternative is to eliminate, to the maximum extent practicable, all impediments to providing uniform sheet flow deliveries from WCA-3B into NESS. It is the intent of this

alternative to remove all potential structural and operational constraints, within the authority of the MWD Project, to maximize restoration of hydrologic conditions in the downstream park area.

The 10.7-Mile Bridge alternative (Figure 5.3) (Alternative 5A in the 2003 GRR) is an elevated roadway built within the existing Tamiami Trail right of way. This alternative consists of a bridge that covers the entire length of the NESS flow-way. At each end, there would be short reconstruction segments of the roadway to transition to the new bridge. The pavement would have a grade transition from the nominal average of an 11 ft elevation to an elevation of approximately 17 ft at the bridge deck. DOI concluded in the 2003 FWCAR that Alternative 5A, with full removal of old Tamiami Trail, was the Environmentally Preferred Alternative, since this plan is the most consistent with the goals of the 1989 ENP Protection and Expansion Act (PL 101-229). This decision is also compatible with modifications to Tamiami Trail anticipated to result from CERP implementation.

Since this alternative provides unconstrained flow from WCA-3B into NESS, many of the original 1992 GDM structural features in the WCAs were modified in the modeling to allow for assessment of more passive water conveyance features. Therefore, the S-345 structures of the 1992 GDM plan were replaced with more passive weirs. The other structural and operational assumptions associated with this alternative are summarized in Table 5.2.

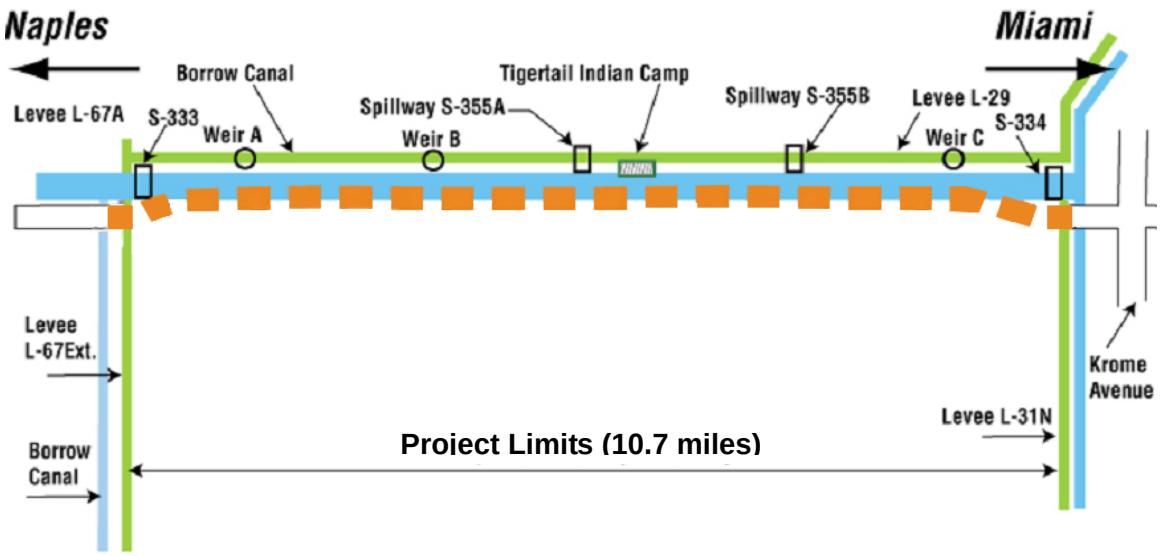


Figure 5.3. Plan view of Alternative 4 (Elevated Highway), with full fill removal of the Tamiami Trail.

6. Hydrological and Ecological Benefits of Alternatives

6.1. Evaluation of Alternative Performance

6.1.1. Performance Measure Scoring Methodology

The performance measures used in this report were derived from the most recent modeling and ecological assessments in the park and WCA-3. The hydrological performance measures are based primarily on SFWMM outputs (version 5.4) from the No Action, 3,000-ft Bridge and 4-mile Bridge model runs. RMA-2 and SEDFLOW modeling was also used, where appropriate. The ecological performance measures are based on the aforementioned modeling results, as well as, recent scientific studies by ENP staff and cooperators (see Appendix for complete list). The performance measure units range from the highly quantitative, such as acres impacted, to the less quantitative, such as a qualitative score based on best professional judgment. In order to present all of the performance measures for all of the objectives into a unified evaluation tool, all performance measures were combined into a matrix for purposes of comparing alternatives. The matrix is used in conjunction with the project constraints and the evaluation methodology described above to identify the ENP environmentally preferred and environmentally acceptable plans.

The four alternatives were assigned a numeric performance score. The values of the performance score is provided in Table 6.1 and is based on the relative performance of each of the alternatives from worst (low numeric score) to best (high numeric score) corresponding to the relative performance for the given performance measure. The exact value of the performance score was derived based on this scoring mechanism: a score of (1) was given to the lowest performing alternative; a score of (2) was given to the second lowest performing alternative; a score of (3) was given to the second highest performing alternative, and a score of (5) was given to the highest performing alternative. Whenever there was a tie for the highest performing alternative, both alternatives were scored a (5). If there was a tie for lowest performing alternative, both alternatives were scored a (1).

6.2. Summaries of Alternative Performance

For each of the four Tamiami Trail alternatives evaluated in this report, project objectives were compared to a suite of performance measures. These performance measures were used to evaluate the ability of each alternative to meet the project objectives using both quantitative and qualitative methods.

The results of the analysis of the Tamiami Trail alternatives are provided below in tabular (Table 6.1) and narrative format to highlight the important performance characteristics of each alternative. The following hydrological and ecological evaluations are based on the most recent research and field studies in ENP and in WCA-3. The performance of the four alternatives is based on the assumption that the associated L-29 levee paralleling the side of the bridge alternative is removed along with the roadbed.

Table 6.1 Performance Matrix

Objectives and Performance Measures	Units	Tamiami Trail Alternatives				
		NPS	1	4	3	2
		Goal	No Action	3,000 ft. Bridge	4-Mile Bridge	10.7-Mile Bridge
Project Objectives						
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999						
A. Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiami Trail.	Yes/No	Yes	Yes	Yes	Yes	Yes
2. Allow for restoration consistent with 1989 ENP Protection and Expansion Act						
2A. Restore water deliveries to ENP						
A. Restore historic distribution of flows to ENP	% ratio (W/E)	30/70	48/52	55/45	44/56	44/56
B. Restore historic overland flow volumes to ENP	ac-ft. x 1000	1677	480	519	987	987
C. Restore historic overland flows from WCA-3A to WCA-3B	ac-ft. x 1000	920	381	106	903	903
D. Restore historic overland flow volumes to NESS	ac-ft. x 1000	1300	104	61	531	531
E. Restore historic sheetflow conditions to NESS	% 3B flow	70	13	11	56	56
F. Reduce high flow discharges associated with structures in Tamiami Trail	Acres of impacts	0	not calculated	1649.3	437.5	165.7
2B. Restore historic water depths and hydroperiods in ENP						
A. NESS Stage Requirement: Eliminate discontinuity in water levels above and below Tamiami T	H--L	High	Low	Low	High	High
B. Reduce water depths in WCA-3A	Av/Ann/Ft.	1	1.34	1.29	1	1
C. Reduction in MFL violations in NESS (dry-season depths)	Years	1 in 10	1 in 6	1 in 6	1 in 12	1 in 12
D. Reduction in MFL violations in mid-NESS (dry-season depths)	Years	1 in 10	1 in 7.2	1 in 7.2	1 in 12	1 in 12
2C. Enhance and restore ecological functions in ENP						
Restore ridge and slough processes						
A. Reconnect historic slough habitats between WCA-3B and NESS	%	100	0	2	37	100
B. Increase physical connectivity of marshes between WCA-3B and ENP	linear ft.	55,366.08	0	3,000	20338.56	55366.08
C. Reduce pattern of scour and deposition at culverts and weirs	H--L	High	Low	Low	High	High
D. Restore sediment flow and transport needed for R & S building in all sloughs	H--L	High	Low	Low	High	High
E. Reverse filling in of sloughs	H--L	High	Low	Low	Moderate	High
F. Minimize difference between average velocity at the road and average velocity in the marsh.	ft/s	0	No bridge	0.038	0.018	0.001
Restore vegetative communities						
A. Shift to open water, spikerush marsh and slough communities in NESS	H--L	High	Low	Low	High	High
B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs	H--L	High	Low	Low	Moderate	Moderate
C. Reduce risk of ridge and tree island peat burning in NESS	H--L	High	Low	Low	High	High
D. Reduce risk of ridge and tree island peat burning fires in Rocky Glades	H--L	High	Low	Low	High	High
E. Increase extent of slough vegetation communities	H--L	High	Low	Low	Moderate	High
F. Potential for invasion of exotic plant species	H--L	Low	High	High	Moderate	Moderate
Restore fish and wildlife resources						
A. Improve characteristics of freshwater aquatic communities						
- Increase total abundance of fishes in ENP marshes, including Shark Slough and Taylor Slough (compared to no action alternative)	%	High	0	8%	17%	not calculated
- Potential for invasion of exotic aquatic species	H--L	Low	High	High	Moderate	Moderate
B. Improve conditions for wading bird foraging and nesting	H--L	High	Low	Low	Moderate	High
C. Improve alligator nesting numbers and distribution	H--L	High	Low	Low	High/Moderate	High
D. Reduction in wildlife mortality (shown as % reduction compared to no action)	%	100	0	5	37	<100
Improve water quality in ENP						
A. Reduce concentration of TP discharges to ENP from L-67A Canal	ug/L	8	11	11	8	8
B. Reduce injurious effects of organic forms of nutrients--TOC, TON, and TOP	H--L	High	Low	Low	High/Moderate	High
C. Increase dissolved oxygen to support health of aquatic species	H--L	High	Low	Low	High/Moderate	High
D. Reduce specific conductance and sulfate concentrations	H--L	High	Low	Low	High/Moderate	High
E. Reduced erosion--less sediment and TSS transport	H--L	High	Low	Low	High/Moderate	High
F. Increase in nutrient cycling, uptake by biota	H--L	High	Low	Low	High/Moderate	High

6.2.1. *Meet the Reasonable and Prudent Alternative requirements for the endangered Cape Sable Seaside Sparrow as specified in the U.S. Fish and Wildlife Service Biological Opinion of 2/99.*

Each of the alternatives meets this project objective; however, the 10.7-Mile Bridge and 4-Mile Bridge alternatives meet this objective in a manner more consistent with future CERP objectives to eliminate adverse effects of regulatory discharges and to promote a more natural, passive flow regime between WCA-3 and ENP. For example, future CERP projects expect the majority of overland flows from WCA-3B to flow to NESS, instead of western Shark Slough. The No Action and 3,000-ft alternatives provide very small volumes of overland flows to NESS.

6.2.2. Allow for Restoration Consistent with the 1989 ENP Expansion Act: including (1) restoring water deliveries to ENP, (2) restoring water depths to NESS, and, (3) enhancing and restoring ecological functions

6.2.2.1. Restore Water Deliveries to ENP

It is the goal of the NPS that an acceptable alternative for the modifications to Tamiami Trail will create conditions that would comply with the 1989 Everglades Protection and Expansion Act, including substantial improvements in the following areas,: (1) restore historic distribution of flows to ENP, (2) restore historic flow volumes to ENP, (3) restore historic overland flow volumes to NESS, (4) restore historic sheetflow conditions in NESS, and (5) reduce high flow discharges associated with structures in Tamiami Trail.

6.2.2.1.1. *NPS Performance Goal: Restore historic distributions of overland flows to ENP*

The NPS goal for restoration of flow distributions is 70% of overland flows from WCA-3 into NESS, and only 30% to western Shark Slough. Currently, the levees around WCA-3B function as a dam preventing any overland flows from entering NESS. The 4-Mile Bridge and 10.7-Mile Bridge alternatives substantially improve the overland flows to NESS and reduce the deleterious effects of too high flows and impounding conditions in WCA-3. These alternatives also improve the distribution of flows to the east and west shark sloughs. The 4-Mile Bridge and 10.7-Mile Bridge alternatives come closest to meeting the NPS expectation by providing 56% of the overland flows to NESS and 44% to western Shark Slough. In contrast, the 3,000-ft Bridge alternative provides only 11% of flows to enter NESS from WCA-3B and the No Action alternative provides only 13% from WCA-3B to NESS.

6.2.2.1.2. *NPS Performance Goal: Restore historic overland flow volumes to ENP*

The NPS goal is that NSM flow volumes from WCA-3A through WCA-3B to ENP will provide the historic flow conditions needed to restore many of the wetland functions associated with the ridge and slough landscape that characterizes much of ENP. For instance, improving the overland flow volumes to ENP is needed to improve slough vegetation and Loxahatchee peat-forming conditions (2.0 ft. deep, 365 day hydroperiods), and improve hydroperiods in the Rocky Glades, Taylor Slough headwaters, and Taylor Slough. The 10.7-Mile Bridge and 4-mile Bridge alternatives allow for significant improvements in total overland flow volumes to ENP—987,000 ac-ft/per year compared to only 519,000 ac-ft/per year for the 3,000-ft Bridge alternative and 480,000 ac-ft/per year for the No Action alternative. In the 4-Mile Bridge and 10.7-Mile Bridge alternatives the flow volumes from WCA-3A to WCA-3B are 903,000 ac-ft per year compared to only 192,000 ac-ft. per year for the 3,000-ft Bridge alternative and 381,000 ac-ft/per year for the No Action alternative. Benefits of these increased overland flow volumes to ENP include: (1) significant increase in sediment transport (needed for supporting ridge and slough processes), (2) reduction in the prevalence of abnormal vegetation (including elimination of non-native species), (3) increase in wildlife species movements and genetic diversity, (4) improvement in water depths and durations needed to support various aquatic species and wading birds, (5) increase in the uniformity of marsh flow velocities, improving physical conditions for maintenance of native flora and fauna, and (6) reduction in acres of wetland impacts associated with flow velocities through structures in the Tamiami Trail—165.7 acres for the 10.7-Mile Bridge, 437.5 acres for the 4-Mile Bridge, and 1649.3 acres for the 3,000-ft. Bridge.

6.2.2.1.3. *NPS Performance Goal: Restore historic overland flow volumes to NESS*

The NPS goal is that NSM flow volumes will once again flow from WCA-3B to NESS. This annual volume from WCA-3B to NESS, according to the latest SFWMM, is approximately 1.3 million ac-ft per year. Historically, this volume was needed not only to provide the deeper water conditions in NESS during the dry seasons (for fish and invertebrates and wading birds who prey on them), but also to provide critical freshwater flows to the estuaries in the early dry season to support the spawning of many coastal estuarine species. The 10.7-Mile Bridge and 4-Mile Bridge alternatives perform much better than the 3,000-ft. Bridge alternative in meeting this target, as they would provide 531,000 ac-ft per year to NESS, while the 3,000-ft Bridge alternative would provide only 61,000 ac-ft per year and the No Action alternative provides only 104,000 ac-ft per year.

6.2.2.1.4. *NPS Goal: Restore historic sheetflow conditions to NESS*

The NPS goal is that increased sheetflow across Tamiami Trail will provide greater marsh connectivity between the WCA-3 and ENP, primarily through the restoration of sheetflow through WCA-3B. The target is 70% sheetflow through WCA-3B to NESS. The percent of sheetflow through WCA-3B to NESS in the 10.7-Mile Bridge and 4-mile Bridge alternatives is 56%, while the No Action alternative has 13% and the 3,000-ft. Bridge alternative has only 11% sheetflow. Thus, the 4-Mile Bridge and 10.7-Mile Bridge alternatives provide a 65% improvement in sheetflow over the 3,000-ft Bridge alternative. The increased sheetflow/marsh connectivity serves to (1) eliminate the unnatural effects of impoundment of water especially in WCA-3A, (2) reduce the damaging occurrences of peat fires in WCA-3B that result from excessive dry-down events, (3) reduce wetland impacts from excessive flow velocities near the trail, (4) reduce pollutant loading associated with canal discharges, (5) improve conditions for the restoration and maintenance of periphyton communities in ENP, (6) improve recession rates in ENP, providing water depths and durations necessary to sustain aquatic communities, (7) increase ridge and slough processes, including sediment transport, (8) improve aquatic species movements between WCA-3 and ENP, and (9) generally improve conditions for fish and invertebrates, as well as wading birds in WCA-3 and ENP.

Sheetflow and marsh connectivity are important processes for the maintenance of healthy slough ecosystems. Sloughs are species-rich habitats, and their filling in with sawgrass reduces biodiversity and contributes to a loss of wading bird foraging habitat. Aerial photographs (Figure 6.4) of WCA-3A show an intact ridge and slough system while WCA-3B shows the damaging effects of a constrained system with linear features such as the L-67 and L-29 canal and levee systems. It is clear that the ridge and slough landscape is degrading and that the most severe degradation is geographically associated with major linear structures that inhibit flow. Figure 6.5 shows a typical cross-section of the ridge and slough landscape with four bridge alternatives superimposed. Marsh connectivity for aquatic fish and wildlife would improve by 5% with the construction of a 3,000-ft bridge, and by 37% for a 4-mile bridge.

Figure 6.4. Aerial images: (right) Intact Ridge and Slough WCA-3A, (left) Degraded Ridge and Slough in WCA-3B.

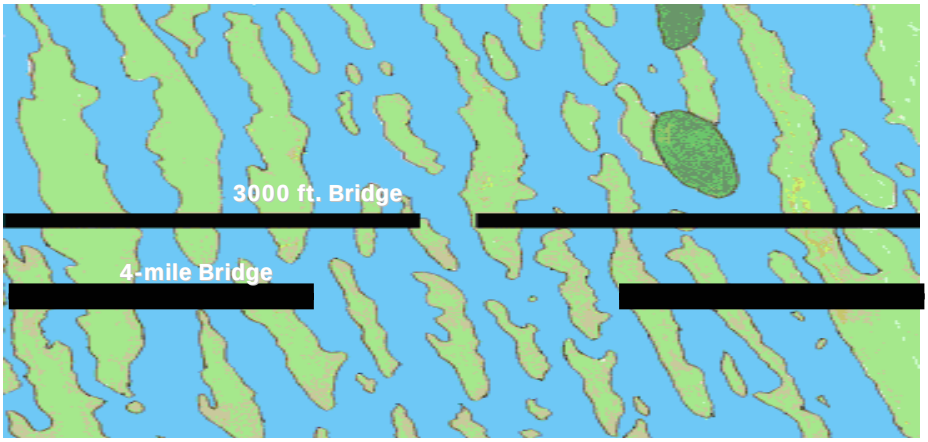


Figure 6.5. Typical cross-section of the ridge and slough landscape and the potential impacts of various bridge alternatives on marsh connectivity. Marsh connectivity for aquatic fish and wildlife would improve by 5% with the construction of a 3,000-ft bridge and by 37% for a 4-mile bridge (if an equal amount of L-29 levee is removed, as well). Ecological connectivity requires both the removal of the road and the associated levee that also functions as an obstruction to connectivity.

Figure 6.6 shows the average annual overland flow vectors for the three model alternatives: No Action (7.5 ft L-29 stage constraint), 3,000-ft Bridge (9.3 constraint), and 4-Mile Bridge (no constraint). The 4-mile Bridge shows a 65% increase in sheetflow through WCA-3B and into NESS providing substantial improvement in marsh connectivity between the WCA-3 and ENP with the restoration of flows through WCA-3B.

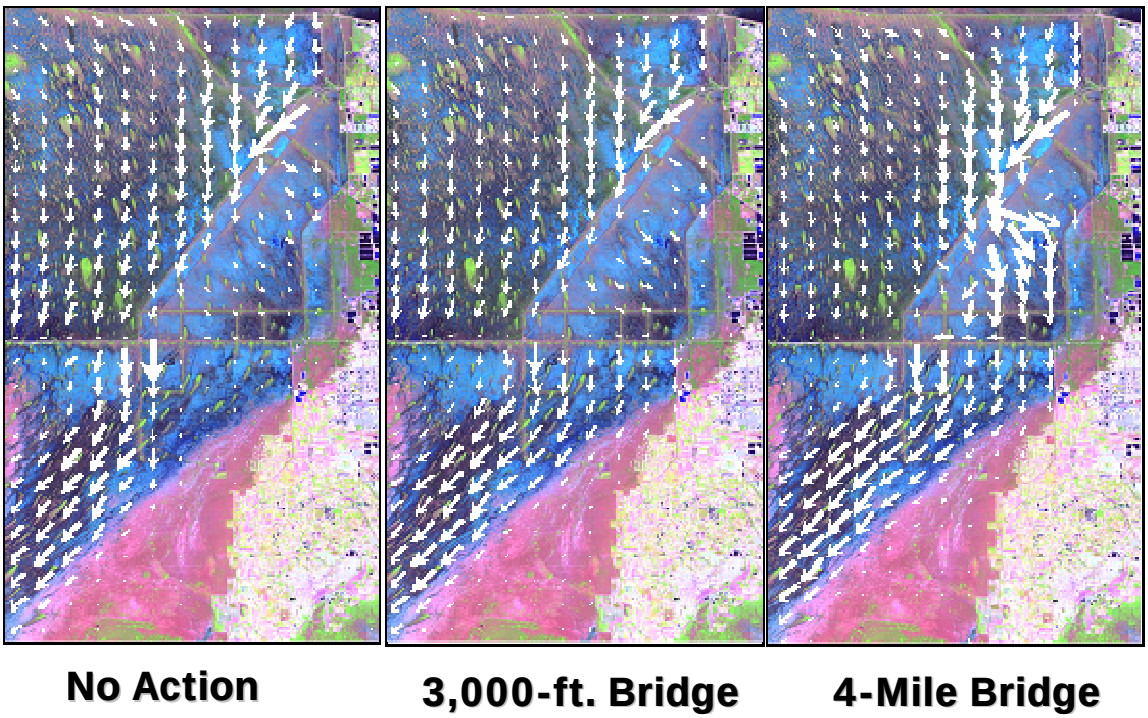


Figure 6.6. Average annual overland flow vectors for the simulation period 1965 – 2000.

Finally, Table 6.2 summarizes the comparison of three bridge alternatives: a 4-mile bridge, a 3,000-ft bridge, and a 10.7-Mile Bridge. In conclusion, longer bridges provide for a more uniform flow velocity downstream and improve marsh connectivity for aquatic fish and wildlife.

Table 6.2. A comparison of the impacts of 3 bridge alternatives (from previous FWCAR report).

Project Objectives	Target	No Action	Alt. 7 (3000 ft bridge)	Alt. 6 (4 mi bridge)	Alt. 5 (10.7 Mile Bridge)
Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999	Avoid jeopardy	Yes	Yes	Yes	Yes
Threatened and endangered species*	Avoid adverse effects	Yes	Yes	Yes	Yes
Area adversely affected by increased flow velocities (acres)	Minimize acres effected		1649	438	165.7
Connectivity between WCA-3B and ENP for aquatic fish and wildlife (linear ft.)	Maximize linear ft of connectivity		3,000 (5 %)	21,120 (37 %)	56,496 (100%)
Wetlands permanently lost within ENP (acres)	Minimize loss of wetlands	NA	3	0.3	NA

It is widely believed that the magnitude and direction of flow through the Everglades landscape are critical factors in the development and maintenance of the Ridge and Slough microtopography. High velocities can be erosive and can carry excessive sediment loads. It is also understood that fish and

aquatic invertebrates are affected by flow rates. In this section, attempts have been made to quantify the severity of the effect on flow velocities at the road and the area downstream of the road required to minimize flow velocities in the marsh.

From the previous FWCAR, flow distributions for 4 alternatives were simulated using RMA-2. Contour maps of velocity magnitude in the first 2 miles downstream of the road are presented in Figures 6.7 a-d. These images clearly show the distribution of flow through culverts. The smaller flow openings (culverts/short bridges) force higher velocities in the structures and immediately downstream while the larger flow openings have less severe effects at the discharge site and greater beneficial effects over a broader spatial area.

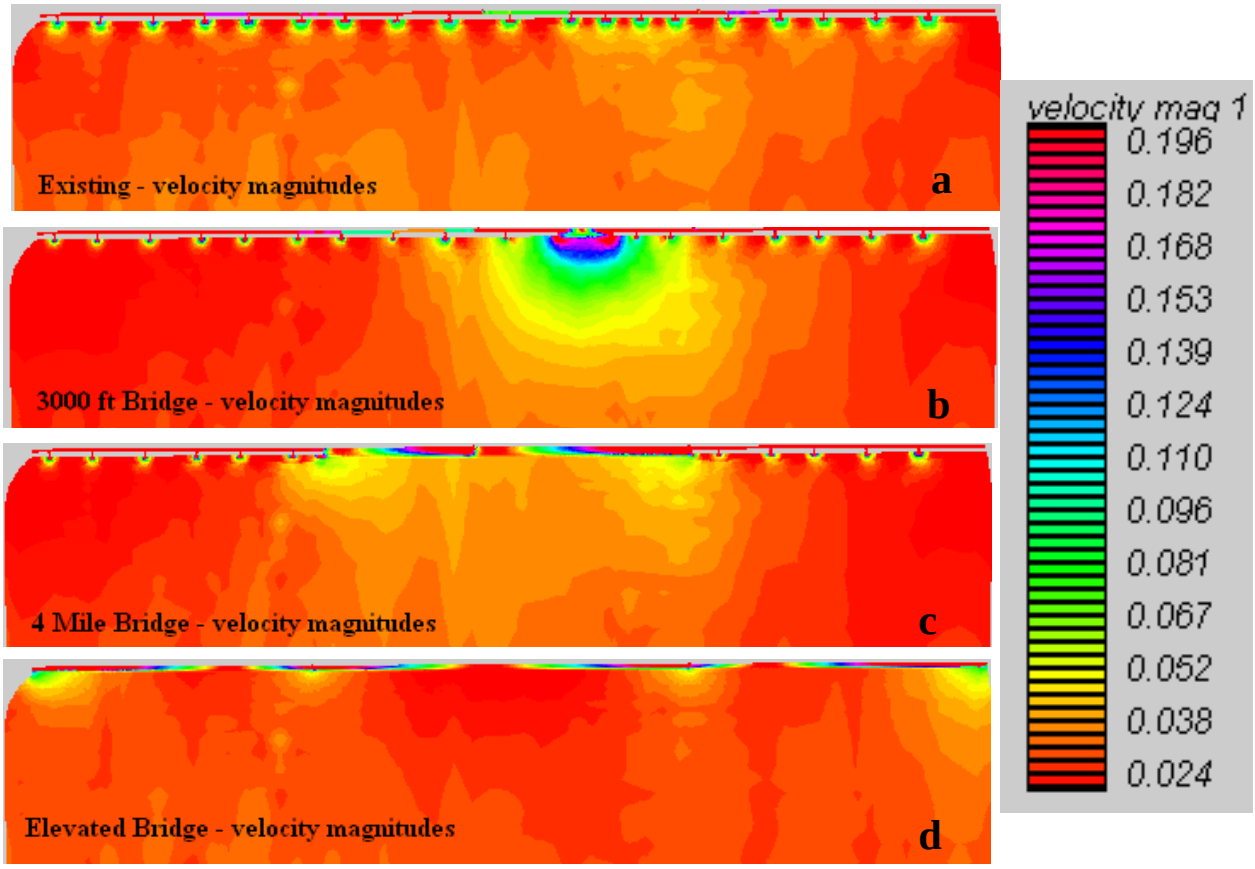


Figure 6.7. Contour maps of velocity of 4 bridge alternatives

To assess the effects of the alternatives on velocities at the road and in the marsh, transects (1/4 mile wide) were selected at distances from the road of ¼, ½, 1, 2, and 5 miles. One additional transect (1/8 mile wide) was selected at the road. The mean velocity was calculated for each of these transects at the highest flow rate (5548 cfs). The mean velocity graph, Figure 6.8, shows generally higher velocities near the road in alternatives that confine flow to culverts or narrow bridges. Most of the alternatives reach a steady marsh velocity of 0.029 ft/s within 2 miles of the road. The 10.7-mile Bridge shows a mean velocity at the road (0.03 ft/s) which is consistent with downstream velocities.

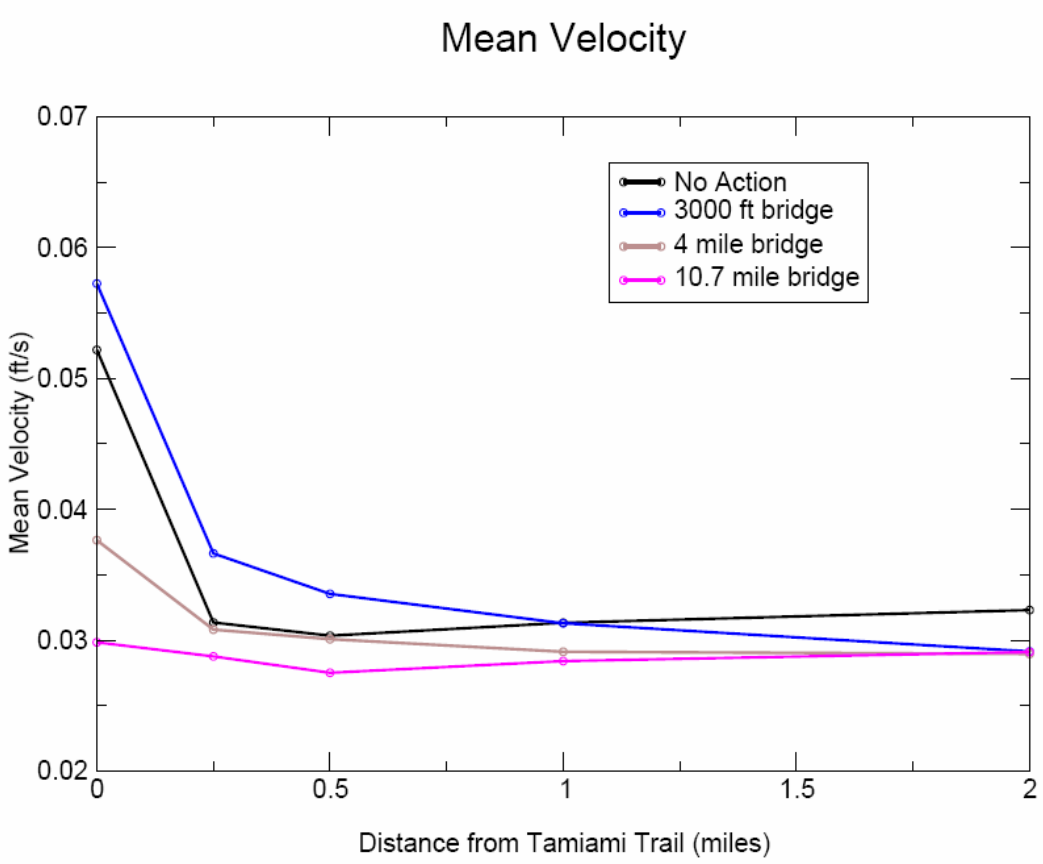


Figure 6.8. Mean velocity as a function of distance from Tamiami Trail for each of the alternatives.

The 4-mile bridge has a slightly higher mean velocity at the road (0.0375 ft/s) than downstream, and the velocity drops to a more natural velocity within the first ¼ mile. The existing condition, also achieves a more natural velocity within the first ¼ mile, although at the road it has a much higher velocity (0.052 ft/s). The 3,000-ft Bridge has roughly the same effect on marsh velocities, but has higher velocities at the road (0.057 ft/s) due to its shorter opening.

Standard deviation in the mean was also calculated for each transect. In the marsh, 5 miles from the road, the standard deviation for the simulations ranged from 0.003 to 0.005. To estimate the spatial extent of the higher velocities, the area inside the 0.045 ft/s contour (outside 3 standard deviations of the mean) was estimated for all of the alternatives. Because of the higher overall velocities in the four-bridge alternative, the analysis was performed using the mean marsh velocity of 0.043 ft/s (threshold of 0.58 ft/s) particular to this simulation. The full elevated highway, with completely unobstructed flow required only 165.7 acres to reach normal velocity. (This acreage is located directly downstream of the 4 structures contributing water to the L-29 canal which is effectively a spreader canal in this alternative).

Clearly, the full elevated highway reduces both the severity of the effect of the road and the total area affected by not forcing flow through constricting openings. The four mile bridge spreads flow over a long distance, and therefore could have a large area of impact, but the velocities are slow enough coming through the road to reach comparable marsh velocities over a very short distance.

In summary, shorter bridges force high velocities through the structures and impact larger areas downstream. Long bridges spread the velocity more uniformly over the marsh. The high flow zones alter sediment transport and nutrient dynamics, which tends to change natural marsh communities.

6.2.2.1.5. *NPS Performance Goal: Reduce high flow discharges associated with structures along Tamiami Trail*

The NPS goal is that the bridging of Tamiami Trail will provide for significant hydrological and ecological improvements to WCA-3 and ENP, but will also be accomplished with as few impacts as possible to the wetlands adjacent to Tamiami Trail. Previous RMA-2 modeling indicates that the 10.7-mile bridge (with its associated levee removed) would provide more marsh-like flow velocities at the trail than the other alternatives, causing impacts to only 165.7 acres of wetlands. The 4-Mile Bridge alternative with levee removed does not perform as well as the 10.7-mile bridge, causing impacts to 437.5 acres of wetlands. The 3,000-ft. Bridge alternative performs the worst, causing impacts to 1649.3 acres of wetlands. The No Action alternative was not modeled for this impact.

6.2.2.2. NPS Performance Goal: Restore historic water depths and hydroperiods in ENP

The weirs in the L-67 and L-29 canals in the 4-Mile Bridge alternative (and 10.7-Mile Bridge, presumably) alleviate the unnatural effects of impoundment of water especially in WCA-3A. The 4-Mile bridge provides a decrease in average wet season depths in WCA-3A closer to the natural system while increasing the depths in WCA-3B and NESS (Figure 6.9). The surface maps of water depths in Figure 6.10A and B illustrate the degree to which water is impounded in WCA-3A in the 3,000-ft Bridge alternative, compared to the 4-Mile Bridge alternative.

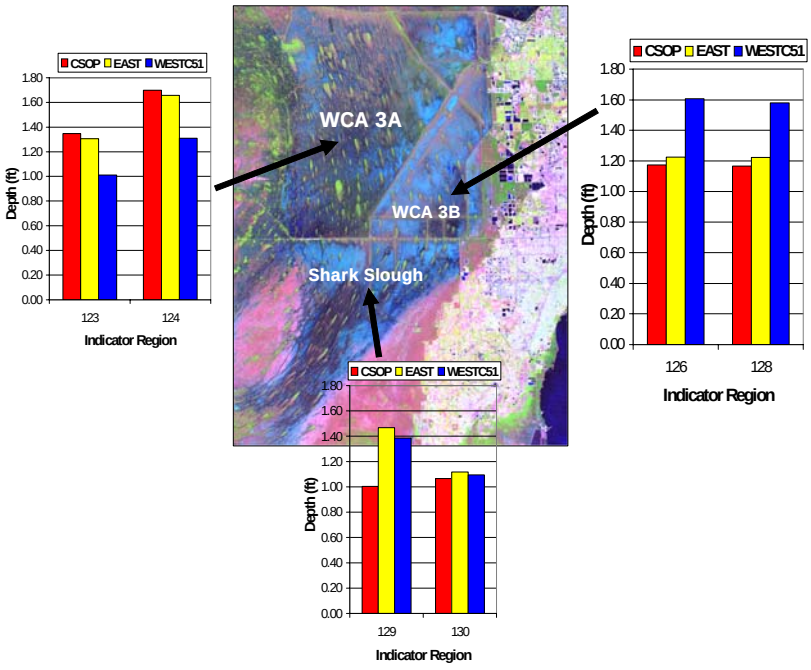


Figure 6.9. Average wet season depths for the simulation period 1965 -2000 for CSOP base/No Action (red), east bookend/3000-ft bridge (yellow), and west bookend/4-mile bridge (blue). The East Bookend increases NESS inflows, while the WCAs are largely unchanged. The West Bookend reduces damaging ponding in WCA 3A, but flows out of WCA 3B and into NESS are insufficient (WCA 3B inflows >> outflows).

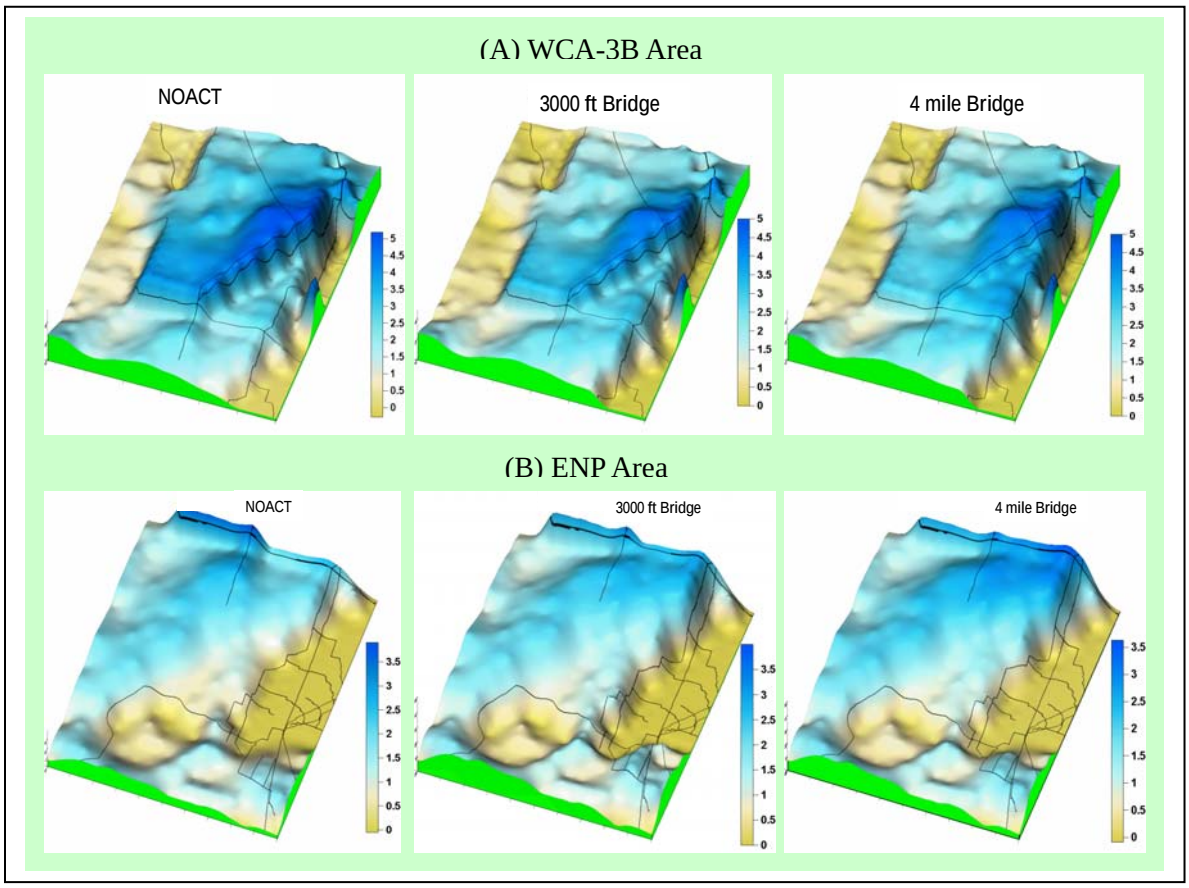


Figure 6.10 A. Average Simulated Ponding Depths in October 1995, WCA-3B Area for the No Action, 3000-ft Bridge, and 4-mile Bridge. Figure 6.10 B. Average Simulated Ponding Depths in October 1995, ENP for the No Action, 3000-ft Bridge, and 4-Mile Bridge

The 4-Mile Bridge alternative and 10.7 Mile Bridge alternatives improve stages in NESS (Figure 6.11), and the Rocky Glades (Figure 6.12 and 6.13), compared to the 3,000-ft Bridge and No Bridge alternatives. The 4-Mile Bridge and 10.7 Mile Bridge alternatives also allow for an increase in beneficial dry season flows into NESS that better mimic the monthly flow distribution of the NSM v4.6.2 (Figure 6.14).

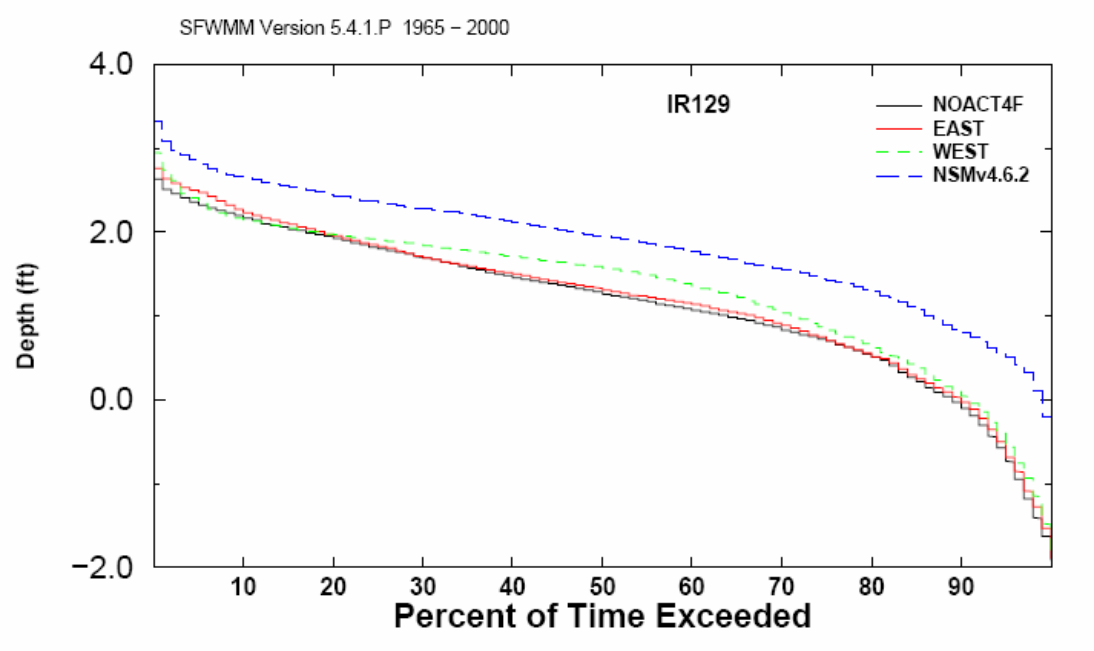


Figure 6.11. Depth duration curves for Indicator Region 129 in NESS for the simulation period 1965 – 2000.

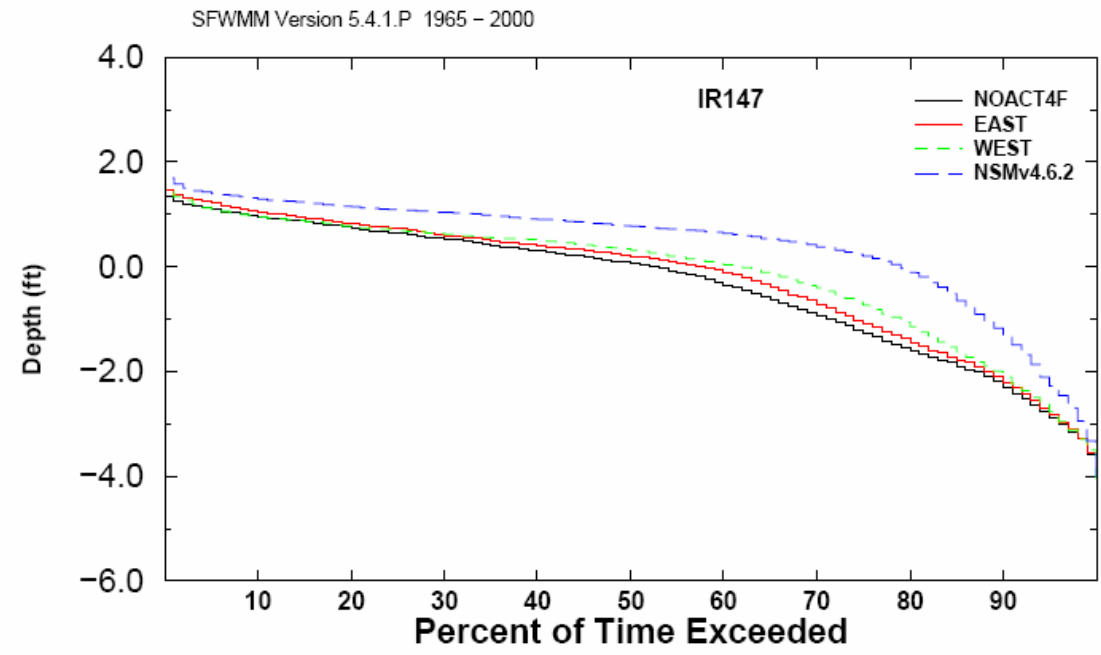


Figure 6.12. Depth duration curves for Indicator Region 147 in the western Rocky Glades for the simulation period 1965 – 2000

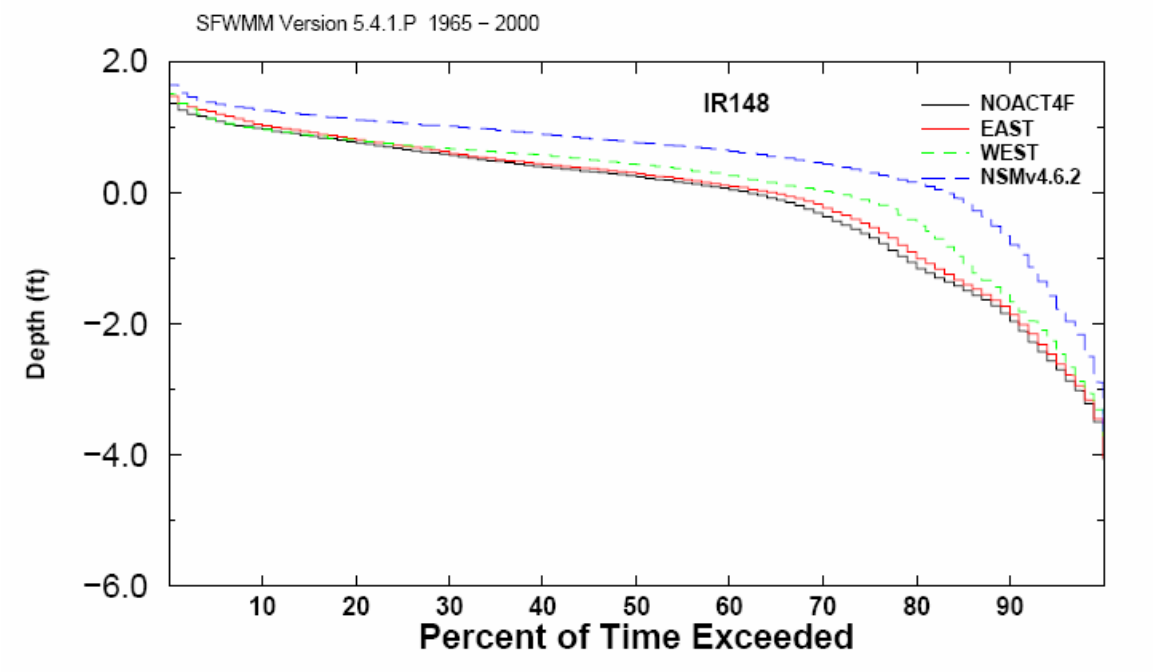


Figure 6.13. Depth duration curves for Indicator Region 148 in the eastern Rocky Glades for the simulation period 1965 – 2000

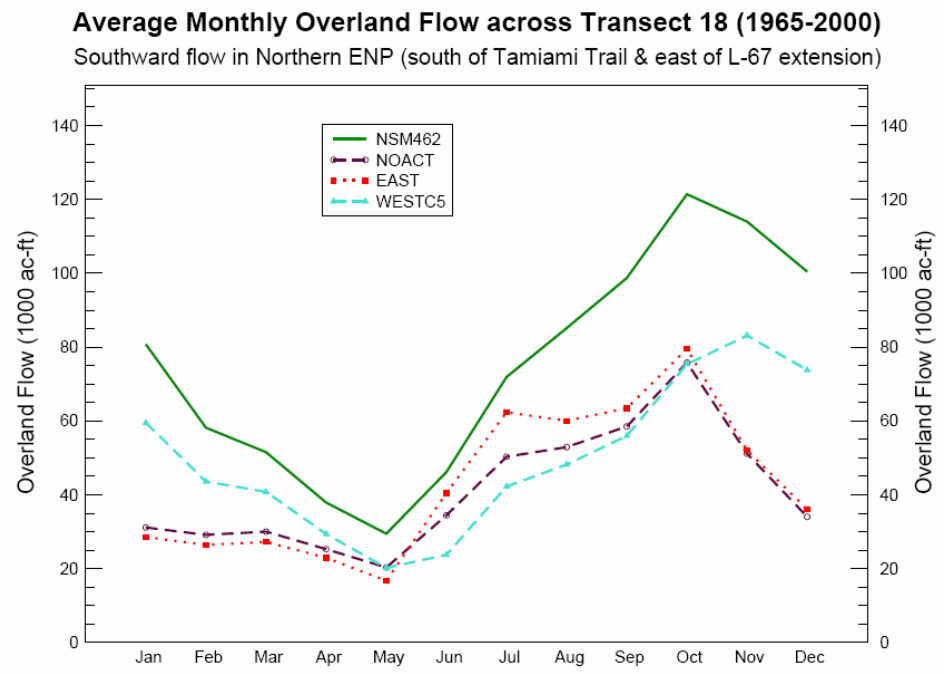


Figure 6.14. Average monthly distribution of overland flows across Transect 18 southward into NESS for the simulation period 1965 -2000.

The increased flows through the Rocky Glades in the 4-Mile Bridge and 10.7-Mile Bridge alternatives restore a natural flow-way connecting NESS with Taylor Slough. These alternatives also allow for an increase in beneficial dry season flows into NESS increasing hydroperiods towards more natural conditions and decreasing the number of MFL violations. The increase in dry season flows in the 10.7 Mile Bridge and 4-Mile Bridge alternatives reduce the number of MFL violations in NESS from 1-in-6 years to 1-in-12 years. Similarly, there is a reduction in MFL violations in mid-NESS from 1-in-6 years to 1-in-12 years when compared to the 3,000-ft Bridge alternative.

Table 6.3 summarizes the benefits of the 4-Mile Bridge alternative relative to the No Action and the 3,000-ft Bridge alternatives.

Table 6.3. Comparison of selected hydrological PMs for No Action alternative, 3,000-ft. Bridge and 4-Mile Bridge alternatives (10.7-Mile Bridge was not modeled).

Project Objectives	Metric	Alternatives		
		No Action	3,000-ft Bridge	4-Mile Bridge
Improve Distribution of Flow to Shark Slough (SS)	Percent of Total Flow (West SS /East SS)	78/22	55/45	44/56
Reduce water depths in WCA3A	Average Water Depth (ft)	1.34	1.29	1.00
Improve hydrologic connectivity between WCA3A and WCA3B	WCA3A to WCA3B flow (ac-ft x 1000)	0	192	903
Improve hydrologic connectivity between WCA3B and NESS	WCA3B to NESS flow (ac-ft x 1000)	0	61	531
Eliminate Tamiami Canal stage Constraint	L-29 Stage (ft)	7.5 ft (highly constrained)	9.3 ft (mod. constrained)	9.8 ft (unconstrained)

In conjunction with improvements in depths and hydroperiods, improvements in the timing of water deliveries to ENP are essential to the restoration of the ridge and slough landscape. The 10.7-Mile Bridge and/or 4-Mile Bridge alternative improve the timing of water deliveries so that flows fluctuate once again in consonance with natural climatic changes. This more natural flow regime based on climatological conditions reduces the deleterious effects of pulsed flows associated with regulatory discharges. The target is to mimic the NSM (shape of curve) for hydroperiods. The model results indicate that the 10.7 Mile Bridge and 4-Mile Bridge alternatives more closely mimic NSM hydroperiods in NESS and WCA-3 (see Appendix C). These results are supported by recent work by Trexler et al. (Appendix H) that indicates the following benefits associated with the 10.7-Mile Bridge and 4-Mile Bridge alternatives, including (1) improved natural recession rates in the dry season supporting larger populations of fish and invertebrates in ENP and WCA-3B, (2) reduction in dry-down events that result in damaging fires and loss of peat soils, and (3) improved recession rates needed to support healthy aquatic communities, as well as, wading birds.

In addition, the restoration of historic water depths in NESS will eliminate the discontinuity in water levels above and below Tamiami Trail. This will result in the reduction in the number and extent of dry-down events in NESS and WCA-3B, improving ecological conditions for numerous flora and fauna, including fish and invertebrates, alligators, and wading birds. Increased depths and hydroperiods in conjunction with improved timing of water deliveries to NESS will once again support the formation of

peat-forming sloughs, the most dynamic attribute of the ridge and slough landscape. Recent studies (Appendix A) indicate that the 10.7-Mile Bridge and 4-Mile Bridge alternatives would provide substantial improvements in water depths and hydroperiods in NESS associated with flow volumes and the timing of flows to support the re-establishment of ridge and slough processes. Barriers to sheetflow have resulted in the filling in of sloughs with sawgrass, reducing biodiversity and contributing to the loss of wading bird foraging habitat. Increased water depths in WCA-3B and NESS will also benefit the apple snail, a food source for a wide array of animals, and the essential food source for the endangered snail kite. Regional snail kite populations, therefore, would be expected to increase as the snail kites repopulate the area. Increased flows and water depths in NESS will also benefit the CSSS by reducing flows and depths in western Shark Slough.

6.2.2.3. Enhance and restore ecological functions in ENP

The NPS goal is that improved water deliveries to ENP will result in substantial enhancement and restoration of ecological functions in ENP, including improvements in the following four broad categories: 1) the restoration of ridge and slough processes, 2) restoration of vegetative communities, 3) restoration of fish and wildlife resources, and 4) improvements to water quality. Specific quantitative and qualitative expectations for ecological indicators of restoration within each of these broad categories are explained in the sections to follow.

6.2.2.3.1. *Restore Ridge and Slough Processes*

The NPS goal is that restoration of ridge and slough processes will provide substantial improvements in the following areas: (A) Reconnect historic slough habitats between WCA-3B and NESS, (B) Increase physical connectivity of marshes between WCA-3B and ENP, (C) Reduce pattern of scour and deposition at culverts and weirs, (D) Restore sediment flow and transport needed for Ridge & Slough building in all sloughs, (E) Reverse filling in of sloughs, and (F) Minimize difference between average velocity at the road and average velocity in the marsh.

A. Reconnect historic slough habitats between WCA-3B and NESS

The NPS goal is to maximize the reconnection of historic sloughs between WCA-3B and NESS. The 10.7-Mile Bridge would reconnect 100% of these sloughs. The 4-Mile Bridge would reconnect 37% of the sloughs, while the 3,000-ft. Bridge alternative would only reconnect 2% of the sloughs. The No Action alternative was not evaluated for this PM. It is clear that the 10.7-Mile Bridge would be much more effective in reconnecting historic slough habitats, although the 4-Mile Bridge would be much more effective than the other two alternatives.

B. Increase physical connectivity of marshes between WCA-3B and ENP

The NPS goal is to eliminate obstructions to sheetflow in Tamiami Trail and maximize the linear feet of connectivity between WCA-3B and NESS. This physical connectivity is needed in conjunction with adequate flow volumes, distributions and timing of flows to provide restoration of many of the ecological attributes in ENP**.** The ENP expectation is that the selected alternative will provide flow patterns between WCA-3B and ENP adequate to substantially reconnect and restore slough habitats in NESS. The 10.7-Mile Bridge performed best by reconnecting 55,366.08 linear ft of marsh. The 4-Mile Bridge reconnected 20,338.56 linear ft of marsh, while the 3,000-ft Bridge reconnected only 3,000 ft of marsh. This linear ft of reconnection does not assume that the flow patterns (volumes, hydroperiods, depths, etc.) are sufficient to restore slough habitats, only that increased connectivity is a critical element in slough restoration.

C. Reduce pattern of scour and deposition at culverts and weirs

The NPS goal is that the re-established flows between WCA-3B and NESS will be of sufficient breadth (bridge expanse) to prevent the pattern of scour and deposition at weirs and culverts associated with existing conditions. Based on the RMA-2 modeling results, it is expected that the 10.7-Mile Bridge and 4-Mile Bridge alternatives would provide the marsh-like flow conditions conducive to reduce the scour and deposition at the culverts and weirs evidenced in the predicted flow patterns for the 3,000-ft Bridge and No Action alternatives.

D. Restore sediment flow and transport needed for Ridge & Slough building in all sloughs

The NPS goal is that the selected alternative will substantially improve sediment flow and transport needed for ridge and slough building in NESS. The SEDFLOW modeling (Appendix E) indicates that the 10.7-Mile Bridge and 4-Mile Bridge alternatives would provide sufficient volumes and depths of flows (during wet and dry seasons) to restore sediment flow and transport needed for ridge and slough building in all sloughs. The 3,000-ft Bridge alternative does not provide adequate flow volumes or timing of flows to recreate the necessary processes for ridge and slough formation in any of the remnant sloughs.

E. Reverse filling in of sloughs

The NPS goal is that the selected alternative will reverse the current trend of filling in of sloughs. Based on the SEDFLOW modeling (Appendix B), the 10.7-Mile Bridge alternative performs the best, providing a high reduction of infilling in 100% of the sloughs. The 4-Mile Bridge alternative would reverse the infilling in approximately 37% of the sloughs, while the 3,000-ft Bridge alternative would reverse the infilling in only a small number (2%) of the sloughs.

F. Minimize difference between average velocity at the road and average velocity in the marsh.

The NPS goal is to eliminate and/or significantly minimize the impact of the bridge span on upstream and downstream flow velocities. This potential impact was investigated using the RMA-2 model and the SEDFLOW model. The RMA-2 model did not consider the increase in flow volume associated with the 4 mile and 10.7 mile bridges and therefore the flow velocity patterns produced by these simulations would underestimate the actual flow velocities. The SEDFLOW model simulates the flow pattern that result from water levels extracted from the SFWMM west bookend simulation. The SEDFLOW model explicitly accounts for vegetative resistance to water flow. Since the stages are specified in the SEDFLOW model, the changes in stage that accompany the various bridge configurations are approximate, not definitive. The RMA model runs apply no flow boundary conditions to the eastern and western boundaries, ignoring losses to canal seepage. The model simulations indicate that the 3000-ft bridge would create a concentrated zone of high flow velocity and high sediment and nutrient loading. This effect would be reduced with construction of a 4 mile bridge and be eliminated with the construction of a 10.7 mile bridge.

6.2.2.3.2. *Restore Vegetative Communities*

NPS expects successful hydrologic restoration to produce the following alterations in vegetation communities:

- Shift to open water, spikerush marsh and other slough communities in NESS
- Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs
- Reduce risk of peat-burning fires in NESS and the Rocky Glades
- Increase the extent of slough vegetation communities

- Restore deepwater slough vegetative communities (e.g., *Nymphaea*)
- Reduce potential for invasion of exotic plant species
- Reduction in area of disturbed vegetation associated with concentrated flow zones along Tamiami Trail

A. Shift to open water, spikerush marsh and slough communities in NESS

It is the NPS goal that the selected alternative will provide flow patterns to support the restoration of open water, water-lily dominated slough communities in NESS. The results of scientific analyses indicate that the 3,000-ft. Bridge and No Action alternatives would provide only a moderate recovery of slough communities; however, the 10.7-Mile Bridge and 4-Mile Bridge alternative would provide a high level of recovery for open water, slough communities.

B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs

The NPS goal is that the selected alternative should provide annual water depths greater than 2.5 ft in NESS to restore deep-slough vegetation and prevent encroachment of sawgrass and wet prairie vegetation. The results indicate that the slough habitats would continue to be adversely impacted by encroachment of sawgrass and wet prairie vegetation in the 3,000-ft Bridge and No Action alternatives. Conversely, the 10.7-Mile Bridge and 4-Mile Bridge alternatives would significantly reduce the encroachment of sawgrass and wet prairie vegetation.

C. Reduce risk of ridge and tree island peat burning in NESS and the Rocky Glades

The NPS goal is to eliminate the risk of peat-burning fires in NESS and in the Rocky Glades. The 3,000-ft Bridge alterative would provide only a slight reduction in risk of ridge and tree island peat burning fires in NESS; however, the 4 mile bridge and 10.7 mile bridge would provide a significant decrease in the risk of ridge and tree island peat-burning fires.

D. Increase extent of slough vegetation communities

The NPS goal is to restore annual water depths of greater than 2.5 ft. to areas characterized historically as slough habitats in NESS. The 4-Mile Bridge alternative (presumably the 10.7-Mile Bridge, as well) produces substantial improvements in water depths and durations in NESS, thus they would be expected to provide for the restoration of slough vegetation communities in much of NESS. The No Action and 3,000-ft Bridge alternatives would only have slight benefits to the restoration of slough-like conditions. The depth duration curve shows that the 4-Mile Bridge alternative and 10.7-Mile Bridge would produce significant increases in the maximum water depth in NESS, raising the water depth to nearly 3.0 ft at its highest; thus, they are likely to result in the recovery of deepwater slough vegetation communities. Table 6.4 summarizes the results of the effects of each of these alternatives on vegetative community responses.

Table 6.4. Summary of performance goals for Tamiami Trail bridge alternatives

Vegetation Target	3000-ft Bridge	4-Mile Bridge	10.7-Mile Bridge
Increase in slough vegetation	Slight	Moderate	Moderate
Restored deepwater slough	Little or none	Some	Some

Vegetation Target	3000-ft Bridge	4-Mile Bridge	10.7-Mile Bridge
Reduced risk of peat-burning fires -- NESS	Slight reduction	Slight reduction	Slight reduction
Reduced risk of peat-burning fires – rocky glades	Significant reduction	Significant reduction	Very significant reduction
Reduction in disturbed zones	Possible increase	Decrease	Mostly eliminated
Decreased invasion of exotic plants	Slight reduction	Moderate reduction	Moderate reduction

E. Decrease potential for invasion of exotic species

NPS goals for exotic plants are to 1) reduce the populations of exotic plants to a low level and maintain them there, and 2) decrease the potential for invasion of exotic plant species into the park. The drying of park habitats to the east has been associated with rapid establishment and spread of a large number of exotic plant species. The 10.7-Mile Bridge and 4-Mile Bridge alternatives perform much better than the 3,000-ft. Bridge alternative in meeting these expectations for decreasing the potential for exotic plant establishment, as they provide significantly increased hydroperiods and depths for NESS**.**

6.2.2.3.3. *Restore fish and wildlife resources*

Improvements in flow patterns, especially volume, depth, velocity, and duration of flows, should lead to restoration of the ridge and slough landscape in NESS. These improvements should result in similar benefits to fish and wildlife resources. We examined five aspects of the fish and wildlife resources of ENP in order to analyze the benefits of the different alternatives for raising portions of the Tamiami Trail.

A. Improve characteristics of aquatic communities

The 10.7-Mile Bridge alternative does best at minimizing the impact of anthropogenic structures on native fish communities across the landscape: the 4-Mile Bridge alternative also does well. The 3,000 ft bridge does not meet NPS expectations for minimizing the impact of anthropogenic structures on fish communities. In terms of increasing total biomass of fishes over current conditions in NESS and the Rocky Glades, the 4-Mile Bridge alternative provides a greater increase in fish abundance (~17%) than does the 3,000-ft Bridge (~8%) compared to the No Action alternative. The 10.7-mile Bridge was not analyzed for its effects on fish abundance. Lastly, the 10.7-mile Bridge and the 4-Mile Bridge do moderately well in terms of the potential to maintain a low proportion and abundance of exotic aquatic species within all park habitats, whereas the 3,000-ft Bridge alternative does not meet ENP expectations (Appendix H).

B. Improve conditions for wading bird foraging and nesting

With respect to bridging of the Tamiami Trail and associated increases in flow volume and hydroperiods into NESS, NPS goals for wading birds are to 1) substantially increase total abundance of wading bird populations found in ENP compared to current levels, and 2) to approximate pre-drainage patterns of colony formation, including increasing the percentage of breeding colonies found in and adjacent to the estuarine region, and increasing the frequency of formation of super colonies of wading birds.

The 10.7 mile Bridge and the 4 mile bridge are significantly more likely to substantially increase total abundance of wading bird populations found in ENP, than is the 3,000-ft Bridge alternative. The 3,000-ft Bridge alternative is unlikely to provide an increased extent of high quality foraging habitat for wading birds in ENP: it does not provide sufficient water, and the available water is in the wrong place. In addition, the 3,000-ft Bridge alternative, because it is less linked to passive management, is unlikely to provide the consistent patterns of recession and ascension of waters throughout the year that are needed for healthy colony formation and nesting success. Lastly, the 3,000-ft Bridge alternative maintains long-hydroperiod pools in the northern end of the system, rather than in the southern end near historical nesting habitat in the mangrove fringe. The 10.7-mile Bridge and the 4-Mile bridge alternative are much more likely to provide the extent and location of high quality foraging habitat needed to restore patterns of colony formation that reflect pre-drainage conditions (Appendix C).

C. Improve alligator nesting numbers and distribution

Restoration goals for alligators in ENP include the following:

1. Expansion of the geographic range of breeding age alligators

2. A shift in distribution of alligator nests from the central areas of Shark Slough toward the peripheral marshes

3. Increases in alligator total population numbers and increases in numbers of females nesting per year

4. Reduction in the frequency of excessive nest flooding associated with releases from flood control structures.

Hydrologic conditions that will lead to ENP restoration expectations for alligators include increasing the quantity of water entering NESS from the north, providing an unimpeded flow-way that allows water levels in the slough and peripheral marshes to track natural rainfall patterns, and minimizing the frequency and severity of operational hydrologic events that reverse or highly exaggerate natural hydrologic cycles. Hydrologic conditions that allow for about 2 ft of water at gauge NP-203 during late April and early May result in an increase in the number of nests produced.

The 10.7-Mile Bridge alternative would have a high potential for meeting each of the alligator expectations identified above. The 4-Mile Bridge alternative would have a high to moderate potential to meet these expectations, while the 3,000-ft. Bridge and No Action alternatives would have a low potential.

D. Reduce wildlife mortality

The 10.7-mile Bridge would provide the most benefit for wildlife moving north or south in the Tamiami Trail area (Table 6.5). The 4-Mile Bridge provides about a 37% improvement over the No Action alternative, while the 3,000-ft Bridge provides only about a 5% improvement over the No Action alternative**.**

Table 6.5. Benefits to Wildlife of the Tamiami Trail Bridging Alternatives

	Minimum # of roadkills per year*	Estimated % reduction in wildlife mortality**	Minimum # of collisions avoided
No Change	2799	0	0
3,000-ft Bridge	2650	5	149
4.0-Mile Bridge	1753	37	1046
10.7-Mile Bridge	some roadkills***	<100%	>2000

*focus is on the 10.7 mile section of Tamiami Trail east of the L67 junction

**mortality is assumed to be directly related to the length of road in contact with the ground; inversely related to the length of the bridge.

***wildlife mortality is unlikely to ever reach zero

6.2.2.4. Improve water quality in ENP

The NPS goal is that the preferred alternative will improve water quality conditions in ENP. These improved conditions include reducing the numeric concentration of total phosphorus to levels required in the Consent Decree—8.0 ppb. In addition, ENP expects that the 4-Mile Bridge or 10.7-Mile Bridge alternative will substantially reduce canal discharges to the park by providing more overland flow through WCA-3B. This increased overland flow should provide the following specific ecological benefits: (1) reduce the injurious effects of organic forms of nutrients—total organic carbon, total organic nitrogen, and total organic phosphorus—on aquatic communities, (2) increase the levels of dissolved oxygen in park wetlands, contributing to the improved viability of many wetland species, (3) reduce specific conductance and sulfate concentrations, thus reducing the debilitating effects of mercury methylation on aquatic species, (4) reduce erosion that contributes to the transportation of suspended solids and the loss of photosynthesis needed for the production of dissolved oxygen, and (5) increase nutrient cycling by reducing the aforementioned stressors that prevent nutrient uptake by plants as well as nutrient cycling by soil bacteria.

The 10.7-Mile Bridge and 4-Mile Bridge alternatives would reduce concentrations of total phosphorus entering the ENP to 8.0 ppb (OFW criteria); whereas, the 3,000-ft Bridge alternative would discharge into ENP at 11.0 ppb (3.0 ppb above the OFW criteria). In addition, the 10.7-Mile Bridge and 4-Mile Bridge alternative scored a High to High/Moderate on the following ENP performance expectations: (1) reduce the injurious effects of organic forms of nutrients—total organic carbon, total organic nitrogen, and total organic phosphorus—on aquatic communities, (2) increase the levels of dissolved oxygen in park wetlands, contributing to the improved viability of many wetland species, (3) reduce specific conductance and sulfate concentrations, thus reducing the debilitating effects of mercury methylation on aquatic species, (4) reduce erosion that contributes to the transportation of suspended solids and the loss of photosynthesis needed for the production of dissolved oxygen, and (5) increase nutrient cycling by reducing the aforementioned stressors that prevent nutrient uptake by plants as well as nutrient cycling by soil bacteria. In contrast, the 3,000-ft Bridge alternative scored a “Low” on each of these performance expectations.

6.3. Environmentally Preferred Alternative

Based on the performance of the environmental project objectives and performance measures from the matrix (Table 6.1), the NPS concludes that Alternative 4 (10.7-mile elevated highway) exhibits superior performance in meeting the stated environmental objectives compared to the other proposed alternatives. The ENP position is that Alternative 4 is the environmentally preferred alternative as evidenced by the following:

- Provides the highest ratio of overland flows to NESS from WCA-3B.
- Performs equally as well as the 4-Mile Bridge in providing NSM flow volumes to NESS and ENP.
- Provides the highest degree of unrestricted flow across the entire 10.7-mile project corridor between WCA-3B and ENP, providing nearly 69% of historic (NSM) flow volumes to NESS.
- Substantially shifts the historic flow distributions (30/70 W/E) back to the east side of the L-67A canal—from the present 78/22 W/E split to 44/56.
- Provides the highest level of physical connectivity between WCA-3B and NESS with the highest reduction in wetland impacts compared to the other alternatives.
- Reduces and nearly eliminates wildlife mortality by 1,584 individuals, or a 100 percent reduction
- Has no increase in average velocity at the road over marsh velocity
- Eliminates the discontinuity in water levels above and below Tamiami Trail
- Eliminates the pattern of scour and deposition at culverts and weirs, restoring sediment flow and transport needed for ridge building in all sloughs
- Significantly reduces the risk of ridge and tree island peat burning fires in NESS and in the Rocky Glades
- Substantially reduces encroachment of sawgrass and wet prairie vegetation into sloughs, and provides a significant shift toward open water, spikerush marsh and slough communities in NESS
- Provides the highest level of improvement to aquatic fish communities
- Has the highest reduction in the risk for invasion of exotic aquatic species
- Provides the greatest improvement in conditions for wading bird foraging and nesting
- Provides the highest level of improvement for alligator nesting numbers and distribution
- Provides the highest level of water quality improvement to ENP by (1) reducing the concentration of TP discharged to ENP, (2) reducing the injurious effects of TOC, TON, and TOP, (3) increasing levels of dissolved oxygen in ENP, (4) reducing effects of high sulfate concentrations, and (5) increasing nutrient cycling and uptake by biota

7. ENP Views and Recommendations for the Tamiami Trail Component of the Modified Waters Deliveries to Everglades National Park Project

7.1. Review of Evaluation Criteria and Environmentally Preferred Alternative

Four alternatives were evaluated in this report using 30 performance measures (PMs) associated with the two major environmental objectives of this project: (1) meet the Reasonable and Prudent Alternative for the CSSS as specified in the FWS Biological Opinion of February 1999, and (2) allow for restoration consistent with the 1989 ENP Protection and Expansion Act. The latter objective was further sub-divided into six specific environmental objectives: (1) restore water deliveries to ENP, (2) restore historic water depths and hydroperiods in ENP, (3) restore ridge and slough processes, (4) restore vegetative communities, (5) restore fish and wildlife resources, and (6) improve water quality in ENP. These 6 environmental project objectives were further sub-divided into the 30 environmental performance measures (refer to Table 6.1).

The analyses of these performance measures represents a broad spectrum of scientific expertise from both inside and outside of the NPS and represents the best available scientific information at the time of this report. Each of the alternatives was evaluated initially for performance in meeting the environmental objectives of the project for the explicit purpose of identifying the environmentally preferred alternative. Based on this approach, the 10.7-Mile Bridge was determined to be the environmentally preferred alternative, as its performance in meeting the environmental objectives was superior to all other alternatives. These analyses identified the 4-Mile Bridge as the preferred project alternative.

7.1.1. Evaluation Process Used to Identify the Recommended Alternative

The hydrological performance measures used in this report are based primarily on SFWMD model (version 5.4) outputs from the No Action, 3,000-ft Bridge and 4-mile Bridge model runs. RMA-2 and SEDFLOW modeling was also used, where appropriate. The ecological performance measures are based on the aforementioned modeling results, as well as, recent scientific studies by ENP staff and scientists from outside the park (see Appendix for complete list). The PM units range from the highly quantitative, such as acres impacted, to the less quantitative, such as a qualitative score based on best professional judgment. In order to present all of the performance measures for all of the objectives into a unified evaluation tool, all performance measures were combined into a matrix for purposes of comparing alternatives. The matrix is used in conjunction with the project constraints and the evaluation methodology described above to identify the ENP recommended plan.

Using the evaluation matrix, the four alternatives were assigned a numeric performance score. The values for the performance scores are provided in Table 7.1 and summarized in Figure 7.1. Scores are based on the relative performance of each of the alternatives from worst (low numeric score) to best (high numeric score). The scores assigned to the 30 PMs were chosen to simply provide a numeric separation of the alternatives, especially the alternative that provides the most ecological/hydrological benefits. The exact value of the performance score was derived based on the following scoring approach. A score from 1-5 was assigned to each of the 30 PMs based on the following logic: a score of (1) was given to the lowest performing PM; a score of (2) was given to the second lowest performing PM; a score of (3) was given to the second highest performing PM, and a score of (5) was given to the highest performing PM. Whenever

there was a tie for the highest performing PM, both PMs were scored a (5). If there was a tie for lowest performing PM, both were scored a (1). The elevation in score from the second best PM to the best (3 to 5) was used to help differentiate the top two alternatives.

Table 7.1. Objectives and Performance Measure Scores

Objectives and Performance Measures	Tamiami Trail Alternatives				
	NPS	1	4	3	2
	Expectation	No Action	3,000 ft. Bridge	4-Mile Bridge	10.7-Mile Bridge
Project Objectives					
1. Meet the RPA for the CSSS as specified in the FWS BO of Feb. 1999					
A. Design flow passing under the eastern section of Tamiami Trail (between the S-334 and the L-67s) meets 60 percent of the regulatory portion of the rainfall formula derived total flows across the Tamiami Trail.	5	5	5	5	5
2. Allow for restoration consistent with 1989 ENP Protection and Expansion Act					
2A. Restore water deliveries to ENP					
A. Restore historic distribution of flows to ENP	5	2	1	5	5
B. Restore historic flow volumes to ENP	5	1	2	5	5
C. Restore historic overland flow volumes from WCA-3A to WCA-3B	5	2	1	5	5
D. Restore historic overland flow volumes to NESS	5	2	1	5	5
E. Restore historic sheetflow conditions to NESS	5	2	1	5	5
F. Reduce high flow discharges associated with structures in Tamiami Trail	5	1	2	3	5
2B. Restore historic water depths and hydroperiods in ENP					
A. NESS Stage Requirement: Eliminate discontinuity in water levels above and below Tamiami Trail	5	1	1	5	5
B. Reduce water depths in WCA-3A	5	1	2	5	5
C. Reduction in MFL violations in NESS (dry-season depths)	5	1	1	5	5
D. Reduction in MFL violations in mid-NESS (dry-season depths)	5	1	1	5	5
2C. Enhance and restore ecological functions in ENP					
Restore ridge and slough processes					
A. Reconnect historic slough habitats between WCA-3B and NESS	5	1	2	3	5
B. Increase physical connectivity of marshes between WCA-3B and ENP	5	1	2	5	5
C. Reduce pattern of scour and deposition at culverts and weirs	5	1	1	5	5
D. Restore sediment flow and transport needed for R & S building in all sloughs	5	1	1	5	5
E. Reverse filling in of sloughs	5	1	1	3	5
F. Minimize difference between average velocity at the road and average velocity in the marsh.	5	1	1	3	5
Restore vegetative communities					
A. Shift to open water, spikerush marsh and slough communities in NESS	5	1	1	5	5
B. Reduce encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs	5	1	1	5	5
C. Reduce risk of ridge and tree island peat burning in NESS	5	1	1	5	5
D. Reduce risk of ridge and tree island peat burning fires in Rocky Glades	5	1	1	5	5
E. Increase extent of slough vegetation communities	5	1	1	3	5
F. Potential for invasion of exotic plant species	1	1	2	5	5
Restore fish and wildlife resources					
A. Improve characteristics of freshwater aquatic communities					
- Increase total abundance of fishes in ENP marshes, including Shark Slough and Taylor	5	1	2	5	5
- Potential for invasion of exotic aquatic species	1	1	1	5	5
B. Improve conditions for wading bird foraging and nesting	5	1	1	3	5
C. Improve alligator nesting numbers and distribution	5	1	1	3	5
D. Reduction in wildlife mortality (shown as % reduction compared to no action)	5	1	2	3	5
Improve water quality in ENP					
A. Reduce concentration of TP discharges to ENP from L-67A Canal	5	1	1	5	5
B. Reduce injurious effects of organic forms of nutrients--TOC, TON, and TOP	5	1	1	3	5
C. Increase dissolved oxygen to support health of aquatic species	5	1	1	3	5
D. Reduce specific conductance and sulfate concentrations	5	1	1	3	5
E. Reduced erosion--less sediment and TSS transport	5	1	1	3	5
F. Increase in nutrient cycling, uptake by biota	5	1	1	3	5
Objective Mean Score		1	1	3	5
Sum		37.00	41.00	139.00	165.00
Rank		4	3	2	1

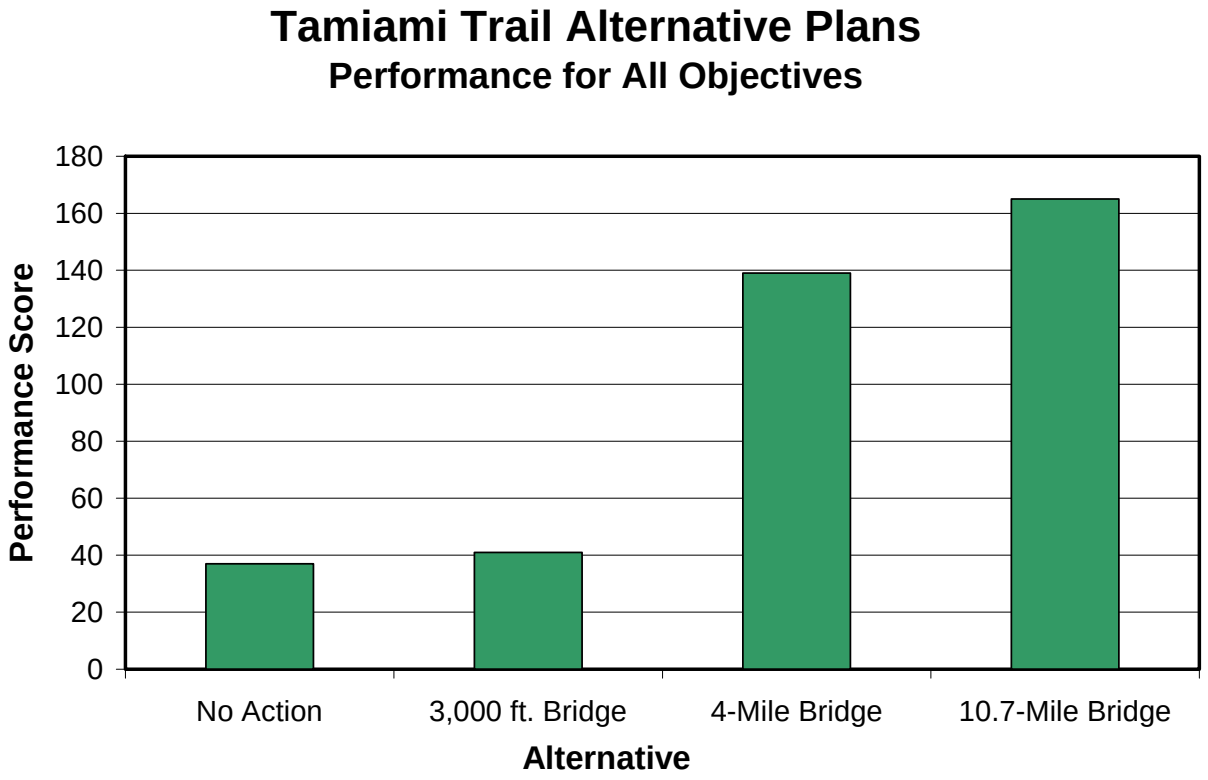


Figure 7.1. Alternative Performance Summary

7.1.2. Screening of Alternatives Based on FDOT Concerns

As stated earlier, NPS will not consider implementation of any alternative that could result in the unmitigated deterioration of the Tamiami Trail roadbed or other conditions that would result in a human safety hazard associated with the continued use of the Tamiami Trail. The No Action and 3,000-ft bridge alternatives, as modeled by the Corps using the SFWMD Model, do not meet the road safety requirements as identified by FDOT.

Based on these designs and the NPS position on road safety, only the 10.7-Mile Bridge and 4-Mile Bridge alternatives meet the FDOT screening criteria for acceptability. More recent CSOP modeling identified a 3,000-ft. bridge alternative with an unconstrained L-29 canal stage that would meet FDOT requirements. These results were not available for evaluation by the scientists who contributed to this report. However, a review by hydrologists of ENP indicates that this 3,000-ft. bridge alternative had similar overland flow characteristics as the 3,000-ft alternative with the 9.3 DHW evaluated in this report, i.e., only 13% of flow from WCA-3B to NESS was overland flow similar to the 11% overland flow from WCA-3B to NESS in the 9.3 DHW alternative.

7.1.3. Screening of Alternatives Based on Current Fiscal Constraints

While the 1989 ENP Expansion and Protection Act states that the MWD Project features are "justified by the environmental benefits to be derived by the Everglades ecosystem in general and by ENP in particular and shall not require further economic justification…" ENP also recognizes the fact that limited funds are

available to the project from the NPS. The March 2005 version of the Capital Asset Plan (OMB Circular A-11 Exhibit 300[b], Modified Water Deliveries) indicates that the current level of funding available from the NPS for the Tamiami Trail component of the MWD Project is $130.3 million (Corps confirm). The current Office of Management and Budget baseline cost for the MWD Project is $398.42 million. This baseline was approved in January 2005 and it includes a cost-sharing proposal in the FY 2006 President's Budget between the DOI, the Corps, and the State of Florida for $259.65M, $123.76M, and $15M, respectively. Should the contribution from the State of Florida not materialize, the funding allocation will be assumed by the DOI.

While this level of funding does not represent the final amount that could potentially be made available by the NPS, it is the opinion of the NPS that alternatives significantly higher than the amounts stated in the Capital Asset Plan would not be supported due to the current funding priorities within the NPS.

The two alternatives that were not eliminated due to FDOT constraints—10.7-Mile Bridge and 4-Mile Bridge—were assessed for relative performance for the environmental objectives in the context of the fiscal constraints imposed by the DOI. The 10.7-Mile Bridge (Environmentally Preferred Alternative) has a construction cost of approximately $230 million (Corps confirm). This exceeds the current amount available by approximately 100 million from the DOI. Based on this decision, the NPS is compelled to screen from further consideration the 10.7-Mile Bridge alternative.

Should additional funding be made available from other sources, NPS would amend this position to include the environmentally preferred alternative that clearly exhibited superior performance for the environmental objectives. However, in the absence of additional sources of funding only the 4-Mile Bridge alternative meets the fiscal constraints identified by NPS.

7.2. Summary of Alternative Performance for the Recommended Plan

7.2.1. 4-Mile Bridge—Alternative 3

The ENP has identified the 4-Mile Bridge alternative as the recommended plan. It is the position of the ENP that Alternative 3 performs sufficiently well for all environmental project objectives and falls within the limits imposed by the project constraints as evidenced by the following:

- Provides the same high ratio of overland flows to NESS from WCA-3B 44/56 (W to E), as in the 10.7-Mile Bridge alternative.
- Provides 69% of historic flow volumes to NESS (same as 10.7-Mile Bridge).
- Substantially shifts the historic flow distributions (30/70 W/E) back to the east side of the L-67A Canal—from the present 22/78 W/E split to 44/56 (same as 10.7-Mile Bridge).
- Meets the FDOT concern for road safety by providing necessary mitigation to offset the adverse impacts to road safety associated with the projected high water following implementation of the MWD Project.
- Provides the acceptable performance for all project objectives for the funds expended. The estimated construction costs are also within the capability of the limited funding available from the NPS.
- While the ENP has concerns that the current configuration of Alternative 3 provides only 37% of the potential connectivity between WCA-3B and NESS, the NPS anticipates that additional connectivity can be provided through future CERP related modifications, such as future removal of the levee paralleling the L-29 canal.
- Reduces wildlife mortality—a reduction of 570 individuals, or a 37% reduction

- Reduces flow velocities and impacts to only 437.5 acres of wetlands
- Increases average velocity at the road by 0.008 ft/s over marsh velocity
- Reduces discontinuity in water levels above and below Tamiami Trail
- Provides the opportunity for reconnection of 37% of sloughs (4 large sloughs)
- Eliminates pattern of scour and deposition at culverts and weirs
- Restores sediment flow and transport needed for ridge building in 37% of area
- Reverses infilling in 37% of sloughs
- Significantly reduces risk of ridge and tree island peat burning fires in NESS and in the Rocky Glades
- Restores vegetative communities in 37% of sloughs
- Reduces encroachment of sawgrass and wet prairie vegetation into ENP and WCA-3B sloughs
- Creates a substantial shift toward open water, spikerush marsh and slough communities in WCA-3B and NESS
- Provides the a moderate level of improvement to aquatic fish communities
- Provides a moderate reduction in the risk for invasion of exotic aquatic species
- Provides a moderate improvement in conditions for wading bird foraging and nesting
- Provides a high to moderate level of improvement for alligator nesting numbers and distribution
- Provides the high to moderate level of water quality improvement to ENP by (1) reducing the concentration of TP discharged to ENP, (2) reducing the injurious effects of TOC, TON, and TOP, (3) increasing levels of dissolved oxygen in ENP, (4) reducing effects of high sulfate concentrations, and (5) increasing nutrient cycling and uptake by biota

7.3. Alternatives Eliminated based on Poor Environmental Performance and/or Human Safety Concerns—No Action and 3,000-ft Bridge alternatives

7.3.1. 3,000-ft Bridge—Alternative 2

- Has a poor distribution of flows to ENP—55/45 (W to E)
- Provides much less flow volumes to ENP, compared to the 4-Mile Bridge alternative—666,000 ac-ft/per year, compared to 987,000 ac-ft/per year.
- Provides only 61,000 ac-ft/per year of flows through WCA-3B to NESS, compared to 531,000 in alternatives 3 and 4.
- Provides only 11% of overland flows to NESS from WCA-3B, compared to 56% in alternatives 3 and 4.
- Increases MFL violations in NESS and Mid-NESS from 1-in-12 years to 1-in-6 years for NESS and 1-in-12 to 1-in-7.2 years for Mid-NESS.
- Continued discontinuity in water levels above and below Tamiami Trail.
- North-south connectivity is only 5.4% of the 10.7-mile project length.
- Wildlife mortality remains a concern with a reduction of only 84 individuals, or a 5.3% reduction.
- Increases flow velocity in 1649.3 acres, compared to only 437.5 for Alt. 3 and 165.7 for Alt. 4.
- Increases average velocity at the road by 0.027 ft/s over marsh velocity;
- Opportunity to reconnect only 2% of sloughs (1 small slough)
- Continued pattern of scour and deposition at culverts and/or weirs

- Continued lack of sediment flow and transport needed for ridge building (and tree island formation)
- Continued filling in of sloughs
- Slightly reduced risk of ridge and tree island peat burning fires in NESS and Rocky Glades
- Continued high water levels in southern WCA-3A, with large open water areas and reduced sawgrass ridge vegetation
- Slight reduction of sawgrass and wet prairie vegetation into sloughs in ENP and eastern WCA-3B
- Reduced but continued encroachment of sawgrass and wet prairie vegetation into sloughs
- Provides low level of improvement to aquatic fish communities
- Provides low reduction in the risk for invasion of exotic aquatic species
- Provides low improvement in conditions for wading bird foraging and nesting
- Provides low level of improvement for alligator nesting numbers and distribution
- Only minimally improves water quality conditions in ENP.

7.3.2. No Action—Alternative 1

- Has a poor distribution of flows to ENP—48/52 (W to E)
- Provides much less flow volumes to ENP, compared to the 4-Mile Bridge alternative-790 thousand ac-ft/per year, compared to 949.
- Provides only 104 thousand ac-ft/per year of flows through WCA-3B to NESS, compared to 531 in alternatives 3 and 4.
- Provides only 13% of flows to NESS from WCA-3, compared to 56% in alternatives 3 and 4.
- Increases MFL violations in NESS and Mid-NESS from “1-in-12” years to “1-in-6” years for NESS and “1-in-7.2” years for Mid-NESS.
- Continued discontinuity in water levels above and below Tamiami Trail
- Wildlife mortality remains a concern with no reduction in mortalities.
- Flow velocities at the trail are not reduced.
- Opportunity to reconnect 0% of sloughs.
- Continued pattern of scour and deposition at culverts and/or weirs
- Continued lack of sediment flow and transport needed for ridge building (and tree island formation)
- Continued filling in of sloughs
- Slight reduced risk of ridge and tree island peat burning fires in NESS and Rocky Glades
- Continued high water levels in southern WCA-3A, with large open water areas and reduced sawgrass ridge vegetation
- Slight reduction of sawgrass and wet prairie vegetation into sloughs in ENP and eastern WCA-3B
- Reduced but continued encroachment of sawgrass and wet prairie vegetation into sloughs
- Provides low level of improvement to aquatic fish communities
- Provides low reduction in the risk for invasion of exotic aquatic species
- Provides low improvement in conditions for wading bird foraging and nesting
- Provides low level of improvement for alligator nesting numbers and distribution
- Only minimally improves water quality conditions in ENP.

7.4. NPS Recommendations for Implementation of the Recommended Plan

The Corps concluded in their 1992 GDM that the final plan for "Conveyance of water from WCA-3A to WCA-3B would restore the historic flow patterns in the Everglades Basin. By so doing, 100,000 acres of prime Everglades' habitat would be brought back as a fully functional component of the Everglades system. The surface water component added to direct rainfall effects in WCA-3B would recreate the hydrologic dynamics in the system that has been almost totally lost since the area was impounded. The additional volume would create a fluctuating water level with seasonally deeper water in the center of the historic slough in WCA-3B, and would restore the historic short hydroperiod in the marshes along the eastern edge. This would build up the food resource base of small fishes and macroinvertebrates for harvesting by wading birds during the dry season recession. The increased water levels and secondary productivity combined with the topographical heterogeneity of the area would create a seasonal diversity of feeding habitats. This would greatly increase the opportunities for wading birds to forage sites under a wide range of water conditions. Ecological restoration of WCA-3B is believed to be the key to restoring long-term trends in successful nesting by wood storks and other wading birds in the park because it historically played such an important role in sustaining the large nesting colonies during the dry season. Increased water depths would also benefit the apple snail, a food resource for a wide array of animals, and the essential food source for the snail kite. Regional snail kite populations, therefore, would be expected to increase as the kites repopulate the area." The 1992 GDM also states that "hydrologic restoration of WCA-3B is also essential to restoring natural water conditions in the park. Diversion of flood waters from WCA-3A into detention in WCA-3B would decrease the volume of and, in some cases, the need for regulatory water releases into the park from WCA-3A."

This emphasis by the Corps on the hydrological and ecological restoration of WCA-3B and restoring the hydrologic connection between WCA-3B and NESS complements many of the hydrological and ecological expectations and subsequent recommendations in this report by the NPS. Importantly, NPS believes that restoring "substantial" overland flows through WCA-3B to NESS must be an essential component of the Tamiami Trail Project. The justification for raising the Tamiami Trail roadbed, removing the parallel levee, and bridging the trail must be based on the scientific understanding that substantial overland flows from WCA-3B to NESS are required to restore the many ecological attributes of both WCA-3B and ENP (as noted in the Corps summary above). It is the scientific position of the NPS that "substantial" volumes of flows from WCA-3B to NESS should be >500,000 ac-feet/per year (refer to Table 6.1). This volume could be considered "substantial" in the sense that it is a reasonable step toward NSM levels (NSM levels are approximately 1.3 million ac-feet/per year). The NPS would find it difficult to scientifically support or monetarily justify any alternative that does not meet a minimum threshold of 374,000 ac-ft/per year. This 374,000 ac-ft/per year figure is based on the expectation that the Tamiami Trail alternative will provide for CERP-level (CERP0) overland flows from WCA-3A through WCA-3B to NESS. Finally, full restoration of "substantial" flows through WCA-3B to NESS will not be effectuated without the removal of the levee that parallels the section of the trail where the bridge is located.

7.5. The NPS Recommendations for Location of the 4-Mile Bridge

The NPS recommends that the 4-Mile Bridge be located along the Tamiami Trail corridor based on the following siting criteria:

1. Enhance ecological connectivity
2. Facilitate hydraulic passage of flows
3. Avoid or minimize adverse effects on state and federally listed species

4. Minimize wildlife mortality
5. Maintain CERP compatibility, and
6. Reduce seepage losses east of L-30 and L-31N

1. Enhance ecological connectivity- A 4-Mile Bridge location in a west-central location of the Tamiami Trail provides more ecological benefits than an eastern location. These benefits include greater reconnection between historic ridge and slough habitats between WCA-3B and NESS, as the eastern area of WCA-3B and NESS has undergone significant subsidence and loss of historic ridge and slough flow patterns. In addition, since the west-central location is less degraded, i.e., maintains the corrugated features associated with a ridge and slough system (Figure 7.2), these locations will be more effective in restoring sediment flow and transport needed for ridge and slough building, reverse filling in of sloughs, restore more vegetative communities, and improve fish and wildlife resources.

2. Facilitate Hydraulic Passage of Flows- As evidenced in Table 7.2, the majority of historic flows (51%) passed through culverts 43-50 in the west-central location of the trail; whereas, only 37% passed through the culverts 51-59 on the eastern end of the trail (Table 7.2). This is because the land elevation is lowest in this area and there is still evidence of slough corrugation, allowing some flows even during the dry seasons. Obviously, the reason the airboat enterprises are located more in the west-central location is due to the fact that there are flows through this area, even during the dry season (Figure 7.2). The NPS recommends that the 4-Mile Bridge be located to optimize the hydrological and ecological benefits of this historic flow path. Moreover, the U.S. Army Corps of Engineers completed a Value Engineering Study in 2001 that evaluated conveyance and seepage features for the MWD project. In this VE report, the Corps recommends passive weirs for the L-67A canal, filling in of the L-67C canal, and the addition of three passive weirs in the L-29 canal to facilitate the passage of flows to NESS. The Corps recommends that two of the weirs be located to the west of S-355A and B in a west-central location of L-29—similar to that proposed by NPS for the 4-Mile Bridge alternative. The other weir would be located to the east of the S-355s. This recommendation by the Corps is consistent with the NPS recommendation designed to maximize flows through WCA-3B to NESS.

Table 7.2. Average Seasonal Culvert Flow for a dry-average and wet year.

	Average Seasonal Flow (cfs)	
Year	**Culverts 43-50**	**Culverts 51-59**
Dry-Average Year		
1943 Wet Season	47.19	11.41
1943 Dry Season	30.3	13.23
Wet Year		
1947 Wet Season	555.85	331.9
1947 Dry Season	576.02	508.25

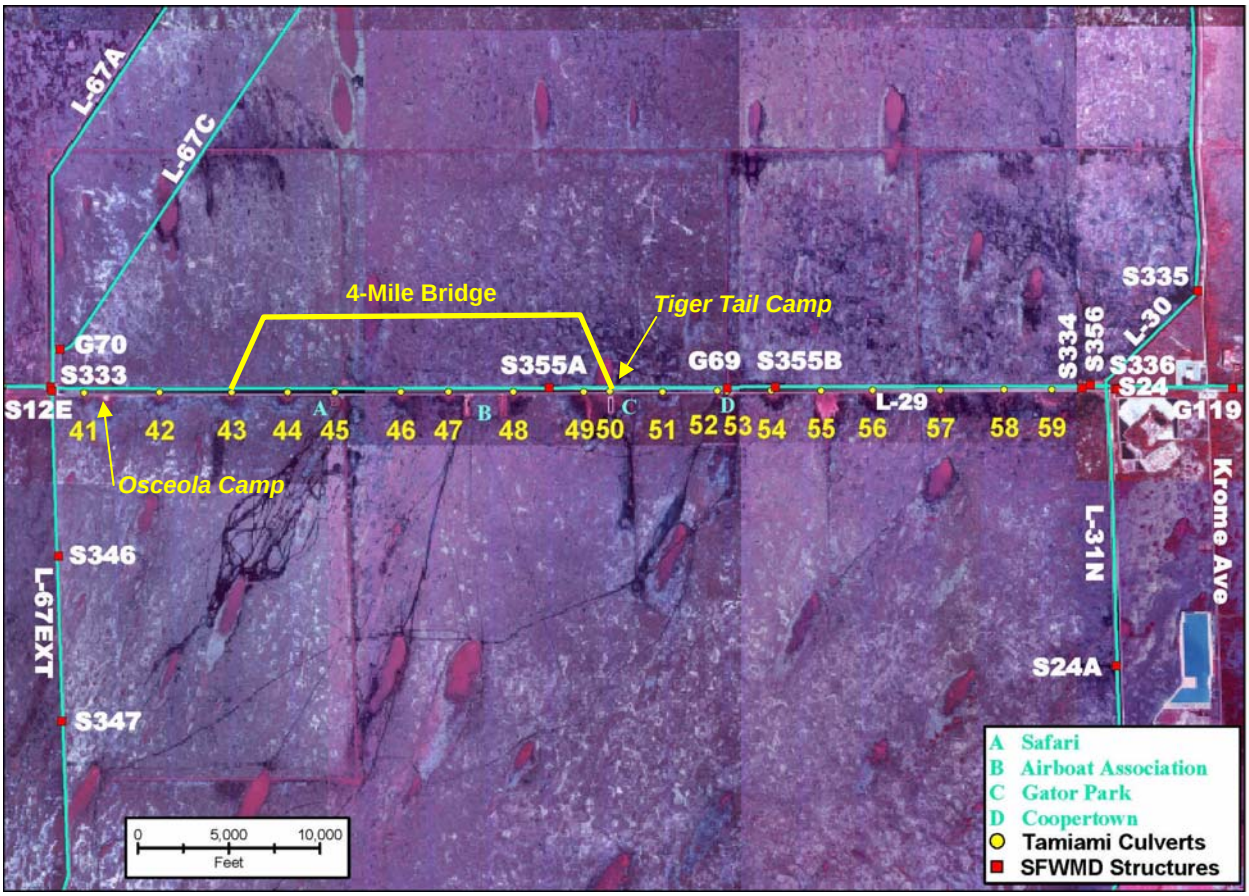


Figure 7.2. Proposed location of the 4-Mile Bridge alternative.

3. Avoid or Minimize Adverse Effects on State and Federally Listed Species- The FWS has identified the potential eastern location as having potential impacts to a colony of wood stork (*Mycteria Americana*) in that area. Based on this information, a more western location would be preferable due to concern for this endangered species.

4. Minimize Wildlife Mortality- There is no significant difference in the performance of different bridge locations in meeting the siting criterion of meeting wildlife mortality.

5. Maintain CERP Compatibility- The west-central location would be more consistent with future CERP objectives compared to the proposed eastern location, as these sites would be more effective in reconnecting historic sloughs between WCA-3B and NESS. The reconnection of these historic sloughs will allow for the increase in flow volumes to NESS associated with future CERP objectives without the increased seepage problems associated with a bridge on the eastern side of the trail.

6. Reduce Seepage Losses east of L-30 and L-31N- Aquifer properties vary along Tamiami Trail and as a result hydraulic control structures breaching the L-29 levee may have different influences on surface waters, depending on where they are located. In highly transmissive areas, surface waters will only minimally converge towards a breach, since they easily pass under the levee. The most transmissive area of Tamiami Trail is along its eastern-most section where L-30 and L-31N meet. This high transmissivity means increased flow volumes from WCA-3B to NESS may be

compromised by similar increases in seepage to the east. Flow convergence may be much greater to the west, since the levee is a more significant barrier, therefore, a larger fraction of surface waters will flow through a western breach than an eastern one. Because of this change in aquifer transmissivity, a 4-mile bridge in the western part of WCA-3B will influence the hydrologic balance over a wider extent than the same bridge in the eastern part.

The NPS has determined that a west-central location of the 4-Mile Bridge starting just west of the Tiger Tail Camp would provide the most ecological and hydrological benefits to WCA-3 and Everglades National Park (Figure 7.2). It would restore or enhance hydrological and ecological conditions in WCA-3 and ENP, facilitate the hydraulic passage of flows between WCA-3B and NESS, avoid impacts to threatened and endangered species, be most compatible with future CERP objectives, and would avoid complications associated with seepage issues to the east of the park. This location would also allow for restoration of flows into areas that are deeper on either side of the trail so that flow volumes will be maximized. Allowing for increased flow volumes from WCA-3 to NESS will reduce the flows through WCA-3A, reducing damaging high water levels in WCA-3A and reducing impacts to the CSSS.

This goal is most attainable for the section of the ridge and slough landscape south of Tamiami Trail, east of S-333 and west of S-355A (Figure 7.2). This is the section of ridge and slough landscape in NESS that is least degraded and therefore most feasible to restore. 100% restoration of this section would require water depths greater than 2 ft for 80-100% of the time in the sloughs and less than 25% of the time on the ridges. Flow velocities should be maximized in the sloughs over large reaches. Reconnection of this flow section would provide for reconnection of approximately 40% of the historic slough habitats between WCA-3B and NESS, and, given the proper upstream conditions, could provide the flow patterns required to restore the ecological functions that are supported by the ridge and slough landscape in this region of the Everglades.

7.6. Segmentation of the 4-Mile Bridge

From an ecological perspective, the more segments in the bridge, the greater the loss of ecological connectivity between WCA-3B and NESS. From a hydrologic perspective, multi-bridge locations could optimize the hydraulic connectivity between WCA-3B and NESS, if the bridge spans could be strategically placed to straddle the major sloughs. In evaluating these options, the NPS has determined that a single 4-mile bridge span between the Tiger Tail Camp and the Osceola Camp (see Figure 7.2) would provide the greatest ecological and hydrological benefits, while reducing costs associated with providing access to establishments along U.S. 41.

7.7. NPS Conclusions

The NPS recommends implementation of the 4-Mile Bridge Alternative based on its performance in providing substantial ecological and hydrological improvements in a cost-effective manner. The alternative exhibiting the best performance for the environmental objectives, the 10.7-Mile Bridge Alternative (Environmentally Preferred Alternative) has a construction cost of approximately 230 million dollars. This level of funding exceeds the current amount available from the NPS. It is the opinion of the NPS that any alternative exceeding the current level of funding is beyond the capability of the NPS and should be eliminated from further consideration.

Should additional funding be made available from other sources, NPS reserves the option to amend this position in order to support the 10.7-Mile Bridge alternative that exhibited superior performance for the environmental objectives.

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FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

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August 11, 2005

Colonel Robert M. Carpenter
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701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Re: Supporting documents for the Draft Revised General Reevaluation Report/Supplemental Environmental Impact Statement (RGRR/SEIS) for the Tamiami Trail, Modified Water Deliveries to Everglades National Park, Miami-Dade County

Dear Colonel Carpenter:

The Habitat Conservation Scientific Services Section of the Florida Fish and Wildlife Conservation Commission (FWC) has coordinated agency review of the supporting documents being used to craft the Draft Revised General Reevaluation Report/Supplemental Environmental Impact Statement (RGRR/SEIS) for the Tamiami Trail Project of Modified Water Deliveries to Everglades National Park (MWD). These documents include the MWD Tamiami Trail Modifications Benefits Analysis, results from RMA-2 modeling of bridge lengths in Tamiami Trail, an Alternative Optimization Report prepared by Everglades National Park (ENP Report), and a Tamiami Trail Road-kill Survey report prepared by the U.S. Fish and Wildlife Service (FWS). Our comments and concerns on the Tamiami Trail Project are included in the following preliminary supplemental Fish and Wildlife Coordination Act Report (FWCAR), which is being submitted under the authority of the Fish and Wildlife Coordination Act of 1958.

Background

This project is one of four components that have arisen from the original 1992 Modified Water Deliveries General Design Memorandum. The other highly interrelated components include flood protection of the 8.5 Square Mile Area residential development along the eastern side of Northeast Shark River Slough (NESRS); conveyance of water between Water Conservation Area (WCA)-3A, WCA-3B, and NESRS; and an overall operational plan for the newly constructed water control structures.

Project Description

The reason that the 2003 GRR/SEIS is being revised is that new information regarding probable damage to the Tamiami Trail was raised during and subsequent to the public and agency review of the final report, leading to a determination by the U.S. Army Corps of Engineers (COE) that the recommended plan did not contain all of the features necessary for implementation. Recent modeling indicates that an increase in the design high-water stage for the L-29 canal from 9.3 ft to 9.7 ft would be necessary, accompanied by the need for a different, and potentially more costly, method such as raising the road to mitigate effects to the Tamiami Trail. Compounding this added expense, worldwide cost of construction materials increased greatly, resulting in substantial increases in cost estimates for the alternatives. Due to these cumulative increases in costs, the tradeoffs between benefits and costs were reanalyzed for the purpose of determining whether a different alternative might make better use of limited funds.

Of the nine basic alternatives previously addressed by our FWCAR dated June 24, 2003, three have been retained for re-evaluation, and a new alignment has been proposed for one of these. Those retained for further evaluation include: Alternative 9, the 3,000-foot bridge located east of the Blue Shanty Canal (the previous Tentatively Selected Plan) with a higher roadway elevation; Alternative 10, a centrally located 4-mile bridge with a higher roadway elevation ("central 4-mile bridge"); Alternative 11, an eastern 4-mile bridge with a higher roadway elevation ("east 4-mile bridge"); and Alternative 17, a 10-mile bridge. The central 4-mile bridge is a slight realignment of Alternative 6a from the 2003 GRR/SEIS, and had been considered by Everglades National Park (ENP) and the COE as a strong contender for the new tentatively selected plan. However, further increases in construction cost estimates led the COE once again into alternative formulation to take into consideration shorter bridge lengths at various locations. Six additional alternatives were identified and are as follows: Alternative 12, a centrally located 3-mile bridge ("central 3-mile bridge"); Alternative 13, a centrally located 2-mile bridge ("central 2-mile bridge"); Alternative 14, a 2-mile bridge on the west end of the project area and a 1-mile bridge on the east end ("2-mile west/1-mile east bridges"); Alternative 15, a 1.3-mile bridge on the west end of the project area and a 0.7-mile bridge on the east end ("1.3-mile west/0.7-mile east bridges") ; and Alternative 16, three 3,000-foot bridges in the central portion of NESRS (Figure 1). We understand that the COE is now proposing the 2-mile west/1-mile east bridge (Alternative14) as the new Tentatively Selected Plan. The western 2-mile bridge would begin approximately 1.5 miles west of the L-67 Levee and extend to the east of the Blue Shanty Canal, requiring one access ramp to the Everglades Safari airboat concession located on the Blue Shanty Canal. The eastern 1-mile bridge would begin approximately 1.5 miles west of the L-31 N levee and extend to the west for 1 mile, capturing an old north-south agricultural canal. This bridge would lie between, and equidistant from, the two wading bird rookeries located immediately south of the Tamiami Trail. For our comments concerning Alternative 17, the 10-mile bridge (previously known as Alternative 5), please refer to our previous FWCAR dated June 24, 2003.

Our three major areas of concern with regard to the potential impacts of this project remain as follows: (1) impacts to existing recreational facilities and access points of the Francis S. Taylor Wildlife Management Area (WCA-3B), (2) impacts to fish and wildlife resources, and (3) potential loss or degradation of Everglades marsh. Many of our comments and concerns on the

Tamiami Trail feature have been conveyed previously to the COE in a letter dated March 17, 2004 (attached), to James C. Duck; in a review of a preliminary draft GRR/SEIS via a preliminary FWCAR (attached) dated June 24, 2003; through a Planning Aid Letter (PAL) dated February 26, 2001; and via the Florida State Clearinghouse in a letter dated January 16, 2002, to Ms. Jasmin Raffington. Our comments in this current letter focus on Alternatives 10 through 16, as well as the ecological benefits to be expected from each. We have already reviewed the design for the 10-mile bridge in our FWCAR dated June 24, 2003.

ENP Report and Benefits Analysis Procedures

The MWD Tamiami Trail Modifications Benefits Analysis was constructed largely from the ENP Report through two collaborative interagency workshops held by the COE in May and July, 2005. Although the ENP report integrated a great deal of historical and ecological information, its direct applicability to the Tamiami Trail RGRR is limited by a number of its assumptions. A screening process was therefore conducted by the interagency team whereby the number of performance measures (PMs) in the ENP Report was reduced from 33 to 12 PMs. The remaining 12 PMs address four important characteristics of ENP: hydrology, ridge and slough processes, vegetation, and fish and wildlife resources. An additional hydrologic PM for restoring water deliveries to ENP was added during the July workshop, resulting in a total of 13 PMs. The quantitative and qualitative values for the PMs were converted into scores (0 to 7) for each of the PMs. These scores were added together to produce an index of the quality of restoration for each alternative. Average annual habitat unit benefits were then calculated for each of the alternatives for relative comparison. The details of the above processes are explained in the COE document entitled "MWD Tamiami Trail Modification Benefits Analysis Procedures August 2005."

Although we support the overall objectives upon which the 13 performance measures for calculating benefits are based, we do not necessarily agree with all the hypotheses that the ENP Report used to justify the selected PMs. For example, we agree that the restoration of ridge and slough processes is an appropriate objective, and that the performance measure to reverse filling in of sloughs is appropriate. However, we do not believe that there is sufficient scientific evidence to support the higher water depths that the report suggests would be necessary to re-create ridge and slough habitat. The report states that the 100% restoration goal for the area downstream of the 4-mile centrally located bridge would require water depths greater than 2 feet for 80 - 100% of the time in the sloughs. On the contrary, we have supporting evidence from the current Everglades system that extreme high water depths of relatively long duration lead to a deterioration of ridge and slough landscape features and to declines in their associated wildlife populations. Southern WCA-3A has experienced severe degradation of its ridge components (sawgrass ridges and tree islands) due to excessive depths and durations during the past 40 years (Heisler et al. 2002, McPherson 1973, Patterson and Finck 1999). The Heisler et al. study found that marsh water levels exceeding 2.0 feet led to tree island flooding impacts demonstrated by a statistically significant ($P < 0.0001$) reduction in tree and shrub species richness. If we agree that tree islands, ridges, and sloughs are all defining components of a restored Everglades, then clearly more work needs to be done to reconcile the recommendation for a hydroperiod that promotes ridge and slough maintenance while also supporting tree islands.

The other objectives being used to calculate habitat units for alternative comparisons include restoring water deliveries to ENP, restoring vegetative communities, and restoring fish and wildlife resources. There appear to be credible sources of both historical and ecological information presented in the ENP Report that could be used to help evaluate the ecological benefits of the five remaining alternatives for conveying flows through the Tamiami Trail. These include hydrologic connectivity, velocity distributions downstream of the bridges, ground elevation, historic flow information, and historic slough locations based on an unpublished 1917 survey by J. W. King.

Comparison of the 4-Mile Bridge Alternatives (Alternatives 10 and 11) to a 3,000-Foot Bridge (Alternative 9)

The implementation of a 4-mile bridge alternative would provide for greater compatibility between MWD and the proposed Comprehensive Everglades Restoration Plan (CERP) Decompartmentalization ("Decomp") project by reducing the amount of retrofitting needed for the Tamiami Trail in that project. Information contained in the COE's Benefits Analysis determined that the central 4-mile bridge (Alternative 10) would produce 32,674 average annual habitat unit benefits and the east 4-mile bridge (Alternative 11) would produce 28,549 unit benefits. In contrast, the 3,000-foot bridge would only produce 12,453 average annual habitat unit benefits. Unfortunately, the COE has indicated that there are no longer sufficient funds to construct a 4-mile bridge.

The greater bridge lengths in Alternatives 10 and 11 would have augmented the hydrologic connectivity between the L-29 canal and ENP marshes to the south, facilitating the movement of aquatic biota between these two areas. As stated in the ENP Report, this enhanced connectivity may lead to improvements in micro-topography in the ridge and slough system in the long term by creating a larger area with open water or sparse vegetation. When water depths are shallow, such habitats are known to harbor greater fish densities and to be more productive foraging sites for wading birds (J.A. Surdick 1998). Improved foraging habitat should benefit the wading bird rookeries located in the vicinity of the Tamiami Trail. For additional comments on connectivity effects, please refer to our previous letter dated June 24, 2003.

The Tamiami Trail road-kill survey conducted by the FWS in 2002-03 documented 991 road-killed vertebrates along two miles of selected transects over 13 monthly sampling periods. Reptiles including turtles, snakes, and alligators were the most commonly found carcasses, constituting 84% of the total, while mammals, birds, and amphibians comprised the remaining 14% of the road-killed animals. Based on the two miles of transects surveyed in the FWS Tamiami Trail road-kill survey, there was an average of 262 road-kills/mile/year. An extrapolation of this data to a 4-mile bridge alternative may reduce the risk of wildlife mortality by seven-fold, resulting in 900 fewer road-killed animals per year than would occur with the 3,000-foot bridge alternative. Both the central and the east 4-mile bridge alternatives would result in a reduction of present road-related wildlife mortality by approximately 37% compared to only 5% reduction by the 3,000-foot alternative. If additional box culverts in these alternatives are strategically placed, further reductions in wildlife mortality could be realized. The FWS survey also reinforces the need for placement of a wildlife crossing at the juncture of

the L-30 and L-31 levees. For more details of our suggestions for reducing road-related mortality, please refer to our previous letter dated June 24, 2003.

Analysis by the COE using the RMA-2 hydrologic model was conducted to evaluate the velocity distribution of flows south of the Tamiami Trail for the different bridge configurations. The COE estimated that velocities in excess of 0.1 feet/second (ft/sec) would be excessive and destructive to the maintenance of the ridge and slough habitat. The RMA-2 modeling results predicted that 411 acres of marsh would be negatively affected by the 3,000-foot bridge, compared to only 98 acres by the central 4-mile bridge and 105 acres by the east 4-mile bridge. The ENP Report identified a lower velocity threshold of 0.045 ft/sec to evaluate differences between alternatives. Using this criterion, velocities greater than 0.045 ft/sec were estimated to negatively affect 1,649 acres under the east 4-mile bridge alternative and 438 acres under the central 4-mile bridge alternative. Although it is assumed that more natural flow velocities would provide greater benefits to aquatic biota, the appropriate target flow velocities, as well as the extent of benefits and their relative importance to wildlife populations is difficult to ascertain.

Another potential issue concerning the greater bridge lengths under Alternatives 10 and 11 is the longer construction time required. Under Alternative 7a (the 3,000-foot bridge) in the 2003 GRR, the construction period was estimated to last 24 months, whereas the length of time for completing construction of any one of the new alternatives is estimated to take 36 months. We hope that any additional time needed to complete the Tamiami Trail modifications does not delay the COE's ability to implement the portion of MWD that will be addressed under the Combined Structural and Operational Plan.

Comparison of central 4-mile (Alternatives 10) and east 4-mile bridge (Alternative 11)

Future plans under Decomp would remove the southern portion of the L-67A levee and the L-29 levee, facilitating sheetflow through the western portion of WCA-3B into NESRS. Alternative 10, with its more centrally located bridge, would provide the most direct routing for these future flows, and, we are hopeful, would reduce potential flooding impacts to WCA-3B.

According to the ENP Report, the average ground elevation at the central 4-mile bridge location is somewhat lower than it is at the east 4-mile bridge location. Culvert flow data during the peak of the 1947 flood were used to demonstrate that 51% of the flows across the Tamiami Trail occurred at the central location, while only 37% of the flows occurred at the eastern location. Information compiled by the COE using recent USGS survey data for ground surface elevations in NESRS 1,000 feet south of the Tamiami Trail confirms the more general ground elevation information contained in the ENP Report. A graphical presentation of this survey data depicts two "deep" sloughs at ground surface elevations less than 6.0 feet NGVD at both the east 4-mile bridge location and the west 4-mile bridge location (Figure 1). The ENP Report likewise analyzes historic photographs from 1917 in the project area and determines that a greater number of "deep" sloughs historically occurred at the central location than at the eastern location. We believe that further benefits could be accrued by placing additional box culverts at historic slough locations, particularly in the deep centrally located slough at Frog City.

The east 4-mile bridge could lead to greater impacts to the Tamiami East and Tamiami West rookery sites located immediately south of the roadway. Several listed species of wading birds, including the white ibis (*Eudocimus albus*), tricolored heron (*Egretta tricolor*), little blue heron (*Egretta caerulea*), and snowy egret (*Egretta thula*) (all state-listed as species of special concern), and the wood stork (*Mycteria americana*) (state- and federally listed as endangered) are known to nest in these colonies (T. Towles, FWC, personal observation, 1997). The FWS roadkill survey documented the mortality of wood storks and snowy egrets along the current roadway. An elevated bridge could lead to an increased risk of wading bird strikes by passing traffic, and reduce productivity through the visual disturbance created by traffic passing within the sight of canopy-nesting wading birds.

The Everglades mink (*Mustela vison evergladensis*) is listed as threatened by the FWC, and approaches the eastern limits of its distribution in the project area. The greatest number of historic Everglades mink roadkills documented for this portion of the Tamiami Trail was in the western portion of the project area, and specifically centered at the Blue Shanty Canal (Smith 1980). Consequently, the central location of Alternative 10, spanning the Blue Shanty Canal, may reduce the risk of Everglades mink road-related mortality to a greater extent than would the more easterly alignment of Alternative 11.

According to the RMA-2 analysis conducted by the COE, the central 4-mile bridge would result in fewer acres being negatively affected by relatively high flow velocities than would occur with the east 4-mile bridge. Using the COE's criterion of 0.1 ft/sec, an additional 187 acres of marsh would be affected by higher velocities in the central bridge alignment than in the eastern bridge alignment. No velocity estimates were calculated for Alternative 11 in the ENP Report.

Comparison of 2-mile west/1-mile east bridges (Alternative 14), a 3-mile central bridge (Alternatives 12), a 2-mile central bridge (Alternative 13), and a 3,000-foot bridge (Alternative 9)

Results of the Benefits Analysis demonstrated that the combined hydrologic and ecologic average annual lift of the 2-mile west/1-mile east alternative (28,371 habitat units [hu]) was slightly greater than the 3-mile central bridge alternative (27,973 hu), but the 2-mile central bridge alternative also demonstrated a considerable amount of lift (22,422 hu). All of these alternatives exceeded the performance of the 3,000-foot bridge (12,453 hu) by quite a margin. The 2-mile west/1-mile bridge design was shown to provide slightly greater hydrologic average lift (24,522 hu) than a single 3-mile bridge (23,998 hu). Improvements in hydrologic connectivity between the L-29 Canal and NESRS and in the distribution of flows from west to east along the Tamiami Trail in the 2-mile west/1-mile east bridges alternative were the primary contributors to this lift. The 2-mile west/1-mile east bridges alternative, with a connectivity value of 34%, offers greater connectivity than does a single central 3-mile bridge, with a value of 30%. As stated in the ENP Report, such enhanced connectivity may lead to improvements in micro-topography in the ridge and slough system in the long term by creating a larger area with open water or sparse vegetation. When water depths are shallow, such habitats are known to harbor greater fish densities and to be more productive foraging sites for wading birds (J.A. Surdick 1998). The creation of such habitat improvements at the eastern bridge location of

Alternative 14 may be of particular benefit to wading birds due to the two rookeries that would be situated at both the east and west ends of this bridge. The 2-mile west/1-mile east bridge alternative was also more effective in re-creating the normal east to west distribution of flows that would occur if the Tamiami Trail did not exist. This alternative matched 59% of the natural east to west distribution, whereas both the 3,000-foot bridge and the central 3-mile bridge matched 57% of the east to west distribution, and the single 2-mile bridge matched only 51% of this distribution. The redistribution of flows is important since it is a primary overarching objective of the MWD project.

We also learned from engineering staff of the South Florida Water Management District (SFWMD) that additional bridge capacity along the eastern reach of the L-29 canal may facilitate the transfer of greater quantities of water from WCA-3B into the L-29 canal and NESRS, which may help reduce the severity of extreme high water predicted to occur in eastern WCA-3B under the Combined Structural and Operational Plan. Flows from the L-29 canal under a 1-mile bridge into the three relatively deep sloughs in the east during dry conditions would also provide for a more uniform and gradual recession rate and reduce unnatural dry downs, possibly enhancing wading bird nesting success. There may also be a greater capacity in the eastern than in the western portion of NESRS for receiving flows due to the greater amount of subsidence that has occurred in the east since 1946 (from 2 to 3 feet) than in the west (none to 2 feet) (Scheidt et al. 2000). Such physical and hydrological characteristics that act to increase the conveyance of flows from the L-29 canal to the south, and augment the capacity of the L-29 canal to receive flows from WCA-3, would be considered as beneficial to Everglades habitat in both WCA-3 and in NESRS.

Both the 2-mile west/1-mile east bridge and the central 3-mile bridge alternatives would result in a reduction of present road-related wildlife mortality by approximately 29% compared to 19% for the central 2-mile bridge, and only 5% reduction by the 3,000-foot alternative. If additional box culverts in these alternatives are strategically placed, further reductions in wildlife mortality could be realized. Based on the two miles of transects on the Tamiami Trail roadway surveyed in the FWS Tamiami Trail road-kill survey, there was an average of 262 road-kills/mile/year. An extrapolation of this data to a three-mile bridge alternative may reduce the risk of wildlife related mortality by more than five-fold, resulting in 635 fewer road-killed animals per year than would occur with the 3,000-foot bridge alternative. The 2-mile bridge alternative may reduce the risk of wildlife related mortality by more than three-fold, resulting in 374 fewer road-killed animals per year than would occur with the 3,000-foot bridge alternative. For more details of our suggestions for reducing road-related mortality, please refer to our previous letter dated June 24, 2003.

The 2-mile west/1-mile east bridges, central 3-mile bridge, and central 2-mile bridge alternatives would not be expected to have any adverse effects on the two Tamiami Trail wading bird rookeries. The 2-mile west/1-mile east bridge alternative avoids potential impacts by locating the eastern 1-mile bridge in between the two wading bird rookeries. The increased flows and hydroperiods to be expected by this bridge alignment may improve foraging habitat for wading birds nesting in these colonies.

The greatest number of historic Everglades mink road-kills documented for the eastern portion of the Tamiami Trail was centered at the Blue Shanty Canal (Smith 1980). Since the western 2-mile bridge of Alternative 14 spans the Blue Shanty Canal, the risk of Everglades mink road-related mortality may be reduced. The reconnection of the linear and natural "upland" and aquatic features associated with the Blue Shanty may also facilitate safe passage for other terrestrial and aquatic wildlife that utilize the Blue Shanty as a travel corridor.

Information contained in the COE's Benefits Analysis determined that the RMA-2 modeling results predicted that 295 acres of marsh would be negatively affected by velocities > 0.1 ft/s under the 2-mile west/1-mile east alternative, compared to 411 acres affected by the 3,000-foot bridge alternative. The 3-mile and 2-mile bridge alternatives would affect somewhat fewer acres than the 2-mile west/1-mile east bridge. Since the ecological significance of these higher velocities is difficult to define and the acreage affected is relatively minor considering the larger benefits to be derived through lengthening inundation periods over much of NESRS, these relatively minor effects would be acceptable for any of the alternatives presently being considered.

Although the implementation of a 2-mile west/1-mile east bridge alternative would not provide as many benefits as a 4-mile bridge, it is believed to offer a sufficient amount of compatibility between MWD and future restoration under the Decomp project, and would reduce the amount of retrofitting needed for the Tamiami Trail under Decomp. We also understand that the central 3-mile bridge and 2-mile west/1-mile east bridge alternatives, as it now stands, both exceed the cost limitations for the project. In the event that construction costs further limit the length of bridge than can be built, we believe that the results obtained from the Benefits Analysis would support as a minimum either the 1.3-mile west/ 0.7-mile east bridge alternative or the 2-mile central bridge alternative as being adequate to convey and distribute MWD flows to ENP. We furthermore believe that the additional benefits identified in the split bridge alternatives warrant maintaining this design and that at least one-third of the total bridge length should be apportioned to the east portion of NESRS. This ratio would improve the redistribution of flows to the full breadth of NESRS, and would improve connectivity between the L-29 canal and ENP to a greater extent than would be afforded by a single bridge span.

Recreation concerns

Those concerns that were previously addressed pertaining to potential impacts to FWC recreational facilities and access points under Alternatives 1 through 8 (see attached June 24, 2003 preliminary FWCAR) remain. The only public recreational access that is anticipated to be lost under either Alternatives 12 or 14 would be the permanent loss of access to three miles of the south side of the L-29 canal and to culvert outfall sites on the south side of the Tamiami Trail for bank anglers. It is assumed that there would also be a temporary loss of access to the south bank of the remaining seven miles of the roadway during the construction period. Perhaps the reduced access to the south bank of the L-29 canal could be compensated for by providing scenic view pull-offs on the two bridges that could also serve as fishing platforms. The increase in connectivity between the L-29 canal and ENP marshes under either three-mile bridge alternative may enhance the recreational fishery value of the L-29 canal to a greater extent than would the

connectivity created by a 3,000-foot bridge. We further understand that Alternatives 12 and 14 would not affect vehicular access to the L-29 Levee or boat access to the L-29 canal.

Other related issues

We understand that water quality treatment for the roadway will probably not be required at this time since the impervious surface of the highway is not expected to significantly increase. On the other hand, we understand that an expensive water quality treatment system is being incorporated into the construction design for the bridge spans. We would support best management practices, such as using stormceptors or similar technologies for improving water quality of stormwater being discharged while minimizing wetland impacts. We encourage further investigation into cost effective treatment technologies for reducing bridge stormwater runoff, so that the bridge lengths and associated ecological benefits can be maximized.

We recognize that some private property issues related to increasing flood stages and possibly to rights of ways south of the Tamiami Trail are under resolution at the present time. We hope that these issues can be satisfactorily resolved such that the ecological benefits of project implementation can be realized in a timely manner.

Concerns and Recommendations

The stated authority limitations of the COE and the financial limitations of ENP will likely preclude them from implementing the more ecologically preferred alternatives, such as Alternatives 10 or 17 for the Tamiami Trail portion of the MWD project. Therefore, Alternative 14, or a derivative thereof, would appear to be the most reasonable interim alternative to implement prior to the approval of a more permanent solution under CERP. In our preliminary FWCAR for the GRR, dated June 24, 2003, we had previously agreed that a 3,000-foot bridge length would suffice due to fiscal constraints at that time. Should budget shortfalls for this project occur, we would continue to support the construction of one or more bridges intermediate in combined length between two and three miles, in order to avoid any further delays in completing the Tamiami Trail, and ultimately the MWD project. In summary, we offer the following recommendations concerning the alternatives under consideration.

1. We continue to support the idea of selecting an alternative that would be as compatible as possible with the upcoming CERP Decomp project, and reduce costly retrofitting of the Tamiami Trail in the future. Contingent on funding commitments from the Department of the Interior, we believe that Alternative 14 best addresses this compatibility.

2. Of the two most promising alternatives now being considered for this project, Alternative 14 would appear to offer the most benefits for fish and wildlife resources while avoiding potential impacts. This alternative would reduce the risk of wildlife mortality at the Blue Shanty Canal, particularly that of the threatened Everglades mink, since this canal would

bridge. This alternative would also avoid possible impacts to two important wading bird bridge between them.

3. Although Alternative 14 is expected to eliminate three miles of bank access along the south bank of the L-29 canal and cause a temporary loss of access to the remainder of the south bank during construction, we consider these impacts to be minimal when compared to some other alternatives. However, special attention will need to be given to the siting of construction staging areas so that access is not blocked to the three boat ramps and parking facilities associated with the popular Recreation Site No. 4, the boat ramp and parking facility at Recreation Site No. 1, or to the boat ramp facility located west of the S-12D structure.

4. Wading bird and snail kite nesting patterns, as well as Everglades mink territories, may vary with the prevailing hydrological conditions, during the multiple years that construction will likely be occurring. Therefore, surveys should be conducted by qualified biologists on an annual basis over the period of active construction to determine whether any mink territories or nesting efforts of state- and federally protected bird species would potentially be affected.

If you or your staff would like to coordinate further on the recommendations contained in this report, please contact me at 850-488-6661, or email me at maryann.poole@MyFWC.com, and I will be glad to help make the necessary arrangements. If your staff has any specific questions regarding our comments, I encourage them to contact Dr. Joseph Walsh at our office in Vero Beach (772-778-5094; email joe.walsh@MyFWC.com).

Sincerely,

Mary Ann Poole

Mary Ann Poole, Director
Office of Policy and Stakeholder Coord.

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ENV 1-3-2
Enclosures (2)
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CC: Mr. Jay Slack, USFWS, Vero Beach
Mr. Dan Kimball, ENP, Homestead
Ms. Tambour Eller, COE, Jacksonville
Mr. Chuck Collins, FWC, West Palm Beach
Mr. Larry Gerry, SFWMD, West Palm Beach

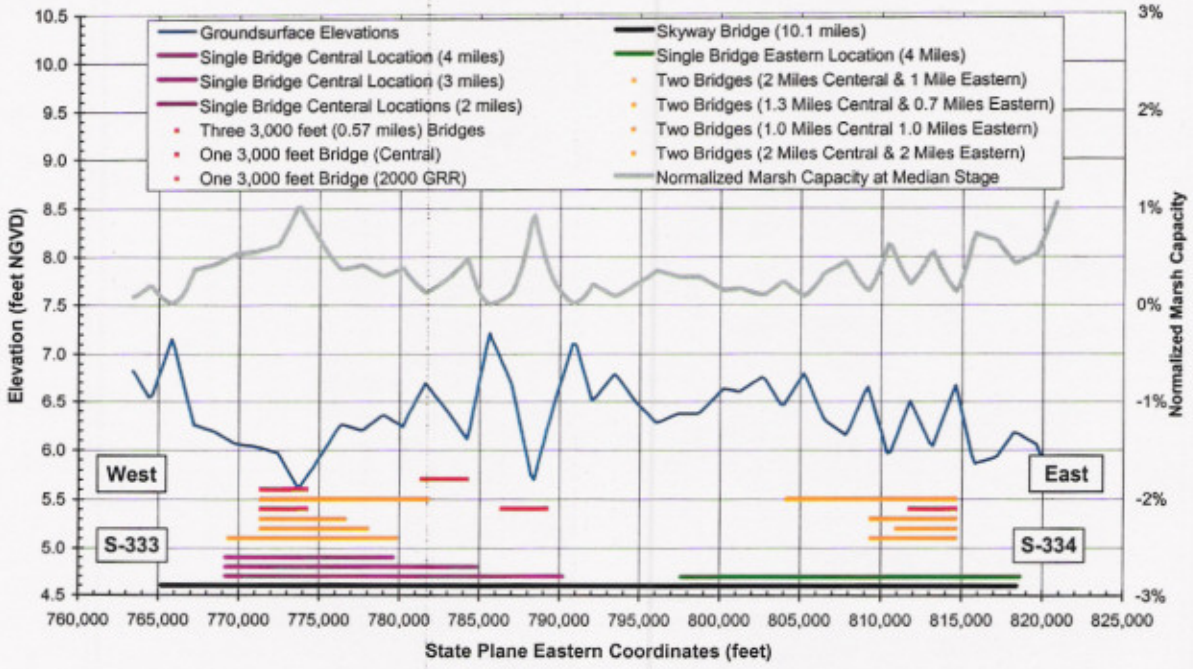

FIGURE 1
Proposed Bridge Locations and Normalized Marsh Capacity at the Median Stage of 7.5 feet NGVD

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FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

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March 17, 2004

Mr. James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: Tamiami Trail Final General Reevaluation Report/Supplement to the 1992 Final Environmental Impact Statement (GRR/SEIS) on Modified Water Deliveries to Everglades National Park, Miami-Dade County

Dear Mr. Duck:

The Office of Environmental Services of the Florida Fish and Wildlife Conservation Commission (FWC) has reviewed the referenced document, and provides the following comments.

This project is one of four components that have arisen from the original 1992 Modified Water Deliveries General Design Memorandum. The other highly interrelated components include flood protection of the 8.5-square-mile-area residential development along the eastern side of Northeast Shark River Slough (NESRS); conveyance of water between Water Conservation Area (WCA)-3A, WCA-3B, and NESRS; and an overall operational plan for the newly constructed water control structures. Many of our comments and concerns on the Tamiami Trail Feature have previously been conveyed directly to the Army Corps of Engineers (COE) via a preliminary Coordination Act Report (attached) dated June 24, 2003, and through a Planning Aid Letter (attached) dated February 23, 2001, and through the Florida State Clearinghouse in a letter to Ms. Jasmin Raffington dated January 16, 2002 (attached). Our comments in this letter focus on the status of a real estate agreement between the COE and the Florida Department of Transportation (FDOT), timely integration with the Decompartmentalizaion and Sheetflow Enhancement project (Decomp), and proper sequencing of the various Mod Waters project components.

First of all, we understand that the COE is still seeking a real estate agreement with the FDOT on the potential maintenance of the Tamiami Trail in lieu of raising the entire road profile. In our letter to Ms. Jasmin Raffington dated January 16, 2002, we had previously requested that an agreement be formalized and made available for public review prior to the release of this final GRR/SEIS. It is stated in the GRR/SEIS that such an agreement will be finalized with FDOT during development of the construction Plans and Specifications for the final approved plan under Mod Waters, and that this timeframe should coincide with the final decision on a plan for Tamiami Trail under the Comprehensive Everglades Restoration Plan (CERP). To accommodate this integration, the Decomp project was split into two separate project implementation reports (PIR), one of which would focus solely on the necessary modifications to the Tamiami Trail in order to pass the additional CERP flows. According to the COE's current Master Program Implementation Schedule, it now appears that a separate PIR for the Tamiami

Trail will not be developed. We also understand that delays in the development of the Decomp PIR are anticipated due to budget shortfalls. Consequently, we are concerned that these factors may result in a lack of integration of the two Tamiami Trail projects, and could result in costly retrofitting of the roadway under Decomp if the entire road profile were to be raised under Mod Waters.

Another area of concern is the sequencing of the Seepage and Conveyance, the 8.5-square-mile-area, and the Combined Structural Operational Plan (CSOP) components with the Tamiami Trail component of Mod Waters. The completion date for the Seepage and Conveyance component, which includes the construction of passive weir structures across the L-67 and L-29 levees, is now scheduled for June 2006. However, the Tamiami Trail component is not scheduled to be complete until 2007. We are concerned about the potential for ecological damage to WCA-3B and further delay in benefits to NESRS, if the Tamiami Trail is not capable of passing the augmented flows by the time these other conveyance features area in place.

We are encouraged that the COE has concurred with us on the placement of the 3,000-foot bridge immediately east of the Blue Shanty Canal. Please refer to our previous comments on the Draft GRR/SEIS in our letter to Ms. Jasmin Raffington, dated January 16, 2002, for a more detailed discussion of our concerns on wildlife passage beneath the bridge, the need for annual surveys of state-listed wildlife species prior to construction activities, and the need for an accurate accounting of impacts to recreational access along the Tamiami Trail.

In conclusion, we support the final recommended plan (7a) with the understanding that 1) a real estate agreement between the COE and FDOT will be formalized as soon as possible to avoid unnecessary delays in implementation of the CSOP and to avoid costly retrofitting during implementation of the Comprehensive Everglades Restoration Plan, 2) appropriate surveys will be conducted for state-listed wildlife species prior to construction, and 3) all potential recreational access impacts are fully addressed.

Sincerely,

Brian Barnett

Brian S. Barnett, Interim Director
Office of Environmental Services

bsb/dtt
ENV 2-16/4
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Enclosures
cc: Environmental Branch, COE, Jacksonville
Mr. Jay Slack, USFWS, Vero Beach
Mr. Dan Kimball, Acting Superintendent , ENP, Homestead
Regional Director, FWC, West Palm Beach

June 24, 2003

Colonel James G. May
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: General Reevaluation Report/ Supplemental Environmental Impact Statement (GRR/SEIS) for the Tamiami Trail, Modified Water Deliveries to Everglades National Park, Miami-Dade County

Dear Colonel May:

The Office of Environmental Services of the Florida Fish and Wildlife Conservation Commission (FWC) has reviewed the revised preliminary draft GRR/SEIS for the Tamiami Trail Project of Modified Water Deliveries to Everglades National Park ("Mod Waters"), dated June 2001. This project is one of four components that have arisen from the original 1992 Modified Water Deliveries General Design Memorandum. The other highly interrelated components include flood protection of the 8.5-square-mile area residential development along the eastern side of Northeast Shark River Slough (NESRS); conveyance of water between Water Conservation Area (WCA)-3A, WCA-3B, and NESRS; and an overall operational plan for the newly constructed water control structures. This report is being submitted following a hiatus in activity on the Tamiami Trail Project due to a legal challenge to the 8.5-square-mile flood protection project, which has since been satisfactorily resolved. Our comments and concerns on the Tamiami Trail Project component are included in the following preliminary Coordination Act Report (CAR), which is being submitted under the authority of the Fish and Wildlife Coordination Act of 1958.

Description of Alternatives

This GRR/SEIS is being developed because new information acquired since the project was approved in 1992 indicates that the original design would be insufficient to pass the volume of water that would need to be conveyed under the Tamiami Trail via Mod Waters. In addition to the six basic alternatives (nine, if water quality treatment options are considered separately) previously addressed in our Planning Aid Letter (PAL), dated February 23, 2001, two completely

new alternatives (seven and eight) have been developed, a modification of Alternative 5 (5C) has been added, and Alternative 6 has now been formally accepted. Also, a new bridge alternative, "Alternative 9 ", with a 2.7-mile span length, intermediate between that of Alternatives 6 and 7, is being floated by the Department of the Interior as a possible compromise. Since we have previously been informed by your staff that any alternatives with bridge expanses much longer than what is deemed necessary to convey Mod Water flows are considered to be outside of your authority for this project, we have opted not to discuss the tentative "9a" and "9b" alternative options any further. For a short description of these 18 alternatives and their associated options, please refer to Table 1. Our three major areas of concern with regard to the potential impacts of this project remain as follows: (1) impacts to existing recreational facilities and access points of the Francis S. Taylor Wildlife Management Area (WCA-3B), (2) impacts to fish and wildlife resources, and (3) potential loss of Everglades marsh.

Impacts to Existing Recreational Facilities and Access Points

Those concerns that were previously addressed pertaining to potential impacts to FWC recreational facilities and access points under Alternatives 1 through 5 remain (please refer to our previous PAL [attached] dated February 23, 2001 and to our Florida State Clearinghouse letter to Ms. Jasmin Raffington dated January 16, 2002), and also apply to the three new alternatives (Alternatives 6, 7, and 8) added in this document. Since the PAL, we have learned of an additional boat ramp, and also now provide supplementary information on the identification numbers of FWC boat ramps within or adjacent to the project area. We know of three boat ramps in the project area that provide access to the marsh of Francis S. Taylor Wildlife Management Area (FSTWMA). The westernmost ramp (#135) is located immediately east of the S-333 structure on the L-29 Levee and has unimproved parking capable of accommodating about ten vehicles. A popular marsh access ramp owned by the South Florida Water Management District is located on the L-29 Levee at Recreation Site No. 1, immediately south of the S-334 structure, and has unimproved parking. A third concrete boat ramp of unknown origin, previously unidentified, is located in a swale on the L-29 Levee opposite the Airboat Association of Florida. Of the three FWC maintained boat ramps that provide access to the canal system within the project area, two are located at Recreation Site No. 4. One of these (#96), immediately north of the S-333 structure, provides access to the popular L-67A canal, while the other boat ramp (#161), at the juncture of the L-67A and L-67C levees, provides access both to the L-67C canal and to the marsh in the "pocket" of WCA-3B. The remaining boat ramp (#153), located at Recreation Site No.2, is the sole access point for the eastern 11-mile stretch of the L-29 Canal.

A cursory look at the recreational fishing pressure along much of the 11-mile stretch of the L-29 Canal that is being examined under this project suggests that use may be relatively low, except near the S-334 and S-333 structures (FWC, unpublished data). However, changes that are soon anticipated to occur with implementation of the conveyance features of the Mod Waters Project, as well as certain features of the Comprehensive Everglades Restoration Plan (CERP),

are likely to improve hydrological connections between the L-29 Canal and the marsh interface, as well as prolong adjacent marsh hydroperiods both to the north and to the south of the L-29 Canal. Consequently, such predicted hydrological changes combined with the addition of new water management structures (bridges, culverts, weirs, etc.) are likely to lead to an increase in local sport fish populations, followed by an increase in recreational fishing demand and concomitant changes in angler distribution patterns along this eastern stretch of the Tamiami Trail. It should be noted that prior to the construction of the L-67 and L-29 levees, this section of the Tamiami Canal (precursor to the L-29 Canal) was one of the premiere fishing areas in the Everglades. Creel surveys conducted during a study in 1960 (Game and Fresh Water Fish Commission [GFC], unpublished report) revealed that the first four miles of the Tamiami Canal west of the L-30 canal received an exceptional amount of use, and that the 11-mile stretch west of the L-30 canal received considerably more fishing pressure than the 9 miles of the Tamiami Canal west of the present-day L-67 Canal. The imminent decline of this great fishery, effected through a separation of the Tamiami Canal from the marsh with the completion of the L-29 Levee, was predicted in the aforementioned GFC report.

Besides recreational access for sport fishing purposes, the airboat ramps provide access to the natural resources of the Everglades marsh contained within the Francis S. Taylor Wildlife Management Area. Recreational frogging, airboating, and seasonal hunting are the primary activities pursued here. Recreational use of these access points may be relatively high during short hunting seasons, particularly when game population levels allow a liberal harvest. For instance, there were 140 airboat permits issued for an approximately 3-week deer season in the FSTWMA in 1984, and 156 permits issued the following year. Although deer population levels in WCA-3B are anticipated to decline under the projected deeper water regime that will occur with the implementation of Mod Waters and CERP, overall recreational use of the area for frogging, general airboating, duck hunting, and fishing is expected to increase. The potential impacts associated with each group of alternatives are listed as follows.

Alternatives 2a, 2b to 2b6, 4a, and 4b to 4b6. This document describes creative water quality treatment options b1 to b3 of Alternatives 2 and 4 as encroaching into the L-29 Canal. We understand from statements made by your staff that it will be necessary to maintain the water supply conveyance capacity of the L-29 Canal for some undefined period of time, which would necessitate maintaining deeper water conditions in this section of the canal. Nevertheless, the above-mentioned water quality treatment options would encroach into the south portion of the L-29 Canal and require widening of the canal to the north. This option would essentially eliminate any existing littoral zone on the south bank of the canal and would result in the loss of boat ramp #153 and impact Recreation Site No. 2 located on the north bank of the L-29 Canal. In the event that a boat ramp is impacted, the Army Corps of Engineers (COE) would be responsible for building a replacement ramp at a new location to be selected by the FWC.

Alternatives 3a and 3b. A reduction in available parking space for recreational users on the north side of the L-29 Canal would negatively impact recreational access to the canal.

Recreation Site No. 2 would probably be negatively affected or eliminated by this northerly road alignment.

Alternatives 5a, 5b, and 5c. The effects of the new subalternative 5c are essentially the same as for Alternatives 5a and 5b, in that recreational access to all sites on the north bank of the L-29 Canal will not be affected. However, the entire south bank of the L-29 Canal would be inaccessible during the 4-year construction period. Following completion of the bridge, only culvert outfalls located within the first mile on the east end and within the last one-half mile on the west end of the project would potentially be available for angler use. This loss of access to the south bank of the L-29 Canal from the Tamiami Trail could possibly be ameliorated by the provision of some degree of fishing access from the elevated bridge span.

Alternatives 6a and 6b. Although approximately 4 miles of the southern bank of the L-29 Canal would be unavailable to bank anglers, the remaining 6 miles should still be accessible, as well as the entire northern canal bank. However, the employment of creative water quality treatment options 6b1 to 6b3 could potentially impact the L-29 Canal, as described previously under Alternatives 2 and 4. As in Alternative 5, less opportunity would be lost if fishing access were possible from the bridge span. The feasibility of providing limited fishing access from designated portions of such extensive bridge spans should be explored as a means of reducing public fishing access losses. All existing boat ramps would remain accessible under this alternative. Culvert outfalls south of the roadway would not be accessible during highway construction (18-24 months) in Alternative 6a, and would be plugged under Alternative 6b. The addition of eight box culverts at designated low points in Alternatives 6a and 6b may provide additional angler opportunities.

Alternatives 7a and 7b. Recreational access to all boat ramps and the north bank of the L-29 Canal would remain intact, while fishing access to the south bank of the canal would be blocked during the 2-year construction period. Most of the culvert outfall structures would be accessible during and after construction in Alternative 7a, but all would be filled and eliminated in Alternative 7b. Although the preliminarily selected preferred alternative is Alternative 7a, the decision as to whether additional water quality treatment will be required has not yet been officially decided. Should Alternative 7b be selected, it is not known how the channeling of all water outflows through the single 3,000-foot gap will affect the L-29 Canal fishery. Also, special attention would need to be given to the siting of construction staging areas so that access is not blocked to the three boat ramps and parking facilities associated with the popular Recreation Site No. 4 that provides access to the L-67 canals and FSTWMA, or to the boat ramp facility (#90) located 200 yards west of the S-12D structure.

Alternatives 8a and 8b. Alternative 8a should not impact existing recreation access sites, and could provide new fishing opportunities at the 24 additional box culverts, particularly

if the culvert outfalls are scalloped out to improve the passage of water into northeast Shark River Slough. Alternative 8b would require filling the existing culverts, and could result in a loss of fishing opportunities unless the 40 new box culverts are constructed in a way that creates shallow collection basins at the outfalls.

Impacts to Fish and Wildlife Resources

Of particular concern are the impacts that an alternative could have on state-listed species of wildlife or important habitat components. There are three historic wading bird rookeries containing species listed by the state as endangered or species of special concern, recent records of endangered snail kite nests in southern WCA-3B, a number of records of the threatened Everglades mink along the highway corridor, and a single documented occurrence of the endangered West Indian manatee in the L-29 Canal. In addition, other listed species such as the limpkin and roseate spoonbill (both listed as species of special concern) utilize marsh areas, and the least tern (threatened) forages in canal habitats that could be impacted under certain alternatives. The potential impacts that could occur are listed by alternative groups as follows.

Alternatives 1 and 2a. The temporary road for detouring traffic while proposed bridge #3 is under construction would encroach into the pond apple forest at the Tamiami West wading bird colony, on the south side of the Tamiami Trail, that provides nesting substrate for white ibis, tricolored herons, little blue herons, snowy egrets, and wood storks. Consequently, a portion of this forested area would be eliminated as a nesting substrate for an unknown number of years. Any heavy construction activity that would be expected to occur within 600 meters of a known rookery location, including construction of the temporary road, should be conducted outside of the wading bird nesting season, which normally extends from early February to the onset of the rainy season.

Alternative 2b. This alternative encroaches to a greater extent (average of 51 feet) into the marsh south of the existing Tamiami Trail, with incursions of 5 to 6 additional feet at bridge approaches. Consequently, this alternative would have a greater permanent impact on the Tamiami East and Tamiami West wading bird colonies due to a greater permanent loss of nesting substrate as well as a decrease in the amount of buffer capacity available. The Everglades mink has been documented to use both natural and artificial upland areas for denning purposes; therefore, this alternative could potentially impact mink denning areas that may occur in either native upland areas or at the artificially created upland areas where the airboat concession and radio tower sites are located. Option 2b1, which shifts the alignment to the north, is only a slight improvement over Alternative 2b.

The 2b creative water quality treatment options of 2b2 to 2b6 (Table 1) result in much more modest incursions into the two Tamiami wading bird colonies; however options 2b2 and 2b3 would eliminate littoral zone elements on the south shore of the L-29 Canal, eliminate reptile oviposition and basking sites on the south shore of the canal, and could result in the entrapment of terrestrial animals attempting to cross the canal.

Alternatives 3a and 3b. Both of these alternatives and the various 3b options presented would result in the loss of a significant amount of high quality wildlife habitat. The woody vegetation supporting the Frog City wading bird colony, which has been documented to contain nesting tricolored and little blue herons (both species of special concern), would be either eliminated or severely impacted by the road alignment, which would encroach further into the marsh at this point in order to avoid the Tigertail Camp. This northerly diversion of the road around the Tigertail Camp would also impact a high quality tree island (WRAP score of 0.83) that may also have a special cultural value to the Tigertail family. The relocation of a high-speed highway to the north of the L-29 Levee would result in much greater wildlife mortality during high water episodes in WCA-3B than presently occurs. There could be dens of the Everglades mink in the L-29 Levee or on adjacent tree islands that are impacted, as well.

Alternatives 4a and 4b. Both of these alternatives would produce significant incursions into the Tamiami West and Tamiami East wading bird rookeries, as well as eliminate important swamp forest habitat along the remainder of the corridor. Although options 4b1-4b6 would reduce the amount of encroachment from Alternative 4b, they are only slightly better than Alternative 2b. The Everglades mink has been documented to use some of the man-made upland sites along this alignment for denning purposes, and could potentially be impacted by construction activity.

Alternatives 5a, 5b, and 5c. These alternatives are believed to be the most beneficial to wildlife, with little known impacts. These alternatives would leave important rookery vegetation intact on both sides of the Tamiami Trail and reduce potential impacts to mink denning areas. Road-related mortality of the Everglades mink, with at least 14 documented occurrences, would essentially be eliminated. However, the leaving in place of renovated sections of the old roadbed under Alternatives 5a and 5b could possibly provide suitable habitat for Everglades mink and oviposition sites for alligators and other egg-laying reptiles, as well as provide safe havens for terrestrial wildlife during high water periods.

Alternatives 6a and 6b. Alternative 6a would produce impacts to the two Tamiami rookeries as described for alternatives 1 and 2a, above. Alternative 6b and its various options would result in impacts to these rookeries and to the L-29 Canal identical to those

described under Alternative 2b, above. Road-related mortality of the Everglades mink and other wildlife would be eliminated at the four-mile bridge, and mink survival could be further enhanced by providing elevated wildlife crossing shelves under the east and west ends of the extended bridge. Mink denning areas could also be protected by avoiding the need to encroach upon the upland sites south of the existing road. Mink habitat could actually be improved by planting the abandoned upland sites south of the Trail with shrubs and trees so as to resemble native Everglades tree island communities.

Alternatives 7a and 7b. Alternative 7a would have negligible permanent impacts on the two Tamiami rookeries, but Alternative 7b would result in impacts as described above for Alternative 2b. However, we believe that greater ecological and wildlife benefits may be derived from these alternatives by a shift of the 3,000-foot bridge to the east of the Blue Shanty Canal. This would result in water discharges onto a land surface with a slightly lower average ground elevation and would be more centrally located in present day northeastern Shark River Slough. This location may likewise facilitate the safe passage of wildlife, especially if the bridge were equipped with a wildlife shelf.

Alternatives 8a and 8b. Alternative 8a would likewise have little effect on the two Tamiami rookeries, as long as new box culverts are not constructed at the rookery locations. Alternative 8b would produce impacts similar to those described for Alternative 2b. The additional box culverts under these alternatives, if placed at strategic locations, could improve the passage of aquatic and semiaquatic fauna across the roadway, especially if animal barriers were erected to deflect animals to the culvert crossings.

Potential loss of Everglades marsh and connectivity effects

In order to ascertain the potential impacts that each alternative iteration would pose to the functionality of wetlands, a multi-agency team was assembled to apply the Wetland Rapid Assessment Procedure (WRAP) to the various wetland plant communities in the Tamiami Trail corridor. The results of this assessment found that the functional value of wetland communities immediately north of the L-29 Levee in WCA-3B were of somewhat higher quality (average score of 0.74) than similar wetlands situated immediately south of the Tamiami Trail in the Everglades Expansion Area of Everglades National Park (average score of 0.62).

Alternatives 1, 2a, 2b to 2b6, 4a, and 4b to 4b6. The nine water quality treatment options of 4b through 4b6, 2b, and 2b1 were predicted to result in the loss of from 34 (2b1) to 64 (4b) wetland functional units in the Everglades Expansion Area, whereas Alternative 4a (without water quality treatment) was little better, with a predicted loss of 40 wetland functional units (Table 1). By comparison, Alternative 2a, using the existing

highway alignment and four new bridges, resulted in a relatively low loss of wetland function (10 units) at a substantially lower cost than the 2b2 to 2b6 water quality treatment options. Each of these alternatives physically connect the L-29 Canal to the marsh in Everglades National Park for only 2.5% of the entire project corridor length (i.e., create a 2.5% marsh-canal interface) by means of the four new bridges; however, creative water quality treatment options b1 to b3 of Alternatives 2, 4, and 6 would encroach into the L-29 Canal.

Alternatives 3a and 3b. The seven water quality treatment options of 3b through 3b6 presented for Alternative 3 were predicted to result in the loss of from 15 to 30 wetland functional units in WCA-3B, whereas Alternative 3a (without water quality treatment) was predicted to result in the loss of 19 functional units (Table 1). Although north-south connectivity for these alternatives is stated to be 10%, the primary purposes of the eight bridges that supposedly create this connectivity are to cross the L-29 Canal, and to span the two S-355 and three weir water conveyance structures on the L-29 Levee. Connectivity between the L-29 Canal and wetlands to the south would be no greater in Alternative 3 than under Alternatives 2 or 4, since no additional breaching of the Tamiami Trail is included under this alternative.

Alternatives 5a, 5b, and 5c. This suite of alternatives performs the best in that there is actually a net gain in functional units of wetlands (from 29 units in 5b to 45 units in 5c) compared to the base condition. Connectivity under Alternatives 5a (98%) and 5c (nearly 100%) are excellent, but if in situ water quality treatment is required (5b), connectivity would decrease markedly to 75% due to the need to leave sections of the old highway bed in place for dry retention. From a purely ecological perspective, without regard to cost or authority, Alternative 5 appears to exhibit the best overall performance.

Alternatives 6a and 6b. Alternative 6a would result in the loss of only 6.6 wetland functional units (< 10 acres) whereas Alternative 6b would result in significantly greater losses (22.8 functional units) due to the broad footprint necessary for water quality treatment. Alternative 6a is also estimated to result in about a 36% opening of the entire 10.7-mile length of the Tamiami Trail corridor, providing for a significant improvement in aquatic connectivity. Alternative 6b would provide a reduced level of connectivity (27%) due to the necessity to leave portions of the old Tamiami Trail for water quality treatment.

Alternatives 7a and 7b. Alternative 7a would result in a minimal loss of only 3.4 functional units (5 acres) of marsh. In contrast, the acreage demand for standard water quality treatment along 10 miles of roadway in Alternative 7b would result in wetland losses approaching 50 functional units (72 acres). Both of these alternatives would result in a 5% increase in the connectivity of the L-29 Canal to Everglades marshes in the south

near the western end of the project area. The ground elevation of the Everglades marsh at the western end of the project area appears to be slightly higher than at other locations to the east. If this is actually the case, the aquatic connectivity between the L-29 Canal and the marshes south of the Tamiami Trail would be severed sooner during low water conditions than would occur if such an opening were situated at a point east of the Blue Shanty Canal. Aquatic connectivity may even be reduced beyond current levels during periods of low water if Alternative 7b were selected, since the existing culverts would be filled in.

Alternatives 8a and 8b. Alternative 8a would likewise produce a minimal loss of only 3.5 wetland functional units, resembling Alternative 7a. However, wetland losses under Alternative 8b would be considerably greater (46.6 functional units). These alternatives rely on additional box culverts to convey Mod Waters flows, and would increase connectivity between the L-29 Canal and the marsh south of the roadway by a mere 0.4%. These alternatives are not compatible with the CERP concept of removing the Tamiami Trail as an impediment to flow by elevating portions of the roadway.

Features for reducing road-related wildlife mortality

In an effort to obtain some data that could be used for evaluating the need for highway features that could be employed to reduce road-related wildlife mortality, and that could be used as an aid in determining the placement of such features along the project corridor, biologists from the FWC, the U.S. Fish and Wildlife Service, and the COE conducted a preliminary survey of wildlife mortality along five miles of the Tamiami Trail corridor. Remains representing 411 individual animals were found during a walking survey of 3 miles of the Tamiami Trail on December 19-20, 2000 (Tables 2, 3, and 4) and of 2 miles on April 18, 2001 (Tables 5 and 6). During these single visit surveys, an average of 82 wildlife deaths were recorded per mile. If this same level of mortality is extrapolated for the entire 10.7 mile road corridor, the number of road-kill casualties observable on a given day would equal 880 individuals. However, since 60% of the survey length was surveyed during the coldest part of the year when reptile activity is at its lowest point, and since many carcasses are quickly scavenged from the road before they can be counted, we believe that the actual mortality would likely be several times greater than this. For example, during December, an average of 2 dead snakes and 1 alligator were documented per mile of highway; these numbers increased dramatically, following a marsh dry-down in April, to an average of 22 dead snakes and 7 alligators per mile. Recent data collected by FWS staff similarly suggests that there may be an increase in road-killed snakes during the autumn (Mike Abney, pers.comm.) An Arizona study (Kline and Swann 1998) attempting to quantify wildlife road mortality found that only 24% of road-killed animals recorded during all-night surveys were discovered on surveys the following day. Likewise, a daily walking survey of a section of central Florida secondary highway found that most road-killed snakes were present for only a

day or two, with few remains detectable for as long as two weeks (Kristin Wood, pers com.). During our study, aquatic turtles were the most commonly encountered taxa group, accounting for 66% of the total recorded mortality, followed by snakes (13%), birds (10%), mammals (5.5%), alligators (4.5%), and frogs (1%). A total of 21 species were identifiable from the remains, including 4 turtles, 7 snakes, the alligator, 4 birds, and 5 mammals. Due to the tendency for turtle shell fragments to persist for long periods of time along the road, their prevalence may have actually been less than suggested in our surveys. Aquatic or semiaquatic reptiles dominated the survey with only one terrestrial snake (*Elape guttata*) detected. Of the mammals found, only the river otter and the marsh rat were semiaquatic. The other road-killed mammals, requiring an upland habitat component, included the raccoon, the opossum, and the armadillo.

The construction of animal barriers along the Tamiami Trail corridor in between the bridges or culverts on both sides of the road could aid in reducing road-related wildlife mortality. Perhaps a barrier based on the design currently being used at Payne's Prairie State Preserve south of Gainesville, Florida would serve well here also. The review of an unpublished evaluation by Dick Franz (1996) on the effectiveness of different barrier heights ranging from one to four feet suggests that a 2-foot barrier would be sufficient for deterring all turtles, all small snakes and most large-bodied aquatic snakes, all ranid frogs, most alligators, and all rabbits. The addition of a six-inch overhang would further increase the effectiveness of this barrier. It would be difficult to exclude arboreal animals such as raccoons, opossums, treefrogs, and rat snakes, and potentially large alligators, even with the 4-foot barrier design. Furthermore, the 4-foot barriers would be a difficult obstacle for bank fishermen to traverse, especially if an over-hanging lip is present. The scenic vistas of the Everglades from the highway would likewise be greatly reduced by a 4-foot barrier. For these reasons, and the high cost ($124.24/ linear foot) associated with constructing the higher concrete barriers, we recommend that a 2-foot barrier height be considered in project design. Further cost reductions could be achieved by using alternate barrier materials such as a low field fence with aluminum flashing at the base.

Since most mammal mortality was documented in the first and last mile of the project corridor (Tables 3 and 4, Mike Abney pers. comm.), we believe that the use of wildlife underpasses and diversion fences to connect the L-30 to the L-31 Levee and the L-67A to the L-67 Extension Levee would help alleviate much of the mammalian mortality. A wildlife crossing at the L-30 Levee would be of most value since no crossing of the L-29 Canal currently exists here, and because the L-30 and L-31 levees must remain in place for flood protection. Neither would this location impede boat use of the L-29 Canal. A successful and economical design used on State Road 29 by the Florida Department of Transportation to allow safe passage for the Florida panther consists of a 50-foot concrete slab bridge placed in the highway alignment, providing a 24-foot-wide passageway with a clearance height of 8 feet. The diversion fences for channeling animals to the crossings should be of a small mesh design and extend for one-half mile on each side of the underpass. The only other section of road surveyed that exhibited a

trend of greater mammal mortality and where the greatest number of historic Everglades mink road-kills have been documented was the 1-mile section centered at the Blue Shanty Canal (Table 5). Consequently, if the western end of the bridge expanse were relocated to the vicinity of the Blue Shanty Canal, the installation of a bridge shelf there could create a safe passage corridor for large mammals (including the endangered Florida panther), medium-sized mammals and other wildlife that utilize this tree-lined agricultural canal that traverses the Tamiami Trail. A shelf width of 10 to 15 feet placed at an elevation slightly above the mean high water line would accommodate the larger animals as well as the small.

Furthermore, an improved highway design will most likely lead to faster driving speeds by motorists, which may necessitate strict enforcement of posted speed limits and stiff fines to insure that wildlife mortality does not increase.

Concerns and Recommendations

Given the stated authority limitations of the COE and the financial limitations of Everglades National Park to implement alternatives such as Alternative 5 or 6 for the Tamiami Trail portion of the Mod Waters project, Alternative 7a, or a derivative thereof, would appear to be the most reasonable interim alternative to implement prior to the approval of a more permanent solution under CERP. Although implementation of Alternative 7a will not entirely remedy all of the predrainage flow characteristics that existed prior to construction of the Tamiami Trail, it is anticipated to be capable of handling a shift in the bulk of Shark River flow volumes that will be channeled from the west side of the L-67 Levee to the east and into northeastern Shark River Slough.

Lacking in-house hydrological expertise, we must rely on the COE's modeling results, which indicate that a design high water level of 9.3 feet is sufficient for protecting the integrity of the Tamiami Trail road base, as the basis for our support of Alternative 7a. We note that the approved CERP conceptual plan, Alternative D-13R, as designed, is not expected to return the Everglades entirely to its historical flow regimes. The CERP plan may, in fact, need to be improved upon in order to reduce unnaturally high water levels and inundation periods that have been predicted under Alternative D-13R for WCA-3B. However, should any re-evaluation by the COE suggest that the design high water level of 9.3 feet would not be adequate to efficiently move flood water out of WCA-3B, then we would favor the adoption of a higher criterion to lessen the likelihood of deleterious flooding impacts upon the wildlife and vegetative communities of WCA-3B.

In summary, we offer the following recommendations concerning the alternatives under consideration, including possible improvements to Alternative 7a, the preliminary preferred alternative.

1 We support the idea of selecting an alternative that would be as compatible as possible with the upcoming CERP Decompartmentalization Project, and recommend that a real estate agreement between the COE and the Florida Department of Transportation for the Tamiami Trail be pursued in lieu of raising the profile of the roadway. We understand that such an agreement is expected to occur when the COE completes its design and specification plans for the project.

2. We understand that water quality treatment will probably not be required at this time since the impervious surface of the highway is not expected to significantly increase. Due to the potential for significant losses of high quality wetlands, impacts to important wildlife habitats, impacts to bank fishing, and possible incompatibility with CERP that would occur by including water quality treatment, we support the implementation of a water quality monitoring plan to ascertain whether treatment would be desirable in the future.

3. We are concerned about the potential reduction in public recreational access to the FSTWMA and fishing sites along the Tamiami Trail that could occur under Alternatives 3a, 3b, and the water quality treatment options b1 to b3 of Alternatives 2, 4, and 6, since such access is anticipated to decline as a result of restoration activities associated with both the Conveyance and Seepage component of Mod Waters and with the Decompartmentalization of WCA-3A Project of CERP. We are pleased to see at this time that, apart from a temporary lack of access to the south bank of the L-29 Canal during construction, Alternative 7a is expected to have minimal impacts on recreational use. However, special attention will need to be given to the siting of construction staging areas so that access is not blocked to the three boat ramps and parking facilities associated with the popular Recreation Site No. 4, the boat ramp and parking facility at Recreation Site No. 1, or to the boat ramp facility located west of the S-12D structure.

4. Of the viable alternatives being considered for this project, Alternative 7a would appear to have the least amount of impact on fish and wildlife resources. However, we believe that greater ecological and wildlife benefits may be derived from this alternative by a shift of the bridge from the proposed site one mile east of the L-67 Levee to a location east of the Blue Shanty Canal. If feasible, the placement of the western end of the bridge span, equipped with a wildlife crossing shelf beneath it, at a location immediately east of the Everglades Safari Airboat concession could aid in the reduction of wildlife mortality, particularly of the threatened Everglades mink.

5. Since wading bird and snail kite nesting patterns, as well as Everglades mink territories may vary with the prevailing hydrological conditions, surveys should be conducted on an annual basis by qualified biologists to determine whether any nesting efforts of state and federally protected bird species, or mink dens, would potentially be affected, prior to the commencement of construction activities. There is, in particular, a need for the COE to support a detailed study of the status and current distribution of the threatened Everglades mink along the Tamiami Trail corridor prior to the completion of the CERP Decompartmentalization Phase 1 project plan.

6. Alternatives 2b, 3a, 3b, 4a, 4b, 6b, 7b, and 8b produce an unacceptable amount of wetland functional loss, result in permanent impacts to wading bird rookeries, and have the potential to impact the threatened Everglades mink population; therefore, we recommend that they be removed from further consideration as ecologically viable alternatives.

7. Results from our preliminary wildlife mortality surveys and historical information suggest that there is a need for a more detailed wildlife mortality study on this portion of the Tamiami Trail prior to the completion of the Decompartmentalization Phase I project design plans. We are pleased that the COE is now supporting such a wildlife mortality study through the U.S. Fish and Wildlife Service, and hope that some nighttime surveys will be incorporated to document the potential effects of nocturnal or early morning scavengers on road-kill results.

8. Any reduction in recreational access or use of the Francis S. Taylor Wildlife Management Area that occurs in connection with this project would need to be compensated for on terms amenable to the FWC. We urge that the COE devise a program whereby the development of the recreational potential, adequate to meet anticipated public-use requirements, is more fully incorporated into project plans.

Sincerely,

Brian Barnett

Brian S. Barnett, Interim Director
Office of Environmental Services

BSB/DTT
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Enclosures

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Table 1. Description of Alternatives being considered for the Tamiami Trail Project and their effects on wetland extent and function as determined by the Wetland Rapid Assessment Procedure.

Alternative	Description	Acres Lost	Functional Units Lost- / Gained+
1	Existing alignment and profile with 4 new bridges without water quality treatment	-1.6	-2.9
2a	Existing alignment with raised profile and 4 new bridges without water quality treatment	-11.8	-10.1
2b	Existing alignment with raised profile, 4 new bridges, with standard dry detention water quality treatment	-86.0	-37.5
2b Options	"Creative" water quality treatment options		
2b 1	Shift alignment to north and compress swale with wall elements/south side	-44.6	-33.6
2b 2	Shift alignment to north and compress swale with wall elements/north side	-8.0	-8.4
2b 3	Shift typical section north encroaching approximately 50 ft. into L-29 Canal	-8.0	-8.4
2b 4	Grass strips	-8.0	-8.4
2b 5	Exfiltration trenches with curb and gutter	-8.0	-8.4
2b 6	Exfiltration trenches with shoulder gutter	-7.9	-8.3
3a	New north alignment in WCA-3B with raised profile and 8 new bridges without water quality treatment	-14.3	-18.8
3b	New north alignment in WCA-3B with raised profile, 8 new bridges, and standard dry detention water quality treatment	-28.9	-30.2
3b Options	"Creative" water quality treatment options		
3b 1	Modified 2b 1 Option	-22.8	-25.4
3b 2	Modified 2b 2 Option	-10.6	-16.0
3b 3	Modified 2b 3 Option	-13.5	-18.2
3b 4	Grass strips	-9.6	-15.2
3b 5	Same as 2b 5	-10.3	-15.8
3b 6	Same as 2b 6	-10.4	-15.9

Alternative	Description	Acres Lost	Functional Units Lost (-) / Gained
4a	New south alignment with raised profile and 4 new bridges without water quality treatment	-68.4	-40.4
4b	New south alignment with raised profile, 4 new bridges, and standard dry detention water quality treatment	-103.9	-64.4
4b Options	"Creative" water quality treatment options		
4b 1	Modified 2b 1 Option	-62.6	-36.5
4b 3	Modified 2b 3 Option	-62.5	-36.5
4b 4	Grass strips	-61.3	-35.6
4b 5	Same as 2b 5	-62.6	-36.5
4b 6	Same as 2b 6	-62.5	-36.5
5a	Elevated roadway within existing right-of-way without water quality treatment	57.3	39.3
5b	Elevated roadway within existing right-of-way with water quality treatment	43.0	29.5
5c	Elevated roadway within existing right-of-way, without water quality treatment, with degradation of the existing highway embankment	65.9	45.3
6a	Existing alignment with raised profile, 4-mile bridge and 8 new box culverts without water quality treatment	-9.6	-6.6
6b	Same as alternative 6a with standard dry detention water quality treatment	-33.3	-22.8
6b Options	"Creative" water quality treatment options		
6b 1	Same as Option 2b 1 applied to remaining roadway	-30.4	-20.9
6b 2-6b 5	Same as Option 2b 2 - 2b 5 applied to remaining roadway	-4.8	-3.3

Alternative	Description	Acres Lost	Functional Units Lost- / Gained+
7a	Existing alignment with raised profile and 3000-foot bridge without water quality treatment	-5.0	-3.4
7b	Existing alignment with raised profile and 3000-foot bridge with standard dry detention water quality treatment	-72.4	-49.5
7b Options	"Creative" water quality treatment options		
7b 1	Same as Option 2b 1 applied to remaining roadway	-10.4	-7.2
7b 2	Same as Option 2b 2 applied to remaining roadway	-5.0	-3.4
7b 3	Same as Option 2b3 applied to remaining roadway	-10.4	-7.2
8a	Existing alignment with raised profile and 24 additional culverts without water quality treatment	-5.1	-3.5
8b	Existing alignment with raised profile and 40 additional culverts with standard dry detention water quality treatment	-68.0	-46.6
8b Options	"Creative" water quality treatment options		
8b 1& 8b3	Same as Options 2b1& 2b 3 applied to remaining roadway	-15.9	-7.5
8b2	Same as Option 2b2 applied to remaining roadway	-5.1	-3.5
" 9a"	Existing alignment with raised profile, 2.7-mile bridge and 8 new box culverts without water quality treatment	-2.8	-1.9
"9b"	Existing alignment with raised profile, 2.7-mile bridge and 8 new box culverts with standard dry detention water quality treatment	-39.1	-33.4

Table 2. Wildlife remains identified along Tamiami Trail, one-half mile on each side of Agricultural Canal at Coopertown, located four miles west of S-334 (December 19, 2000).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	16	12	28
Snakes	1	2	3
Frogs	1	1	2
Alligators	0	0	0
Birds	0	0	0
Mammals	0	1	1
Unidentified	1	4	5
SOUTH SIDE OF TAMIAMI TRAIL			
	East ½ mile	West ½ mile	Total
Turtles	4	6	10
Snakes	0	3	3
Frogs	0	0	0
Alligators	0	1	1
Birds	4	1	5
Mammals	0	0	0
Unidentified	2	1	3

TOTAL: 61

Table 3. Wildlife remains identified along one mile of Tamiami Trail beginning at the Flight 592 Memorial adjacent to the L-67 Canals and ending ½ mile east of Osceola Camp (December 20, 2000).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	11	7	18
Snakes	0	0	0
Frogs	0	0	0
Alligators	0	0	0
Birds	3	0	3
Mammals	0	1	1
Unidentified	0	0	0

Table 3. Continued

SOUTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	5	4	9
Snakes	0	0	0
Frogs	0	0	0
Alligators	1	1	2
Birds	1	0	1
Mammals	2	4	6
Unidentified	2	2	4

TOTAL: 44

Table 4. Wildlife remains identified on December 20, 2000 along one mile of Tamiami Trail beginning at the L-30 Canal extending one mile west and ending at a bank of culverts (Begin: UTM 550299 N; 2849310 E End: 548615 N; 2849297 E).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	38	20	58
Snakes	0	0	0
Frogs	0	0	0
Alligators	0	0	0
Birds	3	0	3
Mammals	3	0	3
Unidentified	0	1	1
SOUTH SIDE OF TAMIAMI TRAIL			
	East ½ mile	West ½ mile	Total
Turtles	18	4	22
Snakes	0	0	0
Frogs	0	0	0
Alligators	1	1	2
Birds	1	2	3
Mammals	2	1	3
Snakes	1	1	2

TOTAL: 97

Table 5. Wildlife remains identified by FWC on April 18, 2001, along one mile of Tamiami Trail (between culverts #44 to #46 at the Blue Shanty Canal [culvert #45]).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	18	3	21
Snakes	1	0	1
Frogs	0	0	0
Alligators	2	2	4
Birds	0	0	0
Mammals	0	1	1
Unidentified	1	1	2
SOUTH SIDE OF TAMIAMI TRAIL			
Turtles	19	12	31
Snakes	4	2	6
Frogs	0	0	0
Alligators	2	1	3
Birds	3	3	6
Mammals	1	5	6
Unidentified	1	0	1

TOTAL: 82

Table 6. Wildlife remains identified by FWC on April 18, 2001, along one mile of Tamiami Trail (between culverts #56 to #54 at the Tamiami West woodstork colony [culvert #55]).

NORTH SIDE OF TAMIAMI TRAIL			
Class	East ½ mile	West ½ mile	Total
Turtles	16	20	36
Snakes	5	3	8
Frogs	2	1	3
Alligators	1	2	3
Birds	4	6	10
Mammals	0	0	0
Unidentified	1	1	2
SOUTH SIDE OF TAMIAMI TRAIL			
Turtles	9	15	24
Snakes	23	7	30
Frogs	0	0	0
Alligators	2	2	4
Birds	4	3	7
Mammals	0	0	0
Unidentified	0	0	0

TOTAL: 127

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MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK RGRR/SEIS ON TAMIAMI TRAIL COMPONENT

Corps Responses to Recommendations in the FWCA Reports

I. Responses to USFWS Recommendations

A. Recommendations in the August 2005 Draft CAR

Threatened and Endangered Species

1. As recommended, the Corps will integrate the FWS Construction Restrictions into the detailed design, specifications, and construction documents to avoid adverse effects on the wood stork colonies along Tamiami Trail near the one-mile bridge location.

2. The recommended wood stork monitoring plan is essentially covered in the on-going Wading Bird Nesting Success study that the Corps funds Dr. Peter Frederick to conduct each year.

3. The recommended Endangered Species Act Biological Assessment and determinations are included in Appendix K of the Final RGRR/SEIS.

Mitigation for Wetland Functional Losses

1. A recent analysis using the FLUCCS system of wetland delineation shows that there will be a net gain of 6.4 acres of wetlands, so no "enhancement plan" would need to be developed.

2. Noted.

Recreation:
None of the existing boat ramps in the general project area will be affected, so no replacement ramps would be needed.

Wildlife Mortality/Connectivity Features

1. Do not concur with the recommendation for inclusion of wildlife crossing features such as road underpasses and canal crossing bridges. These are beyond the scope and authority of the MWD project. Such features could be constructed if a separate funding source became available. They also could be addressed during the CERP decompartmentalization study.

2. The additional wildlife features will be considered as recommended.

B. Recommendations in the October 2005 Final CAR

1. The Corps would evaluate a number of different factors if there were a future need to consider shortening the span length of either of the two bridges in the recommended plan (e.g. budget shortfall). The recommendation to consider only the eastern one-mile bridge for shortening cannot be committed to at this time, but the expressed viewpoint would be factored into any decision.

2. The recommended siting of the L-29 weirs being considered in CSOP reflects current thinking, but the final sites will be decided as part of that project.

II. Responses to FFWCC Recommendations (August 11, 2005)

1. Noted.

2. Noted

3. There would be no effects on any of the existing boat ramps at any time.

4. Do not concur with recommendation for surveys of Everglades mink territories and wading bird and snail kite nesting efforts during construction to assess potential effects. Effects on wading birds would be adequately addressed by the USFWS Construction Constraints that the Corps has agreed to follow. There is no indication that snail kites would be likely to nest close enough to the construction area to be adversely affected. Any observations to the contrary that are brought to the Corps attention would be addressed appropriately at the time. It is not clear what actionable steps could be taken to avoid adverse effects on the Everglades mink in the unlikely event that territories could accurately be delineated and assessed within the construction zone of influence. The mink is not a Federally listed species under the Endangered Species Act.